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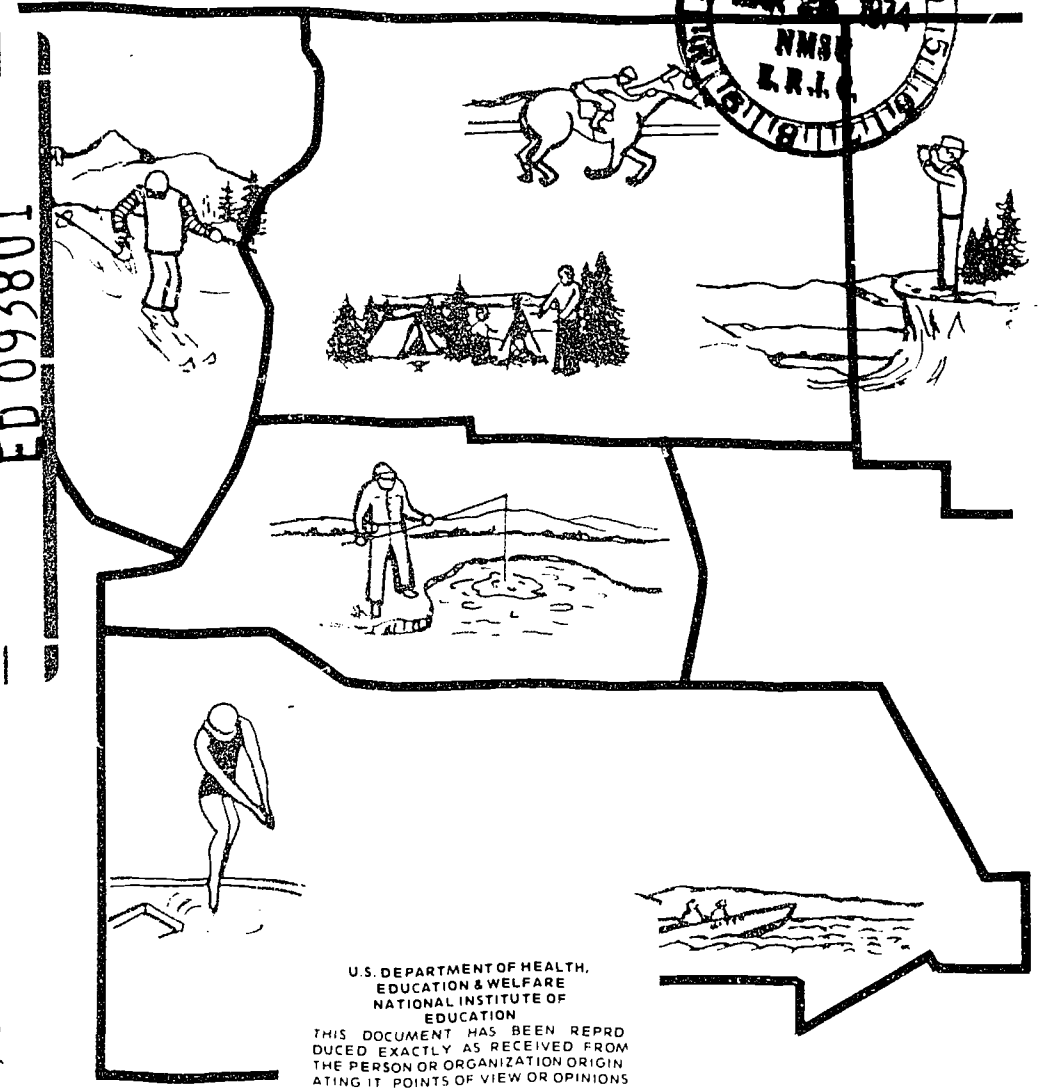
ABSTRACT

A study was made in northeastern New Mexico, centering in Colfax County, to determine potential economic benefits from specific developments at the recreation sites in the area. The emphasis of the study was on the demand for recreational facilities. Supply aspects were considered only in terms of available facilities. The first step was to identify the characteristics of the recreationists at the sites. Anyone engaging in any one of 27 different kinds of outdoor recreation activities was considered a recreationist. An economic model was developed that included two major limiting factors that influence recreationists to choose one site over another. These are the economic and leisure time factors. The purpose of the study was to determine, site by site, which recreational activities should be encouraged and which should be discouraged. The results of the survey are reported in several tabulations, including a) characteristics of recreationists, b) inventory of facilities, c) investments of facilities, d) costs to recreationists, e) direct and indirect benefits, f) recreational values by activities, g) values based on changes and income and leisure time, and h) quality of site. (HMD)

Use and Development of Outdoor Recreation Resources in Northeastern New Mexico



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October 1973 Las Cruces, New Mexico

SUMMARY

Recreational developments can be planned partially on the basis of how much time and money recreationists spend in an area and partially on the quality of resources available. Recreationists' expenditures of time and money, facilities, and scenic values were studied at 13 sites in northeastern New Mexico. The results indicated that some recreational activities were several times more important than others, in terms of money and time spent.

Recreationist Activity Preferences

Three sites were classified originally as camping and picnicking areas. If future investments in recreational facilities are to be based on the time and money spent by recreationists in Lower Cimarron Canyon, fishing, camping, and sightseeing facilities should receive priority. In Upper Cimarron Canyon (divided from Lower Cimarron Canyon at Clear Creek), sightseeing, fishing, and camping facilities should be further developed. At the Port-of-Entry Picnic Area north of Raton, recreationists ranked their major activities as sightseeing, camping, and fishing in nearby areas.

Seven sites were classified originally as lake fishing areas. Hunting in nearby areas, fishing, and camping were the three most important activities at Charette Lake. At Conchas Lake, recreationists spent their time and money for fishing, boating, and swimming. At Eagle Nest Lake, fishing and boating were the two major activities. Lake Maloya recreationists preferred fishing, camping, and sightseeing; at Maxwell Lakes, Miami Lake, and Storrie Lake, the recreational activities of fishing and camping were important.

Sightseeing areas studied were Capulin Monument, La Mesa Racetrack, and Red River. Horse racing, sightseeing, and fishing were major activities of recreationists who were contacted at Capulin Monument, while fishing, horse racing, and hunting were the three most important activities of La Mesa Racetrack patrons. Camping, hiking and mountain climbing, and snow skiing were major attractions at Red River.

Activity Changes with Changes in Recreationists' Time and Money

Real incomes and leisure times were varied by 10-percent increments from -10 percent to +30 percent of the 1969 level. Wide changes usually resulted in the index used to represent a proxy of recreational values of the various activities at each site. The index

for camping usually would increase were the incomes of recreationists to increase. The camping index usually would decrease were the leisure time increased. The demand for fishing and sightseeing would increase at some sites and decrease at others were incomes and leisure times changed.

Direct and Indirect Economic Benefits, by Sites

The money spent for recreation (additional to the amounts spent had the recreationists stayed home) varied from an average of 75 cents per man-day for those visiting Maxwell Lakes to $20.30 at La Mesa Racetrack. The average spent by recreationists at three camping and picnicking sites was $11.69 per man-day. At the seven lake fishing areas it was $7.59, and $14.38 at the three sightseeing areas.

Estimated investments in recreation facilities (excluding land, dams, and state-maintained roads), based on 1969 replacement costs, varied from $19,320 at Miami Lake to $1,833,540 at Conchas Lake. Eight sites had recreation facility investments of less than $100,000 while two had investments in excess of $1,700,000.

Direct and indirect benefits, based on the difference between recreationists' expenditures and costs of maintenance, depreciation, and interest, varied from negative direct benefits at three sites (Port-of-Entry, Eagle Nest Lake, and Maxwell Lakes) to positive direct benefits at the remaining 10 sites. Direct benefits were in excess of $2,200,000 at three sites. Benefits can be used to order the priority of development each site should receive. Also, benefits may be used to determine how much development may be feasible based on present benefit-cost ratios. No attempt was made to determine whether additional supplies of natural resources were available at the various sites for development other than those presently being used. Before development can take place, this information should be determined by administering agencies.

Scenic Value of Sites

When recreation areas were rated on the basis of their scenic value, Lake Maloya ranked highest of the 13 sites. Three other areas rating high were Eagle Nest Lake, Capulin Monument, and one site in Lower Cimarron Canyon. The number of eyesores varied from 2 at Capulin Monument to 12 at La Mesa Racetrack.

Use and Development of Outdoor Recreation Resources in Northeastern New Mexico

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Recreation can rapidly become a headache for decision-makers in charge of developing rural areas when they see the resources and a need for recreational development but no established method of proceeding. They have been handicapped because the usual economic measures of costs and returns, prices, and traditional economic models have been inadequate for evaluating potential benefits from such developments. The decision-makers must also consider social benefits, and evaluating the potentialities of these has been even more difficult.

A study was made in northeastern New Mexico, centering in Colfax County, to determine potential economic benefits from specific developments at the recreation sites in the area. The first step was to identify the characteristics of recreationists at these sites. Anyone engaging in any one of the 27 different kinds of the outdoor recreation activities listed in the questionnaire (Appendix A) was considered a recreationist. An economic model was developed that included two major limiting factors that influence recreationists to choose one site over another. These are the economic (expenditure) and leisure (time for recreation) factors. The purpose of the study was to determine, site by site, which recreational activities should be encouraged and which should be discouraged. The conclusions, reported in this bulletin, are based on how much time and money recreationists are spending on recreational activities.

The emphasis in this study was on the demand for recreational facilities. Supply aspects were considered only in terms of available facilities. Agencies making decisions will need to inventory the sites which they administer and decide whether undeveloped recreational resources are available. If they are, or if developments that can be changed to another kind of recreational use are available, the results of the analyses in this bulletin may provide a guide to the kinds of

recreational activity "preferred" by recreationists now using the sites. Also, an analysis is made in which the recreational expenses of all people using a site are compared with the costs of maintaining that site. The difference is net direct benefits, which can be used in a benefit-cost analysis. If the decision-maker knows that benefits exceed costs, he is in a better position to plan developments. Additional investments in facilities, in any one site, particularly one with a very favorable ratio of benefits over costs, will result in a favorable ratio. Continued additional investment eventually will force a reduction in benefits until the ratio is 1:1. The major advantage of additional investments is that the site will, for some time, be able to serve more recreationists, a goal of most decision-makers in recreational resource management.

Decision-makers should also find the results of the study useful because they indicate which sites are high or low valued, both aesthetically and economically, and which sites require further investments. Their decisions on development can be based at least partly on present uses of facilities.

PROCEDURES

Local, state, and federal resource managers were asked which sites in and near Colfax County are most used for recreation. From the list of approximately 30 sites, 16 were selected on the basis of present and potential value. Of these sites, three were later eliminated because they were temporarily closed, recreationists could not be separated from permanent residents, or not enough recreationists were interviewed to permit analyses. Some of the 13 remaining sites were designated as popular, based on estimates of recreational use, and the remainder were designated as minor. Two of the 13 recreation areas were 50 to 150 miles from the center of the study area, and interviewers visited these only once to interview recreationists.

A stratified random sampling procedure was used. The sites were selected at random without replacement, and the interview periods at the sites were stratified by weekend days and weekdays. The popular sites, used by many recreationists, were sampled twice as heavily as the less-popular sites (table 1). An attempt was made to interview all recreational parties at the selected site, except at La Mesa Racetrack, where patrons were selected at random. Personal interviews were conducted according to a prepared questionnaire. The questionnaire consisted of sections dealing with general characteristics of the recreational parties (home, distance, party size, places visited, purpose of trip, and so forth); types of recreation in which they participated at the site; their opinions as to a ranking of need for facilities; recrea-

tional equipment investments; expenditures made in addition to those that would have been made had the recreationists stayed home; personal data on the recreationists and their families (marital status, age, sex, occupation, health, income, ethnic group); and effects of changes in income and leisure time on the kinds of recreation activities chosen. The questionnaire, which is shown in Appendix A, was modeled partly on one used in Texas (7).

The analysis was made in several sections (figure 1), with a description of the recreationists being the first step. This description has been published (4), and a copy of the questionnaire used to gather the information is included as a part of Appendix A.

The next step was to inventory the recreational facilities at each site. In some areas these were counted. In areas under state control, a report was used.[1]

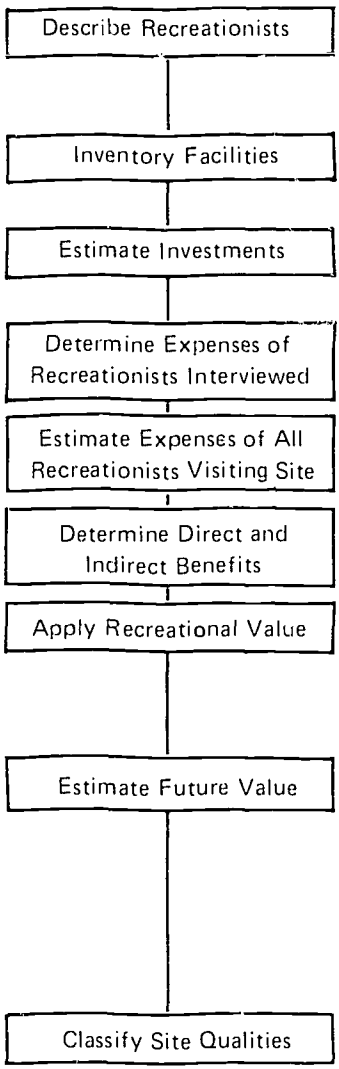
The third step was to estimate the replacement costs of the recreational facilities at each site. Values were selected from a tabulation of

[1] Lang, F.M. "Recreation Area Fee Summary," New Mexico Department of Game and Fish, Santa Fe, May 1972.

Table 1. Results of random sampling scheme, by area and anticipated major type of activity, northeastern New Mexico, 1969

Area	Days of Sampling: Weekdays	Days of Sampling: Weekend days	Completed Questionnaires	Major Types of Activities
		number		
Major Areas				
Lower Cimarron	5	1	77	Camping, picnicking, fishing
Upper Cimarron	4	2	67	Camping, picnicking, fishing
Red River	4	2	55	Camping, picnicking, fishing
Eagle Nest Lake	6	1	28	Fishing, boating
Lake Maloya	4	2	71	Fishing, picnicking
La Mesa Racetrack	0	4	35	Horse racing
Minor Areas				
Charette Lake	2	2	27	Fishing, camping
Maxwell Lakes	2	2	34	Fishing, boating
Miami Lake	2	2	22	Fishing, picnicking
Capulin Mountain	2	2	36	Sightseeing
Port-of-Entry picnic area	2	2	36	Picnicking, touring
Single Visits				
Storrie Lake	1	1	22	Fishing, boating, picnicking
Conchas Lake	1	1	20	Fishing, boating, camping
Total	35	24	530	

Fig. 1. Steps in analysis of recreational development values, northeastern New Mexico



59 kinds of recreational facilities reported by 21 different agencies (1). Estimated investment values in recreational facilities at each site were determined by multiplying the number of each kind of facility by its average replacement value.

The amounts spent by the recreational parties contacted at each site were accumulated. When combined with size of party and time spent, the result was the amount spent per man-day.

In the fifth step, various state and local officials were contacted to determine the numbers of man-days of recreation each site provided in 1969 or 1970. Some of this information had been published (6), and attendance records were available from the agency in charge or owning the other sites. The expenditure per man-day was multiplied by the total number of man-days for an estimate of the expenses for all recreationists at each site.

Little information was available to indicate the amounts spent at each site for labor and supplies used in operation and maintenance. A study of five kinds of outdoor recreational enterprises on cattle ranches in New Mexico provided a comparison of investments and costs (3), and from this it was estimated that costs would be 60 percent of the investment. This is probably in the upper ranges of cost, but it was used so that the estimate of direct benefits would be conservative. The difference between the expenses of all recreationists at a site and its cost, including maintenance, depreciation, and interest, were the net direct benefits of the site.

Another recently published study, which dealt with the economy of north-central New Mexico, including Colfax County (2), established output or final-demand multipliers, by industry, that measure the indirect effects of the expenditures of each industry on the economy. The industry in which recreation is included (personal services) had a multiplier of 1.0584. This multiplier was used to estimate direct and indirect benefits for each recreation site.

In the seventh step of the analysis, a proxy value was estimated for each kind of recreational activity. Lagrangian multipliers were used to determine the proxy value, based on expenditures of money and time. Theoretical framework and details of this analysis are given in Appendix B.

In the eighth step, incomes and the amounts of leisure times were varied for each recreation party and the analyses in the seventh step were repeated. The levels chosen were in 10 percent increments from -10 percent to +30 percent of the 1969 level. The results indicated how recreational values would change for each recreational activity at the various sites. Details of results are included in Appendix C.

The last step consisted of attempting to set a quality value on the recreational sites by classifying various features of each site. Procedures for this step were based partly on a study conducted in

Vermont (5). Three researchers scored most of the sites, using score sheets in their evaluations (see Appendix A). When two or three researchers agreed on a particular feature, this score was recorded. If each researcher recorded a different score, the scores were averaged. Scores were accumulated and the result indicated the "quality" of the site, based on its scenic value. The numbers of eyesores were totaled, and resources for the various kinds of recreation activities were rated as being "poor," fair," or "good."[2]

DESCRIPTION OF STUDY AREA

Location of Recreation Sites

The recreation sites for the study are in northeastern New Mexico (figure 2). Eight are in Colfax County. Red River, a major recreation area in Taos County, is near the western boundary of Colfax County. Storrie Lake, in western San Miguel County, and Conchas Lake, in the eastern part, were studied because they compete for recreationists using the facilities in Colfax County. Capulin National Monument is in Union County, and Charette Lake is in Mora County.

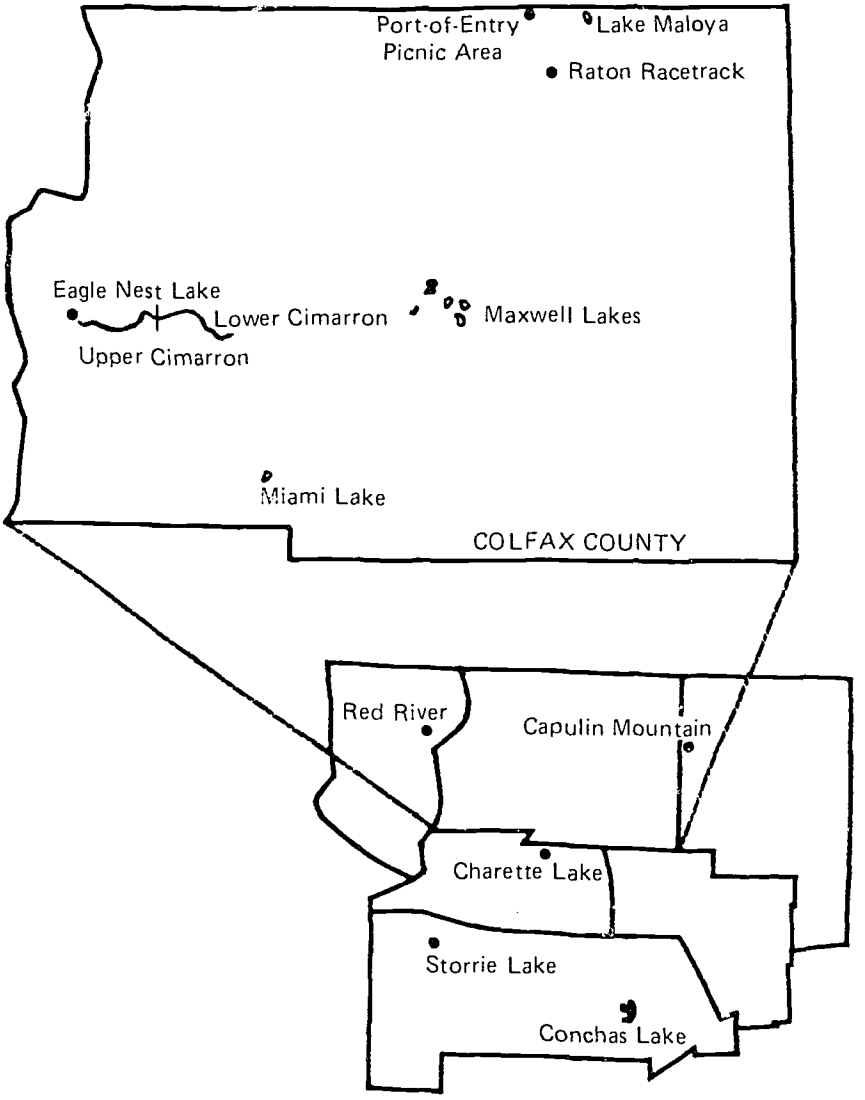
Physical Characteristics. The southeastern half of the study area consists of undulating plains, while the northwestern half encompasses the foothill and mountain area of the Rocky Mountain front. An interstate highway separates the two parts of the area. Most of the recreation sites are scattered in the foothills and mountains of the north and west. This portion of the area includes natural resources that lend themselves to increased development for recreation. Besides the mountain and canyon topography that appeals to recreationists, several creeks and one river flow through the area.

Economic Characteristics. Land ownership consists of two large national forests, large tracts of privately-owned lands that were within original Spanish land-grant boundaries, and small scattered areas of state-owned lands.

Most of the area does not have the socioeconomic problems found in the tri-ethnic counties to the west and south. The area had a population of 61,235 in 1970. In the 1960s, the area lost more than five percent of its population. Its labor force of about 21,500 persons in 1969 was 7.8 percent unemployed—much above the national average. The economy has been largely agricultural; cattle ranching and forest product industries are the major resource-based industries in the area.

[2]All three researchers were economists. One was native to New Mexico, another to the Pacific Northwest, and the third to Australia.

Fig. 2. Sites where recreationists were surveyed



RESULTS

Characteristics of Recreationists

The detailed characteristics of recreationists at each site have been published (4). These details are summarized according to the major activities available at the sites--camping and picnicking, lake fishing, and sightseeing. Recreationists are described in terms of their home locations, distance travelled to the recreation sites, size of party, frequency of visits, and length of stay (tables 2 to 6). Most campers, picnickers, and sightseers came from neighboring states, while most lake fishermen were from either Colfax County or other New Mexico counties. Almost half of the recreationists travelled 101 to 500 miles, one way, to the study sites. Sightseers travelled farther than the other two groups. Two-thirds of the parties had two to four persons. Most of the recreationists made only one trip to the recreational sites. After arriving, most recreationists (74 percent) remained at the sites five days or less; 39 percent remained one day or less, and 35 percent remained from two to five days.

Table 2. Geographic origin of recreational parties, by type of area, northeastern New Mexico, 1969

Major Type of Area	Number of Parties from— Colfax County	Other counties in New Mexico	Neighboring states	Other states
		number		
Camping and picnicking[1]	9	17	134	20[2]
Lake fishing[3]	74	80	56	14
Sightseeing[4]	13	6	87	20
Total	96	103	277	54
Percent of total	18	20	52	10

[1]Lower Cimarron, Port-of-Entry Picnic Area, and Upper Cimarron.

[2]Includes one party from Europe.

[3]Charette Lake, Conchas Lake, Eagle Nest Lake, Lake Maloya, Maxwell Lakes, Miami Lake, and Storrie Lake.

[4]Capulin Mountain, La Mesa Racetrack, and Red River.

Table 3. Distance travelled one way by recreationists, by type of area, northeastern New Mexico, 1969

Major Type of Area	Number of Parties Travelling— 0 to 100 miles	101 to 500 miles	501 to 1,000 miles	Over 1,000 miles
	number			
Camping and picnicking[1]	12	102	47	19
Lake fishing[2]	102	97	11	14
Sightseeing[3]	18	44	46	18
Total	132	243	104	51
Percent of total	25	46	19	10

[1]Lower Cimarron, Port-of-Entry Picnic Area, and Upper Cimarron.

[2]Charette Lake, Conchas Lake, Eagle Nest Lake, Lake Maloya, Maxwell Lakes, Miami Lake, and Storrie Lake.

[3]Capulin Mountain, La Mesa Racetrack, and Red River.

Table 4. Sizes of recreation parties, by type of area, northeastern New Mexico, 1969

Major Type of Area	Number of Parties Reporting Sizes of— One person	Two to four persons	Five to eight persons	More than eight persons
	number			
Camping and picnicking[1]	7	114	52	4
Lake fishing[2]	31	156	21	17
Sightseeing[3]	16	84	22	6
Total	54	354	95	27
Percent of total	10	67	18	5

[1]Lower Cimarron, Port-of-Entry Picnic Area, and Upper Cimarron.

[2]Charette Lake, Conchas Lake, Eagle Nest Lake, Lake Maloya, Maxwell Lakes, Miami Lake, and Storrie Lake.

[3]Capulin Mountain, La Mesa Racetrack, and Red River.

Table 5. Frequency of recreationists' visits, by type of area, northeastern New Mexico, 1969

Major Type of Area	Number of Parties Reporting Frequency of Visits of--											
	Once	Twice	Three times	Four times	Five times	Six times	Seven times	Eight times	Nine times	10 to 19 times	20 or more times	Total parties
	number											
Camping and picnicking[1]	128	21	12	6	2	2	0	1	0	3	5	180
Lake fishing[2]	83	24	14	10	14	9	6	4	0	25	35	224
Sightseeing[3]	88	10	7	2	1	0	1	1	0	8	8	126
Total	299	55	33	18	17	11	7	6	0	36	48	530
Percent of total	57	11	6	3	3	2	1	1	0	7	9	100

[1]Lower Cimarron, Port-of-Entry Picnic Area, and Upper Cimarron.

[2]Charette Lake, Conchas Lake, Eagle Nest Lake, Lake Maloya, Maxwell Lakes, Miami Lake, and Storrie Lake.

[3]Capulin Mountain, La Mesa Racetrack, and Red River.

Table 6. Lengths of stay by recreationists, by type of area, northeastern New Mexico, 1969

Major Type of Area	Number of Parties Reporting Lengths of Stay of— One day or less	Two to five days	Six to ten days	More than ten days
	number			
Camping and picnicking[1]	68	71	16	11
Lake fishing[2]	114	75	32	42
Sightseeing[3]	23	41	15	22
Total	205	187	63	75
Percent of total	39	35	12	13

[1]Lower Cimarron, Port-of-Entry Picnic Area, and Upper Cimarron.

[2]Charette Lake, Conchas Lake, Eagle Nest Lake, Lake Maloya, Maxwell Lakes, Miami Lake, and Storrie Lake.

[3]Capulin Mountain, La Mesa Racetrack, and Red River.

Inventory of Facilities

The inventory of facilities included 30 kinds (table 7). Picnic tables and garbage cans were counted frequently at almost all sites. The sites with the most facilities were Upper and Lower Cimarron Canyon (divided at Clear Creek), Port-of-Entry, Conchas Lake, Storrie Lake, Capulin Monument, La Mesa Racetrack, and Red River. La Mesa Racetrack had more different kinds of facilities than the other sites. Those with few facilities were Eagle Nest Lake, Lake Maloya, Maxwell Lakes, and Miami Lake. In general, camping and picnicking sites and sightseeing sites had a full range of facilities. Storrie and Conchas lakes were also well supplied with facilities. None of the lake sites in Colfax County was as well supplied as the lake sites outside the county.

Investment in Facilities

Investment estimates were based on the numbers of facilities, by kind, at the various sites and the amounts spent to install similar facilities by various agencies in New Mexico or nearby states (table 8). Data were collected to indicate levels of condition for the facilities at each site, but the investment estimates were based on replacement costs rather than present values. The 1968-70 replacement costs reported in a compilation, by type of facility, were used (1).

Table 7. Inventory of facilities at recreation sites, northeastern New Mexico, 1969

Type of Facility	Camping and Picnicking Areas				Lake Fishing Areas						Sightseeing Areas			
	Lower Cimarron	Upper Cimarron	Port-of-Entry	Charette Lake	Conchas Lake	Eagle Nest Lake	Lake Maloya	Maxwell Lakes	Miami Lake	Storrie Lake	Capulin Monument	La Mesa Racetrack	Red River
	number												
Water hydrants	3	1	1	1	40					15	1	3	5
Pit toilets	18	12		28	17		4	5	4	2	4		8
Flush toilets			3		5					0	2	10	
Picnic tables	58	43	16	27	84			2	6	24	10		24
Grills	16	11	5	7	84					24	5		24
Shelters			4		105					24	0		20
Cabins					60	4							
Garbage cans	80	54	9	44			20	19	6	26	15	20	15
Nature trails			2								1		
Playgrounds					3					1		1	
Visitor centers											1		
Information booths							1				1	1	
Amphitheaters											1		
Paved parking areas			1		2					1	1	1	
Piers					2								
Slips					30								
Launching ramps					1	1				1			
Marinas					1								
Lodges					1								
Swimming pool					1								
Golf courses													
Concessions stands					2							1	
Grandstands												1	
Roads, paved			.5		8					.5	5	2	
Roads, improved				5	10	2	1	2	1	1		1	
Other					1*							1**	

*Includes 84 trailer spaces, 6 boat rental facilities, 2 gas stations, and 1 campground.

**Includes a stable for 1200 horses.

Table 8. Average investment value, based on replacement cost, for recreation facilities, northeastern New Mexico, 1969

Type of Facility	Average Investment Value
	dollars
Water hydrant facility, each	1,540
Pit toilet facility, each	1,500
Flush toilet facility, each	10,000
Picnic table, each	200
Grill, each	50
Shelter, each	1,570
Cabin, each	4,000
Garbage can, each	20
Nature trail, per mile	5,000
Playground, each	1,500
Visitor center, each	80,000
Information booth, each	5,000
Amphitheater, each	30,000
Paved parking area	20,000
Pier, each	12,000
Slip, each	1,500
Launching ramp, each	9,000
Marina, each	100,000
Lodge, each	200,000
Swimming pool, each	10,000
Golf course, each	90,000
Concession stand, each	25,000
Grandstand, each	800,000
Roads, paved, per mile	45,000
Road, improved, per mile	12,000

Grandstands, lodges, marinas, and visitor centers were the most costly types of facility; garbage cans, grills, and picnic tables were least costly. Roads were not included in investment values unless they were maintained by the agency managing the site (i.e., state roads were not included).

Investment levels were lower at camping and picnicking sites than at most sightseeing sites (table 9). Estimated investments at lake fishing areas varied widely, from $19,320 at Miami Lake to $1,800,000 at Conchas Lake.

Costs to Recreationists

The sample of recreationists spent as little as $396 in visiting Maxwell Lakes in 1969 and as much as $16,220 in Lower Cimarron

Table 9. Estimated investment value, based on replacements cost, by recreation site, northeastern New Mexico, 1969

Recreation Site	Estimated Investment Value
	dollars
Camping and picnicking areas	
Lower Cimarron Canyon	45,620
Upper Cimarron Canyon	29,770
Port-of-Entry Picnic Area	75,950
Lake fishing areas	
Charette Lake	110,170
Conchas Lake	1,833,540
Eagle Nest Lake	49,000
Lake Maloya	23,400
Maxwell Lakes	20,280
Miami Lake	19,320
Storrie Lake	135,300
Sightseeing areas	
Capulin Monument	395,090
La Mesa Racetrack	1,700,000*
Red River	57,400

*Includes land.

Canyon (table 10).[3] The major items of expense were auto travel costs, depreciation on recreation equipment, groceries, and lodging. Licenses and fees were a major expense for lake fishermen.

More meaningful is comparison of expenses per man-day for recreationists. Man-days are the travel time to the site and the length of stay there, both in days, times the number of recreationists in the parties. Auto travel costs were occasionally found to be a major expense at the Port-of-Entry Picnic Area, Eagle Nest Lake, and the three sightseeing areas (table 11).

Depreciation due to wear and tear on recreation equipment was a major expense at Upper Cimarron Canyon, Conchas Lake, and Storrie Lake. At each site, campers, travel trailers, and boats at the lake sites were the major items of equipment.

Sightseers at Capulin Monument and La Mesa Racetrack spent more for lodging and restaurant food than recreationists at other sites. Recreationists did not patronize bars to any large extent. The largest bar expenses per man-day were reported by recreationists visiting Conchas Lake and La Mesa Racetrack. Equipment rentals per man-day were largest for the recreationists who were camping and

[3]Expenses reported are those in addition to those that would have been spent had the recreationist stayed home. The amounts reported are not the total amounts spent, but the portion of the amounts spent that can be attributed to the recreation experience. No attempt was made to determine where the expenditure occurred.

Table 10. Expenses of sample of recreationists, by recreation site, northeastern New Mexico, 1969*

Type of Additional Expense	Camping and Picnicking Areas				Lake Fishing Areas						Sightseeing Areas		
	Lower Cimarron	Upper Cimarron	Port-of-Entry	Charette Lake	Conchas Lake	Eagle Nest Lake	Lake Maloya	Maxwell Lakes	Miami Lake	Storrie Lake	Capulin Monument	La Mesa Racetrack	Red River
	dollars												
Lodging	880	419	183	33	119	59	669	5	8	33	347	1,294	510
Cafe	974	358	83	62	157	27	847	5	25	73	370	899	494
Groceries	2,772	1,422	102	168	352	12	982	16	16	368	285	293	1,135
Bars	131	61	9	5	96	6	312	5	0	49	9	177	66
Equipment rental	450	246	33	3	70	0	0	0	0	109	28	0	724
Fees	543	276	7	38	326	24	424	0	4	64	51	14	428
Licenses	824	665	12	249	134	9	2,521	37	62	781	2	0	197
Baits and lures	75	82	0	100	35	0	201	11	33	30	0	0	33
Fuel	0	0	0	22	88	0	22	0	0	12	0	0	0
Miscellaneous	19	0	3	3	23	0	0	0	0	67	0	1,328	16
Subtotal	6,668	3,529	432	683	1,400	137	5,978	79	148	1,586	1,092	4,005	3,603
Depreciation	5,244	4,869	175	1,528	2,160	586	1,762	301	914	2,399	554	61	3,454
Auto cost	4,308	2,199	2,169	602	850	1,154	5,332	16	45	1,812	1,776	9,759	4,195
Total	16,220	10,597	2,776	2,813	4,410	1,877	13,072	396	1,107	5,797	3,422	13,825	11,252

*Expenses attributable to recreation, in addition to those had the recreationists remained home.

Table 11. Recreationist expenses per man-day, by recreation sites, northeastern New Mexico, 1969*

Type of Additional Expense	Camping and Picnicking Areas				Lake Fishing Areas						Sightseeing Areas		
	Lower Cimarron	Upper Cimarron	Port-of-Entry	Charette Lake	Conchas Lake	Eagle Nest Lake	Lake Maloya	Maxwell Lakes	Miami Lake	Storrie Lake	Capulin Monument	La Mesa Racetrack	Red River
	dollars												
Lodging	.47	.41	1.06	.12	.31	.20	.30	.01	.02	.11	1.62	1.90	.31
Cafe	.52	.35	.48	.23	.41	.09	.38	.01	.06	.24	1.73	1.32	.30
Groceries	1.48	1.39	.59	.62	.92	.04	44	.03	.04	1.21	1.33	.43	.69
Bars	.07	.06	.05	.02	.25	.02	.14	.01	0.00	.16	.04	.26	.04
Equipment rental	.24	.24	.19	.01	.18	0.00	0.00	.00	0.00	.36	.13	0.00	.44
Fees	.29	.27	.04	.14	.85	.08	.19	.00	.01	.21	.24	.02	.26
Licenses	.44	.65	.07	.92	.35	.03	1.13	.07	.15	2.57	.01	0.00	.12
Baits and lures	.04	.08	0.00	.37	.09	0.00	.09	.02	.08	.10	0.00	0.00	.02
Fuel	0.00	0.00	0.00	.08	.23	0.00	.01	.00	0.00	.04	0.00	0.00	0.00
Miscellaneous	.01	0.00	.02	.01	.06	0.00	0.00	.00	0.00	.22	0.00	1.95	.01
Subtotal**	3.56	3.45	2.50	2.52	3.65	.46	2.68	.15	.36	5.22	5.10	5.88	2.19
Depreciation	2.80	4.76	1.01	3.16	5.64	1.98	.79	.57	2.23	7.89	2.59	.09	2.10
Auto cost	2.30	2.15	12.54	1.21	2.22	3.90	2.39	.03	.11	5.96	8.30	14.33	2.55
Total**	8.66	10.36	16.05	6.89	11.51	6.34	5.86	.75	2.70	19.06	15.99	20.30	6.84

*Expenses attributable to recreation, in addition to those had the recreationists remained home.

**May not add because of rounding error.

picnicking at Storrie Lake and at Red River. Baits and lure expenses were largely concentrated at the two Cimarron Canyon sites and at three lake sites. Miscellaneous costs at La Mesa Racetrack were mainly for commercial transportation. Wagering costs were not included.

Total expenses varied widely by sites and within groups of sites with similar activities. The largest total expenses per man-day were at La Mesa Racetrack, Storrie Lake, Port-of-Entry, and Capulin Monument. At three of these four areas, auto travel costs made up the largest expense category. Because of the very large amounts of equipment (camping, boating, and fishing) at Storrie Lake, the depreciation expense there was large.

Expenses of visitors to Maxwell Lakes, Miami Lake, Lake Maloya, Red River, and Charette Lake were seven dollars or less per man-day, and expenses at Maxwell Lakes were less than one dollar per man-day. Travel costs were modest for visitors to these sites.

Estimated Recreationist Expenses, by Site

Total number of man-days of recreation varied widely by sites (table 12). The two most popular sites were Conchas and Storrie

Table 12. Estimated total expenses of all recreationists, by recreation site, northeastern New Mexico, 1969

Site	Sample Expense per Man-Day	Numbers of Man-Days*	Estimated Total Expenses
	dollars	man-days	dollars
Camping and picnicking areas			
Lower Cimarron	8.66	48,000	415,680
Upper Cimarron	10.36	32,000	331,520
Port-of-Entry	16.05	2,400	38,520
Lake fishing areas			
Charette Lake	6.89	11,680	80,475
Conchas Lake	11.51	338,729	3,898,771
Eagle Nest Lake	6.34	4,276	27,110
Lake Maloya	5.86	18,000	105,480
Maxwell Lakes	.75	6,500	4,875
Miami Lake	2.70	15,120	40,824
Storrie Lake	19.06	198,111	3,775,996
Sightseeing areas			
Capulin Monument	15.99	48,680	778,393
La Mesa Racetrack	20.30	146,173	2,967,312
Red River	6.84	10,000	68,400

*From attendance records, number of seasonal permits, or estimates of the New Mexico State Departments of Game and Fish, and Parks and Recreation.

lakes. La Mesa Racetrack, the two Cimarron Canyon sites, and Capulin Monument were also popular, providing 30,000 or more man-days of recreation in 1969. Areas which had comparatively few recreationists were Port-of-Entry, Eagle Nest Lake, and Maxwell Lake.

The sites in northeastern New Mexico where estimated expenses of all visiting recreationists were highest were Conchas Lake, Storrie Lake, and La Mesa Racetrack. Estimated expenses were lowest at Maxwell Lakes and Eagle Nest Lake. At the two Cimarron Canyon sites together, the estimated recreational expenses totaled $747,200, or slightly less than the total at Capulin Monument.

Direct and Indirect Benefits

Net direct benefits are the expenses paid by recreationists over those they would have had at home, less the maintenance cost, including labor and materials, depreciation, and interest on investment. These latter costs were estimated to be 60 percent of the investment in facilities, except at La Mesa Racetrack, where they were estimated to be 40 percent of the total investment, including land.[4]

Net direct economic benefits to society from recreation activities at the 13 sites in northeastern New Mexico varied from being negative at three sites to a positive $3.0 million for Conchas Lake (table 13). The negative benefits were at the Port-of-Entry Picnic Area, Maxwell Lakes, and Eagle Nest Lake. Sites with relatively low direct benefits were Charette Lake and Miami Lake. Substantial net direct benefits were realized for both Cimarron Canyon sites, Capulin Monument, and Lake Maloya. Indirect benefits increased the total of direct benefits by 5.84 percent.

Recreational Values by Activities

The analysis of expenditures of time and money permits not only a ranking but a comparison of the importance of each recreational activity at each study site. For example, a proxy recreational value of 1.000 means that the activity with this value is twice as important as an activity with a value of 0.500. Recreationists spent twice as much of both money and time in the first activity as in the second (see Appendix B).

[4]Based on a study of recreational enterprises on ranches in New Mexico (3), information compiled by the New Mexico Department of Game and Fish, and/or records of the manager of the facility.

Table 13. Direct and indirect benefits, based on recreational expenditures and costs of facilities, by recreation site, northeastern New Mexico, 1969

Recreation Site	Population Values of Expenses	Maintenance, Depreciation, Interest*	Net Direct Benefits	Direct and Indirect Benefits**
		dollars		
Camping and picnicking areas				
Lower Cimarron	415,680	27,372	388,308	410,985
Upper Cimarron	331,520	17,862	313,658	331,976
Port-of-Entry picnic area	38,520	45,570	-7,050	--
Lake fishing areas				
Charette Lake	80,475	66,102	14,373	15,213
Conchas Lake	3,898,771	1,100,124	2,798,647	2,962,088
Eagle Nest Lake	27,110	29,400	-2,290	--
Lake Maloya	105,480	14,040	91,440	96,780
Maxwell Lakes	4,875	12,168	-7,293	--
Miami Lake	40,824	11,592	29,232	30,939
Storrie Lake	3,775,996	81,180	3,694,816	3,910,593
Sightseeing areas				
Capulin Monument	778,393	237,054	541,339	572,953
La Mesa Racetrack	2,967,312	680,000	2,287,312	2,420,891
Red River	68,400	34,440	33,960	35,909

*Based on a study of investments, costs and returns of recreation enterprises on New Mexico ranches with maintenance (including labor), depreciation and interest on investment amounted to 60 percent of total investment (3) except at La Mesa Racetrack, where these expenses were estimated at no more than 40 percent, since land was included in the total investment of this privately-owned site.

**Indirect benefits were estimated with a recreation income multiplier of 1.0584 (2).

Although the sites were classified originally according to kinds of resources and the facilities developed at each, the analysis indicated that recreationists engaged in many different kinds of activities, some of which were available at other sites in the area.

Camping and Picnicking Sites. Among the sites classed originally as camping and picnicking areas, Lower Cimarron Canyon attracted recreationists who spent their time and money mostly for fishing, camping, and sightseeing, in that order (table 14). Although more parties reported camping as a major activity, the recreationists spent more time and money in fishing. Facilities at this site should be developed to enhance fishing, camping, and sightseeing, in that order. In Upper Cimarron Canyon, sightseeing is the most important activity, being more important than fishing and more than twice as important as camping. Hunting should be discouraged in the canyon (zero or minus value). At the Port-of-Entry Picnic Area, sightseeing is the most important activity, followed by camping and fishing.

Lake Fishing Sites. Hunting had a higher recreational value at Charette Lake, based on expenditures of time and money, than either fishing or camping (table 15). Recreationists at Conchas Lake engaged

Table 14. Recreational value based on expenditures and time spent by recreationists, by major activities, camping and picnicking sties, northeastern New Mexico, 1969

Camping and Picnicking Sites	Recreational Values	Number of Parties
Lower Cimarron		
Camping	.8233	67
Fishing	1.5207	60
Sightseeing	.6636	24
Hiking and climbing	.3849	13
Picnicking	.5594	7
Hunting	-.1970	4
Upper Cimarron		
Fishing	1.2998	52
Camping	.7229	51
Sightseeing	1.6303	16
Hiking and climbing	.5097	11
Picnicking	.2499	9
Port-of-Entry		
Sightseeing	1.2884	28
Camping	.9454	10
Fishing	.2620	7
Picnicking	.0634	6

Table 15. Recreational values based on expenditures and time spent by recreationists, by major activities, lake fishing site, northeastern New Mexico, 1969

Lake Fishing Site and Activity	Recreational Values	Number of Parties
Charette Lake		
Fishing	1.0233	26
Camping	.7685	12
Hunting	1.4289	6
Conchas Lake		
Fishing	1.3078	13
Camping	.8018	10
Swimming	.8958	9
Boating	.8250	7
Water Skiing	1.1581	7
Picnicking	.0111	5
Sightseeing	.2326	4
Eagle Nest Lake		
Fishing	1.2051	26
Camping	.9703	8
Sightseeing	.0719	4
Hunting	.0504	4
Lake Maloya		
Fishing	1.6911	61
Hunting	.1772	27
Camping	.4905	21
Horse Racing	.2380	10
Picnicking	.0617	9
Sightseeing	.2724	6
Maxwell Lakes		
Fishing	1.5937	32
Hunting	.0342	13
Camping	.6154	3
Boating	.2849	4
Swimming	.0695	4
Miami Lake		
Fishing	1.6147	22
Camping	.8291	13
Hunting	.1794	10
Boating	.2549	5
Storrie Lake		
Fishing	1.7924	16
Camping	.8335	11
Boating	.4568	4
Water Skiing	.4087	4

in a wide variety of activities. Fishing was the most important, followed by water skiing. Camping, swimming, and boating were almost equally important. The picnicking recreational value was too low to warrant any expenditures for additional picnicking facilities. Fishing was the major activity at Eagle Nest Lake. At Lake Maloya, fishing was most popular, camping was next, and sightseeing was the third most popular activity, based on expenditures of time and money; horse racing and hunting were more popular activities than picnicking. At Maxwell Lakes, fishing had the highest recreational value, followed by camping. Camping was more important than boating.

The four activities at Miami Lake were fishing, camping, boating, and hunting. Storrie Lake provided four kinds of recreational activities. The most important was fishing, followed by camping, boating, and water skiing.

Sightseeing Sites. Horse racing, sightseeing, and fishing were the three major activities of recreationists visiting Capulin Monument (table 16). Maintaining horse racing facilities at the track will enhance attendance at the Monument. Horse racing was more important than

Table 16. Recreational values based on expenditures and time spent by recreationists, by major activities, sightseeing sites, northeastern New Mexico, 1969

Sightseeing Site	Recreational Value	Number of Parties
Capulin Monument		
Sightseeing	1.2628	33
Camping	.2539	7
Horse racing	1.3148	5
Hiking and mountain climbing	.1884	5
Fishing	.8889	4
La Mesa Racetrack		
Horse Racing	1.2143	25
Fishing	1.4377	15
Hunting	.4889	8
Snow skiing	.2783	4
Camping	.0035	4
Red River		
Camping	1.7890	42
Fishing	.5424	33
Hiking and mountain climbing	1.1841	17
Sightseeing	.3542	16
Snow skiing	.9946	7
Picnicking	.4645	6
Horse riding	.3025	4
Swimming	.0663	4

sightseeing, and sightseeing was more important than fishing in nearby areas. Camping and hiking and mountain climbing ranked a poor fourth and fifth at Capulin Monument, based on the time and money spent by recreationists in these activities.

Racetrack patrons sampled at La Mesa Racetrack spent more time and money for fishing in nearby areas than for attending the races. Attendance at the track could be increased materially if nearby fishing areas were developed further. Fishing was more important than attending the races, and racing was more important than hunting. Although snow skiing is a winter activity and racing takes place in the summer, apparently a few race fans enjoy skiing. Any activity in an area that attracts people tends to enhance use of other kinds of recreational developments. Most people like more than one recreational activity.

The Red River area provided many kinds of recreational experiences. The three major activities, based on the time and money spent by recreationists, were camping, hiking and mountain climbing, and snow skiing.

Values Based on Changes in Income and Leisure Time

The foregoing analysis was based on the time and money spent in 1969 at each recreational site for the various available recreational activities. Future incomes and leisure time that recreationists have, however, may change. Therefore, an analysis was made to determine how much time and money recreationists would spend for the three major activities at each site as their incomes and leisure time might change. With changes in either income or leisure time, without corresponding changes in the other, large shifts would occur in the value for a particular kind of activity. Details for each site are given in Appendix C.

When recreationists have more time and/or more money, they frequently will choose to visit a higher quality area. However, if they are satisfied with fishing in a particular lake, more leisure time may permit them to spend more time at that lake. Some people with more money might shift from camping to staying at lodges or cabins. Others may do the reverse, particularly in a high-quality camping area. The analysis using Lagrangian multipliers permits an estimate of the recreational values of various activities when incomes and leisure times are changed (see Appendix B).

Future demands for recreation, based on changes in income and amounts of leisure time of recreationists, will have widely varying impacts on sites in northeastern New Mexico. Apparently, the kind of activity available at each site, the combinations of activities avail-

able, location of the site in relation to the home location of the recreationist, and the quality of the site all influence recreationists' choices of activities as their income and leisure time change. Each site, by being unique, should be examined separately.

Camping Activities. If incomes decline by 10 percent and leisure time remains constant, recreationists visiting most sites in northeastern New Mexico would reduce their camping activities (table 17). Exceptions were recreationists at Lower Cimarron, Port-of-Entry, Eagle Nest Lake, and Red River. But at 7 of the 11 sites, recreationists would reduce their camping even if, with the reduction in income, their leisure time were increased 30 percent. In general, camping activities would increase if recreationists have more income and decrease if they have more leisure time. With more leisure time, recreationists visiting northeastern New Mexico apparently would prefer activities other than camping. The quality of sites for camping tends to be lower than in many other areas of the Rocky Mountain states. With increases in incomes, recreationists probably would invest more in camping equipment and engage in this activity more frequently.

Fishing Activities. With large increases either in leisure time and/or income, recreationists visiting most sites in northeastern New Mexico would moderately increase their fishing. Exceptions were recreationists at Lower Cimarron and Conchas Lake. In general, recreationists who fish would not react as strongly to changes in income and leisure time as those who engage in camping.

Sightseeing Activities. Among the five sites where sightseeing was important, only recreationists at Lower Cimarron would change their sightseeing activities with changes in leisure time and income. At the other four sites, reactions were more moderate.

Boating Activities. Boating by recreationists would increase at three of the four lakes with increased recreationists' income, and decline with increases in leisure time.

Hunting Activities. Some recreationists spend a part of their leisure time and income in hunting. Reactions to changes in leisure time and income were mixed. Those visiting Charette Lake are mostly from central New Mexico, while recreationists at La Mesa Racetrack are either local residents or a mixture of both in-state and out-of-state patrons. Apparently, leisure time limits hunting by La Mesa Racetrack patrons, while income limits hunting activities of recreationists visiting Charette Lake.

Table 17. Estimated indexes of demand for the major recreational activities, with changes in income and leisure time, by site, northeastern New Mexico (1969 = 100)

Type of Activity and Site	Income and Time =	Index of Demand with Changes of—			
		-10% 0%	-10% +30%	0% -10%	+30% -10%
Camping Activity					
Lower Cimarron		201	536	-11	-316
Upper Cimarron		68	4	122	216
Port-of-Entry		124	228	66	-8
Charette Lake		66	-5	124	225
Conchas Lake		-6	-297	197	517
Eagle Nest Lake		100	131	90	89
Lake Maloya		52	-61	138	281
Maxwell Lakes		61	-25	129	245
Miami Lake		60	-31	130	251
Storrie Lake		88	82	102	138
Red River		113	183	77	37
Fishing Activity					
Lower Cimarron		58	-39	132	259
Upper Cimarron		95	109	95	110
Charette Lake		103	141	87	79
Conchas Lake		186	477	3	-256
Eagle Nest Lake		89	85	101	135
Lake Maloya		94	105	96	115
Maxwell Lakes		94	106	95	114
Miami Lake		86	74	104	146
Storrie Lake		95	109	95	111
La Mesa Racetrack		107	157	83	63
Sightseeing Activity					
Lower Cimarron		-22	-356	212	576
Upper Cimarron		141	273	49	-73
Port-of-Entry		84	67	106	153
Eagle Nest Lake		96	113	94	107
Capulin Monument		90	89	100	131
Boating Activity					
Conchas Lake		38	-117	152	337
Maxwell Lakes		67	0	123	220
Miami Lake		369	1,208	-179	-987
Storrie Lake		80	17	118	203
Hunting Activity					
Charette Lake		63	-16	126	236
La Mesa Racetrack		107	159	83	61
Horse Racing Activity					
Lake Maloya		72	18	118	202
Capulin Monument		100	132	90	88
La Mesa Racetrack		89	85	101	135

Horse Racing Activity. At two of the three sites, recreationists indicated that they would attend fewer races if their incomes and leisure time were reduced. Those visiting Capulin Monument reacted in an opposite manner.

Site Quality

The last step in the analysis of recreation sites in Colfax County and vicinity consisted of valuing sites on the basis of their scenic value. Scores, based on a combination of 12 items, were assigned to each site. An additional site quality item (people) was eliminated from the scoring because time of day, day of week, and weather conditions exerted a heavy influence on the number of people at a site at any particular time, and these conditions varied widely.

As New Mexico is mostly a semi-arid state in an arid or semi-arid region, water influences the quality of a recreation site more than it would in more humid areas. Therefore, emphasis was placed on water by including three factors--quantity, quality (color), and site (lake or stream banks). Each of these factors was given equal weight in the total site evaluation. Some recreationists may stress one factor (such as vegetation), while others may stress another (such as depth). Vegetation is a measure of whether trees, grass, brush, or bare areas are present; depth determines whether plains, hills, or mountains are visible. No acceptable method is known for weighing these factors, because each recreationist varies in his aesthetic tastes. Therefore, the factors were given equal weight. For each factor, a higher number means a higher rating. The score sheet in Appendix A includes the meaning of each number used as a score.

The scenery classification technique is only one of several that can be used to rate the quality of a site. Other techniques include an index of accessibility, a comparison of use rates and capacity, availability of complementary recreational sites and activities, and a count of recreationists with popularity being synonymous with quality. Possibly a combination of techniques, including considerations of supplies and possible ecological impacts, would result in a more objective estimate of site quality.

Camping and Picnicking Areas. Each Cimarron Canyon site extends five to seven miles along a canyon. Therefore, three representative areas were selected in each of these sites. At the lowest area in Lower Cimarron Canyon, the overall scenic value was rated at 30 (table 18). As the canyon was ascended, the total value increased. In general, the total scenic values in Upper Cimarron Canyon ranged from 36 to 39.

Table 18. Scenic value, by camping and picnicking areas, northeastern New Mexico, 1971

Characteristic	Unit	Sites						
		Lower Cimarron			Upper Cimarron			
		A	B	C	A	B	C	Port-of-Entry
Satisfaction Ratings (1-3)**								
Picnicking	Score	1	1	1	2	2	1	2
Camping	Score	1	2	2	2	3	1	1
Hiking	Score	2	2	1	2	1	2	1
Nature study	Score	1	3	2	2	2	2	3
Fishing	Score	1	1	2	1	2	1	-
Other	Score	2	2	2	2	2	-	-
Facility Conditions (1-3)**								
Water hydrant	Score	2	2	-	3	-	-	1
Pit toilets	Score	-	-	2	2	1	-	2
Picnic tables	Score	2	1	1	2	2	1	3
Grills or fireplaces	Score	-	-	1	1	1	3	3
Garbage cans	Score	1	1	2	2	2	2	3
Separate areas	Score	1	1	-	2	1	-	3
Adjacent fishing	Score	2	-	2	1	1	-	-
Nature trails	Score						-	2

*Weather at time of observation.

**The higher scores are for higher site qualities, satisfaction ratings, or conditions of facilities. See the questionnaire in Appendix A.

Table 18. (Continued)

Characteristic	Unit	Sites: Lower Cimarron A	Lower Cimarron B	Lower Cimarron C	Upper Cimarron A	Upper Cimarron B	Upper Cimarron C	Port-of-Entry
Identification								
Distance from Raton	Mile	53	56	58	60	61	62	7
Direction of view	--	W	NW	N	N	E	SE	W
Weather*	--	Rain	Sun	Sun	Sun	Overcast	Overcast	Sun
Site Quality (1-5)**								
Distance	Score	4	3	4	3	3	4	5
Variety	Score	2	3	2	3	2	2	3
Depth	Score	2	5	5	5	5	4	4
Width	Score	2	4	5	5	5	3	4
Intermittency	Score	3	5	3	3	3	5	4
Color	Score	4	5	4	2	2	2	4
Water Quantity	Score	1	1	1	4	1	4	0
Water Quality	Score	3	3	3	3	3	3	0
Water site	Score	4	5	5	4	4	4	0
Vegetation	Score	5	5	5	3	4	4	3
Animals and birds	Score	0	0	4	4	4	4	4
Historical value	Score	0	0	0	0	0	0	4
Total site value	Score	30	39	41	39	36	39	35
Eye sore totals	No.	6	7	4	5	4	6	7

At the Port-of-Entry Picnic Area, the overall scenic value was 35. Since no water was in view at this area, the site failed to score higher even though the view (distance) is exceptional.

Eyesores such as old cars, abandoned cars, or power lines were noted at each site.

Satisfaction ratings of various kinds of recreational activities were also determined based on the judgments of the three scorers. Nature studies were scored "good" at the upper point in Lower Cimarron Canyon and at Port-of-Entry, and camping was scored "good" at the middle point in Upper Cimarron Canyon.

Lake Fishing Areas. Among the lake fishing areas, Lake Maloya scored highest among the lakes and among all other sites (table 19). Maxwell Lakes, despite the benefit of having water in the landscape, scored lowest of the lakes and among all other sites. "Good" satisfaction ratings were concentrated in the fishing activity among the lakes, and at Lake Maloya among the other activities.

Sightseeing Areas. Two areas at Capulin Monument were rated (table 20). They were the overlook, near the top of the mountain, and the picnic area part way up the mountain. Both areas scored high (40 or more). More eyesores were visible at the picnic area than at the overlook.

La Mesa Racetrack scored poor to fair in scenic value, being high in depth and intermittency. Notable, however, at the La Mesa Racetrack site was the large number of eyesores.

Red River scored best in vegetation (trees), but a large number of eyesores were noted. The area selected there for sampling was an overview of the town and canyon to the west.

Satisfaction ratings were good for sightseeing at Capulin Monument, good for racing at the racetrack, and good for camping at Capulin Monument.

Site Quality Summary. Facilities were mostly in fair to good condition at the sites except at Red River, where only one facility was noted at the rating area.

Overall, Lake Maloya scored highest in site quality, followed by Eagle Nest Lake and the Capulin Mountain Overlook. The other site at Capulin Monument and one site in Lower Cimarron also scored high. Maxwell Lakes scored lowest, with La Mesa Racetrack next, and one site in Lower Cimarron Canyon third from the bottom.

Table 19. Scenic value, by lake fishing areas, northeastern New Mexico, 1971

Characteristic	Unit	Sites						
		Charette Lake	Conchas Lake	Eagle Nest Lake	Lake Maloya	Maxwell Lakes	Miami Lake	Storrie Lake
Identification								
Distance from Raton	Mile	63	185	65	10	28	55	112
Direction of view	--	NE	N	S	W	W	NW	NW
Weather*	--	Sun	Sun	Cloudy	Sun	Cloudy	Cloudy	Sun
Site Quality (1-5)**								
Distance	Score	4	4	5	4	2	3	4
Variety	Score	2	2	4	3	1	3	3
Depth	Score	2	3	3	5	1	1	3
Width	Score	5	5	5	5	5	4	5
Intermittency	Score	5	5	5	4	5	5	5
Color	Score	2	2	4	4	3	2	2
Water quantity	Score	5	5	5	5	1	5	5
Water quality	Score	4	4	3	4	1	2	2
Water site	Score	3	3	1	4	1	1	1
Vegetation	Score	2	2	2	4	2	3	2
Animals and birds	Score	4	4	4	4	2	4	0
Historical value	Score	0	0	2	0	0	0	0
Total site value	Score	38	39	43	46	24	33	32
Eye sore totals	No.	3	4	7	6	6	6	5
Major activity	--	Fishing	Fishing	Fishing	Fishing	Fishing	Fishing	Fishing

Table 19. (continued)

Characteristic	Unit	Sites: Charette Lake	Conchas Lake	Eagle Nest Lake	Lake Maloya	Maxwell Lakes	Miami Lake	Storrie Lake
Satisfaction Ratings (1-3)**								
Picnicking	Score	1	2	1	2	1	1	1
Camping	Score	1	2	1	1	-	1	1
Hiking	Score	1	1	1	3	-	-	1
Sightseeing	Score	2	2	2	3	1	1	1
Nature study	Score	1	1	1	2	1	1	1
Fishing	Score	3	3	3	3	1	2	2
Boating	Score	1	2	2	1	-	2	2
Swimming	Score	1	1	1	-	-	2	2
Other water sports	Score	1	2	2	-	-	1	2
Other	Score	2	1	1	2	-	-	-
Facility Conditions (1-3)**								
Water hydrant	Score	-	-	-	-	-	-	2
Pit toilets	Score	2	3	-	1	-	2	2
Picnic tables	Score	2	1	-	-	-	2	3
Grills or fireplaces	Score	1	1	-	-	-	-	3
Garbage cans	Score	3	-	-	1	-	2	2
Adjacent fishing	Score	2	-	2	-	-	2	2
Launching ramp	Score	2	3	2	1	-	1	1

*Weather at time of observation.

**The higher scores are for higher site qualities, satisfaction ratings, or conditions of facilities. See the questionnaire in Appendix A.

Table 20. Scenic value, by sightseeing areas, northeastern New Mexico, 1971

Characteristic	Unit	Sites: Capulin Monument Overlook	Capulin Monument Picnic Area	La Mesa Racetrack	Red River
Identification					
Distance from Raton	Mile	36	35	2	85
Direction of view	--	W	E	E	W
Weather*	--	Overcast	Sun	Sun	Sun
Site Quality (1-5)**					
Distance	Score	5	2	3	3
Variety	Score	4	2	3	4
Depth	Score	5	5	5	4
Width	Score	5	5	4	4
Intermittency	Score	5	3	5	3
Color	Score	4	4	4	4
Water quantity	Score	1	4	0	1
Water quality	Score	1	3	0	2
Water site	Score	1	4	0	3
Vegetation	Score	3	5	2	5
Animals and birds	Score	3	3	2	0
Historical value	Score	5	0	2	2
Total site value	Score	42	40	30	35
Eye sore totals	No.	2	6	12	8
Major activity	--	Sightseeing	Picnicking	Racing	Sightseeing
Satisfaction Ratings (1-3)**					
Picnicking	Score	2	2	1	1
Camping	Score	-	3	-	1
Hiking	Score	2	2	-	2
Sightseeing	Score	3	3	1	2
Nature study	Score	2	2	-	1
Water sports	Score	-	1	-	2
Racing	Score	-	-	3	-
Facility Conditions (1-3)**					
Water hydrants	Score	3	1	2	-
Toilets	Score	3	2	-	-
Picnic tables	Score	3	3	-	-
Grills or fireplaces	Score	3	3	-	-
Garbage cans	Score	3	3	-	-
Concession stands	Score	2	-	3	-
Restaurants	Score	-	-	3	2

*Weather at time of observation.

**The higher scores are for higher site qualities, satisfaction ratings, or conditions of facilities. At Red River, the site was classified between the town and the campground area. Hence, several campground facilities were not rated. See the questionnaire in Appendix A.

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APPENDIX A

NEW MEXICO STATE UNIVERSITY

Department of Agricultural Economics and Agricultural Business

COLFAX COUNTY RECREATION STUDY

Recreational Area_____ Date of Interview_____
Analysis Code_____ Interviewer_____

I. GENERAL INFORMATION

1. Have you been interviewed previously by the Experiment Station in this area? Yes___ No___

2. Where is your home?_____
City State

3. How far is your home from this area in miles? _____
In travel time?_____ _____(hours or days)

4. How many persons are in your family party?_____

5. How long will you be here in this area? _____(hours or days)

6. Is this the only place to be visited on this trip? Yes____ No____
If "No", list other places visited and time spent at each.

Places Visited	Time (hours or days)
a. _____	_____
b. _____	_____
c. _____	_____
d. _____	_____
e. _____	_____

7. How often will you visit this area for the period January 1 through December 31, 1968?_____
Is the number of visits this year typical of past years? Yes ____
No ____ If "No", explain _____
_____

8. What is the primary purpose of your trip? (recreation, business, etc.)
_____
If the purpose is other than recreation, how many miles did you drive for recreational purposes? _____

9. What is the make and model of car used on this trip? _____
_____ _____
year make

II. TYPE OF RECREATION

10. Rank the recreational activities participated in in this area this year (1 signifies first choice):

Activity	Adults	Children	Activity	Adults	Children
Camping			Auto Racing		
Picnicking			Riding, auto		
Boating			Riding, bikes		
Water skiing			Motorcycling		
Fishing			Riding, horse		
Swimming			Rodeos		
Hunting			Hiking		
Skiing, snow			Nature study		
Archery			Playground		
Golf			Dancing, out-doors		
Tennis			Racing, horse		
Baseball			Other		
Softball					
Football					
Volleyball					
Horseshoes					

11. What would you and your children like to do that you either are not doing or not doing enough of in this area if facilities were available? (List in order of preference.)

Activity	Adults	Children	Activity	Adults	Children

12. Indicate the period of the year (month(s)) you prefer to engage in your top five activities:

Activity	Period of Year	
1.	From	To
2.	From	To
3.	From	To
4.	From	To
5.	From	To

13. Name the areas (portions of New Mexico or other states) that would have been your second choice had you not come to this area. _____

14. What features of the Colfax County area are superior to those in the area of your second choice? _____

15. What features of the Colfax County are inferior to those of the area of your second choice? _____

III. MINIMUM FACILITIES SECTION

16. Please indicate your opinion of the desirability of each of the facilities in the following list:

Facility	Not Necessary	Preferable	Absolutely Necessary
1. Water hydrant			
2. Water hook-up facility			
3. Electric hook-up facility			
4. Sewer hook-up facility			
5. Showers, public			
6. Pit toilets, public			
7. Flush toilets, public			
8. Automatic laundry			
9. Picnic tables			
10. Grills			
11. Garbage cans			
12. Security patrol			
13. Separate area for picnickers			
14. Campground closed at night			
15. Swimming area in lake			
16. Swimming pool			
17. Concession stand			
18. Fishing adjacent to camp			
19. Nature trails			
20. Motels			
21. Lodge			
22. Cabins			
23. Sewage dump pit			
24. Horseback riding facilities			
25. Bicycle trails			
26. Dancing area			
27. Lakes			
28. Trees			
29. Mountains			
30. Reservation system			
31. Screened shelters			
32. Playground			
33. Ball diamond			
34. Volleyball court			
35. Grandstand			
36. Marina			
37. Dry storage for boats			

Facility	Not Necessary	Preferable	Absolutely Necessary
38. Slips			
39. Pier			
40. Launching ramp			
41. Repair shop			
42. Restaurants			
43. Zoned fishing areas			
44. Zoned water skiing area			
45. Reserved hunting area			
46. Guides			
47. Boat rentals			
48. Paved road			
49. Streams			
50. Other_____			

IV. INVESTMENTS IN RECREATIONAL EQUIPMENT

17. What is your original investment in the following equipment used on this trip to this area?

a. Tent $_____
b. Camping trailer or camper $_____
c. Sleeping bags and equipment $_____
d. Stoves, lanterns, cooking utensils $_____
e. Special clothing $_____
f. Boats and motors $_____
g. Boating equipment including trailers $_____
h. Fishing tackle $_____
i. Rifles and hunting equipment $_____
j. Binoculars $_____
k. Cameras and other photo equipment $_____
l. Horses and other riding equipment $_____
m. Motorcycles, bicycles, motorscooters $_____
n. Other (indicate)_____ $_____
o. Other (indicate)_____ $_____

V. ADDITIONAL EXPENDITURES THIS TRIP

18. The additional expenditures made this trip above that which would have been spent had you stayed home were:

a. Lodging Additional $_____
b. Food and refreshments
(1) Cafes Additional $_____
(2) Groceries Additional $_____
(3) Bars and package goods Additional $_____
(4) Other Additional $_____

c.	Rental of equipment	Additional	$_____
d.	Fees	Additional	$_____
e.	Licenses	Additional	$_____
f.	Bait and lures	Additional	$_____
g.	Ammunition	Additional	$_____
h.	Fuel for boat	Additional	$_____
i.	Travel costs	Additional	$_____
j.	Other (indicate)_____	Additional	$_____
k.	Other (indicate)_____	Additional	$_____

VI. PERSONAL DATA SECTION

19. Are you married? ____Yes ____No
20. What is your race? ____White ____Black ____Red ____Yellow
21. What is your major ethnic origin (e.g. German, Jewish, African, etc)
22. What is your sex? ____Male ____Female
23. What is the age of the husband? _____ Of the wife _____? Of other adults living with the family ____, ____, ____, ____? Of the boys in the family____, ____, ____, ____, ____? Of the girls in the family ____, ____, ____, ____, ____?
24. How many people are living together in your household? _____
25. What is the occupation of the husband? _____
    What is the occupation of the wife? _____
    What is the occupation of others working? _____
26. How many hours worked per week by the husband? _____
    How many hours worked per week by the wife? _____
    How many hours worked per week by others? _____
27. How many weeks of vacation are had, or if self-employed, how many weeks are taken? By the husband? _____ By the wife? _____
    By others? _____, _____
28. How many years of schooling has been had by the following: By the husband? _____ By the wife?____ By other adults _____, _____
29. Did the state of health of any adult member of the household prevent general participation in outdoor activities for most of last year?
    _____ Yes _____ No

30. Did the state of health of any of your children prevent general participation in outdoor activities for most of last year? ____Yes ____No

31. Did any member of the household have a disability that kept them from engaging in outdoor recreation most of last year? ____Yes ____No

32. Where was the husband reared?

a. Farm or ranch _____
b. Town of less than 2,500 ____
c. City of 2,500 to 10,000 ____
d. City of 10,000 to 50,000 ____
e. City of 50,000 to 100,000 _____
f. City of 100,000 to 250,000 _____
g. City of 250,000 and over _____

33. Where was the wife reared?

a. Farm or ranch _____
b. Town of less than 2,500 ____
c. City of 2,500 to 10,000 ____
d. City of 10,000 to 50,000 ____
e. City of 50,000 to 100,000 _____
f. City of 100,000 to 250,000 _____
g. City of 250,000 and over _____

34. What was your total household income in 1967? This includes wages, salaries, business profits, net farm income, pensions, rents, and any money income received by members of your household.

a. Under $1,000 _____
b. $1,000-$1,999 _____
c. $2,000-$2,999 _____
d. $3,000-$3,999 _____
e. $4,000-$4,999 _____
f. $5,000-$5,999 _____
g. $6,000-$6,999 _____
h. $7,000-$7,999 _____
i. $8,000-$8,999 _____
j. $9,000-$9,999 _____
k. $10,000-$10,999 _____
l. $11.000-$11,999 _____
m. $12,000-$12,999 _____
n. $13,000-$13,999 _____
o. $14,000-$14,999 _____
p. $15,000-$15,999 _____
q. $16,000-$16,999 _____
r. $17,000-$17,999 _____
s. $18,000-$18,999 _____
t. $19,000-$19,999 _____
u. $20,000-$20,999 _____
v. $21,000-$21,999 _____
w. $22,000-$22,999 _____
x. $23,000-$23,999 _____
y. $24,000-$24,999 _____
z. $25,000 and over _____

35. If your present household income was increased by 10 percent next year, would the amount of time for outdoor recreation be:
About the same____ Less than this year____ More than this year____

36. If your household income was increased by 25 percent next year, would you engage in outdoor recreation activities that would be:
About the same as this year____ Different from this year____

If different from this year, what different activities would you choose?

_____
_____
_____

SCENERY CLASSIFICATION AND FACILITY SCORE SHEET

Department of Agricultural Economics and Agricultural Business
NEW MEXICO STATE UNIVERSITY

(WM-59, H-167--An Economic Study of the Demand for Outdoor Recreation)

1971

I. SITE IDENTIFICATION

1. Name of site or route for site _____
2. Distance from Raton _____ miles.
3. Direction of view _____
4. Type of road at point of classification:
   a. Paved _____
   b. Improved gravel _____
   c. Improved dirt _____
   d. Unimproved dirt _____
   e. Other (specify) _____ _____
5. Weather condition (sunny, overcast, raining) _____

II. SITE CLASSIFICATION

1. Distance
   a. Bank of dirt, ledge or curtain of trees beside road obscures view — Score 1
   b. Scene of a few fields, small foothills — Score 2
   c. Scene with high or distant foothills — Score 3
   d. Scene with range of foothills and one to two high peaks in background — Score 4
   e. Distant range of high mountains with broad sweep of plains and foothills — Score 5

   _____ Score

2. Variety (fields, hills, mountains, forests, water, farmsteads, villages, ledges
   a. Scene with preponderantly one feature — Score 1
   b. Scene with two major features — Score 2
   c. Scene with three major features — Score 3
   d. Scene with four major features — Score 4
   e. Scene with five or more major features — Score 5

   _____ Score

3. Depth (hold ruler at arm's length and score based on inches from points approximately 100 feet from observation point to the average horizon)

a. 0 to 2.5 inches	Score 1
b. 2.6 to 4.5 inches	Score 2
c. 4.6 to 6.5 inches	Score 3
d. 6.6 to 8.5 inches	Score 4
e. 8.6 or more	Score 5

_____ Score

4. Width (estimate of degrees of horizontal distance that can be seen from observation point)

a. 0 to 45 degrees	Score 1
b. 46 to 90 degrees	Score 2
c. 91 to 135 degrees	Score 3
d. 136 to 180 degrees	Score 4
e. Over 180 degrees	Score 5

_____ Score

5. Intermittency (degree to which scenic barriers obscure scenery on approach and leaving observation point--distance of approximately 100 yards on both sides of point)

a. Almost continuous barrier	Score 1
b. Several barriers on either side	Score 2
c. One or two barriers on either side	Score 3
d. One barrier on either side	Score 4
e. No barriers	Score 5

_____ Score

6. Color (season of observation _____)

a. Mostly one pastel color	Score 1
b. One pastel and one dark color	Score 2
c. Two or more pastel colors	Score 3
d. Two or more pastel colors and dark colors	Score 4
e. Several colors including one vivid color	Score 5

_____ Score

7. Water Quantity

a. Distant view of water, less than 1 percent	Score 1
b. Distant view of water, over 1 percent	Score 2
c. Intermediate view of water, 1-10 percent	Score 3
d. Close view of water, 10-20 percent	Score 4
e. Close view of water, over 20 percent	Score 5
f. No water	Score 0

_____ Score

8. Water Quality

a. Turgid, brown	Score 1
b. Light tan	Score 2
c. Gray	Score 3
d. Light blue or light green	Score 4
e. Dark blue or dark green	Score 5
f. No water	Score 0

_____ Score

9. Water Site

a. Wide silt flats	Score 1
b. Tall grasses or marshes around water	Score 2
c. Smooth grassy banks, small rocky shores	Score 3
d. Occasional trees, grassy banks or sandy beaches	Score 4
e. Trees and large ledges to water line and sandy beaches	Score 5
f. No water	Score 0

_____ Score

10. Vegetation Surrounding Site

a. Bare ground and occasional small shrubs	Score 1
b. Grassy plains	Score 2
c. Small trees, grassy plains	Score 3
d. Occasional large trees, grasses and flowers	Score 4
e. Forests (primeval), grasses, flowers	Score 5

_____ Score

11. Animals and Wildlife

a. Distant domestic animals	Score 1
b. Nearby domestic animals	Score 2
c. Distant birds or rodents	Score 3
d. Nearby birds, rodents, or fish	Score 4
e. Deer, elk, antelope, bear, other carnivors	Score 5
f. No animals, rodents, birds in sight	Score 0

_____ Score

12. People

a. Numerous large groups of people	Score 1
b. One large group (over 20)	Score 2
c. One medium size group (5-20)	Score 3
d. One small group (1-4)	Score 4
e. No persons in sight	Score 5

_____ Score

13. Historical Values

a. No significance	Score 0
b. Local significance	Score 2
c. State significance	Score 3
d. Regional significance	Score 4
e. National significance	Score 5

_____ Score

14. Eyesores (check if present)

a. Auto dumps	_____
b. Junkyards	_____
c. Dumps	_____
d. Litter and trash	_____
e. Old cars	_____
f. Oil and gas tanks	_____
g. Dead trees	_____
h. Garbage cans	_____
i. Billboards	_____
j. Newly abandoned buildings	_____
k. Accelerated eroded areas	_____
l. Dead animals	_____
m. Industrial plants	_____
n. Power lines and antennas	_____
o. Noticeable air or water pollution	_____
p. Other_____	_____
q. Other_____	_____

III. MAJOR ACTIVITY--SITE RELATIONSHIPS

1. Major activity from observation_____
2. Major activity from survey_____

3. Satisfaction Rating

	Satisfaction			
	Low	Medium	High	Not Applicable
a. Picnicking	_____	_____	_____	_____
b. Camping	_____	_____	_____	_____
c. Hiking	_____	_____	_____	_____
d. Sightseeing	_____	_____	_____	_____
e. Nature study	_____	_____	_____	_____
f. Fishing	_____	_____	_____	_____
g. Boating	_____	_____	_____	_____
h. Swimming	_____	_____	_____	_____
i. Other water sports	_____	_____	_____	_____
j. Winter sports	_____	_____	_____	_____
k. Trail riding	_____	_____	_____	_____
l. Other_____	_____	_____	_____	_____
m. Other_____	_____	_____	_____	_____
n. Other_____	_____	_____	_____	_____

IV. FACILITIES

(Complete only at recreation site)

Facility	Number	Average Condition: Poor	Fair	Good	Unknown or Not Applicable
1. Water hydrant					
2. Water hookup facility					
3. Electric hookup facility					
4. Sewer hookup facility					
5. Showers, public					
6. Pit toilets, public					
7. Flush toilets, public					
8. Automatic laundry					
9. Picnic tables					
10. Grills or fireplaces					
11. Garbage cans					
12. Separate area for picnickers					
13. Swimming area in lake					
14. Swimming pool					
15. Concession stand					
16. Fishing adjacent to campground					
17. Nature trails					
18. Motels					
19. Lodge					
20. Cabins					
21. Sewage dump pit					
22. Horseback riding facilities					
23. Bicycle trails					
24. Dancing area					
25. Screened shelters					
26. Playground					
27. Ball diamond					
28. Volleyball court					
29. Grandstand					
30. Marina					
31. Dry storage for boats					
32. Slips					
33. Pier					
34. Launching ramp					
35. Repair shop					
36. Restaurants					
37. Zoned fishing areas					
38. Zoned water skiing area					
39. Reserved hunting area					
40. Paved parking areas					
41. Boat rentals					
42. Estimated land area (acres)					
43. Other_____					

Enumerator _____ Date _____

APPENDIX B

Conceptual Framework

A proxy value for recreation can be expressed in terms of a function for a particular activity in combination with other activities at a particular site. The function for a group of consumers is defined in such a way as to depend on the manipulation by computer simulation of commodities flowing to consumers. In the model to be simulated, quantities of recreation are defined as values based on the cost of participating in particular kinds of activities. Consumers tend to increase their benefits by minimizing their costs subject to a combination of monetary budget constraints and time constraints. Or conversely, a given maximum level of recreational quantities is realized by selection of various combinations of activities chosen based on these budget and time constraints.

Once a function has been determined, solutions will indicate the types of recreation activities that should be maintained at a particular site, based on a cardinal ordering of the results of the activity analysis. By varying the budget and time constraints, the model will indicate the quantities of activities that should be added to those available in order to take care of additional expenditures of time and money by recreationists. These quantities of activities can then be related later by decision-makers to the resources actually available. If the investments or replacement costs of facilities are known, decision-makers will be able to determine the mix of investments demanded, their costs, and the income generated from changed levels of activities.

When the difference between the expenditures of recreationists and the costs of maintaining facilities is determined, this difference becomes the net benefit of the recreation site to society. That is, society provides facilities and services equivalent to the costs of these services to the public. Recreationists realize benefits equal to their expenditures of time and money to enjoy the activities in which they participate. The difference between the two becomes a net direct benefit exactly as the difference between receipts and expenses becomes the net income in private enterprise.

A further application may be possible. That is, input-output analysis of an area will result in a recreation multiplier. The recreation multiplier when applied to the output (expenditures of recreationists) will permit inclusion of secondary benefits of the recreation sector (2).

Sources of Bias

Several sources of bias exist in the study, resulting mostly from the assumptions implied by the manner in which the data were collected. These were:

1. The sample was representative of the population: only on-site recreationists were interviewed during the summer season. The validity of the results from this procedure decreases as projections are made for future developments of non-summer recreation facilities (i.e., new developments may attract a population different from the sample). Off-site interviews could have partially compensated for this bias. This assumption applies mainly to the validity of the results rather than to the validity of the model.

2. Most recreationists participated in more than one recreation activity. For cost and benefit accounting, it was assumed that expenditures by recreationists could be allocated arbitrarily as fully for a single activity, two-thirds and one-third for the first and second activities, and one-half, one-third, and one-sixth for the first, second, and third activities.

3. Additional expenditures for recreation were assumed to be valid estimates of the wealth parameter W, and time allocations valid estimates of the leisure parameter T. Future changes in additional expenditures and recreation times were assumed to be related to future changes in deflated family income and leisure.

4. Once the value projections were made, several secondary sources of information were used to estimate population parameters from the sample. Attendance records or the number of permits issued were the usual sources.

5. Additional investments anticipated as needed were based on 1968-70 replacements costs of the individual items. Decision-makers may wish to inflate costs at the rate of about eight percent per year for future decision-making.

6. Little information was available regarding the operating costs at the four sites studied. A study dealing with private ranch recreational enterprises and an agency's operational budget at some sites in the study area were used primarily to estimate the relationship between replacement costs and current operating costs. It was assumed that expenditures by recreationists must exceed operating costs plus eighteen percent of the investment in needed facilities (ten percent for depreciation and/or maintenance and eight percent for interest on investment) for expansion to become feasible. The direction that should be undertaken in the expansion could be determined by the changes in recreational value for each of the activities.

7. A major source of bias in applications of the result may stem from the assumption that unused recreational resources are available

at each site for future development. Decision to invest in facilities will depend on whether adequate amounts of natural resources are available to permit additional development.

The Analytical Model

The recreational value for a group of consumers was defined in such a way as to depend on the manipulation by computer simulation of commodities flowing to consumers.

In the system to be simulated, value was defined as depending upon a set of quantities of activities $X_1, X_2, \ldots, X_i, \ldots, X_n$ where X_i is the quantity of the ith activity. Included among $X_1, X_2, \ldots, X_n$ are the activities in which consumers participate. Consumers tend to increase their benefits by minimizing their costs subject to monetary budget constraints and time constraints to satisfy their needs. Or conversely, a given maximum level of value is realized by selection of various combinations of activities subject to the budget and time constraints.

That is to say: $V = X_1^2 + X_2^2 + \ldots\ldots + X_n^2$

is maximized subject to constraints:

$$P_1 X_1 + P_2 X_2 + \ldots\ldots + P_n X_n = W$$

$$t_1 X_1 + t_2 X_2 + \ldots\ldots + t_n X_n = T$$

where $X_1, X_2, \ldots X_n$ are quantities of consumption activities whose respective prices are non-negative ($P_1 \geq 0, P_2 \geq 0, \ldots, P_n \geq 0$). The wealth parameter W is fixed to be the total monies available for recreation by recreationists in addition to those expenditures or monies that would have been spent had the recreationists chosen to stay home. The respective times are also non-negative ($t_1 \geq 0, t_2 \geq 0, \ldots, t_n \geq 0$). The values of t_i will be in days. The time parameter T is the total length of time the recreationists spend in the recreation area.

To maximize the recreational value function subject to the time and money constraints, the following expression for a group of recreationists was developed:

$$L = X_1^2 + X_2^2 + \ldots + X_n^2 + \lambda(P_1 X_1 + P_2 X_2 + \ldots + P_n X_n - W) + \eta(t_1 X_1 + t_2 X_2 + \ldots t_n X_n - T)$$

where λ and η are adjustable multiplying parameters known as Lagrange multipliers and L is the adjoined function which when extremized will yield the optimum solution for a group of recrea-

tionists. For both $V = X_1^2 + X_2^2 + \ldots + X_n^2$ to have a maximum and the constraints to be satisfied, it is necessary that the following conditions hold:

$$\frac{\partial L}{\partial x_i} = 0 \qquad \text{for } i = 1, 2, \ldots, n$$

$$\frac{\partial L}{\partial \lambda} = 0$$

$$\frac{\partial L}{\partial \eta} = 0$$

The first order Lagrange conditions constitute $n+2$ equations in $n+2$ unknowns $(X_1, X_2, \ldots, X_n, \lambda, \eta)$. It is possible to solve the system of equations for $X_1, X_2, \ldots, X_n$, λ and η in terms of $P_1, P_2, \ldots, P_n, t_1, t_2, \ldots, t_n, W$ and T. A unique solution to the system of linear equations exists if the determinate of the partials is nonsingular:

$$\begin{vmatrix} 2 & 0 & 0 & \cdots & 0 & P_1 & t_1 \\ 0 & 2 & 0 & \cdots & 0 & P_2 & t_2 \\ 0 & 0 & 2 & \cdots & 0 & P_3 & t_3 \\ \vdots & & & & & & \\ 0 & 0 & 0 & \cdots & 2 & P_n & t_n \\ P_1 & P_2 & P_3 & \cdots & P_n & 0 & 0 \\ t_1 & t_2 & t_3 & \cdots & t_n & 0 & 0 \end{vmatrix} \neq 0$$

that is, a unique solution of the $n+2$ equations in terms of $X_1, X_2, \ldots X_n$, λ and η each as (single valued) functions of $P_1, P_2, \ldots P_n$, $t_1, t_2, \ldots t_n$, W and T is obtainable on a neighborhood of prices and time. Thus the formulation yielded the following demand functions:

$$X_1 = f_1(P_1, P_2, \ldots, P_n, t_1, t_2, \ldots, t_n, W, T)$$

$$X_2 = f(P_1, P_2, \ldots, P_n, t_1, t_2, \ldots, t_n, W, T)$$

$$X_3 = f_3(P_1, P_2, \ldots, P_n, t_1, t_2, \ldots, t_n, W, T)$$

$$\vdots$$

$$X_n = f_n(P_1, P_2, \ldots, P_n, t_1, t_2, \ldots, t_n, W, T)$$

$$\lambda = f_{n+1}(P_1, P_2, \ldots, P_n, t_1, t_2, \ldots, t_n, W, T)$$

$$\eta = f_{n+2}(P_1, P_2, \ldots, P_n, t_1, t_2, \ldots, t_n, W, T)$$

The first n functions $f_1, f_2, \ldots, f_n$ represented the recreational value for activities that require potential expenditures of time and money. The last two functions, f_{n+1} and f_{n+2} yielded solutions for the Lagrange multipliers λ and η.

A unique solution of the $n+2$ equations in terms of $X_1, X_2, \ldots, X_n$, λ and η yielded the maximum distribution of recreation activities based on the time and money constraints of the recreationists.

A unique recreational value function was generated for each area according to the recreation activities in which the repondents participated. If the recreationist participated in only one activity such as X_i then that activity becomes one of the variables in the recreational value function to be maximized. The total expenditures and time spent by the respondent were added to the cost and time constraint coefficients P_i and t_i respectively. If the recreationist participated in two activities X_i and X_j, then both X_i and X_j became part of the value function. In this case two-thirds of the total expenditures and time were assigned to the cost and time constraint coefficients P_i and t_i where i denotes the first recreation choice of the respondent. One-third of the total expenditures and time were assigned to the cost and time constraint coefficient P_j and t_j where j denoted the second recreation choice of the respondent.

If the person interviewed participated in three recreation activities X_i, X_j, and X_k then all three of these activities became part of the value function. One-half the total expenditures and time were assigned to the cost and time constraint coefficients P_i and t_i where i denotes the first recreation choice of the recreationist. One-third of the total expenditures and time were assigned to the cost and time constraint coefficients P_j and t_j where j denotes the second recreation choice. One-sixth of the total expenditures and time were assigned to the cost and time constraint coefficients P_k and t_k where k denotes the third recreation choice of the respondent. The combined total expenditures and times became the parameters W and T, respectively.

Once the value function for a site has been generated, it was then maximized subject to the cost and time constraints for that size. This was accomplished by taking the partial derivatives of the expression L, with respect to X_i for $i = 1, 2, \ldots, n$, with respect to λ and with respect to η. This system was then placed into matrix form and solved.

In solving the matrix for X_i where $i = 1, 2, \ldots, n$, λ and η the matrix lended itself to special treatment. Let the matrix be denoted by R.

Then:

$$R = \begin{vmatrix} 2 & 0 & 0 & 0 & \cdots & 0 & P_1 t_1 \\ 0 & 2 & 0 & 0 & \cdots & 0 & P_2 t_2 \\ 0 & 0 & 2 & 0 & \cdots & 0 & P_3 t_3 \\ 0 & 0 & 0 & 2 & \cdots & 0 & P\ t \\ \cdots & & & & & & \\ \cdots & & & & & & \\ \cdots & & & & & & \\ 0 & 0 & 0 & 0 & \cdots & 2 & P_n t_n \\ P_1 & P_2 & P_3 & P_4 & \cdots & P_n & 0\ 0 \\ t_1 & t_2 & t_3 & t_4 & \cdots & t_n & 0\ 0 \end{vmatrix}$$

It was observed that R can be reduced to an upper triangular matrix by operating only on the n+1st and n+2nd rows. Back substitution was then used to solve for λ, η, and X_i where $i = 1, 2, \ldots, n$.

The values of $X_1, X_2, \ldots, X_n$ yielded a unique solution indicating the recreation activities to best satisfy recreationists needs according to the time and money available to them. These values also implied the importance of recreation activities in relation to each other; for example, an activity with a value of 1.000 was twice as important in that recreation area as an activity with a value of 0.5000.

By varying the parameters W and T, and leaving the P_is and t_is fixed, predictions for additional recreation needs at present expenditures and times were made. The FORTRAN program for the model has this feature and was designed to yield predictions varying the parameters W and T from 10 percent less to 30 percent more time and expenditures available. The predictions were computed in increments of 10 percent.

In addition to the optimization program there is also a descriptive program which tabulates data and prints out tables relating recreation characteristics. Examples of such tables would be the total family income of the respondents by recreation areas, the desirability of various kinds of recreation facilities, choices of recreation activities for members of the party, and expenditures per party and per man-day.

The Program

The computer program was constructed in segments which corresponded to segments of the mathematical model. A set of binaries, or an object deck, was generated from the FORTRAN deck, which

eliminated compilation time after the first run for subsequent runs with varying expenditures and times. The major segments were:

Allocate and initialize
Calculate travel costs
Calculate recreation expenditures and times
Generate the value function and constraints
Set up coefficient matrix
Reduce coefficient matrix to an upper triangular matrix
Solve upper triangular matrix by back substitution
Compute changes by varying parameters W and T

In the second segment travel costs were calculated based on type of vehicle used, its age, and distance driven.

In the next segment was totaled the expenditures incurred by the recreationist for equipment. A depreciation rate of 10 percent was used divided by the number of recreation trips taken per year. Expenditures in addition to those the recreationist would have spent had he chosen to stay home, were added to depreciation and travel costs and divided by the number of persons in the party to yield expenditures per person. This value was used as the wealth parameter, W, for that respondent. The time parameter, T, was equal to the time that the recreationist spent in the area.

The recreational value function and constraints were then generated according to the first three recreation activities in which the respondent participated.

APPENDIX C

Table 1. Estimated indexes of the demand for three major recreation activities at Lower Cimarron with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
			percent		
			Camping		
-10	90	201	313	424	536
0	- 11	100	211	322	434
+10	-113	- 1	110	221	333
+20	-214	-103	9	120	231
+30	-316	-204	- 92	19	130
			Fishing		
-10	90	58	26	- 6	- 39
0	132	100	68	35	4
+10	174	142	110	78	46
+20	216	184	152	120	88
+30	259	226	194	162	130
			Sightseeing		
-10	90	- 22	-133	-245	-356
0	212	100	- 12	-123	-235
+10	333	222	110	- 2	-113
+20	455	343	232	120	8
+30	576	465	353	241	130

Table 2. Estimated indexes of the demand for three major recreation activities at Upper Cimarron with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
			percent		
			Fishing		
-10	90	95	100	104	109
0	95	100	104	110	115
+10	100	105	110	115	120
+20	105	110	115	120	125
+30	110	115	120	125	130
			Camping		
-10	90	68	47	25	4
0	122	100	78	57	35
+10	153	132	110	88	67
+20	185	163	142	120	98
+30	216	194	173	151	130
			Sightseeing		
-10	90	141	191	242	293
0	49	100	151	201	252
+10	8	59	110	161	211
+20	-32	18	69	120	171
+30	-73	-22	28	79	130

Table 3. Estimated indexes of the demand for three major recreation activities at Port-of-Entry Picnic Area with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
			percent		
			Sightseeing		
-10	90	84	78	72	67
0	106	100	94	88	82
+10	122	116	110	104	98
+20	138	132	126	120	114
+30	153	147	141	135	130
			Camping		
-10	90	124	159	193	228
0	66	100	134	168	203
+10	41	75	110	144	179
+20	17	51	86	120	154
+30	- 8	27	61	96	130
			Fishing		
-10	90	101	111	122	132
0	89	100	110	121	132
+10	89	99	110	121	131
+20	88	99	109	120	131
+30	88	98	109	119	130

Table 4. Estimated indexes of the demand for three major recreation activities at Charette Lake with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
			percent		
			Fishing		
-10	90	103	115	128	141
0	87	100	113	125	138
+10	85	97	110	123	135
+20	82	95	107	120	133
+30	79	92	105	117	130
			Camping		
-10	90	66	43	19	- 5
0	124	100	76	53	29
+10	157	134	110	86	63
+20	191	167	144	120	96
+30	225	201	177	154	130
			Hunting		
-10	90	63	37	10	- 16
0	126	100	73	47	20
+10	163	137	110	83	57
+20	200	173	146	120	93
+30	236	210	183	156	130

Table 5. Estimated indexes of the demand for three major recreation activities at Conchas Lake with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
		percent			
			Fishing		
-10	90	186	283	380	477
0	3	100	196	293	390
+10	- 83	13	110	207	303
+20	-170	- 73	23	120	216
+30	-256	-160	- 63	33	130
			Camping		
-10	90	- 6	-103	-200	-297
0	197	100	3	- 93	-190
+10	303	207	110	13	- 83
+20	410	313	217	120	23
+30	517	420	323	227	130
			Boating		
-10	90	38	- 13	- 65	-117
0	152	100	48	- 3	- 55
+10	213	162	110	58	7
+20	275	223	172	120	68
+30	337	285	233	182	130

Table 6. Estimated indexes of the demand for three major recreation activities at Eagle Nest Lake with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
		percent			
			Fishing		
-10	90	89	87	86	85
0	101	100	99	97	96
+10	113	111	110	109	107
+20	124	123	121	120	119
+30	135	134	133	131	130
			Camping		
-10	90	100	111	121	131
0	90	100	110	121	131
+10	89	100	110	120	131
+20	89	99	110	120	130
+30	89	99	109	120	130
			Sightseeing		
-10	90	96	101	107	113
0	94	100	106	111	117
+10	99	104	110	115	121
+20	103	109	114	120	126
+30	107	113	119	124	130

Table 7. Estimated indexes of the demand for three major recreation activities at Lake Maloya with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
		percent			
			Fishing		
-10	90	94	98	101	105
0	96	100	104	107	111
+10	102	106	110	114	118
+20	109	112	116	120	124
+30	115	119	122	126	130
			Camping		
-10	90	52	15	- 23	- 61
0	138	100	62	25	- 13
+10	185	148	110	72	35
+20	233	195	158	120	82
+30	281	243	205	168	130
			Horse Racing		
-10	90	72	54	36	18
0	118	100	82	64	46
+10	146	128	110	92	74
+20	174	156	138	120	102
+30	202	184	166	148	130

Table 8. Estimated indexes of the demand for three major recreation activities at Maxwell Lakes with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
		percent			
			Fishing		
-10	94	94	98	102	106
0	96	100	104	108	112
+10	101	106	110	114	118
+20	108	112	116	120	124
+30	114	118	124	126	130
			Camping		
-10	90	61	33	4	- 25
0	129	100	70	43	14
+10	167	139	110	81	53
+20	206	177	149	120	91
+30	245	216	188	159	130
			Boating		
-10	90	67	45	22	0
0	123	100	77	55	32
+10	155	133	110	87	65
+20	188	165	143	120	97
+30	220	197	175	152	130

Table 9. Estimated indexes of the demand for three major recreation activities at Miami Lake with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
		percent			
			Fishing		
-10	90	86	82	78	74
0	104	100	96	92	88
+10	118	114	110	106	102
+20	132	128	124	120	116
+30	146	142	138	134	130
			Camping		
-10	90	60	29	- 1	- 31
0	130	100	70	39	9
+10	171	140	110	80	49
+20	211	181	150	120	90
+30	251	221	191	160	130
			Boating		
-10	90	369	649	928	1,208
0	-179	100	379	659	938
+10	-448	-169	110	389	669
+20	-718	-439	-159	120	399
+30	-987	-708	-429	-149	130

Table 10. Estimated indexes of the demand for three major recreation activities at Storrie Lake with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
		percent			
			Fishing		
-10	90	95	99	104	109
0	95	100	105	109	114
+10	101	105	110	115	119
+20	106	111	115	120	125
+30	111	116	121	125	130
			Camping		
-10	90	88	86	84	82
0	102	100	98	96	94
+10	113	112	110	108	106
+20	126	124	122	120	118
+30	138	136	134	132	130
			Boating		
-10	72	80	54	35	17
0	118	100	82	64	45
+10	146	128	110	92	74
+20	175	156	138	120	102
+30	203	185	166	148	130

Table 11. Estimated indexes of the demand for three major recreation activities at Capulin Monument with changes in income and leisure

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
		percent			
			Sightseeing		
-10	90	90	89	89	89
0	100	100	100	99	99
+10	110	110	110	110	109
+20	121	121	120	120	120
+30	131	131	131	130	130
			Horse Racing		
-10	90	100	111	121	132
0	90	100	110	121	131
+10	89	100	110	120	131
+20	89	99	110	120	130
+30	88	99	109	119	130
			Fishing		
-10	90	100	111	121	131
0	90	100	110	121	131
+10	89	100	110	120	131
+20	89	99	110	120	130
+30	89	99	109	120	130

Table 12. Estimated indexes of the demand for three major recreation activities at La Mesa Racetrack with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of: -10	0	+10	+20	+30
		percent			
			Horse Racing		
-10	90	89	87	86	85
0	101	100	99	97	96
+10	113	111	110	109	107
+20	124	123	121	120	119
+30	135	134	133	131	130
			Fishing		
-10	90	107	124	140	157
0	83	100	117	134	150
+10	76	93	110	127	144
+20	70	86	103	120	136
+30	63	80	96	113	130
			Hunting		
-10	90	107	124	142	159
0	83	100	117	135	152
+10	75	93	110	127	145
+20	68	85	103	120	137
+30	61	78	95	113	130

Table 13. Estimated indexes of the demand for three major recreation activities at Red River with changes in income and leisure time (1969 = 100)

Changes In Income	Changes in Leisure Time of:				
	-10	0	+10	+20	+30
	percent				
			Camping		
-10	90	113	137	160	183
0	77	100	123	147	170
+10	63	87	110	133	157
+20	50	73	97	120	143
+30	37	60	83	106	130
			Hiking and Mountain Climbing		
-10	90	151	212	274	336
0	39	100	161	222	284
+10	- 12	49	110	171	233
+20	- 64	- 3	59	120	181
+30	-116	- 54	7	69	130
			Snow Skiing		
-10	90	170	251	332	413
0	19	100	181	262	342
+10	- 51	29	110	191	272
+20	-122	- 42	39	120	201
+30	-193	-112	- 32	49	130

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