PROCEEDINGS —

Twenty-second Annual Meeting

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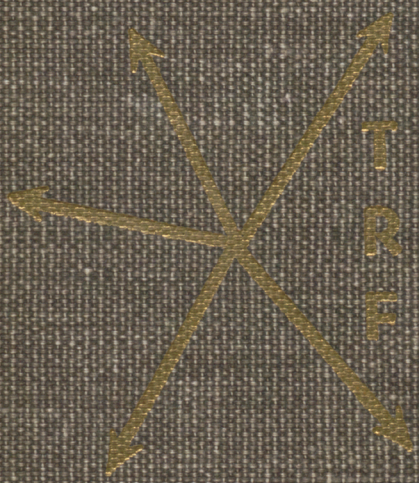

TRANSPORTATION RESEARCH FORUM

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Theme:

"Opportunities and Challenges in the New Environment of Transportation"

November 4-5-6, 1981
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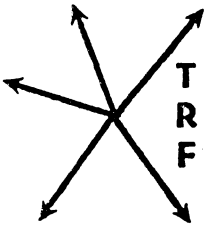

TRANSPORTATION RESEARCH FORUM

Impact of Energy Constraints on Outdoor Recreation Demands

by Robert S. Mealey and Milan Krukar***

I. INTRODUCTION

THE growing scarcity of cheap energy is fundamentally altering the way we live. Yet little is known about the nature and scope that these changes will bring, especially on recreation demands.

Several questions vital to public agency investments need to be answered. Appropriate public policy demands answers to the following questions: (1) How will people reduce their recreation demands as fuel costs increase?; (2) By how much?; (3) Who will suffer the most?; and (4) How will people adjust to a world in which travel becomes increasingly expensive?

Efficient allocation of scarce public resources depends on answers to these questions and their mitigation into recreation planning, recreation investment, and management policies.

II. PURPOSE OF STUDY

This study examines the sensitivity of various recreation activities under alternate energy assumptions. The analysis examines the economic character of different recreation demands, develops measures of price and supply elasticities, and provides inferences about how the recreating public will alter their recreation preferences. Policy implications are discussed. Data from King and Snohomish Counties in Washington State were used to answer how and which recreational activities would be most affected under six energy scenarios—three market place and three rationing scenarios.

III. STUDY AREAS

The recreation areas examined were King and Snohomish Counties in the State of Washington.[1] Both are considered to be part of the Puget Sound Region and have common borders. King County with 1,241,200 people, is the most populated region in Washington.[2] The City of Seattle and its suburbs are located here. This is a rapidly growing area as is the Everett-Seattle-Tacoma-Olympia population corridor. Seattle is the economic and cultural center for most of Washington. King County is the location for the University of Washington, the Boeing Aircraft Company, and for many high technology industries. The area also contains many recreation opportunities in the nearby Cascade Mountain Range, surrounding lakes and rivers, and the Puget Sound. The county's large urban population makes it a major generator of recreation demands as well.[3]

Snohomish County, which is north of King County, is a rural area. It is economically dependent upon farming and forest products. The population is 283,700.[2] The area's scenic attractions lures many out-of-county tourists. The county generates little internal recreation demand.[4] King and Snohomish Counties characteristics are similar elsewhere where populated, highly-industrialized counties border less populated rural counties. Recreation demand information developed from data obtained from these two counties can be applied to similar situations elsewhere.

IV. LIMITATIONS ON RECREATION RESEARCH

It is somewhat surprising that there have been few attempts to evaluate the impact of higher energy costs on particular travel demands—especially discretionary travel demands. The reason for this lack of attention is because usable information on leisure time travel demands does not exist. This is especially true for recreation.

Recreation data is fragmented, frequently of questionable quality, much of it is inaccessible, and only a small portion of it finds its way into general use. When recreation information is borrowed from another agency, considerable expense may be associated with searching for the data, reformatting the data, and adjusting the data. Recreation information is: (1) scattered; (2) difficult to locate; (3) difficult for anyone other than the collecting agency to use; (4) of random quality and uniformity; and (5) of limited scope.[5]

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These data problems have handicapped the use of empirical information in recreation planning and resource allocation decisions; they have added to the resource allocation bias against recreation.

V. MODEL

A. Description

The impact of rationing and higher travel cost environments are evaluated using two models—a recreation use model and an energy impact model. These models are shown in Table 1. This first model utilizes a system approach in which historical recreation demand trends were estimated for all counties in the Northwest simultaneously. The energy model was based on an econometric estimation of the prict effects on recreation demands. The recreation use model provides baseline projections for 15 recreation activities. These activities are outdoor games, walking-hiking, bicycling, picnicking, swimming, fishing, horseback riding, boating, sightseeing, sport-cultural events, snow activities, golf, camping, hunting, and water skiing.

TABLE 1

RECREATION USE AND ENERGY IMPACT MODELS*

1. Recreation Use Model:

$$T_{ij} = \frac{P_i * A_j * F_{ij}}{\sum F_{ij} * A_j}$$

2. Energy Impact Model:**

$$T_{ijk} = \alpha_k * G_{jk}^{\delta o} * P_{ijk}^{\delta l} + E$$

where:

- T_{ij} = recreation demand occurring between zones i and j,
- P_i = number of recreation occasions produced at zone i,
- A_j = number of recreation occasions attracted to zone j,
- F_{ij} = the impedance between zones i and j,
- T_{ijk} = recreation occasions responding to changes in the number of occasions produced in zone i and sent to zone j for activity k,
- α_k = constant,
- G_{jk} = the number of occasions generated in zone j for activity k,
- P_{ijk} = the price for an activity occasion produced in zone i and sent to zone j for activity k,
- δo, δl = parameter coefficients, and
- E = random error term.

*These are general form equations.
**An equation using this model was developed for each of the 15 outdoor activities.

These projections are based on a series of inputs including population, impedance values, measures of recreation attractiveness, and generated demand estimates. Estimates of generated demand come from comprehensive recreation surveys conducted in Idaho,[6,7] Oregon,[8] and Washington.[9] Recreation attraction estimates were derived from a combination of empirical information including climate, topographical features, access to water resources, facility development, proximity to population centers, fish and wildlife resources, recreation use, and the judgment of recreation and resource experts throughout the Northwest.

The recreation use model projects recreation demands from a 1975 base year. Projections were made at 10-year intervals—1980, 1990, and 2000 for each county in the region, including King and Snohomish Counties. These projections divided recreation demands into five groups: (1) recreation occasions from other counties; (2) occasions sent to other counties; (3) intra-county occasions; (4) total occasions received; and (5) total occasions produced.

These projections consider the impact of energy shortages only implicity. To directly account for alternative energy futures, the recreation use model projections were run through an energy impact model. This is an econometric model that takes into account a number of factors including: generated demands; county origin and destination; interactions; travel costs; and fuel cost estimates discounted by efficiency improvements and income gains. The energy impact model builds on the recreation use model. It incorporates an energy component that explicitly considers assumptions about: (1) the rate at which fuel costs will rise; (2) compliance with fuel efficiency standards; and (3) economic growth.

Two environments were examined—pricing and rationing.[10] Two boundary conditions for each environment reflecting optimistic and severe energy expectations were used. These scenarios put

into prospective energy constraints on recreation demand in King and Snohomish Counties. The third scenario is the moderate alternative. These energy scenarios are examined under two environments—a rationing and a market system. The marketplace environment is described in energy scenarios 1, 2, and 3[11] and the rationing environment in energy scenarios 4, 5 and 6. They are defined in Table 2.

B. Concept of Elasticities

Two measures of elasticity were developed, one under a pricing environment and the other in a rationing environment. Price elasticity is defined as the percent change in activity occasions divided by the percent change in travel costs. The rationing elasticity is defined as the percent change in individual county recreation demands divided by the percent change in regional recreation demands. These are shown in Table 3.

Elasticity is an empirical measure of the responsiveness of the quantity demanded to changes in price or supply availabilities. The concept of price elasticity enables one to measure the extent to which the amount demanded will respond to changes in prices. It is defined as the ratio of the percentage change in the quantity demanded to the percentage change in real price that is responsible for the change in quantity demanded when "other things are given," and when the change in price approaches zero.

VI. RESULTS

A. Pricing Environment

i. Price Elasticity Coefficients

Table 4 shows the sensitivity of recational activities to price. Of the 15 activities examined, six were highly price-sensitive, four were moderately price-sensitive, while five were relatively insensitive to price changes. Overall the price elasticity coefficients were similar for both King and Snohomish Counties.

Table 5 shows the range of price elasticities for high, moderate, and low price-sensitive recreation activities. The range of low to high elasticities for highly price-sensitive recreational activities for King and Snohomish Counties are −1.21 to −1.77 and −1.18 to −1.75, respectively; moderate price-sensitive recreational activities are −0.96 to −1.08 and −1.02 to −1.13, respectively; and low price-sensitive recreational activities are −0.80 to −0.98 and −0.82 to −0.89, respectively.

TABLE 2

DEFINITIONS OF SCENARIOS

SHORTAGE ASSUMPTIONS

Scenarios	Magnitude of Supply Constraints: % Reduction in Demand[1]	Magnitude of Real Price Increase (Fuel): % Annual Rate of Increase	Government Involvement
#1[2]	—	— 1.0	Decontrolled Pump Price
#2[3]	—	0.5	Decontrolled Pump Price
#3[4]	—	1.75	Decontrolled Pump Price
#4	10	—	Rationing
#5	20	—	Rationing
#6	30	—	Rationing

(1) Reduction in recreation occasions.
(2) Assumes major technological breakthroughs in energy.
(3) Recognizes conservation efforts and technological advances will slow fuel prices.
(4) All efforts become effective only during the last decade of the century.

TABLE 3

DEFINITIONS OF ELASTICITIES

1. Price Elasticity: $E_p = \frac{\%\triangle \text{ Activity consumption}}{\%\triangle \text{ Travel Costs}}$

2. Ration Elasticity $E_r = \frac{\%\triangle \text{ Individual County Recreation Demands}}{\%\triangle \text{ Regional Recreation Demands}}$

ii. Highly Price-Sensitive Activities

Recreation activities especially sensitive to increasing travel costs include: outdoor games; walking-hiking; bicycling, picnicking; swimming; and fishing. These activities have the following characteristics: (1) they are for the most part day-use activities; (2) accommodated by urban and rural environments; (3) relatively inexpensive; (4) cut across all levels of society; and (5) offer experiences which are interchangeable with many other recreation activities.

iii. Low Price-Sensitive Activities

Recreation activities relatively insensitive to changes in travel costs include: snow activities, golf, camping, hunting, and water skiing. These activities differ from price-sensitive activities in several important aspects. They are most often: (1) accommodated in non-urban environments; (2) relatively expensive; (3) participation is limited; (4) offer unique recreational experiences; (5) require special equipment; and (6) special facilities and resources.

iv. Moderately Price-Sensitive Activities

Several recreation activities fall between the very price sensitive and insensitive groups. These activities share some of the characteristics of both extremes. These are: horseback riding,

TABLE 4

PRICE-SENSITIVITY OF VARIOUS RECREATIONAL ACTIVITIES

Price-Sensitivity	Recreational Activities	Price Elasticity Coefficients		
		King Co.	Snohomish Co.	Average
High	Outdoor Games	—1.692	—1.750	—1.72
	Walking-Hiking	—1.773	—1.175	—1.47
	Bicycling	—1.296	—1.289	—1.29
	Picnicking	—1.210	—1.210	—1.21
	Swimming	—1.176	—1.243	—1.21
	Fishing	—1.214	—1.220	—1.22
Moderate	Horseback Riding	—1.005	—1.109	—1.06
	Boating	—1.018	—1.130	—1.07
	Sight-seeing	—1.078	—1.070	—1.07
	Sport-cultural Events	—0.964	—1.019	—0.99
Low	Snow Activities	—0.982	—0.893	—0.94
	Golf	—0.924	—0.947	—0.94
	Camping	—0.843	—0.868	—0.86
	Hunting	—0.796	—0.831	—0.81
	Water Skiing	—0.809	—0.821	—0.81

TABLE 5

RANGE OF PRICE ELASTICITIES FOR HIGH, MODERATE AND LOW PRICE SENSITIVE RECREATION ACTIVITIES

Price-Sensitivity Recreational Activities	Price Elasticity Coefficient	
	King County	Snohomish County
High	—1.21 to —1.77	—1.18 to —1.75
Moderate	—0.96 to —1.08	—1.02 to —1.13
Low	—0.80 to —0.98	—0.82 to —0.89

boating; sight-seeing; and sport-cultural events.

B. Rationing Environment

i. Variables Affecting the Rationing Equipment

In a rationing scenario, mandatory allocation measures reduce the amount of fuel available for one's travel needs. Some travel demands such as those associated with one's livelihood are necessary, hence making all other travel discretionary. Leisure time activities can be so classified. Thus, fuel rationing will affect the quantity of recreational opportunities demanded. However, just as in a pricing environment, reduction in recreation demands will not affect all activities equally. Some recreation demands will be affected more under rationing than others. Several factors are important in determining how particular recreation demands will react under a rationing scenario. These are energy consumption of an activity, and the uniqueness of a resource.

ii. Rationing Elasticity Coefficients

Recreation activity demands are less sensitive to rationing constraints. Of the 15 activities examined, three were highly rationing-sensitive, six were moderately rationing-sensitive, while six were relatively insensitive to rationing changes. These are shown in Table 6.

Table 7 shows the range of rationing elasticities for high, moderate, and low rationing-sensitive recreation activities. The range of low to high elasticities for highly rationing-sensitive recreational activities for King and Snohomish Counties respectively are —0.67 to —0.88 and —0.60 to —0.90; moderate rationing-sensitive recreational activities are —0.36 to —0.56 and —0.28 to —0.47, respectively; and low rationing-sensitive recreational activities are —0.14 to —0.22 and —0.10 to —0.17, respectively.

iii. Highly Ration-Sensitive Activities

Activities affected most by rationing limitations include: camping; sight-seeing; and snow activities. These activities are travel dependent and are energy consumptive. They typically involve longer trip distances, and vehicles which are relatively fuel efficient. People travel farthest to camp and sightsee; average trip lengths for these activities exceed 160 minutes, approximately 147 miles. Campers also are prone to travel in a variety of vehicles including: camper pickups; motor homes; vans; station-wagons; and car-trailer combinations, all of which does little to improve one's fuel economy. The average rationing elasticities for this group ranges from —0.64 to —0.89. None of these activities are highly sensitive.

iv. Low Ration-Sensitive Activities

The average elasticity coefficients for this group range from —0.12 to —0.20. Activities which are not as sensitive to rationing constraints generally involve little travel. Outdoor games, horseback riding, golf, and bicycling all occur close to home. Frequently these demands are accommodated in or near recreation areas. Excluding water skiing and swimming, the average trip length for supply-sensitive demands averages 69.7 minutes or 64 miles.

Water skiing and swimming demands have relatively long trip lengths, yet are relatively insensitive to supply constraints. The relative importance of water resources in King and Snohomish Counties may explain this divergence.

C. Price Versus Rationing

People participating in outdoor recre-

TABLE 6

RATION-SENSITIVITY OF VARIOUS RECREATIONAL ACTIVITIES

Supply-Sensitivity	Recreational Activities	Rationing Elasticity Coefficients King Co.	Snohomish Co.	Average
High	Camping	—0.880	—0.904	—0.89
	Sight-seeing	—0.857	—0.821	—0.84
	Snow Activities	—0.671	—0.603	—0.64
Moderate	Walking-Hiking	—0.555	—0.471	—0.51
	Fishing	—0.441	—0.329	—0.39
	Hunting	—0.385	—0.384	—0.38
	Picnicking	—0.454	—0.275	—0.36
	Boating	—0.372	—0.280	—0.33
	Sporting-Cultural Events	—0.356	—0.306	—0.33
Low	Water Skiing	—0.220	—0.174	—0.20
	Outdoor Games	—0.194	—0.116	—0.16
	Horseback Riding	—0.180	—0.160	—0.17
	Golf	—0.180	—0.134	—0.16
	Bicycling	—0.151	—0.113	—0.13
	Swimming	—0.139	—0.102	—0.12

ation activities will react differently in pricing and rationing environments. Each environment greatly influences: (1) the level of participation; (2) the activities people choose to enjoy; (3) the tradeoffs they make; and (4) the destinations they select. Our analysis of recreation demands in King and Snohomish Counties suggests the following conclusions:

1. Price has a much greater impact on recreation decisions than rationing. For example, a 10% increase in price results in an 8% to 17% decrease in various demands. To generate a similar degree in creation demands in a rationing environment, it would be necessary to reduce supply by 9% to 50%.
2. This lack of sensitivity suggests that in a rationing environment people are less apt to change their travel preferences. With an assured supply of fuel people will maintain longer trip destinations. A comparison of elasticities under price and rationing environments suggests that the greatest substitutions occur in response to price changes. The extreme decline in out-of-county day use activities reflect in part the substitution of destination areas close to home. In contrast, out-of-county day use demands remained relatively unchanged in a rationing environment. People were less willing to substitute shorter distance destinations.
3. In a pricing environment the composition of recreation activities will change radically. Out-of-county recreation demands will become increasingly dominated by travel dependent activities such as camping, hunting, water skiing, and snow activities. Out-of-county day use activities will diminish in comparison. In a rationing environment people will make the same kind of substitution. However, these substitutions will occur far less under rationing than price environments. Out-of-county day use will take a larger share of total tourist demands.
4. Out-of-county tourism will decline dramatically. But, total recreation demands in King and Snohomish Counties will not dry up and blow away. Thanks to a counter-balancing effect, recreation demands may actually increase. County residents will react in much the same way as out-of-county visitors. In 1975, King County sent out 5,203,300 visitors to other counties or 14.6% more than the county received. Consequently, higher energy prices may sharply increase county resident demands, especially for day use activities. This effect is the result of the area's position as a net exporter of recreation demands and the destination substitutions of area residents.

TABLE 7

RANGE OF RATIONING ELASTICITIES FOR HIGH, MODERATE AND LOW RATONING SENSITIVE RECREATION ACTIVITIES

Supply Sensitivity Recreational Activities	Rationing Elasticity Coefficients King County	Snohomish County
High	—0.67 to —0.88	—0.60 to —0.90
Moderate	—0.36 to —0.56	—0.28 to —0.47
Low	—0.14 to —0.22	—0.10 to —0.17

VII. POLICY IMPLICATIONS

A. Pricing Environment

Under a pricing environment, more people will stay closer to home than under a rationing environment. Recreation activities will occur near population centers. Counties further away from population centers will lose recreation visitors and income. Recreation-service industries, such as restaurants and motels, will be among the most affected. The mix of activities will change, becoming more oriented towards day use recreation facilities. Recreation trip frequencies will decrease.

Recreation demands will be concentrated near populated areas: in Washington, around the Puget Sound area; in Oregon, in the Willamette Valley and Pacific Coast beaches; in Idaho, near Boise.

Recreation investment priorities recognizing these location shifts would also reflect an emphasis on day use recreation activities. If the goal of resource agencies and private firms is to minimize risk then the results of this study suggest that recreation investments should be made in relatively price inelastic recreation activities. Investment strategies designed to minimize risk, however, may not accommodate recreation demands experiencing the largest shifts in location preferences.

B. Rationing Environment

Under a rationing environment, one's choice of travel destination is less affected. There will be less of a shift in recreation activities from historical uses. Supply constraints must affect the frequency of trips. Recreation investment priorities should focus on where and what kind of investments. A rationing environment also suggests that recreation investments should be made near populated centers.

C. National Implications

The elasticities shown here can be generally applied to similar areas elsewhere. An important observation is that short-run elasticities for total travel demand range from —0.07 to —0.35.[12] While recreation travel demand elasticities are above —0.80. This suggests the following: (1) recreation travel will be affected to a far greater extent than other travel demands; (2) the induced substitution effects will result in a redistribution of recreation and associated economy activity nearer to urban areas; (3) this shift in recreation preferences will result in reduced energy consumption; and (4) the initial and most dramatic energy savings in transportation will occur in recreation-related travel demands.

VIII. OTHER STUDIES

Empirical evidence in 1979 based on tourist visitors to Oregon and Washington parks and recreation areas suggests that people are most concerned about the availability of energy supply and gasoline prices.[13] If motorists are assured of adequate gasoline supplies along the way then prices become the major determinate factor of recreation trip frequency, trip length, and destination location. Tourism in 1979 was down in Oregon and Washington due to a combination of rapid gasoline price increases and perceived gasoline shortages.[14] The combination sharply reduced the number of out-of-state visitors and their expenditures in the state, especially to out-of-way places.

Surveys done in Colorado suggest that recreation demand would not fall off under energy rationing as much as under a pricing scenario.[15] Recreation demands appear to be more sensitive to energy prices than to energy supply. Respondent answers to this survey seem to verify the findings of this paper.

A recent study done on projected rec-

reation demands for North-Central Idaho found similar sensitivity measures.[16] The estimated elasticity coefficients were somewhat lower than those found in this study. This difference was related to the rural character of the area, its remoteness, the local character of the out-of-region recreation and the limited number of surrogate recreation opportunities.

A University of California, Berkeley study on the effect of energy shortages on recreation activities shows that for outdoor activities, elasticities were in the range found in this study.[17] It appears that the study findings have validity.

APPENDIX A

DOCUMENTATION FOR THE ENERGY IMPACT MODEL

Activity	County	Production (G_{jk})			Price (P_{ijk})			Equation	
		δ_0	Statistical Values S.E.	t	δ_1	Statistical Values S.E.	t	R^2	F
Camping	King	0.88	0.029	30.5	-0.84	0.062	13.7	0.92	798
	Snohomish	0.90	0.026	35.0	-0.87	0.060	14.5	0.93	985
Picnicking	King	0.45	0.056	8.1	-1.21	0.124	9.7	0.57	95
	Snohomish	0.31	0.055	5.6	-1.21	0.131	9.2	0.48	65
Swimming	King	0.14	0.052	2.7	-1.18	0.140	8.5	0.40	46
	Snohomish	0.10	0.045	2.3	-1.24	0.130	9.5	0.42	51
Sight-seeing	King	0.86	0.049	17.5	-1.08	0.101	10.7	0.76	225
	Snohomish	0.82	0.050	16.4	-1.07	0.113	9.5	0.73	118
Fishing	King	0.44	0.072	6.2	-1.21	0.153	8.0	0.51	73
	Snohomish	0.33	0.066	5.0	-1.22	0.152	8.0	0.46	59
Boating	King	0.37	0.059	6.3	-1.02	0.149	6.8	0.44	56
	Snohomish	0.28	0.052	5.4	-1.13	0.143	7.9	0.45	57
Water Skiing	King	0.22	0.036	6.1	-0.81	0.103	7.8	0.44	55
	Snohomish	0.17	0.033	5.3	-0.82	0.102	8.1	0.41	50
Walking-Hiking	King	0.56	0.044	12.6	-1.77	0.119	14.9	0.71	176
	Snohomish	0.47	0.044	10.8	-1.75	0.129	13.5	0.66	135
Hunting	King	0.38	0.046	8.3	-0.80	0.105	7.6	0.56	91
	Snohomish	0.38	0.044	8.7	-0.83	0.108	7.7	0.56	89
Outdoor Games	King	0.19	0.058	3.4	-1.69	0.144	11.7	0.55	87
	Snohomish	0.12	0.046	2.5	-1.75	0.125	14.0	0.61	110
Bicycling	King	0.15	0.049	3.1	-1.30	0.142	9.1	0.41	49
	Snohomish	0.11	0.041	2.7	-1.29	0.130	9.9	0.43	54
Golf	King	0.18	0.046	3.9	-0.92	0.130	7.1	0.38	43
	Snohomish	0.13	0.039	3.4	-0.95	0.120	7.9	0.38	43
Horseback Riding	King	0.18	0.041	4.3	-1.01	0.113	8.9	0.42	51
	Snohomish	0.16	0.038	4.2	-1.11	0.113	9.8	0.45	58
Sport-cultural Events	King	0.36	0.065	5.5	-0.96	0.143	6.8	0.38	43
	Snohomish	0.31	0.059	5.2	-1.02	0.141	7.2	0.38	93
Snow Activities	King	0.67	0.034	19.9	-0.98	0.084	37.0	0.80	278
	Snohomish	0.60	0.032	18.8	-0.89	0.087	10.3	0.76	223

FOOTNOTES

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