OUTDOOR RECREATION DEMAND AND SUPPLY: TRENDS AND IMPLICATIONS[1]

John C. Bergstrom and H. Ken Cordell[2]

Abstract.--The Renewable Resources Planning Act (RPA) requires that the U.S. Forest Service produce a comprehensive assessment of the demand and supply situations regarding forest and range products. Demand and supply trends for outdoor recreation were developed using a community-level household production and consumption framework. Results suggest that considerable shortages of many recreational activities will occur if recent past trends in the provision of recreational facilities and resources continues into the future. Potential shortages appear most pronounced for land-based activities. Shortages are also projected for certain water-based and snow and ice-based activities. In order to meet increased demand for outdoor recreation, additional provision of recreational facilities and resources is required. This provision can be achieved through more intensive management of existing public land, water, and snow and ice resources for outdoor recreation, acquisition of additional recreational areas, and increased public access to private lands.

INTRODUCTION

Assessment of outdoor recreation economic trends is a required component of the Renewable Resources Planning Act (RPA). For the 1989 RPA Outdoor Recreation Assessment, outdoor recreation economic trends were analyzed by comparing future changes in outdoor recreation demand and supply. This paper begins by defining outdoor recreation demand and supply, and showing conceptually how outdoor recreation demand and supply can be assessed using "gap" analysis. The general methodology for performing outdoor recreation demand and supply "gap" analysis is then discussed. Following this discussion, empirical estimation results are presented, and implications of these results for future outdoor recreation management are discussed. A summary and conclusions are offered in the final section.

BACKGROUND CONCEPTS

Recreation Demand and Supply

The quantity of outdoor recreation demanded and supplied in the United States can be measured in various ways. For most economic analyses, however, it is most appropriate to measure the quantity of outdoor recreation demanded and supplied in terms of trips (McConnell 1975). Outdoor recreational trips have characteristics of public goods. Thus, the demand and supply situation for outdoor recreational trips differs from the demand and supply situation for essentially private goods, such as timber. The primary difference is that outdoor recreational trips are somewhat intangible commodities, and production and consumption of trips occur within the same household. That is, a household acts as both producer and consumer of outdoor recreational trips or experiences.

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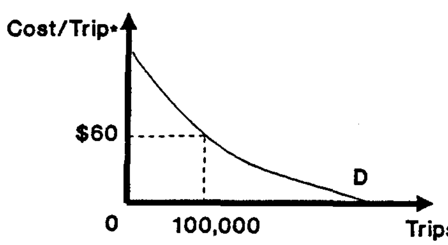
[2]Assistant Professor, Department of Agricultural Economics, University of Georgia, Athens, GA, and Project Leader, Outdoor Recreation and Wilderness Assessment Group, Southeastern Forest Experiment Station, U.S. Forest Service, Athens, GA.

As consumers, households demand and "consume" outdoor recreational trips. Outdoor recreation demand refers to the total number of trips a community of households is willing and able to take at various direct trip costs to themselves. The number of trips demanded at various costs are defined by an aggregate demand curve for outdoor recreational trips. For example, the aggregate demand curve in figure 1 indicates that at an average cost of $60 trip, a typical community would demand 100,000 activity k trips. Trip costs refer to the total costs of a two-way trip, including out-of-pocket expenditures (e.g., gasoline, food, supplies), fees (e.g., park entrance fees), and the opportunity cost of travel time (e.g., wages foregone in order to travel to a park). In general, as total trip costs increase, the number of trips demanded by a community decrease (Dwyer et al. 1977; Ward and Loomis 1986).

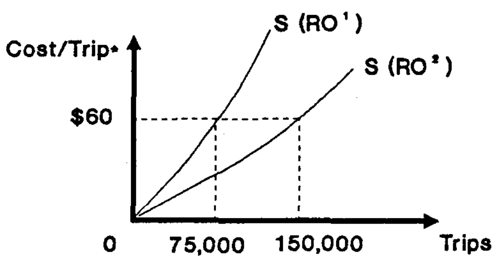
As producers, households combine travel, time, knowledge, equipment, supplies, and recreational sites and settings to "produce" recreational trips. The cost or price of producing a trip is given by total travel costs as defined in the previous paragraph (Bockstael and McConnell 1975; Cicchetti 1973). Outdoor recreational supply therefore refers to the total number of trips that can be produced by a community of households at various trips costs. The number of trips that can be produced or supplied at various trip costs are defined by an aggregate supply curve for outdoor recreational trips. For example, the aggregate supply curve in figure 2 labeled S(RO1) indicates that at an average cost of $60 per trip, a typical community can produce 75,000 activity k trips. The positive slope of the aggregate supply function implies that as trip costs increase (for example, as people drive further distances) more recreational opportunities are opened up to a community and the number of trips that can be produced or supplied increases.

Figure 1 -- Activity k Aggregate Demand Curve for a Typical Community



*Includes travel and time costs for a two-way trip

Figure 2 -- Activity k Aggregate Supply Curve for a Typical Community



*Includes travel and time costs for a two-way trip

The aggregate supply curve for a particular community is dependent on the number and location of recreational sites and facilities available to the community, or recreational opportunities. For example, the aggregate supply curve labeled S(RO1) in figure 2 is dependent on a fixed level of recreational opportunities denoted by RO1. Suppose a change in government policies results in increased funding for new recreational sites and facilities surrounding a community. As a result, recreational opportunities available to the community increase from RO1 to RO2. This increase in recreational opportunities will cause the aggregate supply function in figure 2 to shift out from S(RO1) to S(RO2). Given this new aggregate supply function, a typical community can now produce 150,000 trips at an average cost of $60 per trip.

Thus, provision of outdoor recreational trips to the public occurs in a two-step process. In the first step, public or private agencies, groups, or individuals provide recreational facilities and resources to the public. This first step represents the physical dimension of recreational trip supply. In the second step, households use these facilities and resources to produce or take trips. This second step represents the human dimension of recreational trip supply. Projections of the future supply of recreational trip opportunities must consider both of these supply steps or dimensions.

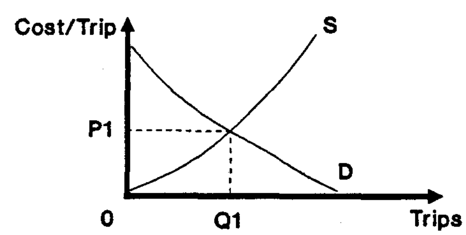
Recreation Equilibrium Consumption

The household market for outdoor recreation trips is composed of both the aggregate demand and supply curves as illustrated in figure 3. The intersection of the two curves defines the household equilibrium point between outdoor recreation demand and supply. At the household equilibrium point, the number of trips that a community demands at a certain cost are equal to the number of trips which the community can produce at that cost. In figure 3, for example, the household equilibrium point is given by point A. At point A, the aggregate demand curve indicates that a typical community demands Q1 trips at a cost of P1 per trip. Also at point A, the aggregate supply curve indicates that a typical community can produce or supply Q1 trips at a cost of P1 per trip. Thus, the number of trips demanded at a cost of P1 equals the number of trips that can be produced or supplied at that cost. Thus, P1 is a market-clearing cost or price since it causes outdoor recreation demand and supply to equilibrate. The number of trips consumed when outdoor recreation demand and supply are in equilibrium at a market-clearing cost or price defines equilibrium consumption of outdoor recreational trips (for example, Q1 in figure 3). figure 3 illustrates that the final level of trip consumption is a function of both demand and supply factors.

Demand and Supply "Gap" Analysis

Outdoor recreation "gap" analysis refers to quantitative assessment of the degree to which outdoor recreation demand is expected to exceed outdoor recreation supply over time. For the 1989 RPA Assessment, projections of future demand for outdoor recreation are expressed in terms of maximum preferred demand. Maximum preferred demand is defined simply as the number of outdoor recreational trips Americans would take if there were no shortages of opportunities and the cost or price of a trip remained what it is today.

Figure 3 -- Community-Level Household Market for Activity k Trips

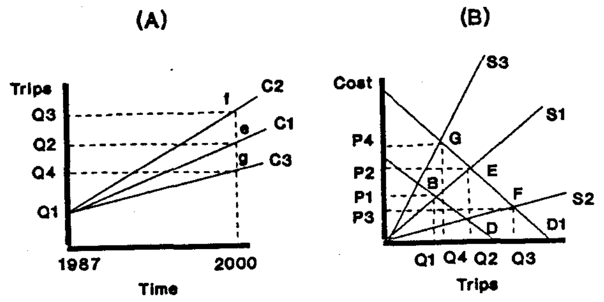


A change in maximum preferred demand over time is illustrated in figure 4. Suppose that the current recreation demand curve is given by D, and the current recreation supply curve is given by S1. Given these demand and supply curves, Q1 recreational trips would be consumed currently at a cost of C1 per trip. Now, suppose demand for recreation trips increases to demand curve D2 in the year 2000. Given this new demand curve, the public would desire or prefer to consume Q2 trips at the current cost of C1 per trip. The maximum preferred demand for recreational trip consumption in the year 2000 is therefore Q2 trips.

The availability of recreational facilities and resources may prevent the public from taking all of the trips they prefer as indicated by their preferred demand. It was assumed for the 1989 RPA Assessment that recent past trends in the provision of recreational facilities and resources would be continued into the future. That is, it was assumed that there would be no significant change either in the private market for outdoor recreation or in public policies (e.g., massive acquisition on new public park and forest lands) that would dramatically alter the availability of outdoor recreational facilities and resources.

Recall that the aggregate supply curve for recreational trips is dependent on the availability of recreational facilities and resources. Given the continuation of recent past trends, suppose that recreational facilities and resources for activity k are projected to increase from S1 to S2 the this increase in recreational opportunities, the aggregate supply curve for activity k trips in figure 4 will shift out from S1 to S2 by the year 2000. Given this new aggregate supply curve, household will be able to produce and consume Q3 trips in the year 2000. Hence, because trip production and consumption is constrained by the availability of recreational facilities and resources, a "gap" between preferred demand and expected supply in the year 2000 will occur. This gap or shortage is equal to the distance Q2 - Q3 in figure 4. In general, a recreation gap is defined as the amount by which the number of recreational trips Americans prefer to take exceeds that amount they are able to take given continuation of recent past trends in the provision of recreational facilities and resources.

Figure 4 -- Consumption Trend Lines Under Alternative Demand/Supply Scenarios



Alternatively, continuation of recent past trends could results in a decrease in activity k recreational facilities and resources. In this case, the aggregate supply curve would shift back from S1 to S3 in figure 4. Given this new aggregate supply curve and the new aggregate demand curve (D1), community households would be able to produce and consume only Q4 trips in the year 2000. The gap between maximum preferred demand and expected supply in the year 2000 would therefore widen by the distance Q2 - Q4 in figure 4.

ESTIMATION METHODOLOGY

Consumption Functions

As discussed in the previous section, equilibrium consumption of recreational trips is determined by both demand and supply factors. In order to estimate equilibrium consumption, the reduced form of the outdoor recreation demand and supply market system illustrated by figure 3 was determined. The reduced form provided a consumption function which predicted equilibrium consumption from demand and supply variables. This consumption function was specified as:

(1) LTCk = f(INC345, PCT18TMD, CCPOP86, PCTFARM, SUBEROS, RO)

where,

- LTCk = natural log of annual activity k trips consumed by a community
- INC345 = percent of community population with income greater than or equal to $30,000
- PCT18TMD = percent of community population age 18 to 32
- CCPOP86 = total community population 12 years old or older
- PCTFARM = percent of community population living on farms
- SUBEROS = substitute recreational opportunities that compete with activity k for recreation time and expenditures
- RO = recreational facilities and resources available for activity k

Equation 1 was estimated by regression analysis using a sample of 243 representative counties across the United States. Annual activity k trips from each county were obtained from data provided by the Public Area Recreation Visitors Study (PARVS). Socioeconomic variables (INC345, PCT18TMD, CCPOP86, and PCTFARM) were obtained from U.S. Census Bureau data. The activity k recreational opportunities variable (RO) and the substitute recreational opportunities variable (SUBEROS) were obtained from several recreational supply data sets maintained by the Outdoor Recreation and Wilderness Assessment Group, U.S. Forest Service, Athens, Georgia. Equation 1 was estimated for land, water, and snow and ice based recreational activities shown in Table 1.

Aggregate Demand Functions

In order to estimate recreation gaps, it was first necessary to estimate aggregate demand functions for outdoor recreational activities. The aggregate demand functions were specified as:

(2) LTDk = f(PRICE, INC345, PCT18TMD, CCPOP86, PCTFARM, SUBEROS, SUIT)

where,

- LTDk = natural log of annual activity k trips demanded by a community
- PRICE = average round-trip total cost of an activity k trip
- SUIT = average suitability of a site for activity k and all other variables are as defined for Equation 1.

Table 1.--Projected gap between maximum preferred demand and expected supply of outdoor recreational trips away from home, measured in percentage growth above the 1987 base number of trips, by decade to 2040.

Resource Category and Activity	Percentage of 1987 Trips														
	2000			2010			2020			2030			2040		
	D	S	G[1]	D	S	G	D	S	G	D	S	G	D	S	G
LAND	percent														
Wildlife observation	116	107	9	131	113	18	146	120	26	162	120	26	174	130	44
Primitive camping	114	108	6	127	115	8	140	122	18	154	130	24	164	134	30
Backpacking	134	124	10	164	144	20	196	165	31	230	185	45	255	198	57
Nature study	105	99	6	113	101	12	120	103	17	131	107	24	138	108	30
Horseback riding	123	114	9	141	125	10	160	135	25	177	144	33	190	149	41
Day hiking	131	123	8	161	144	17	198	168	30	244	198	46	293	229	64
Photography	123	115	8	143	128	15	165	141	24	188	154	34	205	163	44
Visiting prehistoric sites	133	127	6	160	148	12	192	173	19	233	203	30	278	236	42
Collecting berries	113	110	3	126	120	6	143	132	11	166	149	17	192	169	23
Cutting firewood	112	109	3	124	118	6	138	130	8	157	144	13	178	161	17
Walking	116	116	0	131	132	0	146	148	0	164	168	0	177	183	0
Running/jogging	133	131	2	163	160	3	197	192	5	234	229	5	262	260	2
Bicycle riding	125	124	1	148	146	2	173	170	3	202	197	5	222	218	4
Off-road driving	105	104	1	111	108	3	118	112	6	125	118	7	130	121	9
Visiting museums	118	118	0	136	134	2	153	152	1	174	172	2	188	187	1
Attending special events	114	115	0	127	129	0	141	144	0	157	161	0	168	175	0
Visiting historic sites	122	117	5	143	133	10	169	152	17	203	178	25	241	204	37
Pleasure driving	115	110	5	128	120	8	142	129	13	157	139	18	167	145	22
Family gatherings	119	121	0	135	139	0	152	160	0	170	182	0	182	202	0
Sightseeing	118	114	4	136	128	8	156	144	12	183	164	19	212	185	27
Picnicking	108	110	0	117	120	0	126	131	0	136	145	0	144	156	0
Developed camping	120	120	0	137	138	0	155	158	0	173	178	0	186	195	0
WATER															
Canoeing/kayaking	113	113	0	126	126	0	140	138	2	157	153	4	169	163	6
Stream/lake/ ocean swimming	105	108	0	110	118	0	117	128	0	124	140	0	129	152	0
Rafting/tubing	111	123	0	136	151	0	164	182	0	215	229	0	255	267	0
Rowing/sailing	112	110	2	124	120	4	136	130	6	150	142	8	159	150	9
Motor boating	106	107	0	111	114	0	117	122	0	123	131	0	127	138	0
Water skiing	111	112	0	121	122	0	131	132	0	141	144	0	148	152	0
Pool swimming	137	135	2	169	166	3	205	200	5	242	237	5	269	267	2
SNOW AND ICE															
Cross-country skiing	147	122	22	177	136	41	199	142	57	212	141	71	195	126	69
Downhill skiing	153	159	0	197	208	0	247	261	0	298	317	0	333	359	0

[1] D is the maximum preferred demand; S is the expected supply, and G is the percentage difference between demand and supply. D, S, and G are all expressed as percentages of the 1987 base number of trips. In the projection base year of 1987, demand is assumed to equal supply with zero gap.

Equation 2 was estimated using cross-sectional data for the same 243 representative counties identified for estimation of Equation 1. Annual activity k trips demanded by a community were obtained from PARVS. The cost variable, PRICE, was derived from travel distance data reported in PARVS. The suitability variable, SUIT, was derived from data provided by a survey of recreational site managers. Site managers were asked in the survey questionnaire to rank to suitability of their site for activity k on a scale from 0 (not suitable at all) to 10 (perfectly suitable). The semi-log functional form of both Equations 1 and 2 is recommended by previous studies. This functional form is theoretically consistent with recreation demand behavior and reduces hetereoskedasticity problems (Rosental et al. 1984; Ward and Loomis 1986; Ziemer et al. 1980). Equation 2 was estimated using regression analysis for the recreational activities shown in Table 1.

Estimation of Recreation Gaps

Estimation of recreation gaps involved several steps. First, changes in all right hand side variables of the aggregate demand curve except for price were projected for five future time periods; 2000, 2010, 2020, 2030, and 2040. Projections of income and population were provided by Wharton Econometrics. Projections of the right hand side variables were substituted into Equation 2 in order to solve for future demand functions in each future time period. The current cost or price of a trip was then substituted into the future demand functions to solve for maximum preferred demand in each time period.

The number of recreational trips which Americans can produce and consume in future time periods were estimated by first projecting changes in all of the right hand side variables of Equation 1. The same projections of INC345, PCT18TMD, CCPOP86, PCTFARM, and SUBEROS
used for the demand functions, were used in the consumption functions. Projections of the recreation facility and resource variable (RO), were based on continuation of recent past trends. Once projections for all right hand side variables were made, these projections were substituted into Equation 1 in order to solve for the number of trips Americans can produce and consume in each future time period, given changes in demand factors and recreational resource and facility constraints. These trip consumption estimates represent the expected supply of recreational trip opportunities.

In sum, projections of preferred demand indicate the number of recreational trips Americans would prefer to take in the future if the availability of recreational facilities and resources did not limit their opportunities nor increase trip costs. Projections of expected supply indicate opportunities for recreational trip production and consumption assuming that recent past trends in the availability of recreational facilities and resources are continued into the future. Because the units of measure (e.g., trips) were identical, potential gaps were identified by directly comparing expected supply and preferred demand projections. If preferred demand exceeded expected supply in a given year, a gap was identified and measured.

RESULTS AND IMPLICATIONS

Percentage growth projections for maximum preferred demand and expected supply for land, water, and snow and ice recreational activities are shown in Table 1. The percentage by which preferred demand exceeds expected supply, or the demand-supply gap expressed in percentage terms, is also shown in Table 1. The gaps presented in Table 1 should be read with caution; for example, continuation of recent past trends in the provision of recreational facilities and resources may by unlikely for some activities. However, analysis of the gaps provides insight on potential supply shortfalls warranting attention.

Absence of a gap is indicated by entries of "zero" in Table 1. The implication of a "no gap" situation is that past trends extended into the future will increase recreational facilities and resources at rates sufficient to meet preferred demand. A no gap situation is predicted over time for some land-based activities including developed camping, picnicking, family gatherings, walking, and attending special events. A no gap situation is also predicted for several water-based activities including stream/lake/ocean swimming, motorized boating, water skiing, and rafting. One snow and ice-based activity, downhill skiing, is predicted to have a no gap situation (again, assuming that past trends in the provision of downhill skiing facilities and resources will continue into the future which may be doubtful). Near zero gaps are predicted for the land-based activities of bicycling, running and jogging, and visiting museums. Also, near zero gaps are predicted for two water-based activities, canoeing and kayaking and pool swimming.

Relatively small to moderate gaps are predicted for the land-based activities of cutting firewood, collecting berries, and off-road driving. A relatively small to moderate gap is predicted for one water-based activity, rowing and sailing. For a number of land-based activities, relatively large gaps are predicted; included in these activities are primitive camping, backpacking, day hiking, horseback riding, wildlife observation, nature study, photography, pleasure driving, sightseeing, and visiting historic and prehistoric sites. A relatively large gap is also predicted for cross-country skiing.

Management Implications

Continuation of recent past trends in the provision of recreational facilities and resources implies an increase in opportunities for some activities, and a decrease in opportunities for other activities. Most generally, continuation of recent past trends will result in losses of remote, unroaded and roaded forest, farm, and range areas available for recreation. Developed recreation sites, which perhaps respond more readily to market forces, are likely to continue increasing. The sensitivity of expected supply to continuation of recent past trends in recreational facilities and resources varies across the various activities shown in Table 1. Thus, the severity of gaps or shortages varies considerably across activities which has implications for future resource management, research, and assistance.

Gaps are predicted for all three basic categories of recreational activities (land, water, and snow and ice). Gaps appear to most severe for warm-season trips to both unroaded and roaded undeveloped areas. In particular, shortages are predicted to occur most dramatically for trips to roaded, partially developed recreational areas. These areas provide opportunities for hiking, nature study, horseback riding, sightseeing, hunting, and most other general forms of land-based dispersed recreation. Shortages are most likely to occur on private and public recreational lands near population centers. Thus, expansion or more intensive management of these areas for outdoor recreation may need to occur to reduce predicted gaps. Providing adequate future opportunities for wildlife observation, day hiking, photography, pleasure driving, sight-seeing, and similar dispersed land-based activities would address a major portion (about 75%) of the predicted national shortages of outdoor recreation.

Gaps for developed land-based activities are generally small relative to gaps for dispersed land-based activities. One reason for this disparity is that supply of developed recreation sites may be more responsive to private market forces (e.g., as demand for developed camping increases, private campgrounds tend to increase). Because market forces may stimulate sufficient increases in private recreational facilities and resources for developed recreation, large long-run public investment to increase facilities and resources for developed recreation may be unnecessary.

Projected gaps for land-based recreation tend to overshadow gaps for water-based and snow and ice-based recreation. Even gaps for developed land-based recreation are much larger than projected gaps for water-based and snow and ice-based recreation. If recent past trends in the provision of recreational facilities and resources continues, there will be relatively small gaps for water-based recreation. Thus, there may be little need to concentrate resources on the increasing water-based recreational opportunities. Water-based activities requiring the most management attention appear to be pool swimming and nonmotorized lake and river activities (e.g., canoeing, kayaking). Continuation of recent past trends in the provision of snow and ice facilities and resources will result in shortages of primarily dispersed activities, such as cross country skiing. Thus, managers may need to consider means of increasing opportunities for dispersed snow and ice activities.

SUMMARY AND CONCLUSIONS

The Renewable Resources Planning Act (RPA) requires that the U.S. Forest Service produce a comprehensive assessment of the demand and supply situation for outdoor recreation in the United States. Outdoor recreation demand, supply, and consumption functions were developed using a community-level household production and consumption framework. These functions were estimated using a nationwide cross-sectional data set and used to predict gaps over time between preferred demand for recreational trips and the expected supply of recreational trips, assuming continuation into the future of recent past trends in the provision of recreational facilities and resources.

Results suggest that if recent past trends in the provision of recreational facilities and resources continues, gaps or shortages will occur for many recreational activities. Projected gaps are most severe for land-based activities. Compared to land-based activities, gaps for water-based and snow and ice-based activities are relatively small. Hence, it appears that a considerable share of the projected national shortages of outdoor recreation can be mitigated by increasing opportunities for land-based activities, particularly dispersed activities such as day hiking, wildlife observation, and sightseeing. Opportunities for selected water-based and snow and ice-based activities may also have to be increased in order to avoid shortages.

Provision of increased recreational opportunities can be achieved through several means. Existing public resources can be managed more intensively for outdoor recreation, and additional public recreational areas can be acquired to meet specific needs. Recreational opportunities can also be increased by providing more public access to private lands. Continuation of private land closure and leasing trends could seriously hinder efforts to meet outdoor recreation demand in the future. There is a need to determine methods for encouraging private land owners to provide public access to their land for outdoor recreation. In general, avoidance of future recreational opportunity shortages requires increased awareness of changing trends in outdoor recreation demand and supply, and increased attention to resource management, research, and technical assistance.

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