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Regional Demand and Supply Projections for Outdoor Recreation

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and H. Ken Cordell



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INTRODUCTION

The Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), requires the USDA Forest Service to conduct an assessment of national level economic trends in renewable resources, including outdoor recreation, every 10 years. The 1989 RPA Assessment of Outdoor Recreation and Wilderness (Cordell and others 1990) provided national estimates and projections of the demand for and supply of recreation trips for 31 activities.² National-level models, however, can obscure important regional differences in recreation

²Estimates and projections of wildlife and fish recreation were reported in Flather and Hoekstra (1989); however, this report includes the activity "wildlife observation."

preferences, travel behavior, population diversity and growth trends, demand trends, and availability of opportunities. Regional differences in recreation demands and trends also can have important implications for planning and programming at regional and subregional levels. This study, an issue analysis for the 1993 Update of the 1989 RPA Assessment, was designed to provide regionally disaggregated descriptions and projections of possible future recreation consumption and of the supply of recreation opportunities. The four regions of interest were the same as those defined for the 1989 RPA Assessment: North, Pacific Coast, Rocky Mountains and Great Plains (hereafter shortened to "Rocky Mountains"), and South (fig. 1).

Forest Service Regions and Assessment Regions



Figure 1.—Forest Service Regions and Assessment Regions.

STUDY OBJECTIVES

The principal objectives for the recreation resource opportunity portion of this study were to update key resource data used in the 1989 RPA Assessment, and to develop region-specific recreation opportunity effectiveness ratings. These objectives update measures of the effective supply of available outdoor recreation opportunities, and reflect regional differences in resource availability.

The primary objective of the recreation activity analysis was to adapt all projection models to regional bases. Two additional recreation activities not included in the 1989 RPA Assessment — sailing and snowmobiling — were modeled for the 1993 Update.

THEORETICAL BACKGROUND

DEMAND AND SUPPLY OF TRIPS

Research has shown that one appropriate conceptual model for studying recreation demand and supply is that of household trip production (Bockstael and McConnell 1981, Cordell and Bergstrom 1991). It is widely accepted that the most appropriate measurement unit for recreation demand analyses is the recreation trip (McConnell 1975, Cordell and Bergstrom 1991). Typically, trips are not traded in traditional economic markets. Instead, recreating households are both the producers and consumers of recreation trips. In the joint production/consumption process, households combine their time, skills, and knowledge with market inputs and existing recreation opportunities. Thus, for the household production model, both supply and demand of recreation trips are determined from the household's perspective (Becker 1965, Bockstael and McConnell 1981).

A primary objective of the Forest Service's RPA Assessment of Outdoor Recreation is to compare projected demand and supply of recreation trips. The supply side is represented by projected trends in trip production and consumption at future points in time, given expected constraints on land, water, and other resources available for recreation (Cordell and Bergstrom 1991). As resource availability changes, so will average trip prices, increasing as resources become more scarce. In this study, the projected "supply" of trips is synonymous with the projected number of trips that are **expected** to be produced and consumed. These projections have been labeled the "expected supply" of trips (Cordell and Bergstrom 1991).

Future demand for recreation trips is measured by the number of trips households would take if the future trip costs remain unchanged and resource availabilities are unconstrained. This measure, termed "maximum preferred demand" (Cordell and Bergstrom 1991), is interpreted as the number of trips households would **prefer** to take if trip costs remained constant into the future relative to the base year, 1987. Here, resource opportunities are assumed to grow or contract as necessary without constraint to meet changes in use and population so that trip cost and quality remain constant.

Although maximum preferred demand and expected supply both are predicted future consumption scenarios, the difference lies in the assumptions about future trip cost and recreation opportunity. Maximum preferred demand holds trip prices constant at the base year (1987) level, which, in turn, means that recreation resource availability is essentially unconstrained. Maximum preferred demand answers the question, "How many activity trips would American households demand given no change in their per trip cost?" Expected supply, in contrast, leaves trip prices unconstrained, but constrains the amount of resource based on an extension of recent past trends for 12 different recreation resource environments. For some resource environments, the trend indicates future growth; for others, it indicates decline. Expected supply answers the question, "How many activity trips would American households produce and consume if resources change at the same rate as recent past trends?"

For specified future years, projections of expected supply and maximum preferred demand are computed and compared. A "gap" or shortage occurs where projected demand for a specified year exceeds projected supply (Cordell and others 1990). Such a gap indicates that resource or cost constraints prohibit households from producing as many recreation trips as they would prefer to produce, if the relative availability of resources was unconstrained and trip costs unchanged from the base year condition. Reductions in the amount of resources available for recreation is a major factor determining costs of producing trips, primarily because households must travel greater distances to recreate or face reduced quality from congested sites.

Gaps are largest for those activities and regions where both recreation resource availabilities are projected to decline, thus reducing expected supply, and the effects of changes in population, income, and other household characteristics are projected to be relatively large, thus driving up maximum preferred demand. When the

projected supply equals or exceeds the projected demand, households will produce as many trips as they prefer, and no gap results. Gaps typically are minimal to nonexistent where the projected rate of resource growth is increasing enough to keep pace with increases in population and income.

RECREATION OPPORTUNITY INDEX

The Effective Recreation Opportunity Set (EROS) index is a measure of the general availability of recreation opportunities, and can be used in models of household demand and consumption of recreation trips (English and Cordell 1993). Common measures of recreation resources, such as raw facility counts or facilities per capita, have been shown to be inadequate (Harrington 1987). Economic concepts of recreation supply (Clawson 1984, Harrington 1987) are difficult to calculate empirically. Opportunity indices are effective measures of the joint spatial distribution of recreation opportunities and households (Fesenmaier and Leiber 1987; Kim and Fesenmaier 1990). EROS indices are based on this above research, and particularly on Harrington's (1987) 'effective price' measure, and opportunity indices.

A separate EROS index was calculated for each of the 12 recreation environments identified by Cordell and others (1990) for the 1989 RPA Assessment, four each within land, water, and snow and ice resources (table 1).

The household production model shows that recreation resources are one of several inputs to trip production. Households do not "buy" a site; but, they do pay a cost to acquire its use. Harrington's (1987) 'effective price' measures a recreation site's availability to a household. Effective price includes entry fees, travel costs in both money and time, and congestion costs in both queuing time and experience quality. Travel costs are the primary determinant of site availability, are specific to an origin-destination pair, and are assumed to increase with distance. Sites beyond some threshold distance become too expensive to use. Threshold distances vary by recreation setting (Cordell and English 1985). More specifically, threshold distances vary by activity. For example, a household may be willing to drive 10 miles or less to go sledding but would willingly travel several hundred miles for downhill skiing. However, the EROS indices are not activity specific, instead, they correspond to more general recreation environments or settings.

Trip quality declines as the number of users at a site increases, because of congestion and queuing (Harrington 1987). Converting quality decline to an equivalent price variation allows congestion to be treated as a cost. Congestion costs depend on the total number of people at the site. Numbers of users at a site depends on the location and size of population centers and other recreation sites within the appropriate threshold distance (Fesenmaier and Leiber 1987; Kim and Fesenmaier 1990).

EROS indices include travel costs and congestion components (English and Cordell 1993). County-level resolution for population and resource data drive the calculation method. Distance separating spatial units (counties) provides proxies for mean travel distance separating the units.

METHODS

RECREATION TRIP DEMAND AND SUPPLY

The 1993 Update used the same set of aggregate data that was used in the 1989 Assessment. The same methods used to develop national projections for the 1989 Assessment were applied to each of the four regions. The main differ-

Table 1.—Twelve types of recreation environments used as the basis for effective recreation opportunity set (EROS) indices.

Category	Description
Land	
EROS 1	Wilderness and remote backcountry, 3 or more miles from roads
EROS 2	Extensive undeveloped areas near roads, 1/2 to 3 miles
EROS 3	Roaded and partially developed areas, within 1/2 mile of roads
EROS 4	Developed sites
Water	
EROS 5	Wild and scenic or other remote lakes and streams, 3 or more miles from roads
EROS 6	Lakes or streams near roads, 1/2 to 3 miles
EROS 7	Partially developed lakes or streams with roads or crossings, within 1/2 mile of roads
EROS 8	Developed water sites
Snow/Ice	
EROS 9	Wilderness and other remote backcountry, 3 miles or more from roads
EROS 10	Extensive undeveloped areas near roads, 1/2 to 3 miles
EROS 11	Roaded and partially developed areas, within 1/2 mile of roads
EROS 12	Developed winter sports sites

Source: Cordell and others (1990)

ence between the 1989 RPA Assessment and the 1993 RPA Update was that projections of two key independent variables—population and household income—varied by region in this report. A brief summary of the model specifications, data sources, and theoretical background used in the 1989 Assessment (and repeated for the 1993 RPA Update) is presented here. Cordell and Bergstrom (1991) provide a more complete discussion.

Data

Individual survey data from the Public Area Recreation Visitor Study (PARVS) were aggregated to multi-county trip-generating regions containing at least 90 individual responses (Cordell and Bergstrom 1989). PARVS was a cooperative research effort involving more than a dozen federal and state natural resource agencies. Recreationists were interviewed at more than 250 public recreation areas nationwide. Aggregate, rather than household, data were used, because of the RPA goal of analyzing broad, nationwide trends in outdoor recreation. About 26,000 individual responses were used to create 239 aggregate observations for the 1989 RPA Assessment modeling. For each multi-county re-

gion, a single representative county was chosen (fig. 2), based on being the home county of a majority of the individual responses, or if no county had a majority, proximity to the region's geographic center. Recreation behavior was assumed to be homogeneous within a region; so, trips from all cases in the multi-county region were used to construct the dependent variable. For the 1993 Update, each representative county was assigned to the appropriate region.

For each activity, the number of trips per capita for all respondents within a region was multiplied by the representative county's population over age 11, to estimate the dependent variable, total annual activity k trips generated by the representative county. Projections of future demand and supply were calculated by inserting expected future values for independent variables into the estimated regression model equations and solving. For the 1993 RPA Update, regional estimates of population and household income provided by the Bureau of Economic Analysis (U.S. Department of Commerce 1991) were inserted in place of national estimates derived from U.S. Census Bureau data. This region-specific information assured that variation would exist between the regional projections of recreation demand and supply.

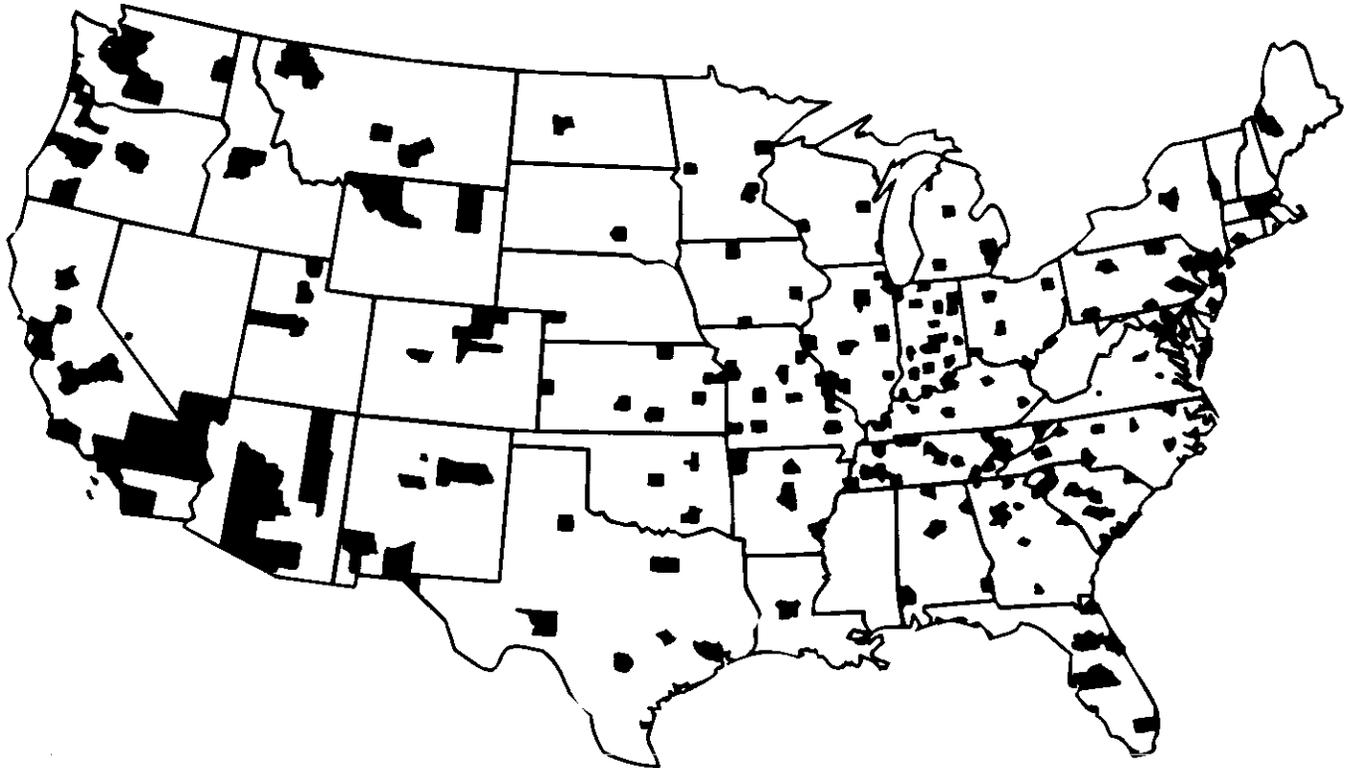


Figure 2.—Representative counties used in RPA Assessment modeling.

Model Specification

Supply

The supply of outdoor recreation trips is defined as the number of trips that households would actually produce/consume under household production theory. The general model of recreation consumption is:

$$\text{ATRIPS} = f(\text{SO}, \text{Z}, \text{S}, \text{RO}_k, \text{H}) \quad (1)$$

where

ATRIPS	=	annual number of trips for activity k consumed by a community,
SO	=	substitute recreation opportunities available to a community
Z	=	community population 12 years old and older
S	=	suitability of sites used for activity k
RO _k	=	recreation opportunities available to a community for activity k
H	=	community characteristics

Salient community characteristics shown in past research to be related to recreation consumption include income, age, and rural/urban residence. Measures of these variables were: percent of households with annual income of \$30,000 or more, percent of the population that was between the ages of 18 and 32, and percent of the population living on farms. The equation estimated for the 1989 Assessment and used in the 1993 Update analyses was:

$$\begin{aligned} \ln(\text{TRIPS}_{ki}) = & \beta_0 + \beta_1 \text{INC345}_i \\ & + \beta_2 \text{PCT18TMD}_i + \beta_3 \text{CCPOP86}_i \\ & - \beta_4 \text{PCTFARM}_i - \beta_5 \text{SUBEROS}_{ki} \\ & + \beta_6 \text{FACILITY}_{ki} * \text{SUTT}_{ki} \end{aligned} \quad (2)$$

where

TRIPS _{ki}	=	natural log of annual activity k trips consumed by representative county i,
SUBEROS _{ki}	=	index of recreation opportunities available to representative county i which are substitutes for activity k,
CCPOP86 _i	=	representative county population 12 years old and older,

SUTT _{ki}	=	mean suitability rating of all recreation sites visited by representative county i for activity k,
FACILITY _{ki}	=	quantity of recreation facilities relevant to activity k and available to representative county i,
INC345 _i	=	percent of households in representative county i with annual income of at least \$30,000,
PCT18TMD _i	=	percent of representative county i population age 18 to 32,
PCTFARM _i	=	percent of representative county i population living on farms

Substitute recreation opportunities (SUBEROS) and recreation resources and facilities (FACILITY) differed depending on the recreation activity being modeled; each activity model contained at least one unique facility or resource variable (table 2). Generally, resource variables were weighted by their suitability for the particular activity. A few resources, such as the number of outdoor swimming pools for outdoor pool swimming, and hourly ski lift capacity for downhill skiing, were perfectly suited to the respective activity and, therefore, were unweighted.

Each activity model was assigned a substitute recreation opportunities index variable (SUBEROS) coinciding with the environment in which the activity predominantly occurs. For example, backpacking was assigned SUBEROS1, wilderness and other remote lands, because most backpacking trips take place in wilderness and other extensive roadless areas. The SUBEROS index is the mean of those Effective Recreation Opportunity Set (EROS) indices whose resource categories are reasonable substitutes for the environment of the target activity. EROS indices are described in detail later in this report.

Community consumption functions estimated at the national level are shown in table 3. These are the consumption models estimated for the 1989 RPA Assessment that were used to predict expected supply (Cordell and others 1990; Cordell and Bergstrom 1991). Model coefficients were then used in deriving regional projections of the expected supply of recreation trips for the 1993 RPA Update.

Differences between 1989 RPA Assessment and 1993 RPA Update.—For the 1993 RPA Update, equations were not re-estimated for each region. To retain consistency with the 1989 RPA results, the same intercepts and coefficients estimated in 1989 were applied

Table 2.--Recreation resource and facility variables used in activity consumption functions.

Activity	R01	R02
	Land	
Developed camping	Federal road mileage converted to acres and federal and state land located within 1/2 mile of a road*	—
Picnicking	Federal and state land located within 1/2 mile of a road, and state forest land open to recreation*	—
Sightseeing	Federal road mileage converted to acres, and federal and state land located within 1/2 mile of a road*	—
Family gatherings	Federal road state, local and private camp-grounds*	—
Pleasure driving	Federal road mileage converted to acres, and federal and state land located within 1/2 mile of a road	—
Visiting historical sites	Federal road mileage converted to acres, and federal and state land located with 1/2 mile of a road*	—
Attending events	Federal road mileage converted to acres, and federal and state land located within 1/2 mile of a road*	—
Visiting museums	Federal road mileage (except for U.S. Army Corps of Engineers and Tennessee Valley Authority) converted to acres, National Recreational Trail mileage open to motorcycles converted to acres, and federal and state land located within 1/2 mile of a road*	—
Off-road driving	Federal road mileage converted to acres, and federal and state land located within 1/2 mile of a road*	—
Biking	Federal road mileage converted to acres, federal and state land located within 1/2 mile of a road, and state forest acres open to recreation*	—
Running/jogging	Federal road mileage converted to acres, federal and state land located within 1/2 mile of a road, and state forest acres open to recreation*	—
Walking	Federal road mileage converted to acres, and federal and state land located within 1/2 mile of a road*	—
Cutting firewood	Federal land located within 1/2 mile of a road, federal and state land located within 1/2 to 3 miles of a road, and acres of nonindustrial forest land open to recreation, both leased and nonleased*	—
Collecting berries	Industrial and nonindustrial forest lands*	—

(Continued)

Table 2.--(continued).

Activity	R01	R02
Visiting prehistoric sites	Federal road mileage converted to acres, federal and state land located within 1/2 mile of a road, federal and state land located within 1/2 to 3 miles of a road, and rural transportation use acres*	—
Photography	Federal and state land located within 1/2 mile of a road, and state forest acres open to recreation*	—
Day hiking	Federal and state land located within 1/2 mile of a road, federal and state land located 1/2 to 3 miles of a road, and federal wilderness*	—
Horseback riding	Federal and state land located within 1/2 to 3 miles of a road, and nonwilderness land more than 3 miles from a road	Miles of National Recreational Trails open to horseback riding
Nature Study	Acres of water in river/streams up to 660 feet wide, and acres of flat-water bodies	Federal and state land located within 1/2 mile to 3 miles of a road, nonwilderness land located over 3 miles from a road, and federal wilderness acres*
Backpacking	Federal and state land located within 1/2 to 3 miles of a road, nonwilderness land located over 3 miles from a road, and federal wilderness acres*	National Recreation Trail state park trail miles*
Primitive camping	Federal and state land located within 1/2 mile of a road, and state forest acres open to recreation*	—
Wildlife observation	Federal and state land located within 1/2 mile of a road, federal and state land located within 1/2 to 3 miles from a road, nonwilderness land located more than 3 miles from a road, federal wilderness acres, The Nature Conservancy acres, and state fish and game land*	Acres of water in rivers/streams up to 660 feet wide, acres of flat-water bodies, and acres of federal water bodies open to recreation*
Water		
Pool swimming	Public and private swimming pools, state parks with some swimming facilities, and tourist accommodations	—
Motorized boating	Acres of flatwater bodies and acres of federal water open to recreation	Number of boat ramps*
Water-skiing	Acres of flatwater bodies and acres of federal water open to recreation*	—
Rafting/tubing	Miles of federal wild and scenic rivers, miles of rivers designated by states as being significant for historic, cultural, scenic or recreational reasons, and miles of Bureau of Land Management recreation rivers*	Indicator variable for presence of mountains (0=no mountains; 1=mountains)*

(Continued)

Table 2.--(continued).

Activity	R01	R02
Canoeing/kayaking	Acres of flatwater bodies, and acres of water in river/streams up to 660 feet wide*	Canoe rental firms and canoe outfitters*
Rowing/paddling, etc.	Acres of flatwater bodies, acres of water in rivers/streams up to 660 feet wide, and acres of federal water bodies open to recreation*	—
Stream/lake/ocean swimming	Federal developed swimming areas*	Miles of public ocean beach*
Sailing	Number of boat ramps*	—
Snow and Ice		
Downhill skiing	Daily ski-lift capacity	—
Cross-country skiing	Federal and state lands located within 1/2 mile of a road, federal and state lands located within 1/2 to 3 miles of a road, and acres of rural transportation use*	—
Snowmobiling	Federal and state lands located within 1/2 mile of a road, federal and state lands located within 1/2 to 3 miles of a road, and acres of rural transportation use*	—

*Resource and facility variables are weighted by the average suitability of sites used by a community for an activity. Average suitability was derived from responses to a survey sent to site managers in which they were asked to rate suitability of the site, on a 10-point scale, across 16 representative outdoor recreational activities.

Source: Cordell and Bergstrom (1989)

across the four RPA regions for all activity models. Independent variable means were calculated by region, to estimate the aggregate regional expected supply of recreation trips. To do this, the 239 representative counties were disaggregated by region, such that each region had a representative sample of counties containing annual recreation trip information. These annual trips could be taken anywhere, either within the region or to other regions. For each region, trips consumed in 1987 served as the base year for an index of growth to the year 2040. Therefore, mean values of the independent variables in each region also were a base from which to multiply expected percentage changes in these variables for each of five planning years out to 2040. The primary difference in the analyses between the 1989 RPA Assessment and the 1993 RPA Update was that the latter included regional projections of the rate of growth

of population and household income in its calculations of expected supply, whereas the 1989 RPA Assessment used national projections of change in all of the independent variables in its calculations of expected supply. A limitation of the 1993 RPA Update is that no regional projections of change for the other independent variables—age, urban/rural residence, and resources/facilities—were available. For those variables the same national projections of rate of change were applied uniformly across the four regions.

Demand

In the 1989 RPA Assessment, demand for recreation trips was estimated based on the behavior and characteristics of the 239 representative counties. Recreation trip behavior was available from PARVS data, and

Table 3.—Estimated community-level consumption functions for outdoor recreation activities.

Activity	Parameter estimates (standard error)								N	Adjusted	
	INTERCEP	INC345	PCT18TMD	CCPOP86	SUBEROS	PCTFARM	RO1	RO2		F-value	R ²
Land											
Developed camping	8.253* (.750)	0.065* (.010)	0.084* (.033)	0.0000012* (1.34 E-07)	-0.060* (.014)	—	0.0000047* (.0000014)	—	239	49.488	.50
Picnicking	8.765* (.718)	.051* (.009)	.118 (.032)	.0000012* (1.30 E-07)	-.071* (.014)	—	.000044* (.00001)	—	239	54.607	.53
Sightseeing	10.885* (.633)	.024* (.009)	.108* (.027)	.0000010* (1.12 E-07)	-.045* (.012)	-0.189* (.018)	.0000019* (.000001)	—	239	80.838	.67
Family gatherings	8.604* (.777)	.062* (.010)	.087* (.037)	.0000013* (1.41 E-07)	-.060* (.013)	—	.00024* (.0001)	—	239	57.467	.54
Pleasure driving	9.579* (.727)	.061* (.01)	.103* (.032)	.0000012* (1.32 E-07)	-.058* (.014)	—	.0000036* (.000001)	—	239	51.895	.52
Visiting historical sites	8.755* (.663)	.039* (.009)	.135* (.029)	.0000012* (1.18 E-07)	-.054* (.012)	-.205* (.019)	.0000032* (.000002)	—	239	87.398	.68
Attending events	7.353* (.761)	.068* (.010)	.123* (.034)	.0000012* (1.37 E-07)	-.081* (.014)	—	.0000051* (.000002)	—	239	56.683	.54
Visiting museums	7.079* (.780)	.079* (.010)	.129* (.036)	.0000012* (1.44 E-07)	-.067* (.015)	—	.0000046** (.000002)	—	239	57.763	.54
Off-road driving	8.070* (1.155)	.037* (.015)	.099*** (.052)	.0000012* (2.10 E-07)	-.027 (.026)	—	.0000041 (.000008)	—	239	14.905	.23
Biking	7.238* (.874)	.098* (.011)	.132* (.039)	.0000013* (1.58 E-07)	-.042* (.016)	—	.0000027* (.000002)	—	239	53.677	.52
Running/jogging	6.913* (1.362)	.103* (.018)	.122** (.061)	.0000013* (2.46 E-07)	-.070 (.026)	—	.0000050* (.000002)	—	239	25.164	.34
Walking	8.647* (.777)	.075* (.010)	.134* (.035)	.0000013* (1.40 E-07)	-.062* (.014)	—	.0000039* (.000001)	—	239	58.998	.55
Cutting firewood	9.186* (.682)	.018** (.009)	.112* (.030)	.00000074* (1.21 E-07)	-.043* (.015)	—	.00012* (.000004)	—	239	53.924	.57
Collecting berries	8.255* (.796)	.019*** (.011)	.134* (.034)	.00000092* (1.42 E-07)	.032** (.013)	-.219** (.023)	.000022* (.000006)	—	239	55.490	.58
Visiting prehistoric sites	8.736* (.691)	.021** (.010)	.071** (.030)	.0000011* (1.23 E-07)	-.033 (.013)	-.230* (.020)	.0000027* (.000002)	—	239	77.633	.66
Photography	7.618* (.834)	.085* (.011)	.114* (.037)	.0000012* (1.50 E-07)	-.084* (.017)	—	.000055* (.00001)	—	239	59.638	.55
Day hiking	8.889* (.681)	.054 (.009)	.116* (.029)	.00000019* (1.21 E-07)	-.065* (.016)	-.194* (.016)	.000024* (.000006)	—	239	97.476	.71
Horseback riding	8.780* (1.02)	.050* (.014)	.033 (.047)	.0000010* (1.86 E-07)	-.088* (.022)	—	.000041* (.00001)	.00059* (.0003)	239	22.402	.35
Nature study	5.938* (.925)	.063* (.012)	.158* (.042)	.0000011* (1.69 E-07)	-.068* (.021)	—	.00706** (.003)	.000021** (.000008)	239	30.993	.43
Backpacking	6.030* (1.467)	.095* (.020)	.081 (.067)	.0000012* (2.66 E-07)	-.105* (.035)	—	.000062* (.00001)	.000000076*** (4.44 E-08)	239	21.337	.34
Primitive camping	7.320* (.788)	.056* (.010)	.094* (.035)	.0000011* (1.4 E-07)	-.076* (.018)	—	.000054* (.00001)	—	239	45.018	.48
Wildlife observation	7.910* (.729)	.068* (.010)	.106* (.033)	.0000011* (1.33 E-07)	-.066* (.017)	—	.000026* (.000007)	.00677* (.0022)	239	49.075	.55

(Continued)

Table 3.—(continued).

Activity	Parameter estimates (standard error)								N	Adjusted	
	INTERCEP	INC345	PCT18TMD	CCPOP86	SUBEROS	PCTFARM	RO1	RO2		F-value	R ²
Water											
Pool swimming	3.091* (1.199)	0.090* (.012)	0.058** (.036)	0.0000010* (1.43 E-07)	-0.023* (.014)	—	0.00143* (.0005)	0.109* (.015)	239	58.521	.59
Motorized boating	9.780* (.833)	.032* (.011)	.076** (.037)	.0000010* (1.44 E-07)	-.075* (.013)	—	.00120* (.0003)	.000219** (.00009)	239	31.265	.43
Water-skiing	8.229 (.903)	.045* (.012)	.080** (.040)	.0000011* (1.62 E-07)	-.054* (.015)	—	.00144* (.0004)	—	239	29.446	.37
Rafting/tubing	-12.760* (5.004)	.183* (.066)	.429*** (.223)	.0000012* (9.20 E-07)	-.041 (.094)	—	.000384* (.0001)	.9553** (.431)	239	6.431	.12
Canoeing/kayaking	5.007* (.958)	.072* (.013)	.140* (.043)	.0000010* (1.73 E-07)	-.038** (.015)	—	.01052* (.004)	.00158* (.0006)	239	33.973	.45
Rowing/paddling, etc.	6.392* (.919)	.066* (.012)	.123* (.041)	.0000010* (1.66 E-07)	-.062* (.015)	—	.000739** (.0003)	—	239	32.137	.40
Stream/lake swimming	9.258* (.827)	.039* (.011)	.104* (.030)	.0000011* (1.41 E-07)	-.066* (.013)	—	.000876* (.003)	.000622* (.0002)	239	43.275	.52
Sailing	3.618*** (1.897)	.117* (.025)	.112 (.084)	.0000016* (3.30 E-07)	-.030 (.030)	—	.000593* (.000008)	—	239	24.238	.33
Snow and Ice											
Downhill skiing	11.455* (2.146)	0.104* (.023)	-0.162** ^a (.068)	0.0000011* (2.74 E-07)	0.0013** (.0005)	-0.256* (.046)	.001086* (.0003)	—	239	41.848	.52
Cross-country skiing	7.570** (4.061)	.187* (.043)	-.248** ^a (.124)	.0000014* (5.06 E-07)	.0025* (.001)	—	.000033* (.000007)	—	239	23.268	.32
Snowmobiling	4.963 (4.730)	.093*** (.050)	-.129 ^a (.145)	.00000049 (5.90 E-07)	.0020*** (.001)	—	.000040* (.000008)	—	239	10.688	.17

*Significant at 0.01 level; **Significant at 0.05 level; ***Significant at 0.10 level

^aFor these activities, age variable was MEDAGE = median age of representative county population.

Source: Cordell and Bergstrom (1989), table 3, page 20

representative county characteristics were obtained from the Bureau of the Census' City and County Databook. The functional form of the community-level recreation demand model (Cordell and Bergstrom 1991), was:

$$ATRIPS^D = f(P, S, SO, Z, H) \quad (3)$$

where

- ATRIPS^D = annual trips demanded for activity k by a community
- P = cost or price of trips for activity k
- S = suitability of sites used for activity k
- SO = substitute recreation opportunities available to a community

- Z = population 12 years old and older
- H = characteristics

The estimated model for demand was:

$$\ln(TRIPS_{kij}) = \beta_0 - \beta_1 PRICE_{kij} + \beta_2 INC345_i + \beta_3 PCT18TMD_i + \beta_4 CCP86_i - \beta_5 PCTFARM_i - \beta_6 SUBEROS_{ki} + \beta_7 SUIT_{ki} \quad (4)$$

where TRIPS_{kij} is the natural log of annual trips for activity k demanded from representative county i to site j, PRICE_{kij} is the cost of trips for activity k from represen-

tative county i to site j , $SUIT_{kj}$ is the suitability of site j for activity k , and all other variables are as defined for the consumption function, eq. [2].³ Table 4 lists the national estimated community demand coefficients. The trip price coefficients and the regional trip price means were critical information in the calculation of maximum preferred demand (MPD) for each activity.

Differences between 1989 RPA Assessment and 1993 RPA Update.—MPD is the number of trips that households would prefer to consume, given constant trip costs and an unconstrained supply of recreation opportunities (Cordell and others 1990). Thus, MPD is a measure of recreation trip consumption similar to expected supply, but with different assumptions. The major difference is that MPD holds price constant at the base year (1987) level, while expected supply allows price to rise to the equilibrium point where the quantity of trips demanded is equal to the quantity of trips supplied. The MPD quantity of trips, therefore, results from shifts in demand and a fixed trip price. Further, no constraints are placed on recreation resources and facilities; a decrease in these would drive up trip costs. MPD uses current consumption of trips (1987) as the base-year starting off point, as does expected supply. The 1993 RPA Update improved on the MPD projections in the 1989 RPA Assessment by using regional calculations of current trip consumption, and regional trip price beta coefficients and means rather than national. A projection of MPD was calculated for each of the recreation activities in the four RPA regions, indexing the projected change back to the base year level of 100.

Projections

Expected Supply

Current regional trip consumption estimates provide a base for regional consumption projections, which are indexed to current levels. The indices are multiplied by an estimate of the actual number of trips taken for a given activity by the entire assessment region. Trip estimates were calculated separately and are described later in this report.

³To estimate trip costs, an allocation index was devised to allocate the reported annual activity k trips, having no site information, to the PARVS sites that were used by residents of each representative county and that were suitable for that activity. Each activity, therefore, had a unique sample size because of different origin-destination combinations. For a more complete discussion of the trips allocation index, see Cordell and Bergstrom (1989).

Regional projections of recreation trip consumption (i.e., expected supply) followed the same methods used for the 1989 RPA Assessment national-level consumption projections. Expected future levels of all independent variables were determined for five planning years: 2000, 2010, 2020, 2030, 2040. The expected future values were derived from anticipated percentage changes which were applied to the base year mean values of the independent variables. The only exception is the substitute recreation opportunities variable, SUBEROS. This variable was held constant at the 1987 base year level throughout the planning horizon under the assumption that substitute recreation opportunities would neither increase nor decrease. Coefficients in the models were assumed to not change over time.

The same projected changes in recreation resource and facility variables that were used in the 1989 RPA Assessment were applied uniformly across the four regions. This is a recognized limitation of the 1993 RPA Update. Ideally, resource projections would reflect regional variation. Nonetheless, these projections represent best estimates of resource change based on extending recent past broad-based national trends into the future. Table 5 lists projected percentage changes in the 12 categories of recreation and wilderness resources and uses (Cordell and others 1990). Resource and facility variables from the 31 recreation consumption models were assigned the expected percentage change of the resource category in which they best fit. For example, the resource variable "backpacking land" occurs primarily in the resource category, "Wilderness and other Extensive Roadless Areas". This individual variable is expected to change at the same percentage rate as the resource category—9% decline by 2000, 15% decline by 2010, etc.

The combination of projected future values for the independent variables and estimated coefficients allows projections of recreation consumption to the year 2040 for each activity. Regional variation in the baseline values for the independent variables and in the expected future values of population and household income enable regional projections. A growth index is calculated for each of the five planning years with 1987 as the base level. Projections are expressed in percentage change from this base.

Maximum Preferred Demand

Regional MPD projections were developed in the same manner as the regional expected supply projections. The demand model functional form, eq. [3], was

Table 4.—Estimated community-level demand functions for outdoor recreation activities.

Activity	Parameter estimates (standard error)								N	Adjusted	
	INTERCEPT	PRICE _{ijk}	INC345 _i	PCT18TMD _i	CCPOP86 _i	PCTFARM _i	SUBEROS _{ki}	SUIT _{ki}		F-value	R ²
	Land										
Developed camping	4.503* (.330)	-0.018* (.0004)	0.075* (.004)	0.088* (.014)	0.000011* (4.43 E-08)	—	-0.026* (.005)	0.122* (.016)	3161	509.337	.49
Picnicking	4.882* (.400)	-.050* (.0011)	.073* (.005)	.136* (.016)	.000014* (6.72 E-08)	—	-.027* (.006)	.093* (.016)	2883	522.744	.52
Sightseeing	7.016* (.248)	-.018 (.0003)	.029* (.003)	.081* (.010)	.0000088* (3.30 E-08)	-0.180 (.007)	-.028* (.004)	.204* (.010)	4538	954.731	.60
Family gathering	3.902* (.273)	-.023* (.0004)	.078* (.003)	.131* (.011)	.000011* (3.78 E-08)	—	-.040* (.005)	.146* (.012)	4179	838.602	.55
Pleasure driving	5.872* (.005)	-.036* (.001)	.076* (.005)	.077* (.017)	.000013* (6.61 E-08)	—	.017* (.007)	.159* (.016)	2877	347.847	.42
Visiting historic sites	6.780* (.303)	-.023* (.0005)	.024* (.004)	.088* (.013)	.0000079* (4.12 E-08)	-.200* (.008)	-.039* (.005)	.215* (.010)	3050	623.000	.59
Attending special events	4.214* (.317)	-.029* (.0007)	.072* (.004)	.112* (.014)	.000011* (4.77 E-08)	—	-.052* (.005)	.142* (.015)	3307	501.783	.48
Visiting museums	5.535* (.367)	-.023 (.0007)	.061* (.004)	.066* (.016)	.000011* (5.39 E-08)	—	.061* (.006)	.183* (.012)	2749	376.924	.45
Off-road driving	6.877* (.864)	-.044 (.004)	.013 (.011)	.083** (.036)	.000016* (1.82 E-07)	—	-.053* (.012)	.286* (.031)	800	55.331	.29
Biking	3.488* (.386)	-.031* (.001)	.116* (.005)	.123* (.017)	.000013* (6.20 E-08)	—	-.015* (.006)	.120* (.015)	2998	434.239	.46
Running/jogging	4.681* (1.100)	-.135* (.014)	.137* (.013)	.070*** (.047)	.0000021* (2.46 E-07)	—	-.009 (.017)	.171* (.047)	843	67.158	.32
Walking	5.001* (.310)	-.027* (.001)	.083* (.004)	.131* (.013)	.000012* (4.70 E-08)	—	-.034* (.005)	.147* (.012)	3534	581.972	.50
Cutting firewood	6.820* (.784)	-.032* (.004)	.036* (.014)	.177* (.033)	.0000075* (1.73 E-07)	.181* (.030)	-.060* (.011)	-.024 (.037)	506	42.010	.36
Collecting berries	5.556* (.800)	-.024* (.003)	.033* (.012)	.232* (.030)	.0000074* (1.31 E-07)	-.196* (.028)	-.072 (.010)	.048 (.034)	579	58.246	.41
Visiting prehistoric sites	7.595* (.441)	-.026* (.001)	.008 (.006)	-.012 (.019)	.000012* (7.55 E-08)	-.215* (.012)	-.016** (.007)	.175* (.014)	1935	220.036	.44
Photography	2.967* (.357)	-.022* (.0009)	.094 (.004)	.122* (.015)	.000012* (5.37 E-08)	—	-.024* (.006)	.198* (.016)	3128	402.231	.44
Day hiking	5.711* (.395)	-.039* (.001)	.064* (.005)	.108* (.016)	.000010* (6.86 E-08)	—	.004 (.006)	.083* (.015)	2656	414.921	.52
Horseback riding	4.498* (.431)	-.046* (.001)	.079* (.005)	.025 (.019)	.000013* (7.72 E-08)	—	-.031* (.007)	.223* (.017)	2688	316.176	.41
Nature study	1.634* (.397)	-.029* (.0009)	.079* (.005)	.156* (.017)	.000011* (5.84 E-08)	—	-.021* (.007)	.176* (.018)	3272	341.182	.38
Backpacking	3.237* (.515)	-.012* (.001)	.106* (.006)	-.006 (.022)	.000013* (7.59 E-08)	—	-.030* (.008)	.279* (.018)	2277	191.289	.33
Primitive Camping	3.819* (.344)	-.029* (.0007)	.069* (.004)	.072* (.015)	.000012* (5.20 E-08)	—	-.043* (.006)	.236* (.013)	2946	501.580	.50
Wildlife Observation	5.622* (.269)	-.022* (.0004)	.051* (.003)	.084* (.011)	.0000089* (3.73 E-08)	-.166 (.007)	-.008** (.004)	.181* (.012)	3940	712.564	.56

(Continued)

Table 4.—(continued).

Activity	Parameter estimates (standard error)								N	Adjusted	
	INTERCEPT	PRICE _{ijk}	INC345 _i	PCT18TMD _i	CCPOP86 _i	PCTFARM _i	SUBEROS _{ki}	SUIT _{kj}		F-value	R ²
Water											
Pool swimming	3.136*	-0.036*	0.107*	0.241*	0.0000012*	—	0.024	—	857	131.410	.43
	(.891)	(.002)	(.011)	(.041)	(1.41 E-07)		(.022)				
Motorized boating	6.280*	-.038*	.061*	.068*	.0000014*	—	-.033*	0.155*	1537	176.174	.41
	(.596)	(.002)	(.007)	(.024)	(1.00 E-07)		(.008)	(.019)			
Water-skiing	4.575*	-.028*	.067*	.062*	.0000014*	—	-.012	.187*	1553	136.448	.34
	(.590)	(.002)	(.007)	(.024)	(9.56 E-08)		(.008)	(.019)			
Rafting/tubing	4.653*	-.033*	.064*	.064***	.0000014*	—	.006	.300*	1379	96.158	.29
	(.816)	(.002)	(.009)	(.036)	(1.28 E-07)		(.012)	(.030)			
Canoeing/kayaking	1.285	-.048*	.087*	.167*	.0000013*	—	-.019*	.250*	2381	455.052	.53
	(.442)	(.001)	(.005)	(.019)	(7.61 E-08)		(.006)	(.016)			
Rowing/paddling, etc.	2.066*	-.024*	.074*	.124*	.000013*	—	-.023*	.221*	2413	248.152	.38
	(.418)	(.001)	(.005)	(.019)	(7.39 E-08)		(.006)	(.015)			
Stream/lake swimming	6.100*	-.034*	.057*	.077*	.0000011*	—	-.035*	.183*	2678	521.61	.54
	(.399)	(.0007)	(.005)	(.017)	(5.68 E-08)		(.006)	(.013)			
Sailing	-0.453	-.028*	.134*	.158*	.0000019*	—	-.016	.126*	1541	129.71	.33
	(.857)	(.0020)	(.010)	(.035)	(1.44 E-07)		(.012)	(.028)			
Snow and Ice											
Downhill skiing	7.765*	-0.031*	0.059**	0.135***	0.00000037*	-0.368*	0.001**	—	138	22.706	0.49
	(2.43)	(.005)	(.028)	(.083)	(1.80 E-07)	(.081)	(.0005)				
Cross-country skiing	1.185	-.034*	.216*	-.130*	.0000015*	—	.002*	.338*	2656	231.917	.34
	(1.08)	(.002)	(.009)	(.033)	(1.27 E-07)		(.002)	(.037)			
Snowmobiling	-3.452*	-.026*	.146*	.091*	.00000089*	—	.172*	.095**	2664	157.859	.26
	(0.787)	(.002)	(.010)	(.035)	(1.41 E-07)		(.009)	(.042)			

*Significant at 0.01 level; **Significant at 0.05 level; *** Significant at 0.10 level.

Source: Cordell and Bergstrom (1989), table 1, page 17

specified nationally for each activity based on all of the origin-destination combinations in the PARVS data set. From the demand models, trip cost coefficients and the mean value of trip costs were used in a formula to calculate MPD from current trip consumption. MPD is the upper limit of trips that households would consume if the cost of a recreation trip was not allowed to increase and available opportunities for recreation were not a limiting factor. Future values of MPD, then, depend primarily on shifts in demand resulting from changes in other determinants, such as age, income, and population. Multiplying the projection indices by the base year number of trips produces an estimate of the absolute change in the total number of trips.

Estimates of Recreation Trips

In addition to projection indices of recreation trip consumption, the absolute number of current trips from each region for each activity was estimated. The estimate was the product of the following four values: (1) regional estimates of the 1987 population age 12 years and older, (2) the national percentage of the population at least 12 years old who participate in the activity, (3) the percentage of trips for the activity that occur away from home, and (4) mean annual activity trips per person, by region. Regional population estimates (1987) were developed from U.S. Census Bureau data. Regional estimates of population at least 12 years old are: North, 98.7

Table 5.—Estimated future trends in land, water, and snow and ice resources and environments if recent trends (1970-1987) in amounts of resources available for outdoor recreation were to continue.

Resources and environments	Projected percentage change from 1987				
	2000	2010	2020	2030	2040
Land					
Wilderness and other extensive roadless areas	-9	-15	-21	-26	-31
Undeveloped areas near roads	-12	-20	-28	-35	-41
Partially developed, roaded areas	-9	-15	-21	-26	-31
Intensively developed sites	8	15	22	29	37
Water					
Wild and remote lakes and streams	3	6	8	9	10
Lakes and streams near roads	-3	-4	-6	-8	-10
Lake and stream sites adjoined by roads	8	15	22	29	37
Intensively developed water sites	12	23	34	47	61
Snow and Ice					
Wilderness and other roadless areas	-9	-15	-21	-26	-31
Undeveloped areas near roads	-12	-20	-28	-35	-41
Partially developed, roaded areas	-9	-15	-21	-26	-31
Intensively developed winter sports sites	17	28	36	43	49

Source: Cordell and others (1990)

million; Pacific Coast, 29.6 million; Rocky Mountains, 15.4 million; South, 64.6 million. Participation estimates were taken from the 1982-1983 Nationwide Recreation Survey (U.S. Department of the Interior 1986). Proportion of trips away from home were estimated by an expert panel of researchers. "Away from home" denotes any trip requiring motorized travel from an individual's permanent residence. Mean annual activity trips per person by region were calculated from PARVS data. Projected recreation consumption indices together with estimates of base year trips provide a projection of the expected supply of activity trips in each region (i.e., the equilibrium number of trips consumed where no shortages or surpluses of recreation supply occur).

Table 6.—Key variables identified for updating in the National Outdoor Recreation Supply Information System (NORSIS) database for the 1993 RPA Assessment Update.

Variable	Description
FEDWILD *	Acres of federally designated wilderness areas
FEDOVER3 *	Acres of federal lands > 3 miles from roads
STWILDS	Acres of state designated wilderness areas
SPOVER3	Acres of state park lands > 3 miles from roads
FEDHALF3	Acres of federal lands 1/2 to 3 miles from roads
NTFOOTMI *	Miles of National Recreation Trails (NRT) for hiking
NTHORSMI *	Miles of NRT's for horseback use
SPHALF3	Acres of state park lands 1/2 to 3 miles from roads
FEDINHLF	Acres of federal lands within 1/2 mile of roads
NTBIKEMI *	Miles of NRT available for bicycle use
NTMOTOMI *	Miles of NRT available for motorcycle use
FEDROAD1	Miles of roads on USFS, NPS and FWS lands
SFRECAC	Acres of state forest open for recreation
SPINHALF	Acres of state park lands within 1/3 mile of roads
FGLACRE	Acres of state fish and game lands
PLOPAC4	Acres of non-industrial, private (NIP) lands open to the public, free or fee, in tracts 500-2499 acres
PLOPAC5	NIP land acres open to public, in tracts of 2500+ acres
FORINDAC	Acres of forest industry owned lands
RURALT	Acres of rural, non-federal roads and railroads
PLOPAC23	NIP land acres open to public, in tracts 20-499 acres
FEDROAD2	Miles of COE and TVA roads
NUMRESRT	Number of commercial resorts
TRSTACCM	Number of tourist accommodation businesses
ZOOS	Number of zoos
GOLFCRSE	Number of public and private golf courses
GEDCGS	Number of federal government campgrounds
STCGS	Number of state government campgrounds
LOCES	Number of local government campgrounds
FEDRIVMI *	Miles of federal rivers, designated or under study for Wild and Scenic designation
CANOOUTF	Number of canoe outfitters
RUNWATR	Acres of water in rivers
CANOERNT	Number of canoe livery and rental firms in the county
STRIVMI	Miles of rivers designated by states as being significant for historic, cultural, scenic or recreational reasons
FLATWATR	Acres of water bodies
BEACHMI	Miles of publicly accessible beach
MARINAS	Number of marinas
PUBPOOLS	Number of swimming pools open to the public
PVTPOOLS	Number of swimming pools open to members
EFSHPIER	Number of fishing piers
VTFH	Vertical transport feet per hour at ski areas
PLOP1AC1	Acres of NIP lands open to recreation (NOT leased) in tracts 20-99 acres
PLOP2AC1	Acres of NIP lands open to recreation (Leased) in tracts 20-99 acres
PVCGS	Number of private campgrounds (Rand McNally)
PLFORAC	Total acres of non-industrial private lands F land in the county
DAILYCAP	Daily lift capacity
LOTOLAC	Total number of acres of local government recreation land (MACPARS)

*Indicates values were actually updated.

Source: National Outdoor Recreation Supply Information System (NORSIS) database, USDA Forest Service, Athens, GA.

RECREATION OPPORTUNITY INDICES

Updating Key Variables

In updating the Effective Recreation Opportunity Set (EROS) indices, an attempt was made to update key supply variables within the National Outdoor Recreation Supply Information System (NORSIS). The NORSIS database contains county-level data for more than 400 variables relevant to outdoor recreation supply, and was created during the period 1985-1988. Key variables were determined to be those which were important to a recreation environment, consumption, or demand model, and had a potential to have changed significantly since 1988 (table 6). However, time and budget constraints for completing this report allowed values for only seven variables to be updated. Those included designated federal wilderness acres (FEDWILD), federal lands more than 3 miles from roads (FEDOVER3), miles in the National Wild and Scenic River System (FEDRIVMI), and miles of National Recreation Trails for use in hiking (NTFOOTMI), horseback riding (NTHORSMI), bicycling (NTBIKEMI), and motorcycling (NTMOTOMI).

Changes in wilderness area data were supplied by the Forest Service (FS) and Bureau of Land Management (BLM). Data on FS wilderness acres were obtained from regional Land Area Resource (LAR) reports. These reports list actual or estimated acreage by county for each wilderness area within the region. BLM data were obtained from a national database in their Washington, D.C. office, and from state maps showing the location of wilderness areas and study areas. Several National Park Service (NPS) units were added to the system since 1988. Acreage information for these areas also was obtained from BLM sources. In cases where it was not possible to directly obtain county level estimates, a grid-based sampling method was used to estimate wilderness acreage in a specific county. The sampling process was repeated three times, and the mean of the observations was used.

NPS provided updated information on National Recreation Trails, through the National Recreation Trail Guide. NPS staff provided updates in both additions and deletions to the system, and corrections to errors in the 1988 Guide. In general, few changes have occurred since 1988. Most of the changes involved previous error corrections. NPS also was the primary source for updates for Wild and Scenic River System miles. To get county-level mileage estimates, a small distance mea-

suring wheel was traced along maps to derive mileage estimates. The measuring process was repeated three times, and the mean of the observations was used.

Regional EROS Calculation

Regional EROS measures extend national indices developed for the 1989 RPA Assessment by accounting for regional differences in travel distance thresholds. Before explaining the steps taken for the regionalization, a brief review of the steps taken for EROS calculation is presented. More detailed discussion is provided in English and Cordell (1993), and Cordell and others (1989). EROS is an index of the amount and location of publicly available recreation resources, facilities, and services relative to the number and location of population. EROS values corresponding to the 12 types of recreation environments were produced for each of the 239 representative counties. These environments represent resources arrayed by distance from the nearest road passable to a two-wheel-drive passenger vehicle, for the major categories of land, water, and snow and ice resources.

The primary data source for EROS calculations was the National Outdoor Recreation Supply Information System (NORSIS). For each recreation environment, an expert panel of researchers identified specific recreation resources that were either integral and essential components of that environment's resource base, or relevant, but not critical, to that recreation environment. Selected resources were assigned weights of 3 and 1, respectively.

The first step was to compute the relative abundance of the resources in each environment for each county. Resources were first transformed to resources per capita, to account for congestion effects. Resulting values were indexed to the 95th percentile of national resource per capita values. For each environment, a weighted average of relevant resource per population indices was computed, and the result was re-indexed over all counties to the national maximum. The result yielded Weighted Opportunity Set Indices (WOSI) for each of the 239 representative counties.

Next, WOSI values were transformed to reflect inter-county use pressures and account for travel distance effects. Data collected in the Public Area Recreation Visitors Study (PARVS) were used to obtain relevant travel distances (RTD) specific to each of the twelve recreation settings. These mileage figures reflect the distance within which 75% of the PARVS respondents

traveled for activities occurring in that setting. The 75% level was used to eliminate households taking long vacations. Effectiveness of resources was assumed to decline linearly with distance, and to vanish at the threshold distance. Distances between counties were measured from county centers. The effectiveness decay weight (EW_{ij}) for each opportunity set i between any two counties x and y was calculated as:

$$EW_{xy} = 1 - (D_{xy} / TD_i), \text{ where } D_{xy} \leq TD_i$$

$$EW_{xy} = 0, \text{ where } D_{xy} > TD_i$$

where

- D_{xy} = distance between counties x and y
 - TD_i = threshold distance for opportunity set i .
- EROS values were computed as:

$$EROS_{ix} = \frac{\sum_{y=1}^n (WOSI_{iy} * EW_{ixy})}{\sum_{y=1}^n EW_{ixy}}, \quad i = 1, 2, \dots, 12 \quad (5)$$

where

- $EROS_{ix}$ = EROS value of recreation environment i for county x
- $WOSI_{iy}$ = WOSI value of recreation environment i for county y
- EW_{ixy} = effectiveness decay weights between counties y and x for recreation environment i .
- n = Number of counties whose centroids are within RTD_i of county x .

EROS values were calculated regionally by using regional relevant travel distances in the final step of EROS calculation. For the first eight recreation environments, an expanded PARVS data set was used to derive regional distances. Respondents were assigned a region based on their home location. As was done in 1989, the travel distance at the 75th percentile of respondents for each activity environment determined the regional RTD. For winter recreation environments, RTD's used in the 1989 Assessment were also used for regional distances because of an insufficient number of cases in the PARVS data set.

The inclusion of regional distances changes the previous EROS model only slightly. Effectiveness weights are now computed as:

$$EW_{xy} = 1 - (D_{xy} / TD_i) \text{ if } D_{xy} \leq TD_i$$

$$EW_{xy} = 0 \text{ if } D_{xy} > TD_i$$

where

- D_{xy} = distance between counties x and y
- TD_i^r = threshold distance for opportunity set i in region r , where r is region of county x .

The formula for EROS value computation (eq. [5]) is unchanged.

Projections

The 1989 RPA Assessment included effective recreation supply projections for the years 2000-2040. These projections used 1987 as a baseline index. Information for assumed futures was obtained from several sources. Population projections were based on Wharton Econometrics projections. Exogenous land use and recreation resource availability projections were based on past trends, mostly since 1970. Exogenous economic influences and public finance projections were assumed to remain constant (Cordell and others 1989). After estimating future values for the variables, EROS calculation methods as discussed previously were applied.

Methods for projecting regional EROS values were similar to those used in 1989. The major difference was that the current set of projections were calculated using regional population projections. For resource availability, the same resource trend projections used in the 1989 Assessment were applied to each RPA Assessment region to develop projected WOSI values. The methods described earlier to calculate EROS values from WOSI values then were applied for each projected year from 2000-2040. Projections are based on resource trends from 1970 to 1987 and projected changes in U.S. population.

RESULTS

REGIONAL POPULATION COMPARISONS

Current Situation

Population statistics describing the sample of representative counties are presented in table 7. For each of the model independent variables—population, income, age, and rural/urban residence—the representative county national mean is the mean of the four Assessment regions **weighted** by the number of aggregate observations. The Pacific Coast population mean is heavily influenced by the presence of representative counties in metropolitan southern California and the

Table 7.—Means of population descriptive variables for representative counties by region, 1987.

Assessment region	Number of representative counties	Means (standard deviation)							
		Total population		Total % households with income >\$30,000		Total % population ages 18-32		Total % population living on farms	
North	92	330,922	(640,966)	26.40	(9.35)	21.76	(2.01)	4.67	(5.10)
Pacific Coast	22	834,614	(1,432,827)	29.27	(7.88)	22.36	(2.04)	1.96	(2.13)
Rocky Mountains	37	158,371	(283,237)	23.81	(7.24)	20.22	(3.35)	4.60	(4.94)
South	88	212,594	(343,106)	19.06	(7.37)	21.30	(2.31)	3.27	(2.87)
National	239	307,005	(652,750)	23.56	(8.96)	21.41	(2.43)	3.89	(4.22)

Source: Outdoor Recreation and Wilderness Assessment Research, USDA Forest Service, Athens, GA.

San Francisco Bay area. The much larger population mean for the Pacific Coast region is inconsequential in the projections methodology, because each region is analyzed separately. For each variable, the regional means listed in table 7 are the population characteristics from which expected future values are calculated by multiplying these figures by expected future growth rates. Because aggregate observations are, in part, a function of population, the eastern regions have a greater number of aggregate observations.

Projected Changes

Expected percentage growth rates of population and income varied by region (table 8). The Bureau of Economic Analysis (BEA) provided regional population projections (U.S. Department of Commerce 1991). These were applied to the population age 12 years and older (CCPOP86). BEA also provided projections of total personal income by region. These were divided by population projections to produce projections of per capita income. Regional projections of per capita income growth were used instead of information on the percentage of households earning at least \$30,000 annually. It was assumed that the proportion of these households in the economy would grow at about the same rate as per capita income growth.

Regional projections of percentage growth were not available for the age (PCT18TMD) and residence (PCTFARM) variables, nor for any of the recreation resource and facility variables. Expected national growth rates for these variables, as used in the 1989 RPA Assessment, were applied to the regional consumption projec-

tions. It should be noted that the representative county average percent of population living on farms in 1987 was just 3.9%, therefore, changes in this relatively small base year mean percentage show a deceptively large percentage change. For example, the percentage of the population living on farms is projected to decline to 3.0% in 2000 which is a 22.9% decrease from 3.9% in 1987.

RESOURCE OPPORTUNITIES

Key Variable Updates

Significant changes to the National Wilderness Preservation System have occurred since 1987 (table 9). More than 5 million acres have been added to the system during that time. Of this amount, 1,086,698 acres have been added in the Forest Service, 1,693,148 in the National Park Service, 1,127,088 in the Bureau of Land Management, and 1,343,444 in the Fish and Wildlife Service. There are 95 million acres in the entire National Wilderness Preservation System. Of this total, 57.4 million acres, or more than 60%, are in Alaska.

In total, 1619 miles of rivers have been added to the Wild and Scenic River system since 1987 (table 10). Of these additions, 983 miles are managed by the Forest Service, 17 miles by the National Park Service, 602 miles by the Bureau of Land Management, and 17 miles by the State of Illinois. After including all of these updates, the amount of resources and facilities within 120 miles of each representative county were calculated. This resource amount was used in the consumption models as a facility measure.

Table 8.—Projected percentage growth rates of population descriptive variables from base year 1987, by region.¹

Variable and region	1987 Base ²	Percent change from 1987 base				
		2000	2010	2020	2030	2040
Population³						
North	330.9	4.1	8.3	12.2	13.2	14.2
Pacific Coast	834.6	24.7	35.0	41.8	44.4	46.9
Rocky Mountains	158.4	15.9	23.9	30.0	32.2	34.5
South	212.6	10.4	16.3	21.5	23.2	24.9
Income⁴						
North	26.4	13.3	22.7	29.9	31.7	33.1
Pacific Coast	29.3	12.4	21.5	29.1	37.9	46.1
Rocky Mountains	23.8	16.0	27.2	35.5	45.1	54.0
South	19.1	16.3	27.7	36.1	45.7	54.6
Age⁵						
National	21.4	-6.5	-9.8	-12.6	14.0	-15.0
Residence⁶						
National	3.9	-22.9	-38.3	-53.7	69.2	-84.6

¹Percentage growth rates by region were not available for the age and residence variables. National rates of percentage growth were applied uniformly across the four regions.

²1987 base represents the independent variable mean values for the representative counties within each region.

³CCPOP86—population age 12 & older in 1000's.

⁴INC345—percent of households with more than \$30,000 annual income.

⁵PCT18TMD—percent of population between ages 18 and 32.

⁶PCTFARM—percent of population living on farms.

Sources: 1989 RPA Assessment of Outdoor Recreation and Wilderness. USDA Forest Service. Athens, GA. U.S. Department of Commerce (1991).

Regional EROS Indices

Regional EROS values provide a more accurate perspective of effective recreation opportunities. By incorporating relevant travel distances on a regional basis, variations in travel behavior are reflected in the final EROS values. Based on PARVS data, the greatest variation in relevant recreation travel distances exist between the Rocky Mountain region and all other regions (table 11). Specifically, the travel distances were significantly higher in this region for EROS categories four through eight. This may result from greater distances separating recreation areas and the recreating public. In contrast, the South region tended to show shorter relevant travel distances than the other regions for most of the EROS categories.

Table 12 shows means of the EROS indices, both by region and for the nation as a whole. A significant amount of regional variation is masked by simply looking at the national EROS mean alone. In general, effective

recreation opportunities are much greater in the Pacific Coast and Rocky Mountain regions for many EROS categories than in the North and South regions, as expected given the presence of more land for recreation in the West and less population pressure.

Within the land-based categories, effective wilderness opportunities (EROS 1) average about 22 times greater opportunity for people living in the Pacific Coast and Rocky Mountain regions than in the North and South regions. This result reflects the regional distribution of acreage of wilderness resources, as well as the greater numbers of people competing for these resources in the East. "Extensive undeveloped areas near roads" (EROS 2) and "roaded and partially developed areas" (EROS 3) show similar, but not as extreme variation. "Developed sites" (EROS 4) show a more balanced distribution. For all four land recreation environments, the Rocky Mountain Region has the greatest amount of effective recreation opportunities.

Opportunities among water-based environments also vary across regions. The greatest opportunities exist in the Rocky Mountain region for recreation on "Wild and Scenic or other remote lakes and streams" (EROS 5) and "lakes or streams near roads" (EROS 6), and in the Pacific Coast region for "lake/stream sites adjoined by roads" (EROS 7) and "developed water sites" (EROS 8). Although one of these two regions tended to provide the greatest effective opportunities for each of the four water-based environments, the western regions did not dominate the opportunities as they did with land-based opportunities. For example, although the Rocky Moun-

Table 9.—National Wilderness Preservation System (NWPS) acreage (in thousands of acres) in 1987 and 1992, and growth (1987-1992), by managing agency.

Managing agency	1987	1992	Change since 1987
USDA Forest Service	32,549	33,636	1,087
National Park Service	37,385	39,078	1,693
Bureau of Land Management	484	1,611	1,127
Fish and Wildlife Service	19,333	20,676	1,343
Total	89,751	95,001	5,250

Source: National Outdoor Recreation Supply Information System (NORSIS) database, USDA Forest Service, Athens, GA.

tain region provided the most effective opportunity for "lakes and streams near roads" (EROS 6), the Pacific Coast region had the least opportunity in this environment. The reverse was true for opportunities involving "developed water sites" (EROS 8). Of the four water-based opportunity environments, "Wild and Scenic or other remote lakes and streams" (EROS 5) is the most balanced across regions.

Similarly, analysis of the snow and ice-based environments revealed far more opportunity in the western regions than in the eastern regions. For "wilderness and other remote back-country" (EROS 9), opportunities are

Table 10.—National Wild and Scenic River system mileage in 1987 and 1992, and growth (1987-1992), by managing agency.

Managing agency	1987	1992	Change since 1987
USDA Forest Service	2,570	3,553	983
National Park Service	2,015	2,032	17
Bureau of Land Management	2,437	3,039	602
Fish and Wildlife Service	1,043	1,043	0
State of Illinois	0	17	17
Total	8,065	9,684	1,619

Source: National Outdoor Recreation Supply Information System (NORSIS) database, USDA Forest Service, Athens, GA.

Table 11.—Relevant travel distances in miles, by recreation environment and region.¹

Resources and environments		North	Pacific Coast	Rocky Mountain	South	National
Land						
EROS1:	Wilderness and other extensive roadless areas	100	95	75	65	80
EROS2:	Undeveloped areas near roads	75	95	75	75	75
EROS3:	Partially developed, roaded areas	95	95	90	65	80
EROS4:	Intensively developed sites	95	100	140	70	95
Water						
EROS5:	Wild & remote lakes/streams	85	75	130	50	80
EROS6:	Lakes/streams near roads	70	65	140	40	60
EROS7:	Lake/stream sites adjoined by roads	55	85	140	40	50
EROS8:	Intensively developed water sites	45	45	140	35	40
Snow and Ice²						
EROS9:	Wilderness & other roadless areas	100	100	100	100	100
EROS10:	Undeveloped areas near roads	100	100	100	100	100
EROS11:	Partially developed, roaded areas	200	200	200	200	200
EROS12:	Intensively developed winter sports sites	250	250	250	250	250

¹Relevant travel distances are those distances (rounded to nearest 5 miles) within which 75% of PARVS respondents traveled for activities occurring in that setting effectively eliminating vacation trips.

²Relevant travel distances did not vary by region for the four snow and ice EROS categories because of an insufficient number of survey observations.

Source: Public Area Recreation Visitor Study (PARVS), 1985-1989.

Table 12—Mean effective recreation opportunity set (EROS) indices, by region, 1987.¹

Resources and environments		North	Pacific Coast	Rocky Mountain	South	National
Land						
EROS1:	Wilderness and other extensive roadless areas	0.72	24.96	30.66	1.86	8.00
EROS2:	Undeveloped areas near roads	4.09	17.34	22.67	4.01	8.16
EROS3:	Partially developed, roaded areas	7.27	17.35	24.09	8.34	11.20
EROS4:	Intensively developed sites	17.08	25.94	27.29	13.87	18.29
Water						
EROS5:	Wild & remote lakes/streams	4.32	6.64	8.31	3.59	4.88
EROS6:	Lakes/streams near roads	11.26	9.68	21.79	13.03	13.40
EROS7:	Lake/stream sites adjoined by roads	8.08	20.16	16.62	9.19	10.93
EROS8:	Intensively developed water sites	15.30	28.88	11.22	14.03	15.45
Snow and ice						
EROS9:	Wilderness & other roadless areas	0.62	23.95	26.34	0.16	6.58
EROS10:	Undeveloped areas near roads	4.80	16.48	19.95	0.30	6.57
EROS11:	Partially developed, roaded areas	7.11	24.31	27.61	0.64	9.48
EROS12:	Intensively developed winter sports sites	10.68	22.42	17.24	0.92	9.18

¹The EROS index is a measure of the relative availability of recreation opportunities to households in different locations and is calculated separately for each of the 12 recreation environments.

Source: Outdoor Recreation and Wilderness Assessment Research, USDA Forest Service, Athens, GA.

almost non-existent among the eastern regions compared to opportunities in the two western regions. The Rocky Mountain region provides the greatest opportunities for all of the snow and ice-based environments except "developed winter sports sites" (EROS 12). For this recreation environment, the Pacific region ranks highest. The lack of these types of opportunity is understandable for the South region because of the lack of sufficient snowfall. However, the relative lack of effective opportunities in the North region, compared to the two western regions, indicates the presence of greater population competing for fewer available resources.

Substitute Recreation Opportunities

Availability of substitute recreation opportunities is important in modeling recreation demand and consumption. One general measure of the availability of substitutes for a recreation environment is provided by the average of the EROS indices for other recreation settings that might provide a reasonable substitute (table 13). Snow and ice environments were not considered as substitutes for land and water settings; but, land and water resources were regarded as potential substitutes for each other. Although substitute recreation opportunities can be expected to change in the future,

along with recreation resource opportunities, the decision was made to hold the substitute indices constant at the base year level. Recreation supply and demand projections continued under the scenario of no change in the amount of substitutes available.

For all 12 environments, the largest substitute index values are found in the Rocky Mountain region. The most pronounced differences are between the eastern and western regions, because the large amounts of public lands in the West affect virtually all substitute index values. The North region ranks slightly below the South for all land environments, and for three of four water environments.

Regional EROS Projections

A relatively higher percentage of population growth to the year 2040 is expected to occur in the Pacific Coast and Rocky Mountain regions, as shown in table 8. Although overall population, and thus demand, for recreation resources will continue to be greater in the eastern regions, the rate of change in demand likely will be greater in the western regions. National decreases in many, but not all, land, water, and snow/ice resources and environments will coincide with these increases in population, if recent trends continue as identified in

Table 13.—Mean substitute effective recreation opportunity set (SUBEROS) indices, by region.¹

Resources and environments		North	Pacific Coast	Rocky Mountain	South	National
Land						
SUBEROS1:	Wilderness and other extensive roadless areas	9.155	16.913	17.572	9.483	11.293
SUBEROS2:	Undeveloped areas near roads	8.704	15.169	15.644	9.130	10.530
SUBEROS3:	Partially developed, roaded areas	8.248	15.286	15.507	8.448	10.093
SUBEROS4:	Intensively developed sites	6.827	13.908	14.950	7.671	9.047
Water						
SUBEROS5:	Wild & remote lakes/streams	9.100	17.167	18.222	9.510	11.406
SUBEROS6:	Lakes/streams near roads	7.718	16.241	16.452	7.630	9.822
SUBEROS7:	Lake/stream sites adjoined by roads	8.151	14.825	16.944	8.349	10.199
SUBEROS8:	Intensively developed water sites	7.123	13.492	16.899	7.705	9.437
Snow and Ice						
SUBEROS9:	Wilderness & other roadless areas	7.221	19.923	20.683	0.485	7.994
SUBEROS10:	Undeveloped areas near roads	5.995	15.886	17.145	0.391	6.553
SUBEROS11:	Partially developed, roaded areas	5.434	14.300	15.715	0.376	5.979
SUBEROS12:	Intensively developed winter sports sites	4.047	13.986	17.878	0.225	5.696

¹SUBEROS indices are means of the Effective Recreation Opportunity Set (EROS) indices of other resource categories that could substitute for the principal environment in which a recreational activity occurs. That is, the amount of effective opportunity in all other land and water resource categories is assumed to be a potential substitute setting for the land or water resource category in which the recreational activity predominantly occurs. See Cordell, English and Bergstrom (1989) or English and Cordell (1993) for details on the EROS indices.

table 4. The impact of these changes on regional effective recreation opportunities was examined in this study on a regional basis.

In the case of land-based environments, the results show effective recreation opportunities decreasing for “wilderness and remote back-country” (EROS 1), “extensive undeveloped areas near roads” (EROS 2), and “roaded and partially developed areas” (EROS 3) in all four RPA regions (table 14). The reductions range from 10% to 36% less in 2040 than in the 1987 base year, and are projected to be greatest in the North and South regions. In most cases, these decreases are two to three times greater than those in the western regions. One exception is for opportunities in “extensive undeveloped areas near roads” (EROS 2), where the Pacific Coast region falls just behind the North and South regions. Effective opportunities in “developed sites” (EROS 4) are projected to increase over time, although this increase should be much less for the South region than the other three regions. In fact, initial projections are expected to actually decrease for this region before gradually increasing. The greatest increase in opportunities should occur in the Pacific Coast Region followed by the Rocky Mountains and North regions.

The projected effective opportunity changes in water-based environments show varied results. In the case of “Wild and Scenic or other remote lakes and

streams” (EROS 5), effective opportunities are expected to decrease in the eastern regions, and increase in the western regions. Although these changes are relatively small (i.e., averaging 1% to 4.5%) when compared with other environments, the results are interesting given the specific regional population changes expected and the fact that resources available are expected to increase for this category. Opportunities associated with “lakes or streams near roads” (EROS 6) are expected to decrease for all four RPA regions, again with much greater decreases in the North and South regions than in the western regions. Conversely, effective opportunities in “partially developed lakes or streams with roads or crossings” (EROS 7) and “developed water sites” (EROS 8) are expected to increase over time for all four RPA regions. Opportunities in the South region are expected to increase at a slower rate than is the case for the other three regions.

Projected opportunity changes for snow and ice-based environments are expected to decrease for all environments except “developed winter sports sites” (EROS 12). The decreases in “wilderness and other remote back-country” (EROS 9) and “extensive undeveloped areas near roads” (EROS 10) should be much greater in the South region. The Pacific Coast region is expected to show slower rates of decreases in “roaded

Table 14.—Percent change in projected mean effective recreation opportunity set (EROS) indices from base year 1987, by region.

Resources and environments (region)		Percent change from 1987				
		2000	2010	2020	2030	2040
Land						
EROS 1:	Wilderness and other extensive roadless areas					
	North	-9.3	-17.0	-23.4	-27.4	-31.2
	Pacific Coast	-3.8	-6.3	-9.2	-11.8	-14.6
	Rocky Mountains	-2.8	-4.7	-6.8	-8.6	-10.4
	South	-9.9	-16.1	-22.7	-26.0	-30.5
EROS 2:	Undeveloped areas near roads					
	North	-8.4	-15.3	-21.6	-26.2	-30.5
	Pacific Coast	-5.6	-9.5	-14.1	-18.6	-22.6
	Rocky Mountains	-3.1	-5.6	-8.4	-11.3	-13.9
	South	-8.9	-14.0	19.4	-23.1	-26.9
EROS 3:	Partially developed, roaded areas					
	North	-10.0	-17.7	-24.5	-28.3	-32.8
	Pacific Coast	-5.2	-8.9	-12.6	-16.3	-19.9
	Rocky Mountains	-4.9	-8.3	-12.1	-15.4	-18.8
	South	-13.3	-20.8	-27.8	-31.8	-36.2
EROS 4:	Intensively developed sites					
	North	2.4	3.5	5.2	9.1	12.9
	Pacific Coast	4.9	9.2	13.3	17.2	21.5
	Rocky Mountains	3.8	6.9	9.8	12.7	15.6
	South	-1.6	-0.9	-0.4	2.8	5.8
Water						
EROS 5:	Wild and remote lakes/streams					
	North	-0.2	-0.7	-1.2	-1.0	-1.0
	Pacific Coast	0.7	1.4	1.9	2.2	2.4
	Rocky Mountains	0.2	0.4	0.5	0.6	0.6
	South	-2.7	-3.5	-4.6	-4.5	-4.8
EROS 6:	Lakes/streams near roads					
	North	-5.9	-10.3	-14.5	-16.1	-18.4
	Pacific Coast	-2.7	-3.6	-5.4	-7.1	-9.0
	Rocky Mountains	-1.6	-2.3	-3.4	-4.5	-5.6
	South	-10.8	-15.6	-20.8	-23.0	-25.5
EROS 7:	Lake/stream sites adjoined by roads					
	North	1.9	2.8	4.0	7.2	10.1
	Pacific Coast	2.6	4.9	7.2	9.2	11.4
	Rocky Mountains	2.7	4.9	7.0	9.0	11.3
	South	-1.4	-0.9	-0.4	2.1	4.5
EROS 8:	Intensively developed water sites					
	North	3.4	5.7	8.0	12.4	16.3
	Pacific Coast	6.3	12.0	17.1	22.6	28.1
	Rocky Mountains	5.7	10.3	14.2	18.3	22.2
	South	0.6	2.9	4.9	9.6	13.6
Snow and ice						
EROS 9:	Wilderness & other roadless areas					
	North	-3.7	-6.7	-9.3	-11.6	-14.1
	Pacific Coast	-2.3	-3.9	-5.5	-7.1	-8.7
	Rocky Mountains	-1.5	-2.6	-4.1	-5.4	-6.7
	South	-14.4	-24.5	-30.9	-35.3	-39.6
EROS 10:	Undeveloped areas near roads					
	North	-4.8	-8.7	12.9	-16.2	-19.6
	Pacific Coast	-3.6	-6.3	-9.7	-13.0	-16.1
	Rocky Mountains	-2.6	-4.6	-6.9	-9.2	-11.5
	South	-12.4	-21.4	-30.0	-35.6	-42.0

(Continued)

Table 14.—(continued).

Resources and environments (region)		Percent change from 1987				
		2000	2010	2020	2030	2040
EROS 11:	Partially developed, roaded areas					
	North	-22.2	-27.9	-33.0	-36.0	-39.4
	Pacific Coast	-10.2	-12.4	-14.7	-16.9	-19.3
	Rocky Mountains	-14.0	-16.8	-19.7	-22.2	-24.9
	South	-17.7	-24.8	-30.5	-34.6	-38.0
EROS 12:	Intensively developed winter sports sites					
	North	6.8	9.4	10.9	14.0	16.0
	Pacific Coast	7.2	11.4	14.1	16.2	17.9
	Rocky Mountains	6.4	10.2	12.5	14.5	16.0
	South	5.1	8.0	8.7	12.0	13.9

Source: *Outdoor Recreation and Wilderness Assessment Research*, USDA Forest Service, Athens, GA.

and partially developed areas" (EROS 11) than the other three regions. In the case of "developed winter sports sites" (EROS 12), all four RPA regions are expected to increase at similar rates.

RECREATION TRIPS

Current Consumption

Because the number of trips consumed is closely tied to population, more trips were consumed in the North region in 1987 than in any other region for all activities except motor-boating (table 15). For motor-boating, the South region consumed the most recreation trips. Because of its much smaller population base, the Rocky Mountain region accounts for the smallest proportion of trips consumed.

Across the four regions, the same seven activities were the most popular, although the rankings within regions varied (table 16). For all four regions, driving for pleasure ranked at the top. For three of the regions, sightseeing ranked second. In the Rocky Mountain region, picnicking was the second most popular activity. In the eastern two regions, outdoor pool swimming ranked seventh; but, in the western regions, it ranked either third or fourth.

Projected Supply

Driving for pleasure and sightseeing are expected to remain the top two activities through 2040, in terms of the nationwide volume of expected supply of annual

trips (table 15). Neither activity ranks lower than fourth in any RPA region. Closely related activities that are often consumed together, sightseeing and driving for pleasure are both dependent on roads and motorized transportation.

There is greater variety among the regions in the activities which are expected to show the greatest percentage increases in expected supply or trip consumption by 2040 (table 17). Five activities are among the top 10 fastest growing activities in all regions. These include downhill skiing, sailing, rafting/tubing, running/jogging, and outdoor pool swimming. The RPA projections for downhill skiing, however, have met sharp criticism from more than one reviewer. Although an extension of recent past trends projects continued steady growth in the developed winter sports sites recreation environment, in reality, the number of downhill skiing resorts has declined in recent years. While larger resorts have been steadily increasing their skier capacity, the overall trend has been a reduction in skier capacity and a gradual decline in the annual number of skier visits (United Ski Industries Association 1991).

It also should be noted that the high projected growth rates of sailing and rafting/tubing are largely a function of their small number of base year trips, making moderate growth in trips appear deceptively large in terms of percent change. Moreover, the regression models for expected supply of sailing and rafting/tubing trips were among the least stable of all of the activity models. The sailing model explained 33% of the variation in sailing trips and the rafting/tubing model performed worst of all, with an adjusted R-square of 0.12.

Table 15.—Current consumption of recreation trips away from home and indices of future growth to 2040, if recent past trends in resource availability continue.

Resource category and activity (national) region	1987 Base ¹ (mm)	Percent change from 1987 base				
		2000	2010	2020	2030	2040
Land						
Wildlife Observation	69.5	107	113	120	120	130
North	31.5	106	114	119	117	114
Pacific Coast	8.9	124	140	152	169	188
Rocky Mountains	5.4	105	111	114	123	132
South	23.8	102	107	109	115	122
Primitive Camping	38.1	108	115	122	130	134
North	16.2	105	113	118	117	116
Pacific Coast	5.8	123	138	248	261	176
Rocky Mountains	2.9	107	115	119	129	139
South	14.4	105	111	114	122	130
Backpacking	25.9	124	144	165	185	198
North	11.2	125	151	174	178	181
Pacific Coast	4.0	134	158	177	203	231
Rocky Mountains	2.2	114	127	134	149	166
South	8.5	122	142	158	182	210
Nature Study	70.7	99	101	103	107	108
North	31.2	97	100	101	97	95
Pacific Coast	9.3	115	125	131	143	158
Rocky Mountains	5.8	98	100	100	106	113
South	24.5	95	95	93	97	102
Horseback Riding	63.2	114	125	135	144	149
North	25.1	113	126	136	137	138
Pacific Coast	11.5	127	143	154	166	179
Rocky Mountains	6.1	107	113	115	121	127
South	20.4	112	122	129	139	150
Day Hiking	91.1	123	144	168	198	229
North	42.4	126	154	184	209	239
Pacific Coast	13.7	125	143	159	181	207
Rocky Mountains	7.7	124	146	169	205	249
South	27.3	116	132	148	172	201
Photography	42.1	115	128	141	154	163
North	18.9	112	127	138	138	136
Pacific Coast	5.7	131	154	172	197	226
Rocky Mountains	3.0	117	133	145	166	189
South	14.5	110	120	127	140	155
Visit Prehistoric Sites	16.7	127	148	173	203	236
North	7.2	124	148	174	202	236
Pacific Coast	2.7	130	150	168	187	208
Rocky Mountains	1.2	127	151	179	215	260
South	5.6	116	130	145	165	189
Collecting Berries	19.0	110	120	132	149	169
North	8.6	110	122	136	152	173
Pacific Coast	2.7	111	119	124	132	142
Rocky Mountains	1.3	115	130	146	172	203
South	6.3	104	110	117	129	143
Collecting Firewood	30.3	109	118	130	144	161
North	15.4	111	123	137	152	170
Pacific Coast	3.3	109	115	119	125	133
Rocky Mountains	1.8	110	121	131	148	269
South	9.8	105	111	118	129	143

(Continued)

Table 15.—(continued).

Resource category and activity (national) region	1987 Base ¹ (mm)	Percent change from 1987 base				
		2000	2010	2020	2030	2040
Walking for Pleasure	266.4	116	132	148	168	183
North	118.0	111	125	136	138	140
Pacific Coast	40.3	147	189	230	288	361
Rocky Mountains	18.8	118	136	151	177	208
South	89.3	111	124	134	152	174
Running and Jogging	83.7	131	160	192	229	260
North	38.4	125	152	177	183	189
Pacific Coast	13.0	169	241	317	434	591
Rocky Mountain	6.3	134	169	201	253	317
South	26.0	124	149	170	205	248
Bicycling	114.5	124	146	170	197	218
North	47.5	118	140	158	161	165
Pacific Coast	18.9	157	210	264	343	445
Rocky Mountain	10.3	126	153	176	214	259
South	37.8	117	136	150	176	206
Offroad Vehicle Driving	80.2	104	108	112	118	121
North	35.9	100	104	106	105	105
Pacific Coast	11.0	124	138	148	159	171
Rocky Mountains	5.9	103	106	109	114	121
South	27.4	100	103	104	108	113
Visiting Museums	9.7	118	134	152	172	187
North	4.7	113	129	142	144	147
Pacific Coast	1.2	148	192	235	297	374
Rocky Mountains	0.6	119	139	155	183	215
South	3.2	112	125	135	153	174
Attend Special Events	73.7	115	129	144	161	175
North	35.2	110	122	133	135	137
Pacific Coast	9.8	144	182	218	269	332
Rocky Mountains	5.2	116	133	146	169	196
South	23.6	110	122	131	147	167
Visiting Historic Sites	73.0	117	133	152	178	204
North	33.9	118	138	159	180	206
Pacific Coast	10.2	121	137	151	170	194
Rocky Mountains	4.9	122	143	166	201	245
South	24.0	110	121	133	151	174
Driving For Pleasure	421.4	110	120	129	139	145
North	198.3	107	117	125	124	124
Pacific Coast	52.5	132	155	273	195	221
Rocky Mountains	27.9	111	122	129	142	157
South	142.7	105	112	116	124	134
Family Gatherings	74.4	121	139	160	182	202
North	35.3	117	136	153	161	171
Pacific Coast	11.4	150	192	232	284	346
Rocky Mountains	5.9	120	138	154	178	206
South	21.7	115	130	143	162	184
Sightseeing	292.1	114	128	144	164	185
North	128.2	115	131	148	166	188
Pacific Coast	45.1	122	137	149	163	180
Rocky Mountains	19.8	118	134	151	177	208
South	99.0	108	117	126	139	156

(Continued)

Table 15.—(continued).

Resource category and activity (national) region	1987 Base ¹ (mm)	Percent change from 1987 base				
		2000	2010	2020	2030	2040
Picnicking	262.1	110	120	131	145	156
North	115.7	105	114	121	122	125
Pacific Coast	36.6	139	171	201	241	289
Rocky Mountains	20.1	110	122	131	147	166
South	89.7	106	113	120	131	145
Developed Camping	60.5	120	138	158	178	195
North	26.8	115	131	145	145	152
Pacific Coast	8.5	150	194	238	294	364
Rocky Mountains	4.9	121	141	158	184	214
South	20.3	116	132	145	165	188
Water						
Canoeing/Kayaking	39.7	113	126	138	153	163
North	17.1	111	124	135	136	138
Pacific Coast	5.2	133	160	183	217	257
Rocky Mountains	3.0	113	128	138	158	180
South	14.4	108	118	125	139	155
Stream/Lake Swimming	238.7	108	118	128	140	152
North	104.9	105	113	121	125	131
Pacific Coast	31.8	131	154	175	202	233
Rocky Mountains	15.3	105	111	115	124	133
South	86.6	106	114	122	135	151
Rafting/Tubing	9.0	123	151	182	229	267
North	4.3	116	146	171	172	175
Pacific Coast	0.9	160	232	308	472	722
Rocky Mountains	0.6	131	172	206	289	406
South	3.2	114	139	155	202	265
Rowing/Paddling, etc.	61.8	110	120	130	142	150
North	27.4	107	118	125	125	125
Pacific Coast	6.8	131	156	177	206	240
Rocky Mountains	4.2	112	124	132	148	166
South	23.4	106	114	119	129	142
Motorboating	219.4	107	114	122	131	138
North	90.3	104	110	115	117	120
Pacific Coast	22.9	128	147	164	183	205
Rocky Mountains	12.4	108	116	123	133	145
South	93.9	104	109	112	119	127
Waterskiing	107.4	112	122	132	144	152
North	44.5	107	115	122	123	125
Pacific Coast	11.1	134	160	182	209	240
Rocky Mountains	8.5	114	127	139	156	176
South	43.4	107	115	121	131	142
Outdoor Pool Swimming	221.0	135	166	200	237	267
North	89.2	134	170	206	222	240
Pacific Coast	37.0	162	220	281	365	470
Rocky Mountains	20.0	134	167	195	238	287
South	74.8	126	151	172	202	236
Sailing	35.0	141	181	226	279	322
North	15.3	137	180	222	239	256
Pacific Coast	5.1	189	281	384	537	743
Rocky Mountains	2.3	140	181	218	278	351
South	12.3	130	161	188	231	282

(Continued)

Nine of these are expected to grow by more than 250%. In the Rocky Mountain region, 10 activities are expected to double trip consumption by 2040. Eight of these are projected to increase by more than 150%. By contrast, the top two activities in both the North and South regions are projected to grow as much as 150% by 2040.

Three activities—bicycling, day hiking, and visiting prehistoric sites—rank among the top 10 consumption growth activities in three of four regions. Only in the North region is sightseeing expected to grow rapidly. Collecting firewood is expected to grow relatively faster only in the Rocky Mountain region. The Pacific Coast is the only region where visiting museums and walking for pleasure are among the fastest growing activities. Some shifting of the order of activities in terms of the expected supply in absolute number of trips is expected across the four RPA regions; but, generally the same group of activities should remain at the top. Pool swimming trips are projected to be the most popular in both the Pacific Coast and Rocky Mountain regions by 2040. In the North, driving for pleasure and sightseeing are expected to still rank first and second, respectively, in number of trips consumed. In the South, driving for pleasure is expected to remain the most popular activity; but, pool swimming will replace sightseeing as the second most frequently consumed activity.

Projected Demand

Percentage growth in maximum preferred demand (MPD) for recreation trips, paced by changes in income, age, and population is expected to be greater in the Rocky Mountains and Pacific Coast regions than in the eastern regions, for almost every activity (table 18). For day hiking, downhill skiing, visiting prehistoric sites, rafting/tubing, sightseeing, and visiting historic sites, percentage growth in trips demanded is expected to be greater in the Rocky Mountain region than in the Pacific Coast region. For all other activities, the reverse is true.

Again, there are regional differences in the ranking of activities for which demand is expected to grow fastest over the next 50 years (table 19). Four activities rank among the highest 10 percentage growth activities for all regions. These activities are downhill skiing, sailing, running/jogging, and backpacking. Three different activities rank at the top for the four regions. Downhill skiing is expected to have the greatest growth in the North, rafting/tubing in the Rocky Mountains, and sailing in the Pacific Coast and South.

There also are regional differences in the overall rate of growth in MPD. In the North, seven activities have MPD indices at or above 200 by the year 2040. Nine activities reach that level in the South. In the western regions, all of the 10 fastest growing activities have MPD indices greater than 300 by 2040. Three activities in the Rocky Mountains and seven in the Pacific Coast have MPD indices greater than 400.

These changes primarily reflect the expected higher percentage growth in population in the western regions. From 1987 to 2040, the projected growth by region is: Pacific Coast 46.9%; Rocky Mountains 34.5%; South 24.9%; and North 14.2%, as shown in table 8. Projections of percentage growth of the percent of households with at least \$30,000 real income also shows significant gains in all regions. The South region leads the way with a projected 54.6% increase, followed by the Rocky Mountains (54.0%), Pacific Coast (46.1%) and North (33.1%). The combination of population and income projections explain why the North region trails in projected demand for most of the recreation activities.

COMPARISON OF DEMAND AND SUPPLY

Maximum preferred demand and expected supply are closely related concepts. Both measure consumption of recreation trips, but under different assumptions. MPD measures consumption with price held constant and no constraints on the availability of recreation facilities and resources. Expected supply measures the number of trips that households would actually produce and consume at varying price levels and assumed futures for the availability of resources. If expected supply exceeds MPD, no gap is present. However, if projected MPD exceeds expected supply, there is a shortage or "gap." A gap implies that the number of trips households would like to produce, if prices were unchanged, surpasses the number of trips that they would actually produce.

Table 20 lists the MPD, expected supply, and resultant gaps for each of the activities, by region and for the nation as a whole. For a number of activities, gaps appeared in some regions, but not in others. For example, the North region should have an adequate supply of canoe trip opportunities through the year 2040; but, the other three regions show gaps in supply, as much as 61% of current trips in the Pacific Coast region.

Table 18.—Maximum preferred demand for recreation trips away from home and indices of future growth to 2040.¹

Resource category and activity (national) region	1987 Trips ² (mm)	Future number of trips as percentage of 1987 demand				
		2000	2010	2020	2030	2040
Land						
Wildlife Observation	69.5	116	131	146	162	174
North	31.5	112	127	138	139	140
Pacific Coast	8.9	143	179	211	256	308
Rocky Mountains	5.4	118	136	150	173	201
South	23.8	111	122	130	145	162
Primitive Camping	38.1	114	127	140	154	164
North	16.2	110	122	131	131	132
Pacific Coast	5.8	143	178	208	246	290
Rocky Mountains	2.9	115	130	142	161	183
South	14.4	109	118	125	137	151
Backpacking	25.9	134	164	196	230	255
North	11.2	129	160	187	193	197
Pacific Coast	4.0	167	231	295	385	497
Rocky Mountains	2.2	136	172	203	252	309
South	8.5	126	151	171	203	238
Nature Study	70.7	105	113	120	131	138
North	31.2	101	108	113	111	111
Pacific Coast	9.3	129	153	172	202	238
Rocky Mountains	5.8	107	117	124	140	158
South	24.5	100	105	108	117	128
Horseback Riding	63.2	123	141	160	177	190
North	25.1	118	135	150	153	156
Pacific Coast	11.5	150	190	226	267	312
Rocky Mountains	6.1	123	142	158	180	203
South	20.4	117	132	144	159	176
Day Hiking	91.1	131	161	198	244	293
North	42.4	132	167	206	240	282
Pacific Coast	13.7	142	177	212	262	322
Rocky Mountains	7.7	138	178	221	289	379
South	27.3	122	145	168	203	247
Photography	42.1	123	143	165	188	205
North	18.9	118	139	156	158	160
Pacific Coast	5.7	154	202	248	313	392
Rocky Mountains	3.0	125	150	171	206	246
South	14.5	116	133	145	167	191
Visit Prehistoric Sites	16.7	133	160	192	233	278
North	7.2	130	159	193	230	276
Pacific Coast	2.7	139	167	193	222	256
Rocky Mountains	1.2	134	165	201	251	314
South	5.6	120	138	158	184	216
Collecting Berries	19.0	113	126	143	166	192
North	8.6	114	130	148	171	199
Pacific Coast	2.7	119	132	143	158	177
Rocky Mountains	1.3	117	135	154	184	222
South	6.3	106	114	124	139	158
Collecting Firewood	30.3	113	127	143	161	183
North	15.4	113	127	143	161	183
Pacific Coast	3.3	116	128	137	151	166
Rocky Mountains	1.8	116	131	148	173	204
South	9.8	106	114	122	136	152

(Continued)

Table 18.—(continued).

Resource category and activity (national) region	1987 Trips ² (mm)	Future number of trips as percentage of 1987 demand				
		2000	2010	2020	2030	2040
Walking for Pleasure	266.4	116	131	146	164	177
North	118.0	111	125	137	137	137
Pacific Coast	40.3	147	187	224	275	337
Rocky Mountains	18.8	118	136	150	176	206
South	89.3	109	121	128	144	162
Running and Jogging	83.7	133	163	197	234	262
North	38.4	126	157	184	187	191
Pacific Coast	13.0	171	241	313	420	560
Rocky Mountains	6.3	136	173	206	261	329
South	26.0	124	148	167	201	241
Bicycling	114.5	125	148	173	202	222
North	47.5	120	143	163	165	167
Pacific Coast	18.9	160	217	272	354	457
Rocky Mountains	10.3	128	157	181	223	274
South	37.8	117	136	150	176	206
Offroad Vehicle Driving	80.2	105	111	118	125	130
North	35.9	101	106	109	108	108
Pacific Coast	11.0	132	154	171	191	213
Rocky Mountains	5.9	105	111	115	124	133
South	27.4	101	104	106	111	118
Visiting Museums	9.7	118	136	153	174	188
North	4.7	113	130	144	145	146
Pacific Coast	1.2	149	192	232	289	359
Rocky Mountains	0.6	121	143	160	190	226
South	3.2	112	125	135	153	174
Attend Special Events	73.7	114	127	141	157	168
North	35.2	109	122	132	132	133
Pacific Coast	9.8	143	179	211	255	308
Rocky Mountains	5.2	116	132	144	167	193
South	23.6	108	118	125	139	155
Visiting Historic Sites	73.0	122	143	169	203	241
North	33.9	122	147	175	203	238
Pacific Coast	10.2	130	154	177	208	247
Rocky Mountains	4.9	128	157	189	240	306
South	24.0	113	128	143	167	198
Driving for Pleasure	421.4	115	128	142	157	167
North	198.3	110	122	132	133	133
Pacific Coast	52.5	145	181	213	253	301
Rocky Mountains	27.9	116	131	143	163	186
South	142.7	109	119	126	139	153
Family Gatherings	74.4	119	135	152	170	182
North	35.3	113	129	141	142	144
Pacific Coast	11.4	154	197	238	288	346
Rocky Mountains	5.9	120	138	153	176	203
South	21.7	112	125	134	149	166
Sightseeing	292.1	118	136	156	183	212
North	128.2	118	138	160	183	211
Pacific Coast	45.1	131	153	172	196	224
Rocky Mountains	19.8	122	144	168	203	247
South	99.0	111	122	134	152	174

(Continued)

Table 18.—(continued).

Resource category and activity (national) region	1987 Trips ² (mm)	Future number of trips as percentage of 1987 demand				
		2000	2010	2020	2030	2040
Picnicking	262.1	108	117	126	136	144
North	115.7	103	111	116	116	115
Pacific Coast	36.6	137	166	189	219	254
Rocky Mountains	20.1	109	119	126	140	156
South	89.7	103	109	112	121	131
Developed Camping	60.5	120	137	155	173	186
North	26.8	115	131	145	147	149
Pacific Coast	8.5	153	197	238	290	351
Rocky Mountains	4.9	121	141	157	182	210
South	20.3	114	127	137	153	174
Water						
Canoeing/Kayaking	39.7	113	126	140	157	169
North	17.1	109	122	132	131	131
Pacific Coast	5.2	141	177	210	258	318
Rocky Mountains	3.0	116	134	147	174	205
South	14.4	107	117	124	139	158
Stream/Lake Swimming	238.7	105	110	117	124	129
North	104.9	101	105	108	107	107
Pacific Coast	31.8	131	152	169	189	212
Rocky Mountains	15.3	105	111	116	125	136
South	86.6	100	104	105	111	118
Rafting/Tubing	9.0	111	136	164	215	255
North	4.3	106	135	156	148	145
Pacific Coast	0.9	146	210	275	442	720
Rocky Mountains	0.6	132	194	245	417	724
South	3.2	100	119	128	176	249
Rowing/Paddling, etc.	61.8	112	124	136	150	159
North	27.4	108	120	129	129	129
Pacific Coast	6.8	136	166	192	229	273
Rocky Mountains	4.2	114	129	140	160	184
South	23.4	107	116	122	135	150
Motorboating	219.4	106	111	117	123	127
North	90.3	102	107	110	110	110
Pacific Coast	22.9	128	147	162	178	196
Rocky Mountains	12.4	106	112	116	124	132
South	93.9	102	105	108	113	118
Waterskiing	107.4	111	121	131	141	148
North	44.5	107	116	123	123	124
Pacific Coast	11.1	136	163	185	211	241
Rocky Mountains	8.5	112	123	131	144	159
South	43.4	106	114	118	127	137
Outdoor Pool Swimming	221.0	137	169	205	242	269
North	89.2	132	166	196	203	208
Pacific Coast	37.0	167	231	298	389	502
Rocky Mountains	20.0	141	181	217	272	337
South	74.8	130	157	181	215	255
Sailing	35.0	145	188	237	293	335
North	15.3	137	178	218	225	232
Pacific Coast	5.1	200	307	425	603	844
Rocky Mountains	2.3	150	205	256	342	453
South	12.3	133	168	197	244	302

(Continued)

Table 18.—(continued).

Resource category and activity (national) region	1987 Trips ² (mm)	Future number of trips as percentage of 1987 demand				
		2000	2010	2020	2030	2040
Snow and Ice						
Cross-Country Skiing	9.7	147	177	199	212	195
North	5.3	140	174	190	154	121
Pacific Coast	1.3	198	288	364	484	615
Rocky Mountains	1.2	157	206	232	284	336
South	2.0	135	160	164	181	194
Downhill Skiing	64.3	153	197	247	298	333
North	32.7	164	229	294	317	336
Pacific Coast	11.2	173	234	288	361	441
Rocky Mountains	8.9	168	233	298	398	521
South	11.5	142	176	202	241	284
Snowmobiling	17.7	119	128	134	137	130
North	11.0	116	128	132	118	104
Pacific Coast	2.1	132	155	170	193	215
Rocky Mountains	1.6	123	139	146	161	173
South	3.1	114	123	123	128	131

¹Maximum preferred demand is the number of trips households would take if future per trip costs were unchanged from the base year amount and resource availability were unconstrained.

²Regional trips may not sum exactly to the national total because of rounding.

Source: Outdoor Recreation and Wilderness Assessment Research, USDA Forest Service, Athens, GA.

Table 19.—Top 10 fastest growing activities in maximum preferred demand to 2040, as percentage of 1987 base, by region.

Activity	Region			
	Pacific North	Rocky Coast	Mountains	South
			(rank)	
Downhill skiing	1	7	2	2
Sailing	4	1	3	1
Day hiking	2	—	4	5
Rafting/tubing	—	2	1	4
Pool swimming	7	—	5	3
Visiting prehistoric sites	3	—	8	8
Cross-country skiing	—	3	6	—
Visiting historic sites	6	—	10	10
Running/jogging	10	4	7	6
Sightseeing	5	—	—	—
Backpacking	9	5	9	7
Bicycling	—	6	—	9
Photography	—	8	—	—
Collecting berries	8	—	—	—
Visiting museums	—	9	—	—
Developed camping	—	10	—	—

Source: Outdoor Recreation and Wilderness Assessment Research, USDA Forest Service, Athens, GA.

In most cases where no national gap was projected, regional gaps also were zero. Three exceptions were downhill skiing, snowmobiling, and rafting/tubing. Skiing had no projected gap in the North region, but projected gaps of 5%, 18%, and 37% in the Pacific Coast, Rocky Mountains and South regions, respectively. Snowmobiling showed a gap (9%) of only in the South region. Rafting/tubing had an anticipated shortage of supply only in the Rocky Mountain region, where the gap was 318% of current trips. Because of the small number of base year trips (0.6 million), this rather large percentage gap translates to only 1.9 million trips.

There are some consistencies across regions regarding the five activities projected to have the highest percentage gaps (table 21). For all four regions, cross-country skiing is projected to have one of the five largest regional percentage gaps. Like sailing and rafting/tubing, it had a low number of base year trips and its supply and demand models were relatively weak. Backpacking, day hiking, and wildlife observation rank in the top five activities for three of the four regions. However, there also are regional differences. Even though rafting/tubing is projected to have the largest percentage gap in the Rocky Mountain region, no other

Table 20.—Projected gap between maximum preferred demand and expected supply of outdoor recreation trips away from home, measured as percentage difference by decade to 2040, by region.

Resource category and activity (national) region	1987 Trips ¹ (mm)	2000 D/S/G ²	2010 D/S/G	2020 D/S/G	2030 D/S/G	2040 D/S/G
Land						
Wildlife Observation	69.5	116/107/9	131/113/17	146/120/26	162/120/42	174/130/44
North	31.5	112/106/6	127/114/13	138/119/19	139/117/22	140/114/26
Pacific Coast	8.9	143/124/19	179/140/39	211/152/59	256/169/87	308/188/121
Rocky Mountains	5.4	118/105/13	136/111/25	150/114/36	173/123/50	201/132/69
South	23.8	111/102/9	122/107/15	130/109/21	145/115/30	162/122/40
Primitive Camping	38.1	114/108/6	127/115/12	140/122/18	154/130/24	164/134/30
North	16.2	110/105/5	122/113/9	131/118/13	131/117/14	132/116/16
Pacific Coast	5.8	143/123/20	178/138/40	208/148/60	246/161/85	290/176/114
Rocky Mountains	2.9	115/107/8	130/115/15	142/119/23	161/129/31	183/139/44
South	14.4	109/105/4	118/111/7	125/114/11	137/122/15	151/130/21
Backpacking	25.9	134/124/10	164/144/20	196/165/31	230/185/45	255/198/57
North	11.2	129/125/4	160/151/9	187/174/13	193/178/15	197/181/16
Pacific Coast	4.0	167/134/33	231/158/73	295/177/118	385/203/182	497/231/266
Rocky Mountains	2.2	136/114/22	172/127/45	203/134/69	252/149/103	309/166/143
South	8.5	126/122/4	151/142/9	171/158/13	203/182/21	238/210/28
Nature Study	70.7	105/99/6	113/101/12	120/103/17	131/107/24	138/108/30
North	31.2	101/97/4	108/100/8	113/101/12	111/97/14	111/95/16
Pacific Coast	9.3	129/115/14	153/125/27	172/131/41	202/143/59	238/158/80
Rocky Mountains	5.8	107/98/9	117/100/17	124/100/24	140/106/34	158/113/45
South	24.5	100/95/5	105/95/10	108/93/15	117/97/21	128/102/26
Horseback Riding	63.2	123/114/9	141/125/16	160/135/25	177/144/33	190/149/41
North	25.1	118/113/5	135/126/9	150/136/14	153/137/16	156/138/18
Pacific Coast	11.5	150/127/23	190/143/47	226/154/72	267/166/101	312/179/133
Rocky Mountains	6.1	123/107/16	142/113/29	158/115/43	180/121/59	203/127/76
South	20.4	117/112/5	132/122/10	144/129/15	159/139/20	176/150/26
Day Hiking	91.1	131/123/8	161/144/17	198/168/30	244/198/46	293/229/64
North	42.4	132/126/6	167/154/13	206/184/22	240/209/31	282/239/43
Pacific Coast	13.7	142/125/17	177/143/34	212/159/53	262/181/81	322/207/115
Rocky Mountains	7.7	138/124/14	178/146/32	221/169/52	289/205/84	379/249/130
South	27.3	122/116/6	145/132/13	168/148/20	203/172/31	247/201/46
Photography	42.1	123/115/8	143/128/15	165/141/24	188/154/34	205/163/42
North	18.9	118/112/6	139/127/12	156/138/18	158/138/20	160/136/24
Pacific Coast	5.7	154/131/23	202/154/48	248/172/76	313/197/116	392/226/166
Rocky Mountains	3.0	125/117/8	150/133/17	171/145/26	206/166/40	246/189/57
South	14.5	116/110/6	133/120/13	145/127/18	167/140/27	191/155/36
Visit Prehistoric Sites	16.7	133/127/6	160/148/12	192/173/19	233/203/30	278/236/42
North	7.2	130/124/6	159/148/9	193/174/19	230/202/28	276/236/40
Pacific Coast	2.7	139/130/9	167/150/17	193/168/25	222/187/35	256/208/48
Rocky Mountains	1.2	134/127/7	165/151/14	201/179/22	251/215/36	314/260/54
South	5.6	120/116/4	138/130/8	158/145/13	184/165/19	216/189/27
Collecting Berries	19.0	113/110/3	126/120/6	143/132/11	166/149/17	192/169/23
North	8.6	114/110/4	130/122/8	148/136/12	171/152/19	199/173/26
Pacific Coast	2.7	119/111/8	132/119/13	143/124/19	158/132/26	177/142/35
Rocky Mountains	1.3	117/115/2	135/130/5	154/146/8	184/172/12	222/203/19
South	6.3	106/104/2	114/110/4	124/117/7	139/129/10	158/143/15
Collecting Firewood	30.3	113/109/4	127/118/9	143/130/13	161/144/17	183/161/22
North	15.4	113/111/2	127/123/4	143/137/6	161/152/9	183/170/13
Pacific Coast	3.3	116/109/7	128/115/13	137/119/18	151/125/26	166/133/33
Rocky Mountains	1.8	116/110/6	131/121/10	148/131/17	173/148/25	204/169/35
South	9.8	106/105/1	114/111/3	122/118/4	136/129/7	152/143/9

(Continued)

Table 20.—(continued).

Resource category and activity (national) region	1987 Trips ¹ (mm)	2000 D/S/G ²	2010 D/S/G	2020 D/S/G	2030 D/S/G	2040 D/S/G
Walking for Pleasure	266.4	116/116/0	131/132/0	146/148/0	164/168/0	177/183/0
North	118.0	111/111/0	125/125/0	137/136/1	137/138/0	137/140/0
Pacific Coast	40.3	147/147/0	187/189/0	224/230/0	275/288/0	337/361/0
Rocky Mountains	18.8	118/118/0	136/136/0	150/151/0	176/177/0	206/208/0
South	89.3	109/111/0	121/124/0	128/134/0	144/152/0	162/174/0
Running and Jogging	83.7	133/131/2	163/160/3	197/192/5	234/229/5	262/260/2
North	38.4	126/125/1	157/152/5	184/177/7	187/183/4	191/189/2
Pacific Coast	13.0	171/169/2	241/241/0	313/317/0	420/434/0	560/591/0
Rocky Mountains	6.3	136/134/2	173/169/4	206/201/5	261/253/8	329/317/12
South	26.0	124/124/0	148/149/0	167/170/0	201/205/0	241/248/0
Bicycling	114.5	125/124/1	148/146/2	173/170/3	202/197/5	222/218/4
North	47.5	120/118/2	143/140/3	163/158/5	165/161/4	167/165/2
Pacific Coast	18.9	160/157/3	217/210/7	272/264/8	354/343/11	457/445/12
Rocky Mountains	10.3	128/126/2	157/153/4	181/176/5	223/214/9	274/259/15
South	37.8	117/117/0	136/136/0	150/150/0	176/176/0	206/206/0
Offroad Vehicle Driving	80.2	105/104/1	111/108/3	118/112/6	125/118/7	130/121/9
North	35.9	101/100/1	106/104/2	109/106/3	108/105/3	108/105/3
Pacific Coast	11.0	132/124/8	154/138/16	171/148/23	191/159/32	213/171/42
Rocky Mountains	5.9	105/103/2	111/106/5	115/109/6	124/114/10	133/121/12
South	27.4	101/100/1	104/103/1	106/104/2	111/108/3	118/113/5
Visiting Museums	9.7	118/118/0	136/134/2	153/152/1	174/172/2	188/187/1
North	4.7	113/113/0	130/129/1	144/142/2	145/144/1	146/147/0
Pacific Coast	1.2	149/148/1	192/192/0	232/235/0	289/297/0	359/374/0
Rocky Mountains	0.6	121/119/2	143/139/4	160/155/5	190/183/7	226/215/11
South	3.2	112/112/0	125/125/0	135/135/0	153/153/0	174/174/0
Attend Special Events	73.7	114/115/0	127/129/0	141/144/0	157/161/0	168/175/0
North	35.2	109/110/0	122/122/0	132/133/0	132/135/0	133/137/0
Pacific Coast	9.8	143/144/0	179/182/0	211/218/0	255/269/0	308/332/0
Rocky Mountains	5.2	116/116/0	132/133/0	144/146/0	167/169/0	193/196/0
South	23.6	108/110/0	118/122/0	125/131/0	139/147/0	155/167/0
Visiting Historic Sites	73.0	122/117/5	143/133/10	169/152/17	203/178/25	241/204/37
North	33.9	122/118/4	147/138/9	175/159/16	203/180/23	238/206/32
Pacific Coast	10.2	130/121/9	154/137/17	177/151/26	208/170/38	247/194/53
Rocky Mountains	4.9	128/122/6	157/143/14	189/166/23	240/201/39	306/245/61
South	24.0	113/110/3	128/121/7	143/133/10	167/151/16	198/174/24
Driving For Pleasure	421.4	115/110/5	128/120/8	142/129/13	157/139/18	167/145/22
North	198.3	110/107/3	122/117/5	132/125/7	133/124/9	133/124/9
Pacific Coast	52.5	145/132/13	181/155/26	213/173/40	253/195/58	301/221/80
Rocky Mountains	27.9	116/111/5	131/122/9	143/129/14	163/142/21	186/157/29
South	142.7	109/105/4	119/112/7	126/116/10	139/124/15	153/134/19
Family Gatherings	74.4	119/121/0	135/139/0	152/160/0	170/182/0	182/202/0
North	35.3	113/117/0	129/136/0	141/153/0	142/161/0	144/171/0
Pacific Coast	11.4	154/150/4	197/192/5	238/232/6	288/284/4	346/346/0
Rocky Mountains	5.9	120/120/0	138/138/0	153/154/0	176/178/0	203/206/0
South	21.7	112/115/0	125/130/0	134/143/0	149/162/0	166/184/0
Sightseeing	292.1	118/114/4	136/128/8	156/144/12	183/164/19	212/185/27
North	128.2	118/115/3	138/131/7	160/148/12	183/166/17	211/188/23
Pacific Coast	45.1	131/122/9	153/137/16	172/149/23	196/163/33	224/180/44
Rocky Mountains	19.8	122/118/4	144/134/10	168/151/17	203/177/26	247/208/39
South	99.0	111/108/3	122/117/5	134/126/8	152/139/13	174/156/18

(Continued)

Table 20.—(continued).

Resource category and activity (national region)	1987 Trips ¹ (mm)	2000 D/S/G ²	2010 D/S/G	2020 D/S/G	2030 D/S/G	2040 D/S/G
Picnicking	262.1	108/110/0	117/120/0	126/131/0	136/145/0	144/156/0
North	115.7	103/105/0	111/114/0	116/121/0	116/122/0	115/125/0
Pacific Coast	36.6	137/139/0	166/171/0	189/201/0	219/241/0	254/289/0
Rocky Mountains	20.1	109/110/0	119/122/0	126/131/0	140/147/0	156/166/0
South	89.7	103/106/0	109/113/0	112/120/0	121/131/0	131/145/0
Developed Camping	60.5	120/120/0	137/138/0	155/158/0	173/178/0	186/195/0
North	26.8	115/115/0	131/131/0	145/145/0	147/145/2	149/152/0
Pacific Coast	8.5	153/150/3	197/194/3	238/238/0	290/294/0	351/364/0
Rocky Mountains	4.9	121/121/0	141/141/0	157/158/0	182/184/0	210/214/0
South	20.3	114/116/0	127/132/0	137/145/0	153/165/0	174/188/0
Water						
Canoeing/kayaking	39.7	113/113/0	126/126/0	140/138/2	157/153/4	169/163/6
North	17.1	109/111/0	122/124/0	132/135/0	131/136/0	131/138/0
Pacific Coast	5.2	141/133/8	177/160/17	210/183/27	258/217/41	318/257/61
Rocky Mountains	3.0	116/113/3	134/128/6	147/138/9	174/158/16	205/180/25
South	14.4	107/108/0	117/118/0	124/125/0	139/139/0	158/155/3
Stream/Lake Swimming	238.7	105/108/0	110/118/0	117/128/0	124/140/0	129/152/0
North	104.9	101/105/0	105/113/0	108/121/0	107/125/0	107/131/0
Pacific Coast	31.8	131/131/0	152/154/0	169/175/0	189/202/0	212/233/0
Rocky Mountains	15.3	105/105/0	111/111/0	116/115/1	125/124/1	136/133/3
South	86.6	100/106/0	104/114/0	105/122/0	111/135/0	118/151/0
Rafting/Tubing	9.0	111/123/0	136/151/0	164/182/0	215/229/0	255/267/0
North	4.3	106/116/0	135/146/0	156/171/0	148/172/0	145/175/0
Pacific Coast	0.9	146/160/0	210/232/0	275/308/0	442/472/0	720/722/0
Rocky Mountains	0.6	132/131/1	194/172/23	245/206/39	417/289/128	724/406/318
South	3.2	100/114/0	119/139/0	128/155/0	176/202/0	249/265/0
Rowing/Paddling, etc.	61.8	112/110/2	124/120/4	136/130/6	150/142/8	159/150/9
North	27.4	108/107/1	120/118/2	129/125/4	129/125/4	129/125/4
Pacific Coast	6.8	136/131/5	166/156/10	192/177/15	229/206/23	273/240/33
Rocky Mountains	4.2	114/112/2	129/124/5	140/132/8	160/148/12	184/166/18
South	23.4	107/106/1	116/114/2	122/119/3	135/129/6	150/142/8
Motorboating	219.4	106/107/0	111/114/0	117/122/0	123/131/0	127/138/0
North	90.3	102/104/0	107/110/0	110/115/0	110/117/0	110/120/0
Pacific Coast	22.9	128/128/0	147/147/0	162/164/0	178/183/0	196/205/0
Rocky Mountains	12.4	106/108/0	112/116/0	116/123/0	124/133/0	132/145/0
South	93.9	102/104/0	105/109/0	108/112/0	113/119/0	118/127/0
Waterskiing	107.4	111/112/0	121/122/0	131/132/0	141/144/0	148/152/0
North	44.5	107/107/0	116/115/1	123/122/1	123/123/0	124/125/0
Pacific Coast	11.1	136/134/2	163/160/3	185/182/3	211/209/2	241/240/1
Rocky Mountains	8.5	112/114/0	123/127/0	131/139/0	144/156/0	159/176/0
South	43.4	106/107/0	114/115/0	118/121/0	127/131/0	137/142/0
Outdoor Pool Swimming	221.0	137/135/2	169/166/3	205/200/5	242/237/5	269/267/2
North	89.2	132/134/0	166/170/0	196/206/0	203/222/0	208/240/0
Pacific Coast	37.0	167/162/5	231/220/11	298/281/17	389/365/24	502/470/32
Rocky Mountains	20.0	141/134/7	181/167/14	217/195/22	272/238/34	337/287/50
South	74.8	130/126/4	157/151/6	181/172/9	215/202/13	255/236/19
Sailing	35.0	145/141/4	188/181/7	237/226/11	293/279/14	335/322/13
North	15.3	137/137/0	178/180/0	218/222/0	225/239/0	232/256/0
Pacific Coast	5.1	200/189/11	307/281/26	425/384/41	603/537/66	844/743/101
Rocky Mountains	2.3	150/140/10	205/181/24	256/218/38	342/278/64	453/351/102
South	12.3	133/130/3	168/161/7	197/188/9	244/231/13	302/282/20

(Continued)

Table 20.—(continued).

Resource category and activity (national) region	1987 Trips ¹ (mm)	2000 D/S/G ²	2010 D/S/G	2020 D/S/G	2030 D/S/G	2040 D/S/G
Snow and Ice						
Cross-Country Skiing	9.7	147/125/22	177/136/41	199/142/57	212/141/71	195/126/69
North	5.3	140/112/28	174/120/54	190/116/74	154/88/66	121/66/55
Pacific Coast	1.3	198/154/44	288/191/97	364/211/153	484/245/239	615/277/338
Rocky Mountains	1.2	157/132/25	206/155/51	232/161/71	284/181/103	336/197/139
South	2.0	135/126/9	160/143/17	164/146/18	181/157/24	194/165/29
Downhill Skiing	64.3	153/160/0	197/207/0	247/256/0	298/305/0	333/338/0
North	32.7	164/174/0	229/243/0	294/309/0	317/336/0	336/357/0
Pacific Coast	11.2	173/178/0	234/241/0	288/295/0	361/364/0	441/436/5
Rocky Mountains	8.9	168/168/0	233/230/3	298/290/8	398/376/22	521/478/43
South	11.5	142/136/6	176/163/13	202/184/18	241/213/23	284/243/41
Snowmobiling	17.7	119/120/0	128/131/0	134/137/0	137/141/0	130/137/0
North	11.0	116/123/0	128/140/0	132/146/0	118/135/0	104/124/0
Pacific Coast	2.1	132/137/0	155/162/0	170/179/0	193/204/0	215/228/0
Rocky Mountains	1.6	123/124/0	139/141/0	146/148/0	161/162/0	173/174/0
South	3.1	114/110/4	123/117/6	123/117/6	128/120/8	131/122/9

¹Regional trips may not sum exactly to the national total because of rounding.

²D is the maximum preferred demand; S is the expected supply; and G is the percentage difference (gap) 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, that is, demand and supply are in equilibrium.

Source: Outdoor Recreation and Wilderness Assessment Research, USDA Forest Service, Athens, GA.

regions are projected to have any gap for that activity. While all regions are projected to have some gap for both visiting historic and prehistoric sites, only in the North region are these gaps among the top five activities with gaps.

Table 21.—Outdoor recreation activities with the largest projected percentage gaps in 2040, by region.

Activity	Region			
	Pacific North	Rocky Coast	Mountains	South
Gap in percent (top five ranked gaps)				
Cross-country skiing	55 (1)	338 (1)	139 (3)	29 (4)
Rafting/tubing	—	—	318 (1)	—
Day hiking	43 (2)	115	130 (4)	46 (1)
Backpacking	16	266 (2)	143 (2)	28 (5)
Wildlife observation	26 (5)	121 (5)	69	40 (2)
Visiting prehistoric sites	40 (3)	48	54	27
Photography	24	166 (3)	57	36 (3)
Visiting historic sites	32 (4)	53	61	24
Horseback riding	18	133 (4)	76	26
Sailing	—	101	102 (5)	20

Source: Outdoor Recreation and Wilderness Assessment Research, USDA Forest Service, Athens, GA.

Regional differences are less apparent when examining projected gaps in terms of the absolute number of trips (table 22). Gaps in numbers of trips for sightseeing, driving for pleasure, and day hiking are among the top four activities with gaps in each of the four regions. Although no gap is projected for outdoor pool swimming for the North region, in each of the other regions that activity is projected to have relatively large gaps. In the two eastern regions, relatively large gaps in trips are predicted for wildlife observation, but not for horseback riding. The reverse is true for the two western regions.

Almost every activity for which a small or zero gap was projected occurs primarily in an environment with developed recreation facilities. Recent trends in developed land and water resources indicate that the supply of such recreation opportunities will continue to increase fast enough to absorb additional trip demands. Growth in recreation resources and facilities implies reduced cost for trip production. Lower trip costs induce households to produce more trips. As a result, supply and consumption is greater, and gaps are less likely.

Activities such as backpacking, day hiking, and wildlife observation that occur most often in less developed and more remote settings are projected, to a large extent,

to experience growth in preferred demand that will outpace consumption and production of trips. The models predict that, as accessible recreation resources decline or fail to keep pace with growth in demand, households will not be able to produce the number of trips they would prefer to take in the future at the 1987 price. Here, preferred demand will exceed the expected supply of trips.

CONCLUSIONS

Changes in EROS values are determined by both projected population growth and expected changes in recreation resources. Resource trends for undeveloped recreation resources reflect broad social and land use trends, especially the conversion of land from open space to urbanized areas. Offsetting increases in undeveloped lands owned by state and federal agencies are not expected; therefore, opportunities for most undeveloped environments are expected to decline. Developed opportunities are expected to increase, because of both additional parkland acquisition by local governments, and increased opportunities provided by the private sector.

Much regional variation is masked by national level analyses. Each region has a unique combination of resources, travel behavior, population characteristics, and projected changes. In general, the western regions have greater amounts of resources, longer effective travel distances, and higher projected rates of population growth. Because of these combinations, EROS values are not expected to be as sensitive to population

increases as in the eastern regions. Although population is expected to grow more rapidly in the West, longer effective travel distances mean that the demand for recreation resources will be spread over a broader area. In the eastern regions, where travel distances are shorter, resources closer to population centers will bear a relatively greater share of increased demand. As the capacity of these resources is reached more rapidly, the availability of these resources for other recreating households will be reduced. Therefore, a higher level of use pressure can be expected to be put on recreation resources located near population centers in the eastern half of the country, compared to resources in the West.

In general, the rate of demand growth is expected to be greatest for some strenuous activities, including running and jogging, backpacking, bicycling, hiking, swimming and cross-country skiing. Many of these activities take place in undeveloped environments and on or near trails. Other activities with generally high rates of projected demand growth use scenic or historic resources, including visiting historic and prehistoric sites, sightseeing, and photography. Many of these activities also are those expected to have the greatest absolute number of trips demanded over the next 50 years.

Gap analyses represent the combined results of expected shifts in demand based on trends in population characteristics and income changes, as well as expected trends in resource availability and trip substitution. Gaps partly depend on projected changes in recreation resources, because consumption of recreation trips depends on the availability of effective recreation opportunities. This implies that a large gap for an activity can be reduced by increasing recreation resources that support the activity.

Projected growth in the expected supply of trips is generally highest for activities that occur in developed recreation environments, because those are the opportunities that are predicted to increase most in availability. Projected consumption increases in these activities are further bolstered by the anticipated decline in substitute, less developed, opportunities. As less developed opportunities become more scarce or equivalently, more expensive, households are expected to substitute trips to less expensive developed environments for more expensive undeveloped environments. As a result, these types of activities are generally expected to have gaps at or near zero.

Examining the activities that are projected to have the largest gaps indicates that across all regions, a high degree of use pressure will be placed on trail and scenic

Table 22.—Outdoor recreation activities with the largest projected gaps in absolute number of trips in 2040, by region.

Activity	Region			
	Pacific North	Rocky Coast	Mountains	South
	Gap in percent (top five ranked gaps)			
Sightseeing	29.5 (1)	19.8 (2)	7.7 (4)	17.8 (2)
Driving for pleasure	17.8 (3)	42.0 (1)	8.1 (3)	27.1 (1)
Day hiking	18.2 (2)	15.8 (3)	10.1 (1)	12.6 (4)
Outdoor pool swimming	0	11.8 (5)	10.0 (2)	14.2 (3)
Visiting historic sites	10.8 (4)	5.4	3.0	5.8
Horseback riding	4.5	15.3 (4)	4.6 (5)	5.3
Wildlife observation	8.2 (5)	10.8	3.7	9.5 (5)

Source: *Outdoor Recreation and Wilderness Assessment Research*, USDA Forest Service, Athens, GA.

resources near population centers. These are the resources that provide a primary resource base for activities, such as day hiking, backpacking, horseback riding, sightseeing, and pleasure driving. Because much wildlife observation activity also occurs on or near trails, this activity's gaps are also affected. Even though the western regions may have substantial amounts of trail resources, many are not located near cities. For all regions, resources near population centers are most important in providing effective recreation opportunities. These also are the resources that will undergo the most land conversion and use pressures as the United States population continues to grow.

Some regional differences are evident from the gap analyses as well. In the western regions, some water-based recreation activities will have large gaps, including swimming and rafting/tubing. This may indicate increased pressure by the public for additional water-based recreation resources. In the East, opportunities for wildlife observation or green space activities may be insufficient to meet recreation demand, especially opportunities near population centers. An important part of the resource base in this part of the country that has in the past supported such activities are privately owned rural lands.

In general, regional demand and supply analyses appear to be a significant improvement over national analyses. Further research is needed to improve the capacity of these types of analyses to provide guidance for assessing aggregate future trends. These research areas include:

1. Tracking region-specific trends in resource changes, rather than applying national trends to regional resource levels, to increase the specificity of effectiveness and resource values;
2. Estimating region-specific demand and consumption models, to allow coefficients to vary across regions;
3. Improving methods for estimating EROS values, for example by eliminating the simplifying assumption of linearly declining effectiveness decay weights;
4. Examining substitution between activities for recreating households, in order to improve the substitution measure in consumption models;

5. Examining the stability of coefficients in demand and consumption models over time, to see if projections for these values can be accomplished with static coefficients;
6. Building explanatory models using the individual approach, as opposed to the zonal method;
7. Incorporating a measure of ethnicity into the models, especially in light of increasing ethnic diversity.

These types of additional research can yield another round of improvements in the methods and results for assessing the demand and supply of outdoor recreation in the United States.

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Abstract

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This paper develops regional recreation supply and demand projections, by combining coefficients from the national 1989 RPA Assessment models with regional regressor values. Regional recreation opportunity estimates also are developed, based on regional travel behavior. Results show important regional variations in projections of recreation opportunities, trip supply, and trip demand.

Keywords: Outdoor recreation, regional demand, regional supply, recreation projections, demand/supply comparisons, projection models, trends.

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