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## CHAPTER VII

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### DEMAND FOR AND SUPPLY OF WILDERNESS

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**John Loomis<sup>1</sup>**  
**Kenneth Bonetti**  
**Chris Echohawk**

#### Acknowledgments:

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#### INTRODUCTION

In 1974, Congress passed the Renewable Resources Planning Act (RPA) to provide long-term direction for the management of the National Forest System and other U.S. Forest Service (USFS) programs. As part of that act, Congress required a nationwide assessment of the supplies of and demand for natural resources every 10 years. This assessment compares the current supply of renewable natural resources—range, recreation, timber, water, wildlife, and wilderness—with current and likely future demands on these resources. Since all land ownerships together provide these renewable natural resources, the assessment looks at private lands as well as public lands, from state to federal agencies. The assessment provides the overall context for the Forest Service to develop its own five-year RPA program for managing National Forests and related programs. Given that many of the values of natural resources on public lands are non-market, the price mechanism is unavailable to balance the quantity demanded with the quantity supplied.

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<sup>1</sup> John Loomis is a professor and Kenneth Bonetti is a doctoral student, Department of Agricultural and Resource Economics, Colorado State University, Fort Collins, CO; and Chris Echohawk is a graduate student, Department of Earth Resources, Colorado State University, Fort Collins, CO.

The comprehensiveness of the RPA assessment is typically broader than individual state and federal agencies, which look at just their own resource base and management mandate. However, the findings of the comprehensive RPA assessment should be of use to all state and federal natural resource agencies in performing ecosystem management. The intention of ecosystem management is that agencies will coordinate their resource management activities with each other so that they complement rather than conflict with each other's action. The comprehensiveness of the assessment is of particular importance for the country's wilderness resource. Federal agencies are required to manage their congressionally designated Wilderness as a part of the National Wilderness Preservation System (NWPS). As such, agency decisions are influenced, in part, by how their recommendations of roadless areas contribute to the overall diversity of the system.

This chapter provides an overview of the NWPS in the United States. This information should prove useful to state and federal land management agencies responsible for wilderness recommendations and management. The chapter describes the current status of the NWPS and how it contributes to recreation and ecosystem protection in the United States.

## HISTORICAL TRENDS AND CURRENT STATUS

### Wilderness Supply Trends 1965 to 1994

More than 30 years have passed since the 1964 National Wilderness Preservation Act designated 54 areas totaling just over nine million acres to comprise the NWPS. Today, the system covers almost 104 million acres in 630 areas and is managed by four federal agencies (Cole 1996). The USFS manages nearly 29 million acres in the lower 48 states (36 million when Alaska is included). The National Park Service (NPS) manages another 10 million acres (39 million when Alaska is included). These two agencies manage over 80 percent of the acreage in the NWPS in the lower 48 states and nearly all of the documented Wilderness recreation occurs in their jurisdictions.

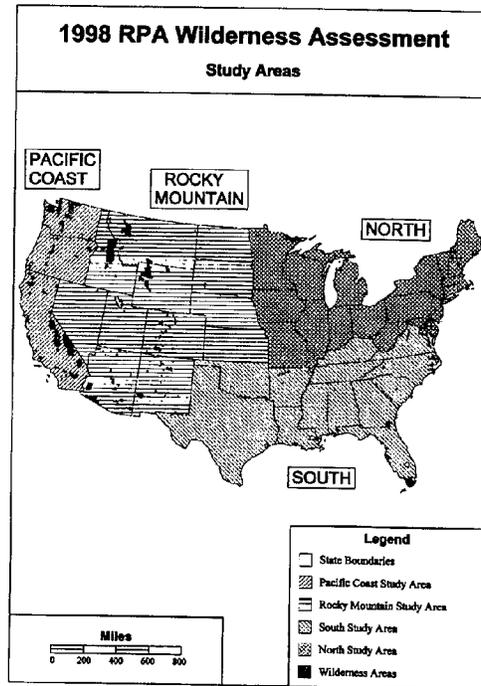
#### *National Forest Wilderness*

USFS designations began in 1964 with the passage of the Wilderness Act. As Table VII.1 shows, Wilderness designation of national forest land occurred sporadically as Congress acted upon recommendations of the USFS and environmental groups. Growth was relatively moderate after the initial enactments. Twenty-five percent was added over 10 years to make a total of 15 million acres in 1975. Between 1975 and 1985 designations grew significantly, increasing the total on national forests to 27 million acres in 1985. From 1975 to 1985, the average annual growth rate was 13.2 percent. Between 1985 and 1995, the annual rate of USFS designations slowed to about 1.1 percent. During that period, significant additions occurred in the Rocky Mountain, Pacific Coast and the Southern regions (see Table VII.1). The vast majority of USFS growth occurred in the Rocky Mountain and Pacific Coast regions, which held 93.3 percent of USFS Wilderness by 1995. In 1995, the USFS managed 28.9 million acres in 40 of the lower 48 states and 5.8 million acres in Alaska.

**Table VII.1: Total Acres of National Forest Land in the National Wilderness Preservation System for the U.S. and by Region and Year**

Year	Continental U.S. Total	Regions			
		North	South	Rocky Mountains	Pacific Coast
1965	12,158,586	804,828	29,425	7,123,389	4,200,944
1970	13,301,846	804,828	29,425	7,130,468	5,337,125
1975	15,214,040	888,247	197,898	8,448,654	5,679,241
1980	22,144,504	941,540	220,636	14,392,495	6,589,833
1985	27,147,329	1,167,003	573,861	16,869,257	8,537,208
1990	28,076,738	1,300,010	683,777	17,551,951	8,541,000
1995	28,941,072	1,307,200	692,200	17,890,100	9,051,572

Figure VII.1: The 1998 RPA Wilderness Assessment Study Areas

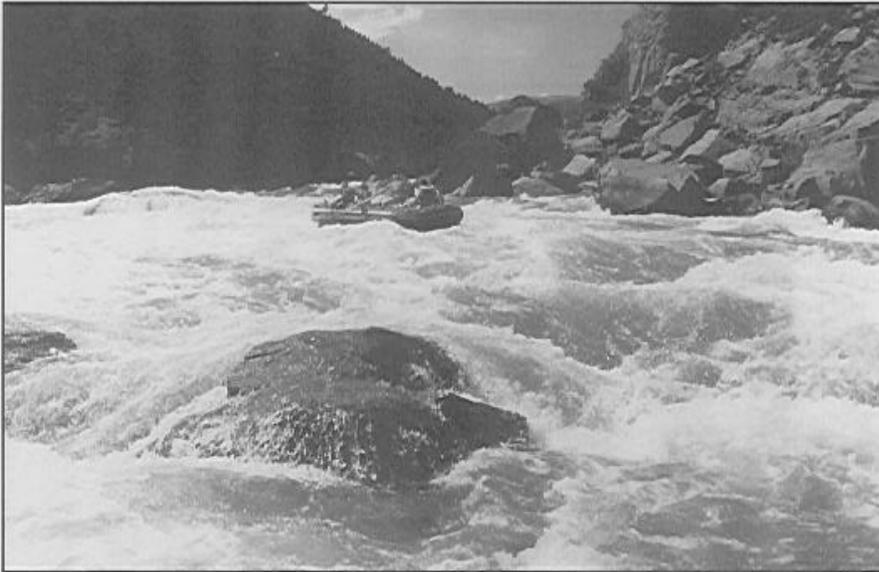


### *National Park Service*

NPS acreage has increased sporadically, with large additions in the late 1970s (Table VII.2). The NPS Wilderness growth pattern is similar to the USFS, with most (five million acres) occurring between 1978 and 1988. There were no additions to NPS Wilderness from 1988 until 1994, when the long-delayed California Wilderness Act added 3.8 million acres. In 1994, NPS holdings totaled 10 million acres or about 9.8 percent of the NWPS. In 1994, the majority of NPS Wilderness acreage was in the Pacific Coast region (77 percent), but the South had a significant share (14 percent), more than double that in the Rocky Mountain region. The North region contained only a little more than one percent of NPS Wilderness in 1994.

### *Other Federal Agencies*

The U.S. Fish and Wildlife Service (USFWS) manages slightly more than 20 million acres of Wilderness on its refuges, with 18.6 million of its Wilderness acreage in Alaska. The Bureau of Land Management (BLM) became eligible to recommend land for Wilderness designation in 1976 with the passage of the Federal Land Policy and Management Act. To date, 5.2 million acres have been designated and many acres identified as having wilderness potential await consideration. Of BLM managed Wilderness, 3.5 million are in California and 1.4 million are in Arizona.



*The Madison River offers some of Montana's most challenging white water as it cuts through Bear Trap Canyon. Part of the Lee Metcalf Wilderness, Bear Trap is the first area administered by the Bureau of Land Management to receive Wilderness designation. Photo courtesy of the USDI Bureau of Land Management.*

## FEDERAL WILDERNESS

Across all four agencies, about 104 million acres of federal land are designated Wilderness. About half of this total is in Alaska; about 40 percent is in the contiguous western states; and 10 percent is in the East.

**Table VII.2: Total Acres of National Park Land in the National Wilderness Preservation System for the U.S. and by Region and Year**

Year	Continental U.S. Total	Regions		
		North	South	Rocky Mountains Pacific Coast
1965	0	0	0	0
1971	93,503	0	0	93,503
1975	203,862	0	0	96,420
1980	3,111,257	133,243	1,435,258	693,152
1985	4,534,677	133,243	1,444,098	693,152
1990	6,227,825	133,243	1,459,108	693,152
1993	6,227,825	133,243	1,459,108	693,152
1994	10,081,063	133,243	1,459,108	693,152
1995	0	0	0	0

## Qualified Roadless Areas by Agency

Information was obtained from a variety of agency sources on acreages of proposed Wilderness. For the USFS and BLM, we were able to obtain both recommended acreages as well as Wilderness Study Area (WSAs) acreages not recommended. Since WSAs met the criteria of being suitable for Wilderness, we were able to estimate an upper limit on acreage and recreation visitor use if all potential wilderness acreage was designated by Congress. For the NPS, data are available only for recommended acres.

In the lower 48 states, the NPS has over seven million acres recommended for but not yet designated as Wilderness. If all of its recommended acres are designated, NPS Wilderness acreage in the lower 48 states would double. For the Rocky Mountain region, the increase would be quite dramatic with an increase in official Wilderness by nearly a factor of 10 (from 700,000 acres to 6,594,500 acres because of large additions in Yellowstone, Glacier, and Rocky Mountain National Parks). In the South, designation of recommended acres would result in a 30 percent increase in Wilderness. Much of this increase is in the Great Smoky Mountains National Park. Increases for the West Coast are much smaller, representing just two percent increases.

Increases in National Forest Wilderness would be modest, representing a 10 percent (three million acres) overall increase if all recommended acres were designated by Congress. The Rocky Mountain region would gain the most acreage (2.6 million acres), representing a gain of 14 percent in that area.

The BLM has 26 million acres of WSAs and recommended about one third of them, or 9.5 million acres as Wilderness. About six million of these acres are in the Rocky Mountain region and 3.5 million are in the Pacific Coast region. As discussed briefly below, addition of these BLM lands would improve the ecological representation in the NWPS. Much of BLM's WSAs are high desert, an ecosystem that is currently under-represented in the system.

### **Ecosystem Representation by the Federal System**

In recent years, policymakers have become more aware of the importance of preserving natural diversity in plants and animals and physical environments. Biological diversity includes both species diversity and genetic diversity within species. Natural diversity incorporates the physical environment and climate within which species interact with biological diversity. Natural diversity therefore depends on the preservation of a full range of functioning ecosystems.

Two methods are used to preserve natural diversity: manipulative management and preservation management. Davis' (1989) previous analysis of Wilderness addresses preservation management, specifically the inclusion of representative samples of naturally occurring ecosystems in the NWPS. Preservation management ensures diversity through the preservation of unrestrained ecological processes. Wilderness protection, however, is only one mechanism for protecting selected portions of the natural landscape. National parks, nature preserves, and similar legal reservations also play important conservation roles.

In its second Roadless Area Review and Evaluation (RARE II) in 1977, the USFS decided to give preference to additions of areas that would increase the diversity of the NWPS. RARE II adopted the Bailey-Kuchler ecosystem classification system, which considers physical (climate and soil) and biological (vegetation) factors. The number of ecosystems identified under the Bailey-Kuchler system total 261. The USFS defines adequate representation of an ecosystem to include two or more distinct examples of at least 1000 acres (400 hectares). In addition, the areas selected must epitomize that particular ecosystem.

As a result of RARE II and subsequent designations by Congress, 157 of the country's ecosystems were represented in the NWPS by 1989. The Bureau of Land Management (BLM) has also adopted the Bailey-Kuchler system for its wilderness studies. Additions of BLM land have the potential to increase the diversity within the NWPS. Davis anticipated that up to 200 ecosystems would be represented by the year 2000. While forest and desert ecosystems are well represented in the NWPS, few of the fertile native grassland ecosystems have been included because most of these lands are privately owned and lack the scenic splendor that encourages citizens to support wilderness designations.

Davis performed the last analysis of ecosystem representation in 1989. Discussions with Davis indicated he had not updated the analysis since then. Discussions with others, such as the GAP GIS project at the University of Idaho, indicated that such an analysis was not complete for the U.S. Therefore, we undertook an updated analysis using Bailey's ecoregions at the province level and federal agency Wilderness GIS data.

### **Data Sources**

The data were collected from several sources with the help of many people in the federal land management agencies. GIS coordinators in the USFS, BLM, and NPS provided map layers. Geographic Information System (GIS) analysis was conducted using Arc/Info, Arc View, and Atlas GIS software. Data sets were provided from sources in one of three formats: Arc/Info coverages, Arc export files, or Atlas GIS .agf files. After these sources were converted to common projections, analysis and display of the data was accomplished using Atlas GIS. Statistics were calculated using Microsoft Excel from the Atlas files. The results were compared with figures obtained independently of the GIS analysis and were found to be satisfactory (5 to 10 percent difference). This analysis was acceptable since the level of detail and accuracy in the GIS data available was highly variable from agency to agency and source to source.

The results of the GIS work are summarized in the maps provided and in the accompanying table. These show the result of overlaying the final wilderness coverage with the Bailey's Ecoregions coverage. The maps show the spatial distribution of the data, including a low wilderness representation in the Great Basin relative to the other western regions. This study is striking considering the large proportion of federal ownership. The greatest representation is in the western mountains and southwestern deserts, and the lowest amounts in the high prairie and southern forests.

Table VII.3: Comparison of Wilderness Acreage by Ecoregion

Ecode	Province	% of Total U.S. Lower 48 Wilderness	% of U.S. in Ecoregion	Wilderness to Ecoregion Area ratio	Ratio over 1?	% Ecoregion as Wilderness	Wilderness (ac)	Total Ecoregion Area (ac)
322	American Semi-Desert and Desert Province	21.0%	2.9%	7.17	Yes	16.4%	9,197,580	56,238,366
M331	Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow Province	17.4%	3.4%	5.10	Yes	11.6%	7,635,330	65,613,296
M332	Middle Rocky Mountain Steppe-Coniferous Forest-Alpine Meadow Province	13.7%	2.4%	5.04	Yes	11.5%	6,021,600	52,324,240
M261	Sierra Steppe-Mixed Forest-Coniferous Forest-Alpine Meadow Province	11.8%	2.3%	5.17	Yes	11.8%	5,164,810	43,748,392
M242	Cascade Mixed Forest-Coniferous Forest-Alpine Meadow Province	11.4%	1.8%	6.40	Yes	14.6%	5,001,910	34,242,360
411	Everglades Province	3.0%	0.3%	11.35	Yes	25.9%	1,289,350	5,014,900
M313	Arizona-New Mexico Mountains Semi-Desert-Open Woodland-Coniferous Forest-Alpine Meadow Province	2.9%	1.7%	1.75	Yes	4.0%	1,287,300	32,182,260
212	Laurentian Mixed Forest Province	2.8%	4.9%	0.57	No	1.3%	1,226,870	94,418,672
313	Colorado Plateau Semi-Desert Province	2.5%	2.5%	1.01	Yes	2.3%	1,115,840	48,280,396
M262	California Coastal Range Open Woodland-Shrub-Coniferous Forest-Meadow Province	2.5%	0.8%	3.00	Yes	6.9%	1,094,610	15,966,126
M333	Northern Rocky Mountain Forest-Steppe-Coniferous Forest-Alpine Meadow Province	2.3%	1.3%	1.84	Yes	4.2%	1,022,580	24,375,970
341	Intermountain Semi-Desert and Desert Province	1.4%	3.6%	0.39	No	0.9%	616,502	68,719,944
331	Great Plains-Palouse Dry Steppe Province	1.2%	9.7%	0.12	No	0.3%	529,926	186,315,184
232	Outer Coastal Plain Mixed Forest Province	1.2%	5.9%	0.21	No	0.5%	527,653	111,395,924
M341	Nevada-Utah Mountains-Semi-Desert-Coniferous Forest-Alpine Meadow Province	1.1%	1.5%	0.77	No	1.8%	492,072	27,947,022
321	Chihuahuan Semi-Desert Province	0.8%	2.8%	0.28	No	0.6%	354,299	54,607,684
342	Intermountain Semi-Desert Province	0.7%	5.3%	0.13	No	0.3%	304,501	101,961,848
M221	Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province	0.6%	2.3%	0.26	No	0.6%	259,940	6,608,040
261	California Coastal Chaparral Forest and Shrub Province	0.5%	0.3%	1.35	Yes	3.1%	202,972	6,608,040
M212	Adirondack-New England Mixed Forest-Coniferous Forest-Alpine Meadow Province	0.3%	1.5%	0.23	No	0.5%	147,172	27,986,370
222	Eastern Broadleaf Forest (Continental) Province	0.2%	9.0%	0.02	No	0.1%	97,687	172,911,328
242	Pacific Lowland Mixed Forest Province	0.1%	0.5%	0.26	No	0.6%	57,497	9,534,571
315	Southwest Plateau and Plains Dry Steppe and Shrub Province	0.1%	5.4%	0.02	No	0.0%	39,815	103,129,536
221	Eastern Broadleaf Forest (Oceanic) Province	0.1%	3.5%	0.03	No	0.1%	38,808	66,889,328
263	California Coastal Steppe-Mixed Forest-Redwood Forest Province	0.1%	0.2%	0.52	No	1.2%	34,481	2,918,990
M222	Ozark Broadleaf Forest - Meadow Province	0.1%	0.2%	0.28	No	0.6%	26,369	4,100,165
231	Southeastern Mixed Forest Province	0.1%	6.4%	0.01	No	0.0%	26,353	123,644,224
M231	Quachita Mixed Forest - Meadow Province	0.0%	0.3%	0.09	No	0.2%	11,908	5,644,113
332	Great Plains Steppe Province	0.0%	4.5%	0.01	No	0.0%	10,148	85,891,360
311	Lower Mississippi Riverine Forest Province	0.0%	0.6%	0.03	No	0.1%	8,504	11,252,168
234	Lower Mississippi Riverine Forest Province	0.0%	1.5%	0.01	No	0.0%	4,122	28,361,032
251	Prairie Parkland (Temperate) Province	0.0%	7.3%	0.00	No	0.0%	0	196,783,520
255	Prairie Parkland (Subtropical) Province	0.0%	2.7%	0.00	No	0.0%	0	51,247,280
262	California Dry Steppe Province	0.0%	0.6%	0.00	No	0.0%	0	12,323,812
M334	Black Hills Coniferous Forest Province	0.0%	0.1%	0.00	No	0.0%	0	2,353,896
Totals		100.0%	100.0%	Median 0.26		2.3%	43,858,509	1,921,547,962

Table VII.3 presents a tabulation of total acres in the continental U.S. by province and the corresponding amount of this in Wilderness areas. This table provides several key types of information: (1) percentage of the ecoregion protected as Wilderness, (2) percentage of lower 48 Wilderness in each province, (3) percent of total lower 48 Wilderness by ecoregion. These data provide several interesting perspectives.

The first is the proportion of an ecoregion protected in Wilderness. Overall, about two percent of the land areas in the continental United States are protected as Wilderness. At the upper end, about 26 percent of the Everglades province and 16.4 percent of the American Desert province are Wilderness (with the latter high percentage occurring just recently with the recent California National Parks Wilderness legislation). High percentages of alpine provinces in the Cascades, Rocky Mountains, and Sierras also are protected. The top five provinces (just 15 percent) contain 75 percent of Wilderness, leaving the other 85 percent of provinces with 25 percent of U.S. Wilderness. This disparity is even more apparent when one looks at Figure 2 (map), which shows that large provinces have essentially no Wilderness protection (20 of the 60 provinces have zero or fewer than 1 percent protected as Wilderness). Plains and Southeastern mixed forest represent substantial portions of U.S. land areas with almost no Wilderness. However, much of these provinces are in areas with limited acreage of federal lands, so the opportunities for Wilderness designation may be limited.

Figure 2 also indicates a large "gray doughnut" in the public states of Utah and Nevada. Under-representation of the Intermountain Desert province could be reduced if BLM WSA's are designated. Figures 3-4, 5-6, 7 and 8 provide a mapping of the Wilderness areas by province for the North, South, Rocky Mountains and Pacific Coast, respectively.

To provide some policy perspective on underrepresentation, we calculate the ratio of Wilderness to ecoregion area. A ratio of one means that the province has equal percentages of the NWPS and continental United States land area. For example in the case of Province M331, a ratio of 5.1 means that this province has five times as much representation in the NWPS as it has in the land area in the Continental United States. Thus this province is well represented in the NWPS. Conversely, Province 341, Intermountain Desert, represents 3.6 percent of the U.S. land area but only 1.4 percent of the NWPS. Thus, this province has a ratio of 0.39, indicating it is underrepresented in the NWPS and underprotected. Addition of another acre would be more important in Province 341 than in M331 in terms of the contribution to protecting diversity of landscapes.

Figure VII.2: The Relative Protection of Ecoregions by Wilderness

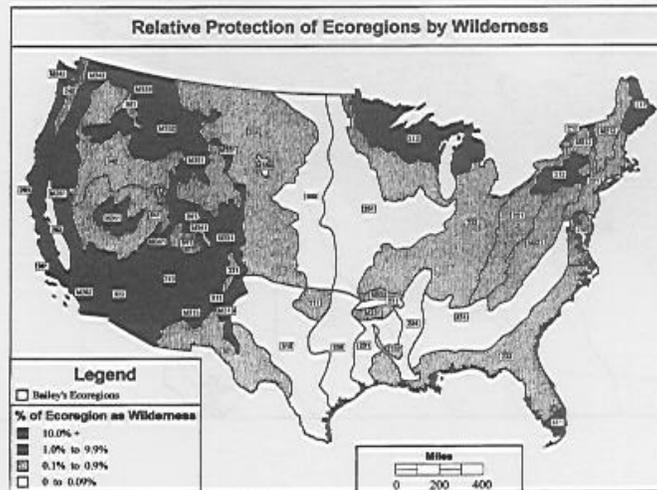


Figure VII.3: Wilderness Ecoregions Within the Eastern Portion of the North Study Area

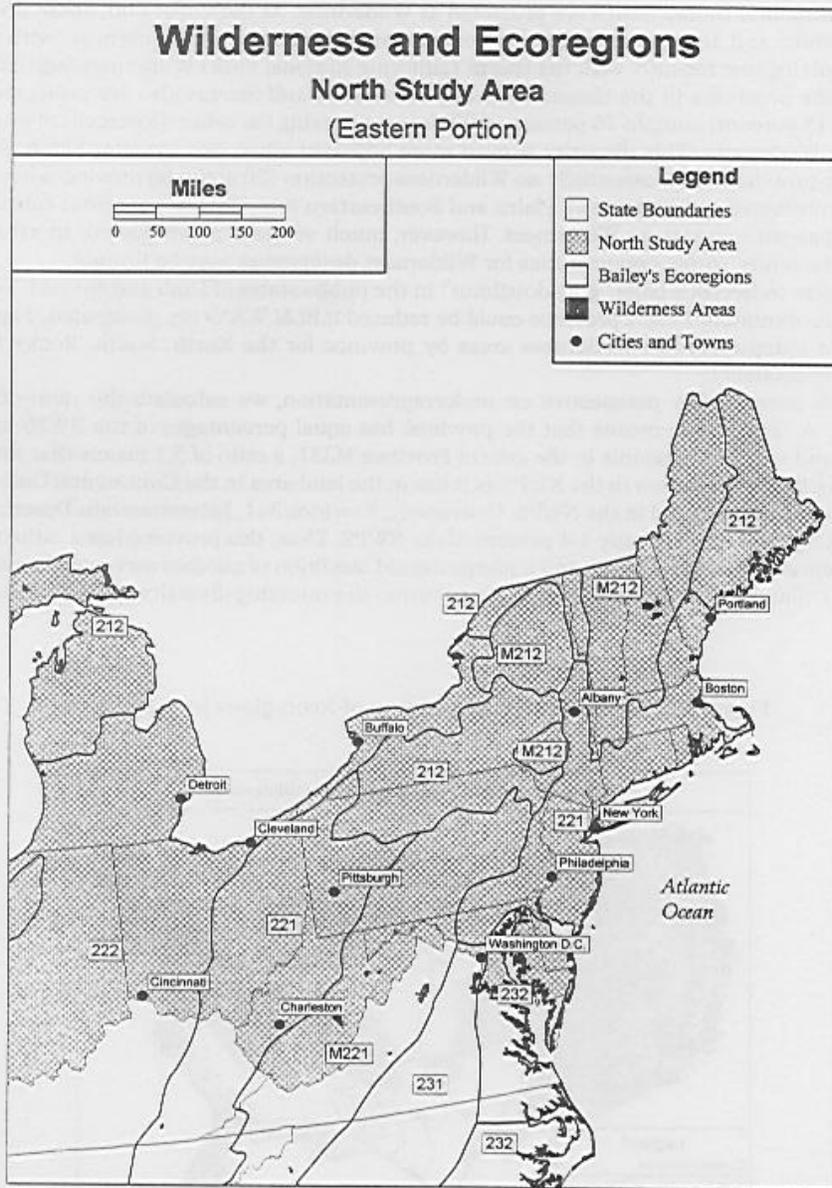


Figure VII.4: Wilderness Ecoregions Within the Western Portion of the North Study Area

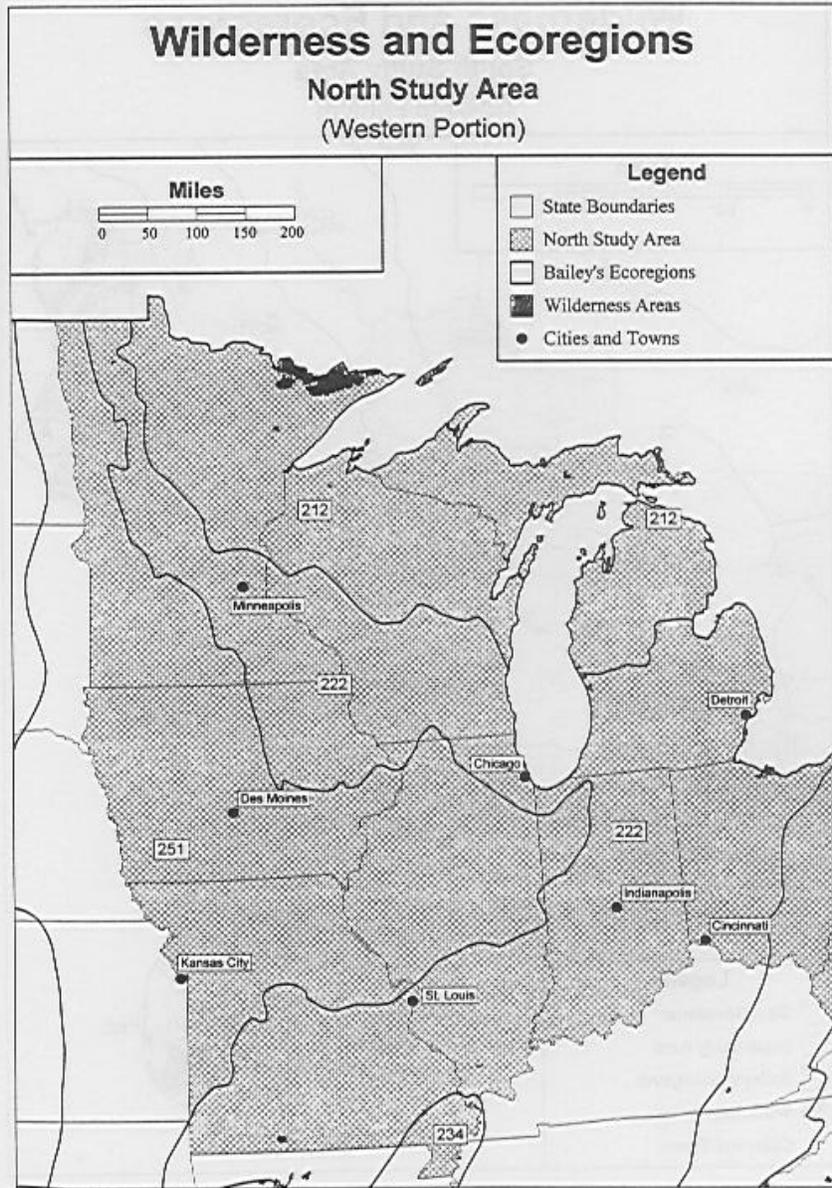


Figure VII.5: Wilderness Ecoregions Within the Eastern Portion of the South Study Area

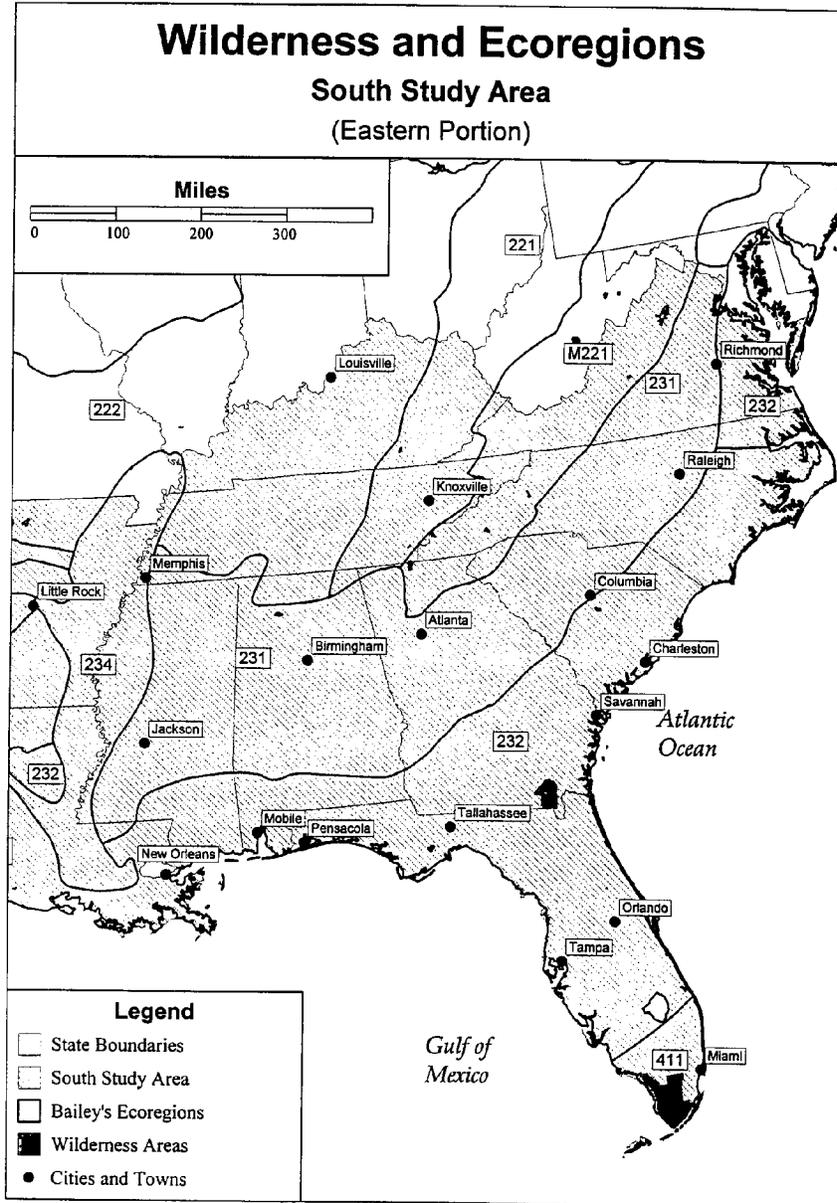


Figure VII.6: Wilderness Ecoregions Within the Western Portion of the South Study Area

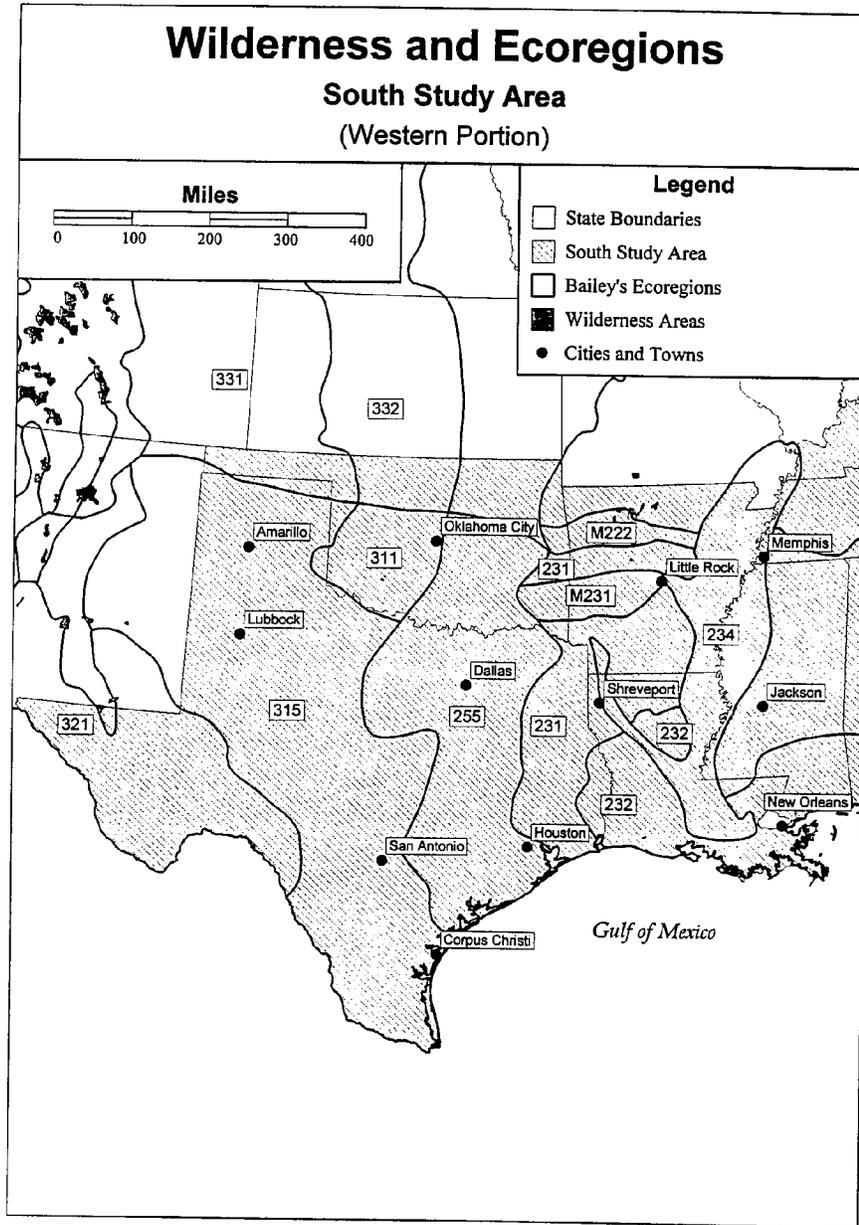
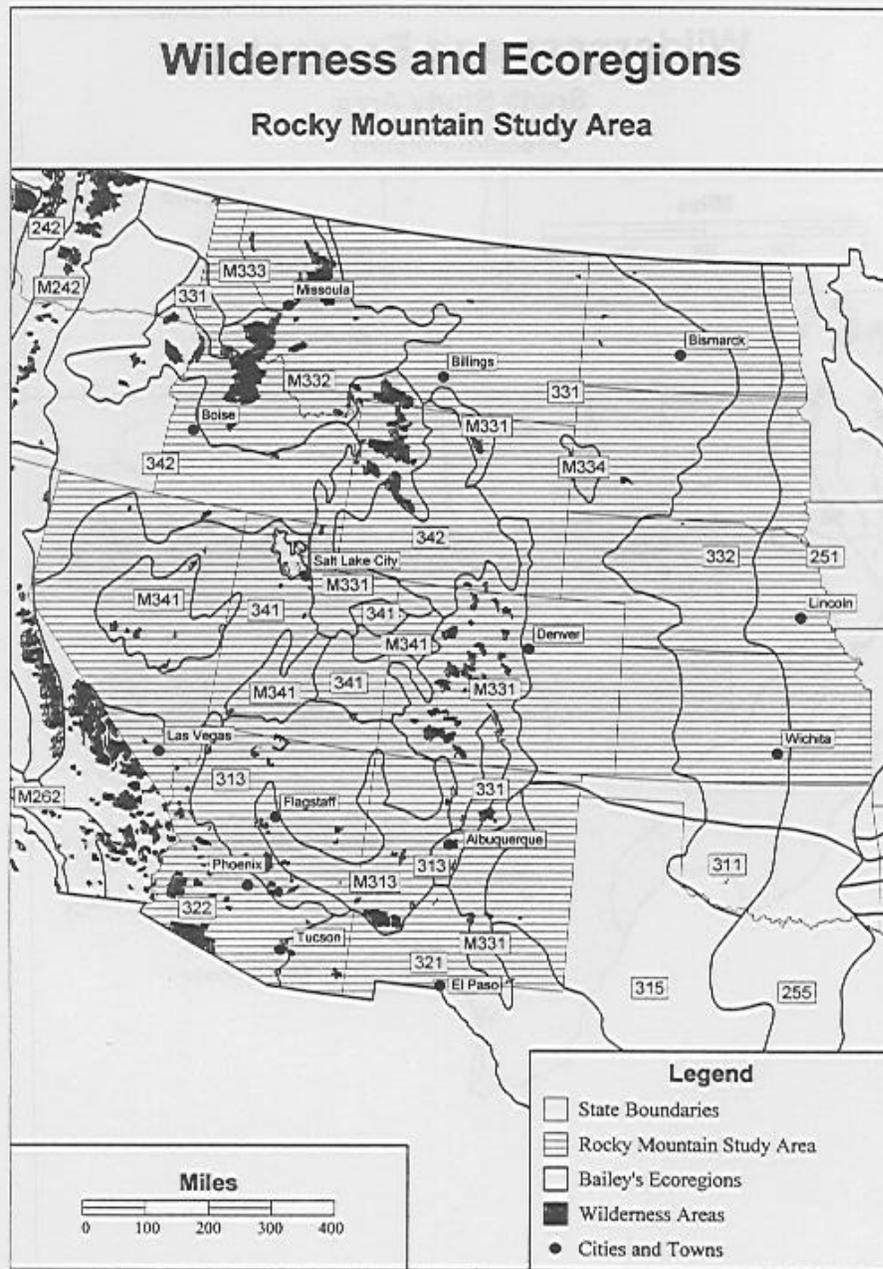


Figure VII.7: Wilderness Ecoregions of the Rocky Mountains Study Area





About 40 percent of 261 major terrestrial ecosystems recognized by a combination of Bailey's ecoregions and Kuchler's potential natural vegetation are not protected in the National Wilderness Preservation System. State wilderness can serve an important recreation role where federal land holdings are scarce or nonexistent, particularly in the Eastern U.S., which holds one half of the country's population but less than five percent of the federal Wilderness.

### **Current Recreation Use**

Data on state Wilderness visitation is sparse: only Alaska and New York systematically collect information on visitation levels. According to Wilderness managers, 34 percent of areas are in the "high" use category, 39 percent are in "medium" use, and 27 percent are rated as "low" use areas (Peterson, 1996). Despite relatively high levels of use experienced in several states, only California, Michigan, and New York limit the number of people entering a Wilderness Area (Peterson, 1996). Most states have not adopted a comprehensive visitor management strategy such as Limits of Acceptable Change, Visitor Impact Management, or the Recreation Opportunity Spectrum (ROS).

Visitor impacts are monitored by most states except California and Maryland. Of 14 biophysical and sociocultural wilderness resources identified in the survey, seven were identified to be unacceptably impacted by visitor use in one or more states. Impacts include campsite spreading, erosion, vegetation impacts, increasing trail depth and width, overcrowding, and declining user satisfaction. Sixteen issues not related to direct use were reported to impact wilderness resource values at least to a "medium" magnitude. These impacts included: subdivision of land on wilderness boundaries, limitations to public access through private lands, disruption of wildlife corridors due to adjacent land uses, noise and visual impacts from nearby activities, exotic plant species, unnatural plant succession, use of toxic chemicals by adjacent land owners, nontraditional, motorized or illegal uses; inadequate staffing of field stations; and political pressures from local governments regarding wilderness management policies. Managers report that funding for state Wilderness areas is not formalized in state budgets, and appropriations for management are not adequate.



*A backpacker in Ernie Creek Valley glances toward Gates of the Arctic Wilderness Preserve in Alaska, which is managed by the National Park Service. Photo courtesy of USDI National Park Service. Photo by John M. Kauffmann.*

## TRENDS IN RECREATION USE OF FEDERAL WILDERNESS AREAS

### USFS and NPS Wilderness Use Trends 1965 to 1994

Time series data were obtained from Cole (1996). These data are the best available, consistently compiled data for the USFS and NPS. However, Wilderness use trends are difficult to measure accurately for several reasons. For example, methods for collecting visitor-use data at non-permit Wilderness areas have sometimes changed from year to year. The quality of data—collection efforts varies with funding and staffing devoted to the task. Further, the USFS and NPS use different units of measurement—the Recreation Visitor Day (RVD) and the Overnight Stay (OS), respectively. The Overnight Stay is considered to be a better indicator of intensity, although a factor of 2.5 is often employed to obtain equivalent RVDs (Cole, 1996).

Generally speaking, the trend in recreation visits to National Forest Wilderness has paralleled designations. Use grew at more than 9.4 percent annually between 1965 and 1974. In the Pacific Coast region, use grew at a faster pace (nearly 17 percent annually) than designations. Between 1975 and 1985 the rate of growth in use increased to roughly 10 percent per year. USFS Wilderness visits increased by about 4.5 million RVDs, led by a 298.4 percent gain (3.3 million visits) in the Rocky Mountain region, and a 700,000 RVD increase in the Pacific Coast region. Large increases in the South during that period closely follow substantial acreage additions. After 1985, as growth in supply leveled off, USFS Wilderness use grew more slowly, rising 8.4 percent by 1993. Recreation visitor days at USFS Wilderness between 1965 and 1993 are shown in Table VII.5.

Table VII.5: National Forest Wilderness Visitor Use in 12-Hour Recreation Visitor Days for the U.S. and Regions for Selected Years

Year	Continental U.S. Total	Regions			
		North	South	Rocky Mountains	Pacific Coast
1965	2,951,500	717,200	13,700	996,500	1,224,100
1970	4,646,000	1,171,500	15,300	1,054,500	2,404,700
1975	6,465,000	1,205,200	169,900	1,635,900	3,454,000
1980	9,079,360	1,421,300	422,600	3,751,460	3,484,000
1985	10,954,170	1,352,920	527,850	4,917,400	4,156,000
1990	11,569,821	1,821,800	519,783	5,136,700	4,091,538
1993	12,028,873	1,837,800	507,716	5,959,575	3,723,782

Use of NPS Wilderness (Table VII.6) closely follows large acreage designations, but a large number of additions in 1978 did not seem to affect total use. After 1983, use of NPS Wilderness jumped with each new designation, fell slightly, then leveled off or grew slowly in subsequent years until the next designation. The largest increase in NPS Wilderness use occurred in 1984 with the addition of Yosemite and Sequoia-Kings Canyon in California to the NWPS.

Table VII.6: National Park Service Wilderness Overnight Stays and Recreation Visitor Days Statistics, U.S. Total, and Regions for Selected Years

Year	U.S.	Overnight Stays			
		North	South	Rocky Mountains	Pacific Coast
1965	0	0	0	0	0
1971	73			73	
1975	15,244			282	14,911
1980	179,763	28,043	89,101	15,801	46,684
1985	417,774	32,313	73,570	13,065	298,826
1990	559,093	37,489	81,459	11,631	428,504
1993	688,208	40,690	106,921	14,966	525,625
1994	738,434	43,673	109,174	17,976	567,611

Table VII.6 Cont.

Year	U.S.	Recreation Visitor Days		Regions	
		North	South	Rocky Mountains	Pacific Coast
1965	0	0	0	0	0
1971	183			183	
1975	38,110			705	37,278
1980	449,408	70,108	222,753	39,503	116,710
1985	1,044,435	80,783	183,925	32,663	747,065
1990	1,397,733	93,723	203,648	29,078	1,071,260
1993	1,720,520	101,725	267,303	37,415	1,314,063
1994	1,846,085	109,183	272,935	44,940	1,419,028

The intensity of use, usually expressed as RVD/Acre, is another indicator of Wilderness use. By accounting for increased acreage, this measure modifies changes in observed use resulting from new additions to the NWPS. The intensity of overall USFS Wilderness use has been fairly constant when observed between 1971 and 1993. The national average fluctuates between 0.39 and 0.44 RVD/Acre over the 22-year period. However, there is substantial variability between regions (Figure 9). The North and the South have high RVD/Acre, while the Rocky Mountains have the least. After 1984, when few additions occurred, use intensity was virtually constant at about 0.4 RVD/Acre.

Observed use intensity for NPS Wilderness areas also has fluctuated. Large additions of well-used NPS areas in the Rocky Mountain and North regions resulted in a near doubling of national average use intensity from 0.19 to 0.36 RVD/Acre (see Figure 10). Addition of several less intensively used areas, including the 1.3 million acre Everglades Park, brought the national average back down to 0.14 RVD/Acre in 1978 where it remained fairly constant at about 0.15 RVD/Acre until 1984 with the addition of the big, heavily used California parks. Between 1984 and 1993 intensity remained between 0.21 and 0.27 RVD/acre. The addition of the lightly used 3.2 million acre Death Valley reduced overall intensity to 0.18 RVD/acre in 1994.

Intensity of use varies significantly among regions. Not surprisingly, the North has substantially higher RVD/Acre than the other regions. Designation of much of Yosemite National Park as Wilderness in 1983 boosted the RVDs per acre in the Pacific Region. As in USFS Wilderness, the Rocky Mountains have the least use per acre. Part of the reason for the region's low value, however, is the most intensively used areas, such as Rocky Mountain National Park, have not been designated.

Figure VII.9: Number of Recreation Visitor Days (RDVs) per Acre on USDA Forest Service Land

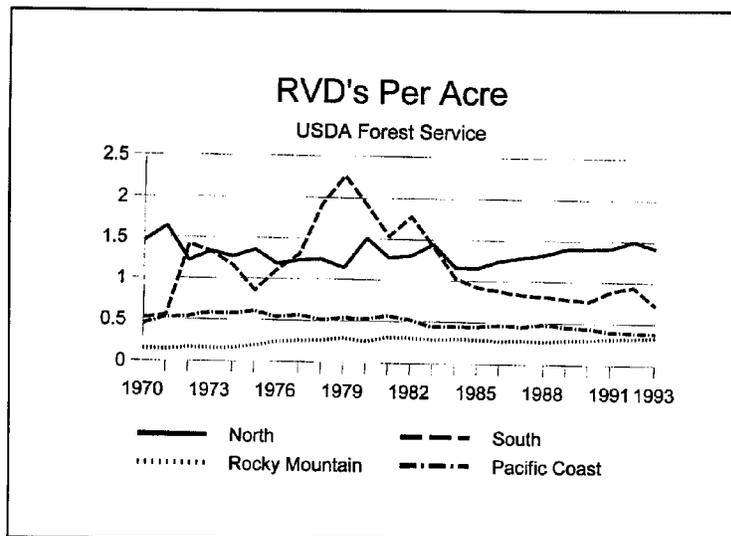
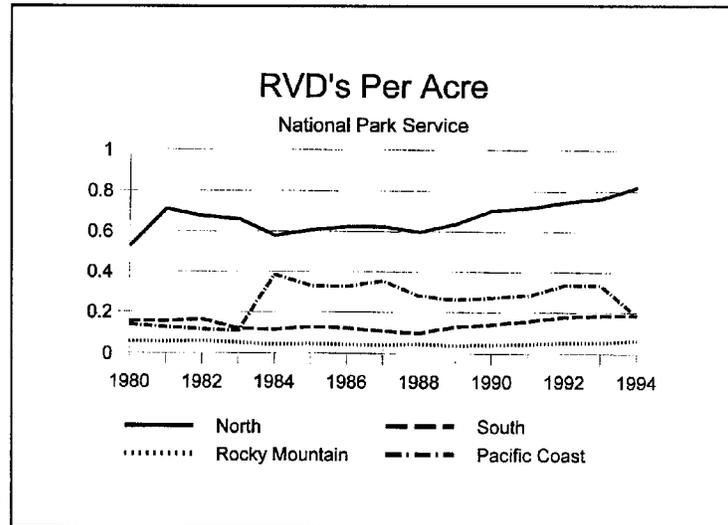


Figure VII.10: Number of Recreation Visitor Days (RDVs) per Acre on National Park Service Land



### U.S. Fish and Wildlife Service Visitor Use

The USFWS does not maintain or report data on visits to Wilderness areas within its National Wildlife Refuges. It reports only total visits to an entire refuge. To determine the visitor days occurring in Wilderness areas in National Wildlife Refuges, we obtained information on the Wilderness acres within each refuge and then individual refuges were contacted to determine the number of total visits that are attributable to the Wilderness acres. While 63 refuges have designated Wilderness acreages, only the 14 that have substantial percentages of wilderness acres were contacted for two reasons. First, only on refuges where Wilderness acreage represents a large percent of the refuge or a large absolute amount of acreage would managers likely be able to provide accurate estimates of the proportion of refuge visits attributable to Wilderness. Second, refuges with only a few hundred acres of Wilderness would likely contribute such a small amount to total visits that it was not deemed worthwhile to contact the refuge managers for such information. Thus, managers for each of the 14 refuges were contacted and asked about the percentage of activities that take place in the Wilderness areas.

We surveyed most of the Wilderness acreage in National Wildlife Refuges in the Rocky Mountain and Southeast regions (Table VII.7). The areas in these refuges account for nearly all of the Wildlife Refuge acreage in the lower 48 states. Combining each refuge manager's estimates yields a total of about 350,000 visits to Wilderness Areas on refuges. About 80 percent of the visits occur in the South. More accurate assessment of Wilderness use on National Wildlife Refuges will not be possible unless the USFWS makes Wilderness data collection a priority.

Table VII.7: Total Acreage and Estimates of Visitor Use in National Wildlife Refuge Wilderness Areas, 1996

Region	Total Wilderness Acres	Acres Surveyed	Estimated Use
Alaska	18,676,320	None surveyed	—
Pacific	1,475	None surveyed	—
Rocky Mountain	1,473,384	1,405,251	66,785
Northeast	63,528	25,150	2,170
Southeast	461,630	403,693	283,328
Total	20,676,340	1,834,094	352,283

### **Bureau of Land Management Visitor Use**

The BLM recently developed a database system for recording recreation use at its Wilderness Areas. However, the system is not accessible to either BLM staff nor the public on any centralized computer system. Not surprisingly, the visitor use data is incomplete and the lack of access provides little incentive for agency personnel to use or update the system.

The most detailed data available are for Arizona Wilderness Areas. Combining the data for Arizona, Colorado (only three areas reported), Montana, and Utah (only one area each is reported) yields 63,000 visits in 1996 on 1.15 million acres. The Pacific Coast region reports 53,700 visits in 1996 on 735,200 acres, with the majority of the visits being in California.

The visitor use statistics in the BLM database are very likely substantial underestimates of use as zero visitation is reported for thousands of acres of Wilderness Areas located in several BLM districts in California. Wilderness visitation data is reported in the database for less than half the designated acreage. Given that much BLM Wilderness is high desert with spring and fall seasons of use that complement rather than substituting for Forest Service and Park Service alpine Wilderness Areas (e.g., primarily summer use), one would expect total visits to be in the millions, not 116,000 visits as reported for 1996. Knowing visitor use is part of the foundation of an agency's Wilderness management program. Without knowing current use, it is difficult to assess trends for monitoring impacts and to evaluate the merits of designations of additional areas objectively.

### **Other Sources of Visitor Use Data**

Given the variable reliability of Wilderness visitor use information, especially from BLM and USFWS, it is useful to have other independent estimates of visitation. One available estimate is provided by Cordell and Teasley (1997) using data from the 1994-95 National Survey on Recreation and the Environment. Their approach employed a telephone survey of U.S. households, so it is based on these individuals' self-reported number of visits to areas they perceived to be Wilderness areas. Based on these responses, Cordell and Teasley conservatively estimated 40.4 million visits to Wilderness areas in 1995. Since the sum of USFS and NPS RVDs is about 14 million, and with about 100,000 visits from BLM and 352,000 from the USFWS, the combined agencies' reported total is about 14.5 million visits. Thus, the agency-derived estimates appear to be conservative. Given the heated debates over Wilderness acreage recommendations, it would seem that agencies would want to have data on visitor use. This is particularly true for BLM. This agency has more acres being debated for Wilderness than any other agency, yet it knows the least about visitor use of its Wilderness areas. This discrepancy contributes to the debates being based on emotion rather than data.

## **OFF-SITE PUBLIC GOOD BENEFITS OF WILDERNESS**

Undeveloped and pristine environments cannot be created. As a result, Weisbrod (1964) suggested that preservation of natural environments might have an option value—preserving them maintains the opportunity to visit them in the future.

The Wilderness Act of 1964 emphasizes many societal benefits to Wilderness preservation that go well beyond recreation. Wilderness preservation also provides benefits to the nonvisiting general public who take comfort in knowing that particular natural environments exist and are protected. This motivation leads to existence benefits. As the empirical examples below indicate, it is likely to be one of the more dominant motivations for maintaining Wilderness in the future. Another off-site benefit is the benefit the current generation obtains from knowing that protection today will provide Wilderness to future generations. Existence and bequest motivations are sometimes referred to as nonuse or passive use benefits. Passive use benefits of Wilderness have all of the required characteristics of a pure public good. For example, such benefits can be simultaneously enjoyed by millions of people without reducing the passive use benefits of others. In addition, no one can be prevented from enjoying the knowledge that a particular Wilderness is protected.

The economic theory underlying these existence motivations allows us several generalizations. First, a Wilderness area need not be absolutely unique to generate existence benefits (Freeman, 1993). However, the more unique the area is, the fewer the possible substitutes, and the higher the passive use benefits. The more unique the Wilderness is, the rarer or scarcer it is, so we would expect this would result in higher benefits. Second, the potential loss of the resource need not be irreversible to generate existence benefits (Freeman, 1993), but existence benefits are likely to be largest when the resource is both unique and irreplaceable (i.e., without effective substitutes). Preservation of a Wilderness jointly produces recreation and passive use benefits. Lastly, active users can also receive existence benefits (Loomis, 1988).

### Empirical Examples of the Relative Importance of Passive Use Values

Walsh, Loomis, and Gillman (1984) made the first attempt to measure the option, existence, and bequest benefits as well as the recreation benefits of Wilderness. They conducted a mail survey of Colorado residents in 1980. In the survey booklet, they asked sampled individuals about their household's willingness to pay (WTP) annually into a fund for continued preservation of the current (at the time of the study) 1.2 million acres of Wilderness in Colorado. They were also asked about their WTP for 2.6 million acres, five million acres and finally designating all roadless areas in Colorado (10 million acres) as Wilderness. Following these questions, individuals were asked what percent of their WTP was for recreation use this year, maintaining the option to visit in the future, knowing that Wilderness areas exist as a natural habitat for plants, fish and wildlife, and finally, knowing that future generations would have Wilderness areas. Results are summarized in Table VII. 8.

The second study of the benefits of Wilderness preservation was performed by Pope and Jones (1990) in Utah. They conducted telephone interviews of Utah households regarding designation of alternative quantities of BLM land as Wilderness. While these authors did not split out the different motivations for payment to preserve Wilderness, they did find households willing to pay substantial amounts.

The most recent U.S. Wilderness preservation study was conducted by Gilbert, Glass, and More (1992) to value Wilderness Areas in the eastern U.S. A mail questionnaire was sent to a sample of Vermont residents; after two mailings the overall response rate was 30 percent. The questionnaire asked respondents to value protection of all Wilderness areas east of the Mississippi River. Respondents indicated that 84 percent of their value was related to such passive uses as existence and bequest.

Table VII. 8 shows the decomposition of total value individual motivations. It is evident that a majority of the value of Wilderness is related to option, existence, bequest, and Gilbert et al.'s new category, related to altruism (defined as protecting it for use by others).

Table VII.8: Distribution of Motivations for Paying For Wilderness Designation

	Own Recreation	Option Benefit	Existence Benefit	Bequest Benefit	Altruistic Benefit
	Percentages				
Walsh, et al. Colorado Wilderness	43	16	20	21	not asked
Gilbert, et al. All Eastern Wilderness	16	17	21	29	17

### ESTIMATING FUTURE RECREATION USE OF WILDERNESS

A multiple regression model was constructed to estimate future use of Wilderness areas with and without designation of eligible roadless areas. In the regression model, visitor use is the dependent variable and demographic variables, along with Wilderness acreage, are the explanatory variables. Combining the estimated coefficients with projections of future values of the demographic variables, we forecast future recreation use with the current Wilderness acreage and proposed Wilderness acreage.

#### Dependent Variable

Visits per capita are an appropriate measure of wilderness demand. To calculate visits per capita, data are needed on visits and population. Data on RVDs from 1965 to 1993 were obtained from the Intermountain Research Station of the USFS. These data are of varying quality, only 13 percent come from systematic counts such as permits or counters (McClaan and Cole, 1993). This was one reason to take as the unit of observation, RVDs of all Wilderness areas in a given U.S. Census region. We believe this aggregation of individual areas would net out much of the variability in use arising from inconsistencies in administrative estimating procedures across areas. Cole (1996) also suggests that aggregating areas will improve the reliability of the recreation use data. Trend relationships are more evident in aggregate data. Data on National Park Service Wilderness visits also were obtained from the Intermountain Research Station. This agency's data were originally collected as overnight visits and then converted to visitor-days by Cole using average length of stay. Then day use was added to this figure (see Cole, 1996 for more details).

Population is perhaps one of the most important determinants of total demand for nearly any product. We collected state population statistics from the U.S. Census and the *Statistical Abstract of the U.S.*

Since it is unlikely that population would simply have a linear additive effect on visits irrespective of other factors, we choose to divide visits by Census region population to yield visits per capita. This is a common formulation for many recreation demand models, such as the zonal travel cost model (Hellerstein, 1995; Loomis & Walsh, 1997). In addition, by moving population from the right-hand side into the left-hand side eliminates the multicollinearity between acres and population on the right hand side.

Finally, the natural log of visits per capita was used to estimate a nonlinear relationship between visits per capita and the independent variables.

## **Independent Variables**

### ***Per Capita Income***

Per capita income is a commonly investigated determinant of recreation behavior. It measures the ability of households to incur the travel cost to visit Wilderness areas as well as purchase the appropriate equipment.

To allow for comparability across years, income was deflated and put into 1992 dollars. The natural log of income was used to allow for a nonlinear effect of changes in income on quantity of visitation. Since the dependent variable is logged the coefficient on income can be interpreted as an elasticity. Per capita personal disposable income data are found in *State Personal Income 1929-1993*, U.S. Bureau of Economic Analysis (1995).

### ***Unemployment Rate***

This variable was included to reflect the possibility that the performance of the overall economy, and specifically labor market conditions, might influence Wilderness use. Since Wilderness trips are relatively inexpensive but quite time intensive, it may be that the opportunity costs of such trips are lower when the unemployment rate is high. That is, with high unemployment rate, many people are without jobs and wages tend to be lower. This factor would make the travel and on-site time cost of Wilderness visits less. In addition, with a high unemployment rate people may substitute Wilderness visits for more expensive forms of outdoor recreation such as staying at resorts. The unemployment rate by state was taken from the *Statistical Abstract of the U.S.*

### ***Acreage***

The acres of Wilderness can serve as a proxy for quality or for supply of Wilderness recreation opportunities. The more acres there are, holding everything else constant, the less crowding and hence more opportunities for solitude there are. Crowding has been shown to result in a statistically significant reduction in the value of a Wilderness recreation experience (Walsh & Gilliam, 1983). If acreage is statistically significant, it will allow forecast of future visitor days with different Wilderness designation scenarios. Scenarios range from no additional acreage to designation of the all-qualified roadless areas. Since economic theory suggests diminishing marginal value for additional acres of Wilderness, the natural log of acres was used as the independent variable. Thus the coefficient can be interpreted as an elasticity. We expect this elasticity to be less than one.

### ***Year***

Many other demographic factors and preferences may have influenced recreation use of Wilderness areas over the past 30 years and may continue to influence future recreation use as well. Unfortunately it is difficult to get annual data on such variables as ethnicity of the population and education. These variables are collected at the state level only each decade during the U.S. Census. Wilderness users tend to have above-average levels of education (Hendee, et al., 1990), and they tend to be non-minorities (National Park Service, 1986:21). The trend in the U.S. and particularly in populous states like California is toward increasing percentages of the population being minority. As Cole (1996) notes, use slowed at Forest Service Wilderness areas and actually declined at National Park Wilderness areas during the 1980s. However, use accelerated at National Park Wilderness areas in the early 1990s. Given the lack of consistent data on demographic variables such as ethnicity, a trend variable is used to capture all of these influences.

### **Regional Influences**

The fixed effects regression model estimates a separate constant for each of the Census/RPA regions for the NPS model and eastern versus western regions for the USFS model. If these regional constants are significantly different from zero (using a standard t-test) and contribute significantly to model fit (using a likelihood ratio test and F-test), then each region has specific factors that are different from each other but vary in a systematic way. These variables then reflect the unquantified influences that vary across Census or RPA regions. For consistency, we estimated and compared fixed effects models for the NPS and USFS using both Census/RPA region and eastern-western U.S. as regional constants. The logic of the eastern-western division was developed by recognizing that a separate Eastern states Wilderness Act was passed by Congress about 10 years after the Wilderness Act of 1964. The Eastern States Wilderness Act was necessary because much of the potential Wilderness land in the East could not meet the same standards of being pristine and untouched that western roadless areas did. Thus, including a geographic constant or variable would allow for testing differences between regions. Region is indexed as in the regression models that follow.

### **Age**

Hendee et al. (1990) suggested that the aging of the population may influence wilderness use trends. However, research by English and Cordell (1985) suggests that recreation participation rates among all age cohorts have risen steadily since 1960. We assembled data on percentage of the population in the 18-44 age categories to test if the percentage of this prime-age Wilderness use group had any influence.

### **Use Estimating Model**

To take full advantage of the available data and to allow for estimation of the effect that acres have on wilderness visits, time series data over the four U.S. Census/RPA regions was pooled. The time series nature of the data and the pooling of time series and cross section raise several econometric issues that are dealt with at length in a technical appendix available from the USDA Forest Service.<sup>1</sup>

The basic multiple regression model estimated is:

$$(1) \ln(\text{RVD}/\text{POP})_{it} = \alpha D_i + \beta X_{it} + (\rho \epsilon_{it-1} + \eta_{it})$$

where  $D_i$  are the regional constants reflecting the fixed effects and  $i = 1, 2, 3, 4$  reflecting Northeastern, Southeastern, Rocky Mountain and Pacific Coast regions in the NPS model and  $i = 1, 2$  represents eastern U.S. and western U.S. in the USFS model.  $\epsilon_{it-1} + \eta_{it}$  is the error term. The difference in region-specific constants between USFS and NPS resulted from comparative analysis of the same fixed effects structure for the two agencies.<sup>1</sup>

### **Statistical Results**

The multiple regression results of RVDs of Wilderness areas administered by the USFS are quite satisfactory.<sup>1</sup> Log of acres is significant at the 0.01 level, while log of disposable per capita income is significant at the 0.02 level. Because of the double log specification, the coefficient on acres can be interpreted as an elasticity. Thus, a 10-percent increase in Wilderness acres results in a nine-percent increase in recreation visitor days. This variable allows us to predict changes in visits with additions to the NWPS. Technical Appendix VII table A-3 presents the results of the multiple regression analysis for visitor use of Wilderness areas administered by the National Park Service. Here, log of acres, log of disposable per capita income and year are statistically significant at the 0.01 level.<sup>1</sup>

### **Forecasting**

#### **Source of input values**

The accuracy of future forecasts of visits is as dependent on the future estimates of the independent variables as it is on the coefficient estimates themselves. As part of the RPA Assessment process, the USFS commissioned the USDA Economic Research Service's Macroeconomics Team to estimate several future demographic variables, including disposable personal income and unemployment rates (Torgeson, 1996). State-

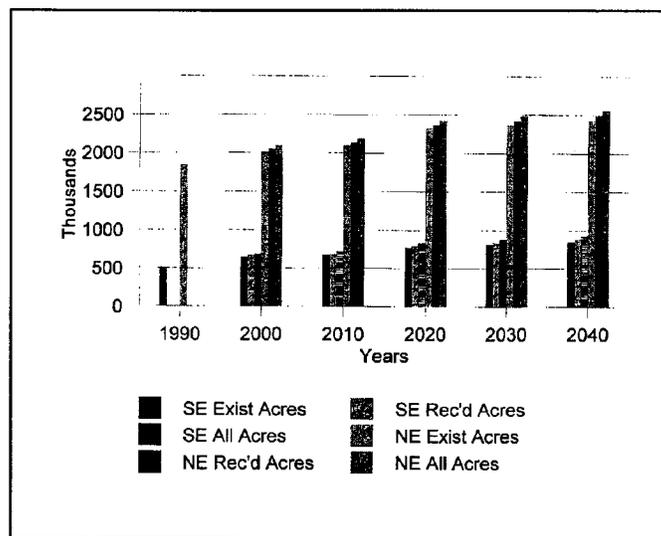
<sup>1</sup>This technical appendix is available in table form from the USDA Forest Service, Outdoor Recreation and Wilderness Assessment Group, 320 Green Street, Athens, GA 30602-2044. Herein all references to Technical Appendices shall be abbreviated as TAs.

level population forecasts were developed from U.S. Census projections and Bureau of Economic Analysis data by Dr. Linda Langner of the USFS RPA staff. Generally, the forecasted future values of the input variables are in line with recent trends. For example, disposable income is projected to grow at two percent a year, which is well below the historic time period but consistent with the experience of the last six years.

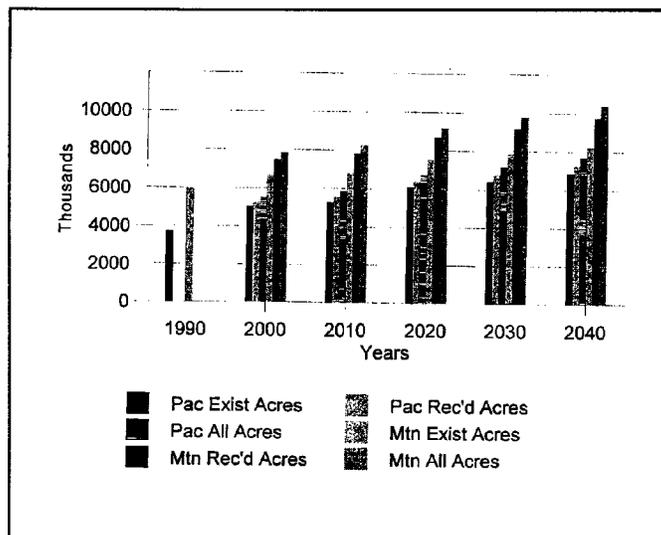
One of the biggest unknowns is future Wilderness acreage. Our initial forecast starts with the current quantity of Wilderness as a baseline. Future visits are then estimated with acreage at its current level in each of the four regions for each agency. The resulting estimate is the number of visits in absence of any additional Wilderness designation. The change in visits, therefore, is due to changes in population and income.

Figures VII.11 and VII.12 illustrate the forecasted future use of Forest Service Wilderness at three different Wilderness acreages: (a) holding acreage fixed at the current level, (b) adding the Wilderness acreage recommended for designation, and (c) adding all WSA acreages.

**Figure VII.11: Forecasted Wilderness RVDs with Alternative Acreage Supply for National Forests in the Northeast and Southeast Region**



**Figure VII.12: Forecasted Wilderness RVDs with Alternative Acreage Supply for National Forests in the Pacific Coast and Rocky Mountain Regions**

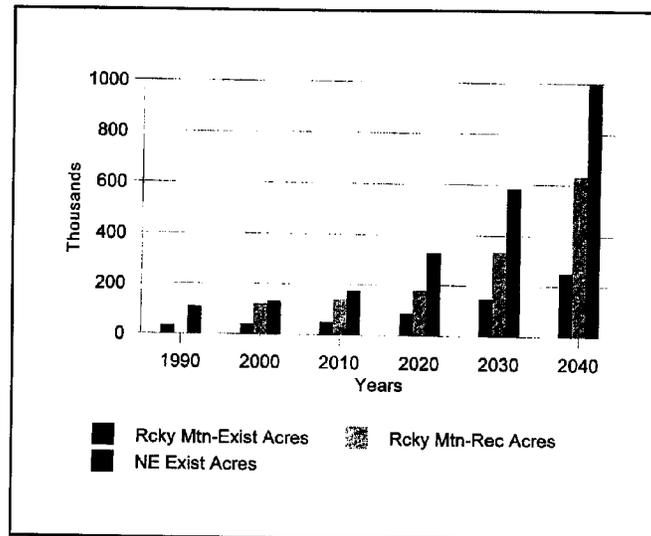


When acreage is held constant at current levels, recreation use is forecast to increase by about 0.5 percent per year during the next 50 years (cumulative increase of 24 percent and 27 percent, respectively, over the 50 years) in the Northeast and Rocky Mountain regions. In the Southeast and Pacific Coast, recreation use is forecast to increase by just slightly less than one percent per year for a cumulative increase of 40 percent and 45 percent, respectively.

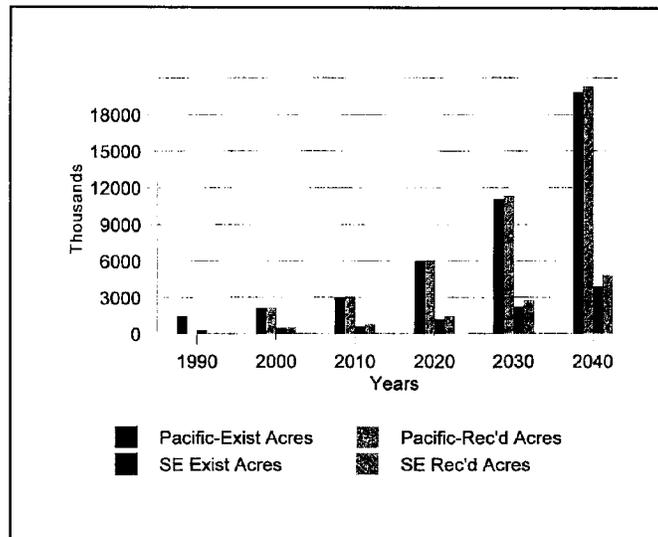
Designating additional acres generally shifts the pattern of use upwards. In the North and Southeast, total use would rise from 24 percent to 26 percent and 40 percent to 42 percent, respectively, if recommended acres were designated. In the Pacific Coast, the additional acres are estimated to increase visits from 45 percent to 49 percent over the 50-year period, a net gain of four percent from the added acres. In the Rocky Mountain region, the large recommended increase in Wilderness (2.6 million acres) would result in a 12-percent increase in visitor use, from 27 percent to 39 percent over the 50-year period.

National Park Service Wilderness use is estimated to increase substantially over the next four decades (Figures VII.13 and 14). Holding acres constant, use would grow by about four percent per year. Whether the NPS will accommodate this increased demand will depend upon its management strategy. The increase in NPS Wilderness use results from the sizeable positive trend variable in the national park regression. As illustrated in these figures, designation of recommended acreages as Wilderness reinforces this trend. A large part of the forecasted increase in visits in the Rocky Mountain region with recommended acres is due to additions of backcountry areas in heavily visited Parks, such as Yellowstone (two million acres).

Figure VII.13: Forecasted Wilderness RVDs with Alternative Acreage Supply for National Forests in the Northeast and Rocky Mountain Regions



**Figure VII.14: Forecasted Wilderness RVDs with Alternative Acreage Supply for National Forests in the Southeast and Pacific Coast Regions**



## CONCLUSION AND MANAGEMENT IMPLICATIONS

There are four main management implications of this analysis:

1. The benefits of Wilderness to society go far beyond recreation. The current imbalance of ecoregion representation in the National Wilderness Preservation System can be rectified with strategic designations of low elevation and high desert Wilderness Study Areas. In this way, Wilderness can contribute to protecting the diversity of ecoregions located throughout the U.S. In addition, these areas offer differing seasons for recreation (e.g., spring and fall) to the current high elevation Wilderness areas of the USFS and NPS (e.g., primarily summer).

2. A review of the literature on passive use values, such as existence and bequest values, provided by Wilderness protection suggests that the nonrecreation benefits of Wilderness are larger in percentage terms and in the aggregate than the recreation use benefits of wilderness. Accurate assessment of the benefits of Wilderness management and designation requires inclusion of these benefits. Otherwise, benefits of Wilderness are underestimated by at least 50 percent.

3. The multiple regression model for predicting future recreation use showed a statistically significant positive influence of additional Wilderness acreage on recreation use. Thus, additions to the National Wilderness Preservation System will be used by recreationists.

4. Recreation use of both USFS and NPS Wilderness areas is expected to increase in the future. Visitor use of Wilderness areas on national forests are forecast to grow between 0.5 percent and one percent each year for the next 50 years. If current trends continue, NPS Wilderness areas will see substantially increased visitor demand. Whether the National Park Service can accommodate this additional demand within the carrying capacity of these areas is a question that may require further research by that agency.

In the course of assembling visitation data and GIS maps it became clear that Wilderness management has fallen from being a serious priority of the federal land management agencies. The data available to the agencies themselves for making wilderness management decisions are often incomplete, and little effort appears to be made to make it more complete. Much of the existing data are often not consistently maintained or accessible to agency personnel or the public. Data on and trends in visitor use, along with knowledge of the ecological representation of the current Wilderness areas are critical to informed decision making about Wilderness management and allocation issues. The consequences of this lack of basic data on the current status of Wilderness will make it difficult to put wilderness management and allocation decisions on an objective rather than emotional level.

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