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**Ecosystems in Wilderness:  
Effects of System Expansion<sup>1</sup>**

**A Natural Lands Research Report in the IRIS Series<sup>2</sup>**

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<sup>2</sup> The Internet Research Information Series (IRIS) is an internet accessible science report series covering outdoor recreation statistics (**RECSTATS**), natural lands research (**NATURAL LANDS**) and other human-dimension and demographics research (**DEMOSTATS**) related to natural resources. This research is a collaborative effort between the USDA Forest Service's Southern Research Station and its Forestry Sciences Laboratory in Athens, Georgia; the University of Georgia in Athens; and the University of Tennessee in Knoxville, Tennessee.  
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## **Ecosystems in Wilderness: Effects of System Expansion**

Consideration of protecting ecosystems through Wilderness designation of federal lands dates back at least to the Forest Service's second Roadless Area Review and Evaluation (RARE II) in 1978. RARE II sought to evaluate the diversity of ecosystems in roadless areas using the Bailey-Kuchler ecosystem classification system (USDA Forest Service 1978). Davis (1989) undertook a review of diversity of ecosystems in the National Wilderness Preservation System. Across the 261 major U.S. terrestrial ecosystems, he found 104 not protected by NWPS designation. A follow-up evaluation of ecosystem representation in Wilderness was conducted by Loomis and Echohawk (1999) and was one of the early studies to rely on modern GIS overlays of NWPS and Bailey's (1995) ecoregion boundary data. They found that 23 of the 35 Bailey's provinces in the 48 coterminous states have less than 1 percent of their land area protected as Wilderness, and 7 provinces had no land at all protected through Wilderness designation. Cordell et al. (forthcoming) conducted a similar study of ecosystem representation in Wilderness at the Bailey's Division level (one level above province in Bailey's ecosystem hierarchy). This was done as part of the U.S. Forest Service 2010 RPA Assessment.

**Data.**—The Loomis and Echohawk boundary data for U.S. ecoregions (at division level) and the NWPS (as of 1994) were compared with the Cordell et al. data (for the NWPS as of 2009) (table 1). There are 11 divisions across the 48 contiguous states (including 8 mountainous subregions). While different GIS data sources were used in the two studies, they appear to be comparable in that each shows a total U.S. land area of 1.92 billion acres and very little difference in acreage by division.

**Effects of NWPS Expansion.**—In the contiguous states, the NWPS was expanded by about 7.9 million acres, a growth of about 18 percent between 1994 and 2009. Nearly half (3.6 million acres) of this growth occurred in the Temperate Desert Division and its associated mountainous area, which increased the percentage of the NWPS that occurs in this division from just over 3 percent in 1994 to nearly 10 percent in 2009 (see last two columns in Table 1).

The Tropical/Subtropical Desert and Mediterranean Divisions each also added more than one million Wilderness acres, though both changed very little in their respective proportions of the NWPS total acreage. Because the overall area of the NWPS was increased substantially, the

proportion of the System represented by the Marine Division (mountains) declined from 11.4 percent in 1994 to 10 percent of the NWPS in 2009. As well, the Savanna Division as a proportion of the NWPS decreased from 3 percent to 1.5 percent (Table 1). However, this may reflect that the 2009 data appear not to include water acres in the Marjory Stoneman Douglas Wilderness in the Florida Everglades.

The columns in Table 1 titled ‘Percent of division in Wilderness Areas’ indicate the growth in NWPS acreage within each division, independent of the complete NWPS. Of the 19 table rows (11 divisions plus 8 with mountains), 14 showed an increase in the percent of area that is Wilderness, though three of these grew by just 0.1 percentage point. Only four divisions (or mountain areas) grew by 1.0 percentage point or more. In 1994, 10 divisions (mountains) had less than 0.5 percent of their area in the NWPS. By 2009, this number had decreased to 8 divisions. The Prairie Division still has essentially no Wilderness and very little (less than 0.5 percent) also exists in the Temperate Steppe, Hot Continental, and Subtropical Divisions.

**Table 1**—Trend in acreage of contiguous U.S. surface area by ecosystem division, acres of the National Wilderness Preservation System (NWPS) in each division, percentage of division in National Wilderness Areas, and percentage of the National Wilderness Preservation System area in each division, 1994 to 2009.

Ecosystem Division	Percent	Total surface acres (1,000s)		National Wilderness Area acres (1,000s)		Percent of division in Wilderness Areas		Percent of NWPS in the division	
		1994	2009	1994	2009	1994	2009	1994	2009
<b>DRY DOMAIN</b>									
Temperate Desert Division	8.9	170,687.9	172,248.7	921.0	3,835.1	0.5	2.2	2.1	6.7
Mountains	1.5	27,948.0	27,947.7	492.1	1,182.0	1.8	4.2	1.1	2.1
Temperate Steppe Division	14.2	272,216.2	272,098.5	540.1	537.5	0.2	0.2	1.2	0.9
Mountains	7.5	144,672.5	144,647.2	14,680.0	15,312.4	10.2	10.6	33.4	26.9
Tropical/Subtropical Desert Division	5.7	110,850.0	110,639.7	9,552.2	11,274.4	8.6	10.2	21.8	19.8
Mountains	1.7	32,183.4	32,098.8	1,287.3	1,306.5	4.0	4.1	2.9	2.3
Tropical/Subtropical Steppe Division	8.5	162,667.9	162,959.7	1,164.2	1,364.2	0.7	0.8	2.6	2.4
<b>HUMID TEMPERATE DOMAIN</b>									
Hot Continental Division	12.5	239,809.2	239,053.2	136.5	194.9	0.1	0.1	0.3	0.3
Mountains	2.5	47,717.5	47,724.6	286.3	642.1	0.6	1.4	0.7	1.1
Marine Division	0.5	9,534.9	9,342.9	57.5	53.4	0.6	0.6	0.1	0.1

Ecosystem Division	Percent	Total surface acres (1,000s)		National Wilderness Area acres (1,000s)		Percent of division in Wilderness Areas		Percent of NWPS in the division	
		1994	2009	1994	2009	1994	2009	1994	2009
Mountains	1.8	34,243.6	34,243.6	5,002.1	10,395.2	14.6	30.4	11.4	18.3
Mediterranean Division	1.1	21,851.6	21,744.2	237.5	311.1	1.1	1.4	0.6	0.6
Mountains	3.1	59,716.6	59,769.2	6,259.6	7,398.9	10.5	12.4	14.3	13.0
Prairie Division	10.0	191,037.6	191,037.9	0.0	2.2	0.0	0.0	0.0	0.0
Subtropical Division	13.7	263,410.5	262,963.2	558.2	685.0	0.2	0.3	1.3	1.2
Mountains	0.3	5,644.3	5,629.9	11.9	48.0	0.2	0.9	0.0	0.1
Warm Continental Division	4.9	94,422.0	93,923.0	1,226.9	1,399.3	1.3	1.5	2.8	2.5
Mountains	1.5	27,987.4	28,035.3	147.2	247.3	0.5	0.9	0.3	0.4
<b>HUMID TROPICAL DOMAIN</b>									
Savanna Division	0.3	5,015.1	5,019.9	1,299.4	765.0	25.9	15.2	3.0	1.3
<i>Total</i>	<i>100.2</i>	<i>1,921,616.1</i>	<i>1,921,127.0</i>	<i>43,860.1</i>	<i>56,954.4</i>	<i>81.6</i>	<i>97.2</i>	<i>99.9</i>	<i>100.0</i>

Source: Loomis and Echohawk (1999) and Cordell et al. (forthcoming).

Note: The 1994 data included the contiguous states only but the 2009 data included the Marine Division (Mountains) of southeast Alaska. To make this division comparable, all Forest Service wilderness and the National Park Service's Glacier Bay Wilderness were subtracted from the 2009 National Wilderness Areas acres column. Total surface acres in 2009 were set equal to the amount in 1994. Rows labeled 'Mountains' belong to the ecosystem division immediately above. Percents may not sum to 100.0 exactly due to rounding. Percent for total surface acres is based on 1994 acres. Total surface acres differ slightly between 1994 and 2009 because of the previously mentioned difference in the Marine Division (Mountains) as well as the different GIS data sources. Percent of division in Wilderness Areas for each year is the proportion of National Wilderness Area acres to total surface acres. Percent of NWPS in the division for each year is the proportion of National Wilderness Acres in each division (row) to the Total acreages in the bottom row.

## References

- Bailey, Robert G. 1995. Description of the ecoregions of the United States. 2<sup>nd</sup> ed. rev. and expanded. Misc. Publ. No. 1391. Washington, DC, USDA Forest Service, 108 pp.
- Cordell, H. Ken, Carter J. Betz, and Stanley J. Zarnoch. (Forthcoming). Recreation and Protected Land Resources in the United States: A technical document supporting the Forest Service 2010 RPA Assessment. Gen. Tech. Rep. SRS-XXX. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station.
- Davis, G.D. 1989. Preservation of natural diversity: The role of ecosystem representation within wilderness. In: Helen R. Freilich, ed., Wilderness Benchmark 1988: Proceedings of the National Wilderness Colloquium, USDA Forest Service General Technical Report SE-51:76-82.
- Loomis, J. and J.C. Echohawk. 1999. Using GIS to identify under-represented ecosystems in the National Wilderness Preservation System in the USA. *Environmental Conservation* 26(1): 53–58.
- U.S. Department of Agriculture (USDA) Forest Service. 1978. RARE II Draft Environmental Impact Statement 78-04, Roadless Area Review and Evaluation. Washington, DC, USA: 112 p.