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Volume 2: Wilderness Within the Context of Larger Systems

Missoula, Montana
May 23–27, 1999



Abstract

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Thirty-eight papers related to the theme of wilderness in the context of larger systems are included. Three overview papers synthesize existing knowledge and research about wilderness economics, relationships between wilderness and surrounding social communities, and relationships between wilderness and surrounding ecological communities and processes. Other papers deal with wilderness meanings and debates; wilderness within larger ecosystems; and social, economic, and policy issues.

Keywords: boundaries, ecological disturbance, ecosystem management, regional analysis, wilderness economics, wilderness perception

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Wilderness Science in a Time of Change Conference

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Compilers

Stephen F. McCool

David N. Cole

William T. Borrie

Jennifer O'Loughlin

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1. Overviews

2. Wilderness Meanings and Debates

3. Wilderness Within Larger Ecosystems

4. Social, Economic, and Policy Issues

5. Dialogue Session Summaries

Wilderness Within the Context of Larger Social and Biophysical Systems

Stephen F. McCool
David N. Cole

If we have learned anything since the National Wilderness Preservation System was first formally established in 1964, it is that it exists within a larger context of biophysical and social change and influence. The ever-changing character of ecosystems, shifts in social-demographic characteristics, changes in climates, and the vicissitudes of society's orientation toward nature present challenges for the protection of areas formally designated as wilderness. Conversely, wilderness is linked to the surrounding natural, political, and cultural landscapes; the presence of wilderness influences the economics and quality of life in local communities. Wilderness may serve as a refuge for wildlife populations that cross wilderness boundaries.

Because wilderness is linked to its surroundings, our attempts to protect natural processes and conditions and to ensure that wilderness remains untrammelled raise significant and socially problematic questions about the linkages between wilderness and its connection with larger scale social and biophysical processes.

Many of these questions are greatly influenced by boundaries and the respective, and often incompatible, institutional mandates of the agencies involved on each side of the boundary. While political and jurisdictional boundaries often have good historical foundations, in many cases the boundaries, even among contemporary wilderness designations, do not coincide with those appropriate for the free play or management of ecological processes, such as natural or anthropogenic fire, wildlife migration, and pathogenic influences. For example, fires that once started outside what is now designated wilderness are suppressed, with resulting vegetation change inside wilderness. Fire management and suppression policies may or may not coincide with wilderness boundaries, complicating decision processes and raising uncertainty as to policy and consequences. Designation of wilderness immediately adjacent to urbanizing areas, such as the Pusch Ridge Wilderness next to Tucson, Arizona, makes implementing policies that restore natural processes and conditions difficult at best. Even restoration of endemic species in such relatively remote areas as the Selway-Bitterroot Wilderness astride the Montana-Idaho state line become embroiled in controversy, in part because nearby growing human populations feel threatened.

Still-evolving attitudes toward management of wilderness and natural fire have changed dramatically since the National Wilderness Preservation System was established, influencing the acceptability of management practices. Forty years ago Walter Firey noted that land management policies must be economically feasible, ecologically possible, and culturally adoptable. Cultural mores, norms, and philosophies toward nature, protected areas, and wilderness have changed dramatically and will likely change in the future. In this sense, problems never stay solved because the context changes. Such factors influence the acceptability of various management policies.

Thus, external processes, be they policy, economics, cultural, or biophysical, condition the presence and management of wilderness. This volume addresses many of the questions and issues confronting wilderness within this dynamic and often unpredictable context. The papers are organized into five sections. The first includes three overview papers that assess the state of knowledge concerning links between wilderness and its larger context. Peter White reviews ecological disturbance processes and the issues associated with dealing with them as they cross jurisdictional boundaries. Gundars Rudzitis and Becky Johnson deal with a developing set of questions that concern the relationship between human population demographics and growth and wilderness. John Loomis assesses what we know about the economics of wilderness recreation and passive uses of wilderness.

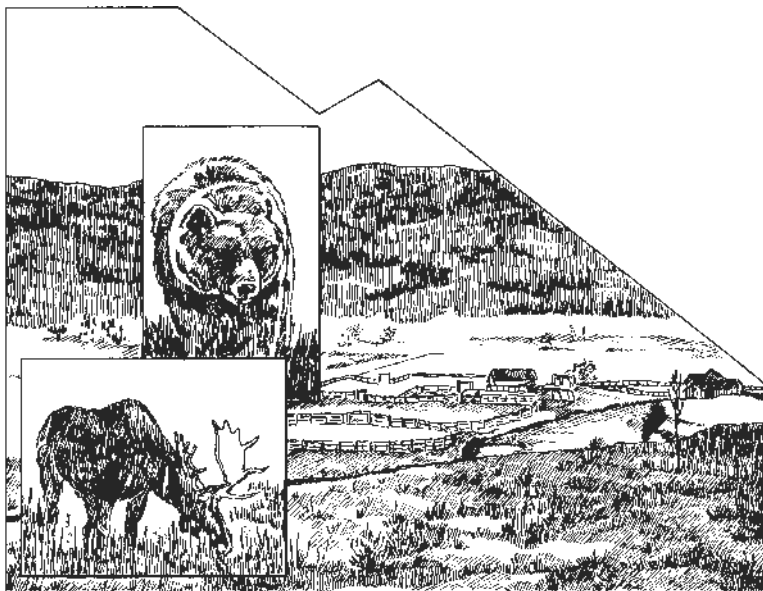
Research papers offered at the conference are found in the next three sections. Many of these papers deal directly with contextual factors, affecting how not only wilderness is perceived and managed, but which also place pressures on the presence of wilderness and other similar protected areas. Section two includes several papers that explore and examine meanings of wilderness and the consequences of different interpretations. Papers linking wilderness with larger ecological processes and conditions are found in section three. Many of these papers examine methods for identifying potential wilderness areas. A variety of economic, social, and policy questions that influence how wilderness is managed and debated in contemporary society are examined in the papers located in section four.

The fifth section of this volume contains reports resulting from several dialogue sessions that occurred during the conference. Each of these papers summarizes the dialogue session, although the format varies from paper to paper. Please note that the paper by Cawley was presented as a formal paper within a dialogue session concerning protection of large reserves; no summary paper was submitted for that session.

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Stephen F. McCool is Professor, School of Forestry, The University of Montana, Missoula, MT 59812 U.S.A., e-mail: smccool@forestry.umd.edu. David N. Cole is Research Biologist, Aldo Leopold Wilderness Research Institute, Missoula, MT 59812 U.S.A., e-mail: dcoole@fs.fed.us

1. Overviews



Economic Values of Wilderness Recreation and Passive Use: What We Think We Know at the Beginning of the 21st Century

John B. Loomis

Abstract—Two techniques are used to estimate the economic value of recreation and off-site passive use values of wilderness. Using an average value per recreation day (\$39), the economic value of wilderness recreation is estimated to be \$574 million annually. Generalizing the two Western passive use values studies we estimate values of Western wilderness in the lower 48 states to be \$168 per acre, for a total value of \$7 billion for the 42.7 million acres. Using the one study of Eastern wilderness we estimate a value of \$103 per acre, for a total value of the 4.5 million acres to be \$468 million.

What Is Wilderness Economics? _____

Wilderness economics may seem as much an oxymoron as wilderness management may have when it was first proposed. When I attended a conference on public land management in 1978 and asked why the USDA Forest Service Research stations were not addressing the economic value of wilderness, I was told “Wilderness designation is a political issue.” Well, true enough, but the political issue often revolves around the economic trade-offs of wilderness uses versus commodity uses. Information to make an informed trade-off might lead to less grandstanding by both sides.

The recognition that economic issues associated with wilderness should be objectively analyzed, coupled with advances in non-market valuation has lead to a steady increase in wilderness economics. The Proceedings of the 1985 National Wilderness Research Conference contained one page out of 370 that mentioned economic benefits (Driver and others 1987). In the Wilderness Benchmark 1988, one paper summarized what was known about the “non-traditional” economic values of Wilderness (Walsh and Loomis 1988). However, it was not until 1991 that sufficient research had accumulated on the economic value of wilderness to make it apparent that this line of inquiry could make useful contributions to debates over wilderness designation and even wilderness management. It was in 1991 that the Forest Service, USDI Bureau of Land Management and the Society of American Foresters held the first conference devoted specifically to the “Economic Value of Wilderness” (Payne and others 1992). The breadth of topics addressed at this conference was comprehensive, ranging from recreation

economics to regional economic impact analyses. As presented below, there have been more than a dozen studies quantifying the economic value of wilderness recreation and the other economic benefits that wilderness provides society.

While economic factors should never be the driving force in wilderness designations or wilderness management, neither can they be overlooked. One side or the other in the contentious debates about wilderness designation and sometimes wilderness management, will raise economic issues. It is often done as a “smokescreen” to obscure the individual’s or group’s real motivation. Only by quantitative economic analysis can we evaluate whether economic factors really are critical in each specific case. Many wilderness designations preclude the managing agency from doing economically inefficient things like below-cost timber sales (Stewart and others 1992). In these cases, national economic efficiency is enhanced even if visitation is minimal. In other cases, wilderness designation of under-represented ecosystem types may carry large opportunity costs of efficient development foregone. As illustrated below for Colorado, wilderness economics can also help us answer the question of “how much wilderness is enough?” Few things in economics are all or nothing, and the same is true for Wilderness. In Colorado, 9.6 million acres out of 10 million roadless acres appeared to be the economic optimum in 1984 (Walsh and others 1984). Economics also provides another way to communicate the natural and social values of wilderness to the public officials who must ultimately decide whether an area is designated or not and, once designated, how it should be managed.

Conceptual Basis for Economic Values of Wilderness _____

Wilderness preservation provides many direct, economic benefits to humans (Morton 1999). Wilderness protects watersheds, providing high quality waterflows to support fish, wildlife and consumptive uses of water. Wilderness is well-known for providing habitat to wildlife. In California, where only a small fraction of National Forest land is Wilderness, a large proportion of the deer hunting takes place in wilderness areas (Loomis 1993). Of course wilderness provides hiking, backpacking, horseback riding, mountain climbing, and primitive camping experiences as well as canoeing in some wilderness areas (for example the Boundary Waters).

Historically, federal agencies have not charged for access to wilderness areas. Nonetheless such recreation opportunities do have economic values since they meet two conditions: 1) wilderness recreation is scarce; 2) it provides enjoyment and satisfaction. What visitors would pay over and above

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John B. Loomis is Professor, Department of Agricultural and Resource Economics, Colorado State University, Fort Collins, CO 80523 U.S.A.

their actual cost is the conceptually correct measure of the value of gains (Sassone and Schaeffer 1978; Stokey and Zeckhauser 1978) and the federally accepted measure of benefits as well (U.S. Water Resources Council 1983; U.S. Dept of Interior 1986, 1994). This net willingness to pay is sometimes called consumer surplus. We present below estimates of visitor willingness to pay (WTP) for wilderness recreation.

Only a portion of the economic value of wilderness relates to recreation. The general public's value from just knowing that self-regulating, intact ecosystems represented in wilderness areas exist and will be available for future generations has a sizeable economic value as well. The empirical literature on existence values and the current generation's bequest values to future generations from wilderness preservation is reviewed below.

Methods for Estimating the Economic Values of Wilderness

Travel Cost Method

This method uses variation in travel costs of visitors living at different distances from wilderness areas as prices and associated number of trips taken as a measure of quantities to statistically trace out a demand curve for recreation to a particular site. From the demand curve the consumer surplus or net WTP for wilderness recreation is calculated (Loomis and Walsh 1997). The travel cost method is quite capable of measuring the value of hunting, fishing, wildlife viewing, canoeing, backpacking, etc. This method has been extensively used to estimate the recreation benefits associated with wilderness but is not capable of estimating existence or bequest values.

Contingent Valuation Method

The contingent value method (CVM) is a survey technique that constructs a hypothetical market to measure willingness to pay or accept compensation for different levels of nonmarketed natural and environmental resources. The method involves in-person or telephone interviews or a mail questionnaire. CVM is not only capable of measuring the value of outdoor recreation under alternative levels of wildlife/fish abundance, crowding, instream flow, etc., it is the only method currently available to measure ecosystem values, such as benefits the general public receive from the continued existence values of unique natural environments or species.

The basic notion of CVM is that a realistic but hypothetical market for "buying" use and/or preservation of a nonmarketed natural resource can be credibly communicated to an individual. Then the individual is told to use the market to express his or her valuation of the resource. Key features of the market include: (1) description of the resource being preserved; (2) means of payment (often called payment vehicle) and (3) type of willingness to pay question (such as open-ended or close-ended). For a more complete discussion of CVM see Loomis and Walsh 1997.

Use of TCM and CVM by Federal and State Agencies

Both TCM and CVM are accepted by government agencies for valuing both recreation and other nonmarketed benefits of ecosystem services. TCM and CVM have been recommended twice by the U.S. Water Resources Council (1983) under two different Administrations as the two preferred methods for valuing outdoor recreation in federal benefit cost analyses. The U.S. Department of Interior (1986, 1994) endorsed both as methods for estimating the value of nonmarketed natural resources damaged by oil spills and other toxic events.

The U.S. Bureau of Reclamation and National Park Service (NPS) relied on CVM to value in dollar terms the recreational fishing and rafting effects of alternative hydro-power water releases from Glen Canyon dam into the Grand Canyon. The Montana Department of Fish, Wildlife and Parks relied on a CVM survey of the benefits of viewing and hunting elk when justifying its purchase of additional elk winter range outside of Yellowstone National Park. State fish and game agencies in Arizona, California, Idaho, Maine, Missouri, Nevada and Oregon use TCM and CVM for valuing wildlife-related recreation.

Incorporating existence and bequest (passive use) values is becoming more frequent in Federal benefit-cost analyses. The U.S. Fish and Wildlife Service used CVM to value the passive use values of the wolf recovery program. The USDA Economic Research Service's economic analysis of salmon recovery efforts on the Snake River included rough estimates of passive use values drawn from the existing literature (Aillery and others 1996). The U.S. Bureau of Reclamation monetized passive use values from a more natural river flow regime from Glen Canyon dam above Grand Canyon National Park.

Results on Recreation Value of Wilderness

Recreation Use in USFS and NPS Wilderness

To estimate the recreation economic benefits from wilderness requires data on economic benefits to visitors and the number of visitors. Cole (1996) has compiled much of what we know about wilderness visitation. These data are the best available, consistently compiled for the U.S. Forest Service and National Park Service. 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 U.S. Forest Service and National Park Service 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 Forest Service wilderness has paralleled designations of acreage. 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. Forest Service wilderness visits increased by about 4.5 million RVDs, led by a 298.4 percent gain (3.3 million recreation visitor days) 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 followed substantial acreage additions. After 1985, as growth in supply leveled off, Forest Service wilderness use grew more slowly rising 8.4 percent by 1993. Recreation visitor days at Forest Service Wilderness for selected years between 1965 and 1993 are shown in table 1.

Use of National Park Service wilderness (table 2) generally follows large acreage designations, with a few exceptions or lags. The largest increase in National Park Service wilderness use occurred in 1984 with the addition of Yosemite and Sequoia-Kings Canyon in California to the National Wilderness Preservation System (NWPS).

U.S. Fish and Wildlife Service Visitor Use

The U.S. Fish and Wildlife Service (FWS) does not maintain or report data on visits to wilderness areas within its National Wildlife Refuge System. It reports only total visits to each Refuge taken as a whole. 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 acreage, only the 14 with a substantial percentage of wilderness acres were contacted for two reasons. First, only on refuges where wilderness acreage represents a large percentage 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, Refuge managers for each of the 14 Refuges were

Table 1—National Forest wilderness visitor use in 12-hour recreation visitor days for the U.S. and Regions for selected years.

Year	U.S. total	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

Table 2—National Park Service wilderness visitation statistics, U.S. total and Regions for selected years.

Year	U.S.	Regions			
		North	South	Rocky Mountains	Pacific Coast
Overnight stays					
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
Day use					
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

Table 3—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

contacted and asked about the percentage of activities which 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 3). 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 FWS makes wilderness data collection a priority.

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 or the public on any centralized computer system. Not surprisingly, the visitor use data are 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 are 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 substitute for Forest Service and Park Service alpine wilderness areas that receive 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 objectively evaluate the merits of designations of additional areas.

Other Sources of Visitor Use Data

Given the variable reliability of wilderness visitor use information, especially from the BLM and FWS, it is useful to have other independent estimates of visitation. One available estimate is provided by Cordell and Teasley (1997), who used 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 the self-reported number of visits to areas the respondents perceived to be wilderness areas. Based on these responses, Cordell and Teasley estimated 40.4 million visits to wilderness areas in 1995. Since the sum of Forest Service and National Park Service RVD's is about 14 million, with about 100,000 visits from the BLM and 352,000 from the FWS, 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 the 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 contributes to debates being based on emotion rather than data.

Results on Recreation Values Per Day

There have been about two dozen empirical studies of the economic value of recreation in wilderness areas. These were originally compiled by Sorg and Loomis (1984), added to by Walsh and others (1992), and recently updated by

Table 4—Recreation values of wilderness (1996 dollars).

Author	Year	Location	Method ^a	Value/day
Brown & Plummer	1979	WA & OR	TCM	\$141
Loomis	1979	UT	TCM	\$30
Smith & Kopp	1980	CA	TCM	\$35
Walsh and others	1981	CO	TCM	\$25
Walsh & Gilliam	1982	CO	CVM	\$28
Walsh and others	1985	CO	CVM	\$33
Walsh and others	1985	CO	TCM	\$36
Barrick	1986	WY	CVM	\$15
Peterson & Rosenthal	1986	MN	TCM	\$24
Rosenthal & Walsh	1986	CO	CVM	\$17
Leuschner and others	1987	NC	TCM	\$13
Prince	1988	VA	CVM	\$17
Peterson and others	1988	MN	TCM	\$12
Peterson and others	1988	MN	TCM	\$36
Hellerstein	1991	MN	TCM	\$29
Halstead and others	1991	NH	CVM	\$2
Englin & Shonkwiler	1994	WA	TCM	\$22
Englin & Shonkwiler	1994	WA	TCM	\$34
Casey and others	1995	NC	TCM	\$218
Baker	1996	CA	TCM	\$25
Overall average				\$39.61

^aTCM is travel cost method; CVM is contingent valuation method.

Loomis and others (1998). Table 4 presents the summary of values per day. The average value of these studies is \$39.61 per day in 1996 dollars. This means each visitor would pay nearly \$40 more than his or her travel cost rather than lose a day visiting a wilderness area for recreation. When multiplied by the estimated 14.5 million days of wilderness recreation, the aggregate value is \$574 million annually.

Estimates of Passive Use Values of Wilderness

Undeveloped and pristine environments by their nature cannot be created, only destroyed. It was this fact that led Weisbrod (1964) to suggest they might be a source of option value, to maintain the opportunity to visit them in the future. To this, Krutilla (1967) added the categories of existence and bequest value. The Wilderness Act of 1964 emphasizes many societal benefits to wilderness preservation that go well beyond simply recreational use. Wilderness provides a storehouse of biodiversity and, even to non-visiting members of the general public represents the last vestiges of what North America was before Europeans arrived.

Walsh and others (1984) represent the first attempt to apply CVM to measure the option, existence, bequest as well as recreation value of wilderness. They conducted a mail survey of Colorado residents in 1980. In the survey booklet they asked households their annual willingness to pay (WTP) into a fund for continued preservation of the current (at the time of the study) 1.2 million acres of wilderness in Colorado, then WTP for 2.6 million acres, 5 million acres and finally for designating all roadless areas in Colorado (10 million acres) as wilderness. Following these questions, they asked what percent of 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. The mail survey had a 41% response rate after two mailings.

The results are summarized in table 5 on both a per household basis as well as in the aggregate for Colorado households. This second calculation illustrates the public good nature of option, existence and bequest values: they are summed over the entire population. Given the sample was just Colorado households, the expansion is just to Colorado households, although clearly, households outside of Colorado receive existence and bequest values as well. To include an estimate of the value the rest of U.S. households receive from Wilderness, we use the rough approximation of Walsh and others (1982). This approximation is based on what Colorado residents would pay for wilderness protection in the rest of the U.S. This is probably a conservative estimate of what non-Colorado residents would pay for wilderness, as Colorado residents had more than a million acres of wilderness at the time of the survey. The majority of the U.S. population in the east and Midwest have little wilderness, so an additional acre of wilderness is probably worth more to them than to Colorado residents.

To calculate a land value comparable to a stumpage value for timber or the value of a mineral deposit the annual values of wilderness benefits are summed over time. Specifically, the annual benefits of wilderness in perpetuity are discounted back to the present using the interest rate. The resulting sum is referred to as the present value of this future stream of wilderness benefits.

Two other patterns are worth pointing out in this table. First, WTP per household and in the aggregate increases with the number of acres protected, but at a decreasing rate

Table 5—Recreation and passive use values of wilderness in Colorado and Utah.

Study	1st Acres	2nd Acres	3rd Acres	4th Acres
Colorado				
Walsh and others (1982) (millions of acres)	1.2	2.6	5	10
Total passive use per household	\$13.92	\$18.75	\$25.30	\$31.83
Total for CO (millions of 1980 dollars)	\$15.3	\$20.6	\$27.8	\$35.0
Recreation	\$13.2	\$21.0	\$33.1	\$58.2
Total economic value for Colorado (millions)	\$28.5	\$41.6	\$60.9	\$93.2
Percent passive use	54%	50%	46%	38%
Marginal present value per acre to Colorado and U.S. residents	\$1,246	\$320	\$220	\$220
Utah				
Pope & Jones (millions of acres)	2.7	5.4	8.1	16.2
Total economic value per household	\$52.72	\$64.30	\$75.15	\$92.21
Total for Utah (millions of 1990 dollars)	\$26.7	\$32.5	\$38.0	\$46.7
Marginal present value per acre to Utah and U.S. residents	\$402	\$245	\$190	\$117

as expected from diminishing marginal rate of substitution. Second, option, existence and bequest values represent about half the total economic value of wilderness. Walsh and others, also concluded that WTP exceeded the opportunity costs of designating 9 of the 10 million acres as wilderness. The present value per acre of wilderness to Colorado and rest of U.S. households ranged from a high of \$1,246 per acre for 1.2 million acres to \$220 per acre when 5-10 million acres was preserved.

The second study of the total economic value 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. They obtained a 62% participation rate of households contacted. The results are presented in table 5 and illustrate a similar pattern of WTP rising at a decreasing rate for increased acreage designated.

The only study of total economic value of eastern U.S. wilderness was conducted by Gilbert and others (1992) to value the Lye Brook Wilderness Area and other wilderness areas in New England. Two versions of a mail questionnaire were mailed to separate samples of Vermont residents, which resulted in an overall response rate of 30% after two mailings. One version of the questionnaire asked respondents to value continued protection and management of the Lye Brook Wilderness area; the other to value protection of all wilderness areas east of the Mississippi River. Two separate samples composed of individuals who had visited an eastern wilderness area were apparently able to use this familiarity to distinguish between valuation of one area and all Eastern wilderness areas. Their annual total value was \$9.71 for Lye Brook while a separate sample of people that had visited at least one Eastern wilderness area, had a total economic value for all Eastern wilderness areas of \$14.28.

Table 6 presents the apportionment of total value into the individual use and passive use components and yields a pattern similar to that of Walsh and others—a majority of the value of wilderness is related to option, existence and

bequest values. Table 6 also presents Gilbert and others' (1992) new category, related to altruism, protecting it for current use by others.

Barrick (1986) provides estimates for the option value of one wilderness area (Washakie in Wyoming). On-site users' option value for future visits was \$46 in 1983, or \$69 in 1996 dollars. For urban and rural non-visiting households living throughout the U.S., the option value for the Washakie Wilderness area was \$9.70 and \$8.40, respectively in 1983 dollars, or \$14.60 and \$12.70 in 1996 dollars.

As contingent valuation has spread internationally, it has been used to estimate the value of placing public forest lands off limits to logging in national parks. One such study was performed by Lockwood and others (1993) for preservation of wet and dry eucalyptus forests on the Errinundra Plateau in Victoria and New South Wales, Australia. A mail survey of households in the two states was sent out asking households their WTP to preserve roughly 100,000 hectares of old-growth forests. The survey had a response rate of 65%. Dichotomous choice CVM was used and the median WTP was \$52 per household. As shown in table 6, the distribution of total economic value is dominated by existence and bequest values, again illustrating the importance of including these values in economic analyses of forest allocation decisions. Lockwood and others also performed a benefit-cost analysis that shows that the net present value of protecting these old growth forests in National Parks is positive for a wide range of assumptions about discount rates and assumptions about WTP of non-respondents.

Table 7 displays a rough estimate of the present value per acre of passive use value for wilderness in the West (using Walsh and others 1982 and the Pope and Jones 1990) and in the East using Gilbert and others (1992). As explained above, we used a conservative assumption of Walsh and others (1982) which uses what Colorado residents would pay for wilderness in the rest of the U.S. to estimate what U.S. households would pay for wilderness. The Utah value was estimated taking Utah resident value per acre divided by

Table 6—Distribution of total economic value per household.

	Own recreation	Option value	Existence value	Bequest value	Altruistic value
Walsh and others					
Colorado	\$14.00	\$5.44	\$6.56	\$6.75	not asked
Gilbert and others					
Lye Brook	\$1.27	\$1.64	\$1.95	\$2.87	\$1.97
All Eastern wilderness	\$2.26	\$2.41	\$3.03	\$4.14	\$2.44
Lockwood and others					
S.E. Australia	\$5.46	\$9.88	\$18.98	\$17.16	not asked

Table 7—Total passive use value.

	Acres	\$/Acre	Total value
	Millions		Millions
Lower 48 Western	42.7	168	\$7,173
Eastern U.S.	4.5	104	\$468

Walsh and others (1982) discount rate of 7.375%. Using this procedure the value per acre in the Western states outside of Alaska is estimated to be \$168 per acre. When applied to the 42.7 million acres yields a present value of \$7.17 billion. To estimate the economic value of Eastern wilderness, the Eastern value per household was multiplied times number of households in U.S. The present value of this Eastern wilderness is estimated at \$468 million. Thus the total benefits in the lower 48 states is \$7.5 billion. This is, of course, a very rough approximation that should be refined as additional passive use value of wilderness studies are performed.

Passive Use Values for Canadian Wilderness Using CVM and Constructed Preferences

An alternative approach to estimating recreation and passive use values for wilderness adapts multiattribute theory to help individuals construct their preferences toward wilderness. In this approach, small groups of individuals are asked to first think through the trade-offs of wilderness preservation benefits versus costs of wilderness to society. This first step involves ranking and then weighting various benefit categories such as recreation, biodiversity, existence and bequest values. In McDaniels and Roessler's (1998) application in British Columbia, individuals in the group decide how much timber revenue the Provincial government should give up for the proposed doubling of Provincial wilderness acreage. They ask individuals to make this monetary determination twice, first for the benefits to the current generation and then for the benefits to future generations. This small sample (n=26) of students believes it would be appropriate for British Columbia government to sacrifice between \$169 million and \$338 million annually for a doubling of Provincial wilderness. The authors note the lower of these estimates is fairly close to the dichotomous choice CVM results of Reid and others (1995) for the same doubling of Provincial wilderness. Their CVM study estimated household WTP of \$119 annually based on 1,571 surveys returned out of 3,000 mailed. The total Provincial benefits were calculated at \$159 million annually. This yields an annual value of \$28 per hectare of additional wilderness. Using the Provincial discount rate of 6%, this yields a present value of \$466 per hectare, or \$1,151 per acre. This value is equal to the upper range of the present values in Colorado.

Conflicting Views on Costs of Wilderness Designation

How Significant are the Opportunity Costs of Commodities Foregone?

While there is almost always a large perceived cost of wilderness designation, often held by local residents or industry, net economic benefits of development foregone are generally quite small or zero. As Irland (1979) points out, most roadless areas remained roadless because they were quite marginal for timber, especially when compared to the road construction costs. Outside of Oregon, Washington and

northern California, most National Forests lose money on timber sales as the roading and restoration costs exceed the value of timber. In Montana, a U.S. Forest Service study by Stewart and others (1992) demonstrated that timber harvesting in three roadless areas on the Lolo National Forest would have a net present value loss of \$2.14 million.

Are There Non-Market Costs of Wilderness Designation?

Sometimes it is alleged that locals would pay not to have wilderness. Certainly, there are such individuals in the population. However, it is important to determine whether their motivation for being against wilderness is related to market costs that would already be counted in the cost side of a benefit-cost analysis. If there are net economic losses (producer surplus losses) to local logging and mining activity that are not off-set by production elsewhere, these costs are normally counted in benefit-cost analysis using market prices minus production costs. There is no need to elicit such costs from the public in a survey and doing so would double count these costs. Sometimes, there is local concern over lost jobs as well. However, these jobs are usually gained elsewhere, resulting in no net change in national employment. Hence they are not properly counted as a loss in benefit-cost analysis (U.S. Water Resources Council 1983; Sassone and Schaefer 1978). Occasionally, there may be non-market losses associated with wilderness designation. For example, the loss of ORV opportunities. It has even been alleged that there may be passive use values lost for wilderness designation (Keith and others 1986; Barrick 1986). Lockwood and others (1994) were the first to estimate whether there was a significant passive use value for logging of forests. The median WTP was zero, although 19% did indicate a positive WTP for logging. When asked to state the reasons, the majority indicated it was related to the economic activity generated or timber jobs. Since protection of old-growth forests will result in increased harvesting of timber elsewhere in order to meet demand, overall economic activity will likely not change, and logging jobs will increase elsewhere by the amount they fall in the wilderness area. Only 30% of the WTP of those 19% offering a positive WTP (6% of the sample) was related to the benefits derived from knowing the forests are logged. This amounts to \$6 per year, for the 19% that would pay. While Keith and others (1986) found sizeable values for retaining multiple use instead of wilderness it is not clear, how much of this is a non-market value versus market effects on ranching, mining and logging, as the authors did not net these out. Thus, the potential for double counting of costs is evident in their study.

Directions for Future Research

Several recommendations are in order for improving our knowledge of wilderness values. First and foremost is the need for agencies to put a high priority on collection of visitor use data in wilderness. As noted by Cole (1996), only 13% of Forest Service wilderness areas in 1989 had counts based on permits or counters. Much of the rest of the Forest Service wilderness area data are based on field personnel estimates. This adds unnecessary noise and variance to the estimates.

This lack of documented visitor use has brought criticism of Forest Service economic analysis of recreation use in the recent past (Schallau and others 1997) and will continue to do so until the agency recognizes the far reaching importance of the visitor estimates in many facets of its management.

While the Forest Service estimates are not as systematic as they could be, their coverage of their wilderness areas is far superior to the Bureau of Land Management and U.S. Fish and Wildlife Service. The FWS does not appear to maintain any central database on visitor use of its wilderness. The BLM has a database, but only one person in the entire agency knows how to access it. The numbers in the database are questionable as the database reports that visitation at many of BLM's wilderness areas in southern California is zero. It is hard to believe that large areas of public land next to more than 15 million people receive no use. Visitor use statistics are fundamental to monitoring of ecological impacts, social carrying capacity as well as economic analysis. Given the controversial nature of BLM wilderness recommendations, some simple visitor counts would add a great deal of light to rather emotional debates on this topic.

We also recommend that the U.S. Forest Service augment its current Resource Planning Act values, which currently reflect only multiple use outputs, to include the economic values of ecosystems. The need for such information is greatest with regards to wilderness. At present, the only economic value reflected in the RPA system for wilderness is a value per recreation visitor day. However, the Wilderness Act specifies that recreation is just one of many important reasons for the preservation of wilderness. It is often no wonder that Forest Service managers are hesitant to rely on the agency's economic analysis in making wilderness recommendations when the only representation of the economic value of wilderness is a value per visitor day. The existing literature (Walsh and others 1984) suggests that recreation is about 50% of the total value of wilderness. Augmenting the RPA accounts to include a value per acre for wilderness would better reflect its economic values. This would go along way toward demonstrating the relevance of economics to wilderness allocation and management issues.

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The Impact of Wilderness and Other Wildlands on Local Economies and Regional Development Trends

Gundars Rudzitis
Rebecca Johnson

Abstract—There have been few economic studies of the impact of wilderness on nearby communities. The few studies that have been carried out find relatively modest economic impacts on the surrounding communities by people who come to recreate in federally designated wilderness areas. However, studies find that people are moving to areas near federally designated wilderness and other wildlands because of the environmental amenities associated with such areas. These rapid population increases are having dramatic impacts on the ongoing changing structure of local and regional economies.

Wilderness areas around the world exist within the context of the ecological and social systems that surround them. Some are very remote, with surrounding ecological and social characteristics similar to those within the wilderness area. In other areas, demand for commodities has brought extractive uses right up to the borders of wilderness. Some are near major population centers and experience the influence of human use, both within the wilderness and in the surrounding lands. While much of wilderness science has investigated how human influences have affected wilderness, there is a growing literature on the ways that wilderness areas are affecting surrounding communities. This paper focuses on the socioeconomic impacts of wilderness on local economies and regional development trends. We use the term “wilderness” to denote both officially designated wilderness areas and other wildland areas.

Wilderness affects surrounding communities in a number of ways. Perhaps the most obvious is that wilderness visitors often spend money in the local economy, which generates jobs and income for local residents. The economic impact of tourism spending is easily recognized by local economic development officials. However, wilderness contributes to economic development of an area in other ways. The amenities offered by wilderness contribute to the quality of life of nearby residents and often attract new residents. New businesses are also attracted, including tourism-related businesses and other businesses that are interested in providing amenities to employees. New residents (who are also consumers) and businesses increase employment and

income in the community, as well as provide additional taxes for social services.

Whether the positive economic impacts of wilderness are a net benefit to local residents is a matter of debate. Along with new residents and businesses come new values, customs and cultures. Increased population can lead to more congestion, crime and housing shortages. Traditional industries may suffer, either through losses in raw materials from newly designated wilderness areas or through less acceptance by new residents. These types of changes in a community will be welcomed by some and lamented by others, but they should be recognized as part of the impact of a growing desire to live near amenities provided by wilderness.

While social changes within local communities are very important, this paper concentrates on the economic impacts of wilderness. Some of these impacts are beneficial to local economic development, while others, such as reduction in traditional industries, are costly. Because most of our experience is in the American West, our examples rely heavily on communities near Western wilderness areas.

Wilderness Communities

The economic influence of wilderness areas on surrounding communities can extend quite far, geographically. Wilderness visitors who live in metropolitan areas purchase much of their equipment, and even their trip-related products (such as groceries and gasoline), in their residence location. Major suppliers of outdoor recreation equipment are usually located in metropolitan areas, providing jobs and income to urban residents. However, most of the research on the economic impacts of wilderness has concentrated on rural communities. Many of these communities have been going through economic transition over the past 15-20 years, and the role that wilderness plays in that transition has been the topic of a number of studies.

Rudzitis and others (1996) provided an overview of how demographic variables were changing in Pacific Northwest communities near protected areas. They state that “among the fastest growing counties in the nation are those adjacent to federally designated wilderness areas” (p. 7). They note that the population of wilderness counties increased six times faster than the national average for other nonurban counties in the 1980’s, and nearly twice as fast as other nonurban counties in the West. They found a similar trend in population for counties near national parks (table 1).

Along with a growing population, there has been a changing economic base throughout much of the Pacific Northwest. As in other parts of the country, manufacturing as a

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Gundars Rudzitis is Professor of Geography, Department of Geography, University of Idaho, Moscow, ID 83843 U.S.A. Rebecca Johnson is Professor of Forestry, Department of Forestry, Oregon State University, Corvallis, OR 97331 U.S.A.

Table 1—Percent county population change.

Year	Metropolitan	All nonmetro	Wilderness	Park
1960-1970	17.1	4.3	12.8	24.6
1970-1980	10.6	14.3	31.4	34.2
1980-1990	11.6	3.9	24.0	26.0

Source: Rudzitis 1996.

share of total employment has been steadily decreasing, from 28.3% in 1970 to 18.4% in 1992 (Rudzitis and others 1996). At the same time, the service sector has grown from 19.6% of employment to 31.3% in the region.

An example of a rapidly growing county near wilderness areas is Deschutes County in central Oregon. Deschutes County has experienced the same type of changes in industrial structure as described above. There has been a major decline in the percentage of employment in lumber and wood products, from 17% in 1975 to 7% in 1995 (fig. 1; State of Oregon, 1975 & 1995). At the same time, the percentage of employment in services has increased from 15% to 25%. The three major sectors in terms of employment are now trade, services and government, although the relative share of government employment has been declining. In terms of payroll, the share in lumber and wood products has decreased from 20% to 8%, while services increased from 10% to 23% over this same time period (fig. 2).

Many people feel that an increase in service jobs means more low-paying jobs, especially compared to lumber and wood products jobs, which are traditionally high-paying. But the service sector is a combination of many different types of businesses, some employing predominantly low-skilled workers and others predominantly high-skilled workers. In Deschutes County, the payroll per employee (adjusted for inflation) in services has risen from \$16,800 in 1975 to \$21,400 in 1995 (fig. 3). At the same time, payroll per employee in lumber and wood products has decreased from \$33,600 to \$28,900. Trade, however, has a relatively low payroll per employee, partially because of the many part-time jobs in this sector.

The changes in population growth and industrial structure in wilderness counties have led many people to assert that wilderness is the cause of those changes. But proving causality turns out to be a much more difficult issue addressed later in this paper. In this first section, we focus on the science of estimating jobs and income from known changes related to wilderness use or designation.

Estimating Jobs and Income

There are two distinct types of economic measures that are relevant to wilderness areas: economic value and economic impacts. Economic value refers to the willingness to pay for wilderness, either for direct or indirect use, or simply to know that the wilderness exists (sometimes called passive use value). Economic value is a welfare measure that can be used in benefit-cost analysis, and there is an extensive literature on nonmarket valuation. The paper by Loomis in these proceedings discusses the science of estimating economic values of wilderness. This section focuses on economic impacts, which are the sales, jobs and income generated

from an activity, such as wilderness visitation. They are not a measure of net benefit, since the expenditures that generate the jobs and income would not be lost to the economy if wilderness areas did not exist. They would simply be spent on some other good or service, probably in a different location, and would generate jobs and income in that other location. Economic impacts are important regionally (especially in regional economic development efforts), but they simply represent a transfer of impacts from one location to another at the national level.

There are a number of methodological issues related to employment and income estimation that have been discussed for many years (Propst 1985), including how to define the impact region. Regarding visitor expenditures, the impacts often extend to the visitors' residences, where much of the equipment and trip-related items are purchased. Usually, however, analyses are concerned only with the communities immediately surrounding the wilderness. In those cases, defining the local impact region can still be difficult, in part because economic data are often available only at the county level. In locations where the wilderness community is only a small part of a larger county, the county-level data can mask any changes occurring on the local level.

Modeling the local or regional economy can be done in a number of ways, the most common being input-output (I/O) models. I/O models describe the economy through a transactions table that shows the amount that each industry purchases from every other industry to produce their output. These models have a number of assumptions and limitations (Miller and Blair 1985), and econometric and computable general equilibrium (CGE) models have been developed to overcome some of those. Econometric models use time-series data to estimate employment in each sector as a function of other economic indicators. CGE models assume particular forms for production and utility functions, then choose parameters of those functions based on empirical evidence. Numerical solutions are then generated and "calibrated" to reflect reality (Nicholson 1998). These latter types of models can be more complex to estimate, but they may leave more flexibility for analyzing changes in an economy.

Finally, there is the issue of linking wilderness to the model of the local or regional economy. How does the existence or use of wilderness areas result in a change in the local economy?

Direct Employment

The most obvious linkage is the direct employment of people in the wilderness. This would include rangers, planners, managers and researchers. The Forest Service has a target of one wilderness ranger for every 100,000 acres of wilderness. If we assume that other wilderness management agencies have similar targets, and expand this to the total acreage of designated wilderness in the U.S., there should be 1,040 people employed directly as wilderness rangers. It is much more difficult to estimate the number of people employed in planning, management and research, and these data are not readily available from the agencies. Most of these people would have responsibilities that extended beyond wilderness areas, and calculating the percentage of their time devoted to wilderness would be extremely difficult.

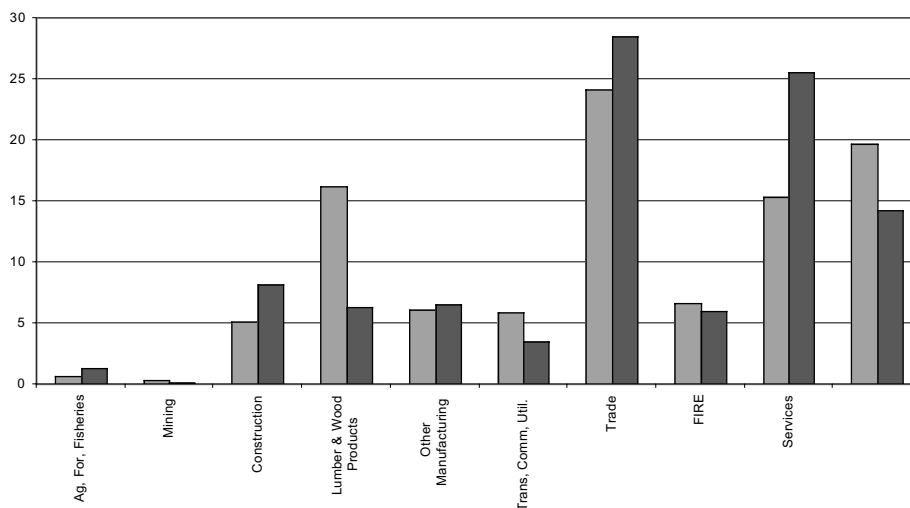


Figure 1—Employment by industry sector as a percent of county total, Deschutes County.

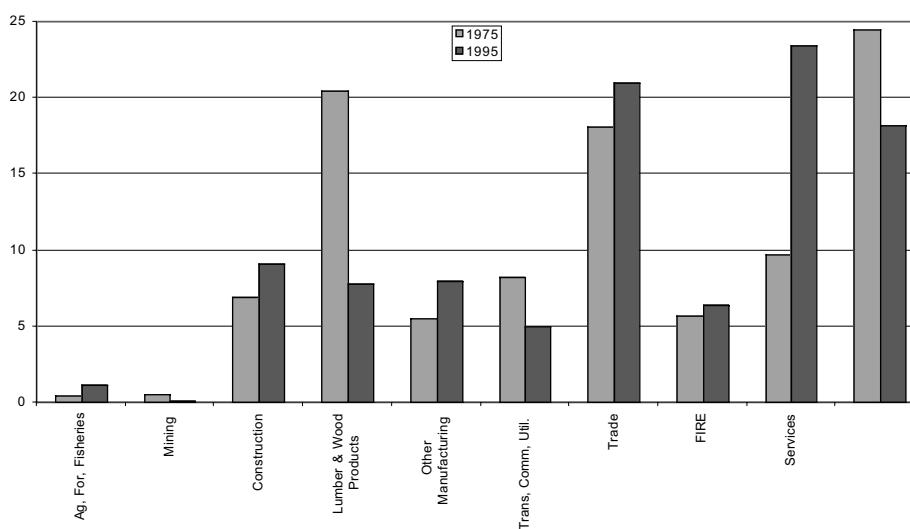


Figure 2—Payroll by industry sector as a percent of county total, Deschutes County.

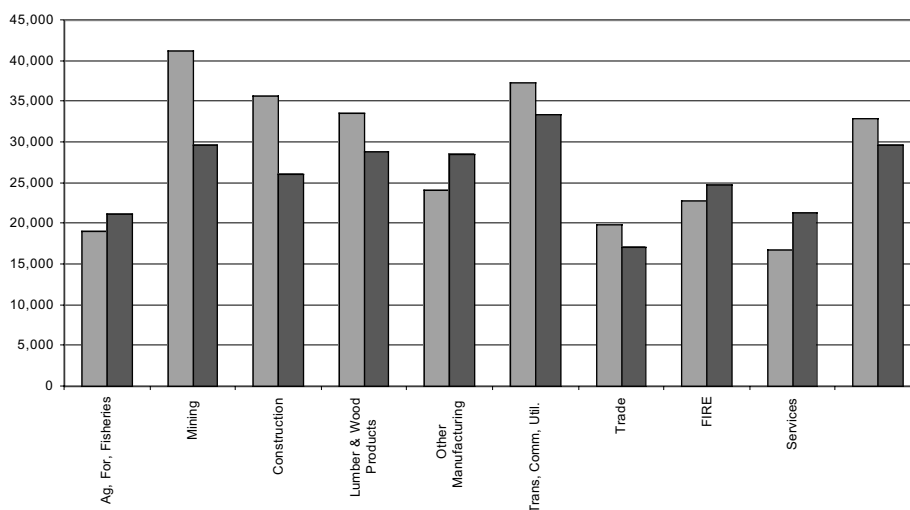


Figure 3—Payroll per employee by industry sector (1998 dollars), Deschutes County.

Visitor Expenditures

A second linkage between wilderness and local economies is through wilderness visitor expenditures. Very few studies were found with empirical estimates of wilderness visitor expenditures. One of the available studies is of Great Basin National Park visitors (Dawson and others 1993). Although Great Basin is a remote park with a large backcountry area, many of the visitors surveyed were taking guided tours of Lehman Caves, and would not be comparable to other wilderness visitors. The numbers are included here, however, since at least some of the visitors would be wilderness users. Table 2 shows that the expenditures per person, per day, estimated at three different wilderness areas (adjusted for inflation, 1998 dollars) are remarkably similar (Dawson and others 1993; Keith and Fawson 1995; Moisey and Yuan 1992). Compared to many other types of tourism and recreation, these expenditures are fairly low, reflecting the less-developed nature of wilderness recreation. Looking at how these expenditures are distributed across different sectors of the economy (table 3), however, shows some differences between studies (Dawson and others 1993; Keith and Fawson 1995; Lichty and Steinnes 1982; Moisey and Yuan). Great Basin National Park has a higher proportion of expenditures in the transportation sector, as would be expected for a remote area. Montana wilderness visitors had a higher proportion in lodging, perhaps due to longer lengths of stay.

Once visitor expenditures are estimated, the economic model of the regional economy is used to show how those expenditures get recirculated within the regional economy—that is, the multiplier process. A methodological issue is the

treatment of local residents' expenditures. The multiplier process should be used only when analyzing exports, or "new" money that has come into the regional economy. Since nonlocal visitors bring their money from outside the region, their expenditures represent exports. However, local visitors' expenditures simply represent a recirculation of money that already existed in the local economy and shouldn't be included in the multiplier analysis. An exception is when local expenditures represent import substitution (Johnson and Moore 1993). For example, if local visitors are substituting a local wilderness for a nonlocal wilderness, their expenditures can be considered "new" money that would not be present in the local economy if the local wilderness were not available. This type of information can be gathered only through a survey of wilderness users that asks detailed questions about substitution decisions in the absence of the local wilderness.

Multipliers will vary from industry to industry, and from economy to economy. In general, industries that purchase a large share of their inputs locally will have higher multipliers, and larger, more diversified economies will have larger multipliers. Table 4 shows an example with output multipliers from two different counties in Oregon. Deschutes County is a larger, more diversified economy, and Wallowa is a smaller, more remote county. The output multipliers are significantly larger for Deschutes County. In both counties, the output multiplier for sawmills is higher than those for the recreation-related sectors, showing more linkages between sawmills and other sectors in the local economy.

Output multipliers are an indication of overall spending that is generated by any sector. However, a more useful measure of economic impact is the income and employment that are generated. Overall spending may be quite high, but if little ends up in the pockets of local residents, their welfare will not be improved. Table 4 shows the employment and income generated by sales in each of the sectors listed. Recreation-related industries are very labor-intensive and generate more jobs per million dollars of sales than sawmills. Although many recreation-related jobs are low-paying, these sectors also generate more income per dollar of sales than sawmills. However, the analysis must also account for the overall level of sales, which is usually significantly higher in sawmills than in the recreation-related sectors.

Table 2—Expenditures of wilderness visitors.

Location	\$1998/person/day
Montana wilderness	\$36.90
Utah wilderness	
Box Death	\$36.37
Dark Canyon	\$44.49
Grand Gulch	\$35.63
Paria Canyon	\$34.21
Great Basin National Park	\$32.69

Table 3—Distribution of expenditures among economic sectors (% of total).

Location	Food	Lodging	Transportation	Retail	Other
Montana wilderness	26	34	18	15	7
Utah wilderness					
Box Death	27	15	24	19	14
Dark Canyon	39	19	22	12	9
Grand Gulch	37	10	21	25	7
Paria Canyon	37	17	20	12	15
Ely, MN	22	19	12	35	12
Great Basin National Park	18	14	31	27	11

Opportunity Costs and Offsite Impacts

Finally, there are measurable impacts on industries that can be excluded from wilderness areas, and the science of estimating those impacts is relatively straightforward. Income, employment and output multipliers can be used in conjunction with estimates of lost direct sales in these industries to calculate the total impacts on the local economy. A study of wilderness designation in the Lolo National Forest (Stewart and others 1992) estimated a loss of 136 timber-related jobs and \$3.1 million of timber-related income. However, since much of the timber was sold in below-cost timber sales, the present net value of the area increased by \$6,504,000 after designation. Another study in British Columbia (M'Gonigle and others 1992) estimated 4,911 fewer lumber and wood products jobs in B.C. after the first year of implementation of a wilderness protection strategy.

Table 4—Comparison of multipliers across sectors and economies.

	Output multiplier		Emp./\$1mm sales		Income/\$1 sales	
	Deschutes	Wallowa	Deschutes	Wallowa	Deschutes	Wallowa
Restaurants	1.58	1.33	46.4	45.5	0.67	0.55
Lodging	1.63	1.35	47.7	59.5	0.88	0.73
Recreation Services	1.62	1.34	53.0	57.0	0.77	0.66
Sawmills	1.93	1.73	7.1	14.3	0.55	0.42

On the positive side of wilderness designation and protection, there can be off-site benefits, such as habitat improvement, that lead to increased populations of fish and game outside of the wilderness area. For example, one study estimated the impact in Alaska to be \$72 million in commercial fishery impacts (Glass and Muth 1992).

Reflections on Estimating Economic Impacts of Wilderness

We have focused on estimating economic impacts of wilderness designation and use. This involves collecting data on wilderness visitor expenditures and combining them with a regional economic model to estimate multiplier effects. The availability of data and models of regional economies has increased dramatically in the last decade, making estimates of economic impact much more accessible to researchers and decision-makers. This methodology has been applied in many different recreation and tourism settings, but problems still exist. Careful application of models and interpretation of results are necessary to avoid making common mistakes. The ease and accessibility of some of these models will result in more use by untrained analysts and future skepticism about their accuracy. Future work should improve expenditure estimates through better surveying techniques and our ability to define meaningful economic regions for impact assessment.

While there are many empirical studies of the economic impact of recreation and tourism, very few have looked specifically at wilderness use. And those have relatively consistent results, showing wilderness visitors spending relatively modest amounts compared to other types of recreation and tourism. Estimates of jobs and income directly and indirectly tied to wilderness visitation may be small, but those small impacts are significant for some rural communities.

Wilderness and Changing Economies of the American West

In the American West, particularly in and around wilderness areas, there has been and continues to be a restructuring of the economy. There has been a significant decline in employment in the traditional extractive industries, whether in forestry, mining and minerals, agriculture or associated manufacturing and processing industries. These employment shifts and associated losses should have, according to conventional regional development models

described previously, resulted in widespread unemployment and economic depression. Indeed, this is what was predicted for much of the region given decreases of timber harvesting on public lands and the fallout from the consequences of enforcing the Endangered Species Act, most noticeably in the case of the spotted owl. Instead, the American West has experienced unprecedented economic growth.

The economy of the American West traditionally has been based on farming and ranching, mining, forestry and, more recently, on the federal government, which built dams, power plants, military installations and the like. A way of life based on an extractive culture went along with the extractive and agricultural activities.

Today the role of extractive industries is changing dramatically as the number of people employed in such activities has declined, and it is expected to continue to decline (Lorah 1996; Power 1995, 1996; Rasker 1995; Rudzitis 1993, 1996). Nor is this a recent trend: The interior West stagnated in the past because its economy was based so completely on primary products from farms, forests and mines (Meinig 1991).

Currently, places and states in the American West are growing primarily from in-migration of people, and despite the decreased importance of extractive based industries (Dahmann and Dacquel 1993; Rudzitis 1996). Again, much of this growth is contrary to what developmental models would predict for the regions, raising the question about which models are appropriate when considering the role played by federal wilderness and other public wildlands in the development process.

The Increasing Role of Migration in Explaining Population Change and Development in and Around Wilderness and Wildland Counties

We showed in table 1 that population in and around wilderness counties has grown rapidly. These changes are part of larger population trends which need to be understood to put the population changes in context of regional and national trends. After discussing these trends, we look more closely at the changes taking place in wilderness counties.

Before the 1970s, rural counties were either losing population or growing more slowly than urban areas. With the 1970s, however, came what was hailed as a rural renaissance, during which, for the first time in U.S. history, rural or nonmetropolitan areas grew at a faster rate than urban areas. This turnaround came unannounced and unpredicted by the "experts." It was hailed as one of the most significant

demographic events of this century. It was pronounced as a pervasive new counter-urbanization trend destined to profoundly change the geographic structure of the United States (Berry 1978; Morrill 1979; Wardwell and Brown 1980).

The 1980s brought a collective sigh of relief to those taken by surprise by the population turnaround of the 1970s. Urban areas were once again growing at a faster rate than rural areas. But not everywhere. New classifications emerged. There were now more remote counties that were categorized as retirement, recreation, manufacturing, farming, energy, mining or timber counties. This breaking of rural America into specific types of counties is simplistic, but it helped to explain why some rural counties continued to grow, contrary to the overall trend. The 1980s also had economic recessions at the beginning and end of the decade. Recessions usually are worse in rural areas.

The rural counties that were not growing included many farming-based counties and others such as those classified as manufacturing, mining, energy and timber. The counties that continued to grow included those which can be included in a broad based amenity category with both a desirable physical environment and a relaxed small town atmosphere. Wilderness counties were among this category.

In the 1990s, rural growth again increased faster than metropolitan growth. The process of “deconcentration” continued as people moved into rural areas and most current residents stayed in these counties. Among the fastest growing counties were those classified as either retirement or recreation. By contrast, counties dependent on agriculture or mining continued to have out-migration of people from them (Beale and Johnson 1998; Johnson 1998; Johnson and Beale 1994; Brown and others 1997).

In trying to explain why these rural places were growing, researchers conducted surveys which showed that if given a choice, people would prefer to live in small towns (Morgan 1979; Dillman 1979). Studies also began to show that amenities such as environmental quality and pace of life have become increasingly important in explaining why people move (Williams and Sofranko 1979; Long and DeAre 1980). The apparently sudden preference of people for rural life was a surprise because rural areas were thought to be at a major disadvantage to urban areas. Moreover, a general movement toward isolated wilderness counties was not expected. Some 1960s dropouts and “return to the land” types might seek out such places, but they were the exception, not the norm.

Theories could not be built around people who were dropping out or detaching themselves from mainstream society. Such persons were not driven by the motivation to maximize their incomes. Earlier studies had argued that economic reasons explain why people move: they move because they want jobs and higher pay. People would do a rough cost-benefit analysis: if the costs of moving, both economic and psychological, were less than the benefits of increased income, people would move.

The economic model described well the historical movement from rural farming areas to cities as the nation became increasingly urbanized. People moved to cities for jobs and higher incomes. Cities with good job prospects attracted migrants. Places that did not, did not.

The acceptance of this almost total focus on the economic rationality of people explains much of the surprise when rural and wilderness areas began growing faster than urban

areas. These are not supposed to be attractive places for entrepreneurs and industries. Retired people might move to such places since they were no longer working. But, why would retired people move toward wilderness and other isolated public land counties where services are remote?

It became increasingly difficult to explain the movement out of cities as a search for higher wages. Various explanations were suggested, including the decentralization of many industries, increased mobility because of improvements in transportation and communications and the growth of recreation and retirement activities, to name a few. However, these all have an ad hoc feel to them.

A harder look was taken at people’s preferences. Perhaps if people wanted to live in a small town, they might actually move there. Maybe people had preferred cities, and now they wanted to live in rural areas and small towns. If cities were once considered beautiful, and wilderness threatening and scary, had wilderness now become beautiful, enticing people to move to such places? Questions about societal preferences changing over time are difficult to answer because prior to the 1970s, there is a paucity of data on such issues. Such questions were not asked, at least not on surveys.

There are several reasons why the move out of cities and toward rural areas (including wilderness) should not have been a big surprise. For one, the movement out of the cities had already started after World War II with the growth of affordable housing for lower and middle income persons in the much criticized look-alike suburbs with mass-produced housing. The early movement to rural areas was a spillover from metropolitan suburbs. The suburban fringe was simply extending its boundary and becoming more exurban. However, growth outside of metropolitan areas and near wilderness was far removed from a simple extension of commuting patterns to the fringe. Studies found that amenities such as environmental quality, pace of life and crime rates were the important reasons why people moved (Williams and Sofranko 1979; Long and DeAre 1980).

Why are People Moving to Wilderness Counties

A study funded by the National Science Foundation attempted to discover why people were moving to wilderness counties (Rudzitis 1996, 1999; Rudzitis and Johansen 1991). Questionnaires were sent to people who had moved into counties with federally designated wilderness during the past ten years, as well as to longer term residents of these areas. People who migrate to high-amenity counties are often assumed to be retirees. In the wilderness survey, however, only 10 percent of the new migrants were over 65 years of age. Instead, migrants were more likely to be young, highly educated professionals. This was unexpected, since according to the logic of the economic model, rural areas neither attract entrepreneurs nor provide jobs.

People also are assumed to move because of dissatisfaction with their previous location, resulting from crime, congestion, pollution or other “urban” ills. However, most wilderness migrants were not particularly dissatisfied with the places they had left (table 5). For example, only 28 and 30 percent of the migrants said they were dissatisfied with the crime rate and environmental quality of their previous

Table 5—Dissatisfaction with previous location and importance of attributes of wilderness county in decision to move.

Factors	PUSH		PULL	
	Dissatisfied	Not dissatisfied	Important	Not important
Employment opportunity	16	67	30	56
Cost of living	14	64	14	58
Climate	22	57	47	28
Social services	7	85	10	69
Family access	11	76	19	64
Outdoor recreation	18	63	59	20
Crime rate	28	48	31	45
Scenery	20	62	72	13
Pace of life	31	47	62	18
Environmental quality	30	46	65	16

Source: Rudzitis 1999.

location. The lack of employment opportunity and cost of living were cited by 16 and 14 percent (Rudzitis 1999).

When asked what “pulled” or attracted them to the Western counties, 30 percent cited employment opportunities and 31 percent the lack of crime as important factors. They assigned more importance to scenery (72 percent), environmental quality (65 percent), pace of life (62 percent) outdoor recreation opportunities (59 percent) and climate (47 percent).

When asked what single factor was the most important in their decision to move to their current county, 23 percent cited employment opportunities. Of the other attributes of the county, those contributing to the social environment accounted for 42 percent of the most important reasons for moving, while those specific to the physical environment made up 35 percent. Thus, amenity characteristics provided 77 percent of the reasons that people moved and employment-related reasons 23 percent.

The importance of employment opportunities did not vary much by age, except for persons over 65. For example, 31 percent of those age 20-35 gave employment opportunities as the major reason for moving, compared with 29 percent for persons aged 36-50 and 16 percent for those 51-65. Family access, at 24 percent, was the single most important “pull” factor for people over age 65, followed closely by climate (21 percent) and outdoor recreation (21 percent). Outdoor recreation, pace of life, scenery and climate were cited as the second and third most important factors by the younger age groups.

Contrary to the economic theory of migration, almost 50 percent of the migrants reported lower incomes, and only 28 percent had increased their income, with the rest showing no change. Recall that these are primarily younger employed migrants. These are not social dropouts moving to areas and putting stress on the social welfare systems.

The actual presence of wilderness served as a magnet attracting people to these areas, as 72 percent considered it a major factor in their decision to move to the county. Among long-term residents, a majority (55%) also felt wilderness was an important reason for living in the area. The importance of wilderness was emphasized by the desire of a majority of both migrants and residents to have more access to these areas; 60 percent of the newcomers felt there was a need for even more wilderness nearby. This can be partly

explained by the use of wilderness at least 12 times a year by more than a third of migrants and residents (Rudzitis and Johansen 1991).

Given the importance of quality-of-life factors in why people move toward wilderness, there is no reason to expect such trends to diminish. Although there was a decrease in the intensity of movement to wilderness counties during the early 1980s, partly because of the recession, the 1990s have been a period of rapid in-migration of people into wilderness counties.

Why People Move Into Wildland and Other Counties in the West

A recent study addressed motives for migration in a 100 county contiguous area in the interior Columbia River Basin, which included all of Idaho and parts of Washington, Oregon, Montana, Wyoming, Utah and Nevada. Anywhere from 25 to over 80 percent of this land is owned and managed by the federal government. This study also looked at the importance of the major public lands amenities in the region (Rudzitis and others, 1996).

Again, when asked to choose the three most important reasons for moving to or living in their county, just over 34 percent of respondents cited employment opportunity (table 6). Forty-five percent considered the amenities related to the social environment as most important and 18 percent the physical environment.

As the second most important reason for moving, respondents cited outdoor recreation most often at 16 percent. Employment opportunities were sixth, at 10 percent. The social environment captured 47 percent of second reasons for residence and the physical environment reasons 42 percent. The same trend is apparent for the third most important reason: Pace of lifestyle leads at 22 percent, with employment opportunities only 6 percent. As further indication of the importance of the social/physical environment, 28 percent said they moved first and looked for/created a job after the move.

Another recent survey also showed an amazing similarity in why people moved there and what kinds of lifestyle tradeoffs they made. A survey of over 1,500 people in Oregon found that most people moved to Oregon for noneconomic

Table 6—Most important reasons for moving or staying in area.

	First reason	Second reason	Third reason
	----- Percent -----		
Employment opportunity	34.1	10.3	6.4
Access to family and friends	23.9	15.0	6.3
Pace of lifestyle	12.9	12.1	21.5
Outdoor recreation	7.1	15.6	16.0
Landscape, scenery and environment	6.2	14.9	16.9
Climate	4.8	11.2	10.8
Quality of schools	3.5	6.0	3.7
Other	3.0	1.6	5.9
Cost of living	2.3	9.1	6.1
Crime rate	1.9	3.4	5.9
Social services	0.4	0.7	0.6

Source: Rudzitis and others 1995.

reasons. Only 30 percent said they moved into Oregon for employment-related reasons, about the same percentage as in the wilderness survey. Again, jobs account for a minority of the reasons for moving. A majority of migrants also had lower incomes after their move (Judson and others 1999).

In the wildlands West, employment alone cannot explain why people move and live where they do. The amenities of places around wilderness and other public lands single them out as desirable living environments. Unfortunately, current regional development theories often do not incorporate findings from migration studies into their models.

Regional Growth Theories and Approaches

In the first section of this paper, we briefly described and gave examples of how specific economic development models can be used to estimate some benefits from the geographical proximity of wilderness and other wildlands. Most regional development approaches are evolutionary, demand-driven, top-down hierarchical models. Although these models may provide estimates of some economic benefits such as tourism for example, they have serious limitations when used to explain the population and economic changes taking place in and around wilderness areas.

The traditional approach to development of the predominantly rural and small town communities surrounding public wildlands has been the promotion of export-based economies. The argument harkens back to a famous debate in the economic literature begun by Douglas North (1955), who argued that the demand for the products a region exports drives its development. The export industry, with its associated multiplier effects, determines the growth and income levels in a region. In the nonmetropolitan West, historically, the export-based economies have been based on extractive economies. This demand-driven theory became a standard approach, both in academia and in local and regional development communities.

Of these demand-based models, the most widely used are input-output, as we have shown and often the simpler economic

base models. However, irrespective of their level of mathematical sophistication, the heart of the demand models is the notion that regional economic growth is a function of the demand for products exported from the local or regional economy. These “products” can vary from revenues generated from logging to tourist dollars.

The economic base model approach has been indelibly imprinted on United States citizens, chambers of commerce, local politicians and planners. As employment in the extractive industries in the West decreased, the economic base models predicted an overall decline in the economy of the interior West. Fortunately, this has not happened. The model predictions were simply wrong.

Some areas were hard hit with job losses during the economic recessions of the 1980s, but even these areas have turned around. Indeed, Richard Morrill (1992) found that environmentally attractive counties continued to experience growth well into the 1980s. Lost jobs in the extractive sectors have been replaced by new jobs in the nonextractive sector (Rudzitis and others 1996).

Another disadvantage for the nonmetropolitan interior West is that, according to the product-life-cycle model, rural areas would largely attract firms producing standardized products requiring low skilled labor. Newer, innovative industries (and entrepreneurs as well) would locate in metropolitan areas. A pattern of industries following a product-life-cycle approach did not bode well for many areas in the rural West.

Critics contend that the product-life-cycle approach lacks the conceptual underpinnings to explain or predict ongoing changes taking place in the American West (Higgins and Savoie 1995; Rudzitis 1989). More generally, current regional development theories rooted in an economic paradigm are less and less able to explain changes in the American West, especially the rapid growth around federally designated wilderness areas.

In a more general context, it is not that demand is inappropriate, but rather that the emphasis on demand-side modeling has ignored the supply side. Moreover, in the input-output models, demand is assumed to be constant, just the opposite of what is happening in and around wildland counties. Too often, the models used to predict change assume a constant demand while ignoring the influence of supply. For our purposes, the supply side consists largely of the attributes of an wildlands region and its residents. Among these attributes is the physical environment and/or “Nature.”

Another characteristic of most of the models is that they impose a jobs versus the environment logic. For example, attempts to impose traditional demand-based models of development may lead to “expert advice” that is biased toward exploiting forests and agricultural products for the good of local development. For example, a recent analysis of management policies on the Clearwater National Forest suggested that the forest cut might have to be increased up to 10 times to provide adequate jobs in local communities (Robison and others, 1996). The analysis ignored the private and environmental costs of such a policy and a host of potential current benefits from protective policies such as improved quality and protection of waterways and ecosystems among others.

Nancy Langston (1995) also shows how, despite a history of federal management policies that have negatively altered

the ecology of the Blue Mountain area in Oregon, some forest analysts recommend the same failed policies that led to the destruction of the original forests. She points to a recent study (O'Laughlin and others, 1993) as promoting an industrial position of expanded tree harvesting, when just the opposite is needed.

Such stores are not uncommon and provide much of the impetus for the ongoing debates over public lands management. The models used to justify such actions are biased because they assume that the higher wages and incomes derived from commodity extraction jobs are higher than the available jobs in the tourist industry -- the major alternative often presented to a continued harvesting of our public forests. However, too often no attempts are made to calculate the costs of such actions or the benefits that can be derived from not harvesting public wildlands or not promoting tourism. This brings us back to Douglas North and his export argument.

At the time North made his argument, another economist, Charles Tiebout (1956) responded by arguing that there was no reason to assume that exports are the sole or even most important factor determining regional growth and income. Instead, the nonexport or residentiary (local) industries can serve as a key factor in the potential development of a region.

North won this argument in the 1950s, in that his views prevailed and have been internalized in public lands management. Indeed, they have even entered Western economic history mythology. As the pioneers and their descendants conquered and tamed the wildlands, they cut trees, exported wheat and extracted and exported lead, gold and silver. When they did so, times were good. When they did not, times were bad. Local development is based on keeping the good times going.

Computer models often verify what seems obvious. When commodity production goes down, local economies go down. Fortunately, for many communities, such models and their projections have also been wrong. From a regional perspective, there is little correlation between harvesting on public lands and economic growth, except in a small number of communities. Recent research shows that local citizens and politicians, as well as academics, would have been more farsighted if they had listened more closely to Tiebout than North (Durning 1999; Power 1996; Rasker 1995; Rudzitis 1996).

A recent study by Duffy-Deno (1998) examined whether local economies may be adversely affected by designation of federal-owned wilderness in the eight states of the intermountain western United States. He found no evidence that the existence of federal wilderness is directly or indirectly associated with population or employment growth between 1980 and 1990. Much of the economic concern over the designation and presence of federal wilderness is on its perceived effect on resource based industries. The Duffy-Deno study found no empirical evidence that county-level resource-based employment is adversely affected by the existence of federal wilderness. Indeed, there is some evidence of a positive association between federal wilderness and nonresource, nonfederal county employment growth. On average, from a utilitarian perspective wilderness designation causes little aggregate economic harm to county economies, promoting instead increases in total population and employment.

The Quality of Life or Amenities Model of Regional Development

An alternative approach to regional growth more in line with Tiebout's logic is a model based on the role of environmental amenities (Diamond and Tolley 1982; Graves and Linneman 1979; Rasker 1994; Rudzitis and Streatfeild, 1993). This approach, sometimes referred to as the quality of life model, essentially argues that people migrate, particularly in the American West, for noneconomic reasons: firms also follow people to seek out high amenity physical and sociocultural environments. Population growth around wilderness areas is to be expected if people value these areas and want to live near them.

Ridker and Henning (1967) and Harris and others (1968) were among the first to suggest that demand for both social and physical amenities were key determinants of residential location decisions. The logic, as formulated by Diamond and Tolley (1982), assumes that what makes one location different from another is amenities. Amenities, like other goods, affect the level of either a firm's profits or a household's satisfaction. But unlike other goods, increments to amenities can only be gotten by a change in location.

An amenity is defined as a nontraded or location-specific good (Tolley 1974; Graves and Linneman 1979). Migration serves as an equilibrating reaction to a non-optimal location. If the demand for location-specific amenity changes (proximity to wilderness or other wildlands), migration should occur. The demand for amenity goods may vary over a household's lifetime and change in income. Changes in technology, such as declining transportation costs, also can promote migration to places with higher amenity values (Rudzitis, 1982, 1989). Economic motivations, while important are not necessarily the main determinants of why people move. Indeed, Graves (1983) argued that there is neither theoretical or empirical justification for believing that inter-regional moves are primarily job-related.

Amenities are important in attracting and retaining businesses. Both entrepreneurs and businesses place greater importance on amenity and environmental factors in their decisions to locate or stay where they are (Johnson and Rasker 1993, 1995). Consequently, developing a community's unique character can be an important economic development strategy.

The Amenities Model and Wildlands West

With the increased mobility of some types of industry, services in particular, rural communities with amenity characteristics have an advantage in attracting business. New forces built around services and information technologies are driving the regional economies in the wildlands West.

The economic forces driving the new wildlands economy include export-oriented producer services and other professionals selling services externally. In a series of studies, William Beyers and associates found amenity factors to be among the major factors in the location decisions of producer service firms nationwide, not just in the amenity-rich American West (Beyers 1991, 1999; Beyers and Lindahl 1996; Beyers and others 1985).

Various researchers have described this new economy in the Greater Yellowstone and Columbia River Region., the Northwest and for the interior West as a whole (Booth 1999; Durning 1999; Power 1996; Rasker 1993; Riebsame 1997; Rudzitis 1996; Rudzitis and others 1996). Again, there is declining employment and incomes in the traditional extractive sectors and a rise in the role of the high income services sector. This is the result of many "footloose" businesses and jobs following migrants rather than people following jobs. Increasingly, much of this growth comes from the immigration of people with either nontraditional income such as investments (Nelson 1997, 1999).

Most regional development models assume people follow jobs. Or, alternatively, do jobs follow people? This is the old "chicken or egg" analogy. Which comes first? Do people follow jobs, or jobs follow people in the American West?

Recent research shows that jobs follow people in the American West. People either move into areas bringing jobs with them, or move hoping to get jobs. In one survey, about 30 percent said they moved first and would look for jobs later. The traditional assumption that industries move first and people follow is not true for the current amenity-driven trends in the West (Rudzitis, 1996; Rudzitis and others; 1996; Wardwell and Lyle, 1997).

A few studies have addressed this using a simultaneous-equations framework. Rudzitis and Johansen (1989) examined growth in and around counties with federally designated wilderness and found that employment did not explain migration, while migration did explain employment. A few other studies looking at a larger subset of counties found similar results. Whether looking at wilderness counties, the Pacific Northwest or the interior Rocky Mountain West, these studies conclude that jobs are following people (Rudzitis and Johansen 1989; Vias 1997; von Reichert 1992). Vias (1997, 1999) looked at all 254 non-metropolitan counties in the Rocky Mountain West for three time periods, the 1970s, 1980s and 1990-1995 and found that population was driving employment growth, but that there was also a negative relationship between employment and population. As employment declined, population increased. The value of amenities, however, increased over time.

The environmental amenities and quality of life regional development models demonstrate the importance of individual and business preferences for living environments in determining the location of economic activity. The landscape of the public wildlands and associated towns provide a range of physical and social amenities, which many migrants and long-term residents want.

Wilderness and Sense of Place

Much stress has been placed on economics as the driving force behind regional development efforts in the American West. Often "experts," citizens and politicians assume that the promotion of local or regional development depends on harnessing the desire of people to make money and firms to maximize profits. Many of these theories are faltering because they are too reductionistic and simplistic.

Traditional economic models of wildland development don't consider the context of peoples' lives and how they interact with, shape and are affected by their social and spatial environments. Despite the old cliché that "money

does not buy happiness," it lies at the core of most economic models.

The amenities modeling approach better explains some of the recent growth trends in and around wilderness areas. However, we also need to consider the attachments people form with places or their "sense of place." It is attachment to a place or region that keeps people from moving away during times of economic distress, a loyalty to landscapes and communities. (Berry 1978; Bolton 1992; Marsh 1987; Pena 1998; Relph 1986; Rudzitis 1982, 1991, 1996; Tuan 1997a, 1977). Current regional development models ignore loyalties and ties to place and "wild" landscapes. Geographer Yi-Fu Tuan (1974) introduced the term *topophilia* to designate the emotive ties people can have to a place and their immediate environment. Tuan (1977) also showed how a space become a place when people attach or fill it with meaning.

If attachments to place are important, how they are formed becomes critical in understanding how local and regional communities maintain their vitality. In the wildlands West, this uniqueness is rooted in a physical environment that interacts with the social lives of the people who live there. The interaction with wilderness and other wildlands creates a "sense of place" and "roots." Wallace Stegner called such people "stickers," people who stay despite natural, economic or social calamities (Stegner 1990). Kemmis (1990) and Rudzitis (1996) also have written about the importance of considering attachments to place in the economic and political development of the contemporary American West.

Too long as Jackson (1991 reminds us there has been and artificial separation of the economic and cultural in the process of local and regional development change. He calls for research that does not see economics and culture as separate sphere, but recognizes that they intersect in specific times and places. We must recognize the interwoven nature of economics and culture. People in and around wilderness and other wildlands areas form place attachments by using those areas in a variety of ways. They may work the range, flyfish, hike, watch the stars, grow food, or engage in a variety of activities that give meaning to their lives as they interact with their environment (Bolton 1998; Nelson 1999; Rudzitis 1996).

There have been recent attempts to outline and develop models that incorporate sense of place and culture in developmental models (Nelson 1999; Rudzitis 1998; Rudzitis and Tolley 1998; Tolley and Rudzitis 1999; Tolley and others 2000). Models that ignore the role of environmental amenities, ties to the land, sense of place, commitment to a landscape and culture may well misdirect public policy in ineffective ways.

One consequence of increased demand for a greater sense of place as evidenced by migration to places with amenity features should be the willingness of people to accept lower relative wages to live in such places. Survey evidence indicates that people who move to areas around federally designated areas wilderness areas are more likely to either have decreases in incomes or no income change. Also, contrary to expectations, people with lower incomes accept proportionately greater declines in incomes than those with higher incomes (von Reichert and Rudzitis 1992). The difference in incomes between the places people left and their new living environments apparently is compensated

by greater amenities and other noneconomic factors. Areas surrounding wilderness also have lower real wages. However, despite having lowered incomes, migrants to wilderness counties are highly satisfied with where they presently live (Rudzitis and Johansen 1989, 1991; von Reichert and Rudzitis 1992.)

Another indirect indicator of a greater attachment and sense of place is the high level of agreement when people in wilderness counties are asked if their lives are now happier, less stressful and more enjoyable (Rudzitis and Johansen 1989; 1991). People who are more satisfied with where they live feel more attached to their communities and are less likely to move (Bolan, 1998; Fernandez and Dillman 1979; Heaton and others 1979; Rudzitis and Johansen 1989; Samson 1998; Stinner and others 1990).

If sense of place is important, long-term residents should have greater place attachments than recent migrants. Studies show this to be partially true, both for people who live in wilderness countries and for those who do not (McCool and Martin 1994; Stinner and others 1990; Rudzitis 1996).

Recent migrants to Western rural areas near wilderness say that they have rapidly formed an attachment to the place and region to which they have moved (Carlson and others; McCool and Martin 1994; Rudzitis 1996; Rudzitis and Johansen 1989, 1991). In one recent survey of people over age 50, less than 18 percent said they were likely to move away from their new communities. (Carlson and others 1998) For these migrants, their current communities are where they plan to spend the rest of their lives. In contrast to younger migrants, who would be expected to be somewhat more transient and less tied to any given place, older persons have more incentive to rapidly develop an attachment to their new communities.

When older migrants were asked about how they developed ties and attachments to their new communities, association with friendly neighbors was more important than organizational ties such as community service groups, church activities or clubs. Activities within the community and region, including a variety of outdoor activities such as fishing, boating or hiking affected the new migrants' sense of place. Williams and others (1992) found that attachment to place and wilderness areas could be explained by a variety of socioeconomic variables and they stress the importance of the emotional and symbolic ties that people have when living or using federal wildlands.

Concluding Comments

The federal lands have and will continue to play an important role in local and regional development in the American West. The focus generally has been on how commodity extraction or recreation can contribute to generating direct and indirect income flows to local communities and region. Economic base and input-output models have primarily been used to make these estimates.

The use of conventional input-output models to measure the economic impacts of wilderness use has been quite limited. The small number of studies on the economic impacts from wilderness use show that they generate a relatively small number of jobs compared to other forms of recreation and tourism. Indeed, the justification for

designation of wilderness and other protected non-parklands is not to generate jobs by increasing tourism in a place or region. It would be helpful to have more studies for comparative purposes of the job and income affects of designating wilderness and implementing non-commodity management strategies on our federal lands.

In the short-term commodity extraction on federal lands may create more jobs than wilderness designation. However, research indicates that wilderness designation plays a substantial role in attracting new migrants to a place or region. These migrants increasingly bring incomes and create new non-resource related jobs. This partially explains why previous estimates of large employment declines from decreased timber harvests, the implementation of protective strategies and the protection of endangered species have largely proven to be wrong.

The recent declines in the 1990s of timber harvests and resource extraction have been accompanied by some of the most rapid population increases in the nation. And they are expected to continue. Survey research and modeling studies show that environmental amenities in and around federal wilderness and other wildland areas attract people to live and stay in these areas. Studies also show that people move into these areas and firms and jobs then follow them. The relationship between timber harvesting and regional growth no longer holds except in a small number of places.

The research indicates that we must recognize that places and their social and physical environments are critical in understanding why people and firms migrate and regions develop. The rapid growth of areas around federally designated wilderness reveals a preference for development that maintains or improves the quality of life by fitting harmoniously into the natural and social environment. It also reveals a search by people for the "good" life.

The "good" life is lived in place, and what, in part, makes a place unique in the West is a lot of public open space, a clean environment, wilderness and friendly neighbors. We need more research as to the relative importance of the social and physical environments in how and why people live in and around federal wildlands. We need to better understand how much importance is ascribed to the physical environment and how much to the more rural small town and city settings within which these local economies and cultures are embedded? Whatever, the relative importance of the physical and social components of a setting, the economic value of many places and regions is enhanced by "preserving," sustaining and strengthening both the physical and social environment within which they exist.

Keeping a high-quality "wild" environment is a "development" strategy. It puts quality of life of life and environmental quality at center stage, instead of off stage or in a peripheral and minor supporting role. It shifts attention to the importance of places and what makes them unique and desirable.

More emphasis needs to be put on place attachments. We need to consider how people want to spend the scarce resources of their time and the types of places and environments they want to live in. Such a development theory would better represent the hopes and desires of the people who consistently cite the importance of noneconomic reasons for why they live in and around wildlands often sacrificing economic gains in order to do so.

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Disturbance, Scale, and Boundary in Wilderness Management

Peter S. White
Jonathan Harrod
Joan L. Walker
Anke Jentsch

Abstract—Natural disturbances are critical to wilderness management. This paper reviews recent research on natural disturbance and addresses the problem of managing for disturbances in a world of human-imposed scales and boundaries. The dominant scale issue in disturbance management is the question of patch dynamic equilibrium. The dominant boundary issue in disturbance management is the effect of boundary conditions on disturbance frequency and magnitude. Human property and attitudes outside wilderness areas influence management decisions on disturbances within natural areas.

The preservation of wilderness involves two paradoxes: First, we seek to preserve ecosystems that must change and, second, we must often apply human management to ecosystems where we ultimately want minimal human influence (White and Bratton 1980). Natural disturbances are among the most important sources of ecosystem change. If our goal in wilderness management is to promote such natural processes, we must understand the spatial and temporal scales at which they occur. The role of disturbance in wilderness leads directly to issues of scale and boundary: All of conservation is a sampling problem, in that our protected areas are a bounded subset of the original whole. Furthermore, it is the very nature of administrative units to be fixed in space, with management plans that prescribe actions that are fixed in time. This contradicts an important historic quality of natural areas which experienced considerable stochastic dynamics and directional changes in the past. In addition, nature had a certain resilience at large spatial scales. This resilience was the ability to change without loss of parts. Despite fluctuations in species abundance and distribution, extinction was relatively rare. Managers of wilderness areas should understand and provide for this resilience—that is, for persistence of species and habitats despite local fluctuations in abundance.

During the past 15 years, scale and boundary issues have produced a large literature in conservation biology (Angelstam

1992; Forman 1990; Hansen and di Castri 1992; Janzen 1986; Knight and Landres 1998; Newmark 1985, 1987; Schoenwald-Cox 1983; Schoenwald-Cox and Balyiss 1986; Schoenwald-Cox and Buechner 1993; Schoenwald-Cox and others 1992; Shafer 1994; Theberge 1989). This work has often focused on the effect of park size on population persistence and on negative impacts along natural area edges. For example, Schoenwald-Cox (1983) investigated the relationship between reserve size and persistence for three groups of mammals. Using a population size of 1,000 individuals as a correlate of long-term persistence, she concluded that small herbivores required at least 10^3 hectares, large herbivores required at least 10^5 hectares, and large carnivores required at least 10^6 hectares. Populations were present on smaller preserves initially, but would be subject to higher extinction risks. An empirical study found that park size was correlated with the number of mammal species extirpated from the western United States (Newmark 1987).

Managing wilderness is also challenging because the species and ecosystems we observe at a particular time are manifestations of processes difficult to observe and to document. As the poet W. B. Yeats wrote:

Oh chestnut-tree, great rooted-blossomer,
Are you the leaf, the blossom or the bole?
O body swayed to music, O brightening glance,
How can we know the dancer from the dance?

In our case, the dancers—the species and ecosystems—are both the products and the producers of the dance. It is easier to observe and write management plans for the dancers; it is much harder to understand and protect the dance, though it is the dance that has produced the very wilderness we seek to perpetuate. In the extreme, we may perpetuate the dancers in ways that prevent future change. Some conservationists have argued that we will not be able to sustain the continued evolution of large mammals, but can only retain the species by managing for diverse but unchanging gene pools. Similarly, some management options would freeze ecosystems in historic states or restore them to a historic state and let them resume natural dynamics in an otherwise changed environment (for example, Bonnicksen and Stone 1985). Managing nature so that it can continue to change represents a difficult challenge, one that requires a paradigm shift in our view of wilderness. We will return to this dilemma at the end of this review.

This paper discusses the problem of managing natural disturbances in a world of human-imposed scales and boundaries. Our essay is aimed at generality across different wilderness areas; as a preamble, we make a brief statement

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Peter S. White is Professor, Department of Biology, and Director, North Carolina Botanical Garden, Campus Box 3280, University of North Carolina at Chapel Hill, Chapel Hill, NC 27599 U.S.A. Jonathan Harrod is Postdoctoral Research Fellow, Harvard Forest, Harvard University, Petersham, MA 01366 U.S.A. Joan L. Walker is Research Ecologist, USDA, Forest Service, Clemson University, Clemson, SC 29634 U.S.A. Anke Jentsch, Department of Experimental and Systems Ecology, University of Bielefeld, Universitätsstr. 25, D-33619 Bielefeld, Germany.

of the ecological and evolutionary context that makes finding generality difficult. After reviewing recent findings about disturbance, we address the question, How are today's bounded wilderness areas different from the original state in which natural disturbances prevailed? We address two topics in seeking to answer this question. First, we consider the size of wilderness areas relative to the scale of their dynamics and the question of long-term dynamic equilibrium, a phenomenon recently redefined in the context of the historic range of variation and the natural range of variability (Morgan and others 1994). In terms of disturbance, the historic range of variation, and the potential for dynamic equilibrium, large wilderness areas have made fundamental and irreplaceable contributions to our basic understanding of the way nature works. Our second topic in the analysis of bounded wilderness is to consider the influence of boundaries themselves. Wilderness areas adjoin non-wilderness areas. Boundary problems virtually guarantee that wilderness managers will have to be concerned with external, as well as internal, processes. Boundaries also signal the changed spatial context of wilderness areas—the changed context can affect disturbance regime and recovery. Edges will require management if we are to avoid progressively losing what remains of landscape function. In a final section, we discuss prospects for the future of wilderness management.

The Search for Generality in an Ecological and Evolutionary Context

We propose that the search for generality in understanding ecosystems must take into account five principles that are rooted in past events and produce characteristics that change very slowly relative to disturbance, succession and management action (Table 1). In essence, these five principles produce the factors that are the “givens” of wilderness management.

First, the absolute rates of ecosystem processes like growth, establishment, mortality, productivity and succession vary among ecosystems because of differences in the physical environment. Some ecosystems change quickly, others

slowly, in the face of particular disturbances, fragmentation, or boundary conditions. Since the physical environment and resource levels vary among ecosystems, the effect of disturbance—which often removes dominant competitors and transfers material from living to detrital pools, thus promoting mineralization—on resource levels will vary among ecosystems. While disturbances usually increase resources, the relative increase depends on the predisturbance condition. Thus, disturbance effects should be interpreted relative to predisturbance conditions in any search for generality. We should search for repeated patterns of system response to disturbance that change along gradients, thus resulting in general hypotheses about ecosystem dynamics that will help us formulate recommendations for wilderness management under given circumstances.

Second, the species of a particular landscape have different life history traits, responses to environmental gradients and disturbance, and dispersal and gene flow characteristics. Different disturbances promote different species. This makes simple labels—for example, with regard to successional role—difficult to apply. For example, Vogl (1974), when abandoning early vs. late successional terminology for grassland species, classified them as increasers, decreasers, invaders, retreaters and neutrals relative to a particular fire event. A straightforward corollary of species differences is that a given disturbance will be good for some, but not all species. Furthermore, a given disturbance may occur at different times relative to species life history, resulting in a range of effects on a particular species (Pavlovic 1994). Clearly, a mix of conditions and processes is required for all species to reproduce and persist. The question then arises, whether a given wilderness area is large enough for such dynamics to occur, or whether management needs to influence the intensity and return interval of disturbances within the given boundaries in order to allow for regeneration.

Third, given the first two principles, we deduce the following: Species differences span a different range of absolute values in different ecosystems. For example, all forests have trees with differences in height growth rates after disturbance; the maximum height growth rates of disturbance-responding trees varies systematically from the tropics (up to 2-3 m per year) to the temperate zone (up to 1 m per year),

Table 1—The five “givens” of disturbance management. These factors cause variation in ecosystem response to disturbance and make generalization difficult across ecosystems.

Factor	Comments
Absolute rates vary	While disturbance dependent plants often grow more quickly than other species, absolute values (the range of expected maximum and minimum rates) vary systematically and geographically with physical factors and resources
Species vary	The species living in any landscape vary in their response to disturbance; individual species respond to a given disturbance differently depending on life stage or season and often have plastic responses to environment.
Absolute response varies	Given the first two factors, responses to disturbance vary across ecosystems and there will be considerable variation, at least locally, in how a particular ecosystem responds to a particular disturbance.
Two-fold preconditioning	Ecosystems are the result of past events; disturbance response varies with the history of prior disturbances in ecosystems. Species have been exposed historically to disturbances; they have traits that reflect survival over those past conditions.
The spatial template	The configuration of habitats in landscapes determines critical parameters like area and isolation which influence the propagation of disturbances regardless of physical environmental factors and species present.

to the boreal forest (up to 0.3 m per year). These values are 5-10 times greater than the height growth rates of shade tolerant species in the same ecosystems. Species richness also varies along the latitudinal gradient. The consequence is that while all three areas have disturbance-dependent "fast" growing species, the number of such species and their absolute rates of growth vary with the physical environment. Similar comments could be made about other life history traits and the patterns of succession derived from them. We believe nonetheless that the ranges of absolute values and the patterns of system responses vary systematically; thus, it will be possible to work towards generality in understanding the effects of disturbances across ecosystems.

Fourth, the characteristics of species and ecosystems are themselves the products of past events on evolutionary and ecological time scales. This produces a two-fold preconditioning in ecosystem response to disturbance. Species responses are preconditioned, in the sense that their physiological abilities and life history traits are the result of evolutionary exposure to past conditions. The history of an ecosystem also influences its range of possible responses to present events because it controls species presence and resource levels. McCune (1984) showed, for example, that differences in present vegetation of three neighboring valleys with identical environmental conditions were due to historic factors: the different past influences of fire and settlement within these three valleys. The evolutionary and historic context of species and ecosystems means that managers, in some sense, will always need to investigate the nature of past conditions, in order to understand the range of current options.

Finally, the surface of the earth forms a unique template for each wilderness we manage. The physical template sets the pattern of environmental gradients and the size and position of habitat patches. These, in turn, affect disturbance regime and responses to other changes (such as, climate variation). Even if we had abstract rules for species traits, ecosystem characteristics, disturbance, scale and boundary, how these play out in a given situation is contingent on the underlying geophysical template.

The differences among species and ecosystems mean that generality of response to variation in disturbance, scale and boundary must be developed as a function of variation in absolute properties, such as the shape of the physical template, dispersal distances, seasonal migrations, birth rates, death rates, regeneration patterns and productivity. A corollary is that there will always be a need to understand the history, characteristic dimensions and rates of change of the ecosystems we manage. The significance of disturbance, size and boundary will vary among ecosystems, depending on these characteristics. If we are interested in generality about disturbance (or scale or boundary), we should examine variation in disturbance along a continuum of environmental conditions and ecosystem properties. This would point the way to the development of general principles that could be adapted to particular wilderness areas.

Disturbance and Disturbance Regime

Natural ecosystems are dynamic. Changes can be gradual (succession, climate change, geomorphologic evolution, soil

development), annual (seasonality), interannual and semiperiodic (hydrologic flux, the ecological consequences of the Southern Oscillation in Pacific Ocean surface temperatures that produces El Nino/La Nina climate variation) or abrupt and destructive (disturbance) (DeAngelis and White 1994). These processes of change interact and, with topography and geology, they create the spatial variation we observe at any one time. Whether we look at the relatively recent past or at evolutionary time scales, historical patterns and processes have shaped modern ecosystems and their biota.

Disturbances are relatively discrete events in time that disrupt ecosystem, community or population structure and change resources, substrate availability or the physical environment (White and Harrod 1997; White and Pickett 1985; White and others 1999). A subset of this definition is that proposed by Grime (1979): disturbance as the destruction of biomass. Although these definitions are absolute (as opposed to definitions that suggest that disturbance is a departure from normalcy), the magnitude of disturbance in a particular ecosystem must be expressed in relative terms (White and Pickett 1985)—that is, by the change in biomass in relation to predisturbance biomass or the change in resources in relation to predisturbance resource levels. Responses to disturbance will vary with the magnitude of change relative to the predisturbance conditions.

Disturbances are described in terms of their spatial characteristics (area, shape, spatial distribution), temporal characteristics (frequency, return interval, rotation period), specificity (to species, size class, successional state), magnitude (force, intensity, severity) and synergisms (interactions among disturbances) (White and others 1999). Disturbance occurrence and characteristics vary with climate, topography, substrate, and history. Together, the disturbances that occur within a particular landscape or ecosystem define its disturbance regime. Documenting historic and modern disturbance regimes has been a major focus of wilderness science over the past three decades, and the restoration of historic disturbances, particularly fire (Baker 1994) and flooding (Dahm and others 1995), is one of the most common restoration goals.

Some 15 kinds of natural disturbances occur in North America (Table 2; White and others 1999). Under some circumstances, almost all of these present problems of boundary and scale in the sense that they disturbance can move across boundaries and the scale of their dynamics can exceed the size of wilderness. However, five kinds of disturbance are particularly important because they routinely impinge upon or move across boundaries and because they are, at least potentially, under management control: fires, hydrologic flux (floods, associated alluvial erosion and deposition and water level fluctuation in basins), coastal erosion and deposition, episodic outbreaks of heterotrophs (insects, pests and diseases and grazing animals) and animals that routinely alter ecosystem structure (burrowing animals, beavers). Three other disturbances may move across wilderness boundaries but are restricted to particular topographic and geological circumstances: wind-caused substrate movements (dune migration), gravity-caused substrate movements (avalanches, debris flows) and volcanic eruption. Several other disturbances (drought, salinity changes and shoreline battering by ice and waves) become boundary issues when land uses surrounding a natural area affect their occurrence. Conservation design might help with some

Table 2—Boundary and scale issues associated with natural disturbances in North American wilderness. “Design principles” indicate those disturbances for which preserve design can play a strong role in the occurrence of boundary and scale issues. “Management” indicates those disturbances that are directly managed as disturbance forces (“Dist.”) or are indirectly managed through influence on ecosystem structure (“Struct.”). “Surrounding land use” indicates those disturbances whose occurrence in wilderness is influenced by surrounding land use.

Disturbance	Boundary issues	Scale issues	Design principles	Management		Surrounding land use
				Dist.	Struct.	
Wind	Rarely	Rarely	Rarely	No	No	Yes (edges only)
Fire	Yes	Yes	Yes	Yes	Yes	Yes
Hydrologic flux	Yes	Yes	Sometimes	Yes	No	Yes
Pest outbreaks	Yes	Yes	Yes	Yes	Rarely	Yes
Animals/structure	Yes	Yes	Yes	Yes	Rarely	Yes
Dune movement	Rarely	Rarely	Rarely	No	Rarely	Rarely
Substrate movement	Rarely	Rarely	Rarely	No	Rarely	Rarely
Coastal erosion/dep.	Yes	Rarely	No	No	Rarely	Yes
Drought	Rarely	Rarely	No	No	Rarely	Yes
Freezes	No	Rarely	No	No	No	No
Cryogenesis	No	Rarely	No	No	No	No
Ice storm	No	Rarely	No	No	No	No
Salinity changes	Rarely	Rarely	Rarely	No	No	Yes
Shore battering	Rarely	Rarely	Rarely	No	No	Yes
Volcanic eruption	No	Rarely	No	No	No	No

disturbances—in the sense of maintaining dynamics within the conservation area and preventing conflicts with surrounding lands—but many occur at such large scales and involve such large forces that they can rarely be designed away as management issues (Table 2).

The five disturbances that frequently raise boundary issues often pose scale issues—issues based on area and dynamic pattern (Table 2). Significantly, the frequency and magnitude of disturbances that pose the most frequent scale and boundary issues are also strongly influenced by climate and can become regional phenomena because of the scale of atmospheric processes, as discussed below.

It is not just the disturbance force that we should consider in scale and boundary issues. Disturbance in natural areas sometimes threatens property or economies outside these tracts. The perception and values of people outside the natural area will influence management options for disturbances within it—an important kind of boundary issue in itself.

During the past 20 years, research on the role of natural disturbances in ecosystem dynamics has expanded the kinds of disturbances studied, the geographical distribution of places studied and the spatial and temporal scales of study. The process of disturbance, called nudation by Clements (1916), has been a rich area of study and has been found to be a source of variability in ecosystems. In the following paragraphs, we summarize five findings of the past two decades of research about the process of disturbance (see White 1979, White and Pickett 1985, and White and others 1999 for reviews of the disturbance literature more generally): (1) disturbances produce a continuum of conditions between extremes termed primary and secondary succession and leave behind a wide range of legacies from the predisturbance ecosystem; (2) there are feedbacks and interactions between disturbances; (3) disturbance probability varies with climate; (4) disturbance regime is influenced by landscape pattern; and (5) disturbance regime can be altered by exotic species invasions.

The Continuum From Primary to Secondary Succession and Ecosystem Legacies

Text books have commonly defined primary and secondary successions as discrete: Primary successions occurred on sterile sites without the imprint of previous occupation by living things, whereas secondary successions occurred on sites previously occupied and affected by living things. Recent studies of the effects of disturbance, however, show that there is a continuum between these extremes (Swanson and Franklin 1992) and considerable variation within each (Figure 1). Disturbances create a variety of primary successions that vary in the quality and depth of the parent material. They also produce a variety of secondary successions, which differ in the amount and distribution of organic matter after disturbance and vary also in other legacies left by the previous ecosystem.

The residual material from the previous ecosystem—including organic matter, seeds, rhizomes, plants, fungi, insects and other animal populations—has been termed biological or ecosystem legacy (Franklin 1989; Swanson and Franklin 1992). This legacy influences site environment, the location of organisms that affect disturbance recovery, and recruitment. The magnitude of disturbance and the legacy after disturbance also affect the success of various plant colonization strategies. After fire in the Swedish boreal forest, for example, Schimmel and Granstrom (1994) found that depth of burn controlled the dominant colonization strategy: Shallow burns were followed by resprouting and regeneration from perennial rhizomes, medium burns were followed by regeneration from the seed bank, and deep burns were followed by colonization of wind dispersed species. Nakishizuka and others (1993) showed that as the amount of residual material decreased, the importance of wind-dispersed species increased on Japanese avalanche scars.

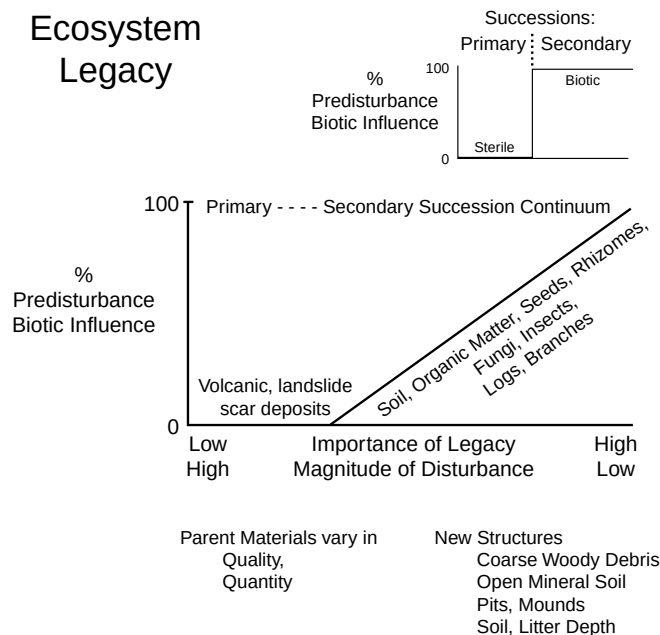


Figure 1—The continuum from primary to secondary succession based on ecosystem legacy and the effects of disturbance. The x-axis is a gradient of increasing ecosystem legacy and decreasing disturbance magnitude and the y-axis represents the influence of the pre-disturbance ecosystem on recovery from low (0%) to high (100%). The smaller diagram in the upper right presents the historic and overly simplified definition of primary (no influence of the pre-disturbance ecosystem) and secondary (100% influence) succession.

Ecosystem legacies also influence the likelihood of further disturbance and thereby the length of recovery interval and the amount of successional change. For example, the amount of organic detritus after a disturbance event determines fuel levels and the occurrence of fire.

Disturbance also creates new structures—new arrangements of the substrates and organic matter in an ecosystem—compared with the predisturbance stand. The tangled branches of a windfall have been shown to provide a refuge for seedlings against deer browsing in U.S. deciduous forests (Peterson and Pickett 1995). Snapping of tree boles increases light to the intact forest floor; uprooting of trees, by contrast, increases light, but also creates pit and mound microtopography and exposed mineral soil. Similarly, spring and summer fires vary in impacts on canopy and forest floor. Whereas some species respond to the increased light alone, others depend on the new microsites and particularly on soils with no covering of leaf litter and low competition for space (Forcier 1975; Harmon 1982). Such sites often have high germination rates.

In short, disturbances are not equal, and the pattern of recovery is a function of the kind and intensity of disturbance and the legacy of the predisturbance stand. The legacies created by disturbance often create internal heterogeneity within the ecosystem, with different species favored in different kinds of patches. For example, fires do not burn at uniform intensity but have patches of relatively high and low intensity. These patches are left with different amounts of organic matter and have different mortality levels of the plants from the pre-fire stand. Such patches present a diverse

array of postdisturbance microsites for plant recovery. Heterogeneity of disturbance effects may also be important in recovery because less disturbed areas may act as sources of colonists for more disturbed patches.

One of the ways that some human disturbances differ from natural disturbances is in the different ecological legacies that remain after disturbance. For example, Hansen and others (1991) described the differences in coarse woody debris of managed and unmanaged forests in the northwestern U.S. They found that logged stands lie outside the bounds of naturally disturbed stands in terms of several measures of ecosystem structure, including the sizes and amounts of coarse woody debris.

Disturbance Interactions and Feedbacks

Interactions among disturbances are reported for all ecosystem types (see review in White and others 1999). The feedbacks between disturbances can be positive; that is, one disturbance promotes the next, so repeat disturbances are likely. For example, gaps expand over time as gap edge trees are exposed to wind (Runkle and Yetter 1987). Fire-damaged trees are vulnerable to fungal infections, making the trees more vulnerable to future wind disturbance (Matlack and others 1993). Disturbance feedbacks can also be negative, as when one disturbance delays another. Romme (1982; see also Romme and Despain 1989; Romme and Knight 1981) showed that hot fires burn fuels that take centuries to reaccumulate in Wyoming; hot fires are thus spaced by centuries. However, those hot fires, once they start, can burn across stands with varying fuel levels (Johnson and Wowchuk 1993). In Colorado, Veblen and others (1994) showed that avalanche scars restrict fire spread, thus limiting fire size and increasing recurrence intervals. Veblen and others also showed that spruce trees become vulnerable to spruce bark beetles only after 70 years of postfire succession. Fire and beetle outbreaks thus tend to be nonoverlapping in space as well.

Land use history and the history of past natural disturbances can alter the frequency and magnitude of current disturbances (Baker 1995). In central New England, Foster (1988; Foster and Boose 1992) showed that hurricane damage increased with stand age, but at a different rate for old field pine compared to hardwood forests. Tyrell and Crow (1994) showed that gap sizes increase with stand age as tree size increases in mesic deciduous forest, making older stands more patchy in light regime than younger stands. In the Great Smoky Mountains, Harmon (1984) found that fire-caused mortality at a given fire intensity decreases with time since last fire as trees age into fire-resistant size classes (bark grows proportionally faster than diameter in fire-adapted species). If fires are too far apart, trees survive into fire-resistant size classes, changing the effects of future fires. In general, stands can be preconditioned to current disturbance by their history of past disturbance.

Disturbance and Climate Variation

The past decade has seen demonstrations of strong links between disturbance and climate (Clark 1988; Johnson and Larsen 1991; Johnson and Wowchuk 1993; Nash and Johnson 1996; Swetnam 1993; Webb and Betancourt 1992). Human-induced climate change will influence disturbance regimes,

as well as other ecosystem processes (Romme and Turner 1991). Swetnam and Betancourt (1990) demonstrated that the area burned in the American Southwest from 1905-1990 varied with an index of the intensity of the Southern Oscillation. They also showed that climate can synchronize vegetation dynamics over large areas. Over a 300-year sequence, an average of 5-10 sites experienced fire each year, but there were 20 unusually dry years in which fire events were many times more frequent than this average.

Johnson and Wowchuk (1993) produced similar findings for central Canadian boreal forest, reporting that years with persistent high-pressure systems had more lightning strikes, more ignitions, larger fires and higher fire intensities and rates of spread than other years. Fire size was particularly important: 2% of the fires burned 99% of the area. During persistent highs, temperature was warmer than normal and precipitation lower for days to weeks. Fuel moisture was low, which resulted in more fires, but fires burned across different fuel conditions. As a result, fires were strongly correlated with weather but weakly correlated with fuel conditions—fuel loading varied less than weather—hence successional age and fire suppression were relatively unimportant in fire occurrence. Johnson and others (1995) have shown that there was a shift in fire regime in their study area ca. 1730. Warmer and drier conditions before 1730 produced a fire rotation of 50 years, but this increased to 90 years after 1730.

Regional synchronization by climate variation has important consequences for human societies because it means that fire years for one place are correlated, at regional spatial scales, with fire years for all places (the scale of such synchronization will vary with the scale of climate effects). Regional synchronization stretches management resources thin. There are also consequences for conservation: Regional synchronization invalidates metapopulation models that describe persistence of species as a function of the independent dynamics of local populations. More generally, all populations, even those not connected by migration and gene flow, would experience parallel fluctuations under regional synchronization. Age structures of populations would be similar across space, and extinction risks would not be independent in a given year. Such a situation would create problems for a “put your eggs in different baskets” strategy of allocating more resources to separate populations, rather than lowering extinction risk within a single population (see discussion in White 1996).

Climate variation is also directly tied to estimates of flood regimes. Webb and Betancourt (1992) showed that the calculation of the 100-year flood event in Tucson, Arizona, was highly dependent on the period of time used in the models. Using data from 1930-1960, the 100-year flood discharge was 300 cubic meters per second and was dominated by the pattern of monsoonal storm floods. After 1960, the 100-year flood discharge was over 1,000 cubic meters per second, an increase due to increased tropical cyclone floods, as well as increased monsoonal storm floods. A change in atmospheric flow altered the sources and amounts of precipitation to the Santa Cruz River.

Disturbance and Landscape Configuration

The probability of disturbance at one point is influenced by the structure and composition of the vegetation surrounding

that point and the occurrence of disturbances within the surrounding area (Knight 1987; Rykiel and others 1988; Turner 1989; Turner and others 1989). Some disturbances, such as fire and insect outbreak, spread contagiously through a landscape. Such disturbances may affect sites that otherwise have a low probability of disturbance. Humans alter disturbance regimes not only by affecting the agents of disturbance (for example, in fire suppression, Baker 1992a), but by altering the pattern of vegetation on the landscape and enhancing or reducing heterogeneity of patches. This can both increase and decrease disturbance frequency (Franklin and Forman 1987). It has been hypothesized that large-scale logging in northeastern Maine has created large areas of even-aged stands of balsam fir through which insect outbreaks spread quickly. It has been argued that forest fragmentation has reduced fire size in the longleaf pine stands of the southeastern U.S. (Frost 1993). Bergeron and Brisson (1990) have shown that lake islands in the Canadian boreal forest have different fire regimes than the nearby mainland. Many investigators have shown that fire size plays a larger role than the number of fire ignitions in the boreal forest—five percent of the fires have been said to burn 95 percent of the area (Johnson and others 1995). Fire size is affected by human activities and land use patterns.

In a comparative example with implications for understanding the interaction of disturbance regime and landscape configuration, Minnich (1989) showed strong differences in fire size and frequency between areas with natural fire-regimes in Baja California and those with fire suppression management in Southern California despite overall similarity in the amount of land burned per century in the two areas. Without fire suppression, vegetation heterogeneity and ignition rate was high, but the size of burned patches was low, while under fire control, vegetation was more homogeneous, ignition rate was low, but size of burned patches was high because of rapid fire spread through homogeneous fuels.

Disturbance Regime and Exotic Species Invasions

Exotic species invasions are now one of the major human influences in natural areas. Among invaders, some cause particularly drastic effects because they alter fundamental processes within ecosystems, including disturbance regime. Billings (1990) showed that brome grass invasion alters fire regimes in the western U.S. Bodle and others (1994) proposed that exotic tree species in the Everglades transpire more water than native species, thereby lowering the water table and altering fire regimes. Disturbance can also foster exotic invasions by removing established competitors (R. White and P. S. White, unpublished data).

Scale, Disturbance, and Wilderness Management

Since the earliest disturbance studies, investigators have asked whether small-scale dynamics can lead to a dynamic equilibrium at larger scales (see reviews in White 1979; White and Pickett 1985; White and others 1999). An early discussion of the consequences of disturbance dynamics concluded that the minimum area for reserves should be

based on the area required for successional states and implied the idea of the dynamic equilibrium (Pickett and Thompson 1978; White 1979).

If the creation of newly disturbed patches of low biomass and early successional species is balanced by succession to higher biomass and older aged vegetation elsewhere in the same landscape, a dynamic equilibrium is possible (Shugart 1984). The distribution of land into various patch states would remain the same, even though the location of the various patch types would shift in space. At any one time, the landscape would have a characteristic patchiness in age and structure—and it would exhibit constant and predictable structure at large spatial scales, despite high variance at smaller scales (Busing and White 1993; Smith and Urban 1988; Urban and others 1987). Species both dependent on and sensitive to disturbance would persist. If a mix of species with different successional strategies is always present, the rate and pattern of succession will also be stable—no species will be missing from succession because of extirpation or dispersal limitation. Such a landscape would be robust in retaining its biodiversity over time and would be relatively easy to manage: Natural processes would maintain the dynamic equilibrium of species and patch types. It is one of the major challenges for conservation management to understand the spatial and temporal scales at which natural processes and disturbance regimes operate, and whether a particular conservation area is large enough for the processes to result in dynamic equilibrium. Often, boundaries of wilderness areas are administrative rather than functional, so that processes outside nature conservation areas affect internal dynamics and internal dynamics affect outside areas.

Questions about equilibrium, scale and process have been asked specifically at the population level. Zedler and Goff (1973) showed that sugar maple (*Acer saccharum*), a shade-tolerant tree, had a reverse-J, all-aged population structure at relatively small scales, but quaking aspen (*Populus tremuloides*), a shade-intolerant tree, attained this stable distribution only at scales large enough to include many independent patches of different successional ages. Reproduction is absent within populations of adults and age structures are unbalanced if observed at small scales of time and space. Shifting sites of reproduction are one sort of metapopulation dynamics (see discussion in White 1996). In such cases, the absence of reproduction within adult populations is to be expected; persistence depends on new sites becoming available for establishment within the years of reproductive maturity and within the dispersal distance of the adults.

Given the potential importance of patch dynamic equilibrium to wilderness management, we should ask what conditions would tend to produce equilibrium, whether such conditions are common in nature and whether human influences have affected the likelihood of a dynamic equilibrium. We start with a more detailed discussion of the nature of dynamic equilibria.

Four kinds of patch dynamic equilibrium are described in the literature (White and others 1999): (1) persistence or qualitative equilibrium; (2) the shifting mosaic, steady state or quantitative equilibrium; (3) the stable trajectory or stationary dynamic equilibrium; and (4) the statistical equilibrium. These are briefly described below (see also Figure 2).

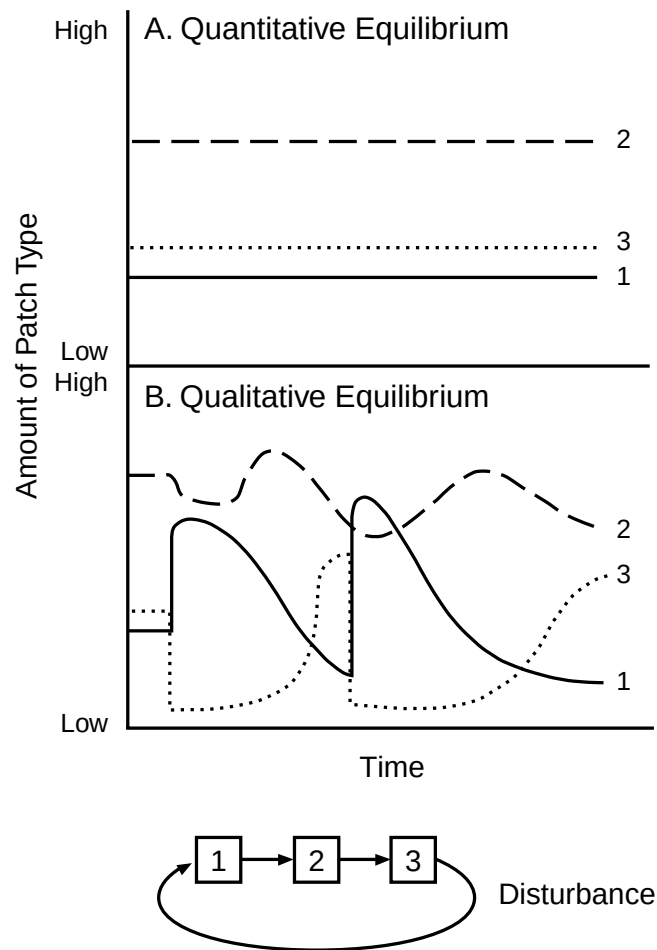


Figure 2—Quantitative and qualitative equilibrium. The relative importances of three successional states (1, 2 and 3) across a hypothetical landscape are shown through time. A. Quantitative equilibrium in which the three states occupy a constant proportion of the landscape through time. B. Qualitative equilibrium in which the three states fluctuate in abundance but all persist.

Persistence or Qualitative Equilibrium (DeAngelis and Waterhouse 1987)—This is the least stringent of the definitions. Species, successional states and patch types all persist through time, but they may fluctuate widely in abundance. The key criterion is that the species and patch states are never lost from the landscape.

The Shifting Mosaic, Steady State, or Quantitative Equilibrium (Bormann and Likens 1979; Cooper 1913, 1926; Heinzelman 1973; Sprugel 1976)—This definition of equilibrium is more narrow, in that it requires that the species abundances and the fraction of the landscape in each patch type remain constant through time despite shifts in spatial location.

The Stable Trajectory or Stationary Dynamic Equilibrium (Loucks 1970)—This is an equilibrium in which the same successional sequence repeatedly occurs, despite fluctuation in the abundance of species or the frequency of patch states. The stable trajectory equilibrium requires that

all species important to successional changes have access to a site through continual reproduction, dispersal or seed banks, but not that the species be constant in abundance or present as adults.

Statistical Equilibrium (Johnson and Gutsell 1994)—Like quantitative equilibrium, this is equilibrium with a stringent definition. Annual rates of disturbances are not required to remain constant, but may vary considerably from year to year. If the annual proportion of the landscape disturbed, examined over many years, conforms to a statistical distribution such as a negative exponential or Weibull function, mean disturbance rates and landscape conditions will remain stable through time.

Whether equilibrium is likely to occur and, more particularly, which kind of equilibrium is to be expected, will vary with the size of the disturbance patch, relative to the landscape in which it occurs, and the rate of recovery of the patch, relative to length of the return interval between disturbances (Turner and others 1993). For example, when patches are small relative to the landscape where disturbance interval is long enough to allow recovery to the original condition (that is, biomass levels), and where dynamics on adjacent patches are independent, each patch will exhibit the full range of patch state values over time (biomass levels, successional states) and the average of a large collection of patches will be a constant (White 1979; White and Pickett 1985). Using simulation models, Shugart (1984) suggested the 1:50 rule: When independent patches that are smaller than $1/50^{\text{th}}$ of the size of the landscape in which they occur, and when each patch recovers to the undisturbed biomass level before becoming vulnerable to disturbance again, biomass averaged across all patches is constant. This is one formulation (based on biomass) for shifting mosaic or quantitative equilibrium. In Shugart's model, disturbance intervals were set by successional time because patches became vulnerable to disturbance only as patch age reached a maximum. As a general principle, White and Pickett (1985) suggested that a feedback between disturbance risk and time since disturbance would make an equilibrium patch dynamics more likely, given independent dynamics of small patches in a large landscape and lack of contagious spread among patches. However, when disturbances can spread contagiously from patch to patch, increases in disturbance susceptibility with stand age may contribute to the synchronization of disturbance across large areas. Such appears to be the case with the Yellowstone fires of 1988. These fires resulted in large fluctuations rather than less: Hot fires spread to less susceptible patches, leading to very large patch sizes (Turner and others 1993). White and Pickett's (1985) condition that risk of disturbance increases through successional time is also violated when one disturbance increases the likelihood of subsequent disturbance.

Turner and others (1993) further clarified the expectation by expressing the spatial and temporal scale issues on two axes and by adding variance to the idea of dynamic stability (Figure 3). The first axis was the amount of disturbed area relative to landscape area. As this ratio decreases, they predicted the chance for a dynamic equilibrium increased. The second axis was the length of the interval between disturbances, relative to the time required for complete recovery to undisturbed conditions. As this ratio increases (as more time is available for full recovery), the chance for a dynamic

equilibrium increases. By creating a two dimensional graph of these two ratios, they defined a range of conditions from stable (species and successional patches persist) to unstable (species and successional patches do not persist) and further showed that stable landscapes could nonetheless exhibit a range of behaviors from low variance to high variance. A stable landscape with variance fits the definition of qualitative equilibrium—persistence of species and patch states despite fluctuation in abundance. They suggested that the ecosystems of Yellowstone National Park, which are characterized by infrequent but very large and intense fires, would fit the definition of a stable landscape with high variance.

In situations in which patches are small relative to landscape area, the patches have independent dynamics, disturbance regime is constant, and the patches recover fully between disturbances, patch dynamic equilibrium can occur in both a qualitative and quantitative (low variance in abundance) sense. If the rate of disturbance is controlled in part by the community itself (for example, vulnerability to disturbance increases with successional time or plant size or age), disturbances will have a relatively constant return interval, and statistical equilibrium of disturbance regime may also occur. These conditions may hold for small-scale gap dynamics in some forests, patch-wise mortality in heathland communities (Watt 1947), and the dynamics of inland dunes (Jentsch, unpublished data). A classic example is the fir wave phenomenon in montane fir forests (Sprugel 1976).

In contrast, where patches are large, where disturbance in one patch affects the probability of disturbance in neighboring patches regardless of patch conditions there, where disturbance regime is strongly linked to climate variation, and where disturbance intervals are at best loosely correlated with the time between disturbances, landscapes are either nonequilibrium or, perhaps, in qualitative equilibrium.

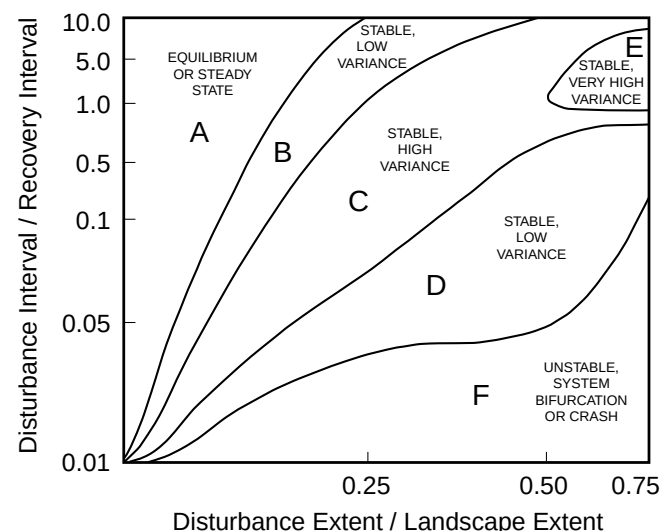


Figure 3—Stability and variance as a function of two ratios: the relation of disturbance patch size to landscape area (x-axis) and disturbance interval to recovery interval (y-axis) (redrawn from Turner and others 1993). When disturbance extent is small relative to landscape area, stability is promoted. When disturbance interval (the time between disturbances) is long relative to recovery interval (the time needed for recovery to the pre-disturbance state), stability is promoted.

Indeed, E. A. Johnson (Johnson and Gutsell 1994; Johnson and Larsen 1991; Johnson and Wowchuk 1993; Johnson and others 1995; Nash and Johnson 1996) has argued that fire regime in the boreal forest is characterizable but not fixed, that infrequent but very large fires dominate forest dynamics, and that fuel buildup with time since fire is unimportant to fire occurrence because of the overriding influence of climate.

The question of dynamic equilibrium is a fundamental one in wilderness management (Baker 1989a, 1992b, 1994; Pickett and Thompson 1978; Sprugel 1991; Turner and others 1993). It is one aspect of the questions about the “balance of nature”. Conservation managers often have the goal of a situation in which species and habitat types persist even if they fluctuate in abundance—the less stringent equilibrium known as persistence or qualitative equilibrium. In essence, we have to ask: How closely do we have to replicate disturbance processes to get persistence of all biota and patch types? Because human use of the landscape has reduced the size of protected landscapes, the ratio between disturbance area and landscape area has mostly increased, which would tend to make landscapes less stable and higher in variance. In nature, persistence occurred despite high variance because of large size and juxtaposition of unlike conditions. Disturbances create patchiness across landscapes that, historically, allowed both disturbance-dependent species and disturbance-sensitive species to persist. The mix of newly disturbed conditions and refuges from disturbance is critical to nature’s resilience.

Management for persistence may be particularly challenging in small protected areas in which fragmentation has increased the ratio between disturbance size and landscape size, decreasing stability and increasing variance relative to unfragmented landscapes. One consequence of increased temporal fluctuations in these small landscapes may be the loss of species that require either early- or late-successional conditions.

The relationship of wilderness size to the area needed for a patch dynamic equilibrium is therefore an important question. While larger is always better, is wilderness size ever large enough to encompass equilibrium dynamics? As early as 1963, Leopold and others wrote that few of the world’s parks were large enough to be self-regulating ecological units. While they considered seasonal animal migrations and the source areas of park waters, subsequent research on landscapes with large fire sizes (such as, Baker 1989a; Johnson and Gutsell 1994; Turner and others 1993) has also indicated that quantitative equilibrium is rare except for the smallest disturbance patches in the largest areas. The result is that wilderness managers are likely to have to take a role in monitoring and maintaining patch variability, particularly in smaller wilderness blocks or where natural fires cannot be permitted to burn uncontrolled. A related question concerns the time necessary for recovery after disturbance. If wilderness size in relation to disturbance patch size is too small to allow for dynamic equilibrium, then temporal parameters like return intervals or frequency of disturbance might have to be controlled by wilderness managers if all species are to reproduce.

The interaction of disturbance regime with landscape area has implications for our understanding and management of old growth (Figure 4; Johnson and others 1995). In natural landscapes, the occurrence of disturbance has a

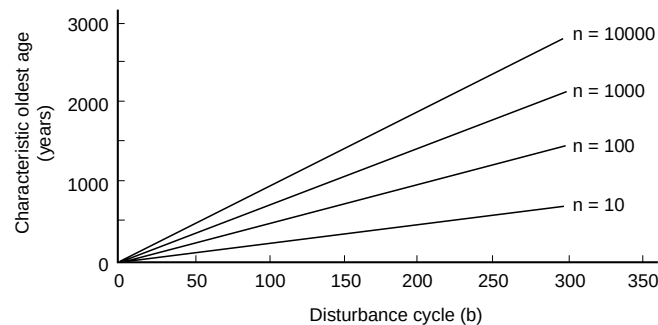


Figure 4—Implications of disturbance rate and landscape area for the age of the oldest aged patch (redrawn from Johnson and others 1995). Under a given disturbance regime (disturbance cycle), the larger the landscape (the higher the number of patches, n), the greater the maximum age expected in the landscape for individual patches (these are the patches escape disturbances for longer than the average for the landscape as a whole). For a particular landscape size (as represented by n), the longer the disturbance cycle, the greater the characteristic oldest aged patch.

stochastic component; by chance, some patches will experience at intervals shorter than the mean, while others will escape disturbance for much longer periods. These rare, old patches will represent the tail of the statistical distribution. The larger the wilderness relative to disturbance patch size, the longer the tail, and the older the maximum expected age. Wilderness area thus has implications for how old patches can become—for a given disturbance cycle and without management intervention. The spatial variation in ecosystem structure is predicted to be a function of disturbance rate and landscape area.

Bergeron and others (1998) applied this idea in a comparison of two landscapes, one managed on a 100-year logging rotation and the other with a 100-year natural fire rotation. Despite similar mean disturbance return intervals, the two boreal forests would have very different stand age distributions. The managed forest would have equal numbers of stands in all age classes up to 100 years, but nothing older. The distribution of patch ages in the wilderness landscape would follow a negative exponential or Weibull distribution of time since fire; this landscape would thus have both a higher proportion of young stands and a larger portion (~1/3) of stands older than 100 years.

Historic Range of Variation and Natural Range of Variability

Whether we look at the relatively recent past or at evolutionary time scales, historical patterns and processes have shaped modern ecosystems and their biota. Documenting the history of ecosystems is thus a key to understanding and managing their current dynamics. It is also natural to ask whether current conditions and dynamics have historical precedence. The historical range of variation approach (Figure 5; Landres 1992; Landres and others 1998c; Morgan and others 1994; Swanson and others 1994; Swetnam 1993; Wright and others 1995) goes beyond a general recognition of the importance of history to ask a more specific question: Are current dynamics within the range of values that characterized the

ecosystem in the past? The concept of the natural range of variability is similar; here we suggest that this concept be applied to the variation in space and time for an ecosystem without the constraint of an arbitrary historic record.

Wilderness exhibits neither static and predictable conditions nor totally random or unpredictable ones. Nature has variation—but variation within bounds. This is presumably why extinction is rare, despite great fluctuation in local abundances. However, the historic range of variation poses several difficult questions: What ecological parameters should be considered and at what spatial and temporal scales should these be evaluated? Over what historical period should variability be assessed? Can past conditions be reconstructed with acceptable accuracy and resolution? Do parameters of interest remain within well-defined bounds around a stable long-term mean, or does the amount of variation or the mean change through time? Will novel conditions such as exotic species invasions or a changing global climate render past conditions irrelevant? Regardless of the answers to these questions, documenting the history of the ecosystems is an essential step in understanding their dynamics and trajectories.

Boundary, Disturbance and Wilderness Management

Disturbances occur at particular places and either have indirect effects on nearby areas or spread contagiously to them. Because of this inherent importance of spatial

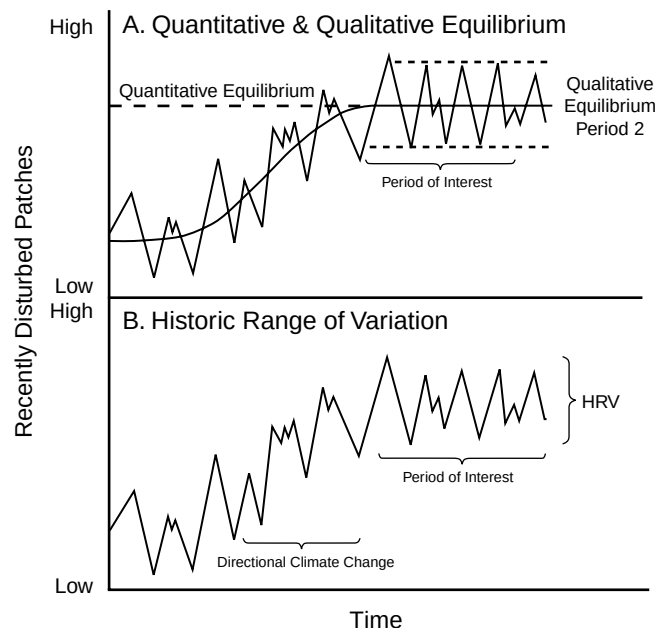


Figure 5—Quantitative equilibrium, qualitative equilibrium and the historic range of variation (HRV) illustrated by trends in the number of recently disturbed patches in a hypothetical landscape undergoing two periods of relative stability and a period of directional climate change. A major challenge in this approach is the development of data of sufficient spatial and temporal resolution, the available time periods of record and the inherent rarity of extreme, but nonetheless important, events.

location, wilderness boundaries raise issues for disturbance management (Angelstam 1992; Forman 1990; Schoenwald-Cox and others 1992; Shafer 1994). This section describes boundary characteristics and examples of cross-boundary problems.

Natural boundaries are rare, relatively gradual, old or all three. By contrast, administrative boundaries are ubiquitous, relatively sharp (or become so through time) and relatively recent. The effects of boundaries vary with the amount and rate of ecological change across them and their influence on natural processes like individual movement, the physical environment and disturbance spread (Landres and others 1998a, 1998b).

Whether or not boundaries affect natural processes, they can affect management in other ways. Boundaries often separate public from private ownership or conservation management from other land uses. Even public lands managed by a single agency may have internal zones for different purposes (such as, natural area protection, historic scene management and recreation) and with different management plans. Just as with the ecological contrast that exists or develops on either side of administrative boundaries, the contrast in land use and management goals can affect management practices and their ecological outcomes. For example, a natural fire may be perceived as a threat to development outside a wilderness—a situation exacerbated if wilderness attracts residential or other development—to the tourism industry that develops around the wilderness or to the safety of traffic in areas affected by smoke.

Single agency lands may also be compartmentalized by division into management units, even when the overall management goals are the same for these subunits. Managing disturbances within these units may impose constraints similar to the management of individually small wilderness areas.

Boundary Placement: Natural, Artificial and Historic Boundaries

Some administrative boundaries follow natural features, such as rivers, bodies of water or watershed divides, while others are made up of arbitrary survey segments (Newmark 1985; Theberge 1989). Those that follow natural features usually are derived from topography which, in turn, affects environmental gradients, the flow of water and the position of land relative to water bodies. However, even topographically determined boundaries are unlikely to be arrayed with regard to natural processes, such as migration of animals or the spread of disturbances. In some sense, no ecosystems have natural boundaries unless these are set by the natural process with the furthest spatial extent. Boundaries therefore range from arbitrary to natural. Most boundaries only partially encompass natural processes.

Boundaries may also be determined by previous human land use (for example, old-growth forest vs. farmed land). These historical boundaries can also be correlated with natural features—productive and flat valleys were taken by agriculture, with steep and rocky land left in forests. In any case, historical land use boundaries used to determine administrative boundaries are also unlikely to be defined with regard to natural processes.

Boundary Width, Dynamics and Edge Effect

Management and administrative units are usually delineated by a line on a map with no definable width, although units are sometimes separated by transition or buffer zones of defined width (Figure 6). By increasing the width of a boundary, buffers reduce the rate of change across the boundary (Landres and others 1998a, 1998b). The quantitative description of boundaries and edges is still in its formative stages (Fortin and Drapeau 1995).

Administrative boundaries may begin as boundaries through contiguous natural areas and then develop as ecological boundaries through time. Landres and others (1998a) call these induced or generated edges and note the importance of three characteristics: width (buffers increase the width and reduce the rate of change across the edge), the amount of change (ecological contrast) between ecosystems on either side of the edge, and the rate of change of ecosystem structure across the edge.

If land use sharpens ecological boundaries, edge effects develop. These are not constant, but develop through time. For example, increased wind exposure on an induced edge may result in higher rates of treefall, so that, over time, the edge is transformed as tree density decreases and the density of shrubs and saplings increases. That change causes a change from increased sunlight and reduced humidity at the forest floor on the edge to dense shade and increased humidity later. The age and stability of the edges on an administrative boundary are thus important to its ecological effects.

Edges also vary as a function of position on the landscape. For example, in the north temperate zone, north-facing forest edges receive little direct sunlight, while south-facing edges receive the most direct sun; west-facing edges receive

direct sun during hotter hours of the day than east-facing edges. The penetration of edge effects will also vary as a function of topographic characteristics (steepness, slope position and slope shape) or environmental factors (such as prevailing wind direction).

Edges affect ecological fluxes (Hansen and di Castri 1992; Landres and others 1998a, 1998b; Schoenwald-Cox and Bayliss 1986; Schoenwald-Cox and others 1992): the movement of individuals, propagules, genes, water, soil nutrients, leaf litter, woody debris, and wind. Edges become the semipermeable membranes of natural areas and can act as filters that change both the quantity and quality of the fluxes. Edges may be resistant to flux (for example, fire breaks) or may direct fluxes parallel to the edge (for example, animal movements along, rather than across the edge). Permeability of the edge is a key to understanding boundary effects. Edges can be absolute barriers or barriers with "pores" that are neutral or conducent to movement of individuals, environmental influences and disturbances (Landres and others 1998a).

Examples of Disturbances that Cross Boundaries

Disturbances that are affected by boundaries include fires, hydrologic flux (flood-caused alluvial erosion and deposition), wind-caused substrate movements (dune migration), gravity-caused substrate movements (avalanches, debris flows), coastal erosion and deposition and episodic outbreaks of heterotrophs that can cause elevated plant mortality (insects, pests and diseases, grazing and burrowing animals). Boundaries can both increase and decrease these disturbances within wilderness. Even when the boundary itself plays no ecological role, the proximity of other land uses and human life and property near wilderness boundaries often brings political pressure to reduce fire, flood and pest outbreaks. We briefly review the three most common disturbances affected by boundaries (Figure 6, Table 3): fires, floods and insect, pest and disease outbreaks.

Fires—Forest fragmentation and the permeation of fire breaks, such as roads and land conversion, are widely blamed for the reduction in fire frequency in the longleaf pine forests of the Southeastern coastal plain (Frost 1993). Compartmentalizing this ecosystem has greatly reduced fire sizes and nearby tracts must be ignited by independent lightning strikes. Research in Sequoia-Kings Canyon National Park suggests that ignitions in low-elevation chaparral created fires that burned into montane sequoia groves. These sites of ignition were largely excluded when the park boundary was created (Kilgore and Heinzelman 1990; McKelvey and others 1996).

Boundary effects can also increase fire incidence. For example, Habeck (1985) suggested that fire suppression on the edge of the Selway-Bitterroot Wilderness increased fuel loads and increased fire frequency and intensity in western red cedar forests within the Wilderness. Arson fires in Great Smoky Mountains National Park are mainly set on roadsides and park boundaries, increasing fire frequencies on lower slope positions (Harmon 1982).

In addition to fires that move across wilderness boundaries, the smoke produced by fires is a significant management

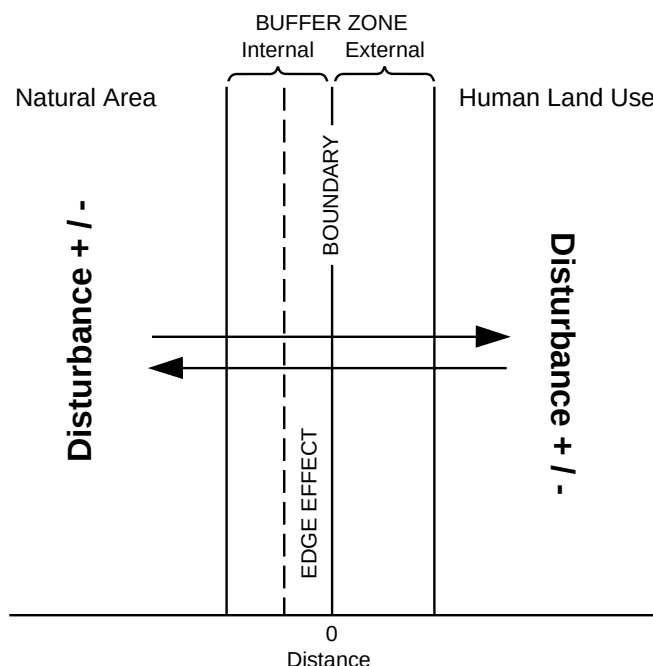


Figure 6—Boundary effects on disturbance (see text and Table 3).

Table 3—Disturbances that are frequently influenced by wilderness boundaries.

Disturbance	Increased rate	Decreased rate
A. Effects of surroundings on wilderness:		
Fire	Human set fires in surrounding areas	Suppression in surroundings
	High fuel loads in surrounding areas	Fragmentation, isolation Fewer ignitions Smoke impacts Risk to life and property
Flood	Increased runoff	Impoundments
Insects, pests	Homogeneous vulnerable vegetation	Fragmentation, isolation
B. Effects of wilderness on surroundings:		
Fire	Management fires that escape	Construction of fire breaks
	Management for intense fire	Reduced fuel loads at boundaries
Flood	Unregulated flow	Protection of wetlands, soils
Insect, pests	Native species allowed to outbreak	Heterogeneous vegetation

concern and may constrain the seasons and intensities of fires possible in wilderness landscapes. Changes after fire can also influence downstream water quality. For example, fire can increase nitrate levels in streams, and these may influence aquatic productivity.

Hydrologic Flux—Many wilderness areas do not control the headwaters or other parts of their watersheds. The control of water flow by activities outside Everglades National Park (Kushlan 1987), Grand Canyon National Park (Johnson and Carothers 1987; Stevens and others 1995) and many other areas often decreases water flow to these areas, removes the peak floods and creates a higher frequency of droughts. Reduction in flooding reduces scouring and alters succession on riparian bars and banks, leading to regeneration failures in some species (Johnson 1994; Kaufman and others 1997). The artificial stabilization of riverside habitats can cause successional changes and exotic species invasions. Restoration of natural water flows is a major issue for these areas. In Everglades National Park, the problem is made worse in some areas by the invasion of exotic trees able to transpire water at greater rates than the native ecosystems (Bodley and others 1994). As a result, water levels drop, exacerbating lowered levels caused by water impoundments upstream and perhaps leading to more severe fires. Boundary influences can also increase water flow and change water quality within a wilderness. For example, higher runoff from developed areas can increase downward erosion and increase siltation in natural areas.

Diseases and Pests—The dispersal of pest organisms can be influenced by landscape characteristics. The control of the southern pine beetle outside Great Smoky Mountains National Park may affect outbreaks inside the Park; in addition, neighbors campaign for control of the beetle within the wilderness areas of the Park itself. Surrounding land use can also increase pest outbreaks in wilderness. For example, it is hypothesized that large scale logging in Canada has led to the development of large, contiguous tracts of second-growth balsam fir and thus has increased the areal extent and severity of outbreaks of spruce budworm.

Other Boundary Problems—Preserved wilderness may attract development along its edges. That development brings both property vulnerable to disturbance (by fire) and people in proximity with the edge. Increased populations can also result in higher taking of plants, animals, and fungi, whether legally or by poaching. Increased populations also bring roads (Schoenwald-Cox and Buechner 1992), other disturbances and such activities as horticulture and animal farming that both create corridors for invasion by exotic species and increase the availability of these species for invasion. If wilderness attracts development on its edges, boundaries can sharpen.

Habitat loss and fragmentation around wilderness can also reduce immigration into and out of the wilderness area. Changes in species presence can be random but are often differential: Area-sensitive and poorly dispersing species (whether because of inherent lack of dispersal ability or reaction to the disturbed matrix around the wilderness area) are lost. Some species with important ecological roles, like large mammalian predators, are among those most affected, leading to increases in other populations, such as large herbivores.

The Importance of Boundary as a Function of Shape and Area

The shape (perimeter to area ratio) of a wilderness tract will influence the relative importance of boundary and scale issues. A large wilderness of more-or-less round shape will have less edge relative to interior habitat and, if its dynamics are characterized by relatively small patch size (relative to its total area), managers may more readily treat the edge and boundary as buffering lands. In the extreme, the boundary would be considered a barrier to the outside, and the wilderness would then become fortress-like (Hales 1989). By contrast, a wilderness with large-scale dynamics or impinging forces along the boundary cannot simply buffer itself from the surrounding world. Yellowstone National Park is an example of the need to integrate management across very large areas (Christensen and others 1989). The

Park is one of the largest in the world and yet has experienced the full range of boundary and size problems.

Conclusions: Prospects for the Future of Wilderness

Content is what lies within wilderness, but the future of that wilderness is also dependent on context (Landres and others 1998a). Parks have been considered as islands, in the sense that they may be surrounded by very different land uses. However, Janzen (1986) wrote “no park is an island” in an essay entitled “the eternal external threat” to draw attention specifically to this context. Not only are parks surrounded by different land uses, those land uses may impinge on the values of the natural area itself, in both negative and positive ways. In that sense, the “sea” surrounding a park is not simply a neutral expanse that can be represented merely by the distance of isolation. Rather, the surroundings have a host of influences on the wilderness tract itself.

The relationship of disturbance regime to the size of wilderness will influence management options. Small-scale disturbances in large areas may result in steady state landscapes. Disturbances characterized by large patch sizes are of greater concern. Some large disturbances (fire, hydrologic flux and pests and diseases) can be influenced by management and may be influenced both positively and negatively by wilderness boundaries. Even disturbances like hurricanes that are not under direct management control have consequences subject to management action and political pressure, such as influences on fuel loading, loss of native species in affected areas, pest species and water quality.

Disturbances can traverse wilderness boundaries in either direction, and land use surrounding wilderness can both decrease and increase the rate of disturbance within the wilderness. Boundaries can influence both ecological processes and management policies—for example, when the wilderness is perceived as creating danger to surrounding lands and property. Wilderness managers will have to form partnerships with neighbors to be able to manage their areas for natural processes and wilderness values.

Nature’s dynamics are both cause and effect: The dynamics are responsible for the diversity of species and ecosystems that are present, but these species and ecosystems then contribute to the responses to future dynamics. Various sources of historical and contemporary data will help us understand these dynamics (White and Walker 1997). However, the future is unlikely to duplicate the past in all details. Because of our evolving understanding and the likelihood of continued environmental change, we must employ both monitoring and adaptive management. We will have to determine the actions needed for qualitative or persistence equilibrium; this will force us to ask how sensitive that persistence is to the details of management. Particularly troubling for wilderness managers will be the forces that act across large distances, that have influenced even large and remote wilderness areas, that may introduce novel conditions and that reset the basic properties and geographies of ecosystems: exotic species invasions, climate change and air pollution.

These occur in even the largest wilderness areas, easily traverse boundaries and affect disturbance regimes.

Because of our ambivalence about managing areas where we want natural forces to reign, we are now faced with a series of choices that collectively reflect the paradigm shift forced upon us by expanding human use of land and dwindling wilderness areas. At one extreme with regard to natural process management (vs. managing for species), we can leave wilderness unmanaged. This treats wilderness as the “canaries in cages,” its fate determined by a host of ecological changes, including the change in scale and boundary that causes a loss of natural dynamics. At the other extreme, we can manage for historic state and essentially attempt to “freeze” ecosystems through a management regime that may incorporate disturbance, but does so in a way that allows no deviation from a particular, historically determined conditions. Such management ignores changing climates, although the historic disturbance regime may be contingent on climate conditions that no longer exist.

In between these two extremes lies many options among which is another course of action: Introducing those disturbances missing because of scale and boundary problems but allowing prescriptions to vary, as natural disturbances did, by coupling them to a climate signal or even allowing stochastic inputs. For example, because variation in hydrology through the Everglades was historically correlated with precipitation, precipitation measured at a monitoring station could be used to determine water releases from the water management districts upstream from the Park. The variation in rainfall would then drive the variation in a major ecosystem variable, as it did before impoundments were created. Whether this approach can be used in other cases is unknown. Such approaches would, however, still raise scale and boundary issues. For example, there would still likely be political pressure to eliminate the most extreme events from the prescription if they threatened human life and economic value.

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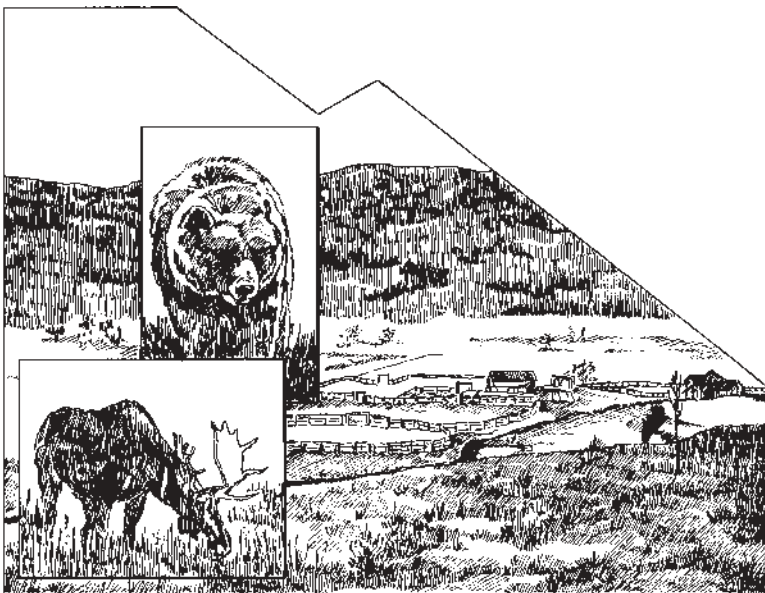
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2. Wilderness Meanings and Debates



The Influence of the Adirondacks on the Wilderness Preservation Contributions of Robert Marshall and Howard Zahniser

Chad P. Dawson
Ed Zahniser

Abstract—Two wilderness visionaries, Robert Marshall and Howard Zahniser, were influenced by their personal wilderness experiences in the Adirondack Mountains of New York and the “forever wild” legislation that protected those Forest Preserve areas. Both learned from and contributed to the wilderness preservation movement in the Adirondacks and the nation. The wilderness advocacy roles of Marshall and Zahniser were formative in the development and eventual passage of the Wilderness Act of 1964.

The national wilderness movement, as we know it today, coalesced in the 1920s and 1930s with the influence of such visionaries as Aldo Leopold and Robert Marshall, who wrote and campaigned tirelessly for the creation of wilderness within the U.S. Forest Service and later for a national wilderness system. Aldo Leopold was chiefly responsible for the establishment of the Gila Wilderness in the Gila National Forest in 1924, based on the importance of ecological processes evident in wilderness and the recreational values that the users enjoyed. However, the Wilderness Act was not passed until 1964, when it established a National Wilderness Preservation System under the management of four federal land management agencies. The Wilderness Act designated more than nine million acres as the beginning of the National Wilderness Preservation System (NWPS). The NWPS now totals more than 100 million acres, and the concept of such a national system and, more important, the ideals of wilderness preservation have spread as an international wilderness movement.

When discussing wilderness preservation and the Wilderness Act as an important environmental turning point in the history of the United States, numerous people are often mentioned—Henry Thoreau, John Muir, Aldo Leopold, Benton MacKaye, Robert Marshall, Howard Zahniser and others (Brooks 1980; Magill 1995). Two names often emerge as legendary figures in these historical narratives—Robert Marshall and Howard Zahniser (Glover 1988; Zahniser 1992; Jackson 1994; Magill 1995). Both men had inspirational experiences and love of a wilderness place—the Adirondack Mountains of New York—that shaped how they viewed the wilderness preservation movement.

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Chad P. Dawson is a Professor of Recreation and Tourism at the SUNY College of Environmental Science and Forestry, 211 Marshall Hall, One Forestry Drive, Syracuse, NY 13210-2787 U.S.A. Ed Zahniser works as a writer and editor in the Division of Publications of the National Park Service at Harper's Ferry, West Virginia 25425 U.S.A.

The Adirondack Mountains of New York include one of America's first legally protected wild areas. The New York State legislation that protected these areas and the personal Adirondack wilderness experiences of Robert Marshall and Howard Zahniser directly influenced their wilderness vision and advocacy. Indirectly, the preservation of the Adirondacks influenced the national wilderness preservation movement through these men, their wilderness experiences and their vision of wilderness for recreational use, appreciation, and preservation for future generations. Similar observations over the past 30 years about these two men and their relationship with the Adirondacks (Schaefer 1989; Glover 1986; Zahniser 1992; McKibben 1994; Peterson 1996) suggest that New York's Adirondacks made several important contributions to the national wilderness movement.

The purpose of the paper is to highlight how two wilderness visionaries, Robert Marshall and Howard Zahniser, were influenced by their wilderness experiences in the Adirondacks of New York State and how this inspiration influenced their contributions to the state and national wilderness preservation movements. Our approach was to review the writings about their experiences in the Adirondacks, as well as literature written by those who knew about or shared those experiences.

New York State Wilderness

The roots of the wilderness preservation movement in New York State began in 1885 with legislation to create the Forest Preserve lands that were to be “forever kept as wild forest lands.” The citizens of the state passed a referendum in 1894 to add constitutional protection to the Forest Preserve lands set aside within the Adirondack and Catskill Mountains. The most often quoted portion of the legislation is Article XIV, which, in part, states: “The lands of the state, now owned or hereafter acquired, constituting the forest preserve as now fixed by law, shall be forever kept as wild forest lands. They shall not be leased, sold or exchanged, or be taken by any corporation, public or private, nor shall the timber thereon be sold, removed or destroyed.”

The state-owned lands within the Adirondack and Catskill forests were subsequently termed the “Forest Preserve.” These lands, in combination with extensive private land holdings, were established as regional planning and management areas labeled the Adirondack and Catskill Parks.

The specific designation of some of the Adirondack Forest Preserve lands as “wilderness” was first proposed by the state legislature in 1960 and finally adopted in 1972. Today, there are 16 wilderness management units in the Adirondack Forest Preserve, totaling more than one million acres. In

1985, four wilderness units in the Catskill Forest Preserve were created by state agency action and total more than 100,000 acres.

Robert Marshall: Wilderness Advocate, Planner, and Manager _____

One of early champions of the wilderness movement in New York was Louis Marshall, a constitutional delegate and lawyer, who led the debate in favor of creating and protecting the forest preserve. Louis later noted: "the most important action of the convention of 1894 was, I would say without the slightest hesitation was the adoption of section . . . of the Constitution which preserved in their wild state the Adirondack and Catskill forests" (Glover 1986).

Robert Marshall, or "Bob" as he preferred, was the son of Louis Marshall. He grew up exploring and spending his summers with his family at Lower Saranac Lake in the Adirondacks. Bob learned to appreciate the Adirondacks as a user and, later, as an advocate for their preservation. He traveled extensively throughout the Adirondacks whenever he had an opportunity with his brother George, guide Herb Clark and some classmates. Here he began making long treks to distant ponds and mountain tops. Bob and George were the first to climb all 46 peaks in the Adirondacks higher than 4,000 feet. He wrote of the beauty he saw and valued and made long "guidebook" commentaries on what he observed, rating the quality of everything from trail conditions to panoramic views (Marshall 1922; 1923; 1942).

Bob graduated from the New York State College of Forestry in Syracuse in 1924 and went on to earn his master's (at Harvard Forest) and Ph.D. (at John Hopkins) degrees as a forester and plant physiologist. He became a wilderness resource manager, but he is most often remembered as an activist and advocate for wilderness (Glover 1986; 1988).

Marshall frequently returned to the Adirondacks in later life when not traveling or working elsewhere in the United States. He supported wilderness protection in the Adirondacks, such as the need to stop timber harvesting above 2,500 feet and to prohibit truck road construction into roadless areas. He spoke about and wrote in favor of protecting the "forever wild" land areas because they were often threatened by development interests (Marshall 1953; Schaefer 1966). Bob believed strongly in the value of wilderness and thought that the public should support the wilderness preservation efforts and, thereby, influence agency decisions and legislative actions.

On a trip to the top of Mount Marcy in the Adirondacks in 1932, Bob met Paul Schaefer, from the Association for the Protection of the Adirondacks, and discussed wilderness preservation at the state and national level. Bob noted: "We simply must band together – wherever and whenever wilderness is attacked. We must mobilize all our resources, all of our energies, all of our devotion to wilderness" (Schaefer 1966). Marshall was one of the founding members of The Wilderness Society in 1935 and encouraged Paul Schaefer and the Association for the Protection of the Adirondacks to carry on similar work in the Adirondacks.

One of Bob Marshall's most significant written works was his article on *The Problem of The Wilderness* (1930), in which

he stated the benefits that accrue from wilderness – physical, mental and aesthetic. He also outlined how exploration had shaped the nation and its culture but concluded with a call to action: "There is just one hope of repulsing the tyrannical ambition of civilization to conquer every niche on the whole earth. That hope is the organization of spirited people who will fight for the freedom of the wilderness."

The national and New York State trends toward rapid development and the loss of wild conditions were of great concern to Marshall (1930), who reasoned that: "The preservation of a few samples of undeveloped territory is one of the most clamant issues before us today. Just a few years more of hesitation and the only trace of that wilderness which has exerted such a fundamental influence in moulding American character will lie in the musty pages of pioneer books and the mumbled memories of tottering antiquarians. To avoid this catastrophe demands immediate action." This theme emerged often in his writings as he exhorted both private individuals and agency professionals to act to preserve wilderness while there was still an opportunity to do so and preserve the experience for future generations.

After several trips to Alaska, Marshall returned to the Adirondacks worried that they might have lost their grandeur compared with the places he had visited. After a 1932 trip in the Adirondacks, he commented that he had recaptured, much to his relief, the sense of wilderness that he had experienced in his past climbs on Mount Haystack (Schaefer 1966).

In the 1930s, Bob worked, in several professional capacities, for wilderness management and toward a national policy of wilderness preservation on the national forests. During 1933-39, he worked as wilderness resource manager. Bob was director of the Forestry Division of the U. S. Office of Indian Affairs and then chief of the Division of Recreation and Lands within the U. S. Forest Service. He spent about half his time in Washington, D.C. and the other half in the field studying wilderness issues. Long hikes and backpacking trips were common and kept the field staff busy trying to keep up with his enormous enthusiasm for the wilderness experience. As often as his busy schedule would allow, Bob made trips back to the Adirondacks to stay involved in the issues there and to enjoy their beauty.

By 1937, Marshall had grown more vocal about the need to preserve wilderness after observing the enormous demand by the American public for recreation and tourism opportunities. As a result, he published his most strongly worded warning about the consequences of not preserving wilderness immediately in an article appropriately titled *The Universe of the Wilderness is Vanishing*. Bob clearly stated the choices: "The world is full of conflicts between genuine values. Often these conflicts are resolved entirely from the standpoint of one of the competing values, and thus whole categories of human enjoyment may be needlessly swept away. It is far more conducive to human happiness to attempt some rational balance that will make possible for the immensely different types of people the varied values they crave. Emphatically this is true of the conflict between the values created by the modification of Nature and the values of the primitive . . . the fate of unmodified Nature rests in the activity of its friends." Through his work with The Wilderness Society, he championed popular campaigns for wilderness preservation and

encouraged supporters to challenge the federal land managing agencies to action. Within the Forest Service, Marshall pushed for protection of roadless areas and included several Adirondack areas, of state Forest Preserve lands, in national studies of roadless areas and recommended wilderness protection—based on their national significance.

In the midst of his seemingly boundless energy for hiking, adventure, wilderness resource management and advocating wilderness preservation, Bob died in 1939 at the age of 38. There are many biographical writings about Bob Marshall that chronicle his life in more detail and describe his many achievements (Marshall 1951; Marshall 1976; Jamieson 1983; Glover 1986; Vickery 1986; Jackson 1994). Some of the most noticeable tributes to him include the creation of the Bob Marshall Wilderness in Montana, the naming of Mount Marshall in the Adirondacks and the proposed Bob Marshall Great Wilderness in the Adirondacks (DiNunzio 1992). Probably the most significant tribute to Bob Marshall and wilderness preservation was the leadership and perseverance shown by the many people who took up the challenge of ensuring that wilderness would be available for present and future generations. The wilderness preservation movement might have faltered without its most prominent and vital advocate, but that leadership was taken up by others, including one tireless visionary and advocate—Howard Zahniser.

Howard Zahniser: Wilderness Legislation Architect

One of Bob Marshall's fellow charter members of The Wilderness Society, in 1935, was Howard Zahniser. In 1945, Zahniser, or "Zahnie," became the executive secretary of The Wilderness Society and editor of *The Living Wilderness*. The next year, he visited New York's Adirondacks with Paul Schaefer and discussed the need to preserve free-flowing rivers and wilderness areas in New York State and the entire nation. During their wilderness trip, Zahniser shared his national vision and how it related to the New York preservation movement: "In addition to such protection as national parks and monuments now are given, we need some strong legislation which will be similar in effect on a national scale to what Article XIV, Section 1, is to New York State Forest Preserve. We need to reclaim for the people, perhaps through their representatives in the Congress, control over the wilderness regions of America" (Schaefer 1992).

Zahniser fell in love with the Adirondacks and later that year purchased land and a cabin near what is now known as the Siamese Ponds Wilderness. He spent much of his free time there with his family, when he could get away from his busy professional life in Washington, D.C. or from traveling for The Wilderness Society. As an advocate for national wilderness, Zahniser often came to New York to support state efforts for wilderness and river preservation from 1946 until his death in 1964. He found kindred spirits in members of the Association for the Protection of the Adirondacks. George D. Davis, former executive director of The Wilderness Society, commented in 1992 that "Zahniser not only took preservation ideas and inspiration from the Adirondacks, he also gave to Adirondack preservation."

On one of his talks with a New York Legislative Committee in 1953, Zahniser noted that in the state and the nation "... we must not only protect the wilderness from exploitation. We must also see that we do not ourselves destroy its wilderness character in our own management programs. We must remember that the essential quality of the wilderness is its wildness." These observations led to considerable debate and an inventory of potential areas for wilderness designation within the Adirondack Forest Preserve. Wilderness designations within the Adirondack Forest Preserve were not adopted by New York State until 1972.

In 1957, during one of his many trips to New York from Washington, he addressed the New York State Conservation Council with a speech entitled "Where Wilderness Preservation Began," a direct tribute to the state's contribution to the national wilderness movement. Stewart Udall (1988) observed that Zahniser had: "acquired vital insights into wilderness values on hikes in the same Adirondack expanse that had earlier fired the imagination of Bob Marshall. Moreover, when he presented testimony to the New York Legislature in support of the 'forever wild' covenant in the state's constitution, Zahniser formulated in his mind some of the basic concepts he later incorporated into the initial wilderness bill he submitted to his friends in Congress."

Zahniser attended and participated in many hearings and meetings in New York State between 1946 and 1964, contributing to wilderness and river preservation efforts. His time in New York often involved a multitude of purposes, from spending time with his family and friends to both seeking and giving council about wilderness preservation. Many of the 60 or more legislative drafts, of what became the Wilderness Act, were worked on by Zahniser in his cabin in the Adirondacks.

The visionary role of Howard Zahniser was best summarized by Douglas Scott (1992) when he acknowledged that: "Zahniser was the true architect of the Wilderness Act, not merely because he drafted its language and catalyzed the endless details of the legislative campaign to see it enacted, but because he motivated so many to see the need, inspired thousands to think it possible, and emboldened all to preserve, even when discouragement set in. He was happiest, this remarkable leader, when his leadership was least visible, when a dozen others rose to voice the support he had engendered, speaking for wilderness from their own hearts."

Zahniser spoke eloquently of the values of wilderness that were important to him personally, as well as to wilderness users and all of our society—personal renewal, inspirational, educational, scientific, historical and recreational. In his landmark article on the need for wilderness, he states: "In the areas of wilderness that are still relatively unmodified by man it is, however, possible for a human being, adult or child, to sense and see his own humble, dependent relationship to all of life. In these areas, thus, are the opportunities for so important, so neglected a part of our education—gaining of the true understanding of our past, ourselves, and our world which will enable us to enjoy the conveniences and liberties of our urbanized, industrialized, mechanized civilization and yet not sacrifice an awareness of our human existence as spiritual creatures nurtured and sustained by and from the great community of life that comprises the wildness of the universe, of which we ourselves are a part" (Zahniser 1956).

In Sierra Club conferences during 1961 and 1963, Zahniser, as executive director of The Wilderness Society, tirelessly advocated support for wilderness legislation and encouraged others to join with the philosophy: “. . . we are facing a frontier. We are not slowing down a force that inevitably will destroy all the wilderness there is. We are generating another force, never to be wholly spent, that, renewed generation to generation, will be always effective in preserving wilderness. We are not fighting progress. We are making it. We are not dealing with a vanishing wilderness. We are working for wilderness forever.” (Zahniser 1961; 1963).

On September 3, 1964, only months after the death of Howard Zahniser at age 58, President Lyndon Johnson signed the Wilderness Act into law. Some have referred to the passage of this legislation as one of the great environmental events in the history of our country (Magill 1995).

Adirondack Influences

The Adirondack wilderness movement and the personal Adirondack wilderness experiences of Bob Marshall and Howard Zahniser directly influenced their wilderness vision and advocacy. Some of the influences of the Adirondack wilderness movement on Marshall and Zahniser include: 1) establishing, through example of the “forever wild” covenant in the state constitution, the importance of legislation to protect wild areas and wilderness for long-term stability and preservation; and 2) demonstrating the need for people who value and use wilderness to actively work for its preservation, such as the wilderness advocacy of Paul Schaefer and The Association for the Protection of the Adirondacks. The travel and personal experiences of Marshall and Zahniser in the Adirondacks also inspired these leaders to advocate for wilderness preservation and management.

Indirectly, the preservation of the Adirondacks influenced the entire national wilderness preservation movement through these men, their wilderness experiences, and their vision of wilderness for personal renewal, recreational use, appreciation and preservation for future generations. Interestingly, the work of Marshall and Zahniser came full circle over many decades, when the national wilderness definition was modified slightly and adopted to become the legal definition used in the New York State for designation of 16 wilderness areas within the Adirondack Park.

Some authors suggest that the story of the preservation of the Adirondacks, its ecological restoration and the unique mix of public and private interests and lands continues to influence the national wilderness preservation movement (McKibben 1994). For example, the dynamic tension between development and preservation in the Adirondack area may have reached some equilibrium in recent decades. In the Adirondack Park, public lands are interspersed with private lands that are regionally zoned for different levels of development. This attempt to balance these two interests may offer continued insight for national and international attempts at wilderness preservation and compatible private development for regional sustainability.

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Navigating Confluences: Revisiting the Meaning of “Wilderness Experience”

Karen M. Fox

Abstract—Concepts of wilderness and “wilderness experience” merge into a grand or metanarrative that describes how “wilderness experience” is and provides a normalized reference point for values, beliefs, actions, and choices. This paper engages and juxtaposes critiques by scholars and authors representing nondominant perspectives with the North American, wilderness metanarrative. The *bricolage* analysis develops a repleteness of interpretation, feeds new visions from the margin to the center, and enhances a particular style of ethical discourse.

Our concepts of the “wilderness experience” inevitably connect us with the cultural and historical forces of societies. If you live in the United States, the words and images created by John Muir, David Thoreau, Wallace Stegner, Aldo Leopold and Theodore Roosevelt will surface. If you live within the large expanse of Canada, tales of voyagers, scientific expeditions, trade routes, annual climbing Camps, natural history explorations and railroad expansion will spring to mind. For managers of wilderness areas, ecological management, ecosystem approaches, social carrying capacity and conflict management reflect specific culturally-bound facts and values. As outdoor leaders or recreationists, settings such as group dynamics, individual psychological growth, facing risk and developing technical skills will delimit the encounters.

Each of the historical and cultural forces, in their own way, merge into a grand or metanarrative (Lyotard, 1984) that describes how wilderness is and provides a normalized reference point for values, beliefs, actions and choices. A grand narrative structures how we interact with areas entitled “wilderness.” Cultural, historical and individual accounts, management practices and outdoor recreation intersect within a constructed metanarrative that claims, through its use of discourse, to present reality or truth. In the spirit of Thoreau or Muir, a present day wilderness trip is sketched with shades of grandeur, solitude, risk or the images of the first white, male explorers. The spirit of voyagers permeate modern trips through the Canadian Shield as participants learn French songs to establish paddling rhythms or retrace the routes of English and French explorers. The outdoor recreationist or wilderness traveler unites with the wilderness through a metanarrative circumscribed, at a minimum,

by chronicles of nationality, race, human-nature relationships, ethics, power, and activity.

The purpose of this paper is to engage and juxtapose critiques by scholars and authors representing nondominant perspectives with the wilderness metanarrative that we seemingly cannot live without. The metanarrative that structures “wilderness experience” is far more complex than imagined and carries unconscious, sometimes invisible, meanings, which do not disappear simply because we are unaware of those forces or because we did not intend those messages. Using literary and scholarly perspectives, I consider how discourse mediates experiences in the wilderness, calls out for interpreting the experience as constructed, and reveals ethical implications for those of us who gravitate toward, and live within, the dominant, North American wilderness metanarrative. Ethical processes, as argued elsewhere (Fox, 1998; Fox, Ryan, van Dyck, Chuchmach, Chivers, and Quesnel, 1999), begins with multiple and critical perspectives. The juxtaposition of propositions helps initiate and sustain an ethical focus within the discussion about wilderness and “wilderness experience.”

The streams of this discussion are confluent. While the streams flow into one another or contribute to the identity of overall patterns, they do not fuse into one, or melt, but rather retain their separate and unique identities while surfacing and maintaining various analyses, including paradoxical ones. However ubiquitous the dominant, North American grand narrative of wilderness, it is far less culturally defining than the land, the climate and the particular narratives that permeate a region in all of its social dimensions. “Cultural geographies, far more than geological or political ones, give rise to regional definitions of use to human beings, so it seems wisest for readers to think of the cultural dimensions of our “multicultural” spiritual-psychic locations rather than of the geopolitical ones” (Allen, 1999).

Understanding the Currents: The Analytical Frames

The analytical frame for this paper represents a postmodern *bricolage* or a blending of diverse perspectives, critiques, disciplinary knowledges, and analyses. First, a description of various components of the North American wilderness metanarrative is presented. These elements are “entry points” into the discussions and analyses; they do not represent an exhaustive analysis of the discourse surrounding wilderness or wilderness experiences. A thorough description of the power, oppressive and resistive forces within the grand narrative of wilderness and “wilderness experience” is left for another day. The brief description is vital for negotiating the critiques developed on the margins.

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Karen M. Fox is an Assistant Professor with the Faculty of Physical Education and Recreation at the University of Alberta, E-421 Van Vliet Centre, Edmonton, Alberta T6G 2H9, Canada, e-mail: karen.fox@ualberta.ca

Second, the analysis transfigures the scholarship not often associated with concepts of North American wilderness and “wilderness experiences” within the wilderness debates. The relevance of these writings may not be immediately obvious. However, part of the process of *bricolage* is identifying connections between seemingly unrelated items or movements. If we, as people who operate within the wilderness metanarrative, are to initiate and sustain ethical dialogues, we must begin to imagine ourselves as others see us by listening closely to their interpretations and critiques. This analysis of “wilderness experience” is grounded in the works of Native American and Aboriginal women, Native Hawaiian men and women, Chicanas, African-American feminists, and Euro-North American men and women in postmodern discourses. These authors simply make us *see* more, seek a kind of repleteness of interpretation that is only achieved when phenomena are read from multiple perspectives. “Feeding new visions from the margins to the center, the formerly disqualified on the borders are likely to enrich, complicate, and thicken what we construct (without warranty) as the center of all things” (Greene, 1993). Multiple viewpoints support ethical discussion, because they make visible contradictory ideas, enhance and diversify the participation and engage power forces between *whitestream* and alternative voices. *Whitestream* is a term coined by Denis (1997) to indicate that society, although principally structured on the European, white experience, is more than a “white” society in socio-demographic, cultural and economic terms. However, it is also a problematic term, because it leaves hidden the various experiences and margins within a “white culture.” For instance, “poor white Appalachians” were displaced to form national parks during the 1930s, and surely their voices are not usually included within dominant white discourses. However, the term does serve to foreground how race, culture, sexual orientation, class, economics, and ability among others conditions our knowledge and understanding.

Third, *bricolage* is a form of “caring,” that is thinking carefully about our conceptual frameworks, ubiquitous discourses and critiques from “outsiders” is a process of honoring voices not usually attended to, remaining accountable for the paradoxical consequence of all actions and creating discourse focused on ethical dimensions. Like Dewey (Boydston, 1969-1991) and Arendt (1977), Foucault (1984) calls for reflection on the rules that govern discourse at particular moments of time, and on the assumptions that underlie it. So thinking and careful analyses, as Dewey (Boydston, 1969-1991) says, “is what allows one to step back from this way of acting or reacting, to present it to oneself as an object of thought and question its meanings, its conditions, and its goals. Thought is freedom in relation to what one does, the motion by which one detaches oneself from it, establishes it as an object, and reflects upon it as a problem” (Boydston, 1969-1991). Therefore, thinking, as a type of caring, allows for choosing different actions or behaviors, redefining ethical criteria to include multiple standpoints and material interaction and becoming accountable for the harms and benefits associated with every action.

The Main Current: The Metanarrative of Wilderness and Wilderness Experience

Wilderness” has a deceptive concreteness at first glance. The difficulty is that while the word is a noun it acts like an adjective. There is no specific material object that is wilderness. The term designates a quality (as the ‘-ness’ suggests) that produces a certain mood or feeling in a given individual and, as a consequence, may be assigned by that person to a specific place. Because of this subjectivity a universally acceptable definition of wilderness is elusive (Nash, 1982).

Nash’s (1982) difficulties with defining wilderness may seem peculiar since wilderness is an apparently natural phenomenon, not dependent on human thought as are obvious human constructs such as experience, recreation or leisure. However, mountains, flora, fauna, land and space are all found in such designations as parks, wilderness, Crown lands, forests, wildlands, protected areas, special places and uninhabited lands. The designations are all based upon the interpretations and needs of human beings and do not reflect a “reality” that is found among the mountains, land, flora and fauna. Wilderness is created from the interplay of thought, language and cultural practices. But while human constructs, such as definitions of experience, are ultimately dependent on human thought, the same is not true of natural objects. As Sylvester (1991) points out, both ancient and modern people could easily recognize that a flat stone that fits the palms of their hands is good for skipping across water. The usefulness of a good throwing stone is not dependent on what we think, but rather on the properties of nature (McLean, 1999). However, designating a stone for throwing is a human construction, and hence the never-ending dynamics of interpretation are once again brought into play.

Although there are entities (potentially physical, abstract and spiritual) that are inviolate and exist beyond human need and justification, the sharing of understandings and knowledges places humans within a discursive world. Floating through an example of our discourses can help explicate how we construct layers of interpretations and reality. For example, ecology offers a very powerful set of metaphors to speak about the natural world. Metaphors such as “space-ship earth,” trees forming the lungs of the planet or marshes and wetlands as filters similar to an animal’s kidneys are part and parcel of ecological and environmental discourses. Ecology claims to present what *is* in the world, not what *ought to be* (Ryan, 1999). The discourses build upon concepts and metaphors of balance, homeostasis, stability and integrity over competition, fluctuation and change. Yet, the metaphors are not “in” the world but are applied based on human understanding through physical bodies (Lakoff & Johnson, 1999) and implies certain value orientations. Furthermore, the metaphors have changed over time (witness Kuhn, and his classic paradigm shifts) and are always contested. So, at one time, the commonality at the center of an ecosystem was the focus of wildlife studies, while edges have only recently come to the foreground. The metaphors shape reality in

terms of human bodily awareness and imply what ought to happen (for example, we should keep the marshes healthy). To think we have reached the final, complete understanding of ecological and wilderness metaphors seems to belie the history of science and knowledge.

In this paper, wilderness is framed as socially constructed, and the wilderness and “wilderness experience” metanarrative provides claims about what is and should be as well as implications for ethical behavior. The wilderness and “wilderness experience” concepts are imbued with cultural context including power relationships. For reasons that should not need explanation here, the writings of Muir, Thoreau, Stegner, Leopold and other white Canadian and American males structure the construct of wilderness more frequently and influentially than the writings (Warren, 1996), for example, of women, African-Americans, or Native Americans (Abajian, 1974; Blackett, 1986; Drimmer, 1987; Katz, 1973; Quarles, 1988). The occasional exception or the reclaiming of voice through feminist, Aboriginal, or African-American scholarship serves to emphasize the power of the norm. One example is the lack of identification given to the African-Americans, both individuals (for example, Matthew Henson, James Beckwourth or Estancio) or as groups of slaves, who were essential to the success of expeditions. Their contributions are rarely acknowledged let alone highlighted in the historical accounts. The social construction of gender and race, financial resources, opportunities, and acceptable behavior patterns privileged the experiences, perspectives, and achievements of white male accounts of wilderness. It would be difficult, given the social systems of the period, to imagine women, African-Americans, First Nations or Native Americans with access to such freedom, power, influence and opportunity to lead explorations, publish accounts, or garnish political support. The world of Canadian voyagers and explorers was limited to men especially the men of European descent, while Aboriginal and Metis previous achievements (most areas “discovered” by the English and French were well known to the Aboriginal residents) and involvement within European endeavors were left invisible. Ecology and wilderness management are systems with specific cultural, gender, and power perspectives as demonstrated by critical theorists and feminist scholars (Harding, 1989; Warren, 1996). The preponderance of white, Euro-North American males authors within outdoor recreation and leadership (Ewert, 1989; Ford and Blanchard, 1993; Meier, Morash, and Welton, 1987; McAvoy, 1990; Priest and Gass, 1997; Schleien, McAvoy, Lais and Rynders, 1993) hints at a monogenous approach.

If wilderness is a constructed and bound concept, what is this entity called “wilderness experience?” Can “wilderness experience” exist outside of the cultural and historical forces? How would one delineate a “wilderness experience?” When does a “wilderness experience” begin or end? What counts as a “wilderness experience?” If the “wilderness experience” is over (e.g., a discrete river trip), are the learnings derived from that event, recognized in the future, part of the original “wilderness experience?” Or are they a different experience? Or is it an ongoing “wilderness experience?” The concept or construct of “wilderness experience” is one we seemingly cannot live without, yet it is complex and complicated enough to give us pause.

Although there is no unproblematic theory of experience that philosophically defines what counts as an experience or delineates the components of an experience, there are numerous scholars wrestling with the epistemology and ontology of experience. Experience may begin with what Harding (1989) calls “spontaneous consciousness,” or the awareness one has of one’s “individual experience” before any reflection on that experience or any consideration of social construction of one’s identity. However, Harding suggests that this experience cannot be called “immediate” for it is thoroughly mediated by dominant cultural texts. “It is, however, spontaneous, for it is experienced as if it were an immediate view of one’s life and world” (Stone-Mediatore, 1998).

Dewey’s (Boydston, 1969-1991) theory of experience begins with a learning which bridges past, present, and future. Experience makes a backward and forward connection between what we do to things and what we enjoy or suffer from things in consequence. Arendt (1977) parallels Dewey’s connection between time periods while adding political and ethical ramifications. In Arendt’s sense, experiences are grounded in the world we have inherited from the past, filled with actions we do and do not like. Yet new and creative perspectives can be developed about the inherited past that enrich the present. This process “between past and future,” of constructing new interpretations, interrupts the seeming momentum of history and enables us to envision and work toward alternative futures (Stone-Mediatore, 1998). Arendt (1968) labels this potential “natality:” the power to choose other than who we have been constructed to be, a chance to resist or subvert metanarratives, an opportunity to tease apart the benefits and harms in any narrative and choose new actions and the revision of interpretations we embody as individuals and groups.

Understanding “wilderness experience” requires us to address, at a minimum: how the concept historically emerged and was passed down to the current generations; how the concept is used now to enable protection of flora, fauna and land as well as creating harm; how “wilderness experience” is circumscribed by wilderness history, literature, and concepts; how the concept privileges certain genders, socio-economic classes, races, cultural heritages, and experiential approaches; and how it conditions the future. Native American and Lebanese scholar, Paula Gunn Allen (1999), challenges views of experience that are bound to an individual and the present. These frameworks of experience create exclusions that can be particularly harmful for perspectives offering views outside the dominant paradigms: “For how can one immediately experience the present without regard to the shaping presence of the past? Yet Americans have been, at least in the expressions of their artists and scholars, profoundly present-oriented and idea- or fantasy-centered. Their past has fascinated them, in a made-up form, but the real past is denied as though it is too painful—too opposed to the fantasy, the dream, to be spoken” (Allen, 1999).

If we are to realize Arendt’s (1968) “natality,” we must reassess the wilderness metanarrative, incorporate the contradictory aspects of the historical context and work toward more conscious choices and accountable actions. Although humans can never fully comprehend all cultural and historical forces that impinge on the present, the movement toward understanding, critiquing and material

interaction allows for a deepening and mature comprehension for different ethical processes and decisions. Under such conditions, wilderness experiences are experiments with the world to find out what it is like. The undergoing of an experience becomes instruction or a discovery of the connection of things, perspectives and forces. A world where possibilities for creating harm or benefit (or both simultaneously) are ever-present is an existential package of contingency, responsibility and the possibility of failure. It is also a world in which intelligent participants have to carefully gauge word choices, structures and forces within and without and the consequences of their actions in a world of uncertainty. "Intelligence-in-operation" requires individuals to develop multiple viewpoints so that experience and judgement can lead to authentic and just interactions (Boisvert, 1998).

As Bordo and Jaggard (1989) suggest, we can start with experience, but the analysis cannot end there. Analyses must be critical of experiences and prepared to accept, modify or reject any wilderness experience that might contribute to the continuing oppression and destruction of life. The temptation is that, in trying to be sensitive to historically particular and culturally specific experiences, people will equate experience and truth. Experience is neither unmediated nor transparent. Lauretizen (1997) reflects upon the paradoxical nature of experience: "Relying on experience creates a tendency to accept a self-authenticating subjectivity, which does not adequately acknowledge the fact that, far from explaining or justifying particular moral claims, 'experience' may be the reality in need of explanation. On the other hand, thoroughly to historicize 'experience' runs the risk of undercutting the authority any appeal to experience might have in...an argument." Wilderness experiences are vital for our understanding and connection to the natural world, and they are a representation of our cultural history. These same wilderness experiences are always already constructed events that open up opportunities and replicate social forces. Euro-North American wilderness experiences open opportunities for self-development, spiritual experiences, and solitude as demonstrated by the field's research (Driver and others 1996), while replicating patterns of white participation in wilderness areas, glorifying the stories of white male explorers and naturalists and images of self based on autonomy, solitude, and detachment. The structure of trips for small groups who move by "their own power" rather than larger communal or family groups with varying levels of ability excludes a number of cultural heritages. In the long term, working toward concepts of "wilderness experience" that are inclusive or make space for multiple views requires an understanding of limits, accepting critiques and working to subvert, resist, and modify power structures. The foundation is a comprehension of how cultural and historical trends, invisible forces, and group movements condition individual selves, behavior, and knowledge. If we are to choose different currents and hear critiques from other perspectives, we must understand and engage a complexity of narratives.

Rethinking Who Has a "Wilderness Experience"

For purposes of discussion, I start with the assumption that selves ("subjects") are socially constructed and limited, and I describe powerful themes of self and wilderness experience. Interweaving Arendt's (1977) concept of natality, I open the possibility that we can choose to be other than what the world, metanarratives and we have made ourselves. My intention is to briefly indicate that within the diverse wilderness literature, the metanarrative surrounding "wilderness experiences" is grounded in only one metaphor of self (that is, masculine, unitary, consistent, rationale and solitary). Such a unitary view has oppressive and limiting implications in terms of accessing the "wilderness experience."

Classically, the Euro-North American tradition has focused on a rationale, masculine, consistent, autonomous self, where the body may not necessarily play an important role. Such a perspective often permeates the narratives associated with wilderness experiences. "*Walden* is the self-proclaimed triumph of the isolated, superior individual. Alone with nature, not in it. Not of it. One can be with it as a scholar is with a book, but as an observer, not a creative participant...Thoreau revealed the most about himself (and his admirers) by saying that he felt that the name *Walden* was originally 'walled in.' He was most taken by the idea that *Walden* (or *White*) Pond had no apparent source for its water, and no outlet. Entire unto itself...A wall to keep its pristine clarity, its perfect isolation. Secure." (Allen, 1999).

Feminist voices from alternative traditions and perspectives (Allen, 1999; Anzaldúa, 1987; Harjo and Bird, 1997; Keating, 1996; Lorde, 1984; Willet, 1995) have theorized self through emphasizing relationships, connections, interdependencies, discursive realities and multicultural identities. Braidotti (1994) explores a politically informed account of an alternative subjectivity that is in transit and yet sufficiently anchored to a historical position to accept responsibility and accountability. Willet (1995) builds on the mother-child experience to describe identity in terms of "proximate others." Butler (1990) develops a theory related to "performativity" and how meaning is inscribed through power and cultural forces on entities. Work by women with Native and multicultural heritages (Allen, 1999; Anzaldúa, 1987; Harjo and Bird, 1997; Keating, 1996; Lorde, 1982, 1984; Lugones, 1990) describe selves that cross borders, hold contradictory images and practices in tension, moves within various and multiple cultural views and choose to work from margins in order to resist oppression and maintain alternative voices.

When these inquiries are focused upon wilderness discussions, new tributaries for explorations emerge. What narrative would come forth when the struggles of Native Americans to sustain traditional relationships to wilderness and succeed within the whitestream world moves to center stage? What stories could we reclaim from the historical writings of women, African-Americans, Chinese-Americans, and Japanese-Americans relevant to the construction and designation of wilderness? How would our ethical frameworks be challenged if we assumed the "proximate other"

was essential for our moral development? What tales of injustice and oppression would seep out as we listen to the realities of the people who supported the famous explorers?

Given the rational, unitary, disembodied, autonomous and separate self within the “wilderness experience” metanarrative, it is not surprising to find that the role of the “body” has been left invisible in most Euro-North American philosophical discussions. Among others, Dewey (Boydston, 1969-1991) rejected such a dualism. Although he did not specifically explore the role of the body, it is implied within his notions of experience and his use of the term “embodied.” Recent work by a variety of scholars (Bordo, 1993; Butler, 1992; Butler & Scott, 1992; Fishburn, 1997; Jaggar & Bordo, 1989; Willet, 1995) has presented evidence and rationale for the necessity of body and embodied processes in philosophical inquiry.

Yet, dominant discourses give scant attention to bodily knowledge as we construct images of “wilderness experiences” and ethical practices. The separation of mind and body, with the body considered secondary, seems to be exemplified in the English language. Fishburn (1997) remarks that most Euro-North American cultures engage with the world through a conceptual construction, and find themselves, the majority of the time, attending to the world and away from their bodies. English sentences structure the experience as “I have a body” or “My body feels pleasure.” Yet, the “I” in these statements is indistinguishable from the body or the senses. The “I,” in these sentences, is not a captain steering a ship. The sadness is not separate from a certain heaviness of bodily limbs, nor is the widening of eyes and bouncing steps distinguishable from the delight. It is only when something goes amiss, that bodies become the focus of attention.

A discussion of the role of bodies and embodied knowledge is relevant because of the implied significance of bodily knowledge within the “wilderness experience,” and the possibility that alternative understandings will deepen our awareness of a human-wilderness relationship. The role of the body as an important link to the physical world within the “wilderness experience” may become a more immediate conduit (e.g., smelling the rain or pine needles, hearing the songs of the birds or touching the softness of a feather) and for creating knowledge about the wilderness. “The boundaries are more like membranes than barriers as they define a surface of metamorphosis and exchange” (Abram, 1996). Lakoff and Johnson (1999) provide linguistic and neuroscientific evidence that reason arises from the nature of our brains, bodies and bodily experiences, and they argue that traditional philosophical strategies are not complementary with this evidence. They explore metaphoric structures of language based on bodily orientations (for example, up/down, front/back or in/out) and claim that the very structure of reason is “shaped crucially by the peculiarities of our human bodies, by the remarkable details of the neural structure of our brains, and by the specifics of our everyday functioning in the world.” If, as they argue, “abstract reason builds on and makes use of forms of perceptual and motor inference present in ‘lower’ animals” (Lakoff & Johnson), then reason places us on a continuum with other animals and is universal in that it is a capacity shared by all human beings. What narratives would emerge if we could imagine a dynamic and personal interconnection with nature? What

stories would we draw if we seriously respected “dancing the world into being” or “singing the sun to rise?” What picture would be painted if we could sense the movements of animals outside our vision? The body becomes the very means of entering into relation with all things and participating in the here-and-now of the fathomless and wondrous events of the wilderness.

Whether autonomous or interconnected, abstract or sensual, detached or interwoven, metaphors for self are a reflection of the limitations within the human organism. Orlie (1997) suggests that an embodied, individual living entity is a “limit experience,” that is, the limitlessness of life can only be experienced through the limited. Whatever and whoever an individual is reflects a process of limits. The limits are unavoidable and reflect the contingent aspects of life. “Limit experiences are heady and disorienting. They reveal the contingency of what selves and the world are made to be, and they throw into question all guides for action and the necessity of their effects” (Orlie, 1997). Attending to diversity strengthens and enhances narratives, moves us toward multiple levels of cognition and helps sustain ethical knowledge from differing standpoints.

The Currents of Postmodernism

Juxtaposing postmodernism to the North American wilderness metanarrative provides another set of insights and transfigures wilderness discourse. Postmodernism is not a specific theoretical position, but an intellectual trend that touches philosophy, architecture, the graphic arts, dance, music, literature, literary theory and education, among many. As a cultural phenomenon, it has such features as the challenging of convention, the mixing of styles, tolerance of ambiguity, acceptance (indeed celebration) of diversity, innovation, change and emphasis on the constructedness of reality. Within philosophical postmodernism, there are multiple viewpoints and a constant debate about the “true” postmodern approach to life and inquiry. One wonders if there can be an “expertise” in postmodernism, although there are scholars who display a greater depth of understanding or analysis such as Braidotti (1994), Butler (1992), Derrida (1997), Flax (1992), Foucault (1984), and Lyotard (1984). Given the postmodern style and proclivity to disrupt the “givenness” of life, it is tempting to avoid or ignore the postmodern critique. However, the postmodern analysis has resonated with individuals and groups most often outside powerful whitestream forces; hence, the importance of addressing the critique of postmodern scholars. One of the fundamental challenges of postmodernism is its challenge to metanarrative’s claims about straightforward, transparent and accepted ideas and knowledges of existing concepts or powerful bodies. The fluidity within the postmodern construct of reality requires participating in the discussions to expose ourselves and respond to a whole family of related outlooks and approaches (Beck, 1993).

Although I claim no expertise in postmodern perspectives, some major guideposts are relevant. Postmodernism represents an erosion of faith in the so-called “Enlightenment Project,” which linked rationality of human promise and the conviction of ongoing progress (Greene, 1993). A common characterization of postmodernism comes from Lyotard

(1984): "Simplifying to the extreme, I define *postmodernism* as an incredulity toward metanarratives." Postmodernism would deny the possibilities of metanarratives related to "wilderness experiences," and reject as monolithic and hegemonic the ones that North Americans have embraced and see them as creating power forces of oppression, movement, and resistance.

However, "incredulity" is the more fascinating and unexpected word. Incredulity is not denial or rejection or refutation; *it is an inability to believe*. Incredulity replaces notions such as "denial" and "refutation" with notions such as "doubt," "displacement," "instability" and "uncertainty" (Burbules, 1993). Applying a postmodern critique to wilderness and "wilderness experience" leads to doubting wilderness as inevitable, as a given, or as the only way to sustain life in natural areas. The postmodern doubt acknowledges that we must learn to live with the positive and negative consequences of all narratives including, and especially, the North American wilderness grand narrative and become accountable for the material consequences of the metanarrative. Therefore, social circumstances such as cultural diversity, certain dynamics of asymmetrical power that distort and compromise even the best of human intentions, and particular ways that discourse colors and shapes our ways of living and being in the world lead the postmodernist to doubt whether doing more and more of what we are doing, even when it might be a *good* thing, will solve our problems, settle questions of truth or right and wrong or even make people's ways of living better (Burbules, 1993).

Although postmodern analysis focus on discursive or constructed aspects of reality, they do not necessarily deny an independent existence of humans, flora, fauna or land forms. Postmodernists see reality as more complex than we had previously imagined. Reality does not exist objectively, "out there," simply to be mirrored by our thoughts. Rather, it is in part a human creation. We mold reality in accordance with our needs, interests, biological capabilities, prejudices, and cultural traditions. Reality is not *entirely* a human construction. Knowledge is the product of an *interaction* between our ideas about the world and our experience of the world. Therefore, our experience is influenced by our concepts, and we see things (physical and nonphysical things) through cultural lenses. Meyer (1998) through a description of Native Hawaiian epistemology would add the role of the invisible or "spirit world" in knowing. Both positivist and postmodern views do not substantially address the potential for this presence. The influence of the discursive is not all-controlling, for the entities "talk back," and we have been mistaken. We thought the world was flat, for example, but were obliged eventually to change our minds (Beck, 1993). Postmodernists posit the textual or discourse field as powerful with material implications that mediates our understanding of the empirical world. These material implications are bound with who gets the right to interpret whom, who has access to resources and power and what view holds salience.

In the early years, the wilderness movement was a relatively small, active group of people resisting whitestream forest practices that favored logging and industry. Currently, the forces for wilderness bridge differing perspectives. There is a strong current in wilderness management and protection housed within powerful

whitestream institutions (such as, U.S. Park Service, U.S. Forest Service, or Parks Canada) that employ dominant, culturally bound concepts related to Euro-North American culture. Other groups move along a continuum between creating resistive practices and paralleling dominant societal patterns related to socio-economics, white culture, and privileged access. Most of the groups associated with wilderness management, designation, and protection have received criticism from people on the margins (such as African-Americans concerned with environmental racism). In current wilderness organizations, practices and scholarship, the lack of substantial representation from various nondominant perspectives leads to the invisibility of the positions or reinterpretations from the dominant perspectives. In many political and policy arenas, supporting evidence for arguments, policy changes, and management strategies must follow a specific, positivist, Euro-North American process that privileges objective, measurable, and detached knowledge, which is often contrary or inimical to positions on the margin.

Questions related to the interaction between discursive representations and empirical realities are questions yet unresolved even among postmodern theorists. Such differences, contradictions, and tensions demand ethical analysis and decision-making.

Postmodern scholarship has brought into question the "wilderness experience" and challenges "the givenness" of any particular metanarrative from dominant North American discourse. Playing with multiple interpretations and discourses, postmodernism can expose unintended but material forces of society, groups and individuals. Postmodernism as another form of analysis is a process of infusing power into our theories, ethics and understandings of "wilderness experiences," thereby providing more alternatives while acknowledging that all actions create both harm and good, exclusion and inclusion, oppression and resistance. Postmodernism is not a form of resolution, but a process of questioning and analyzing.

Other Rhythms of the Confluent Currents

Scholars within traditions aligned with Aboriginal, Indigenous and multicultural heritages are wary of postmodern critiques, partially because of the exclusion of a spiritual or invisible world (that is, postmodern critique remains completely within a rational, Euro-North American tradition). Meyer (1998), in a study of Native Hawaiian epistemology, noted that spirituality is a "domain of experience," and conduct between gods and humans are a part of knowledge. Underwood Spencer (1990) found similar patterns within Oneida tradition. This discussion is beyond the parameters of the analysis undertaken herein; however, it is a perspective that creates an opening for critiquing the absence of an independent, spiritual world and related epistemological processes and structures within whitestream Euro-North American discourses on wilderness. Notice that the form of analysis within the paper holds its own paradox as it critiques but replicates the Euro-North American paradigm (rational, solitary, autonomous, detached, cognitive and empirical) in the critique.

Epistemologies connected with Aboriginal peoples also open another view of human-nature relationships, ethical behaviors and meanings of experience. Many of these traditions are “nature-inclusive” (Underwood Spencer, 1990), view embodiment within a spiritual world and redefine “use” (Allen, 1999; Meyer, 1998; Underwood Spencer, 1990) as an organic, interactive and respectful relationship. Furthermore, authors within these traditions have produced critiques of dominant metanarratives useful for expanding awareness, for understanding positive and negative consequences and for bridging shifting boundaries. Reading, understanding, working along with and becoming open to the critiques of authors along margins and borders spotlight dimensions of a center (that is, the dominant North American view of wilderness experiences) never noticed before, and largely because they are consciously looking from the border.

The Challenge Within the “Wilderness Experience”

I suggest that “wilderness experience” is a category we cannot live without, because it connects some people to wilderness, is a force within today’s society and carries a constructed historical reality with material consequences. Furthermore, it is typically taken for granted in ways that ought not to be (Scott, 1992). The process of creating and sharing meaning from “wilderness experiences” requires language, metaphors of self, nature, human beings and cultural frameworks. Although “wilderness experiences” and meaning need to be seen as separate but intertwined components, “wilderness experience” and language (and discursive realities) must be seen as integral. “Wilderness experience” is at once always already an interpretation *and* is in need of interpretation. What counts as “wilderness experience” is neither self-evident nor straightforward; it is always contested, always therefore political (Scott, 1992).

If we are concerned with ethical action, accept the complexity of the world, and acknowledge that all actions have negative and positive consequences, then ethical decision-making must include multiple perspectives and accountability for the limitations of being human. The North American wilderness metanarrative has nurtured a profound relationship between many white Euro-North Americans and nature while leaving invisible the work of people on the margins or allocating resources away from priorities established by people of other cultural heritages. Engaging other critiques allows us to honor our tradition, look for changes in future action, and address the concerns of others.

Therefore, the metanarrative and constructed realities of “wilderness experiences” become the tools of analysis; they are not fixed or universal patterns that prescribe or determine what a “wilderness experience” ought to be. The wilderness grand narrative becomes an obstacle to moral and meaningful interaction if it *presumes to replace individual and contextual reflection about the meaning of “wilderness experiences.”*

We cannot rely solely on the theoretical use of intelligence to construct rules or frameworks that will obviate the need to re-re-examine the meaning of “wilderness experiences” in a changing, contingent world. Experience-oriented writings

about “wilderness experiences” are valuable, not because they provide direct access to truth, but because they bring into public discussion questions and concerns about the metanarratives of “wilderness experiences,” including those usually excluded in dominant ideologies (Stone-Mediatore, 1998). We must engage in processes that nurture critiques from those who have been harmed; we must find avenues for material interactions with people who have different priorities; we must negotiate and adjust so the field itself includes those who will be most critical.

Even though the experience of “others” may not seem present or relevant (that is, African-Americans did not write specifically about wilderness), Morrison (1992) suggests that the act of enforcing racelessness in discourse is itself a racial act. Morrison (1992), in *Playing in the Dark*, explores how language powerfully evokes and enforces hidden signs of racial superiority, cultural hegemony and dismissive “othering” even when the theme is not devoted to any of these aspects. Using American literature, Morrison (1992) explores questions such as: When does racial “unconsciousness” or awareness of race enrich interpretive language, and when does it impoverish it? How do embedded assumptions of racial (not racist) language work in the [wilderness] enterprise that hopes and sometimes claims to be “humanistic?” An analysis of literature and scholarship associated with wilderness and “wilderness experience” is much needed given the recent advances in African-American, Native American, First Nations, and feminist scholarship.

Morrison (1992) challenges the validity or vulnerability of a set of assumptions conventionally accepted by scholars and critics and circulated as “knowledge.” This knowledge holds that traditional, canonical literature and information is free of, uninformed and unshaped by the four-hundred-year-old presence of Aboriginal, First Nations, Native Americans, Africans, African-Americans or Black Canadians (among others) in North America. It assumes that this presence—which shaped the body politic, the laws, and the entire history of the North American culture—has had no significant place or consequence in the origin and development of that culture’s literature, scholarship, politics (the controversy over the role of Riel and Confederation is an excellent example) or leisure movements. Moreover, such knowledge assumes that national characteristics emanate from a particular “Americanness” or “Canadianness” that is separate from and unaccountable to this presence. The contemplation of this nonwhite presence is central to any understanding of our wilderness understanding and should not be permitted to hover at the margins.

Another factor for race as a marginal actor within wilderness is the pattern of thinking about racialism in terms of its consequences on the victim—of always defining it asymmetrically from the perspective of its impact on the object of racist policy and attitudes. Very little time or energy is directed toward the impact of racism on those who perpetuate it. There is no escape from racially inflected language. There are ethical problems with omission as well as commission and race receives a kind of willful critical blindness from whitestream scholarship and practice in wilderness and “wilderness experience.”

Morrison (1992) then intersects race, freedom and slavery which is relevant to the concept of freedom inherent within concepts of “wilderness experience” and autonomous selves.

The concept of freedom developed in North America was described as “beginning anew,” exploring unbridled nature and creating new lives; this freedom also brought a fear of boundarylessness, fear of the absences of civilization and the terror of human freedom. The fear and terror, within North American literature, scholarship and psyche, becomes intimately connected to people who are black. “The ways in which artists—and the society that bred them—transferred internal conflicts to a “blank darkness,” to conveniently bound and violently silence black bodies, is a major theme in American literature...The concept of freedom did not emerge in a vacuum. Nothing highlighted freedom—if it did not in fact create it—like slavery” (Morrison, 1992). Cultural identities are formed and informed by a nation’s literature, and that what seemed to be on the “mind” of the literature in North America was the self-conscious but highly problematic construction of the North American as a new white man (Roosevelt, 1909). Even when texts are not “about” Africa, African-Americans, Black Canadians, Native Americans or First Nations, the shadow hovers in implication, in sign, in line of demarcation. An analysis of the literature, scholarship and practice surrounding wilderness and “wilderness experience” would make visible the harm and benefit of the development of wilderness.

We cannot forestall the loss of strict definitions or move to diverse narratives, and we cannot do much better than strive for some reciprocity among incommensurable ideas and points of view (Greene, 1993). Whether it is Welch’s (1990) “material interaction,” Arendt’s (1997) “public arena,” Orlie’s (1997) “living ethically and acting politically,” or Dewey’s (Boydston, 196-1991) “democratic processes,” *the emphasis is on certain ways of interacting with others in the world, certain kinds of communities and certain kinds of communication. The moral agent is conceived as a participant in a network of relations in situations* (Pappas, 1998).

However, participating or working materially with others, especially those with alternative and challenging positions, does not guarantee the emergence of critical knowledge. Critical knowledge from a perspective grounded in Euro-North American rationality develops only with the struggle to be accountable for both the harm and good of our actions, to address mechanisms of oppression and exclusion and to resist or consciously choose social and cultural norms. It is the arduous and creative process of remembering, reprocessing and reinterpreting lived experience in a collective, democratic context—and not the mere “substitution of one interpretation for another”—that transforms experience, enabling one to claim subjecthood and to identify the material consequences of decisions imbued with power, to claim ethical purchase, and to support oppositional struggles (Stone-Mediatore, 1998). For instance, stories of wilderness experiences and protection need to include more attention to how African-Americans have been harmed by the designation of wilderness areas, how the definitions of self and wilderness experience undermine Indigenous ways of knowing and interacting with natural areas, or how nature can be defined to include humans and their artifices.

In this confluence, wilderness and “wilderness experiences” are viewed as resources for confronting and renarrating the complex forces that constitute the experiences, individuals, groups, material consequences and cultural structures. The tools of analysis require that historical

accounts and scholarship remember and rewrite specific lived experiences, including particular painful experiences of cultural confusion throughout academic, institutional, political, literary and cultural interactions. The process requires the courage to confront the forces weighing choices and actions, and the initiative to contribute to forces of change, resistance, and subversion. As “wilderness experiences” are rewritten as part of a common understanding across diversity, they begin to contribute to the collective memory that honors, respects and protects wilderness, sustains political communities, highlights multiple themes or limit experiences, brings into relief paradoxical forces, and allows us to navigate the confluences (Stone-Mediatore, 1998).

Final Remarks for Entering Confluences

The insights from scholars in the currents of postmodernism and seldom heard perspectives open space for viewing dominant discourses related to “wilderness experiences” from various and multiple perspectives. These commentaries highlight the partiality of the metanarrative, the material consequences from the inherent power of dominant discourses, and the alternative strategies for beginning anew. A notion of “wilderness experiences” inspired by Mohanty (1991) facilitates oppositional discourses and consists of tensions among experience, language and situational knowledges. These tensions are endured subjectively as contradictions within “wilderness experiences.” Stories that reckon with and publicize contradictory, hitherto muted aspects of “wilderness experiences” are ‘between past and future,’ enable us to envision and work toward alternative futures. As an individual committed to human rights, I am acutely aware that I have never shared a wilderness experience with someone of a non-Euro-North American heritage. I practice minimum impact camping in the wilderness but am part of the one-third of the population that uses two-thirds of the world’s resources.

Returning to the concepts inherent in the original Greek and Roman Cynics, cynicism is related to the pursuit of happiness. The cynics argued that genuine happiness must involve critical self-knowledge, virtuous action and a deep mistrust of external goods like wealth, reputation and social convention. As Kingwell (1998) states:

They were sharply critical of ignorance, however, blissful, and favored the literary genres of diatribe and polemic to shock their listeners into an awareness of society’s many somnambulant features. Radical, satirical and iconoclastic, the Cynics believed that lasting satisfaction was to be found only in overcoming the cheap temptations of the cultural marketplace and in calling society to moral account. They were prickly, yes, but not dismissive. They advocated self-mastery and reform, not destruction or hopelessness. They were happy.

Looking more closely at wilderness and “wilderness experience” grand narratives, engaging in feminist and critical commentaries, embracing racial analyses or applying critiques from the margins will lead to explicating invisible and complex forces with material consequences. Changing the frames of reference to something more eclectic, redefining

the entities we identify as subject and devising methods of reasoning moves us toward enhanced understandings about wilderness experiences. Connecting knowledge with power, Aboriginal peoples, African-Americans and Black Canadians, and many other voices on the margins have sketched the responsibilities attached to knowledge and power. Honoring this insight, we may begin to understand how our actions will have repercussions far beyond the merely psychological, personal or social, because everything may be infused with the sacred. Responsibility of power requires living differently from others in our community, and for people who place great value in a homogeneous community, this demand can make life difficult, if not painful (Allen, 1999). The cynic posits that it is in the self-mastery and reform that allows happiness to bloom.

Wisdom arises from "wilderness experiences" and thoughtful reflection when we consciously blend experience, knowledge, critique, choice, and understanding. Allen (1999) sees knowledge, understanding, and choice as dependent on two characteristics: autonomy and honesty. Autonomy and honesty depend on vulnerability, on fragility.

If the metanarrative of wilderness and "wilderness experiences" is problematized and set adrift among other currents, what is the point of narratives? Because they're ours. But what if such an answer becomes less and less convincing.

Pondering risk-taking, he says that you cannot change humanity, you can only know it. "Pride makes us long for a solution to things—a solution, a purpose, a final cause; but the better telescopes become, the more stars appear. You cannot change humanity; you can only know it (Barnes, 1985).

This, for me, is a postmodern ending, articulated by someone whose narrative I somehow achieve as meaningful against my own lived life and through reading, and participating, is forever incomplete. I am saddened with the changes and loss of earlier traditions and narratives, for they have given much meaning to my personal "wilderness experiences." On the other hand, I am also saddened with the loss of the voices of Native Americans, First Nations Peoples or African-Americans, among others who contributed to my privilege related to wilderness, and I am committed to highlighting their visibility in my scholarship, classrooms and political participation. The life, health and survival of the flora, fauna and land now requires moving into the confluences and leaning into the currents. How compelling are the stories of people and groups who take responsibility for all of the values they bring to their stories and actions. How stunning is the achievement of those who have searched for and mined a shareable language for the words (Morrison, 1992). I make this a tale of a search for meaning while navigating powerful confluences, trying—in a flow without eddies—to keep moving, to keep asking, to keep trying to create an identity, to resisting thoughtlessness, and to renewing wilderness experiences.

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An Ecosystem Approach to Management: A Context for Wilderness Protection

Paul A. Gray
Robert J. Davidson

Abstract—Sustainable development, ecosystem management and ecosystem health are three prominent catch phrases that now permeate the scientific and popular media, and form the basis of a growing number of private sector, government and academic programs. This discussion paper briefly explores the definition and application of these concepts as a context for wilderness protection programs by arguing that the idea of “sustainable living” is preferred over “sustainable development” as a vision for the future, an ecosystem approach to management is one method by which sustainable living might be achieved, and that an ecosystem approach to management must provide for a balanced spectrum of human activities that cumulatively contribute to ecosystem health.

Organisms derive their existence from the ecosphere, and humans are no exception. People depend on Earth, her processes and resources to survive. But unlike the other 10-30 million species, humans have evolved the ability to transform unprecedented numbers and amounts of ecosystem services and products. Insignificant and isolated at first, human endeavor had little influence on the ecosphere, but the rates at which, and methods by which, people currently consume resources are jeopardizing ecospheric health and the long-term future of humankind. For example, in the past, wilderness surrounded people as encompassing, roadless and untouched areas. Today, remaining patches of wilderness have been relegated to the more remote places on Earth. The existence of wilderness now depends on human goodwill and associated actions.

Many agree with the need to recast the ecospheric-human relationship. Over the past 20 years, jurisdictions around the world have acknowledged that the altering power of unchecked human endeavor needs to be brought into balance with Earth's metabolism. For example, global reciprocity was provided some tenure as an element in the controversial and much debated concept of sustainable development articulated by the World Commission on Environment and Development in its report, “Our Common Future” (World Commission on Environment and Development 1987). Predictably, the popular, scientific and agency literature has exploded with ideas, guidelines and recommendations to

assist in the quest for initiatives (such as ecosystem management) that will lead to a new ecospheric-human relationship. This discussion paper briefly examines the definition, relationship and application of sustainable development, ecosystem management and ecosystem health as a context for programs such as wilderness management.

Sustainable Development (Sustainable Living)

Sustainable development is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development 1987). It is an unfortunate catch phrase. To sustain is to keep, to preserve, to continue to maintain something (Shields and others 1993). Generically, the word is linked to the idea of well-being, but carries a different meaning for each person, a function of individual values, perspectives, education and life-experiences. And when linked with “development” in reference to ecospheric well-being, its meaning is further clouded by the conflicting concepts and paradoxes that result.

Some people identify more with the “sustainable” part and work in support of efforts devoted to ecological and social transformation. Others identify with “development” and interpret it to mean a redefined version of the *status quo* (Wackernagel and Rees 1996). From this perspective, the World Commission on Environment and Development's definition (and its derivatives) has been challenged because, among other concerns, many suggest it advances an anthropocentric and utilitarian perspective that underwrites a recipe for perpetual growth (industrial development, for example), continued deterioration of ecosystems and loss of constituent biological assets (Dovers and Handmer 1993; Pearce and others 1989; Rees 1990; Robinson 1993; Robinson and others 1990; Willers 1994). Many of the questions that have emerged from the examination of, and associated debates over, sustainable development are about values and beliefs that ultimately guide human behavior in the finite ecosystems that provide the products, services and experiences required for life—sustained life. While admittedly anthropocentric, the ideas associated with the concept of “sustained life” are perhaps more tenable because they signify balance—balance between the people who draw from and use Earth's processes and resources to survive and the ecosystems of which they are a part. Accordingly, sustainable living is envisioned as an ecosphere filled with healthy ecosystems and healthy people—a condition or state of

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Paul A. Gray is a Policy Advisor, Natural Heritage Section, Lands and Natural Heritage Branch and Robert Davidson is a Conservation Geologist, Ontario Parks, Ministry of Natural Resources, 300 Water Street, Peterborough, Ontario, K9J 8M5, Canada, e-mail: paul.gray@mnr.gov.on.ca; bob.davidson@mnr.gov.on.ca

ecospheric-human balance that society predicts can be attained and maintained.

While the concept of sustainable living can serve as the basis for an optimistic vision of (a prediction about) the future, it does not provide the means or the path to get there. Despite the limitations of the original concept(s) of “sustainable development,” the associated debates have highlighted the need to examine human conduct in the ecosphere. For example, in the decade following publication of “Our Common Future,” the literature has been populated with reports on initiatives that examine the notion of culture as the primary cause and possible cure for Earth’s ecological ills (one of the paradoxes), managing for uncertainty, intergenerational and intragenerational equity, individual versus collective interests, empowerment, the adaptive ability of humans and their institutions to cope with change and the sustainable scale of the human economy relative to the life-support system(s) upon which that economy relies (that is, what are the ecospheric limits to growth?). But how do we transform these issues and ideas, and any decisions about them (for example, to protect or not protect wilderness) into tangible action in, on and above Earth’s landscapes and waterscapes? An ecosystem approach to management is one available path.

The Concept of an Ecosystem Approach to Management

Fundamentally, an “ecosystem approach” is based on the idea that if humans subscribe to and apply an appropriate set of values and are equipped with the required knowledge and tools, they can protect and maintain ecosystems, derive a quality existence from them and simultaneously ensure that opportunities for future generations are retained (Gray and others 1995, 1996). An ecosystem approach is an adaptive process that employs a suite of integrated programs to care for Earth’s natural assets by managing our relationship with the other components of ecosystems and ensuring that our perceptions, values and behaviors work in support of ecosystem function. It is an encompassing process that captures the range of cultural, social, economic and ecological values that ultimately define human-ecosystem relationships (fig. 1). An ecosystem approach to management is a method that can assist committed people in their efforts to keep landscapes and waterscapes working (Merriam 1994)—an absolute requirement for the attainment and maintenance of healthy ecosystems and healthy people and a necessary prerequisite for successful wilderness protection programs.

“Management” is a sweeping, generic term for the cadre of tools and techniques we use to meet our objectives and attain our goals. It is a controversial aspect of human endeavor and a frequent focal point of conflict because, as traditionally applied, it has failed to account for the range of values and philosophies held by the variety of peoples who comprise Earth’s cultures and societies. For example, the neoclassical utilitarian’s approach to management is radically different from the emergent eco-centrist’s perspective and approach. In addition, the term often is used to imply that people understand the complex nature of ecosystem composition, structure and function when, in fact, we do not. Is ecosystem

management possible? No, not now, or in the near future. But an ecosystem *approach* to management is an encompassing endeavor that:

- Captures the range of cultural, social, economic, and ecological values that ultimately define ecosystem-human relationships
- Requires decisions be made in the context of ecosystems as holistic entities with many natural assets, not individual resources
- Is sponsored by flexible, adaptive, accountable and learning-oriented institutions
- Is participatory and knowledge-based
- Is dynamic and adaptive so that the impacts (positive-neutral-negative) of human actions are identified, monitored and constantly evaluated against prescribed measures of healthy ecosystems and healthy people
- Results in a balanced spectrum of human activities (ranging from complete protection to active manipulation of natural assets) that are at least impact-neutral.

Historically, protected areas have been designated and managed as isolated patches of land and water. Early in the 20th century, this approach worked in many ecosystems because of the relatively remote and pristine nature of large tracts of land (such as the northern and mountainous reaches of North America) and the limited use of surrounding areas. However, this condition no longer exists in most jurisdictions—land use pressures now require protected areas to be linked and managed in concert with decisions that impact entire landscapes and waterscapes. The idea of a protected area system plan is simple enough—protected areas such as wilderness parks must be cared for in the context of the ecosystem(s) of which they are a part. Design and implementation of the system plan, however, is much more complex. So how do we organize ourselves to develop and implement effective and accepted systems management plans and area management plans that ensure the continued existence of the values for which a wilderness area is protected? Strategic, tactical and “on-site” management plans fill our bookshelves and our hard drives. They provide thousands of useful ideas and recommendations that implicate all sectors of society. But many are limited by organizational frameworks that constrain a society’s ability to adequately cast natural assets (including humans) within an ecological context and to identify, explore and wisely employ the full

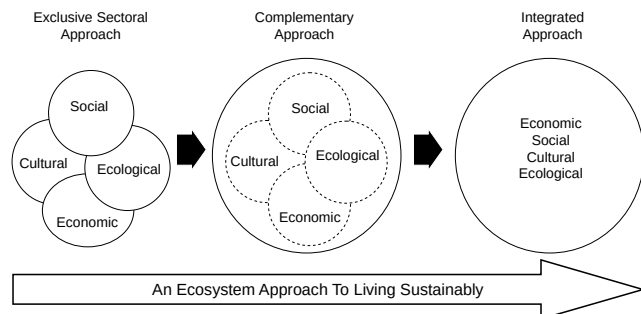


Figure 1—Sustainable living requires that society move from an exclusive sectoral approach to valuing and using natural assets to an integrated approach.

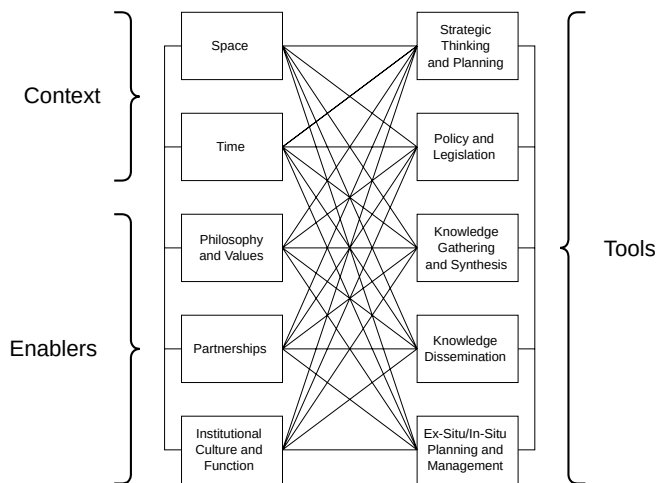


Figure 2—An ecosystem approach to management framework. The modules are linked and often employed simultaneously or in unison to develop and deliver ecologically-based programs (e.g., wilderness protection) (adapted from Gray and others 1995).

spectrum of social conditions and forces that determine human behavior and impact ecospheric function. In this paper, we suggest that wilderness management programs can be enhanced by commitment to, and application of, a unifying, ecologically oriented framework comprised of three themes and nine interrelated modules (fig. 2):

- A. An ecologically meaningful spatial and temporal *context* in which to manage human activity in the ecosystem. It requires that we:
 1. Define and describe Earth's ecosystems in-space-in-time and align our decisions and actions accordingly
- B. The appropriate *enabling* mechanisms, including:
 2. A philosophy and corresponding suite of societal values that enable natural asset managers to take effective action
 3. Institutional cultures and structures that sponsor proactive and integrated programs
 4. Programs involving all sectors of society as partners and participants in decision-making processes
- C. The appropriate suite of *tools* to help us understand Earth and to guide human behavior in, on, and above her landscapes and waterscapes. Accordingly, society must sponsor:
 5. Useful data and information gathering and management programs (such as research, inventory, monitoring and assessment) to advance our knowledge of ecospheric function and human impacts
 6. Knowledge dissemination through life-long learning opportunities that are accessible and current (education, extension, and training programs)
 7. Strategic thinking and planning to identify, establish and modify short- and long-term direction
 8. Policy, legislation, and regulation to guide society in adoption and attainment of sustainable lifestyles
 9. In-situ and ex-situ planning and management techniques designed to protect the pieces, the patterns and the processes.

The importance of a commitment to care for Earth's natural assets cannot be overstated—it is a critical element of any successful initiative. But commitment is meaningless in the absence of an integrated, unified and practical protocol for action. The modules provide a basis to identify the appropriate questions and organize the suite of programs (ecosystem description, research, inventory, policy development, on-site protection, etc.) required for implementation. Detailed description and analysis of each module is beyond the scope of this paper. And while all modules are important, establishment of an ecologically meaningful spatial framework (a physical context) is a fundamental requirement for successful implementation of an ecosystem approach to management. Accordingly, the following section summarizes a few ideas about the definition and description of ecosystems.

Ecosystem Defined

Our ideas about an ecosystem approach to management are based on the concept that Earth operates as a series of interrelated systems, within which all components are linked. Rowe (1961), Bailey (1996) and many others argue that an ecosystem is a definable entity that has currency as a context in which to pursue sustainable living objectives – it is a recognizable chunk of Earth space, in which the flow of energy and the transformation of matter in-space-in-time create networks of organisms (such as plants and animals, including humans), atmosphere, rock, soil and water, interacting with each other and with other ecosystems. As the fundamental context for wilderness management, ecosystems are used as bounded, geographic units of the landscape, waterscape and airspace that include all natural phenomena.

Why use an ecological perspective, a relatively new and little tested technique, as the spatial context within which to pursue sustainable living objectives and associated programs like wilderness protection? After all, over the last few thousand years, societies throughout the world have invested significant resources in the creation of spatially based jurisdictional or administrative (for example, country, province, district and township) and thematic (such as mineral resources, species habitat, protected areas and forested land) units to define their relationships with other societies and Earth's natural assets. The simple fact is that ecosystems have sponsored life for billions of years. And no society, however well endowed with knowledge and technology, can escape the reality that life derives from the ecosystem and her constituent ecosystems—life does not equal organisms; life equals organisms plus the ecosystem(s) upon which they depend (Rowe 1992a). And sustained life, through appropriate long-term management of human activities in, on and above Earth's landscapes and waterscapes, depends on our success at identifying the interrelationships between the natural assets that comprise each ecosystem—understanding ecosystem composition, structure and function (fig. 3).

In contrast to jurisdictional and thematic units, the ecosystem provides an integrating framework within which natural asset managers can work to address the spectrum of cultural, social, economic and ecological factors and forces. Now that human actions have created significant impacts of continental and global proportions, an ecological context is

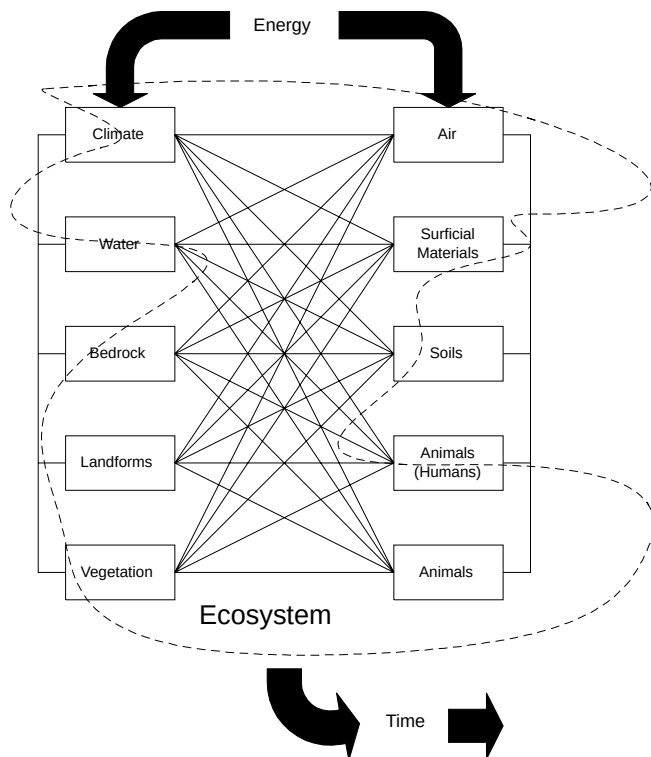


Figure 3—The forces and factors that create and shape ecosystems. The dashed line represents the permeable ecosystem boundary through which various forms of energy come and go. In this regard, it is important to recognize that ecosystems constantly change in space and time.

increasingly required to scope out and understand the issues, establish partnerships and design appropriate management programs.

Ecosystems can be very large (indeed, the ecosphere is the largest earthly ecosystem) and very small (a pond, for example), where the smaller ecosystems fit into the larger ecosystems. This hierarchical organization has been described as “successively encompassing levels of interacting components or units” (Grobstein 1974) that constitute a system of “discrete interactive levels” (Pattee 1973). An hierarchical approach helps us perceive complex systems by dividing them into understandable levels. Natural asset managers must be able to make decisions about human activities in ecosystems of all sizes, which requires that they know the location of ecosystem boundaries. The task of spatially and temporally delineating and describing ecosystems is called ecosystem classification (in Canada, the national program is referred to as ecological land classification).

Each ecosystem is unique and complex, and its boundaries exist as a gradient between neighboring systems. This presents natural asset managers and users with a problem. How can we hope to understand ecosystems in all their complexity and diverse shapes and sizes if they are all different? Fortunately, advances in ecological theory, analytical techniques and spatial technologies now permit managers to apply integrated and interactive ecosystem delineation tools and techniques (see Rubec [1992] and Sims and Uhlig [1992] for a summary of some programs). While not perfect by any

means, scientists and managers have identified criteria and rules with which to define and describe ecosystems as recognizable chunks of space-in-time (fig. 4). The criteria are based on the factors and forces that create and shape ecosystems (see fig. 3). For example, the boundaries of large ecosystems can be delineated by integrating climate and landform patterns, while smaller ecosystems can be identified through examination of soils and vegetation patterns.

The Concept of Ecosystem Health

A principal indicator of sustainable living is ecosystem health. But what is it, and can society protect wilderness by maintaining healthy ecosystems, or vice versa? Are wilderness and ecosystem health convergent or divergent concepts? In its simplest terms, health measures system performance

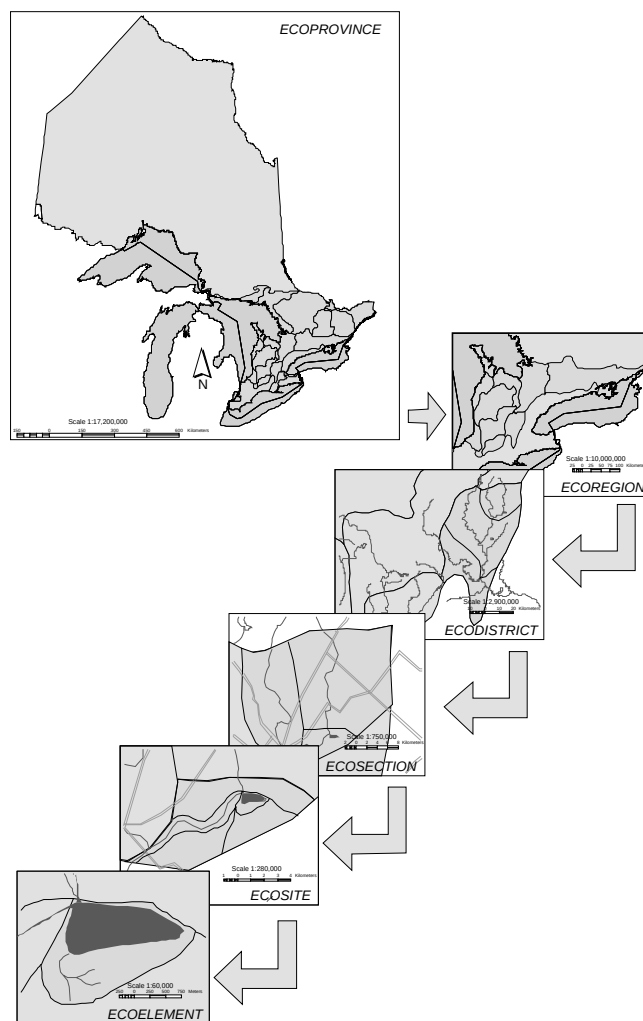


Figure 4—Using the national Ecological Land Classification terminology, this spatial simulation model demonstrates how ecosystems of varying size and shape are related to each other in ladder-like levels. Use of this type of classification system allows natural asset managers to design and deliver programs within an ecologically meaningful spatial framework.

through the behavior (function) of its parts (composition and structure) (Costanza and others 1992). Costanza and Patten (1995) suggest that a system is sustainable if and only if it persists in a nominal behavioral state as long or longer than its expected existence time—that it attains its full expected life span within the nested hierarchy of systems in which it is embedded.

While most people immediately and correctly equate ecosystem health with lots of indigenous plants and animals relative to the ecosystem(s) in which they evolved, abundant clean water, forests and wetlands, there is more. Humans are an important part of the ecosphere. From this perspective, Rapport (1995) characterizes ecosystem health as a measure of the level of distress in the ecosystem, the ecosystem's resilience to perturbation, the ecosystem's ability to sustain itself, the degree to which an ecosystem's function does or does not impair the healthy functioning of adjacent ecosystems and the extent to which the ecosystem supports healthy human communities. Therefore, ecosystem health is an integrated combination of cultural health, social health, economic health, and ecological health (fig. 5).

Does a healthy ecosystem equal wilderness? No, not necessarily. It depends on the state or condition of ecosystem health to which we aspire. In this regard, ecosystem health has operational meaning only when it is defined in terms of a desired state or condition for that ecosystem—a condition or state that we predict can be achieved and sustained. For example, society may elect to pursue activities conducive to the protection of wilderness (such as the creation of wilderness parks and strictly controlled ecotourism activities inside them), or sustained yield of timber, or agricultural products, or all of these. Each prescription requires unique decisions that result in the evolution of a unique ecosystem (Lackey 1994). Similarly, Rowe (1992b) asks to what extent should we maintain natural (areas designated for preservation—in

some cases wilderness), semi-natural (areas in which resources are managed for sustained use), artificial (devoted to high input, intensive use such as farming and forestry) ecosystems, and to what extent do we establish restoration and rehabilitation programs for entire ecosystems? These questions are, of course, critical to visioning, establishing goals (such as healthy ecosystems and healthy people) and setting management objectives (such as wilderness protection targets). And, in large part, the answers are contingent upon a commitment to, and decisions respecting attainment of, a prescribed level of ecosystem health.

Summary

Most people now live in ecosystems that have been degraded and impaired to some degree, and societies throughout the world continue to accumulate natural debt to which the ecosphere has begun to respond. Recognition that the cumulative effects of human activity require mitigation is one of many factors contributing to a global call to change the ways people think about and work the Earth – a call to repair what is broken and degraded and to maintain and/or protect what works. Accordingly, societies around the world are exploring the type of change required and the ways of implementing it. Routinely, this change is expressed through the lofty concepts of sustainable development, ecosystem management, and ecosystem health – three prominent catch phrases that now permeate the scientific and popular media, and form the basis of a growing number of private sector, government, and academic programs. In this regard, the protection or enhancement of remaining wilderness will depend on a conscious commitment to it, on adoption of sustainable living as a vision of the future, and on the development and implementation of an encompassing, ecologically oriented approach to management.

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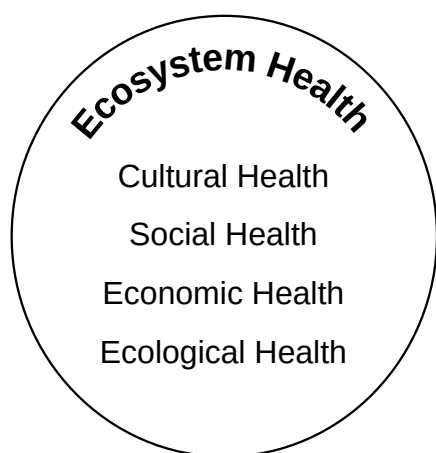


Figure 5—A commitment to sustainable living and implementation of an ecosystem approach to management strives to establish a balance between Earth's ecosystems (ecological health) and the people who live in them (cultural, social, and economic health). Therefore, ecosystem health is an integrated combination of cultural health, social health, economic health, and ecological health.

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Science, Economics, and Rhetoric: Environmental Advocacy and the Wolf Reintroduction Debate, 1987-1999

Dayle C. Hardy-Short
C. Brant Short

Abstract—This paper examines the arguments employed in the debate over reintroduction of wolves into Idaho, Montana, and the Yellowstone National Park Ecosystem; and in Arizona and New Mexico. The study reviews common rhetorical themes used by advocates and opponents of wolf reintroduction and identifies a significant rhetorical shift in the debate. Advocates opposed to wolf reintroduction have turned to scientific appeals in their efforts to shift public opinion; on the other hand, proponents of reintroduction increasingly use aesthetic arguments and personal narratives in their public discourse.

In his classic book, *The Singing Wilderness*, Sigurd Olson described a winter night encounter with two timber wolves in Minnesota. “Although thrilled to hear them once again,” wrote Olson, “I was saddened when I thought of the constant war of extermination which goes on all over the continent.” Reflecting on the hatred of wolves that he witnessed throughout his life, Olson concluded, “I wondered if the day would ever come when we would understand the importance of wolves. . . . We seem to prefer herds of semidomesticated deer and elk and moose, swarms of small game with their natural alertness gone” (Olson 1957). Olson did not live to see the great shift in how many Americans think about wolves. “To many,” observed naturalist Robert Busch, “the wolf *is* the very symbol of wilderness, the symbol of freedom, and a reminder that there is Something Out There stronger than ourselves” (Busch 1994). But those who distrust the wolf are equally opinionated. “They’re vicious animals, and they kill for fun,” said one Idaho rancher. “Wolves will kill cows and sheep before going after wildlife—but they’ll also kill domestic dogs, coyotes, and spawning salmon” (in Brock 1995).

The cultural hatred of wolves that guided wildlife policy during most of the 20th century and that led to the extermination of nearly all wolf populations in the continental United States was firmly rejected by the passage of the Endangered Species Act of 1973. According to the *Harvard Environmental Law Review*, when a species is listed as endangered the Federal Government “has an affirmative

duty to utilize means necessary for bringing the species back from the brink of extinction” (Bader 1989). But the case of the wolf presents some unique questions for those who must create, implement and enforce wildlife policy. What happens when a species has become extinct in a given location? Does the federal mandate extend to *reintroducing* a species, even if it is not considered endangered in other regions? Does reintroduction of a species threaten the ecological relationships that have developed since the extinction? Can a species declared extinct ever be restored to its original population? Although scientists are eager to present their responses to such questions, the final answers can only emerge in a complex debate that addresses the political, economic and social consequences of such actions.

Our purpose is to examine the continuing public debate that began in 1987 regarding the reintroduction of the Rocky Mountain gray wolf into Idaho, Montana, and the Yellowstone Ecosystem, as well as the debate over the reintroduction of the Mexican gray wolf into parts of Arizona and New Mexico. We believe that this particular environmental debate is unique in two significant areas when compared to other wildlife controversies, especially those that concern the protection of endangered plants and animals. At one level, the wolf debate centers on the concept of *reintroduction* rather than *preservation*, altering the rhetorical situation which guides and constrains public argumentation. Nearly all other species named by the Endangered Species Act inhabit the geographical area where they are protected. Wolves, however, are being placed into ecosystems where they were declared extinct; or they are being protected as they recolonize other areas. At another level, the debate concerns attitudes toward and treatment of a wild animal with which humans have deep emotional ties, both positive and negative.

These two differences have fostered a compelling change in public argumentation, which we define as the claims and evidence used by advocates to shape the beliefs and attitudes of the general public. While historical opposition to wolves centered around Old World fears and hatred of the animals, contemporary anti-wolf advocates have increasingly focused upon *scientific*, *economic*, and *political* arguments. In contrast, the early advocates for wolves in the 20th century, conservationists like Aldo Leopold and Sigurd Olson, argued for ecological harmony and scientific balance. But the supporters of wolf reintroduction have increasingly turned to personal narratives, anecdotes and aesthetic appeals. A significant theme in recent pro-wolf discourse is an explicit construction of wolves as human-like creatures; advocates are anthropomorphizing this species. Opponents, too, have claimed the wolf has evil human traits; but we argue that the

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Dayle C. Hardy-Short is Associate Professor of Speech Communication and C. Brant Short is Associate Professor of Speech Communication, School of Communication, Box 5619, Northern Arizona University, Flagstaff, AZ 86011 U.S.A., e-mail: dayle.hardy-short@nau.edu, brant.short@nau.edu

contemporary focus of supporters and opponents has shifted from traditional strategies. This shift may have occurred as a way to adapt to the opposition, but leaves supporters and opponents still arguing about different issues.

In order to illuminate the rhetorical dimensions of the wolf reintroduction debate, this essay reviews the issues surrounding the management of wildlife, especially concerns related to the wolf. Next, we explore the status of the Rocky Mountain and the Mexican gray wolf and plans to reintroduce this species in the West. Finally, we analyze the debate itself and evaluate the rhetorical strategies used by various advocates on both sides of the issue. We believe that this analysis merits interest at two levels. For those who study environmental issues and public policy, this paper will help explain the process of policy-making in a consequential and unique case study. For those who study public discourse, this paper will reveal how advocates use different forms of argumentation based on the demands of the situation.

It is important to note that we do not purport to assess either the validity of scientific management methods used in current reintroduction efforts or the evidence offered by opponents. Rather, we focus on how proponents and opponents of reintroduction present their arguments to public audiences. Toward that end, we examine arguments advanced in public statements such as essays, speeches, interviews, books and pamphlets, all discourses that address a general audience. We claim that, ultimately, all issues related to environmental management are decided by public, and therefore political, argument rather than by scientific information. Without the scientific information, decision-makers have no logos for their claims, but without interpretation of such information by partisans, policy cannot be made.

Of course, implicit in this claim is an assumption that policy *should* be made about certain issues. Consistent with Aristotle's claim, all advocates use the available means to persuade policy-makers of appropriate choices by employing the three classical genres of rhetorical proof. Arguments of pathos focus on popular emotions about wolves. Opponents portray them as conniving and thieving, while proponents paint them as family-oriented and loving. Arguments of ethos focus on the motives of those proposing and opposing introduction. Opponents claim proponents do not care about economic losses, while proponents claim opponents are selfish and uncaring about future generations, of maintaining nature the way it was meant to be. Arguments of logos focus on what scientific research shows us to be true about wolves. Proponents point out that wolf packs mimic human families, while opponents point to the number of sheep and cattle lost to wolf predation.

Wolves, Wilderness, and Wildlife Policy

Throughout the 20th century, the value of wilderness and wildlife has been an issue of contention at the local, state and federal levels of government. Numerous works have detailed the historical and contemporary development of wilderness policy (see, for example, Hays 1975; Nash 1982). Rather than reiterate those accounts, we will instead explore the place of the wolf in American culture. From the very beginning of

wilderness policy, certain animals took precedence for preservation. "The good animals—the fishable, huntable trophy animals—had a bureau devoted to their protection; the bad ones did not," noted Limerick (1987). "In fact, the bad animals were attacked by the government. . . . Ranchers joined hunters in condemning the nonhuman carnivores, and government rallied to the cause—trapping, poisoning, and shooting." Chase detailed the history of predator killings in Yellowstone National Park and quoted from Vernon Bailey, who in 1915 set up a predator control program in the park. Finding "wolves common, feeding on young elk," Bailey wrote, "their numbers have become alarming. . . . It is strongly recommended that the Biological Survey continue their campaign in this region without abatement until these pests are greatly reduced in numbers" (Chase 1987). Chase cited other Yellowstone officials to reflect the evolution of Park policy in regard to predators. Writing in 1932, the Park Superintendent noted, "We have always assumed that the elk and the deer and the antelope were the type of animals the park was for. . . . To me a herd of antelope and deer is more valuable than a herd of coyotes" (Chase 1987). In response to criticisms of the predator control program in 1930, the Director of the Park Service Stephen Mater claimed, "In Yellowstone, if Mr. Albright didn't kill off his 200 to 300 coyotes a year it might result in being the developing ground for the coyotes and wolves spreading out over the country and the cattle or sheep men getting much greater losses than they ordinarily would" (cited in Chase 1987). By the early 1930s, most cougars and wolves were gone from the park, exterminated because of their predatory nature. The attitudes of those who controlled Yellowstone Park were common throughout the region; predator control programs flourished in the West in the 1920s and 1930s. According to one source, between 1884 and 1918 in Montana, 80,730 wolves were killed for cash bounties (Carey 1987); and between 1897 and 1908 in Wyoming, 10,819 bounties were paid for wolves (Watkins 1987). By the 1950s, "the wolf was no longer seen in the Rockies in packs. The survivors were loners, most likely subdominant individuals that had dispersed from packs in Canada" (Steinhart 1988).

With the rise of an "ecological conscience" in the 1950s and the development of environmentalism in the 1960s, wildlife preservation became a popular theme. Two of the animals associated closely with the American West, the bear and the buffalo, received special attention. As Limerick observed:

The sentiment of the nineteenth century had fixed on buffalo and bears as the representatives of Western animals. The vast numbers of the buffalo and the strength of the grizzly were both emblems of Western distinctiveness--of the power and magnetism of Western nature. Into the twentieth century, those two animals remained symbols of the 'real West'; their survival was a central statement that intervention came in time, before the real West was entirely lost; and past and present remained linked in the continued life of the West's classic animals (1987).

Unfortunately for the wolf, no such romantic cultural images were found in white society. Indeed, the wolf presented a frightening image for many, probably because of Old World legends. According to one authority, "the wolf has consistently personified the darkest side of the human race. . . . Babylonians and Greeks spun yarns about supernatural wolves that devoured human souls; Dante used the animal

as a symbol of greed in the *Inferno*; and today, we flock to see werewolves on the silver screen” (Carey 1987).

Native American culture, however, viewed the wolf very differently. In their book profiling prominent wolf researchers, Mike Link and Kate Crowley discussed Native beliefs about wolves. With the exception of the Navajo story about the relationship between witches and wolves, native views of the wolf are quite positive (Link and Crowley 1994). Other conservationists also contrast European views with Native views (Busch 1994, McIntyre 1993). As Colorado Senator Ben Nighthorse Campbell pointed out, “according to the traditions and myths of my own people, the American Indian, the wolf was not to be feared . . . Rather, the wolf was respected and revered, for his intelligence, his family and even ‘tribal’ orientation, his cleverness, and his coordinating skills in the hunt.” Referring to wolves as “our wild cousins,” he added that “people can learn valuable lessons from these animals and that wolves deserve the same reverence and good will to which we accord the buffalo and the beaver, the bear and the eagle” (in McIntyre 1993).

Given the historic domination of white over Native society, it is not surprising that wolves were systematically destroyed in the American West with little public outcry. Not until the 1970s did society seriously reconsider the consequences of the wolf extermination, and as Senator Campbell pointed out, reconsider the traditional Native view of the wolf (in McIntyre 1993). In fact, the positive characteristics Senator Campbell attributes to the wolf are the same characteristics used by contemporary advocates of reintroduction.

The Politics of Wolf Reintroduction

In 1975, the Northern Rocky Mountain Wolf Recovery Team was set up to study methods to reintroduce the gray wolf in the Rocky Mountain region. The group had representatives from the U.S. Fish and Wildlife Service, the National Park Service, and other state and federal authorities (Owens 1988). After 12 years of research, public comment and analysis, the Northern Rocky Mountain Wolf Recovery Plan was completed in 1987. The ultimate goal of any recovery plan is eventually to *delist* the particular species from endangered and threatened status. Each plan must contain an “Implementation Schedule” which specifically identifies the organization or agency task assignments, priorities, and funding necessary to achieve the declared objectives (Bader 1989). In the case of the gray wolf, the planning team set up a specific list of criteria for reintroduction sites and three areas were designated as appropriate locations: six million acres in central Idaho, the Bob Marshall ecosystem in Montana, and the Greater Yellowstone ecosystem.

The plan evoked an immediate outcry in the region as ranchers and hunters joined forces to oppose the reintroduction, particularly that planned for the Yellowstone system. The controversy was further fueled by public remarks made by Frank Dunkle, the director of the U.S. Fish and Wildlife Service. In September 1987 he reportedly told a timber industry meeting that he “would not allow the Fish and Wildlife Services to fund any wolf recovery work. ‘The wolf stops at my desk’” (cited in Bader 1989). Later that year, the

Casper [WY] Star-Tribune quoted Dunkle as telling the Wyoming Wool Growers that “the only wolves I will bring to Wyoming or that I will sponsor to Wyoming. . . are on [my] tie” (cited in Bader 1989). Although no formal change in the wolf recovery implementation plan was made by Dunkle, the *Harvard Environmental Law Journal* claimed that Dunkle’s negative comments “effectively reverse[d] the Recovery Plan” (Bader 1989).

Ironically, at the same time in 1987, red wolves, the ancestors of the gray wolf (McIntyre 1993), were being reintroduced into the wild in North Carolina (Rennicke 1999) in what has become a highly successful effort (Hochberg 1998). By the mid-1970s, the red wolf population was so decimated that some wolves were mating with coyotes. In an effort to save the species, biologists identified 17 full-blooded red wolves and successfully bred 14 of them. From that small population, the red wolf group grew; this led to the release of four breeding pairs into the Alligator River National Wildlife Refuge in late 1987, with additional releases in later years (McIntyre 1993). This effort appeared to have significantly less opposition and publicity than the Yellowstone effort and is described as “incredibly successful” by one biologist associated with the program. “And it has been a model for endangered species restoration in general. It’s a real success story for conservation” (Kelley in Hochberg 1998). Now, however, with the red wolf population thriving, some complaints that the wolves are “harassing and killing livestock and pets and other wild animals as well” are emerging. Despite this, “one survey concluded that in the five North Carolina counties where wolves live, most residents are in favor of the program” (Hochberg 1998).

Other areas in the U.S. have been recolonized by wolves. In Wisconsin, where the last “documented” wolf was “hit by a car, then bludgeoned to death with a tire iron” in 1958, some people began reporting wolf sightings in 1975. The wolves “simply walked back,” moving in from Minnesota where the wolf population was increasing because of protection by the Endangered Species Act. The Wisconsin Department of Natural Resources reports approximately “178 to 184 wolves in 47 packs” in its most recent count (Rennicke 1999). Minnesota is well-known for its—relatively speaking—healthy wolf population of 2000-2400 animals that descended from southward-migrating wolves. The wolf’s status in Minnesota is officially “threatened,” and it may soon be removed from the Endangered Species List (Rennicke 1999). Wolves have also migrated from Canada into Glacier National Park, and now number about 85 in northern Montana (Rennicke 1999). Most recently, the U.S. Fish and Wildlife Service stated that “reintroduction of gray wolves to the Olympic Peninsula is feasible” via Olympic National Park (“Gray Wolf Reintroduction” 1999).

But the controversy surrounding wolves in Yellowstone has been heated since inception and has escalated as more groups entered the reintroduction debate. Although supportive of the plan, William Penn Mott, the Director of the National Park Service, announced in 1987 that the plan would be put on hold until approval was gained from the congressional delegations of Idaho, Montana, and Wyoming (Watkins 1987). In response to the actions by Mott and Dunkle, Congressman Wayne Owens of Utah introduced a bill in the U.S. House of Representatives to restore wolves to Yellowstone Park within three years. According to Owens,

the bill was intended to provide “a thorough public discussion of the wolf issue,” which had been blocked by opponents (Owens 1988). In July 1989, Owens introduced a second bill, requiring an environmental impact statement to examine the ecological impact of wolf reintroduction in Yellowstone Park. The bill directed the Park Service to complete the impact statement by the end of 1991 and then implement some form of reintroduction within six months (“Bill Calls” 1989).

Opponents responded to the growing public sentiment in favor of wolves at various levels. For example, at the request of Senators Malcom Wallop of Wyoming and Conrad Burns of Montana, the Interior Department ordered the National Park Service to stop distributing “Wolf Pac,” a series of articles regarding wolves and the issues of reintroduction. According to one source, critics claimed that the materials “fail to adequately address possible adverse effects of wolf reintroduction, such as local livestock losses and effects on public recreation” (“Yellowstone Wolf” 1990). In April 1990, the National Park Service banned sales of a poster depicting wolves in Yellowstone Park from retailers in both Yellowstone and Glacier National Parks. Some individuals believed that the posters were an implicit endorsement of wolf reintroduction.

In order to reconcile supporters and critics of the recovery plan, Senator James McClure of Idaho introduced a compromise bill into the U.S. Senate in May 1990. McClure’s bill would have placed three breeding pairs of wolves in the Idaho and Yellowstone locations but would also have “delisted” them as endangered once they roamed outside the core areas (“McClure Says” 1990). This plan would allow ranchers to shoot wolves legally if they threatened livestock, an action illegal under other recovery policies.

Both supporters and critics of wolf reintroduction were suspicious of McClure’s bill; finally, a compromise was reached by a House-Senate committee in October 1990. A ten-member committee representing different interests was created in order to formulate a recovery policy and submit it to the Secretary of the Interior by May 15, 1991. According to the legislation, once the “wolf management committee” made its recommendations, Congress would have final approval of the policy (“Diverse Group” 1990).

Although planning for reintroduction of wolves continued, a number of lawsuits were filed by ranching and agricultural groups, who sought to block the return of the wolf because it threatened their livelihoods. In January 1995, a federal judge in Wyoming denied an injunction requested by the American Farm Bureau and the Mountain States Legal Foundation, thus opening the way for the wolf release. Finally, after another attempt to block the reintroduction in the courts was rejected, four wolves were released in Idaho on January 15, 1995. School children in Idaho painted radio collars for the wolves and also provided names for them, including “Moon Star Shadow, a two-to-three year old;” “Chat Chaaht, a 76-pound, four-to-five year old dark gray male;” “Akiata, a dark gray-black, 75 pound three-year old;” and “Kelly, an 82 pound five-old dark gray female” (Barker and Burns 1995).

In much the same way the Mexican gray wolf finally gained reintroduction into Arizona and New Mexico. In March 1998 the first 11 wolves were released into the Southwest; but between their release and November, five of

the wolves were shot to death, and two are presumed to be dead. As of March 15, 1999, “in addition to the six wolves still roaming the wild, 11 Mexican wolves are being held in acclimation pens in the Blue Range Wolf Recovery Area” (“Defenders Applauds” 1999). In May 1999 biologists released 14 more Mexican gray wolves into a remote section of the Apache National Forest on the Arizona-New Mexico border. Transported initially by helicopter, the wolves were placed in specially designed saddlebags and carried by pack mules to a site more isolated than the earlier wolf releases (“Group Decides” 1999).

Public Arguments in Favor of and Against Wolf Reintroduction

The public debate concerning wolf reintroduction in Yellowstone National Park began in 1987, when the Recovery Team presented its final report to the Director of the U.S. Fish and Wildlife Service. While critics of the plan focused initially on logical appeals utilizing political and economic arguments, supporters tended to rely on logical appeals utilizing ecological arguments based in aesthetics (such as the logic of wholeness, completeness, naturalness, or balance). Peter Steinhart typified such a response. “What seems most thrilling about the return of wolves is the possibility that listening to their nighttime howls,” he wrote in *Audubon*, and “receiving their cold yellow gaze through the gloom of pines, provides a chance to cross into an unseen world” (1988). Congressman Owens claimed that an urbanized society must have areas “where natural forces still predominate, where bison graze freely and grizzly bears roam unrestrained.” Lack of wolves in the park, concluded Owens, makes the Yellowstone experience incomplete (1988). Photographer Jim Brandenburg observed, “the wolf represents knowledge of nature that we’ll never have. The wolf seems to know something that the other animals don’t understand” (cited in Steinhart 1988). Rupert Cutler, president of The Defenders of Wildlife, told *The New York Times*, “The wolf is a symbol of the American wilderness and represents all we have lost in 200 years of exploitation of nature in America” (Shabecoff 1990).

For many advocates, reintroduction of wolves makes sense from an ecological perspective. “Nature has a way of striking a balance between animals and their food sources,” wrote Congressman Owens, “but, without wolves in Yellowstone, that balance has been disturbed” (1988). In a letter to the *New York Times*, Michael Robinson argued that mountain lions and grizzly bears were not “enough to keep the elk population down” in Yellowstone Park (1989). Indeed, the National Park Service reported that “wolf kills could improve the health of [elk] herds, which often grow too large to be sustained in the restricted range of the park” (Shabecoff 1990). In a published debate on wolves in *Outdoor Life*, Gregory McNamee summarized the importance of the ecological argument. “The environmentalists won because reputable biological opinion is undivided: Wolves play an essential role in the forest ecosystem, a role that does not admit stand-ins” (McNamee 1997).

Since 1995, when implementation of wolf recovery finally began, there appears to be less emphasis on ecological appeals and more discussion of the bonds that wolves and

humans share. For many supporters, the wolf evokes strong emotional images of humankind, and reintroduction thus becomes highly personal. One wolf researcher told a National Public Radio reporter “things about wolves that I did not know at all—how social they are for instance.” In the report, aired nationally, Diane Boyd described wolves in these highly admiring terms:

They have a pretty structured social ranking system: dominance hierarchy prevents a lot of hassles such as, in human cultures, jealousies, murders, divorces, those sorts of things. They seems to have worked it out. They're a good family. They take turns all helping raise the young. They hunt because they have to. They aren't doing it for recreation. And they play, and they seem to have a sense of humor (A. Chadwick 1996).

In another national forum, the pages of *National Geographic* magazine, Douglas Chadwick also portrayed wolves in human terms. “Their family structure more closely resembles ours than do those of primate societies,” wrote Chadwick. “Loyalty and affection toward kin are two of a wolf's most observable characteristics. Curiosity is another. The way wolves learn, communicate, and amuse themselves stretch our definition of animal capabilities” (D. Chadwick, 1998). In seeing wolves as models for human behavior, researchers tend to name the animals, creating an even closer bond. One researcher told Chadwick that biologists were instructed to avoid naming specific animals to “avoid any hint of attachment.” Yet two paragraphs later, while observing a wild wolf, the researcher told Chadwick, “I guess that's not Two. It has got be Joey. . . I mean Number 56” (D. Chadwick, 1998). College students in Wisconsin who help on a wolf research project have nicknamed the animals they observe as “Fred” and “Jude.” Fred, who was the “star of the program,” disappeared and was never found. His mate was found dead after being hit by a car. And Jude, who had been captured and re-released, was found dead near her den, pregnant. “It was a tough loss,” according to the research leader, Dr. Jack Stewart of Northland College. “You try to keep some scientific objectivity with these wolves and not develop a relationship that's too personal, but sometimes that's impossible” (Rennicke 1999). Yet even in the most celebrated event of wolf reintroduction, the first wolves to be released into the Idaho wilderness had acquired names from school children in the state.

The emotional response that advocates have when they hear or see wild wolves has become a prominent feature of their discourse. Kevin McHugh, of The Defenders of Wildlife, reported his response to the howling of the Mexican gray wolves. “I can't describe a pack's howling. I believe that it is a personal experience that no one can describe. . . . The song hits me on a deep, emotional, level. Twice I have stood there and had my breathing become short and jerky during the song” (1998). Just imagining the howling wolf will lead to their acceptance, claimed one advocate. Arguing for the reintroduction of the Mexican gray wolf, Wayne Suggs, Jr. of the Mexican Wolf Coalition concluded, “to hear a wolf howl in the wild invokes the deepest emotion for those who can feel it. They'll help put the wild back into the wilderness” (Bordonaro 1995).

Opponents of reintroduction have used a variety of persuasive strategies to shape public opinion. Most significant, they have attacked wolf recovery at political, economic and

scientific levels of analysis. Although political and economic concerns have been common themes in recent environmental debates, scientific evidence has usually been marshalled by those seeking ecological protection.

The alliance opposing wolf reintroduction includes the Wyoming, Montana and Idaho Farm Bureaus and the region's wool growers and cattle growers. Although some hunters have voiced objections, hunting organizations have not systematically attempted to prevent reintroduction. The opposition focused on the plan to reintroduce wolves into the Yellowstone ecosystem, and less so on the plan to manage natural recovery of wolf populations in the Selway-Bitterroot Wilderness in Idaho and Montana and the Bob Marshall Wilderness in Montana. The difference between the first area and the other two is that Yellowstone National Park is ringed with human development, including farming and ranching areas. In addition, opponents argued that the wolf was extinct from Yellowstone already and that to reintroduce it into the park would be tantamount to “play[ing] God” (“The Genetic Dilemma” 1990).

The Montana Farm Bureau's main objection to reintroducing wolves in the Yellowstone area was that “every place that wolves have been found, they have been associated with the killing of livestock” (“Position Paper” 1990). Despite the success of the model program set up in Minnesota, where farmers and ranchers are monetarily compensated for loss of livestock due to wolf predation—primarily sheep and cattle (see Steinhart 1988)—Yellowstone area livestock growers have argued that compensation is not enough, that they “need flexibility to manage” their livestock by killing “problem animals” themselves (Cecil and Richert 1990). Furthermore, despite the claims of the National Park Service that it would attempt to reintroduce the wolf only after seeking “a political consensus” and then addressing “socioeconomic considerations and local concerns,” area opponents argued that potential livestock losses “may seem immaterial to someone who lives in New York” (Shabecoff 1990). “Wolf introduction is not a national question,” Idaho Farm Bureau President Thomas Geary testified before the Senate, “it is an intensely local issue” (Tracy 1990). One area rancher argued that local control was important and reported being afraid—not of the wolf, but of “the wolf's bodyguard—the federal government” (quoted in Cecil and Richert 1990).

But in addition to the simple and obvious economic objection to reintroduction, the three Farm Bureaus presented a more complex argument, which appears to go to the heart of the Endangered Species Act. “If we introduced a pure bred gray wolf into the Yellowstone and Central Idaho,” the Idaho Farm Bureau claimed, “we might actually lead to the demise of the wolf” (Press Release, Idaho Farm Bureau Federation 1990). According to the *Endangered Species Technical Bulletin* (1990), “biochemical analyses of tissues from 72 Minnesota gray wolves (*Canis lupus*) indicated that more than 50 percent may contain mitochondrial DNA from coyotes (*Canis latrans*). If this is true, these hybrids can only be the result of male gray wolves mating with female coyotes.” Farm Bureau spokespersons seized on the report's conclusion that “this has serious implications for the conservation of pure gray wolves in Minnesota” (*Endangered Species Technical Bulletin* 1990), as a way of using the Federal Government's own research findings to halt the recovery

and reintroduction plans. The three Farm Bureaus filed a petition with the Secretary of the Interior, Manuel Lujan, and John Turner, the Director of the Fish and Wildlife Service, to remove *Canis lupus* from the Endangered and Threatened Species List, as well as to review its status. The gray wolf, the petition argued, “may not be genetically pure because of hybridization with coyotes” and claimed a review of the current scientific literature “indicates that scientists have suspected hybridization between wolves and coyotes for some time.” These research findings, argued a spokesperson from the Wyoming Farm Bureau, proved that “there are scientific questions which need to be resolved” because of the “questions hybridization creates with an animal which cannot be protected under the aegis of the Endangered Species Act” (Bourret 1990). The Idaho Farm Bureau argued that the wolf to be reintroduced, the Northern Rocky Mountain Wolf, was a subspecies of the gray wolf, extinct in Yellowstone although plentiful in other regions. Thus, the Bureau concluded, any other subspecies placed in Yellowstone would be nonnative and such placement would be “contrary to management policies” of the Endangered Species Act (Tracy 1990). In addition, since the gray wolf has apparently cross-bred with coyotes in Minnesota and elsewhere, introduction of any “pure” gray wolf in Yellowstone risked hybridization in the Rocky Mountain West, thus jeopardizing survival of the breed. Farm Bureau opponents concluded that because *Canis lupus* is plentiful elsewhere, protection of the breed mandates *not* placing the wolf in Yellowstone (Tracy 1990).

To bolster its claim that wolves and coyotes have cross-bred and thus become disqualified as an endangered species, the Farm Bureau petition chose “what we consider to be an appropriate scientific name for the cross between a coyote and a wolf. That name is ‘*Canis irregularis*.’ The common name we have selected is ‘woyote’” (Bourret 1990). Without acknowledging that these two terms had no basis in actual scientific decisions, the Farm Bureaus used the labels in their articles and pamphlets about wolves, with the result that some newspaper editorialists adopted the terms as legitimate. The original Farm Bureau petition admitting that it had “selected” this name for hybrid wolves, was altered in a Wyoming Farm Bureau pamphlet to read that “a more realistic name for the wolf-coyote hybrid would be the ‘Woyote,’ *Canis irregularis*” (“The Genetic Dilemma” 1990). By the time this argument was repeated in one rural Idaho newspaper, it had become a discussion of “trying to protect not only wolves, but coyotes and a new group *that has been dubbed the ‘woyote’*” (emphasis added, “Gray Wolves Not Extinct” 1990).

The U.S. Fish and Wildlife Service argued that DNA analysis of western wolves showed no evidence of cross-breeding, and refused to remove the wolf from the Endangered Species list (“Wolf Delisting Denied” 1991). Although this specific attempt to turn scientific research against wolf reintroduction failed, it was again used by wolf opponents in their effort to block the release of Mexican gray wolves into the Southwest. In December 1998, a coalition of ranching groups, including the New Mexico Cattle Growers and the New Mexico Farm and Livestock Bureau, filed suit asking that future wolf releases be stopped. “The lawsuit contends that even without recent releases of wolves, the rare animals already inhabit portions of New Mexico and Arizona. And the lawsuit contends Mexican gray wolves are contaminated

with the genes of dogs and coyotes” (“Enviro Groups Can” 1998).

As a result of four public hearings, the Wolf Management Committee designed a plan that would “place up to 10 breeding pairs of wolves in Yellowstone, Glacier and central Idaho wilderness” and would allow states to “manage the species” as “experimental [and] nonessential” in other areas. The committee held three additional hearings for comments on the proposed plan (Davis 1991), although it had already forwarded the plan to the Interior Department and Congress (“Wolf Meeting Set” 1991). The meetings drew typical testimony from both supporters and opponents of wolf reintroduction. Supporters worried that the proposed plan “would allow ranchers to shoot wolves at will and weaken the Endangered Species Act,” while Montana Congressman Ron Marlenee “vowed, ‘no wolves, no way, nowhere’” (“Wolves Should Be Listed” 1991). Both sides opposed the plan. A representative of the Wolf Recovery Foundation argued that “the rancher becomes judge, jury and executioner without fear of penalty from destroying an endangered species.” But one rancher said “we do not want either the grizzly or the wolf but if we must have them, then take them from the endangered species list so we can protect our livestock” (Ratliff 1991). By “delisting” wolves from the Endangered Species List once they leave designated introduction areas, the committee created what it saw as a compromise. But by defining the wolf as “nonessential” outside these areas, the committee gave ranchers permission to destroy the animals if they determined that they were losing livestock to wolves.

Jim Zumbo charged that pro-wolf advocates view the animals as “romantic figures. We yearn for the primitive, the natural, the world that existed ‘before our time’” (1997). But in Zumbo’s opinion, this perspective will in fact diminish the long-term health of the wolf population. Zumbo has opposed wolf reintroduction for many years and used the pages of *Outdoor Life* to take his case to the sporting community. He reported that wolves were already in the Yellowstone ecosystem prior to government intervention, and they should be allowed to reestablish their populations naturally. Utilizing a scientific perspective, Zumbo argued that the “wild wolf in the Rockies is genetically different than the wolves” that come from Canada. “By diluting the Yellowstone gene pool,” Zumbo concluded, “we’d effectively cause the pure American wolf to become extinct” (1997). Zumbo also turned to science to describe the adverse impact wolves will have on big game populations. He cited research indicating that one wolf kills an average of “one big-game animal—or the equivalent weight in smaller animals—about every four days.” For Zumbo, the logical conclusion is troubling.

A pack of 10 wolves kills the equivalent of 75 big-game animals per month. Extrapolate that number to 100 wolves—the Yellowstone objective—and that population would kill the equivalent of 9,000 big-game animals a year. And that’s only the beginning (Zumbo 1997).

Discussion

In previous environmental and wildlife debates, pro-nature advocates (and support of the Wolf Recovery Plan would be pro-nature) have stressed a rhetoric of logos, placing emphasis on scientific and technical justifications centered

in the aesthetics and desirability of the completeness of nature. As much as possible, these arguments have presented a world-view that does not place humans at the top of a hierarchy of good and bad animals (and other parts of nature), but instead places humans *in* the natural world, as part of it. On the other hand, pro-human arguments (such as opposition to the Recovery Plan) have utilized a rhetoric of logos centered on economic and political concerns, issues that necessarily require all of the natural world to be managed in ways that benefit humans as humans. Part of the opposition to the Wolf Recovery and Reintroduction Plan for the Rocky Mountain West does concentrate on economic arguments. But opponents recognized that in light of the depredation compensation fund established in Minnesota, economically based arguments would not be sufficient to halt reintroduction of wolves into Yellowstone. Consequently, opponents have strategically chosen to strengthen their position by arguing from a scientific and political standpoint, using evidence gathered by wolf reintroduction supporters.

Most of the recent public argumentation for reintroducing wolves fails to detail a specific rationale for the plan. Whereas earlier pro-nature appeals focused on a logic of completeness, more recent pro-wolf discourse reveals a rhetoric of pathos. Wolves are discussed in terms of human characteristics, in a manner unlike any other wild creature. In one sense, anthropomorphizing the wolf allows humans to relate more closely to it, but in another sense, the creature is still apart from human sensibilities. One would not know this from the arguments, however. Opponents have claimed that wolf reintroduction was a “done deal,” arguing that from the outset federal officials were biased in favor of the return of the wolf; thus, most have long since abandoned arguments that wolves are evil and have instead embraced a rhetoric that focuses on numbers—numbers of livestock lost, numbers of pets lost, numbers of game animals lost. For instance, five ranchers near Salmon, Idaho have attached “transmitter-bearing ear tags” to 231 of their calves in an attempt to “prove to government biologists” that “wolves in the vicinity like the taste of beef” (“Ranchers try” 1999). As the Lemhi County Extension Agent Bob Loucks pointed out, “I keep telling [the ranchers] no one will believe you until you have proof—and your methodology has to be beyond reproach” (“Ranchers try” 1999); so the ranchers have chosen the same kind of tracking devices used on wolves. Advocates, however, speak of reintroduction in personal, aesthetic and spiritual perspectives, de-emphasizing science, politics and economics.

It appears that presumption has shifted so strongly to the notion of saving endangered species that supporters see no need to offer a detailed case for protection and preservation policies. Because wolves have been reintroduced in several areas, the debate has shifted from the value of reintroduction to the impact of reintroduction. Opponents therefore focus on losses they have suffered as a result of reintroduction, hoping either that the wolf will be removed as an endangered species, or that additional efforts will be aborted. Advocates focus on restoration of nature.

Despite the shift in presumption, proponents continue to argue in favor of the wolf's presence in the wilderness. And they do so in ways that increasingly humanize the wolf. In researching this essay, we have yet to locate publicly

distributed wolf research reports that do not in some way point out the similarities between wolf society and human society. Perhaps, as humans, we are incapable of studying other species without comparing them to ourselves; and if we identify traits we view positively, we cannot avoid wanting to see more of those traits—and therefore of those animals. At least part, if not much, of our ambivalence about wolves may be that each time we look into our dog's face, we see her “wild cousins,” the wolves. One children's book points out that “scientists tell us that the domestic dog is descended from the gray wolf. Some breeds . . . certainly do look wolfish. Others, however, like the Pekingese or the Boston terrier, have been bred to look quite unlike their immediate ancestor. Yet, even these have been blessed with a wolf's nature. And it's a good thing” (Ryden 1994). The author goes on to detail why, and the characteristics she highlights are those described with favor in other descriptions of wolf behavior, such as those mentioned by Senator Campbell and other advocates.

The public research reports about wolf behavior argue strongly for protection of wolves and expansion of wolf habitat; perhaps this conclusion is inescapable for those who study pack behavior. Perhaps too, those who study wolf society are keenly aware of the fragile hold the few existing packs have on life and freedom; they argue anthropomorphically to create a climate of acceptance for the wolf's presence that will prevent a return to the extermination mentality of the early days of this century. Despite the seeming inevitability of reintroduction and recolonization, human intentional extermination of wolves and human unintentional encroachment on wolf territory have endangered the wolf's existence. Those who argue from an aesthetic of completeness argue from a stance that does not place the human above the wolf, but places the human with the wolf. McIntyre made the point that “in social customs and subsistence lifestyle, wolves were the prime role models for early humans;” and he reported that in 1925, Carveth Read wrote that a human “is more like a wolf” than “like any other animal.” McIntyre added, “perhaps we should think of ourselves as naked wolves rather than naked apes” (1993).

Wildlife agency officials face a dilemma. If opponents successfully remove the wolf from the Endangered Species List in return for acceptance of breeding pair introduction into Yellowstone and elsewhere, wolves that wander outside the Park(s) can, and probably will, be destroyed. This could mean certain extinction of the species by human hands. And yet there are other biologists who argue that “natural recolonization is much better than the wolf reintroduction program that's underway now in Yellowstone and elsewhere” (A. Chadwick 1996). Recolonization seems to have occurred in the northern U.S. without human assistance, yet the Endangered Species Act protection afforded wolves in Minnesota has certainly aided potential recovery. Implicit in this argument, however, is the assumption that wolves will continue a healthy enough existence in Canada to be able to continue to move south. Should that condition change, recovery efforts in the United States will certainly be adversely affected.

If federal and state wildlife agencies prevail in wolf recovery, they will face continued opposition and, presumably, lawsuits from area ranchers and farmers concerning depredation. Eventually, long-term success of

wolf recovery means delisting the wolf as an endangered species—but opponents will claim economic hardship as a result of recovery. The place of the wolf, according to The Defenders of Wildlife, “is one of the severest tests of how willing humankind is to share this planet with other forms of life” (in Begley 1991). The wolf recovery and reintroduction controversy highlights the continuing conflict between a human-centered view of nature and a holistic view of nature, between the belief that humans must and should subdue nature for their own benefit and the belief that humans and nature must coexist for their mutual protection.

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The Arctic National Wildlife Refuge: An Exploration of the Meanings Embodied in America's Last Great Wilderness

Roger W. Kaye

Abstract—The Arctic National Wildlife Refuge has been the subject of more than 50 major studies investigating the bio-physical resources potentially threatened by oil development. This continuing project investigates the more elusive qualities at risk: the set of meanings this place holds for those who value it as wilderness. Findings indicate that these meanings may also be diminished or dispelled by the potential introduction of new technologies, public uses or management actions that leave no footprint, some as intangible as the mere naming of a mountain. A network of fourteen meanings is described to provide a framework for interpreting the wilderness experience visitors seek and discover here, and for understanding the refuge's emergence as a symbolic landscape of national significance.

In 1953, a feature article appeared in the journal of the Sierra Club extolling the wilderness qualities that two scientists found in a remote corner of Alaska. *Northeast Arctic: The Last Great Wilderness* (Collins and Sumner 1953) began the transformation of this remote, little-known section of the Brooks Range into a place internationally recognized as one of the finest examples of wilderness, the Arctic National Wildlife Refuge.

The authors, National Park Service planner George Collins and biologist Lowell Sumner, recruited Wilderness Society President Olaus Murie and his wife Margaret into an effort to seek permanent protection for the area. They were soon joined by other prominent conservationists, including scientists Starker Leopold and F. Fraser Darling, Supreme Court Justice William O. Douglas and Alaskan environmentalist Virginia Wood.

It is noteworthy that their campaign to establish the Arctic Refuge occurred at a pivotal period in American environmental history. The mid-1950s witnessed the beginnings of a new environmentalism, a perspective recognizing a far broader range of landscape values than that of utilitarian conservation.

Two key figures of this emerging paradigm strongly influenced the perceptual lens through which the refuge founders saw this area. Robert Marshall's writings about the values of wilderness, and his two books about adventuring in the

Central Brooks Range, expanded their understanding of the psychological benefits and cultural values one could experience in this landscape (Collins, personal communication 1994, 1995). Aldo Leopold, a personal friend of most of the refuge founders, was another who had a "profound effect" on the range of scientific, experiential, and symbolic values they perceived wild places to hold. Collins says that Leopold's writings gave early refuge proponents more reasons to value wilderness. "It was his ideas that we brought with us to Alaska" (Collins, personal communication 1999).

Through the late 1950s, the founding conservationists' writings inspired a growing constituency to write, speak and testify for the area's permanent protection. In 1960, the nine-million-acre Arctic Range was established by order of the Secretary of the Interior. In 1980, the Alaska National Interest Lands Act more than doubled the Range and renamed it the Arctic National Wildlife Refuge. Although only 41 percent is designated as wilderness, the U.S. Fish and Wildlife Service seeks to preserve the same level of naturalness on both sides of the unseen line separating the designated and de facto wilderness.

The refuge remains a place "where the wild has not been taken out of the wilderness," an agency brochure advises prospective visitors. "Perhaps more than anywhere in America," it continues, the refuge "is a place where the sense of the unknown, of horizons unexplored, of nameless valleys remains alive" (U.S. Fish and Wildlife Service, undated).

But what constitutes this "sense" of wildness (fig. 1)? The best-known component is the refuge's assemblage of wilderness-dependent wildlife, symbolized by the 120,000-strong herd of free-roaming caribou that evokes comparison to the buffalo of yesteryear. Another major component is the scenic and untrammelled completeness of the five major ecosystems through which the caribou move. But the brochure statement alludes to something beyond, something embodied by these biophysical qualities. It was inspired by what Olaus Murie (1959a) articulated in his congressional testimony, stating:

It is inevitable, if we are to progress as people in the highest sense, that we shall become ever more concerned with the saving of the *intangible resources*, as embodied in this move to establish the Arctic Wildlife Range (emphasis added)

Murie readily admitted his inability to "define the wilderness philosophy in human words" (p. 63). Since his time, environmental psychologists have labeled the intangibles that figured so prominently in the establishment of the Arctic Refuge as "psychologically deep," "subliminal," "preverbal," and "archetypal." Perhaps they are best summarized by Aldo Leopold's (1966) simple phrase, "Values as yet uncaptured by language" (p.102).

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Roger W. Kaye is a Wilderness Specialist/Pilot, U.S. Fish and Wildlife Service, 101 12th Avenue, Room 236, Fairbanks, AK 99701 U.S.A., e-mail: Roger_Kaye@fws.gov

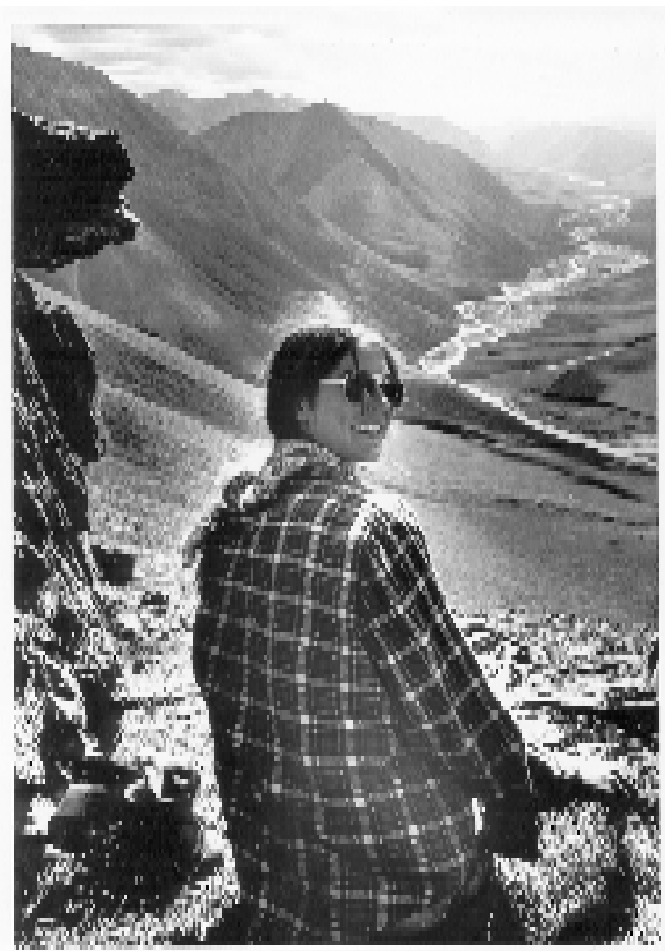


Figure 1—What constitutes wildness?

Wilderness Qualities at Risk

The hard-to-define character of these qualities challenges wilderness advocates, managers and policy makers who wish to preserve them. But as psychologist Herbert Schroeder (1996) reminds us, their elusive nature is part of their essence and strength—their mystique. Thus, this investigation proceeds with misgivings. Like the wild caribou, these qualities of wildness ought to be left alone, unstudied and unexamined. Indeed, they could be if remoteness would continue to protect this landscape. But even the distant Brooks Range is not far enough from new technologies and public and agency actions that threaten qualities that the founders believed should be timeless.

Perhaps the most intangible threat Murie resisted was the attachment of names to natural features (Murie 1959b). But recently, part of the Arctic Refuge was named for a former agency head, who by all accounts, was well liked by the conservation community. Nevertheless, as the director of a Fairbanks environmental organization put it, the name “took some of the wild out of the Refuge,” and “some ineffable quality has been lost” (Ward, personal communication 1997).

A greater threat to elusive wilderness qualities may be the potential development of “quiet” helicopters. If helicopter technology continues, the legitimizing rationale used to exclude

them (noise) from the refuge’s non-wilderness designated areas may be voided. Further, recent legislative attempts to allow helicopters in Alaskan wilderness highlight the need to consider aspects of peoples’ experience that may be altered when they know that any destination, every place along their route, could be accessed by a machine.

Visitors have also questioned the effect of new technologies that have only a temporary presence in wilderness, such as communications systems and the ubiquitous global positioning systems.

But a developing technology that may become more controversial—and raise questions that reach into the deepest philosophical and psychological underpinnings of the wilderness idea—is one that neither leaves a footprint, nor has any physical presence. Beyond anything the refuge founders could have envisioned is the computer wilderness-trip planning program proposed for the Boundary Waters Canoe Area (Lime and others 1995). It is a product of several exponentially expanding technologies converging with geographic information system (GIS) resource databases. Linked to high-resolution remote sensing imagery, this technology could reveal intimate details of wilderness areas through a few keystrokes.

Technology may soon allow users of Internet-based wilderness-trip planning programs not only to “shop” for qualities desired in a wilderness trip, but also to “order up” and view in detail destinations, routes, features or campsites with attributes specified in a visitor’s motive profile. A researcher with the Boundary Water’s project, a first-generation prototype of such a program, predicts that eventually the technology could lead to virtual reality “fly-overs” of wilderness, along with enhanced “fly-ins” for close-up views of selected features or routes. “If there is anything I can tell you about this technology,” Michael Lewis said, “the sky is the limit” (personal communication 1996).

Subjects of this study who have contemplated the prospect of *just knowing* such a technology might someday overlay Arctic Refuge have described it as “sacrilegious as playing a video game in church.” They ask what would happen to the *essence* of wildness if they knew there were no secret places, no hidden corners along their route that aren’t digitized, thus dispelling the *sense* of mystery and the experience of exploration and discovery. The Wilderness Society vice president for Alaska states flatly, “This technology is in direct conflict with what wilderness is all about” (Smith, personal communication 1997).

Purpose

A primary purpose of this ongoing investigation is to explore the system of thought and belief that underlies objections to such potential changes to the Arctic Refuge wilderness. This paper focuses on those “impacts” that would be of little tangible significance, or none whatsoever. It seeks to describe the network of wilderness beliefs, values and attitudes that have been attributed to this expanse of mountains, tundra and forest—endowing it with a sense of place and embodying it with a set of meanings that have led to its emergence as an experiential and symbolic landscape of national significance.

Methods

In seeking to grasp the underpinnings of the perception, experience and valuation of the Arctic Refuge as wilderness, this inquiry combines elements of exploratory, phenomenological, descriptive and interpretive inquiry. It draws on three sources of data: 1) the wilderness themes found in the writings of those who were most instrumental in establishing the Arctic National Wildlife Refuge, supplemented by interviews with three of them, 2) wilderness themes identified in the popular literature subsequent to the refuge's establishment, and 3) phenomenological exploration of the perception and experience of wilderness-oriented refuge visitors who serve as case studies. The concept of environmental "meanings" (Williams and Patterson, in preparation) is employed to synthesize and describe the complex, or network, of wilderness values, beliefs, ideas, concepts, attitudes, benefits and symbolic associations attributed to the refuge by these sources.

This study identified the wilderness meanings expressed in 44 writings, using the thematic content analysis procedure described by W. Lawrence Newman (1997). Nineteen writings were authored by those considered refuge founders, and 25 are more recent popular literatures: coffee-table books, travelogues, natural histories, historic accounts and testimonies. Fourteen recurring themes (meanings) emerged from analysis of these writings. Since none of the existing generic wilderness value classification systems (Driver and others 1987; Nash 1997; Nelson 1998; Rolston 1985) seemed to fully capture the set of recurring meanings associated with the Arctic Refuge, a system specific to this place was developed.

Following Tuan (1976), such writings are considered from two perspectives. First, they serve as reflections, or indices, of meanings that a place is perceived to hold. Second, they influence the formation of meanings: for visitors, they help establish a predisposition, a perceptual readiness to experience the ideas, attitudes and feelings these meanings express.

The 14 meanings are conceptualized as the basic components of a schema representation the refuge holds for those who value it as wilderness. A schema is, ultimately, a neural network with synaptic connections that are strengthened in ways that facilitate certain perceptual tendencies. It provides:

a memory structure that develops from an individual's experience and guides the individual's response to the environment . . . the schema influences the individual not sequentially through its component pieces, but simultaneously as a total mass (Marshall 1995 p.15).

The role of the meanings embedded within the "wilderness schemas" with which wilderness-oriented visitors arrive is being explored through the perceptions and experiences of five refuge visitors who serve as case studies.

These individuals, referred to as co-researchers because of the collaborative nature of the interview methodologies, represent a criterion-purposive sample. That is, they were not selected to be a representation of refuge visitors. Rather, they were chosen because they exemplify the characteristics of interest. Selection criteria provided individuals whose attitudes toward the refuge are most aligned with the purposes expressed by the refuge founders and the provisions of the

Wilderness Act of 1964. It also provided individuals who are willing to spend 15 or more hours exploring underlying belief and value structures. Non-random samples are used in such exploratory research, where the purpose is to obtain a more comprehensive understanding of a phenomenon rather than to generalize patterns to a larger population (Newman 1997).

This multi-stage inquiry began with exploratory interviews with the co-researchers and, separately, with their spouses and trip partners. The second stage continues with a series of thematic apperception exercises. This interviewing technique is an adaptation of the Thematic Apperception Test used in therapeutic psychology to elicit underlying belief and attitude structures that patients are unwilling or unable to disclose in response to more direct methods (Henry 1967; Tomkins 1947).

Each exercise presents a large photo of a wilderness visitor and a scenario describing him or her considering some aspect of the landscape, or one of the potential technologies or actions at issue. The co-researcher writes a creative essay describing that person's response to, for example, a proposal to name a mountain in the photo. Co-researchers are asked to include in their story the beliefs, attitudes and memories the person in the photo drew upon to form their opinion of the proposal. Co-researchers are assumed to project *their* attitudes and beliefs onto the person in the photo. Interviews with a pre-test group of wilderness visitors confirmed that, like patients in therapy, subjects are often reluctant to acknowledge that *they* develop beliefs or respond to issues based on feelings or emotions, but they are more likely to attribute or project those underlying elements onto another person (in the photograph).

The resulting essays are thematized, and the themes (meanings) that emerge are explored thorough a series of probing, dialogal interviews. The development of questions, and the interpretation of responses, is aided by reference to the conceptual and empirical findings of a number of specialities within the area of environmental psychology.

Wilderness Meanings Associated With the Arctic Refuge

Fourteen meanings emerged from the three data sources. Four are widely associated with wilderness in the popular literature, are readily understood by managers and decision makers, and are recognized in Arctic Refuge planning and management documents (U.S. Fish and Wildlife Service 1988, 1993). These common meanings recognize the Arctic Refuge as: 1) a place for wildlife, particularly for species not tolerant of civilization, or tolerated by civilization; 2) a place of scenic values; 3) a place of scientific values; and 4) a setting for recreational activities.

Ten emergent meanings are more elusive. Their role in the establishment of the refuge, and in the experience, perception and valuation of it as wilderness, are less well understood by managers and decision makers. Each of these are briefly described by representative quotations from the historic and popular literature and interviews with co-researchers.

In considering these meanings, please keep in mind that the importance of each varies widely among individuals. No attempt was made to evaluate the relative influence of each

because, as elements of a schema structure, none operates in isolation. While description requires their separation, in the mind they form a gestalt. They meld into one another. The perceiver's conceptualization of this environment derives less from recall of individual component meanings than from an overall "impression" based on a complex and largely unconscious interaction of them.

1. The Arctic Refuge provides a connection to American cultural heritage.

This area offers what is virtually America's last chance to preserve an adequate sample of the pioneer frontier, the statewide counterpart of which has vanished.—George Collins and Lowell Sumner: *Northeast Arctic: The Last Great Wilderness* (1953, p. 26)

The idea that wilderness is a vestige of our frontier heritage was a prominent theme in several of the writings of Leopold that inspired the refuge founders (Collins, personal communication, 1999). Also influential was Robert Marshall's (1938) proposal for a permanent frontier in Alaska. "In Alaska alone can the emotional values of the frontier be preserved."

The idea of preserving a remnant of the frontier and related experience opportunities became prominent in the public testimony supporting establishment of the Arctic Refuge (Kaye 1998), and continues to resonate through the popular literature. One example, *Nameless Valleys, Shining Mountains* describes author John Milton's (1970) discovery of "wilderness on a scale the mountain men once knew in our far west" (p. 63) and his feeling that Lewis and Clark "would probably have felt much as we did" (p. 113).

Two commonalities related to this idea emerge from the co-researchers' interviews: 1) a childhood fascination with these and other frontier icons, and 2) reports of catching an occasional experiential glimpse of this past.

Author and co-researcher Debbie Miller, for example, recalls instances where she imagined, "This is what it must have been like for the early explorers . . . the feeling of exploration they must have known."

Co-researcher geophysics professor Keith Echelmeyer says "On the longer trips I get this sense of not visiting, but moving through the land as Lewis and Clark must have felt." Described as symbolic role enactment (Ittelson and others 1974) such experiences seem to be neither imagining nor a trip motivations or expectations. Echelmeyer says:

It's something that just comes to you when you don't know what's ahead. It's an understanding of what it was like to be in that era . . . It's an identity with a period I find most interesting.

Recent literature in the areas of environmental psychology (Kaplan & Kaplan, 1995) and archetypal psychology (Pearson, 1991) led to examining the role of the frontier and its explorers as more than just touchstones to this venerated past; they may symbolically represent what Olaus Murie and others considered an innate human impulse, represented by the following meaning . . .

2. The Arctic Refuge is a place of mystery and unknown, a place for exploration and discovery.

The urge to go places . . . to explore . . . to discover . . . this urge has come down to us from the earliest time and we must not

ignore it if we believe in progress of the human spirit.—Olaus Murie: *Wilderness Philosophy, Science, and the Arctic National Wildlife Range* (1961, p. 59)

This theme has recurred through the popular literature of the Brooks Range since Marshall first extolled its unknown character and "the exhilarating feeling of breaking new ground" (Marshall 1956 p. 49). Likewise, Milton (1970) was able to feel "that we might be the first white men to set foot" (p. 53). In the glossy book *Earth and the Great Weather*, Kenneth Brower (1970) revels in finding a valley "unexplored as far as we know" (p. 70). In *Midnight Wilderness* (1990), Miller describes "that exhilarating sensation that we may have walked in places where perhaps no human had ever set foot" (p. 133).

Encapsulating a theme expressed by all the co-researchers, she says

There is a tremendous sense of adventure in not knowing what lies ahead. Perhaps one of the greatest values in experiencing this primeval wilderness is the element of discovery (p.150)

This enchanting component of the refuge experience seems to arise from an aura of mystery, the sense that there is something within or beyond a scene that is not apparent. This uncertainty engages visitors' predictive and inferential capabilities, impelling them to venture forth and explore (Kaplan and Kaplan 1995).

Concern about erosion of this quality is the primary basis for co-researchers' objections to the potential electronic information technology. Expeditionary traveler and co-researcher Roger Siglin speculates that just knowing it overlays his route would erode his most memorable experiences: "discovering hidden nooks and crannies that you stumble onto."

Before his journeys, Siglin spends evenings staring at maps, planning and imagining. What would happen to the anticipation, he asks, "if I had to decide whether or not to first 'explore' the route and 'discover' the features on the computer?"

In both the refuge literature and the experiences of co-researchers, namelessness contributes to this experience. Echelmeyer says a named feature is less beckoning because "its connection to pre-modern times is lost . . . the name limits your imagination." For school teacher Frank Keim, "One can hardly explore a named mountain. I'm more inclined to climb a less attractive, but unnamed one."

But what people explore here is not just what's around the next bend or over the horizon . . .

3. The Arctic Refuge provides psychological benefits associated with solitude.

. . . but we long for something more, something that has a mental, spiritual impact on us.—Olaus Murie, Testimony on S.1899, A Bill to Establish the Arctic Range, (1959)

Vastness, remoteness and the separation from modern society's influence that they engender contribute to the Arctic Refuge's renown as a place of solitude, a setting particularly conducive to introspection, self-reflection, restoration and personal growth.

Solitude is a complex and multidimensional transaction between the individual and the environment (Hammitt 1994; Hollenhorst and others 1994). Two cognitive dimensions well

represented in both the refuge literature and the interviews are the experience of the Flow State (Csikszentmihalyi 1990) and Cognitive Freedom (Hammitt 1994).

Flow experience characterizes Murie's (1957) description of the refuge as "a world that compelled all our interest and concentration and put everything else out of mind" (p. 275). Co-researchers describe frequently experiencing the components of flow: absorption in the experience, an exclusion of irrelevant concerns, the coalescence of their actions, intentions and thoughts into a single theme, and a sense of freedom from social norms and controls. In this state, Milton's (1990) problems "take on new form and perspective." He is more able to separate "the meaningful from the meaningless" (p. 129).

Echelmeyer describes how after a few days "I become part of the place . . . you're not traveling on it, you're flowing with it." His internal dialogue changes. He finds that "the extraneous things that get in the way of what's important fade away."

Flow facilitates cognitive freedom, a lessening of the influence of social norms and roles, an enhanced freedom to direct one's attention and thought to what is interesting and relevant. (Hammitt 1994). For Echelmeyer

I lose my self-image. It's like being a kid. I don't worry about what anyone else might think . . . there's this freedom to think about things on a different level . . . to get to know yourself and how you fit into things.

Co-researchers find this state heightened in the context of "route-finding," Echelmeyer's word for exploring. Interviews suggest that the process of getting from one place to another facilitates the process of getting from one way of thinking to another.

Echelmeyer reports that this effect is notably lessened in other areas where signs point the way. Even the unseen presence of place names diminishes this quality of solitude because "their purpose is to influence and control your thinking." As he describes it, such human intentionality is incongruent with a place that fundamentally represents freedom from human influence and control.

4. The Arctic Refuge is a place of wildness, a state where nature is uncontrolled and free to continue along its evolutionary pathway.

[The Arctic Refuge] symbolizes freedom . . . freedom to continue, unhindered and forever if we are willing, the particular story of Planet Earth unfolding here . . . free from the meddling human concerns . . . where its native creatures can still have freedom to pursue their future, so distant, mysterious . . . —Lowell Sumner, Arctic National Wildlife Refuge Address (1985)

For Marshall (1956), a condition central to wilderness was "its entire freedom from the manifestation of human will" (p. xxxii). That essentially defines "untrammelled," a word he used repeatedly in reference to the Brooks Range and which became a key descriptor in the Wilderness Act.

Olaus Murie (1961) described the campaign to establish the refuge as the "basic effort to save a part of nature, as evolution has produced it" (p. 2). Justice William O. Douglas (1960) wrote that the refuge "must forever remain . . . where the ancient ecological balance provided by nature is maintained" (p. 30).

In the popular literature, Brower's account of traversing the refuge describes him pondering "connections to the beginnings of life that wilderness has so far preserved." He asks, "Do we really want to repudiate the evolutionary force?" (p. 14). Milton (1969) expresses the hope that "man continues to have the good sense to allow some of the earth to go its own way" (p. 63). Likewise, Miller's book (1990) emphasizes that "it is this spirit of pure wildness . . . that lingers on in our hearts and mind" (p. 133).

Common across all co-researchers' accounts is the notion that wildness, often held just at the edge of conscious awareness, is the characteristic that sets the refuge experience apart from others. Interviews suggest that it deepens the experience of solitude.

Co-researchers report they wouldn't think to include wilderness if asked to provide a list of trip attributes. Yet most, like Siglin, indicate that it is always in the back of their mind. He compares his trips in the refuge to those in Grand Teton Park, which he says has far more spectacular scenery. But he knows the park is neither as ecologically intact nor as free of human intentionality. Thus, in comparison with the Brooks Range, he says, "Teton Park has preserved the body of wilderness, but not the soul."

5. The Arctic Refuge provides a connection to the natural world and our species' evolutionary past.

Before discussing the Arctic Range in detail, let me first consider how it happens that we want wild country. We came by this urge through evolution.—Olaus Murie: *Wilderness Philosophy, Science, and the Arctic National Wildlife Range*, (1961, p. 58).

In this introduction to his presentation to the Alaska Science Conference, Murie echoed sentiments that were often expressed by Marshall and Leopold, and that continue to resonate through refuge writings and interviews.

While crossing the Romanzof Mountains, Milton (1969) pondered the importance of wild places where one "can relearn what he is and where he came from" (p. 63). Wright (1973) tells readers that wilderness needs to be preserved "as a laboratory in human values . . . a place where man discovers firsthand the kinships, harmonious interdependencies, the essential connections of all life systems" (p. 135). Hiking across the refuge's coastal plain, Miller (1990) experienced "an overwhelming sense that we have been thrown back to a more primitive age" (p. 4).

Keim describes how when he is "out long enough to feel like I'm just part of the country" (flow experience), he senses being "back in touch . . . with where I came from and where I'm going." Interviews suggest that as with many wilderness meanings, this connection more often enters awareness retrospectively. "Out there it's more of a feeling than a subject of thought," Keim says. An avid reader of nature books, he describes how a sense of connection or relatedness to the distant past "comes back to you" when he reads or rereads John Muir, Edward Abbey, Aldo Leopold and Margaret Murie. His wilderness trips provide contextual images through which he interprets the messages of these writings and connects them to his life.

Co-researcher and hunting guide Sandy Jamieson describes the "primal sense of hunting" as what distinguishes his hunts in the refuge from those in non-wilderness areas. He vividly recalls one of his peak experiences, watching

caribou from a hilltop, “a time machine experience that can transport you back in time before the world was altered.” Sensing the outside world loosening its grip on him, Jamieson said. “I felt a part of that mysterious force that moves the caribou,” “For those few days of my life, I was a part of the natural order of things.” That experience continues to remind him that “there is still that ancient quest in us.”

6. The Arctic Refuge is a place to approach and experience humility.

A poetic appreciation of life, combined with a knowledge of nature, creates humility, which in turn becomes the greatness in man.—Olaus Murie: *Journeys to the Far North* (1973, p. 245).

Co-researchers report that the refuge experience provides new perspectives, that they can see themselves in proportion to something they perceive to be greater than modern society and its creations. This meaning is often manifest in the “diminutive effect” (Gallager 1993) experienced in the presence of monumental or vast landscapes. As expressed by Marshall (1956): “As I walked for hours beneath the stupendous grandeur of these colossal mountains, I felt humble and insignificant” (p. 22). The refuge also invites comparison of the human life span with geologic time. Miller (1990), for example, describes the centuries-old lichens and multi-million-year-old rocks that “make me feel as insignificant as a speck of dust” (p. 153).

This meaning is also manifest as a broadening of identity, seeing oneself as a small part of a greater community of life. As expressed by Douglas (1960): “Here [a person] can experience a new reverence for life that is outside his own and yet a vital and joyous part of it” (p. 31).

Evidence of such feelings has been found in the experiences of all co-researchers, yet none reports seeking them. Humility seems to be an emergent quality which, as Echelmeyer says, “just comes to you.”

He provides examples of how these feelings are lessened in the presence of technology, because “technology is about changing things, not accepting things as they are in nature.” He no longer carries a firearm for bear protection because “a gun puts you in control of the bear, above it...you lose that sense of vulnerability...the feeling of smallness.”

Keim describes his experiences as “a personal paradigm shift” in which he is at once humbled and empowered by the realization that “we are a part of something that’s much greater than us.” It is a realization that “just doesn’t come to you in normal life.”

7. The Arctic Refuge is a place of intrinsic value.

Wilderness itself . . . does it have a right to live? Do we have enough reverence for life to concede this right?—Margaret Murie: *Two in the Far North* (1957, p. 374)

This meaning is often expressed in terms of the individual’s satisfaction in just knowing this area exists. However, the meaning is also represented by the Leopoldian notion that nature can have worth in itself, not contingent upon any human benefit.

Milton, for example, describes the popular reasons for preserving wilderness, such as recreation, as secondary values of the refuge. “But that is not the purpose of this place,” he writes. “It’s purpose is to *be*. Man’s role should be

...let it be” (p. 105). Similarly, during his trip, Brower (1970) realizes that wilderness should be left “to serve its highest purpose—being there for itself and its indigenous life forms” (p. 14).

Co-researchers express similar sentiments. Keim, for example, expresses strong disagreement with the idea that the refuge should be managed to provide human benefits. He advocates placing some large portion of the refuge off-limits to all human use as “a gesture of respect for uncontrolled nature.” During his trips, he says there’s a “background voice” reminding him “you’re just a guest up here...a completely and totally privileged guest.”

8. The Arctic Refuge is a bequest to the future.

I feel so sure that, if we are big enough to save this bit of loveliness on our earth, the future citizens of Alaska and of all the world will be deeply grateful. This is a time for a long look ahead.—Margaret Murie: *Testimony on S. 1899, A Bill to Establish the Arctic Range* (1959, p. 60)

“Future generations” is an oft-repeated phrase in the Arctic Refuge literature and interviews, and a concern related to most other meanings. It is most often expressed as a moral obligation to provide future generations the experiential and other benefits the refuge provides.

Thus, Olaus Murie (1961) sought to “let people of the future have a little opportunity to go to the wilderness to have the inspiration that comes with the frontier” (p. 68). As Brower (1970) expressed it, we must “find the grace to leave the arctic as we found it...for the next people to pass that way” (p. 181).

Related is the “option value” of wilderness, the notion that development would deprive subsequent generations the opportunity to choose, whereas preservation maintains that opportunity. This is represented by Wood’s (1958) statement that the refuge could be considered a “mineral bank” for future generations. “But shouldn’t we allow them to make the choice?” she asks. (p. 1). An argument Margaret Murie (1959) offered for preservation was “so that those of the future may have the choice to keep up, or use up” (p. 60).

Miller (1990), who dedicated her book to her young daughters “and future generations of wilderness seekers,” notes that bequest value becomes an increasingly important aspect of the refuge as she matures. Like other co-researchers, she tends to use the word *timeless* in relation to bequest value, explaining that the concept of timelessness connects past ages with the future.

9. The Arctic Refuge is a place of restraint.

. . . this attitude of consideration, and reverence, is an integral part of an attitude toward life, toward the unspoiled, still evocative places on our planet. If man does not destroy himself through his idolatry of the machine, he may learn one day to step gently on his earth.—Margaret Murie: *Two in the Far North* (1957, p. 289)

This meaning is largely expressed as the boundaries of the Arctic Refuge symbolizing the boundaries our society is able to place on development and the use of technology. With Leopold, Marshall (1933, 1956) disparaged mechanized access to wilderness, less because of physical impacts than because of the impact he believed the presence of technology had on a person’s way of thinking and the sense of isolation and unknown they dispel.

Similarly, Wright (1973), describes her repulsion in encountering a helicopter west of the refuge boundary. She says it was not the “screaming whine” of the helicopter that bothered her as much as the machine as “a symbol of human choices.” “It is the values guiding those who decide what use to make of this supercraft, this symbol of the incredible power and accomplishment of our technology, that disturbs me...” (p. 221).

The use of snowmachines in the refuge (allowed by the Alaska National Interest Lands Conservation Act) disturbs Siglin as well. “They contradict the idea of wilderness.” Yet while Siglin believes they should be prohibited in all wilderness, he has used them in the refuge. In fact, contradictions are acknowledged by all co-researchers, and they illustrate an important point: As do systems of religious belief, this wilderness ideal often includes inconsistencies. As with religious belief, the wilderness ideal is not a linear system of logic. Its function as a framework for perception and experience and as a guide to behavior is, like the Lutheran or Catholic’s faith, accompanied by an occasional discrepancy. Inconsistencies are a reminder that the set of meanings that form this wilderness ideal are, foremost, a human construct.

10. The Arctic Refuge is a sacred place.

... this last American living wilderness must remain sacrosanct.”—Justice William O. Douglas: *My Wilderness* (1960, p. 31)

Douglas’s writings echo the common sentiment that this place connects people to—allows them to participate in—something they perceive to be of a more timeless and universal significance than modern society and its creations.

For some, this sacredness is a religious connection, such as that expressed by John Muir. But most co-researchers are not followers of any doctrinaire religion. They characterize sacredness in the more secular, universal sense of the concept, described by Emile Durkheim as that which is set apart as the embodiment of ideals (Pickering 1975). For the founders, that ideal was largely rooted in the creative process of evolution. Thus, for Olaus Murie (1961), the campaign to establish the Arctic Refuge was “this basic effort to save part of nature, as evolution has produced it” (p. 2). As Lowell Sumner (1985) expressed it, the refuge was to be a landscape where people of the present and future can

be inspired, and understand a little of the majestic story of evolution, but also where we can learn to appreciate and respect the intricate and inscrutable unfolding of Earth’s destiny.

Hunter Sandy Jamieson describes his refuge experiences as a connection to “what it is that nurtured us and brought us to who we are and where we are.” Unaltered, wild country is where we are most likely “to learn things about ourselves and our relationship to the planet.” He believes humans have an indwelling “yearning to connect to something beyond your life and lifetime.” “That’s what people want out of religion,” he says. “It’s what I find in wild country with wild animals.”

For teacher Frank Keim, the refuge is a medium through which our evolutionary continuity with the natural world is most apprehensible. His trips “bring it home to you that we’re not the purpose of it all . . . it puts me back in touch with where I came from, where I’m going.” He says he becomes

“more little, but deeper as a person” when surrounded by “the ultimate processes and conditions we evolved from.” “To experience that,” he says, “is among the highest values of this place.”

Conclusions

The Arctic Refuge has become a condensation symbol, summarizing and evoking an array of experiential and symbolic meanings. But this fact is not posited as a decisive argument against development, new technologies or other actions. Rather, the components of this system of meaning are only some among many values that need to be considered in developing policy on where – or whether – to draw the line on such actions here. Two premises underlie this inquiry: 1) Public policy is best served when the full spectrum of both the benefits and the costs of an action are considered, and 2) some wilderness qualities receive less than fair consideration because the measurement, description and comparison of environmental costs and benefits are carried out within a management paradigm historically insensitive or inimical to many core wilderness values. The benefits of actions that impact wilderness values are better represented. This investigation seeks a more equitable understanding of those “intangible resources” Olaus Murie spoke for that may be diminished or lost.

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How Valid are Future Generations' Arguments for Preserving Wilderness?

Thomas A. More
James R. Averill
Thomas H. Stevens

Abstract—We are often urged to preserve wilderness for the sake of future generations. Future generations consist of potential persons who are mute stakeholders in the decisions of today. Many claims about the rights of future generations or our present obligations to them have been vigorously advanced and just as vigorously denied. Recent theorists, however, have argued for a communitarian basis for these obligations, which emphasizes the need future generations will have for clean air, water, biodiversity, and the like. Such a move denies the traditional, liberal, anthropocentric reasons for wilderness preservation and sets up particular criteria for which lands should be preserved. In this paper, we review the arguments about future generations in relation to wilderness preservation. We conclude that these arguments are overly general and lack a solid rational base, making future generations arguments susceptible to misuse.

One of the most powerful, commonly invoked arguments for wilderness preservation is the idea that preservation will benefit future generations. Wilderness enthusiasts argue that population growth has placed unprecedented demands on resources worldwide, and that areas of unspoiled nature are growing increasingly rare. It follows, some suggest, that we should preserve wilderness to give future generations the opportunity to experience virgin or ancient forests, scientific benchmarks from which to judge ecological changes, and a host of other current benefits—clean air and water, biodiversity conservation, etc. Others, particularly the Deep Ecologists, are less concerned about human benefits, but they use future generations arguments to argue for the preservation of wild nature for its own sake (Sessions 1995).

How much credence should such arguments be given? It is difficult to oppose the idea of benefiting future generations; after all, where would we be today if our own forebears had not had the foresight to set aside Yellowstone, Yosemite, the Grand Canyon, the Bob Marshall Wilderness or the Boundary Waters Canoe Area? Yet despite such marvelous prudence, suspicion lingers that the future generations arguments we read in the literature or encounter at public meetings can be somewhat disingenuous, used simply as a

way to forward an individual's or group's particular agenda. Advocates point to past successes such as the national parks and wilderness areas cited above, conveniently forgetting that future generations arguments also have been used to justify odious policies, such as the eugenics programs in Nazi Germany. Can some particular individual really have the audacity to presume to speak on behalf of all the yet-to-be-born? How can we know what future generations will need or want? How can we know who speaks disinterestedly on their behalf? In this paper, we explore the arguments about future generations in the context of the debate over wilderness preservation.

Despite the suspicions raised above, future generations arguments tend to be treated very seriously. Why are we so susceptible to this line of argument? There are three sets of reasons. First, the development of the market economy and its attendant emphasis on the sanctity of the individual has eroded our faith in Providence, making us as individuals increasingly responsible for the welfare of future generations. For most of the past millennium, future generations, not to mention the fates of individuals, were considered to be in the hands of God. People were to do their best, of course, but Providence was the ultimate force in the world (Heilbroner 1987). This theological tradition was reinforced by social organization. The actual conduct of human affairs was guided by power, tradition or a combination of the two. Thus, kings might rule by might, but common people followed their parents into specific occupations. Life had a continuity that crossed generations; the same family worked the same fields, and most people lived in villages where they could contribute to works such as churches that would outlast individual lives. These factors contributed to a sense of transgenerational community, a sense we seem to have lost today (O'Neill 1993).

Through a series of developments that began in the 11th century, but were not complete until the 19th, markets began to evolve, becoming an ever increasingly important determinant of human affairs. The market itself did not flourish as a central controlling factor in human affairs until the 18th century, but when combined with the skeptical humanism of the Renaissance, it led to a concern for well-being in this world, which gradually took precedence over a concern for the next world. Liberalism arose, and the spread of democracy further eroded tradition and authority, giving individuals the ultimate responsibility for their own choices. The 19th century and the Industrial Revolution contributed a sense of optimism—a new faith in progress and in the ability of science to solve problems. This optimism persists today, but it is giving way to growing doubts, at least among Western intellectuals.

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Thomas A. More is a Research Social Scientist, USDA Forest Service, Northeastern Research Station, P.O. Box 968, Burlington, VT 05402 U.S.A. James R. Averill is a Professor of Psychology, University of Massachusetts, Tobin Hall, Amherst, MA 01003 U.S.A. Thomas H. Stevens is a Professor of Resource Economics, University of Massachusetts, Draper Hall, Amherst, MA 01003 U.S.A.

Technology and technological solutions to problems are increasingly suspect, so that we no longer share Mr. Micawber's sense that "Something will turn up" (Hardin 1981).

Second, future generation arguments carry great weight because science and technology have given us enormous power to affect the fate of future populations. There is a growing sense of global ecological crisis among environmentalists, a crisis fueled by population growth, the spread of nuclear materials and wastes, pollution, global climate change, ozone deterioration and any number of other causes. There is likewise a sense that many of these factors, although sufficient to do damage in and of themselves, may ultimately interact with one another, causing huge harm to living biotic systems—a cost to be born by future generations of humans (Norton 1991).

Third, future generations arguments are powerful because future generations play a significant role in validating our own lives and works. The people of the future will sit in judgment over us, just as we judge the lives and works of those who preceded us. Our descendants will be the ones to determine if our own lives were successes or failures (O'Neill 1993), and most of us would like to leave a legacy that matters.

These factors—a decline of faith in both Providence and progress, the tremendous power we have to do damage, and the fact that future generations will sit in judgment on us—combine to give us a new sense of urgency about future generations. Arguments that involve the future are high stakes indeed, and as Passmore (1974) points out, ours is the first generation to bear the sole responsibility for choosing correctly. The moral weight is heavy.

Obligations to Future Generations Pro and Con

There have been many claims advanced in support of responsibilities to future generations, and just as many claims denying them. In this section, we review the major themes in both types of argument, beginning with the negative.

Perhaps the most common claim about future generations is that future people have rights which give them claims that the present generation must consider. Theories that involve rights and reciprocal duties and responsibilities are often termed "contractarian," in that they view the function of ethics as facilitating social exchange between members of a specific moral community. However, Golding (1981) argues that, since it is impossible to achieve any social contract or degree of reciprocity with persons who are only potential, they cannot be said to be part of our moral community. To express concern for them requires some notion of what would be *good* for them, and this is difficult, particularly for distant generations. Imagine, for example, that you were living in the year 1499; could you possibly have predicted what people living in 1999 would need or want? Furthermore, it makes little sense to ascribe rights to people who are only potential, since specific individuals cannot be identified (Macklin 1981); in contractarian theories, rights also imply reciprocal duties, and what duties could possibly be ascribed to people who are not actual?

A second, related line of negative reasoning argues that, since we cannot predict the path of science and technology, we have no idea of what resources and productive capacities the future generations will have. For example, both Rawls (1971) and Solow (1993) argue that what we leave behind is not only depleted resource stocks, but also productive capacity, including plants, equipment and technical knowledge that can solve problems and also create new resources. We can view these as investments that will enhance the capacity of future generations to resolve environmental problems. From Solow's perspective, the key is to not fritter away resources on current consumption without making corresponding investments in capacity.

A third objection to the validity of future generations arguments is based on social justice. Sustainability is really a matter of equity: How much current consumption should we forego in the present in order to share with future potential persons (Solow 1993)? There are poor people in the present generation for whom the importance of consumption far outweighs investment, and current trends show that social inequality in the U.S. has been increasing rapidly over the past 30 years (Cassidy 1995; Hurst 1998; More 1999). Setting aside large tracts of wilderness to benefit future generations is not likely to sit well with those struggling in the present.

A fourth argument against the necessity of preserving wilderness, national parks, sequoias and other components of wild nature for the future is that, once these things are gone, future generations will be unable to develop an appreciation for them and, hence, cannot be harmed by their absence (Beatley 1994). Are we harmed today because we can only know dinosaurs intellectually through imaginative reconstructions in movies or museums? Perhaps closer to the point, are we genuinely harmed by an inability to visit Hetch-Hetchy? Or do we simply lack the ability to appreciate what it once was? One of the real difficulties of future generations arguments is that we are unable to know the tastes, preferences or social and economic circumstances of future people. O'Neill (1993) counters that we have a duty to ensure that future generations *are* part of our moral community by ensuring that they have a common appreciation of our achievements--our arts, sciences and culture, which would include national parks and wilderness preserves. On the other hand, our inability to know their tastes, preferences and wants makes it extremely difficult to make specific policy decisions on their behalf. Will future generations of urban people really want wilderness, or would we be better off to use our limited resources to preserve natural areas in and around cities?

Lastly, with finite resources, and wilderness is often considered a finite resource, policy concerns involve complex questions about slicing and distributing a limited pie. As Beatley (1994) points out, the number of generations is potentially infinite. Consequently, the present generation's fair share is either indeterminable or infinitesimal, neither of which is very helpful for policy decisions. This is particularly a problem for depletable resources--coal, petroleum, etc. Protected wilderness is not depletable in the same way, unless it is alterable by human recreational use. However, unprotected wilderness may be depletable through development.

On the positive side, many philosophers have claimed that we do have obligations to future generations. Utilitarianism, for example, seeks to maximize utility, or happiness, across generations. In its classical version, however, this leads to the idea that we might condone indefinite population growth so long as the aggregate gains to well-being over the population offset losses in well-being due to crowding, a situation that could result in large numbers of people living near the subsistence level (Green 1981). Such conundrums have led some philosophers to reject classical utilitarianism and argue instead for a modified version of Rawls' (1971) theory of justice. Rawls deduces the principles of a just society by asking what choices rational individuals would make for a society if they could not know what position they would occupy within that society. While his concern is primarily with contemporaries, he believes that people are motivated by concerns for their immediate descendants. This would lead them to adopt a "Just Savings Principle" that ensured sufficient savings and investment to protect the future of just institutions. These savings include not only material wealth, but factories, machines, knowledge, culture, and skills. In this way, just institutions would be protected for future generations.

While Rawls (1971) himself tends to be concerned only with the immediate next generation, a number of other philosophers have sought to extend his conception to the problem of distributive justice across multiple generations (Norton 1991; Routley and Routley 1981). We cannot, in justice, it is argued, leave future generations to bear the costs of present consumption; they are mute stakeholders whom we have the power to harm, but who do not have the power to harm us. These theorists would extend Rawls' "original position" to include rational choices made in ignorance of the generation in which a person would live; what we owe to future generations is a matter of justice rather than of happiness, rights or obligations (de-Shalit 1995).

A third, more recent perspective is that of communitarianism (de-Shalit 1995). Communitarian theorists attempt to rebut the contractarians by arguing that people are members of a transgenerational community that extends over several generations and into the future, so that "... just as many people think of the past as part of what constitutes their 'selves', they do and should regard the future as part of their 'selves'. These are the relations that form the transgenerational community, which is the source of our obligations to future generations" (de-Shalit 1995, p. 16).

Under communitarianism, the welfare of the group as a whole takes precedent over the welfare of particular individuals. Traditional liberalism, by contrast, emphasizes individual welfare. The distinction is important to wilderness preservation because it can lead to differing motivations for preservation. For example, wilderness has often been justified as a place that provides solitude, spiritual experiences, a temporary escape from the strictures of contemporary social life, chances to recapture the pioneer spirit and so forth (Hendee and others 1968). Such justifications emphasize the personal benefits supplied by wilderness and thus fall well within the bounds of traditional liberalism. A communitarian approach, which includes future generations as part of our moral community, leads to a different set of justifications for preservation. While we may not know the specific tastes and preferences of future generations, we can

be reasonably sure that they will require clean air and water and stable ecosystems, as well as shelter and protection from environmental hazards (Beatley 1994). Under communitarianism the reasons for wilderness preservation tend to shift from the biological, psychological and social benefits of wilderness toward the physiological benefits like clean air and water—those that benefit people in the abstract and which are immutable across the generations.

Such a shift may call for modifications of management policy to protect these benefits; Sessions (1995), for example, bemoans the "Disneyfication" of wilderness in the form of Forest Service policy that encourages its recreational use. A focus on physiological benefits may also shift preservation debates. Instead of an emphasis on beauty or remoteness, the appropriate questions might have more to do with the ability of an area to produce clean air and water, or to protect biodiversity. It would be these values that would be most significant in a communitarian debate over wilderness, and we would need to identify which areas were most successful in producing them.

The Shortcomings of Future Generations' Arguments

To be conservative, we can assume that most people do acknowledge some sort of responsibility for future generations. This may stem from a love of one's own children (Passmore 1974), from a rational sense of duty (de-Shalit 1995; Partridge 1981), or from a desire for self-fulfillment through a legacy left for the future. It may even be genetic. *Homo sapiens* is among the species that nurtures its young to maturity; this means that a concern for at least the upcoming generation is "hard-wired." Whatever the source, most thoughtful people are anxious to make a contribution that will leave the world a better place than they found it and, hence, are concerned with futurity. That said, however, the future generations literature has two significant shortcomings: (1) It fails to specify the specific kinds of obligations owed to future generations, and (2) the future generations it portrays are completely homogeneous, and undifferentiated either socially or psychologically. We would like to deal with both these problems.

While we may, in general, acknowledge that we have obligations to future generations, what exactly does this mean we should actually *do*? What actions should we take? Which lands should be preserved or which developed? As noted above, Solow (1993) argued that our obligations to the future require that we have savings, which could include land preservation in various categories, and investments. However, as an economist, he argues that different resources are at least partial substitutes for one another (fungible). Consequently, there is no *particular* thing that we owe to the future. In discussing the concept of sustainability he argues:

It is perfectly logical and rational to argue for the preservation of a particular species or the preservation of a particular landscape. But that has to be done on its own, for its own sake, because this landscape is intrinsically what we want or this species is intrinsically important to preserve, not under the heading of sustainability. Sustainability doesn't require that any *particular* species of owl or any *particular* species

of fish or any *particular* tract of forest be preserved.” (Solow 1993, p. 181, emphasis in original).

Alternatively, Beatley (1994) argued that two key obligations are to keep options open and to avoid making irreversible decisions; extinction, for example, is forever and forecloses all options. In terms of wilderness preservation, this begs the question raised by the social constructivists (Cronon 1995, Proctor 1998): Is wilderness a specific place that is growing increasingly scarce as the world population grows (Worster 1997), or is it a human concept that we impose on the natural world, susceptible to all the potential misunderstandings of the human mind? Clearly, a case can be made for both viewpoints; although we tend to favor the social constructivist perspective, the way people answer this question will be central to their willingness to preserve specific tracts of wilderness. Indeed, scarcity (or uniqueness) is a key element in many wilderness preservation arguments and might provide a valuable guide to action. This, too, is problematic, unfortunately. As O'Neill (1993) notes, it is possible to describe a particular tract of land in many different ways: as a landscape, an historical location, a watershed, a soil or vegetative type, an ecosystem, an industrial wasteland, a habitat and so forth. Consequently, it is perfectly possible to construct a description of any particular tract of land that will make it sound rare. Scarcity is not a value in and of itself; it amplifies value under a particular description. Consequently, without a broad social consensus, claims of scarcity are not necessarily a good guide to our obligations in specific instances. Setting aside fanciful claims for zoning the earth (Odum 1971, Sessions 1995), progress in wilderness preservation depends upon interested stakeholders sitting down at the same table and discussing the merits of alternative proposals. The interests of future generations are not irrelevant, but they clearly provide only a limited guide to action at best, and then only when supported by a broad social consensus.

The second shortcoming of future generations arguments concerns their lack of differentiation in social or psychological characteristics. It may be that in the very long run, perhaps for those generations over 100 years out, we can have only vague ideas of what these people and their cultures will be like. In the nearer term future, however, it is reasonable to assume that they will be born into particular groups—they will be black, white, brown, red or yellow (or, increasingly, some combination); they will be rich, middle class or poor; they will be born into particular locations; and so forth. A decision that benefits (or burdens) a particular group today will enhance (or depress) any future person who happens to be born into that particular group. Consequently, an understanding of the distribution of costs and benefits of the wilderness preservation of any particular tract is central to informed decisionmaking. Studies of actual wilderness users indicate that most come from a social elite (Bultena and Field 1978; Vaux 1975). A range of other studies documents wilderness benefits like existence, option and bequest values (Gilbert and others 1993; Krutilla 1967; Weisbrod 1964) that accrue to nonusers. Recently, however, there have been growing concerns about the conceptual foundations of some of these values (Bergstrom and Reiling 1998; More and others 1996). It is somewhat more difficult to estimate the social distribution of wilderness benefits associated with clean air and water, biodiversity, etc. On the one

hand, it could be claimed that these goods benefit everyone. On the other hand, there may be locally specific effects that could make wilderness preservation seem like building a public park in an affluent neighborhood. While we clearly need additional studies of benefit distribution, we also need to treat seriously claims that wilderness preservation will create burdens for some. It is not sufficient to claim that wilderness preservation will benefit future generations of nonspecific individuals. Clearly, given the existing information on the elite social status of current wilderness users, the financing of wilderness preservation and management needs to be made as progressive as possible (More 1999).

Conclusion: Future Generations and Wilderness Preservation

In closing, we return to our original question: How valid are “future generations” arguments for preserving wilderness? There clearly are difficulties with their uncritical application. One set of problems stems from their generality. The future generations literature is probably at its most compelling when discussing specific costs—nuclear waste, global warming, population growth—that we impose on future generations. These are also areas in which there is a strong social consensus regarding cost. In areas of benefit, such as wilderness or historic preservation, the literature seems more vague: It is difficult to link the arguments with specific land areas and proposals; they project an undifferentiated future; and the social consensus is not as strong. The arguments often are so general that they could be appealed to by either side in any given debate, used to justify any number of mutually exclusive alternatives.

To overcome these difficulties, a number of economists have advocated a “safe minimum standard” decisionmaking strategy, in which the current generation refrains from undertaking irreversible action unless the social costs of doing so are intolerable (Berrens and others 1998; Toman 1992). With regard to wilderness, however, there is clearly a debate over whether actions are irreversible (Cronon 1995), and how is one to determine if the social costs are “too high?” Clearly, what is an intolerable cost for one group will seem a small price to pay for another.

A second set of problems stems from the use of rational argument itself. While a number of philosophers have attempted to construct rational arguments to include consideration of future generations in current decisionmaking, these arguments are opposed by other rational arguments. Unfortunately, this may be an area where rationality fails, much the same as arguments that attempt to prove the existence of God from rational premises. A certain level of faith may be necessary in both instances!

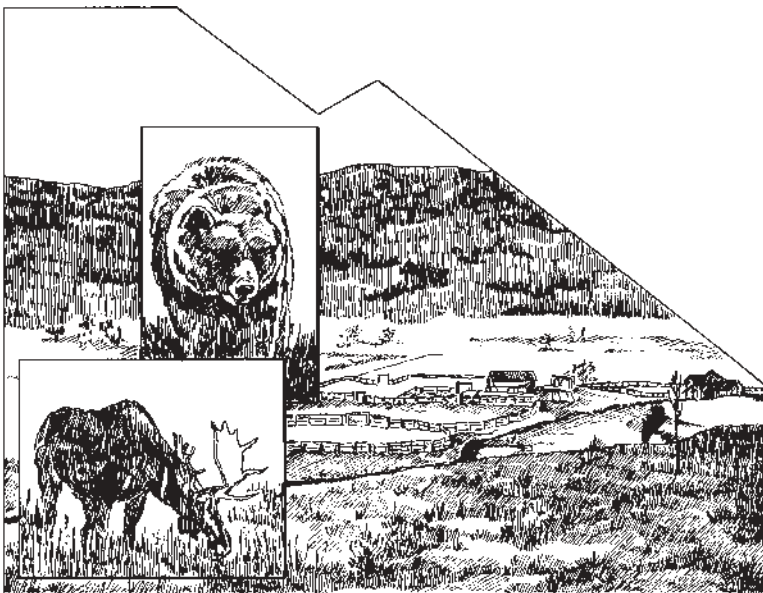
Both of these problems—the generality of the arguments and their lack of a solid rational foundation—can create situations that lends themselves to serious mischief. Future generations arguments can be played as a sort of moral trump card, designed to best the opposition by grabbing the moral high ground in a debate. When used in this way, the argument can create “good guys” and “bad guys,” foreclosing rational debate on a topic. Although common, such uses are improper. Decisionmaking in wilderness preservation, as elsewhere, needs to be based on a rational consideration of

costs and benefits coupled with vigorous public debate. Clearly, we do need to look to the future; like Passmore (1974) and many others, we believe that we all have an obligation to try and leave the world a better place than we found it. However, the best guide to determining if an action will be right both today and in the future is still a rational weighing of alternatives.

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3. Wilderness Within Larger Ecosystems



Indicators of Wildness: Using Attributes of the Land to Assess the Context of Wilderness

Gregory Aplet
Janice Thomson
Mark Wilbert

Abstract—Land can be described in a space defined by two fundamental qualities: naturalness and freedom. The axis of naturalness describes the wholeness of the ecosystem relative to a historical norm, while the axis of freedom describes the degree to which land remains outside of human control. Some land can be natural but not free, and vice versa, but the most natural and free are the most wild — they are the lands we recognize as wilderness. These concepts are illustrated through the mapping of indicators of wildness, derived from readily available data in a Geographic Information System.

The past few years have witnessed considerable attention to conceptions of wilderness. Generally, this attention has taken the form of a “debate” between critics of wilderness as *idea* on one side and defenders of wilderness as *place* on the other (see for example, Callicott and Nelson 1998). Critics contend that white, male, American minds have produced a concept that separates humans from nature, denigrates native peoples, and freezes ecosystems in time. Defenders point out all the myriad values, including wildlife habitat, watershed protection and spiritual healing, provided by the places we call wilderness and conclude that wilderness therefore must be good. Both sides assume they understand what they mean by wilderness; neither states it clearly.

Robert Marshall begins his classic 1930 essay, *The Problem of the Wilderness*, “It is appalling to reflect how much useless energy has been expended in arguments which would have been inconceivable had the terminology been defined.” Seventy years after Marshall offered his observations, it appears we are still suffering from the same misunderstandings. The debate over the value of wilderness is being conducted without a common understanding of its meaning. Before any more “useless energy” is expended, it is worthwhile to stop and consider what exactly we mean by wilderness.

One of the first places to look, of course, is the Wilderness Act itself. The Act (Public Law 88-577) defines wilderness straightforwardly enough as:

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Gregory Aplet is Forest Ecologist and Director, Center for Landscape Analysis, The Wilderness Society, 7475 Dakin Street, Suite 410, Denver, CO, 80221 U.S.A. Janice Thomson is Remote Sensing Coordinator and Mark Wilbert is GIS Analyst, Center for Landscape Analysis, The Wilderness Society, 1424 Fourth Ave., Suite 816, Seattle, WA, 98101 U.S.A.

...an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man’s work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

But this is a carefully crafted legal definition resulting from years of debate and compromise. Surely, we are not to believe that all the places wild enough to count as wilderness are limited to federal land. And why 5,000 acres? These are legal constraints necessary for the implementation of the Wilderness Act. A general definition of wilderness remains elusive.

In his exploration of the legislative direction provided by the Wilderness Act, ecologist David Cole (1996) notes that wilderness is expected to be both “untrammeled,” or uncontrolled and free, and “pristine,” or “what would have existed in the absence of post-aboriginal humans.” Cole concludes that these two goals provide conflicting direction for managers, as manipulation is often needed to repair damage caused by overuse, exotic species invasions, fire exclusion and other processes that have altered ecosystems away from natural conditions. Cole argues that these goals are “to some extent mutually exclusive” and suggests that we must choose one or the other of these goals to emphasize when managing wilderness.

Alternatively, Aplet (1999) suggests that these two outcomes, freedom and naturalness, rather than providing conflicting direction, actually describe two independent qualities of wilderness. Wilderness is that portion of the land that is most wild, and wildness is a function of both naturalness and freedom from human control. This dualistic nature of wildness can be illustrated with a simple figure (fig. 1) that represents landscapes in the two-dimensional space created by freedom and naturalness. In this conception, wildness increases in two directions: from the controlled to the “self-willed” along a gradient of freedom, and from the artificial to the pristine along a gradient of naturalness. At the most controlled and artificial ends of the continuum are the least wild lands — the built environment of the city. Where freedom and naturalness are highest is the wilderness, regardless of size or ownership. In between, lands can possess any combination of freedom and naturalness, and an intermediate

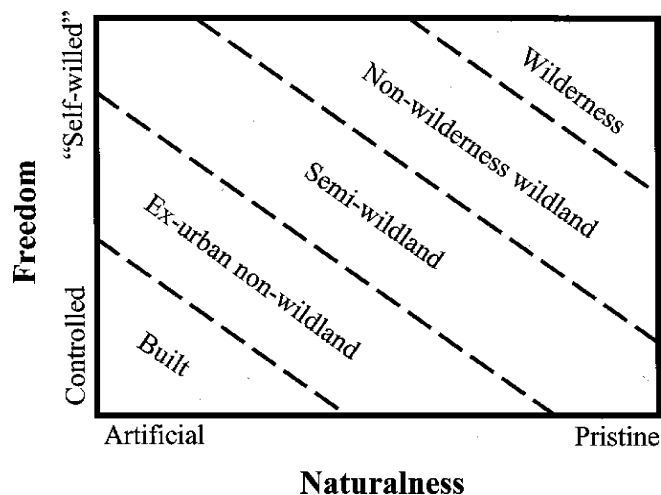


Figure 1—The “continuum of wildness.” Wildness increases as a function of both its naturalness and its freedom from human control.

degree of wildness. All lands fall somewhere within this two-dimensional continuum of wildness.

If wilderness is that portion of the landscape that is most natural and free, it follows that the wilderness manager’s job is to maximize *simultaneously* both of these characteristics. This is where the job becomes difficult, and tradeoffs arise. Maintaining freedom may compromise naturalness — for example, where exotic species are allowed to invade from the outside. Likewise, restoring natural conditions often requires bringing the land under tighter control. Just like the parent who simultaneously struggles to instill discipline and independent thought, the key for managers is to strive always toward both goals. When intervention is required, heed Wilderness Watch president Bill Worf’s good advice: “Manipulation should generally be limited to those minimum actions that will establish conditions that will allow natural processes to hold sway once again” (Worf 1997).

These qualities of freedom and naturalness help clarify what we mean by wildness, but they themselves are rather vague descriptors that cry out for further explanation. Managers need to know what exactly to pay attention to in order to achieve these twin goals. The remainder of this paper is devoted to exploring the attributes of the land that contribute to its naturalness and freedom from control. Ultimately, we would like to be able to measure these qualities to ensure that we are protecting and sustaining the wildness of wilderness. The measurement of wildness raises the possibility of mapping the wildness of the land, and this paper presents the results of some recent progress toward this goal and discusses how this method differs from other approaches to mapping our precious wild places.

Indicators of Wildness

Throughout the history of the idea, wilderness has been thought of both as a place *that* is free and as a place *in which* to be free. In other words, wilderness has been thought of both as a real place and as an experience. For example, Nash (1982) notes the value of wilderness to the Romantics of the

19th century as a place to escape the stranglehold of civilization. In contrast, The Wilderness Act speaks of wilderness as “an area where the earth and its community of life are untrammelled by man,” suggesting that it is the land itself that is free in wilderness. While wilderness will likely always be highly valued for the experience it provides, it is this second sense, the character of wild land itself, that is the focus of the following discussion.

Though perceptions of wildness vary with each individual, there appears to be a limited set of characteristics that contribute to the freedom and naturalness of a place. Generally, the literature exploring wild land characteristics suggests that the attributes of the land that contribute to its freedom are 1) the degree to which land provides opportunities for solitude, 2) the remoteness of the land from mechanical devices and 3) the degree to which ecological processes remain uncontrolled by human agency. The attributes that contribute to the naturalness of the land are 1) the degree to which it maintains natural composition, 2) the degree to which it remains unaltered by artificial human structure and 3) the degree to which it is unpolluted. Each of these attributes need not exist at an absolute maximum in wilderness, but, collectively, they define the qualities of freedom and naturalness and therefore facilitate the measurement of wildness.

Solitude

Solitude has been described as “the opportunity to meet the wilderness, or its maker, personally, quietly, on terms only you prescribe” (Whitney 1997). The “outstanding opportunities for solitude” afforded by wilderness have long been recognized as a key part of the “wilderness experience.” Thoreau (1862) enjoyed his opportunity to “walk ten, fifteen, twenty, any number of miles, commencing at my own door, without going by any house, without crossing a road except where the fox and mink do.” Robert Marshall (1933) required that wilderness have “no permanent inhabitants,” and Sigurd Olson (1938) exalted in “the ordinary phenomena of life in the open.” Though solitude is clearly an experience of the wild, the ability to provide it is a measurable attribute of the land. That the most wild land must be the least inhabited follows naturally from the notion that, at some population density, people necessarily bring land under control to serve their purposes (such as occupancy, transportation, recreation and hygiene). The degree of human-to-human contact is one of the defining measures of the freedom of the land.

The requirement that wilderness be uninhabited has been interpreted by some as ignoring or even subjugating indigenous people, who occupied (or occupy) the land even as it was (or is) considered wilderness (see Bayet 1994; Birch 1990; Denevan 1992; Gomez-Pompa and Kaus 1992; Nabhan 1995; Plumwood 1998). But it need not be. As the poet Gary Snyder (1990) has pointed out, every landscape has its “fire in the kitchen” and its “place less traveled.” Where population density is high, whether in the pre-Columbian or modern era, the ability of the land to afford solitude is diminished. In the “kitchen,” the land may still be “natural” (see below), but it will not be as free.

In practice, we may gauge opportunity for solitude by measuring population density. Over large areas, such as states or continents, we are usually limited to looking at

where people reside, but how people use the land is also a factor. Over smaller landscapes, we may be able to gauge the opportunity for solitude by examining recreation use patterns. In any case, we look to represent some measure of the probability of encountering others.

Remoteness

Roadlessness is also widely recognized as a defining characteristic of wilderness. Aldo Leopold (1921) insisted that wilderness be “devoid of roads,” while his son Starker’s Commission on Wildlife Management in the National Parks considered the roadgrader to be “the most dangerous tool of all” (Leopold and others 1963). Marshall’s (1933) definition required wilderness to “possess no means of mechanical conveyance” in order that wilderness remain “free from mechanical sights and sounds and smells.” Environmental historian Michael Cohen (1984) believes road construction is the first act of “trammeling” the wilderness. He writes, “I am troubled by the term ‘untrammelled’. At what point have we caught and trapped the wilderness? I would presume that a process of capturing or trapping begins when men try to ‘open out routes’ among the mountains.” Thus, the very presence of a road diminishes the freedom of the land, and distance from roads is clearly a time-honored measure of wildness.

The measurement of remoteness is fairly straightforward where we know the location of the road system. Land may be assigned a value depending on the distance from roads of various types, assuming that roads vary in their impact on remoteness. For example, an interstate highway is louder and will bring more people near an area than will a dirt road. Of course, measuring remoteness requires an accurate description of an area’s road system, which often is not available for the most remote lands.

Uncontrolled Processes

The most free land is the least controlled land. With the invasion of new technologies that attended the recent settlement of North America, ancient ecological processes were radically altered in many parts of the country. Where once fires (whether lightning-caused or anthropogenic), floods and migrations marked the passage of the seasons, fire suppression, dams and extermination replaced them. If wilderness is to live up to one of its definitions, “self-willed land” (Turner 1996), its historical ecological processes must be maintained.

The importance of uncontrolled processes to wilderness is amply noted in the literature. Wilderness has been described as a place where “a diversity of beings [flourish] according to their own sorts of order” (Turner 1996) and “where nature prevails or might prevail given the passage of time...so long as active ecological succession, structural diversity, and naturalness are permitted” (Frome 1997). Wilderness pioneer Arthur Carhart (1961) asserts, “[L]ands called ‘wild’ have retained the attribute of freedom. They have their own integrity intact. They have not been skinned, scraped, dug up, regimented and pounded into shapes and services desired and demanded by ‘civilized’ man.” Even the Wilderness Act itself insists that wilderness “retain its primeval character and *influence*” (emphasis added).

The equation of uncontrolled processes with presettlement influences again raises the question of the role of indigenous people in landscape dynamics. Clearly, indigenous people have had tremendous influence on the character of the land in localized instances and may have altered the nature of ecosystems over broad areas through the use of fire and hunting practices (see, for example, Denevan 1992). Where this influence was intensive, we must view the land as under tight control and not free. However, where influence was extensive, aboriginal fire and hunting joined other sources of ignition and mortality, making it very difficult to distinguish between aboriginal control and “the will of the land.” In this case, if only for practical purposes, we should consider extensive aboriginal influences to be part of the processes altered by the invasion of modern technological society.

Alteration of processes is probably the most difficult to measure of the six attributes that contribute to wildness. The science of historical ecology is just beginning to reveal the degree to which disturbance, hydrology, nutrient cycling, long-range migration and other ecological processes have been changed over the past few centuries. And even when we know something about rates of change, it is difficult to ascribe that information to the broader landscape. Nevertheless, progress has been made in mapping altered fire regimes, indices of watershed integrity and other metrics that may allow us to quantify land’s freedom from control of ecological processes.

Natural Composition

Composition, the relative abundance of genes, species, communities and other components of ecosystems, is one of the defining characteristics of ecosystems. An ecosystem that has lost its native species or has been invaded by non-natives has been altered in a fundamental way. In general, we recognize as most natural those ecosystems that have retained their full complement of native species and harbor no exotics.

The protection of intact native ecosystems has long been recognized as a goal of wilderness designation. The Wilderness Act specifically intended to protect “the earth and its community of life...” The protection of species that are easily harmed by, or are harmful to, human contact is a role often relegated to wilderness. Eliminated from much of their historical range, native predators, especially, are considered by many to be a vital part of the wilderness experience. As Turner (1996) says, “Predators are perhaps our most accessible experience of the wild.”

The invasion of non-native species also can decrease the naturalness and therefore the wildness of an area. Severe invasions can even alter the structure and function of ecosystems. As wilderness manager Andy Kulla (1998) has said about invasive exotic plants, “Weeds take the wild out of the wilderness.” Growing realization of the damage to native ecosystems done by exotic species has led many managers to implement weed control programs, halt stocking of fish, especially non-natives, and to insist on the use of weed-free hay and revegetation mixes.

The measure of natural composition is reasonably straightforward, to a point. Most species are understood to be either native or the result of recent artificial introduction. The species composition of any area, therefore, can be quantified

in terms of proportion of native species. Determining the degree to which native species composition has changed as a result of human agency is more difficult. Recent developments in historical ecology and (recent) paleobotany are shedding light on changes in species composition.

Unaltered Structure

Ecosystem structure refers to the spatial arrangement of the components of ecosystems. This can refer to the gross-scale features of geomorphology, the arrangement of vegetation patches or the arrangement and spacing of trees in a forest stand. The degree to which ecosystem components retain their historical arrangement contributes to the naturalness of the system.

The maintenance of unaltered structure has long been a litmus test of wilderness character and is the most familiar criterion for designation. The Wilderness Act requires wilderness to be “without permanent improvements or human habitation...with the imprint of man’s work substantially unnoticeable.” Bob Marshall’s (1933) definition stressed that “all roads, settlements, and power transportation are barred.”

Again, the standard against which alteration is to be judged is the condition of the ecosystem prior to the invasion by modern technological society, begun in North America 300-400 years ago. As has been noted, pre-Columbian North America was a network of trails and settlements (Denevan 1992; Snyder 1990). Some structures, such as the earthworks of the Southeast, were large by any standard. These structures were part of the historical ecosystem and should be considered natural. Interestingly, Marshall (1933) recognized historical structures as entirely consistent with his view of wilderness: “Trails and temporary shelters, features such as were common long before the advent of the white race, are entirely permissible.”

As with composition, the measurement of alteration of structure is fairly straightforward. Roads, dams, airstrips, mines, stockponds and other built structures diminish naturalness. Also, the substitution of square blocks of perfectly spaced plantations for natural forest, even if they comprise native species, alters ecosystem structure and diminishes naturalness. The science of landscape ecology has developed rapidly in the past few decades and has yielded a number of metrics that can be applied to land to measure its departure from historical structure.

Pollution

Wilderness carries with it an expectation of purity: clean water, fresh air, clean soil, darkness. When air, streams and the night sky are dirtied with coal exhaust, road dust, bovine feces and distant industrial light, it diminishes the naturalness of the land and the experience it provides. The poet Mark Strand (1996) makes clear the relationship between pollution and wilderness when he writes, “First we pollute the wilderness, then we pollute our minds with the belief that we’ve done the right thing. Then we pollute the wilderness more because we’ve lost our ability to see it. Soon the wilderness ceases to exist.” Some forms of pollution have direct effects on the ecosystem, such as ozone and nitrogen

deposition; others, such as the influence of city lights, affect mostly the quality of the visitor experience. Even where the effect is only on experience, pollution remains a measurable attribute of the land that affects its wildness.

Because of national laws like the Clean Air Act and the Clean Water Act, pollution is one of the best studied and best documented of the indicators of wildness. Depending on the part of the country, good maps are available for a number of air pollutants and for the quality of surface waters. The Environmental Protection Agency monitors sources of pollution across the country and maintains data in a Geographic Information System. In addition, NASA has used remote sensing to measure from space the light emitted to the night sky. It should be possible to quantify the degree to which any piece of land remains free from pollution.

Each of these attributes contributes to the freedom or the naturalness of a place and therefore to its wildness. But just because they contribute does not mean there will not be cases when they conflict. For example, the maintenance of highly anthropogenic vegetation types (such as indigenous agricultural fields), which would be natural by the above definition, would require such intensive manipulation that it would diminish freedom. Nevertheless, these attributes, when considered in aggregate, should indicate much about the wildness of any given area.

Mapping Wildness

In this section, we present results of an application of the attributes discussed above to the measurement of relative wildness at one scale – that of the contiguous United States. Though there are no hard and fast rules guiding how to apply these concepts, their application does require the selection of a consistent approach. In this case, our approach was to locate the best spatial data we could find to represent each attribute in a GIS data layer, assign each raster cell of the data layer a value for each attribute and, finally, sum the values to derive the “wildness index” for each cell. To accommodate work at a continental scale, we represented the United States as a matrix of just less than 8 million one-square-kilometer cells for analysis. The analysis was conducted with the GRID module of Arc/Info GIS software. Each attribute was represented with a value ranging between one and five. Some attributes (for example, solitude) were derived from a single data set; others resulted from a combination of several data sets (see below). Although our wildness index suffers from many of the same shortcomings attending other indices (such as the addition of unlike units as though they were commensurate), we feel it represents much of what contributes to the wildness of a place.

Solitude

Ideally, the spatial representation of opportunity for solitude would display the probability distribution of encountering another person over a landscape. It would account not only for the presence of occupants of the land, but for visitors to popular locations like national parks. Unfortunately, there are no such data sets available for the entire continental United States. However, the U.S. Bureau of the Census keeps track of the distribution of the resident population

across the country. Map 1 shows the distribution of census block groups assigned to five classes, where the value 1 (lightest) was assigned to cells with a 1990 population density greater than 1,000 persons/km², the value 2 was assigned to cells with a population density between 100 and 1,000 persons/km² and so on to the value 5 (darkest), which was assigned to census block groups with a population density of less than one person/km². Not surprisingly, the results show high population densities along the Eastern seaboard and very few residents in vast parts of the West. This map represents only where people live; it does not consider the accessibility of the land to visitors. Future renditions of the data may take accessibility into account by representing distance from population centers as well as their location.

Remoteness

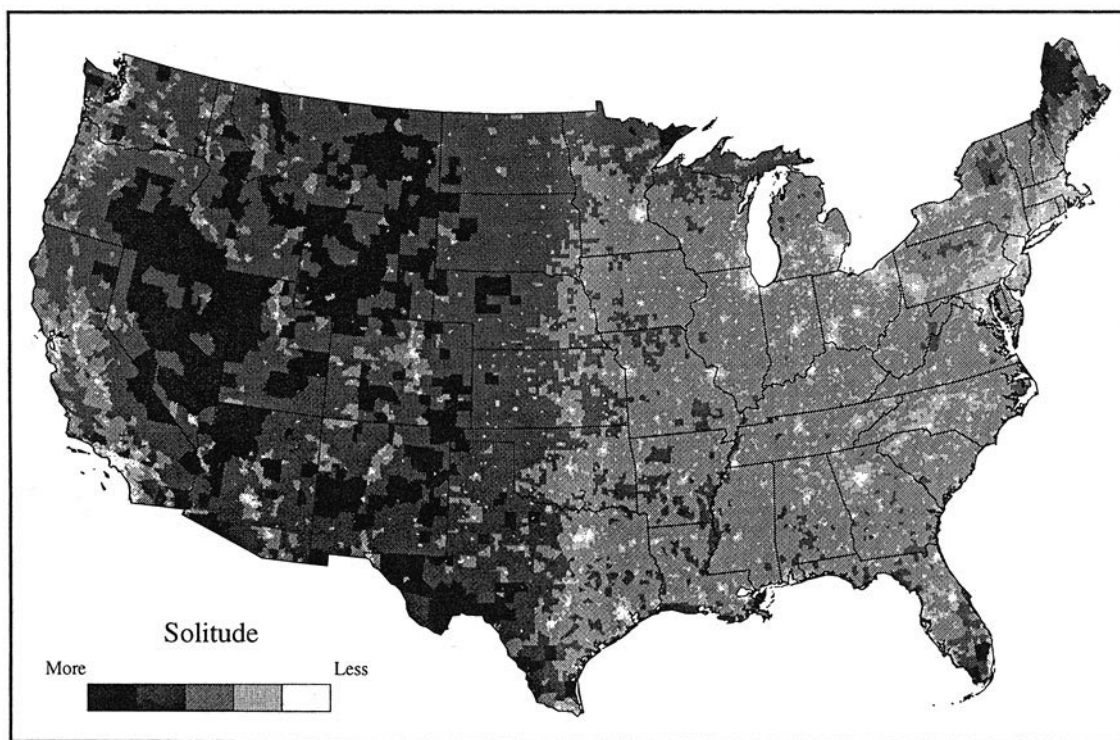
An ideal road data set would include all roads from interstate highways to natural surfaces and include all of the attributes needed to assess their relative influence on remoteness. Unfortunately, such a data set does not exist for the continental United States. Instead, we used a “major highways” (essentially paved intercity routes) data set compiled by the U.S. Geological Survey (USGS). To assign a remoteness value to each cell, we “buffered” the road system at five different distances. Cells within 2 km of a road were assigned a value of 1; between 2 and 5 km a value of 2; 5-10 km a value of 3; 10-25 km a value of 4; and greater than 25 km a value of 5. The results are displayed in map 2. Future

versions may dissolve the five distance classes into one continuous distance “surface.”

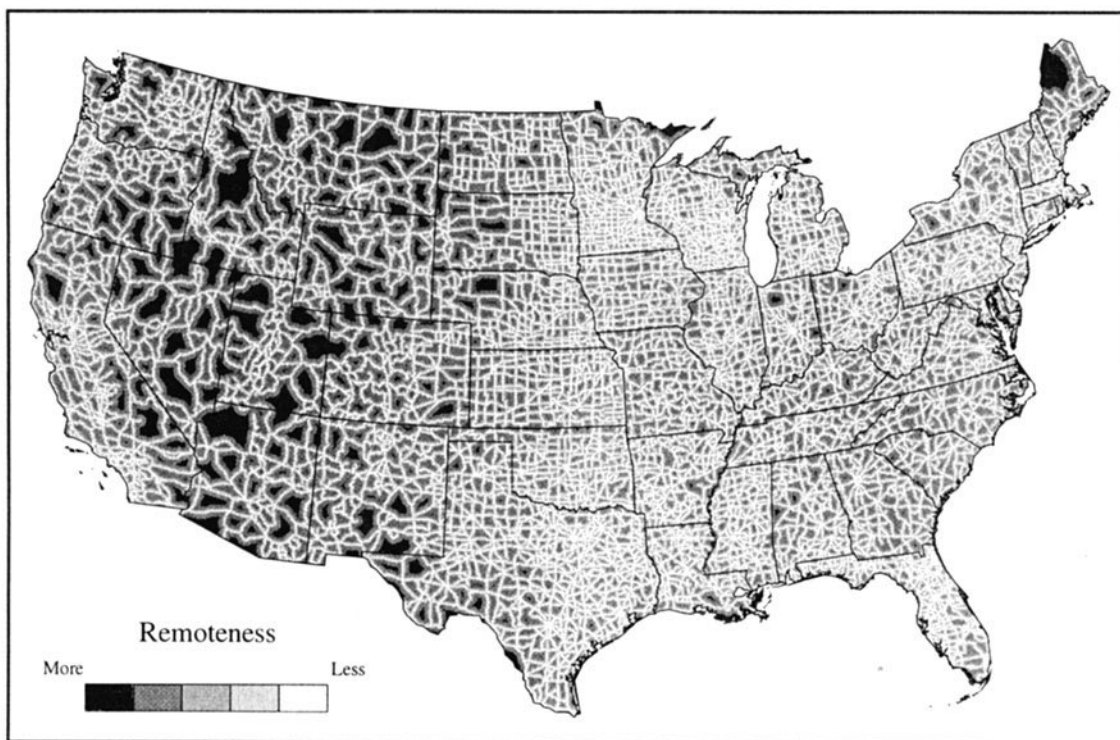
Uncontrolled Processes

Ecological processes are inherently difficult to measure, since we rarely are able to measure rates directly; instead, we generally measure states at different times and infer rates. Mapping processes is even more difficult, as it requires tying process measurements to particular places. Such data with national coverage are extremely difficult to obtain. One of the few data sets that suggests process impacts is the national inventory of dams available from the USGS. To account for changes in hydrologic function, we evaluated the number of dams in major hydrologic units (watersheds) and divided the nation into five classes. We assigned a value of 5 to cells within watersheds with no dams; a value of 4 to watersheds with 1-6 dams; a value of 3 to watersheds with 7-20 dams; a value of 2 to watersheds with 21-50 dams; and a value of 1 to watersheds with more than 50 dams per watershed.

In future renditions, we plan to build on concepts developed by The Nature Conservancy (1998) to develop a surrogate for terrestrial processes based on patch metrics (area, distance to edge, major axis) for polygons of natural vegetation (see below) delimited by major highways, agricultural lands and urban areas. The approach assumes that ecological processes in larger, well-connected patches are under less human control than in smaller, disconnected patches.



Map 1—Opportunity for solitude. Population density by census block group.



Map 2—Remoteness. Distance from major highways.

Natural Composition

There are a number of ways in which ecosystem composition can be measured. Conceptually, one of the most straightforward is species composition. Data sets should provide information on the degree to which ecosystems retain the species typical of the area and the degree to which exotic species have displaced natives. One of the few data sets available with coast-to-coast coverage of species composition is the North American Land Cover Characteristics satellite image classification conducted by the USGS, which assigns surface vegetation to over 200 different classes of natural and anthropogenic vegetation. We combined this data set with the urban classes from a separate USGS Land Use and Land Cover data set. To conduct our analysis, we assigned each one-square-kilometer cell to one of five classes, from unnatural (urban and cropland) to natural vegetation types. Cells exhibiting a mixture of use/cover fell in between. Map 3 illustrates the distribution of natural (darkest) and unnatural (lightest) vegetation across the United States.

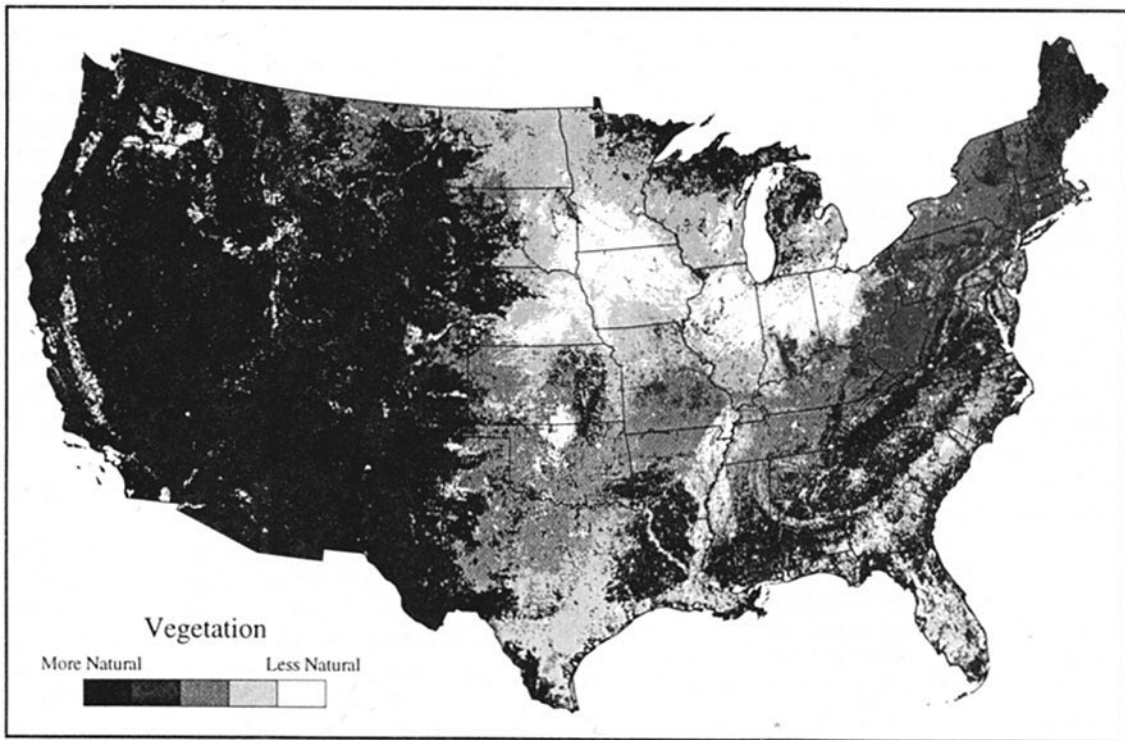
Unaltered Structure

Humans alter ecosystem structure in a number of ways, from the construction of buildings, dams and roads to the leveling of agricultural fields and the clearcutting of forests. An ideal data set would account for all these effects. Unfortunately, available data for the nation as a whole are limited to “built structures.” We mapped the location of cities, towns, highways, dams and airstrips across the country. Cells that included built structures were assigned a value of one; all others were assigned a value of five.

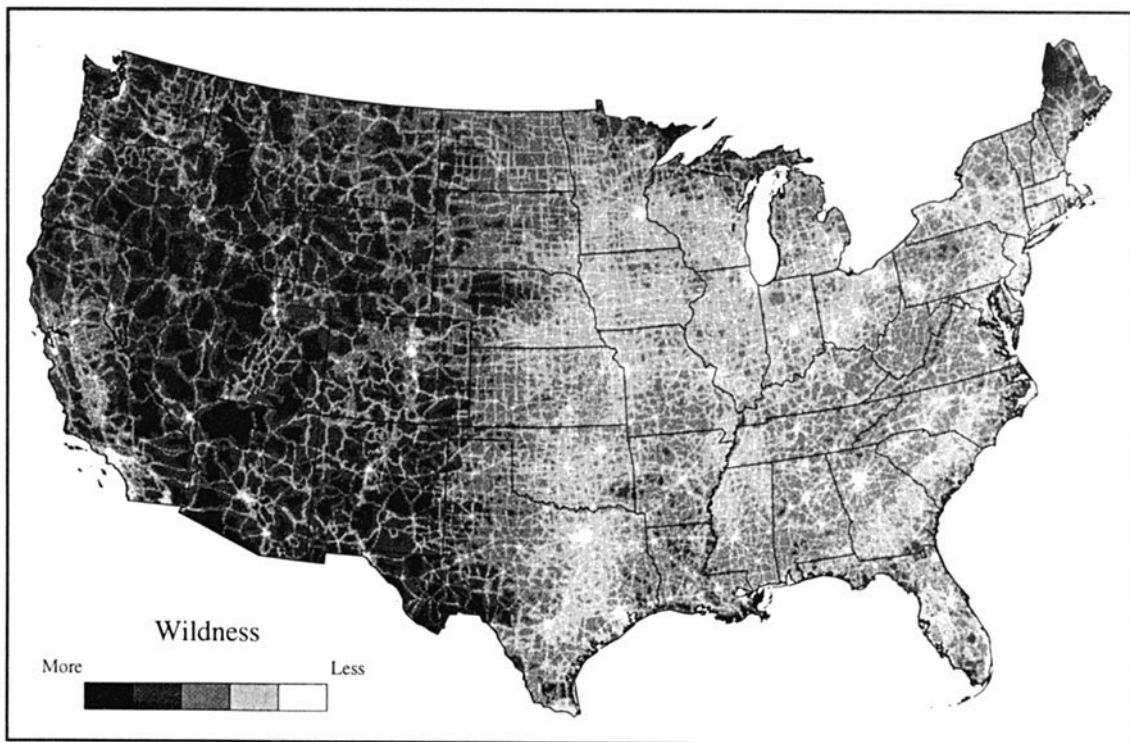
Pollution

Despite the abundance of data on pollution compiled for various locations, there exist very little data describing the distribution of pollution across the entire country in a GIS format. The EPA maintains a “national priority list” in GIS format, recording the locations of all sites they regulate as sources of pollution. In order to assess the influence of light pollution, we evaluated NASA’s image of “lights at night” for the U.S. Again, cells were assigned a value from one to five based on a combination of these data sets. As we further refine the map, we intend to bring in data that reflect actual air and water quality, not simply sources.

To construct the map of wildness (map 4), we summed the values of the six attributes into an overall “wildness index” and displayed that index spatially. Beyond the trivial result showing that the West is notably more wild than the East, some results were somewhat surprising. Because the map was generated without regard for ownership or physiography, it bears little resemblance to maps of the distribution of wilderness areas, federal lands, mountain ranges or river basins. Instead, the map exhibits “features,” such as the swaths of wild land running from southwestern Arizona to eastern Utah and from Death Valley to southwest Idaho, that have nothing in common but their wildness. Other places, like eastern New Mexico and central Nebraska, jump out as particularly wild, though they are traditionally unheralded. The map also confirms what we already knew about places like the Boundary Waters, northern Maine, Okefenokee and the Everglades: These are very special wild places in an otherwise highly developed landscape.



Map 3—Natural composition. Natural and artificial land cover.



Map 4—Wildness.

As interesting as this map is, it is important to remember that it is simply one analysis at one scale. Wild land exists in all landscapes at all scales. Aldo Leopold said it best when he wrote, “[W]ilderness exists in all degrees, from the little accidental wild spot at the head of a ravine in a Corn Belt woodlot to vast expanses of virgin country.... Wilderness is a relative condition” (Leopold 1925). Figure 2 illustrates this sentiment by showing that the wild land continuum does not exist only at the scale of large landscapes from city to wilderness. Within the portion of the land that we call rural are land uses ranging from agribusiness to ranch. We may determine that tilled or developed land is not wild, but that a large ranch is. Even on the nonwild farm landscape, land can range from developed homesites to uncultivated pasture and forest. Within this landscape, these uncultivated areas provide a glimpse of the natural and free and are highly prized for their wildness.

The next step in our process will be to repeat this type of analysis at the scale of a region (a state) and a subregion to show that patterns of wildness emerge at all scales. At these scales, new (and hopefully better) data sets will be applied to show that relatively wild land exists all around us. For example, though it appears as a highly developed patch at the scale of the nation, the city of Chicago is home to hundreds of thousands of acres of precious wild places whose protection is being sought by a coalition known as “Chicago Wilderness.” The next stage of our analysis will demonstrate that the wildness of places like these can be illustrated through the application of the very same approach to smaller landscapes.

At the same time that we are moving forward with these other analyses, we will be working to improve our analytical approach. Currently, the analysis is plagued by a number of problems. For example, by displaying the data in a one-square-kilometer grid, we have implied a level of precision to the data that is inappropriate for an index based on data collected at a number of scales, some of them quite coarse. We are currently working to identify an appropriate level of precision for display. Also, the current approach has the potential to overemphasize the influence of some factors. For example, roads factor in the estimation of remoteness, uncontrolled processes and unaltered structure. We are working toward a more sophisticated way to combine data sets to account for all six attributes without unduly emphasizing any particular factor.

Relationship to Other Efforts _____

The approach to mapping wildness described above is based on an understanding that wildness inheres in varying degrees in all lands as a function of the relative freedom and naturalness of the place. This allows the mapping of all lands as possessing some degree of wildness and the production of a continuous surface describing the wildness of any landscape. Such an approach allows us to discern connections across wild landscapes that are not readily apparent in maps based on any one of the attributes (for example, land use/land cover) or on land ownership. As a result, our method represents a new approach to the study of wild lands, complementary to other existing efforts.

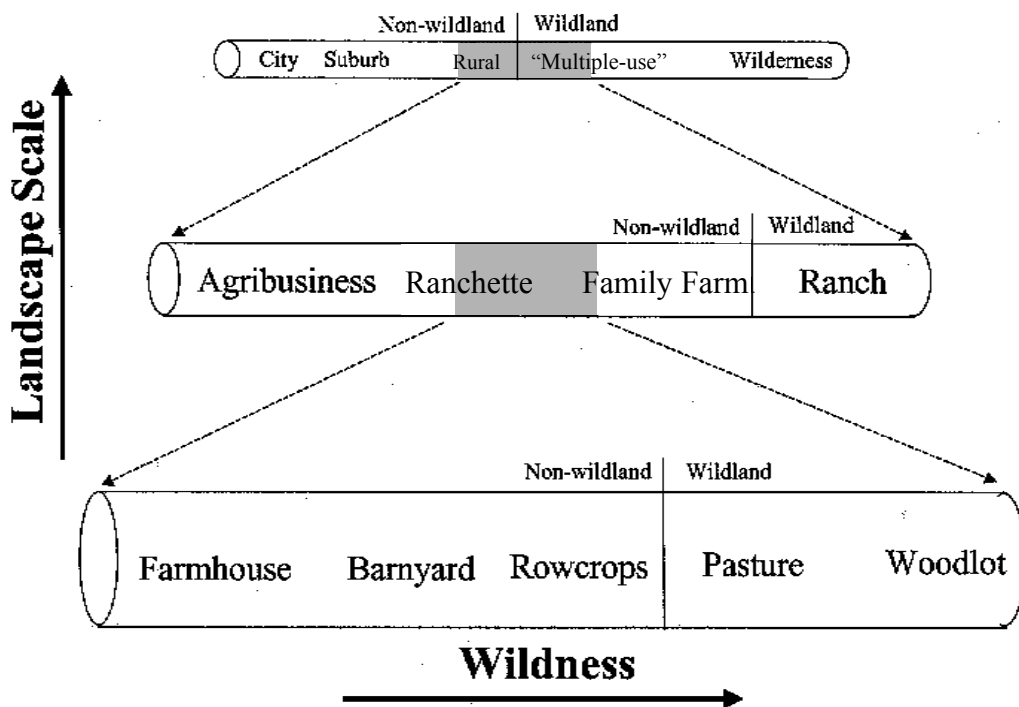


Figure 2—Wild lands can be found in any landscape at any scale.

Generally, efforts to map wild places have been of two sorts: those that focus on biological diversity and those that identify special wild places. Traditionally, mapping efforts have identified special wild places such as nature sanctuaries (Kendeigh and others 1950-51) and wilderness areas (The Wilderness Society 1989), with the implication that lands not identified in the map are not wild. Similarly, a 1997 report by the World Resources Institute characterized the world's forests as either "frontier" or "non-frontier," based on their ability to support a full complement of native species and ecological processes (Bryant and others 1997). Our method allows us to identify lands of particularly high value, while acknowledging the wildness inherent in all lands.

One of the most sophisticated wildland mapping efforts is the National Wilderness Inventory of Australia (Lesslie and Maslen 1995). This effort represents a significant advance over previous efforts because it provides an objective protocol for evaluating the wildness ("Total Wilderness Quality Index") of any particular place based on four indicators: "remoteness from settlement, remoteness from access, apparent naturalness, and biophysical naturalness." The approach described in the Australian National Wilderness Inventory Handbook (Lesslie and Maslen 1995) shares much in common with ours but still must be considered in the traditional mode, as it evaluates the wilderness quality of distinct land units identified as "natural."

The past decade or so has witnessed great progress in the mapping of areas critical to biological diversity. Efforts like the Gap Analysis Project of the USGS Biological Resources Division (Caicco and others 1995, Edwards and others 1995) and similar initiatives, such as that undertaken by the Florida Game and Freshwater Fish Commission (Cox and others 1994), have sought to identify lands of particular conservation value for protecting wildlife in each state. Studies like these improve on traditional conservation mapping initiatives because they acknowledge a continuum or gradient in wildland quality, irrespective of ownership. By including natural composition and uncontrolled processes in our analysis, we, too, recognize biodiversity as critical to wildland quality (although we do not pretend to achieve the level of detail of these other approaches). However, by also recognizing factors like solitude and unaltered structure, we assert that biodiversity is a necessary, but not a sufficient component of wildness.

One particularly noteworthy biodiversity-oriented mapping effort is The Wildlands Project, whose founders believe that "wilderness is absolutely essential to the comprehensive maintenance of biodiversity" (The Wildlands Project 1992). Such a philosophy turns the liabilities of other biodiversity mapping approaches into assets for the mapping of wild places. Because wilderness is essential to biodiversity, protecting biodiversity necessarily must result in the protection of nonbiological wilderness values.

Mapping under The Wildlands Project begins with the identification of "core reserves" essential to the conservation of wildlife – often large predators that have been exploited to extinction elsewhere. To these core reserves are added nonwilderness "buffer zones" and "corridors" to connect the core reserves. Core reserves are usually national parks and existing wilderness areas, augmented with roadless areas and places of particular conservation concern. By adding

buffer zones, The Wildlands Project begins to address some of the shortcomings of traditional wild land mapping, but because mapping generally begins with existing designated areas and builds out, it is a very "bottom-up" approach in the traditional mode of wild land identification. Our approach, in contrast, is very "top down," representing wildness unanchored by existing land designations. We believe our approach complements the "bottom-up" approach and will bring a new perspective to understanding the context of wilderness.

Wild Land Mapping: Toward a Blueprint for Wilderness

The identification of quantifiable attributes of wildness makes possible the representation of wildness and the mapping of wildness across the landscape. The mapping of wildness is important for a number of reasons. First, it allows us to point to specific places, places that are important because they are wild, whether those places occur at the scale of a region, as they do in southern Utah, or at the scale of open space in such urban gems as L.A.'s Santa Monica Mountains or Washington, D.C.'s Rock Creek Park. Maps help make places tangible and the subject of action. They can help educate about wilderness, and they can help conservationists visualize the scope of their work. Maps can also serve as a graphic record of our success.

Second, a map of where the wild places are can help us, as conservationists, set priorities for our limited resources. The wildest places are not necessarily the highest priorities for attention, but we should understand the context of the places that we do work to protect. Also, maps that show the relative importance of various wild land tracts can provide convincing arguments for wild land protection. Maps that show a tract or subregion (for example, Okefenokee or the Grand Staircase-Escalante National Monument) to be the "wildest in the land" contribute to the argument for protection.

Third, maps of wild places can be powerful tools of inclusion. Wild land maps can help direct people who wish to contribute to wilderness protection toward high-priority lands. They can also help recruit new voices for wild land protection by showing people who otherwise think of wild lands only in the abstract just how close these places are.

Finally, maps can help illuminate possibility. As The Wildlands Project has shown, dreaming with a map and crayon can motivate people to work toward a future that is better than the present. A wild land map can show not just where the wild lands are, but where they could be. If done well, wild land maps based on the attributes described above can help identify the specific changes necessary to restore wildness to degraded landscapes and begin the job of building a system of wild lands, rather than simply defending an ever-shrinking wild land base.

Acknowledgments

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Wilderness-Based Ecosystem Protection in the Northern Rocky Mountains of the United States

Mike Bader

Abstract—Wilderness is a source habitat for grizzly bear (*Ursus arctos*) and bull trout (*Salvelinus confluentus*) populations in the northern Rocky Mountains of the United States, helping sustain these indicators of ecosystem health. The spatial distribution of grizzly bear mortalities has changed since the end of legal hunting seasons, increasing the source potential of wilderness habitat. Due to its fragmented spatial distribution, wilderness alone cannot sustain viable populations, and wilderness refugia must be linked through strategies that include restoration. A wilderness-based reserve network of 140,000 km² is proposed as a foundation for ecosystem protection. A legislative version is before the U.S. Congress as The Northern Rockies Ecosystem Protection Act, H.R. 488.

The northern Rocky Mountains represent a unique landscape in the contiguous United States. It supports free-ranging populations of native large mammals and migratory fish within predator-prey systems, while such systems have largely disappeared from other landscapes. The presence of large areas of federal public lands, wilderness areas and national parks may be a critical factor in the persistence of these unique landscape features.

Biodiversity conservation at the landscape level encompasses thousands of species, about many of which we know little or nothing. For practical reasons, we focus our conservation plans on a few species that serve as indicators of ecosystem health and integrity.

Wilderness habitat was analyzed for its role as refugia for species that are primary indicators of the health of terrestrial and aquatic ecosystems. Data on grizzly bear (*Ursus arctos*), and bull trout (*Salvelinus confluentus*), were analyzed for their relationships with wilderness habitat. These species are listed as threatened under the Endangered Species Act and as Management Indicator Species within the national forest planning process. Both are wide-ranging. Grizzly bears have ranges up to 5,374 km² (2,075 mi²) (Blanchard and Knight 1991), while bull trout undergo lengthy spawning migrations up to 250 km (155 mi) (Fraley and Shepard 1989). Both have low reproductive rates (U.S. Fish & Wildlife Service 1993, 1994). Both bull trout (Fraley and Shepard 1989) and grizzly bears (French and French 1989) are known to engage in predatory behavior. They fit the definition of umbrella species (Miller and others 1999), under whose span numerous other species might be protected.

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Mike Bader is Executive Director, Alliance for the Wild Rockies, P.O. 8731, Missoula, MT 59807 U.S.A., e-mail: mbader@wildrockies.org

In this paper, I address four central questions:

- Is wilderness habitat a source habitat for grizzly bears?
- Is wilderness habitat a source habitat for bull trout?
- Has legal hunting for grizzly bears had an effect on the spatial distribution of grizzly bear mortalities?
- Can wilderness serve as a foundation for effective ecosystem protection?

Methods

Analysis Area

The area analyzed is the northern Rocky Mountains of the United States, generally bounded by the 49° and 42° latitudes and 119° and 105° W. longitudes (fig. 1). Study regions for grizzly bear are the Greater Yellowstone Ecosystem (GYE) in Wyoming, Montana, and Idaho and the Northern Continental Divide Ecosystem (NCDE) in Montana; the study area for bull trout is the Columbia River Basin generally east of the 119° W. longitude. Relevant data layers for contiguous Canadian lands were unavailable, although protection of habitats in Canada is important to conservation of these international populations.

Analysis of Wilderness and Indicator Species

I define wilderness habitat as congressionally designated wilderness, inventoried roadless areas and roadless national park lands.

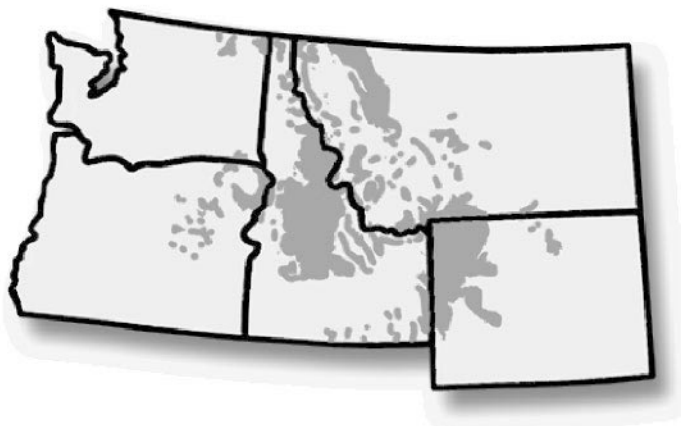


Figure 1—Northern Rockies analysis area.

A Geographic Information System (GIS), Arc/Info 7.11 and ArcView 3.0 with Spatial Analyst (Environmental Systems Research Institute 1997) were used to analyze data layers beginning with a public lands layer (National Center for Geographic Information and Analysis 1996). A digital public lands roadless area database for 27 national forests has been built over several years with information obtained through the Freedom of Information Act process and cooperative arrangements. All recorded GYE grizzly bear mortalities for which Universal Transverse Mercator (UTM) coordinates were available from 1959-1998 ($n = 641$) (Craighead and others 1988; Montana Department of Fish, Wildlife and Parks 1998), and NCDE mortalities from 1980-1997 (Dood and Pac 1993; Pac and Dood 1999) ($n = 229$), were digitized for analysis. An undigitized database of NCDE mortalities from 1970-1979 (Dood and others 1986) were duplicated on transparent overlays for analysis. Undigitized mortality data for 1998 were classified based on descriptive information in reports. Mortality locations for the Selkirk Mountains were unavailable, and sample sizes for the Cabinet-Yaak area were considered too low.

Results reported by Mattson and others (1992) suggest that human-habituated grizzly bears which frequented zones within 2 km (1.24 mi) of roads, and within 4 km (2.49 mi) of major developed areas, faced greater mortality risks than those that did not. Thus, for grizzly bears, the analysis of wilderness habitat was modified by buffering roads 2 km on either side, major developments to a 4 km radius, and the perimeters of roadless areas 2 km inward.

Two boundaries were used to evaluate grizzly bear mortalities. The first used grizzly bear recovery area boundaries (U.S. Fish and Wildlife Service 1993). The second used the mortality locations and the computer program HOME RANGER (Hovey 1998) to construct a 97% isopleth distribution boundary. Using the adaptive kernel method, this program can exclude low frequency outlying data points and includes probability density functions. While designed to describe utilization distribution for individual animals, it was found to be useful for describing distribution of grizzly bear populations (Bader, submitted). The minimum convex polygon method (Mohr 1947) was not used since it included vast amounts of agricultural lands and human settlements, and the 98-100% HOME RANGER isopleths were rejected for the same reasons. Grizzly bear mortality rates were calculated for wilderness and nonwilderness habitats and expressed as mortalities per 100 km² (38.61 mi²) for each habitat type. Wilderness (W), nonwilderness (NW) ratios were calculated.

Mortality data were also bifurcated into years when legal hunting seasons were administered, and years in which they were not. Mean annual mortality totals were calculated for hunting and nonhunting years. Mortality reports were analyzed for cause of death and bifurcated into human-caused and all other causes and percentages calculated for each. Mattson (1998) reported that a majority of reported grizzly bear mortalities were human-caused or related.

Since specific demographic and mortality data for bull trout were not available, digital layers for bull trout distribution and strong populations (Lee and others 1997), aquatic strongholds (Quigley and others 1996) and key watersheds from the INFISH aquatic strategy (U.S. Forest Service 1995) were analyzed and the wilderness, nonwilderness percent composition calculated for each.

Digital presence and absence bull trout data were obtained from the Montana Department of Fish, Wildlife and Parks, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife and Washington Department of Wildlife. These data could not be analyzed for their composition due to data interface problems. These data were overlaid onto the wilderness layer for visual analysis. The bull trout analysis area excluded one small population on the east side of Glacier National Park, and data in Nevada were not available.

Due to major differences in life histories and habitat use, the bull trout analysis made use of a separate definition of wilderness habitat. While most recorded grizzly bear mortality is directly human-caused or related (Bader 1989; Mattson 1998) and available in published reports, bull trout mortality is not so clear, and data were unavailable. Bull trout do not have the behavioral interactions with humans that grizzly bears do where use of habitat directly overlaps. Both grizzly bears and bull trout are impacted by roads, but a major difference for bull trout is that virtually all roadless areas are in higher elevation or headwaters areas, and negative effects from roads, such as sediments, are projected downstream, away from roadless areas rather than towards them. Therefore, roads and roadless area perimeters were not buffered for bull trout analysis.

Results

Wilderness and Grizzly Bears

Analysis of all mortalities from all causes in the GYE from 1959-1998 ($n = 641$) showed that 36.3% of mortalities occurred in wilderness, compared with 63.7% in nonwilderness, and W/NW = 1: 1.8. The per capita ratio per land area is 1: 3 for the recovery zone and 1: 2.1 for the 97% isopleth.

In the NCDE from 1970-1998 ($n = 431$), 35.7% of NCDE mortalities occurred in wilderness and 64.3% in nonwilderness, and W/NW = 1: 1.8. The per capita ratio per land area is 1: 1.5 for the recovery zone and 1: 1.3 for the isopleth.

The results of mortalities per 100 km² and their spatial distribution are shown in tables 1 and 2 and figures 2 and 3. The density of mortalities differs, based on sample sizes, years of coverage and whether or not hunting was allowed.

The more important figures are the W/NW ratios. A definite shift from W to NW has occurred as a result of an end

Table 1—Grizzly bear mortalities per 100 km² in wilderness and nonwilderness habitat.

	Wilderness	Nonwilderness	W:NW Ratio
Yellowstone ^a	1.454	4.376	1:3.0
Yellowstone ^b	1.292	2.678	1:2.1
NCDE ¹	0.681	0.998	1:1.5
NCDE ²	0.731	0.867	1:1.2

^aCalculated using U.S. Fish & Wildlife Service grizzly bear recovery area boundary.

^bCalculated using 97% isopleth mortality distribution boundary.

Note: Densities differ based on sample sizes, years of coverage, and analysis area.

Table 2—Grizzly bear mortalities per 100 km² among hunted and unhunted populations.

Area	Wilderness	Nonwilderness	W:NW Ratio
Yellowstone ^a			
Hunted	0.946	2.779	1:2.9
Unhunted	0.508	1.597	1:3.1
Yellowstone ^b			
Hunted	0.858	1.610	1:1.9
Unhunted	0.435	1.069	1:2.5
NCDE ^a			
Hunted	0.624	0.738	1:1.2
Unhunted	0.058	0.259	1:4.5
NCDE ^b			
Hunted	0.670	0.639	1:1
Unhunted	0.062	0.228	1:3.7

^aCalculated using U.S. Fish & Wildlife Service grizzly bear recovery area boundary.

^bCalculated using 97% isopleth mortality distribution boundary.

Note: GYE hunted years are from 1959-1974 and unhunted years are from 1975-1998. NCDE hunted years are from 1980-1991 and unhunted years are from 1992-1997. UTM locations for NCDE mortalities 1970-1979 and 1998 were unavailable and are not included in the figures in this table.

to legal grizzly bear hunting. This has increased the source potential of wilderness habitat for grizzly bears.

As a straight percentage of all mortalities during hunted years in the GYE, 38.7% were in wilderness and 61.3% in nonwilderness, and W/NW = 1: 1.6. During nonhunted years, 32.5% were in wilderness, 67.5% in non-wilderness,

and W/NW = 1: 2.1. In the NCDE during hunted years, 40.2% were in wilderness, 59.8% in nonwilderness, and W/NW = 1: 1.5. During nonhunted years, 10.9% were in wilderness, 89.1% in nonwilderness, and W/NW = 1: 8.2.

This shift is much more pronounced in the NCDE, although sample sizes were smaller. The shift was more pronounced in the GYE within the FWS recovery area; in the NCDE, the shift was more pronounced within the 97% isopleth.

The undigitized NCDE mortalities from 1970-1979 (not included in tables or figures) were 44.1% in wilderness and 55.9% in nonwilderness, and W/NW = 1: 1.3. However, hunting kills were 64.5% in wilderness and 35.5% in nonwilderness, and W/NW = 1.8: 1, while nonhunting kills were just 14.5% in wilderness and 85.5% in nonwilderness, and W/NW = 1: 5.9. UTM coordinates or specific cause other than hunting and nonhunting were not available, and these data underwent no additional analysis.

The undigitized 1998 NCDE mortalities were 5.9% in wilderness and 94.1% in nonwilderness.

The NCDE results were influenced by including some outlying mortalities, which greatly increased the total area of nonwilderness habitat used for calculations. This decreased the density of mortalities for nonwilderness habitat somewhat unrealistically. One can get different results depending on where the analysis boundary is drawn, and the results from the 97% isopleth may mask some of the source/sink effects in localized areas. Despite these effects, the two boundaries both show the same trends, consistent with other reported results (Doak 1995; Dood and others 1986;

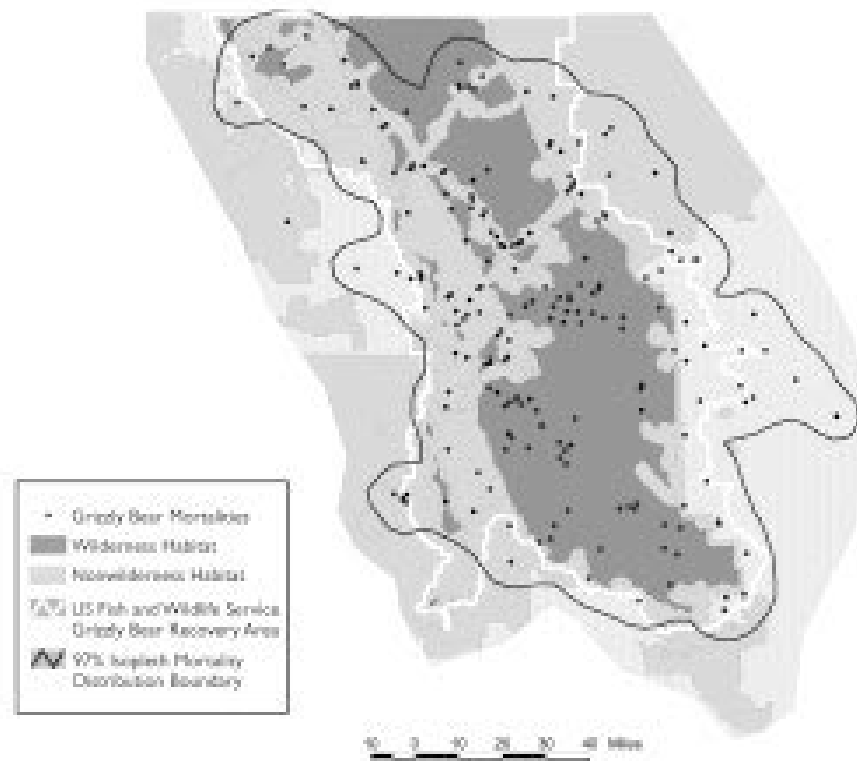


Figure 2—Grizzly bear mortalities in wilderness and nonwilderness habitat in the Northern Continental Divide ecosystem, 1980-1997.



Figure 3—Grizzly bear mortalities in wilderness and nonwilderness habitat in the Greater Yellowstone ecosystem, 1959-1998.

Knight and others 1988; Pease and Mattson 1999). The analysis of mortalities reveals that between 1959-1998, human-caused mortalities accounted for ▲ 90% of mortalities in GYE and ▲ 85% in the NCDE between 1980-1997.

In the GYE, mean annual mortalities were 25.0 in hunted years (1959-1974) and 10.4 in nonhunted years (1975-1998); and in the NCDE, they were 19.1 in hunted years (1967-1991) and 13.0 in nonhunted years (1992-1998).

Wilderness and Bull Trout

Approximately 77.7% of the area inhabited by strong populations of bull trout occurs in wilderness habitat (fig. 4), and $W/NW = 3.5: 1$. Moreover, virtually all of the remainder is located directly adjacent and downstream from wilderness habitat.

INFISH Priority Watersheds are comprised of ▲ 58.2% wilderness habitat, and $W/NW = 1.4: 1$. Known aquatic strongholds are comprised of 59.8% wilderness habitat (fig. 5), and $W/NW = 1.5: 1$. Using known and predicted aquatic strongholds, the amount of wilderness habitat is 49.3% and W/NW ▲ 1: 1.

The different results for bull trout and aquatic strongholds are explained by two factors. The aquatic strongholds data represent strong populations of several native fish species, including watersheds outside the historic range of bull trout. Evidence also suggests that bull trout have more stringent habitat and temperature requirements than other

salmonids (Bitterroot National Forest 1992; Rieman and McIntyre 1993).

The visual comparison of presence and absence data shows a strong link between bull trout presence and wilderness habitat. The demarcation line between presence and absence often coincides with the wilderness and nonwilderness habitat boundary.

Discussion

Source/Sink Relationships

Lambda, the finite rate of population growth, is measured on a scale with 1.0 representing equilibrium. The formal definition of a source habitat is an area with mean $\lambda > 1$, while sink habitats support mean $\lambda < 1$ (Meffe and Carroll 1994). Long-term demographic data on grizzly bear populations are relatively sparse, and few investigators have calculated long-term mean λ across entire population areas. Therefore, source/sink relationships for grizzly bears are often described in the context of mortality risks or rates. Variations of the source/sink concept have been developed for the GYE grizzly bear population. Doak (1995) describes a source/sink relationship using a definition of “good” and “bad” habitats, where grizzlies in “bad” habitats had per capita mortality rates 4.83 times those in “good” ones.

Pease and Mattson (1999) describe a source/sink relationship where wary, never trapped bears are the source, and

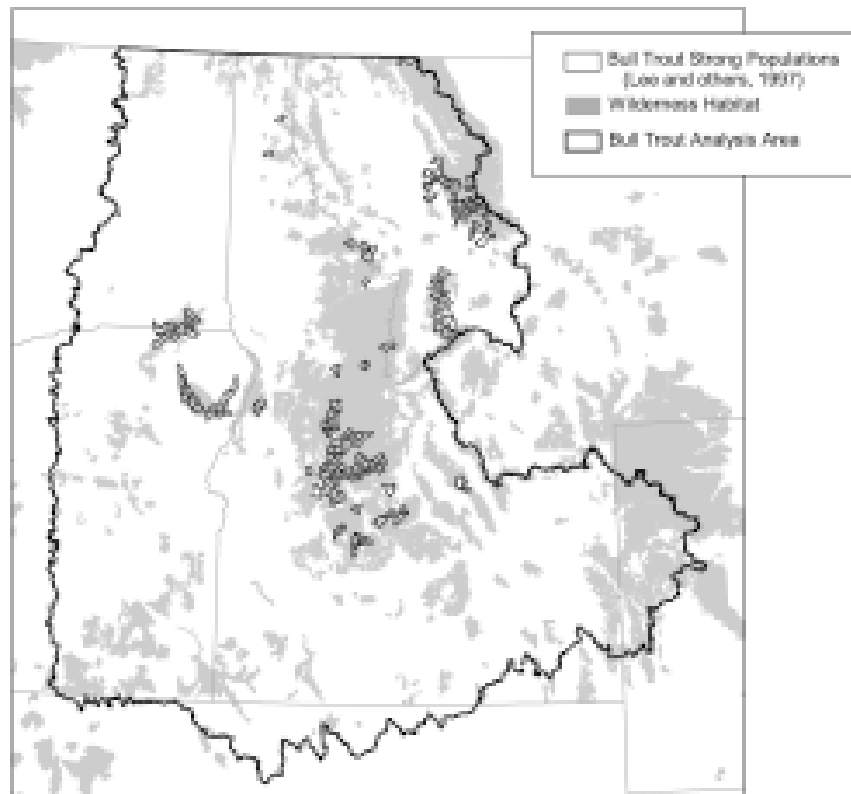


Figure 4—Bull trout strong populations and wilderness habitat in the U.S. Northern Rockies.

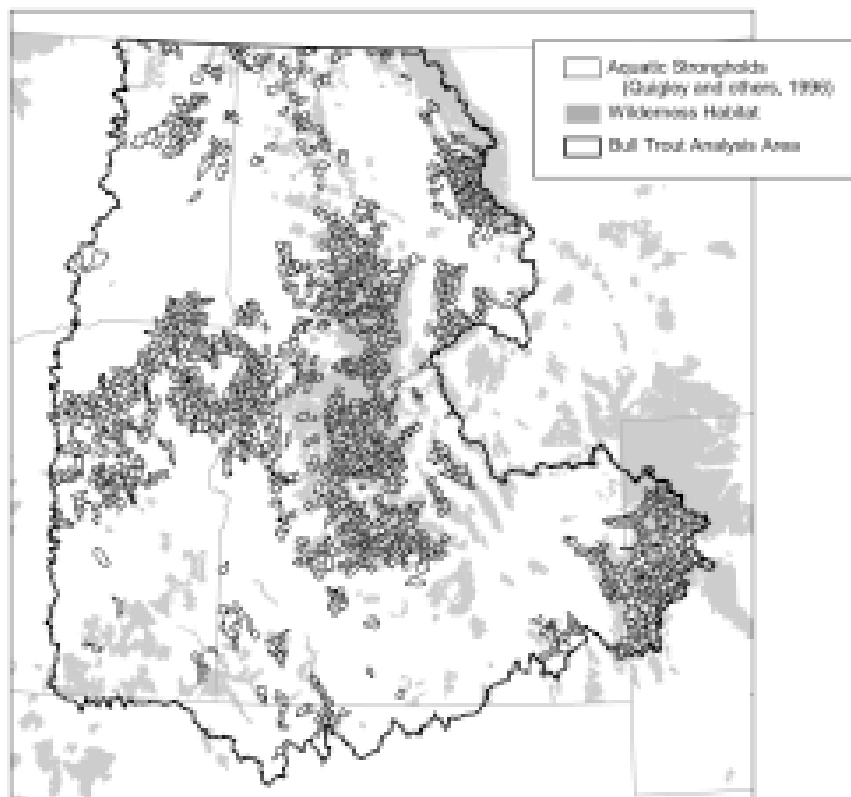


Figure 5—Aquatic strongholds and wilderness habitat in the U.S. Northern Rockies.

habituated, management-trapped bears are the sink. The latter frequent roadside habitats and developed areas and faced mortality rates approximately two times those that did not. Knight and others (1988) identified habitat sinks and found they have large geographic and population-wide effects.

Rieman and McIntyre (1993) used a schematic of historic and current systems to explain bull trout source/sink habitat dynamics. A major problem is that isolated units currently have few opportunities to use alternate habitats, as they have been degraded or blocked off. In many instances, bull trout could not move from one habitat patch to an alternate one, even if alternates were available. In this context, wilderness habitat is not only the best, but often the only refuge for bull trout. In this structure, risks from stochastic events become much greater. Historically, both source and sink areas existed at larger spatial scales, as bull trout are believed to have been extirpated from ³ 50% of their historic range (Thomas 1992), and dams and other barriers have isolated populations.

Wilderness Habitat and Grizzly Bears

Between 1850 and 1920, grizzly bears were extirpated from 95% of their range in the contiguous states (Mattson and others 1995). By 1920, distribution in the U.S. northern Rockies (Merriam 1922) had been reduced to 14 populations in remote areas and national parks. Distribution was further reduced between 1920 and 1970, and grizzlies survived this period of extirpation only in remote wilderness regions > 25,899 km² (10,000 mi²) (Mattson and others 1995). By the 1990s, substantial grizzly bear populations in the contiguous states occurred only in association with large blocks of national park, designated wilderness and other lands with little human intrusion (Metzgar and Bader 1992).

Three populations within extensive wilderness habitat in the Bitterroot Mountains may have been extirpated, but it is believed that they were eliminated by sheepherders and hunters, and not by habitat conditions (U.S. Fish and Wildlife Service 1997), demonstrating that even wilderness is not

entirely effective in providing security for grizzly bears should humans decide to eliminate them.

Human-caused mortality is the force that limits population size of grizzly bears, regardless of where it occurs. The majority of reported grizzly bear mortality in the contiguous states is human caused or related to people and their things (Bader 1989; Mattson 1998). However, the agent most associated with such mortalities are the roads and trails that allow access into grizzly bear habitat. Mattson and Knight (1991) found that secondary roads presented a mortality risk five times that of roadless backcountry areas, ranked second only to primary developments in lethality. They reported that telemetry locations of adult females over a 10-year period coincided with the areas of lowest road and trail densities in the GYE. Several other studies documented that bears avoid roads at all road density levels and that females with cubs select for roadless areas in their use of habitat. Bears avoided areas within 500 m (547 ya) of roads more than expected, and this zone of avoidance ranged up to 3 km (1.86 mi) or more (Archibald and others 1987; Blanchard and Knight 1991; Kasworm and Manley 1990; Mace and Waller 1998; Mattson and others 1987; McLellan and Shackleton 1988; Schallenger and Jonkel 1979; Wakkinen and Kasworm 1997).

The spatial distribution of mortalities (figs. 2 and 3), shows clusters of mortality along major road and railroad access corridors. This pattern is also partially obscured by the fact that some developed areas contained several reported mortalities with the same UTM coordinates, so several dots are piled on top of each other. Several of the clusters within wilderness habitat are near major trailhead access points and areas with high hunter use. The NCDE mortalities from 1970-1979 show the same pattern. The effects of human access on the spatial distribution of grizzly mortalities is clearly visible, which shouldn't be too surprising given that most grizzly mortality is directly human caused or related (fig. 6).

Bears that died in wilderness habitats usually did so because of legal and illegal hunting take, mistaken identity kills, natural causes or because bears came into conflict with

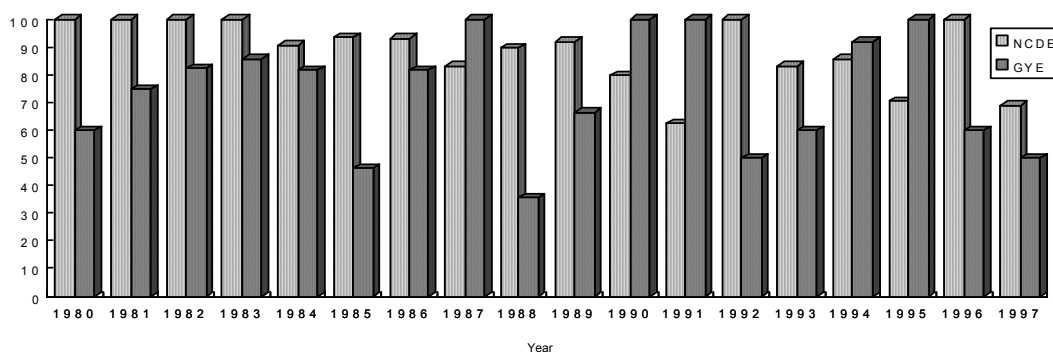


Figure 6—Grizzly bears and human-caused mortality in the Yellowstone and Northern Continental Divide Ecosystem, 1980-1997. Note: GYE data from 1959-1979 were available but not shown in order to provide direct comparison with NCDE data. GYE human-caused or human-related mortalities 1959-1998 were approximately 90% and in the NCDE 1980-1997 were approximately 85%.

“front-country” type situations, such as large camps and cabins in high human-use areas. Poor management, such as unsanitary camp conditions, can elevate mortality risk for grizzly bears and reduce the source potential of wilderness.

There are important management implications in the shift of mortalities from W to NW. If grizzly bear populations are delisted and legal hunting is resumed (the stated intention of state fish and game agencies in Wyoming and Montana), mortality density may shift back to core population areas and increase mortality among wary bears, while nonwary bears in nonwilderness habitats will still face high mortality risks. The source/sink habitat structures in these populations could thus be destabilized, and the source potential of wilderness habitat reduced, as some of the current source area would be converted to sink.

Due to the spatial distribution of wilderness habitat at the core of the GYE and NCDE recovery areas, hunting could have a destabilizing effect on these grizzly bear populations.

Some have theorized that hunting mortality among grizzly bears is compensatory and removes “problem” bears from the ecosystems, reducing the need for control actions (Greer 1976). However, the spatial distribution of the mortalities indicates that hunting mortality may be additive due to the location of numerous hunting mortalities in very remote areas, spatially distant from “problem” bears in front-country areas. Moreover, NCDE hunting mortalities from 1970-1979 were strongly skewed towards wilderness habitat, where more than 85% of the hunting kills occurred. Dood and others (1986) reported that only eight of 81 nonhunting mortalities from 1973-1985 occurred in wilderness. Another corroborating factor indicating that hunting mortality is additive are the mean mortalities per year, which decreased significantly (25.0 to 10.4 in GYE and 19.1 to 13.0 in NCDE) following the end of legal hunting seasons. Dood and others (1986) reported that hunter harvest was the leading cause of NCDE mortalities from 1967-1985. A qualifying factor is that legal hunting mortalities are more likely to be detected or reported.

Another factor is mistaken identity kills. These hunters didn’t even know which species they were shooting, let alone if it was a habituated “problem” bear or not, so many of these kills would not be compensatory.

While NCDE sample sizes were smaller, there are indications that the trend from W to NW is strengthening. For example, in 1998 (a poor food source year), mortalities rose to 23 (Pac 1999). The UTM data for 1998 were unavailable, but those for which enough descriptive information was available to make a determination ($n = 17$), 16, or 94.1% occurred in nonwilderness. Moreover, another 14 mortalities were prevented through direct management intervention (Manley 1998). Previous investigations indicate these bears are living on borrowed time, as once bears are management-trapped, their risk of mortality dramatically increases (Meagher and Fowler 1989; Pease and Mattson 1999). An analysis of more than 100 grizzly bear relocations found that an adult female has only a 60% probability of survival once it comes into contact with humans (Montana Department of Fish, Wildlife and Parks 1992). Most relocations of grizzly bears from one area to another are the result of bear-human interactions in frontcountry locations.

Mattson (1998) and Mattson and others (1992) have demonstrated a strong link between poor food source years and

elevated mortality. They also found that grizzly bears used areas within 5 km (3.1 mi) of roads and 8 km (5 mi) of developments half as intensively during good food source years. This related effect warrants further analysis, as the nonwilderness sink effect will likely be most pronounced in poor food source years, when bears greatly expand their ranges and make greater use of nonwilderness lands.

Finally, an unknown, but significant percentage of mortalities go unreported, and total actual mortality in both wilderness and nonwilderness habitats is likely higher. However, no reliable estimate of unreported mortality is currently available and we must rely on the data that is available. While natural mortalities within wilderness habitat are unlikely to be detected, the same holds true for natural mortalities within nonwilderness habitats. Moreover, illegal and mistaken identity kills often go unreported since the perpetrators of illegal kills seldom turn themselves in. Since grizzly bear deaths appear to be closely tied to human access, I assume that more such deaths occur on nonwilderness habitats than in wilderness. Several reviewers have demonstrated that a large majority of recorded grizzly bear mortalities were directly human-caused or related (Bader 1989; Craighead and others 1988; Mattson 1998), reducing the likelihood that human-caused mortality is over-reported compared to natural mortality.

Another potential complicating factor is that in the GYE area, grizzly bears within Yellowstone National Park had access to garbage dumps which were often located in frontcountry areas. These dumps were closed by 1971, prior to the cessation of legal hunting seasons.

We can infer from the literature and historical distribution that grizzly bear populations without large cores of wilderness habitat decline, don’t grow or remain at low levels that leave them vulnerable to rapid declines and eventual extirpation. Grizzly bears currently inhabit areas in the U.S. northern Rockies that are substantially nonwilderness habitats (Cabinet-Yaak and Selkirk Mountains), but at much lower densities and higher mortality risks than in wilderness habitats (Bader, in prep). Thus, wilderness habitat is the area with the least amount of human access and pressure, providing higher security (lower mortality risk) for grizzly bears.

Wilderness Habitat and Bull Trout

By any measure used, the results show clearly that wilderness habitat is a stronghold for remaining bull trout populations and other salmonids. These findings build upon a growing body of work that reveals a strong link between wilderness habitat, habitat quality and native fish.

Rieman and McIntyre (1993) reported that researchers recognize temperature more consistently than any other factor influencing bull trout distribution. Wilderness habitat, due to its spatial distribution at higher elevations and headwaters areas, contains a disproportionately high percentage of colder waters. These habitats also have generally higher percentages of streamside canopy cover, which helps keep stream temperatures lower.

Bull trout also require very clean water and favor streams with upwelling groundwater for spawning (Fraley and Shepard 1989). A key determinant is the level of fine sediments - 6.35 mm (1/4 in) (Weaver and Fraley 1991). When

these fine sediments comprise 35% and 40% of the gravel substrate, embryo survival declines by 66% and 77%, respectively. Unmanaged drainages generally have lower fine sediment levels. The occurrence of upwelling groundwater may explain the presence of bull trout within managed watersheds, as the upwelling flushes fine sediments from around embryos.

Sedell and Everest (1990) reported that up to 75% of the pool habitat in the Columbia River Basin has been lost to salmonids, and the only areas where fish habitat quality remained stable or increased were in wilderness.

Numerous studies have reported that with bull trout, strong populations, presence and biomass are inversely related to road densities (Bitterroot National Forest 1992, 1993; Huntington 1995; Quigley and others 1996; Rieman and others 1997; Swanson 1992; U.S. Fish and Wildlife Service 1998). Maxell (1996) found that bull trout spawning activity within the Rock Creek watershed was correlated with roadless sub-drainages.

The leading cause of decline in bull trout populations is logging and roadbuilding (U.S. Fish and Wildlife Service 1994); the agency recommended (1998) that remaining roadless areas within bull trout range be maintained in roadless condition. Region-wide assessments also show that the healthiest watershed conditions substantially correspond with wilderness and roadless drainages (Isaacson 1994; U.S. Forest Service 1994).

Quigley and others (1996) concluded that designated wilderness and potentially unroaded areas are important anchors for remaining strongholds of native fish.

Wilderness habitat plays a disproportionate role in sustaining remaining populations of bull trout and other native fish. Put another way, if all wilderness habitat were somehow lost all at once, extinction risks for bull trout would most certainly rise and distribution decrease. Wilderness habitat is a source habitat for bull trout, with the roaded land-base functioning as a sink habitat, increasing in severity as road densities increase.

Population Viability and Area Requirements

Two figures are important to assessments of population viability. These are the total population size (N) and the effective population size (N_e). The effective population refers to that portion of the population that is of breeding age and that actually breeds (Allendorf and others 1991). Extinction risks become severe whenever $N_e < 50$ (Shaffer and Samson 1985), and $N_e \cdot 500$ has been frequently cited as a minimum goal for species conservation (Franklin 1980; Nunney and Campbell 1993). Just as important is the ratio of N_e : N . If populations become too small, they can enter into an irreversible decline or "extinction vortex" (Gilpin and Soule 1986).

Allendorf and others (1991) calculated that for grizzly bear in the U.S. northern Rockies, N_e : N is ≈ 1 : 4. Thus, $N_e = 500$ requires a total $N = 2,000$ for a minimum recovery goal (Metzgar and Bader 1992). Reviewing reported grizzly bear densities, Metzgar and Bader (1992) concluded that a regional $N = 2,000$ requires $\approx 129,495 \text{ km}^2$ ($50,000 \text{ mi}^2$) of secure and connected habitats.

For fish populations, Nelson and Soule (1987) estimated N_e : $N \approx 1$: 10 and, applying a 50/500 rule for species viability, recommended total $N = 5000$ to maintain genetic diversity within a closed system. Based on these data, Rieman and McIntyre (1993) concluded that extinction risks for bull trout increase sharply whenever N is $< 1,000$ - $2,000$ or 500 spawning pairs.

Allendorf and others (1997) reported considerable genetic divergence between bull trout populations and that maintenance of genetic diversity requires conservation of essentially all remaining stocks throughout the range of the species. Rieman and McIntyre (1993) recommended that migratory metapopulations be reconnected throughout the current and historic range.

The total area of bull trout watersheds classified as strong, depressed, present (status unknown) and in migration corridors (Lee and others 1997) within the northern Rockies is $\approx 103,562 \text{ km}^2$ ($39,985 \text{ mi}^2$). Considering that bull trout may have been extirpated from up to 50% of their historic range (U.S. Fish and Wildlife Service 1994), and recovery goals include recolonization of vacant habitats and migratory corridors, recovery habitat for bull trout in the northern Rockies could well be greater than $129,495 \text{ km}^2$ ($50,000 \text{ mi}^2$).

Applying the results of Rieman and McIntyre (1993) estimating lower extinction risks for populations $\cdot 50$ - 100 spawning pairs ($N_e = 100$ - 200) and N_e : $N \approx 1$: 10 (Nelson and Soule 1987), a reasonable rule of thumb for minimum viability within a closed system is $N \approx 2,000$ - $5,000$ fish that are sexually mature within one generation (≈ 10 years), although larger watersheds may require larger goals. With ≈ 100 key bull trout watersheds identified by the states of Montana (1996) and Idaho (1996) and other sources for Oregon (Ratliff and Howell 1992) and Washington (Washington Department of Wildlife 1992), recovery of genetically and demographically viable bull trout populations in the U.S. northern Rockies could well require total $N > 5 \times 10^5$ adult fish, if systems remain closed. Long-term viability requires installation of passage structures or removal of dams and other barriers.

Metapopulation Structures

Source/sink dynamics often occur in association with metapopulation structures, as described by McCullough (1996) and Meffe and Carroll (1994). The metapopulation, (a population or collection of populations, Levins 1969), often occupy patches of source and sink habitats. Populations in sink areas avoid extirpations through "rescue effects" (Brown and Kodric-Brown 1977), whereby immigrants from other patches prevent local extirpations or serve as a source of refounders for vacant patches. Source habitats allow and provide dispersing members of the population to replenish sink patches.

These metapopulation structures provide a mechanism for spreading risk among populations (Rieman and McIntyre 1993) and are believed to significantly increase the likelihood of species persistence as well as genetic viability and variation.

Bull trout likely evolved in a metapopulation structure (Rieman and McIntyre 1993), while grizzly bear populations were once continuous in the contiguous states and were

fragmented by human settlement and activity into a potential metapopulation (Craighead and Vyse 1994).

For more detailed assessments of metapopulation and source/sink concepts, see McCullough (1996); Meffe and Carroll (1994); Rieman and McIntyre (1993).

Limitations to Wilderness

While large blocks of wilderness habitat remain in the northern Rockies, there are limitations to the ability of these habitats to support viable populations of key indicator species and provide comprehensive ecosystem protection. Metzgar and Bader (1992) found none of these semi-isolated blocks are capable of supporting a demographically and genetically viable grizzly bear population. Similarly, bull trout require main river systems for migration in areas where wilderness management is not an option.

Noss (1991a) found that just 19% of Kuchler-Bailey ecosystem types were represented in designated wilderness areas > 100,000 ha (♠ 247,000 ac) in the U.S.

Wilderness habitat also becomes less effective when legal hunting seasons are administered, and it is not always effective at preventing determined efforts at systematic exterminations.

Due to its fragmented spatial distribution, wilderness habitat areas must be linked through other management strategies in order to provide viability. A significant area must also be recovered as wilderness and low road-density habitats. These include special management designations for linkage corridor management, as well as road closure and obliteration efforts that both restore habitat security for grizzly bears and reduce sedimentation, illegal harvest and temperature threats to bull trout.

Due to patterns of wilderness designation, which have often favored higher elevation, more remote areas (Wolke 1991), many designated wilderness areas are comprised of large expanses of alpine terrain of limited value to grizzly bears and other species. In light of its role as critical refugia, more wilderness habitat is needed at lower elevations.

While there are limitations to the ability of wilderness to protect ecosystems and native biodiversity, wilderness is largely accepted as the most secure refugia for a wide array of species, and it is the baseline against which human impacts are measured (Noss 1991b).

A Proposal for Wilderness-Based Ecosystem Protection

Bader (1991, 1999) describes a wilderness-based reserve network for the U.S. northern Rockies. This system has been introduced in legislative form as The Northern Rockies Ecosystem Protection Act, H.R. 488, shown in figure 7.

This network makes use of four essential elements of reserve design identified by Noss (1992). These are cores, buffers, corridors and restoration.

This proposed network, with its 74,415 km² (28,733 mi²) of new wilderness designations, would help provide for connectivity through designated linkage corridors, where road densities would be reduced. Over 2,896 km (1,800 mi) of wild and scenic river designations would maintain connectivity for bull trout and other migratory fish species. One

new national park and preserve area is proposed, and another would be studied for suitability. Another provision is a pilot system of wildland recovery areas totalling 4,030 km² (1,556 mi²), where the process of restoring wilderness habitat, vegetation and low road-density conditions via road closures and obliteration would begin.

The designations are designed to work in concert to achieve ecosystem protection and total 95,705 km² (36,953 mi²); when added to existing wilderness and national park areas these would total ³ 140,000 km² (54,054 mi²), approximately equal to the minimum area requirements for grizzly bears. However, federal legislation cannot provide comprehensive protection for all grizzly bear habitat or for all current and historic bull trout habitat, and many migratory corridors pass through nonfederal lands where wilderness designation is not an option. But this network would protect the core grizzly bear habitat area and virtually all bull trout strongholds, and key habitat areas would be recovered.

The appropriate scale for capturing broader scale environmental phenomena may be 10-15 and as much as 50-100 times the largest disturbance patch (Shugart and West 1981). Wildfires burned ³ 10,460 km² (4,039 mi²) in the northern Rockies in 1988 (National Interagency Fire Center 1999). Therefore, the total minimum dynamic area (Pickett and Thompson 1978) could be ³ 104,606-156,909 km² (40,390-60,585 mi²) and potentially > 5 X 10⁵ km². The proposed network falls within the range of the lower figures. Since the northern Rockies are home to other wide-ranging species, including carnivores such as wolves (*Canis lupus*) that may have minimum area requirements up to 38,849 km² (15,000 mi²) exclusive of corridors (Bader 1991), these figures indicate that large landscapes are required to effect ecosystem protection in the U.S. northern Rockies.

This strategy is designed to work in concert with other efforts, including fish passage proposals, litigation, species listings, conservation easements on private lands and methods to facilitate wildlife movements across major highway and rail corridors, to name a few.

Economic studies by Garrity (1997) and Power (1992) concluded this network can be implemented at a net savings to taxpayers, and with minimal impact on timber industry employment.

Conclusions and Recommendations

Nonwilderness grizzly bear mortalities account for approximately two times those in wilderness, and populations larger than 50 have persisted only in association with large blocks > 10,000 km² (3,861 mi²) of wilderness habitat. The area inhabited by strong populations of bull trout is ³ 78% wilderness habitat. I conclude that wilderness is a source habitat for remnant populations of grizzly bear and bull trout, and the roaded matrix of nonwilderness lands constitute a sink habitat area.

The cessation of legal hunting seasons for grizzly bears has altered the spatial distribution of mortalities and increased the source potential of wilderness habitat. If legal hunting seasons for grizzly bears in the GYE and NCDE areas are reinitiated, the source potential of wilderness habitat would likely be reduced and the source/sink habitat

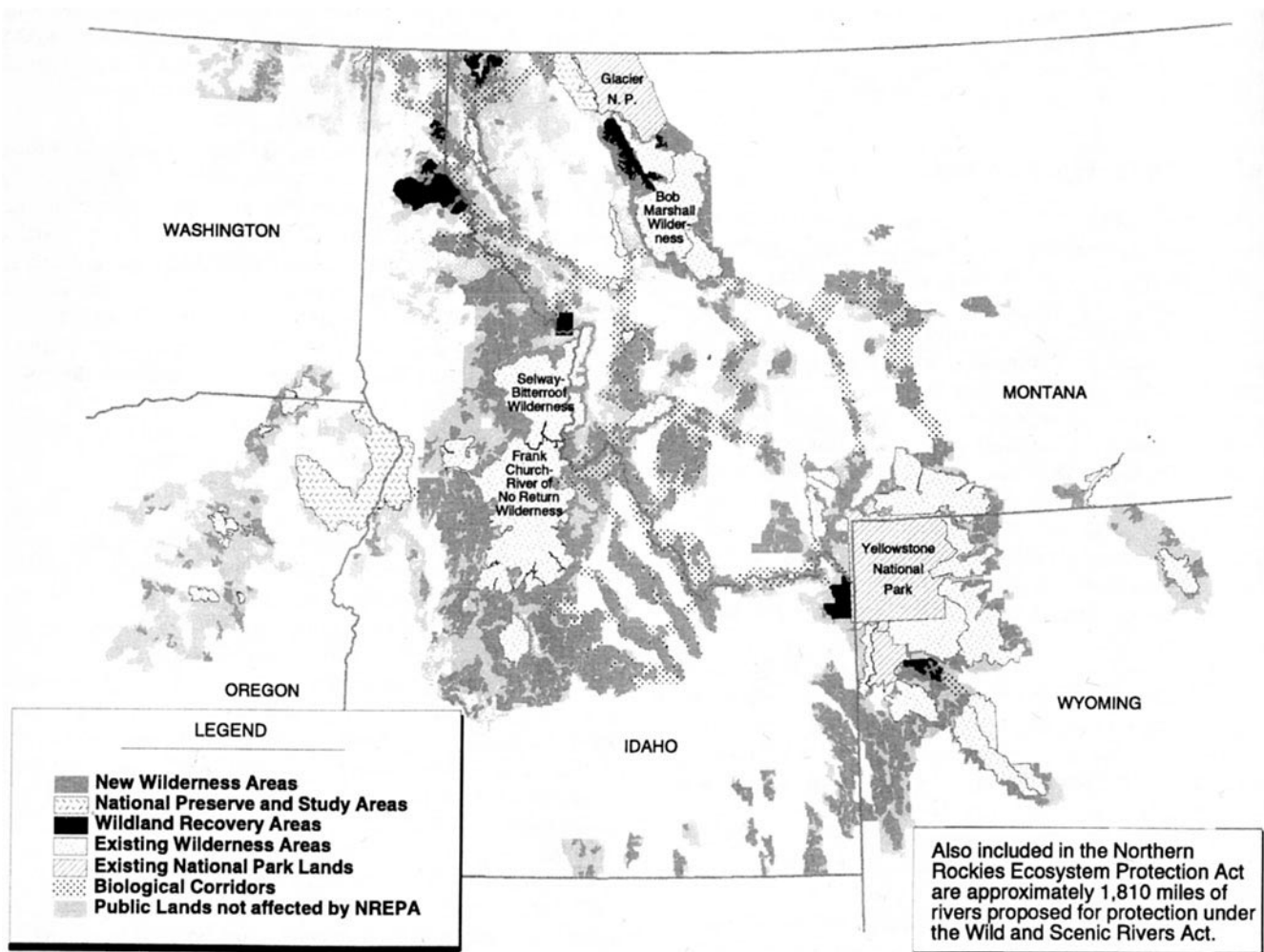


Figure 7—The Northern Rockies Ecosystem Protection Act.

structure disrupted. This could have potentially destabilizing effects, particularly in poor food source years. Bears are still threatened by illegal shootings and mistaken identity kills, which have risen since the cessation of hunting seasons. Moreover, increasing numbers of people are moving into grizzly range, indicating that bear-human conflicts may continue to rise. Thus, the importance of core wilderness source habitats will increase in importance. If increasing the source potential of core areas is a management goal, managers may also wish to consider restricting black bear hunting seasons within occupied grizzly bear range and discourage the use of baits.

Less than 50% of the wilderness habitat area in the U.S. northern Rockies has official legal protection, and it remains vulnerable to degradation. Successful recovery of leading indicator species requires protection of this source habitat area and linkage via other management strategies. Increasing the source area will reduce the overall mortality risk and enhance the possibilities for range expansion of native species, while also preventing local extirpations and range collapse.

Wilderness and unmanaged watersheds may also serve as buffers against climate change effects since forests provide

shade and cooler temperatures (Rieman and others 1997). Sudden climate change could affect bull trout distribution.

Conversely, further losses of wilderness habitat will increase the sink areas and threaten the continued existence of these species. Losses may already have passed critical thresholds. Doak (1995) found that lag effects delay detection of deleterious habitat losses until 10-12 years after they occur. Current wilderness habitat in the northern Rockies may already be too small and fragmented to prevent excessive grizzly bear mortality, particularly in poor food source years. For example, mortality quotas in the NCDE have been exceeded in 1992, 1995, 1997 and 1998 and in four of the last five years in the GYE (Peck 1999).

Due to its fragmented spatial distribution, the current wilderness habitat area, by itself, cannot sustain viable populations of wide-ranging primary indicator species, including grizzly bear and bull trout. Nonwilderness lands also play a vital role in ecosystem functions and recovery habitat, and it may be possible for low road-density lands to serve as source habitats. Wilderness lands do define the core habitat for many species, and effective strategies for landscape scale ecosystem protection in the northern Rockies will have wilderness at their core.

The Wilderness Act remains the only law that specifically protects roadless areas, and its application is a necessary component of effective ecosystem protection. Wilderness habitat is the foundation upon which effective ecosystem protection can be built. Not only is it vital to maintaining remnant populations, it serves as a primary source of individuals to recolonize historic, but currently vacant habitats.

Connectivity of habitats is the key to maintaining the unique landscape features of the U.S. northern Rockies. Functioning metapopulations would greatly enhance the likelihood of recovery and persistence of viable populations of primary indicator species, and urgent action is needed to identify, protect and restore critical linkage areas.

While this analysis is specific to grizzly bear and bull trout, it is reasonable to assume these conclusions generally apply to other species, including elk (*Cervus elaphus*), westslope cutthroat (*Salmo clarki lewisi*), Yellowstone cutthroat (*Oncorhynchus clarki bouvieri*) and other listed salmonids (*Oncorhynchus* spp.).

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State-of-the-Wilderness Reporting in Ontario: Models, Tools and Techniques

Robert J. Davidson
Paul A. Gray
Sheila Boyd
George S. Cordiner

Abstract—State-of-the-environment reporting is used by organizations to inform people about the status of natural resources and health of ecosystems, to recognize and respond to changing environmental conditions and to help citizens better understand their relationship with the ecosystems in which they live and work. The status of wilderness is an important part of state-of-the-environment reporting. Recent opinion polls and consultations on Crown land use planning have confirmed that Ontarians value wilderness and remain concerned about its future. This paper reviews the history of wilderness protection in Ontario and proposes a framework for state-of-the-wilderness reporting. The framework is based on a definition of wilderness and the identification of specific wilderness characteristics.

As in other parts of the world, Ontario's agricultural and industrial growth has marked the decline of wilderness. Aboriginal peoples used fire to clear land for agricultural purposes. European settlers accelerated the removal of trees, built roads and created communities in the pursuit of timber, farms and better lives. Consequently, population growth, intensive agriculture and an expanding industrial base have significantly reduced the quality and quantity of wilderness. In a mere 300 years, just 15 generations, wilderness in Ontario has been relegated to the more remote and isolated parts of the province.

Like many other societies, Ontario values wilderness for different reasons. Some Ontarians view it as a storehouse of natural resources, to be used for social and economic gain. Others see it as a living system, replete with natural wonders and opportunities for discovery, where people live in harmony with nature. Most would agree that wilderness is vast, remote and unspoiled. To many others, however, wilderness can be a small, isolated ravine or a wood lot within a highly developed urban setting.

While our opinions vary greatly, Ontarians are passionate about wilderness. Oracle Research reported in 1996 and 1998 that 97% of people polled believed that protecting wilderness areas was very important and 86% believed that

as much as 20% of existing publicly owned land should be set aside for wilderness protection. In another study, Manifest Communications (1996) reported that 81% of people polled agreed that provincial parks were very important to Ontario's identity and that wilderness is the defining characteristic in people's sense of what makes Ontario's parks special and unique.

This paper provides a brief history and status report on wilderness protection in Ontario. It outlines a framework for state-of-the-wilderness reporting; describes an ecosystem classification model used to determine the distribution, nature and status of wilderness; describes a model to identify and delineate remaining wilderness; and shows how recent Crown land-use planning has contributed to wilderness protection. The application of Ontario's Natural Resource Information System (NRVIS) and related ARC/INFO GIS tools to the framework are illustrated. The paper also presents some preliminary ideas on a wilderness quality index designed to allow natural resource managers to measure the quality and quantity of the wilderness condition and experience.

Ontario's Natural Diversity

The province's northern limits are marked by subarctic tundra along the Hudson Bay Coast. Boreal forest dominates the expansive Canadian Shield; while mixed forests surround the Upper Great Lakes. Farther south, Carolinian forest parallels the shores of Lakes Erie and Ontario. These regions include 1,068,580 km² of lands and waters, of which 87% is Crown-owned. They also support more than 2,000 native species of vascular plants, 450 species of mosses and liverworts, about 1,000 species of fungi, lichens and algae, thousands of invertebrate and close to 600 vertebrate species. With arctic, boreal, Great Lakes, Carolinian, prairie and coastal plain species affinities, Ontario truly represents an ecological melting pot in North America. (Beechey and Davidson, 1992).

History of Wilderness Protection in Ontario

In 1885, Alexander Kirkwood suggested that a park be created between the Ottawa River and Georgian Bay to protect the headwaters and forests of the Muskoka, Petawawa, Bonnechere and Madawaska Rivers. By 1893, Kirkwood's Algonquin Park, with an area of 3,797 km²,

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Robert J. Davidson is Senior Conservation Geologist, Paul A. Gray is Senior Program Advisor for Natural Heritage and Sheila Boyd and George S. Cordiner are Geographic Information Systems Specialists with the Ontario Ministry of Natural Resources, P.O. Box 7000, 300 Water Street, Peterborough, ON K9J 8M5 Canada.

arguably became Ontario's first wilderness park. Other large parks slowly followed, including Quetico (4,650 km²) in 1909 and Lake Superior (1,399 km²) and Sibley (163 km²) in 1944 (Killan, 1993). While logging, mining and some commercial activities were permitted in these early parks, they formed the nucleus of a growing system of protected wilderness areas.

By the late 1960s, Ontario's system included 96 parks, ranging from small roadside picnic areas to vast and remote wilderness-like parks. It became evident that no one park could be all things to all people. In response, Deputy Minister G.H.U. "Terk" Bayly introduced a policy that provided for different kinds of parks, including primitive parks designed to protect large representative landscapes. These parks were to exceed 25,000 acres (10,125 hectares), include natural features in their wild condition and provide high quality wilderness recreational opportunities (Ontario Department of Lands and Forests, 1967). On April 30, 1970, Polar Bear Provincial Park (24,087 km²) became Ontario's first primitive park.

In 1978, a new policy redefined primitive parks, as wilderness parks and proposed that one wilderness park and at least one complementary wilderness zone in another class of park be established in each of Ontario's natural regions. Quetico and Killarney (451 km²), formerly natural environment class parks, joined Polar Bear as wilderness parks. By this time, Ontario and Canada had also reached agreement on the creation of Pukaskwa National Park (1,878 km²). Five new wilderness parks including, Opasquia (4,730 km²), Woodland Caribou (4,500 km²), Wabakimi (1,550 km²), Lady Evelyn-Smoothwater (724 km²) and Kesagami Lake (560 km²) were established in 1983 as part of the implementation of the new policy. By the early 1980s, substantial wilderness zones also had been created in Sibley, Lake Superior and Algonquin Provincial Parks by management plans.

The 1978 provincial park policy defined wilderness parks as: "substantial areas where the forces of nature are permitted to function freely and where visitors travel by non-mechanized means and experience expansive solitude, challenge and personal integration with nature" (Ontario Ministry of Natural Resources, 1978). Logging, mining, sport hunting and commercial fishing were prohibited, while mechanized travel, tourism facilities and other consumptive uses were controlled in wilderness parks. These parks were to average 100,000 hectares in size and, as an absolute minimum, would not be less than 50,000 hectares. Wilderness zones in other classes of park were to range from 5,000 to 50,000 hectares in size and, as an absolute minimum, would not be less than 2000 hectares.

Efforts to protect wilderness were renewed in the 1990s. A new wilderness zone was added to Algonquin (250 km²), and a major addition to Wabakimi (7,371 km²) created one of the largest protected areas of boreal forest in the world. A new category of protected area, called conservation reserves, also was created to help protect wilderness values. These actions were followed by the release of *Ontario's Approach to Wilderness: A Policy* that confirmed government's intent to complete a system of wilderness parks and zones, define the contribution of other designated areas to the protection of wilderness values and address the protection of wilderness values through ongoing management of undesignated areas

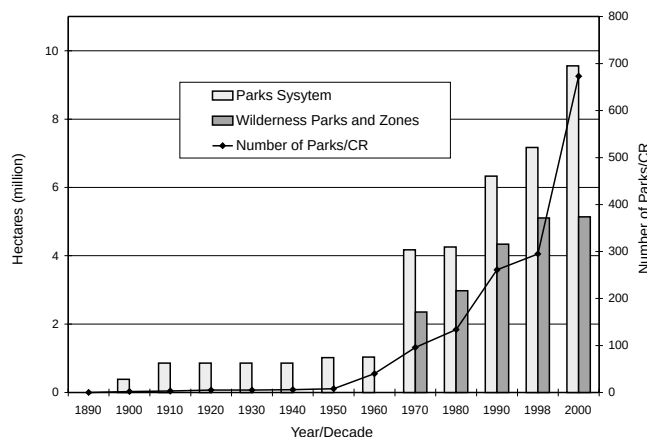


Figure 1—Growth of Ontario's wilderness parks and other protected areas.

on intervening landscape and waterscapes (Ontario Ministry of Natural Resources, 1997).

Today, wilderness parks, including Pukaskwa National Park, are found in 10 of Ontario's 14 natural regions. Wilderness zones have been established in five natural regions. These parks and zones incorporate 5,105,866 hectares, or 4.78% of Ontario's total lands and waters. When combined with other classes of provincial parks and conservation reserves, it could be argued that as much as 7,170,868 hectares, or 6.6% of the province has been assigned to protect wilderness values (fig.1).

Towards a State of the Wilderness Report

Many large natural areas have been protected, but do we share a common understanding or definition of wilderness? Is there any real wilderness left in Ontario? If there is, how do we map it, measure it and manage it? Can more be done to protect it, restore it? Do we know the state of its health or its ecological integrity? Has society in Ontario done enough to protect wilderness? The overwhelming public support for wilderness and the expectation that as much as 20% of all public lands should be protected as wilderness would suggest that much more needs to be done.

A framework for state-of-the-wilderness reporting is presented here to help answer these questions and bridge the gap between the current state of wilderness protection and the expectations of the Ontario public. This framework is premised on the following definition of wilderness.

In its purest form wilderness is vast and primeval. It includes pristine landscapes and waterscapes, native plants and animals and clean water and air. It is a place where nature functions freely, unencumbered by human agricultural and industrial activities. Wilderness is a place of natural wonder, a place of scientific and educational discovery and a place of solitude that has nurtured the evolution of the human body and spirit.

As part of the framework, nine fundamental wilderness principles were developed, using keywords in the definition.

These principles were used to define tangible wilderness characteristics that can be mapped and measured. Utilizing this conceptual framework, models for ecosystem classification, wilderness area identification and a wilderness quality index are being developed. Specific tools and techniques associated with each of these models also have been applied, or are under construction, as methods of measuring the quality and quantity of wilderness (fig. 2).

Specifically, the Natural Resources Values Information System (NRVIS) has been an important tool for assessing wilderness. This geographic information and database management system houses a variety of data on natural values (such as topography, forest cover, wetlands, and fish and wildlife habitats) and the impacts of human activities (including mine sites, pits, quarries, roads and timber harvest areas). NRVIS allows users to work with resource issues and programs in a number of spatial and tabular formats; supports data standardization, integration, data access and sharing; and, provides a variety of spatial frameworks in which to work. It has been invaluable in permitting us to explore, integrate and map a variety of wilderness characteristics.

Ecological Classification Model

Wilderness and its characteristics must be organized and cared for in the context of the ecosystems of which they are part. An ecologically meaningful spatial classification system is a prerequisite for reporting on the state of wilderness. The classification of ecosystems, supplemented by other scientific classifications, permits us to identify a range of representative natural and cultural features, or wilderness characteristics, and to define the diversity and interrelationships that collectively define wilderness.

Ecosystems can be very large or very small, with smaller ecosystems fitting into larger ecosystems. This hierarchical organization has been described as: “successive encompassing levels of interacting components or units” (Grobstein, 1974) that constitute a system of “discrete interactive levels” (Pattee, 1973). The task of spatially and temporally delineating and describing ecosystems is called ecosystem classification. The criteria used to identify ecosystem boundaries are based on the factors and forces that create and shape ecosystems. For example, large ecosystems can be delineated by integrating climate and physiography, while smaller ecosystems can be identified through examination of landforms and vegetation patterns.

The Ministry of Natural Resources has used an ecological land classification since Angus Hills developed a system in 1959 and updated it in 1961 and 1964. Hills’ approach provided a broad-scale ecological context for resource management planning, whereby he divided Ontario into 65 smaller site districts, nested within 13 larger site regions based on climate, physiography and biological productivity. This classification has been adopted as a key part of Ontario’s Provincial Park Policy. As noted earlier, the policy’s intent is to establish one wilderness park and at least one complementary wilderness zone in each natural (site) region. Site districts and even smaller ecosystems, called landscape units, provide context for establishing smaller classes of park and other protected areas. (McCleary, Davidson and Beechey, 1991).

Today, a modified Hills’ ecological land classification, including 67 site districts and 14 site regions, remains the standard for setting the geographic needs for parks and protected areas (Ontario Ministry of Natural Resources, 1997). Site regions characterized by their climate, physiography and biological productivity delineate large ecosystems,

KEYWORD	PRINCIPLES	CHARACTERISTICS	TOOLS and TECHNIQUES	MODELS
Science	<i>Founded on knowledge of nature</i>	Ecosystem diversity	NRVIS/GIS Ecosystem classification	Ecosystem Classification
Nature	<i>Vital force, essential quality</i>	Geological representation Biological representation Cultural representation	Geological classification Biological classification Cultural based classifications	
Vast	<i>Immense, huge, very great</i>	Road Density Size in Hectares	NRVIS-ARC/INFO	
Primeval	<i>Ancient, primitive, first age of the world</i>	Undisturbed natural areas Forest cover by age class	Gap Analysis NRVIS-FRI/ LANDSAT	Wilderness Identification
Pristine	<i>Old and unspoiled, fresh as new</i>	Presence of Old Growth Ecosystems	NRVIS/ARC-INFO/LANDSAT/FRI Inventory, monitoring & assessment	
Native	<i>Innate, indigenous, not exotic</i>	Native flora Native fauna	Inventory, monitoring & assessment NRVIS/ARC-INFO	
Clean	<i>Free of contaminated matter</i>	Clean air, water and soil	Inventory, monitoring & assessment	
Agricultural and Industrial	<i>Unencumbered by cultivation, rearing of animals or mechanized development</i>	No agricultural lands No industrial infrastructure	NRVIS/ARC-INFO	
Solitude	<i>Being alone, a lonely place</i>	Remoteness Distance form roads	Census Park user survey	Wilderness Quality Index

Figure 2—A framework for state-of-the-wilderness reporting.

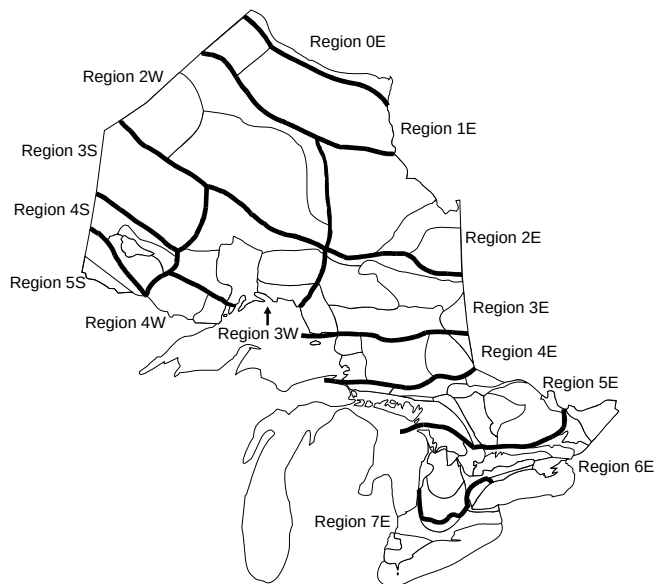


Figure 3—A modified Hills ecological land classification.

within which wilderness and wilderness characteristics are organized and measured in space and time (fig. 3). Successively smaller ecosystems - site districts and landscape units - permit the organization of Ontario's biological diversity by identifying representative or typical recurring landform and vegetation patterns and the communities and species they support (Beechey, 1981). The occurrence of these recurring patterns within wilderness areas provides a more detailed measure of the diversity and quality of Ontario's wilderness.

Ideally, one classification with which people can communicate, share knowledge and information, educate each other and make decisions is preferred. But no single classification can provide the context to address all wilderness questions and issues. The Hills' system, for example, does not adequately address aquatics, nor does it deal with geology or archaeology. Geological classification, for example, has been used to identify Ontario's representative earth science features (Davidson, 1982). As in ecological classification, the occurrence of representative earth science features can provide a measure of the overall diversity of an area. The Ministry's NRVIS and related GIS tools also permit users to select and work with any subset of themes and to overlay and interpret issues that cross both natural and administrative boundaries. Accordingly, wilderness managers must have access to a variety of other spatial classification systems.

Wilderness Identification Model

Ontario is in the enviable position of having wilderness in provincial parks and other protected areas and on intervening landscapes and waterscapes. A commitment to protect all or part of this wilderness requires managers to know how much of it is there and where it is located. To do this, a model has been developed to identify the size and extent of remaining wilderness in the province. The model is based on the keywords vast and primeval. By definition, wilderness is

vast, immense, huge and very great in nature. It also is primeval, ancient and reflective of a primitive world. Wilderness characteristics selected to reflect these principles include the absence of roads, the relative size of roadless areas and the presence of undisturbed natural areas.

Roads and railroads are a reasonable indicator of how deeply our agricultural and industrial society has penetrated wilderness. Appropriately, roads and railroads are used as defining variables in the model. Using data on the province-wide distribution of primary, secondary and tertiary roads, trails and rails available in the Natural Resources Values Information System, ARC/INFO GIS software was used to identify areas without roads. Discreet roadless areas were delineated based on 1, 5 and 10 kilometer buffers from the nearest road or railroad (fig. 4). Those areas falling within the 5 and 10 kilometers buffers were then organized into roadless wilderness blocks of 2,000-5,000, 5,000-10,000, 10,000-50,000, 50,000-100,000 and greater than 100,000 hectares in size (fig. 5).

The model indicates that in the highly developed southern landscape, only a few small fragments of wilderness remain. Across the length of the Canadian Shield, blocks of wilderness isolated by a well-developed network of highways and logging roads become more frequent and larger. Farther north, at the end of the road(s), isolated blocks gradually coalesce into one large contiguous block whose edge delineates Ontario's wilderness frontier. This evolving picture shows that as much as 514,673 km², or 52 percent of Ontario's lands and waters, falls within blocks of wilderness more than 5 to 10 kilometers from the nearest road. Notwithstanding their limitations, these data provide a reasonable first approximation of the size and extent of Ontario's remaining wilderness.

By superimposing ecosystem classification and roadless area mapping, it is possible to determine the amount and location of potential wilderness in each ecosystem in Ontario by site region, site district or smaller ecosystems. An accounting of total potential wilderness area by site region, based on 1, 5 and 10 kilometer distances from roads, is provided in figure 6. A map of Site Region 3W, including Site Districts 3W1, 3W2, 3W3 and 3W5, also is provided to illustrate the shape and distribution of roadless blocks in a large ecosystem (fig. 7). When mapped, larger roadless wilderness blocks become meaningful as candidate wilderness parks and protected areas; while smaller roadless blocks, and patterns of roadless blocks, on intervening landscapes and waterscapes identify opportunities to manage wilderness characteristics, in the hope of retaining and restoring larger blocks over space (large ecosystems) and time.

If we assume that large roadless areas retain many of their inherent natural values, to some degree, we have addressed the primeval nature of wilderness. To embellish our search for a representative primitive world, we can apply a tool called gap analysis. Gap analysis defines representation on an ecosystem basis. It identifies landforms using existing geological maps and landcover data sets using Forest Resource Inventory (FRI) and Satellite Imagery (LANDSAT). These data sets are overlain to create a matrix of representative landform and vegetation (L/V) types at a site district level. Representative L/V types found inside protected areas are considered to be protected and removed from the equation. The remaining L/V types, or gaps, are

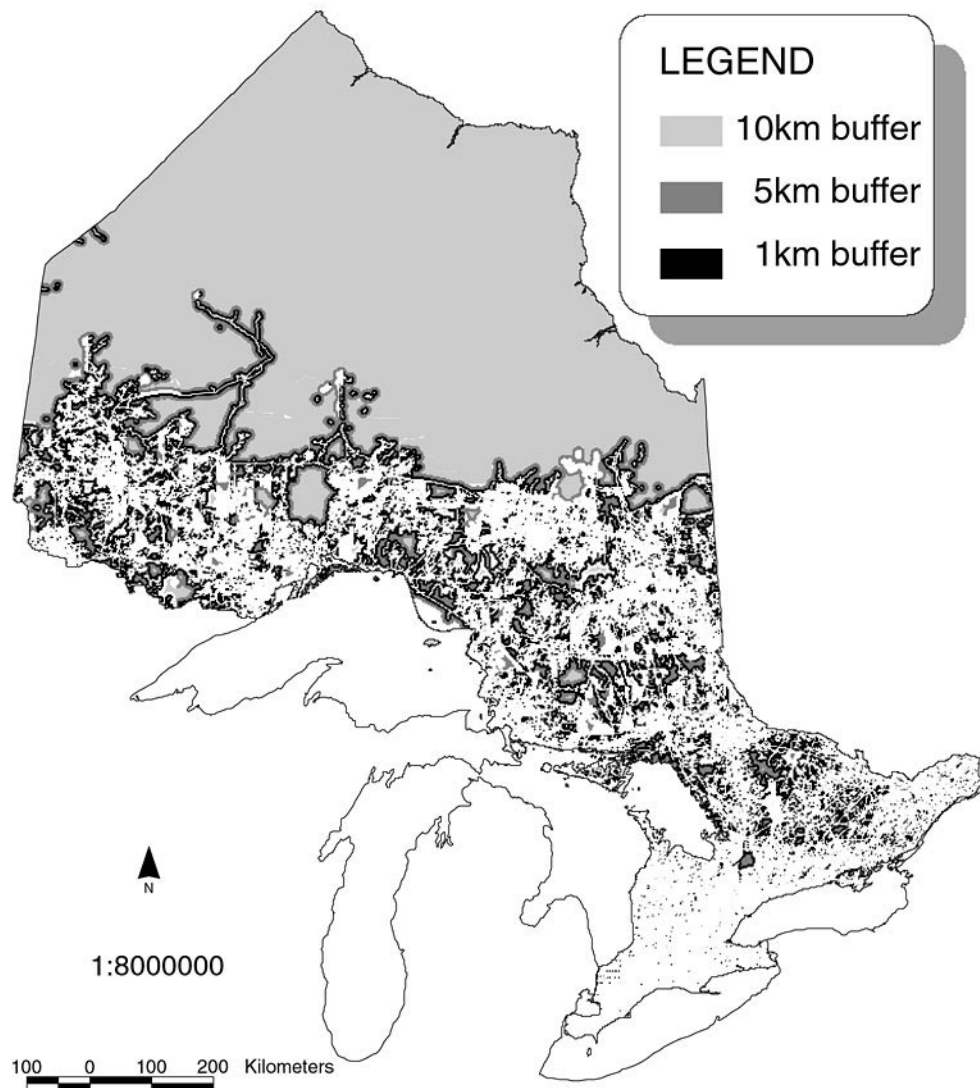


Figure 4—Ontario's wilderness frontier.

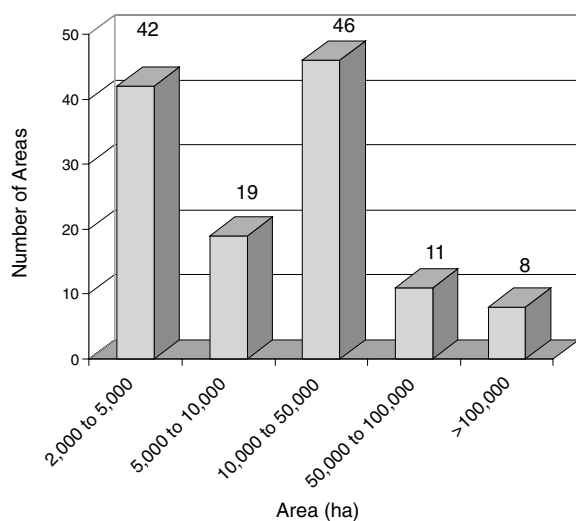


Figure 5—Roadless area blocks 5 kilometers from the nearest road.

Site Regions	10 km	5 km	1 km	Roads	TOTAL
0E	100.0%	0.0%	0.0%	0.0%	100.0%
1E	100.0%	0.0%	0.0%	0.0%	100.0%
2E	90.6%	4.4%	3.7%	1.3%	100.0%
2W	88.1%	6.0%	4.6%	1.3%	100.0%
3E	2.9%	8.2%	29.7%	59.3%	100.0%
3S	65.6%	12.7%	14.7%	7.1%	100.0%
3W	18.9%	10.9%	28.7%	41.5%	100.0%
4E	1.1%	6.4%	35.4%	57.2%	100.0%
4S	13.2%	6.9%	32.6%	47.3%	100.0%
4W	2.4%	8.3%	31.1%	58.1%	100.0%
5E	0.1%	2.2%	28.1%	69.6%	100.0%
5S	2.5%	12.1%	35.6%	49.9%	100.0%
6E	0.0%	0.4%	4.7%	94.9%	100.0%
7E	0.0%	0.0%	0.9%	99.1%	100.0%
Total	46.6%	5.7%	15.6%	32.2%	100.0%

Figure 6—Roadless areas by Site Region.

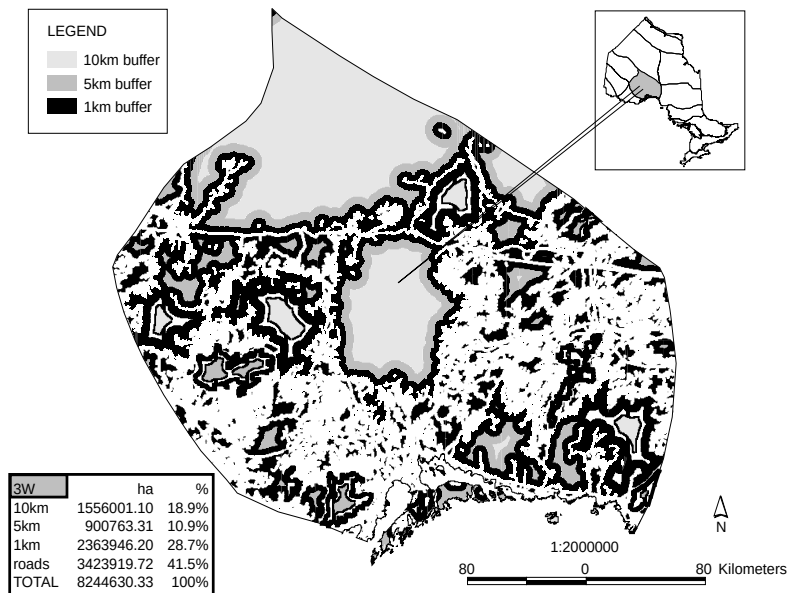


Figure 7—Roadless areas in Site Region 3W.

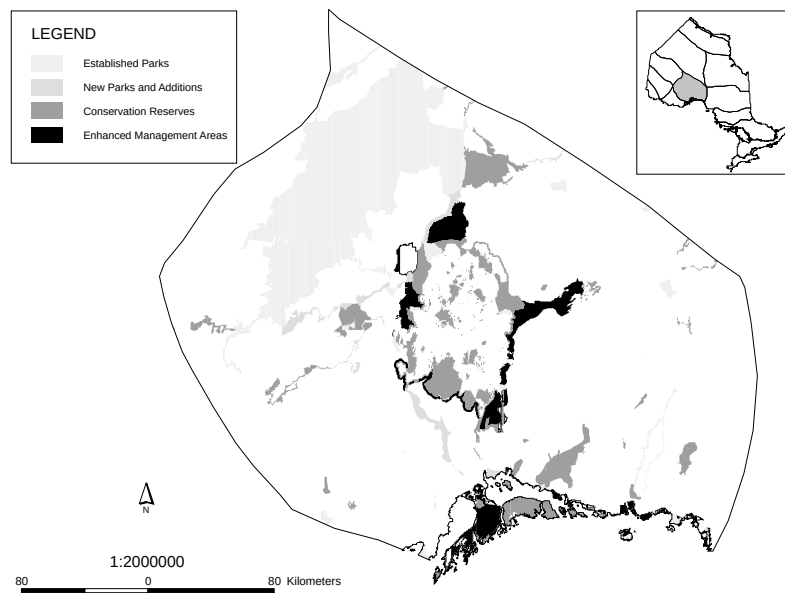


Figure 8—Land-use designations in Site Region 3W.

then screened for human disturbance and assessed for their diversity, ecological condition and special features. The best examples of the remaining L/V types are then identified and mapped using ARC/INFO (Crins and Kor, 1998). The coincidence of “large roadless blocks” and “representative gap sites” are used to help identify wilderness areas that retain their primeval wilderness characteristics.

In the last two years, ecosystem classification, gap analysis and roadless areas have played an important role in developing Ontario’s Crown land use planning strategy (Ontario Ministry of Natural Resources, 1999). This strategy addresses protected areas, angling, hunting, tourism and

industrial needs in an area roughly corresponding to Ontario’s Canadian Shield. The strategy also proposes a variety of land use designations, including provincial parks, conservation reserves, forest reserves, enhanced management areas and general use areas. In many cases, forest reserves and enhanced management areas that either exclude or control logging and other industrial activities are nested alongside provincial parks and conservation reserves (fig. 8). This combination of new land use designation provides the opportunity to manage designated and undesignated wilderness areas and wilderness characteristics in a larger ecological context.

The land use strategy recommends 61 new provincial parks, 45 park additions and 272 conservation reserves, ranging in size from 31 to 158,729 hectares, and totaling 2,386,679 hectares of lands and waters. Many of these lands and waters fall within roadless blocks more than 5 to 10 kilometers from the nearest road. When added to the existing provincial park and conservation reserve system, Ontario's network of protected areas could grow to include as many as 629 areas and 9,424,068 hectares, or close to 9% of the province's total area. This enlarged system of protected areas would include 23 areas that exceed the 50,000 hectare minimum size standard set for wilderness parks and include more than 250 areas that exceed the 2,000 hectare minimum size standard set for wilderness zones.

Wilderness Quality Index Model ---

As society continues to pressure Ontario's remaining wilderness, natural resource managers will need detailed information on the variation in the quality of wilderness and on the factors that influence wilderness. We will need to know what areas have high value and the reasons for this value. To help address these needs, Ministry of Natural Resources staff are exploring the idea of a wilderness quality index to rate/rank areas for their wilderness values. A major purpose of the index would be to determine the relative condition or ecological integrity of Ontario's remaining wilderness. The index would build on the definition of wilderness and wilderness characteristics and constitute part of an overall framework for reporting on the state of wilderness. It would be the product of a procedure in which a combination of wilderness characteristics are rationalized, measured and possibly weighted, ranked and assessed using simple arithmetic.

Some preliminary thoughts on an index are presented here, as simple illustrations, in anticipation of a more systematic and rigorous approach to the design and development of wilderness indices in the future. To start, the index should be founded on some basic principles. It should be simple, logical, practical and user-friendly. It should be easily applied to defining, evaluating and monitoring wilderness characteristics. It should reflect society's values and measure physical characteristics that people attribute to wilderness. A wilderness index also should be sensitive to ecosystem size and based on readily accessible or easily recorded data and information.

Qualitative, and/or quantitative approaches, similar to those used by Parks Canada (1998), can be used to assess and measure wilderness characteristics in relation to human-induced stresses. For example, a qualitative approach can be used to identify human-induced stresses and record their presence or absence using a simple YES/NO response. The cumulative number of YES or NO responses for a geographic area can then be used as a relative assessment of wilderness value and permit the comparison and ranking of one area against another. A quantitative approach can measure the degree or severity of a selected human-induced stress, or combination of stresses, to establish their cumulative effects. If quantifiable data and information are not available, use of explicitly rationalized surrogate expert opinion could be considered. A number of possible

wilderness characteristics that could be measured and some of their possible outputs are summarized in figure 9.

Wilderness characteristics were identified to reflect an areas ecological diversity, recreational values and human interference patterns. No measure is completely unique to the assessment of just one characteristic, and in some cases, several measures of a single wilderness characteristic are possible. For example, absence of water pollution can be measured using water quality standards for alkalinity, aluminum, calcium, chloride, chlorophyll a and dissolved organic carbon. One measure also can represent two or more characteristics. For example road density can, in some cases, provide information about the extent of human activity and access in an area. Therefore, it is important to acknowledge the potential for redundancies and the need to minimize them when creating an index.

A simple example of a wilderness quality index could include an estimate (on a scale of 0 to 1.0) calculated by adding together the scores for all wilderness measures and dividing the total number of points available. Three different roadless wilderness areas in Site Region 3E in northeastern Ontario, for example, were selected and evaluated using the following formula (fig. 10).

$$WI = \sum V_{1-15} / 15$$

$$WI = V_1 + V_2 + V_3 + V_4 + V_5 + V_6 + V_7 + V_8 + V_9 + V_{10} + V_{11} + V_{12} + V_{13} + V_{14} + V_{15} / 15$$

Where $V_n = 0.0$ to 1.0 and 1.0 includes the highest wilderness-like qualities.

A wilderness quality index can help managers to determine the presence or absence of wilderness characteristics in a selected geographic area. This permits the ranking of wilderness areas using a common approach, or yardstick to measures the relative value of each wilderness characteristic. Once areas have been ranked, management priorities for protecting or enhancing its wilderness characteristics can be determined before or after an activity is scheduled to occur. The index can act as a benchmark, against which we can measure the current status of wilderness characteristics on intervening landscapes and waterscapes and contribute, to state-of-the-environment reporting. It also can provide a measure of the success or failure of agency or organization efforts to restore the primeval condition.

Summary and Conclusions ---

Ontario is truly fortunate. While much of our southern wilderness has been lost, there are still significant opportunities to explore Ontario's northern wilderness. This can be attributed to the remote and rugged nature of the north and to the passion most Ontarians have for wilderness. This passion has helped Ontario's system of provincial parks and conservation reserves grow to include 295 areas and more than seven million hectares of lands and waters. Recent Crown land use planning proposals recommend that another 333 areas and more than 2.4 million hectares be added to this total. The vast majority of these lands and waters are either formally designated and managed as wilderness or are managed to retain wilderness characteristics.

A framework for state-of-the-wilderness reporting has been proposed here to facilitate the identification, protection and management of wilderness in Ontario. This framework

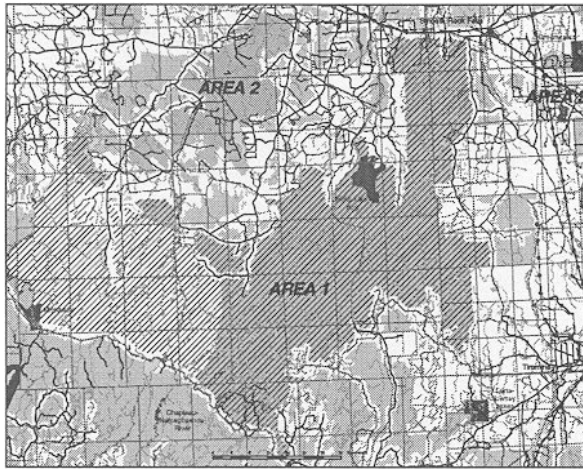
Definition	+/- Wilderness Characteristic	Measurable Impacts	Qualitative Measure	Quantitative Measure
<i>Science</i>	Ecological Diversity	Representation	YES/NO	Number large/small ecosystems
<i>Nature</i>	Geological Features	Representation	YES/NO	Geological diversity
	Biological Features	Representation	YES/NO	Biological diversity
	Archaeological Features	Representation	YES/NO	Archaeological diversity
<i>Vast</i>	Large Area Size		YES/NO	5,000 ha. (Minimum)
<i>Primeval</i>	Roadless	Road Density	YES/NO	50 km of road/10km ²
		Utility Corridors	YES/NO	x km of corridor/10km ²
<i>Pristine</i>	Forest Cover	Fragmentation	YES/NO	% fragmentation/10km ²
<i>Native</i>	Native species	Biodiversity	YES/NO	% of total ecosystem species
	Exotic species	Ratio of Exotic to Native	YES/NO	Fraction/Percentage
<i>Clean</i>	Clean Air	Ground Level Ozone	YES/NO	< 50ppb
		SO ₂	YES/NO	< 11ppb
		NO ₂	YES/NO	< 32ppb
		CO (Climate Change)	YES/NO	< 5ppb
		Suspended Particulates	YES/NO	< 60kpg/m ³
	Clean Water	Acid Rain	YES/NO	< 4.0pH
		PCBs	YES/NO	< 0.001ppb
		DDT	YES/NO	< 0.003ppb
		Mercury	YES/NO	< 0.2ppb
	Uncontaminated Soils	Erosion (man induced)	YES/NO	Erosion rates
		Mine Tailings	YES/NO	Numbers, size, contaminants
		Solid Wastes (Dumps)	YES/NO	Numbers, size, contaminants
<i>Solitude</i>	Remoteness	Population Density	YES/NO	Percent Population per 10km ²
		Backcountry Visitation	YES/NO	Interior camps/site/season
		Aircraft Flybys	YES/NO	Frequency/day/week
<i>No</i>	Outdoor Recreation	Sport Fishing	YES/NO	Take by species/number
<i>Agriculture</i>		Sport Hunting	YES/NO	Take by species/number
<i>or Industrial</i>		Canoeing	YES/NO	Canoes/area/campsites
<i>Activities</i>		Hiking	YES/NO	Hikers/length of trail/campsites
		Snowmobiles/ATV	YES/NO	Numbers/length of trails
		Park Infrastructure	YES/NO	Area developed
	Tourism	Motor Boats	YES/NO	Numbers/size of motors
		Boat Caches	YES/NO	Numbers/10km ²
		Aircraft Landings	YES/NO	Frequency/day/week
		Main Lodges	YES/NO	Numbers/10km ²
		Outposts	YES/NO	Numbers/10km ²
		Waste Disposal Sites	YES/NO	Numbers/10km ²
		Bait Fishing	YES/NO	Licenses/area covered
	Harvest	Commercial fishing	YES/NO	Licenses/take by species/number
		Commercial Trapping	YES/NO	Licenses/take by species/number
		Wild Rice Harvesting	YES/NO	Licenses/area covered
	Water Control	Dams	YES/NO	Numbers/10km ²
		Diversions	YES/NO	Numbers/10km ²
		Hydroelectric Generation	YES/NO	Numbers/10km ²
		Power Lines	YES/NO	Kilometres/10km ²
	Forestry Practices	Logging	YES/NO	Numbers/percent area logged
		Silviculture	YES/NO	% area tended
	Mining Practices	Mineral Exploration	YES/NO	Size of area/ELOs or claims
		Mining Infrastructure	YES/NO	Numbers/area patent/leases
		Mine Tailings	YES/NO	Numbers, size, contaminants
	Others	Poaching	YES/NO	Charges laid/prosecuted

Figure 9—Measuring human induced stresses.

proposes common definitions for wilderness and wilderness characteristics. It applies a spatially meaningful ecosystem classification system to identify and care for wilderness and wilderness characteristics. The framework includes a model for identifying wilderness areas and reviews the success of recent Crown land use planning in protecting wilderness. The framework also recognizes the need to record and

monitor the ecological integrity of wilderness over time and space. It is proposed that a Wilderness Quality Index be developed to facilitate the monitoring of ecological integrity and the rating of a given area's value as wilderness.

The proposed *State-of-the-Wilderness* reporting system has direct application to the development and implementation of wilderness policy and the completion of a system of



Wilderness Characteristics	Rank		
	Area 1	Area 2	Area 3
Rare or unusual biota	.6	.4	.8
Rare or unique landform(s)	.2	.7	.2
Presence of healthy populations or habitats	.9	.3	.6
Presence of intact landform(s)	.6	.6	.1
Size of ecosystem(s)	.6	.3	.1
Absence of water pollution	.9	.2	.6
Absence of air pollution	.7	.5	.6
Absence of soil contamination	.9	.1	.8
Size of the area	.8	.5	.1
Dispersed campsites	.9	.6	.1
Human noise levels	.8	.1	.4
Human contact	.9	.3	.1
Access	.7	.5	.6
Distance from human centres	.6	.8	.1
Absence of human impacts	.9	.2	.8
Score/Potential Total	11.0	6.1	6.0
Index Value (0-1.0)	.733	.407	.400

Figure 10—Map of three roadless areas and sample index for Site Region 3E.

wilderness parks and equivalent reserves in Ontario. The system also can be used to help address the need to protect, restore and monitor wilderness characteristics on intervening landscapes and waterscapes as part of larger regional land use and forest management planning initiatives. It can serve as a powerful tool to help develop, market and manage a wilderness-based ecotourism industry.

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New GIS Approaches to Wild Land Mapping in Europe

Steffen Fritz
Steve Carver
Linda See

Abstract—This paper outlines modifications and new approaches to wild land mapping developed specifically for the United Kingdom and European areas. In particular, national level reconnaissance and local level mapping of wild land in the UK and Scotland are presented. A national level study for the UK is undertaken, and a local study focuses on the Cairngorm Mountains in Scotland. ‘Remoteness from mechanized access’ is mapped on a local scale, using Naismith’s Rule in combination with Dijkstra’s algorithm. ‘Apparent naturalness’ is mapped by using an Internet questionnaire in order to collect perceptual information on how different human-made features affect an individual’s overall perception of wild land. A fuzzy logic modelling framework is proposed to translate the findings from the questionnaire into the spatial domain.

The use of Geographical Information Systems (GIS) for wilderness mapping is a recent development, though several attempts to map wilderness using this technology have already been made that cover a range of different areas across the globe (for example, Lesslie and others 1988; Lesslie and Maslen 1995; Henry and Husby 1994; Kliskey and Kearsley 1993; Kilskey 1994; Carver 1996). Methodologies range from the mechanistic and rigorous approach adopted by the Australian Heritage Commission (Lesslie 1988) to the more subjective approach of Kliskey and Kearsley (1993) using Stankey’s wilderness purism scale (Stankey 1977). None of these methodologies are directly applicable to Europe and Britain in particular, where the term ‘wild land’ or ‘secondary wilderness’ is proposed as a better representation of a landscape that has been dramatically altered due to its long history of settlement and rural land use (Aitken 1977). At present, with the exception of some Arctic districts and a few mountainous areas, the whole of Europe has been severely affected by dense population, intensive industrialization and agriculture (Pyle 1970; Dorst 1982; Zunino 1995).

In terms of biophysical naturalness, ‘wilderness’ has ceased to exist in nearly all parts of Europe. However, people still value the land according to factors such as solitude, remoteness and the absence of human artifacts, and therefore perceive it as wild. However, not all factors can be measured

easily in a quantitative sense (for example, solitude is highly dependent on experiential value).

This paper is divided in two parts. The first focuses on mapping wild land in Britain carried out as part of a national study. The techniques developed are generic and can be potentially applied to other areas of Europe, as long as the particular data limitations of individual regions are taken into account. A national UK level study was undertaken based on similar factors as in the Australian study carried out by the Australian Heritage Commission, but adding another dimension to it within a multi-criteria evaluation (MCE) framework.

The second part focuses on a local study in the Cairngorm area in Scotland. This study quantified two main factors having a strong influence on wild land perception in Scotland. One factor is closely linked to the idea of the ‘long walk in’ and termed here as ‘remoteness from mechanized access.’ It can be measured as the minimum time it takes a walker to reach a particular destination from any origin (usually a road or car park). A second factor strongly influencing wild land perception is the impact of certain human-made features such as roads, hill roads, pylons and hydro-electric power plants. The presence of such features can significantly detract from a ‘wild land experience,’ particularly when the features are highly visible. This factor is termed here ‘apparent naturalness.’ The Cairngorm study describes an approach to building a spatial mapping tool for wild land areas that captures qualitative perceptions of the factors affecting wild land quality. The methodology uses an Internet questionnaire designed specifically to collect softer, perceptual information such as naturalness (forest and land cover) and artificialism (absence of human impacts) that are important wild land indicators. This information is then translated to the spatial domain within a fuzzy modeling framework.

Defining Wilderness and Wild Land

Several authors (for example, Lesslie 1985; Hendee 1990; Countryside Commission, 1994; Carver 1996) agree that there is no generally accepted definition of wilderness or wild land. Ecological and sociological definitions are differentiated. Due to the dramatic alteration of the landscape in most parts of Europe, a sociological definition seems to be more appropriate. A perceptual or sociological definition of wilderness can be found in Roderick Nash’s book ‘Wilderness and the American Mind’ (1982). He defines wilderness from the perspective of the people and notes:

In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O’Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Steffen Fritz is Researcher at the School of Geography, University of Leeds, LS2 9JT, Great Britain, e-mail: PGSF@geog.leeds.ac.uk. Steve Carver is Senior Lecturer at the School of Geography, University of Leeds, e-mail: steve@geog.leeds.ac.uk. Linda See is Researcher at the School of Geography, University of Leeds, e-mail: PglS@geog.leeds.ac.uk

There is no specific material thing that is wilderness. The term designates a quality that produces a certain mood or feeling in a given individual and, as a consequence, may be assigned by the person to a specific place. Wilderness, in short, is so heavily freighted with meaning of a personal, symbolic, and changing kind as to resist easy definition.

Nash (1982) therefore defines wilderness as what people perceive it to be. Since wilderness in the true ecological sense is hardly considered to exist in Scotland, Huxley (1974) uses a similar definition:

wilderness is where one feels oneself to be in a wild place, according to the sensibility of one's particular experience and knowledge on a global and local scale.

Due to the fact that the perception of wilderness quality of recreationists differs widely among individuals and is influenced by a variety of personal factors, the establishment of a wilderness or wild land threshold is arbitrary. Therefore, it is a definite advantage to identify wild areas in a relative way, either as a continuum or using fuzzy concepts.

It has been proposed by several authors (Aitken 1977; Aitken and others 1998) that even though there are hardly any wilderness areas left in Scotland, the wide-ranging vistas of heath-covered moorland and extensive glens provide the visitor with something approaching a true wilderness experience. Due, however, to the problematic use of the word wilderness ('some people refer to it as a wasteland'), the lobby for wild land conservation has tended to shift away from the use of 'wilderness' towards 'wild land' (Fenton 1996).

National Study: A Method of Mapping the Wilderness Continuum for the United Kingdom

Lesslie and others (1988) define wilderness as 'undeveloped land which is relatively remote, and relatively undisturbed by the process and influence of settled people,' and they map Australian wilderness areas based on this definition. A single wilderness quality indicator cannot assess remoteness and primitiveness. Remoteness can be described as a proximity function to settled land and settled people, whereas primitiveness also accounts for the lack of human artifacts and the naturalness of the ecosystem. These factors can be expressed in terms of the following four wilderness indicators (Lesslie and others 1988):

- 1) Remoteness from settlement: remoteness from points of permanent human occupation.
- 2) Remoteness from access: remoteness from constructed vehicular access routes (roads) and railway.
- 3) Apparent naturalness: the degree to which the landscape is free from the presence of the permanent structures of modern technological society.
- 4) Biophysical naturalness: the degree to which the natural environment is free of biophysical disturbances due to the influence of modern technological society.

By summing together the four wilderness indicator values assigned to each grid point, a simple estimation of wilderness quality can be obtained. However, the simple addition of indicators in this manner assumes that they contribute equally

to total wilderness quality. The indicators are not necessarily comparable in a quantitative sense, and computerization of the method allows alterations to be made. One type of alteration would be to give different weights to the different wilderness indicators. Each of the wilderness indicators can be displayed individually and compared with the final wilderness map. This creates the opportunity to locate those features that influence wilderness quality (Lesslie and others 1988; Lesslie and Maslen, 1995). This method has been used to map Australia at the national level. However, it has been criticized for being too mechanistic and not taking into account the perceptual nature of wilderness (Bradbury 1996; Kliskey and Kearsley 1993). Nevertheless, it has been proved to be an effective and efficient way of deriving wilderness quality indices and is seen as particularly useful for environmental planning and legislation (Centre for International Economics, 1998).

Mapping the Wilderness Continuum for the United Kingdom

Wilderness, as defined by Lesslie and others (1988), can be mapped for the UK using similar criteria. However, in this case the more open-ended approach to wilderness definition advocated by Nash (1982) is adopted with a GIS-based MCE approach to mapping the wilderness. This is because, like the continuum concept itself, MCE methods are not restricted by the necessity to specify rigid thresholds or criteria in defining where an entity like wilderness begins and ends.

In highly populated areas such as Britain and most other places in Europe, a model that takes into account all features located within a certain radius is much more appropriate. This is different from the approach in Australia, which only takes into account the feature that affects wilderness quality the most. The approach for Britain has led to a map-based definition of wilderness using weighted distance decay models. This model is applied to remoteness and naturalness factors as follows:

- 1) *Remoteness from population.* Based on the 1991 UK Census of Population, a population-weighted exponential distance-decay model is applied at a 1 km grid resolution.
- 2) *Remoteness from access.* Remoteness from access is also based on a traffic-weighted exponential distance model, taking into account all forms of mechanized transport route (except air traffic) from the Bartholomew's 1:250,000 datasets.
- 3) *Apparent Naturalness.* Again, for mapping apparent naturalness, the above weighted distance-decay function is used by taking into account all highly visible non-natural features such as radio masts, railway lines, roads, industrial sites and urban areas.
- 4) *Biophysical Naturalness.* Landsat-based land classification data supplied by the Institute of Terrestrial Ecology are used to derive a map indicating the likelihood of finding natural or near-natural ecosystems from a weighted distribution of land cover types.

All the datasets were derived and analyzed using the GRID module in the ARC/INFO GIS.

In order to take the subjective nature of the wilderness concept into account, MCE techniques can be used to weight the wilderness indicators differently. This allows the wilderness continuum to be mapped for the whole study area,

describing a continuous surface from the least to the most wild locations (Carver 1996). A simple weighted linear summation model is used here with the above datasets and a range of different weighting schemes to produce a variety of continuum maps for Britain. By using an MCE approach, datasets are not presumed to be of equal weight thereby allowing individual perspectives to shape the model outcome.

The wilderness continuum maps of Britain that stresses remoteness and naturalness factors, respectively, are shown in figure 1 by way of example. This approach can be useful as an initial attempt to get a first impression and to identify national patterns in the distribution of wild land. Furthermore, this approach can be applied to evaluate the wilderness quality of land that is formally protected and identify which parts might require further protection. This method can be potentially applied for the whole of Europe.

Methods of Wilderness Mapping on a Local Level—A Case Study on the Cairngorm Mountains in Scotland

The wilderness-continuum mapping described above works well as a national reconnaissance-level survey. Close examination of individual areas, however, reveals certain inconsistencies. A more detailed local level study can deliver more reliable data. In order to map wild land areas at a local level, other wilderness indicators need to be taken into account. Additional datasets can be considered (for example, footpath data and terrain models) while all factors having an influence on wild land perception can be mapped to a higher level of accuracy.

There are two main factors that have a strong influence on wild land perception in Scotland and can be quantified. One factor is closely linked to the idea of the 'long walk in' and termed here as 'remoteness from mechanized access.' It can be measured as the minimum time it takes a walker to reach a particular destination from any origin (usually a road or car park). A second factor is the effect that human artifacts in the landscape have on wild land perception.



Figure 1—Wilderness continuum stressing remoteness (left) and naturalness factors (right).

Mapping Remoteness: The Impact of Terrain on Pedestrian Travel Times

Remoteness from mechanized access is not only described in terms of distance from roads, but also in terms of accessibility to a certain terrain structure. On a local level, it is possible to develop a model that takes into account the topography and isolation of the area, as perceived by a walker on the ground. A method of measuring accessibility is a time measure of walking distance. This can be achieved by integrating Naismith's Rule and a shortest-path algorithm.

Although first written down in 1892, Naismith's Rule is still used to obtain a rough estimate of the time required for a given walk (Aitken 1977; Langmuir 1984). The basic rule states that a walker can maintain a speed of 5 km/h on level ground, but half an hour needs to be added for every 300 m of ascent. Several refinements have been made to Naismith's Rule. These range from Tranter's Correction, which takes an individual's fitness level and fatigue into account, to simple corrections that assume Naismith to be an optimist and so add 50% (Langmuir, 1984). Aitken (1977) made refinements according to ground conditions. This assumes that 5 km/h can be maintained on paths, tracks and roads, but is reduced to 4 km/h on all other terrain. Langmuir (1984) made the following further refinements: Naismith's Rule of 5 km/h plus 0.5 hour per 300 m of ascent, minus 10 minutes per 300 m descent for slopes between 5° and 12°, plus 10 minutes per 300 m descent for slopes greater than 12°. It is thought that the rule is generally applicable for reasonably fit hill walkers negotiating typical terrain under typical weather conditions. However, further corrections can be made to allow for variations in terrain and conditions under foot, prevailing weather, steep ascents/descents, fitness and load carried.

Using Naismith's Rule, it is possible to calculate the time taken to traverse a set of cells in a digital elevation model (DEM) by taking gradient and slope direction relative to direction of travel into account. A DEM is defined here as a digital model of height (elevation or altitude) represented as a regularly spaced grid of point height values. Values of slope (gradient) and slope direction (aspect) can be calculated from the DEM. Accessibility from different directions relative to the same point in the landscape should be considered and the shortest path taken into account. Using this approach, it is possible to design a model that calculates the time taken to walk from single or multiple origin points to any destination on the terrain surface. Because it is unknown which route a walker will take, the model only considers the quickest possible path.

The model described here integrates Naismith's Rule with Dijkstra's shortest path algorithm (Aho and others, 1974). Dijkstra's algorithm works by considering the relative costs of moving through each of the cells in a matrix. Costs are represented by impedance values in the cell matrix. In order to implement Naismith's Rule within Dijkstra's algorithm, four different matrices were used. These include a heights matrix, a distance matrix, a trace matrix, which marks all the cells that have been dealt with, and a results matrix, the values in which are changed during the analysis process. This process has been automated within the Arc/Info GRID module and custom C code. For a detailed description of the implementation of the algorithm, see Fritz and Carver (1998).

Using this approach, it is possible to define remoteness surfaces for any landscape. Figure 2 shows an example of remoteness surface based on the hybrid Naismith/Dijkstra's algorithm applied to a 50 meter resolution DEM of the Cairngorm Mountains, using all roads as access features. The model has been used by Scottish Natural Heritage (Carver and others, 1999).

Mapping Apparent Naturalness: The Impact of Land Use and Artifactuality

A second factor strongly influencing wild land perception is the impact of human-made features such as roads, hill roads, pylons and hydroelectric power plants. The presence of such features can detract from the 'wilderness' experience, particularly when the features are highly visible within the landscape.

Measuring People's Perceptions According to the Influence of Human-Made Features—Kliskey and Kearsley (1993) mapped different peoples' perceptions of wilderness based upon the concept of 'multiple perceptions of wilderness.' The method is an approach to wilderness mapping in which the concept of wilderness comes close to the definition of Nash (1982). Kliskey and Kearsley's paper concentrates on the management of a national park and maps of wilderness from the viewpoint of a backcountry user. One disadvantage of their approach is that it is area-specific: the wilderness mapping study, which was carried out in the Nelsons National Park in New Zealand, can only be applied locally since the questionnaire was specifically designed for that area. Kliskey and Kearsley (1993) also determined the spatial criteria for mapping the influences of human-made features on an arbitrary basis.

Kliskey and Kearsley's 'wilderness' perception survey looks at measuring four properties: artifactuality (absence of human impact); remoteness; naturalness (in relation to forest and vegetation); and solitude. Four backcountry user groups were categorized with the use of a wilderness purism scale. This scale has been used to provide a mechanism that accommodates the variation of user definitions of wilderness (Stankey, 1977). Backcountry users were asked for their views about desirability of various activities and experiential items in what they considered to be a wilderness setting. A value from 1 to 5 was assigned to each response (from strongly desirable to strongly undesirable), and each group of the wilderness purism scale had a range of scores (for example nonpurist 16-45). Contingency table analysis of purism groups and desirability of items in what is perceived as wilderness were used, supporting the use of these indicators for differentiating and determining variations in perception levels. The results were then translated into a spatial concept according to remoteness (such as roads), artifactuality (mines, lighthouses, etc.) solitude and naturalness. The maps produced reveal that differing user groups have entirely different perceptions of wilderness (Kliskey and Kearsley, 1993; Kliskey, 1994). The work can then be used in a management framework for the zoning of the 'wilderness resource.'

The following method captures the information in a similar way to Kliskey and Kearsley, but with an Internet questionnaire. The difference is that people are directly asked to evaluate the spatial impact of a human-made artifact and the impact of vegetation. In addition, they can differentiate between features which are visible and those which are not. Instead of using simple buffers around the features, factors influencing wild land are combined within a fuzzy framework, and people can establish their individual criteria to produce their own wild land map.

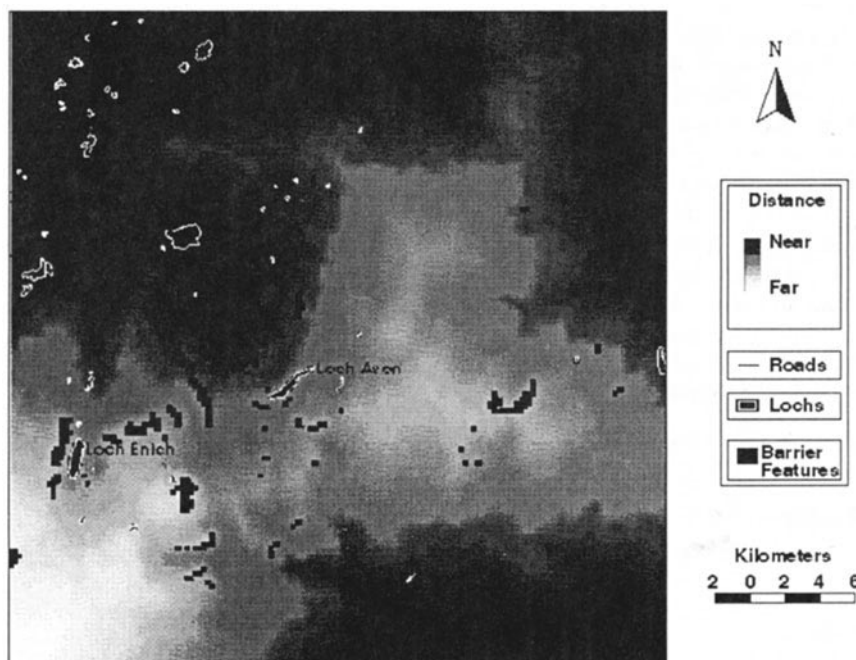


Figure 2—Remoteness surface for the Cairngorm Mountains.

1. What is the impact of a hill road on your perception of wild land when you are:

	near (visible)	medium (visible)	far (visible)	close (out of sight)	further away (out of sight)
very strong impact	○	○	○	○	○
strong impact	▮	▮	▮	▮	▮
medium impact	▮	▮	▮	▮	▮
low impact	▮	▮	▮	▮	▮
very low impact	▮	▮	▮	▮	▮
no impact	▮	▮	▮	▮	▮

Figure 3—Questions about the impact of hill roads from Internet questionnaire.

The Internet Questionnaire—The questionnaire was specifically designed to gather information about the perceived impact of various factors on wild land quality. The questionnaire was posted on the Internet to promote wider accessibility. Participants will also be able to view composite maps based on a combination of all the participants' responses in a future version of the Web site. The Internet questionnaire consists of three parts. In part one, the user is asked to enter personal information, while part two asks some general questions about hiking in Scotland and the area covered by the questionnaire in particular. Information from these two parts will be used to classify the participants into different behavioral/recreational groups. Part three contains the main questions regarding the impact of certain features on the participant's perception of wild land. The respondents are first required to define a set of fuzzy spatial concepts in meters or miles. These include being near to, a moderate distance away from and far from visible features, as well as the concepts of close to and far away from features that are not visible but which can still have an impact on the perception of wild land. Eleven questions follow, all in the same style. The participant is required to think about what impact a particular type of artifact has in terms that range from 'no impact' to a 'very strong impact'. This is divided into two categories based on being near, a moderate distance away and far to a visible feature or close and farther away from features that are out of sight. Questions referring to the factor 'hill road' are provided in figure 3, and all the factors are displayed in table 1. The final question asks whether the participant thinks there are factors additional to the ones listed in the questions that may affect their perception of wild land and which can be used to improve the questionnaire in the future. The questionnaire can be found at the following address:

<http://www.ccg.leeds.ac.uk/steffen/questionnaire1.html>

A Fuzzy Logic Modeling Approach to Wild Land Mapping

Fuzzy logic is one of several new alternative approaches to modeling that has emerged from the fields of artificial intelligence and process-based engineering. Originally formulated by Zadeh (1965), fuzzy logic replaces crisp and

arbitrary boundaries with a continuum, thereby allowing the uncertainty associated with human perception and individual-concept definition to be captured. For this reason, fuzzy logic is particularly well-suited to wild land mapping because it enables different factors influencing the perception of wild land to be integrated into a fuzzy wild land map, analogous to the way in which our brains might handle this information in a decision-making process. It also allows different degrees of wild land quality to be mapped, thereby eliminating the crisp boundary between wild and non-wild land. Moreover, this approach explicitly considers the spatial component by asking people to define their concept of distance and the subsequent impact of certain human-made features on their personal definition of wild land.

Visibility and Distance Analysis—A visibility map of the southwestern area in the Cairngorm Mountains in Scotland was produced using the Arc/Info GRID module at a 50m resolution for five factors on the Internet questionnaire, including paved roads, hill roads, built-up areas, isolated buildings and coniferous plantations. A visibility analysis of the DEM was undertaken for each individual human-made feature. The distance of the closest visible feature of each factor was recorded. These factors were extracted from the Land Cover of Scotland (LCS88) data supplied by the Macaulay Land Use Research Institute. In

Table 1—Factors affecting the perception of wild land embedded in the Internet questionnaire.

Factors/impacts on wild land
Surfaced road (paved)
Hill road (non-paved)
Built-up areas
Isolated building
Pylons
Grazing sheep or cattle
Arable land
Coniferous plantation
Hydroelectric power plant
Ski lifts
Shielings (derelict buildings)

addition, the closest Euclidean distance was calculated for each factor in order to acquire a data set for those areas where a feature is not visible, but which still has a potential influence on wild land perception. Figure 4 shows a map of the DEM, overlaid with the features used for this study. In the future, the remaining factors on the questionnaire will be taken into account, including hydroelectric power schemes, pylons, sheilings (old crofters' cottages), grazing (cattle and sheep), ski lifts and agricultural land.

A Fuzzy Logic Model for Mapping Wild Land—The distances specified by the respondent were used to construct fuzzy sets for defining the concepts near, medium and far for visible features and close and far away for nonvisible features. The user-defined distances were assumed to have membership values of 1.0 and were constructed to completely overlap neighboring sets. The output sets for wild land quality, which range from a very strong impact to no impact were evenly spread across a continuum of 0 to 1. Example fuzzy sets are provided in Figure 5 assuming values of 200m, 400m, 600m, 800m and 5km for the five distances.

Each question regarding the impact of a single factor produces a set of fuzzy rules. Each rule, which might be one of several possible answers input by a respondent, takes the form:

If you are *near* to a surfaced road

Then this has a *very strong impact* on wild land quality.

Each question can yield a maximum of 12 rules that link a distance to one of six fuzzy sets for the impact on wild land quality; six of the rules correspond to visible features while the other six cover nonvisible features. Figure 6 provides a methodological outline of the procedure for processing the rules for each individual layer and then combining the layers to produce an integrated fuzzy wild land map shown in figure 7.

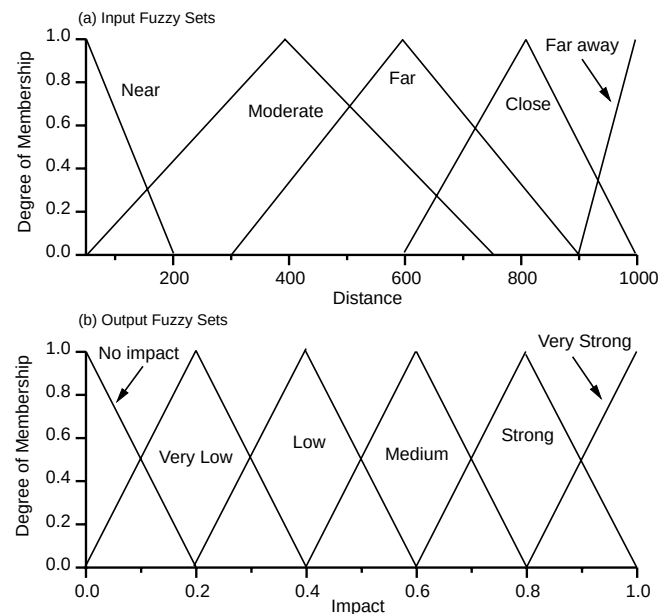


Figure 5—Example fuzzy sets for values of 200m, 400m, 600m, (visible); 800m and 5km (non-visible).

Conclusions

This paper has reviewed existing approaches to wilderness mapping and outlined modifications and new approaches developed specifically for UK and European areas. Particular emphasis is placed on the value of multi-scale approaches to national level reconnaissance and local level mapping of wild land in the UK and Scotland. Recent work on local level

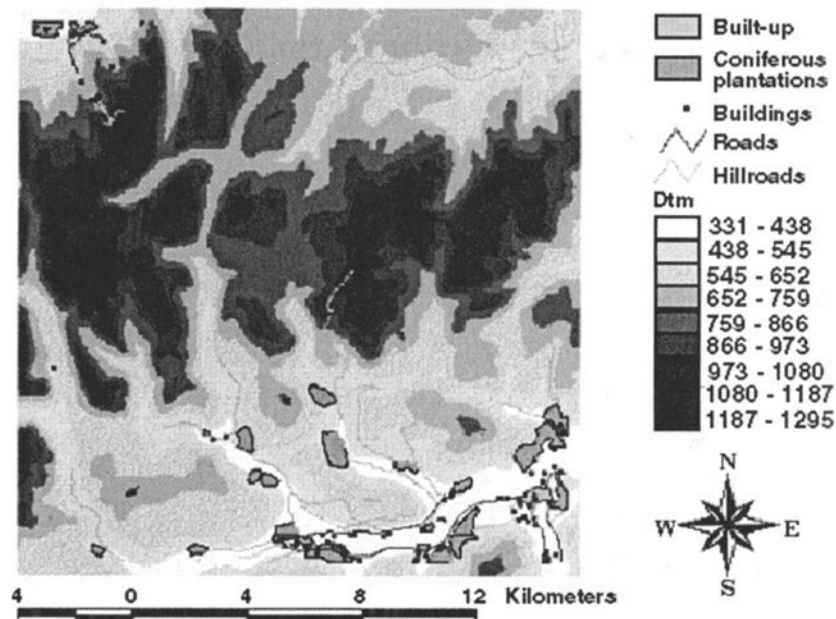


Figure 4—DEM and human artifacts for southwest Caringorms.

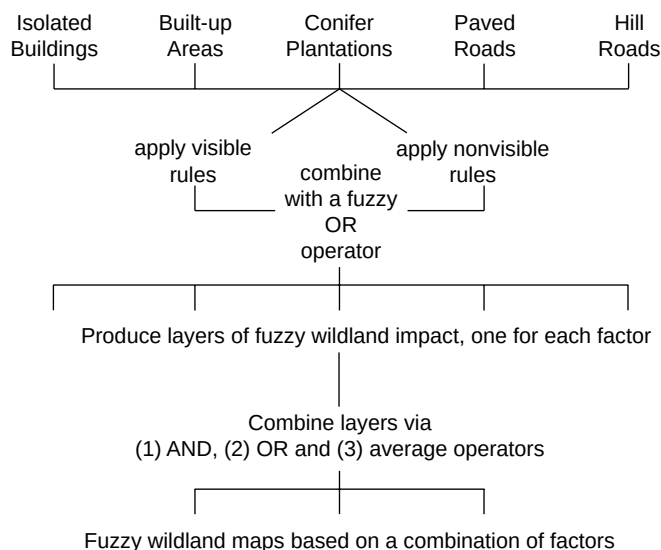


Figure 6—Methodological outline for processing fuzzy rules.

mapping of remoteness and artifactualism are described, using GIS-based models and fuzzy logic.

It has been shown that wild land is not easy to map, and it can only be done to a certain degree using measurable indicators. However, it is becoming increasingly important to try and quantify the less tangible resources such as wild land. For example, in a public inquiry, a stronger case may be made against the construction of a hydroelectric power scheme if quantitative data are available to demonstrate the more nonquantitative points of objection, such as the argument that the wild land character of a vast area may be spoilt. People arguing for a certain case feel much more confident when they can show a map of the size of the area that will be affected and to what degree it would influence

people's 'wild land' perception. In addition, areas with wild land characteristics can only be objectively compared, when quantified. This approach allows the 'use' of an area in an optimal way and to provide an opportunity for satisfactory 'wild land experience', while also maintaining the natural ecological processes in a relatively undisturbed state.

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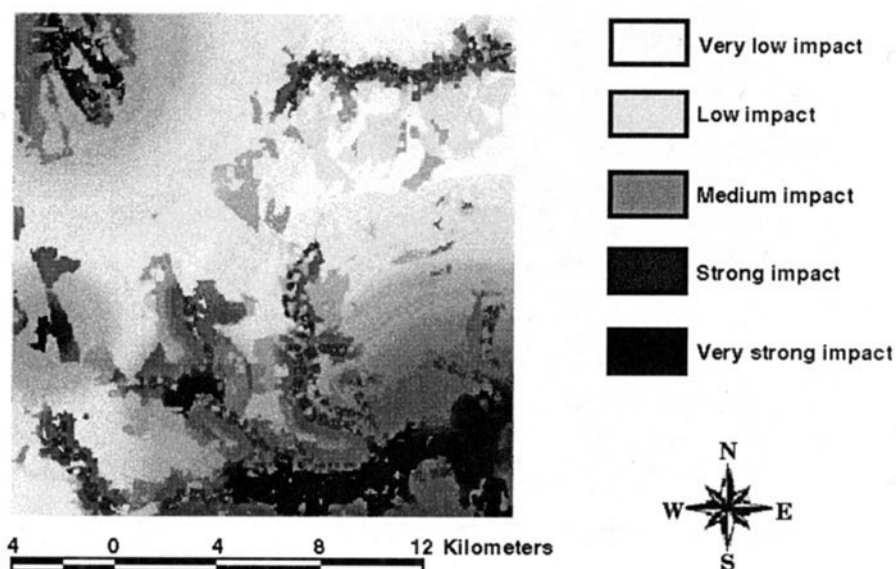


Figure 7—Fuzzy wild land map.

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Gauging the Ecological Capacity of Southern Appalachian Reserves: Does Wilderness Matter?

J. C. Haney
M. Wilbert
C. De Grood
D. S. Lee
J. Thomson

Abstract—A multi-unit wilderness system in the Southern Appalachians was evaluated for its long-term capacity to support biodiversity and provide other forms of “ecological insurance.” Based on spatial thresholds for selected species, community and ecosystem level attributes, ecological capacity was found to be conditional, hierarchical and interactive. Existing reserves appear to have successfully maintained some ecological structure and processes for up to half-century. However, most reserves theoretically large enough to represent certain animal taxa were too small to sustain, in situ, all native habitats for these taxa. Designated wilderness did not represent all major forest types common to the bioregion. Additions to the network would enhance but not completely safeguard the ecological capacity of this wilderness system.

How large must wilderness be? Answers to this question depend on the specific region and goals outlined for a particular wilderness reserve. Size of wilderness can depend on either social preferences or the natural values to be preserved. If the goal is to provide solitude for recreationists, for example, wilderness size might depend on the number of visitors dispersed within a “viewscape,” a feature which in turn is dictated by the region’s topography and proximity to anthropogenic structures.

The wilderness system is often promoted as a means to safeguard ecological attributes no longer found on, or at greater risk within, extensively managed lands. Although this expectation is easily framed, judging whether or not wilderness actually fulfills this role is far more complicated. Such judgement requires knowing whether a protected landscape is sufficiently large and representative to sustain desired ecological attributes over long time horizons.

Two principal approaches exist for testing these expectations. The first uses past trends to judge whether desired ecological values have in fact been maintained, at least up

until the present. The second approach relies on projection of trends into the future to see how well ecological values are likely to be maintained given known rates of disturbance and other sources of natural or anthropogenic risk.

Selected spatial thresholds in ecological structure or function, including natural disturbance regimes, are used here to estimate adequacy in the size of wilderness and other protected landscapes in the Southern Appalachians. We employ both retrospective and futuristic perspectives in these analyses. We also review evidence for the ability of the designated wilderness reserve system in this region to protect certain elements of biodiversity over the last half century. Finally, we examine whether and how the addition of lands adjacent to this wilderness system might enhance long-term sustainability. Our analyses used a combination of existing wilderness areas, nearby public lands and other land units that have been proposed recently for protection.

Ecological Capacity Defined

For any particular landscape, a common goal of wilderness designation may be to protect both its ecological structure and the underlying functional processes that maintain that structure (ecological capacity). We employ the term ecological capacity instead of ecological integrity, since the latter relies mainly on measurement of biotic structure referenced to known benchmarks of endemic natural conditions (Angermeier and Karr 1994, Karr 1993). It is possible for an ecosystem to have low integrity (due to recent degradation) but high capacity so long as restoration is feasible. This situation is typical of Eastern wilderness areas, most of which consist of lands previously harvested, tilled or otherwise altered by human use.

Ecological capacity is therefore a measure of the relative ability of a reserve to adequately protect a suite of designated natural attributes. Ecological capacity is dependent on both the characteristics of the reserve itself and the surrounding landscape matrix. If either a single unit or the wilderness system as a whole is too small, protection of an ecological attribute is likely to be jeopardized. For example, a reserve may be too small to sustain viable populations of some sedentary animal, or too small to withstand fire or other disturbances that typically operate over spatial scales considerably larger than the area of the reserve.

In addition, wilderness might be expected to be sufficiently large or otherwise configured so as to contain all

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J. C. Haney and C. De Grood are Forest Ecologist and Research Analyst in the Ecology and Economics Research Department, The Wilderness Society, 900 17th Street, NW, Washington, DC 20006 U.S.A., e-mail: jchris_haney@twso.org. M. Wilbert and J. Thomson are GIS and Remote Sensing Analysts in the Center for Landscape Analysis, The Wilderness Society, 1424 Fourth Ave., Rm. 816, Seattle, WA 98101 U.S.A. D. S. Lee is Curator of Ornithology, North Carolina State Museum of Natural Sciences, P.O. Box 29555, Raleigh, NC 27626 U.S.A.

ecosystem structure, community types or species representative of the bioregion. Here too the size, shape and distribution of individual protected units and the wilderness system as a whole will dictate whether this ecological capacity is actually achieved.

Fortunately for planning purposes, not all spatial scales are equally relevant in understanding area requirements. Rather, there are critical thresholds in which abrupt shifts in ecological responses occur at certain key scales (Frelich and Reich 1998, With and Crist 1995, With and King 1999). Once identified, these can be used as screening criteria to judge whether land units meet and preferably exceed some minimum threshold in a defined area requirement (e.g., fire disturbance regimes: Heinselman 1973, Johnson and Van Wagner 1985).

A complete assessment of all critical thresholds significant to minimum area planning for wilderness is beyond the state of current knowledge. Nevertheless, a subset of these area requirements can be readily calculated with both empirical data and theoretical considerations. We use a selected suite of area requirements specific to the Southern Appalachian landscape in order to assess the ecological capacity of this wilderness system.

A Case Study: The Southern Appalachians

Study Area

Our study examined protected and other federally managed lands in a four-state region (Tennessee, North Carolina,

South Carolina, Georgia). This portion of the Southern Appalachians contains extensive forest interior habitat bisected by no interstates and few major highways (fig. 1).

The region includes 217,000 acres of wilderness areas, more than 93% of which is forested, in 17 individually designated units scattered across four contiguous national forests: the Nantahala-Pisgah, Sumter, Cherokee and Chattahoochee. The largest single unit is the 36,800-acre Cohutta Wilderness Area; the smallest unit is the 2,600-acre Gee Creek Wilderness Area. Along with the 515,500-acre Great Smoky Mountains National Park (GSMNP), 93% of which is proposed and managed as wilderness, the de facto National Wilderness Preservation System in this region exceeds 730,000 acres.

Some of the region's individual wilderness areas are contiguous and therefore best analyzed in terms of their combined size. We considered wilderness units contiguous if their nearest points were <200 meters apart in the GIS data layer in the Southern Appalachian Assessment (SAMAB 1996). Contiguous wilderness units thus included the Big Frog and Cohutta Wilderness Areas (41,400 acres), Joyce Kilmer/Slickrock and Citico Creek Wilderness Areas (33,600 acres), and the Raven Cliffs and Mark Trail Wilderness Areas (27,500 acres). After combining these tracts, 15 individual land units were available for evaluating ecological capacity (14 on national forests and the GSMNP).

An additional 797,243 acres on nearby lands have been proposed for protection (fig. 1). This total includes all USDA Forest Service roadless areas (164,890 acres; 97.5% forested) and unroaded blocks designated as desirable for protection by a variety of non governmental groups, including

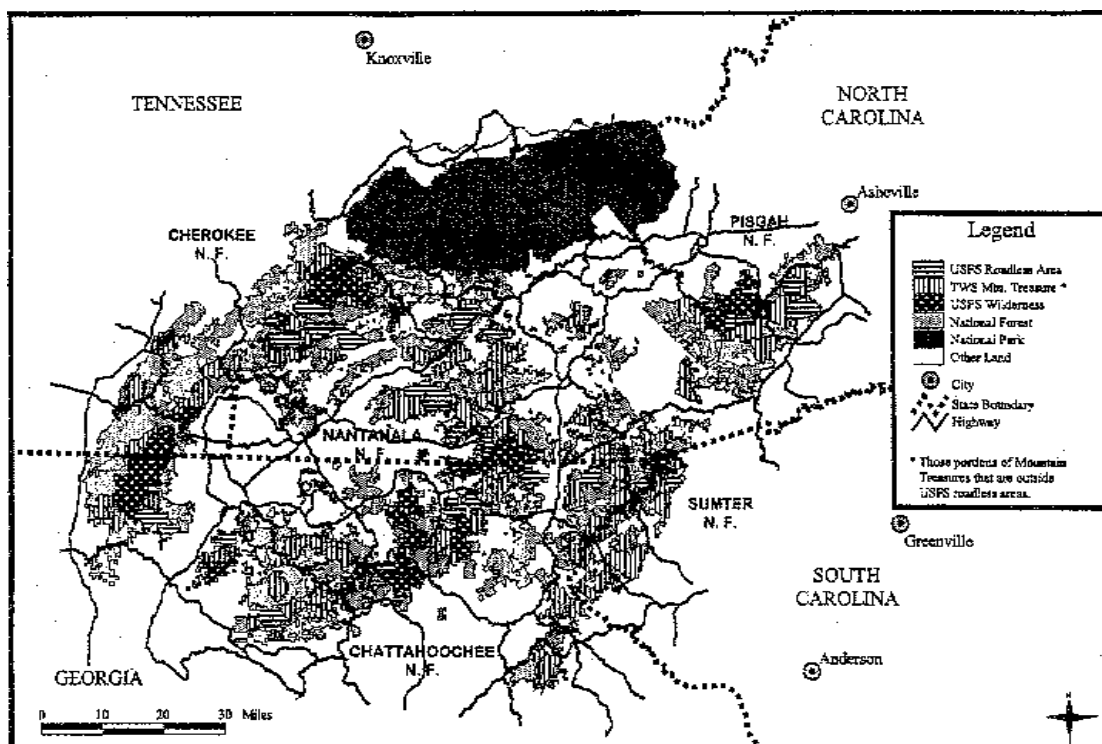


Figure 1—Study region used to evaluate the ecological capacity of existing wilderness, other protected lands, and proposed reserves in the Southern Appalachians.

a multi-state inventory sponsored by The Wilderness Society called the "Mountain Treasures" parcels (632,353 acres; 99% forested). The acreage of Mountain Treasures parcels included in our analyses is that fraction outside and additional to the USDA Forest Service's roadless area inventory. Not all parcels proposed for protection are necessarily eligible for wilderness designation, although most have been recommended by public interest groups for some form of permanent protection in scenic, research natural and other administrative categories.

Forest Type Representation

Forests cover approximately 69% of the 37 million-acre Southern Appalachian region (SAMAB 1996). Eight major forest types are found: mixed mesophytic hardwoods, mixed pine-hardwoods, montane spruce-fir, northern hardwoods, oak, southern yellow pine, white pine-hemlock and bottomland hardwoods. We used the Forest Service's CISC (Continuous Inventory of Stand Condition) data cross-walked to these eight major forest types, as summarized with FIA (Forest Inventory and Analysis) data, to figure acreages of each type within the existing wilderness system, as well as on lands proposed for protected status. We used only the forested acreages in these comparisons.

Representation of each forest type in existing wilderness and in areas proposed for permanent protection was then compared to the relative proportions of forest types characteristic of the Southern Appalachian Assessment region as a whole (SAMAB 1996). We used the regional proportions of forest types in log-linear models and calculated the standardized residuals (Wilkinson 1989) so that individual types over- or underrepresented in the reserve system could be identified. Absolute values of standardized residuals that summed to a minimal total were used to identify particular protection systems (both existing and proposed) that best represented the major forest types.

Disturbance Regimes and Minimum Dynamic Area

We surveyed major sources of disturbances in the Southern Appalachians (Bratton and Meier 1998, Greenberg and McNab 1998, Harrod and others 1998, SAMAB 1996), and used disturbance frequency and spatial extent to estimate minimum dynamic areas for quasi-equilibrium landscapes. Quasi-equilibrium landscapes consist of shifting mosaics made up of all forest age classes that persist in perpetuity, although the location and extent of each successional stage varies (Shugart 1984). The minimum dynamic area (MDA) is the smallest land area on which all successional stages (early, middle, late, old growth) are expected to be maintained at all times by natural disturbance (Frellich 1995). Maintenance of such structural diversity by natural means only is a common scenario if administrative or legal prescriptions preclude more interventionist management within the wilderness system.

Two broad methods have been proposed for calculating MDAs. One approach is rule-based and identifies the MDA as either twice the size of the largest disturbance patch (Johnson and Van Wagner 1985) or 50 times the size of the

average disturbance patch (Shugart 1984). A second approach consists of a stochastic model in which the statistical risk from stand-replacing disturbance is calculated as a function of land area. We used both methods in our analyses to compute MDAs for the Southern Appalachian region.

Large-scale disturbances include those arising singly or in combination from climatic, edaphic and biotic factors. Large-scale rather than small-scale disturbances are more important to MDA estimation because an area large enough to accommodate the most extreme disturbance will automatically accommodate smaller, less catastrophic ones. Thus, we searched the literature for broad categories of disturbance in order to identify the largest disturbance patches likely to occur in the Southern Appalachian region:

Fire—Fire is prevalent in oak, southern yellow pine and mixed pine-hardwood forests of the Southern Appalachians (Abrams 1992, Barden and Woods 1976, Delcourt and Delcourt 1997, Harmon 1982). An average of 6 to 16 lightning fires per million acres strike the region annually (Bratton and Meier 1998, SAMAB 1996). Under the assumption that fires result in at least some deaths of canopy trees, we plotted the probability of stand replacement as a function of hypothetical forest planning areas for 10-year intervals, the approximate time for closure of the canopy following extreme stand-replacing fires. A 10-year interval was chosen for the stochastic fire model because this disturbance frequency would result in perpetual maintenance of some early successional habitat on the planning area.

To figure the acreages actually burned by fires caused by lightning and other sources, we examined fire records from 1970 to 1993 for each of seven regional national forests (table 1). Fires in this region commonly originate from both natural and anthropogenic sources, but because their origin makes little difference when figuring the largest disturbance patch, we sought mainly to identify the sizes of the average and largest fires.

Windthrow—A variety of meteorological and climatic factors cause trees to be windthrown in the Southern Appalachians, including microbursts, macrobursts, tropical storms (including hurricanes), tornadoes, and passage of severe weather fronts (e.g., Bratton and Meier 1998, Greenberg and McNab 1998, SAMAB 1996). Windthrows can lead to increased fuel loads and susceptibility to fire (Bratton and Meier 1998), so the potential for disturbance types to interact and potentially reinforce each other is high.

Table 1—Sizes of burns (in acres) on seven National Forests of the Southern Appalachians, 1970-1993 (SAMAB 1996).

Forest	Mean size	SD	Maximum ^a	Cause
Talladega	16.7	48.1	1055 (155)	incnd.
Chattahoochee	11.0	46.3	1050	ltng.
Cherokee	12.3	70.0	1699 (288)	incnd.
George Washington	20.3	174.6	4359 (550)	equip.
Nantahala-Pisgah	12.1	63.1	2215 (1300)	other
Sumter	20.4	190.3	2856 (87)	other
Jefferson	22.7	112.0	1850 (211)	other
All	14.3	87.4	4359 (1300)	equip.

^aLargest fire from any cause; largest fire caused by lightning (if available) shown in parentheses.

We plotted probability of severe windthrow as a function of forest planning area for 10-year intervals, the approximate time for closure of the canopy following an extreme stand-replacing disturbance. Severe windthrow was defined as the statistical likelihood of F2-F5 tornadoes expressed per unit area. Annual likelihood of storms of this magnitude is 1.1 per 10,000 square miles for the five states of Alabama, Georgia, South and North Carolina and Tennessee (NOAA National Climatic Data Center). As in the stochastic fire model, a 10-year interval was chosen for the windthrow model because disturbances at this frequency would result in perpetual maintenance of some early successional habitat on the planning area.

Other Disturbances—Other types of disturbance common in the region include ice glazing and outbreaks of forest insects (SAMAB 1996). These disturbances rarely if ever cause complete canopy removal or stand replacement, however. Ice storms mainly prune over relatively small areas, often targeting conifers with shallow root systems (<175 acres, Bratton and Meier 1998). Although such disturbance may not immediately replace stands, it could contribute (along with drought) to fuel loads and thus susceptibility to a larger or more complete disturbance from fire.

We found no evidence that outbreaks of native insects routinely cause complete stand-replacement at scales larger than fire or windthrow in the forests of this region. Outbreaks of nonnative insects are another matter. Gypsy moth (*Lymantria dispar*) has not yet reached this study area, but hemlock woolly adelgid (*Adelges tsugae*) could eventually cause (Benzinger 1994), and the balsam woolly adelgid (*Adelges picea*) already has caused (Busing and Clebsch 1988), nearly complete removal of the canopy in white pine-hemlock and montane spruce-fir forest types, respectively. Still, it is not evident that disturbances by nonnative forest insects cause complete canopy turnover at spatial scales equivalent to or greater than those associated with fire and windthrow.

Historical Change, Representation and Productivity of Forest Wildlife Communities

In addition to the distinctiveness that diverse community types and large forest interiors bring in and of themselves to regional landscapes, forest ecosystems are also required habitats for many constituent species. Birds and large carnivores are among several taxa found to be particularly sensitive to forest conditions, including the amount of edge, fragmentation and interior area (e.g., Hawrot and Niemi 1996, Machtans and others 1996, Weinberg and Roth 1998, Wenny and others 1993). Due to “hostile conditions” now prevalent in anthropogenic landscapes (Askins 1995), wilderness areas and other large forest reserves are particularly important because these refugial “sources” promote elevated densities, pairing success and productivity of forest-interior wildlife that subsidize the “sink” habitats in more disturbed landscapes (Clark and Pelton 1999, Robinson and others 1995a, Van Horn and others 1995).

The Southern Appalachians contain the largest block of protected forested landscape in the eastern U.S. (Simons

and others 1999). Long-term changes in the composition and relative population levels of forest birds and other wildlife in the Southern Appalachians were investigated by inspection of the literature (Kendeigh and Fawver 1981, Simons and others 1999, Wilcove 1988), as well as by conducting one new analysis on a 50-year data set from the Unicoi Mountains just south of the Park (Ganier and Clebsch 1944, 1946, Haney and others 1998, McConnell and McConnell 1983).

For birds, actual population levels were available for the Park whereas only data on relative abundance and composition were available from the Unicoi Mountains. Change in composition of the bird community of the Unicoi Mountains was compared via a Friedman’s test on the ranked abundances of all bird species recorded across three time spans: 1944-1946, 1981-1982, and 1996-1998. This test is not sensitive to the relative abundance of individual species, but rather assesses major compositional changes in the community as a whole.

To estimate the minimum area required to represent a regional bird community typical of landscapes in and near the wilderness system, we modeled the species accumulation rate as the function of area sampled in two national forests, the Nantahala-Pisgah in North Carolina and the Cherokee in Tennessee. In 1996 and 1997, 65 transects (11.1 acres each) were conducted during the breeding season and total individuals for each species tallied. Areas both inside and outside existing wilderness were sampled. Habitat types sampled for this landscape-level area curve (Flather 1996) included grass and heath balds, roadsides, clearcuts and other harvested units, and a variety of forest types, including white pine-hemlock, mixed mesophytic, northern hardwoods, oak and mixed pine-hardwoods.

The asymptote to the species area curve for these data was calculated with a maximum likelihood estimator (Raaijmakers 1987) and the minimum area corresponding to this asymptote interpolated along the curve’s horizontal axis. Asymmetric confidence limits (CI) for the asymptote and interpolated survey effort were calculated with $n = 20,000$ Monte Carlo iterations of the curve in 20 separate trials (Henderson and Seaby 1997).

Forest birds are primarily open-cup nesters and thus particularly susceptible to parasitism by the brown-headed cowbird (*Molothrus ater*), normally an occupant of open landscapes (Robinson and others 1995b). Since forested wilderness might be planned to mitigate such reproductive losses in more degraded habitat, we figured the minimum area necessary to offer forest birds at least some absolute protection from nest parasitism. We used a radius of ~23,000 feet to figure the most area- and edge-minimizing patch shape (circle) given the maximum distances traveled by cowbirds during daily commutes from roosting areas (Rothstein and others 1974, Thompson 1994). A major assumption of this minimum area requirement for avian productivity is that the reserved forest block is separate from but still accessible to cowbird feeding sites (Robinson and others 1995b).

Understory Diversity and Forest Regeneration

Overbrowsing by high populations of white-tail deer (*Odocoileus virginianus*) can cause severe impacts to forest

regeneration, understory diversity and wildlife habitat (Anderson and Loucks 1979, Frelich and Lorimer 1985, McShea and Rappole 1992). These disruptions of Eastern forest ecosystems occur typically at threshold densities of ~21-47 deer per square mile (deCalesta 1994). We calculated a minimum area requirement based on the average travel distance of deer that would halve deer density and thereby mitigate negative impacts of browsing at the center of the forest block. This standard is similar to that used in some USDA Forest Service management plans (for example, Alverson and others 1988).

Ecological Capacity of Southern Appalachian Wilderness: A Report Card

Community Representation and Change

Forest Types—Forest Service wilderness areas and the GSMNP jointly contain seven of the eight major regional forest types (fig. 2). Currently, there is no bottomland hardwood forest protected in this portion of the National Wilderness Preservation System. Over-represented forest types in the system as a whole include mixed mesophytic, montane spruce-fir, northern hardwood and white pine-hemlock, all types commonly associated with middle and upper elevations. Mixed pine-hardwood, oak and southern yellow pine, all types more prevalent at middle and lower elevations, are disproportionately uncommon in this wilderness system.

In GSMNP, mixed pine-hardwood (standardized residual = -132) and montane spruce-fir forest (standardized residual = 742) were the most under- and overrepresented types, respectively. In all Forest Service wilderness areas combined, southern yellow pine (standardized residual = -69)

and mixed mesophytic (standardized residual = 126) were the most under- and overrepresented types, respectively. In the combined wilderness system, mixed pine hardwood (standardized residual = -142) and montane spruce-fir forest (668) were the most under- and overrepresented types, respectively (fig. 2).

The much smaller acreage of Forest Service wilderness areas actually better approximated the mix of forest types typical of the region than did the GSMNP, an area more than twice as large (total of standardized residual absolute values = 562 versus 1,700, respectively). The existing wilderness system as a whole was no more efficient in its representation of major forest types than was the GSMNP alone (both standardized residuals total = 1,700).

Areas proposed for protection include all eight major types common to the region (fig. 3), although the amount of bottomland hardwoods is still quite small (720 acres total; 199 acres in Forest Service roadless, 521 acres in Mountain Treasures). Areas proposed for protection tend to be overrepresented with white pine-hemlock (standardized residual = 306) and underrepresented with southern yellow pine (standardized residual = -127). As measured by total absolute values of standardized residuals in the log-linear models, lands proposed for protection were more efficient in representing forest types in proportion to their regional occurrence than GSMNP or the wilderness system as a whole, but not as efficient as existing Forest Service wilderness areas (total of standardized residual absolute values = 940).

Bird Community—Minimum areas capable of representing all species typical of bird communities in forested landscapes of the Southern Appalachians averaged about 600 acres (fig. 4; 568 acres, lower 95% CI; 734 acres, upper 95% CI). This is merely the smallest land area on which there exists a reasonable expectation that all native, woodland species would be represented; it is not equivalent to a

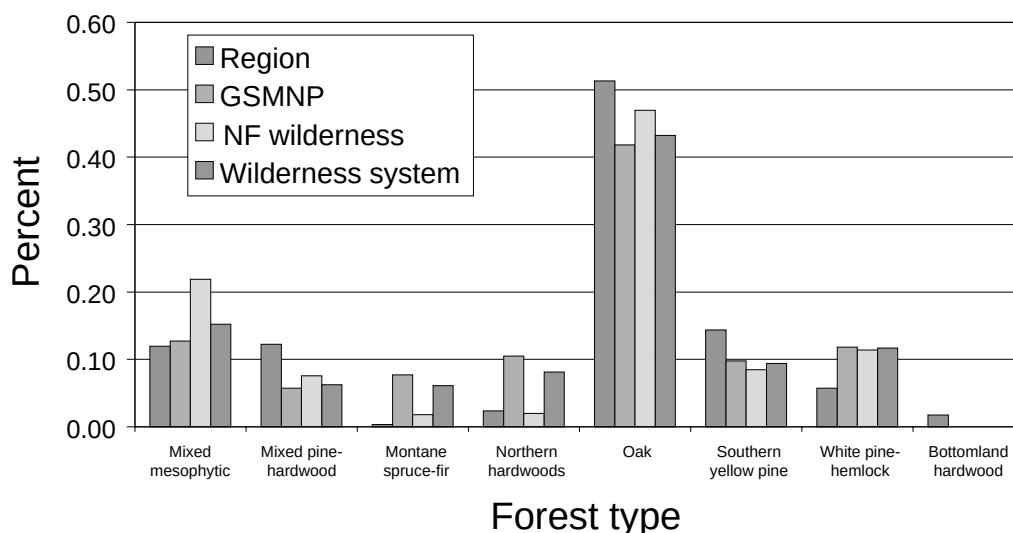


Figure 2—Representation of eight major forest community types in the Great Smoky Mountains National Park (GSMNP; MacKenzie and White 1998), on National Forest wilderness areas (USDA Forest Service data), and in the combined wilderness system compared to forest types found throughout the entire Southern Appalachian Assessment region (SAMAB 1996). Mixed pine-hardwood, oak, southern yellow pine, and bottomland hardwood forest types are more common at lower elevations.

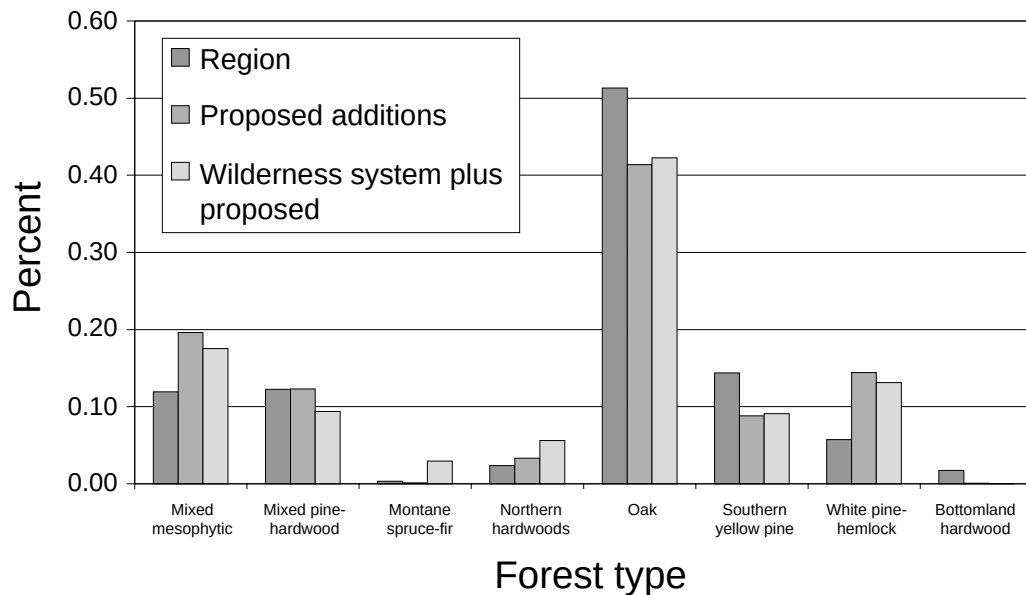


Figure 3—Representation of eight major forest community types in areas proposed for protection (USDA Forest Service roadless areas and the Wilderness Society's® Mountain Treasures inventory), and in the existing wilderness system plus these proposed areas, relative to forest types found throughout the entire Southern Appalachian Assessment region (SAMAB 1996).

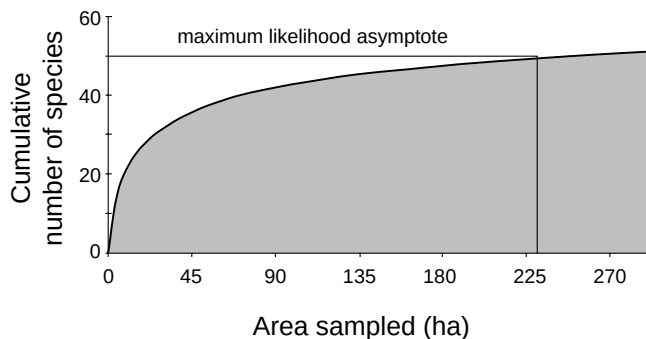


Figure 4—Species accumulation curve for complete representation of the bird community characteristic of the upper Unicoi Mountains, Nantahala-Pisgah and Cherokee National Forests, North Carolina and Tennessee, respectively. Asymptote of the curve was figured with a maximum likelihood estimator (Raaijmakers 1987). The point on the horizontal axis (~600 acres) which corresponds to this asymptote represents the minimum area required to represent all species typically present in the region.

minimum area required for population viability (either for a single or all species). All of the individual wilderness units and thus 100% of the combined acreage in the entire existing wilderness system in the Southern Appalachians exceed this minimum area.

During the last half-century, we found no evidence of major structural changes in the bird community in a portion of the Southern Appalachians that possesses extensive interior forest habitat, including several wilderness areas (Friedman χ^2 corrected for ties = 1.19, df = 2, P = 0.55;

table 2). No species present during the survey conducted 50 years ago in the Unicoi Mountains had disappeared from the regional avifauna. The four dominant bird species remained identical during this half-century: dark-eyed junco (*Junco hyemalis*), chesnut-sided warbler (*Dendroica pensylvanica*), black-throated blue warbler (*Dendroica caerulescens*), and veery (*Catharus fuscescens*).

Other evidence also points to relative stability and high ecological capacity for forest birds in the Southern Appalachians. Although many of the same species have been decreasing elsewhere in the eastern U.S., Wilcove (1988) found no evidence of significant declines in bird populations studied in the GSMNP after 35 years. His comparison included a variety of forest types, including oak, mixed mesophytic, white pine-hemlock and northern hardwood. Bird populations also experience relatively high productivity in or near at least some of the large wilderness areas of this region (Simons and others 1999) despite opposite trends in the same species elsewhere (Robinson and others 1995a).

Table 2—Changes in the composition of the avian community in the Unicoi Mountains, Tennessee and North Carolina, in the Southern Appalachians across three time spans during the last 50 years.

Survey interval	Y ranks	Mean rank
1944-1946	116.5	2.04
1981-1982	107.5	1.89
1996-1998	118.0	2.07

Other Minimum Area Estimates

Minimum Dynamic Areas—Rule-based models gave varied estimates for MDAs in the Southern Appalachian region. Rule-based approaches using disturbance patch sizes caused by fire gave MDAs of 715 and 8,700 acres, based on mean and maximum fire size, respectively (table 1). Rule-based approaches using disturbance patch sizes caused by wind gave an MDA of 1,200 acres, based on maximum size of windthrow (a 1994 tornado near Tullulah Gorge; Bratton and Meier 1998). We could find no published estimates of the average size of disturbance patches caused by wind in this region.

Using these rule-based estimates, about 13% of the individual wilderness units and 76% of the combined acreage in the entire wilderness system in the Southern Appalachians exceed the largest MDA estimated with fire statistics. All of the individual wilderness units and thus 100% of the combined acreage in the entire wilderness system in the Southern Appalachians exceed the largest MDA estimated with windthrow statistics.

MDAs calculated with stochastic models were generally larger than those estimated with rule-based approaches. An MDA in which there exists a high likelihood (95-100%) of fire occurring often enough to create early successional habitat at least once every 10 years is equivalent to about 7,000 acres (fig. 5). An MDA in which there exists a similarly high likelihood of severe windthrow occurring often enough to create early successional habitat at least once every 10 years is equivalent to about 650,000 acres (fig. 5).

Using these figures, about 87% of the individual wilderness units and 99% of the combined acreage in the entire wilderness system in the Southern Appalachians exceed the largest MDA estimated with stochastic fire models. Not a single individual wilderness unit in the entire Southern Appalachian wilderness system exceeds the largest (and thus most stringent) MDA estimated with the stochastic windthrow model. However, at 515,519 acres, the GSMNP comes close to achieving this measure of landscape equilibrium. A reasonably high probability (88%) still exists that stand-replacing windthrow will create early successional habitat on this National Park at least once every 10 years.

Mitigation of Nest Parasitism—The minimum area necessary to offer forest birds some absolute protection from nest parasitism was estimated to be 38,000 acres. Distances used in this calculation have been found to truly mitigate nest parasitism in an Eastern national forest with regional cowbird abundance similar to that found in the Southern Appalachians (Coker and Capen 1995, Robinson and others 1995). About 13% of the individual wilderness units and 76% of the combined acreage in the entire wilderness system in the Southern Appalachians exceed this minimum area requirement. Supporting this theoretical assessment, cowbirds have been essentially absent in and near the largest wilderness areas of this region during the past 50 years (e.g., Ganier and Clebsch 1946, Haney and others 1998, Wilcove 1988).

Mitigation of Understory Degradation—A minimum area that offers some enhanced protection from overbrowsing by deer was figured as 49,662 acres. Only 7% of the individual wilderness units and 70% of the combined acreage in the entire wilderness system in the Southern Appalachians

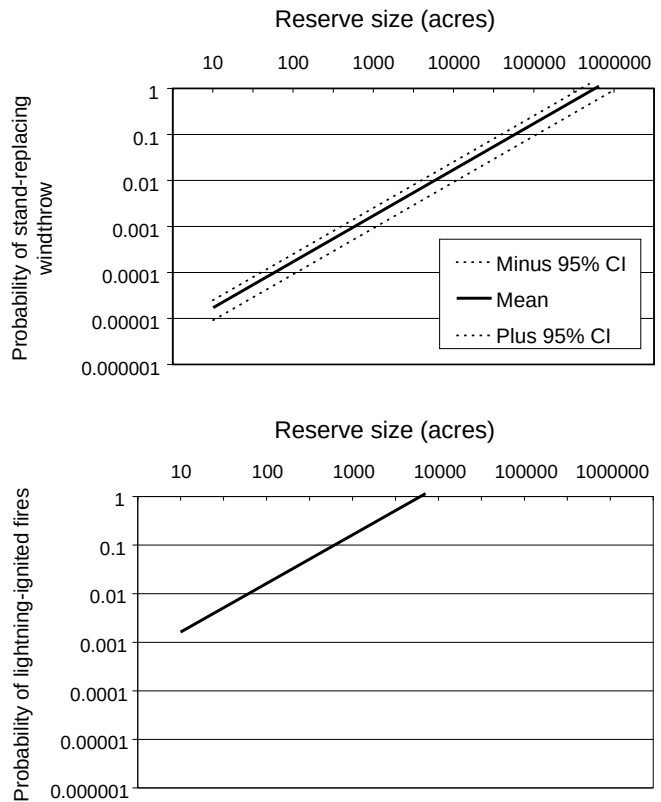


Figure 5—Planning sizes and rates of extreme stand-replacing disturbance for forest reserves in the Southern Appalachian states. Note log scale used for probabilities on vertical axis. Mean and 95% confidence limits for windthrow were figured using intra-regional differences in the frequencies of F2-F5 storms 10 years⁻¹ across a five-state region (Tennessee, North Carolina, South Carolina, Georgia, Alabama).

consist of areas that exceed this minimum. Actual size of blocks for mitigating deer overbrowsing would vary, depending upon the surrounding landscape matrix; the minimum area for any given level of mitigation would increase if early successional habitat were created deliberately (Alverson and others 1988: 355). Notably, very little of the study area (fig. 1) has severe problems associated with the kinds of overbrowsing common in the highly fragmented Mid-Atlantic states (e.g., deCalesta 1994, McShea and Rappole 1992). Only in a few situations is there significant impact to the understory from overbrowsing, such as at Cades Cove, GSMNP, where no hunting, few natural predators and a landscape matrix consisting of both agriculture and woodland combine to promote locally high deer densities.

Implications for Ecological Capacity in the Southern Appalachians

Our analyses provide encouraging evidence that some aspects of ecological capacity are well-maintained in the Southern Appalachian wilderness system. Wilderness protects the majority of forest types (fig. 2), the system as a whole does a superior job of protecting four of the region's seven scarcest forest community types (mixed mesophytic,

montane spruce-fir, northern hardwoods, white pine-hemlock), and one individual unit (GSMNP) approaches landscape equilibrium and thus likely conforms to the most stringent requirement of a minimum dynamic area. Over much of this region, regeneration of understory plants is unimpeded by overbrowsing. The largest remaining and most area-sensitive carnivore, the black bear (*Ursus americanus*), has stable or increasing populations in the core of the wilderness system (Clark and Pelton 1999).

Under the scenario modeled by stochastic disturbance regimes (fig. 5), where distinctions between single and combined units for landscape equilibrium are not necessary, the existing wilderness system as a whole is larger (730,000 acres) than the largest estimate of a minimum dynamic area (650,000 acres). One inference that can be drawn from this finding is that even under a management regime of active fire suppression (Buckner and Turrill 1999), frequency of windthrow is statistically sufficient to ensure a high probability of some early successional habitat in perpetuity for the forests in this regional landscape. (Disturbance intervals in this region are much longer than required for development of old-growth characteristics [Lorimer 1980, White and others 1985]).

Additional evidence of relative stability was obtained in the composition of the regional biota based on historical comparisons of avian communities (table 2). Since establishment of GSMNP and the protection afforded other previously degraded lands acquired earlier this century, bird populations and composition have remained largely unchanged at some locations in the region. Long-term absence of nest parasites (Wilcove 1988) and high productivity of bird populations (Simons and others 1999) also suggest that this wilderness system may be achieving some of its ancillary goals of fostering high-quality forest interior habitat for wildlife.

Several deficiencies in ecological capacity were nevertheless revealed. Single units of the wilderness system are apparently not sufficiently large to serve as effective repatriation sites for large species of extirpated carnivores (Lucash and others 1999). The wilderness system offers no protection for the bottomland hardwoods (fig. 2), although adding some of the proposed areas to the protected system could enhance representation of this forest type (fig. 3). Measured against various minimum dynamic areas, additions of protected areas would enhance the viability of individual units and the wilderness system as a whole (table 3, fig. 6). Even with

these additions, however, the wilderness system of the Southern Appalachians would continue to underrepresent forest types more prevalent at lower elevations (fig. 3).

Implications for Wilderness Planning

Ecological capacity in wilderness is conditional, interactive and hierarchical. These three general principles are likely to dictate management and area planning for any wilderness system. Minimum area requirements are conditional, in that their estimation depends on explicitly framing the desired condition for which the planning is aimed. Disturbance frequency and representation each allowed calculation of specific minimum planning areas as long as empirical data were available and assumptions used were valid (for example, disturbance rates do not change markedly over time). It is important to note that we examined only a few of all possible minimum area requirements for regional ecosystems, and not necessarily those that could be most critical to wilderness design.

A second principle that arises from our evaluations is that use of minimum area requirements for wilderness planning necessitates considerations of multiple interactions. For example, if wilderness reserves are designed to promote metapopulation dispersal in forest interior birds and thus maintain balanced source-sink dynamics (Pulliam 1988), such planning must simultaneously ensure adequate species representation (fig. 4), buffer from excessive nest parasitism and maintain structural habitat diversity (including successional age classes) in all of the regional forest types (figs. 2 and 3). Failure in any one of these (or other) area requirements will compromise a goal of the wilderness system to sustain a regional avifauna.

Similarly, although we analyzed the effects of fire and windthrow separately (fig. 5), the two disturbances clearly interact with each other (Bratton and Meier 1998), as well as with other sources of disturbance. Although a metric that combined cumulative rates of disturbance would be quite useful for wilderness planning, each disturbance in isolation may be more relevant to landscapes that are dominated by a particular forest type (xeric versus mesic) or management regime (such as fire suppression).

Table 3—Increase in ecological capacity for three selected minimum area requirements as a consequence of adding lands proposed for protection to the existing wilderness system in the Southern Appalachians.

Minimum area requirement (size)	Existing system ^a		Existing plus proposed ^b	
	No. units (%)	Area in acres (%)	No. units (%)	Area in acres (%)
Mitigation of nest parasitism (38,000 acres)	2 (13)	556,973 (76)	7 (30)	1,228,801 (87)
Mitigation of overbrowsing (49,662 acres)	1 (7)	515,519 (70)	6 (26)	1,183,540 (84)
Largest disturbance patch caused by fire (8,700 acres)	9 (53)	694,190 (95)	14 (61)	1,350,349 (96)

^an = 15 individual, non-contiguous land units (732,500 acres total) already designated in or proposed for the National Wilderness Preservation System in the Southern Appalachians (fig. 1).

^bn = 23 individual, non-contiguous "patches" consisting of existing wilderness plus contiguous lands proposed for protection (1,402,000 acres total) in the Southern Appalachians (fig. 6).

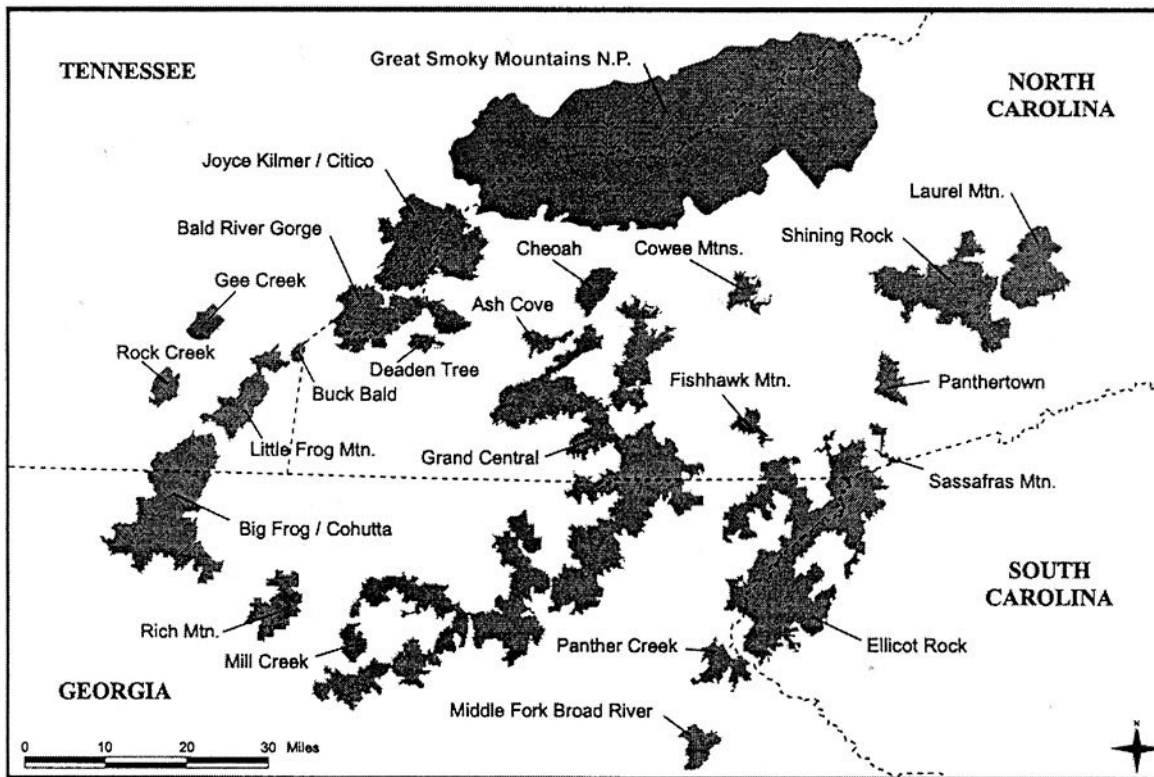


Figure 6—Twenty-three contiguous patches resulting from combining existing units of the National Wilderness Preservation System in the Southern Appalachians with adjacent lands proposed for protection by public interest groups. Contiguity was defined as intersection of adjacent polygons along at least two points within a distance of 656 feet (200 m).

Finally, our analyses underscore the hierarchical nature of factors that combine to influence ecological capacity in wilderness areas. Both spatial and temporal hierarchies can impact such planning. For example, the minimum area requirements that we calculated are insufficient to mitigate impacts to ecological capacity from sources outside wilderness area boundaries. In the Southern Appalachians, these exogenous factors include exotic wildlife and insects (Busing and Clebsch 1988, Peine and Lancia 1999, Schlarbaum and others 1999), atmospheric pollution (Nicholas and others 1999), and regional declines in individual neotropical migrant bird species from habitat degradation on their wintering grounds (James and others 1996, Rappole and McDonald 1994). Such impacts may confound the best planning for and management of the wilderness system itself.

In a temporal sense, planning that is adequate for current levels of natural disturbance may be insufficient in the face of significant long-term changes, including those attributable to global climate. Major shifts in disturbance rates are virtually certain to either increase or decrease the size of minimum planning areas (fig. 5). Restoration of endemic fire regimes in this region, now suppressed for at least 70-90 years (Buckner and Turrill 1999), would likely direct forest succession on a trajectory toward younger age classes and greater representation of the more fire-tolerant forest types (Harrod and Harmon 1998). Such management, coupled with an increasing variety and magnitude of other disturbance agents facilitated by humans, would all act to reduce the size of MDAs in the Southern Appalachians. Under any scenario that effectively reduces MDAs, the wilderness

system should continue to sustain much of the ecological capacity it now provides.

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An Evaluation of Wilderness and Aquatic Biointegrity in Western Montana

Nathaniel P. Hitt
Christopher A. Frissell

Abstract—Although the Wilderness Act of 1964 was justified in part by the importance of aquatic conservation, implementation of the Act has primarily focused on protecting terrestrial ecosystems. In this paper, we investigated the role of Congressionally-designated wilderness towards conservation of aquatic biointegrity in western Montana. To evaluate trends between 6th code watersheds (“subwatersheds”) with and without wilderness, we applied a previous Aquatic Diversity Areas (ADA) analysis which scored subwatersheds for indicators of aquatic biointegrity and conservation significance: road density, native/exotic fish ratio, fish stocking and occurrence of sensitive and endangered species. Wilderness-containing subwatersheds scored disproportionately higher for aquatic biointegrity indicators than subwatersheds with other land uses ($\chi^2=115.71$, $P<0.001$) but were not consistent in this regard.

Since the passage of the Wilderness Act in 1964, millions of acres of wilderness have been established on federal lands to protect the resources and values recognized in the Act. However, although the cultural and economic values of wilderness are well known (Nash 1967; Rudzitis and Johansen 1991), the biological significance of wilderness for aquatic ecosystems has not been systematically evaluated. Given that, compared to terrestrial taxa, aquatic species are disproportionately listed under the Endangered Species Act (Allan and Flecker 1992) and that aquatic biodiversity is being lost more rapidly than terrestrial biodiversity (Moyle and Yoshiyama 1994), evaluations of the aquatic features of conservation reserves are of immediate importance. In this paper, we investigate the role of Congressionally-designated wilderness in conservation of aquatic biointegrity within western Montana.

The concept of “aquatic biointegrity” arose from recognition that purely physical or chemical evaluations may not accurately reflect the biological function or conservation significance of aquatic species or ecosystems. In response, Karr (1981) developed a technique to evaluate aquatic biointegrity by focusing on fish community structure. Known as the Index of Biotic Integrity (IBI), Karr’s (1981) methodology has been subsequently adapted to research of aquatic ecosystems in California (Moyle and Randall 1998; Moyle and Marchetti 1999), Michigan (Allan and others 1997),

New York (Harig and Bain 1998) and Montana (Frissell and others 1995, Frissell and others 1996; Rothrock and others 1998).

Although the indicators of aquatic biointegrity analyses vary according to the scope of each investigation, they converge at Karr and Dudley’s (1981) basic definition of biotic integrity as “the ability [of an ecosystem] to support and maintain a balanced, integrated, and functional organization comparable to that of the natural habitat of the region” (Karr and Dudley 1981). Although investigations of biointegrity may focus on various spatial and temporal features (such as stream macroinvertebrate community structure, nutrient cycling patterns and/or road densities), the ultimate utility of any biointegrity index relies on the ability of that metric to describe the natural patterns and processes of an ecosystem.

Over the last decade, the concept of “ecosystem management” has been endorsed by federal land management agencies in an effort, among other purposes, to consider aquatic biointegrity in management decisions (McCormick 1999; Salwasser 1991, 1992; Slocumbe 1998). In principal, ecosystem management informs land use decisions with scientific evaluations of natural ecosystems (Noss 1999). Although the practice of ecosystem management has been applied with various results (Frissell and Bayles 1996), the concept of ecosystem management offers significant improvements from historical management philosophies in the acknowledgements that 1) management for biodiversity and biointegrity cannot be relegated to within the bounds of protected areas and 2) an understanding of ecosystems requires multivariate evaluations of biointegrity.

The conservation of freshwater species and ecosystems presents a special challenge for land managers and biologists. Due to the cumulative nature of flowing water (Vannote and others 1980), the dynamic watershed-stream relationships (Davies and Walker 1986; Doppelt and others 1993; Hynes 1970; Frissell and others 1986) and the particular importance of surface water-groundwater interactions (Stanford and Ward 1988), conservation of aquatic ecosystems requires ecological considerations at various spatial and temporal scales. Moreover, although the importance of refugia for native fish communities has been thoroughly described (Lee and others 1997; Moyle and Sato 1991; Reeves and others 1995; Schlosser 1991; Sedell and others 1990), the contributions of Congressionally-designated wilderness areas as aquatic refugia remain largely undetermined.

Using data from a previous Aquatic Diversity Areas (ADA) assessment (Frissell and others 1996), here we evaluate the role of Congressionally-designated wilderness towards conservation of aquatic biointegrity in western Montana by asking two related questions: 1) To what extent do wilderness-containing subwatersheds contribute to aquatic

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Nathaniel P. Hitt, Division of Biological Sciences, University of Montana, Missoula, MT 59812 U.S.A., e-mail: than@wildrockies.org. Christopher A. Frissell, Flathead Lake Biological Station, University of Montana, 311 Bio Station Lane, Polson, MT 59860-9659 U.S.A., e-mail: frissell@selway.umt.edu

biointegrity in western Montana? 2) How well does the presence of wilderness predict the relative aquatic biointegrity between subwatersheds? We hope that this analysis helps scientists, conservationists, and land managers better understand the importance of wilderness within a landscape context as well as the importance of aquatic ecosystem conservation.

Methods

In 1995, researchers at The University of Montana's Flathead Lake Biological Station and the Sierra Biodiversity Institute initiated an Aquatic Diversity Areas (ADA) assessment to prioritize 6th code watersheds ("subwatersheds") for their aquatic biointegrity and contribution to regional ecosystem conservation (Frissell and others 1996). Building on efforts in Oregon by the American Fisheries Society (Henjum 1994) and in California by Moyle and Ellison (1991) and Moyle and Sato (1991), the study calculated and ranked ADA scores for subwatersheds in western Montana. Four indices were used to rank each subwatershed for its aquatic biointegrity: road density (data source: Sierra Biodiversity Institute), fish stocking history (data source: Montana Department of Fish, Wildlife and Parks), native/

exotic fish ratio (data source: Montana Rivers Information System, MDFWP) and sensitive species occurrences (data source: Montana Natural Heritage Program). All data layers were analyzed with an ARC/INFOTM Geographic Information System.

Data from each category of information were integrated into an algorithm to calculate an ADA score for each subwatershed (figure 1). In this formula, the presence of roadless areas, native fish and sensitive species contributed positively to the ADA score; stocking of hatchery and exotic fish contributed negatively to the score. The study ranked subwatershed into one of four categories, from lowest to highest, based on a total possible 40.0 points: low-scoring (<15.0 points), lower mid-range (15.1-20.0 points), upper mid-range (20.1-25.0) and high-scoring (>25 points).

Many observational and experimental field investigations have documented direct and indirect impacts of road networks on aquatic systems (for a review, see USDA Forest Service 1997). Accordingly, the ADA methodology used road densities as a proxy for land use intensity and watershed condition, assuming that increasing road densities indicate increasingly degraded aquatic habitat. This assumption is supported by several recent studies that correlated increasing road densities and land use intensity with aquatic

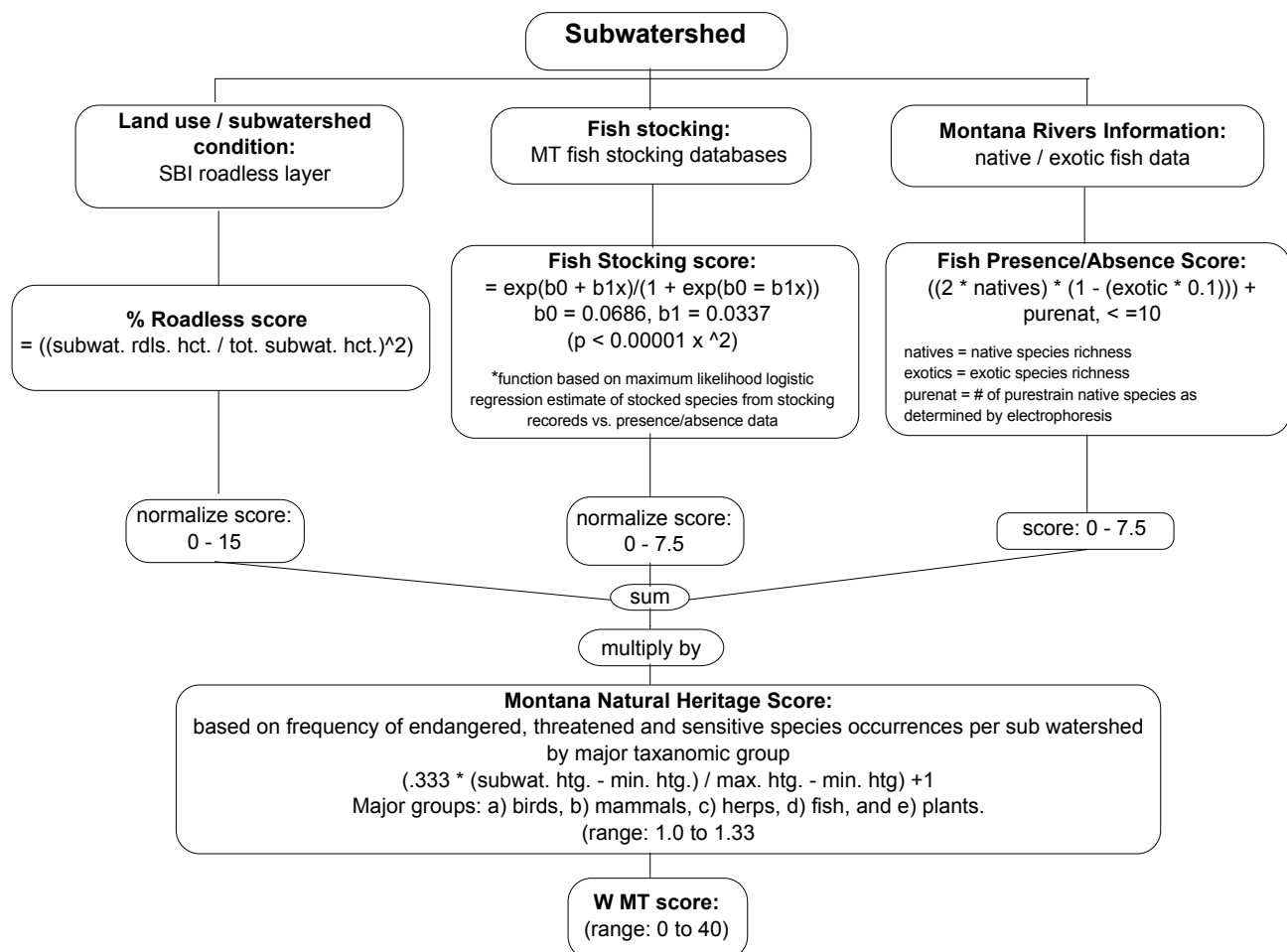


Figure 1—Aquatic Diversity Areas (ADA) scoring algorithm (from Frissell and others 1996).

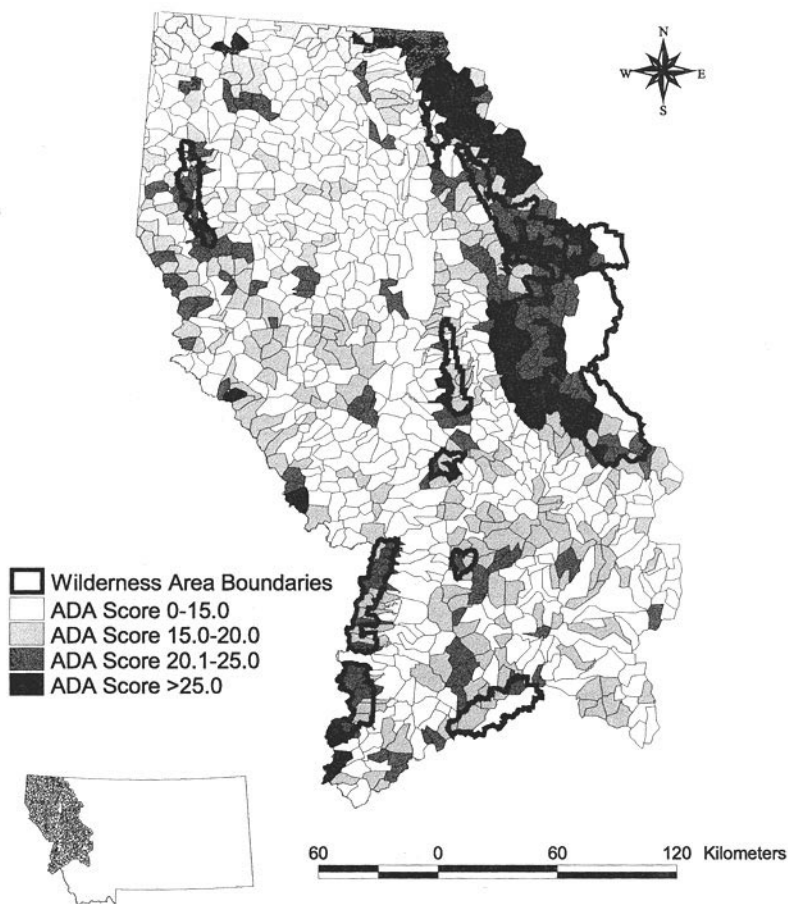


Figure 2—Aquatic Diversity Area (ADA) scores (from Frissell and others 1996) and wilderness areas in western Montana. Higher scores indicate high relative aquatic biointegrity for indices of road density, fish stocking history, native fish presence/absence, and sensitive and endangered species presence. Potential scores ranged from 0-40. Actual scores ranged from 1.46 to 31.13.

ecosystem decline (Bitterroot National Forest 1992; Frissell and others 1995; Roth and others 1996; Haskins and Mayhood 1997; Lee and others 1997; Rothrock and others 1998). Moreover, recent direction from the U.S. Fish and Wildlife Service (USFWS) has acknowledged the importance of road densities for bull trout (*Salvelinus confluentus*) conservation, recognizing an average road density of .45 mi/mi² in bull trout strongholds and the general exclusion of bull trout in watersheds with over 1.7 mi/mi² of roads (USDI Fish and Wildlife Service 1998). The USFWS concluded that bull trout “are exceptionally sensitive to the direct, indirect, and cumulative effects of roads” (USDI Fish and Wildlife Service 1998). Similarly, Quigley and Arbelbide (1997) recommended using “roads as a catch-all indicator of human disturbance.”

To draw inferences about the role of Congressionally-designated wilderness from the results of this ADA study, we mapped seven wilderness complexes (Selway-Bitterroot, Welcome Creek, Anaconda-Pintler, Rattlesnake, Mission Mountains, Cabinet Mountains, Great Bear/Bob Marshall/Scapegoat) and recorded the number of subwatersheds which contained wilderness (>0%). We then evaluated the role of wilderness in two ways: 1) We used a chi-squared analysis to

compare the ADA scores for wilderness-containing subwatersheds to the regional distribution of scores, and 2) we evaluated the ability of wilderness-containing subwatersheds to predict regions of high aquatic biointegrity.

Results and Discussion

High-scoring subwatersheds (>25.0 points) were located predominately within the Middle and South Forks of the Flathead River in westcentral Montana and on east-draining slopes of the Bitterroot Range in southwestern Montana. Mid-range scoring subwatersheds (15.1-20.0 and 20.1-25.0) were found in all major river basins. The largest concentrations of these scores were located in the western portion of the Lower Clark Fork Basin, the west half of the Upper Clark Fork Basin, and the Flint/Rock Creek Basin in southwestern Montana. Low-scoring subwatersheds (<15.0) were scattered throughout the region, with clusters in the eastern sections of the Bitterroot Basin; they comprised a majority of the Stillwater, Blackfoot, Main Flathead, and Fisher Basins. A map of ADA scores and wilderness area boundaries is presented in figure 2.

Wilderness-containing subwatersheds showed disproportionately more high ADA scores (>25.0 points) than subwatersheds with other uses ($\chi^2=115.71$; $P<0.001$). Over 65% of the high-scoring ADAs were found within wilderness subwatersheds. In several cases, clear patterns of high-scoring watersheds followed the boundaries of wilderness areas. However, the distribution of wilderness scores was not consistent: Of the 148 wilderness-containing subwatersheds, 43 (29%) scored within the highest category, 56 (38%) scored within the upper-mid range, 35 (24%) scored within the lower mid-range, and 14 subwatersheds (9%) scored within the lowest category for aquatic biointegrity. As a result, although wilderness is a major source of aquatic biointegrity in western Montana, the presence of wilderness within a subwatershed is not a deterministic predictor of integrity.

These findings highlight several important considerations for modern wilderness designation and management. First, we must recognize that the importance of wilderness in aquatic conservation is extraordinary. Other than wilderness-containing subwatersheds, only 24 subwatersheds scored within the highest category. Of these, 20 were located within Glacier National Park. As remarkable exceptions, the remaining high-scoring subwatersheds were located within the Lolo and Bitterroot National Forests (LNF and BNF): 1) the Great Burn area (LNF) 2) the Sheep Mountain/Stateline area (LNF), and 3) the Blue Joint area (BNF). Although the Great Burn area merited protection in the Lolo National Forest Land and Resource Management Plan, prolific and unregulated off-road vehicle use has threatened the integrity of this area. Important low-elevation areas within the Sheep Mountain/Stateline subwatersheds (LNF) also face development and resource extraction. Additionally, the Blue Joint area in the BNF area is jeopardized by the USDA Forest Service's failure to propose protection for more than high-elevation areas west of Razorback Ridge. To improve aquatic conservation in western Montana, we suggest that the low-elevation areas of the Blue Joint should be protected as well.

Although the boundaries of the contiguous Great Bear/Bob Marshall/Scapegoat complex were clearly discernible by high ADA scores in the South Fork of the Flathead River basin, smaller, more isolated wilderness areas contributed less to the regional distribution of high ADA scores, as illustrated by the Welcome Creek, Anaconda-Pintler, and Cabinet Mountains Wilderness Areas. With the exception of the adjacent Mission Mountains Tribal Wilderness, subwatersheds contained within the Mission Mountains Wilderness Area were found to provide the least benefits to regional aquatic biointegrity; all of these watersheds ranked in the lowest tiers. These marginal and low ADA scores are due to a number of factors, including the frequent encroachment of roads on wilderness area boundaries and the historical and current fish stocking in high-elevation lakes, as well as the absence of sufficient spawning, rearing and migration habitats for native fishes.

Conclusions

Conservation of aquatic species and ecosystems necessitates consideration of landscape-level processes and conditions. Due to the multi-faceted nature of aquatic ecosystems,

multiple factors should be considered in any landscape analysis of aquatic biointegrity. Our application of results from a previous Aquatic Diversity Areas (ADA) study for western Montana indicates that 1) wilderness areas are important areas of aquatic biointegrity in western Montana, 2) the presence of wilderness does not guarantee aquatic biointegrity, and 3) given their importance and rarity, unprotected areas with relative aquatic biointegrity merit permanent protection for conservation of aquatic ecosystems. Ultimately, we believe that our society must decide either to systematically protect landscapes or face the continued deterioration of natural systems and additional listings under the Endangered Species Act.

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The Sundarbans: A Unique Wilderness of the World

Laskar Muqsudur Rahman

Abstract—The Sundarbans, natural mangrove forests of Bangladesh covers an area of 577,000 ha. It is the largest single tract of mangrove forest in the world. The members of the family Rhizophoraceae do not dominate the tree vegetation of the Sundarbans. *Heritiera fomes* and *Excoecaria agallocha* are the two most extensively occurring tree species in the forest and they are members of Sterculiaceae and Euphorbiaceae respectively. The forest is very rich in biodiversity and supports different species of about 334 plants, 120 fishes, 35 reptiles, 270 birds and 42 mammals. The Sundarbans is the only habitat of the famous Royal Bengal Tiger and estuarine crocodile.

The Sundarbans, natural mangrove forests of Bangladesh cover an area of 577,000 ha, of which 401,600 ha is land and remaining 175,400 ha are under the water in the forms of river, canals and creeks of width varying from a few meters to several kilometers. The interconnected network of waterways makes almost every corner of the forest accessible by boat. Unlike most mangrove forests, the members of the family Rhizophoraceae do not dominate the tree vegetation of the Sundarbans. *Heritiera fomes* and *Excoecaria agallocha* are the two most extensively occurring tree species in the forest and they are members of Sterculiaceae and Euphorbiaceae respectively. The forest is very rich in biodiversity.

The Sundarbans play an important role in the economy of the southwestern region of Bangladesh as well as in the national economy. It is the single largest source of forest produce in the country. The forest provides raw material for wood based industries. In addition to traditional forest produce like timber, fuelwood, pulpwood etc., large scale harvest of non wood forest products such as thatching materials, honey, bees-wax, fish, crustacean and mollusk resources of the forest takes place regularly. The vegetated tidal lands of the Sundarbans also function as an essential habitat, nutrient producer, water purifier, nutrient and sediment trap, storm barrier, shore stabilizer, energy storage unit and aesthetic attraction.

The Sundarbans is named after the principal tree Sundri (*Heritiera fomes*) found in it. Another opinion is that it is derived from the words 'Samunder Ban' meaning sea forests. It may also derived from the word 'Sundar,' meaning beautiful, because the forest is beautiful to look at (Choudhury 1968). The Sundarbans is of unique scientific and biological

interest and offers rare opportunities for ecotourism, biological research and conservation education. Some areas in the forest have been earmarked as protected in the form of wildlife sanctuary. No forestry operations are carried out in these areas, which support a rich concentration of wildlife as well as vegetation, which has not been disturbed for decades. The forest was recognized as an important resource base about five centuries ago and actual scientific management of the forest was initiated more than 120 years ago. This is very significant because even today mangroves are not considered as a viable resource base in a number of countries of Asia, Africa and tropical Latin America. For its outstanding natural value the World Heritage Committee of UNESCO inscribed the Sundarbans of Bangladesh in the World Heritage list by their 21st session in 1997 and accordingly the Government of the People's Republic of Bangladesh declared the Sundarbans as World Heritage site in December 1997 (Nuruzzaman and others 1999). This paper describes the vast wilderness of the Sundarbans, its economic and social importance and the need for integrated management and research.

Legal Status

During the Mughal period (1203-1538), the local kings leased the forests of the Sundarbans out. The history of changes in legal status boasts a number of unique features including the distinction of being the first mangrove forest in the world to be brought under scientific management. The area was mapped by the Surveyor General as early as 1764 following soon after proprietary rights were obtained from the Mughal Emperor, Alamgir II, by the East India Company in 1757. Systematic management of this forest tract started in the 1860s after the establishment of a Forest Department in the Province of Bengal, in India. The first Forest Management Division to have jurisdiction over the Sundarbans was established in 1869. The Sundarbans was declared a reserved forest in 1875-76, under the Forest Act, 1965 (Act VIII of 1965). The first management plan was written for the period 1893-98. (Hussain and Acharya 1994; UNDP 1998).

Physiography

The Sundarbans along the Bay of Bengal has evolved over the millennia through natural deposition of upstream sediments accompanied by intertidal segregation. The physiography is dominated by deltaic formations that include innumerable drainage lines associated with surface and subaqueous levees, splays and tidal flats. There are also marginal marshes above mean tide level, tidal sandbars and islands with their networks of tidal channels, subaqueous

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Laskar Muqsudur Rahman, Assistant Chief Conservator of Forests, Forest Department, Government of the People's Republic of Bangladesh, Ban Bhaban, Gulshan Road, Mohakhilai, Dhaka-1212, Bangladesh, Fax: + 88 02 8810704, e-mail: laskarmr@bangla.net

distal bars and proto-delta clays and silt sediments. The Sundarbans' floor varies from 0.9 m to 2.11 m above sea level (Katebi and Habib 1987).

The physical development processes along the coast are influenced by a multitude of factors, comprising wave motions, micro and macro-tidal cycles and long shore currents typical to the coastal tract which vary during the pre-monsoon, monsoon and post-monsoon periods. These are also affected by cyclonic action. Erosion and accretion through these forces maintains varying levels, as yet not properly measured, of physiographic change whilst the mangrove vegetation itself provides a remarkable stability to the entire system.

Biotic factors here play a significant role in physical coastal evolution and for wildlife a variety of habitats have developed including beaches, estuaries, permanent and semi-permanent swamps, tidal flats, tidal creeks, coastal dunes, back dunes and levees. The mangrove vegetation itself assists in the formation of new landmass and the intertidal vegetation plays an important role in swamp morphology. The activities of mangrove fauna in the intertidal mudflats develop micromorphological features that trap and hold sediments to create a substratum for mangrove seeds. The morphology and evolution of the eolian dunes controlled by an abundance of xerophytic and halophytic plants. Creepers and grasses and sedges stabilizes sand dunes and uncompacted sediments

Flora

The Sundarbans flora is characterized by the abundance of *Heritiera fomes*, *Excoecaria agallocha*, *Ceriops decandra* and *Sonneratia apetala*. A total 245 genera and 334 plant species were recorded by Prain (1903). Since Prain's report there have been considerable changes in the status of various mangrove species and taxonomic revision of the mangrove flora (Khatun and Alam 1987). However, very little exploration of the botanical nature of the Sundarbans has been made to keep up with these changes. Whilst most of the mangroves in other parts of the world are characterized by members of the Rhizophoraceae, Avicenniaceae or Lagunculariaceae, the mangroves of Bangladesh are dominated by the Sterculiaceae and Euphorbiaceae (Hussain and Acharya 1994).

The Bangladesh mangrove vegetation of the Sundarbans differs greatly from other non-deltaic coastal mangrove forest and upland forests associations. Unlike the former, the Rhizophoraceae are of minor importance. Differences in vegetation have been explained in terms of freshwater and low salinity influences in the Northeast and variations in drainage and siltation.

The Sundarbans has been classified as a moist tropical forest demonstrating a whole mosaic of seres, comprising primary colonization on new accretions to more mature beach forests, often conspicuously dominated by Keora (*Sonneratia apetala*) and tidal forests. Historically three principal vegetation types have been recognized in broad correlation with varying degrees of water salinity, freshwater flushing and physiography and which are represented in the wildlife sanctuaries:

1. Sundarbans east, where freshwater and Sundri (*Heritiera fomes*) dominate interspersed with Gewa

(*Excoecaria agallocha*) and Passur (*Xylocarpus mekongensis*) with Kankra (*Bruguiera gymnorrhiza*) occurring in areas subject to more frequent flooding. There is a understory of Shingra (*Cynometra ramiflora*) where, soils are drier and Amur (*Amoora cucullata*) in wetter areas and Goran (*Ceriops decandra*) in more saline places. Nypa palm (*Nypa fruticans*) widespread along drainage lines.

2. Sundarbans south, where there is evidently the greatest seasonal variation in salinity levels and possibly represents an area of relatively longer duration of moderate salinity where Gewa is the dominant woody species. It is often mixed with Sundri, which is able to displace in circumstances such as artificially opened canopies where Sundri does not regenerate as effectively. It is also frequently associated with a dense understory of Goran and sometimes Passur.

3. Sundarbans west, in areas which support sparse Gewa and dense stands of Goran and discontinuous patches of Hantal palm (*Phoenix paludosa*) on drier ground and river banks and levees.

Sundri and Gewa occur prominently throughout the area with discontinuous distribution of Dhundul (*Xylocarpus granatum*) and Kankra. Among grasses and Palms, *Poresia coaractata*, *Myriostachya wightiana*, *Imperata cylindrica*, *Phragmites karka*, *Nypa fruticans* are well distributed. Keora is an indicator species for newly accreted mudbanks and is an important species for wildlife, especially spotted deer (*Axis axis*). Besides the forest, there are extensive areas of brackish and freshwater marshes, intertidal mudflats, sandflats, sand dunes with typical dune vegetation, open grassland on sandy soils and raised areas supporting a variety of terrestrial shrubs and trees.

Succession is generally defined as the successive occupation of a site by different plant communities (Weaver and Clements 1938). In an accreting mudflats the outer community along the sequence represents the pioneer community which is gradually replaced by the next community representing the seral stages and finally by a climax community typical of the climatic zone (Watson 1928 and Chapman 1976). Troup (1921) suggested that succession began in the newly accreted land created by fresh deposits of eroded soil. The pioneer vegetation on these newly accreted site is *Sonneratia*, followed by *Avicennia* and *Nypa*. As the ground is elevated as a result of soil deposition, other trees make their appearance. The most prevalent, though one of the late species to appear, is *Excoecaria*. As the level of land rises through accretion and the land is only occasionally flooded by tides, *Heritiera fomes* begins to appear.

Apart from a worldwide interest in botany, especially flowering plants, orchids, grasses and trees the current pervasive fashion for herbal medicines and chemical-free drugs has generated two lines of interest in plants which could be of great value to the Sundarbans Reserved Forests:

- Herbal tour—very popular in many parts of the world, even in countries like Kenya and Tanzania where there are powerful alternative attractions of 'big game and beaches.'
- The pharmaceutical industry which is searching the world for 'natural products' which could have commercial application. Supply of samples either as extractions or wet material is already being widely practiced or

where there is a 'hit' substantial revenues can accrue to the source country.

Fauna

The Sundarbans is very rich in wildlife. However the management of wildlife is presently restricted to the protection of fauna from poaching and designation of some areas as wildlife sanctuaries where no extraction of forest produce is allowed and the wildlife face few disturbance. Although it is clear that the faunal resource of Bangladesh have diminished in recent times (Hussain and Acharya 1994) and the Sundarbans has not been spared from this decline, the mangrove forest retains several good wildlife habitats and their associated fauna. Table 1 shows existing species or groups of animals that are particularly important.

Of these the tiger and dolphin are target species for planning wildlife management and tourism development. There are high profile and vulnerable mammals living in two contrasting environments and their statuses and management are strong indicators of the general condition of wildlife and its management.

The Sundarbans provides a unique ecosystem and extensive habitats for wildlife. A human interface in the Sundarbans in terms of resource extraction and forest management has important effects on wildlife habitats and populations. The river terrapin (*Betagur baska*), Indian flap-shelled turtle (*Lissemys punctata*), peacock soft-shelled

turtle (*Trionyx hurum*), yellow monitor (*Varanus flavescens*), water monitor (*Varanus salvator*), Indian python (*Python molurus*) and the Bengal tiger (*Panthera tigris tigris*) are some of the resident species. Some of these species are protected by legislation, notably by the Bangladesh Wildlife (Preservation) Order, 1973 (P.O. 23 of 1973). Some species such as hog deer (*Axis procinus*), water buffalo (*Bubalis bubalis*), swamp deer (*Cervus duvauceli*), Javan rhinoceros (*Rhinoceros sondaicus*), single horned rhinoceros (*Rhinoceros unicornis*) and the mugger crocodile (*Crocodylus palustris*) have become extinct in the Sundarbans at the beginning of this century (Sarker, 1993).

Recent studies revealed that the Bangladesh Sundarbans support diverse biological resources including at least 120 species of commercially important fishes, 270 species of birds, 42 species of mammals, 35 reptiles and eight amphibian species. This represents a significant proportion of the species present in Bangladesh (i.e. about 30% of the reptiles, 37% the birds and 34% of the mammals) and includes a large number of species which are now extinct elsewhere in the country (Scott 1991). Of these wildlife, Sarker (1993) has noted that two amphibians, 14 reptiles, 25 aves and five mammals are presently endangered. The Sundarbans is a paradise for the ornithologists for watching, study and research on avifauna (Habib 1999). An estimated population of some wildlife species of the Sundarbans is shown in Table 2.

Resource Management

The Sundarbans is the single largest source of supply of timber, fuelwood, pulpwood, thatching material and a whole array of non-wood forest products and non forestry forests products for Bangladesh. The forest has been under scientific management for about 120 years. In early days of management, *Heritiera fomes* was the only tree species, which was commercially exploited and exported from the forest. Gradually, over time, other tree species also became commercially important. The management prescriptions for different tree species in the Sundarbans have been developed gradually by fine tuning prescriptions, which were first implemented in the 19th century.

Administration

In 1875 a large portion of the mangrove forests was declared as reserved forests under the Forest Act, 1865 (Act VIII of 1965). The remaining portions of forests was declared

Table 1—Important wildlife of the Sundarbans, Bangladesh.

Bats	Strong following among wildlife specialists.
Tiger	Main national animal therefore of inestimable value; man killing behavior requires urgent study.
Fishing cat	Small but common secondary carnivore.
Spotted deer	Continental deer but unusual habitat in mangroves therefore of more than unusual value; harvesting may be possible.
Wild boar	Common and with much commercial potential.
Barking deer	Rarely seen but well represented therefore good for wildlife specialists.
Crocodiles	Infrequently seen but important in food chain and ecological stability; farming may be possible.
Otters	Of great value for biodiversity management and as a unique selling point tourist attraction with traditional fishermen; deserve special conservation attention in future.
Turtles	Strong interest among wildlife conservation specialists and deserve special attention in future; wildlife research especially to breeding areas and to secure threatened species is now essential for urgent action.
Python	Infrequently seen but must be well represented. Deserve special effort in future conservation and protection measures.
Dolphin	Indiscriminately harvested. Should be researched and actively protected.

Table 2—Estimated populations of some wildlife of Sundarbans, Bangladesh.

Animals	Number
Tiger	450
Spotted deer	80,000
Wild boar	20,000
Rhesus Macaque	68,200
Otter	20,000
Crocodile	100
White bellied-sea eagle	130 breeding pairs
Water monitor	39,795

Source: Hussain and Acharya 1994.

Table 3—Forest ranges of the Sundarbans, Bangladesh.

Name of range	Area (ha)	Total compartments
1. Sharankhola	130,998	12
2. Chandpai	100,021	15
3. Khulna	161,345	16
4. Satkhira	184,992	12

as reserve forest the following year and the forest, which was so far was administered by the civil administration district, was placed under the control of the Forest Department. A Forest Division, which is the basic forest management and administration unit, was created in 1879. The headquarters of the Forest Division was based in Khulna. The basic unit of management is the compartment. There are 55 compartments in four Forest Ranges (Table 3) and these are clearly demarcated mainly by natural features such as rives, canals and creeks. A new Khulna Forest Circle was created in 1993 and a Conservator of Forests has been posted. The direct administrative head of the Division is the Divisional Forest Officer who is also based at Khulna. The Divisional Forest Officer has a number of professional, subprofessional and support staff and logistic supports for the implementation of necessary management and administrative activities.

Forest Produce

In the 1980s the forest was producing about 45% of the total timber and fuelwood output from the forests of the country. Because of the extensive and diverse resources, which are available from the Sundarbans, the forest generates large-scale employment opportunities. The number of people entering the forest in a given year can be as high as one million. However, the number of people involved in retailing, transportation and processing of products from the Sundarbans is much higher.

The major forest products of the Sundarbans can be broadly categorized as follows for the purpose of discussing resource management practices:

1. Timber and industrial raw material.
2. Fuelwood.
3. Thatching material.
4. Non-wood forest products.

Timber and Industrial Raw Material—Until 1979-80, harvest of all wood and non-wood products in the Sundarbans was carried out on the basis of prescriptions which were laid out in the current working plans. The prescriptions provided the details of the area as well as the location of coupe for a particular year's operation. The silvicultural system prescribed is selection-cum-improvement and the cutting cycle prescribed for important species was 20 years, i.e., wood harvest in each location in the forest was carried out once in 20 years. Exploitable diameters for all timber species of three quality classes were also prescribed and tabulated. *H. Fomes* is the principal timber species in the Sundarbans. Other timber species of commercial species are *Sonneratia apetala*, *Xylocarpus mekongensis*, *Avicennia officinalis*, and *Bruguiera gymnorrhiza*. However, these occur on a much

smaller scale and are commercially not as important as *H. fomes*.

The moratorium order imposed a restriction on all tree felling in the natural Reserved Forests since 1989 and until the year 2000. However, in case of the Sundarbans cutting of Goran, Gewa and top-dying Sundri is allowed to facilitate the supply of raw material for pulp and paper industries and removal of top-dying Sundri trees is permitted.

Fuelwood—The two major fuel wood species in the Sundarbans are *H. fomes* and *Ceriops decandra*. However, there are a number of other species, which, also provide good quality fuelwood. These include *Amoora cucullata*, *Aegiceras majus*, *Rhizophora mucronata*, *Hibiscus tiliaceus*, *Ceriops candellana* and *Cynometra ramiflora*.

Thatching Material—Leaves of *Nypa fruticans* is a major source of thatching material, which is extensively used, by the poorer section of rural population in southwest Bangladesh. The Sundarbans is the only source of Nipa leaves. In addition, *Saccharum cylindricum* or sungrass grows extensively in the sandy areas on the seaward side of the Bangladesh Sundarbans. The grass is harvested in the same fashion as are cereal crops in agricultural fields and is used for thatching.

Non Wood Forest Products—In the Forest Department terminology, fishery resources in the Sundarbans are regarded as minor forest products and their harvest and management is regulated by the Forest Department. It is the most important non-forestry product of the forest. The shallow water, creeks, small and big rivers crossing mangrove forests supports many species of fish. Over 120 species of fish are caught routinely by commercial fishermen. Some species such as *Hilsha ilisha* are exclusively marine but travel through estuaries to the upstream areas for breeding and then return to the sea. Shrimps and prawns constitute the most important fishery of the zone. The most important crustaceans' species are *Penaeus mondon* and *Macrobrachium rosenbergi*. Mud crab (*Scylla serrata*) is the largest edible crab found in the forest area and has high economic value because of its very tasty meat and very high nutrient content.

Although honey and bees-wax are universal non-forest products, in the Sundarbans, these are included in the non-wood forest products and treated with particular importance with respect to their market and food value. *Aegiceras corniculatum* and *Ceriops decandra*, these two species are favored by the honey-bee *Apis dorsata*. Honey made from *Aegiceras* is of high quality and has a distinctive flavor. An estimated 185 t of honey and 45 t of wax are extracted annually.

The bark of various species is used in tannin production. *Ceriops decandra* is a major source of tannin while the barks of other species such as *Bruguiera gymnorrhiza* and *Xylocarpus granatum* also have a high tannin content. *Xylocarpus granatum* fruits are also used in tanning.

Phoenix paludosa is a thorny palm, the stems of which are used extensively in the construction of small huts as roof rafters and framework of the wall. *Phragmites karka*, a reed is collected from the forest and used extensively for making matting used for walls of houses, coverings for boats and as mats. *Myriostachyna wightiana* is collected from the newly

formed land in the forest and used for fencing and covering materials. *Acrostichum aureum* or tiger fern is a gregarious fern, the stems of which are used for the construction of mudwalls and fencing. *Entada scandens* is a woody climber, which is used for cleaning and medicinal purposes.

Wildlife Sanctuaries

There are three wildlife sanctuaries established in 1977 under the Bangladesh Wildlife (Preservation) Order, 1973 (P.O. 23 of 1973). These are: the Sundarbans East Wildlife Sanctuary extending over an area of 31,227 ha; the Sundarbans South Wildlife Sanctuary extending over an area of 36,970 ha; and the Sundarbans West Wildlife Sanctuary extending over an area of 71,502 ha of forests. The World Heritage Committee of UNESCO has declared the Sundarbans as its 522nd World Heritage Site by the 21st session for its outstanding scenic beauty and biological traits on the 6th December 1997. The UNESCO determined about 1400 km² of Sundarbans as World Heritage Site, at the inception. The Honorable Prime Minister of Bangladesh, Sheikh Hasina hoisted the Blue Flag of World Heritage Site and unveiled the plaque at Hiron Point (Nilkamal) of the Sundarbans on the 4th February 1999 (Nuruzzaman and others 1999).

Tourism

Conservation tourism or ecotourism may be developed for the Sundarbans without causing undue disturbance to the forest and wildlife. The Royal Bengal Tiger (*Panthera tigris tigris*) is, in particular, an important and alluring component of the Sundarbans and as such, should be an essential part of conservation and tourism activities. The fishing operation during winter months can also be developed as an interesting tourist spot.

Tourism in the Sundarbans is best undertaken during the winter months and the tourist season is therefore generally considered to last from October/November to February. The difficult terrain of mangrove areas further requires special facilities to be developed for transportation and accommodation needs. At the same time, the value of the Sundarbans resources and the danger of harming the fragile ecosystem must be taken into consideration in the preparation of a tourism plan.

Tourism has been recently regarded as an important component of the management and development of the Sundarbans. It has been recommended that due to the difficult terrain and the conservation needs of the forest ecosystem, the Sundarbans should be considered a site for low volume high-cost ecotourism rather than for a wider, less affluent mass market (UNDP 1998).

The National Tourism Policy of 1992 identifies the Sundarbans as one of the four key areas for development with an emphasis on wildlife. Table 4 lists some points which, have been noted as attractions of the Sundarbans Forest (Hussain and Acharya 1994).

Various constraints to developing the tourism potential of these forests have also been noted by the report and include:

1. Seasonal and climatic factors such as monsoon rains, storms etc.

2. Shortage of drinking water.
3. Lack of power and telecommunication facilities.
4. Lack of medical facilities.
5. Distance from airport.
6. Lack of tourism ethic and institutional framework.
7. Lack of infrastructure and staff for wildlife management, and conservation of wilderness values.
8. A fragile environment and difficult terrain.

Despite the difficult terrain and climatic uncertainties of the Sundarbans, the mangroves remains a source of attraction both in terms of aesthetic and wildlife value as well as in terms of research potential and educational value. The conservation of the natural ecosystem is therefore imperative, not only to maintain the productivity of the forests but for the preservation of wildlife and the various services and functions performed by the forests, many of which we have yet to discover.

Management and Research Needs

The physical environment and the mangrove biota of the Sundarbans are changing in interrelated ways. Deltas are the centers of the development of human civilization. The area presently managed, as natural mangrove forest is more than 50 per cent of the mangrove forest which, existed two centuries ago. Deforestation of the mangrove areas due to

Table 4—Attractions of the Sundarbans Reserved Forests, Bangladesh.

Description	Comments
Location	On the Bay of Bengal and largest mangrove formation in one of the world's largest river deltas.
Tropical climate	Cool and dry during the tourist season.
Waterways	Large and small waterways providing opportunities for cruising and jungle boating.
Forests	Unspoiled mangroves; forest ecology.
Wildlife	The largest single population of the Bengal tiger and exceptional populations of spotted deer and wild boar; adequate bird watching, migratory species and raptors in particular.
Beaches	Unspoiled, wild, unpolluted and totally undeveloped beaches throughout along the Bay of Bengal and around some islands.
History/archaeology	Rare sites set in the forest.
Sociology	Fishermen in particular, otter fishermen, also other traditional collectors of forest produce.
Cuisine	Many different species of edible fish, prawns and crabs.
Culture	Annual festivals at Dubla and diverse culture.

Source: de Vere Moss 1993.

increasing need for food. Fuel and shelter for the growing population had dire effects on the remaining mangrove areas.

Besides, environmental pollution like increased salinity due to altered river water flow as a result of construction of barrage and polders, oil spills in the maritime routes and over-exploitation in the Sundarbans beyond replenishment capacity of the forests, frequent cyclone and tidal surges affect the vast wilderness of the Sundarbans.

It has become a matter of immediate urgency to address the integrated management and research needs of the ecosystem. The resources and functions provided by the mangroves are essential for the coastal communities and for the national economy. In terms of scientific and educational value, and as part of natural heritage, the world's largest block of mangrove forests, straddling across the border of Bangladesh and India, is of both national and international value.

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Climatic Change and Wildland Recreation: Examining the Changing Patterns of Wilderness Recreation in Response to the Effects of Global Climate Change and the El Niño Phenomenon

Vinod Sasidharan

Abstract—Impacts of global climate change on the biophysical components of wilderness areas have the potential to alter their recreational utility of wilderness areas. Concomitantly, the frequency and patterns of both land-based and water-based wilderness recreation activities will be affected. Despite the difficulty of responding to the unclear dimensions of global climate change, it is essential for wilderness recreation managers and policy-makers to acknowledge, and make provisions, for the multifaceted implications of these effects. This paper examines the effects of global climatic change on forests and wilderness areas – and, based upon possible scenarios, elucidates some implications of these effects for wildland recreation and for those who plan and manage wilderness recreation resources.

Wilderness management strategies predominantly focus on the regulation, preservation and conservation of wildlife species and ecobiomes by protecting them from human-induced disturbances/interferences such as recreational resource overuse, mining, logging, air and water pollution, acid rain and pesticide contamination, both within and outside designated boundaries (Wright 1992). Today, in addition to the threats posed by anthropogenic activities, natural resource planners and policymakers worldwide are faced with the apparent ecological consequences of global climate change. Changing global climate patterns (global warming, increasing atmospheric CO₂ levels, ozone layer depletion and the El Niño-Southern Oscillation phenomenon) can cumulatively affect wildland ecosystems and environments (Whyte 1995). Effects of climate change on natural ecosystems may be manifested as responses to changes in temperature, precipitation levels, frequency of extreme events (hurricanes, fire, etc.), sea level and soil chemistry, increases in pests and diseases, competition from other ecosystems, and interrelated factors (Houghton and others 1990; Kristiansen 1993; Whyte 1995).

The impacts of global climate change on the biophysical components of wilderness areas will also alter the recreational utility of wilderness areas, affecting the frequency

and patterns of both land-based (wilderness camping, hiking/trekking, skiing, snow-boarding, nature study, mountain climbing, etc.) and water-based (fishing, wading, swimming, sailing, canoeing, rafting, etc.) wilderness recreation activities, as well as the safety of wilderness recreationists. Based upon existing research on the effects of global climatic change on forests and wilderness areas, this paper attempts to project possible consequences of this change for wildland recreation and elucidates some implications of these effects for those who plan and manage wilderness recreation resources.

Impacts of Global Climate Change on Wildlands and Wilderness Recreation

Although the specific impacts of global climate change on wildlands and other natural-ecosystems are uncertain, some clear consequences can be inferred from continuing scientific investigations (Westman and others 1990). Predicted climate changes such as increased atmospheric CO₂ concentrations, global warming and temperature rise, extreme weather events and the El Niño-Southern Oscillation phenomenon are not unique in the Earth's history. However, the predicted changes may occur at a rate that surpasses previously recorded natural fluctuations (Kristiansen 1993). Rapidly changing climatic conditions may severely affect wildland areas and the recreational utility of wilderness regions.

Effects of Increased CO₂ Concentrations

Estimates suggest that atmospheric CO₂ would increase from the present level of approximately 350 ppm (parts per million) to about 450 ppm by the year 2050, and to about 520 ppm by the year 2100 (Houghton and others 1990), even if human-caused emissions of CO₂ could be kept at present rates. Accelerated increase in atmospheric CO₂ will result in the rapid expansion of plant colonies that react positively to increased CO₂ levels (Melillo and others 1990). For example, scrublands will replace grasslands. With increasing levels of atmospheric concentrations of CO₂, the leading greenhouse gas responsible for global warming (now at the highest level in 150,000 years), “the world will likely face a rate of change in the next several decades that exceeds ‘natural’ rates by a factor of ten” (Flavin and Tunali 1996). While southeastern parts of the United States will experience changes in forest

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Vinod Sasidharan is Ph.D. Student in Leisure Studies, School of Hotel, Restaurant and Recreation Management, The Pennsylvania State University, University Park, PA 16802 U.S.A., e-mail: vxsl8@psu.edu

composition and reductions in the area of healthy forests due to higher temperatures and dry soil conditions that prevent the growth of tree seedlings, the forests of central Michigan (now dominated by sugar maple and oak) might be replaced by grasslands (Hidore 1996). The diminishing capability of these forests to provide suitable resources and opportunities for recreation may decrease participation in wilderness recreation activities by outdoor recreationists and encourage changes in the geographical preferences of wilderness recreationists.

Temperature Rise and Shift in Forest Boundaries

According to recent climate research findings of the United Kingdom's advanced Hadley Center Meteorological Office, global temperatures "are already some 0.6 °C higher than they were at the end of the last century, and global climate will continue to change throughout the next century" (Department of Environment, Transport and the Regions 1997). Forests and wilderness areas respond to global temperature rise and climate change through changes in the distribution of flora and fauna. With shifts in climate and temperature zones, conditions for species may become more or less favorable, and species may retract their ranges where conditions become unsuitable and expand them where conditions improve (Peters and Darling 1985). Excessive heat and associated decreases in soil moisture may cause species to shift to higher elevations as warmer climatic conditions impair chances for species survival and reproduction (Westman and others 1990).

In temperate zones, temperature rises would result in water stress under warmer conditions, air pollution and insect pests would slow the ability of trees to colonize new areas, thus causing species dieback at the southern boundaries of these zones (Whyte 1995). As a result of global temperature rise, forests may experience northward shifts (forest migrations) in species ranges and dieback along their southern edges, accompanied by changes in productivity, soil characteristics, composition and erosion/runoff (Council of State Governments 1994). Since the southern boundary may advance more quickly than the northern boundary, the geographical area of forests would drop if there were a migration rate of 60 miles per century (Hidore 1996). Increased rates of decomposition, weathering and erosion caused by tree mortality along the southern forest boundary will likely reduce stream quality (Botkin and others 1991) in these areas. In response to the gradual inundation of the southern boundary and poor water quality in these areas, wilderness areas along the temperate zones may experience a shift in recreational use patterns, with an incremental shift in use of wilderness resources toward the northern limits of the forests.

Global climate change is likely to have the most impact on geographically localized species of flora and fauna, those found in wildlife reserves and parks, as artificial boundaries and isolation of these sites enhances their susceptibility and sensitivity to the stress and pressures associated with rapid changes in climatic conditions (Westman and others 1990). The effects of global climate change, and effects of the El Niño phenomenon may manifest in the form of species

migration, mortality (Trillmich and Dellinger 1991) and even extinction, in some cases. Isolated wilderness areas that are heavily frequented by visitors may experience a decrease in the number of nature watchers, photographers and other types of nonconsumptive recreationists. Decline in wildlife populations may lead hunters to seek other habitats that offer more substantial populations.

In freshwater ecosystems like lakes and streams, decreases of water supply due to warming, disruption of seasonal flows, changes in seasonal runoff patterns and associated alterations in the quantity of nutrients and sediments may result in exacerbated eutrophication, severe reductions in the rate of fish, amphibian and fish-egg survival, fish mortality and aquatic species displacement (Botkin and others 1991), in addition to migration of marine birds to new nesting grounds (United Nations Environment Program 1992). Distortions in normal fish populations and displacements of trophy fish will then affect recreational fishing patterns as fishermen abandon fishing lakes and streams with low fish populations. Freshwater ecosystems with ample fish supplies will experience simultaneous increases in the frequency of use by fishermen.

Extreme Weather Events and the El Niño-Southern Oscillation Phenomenon

The "climate extreme index" developed by the National Climate Center in Asheville, North Carolina, demonstrates that the frequency of extreme weather events (floods, droughts, blizzards, hurricanes, etc.) has been 1.5 times more frequent since the mid-1970s than in the 65 preceding years (Godbey 1997). Water tables and rivers in wilderness areas will frequently dry up as a direct consequence of increasing evaporation rates, due to high levels of carbon emission, and heightened water demand for irrigation (Ayres 1998). In addition, drought-like conditions in wilderness areas, like those in the western United States and eastern Australia, catalyzed by the El Niño-Southern Oscillation phenomenon, could possibly reduce the recreational demand for wild and scenic rivers, lakes, reservoirs, dams and other water-bodies located within wildlands.

Global climate change is expected to increase the frequency and severity of wildfires in forests and wilderness areas, both because of the projected increases in available fuel with increases in primary productivity and the increased amount of dead fuel accumulating as a result of increased mortality (Westman and others 1990). Increased susceptibility of forests to fire damage has been widely predicted as an accompaniment to hotter, drier climatic regimes in areas such as the western and central United States (Whyte 1995). The frequent closure of wildland recreational areas due to fire in these zones, along with concern for safety, may prompt outdoor recreationists to seek wilderness areas less prone to forest fires, such as northern and eastern United States. The combined effect of global warming and the El Niño phenomenon will increase the occurrences of intense monsoons and accompanying torrential rains, possibly causing severe flooding in previously drought-stricken areas, such as parts of southern United States and South America (Department of Environment, Transport and the Regions 1997). The heightened

vulnerability of areas to catastrophic flash flooding may deter recreationists from utilizing wilderness sites in flood-prone regions, and concomitant increases in the use of 'safer' wilderness zones may become evident.

Overall, global climate change studies suggest that increasing atmospheric CO₂ concentrations, global warming and temperature rise, extreme weather events, the El Niño-Southern Oscillation phenomenon and other changing climatic conditions are likely to intensify already increasing pressures on some wilderness areas. Although the impact of global climate change may, in some cases, be less adverse than other pressures on wilderness areas, even relatively small changes can have detrimental effects on the biophysical composition of these regions. Undesirable environmental impacts associated with global climate change on wilderness zones will, undeniably, have far-reaching influences on the use patterns and frequency of wilderness recreation activities in impacted zones.

Implications for Wilderness Recreation Management

Currently, little is known about the problems associated with global climate change, and further scientific inquiry is essential for better understanding of the implications of this phenomenon for wilderness area management and recreation planning in wildland zones. Moreover, current wilderness management policies need to be reevaluated, and new practices will have to be adopted, to counteract the challenges posed to wilderness areas and other natural ecosystems by our planet's changing climatic conditions.

In response to potential reductions in the area of healthy forests due to global warming, ecosystem researchers need to develop measures for reducing species mortality and for re-establishing those habitats prone to deterioration, especially along southern forest boundaries, by providing suitable soil conditions. Wilderness recreation areas susceptible to deterioration from increased atmospheric CO₂ levels will have to be managed with the objective of maintaining habitats that would continue supporting wilderness recreation activities while tolerating increased CO₂ levels. This would be done by developing diversified and resilient ecosystems with higher CO₂ absorption rates capable of effectively withstanding the effects of global climate change (Council of State Governments 1994) and recreation activities in wilderness recreation areas. Worldwide attempts to reduce CO₂ emissions will be accompanied by the replacement of fossil fuels, primarily oil and coal, by solar, geothermal, wind and other renewable forms of energy (Godbey 1997). Accordingly, recreational resource planning and management agencies will be required to enforce rules and regulations designed to minimize and, possibly, exclude fossil fuel-based equipment, devices and vehicles from forests and recreational areas currently allowing their use near wilderness zones. Stringent laws, and growing awareness among recreationists about the effects of human-induced global climate change, will stimulate the use of renewable energy-based recreational equipment in wilderness areas. In the case of wildlife reserves, parks and freshwater ecosystems, information will have to be gathered and disseminated on the

relative sensitivities of species to climate and climate change (Westman and others 1990). Based on this information, new conservation strategies will have to be adopted in order to protect individual species according to how tolerant they are to climate change variables. In wilderness areas prone to drought-like conditions, it will be necessary to promote alternative seasons for water-based recreational activities. Scientific techniques and simulation models for determining areas susceptible to forest fires need to be developed to predict occurrences and distributions of forest fires and to prevent recreationists from entering/approaching these wilderness areas during such seasons.

While predictions of global climatic change remain ill-defined and unclear, 'the key climate change issue becomes how to prepare in the intervening years' (McAnally and others 1997). Above all, establishment and implementation of appropriate intervention measures for managing the impacts of global climate change on wilderness areas, as well as wilderness recreation activities, must be based on sound and comprehensive information.

Conclusion

The coming period of global climatic change is likely to be erratic and disruptive, and recent studies, as well as reliable global climate change models, predict an increase in the occurrences of floods, cyclones, hurricanes, blizzards and winter storms, droughts, fires and heat outbreaks during the next several decades (Flavin and Tunali 1996). The combined effects of global warming, increasing atmospheric CO₂ levels, ozone layer depletion and the El Niño-Southern Oscillation phenomenon will severely affect the world's natural ecosystems (Kristiansen 1993), including wilderness areas and the recreational use of wildland resources. Despite the difficulty in responding to the unclear dimensions of global climate change, it is essential for wilderness recreational resource managers and policy-makers to acknowledge, and make provisions for, the multifaceted implications of these effects, within current as well as future recreation planning and management policies.

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Assessing Interconnections Between Wilderness and Adjacent Lands: The Grand Staircase-Escalante National Monument, Utah

Janice L. Thomson
Dawn A. Hartley
Gregory H. Aplet
Peter A. Morton

Abstract—Wilderness managers have traditionally managed wilderness lands based on the ecological and social content of wilderness areas. The authors propose a framework to systematically account for the biophysical, socioeconomic, and wilderness characteristics of the broader landscape context. The method was applied to the proposed wilderness lands of the Grand Staircase-Escalante National Monument in southern Utah. The results illustrate patterns of interdependencies across the landscape. Spatial data demonstrate links between the integrity of proposed wilderness lands and the management of adjacent land units, and links between the economic health of local communities and the management of proposed wilderness and adjacent federal lands.

Wilderness carries with it a variety of valued characteristics and management goals. The Wilderness Act of 1964 describes wilderness with such phrases as “untrammeled by man,” “retaining its primeval character and influence,” and “affected primarily by the forces of nature.” Cole (1996) cites three reasons for the importance of wilderness: to protect the natural ecosystem and the life forms within it, to provide a scientific baseline for comparison with other landscapes, and to provide recreational, spiritual and other human values.

Managing lands with these ideas in mind is challenging, to say the least. Traditionally, wilderness management has focused on the protection of the content of ecosystems within the boundaries of a wilderness unit. Yet, wilderness areas share boundaries with other lands with differing management objectives. These boundaries at once divide and link the land units (Landres 1998), as well as the people managing and using these lands.

Management activities can have significant ecological effects across ownership or management boundaries. Landres

and others (1998) emphasize four points regarding ecological impacts across borders: “1) Management goals and actions are the primary cause of boundary effects; 2) altered flows either into or out of an area will likely be detrimental to that area; 3) boundary effects follow a distinct temporal sequence; and 4) once established, these effects may have long-term and far-reaching consequences that are difficult or impossible to overcome.” These issues are further complicated by social effects (Brunson 1998) and policies (Meidinger 1998) across ownership boundaries.

Achieving management goals within wilderness areas requires identifying interactions and interdependencies across multiple land units. The goal of this work was to develop a set of landscape characteristics data and use it to test two points: 1) how is the integrity of wilderness areas affected by surrounding lands and 2) how are surrounding communities affected by wilderness areas. The assessment was applied to the proposed wilderness areas of the Grand Staircase-Escalante National Monument and surrounding landscape of southern Utah and northern Arizona.

Study Area

The Grand Staircase-Escalante National Monument lies in a region of arid canyons and high, forested plateaus in southern Utah and northern Arizona (fig. 1). The Monument is centered in an ecosystem we refer to as the “Crown of the Canyons,” which is defined by the Escalante and Paria River watersheds and upper Kanab Creek watershed. The area includes the headwater regions of the Paunsaugunt and Aquarius Plateaus and reaches south to the edges of Lake Powell and the Colorado River. The Crown of the Canyons lies in a still broader region encompassing the Dixie National Forest to the north, Grand Canyon National Park to the south, Glen Canyon National Recreation Area to the east and Zion National Park to the west (fig. 2).

This broad region sets the context for the Monument’s wilderness resources and encompasses a diversity of natural and human resources. With elevations ranging from deserts at 1,000 feet to 12,000-foot forested plateaus, the study area provides a diversity of habitats for a high number of individual species (Belnap 1998). It includes the Colorado River and some of its major tributaries that have water diverted from the natural flow for human uses. The region includes a host of other federal, state, private and Native American

In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O’Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Janice L. Thomson and Dawn A. Hartley are Remote Sensing and GIS Specialists in the Center for Landscape Analysis. The Wilderness Society, 1424 4th Ave., Ste 816, Seattle, WA 98101 U.S.A. Gregory H. Aplet and Peter A. Morton are Director of the Center for Landscape Analysis/Forest Ecologist and Economist in the Ecology and Economics Research Department, The Wilderness Society, 7475 Dakin St., Ste 410, Denver, CO 80221 U.S.A.

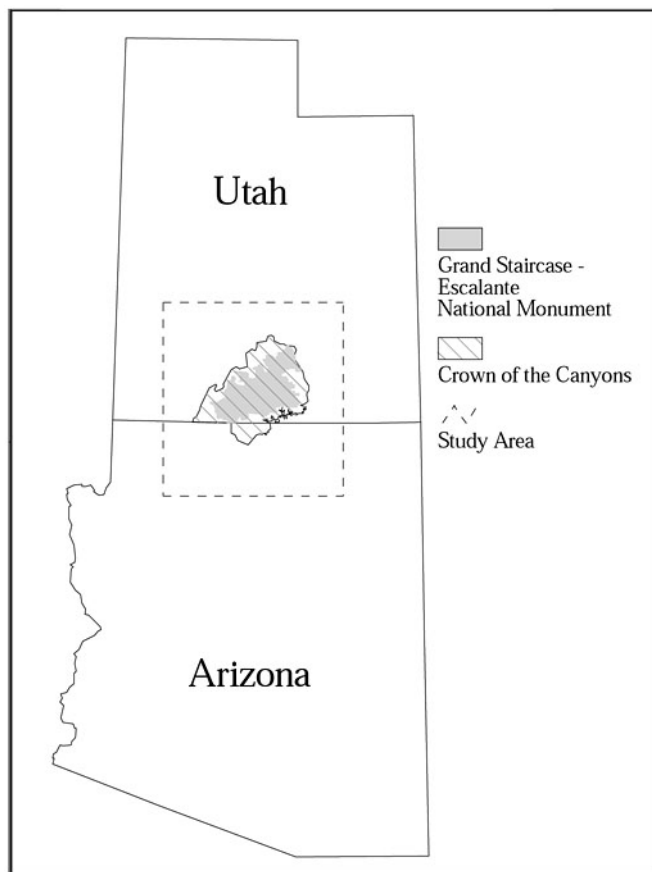


Figure 1—Index map. The proposed wilderness lands of Grand Staircase-Escalante National Monument fall within the Crown of the Canyons watershed-based region which is in turn bounded by a broader study area boundary.

lands whose owners and users can potentially impact wilderness lands within the Monument. While the land is sparsely populated, there are communities throughout the region that use natural resources for traditional extractive industries and amenity-based activities as well.

The Grand Staircase-Escalante National Monument, established under the USDI Bureau of Land Management in the fall of 1996, encompasses 1.9 million acres of land. Of that total, 1.6 million acres are proposed for wilderness designation by the Utah Wilderness Coalition and are shown in figure 3. An assessment of the surrounding lands and the Monument is needed to develop sound management practices if the wilderness qualities of the area are to be maintained.

Methods

Landscape Characteristics

The first step in assessing the content and context of wilderness lands is to determine the landscape features that significantly affect wilderness. We describe these in three categories: biophysical, socioeconomic and wild.

In an effort to simplify the complexity of the biological and physical landscape, we selected biophysical factors from

the “state factor model” presented by Jenny (1941). Jenny’s model uses climate, organisms, relief, soil parent material and time since the last disturbance to determine the condition of an ecosystem. While not providing the most complete description, it lays out constructive elements and processes in the landscape that may be represented by readily available spatial data.

The social and economic features of the landscape are just as important as the ecological factors to the future of wilderness lands. As Freyfogle (1998) says, “To talk of the health of such a land community is to include necessarily the health of the resident people and their social and economic enterprises.” In the western United States, where historical dependence on natural resources for employment has dropped from 85% in 1810 to 5% today (Power 1996), the description of the economy must look far beyond traditional extractive industries. Knowledge-based and service-based industries need to be considered in a regional economic development model. Landscape data need to represent diverse social and economic factors and illustrate their relationship to wilderness lands. Features of the socioeconomic landscape include land tenure, income and employment, with special attention paid to the natural resource based economy.

Many different characteristics affect the degree of landscape wildness and are not easily measured. In contrast to a characterization of wildness simply as the absence of management, Aplet (1999), describes wildness as consisting of two distinct components: 1) the freedom from human control, and 2) naturalness, the degree to which the land retains its primeval character. According to Aplet and others (this volume) attributes of the land that contribute to its freedom from control are: “1) the degree to which land provides opportunities for solitude; 2) the remoteness of the land from mechanical conveyance; and 3) the degree to which ecological processes remain uncontrolled by human agency. The attributes that contribute to naturalness of the land are: 1) the degree to which it maintains natural composition; 2) the degree to which it remains unaltered by artificial human structure; and 3) the degree to which it is unpoluted.” Because of the difficulty of mapping the degree of control of ecological processes, we limited our analysis to five of these six attributes of wildness.

Geographic Information Systems Data

A GIS was used to provide the needed spatial perspective for the biophysical, socioeconomic and wildness features. Data layers were collected and used as is or were generated from standard GIS methods from readily available GIS or tabular data. The work was conducted and products generated with Arc/Info GIS software.

GIS data collected for the study are readily available from state and federal agencies. The benefit of this is that similar data are also available for work applied to other wilderness areas. The drawback is that data that ideally represent each landscape feature are not always available. In addition, because the GIS data come from disparate sources, they vary in scale, spatial extent and intended purpose. We made every effort to use each data set within its inherent limitations.

Table 1 lists the landscape features for the biophysical, socioeconomic and wildness categories. For each feature, a

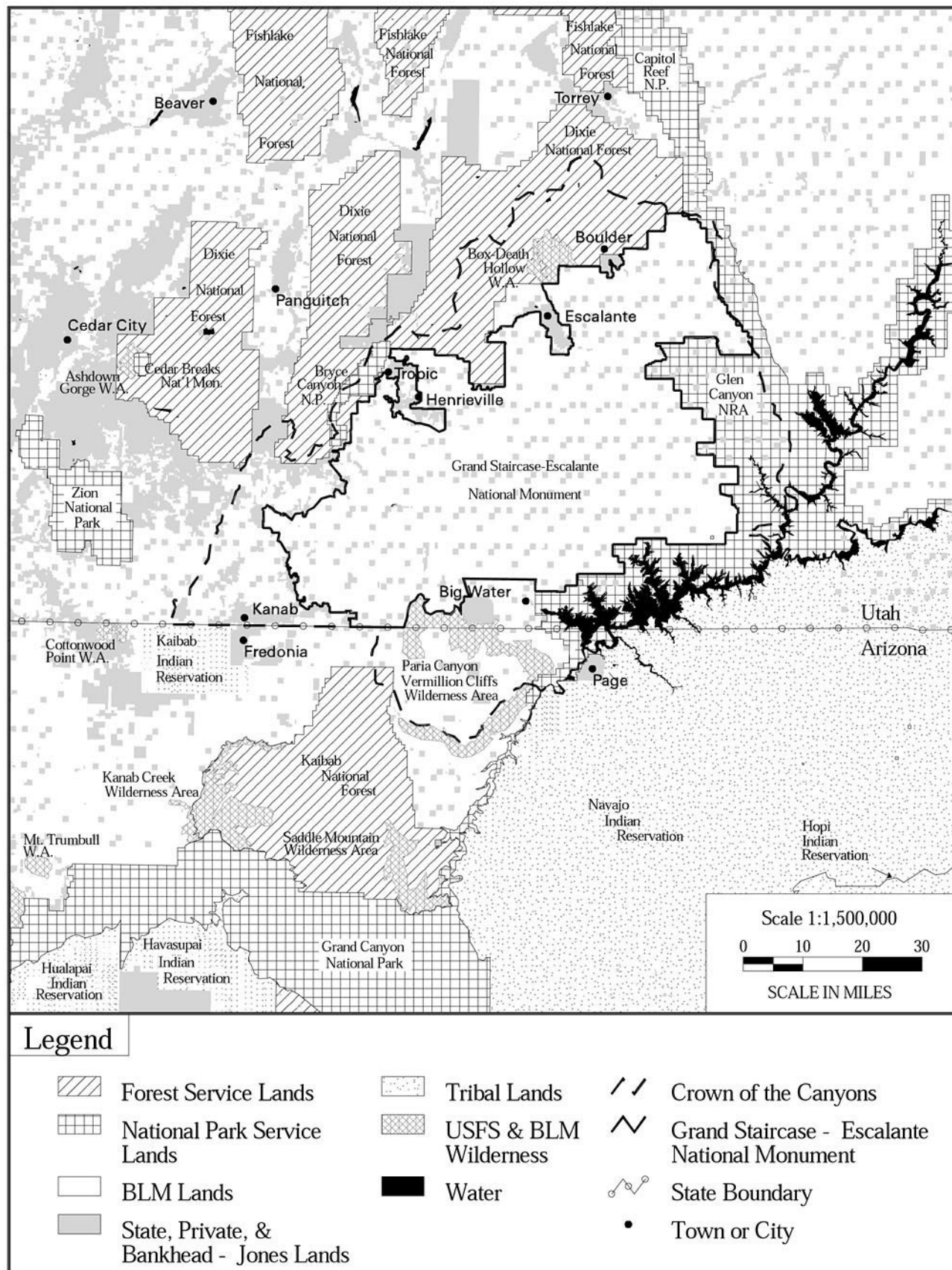


Figure 2—Socioeconomic landscape characteristic map: Land Tenure. The study area has abundant public lands requiring coordinated management by state and federal land management agencies. Note: Due to a 1998 Act of Congress, state lands in the Monument were exchanged for federal lands and mineral leases elsewhere.

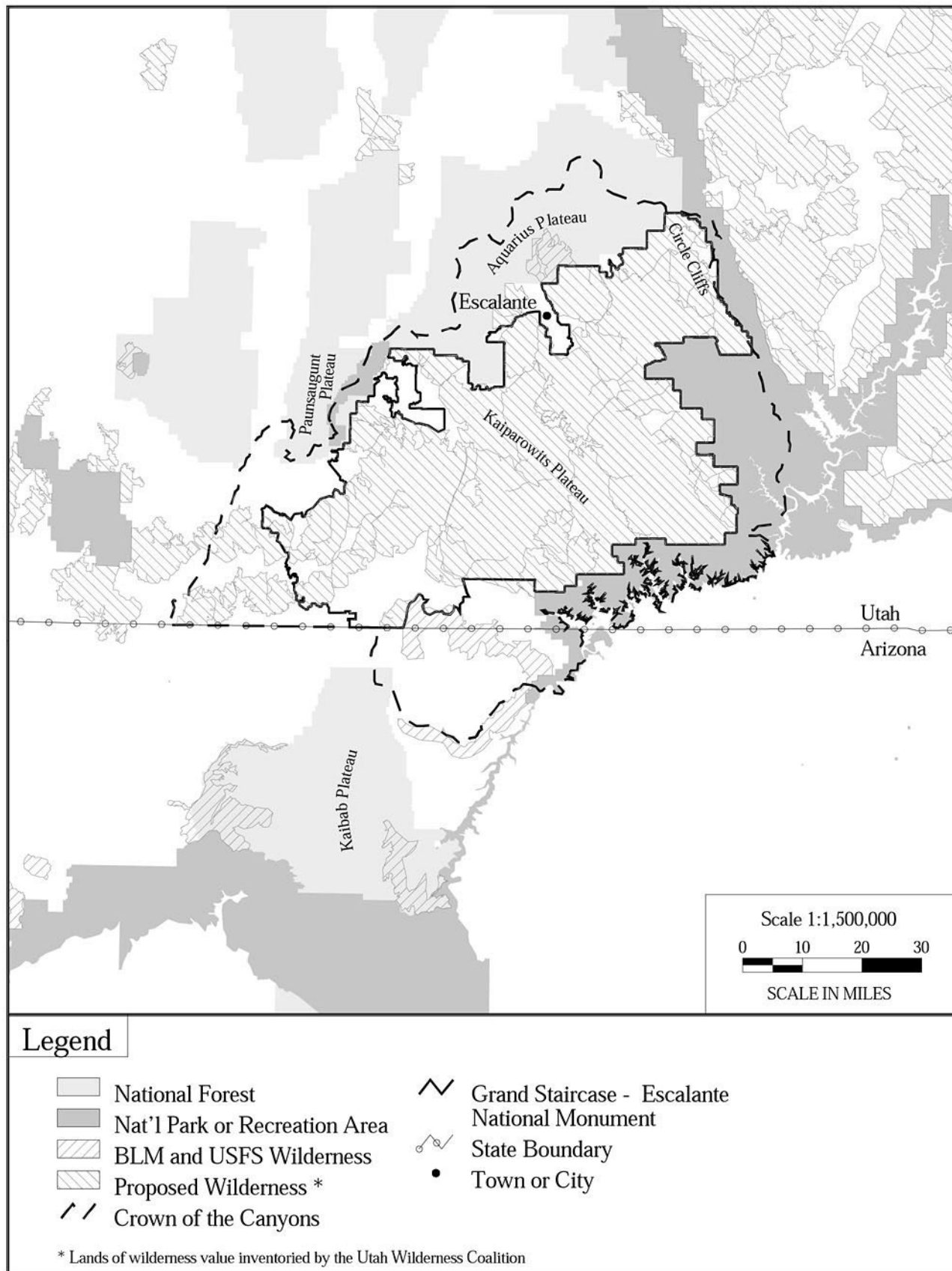


Figure 3—Potential wilderness lands map. The potential wilderness lands discussed in this paper refer to lands within the Grand Staircase-Escalante National Monument with high wilderness value inventoried by the Utah Wilderness Coalition (UWC). The UWC inventory extends across all Bureau of Land Management lands in Utah.

Table 1—A spatial assessment of the Grand Staircase-Escalante study area was made using three major categories of landscape information and selected features contributing to each category.

Category	Feature
Biophysical	Relief
	Parent material
	Climate
	Organisms
	Disturbance
Socioeconomic	Land tenure
	Income
	Employment & earnings
	Mining
	Agriculture
	Recreation & tourism
	Timber
Wildness	Government
	Solitude
	Remoteness
	Unaltered processes
	Natural composition
	Unaltered structure
	Pollution

GIS data layer or layers were collected or generated. Admittedly, each feature listed could involve an exhaustive study of its complexity and variability across the study area. The attempt here, however, was to generate a spatial data set for each feature that would provide a single, if rough, representation of the feature to place the wilderness lands in context.

A series of 20 GIS-based maps were produced and descriptions of results from each are described below with selected maps. A complete set of the color maps and data source list can be found in *Crown of the Canyons, An Atlas of the Ecology, Economy, and Future of the Greater Grand Staircase-Escalante Ecosystem* (Aplet and others 1999), available over the World Wide Web at www.wilderness.org/newsroom/publications.htm.

Results

The Biophysical Landscape

The study area falls within the Colorado Plateau and the Basin and Range physiographic provinces (Allison 1997). Flora in the Monument come from the Great Basin and Arizona deserts, with lesser contributions from the Mojave Desert and the Great Plains (Belnap 1998). Consequently, the biophysical features listed in table 1 vary in complex ways throughout the region. At a regional scale, these can be represented by readily available GIS data that capture important aspects of each feature.

Relief—The elevation ranges from near 1,000 feet along the Colorado River (Lake Powell) to over 11,000 feet on the Aquarius Plateau. The region is dissected by major drainages

and canyons, including the Colorado River, the Escalante River, the Paria River and Kanab Creek. The Monument and its proposed wilderness do not include the high plateau landscapes over 9,000 feet, which occur primarily to the north and west of the Monument on national forest lands.

Parent Material—The landscape's geology is dominated by sedimentary rocks that become progressively older to the south. The Monument is dominated by Mesozoic sedimentary rocks and contains abundant fossil beds, coal deposits and unique geologic features such as burning coal seams and sandstone arches. (Doelling and others 1998). To the south, the rocks become progressively older, with Precambrian rocks exposed in the Grand Canyon. To the north, the rocks become generally younger, with Tertiary volcanics capping some of the higher plateaus. Protection of wilderness areas in the Monument may preserve not only the unique exposures of Mesozoic sediments and paleontological deposits, but the substrates that support 125 species of rare flora found only in Utah or the Colorado Plateau, of which 11 are found only within the Monument (Belnap 1998).

Climate—Precipitation is strongly correlated with the elevation gradient (fig. 4). Precipitation is less than 10 inches per year over much of the Monument, but reaches 25 to 30 inches per year on the Aquarius and Paunsaugunt Plateaus, headwaters for the Escalante and Paria Rivers and Kanab Creek. Water flow and quality within the proposed wilderness lands of the Monument are therefore dependent on management activities allowed in the adjacent national forest areas, including logging, road-building, off-road vehicle use and water development projects.

Organisms—The diversity of flora and fauna across the study area is difficult to represent in a single GIS data layer. The vegetation data produced by the Utah and Arizona Gap Programs were selected to illustrate the variations in vegetation communities and habitats. Because the Gap Programs from the two states do not use the same vegetation classification schemes, the two data sets were simplified to a common, generalized classification that could be used across both states; yet some edge matching problems persist across the state border.

The vegetation map shows complex patterns that often reflect trends in the relief and climate maps. Vegetation patterns grade from alpine and forested highlands to the northwest to blackbrush and mixed Great Basin desert scrub classes near the Colorado River. Vegetation classes covering the largest spatial extent in the study area are the mixed Great Basin desert scrub and pinyon-juniper forest (fig. 5). South- and southeast-trending drainages break up the northwest-trending gradient in elevation and plant communities. These provide migration corridors across elevation zones within the Monument and across its borders.

Disturbance—Disturbance is challenging to represent with GIS data because the natural and anthropogenic disturbance factors that influence the landscape are insufficiently documented. For this work, the fire disturbance regime was mapped by type and frequency, based on the vegetation data. Within the Monument, fire plays the largest role in the lower elevation grassland areas. Outside the Monument, fire has the largest role in low-elevation grasslands and in the ponderosa pine forests of the Aquarius,

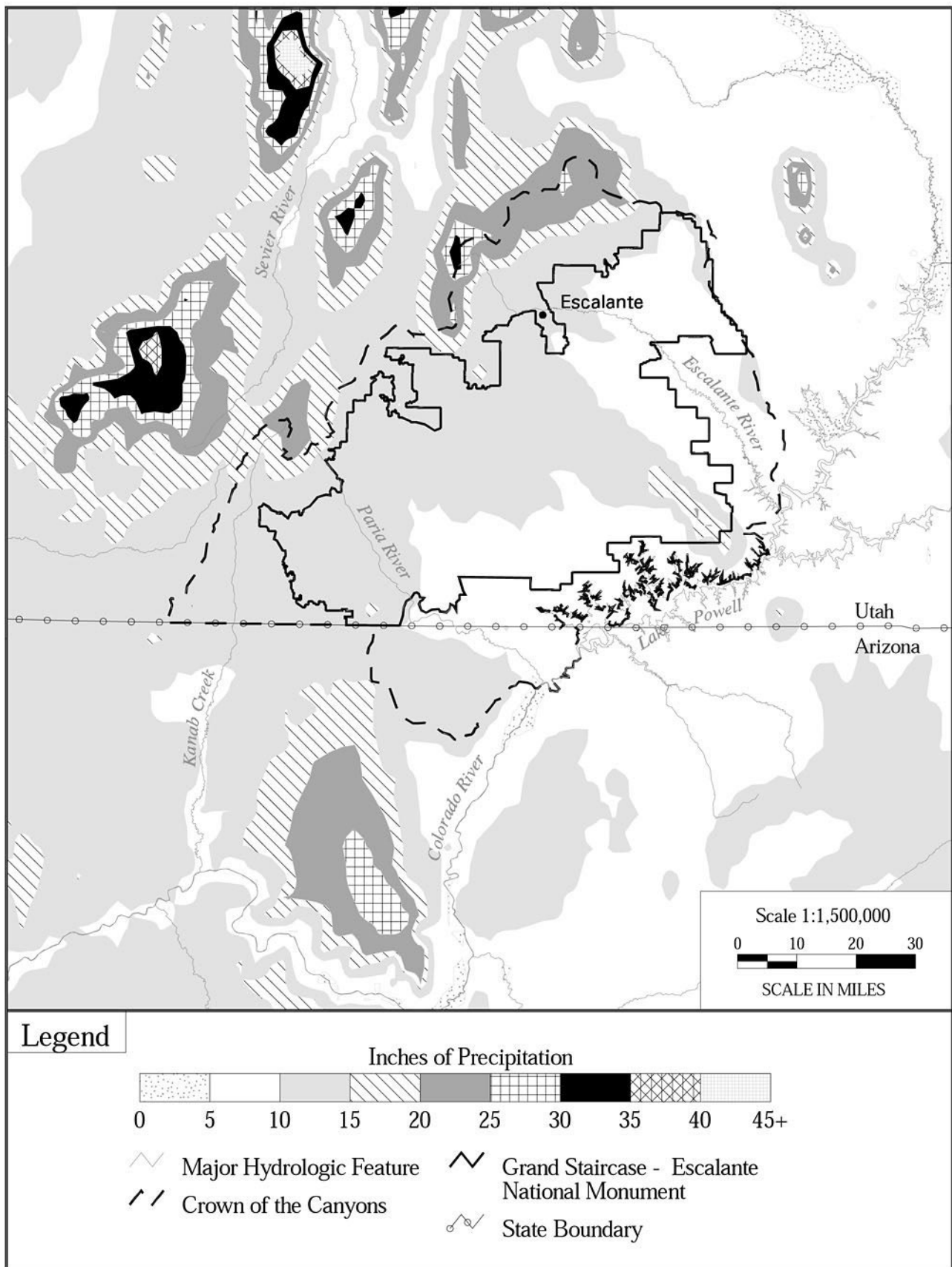


Figure 4—Biophysical landscape characteristic map: Precipitation. The headwaters for the major drainages of the Grand Staircase-Escalante National Monument are in the high precipitation plateaus outside of the Monument. The water flow and quality within the proposed wilderness lands of the Monument depend on management activities allowed in the adjacent national forest lands.

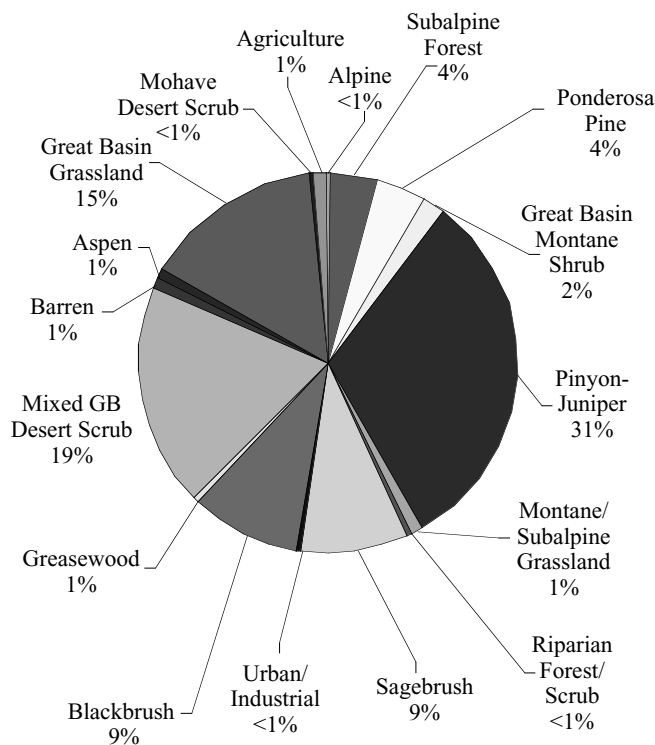


Figure 5—Vegetation classes in the study area.

Paunsaugunt and Kaibab Plateaus. Fire suppression in these areas could affect the composition and structure of plant communities.

The Socioeconomic Landscape

The socioeconomic features listed in table 1 reflect several social and economic activities that are common to the landscape in southern Utah and northern Arizona. Assessment features could vary for other wilderness areas.

Land Tenure—The Monument is nested in a landscape dominated by federal lands managed by the Forest Service, National Park Service and BLM (fig. 2). Ninety-six percent of the Crown of the Canyons region is in some form of public ownership. The integrity of proposed wilderness lands within the Monument depends on coordinating management policies and activities of the agencies managing adjacent lands and resources. Private landowners, communities (such as Kanab, Escalante and Boulder) and the Native American Tribes depend on sound, coordinated management of federal lands for amenity resources and ecological services, as well as more traditional uses.

Non-Labor Income—Bureau of Economic Affairs data indicate that non-labor income is the top component of total personal income, accounting for 39% of total personal income in Kane and Garfield Counties in 1995 (fig. 6). Non-labor income, which includes retirement and investment income, acts in the same way as export-derived income by supporting additional jobs in the regional economy. Non-labor income accounts for a greater share of total personal

income in Garfield and Kane Counties than in the state as a whole, reflecting a growing retirement community and more individuals with investment earnings. The spatial display of census data indicates a majority of census block groups in the Crown of the Canyons region receive significant amounts of investment income (fig. 7). Proposed and existing wilderness lands, when combined with surrounding federal lands, can contribute to future community development by sustaining a natural backdrop for amenity-based community development.

Employment—Employment data indicate that the service sector employs more people than other segments of the economy. The service sector is the top employer in 75 of the 117 census block groups mapped, extractive activities (agriculture, mining, forestry) dominate in 14 and retail trade in 11. Other employment sectors such as construction, manufacturing, communication and utilities, and public administration make up relatively smaller portions of the employment landscape. Bureau of Economic Affairs data show a striking trend of increasing employment in the service-related industries (finance, insurance and real estate, wholesale and retail trade and the service sector) in Kane and Garfield counties, accounting for 53% of the total employment in 1995 (fig. 8). This trend is due in part to an increase

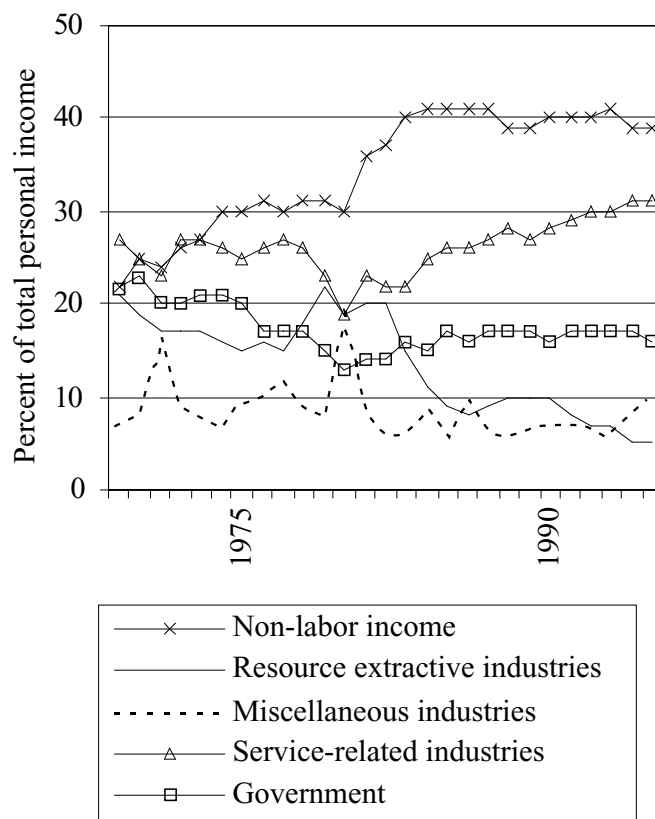


Figure 6—Total personal income (TPI) in Garfield and Kane counties, Utah (1969-1995). Non-labor income, comprised mostly of retirement and investment income, accounts for 39% of TPI. Income from service-related employment has also increased in importance, while resource-extractive industries are declining in relative importance.

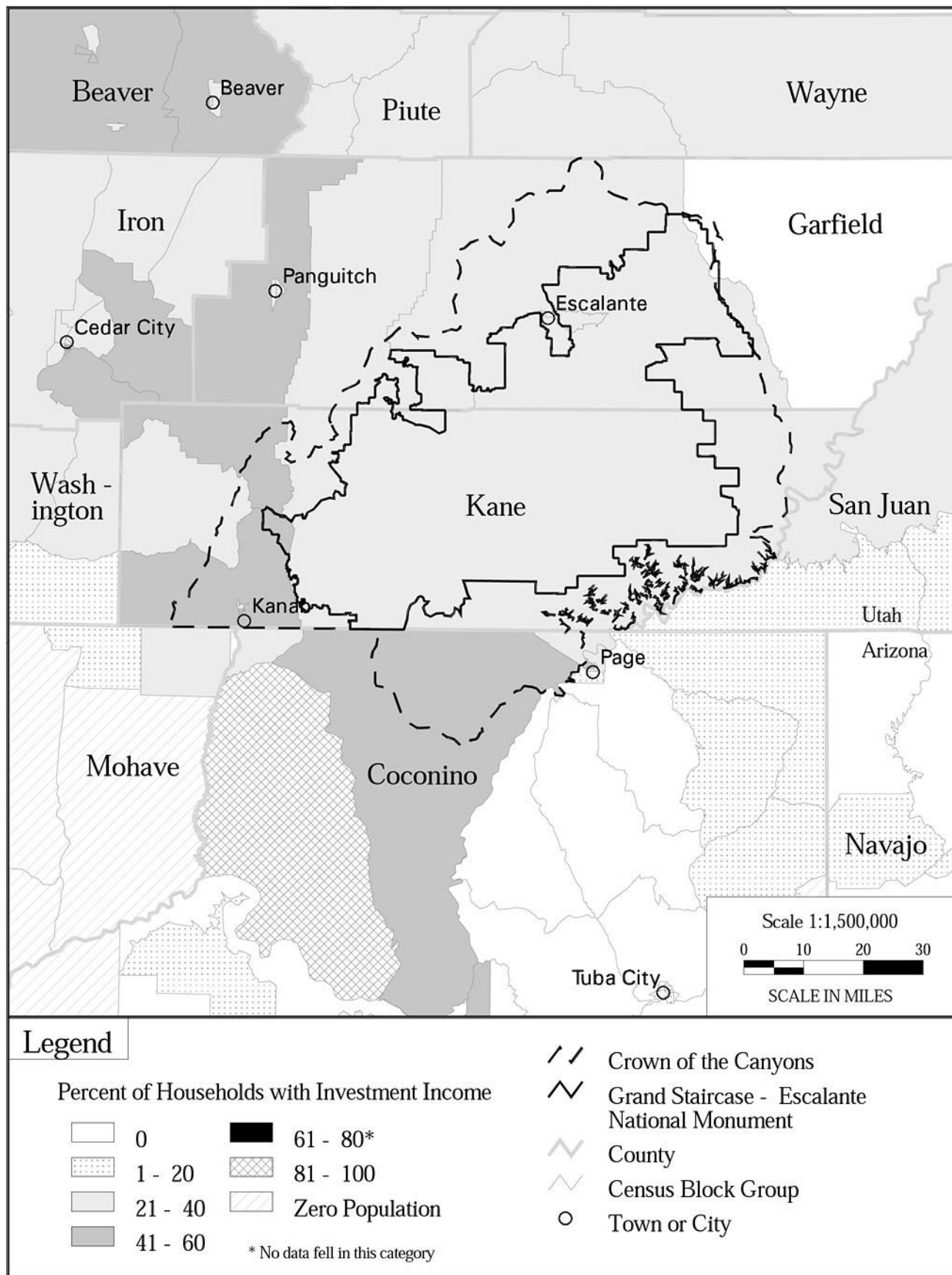


Figure 7—Socioeconomic landscape characteristic map: Income. The percent of households with investment income is mapped by census block. Investments, an important source of nonlabor income, contribute to household income in most census block groups in the region.

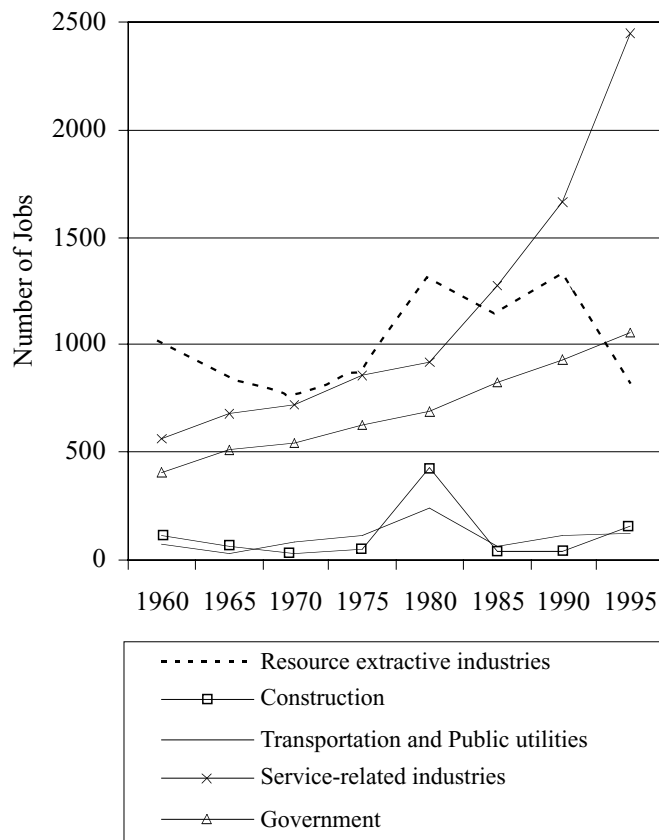


Figure 8—Employment in Kane and Garfield Counties, Utah (1960-1995). Jobs in service-related industries (finance, insurance and real estate, wholesale and retail trade and the service sector) accounted for 53% of total employment in 1995.

in recreation, linking the area's amenity resources to the region's employment sources across the landscape.

Mining—Mineral deposit and lease information was available only for lands within the Monument. Data from the Utah State Geological Survey, the U.S. Bureau of Mines, the Bureau of Land Management and the U. S. Geological Survey show a distribution of deposits across much of the Monument ranging from unexplored deposits to abandoned mines. Geographically notable distributions include concentrations of coal running the length of the Kaparowits Plateau, a concentration of oil and gas wells southeast of Escalante and a concentration of uranium deposits in the Circle Cliffs area. The majority of the deposits are not active. The exploitation of coal, oil or gas reserves could degrade potential wilderness areas and could bring a "boom-and-bust" scenario to the local economies across the region. However, it is unlikely to play an important role in the region's future economic development. Mining income dropped from two percent of total personal income in 1969 to 0.5 percent in 1995 in Kane and Garfield Counties. Increases in efficiency from automation have resulted in downward employment trends in extractive industries throughout the West. In addition, a public subsidy would be required to overcome high start-up and transportation costs associated with the remote geographic location.

Agriculture—While farms in the study area tend to be small, public lands are used for grazing cattle and sheep. Grazing allotments within the Monument show that 98% of the Monument is allocated for grazing. Most of the proposed wilderness across the Monument is at risk of vegetation, soil and water quality degradation from grazing. While the large allocation of public land to grazing seems to suggest that ranching is still an important economic force in the region, employment and income data suggest a downward trend. Agricultural jobs in Garfield and Kane Counties have declined in relative importance from 37% of the total jobs in 1960 to 10% in 1996.

Recreation and Tourism—Eleven percent of the study area is occupied by national parks, 15 percent by national forests and 10 percent by the Monument. Each supplies a different set of recreational opportunities. Scattered across the landscape are public golf courses, ski areas, campgrounds, trailheads, boat launches, visitor centers and unique natural features such as sandstone arches. These recreation opportunities attract tourists; 40 to 60 percent of total employment in Kane and Garfield Counties is associated with travel and recreation.

Timber—While logging history data are not available in spatial format, a map of the locations of commercial forest types was generated from the Utah and Arizona Gap Programs' vegetation data. The distribution of these forests coincides with the distribution of the national forest lands (fig. 9). Timber harvest and management of these forests affect water quantity and quality downstream. Forests on the Aquarius, Paunsaugunt and Kaibab Plateaus form the headwaters for the principal drainages in the Monument. Timber harvest also affects the communities across the region; however, the relative importance of the timber industry is steadily declining, with timber-based income dropping from 19% to 6% of total personal income between 1969 and 1995 in Garfield County.

Government—Sixty-four percent of the land across the study area is in federal ownership. Management of the public estate generates government employment and export dollars for communities across the region. The government is a prominent employer. Within 60% of the census block groups, government accounts for more than 20% of all jobs. Government jobs also account for 16% of total personal income in Garfield and Kane Counties.

The Wildness Qualities of the Landscape

The landscape features contributing to wildness in table 1 are difficult to represent with GIS data. In each of the maps described below, we attempt to illustrate the intended concept, if not a true quantitative measure. One of the six measures of wildness, unaltered ecological processes, is not used here because no adequate GIS data were available.

Solitude—Human population density is used as a surrogate for solitude. The Monument lies in a broad area where census blocks groups average less than one person per square mile (fig. 10). With the exception of a handful of communities, the entire study area averages less than 10 people per square mile, but tourism is increasing the flow of nonresidents to the region. Visitation at the Escalante

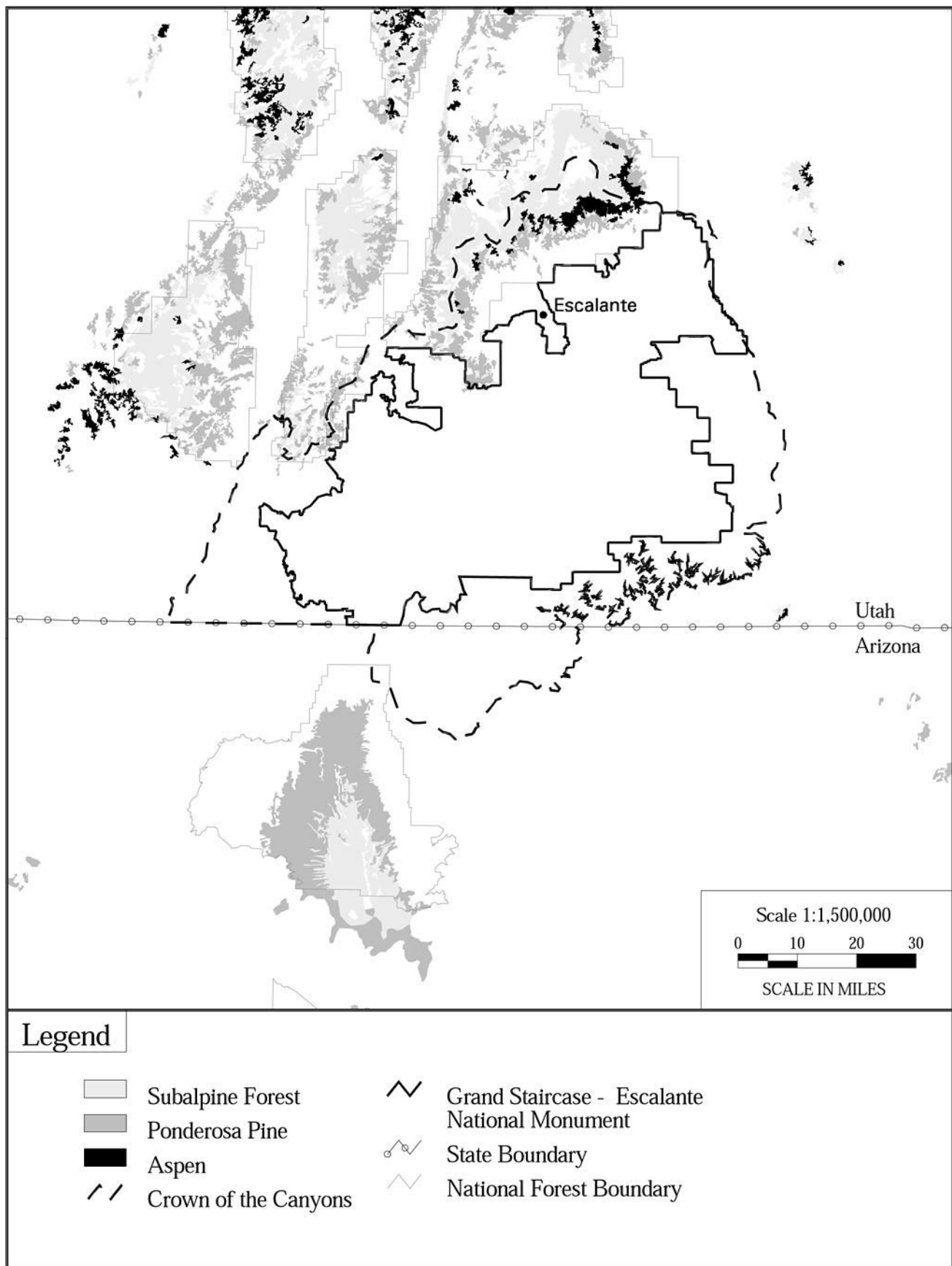


Figure 9—Socioeconomic landscape characteristic map: Commercial forest type. The forest products industry in the study area primarily harvests timber from the high-elevation plateaus outside of the Monument's proposed wilderness areas.

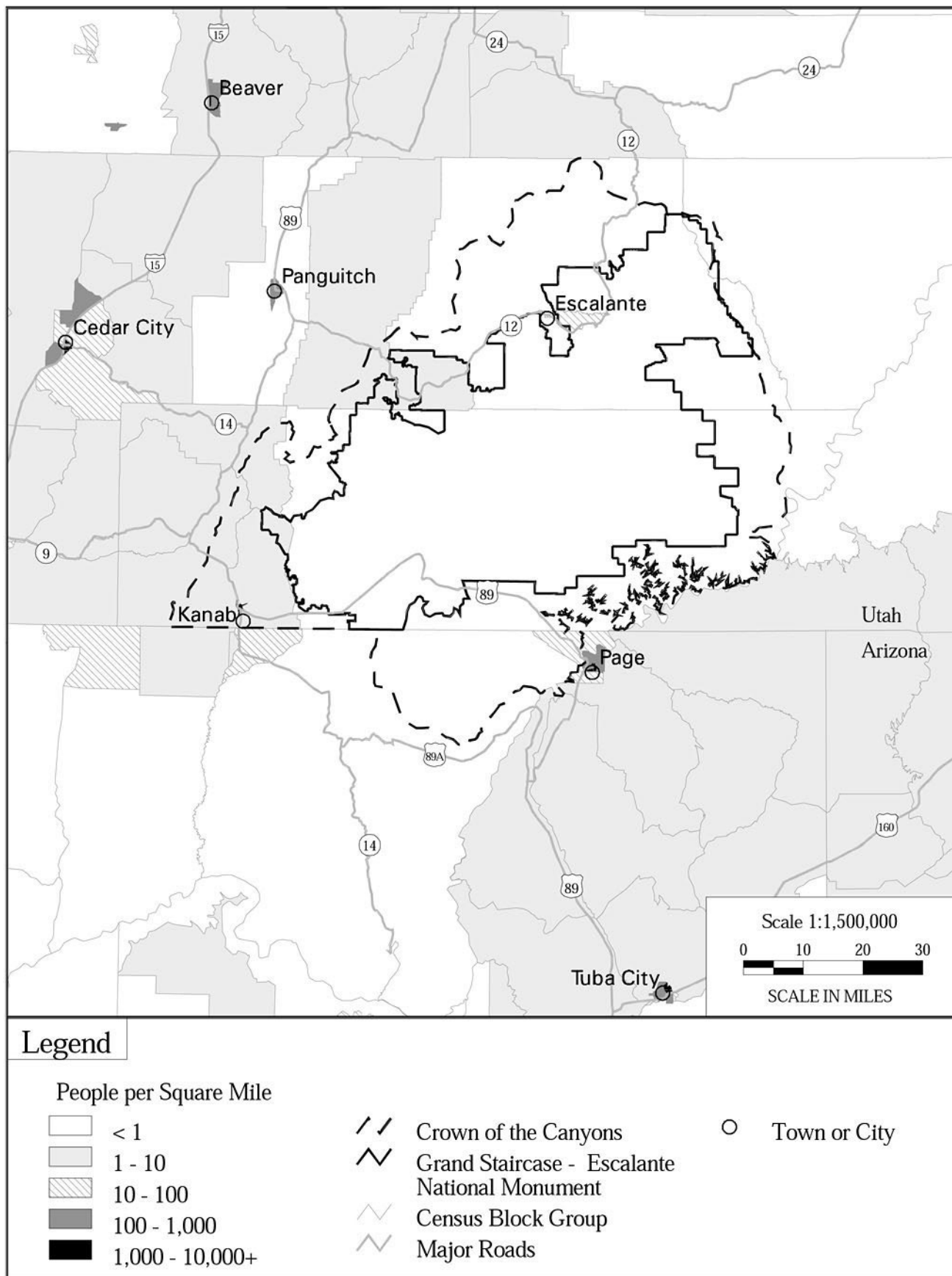


Figure 10—Wildness landscape characteristic map: Population density. The Crown of the Canyons area offers outstanding opportunities for solitude due to the low population density over most of the area.

Visitor Center increased from 5,000 in 1992 to over 25,000 in 1997. This landscape provides abundant opportunities for solitude within and beyond the proposed wilderness areas, but pressures on this aspect of a wilderness experience are growing.

Remoteness—Roads, ranging from major highways to well-maintained dirt roads, were used to show remoteness on the landscape. Much of the total study area is more than two kilometers (1.2 miles) from a road: 71% of the Utah portion of the study area, 84% of the Arizona portion and 80% of the Monument. While other minor but regularly used roads exist in the study area, opportunities for a remote wilderness experience abound.

Natural Composition—We illustrate natural composition with a map of lands that had been altered for urban and agricultural land use, location of natural springs and seeps and desert bighorn sheep habitat. While by no means a comprehensive description of natural composition, these elements demonstrate the natural character of the Monument and its ability to protect “scarce and scattered water resources” and habitat for bighorn sheep, elements that were specifically mentioned by the President in the proclamation establishing the Monument.

Unaltered Structure—Landsat Thematic Mapper satellite image data were used to show altered structure for three regions within the study area. Changes in the natural structure and pattern of vegetation are clearly visible in areas altered by private agricultural fields near Escalante, logging in the Dixie National Forest and chaining (the removal of pinyon-juniper forest for grazing) within the Monument. While these human alterations of the landscape are distinct at a coarse scale, other structural changes occur at a much finer scale, such as the trampling of cryptobiotic crusts by cattle, hikers and off road vehicles. Both are poorly inventoried across the study area.

Pollution—Pollution can take a multitude of forms, from road dust to bovine feces to herbicides. Some pollutants have a profound chemical effect on an ecosystem, and others primarily affect the human experience of wilderness. A map of EPA-regulated sites shows a low concentration of sites in this study area relative to much of the country. One hundred thirty-six sites in the area qualify for EPA monitoring and only one site within the Monument. A map of “City Lights at Night” from NASA shows light pollution from communities around the study area, but virtually none emanating from within the Monument.

Discussion

The results of our use of spatial data to represent the biophysical, socioeconomic and wilderness features showed us a variety of trends and relationships across the landscape. We chose to look closely for relationships that illustrate how the ecological integrity of proposed wilderness areas may be affected by elements outside their boundaries and how communities beyond the proposed wilderness areas are affected by elements in wilderness areas or the adjacent federal lands.

The Monument, most of which is proposed wilderness, shares borders with land managed by the National Park

Service, U.S.D.A Forest Service, BLM, state and private entities (fig. 3). It is also in close proximity to Native American tribal lands. Our biophysical landscape data support the idea that features or activities on these lands affect the ecological integrity of the proposed wilderness lands.

Relief and vegetation data suggest a potential dependence on adjacent lands for migration corridors. Major valleys of the Monument link low elevation Park Service lands along the Colorado River to high elevation Forest Service lands on the Aquarius Plateau. The Monument occupies the intermediate elevation and vegetation zones between these areas. It seems reasonable to expect that species use this gradient as a pathway between management units. Management practices across all of these lands should consider the needs of species that cross Monument boundaries.

Precipitation data show the Monument’s dependency on the adjacent Forest Service lands for its water supply. Precipitation is considerably greater in the higher plateaus of the Forest Service lands to the northwest. This area contains the headwaters of the Monument’s river systems. Activities that affect water quantity and quality in the headwaters will affect the Monument’s water supply. This relationship should be considered when the Forest Service makes decisions on land uses such as logging, road-building, off-road vehicle use and water development projects.

Disturbance data were difficult to represent in the landscape, but the fire regime data suggest that disturbances can cross administrative boundaries and affect the composition and structure of plant communities in the Monument. The data documenting altered structure in the landscape pointed to similar potential effects. Changing vegetative patterns through agriculture and logging adjacent to the Monument can affect ecological processes such as the flow of water or patterns of species movement into and out of the Monument. Land managers prescribing practices that alter natural disturbances or structures of the landscape should consider their impacts on the Monument.

Turning our attention to the communities of the sparsely populated study area, several towns are in close proximity to the Monument (fig. 2). Our results support the idea that these communities are affected by the landscape characteristics of the Monument and other surrounding federal lands.

Income data offer an indication of the relationship of wilderness and federal lands to local communities. The fact that nonlabor income in Kane and Garfield counties accounts for nearly 40% of total personal income, higher than in the state as a whole, suggests that people live here for reasons other than jobs. Individuals that are retired or have investment income choose to live in this area. This suggests that the natural amenities of the region play a role in drawing people to the region. The Monument and its surrounding federal lands define the environment for these towns and are the foundation for amenity-based community development.

Employment data also provide indicators of how the monument and other federal lands may affect local communities. The striking increase in service sector employment and its dominance over other sectors across much of the region indicates that the extractive industries are not the primary source for local employment. This trend is likely associated with increased recreation on the adjacent federal lands, suggesting a link between quality recreational

opportunities and the communities' employment base. The simple presence of so much federal land in the region is important because the management of these lands employ a significant proportion of the population. This is notable because, like nonlabor income and portions of the service sector employment, it brings in dollars from outside the region into the local economy.

The impact of recreation on local communities is more complicated than simply bringing tourist dollars to the local economy. The proposed wilderness lands of the Monument, the national parks, forest service lands and other natural attractions for recreation are spread across the region. The landscape's strong qualities of wildness (solitude, remoteness, natural composition, unaltered structure, and minimal pollution) draw people to the area for outdoor recreation. Maintaining the integrity of all of the public lands throughout the region will tend to increase the numbers of dollars and tourists flowing into these communities. It also places communities in the position of dealing with a set of issues including the increasing proportion of jobs in the service sector, the infrastructure needs of more people, urban development patterns, the influx of major chain businesses obscuring local business and the boom-and-bust cycles of tourism. Management of the federal lands and their recreational opportunities should be done in concert with local community planning.

Conclusions

The use of biophysical, socioeconomic and wildness spatial data proved useful for assessing the content and context of wilderness lands in and around the Grand Staircase-Escalante National Monument. Ecological data identified links between proposed wilderness lands in the Monument and adjacent land units. Socioeconomic data pointed to links between the local communities and the proposed wilderness and adjacent federal lands. This translates into two points of management coordination. First, to maintain the ecological integrity of the proposed wilderness areas they must be managed in a coordinated manner with adjacent federal, state and private lands. Second, the economic health of local communities depends on the condition and coordinated management of the federal public lands that encompass much of the landscape.

In the future, using spatial data to assess landscape characteristics should prove useful for wilderness managers working to provide sound stewardship in ecologically and culturally complex landscapes. Such information should also be useful for educating the public and other constituencies whose support is needed for implementation of sound management practices.

Future work is needed in two aspects of this project: improved data sources and data integration. Some of the landscape features, particularly the wildness features, need more meaningful spatial data sets developed to represent them. Fortunately, sources of GIS data are increasing in quantity, quality and accessibility.

The results of this project were generated from basic GIS processes. A more sophisticated comparison and integration of multiple landscape features across wilderness boundaries could highlight the concentrations and distributions of

important landscape features. This would facilitate their application by wilderness managers and their use in communicating results of wilderness context studies to diverse audiences.

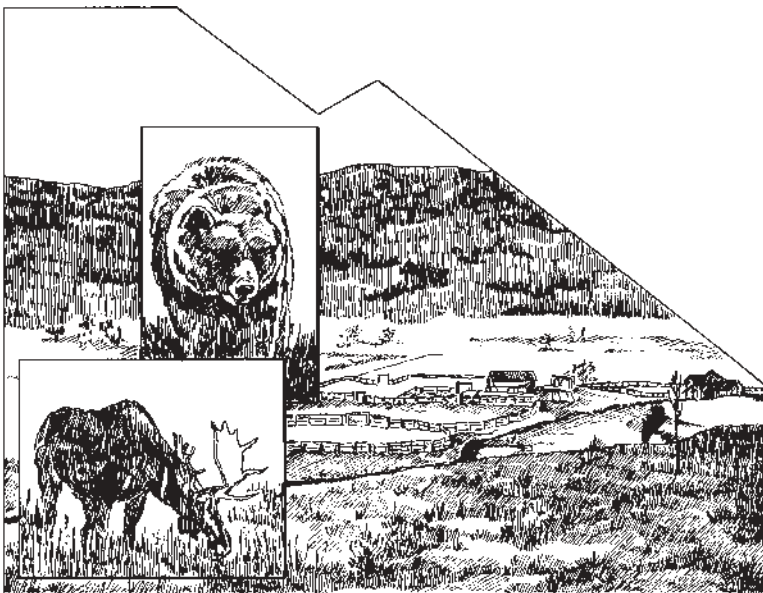
Acknowledgments

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4. Social, Economic, and Policy Issues



Funding Strategies for Wilderness Management

Carolyn Alkire

Abstract—Funding wilderness protection will continue to be a challenge for public land managers. With continuing competition for federal funds and balanced budget goals, other sources of funds may be necessary to supplement annual federal appropriations. This paper identifies and evaluates five potential funding strategies and provides examples of each that are currently in use (or could be used) in the US and other nations. The strategies are: federal funding reform, general public funding, public investment and donations, private initiatives, and capturing ecosystem service values. The paper concludes that a combination of strategies would most likely be appropriate, with the strategies selected depending on regional considerations and wilderness condition.

Funds for land and resource management activities on national forests and grasslands, Bureau of Land Management (BLM) lands, national wildlife refuges and national parks are appropriated annually by Congress to the four land management agencies. There are two different ways expenditures are authorized: as discretionary or mandatory appropriations (also referred to as current or permanent appropriations, respectively). Discretionary appropriations are funded from the General Treasury at levels determined by Congress, while mandatory appropriations are from trust funds and special accounts to which receipts from various activities (some on public lands, some not) have been deposited. Expenditures from the latter type of appropriation are limited by the balance in the accounts rather than by congressional decisions.

Within each of the four agencies' budgets, the funds appropriated for wilderness management are entirely discretionary. As such, the amount of money allocated may be subject to conflicts between political influences in the appropriations process and could be less than the amount requested by the agencies. Additional budgetary pressures include competition for dollars with other activities funded by annual federal appropriations and congressional fiscal restraint to meet the goal of a balanced federal budget. Furthermore, whatever funding levels eventually agreed on are only annual. Budget authorizations for only one year at a time can be a significant impediment to planning and

implementing longer term projects designed to restore or protect ecosystems.

Agency Wilderness Budgets

The Forest Service and BLM are responsible for managing 38 percent (33 and 5 percent, respectively) of the 109 million acres designated as wilderness under the Wilderness Act of 1964. Both agencies receive annual congressional funding for wilderness management within their recreation budgets. The Forest Service is allocated money for Recreation Management, Wilderness Management and Heritage Resources under the Recreation Use budget line within the National Forest System budget account (USDA Forest Service 1999). The BLM is appropriated Wilderness Management, Recreation Resource Management and Recreation Operations funds in the Recreation Management budget line within Management of Lands and Resources budget account (USDI Bureau of Land Management 1999a). In 1998, wilderness management represented 1.2 percent of Forest Service and 1.4 percent of BLM discretionary appropriations (USDA Forest Service 1999, USDI Bureau of Land Management 1999a). In contrast, the areas managed using those funds comprised 15 percent of Forest Service- and 9 percent of BLM-managed lands.

The National Park Service and the Fish and Wildlife Service manage the majority of designated wilderness: 42 and 20 percent of the area, respectively. They do not, however, have dedicated budgets for wilderness. National Park expenses are funded primarily with appropriations for Resource Stewardship under the Operation of the National Park System, Park Management appropriation (USDI National Park Service 1999). This appropriation also covers Natural Resources Applied Research and Management, Cultural Resources Applied Research and Management, and Resources Protection. National Wildlife Refuge wilderness management expenditures are included in Refuge Operations and Maintenance Appropriations under Refuge Operations: Improve Habitat (USDI Fish and Wildlife Service 1999).

All funds designated for wilderness management are not necessarily spent on wilderness. Under certain circumstances, the agency may redirect funds from one purpose to another within an appropriation account (for example, within the Forest Services' Recreation Use budget line). Between 1988 and 1990, for example, \$16.4 million (37 percent) of Forest Service wilderness management funds were redirected (without the required congressional approval) to other activities, primarily timber management, land management planning, law enforcement and visual resources. This resulted in funding and staffing shortfalls for wilderness management (General Accounting Office 1991).

In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Carolyn Alkire is Resource Economist, Ecology and Economics Research Department, The Wilderness Society, 1615 M Street, N.W., Suite 100, Washington, D.C. 20036 U.S.A., e-mail: calkire@twsw.org

Trends

Since only the Forest Service and BLM have dedicated wilderness management budgets, trends in congressional appropriations for wilderness are presented only for these two agencies. Prior to 1984, the BLM was responsible for five acres (Oregon Inlet, Oregon) in the National Wilderness Preservation System (NWPS, designated as wilderness under the Wilderness Act of 1964). In 1984, an additional 403,850 acres were designated. Annual appropriations and acres for both agencies are therefore presented beginning in 1984 until 1998 (the most recent year for which data are available), with estimates to 2000.

Management of designated wilderness and wilderness study areas (areas being considered for possible inclusion in the wilderness system) are funded with BLM's wilderness management appropriation (table 1). There is significantly more BLM acreage in wilderness study areas than in the NWPS: the agency was responsible for 23 million acres in 1984, and this decreased to 17 million acres in 1998 as areas were either designated as wilderness or eliminated from consideration. NWPS area rose substantially (13 times) from 403,855 acres to 5 million acres between 1984 and 1998. Wilderness added in the Arizona Desert Wilderness Act (1990) and California Desert Protection Act (1994) account for the majority of the increase. The Forest Service appropriation covers only designated wilderness.

Annual appropriations for wilderness managed by the Forest Service have tripled since 1984 to \$34 million (table 2). (Unless otherwise noted, all years are fiscal years, and all dollars have been adjusted to 1999 using the gross domestic product implicit price deflator (US Department of Commerce 1999)). Congressional funding substantially increased between 1988 and 1990 to address needs not met with existing funding and staffing levels—that is, cleaning camp sites, visitor education and monitoring the condition of

wilderness areas (General Accounting Office 1991). There was a significant (about 60 percent) rise in appropriations in 1994 and 1995 and a slight decline estimated for 1999. Changes in appropriations have generally corresponded to changes in staffing levels (measured in full time equivalent, or FTEs). Designated wilderness (NWPS) area has increased less than seven percent, from 32 to 34 million acres (figure 1). Funding is now about \$1 per acre.

BLM wilderness management appropriations have risen 45 percent, from \$11 million in 1984 to \$16 million in 1998 (see table 2). Funding remained between \$9 million and \$11 million from 1984 to 1991, then increased about \$2 million in 1992, 1994 and 1998. Designated wilderness and wilderness study area acreage increased 31 percent between 1984 and 1990 (figure 2). The decline in area after 1990 is due to a decrease in wilderness study area acreage, which exceeded the increase in area designated as wilderness (see table 1). Wilderness funding is now about \$0.69 per acre.

Methods

Potential funding strategies to supplement annual appropriations for wilderness management were identified through primary research and suggestions from an expert panel. Available literature was reviewed to compile a range of funding strategies that are feasible in (could be or are being used by) other federal, state and local entities in the US and other nations. These strategies are designed for biodiversity, land, watershed or other resource conservation but could also apply to wilderness.

An expert panel made up of individuals representing a balanced selection of bi-partisan groups—taxpayer organizations, the business community, academics, congressional staff and members of conservative and liberal academic organizations—was also convened to assist the project. The one-day workshop was held in Washington, DC, in 1998. The panel provided some examples of funding strategies and also refined a preliminary list of criteria to evaluate potential mechanisms.

Strategies Not Considered

Nonfederal management and/or nonpublic ownership are not considered viable strategies because neither are consistent with the purposes for which wilderness was created and public lands are to be managed, as described in the Wilderness Act, National Forest Management Act of 1976 and Federal Land Policy and Management Act of 1976. Nonfederal management would include management by state, local or private concerns (see, for example, Dwyer and Hodge 1996, Leal 1995). Nonpublic ownership would entail the sale or other transfer of wilderness to states or other entities (see, for example, Nelson 1996).

Also not considered are funding strategies that involve receipts from direct on-site use or sale of wilderness areas or resources. These include recreation, livestock grazing, bioprospecting (royalties from biological and genetic products from public lands), rights-of-way and communications sites. These and other activities have been authorized by Congress (Gorte 1998), and they have the potential to produce significant additional revenue (see, for example,

Table 1—Wilderness area managed by the Bureau of Land Management with wilderness appropriations, 1984-1998 (thousands of acres).

Fiscal year	NWPS	WSA	Total
1984	404	22,797	23,201
1985	404	24,647	25,051
1986	404	24,778	25,181
1987	502	24,778	25,280
1988	502	25,675	26,177
1989	502	25,198	25,700
1990	1,592	28,699	30,291
1991	1,592	26,643	28,235
1992	1,592	26,643	28,235
1993	1,656	26,555	28,211
1994	5,323	17,401	22,724
1995	5,323	17,401	22,724
1996	5,340	17,401	22,740
1997	5,340	17,342	22,681
1998	5,332	17,298	22,630

NWPS = National Wilderness Preservation System area.

WSA = Wilderness Study Area.

Sources: Meyer 1999; USDI BLM 1985b-1994b, 1996b, and 1997b-1999b.

Table 2—Forest Service and Bureau of Land Management wilderness-related appropriations and area, 1984-2000
(appropriations in current dollars).

Fiscal year	Forest Service			Bureau of Land Management		
	Final appropriations (thousand dollars)	Area* (thousand acres)	\$/acre	Final appropriations (thousand dollars)	Area* (thousand acres)	\$/acre
1984	10,166	32,126	0.32	10,825	23,201	0.47
1985	11,200	32,139	0.35	9,426	25,051	0.38
1986	11,047	32,209	0.34	10,252	25,181	0.41
1987	14,101	32,301	0.44	9,908	25,280	0.39
1988	12,704	32,356	0.39	9,837	26,177	0.38
1989	18,590	33,090	0.56	9,789	25,700	0.38
1990	21,091	33,424	0.63	9,383	30,291	0.31
1991	26,415	33,460	0.79	9,066	28,235	0.32
1992	30,223	33,861	0.89	11,907	28,235	0.42
1993	30,682	34,472	0.89	12,215	28,211	0.43
1994	48,563	34,472	1.41	14,037	22,724	0.62
1995	48,726	34,472	1.41	14,079	22,724	0.62
1996	34,482	34,472	1.00	14,486	22,740	0.64
1997	33,833	34,472	0.98	15,329	22,681	0.68
1998	34,311	34,472	1.00	15,615	22,630	0.69
est 1999	29,584	34,472	0.86	15,873	22,630	0.70
est 2000	36,574	34,472	1.06	16,290	22,630	0.72

*For the Forest Service, area designated as wilderness under the Wilderness Act; for the BLM, designated wilderness plus wilderness study areas.

Sources: Meyer 1999; USDA Forest Service 1985-1999; USDI BLM 1985a-1997a, 1998a-1999a, 1985b-1994b, 1996b, and 1997b-1999b.

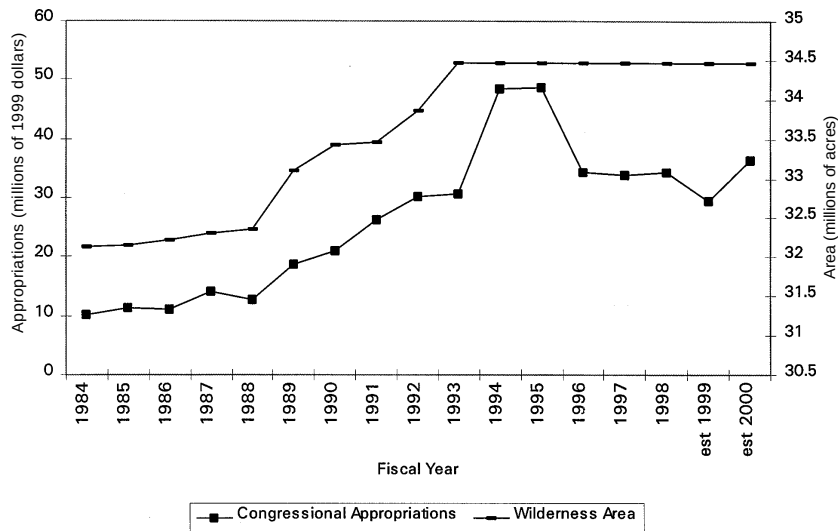


Figure 1—Forest Service Wilderness Appropriations and Area, FY 1984 - 2000.

General Accounting Office 1996, 1994, Milstein 1996). However, as viable strategies, they fall short because money for wilderness would rely to some extent on the sale or use of wilderness lands and resources. This could provide a financial incentive for depleting or degrading the very resources the funds are intended to protect. Furthermore, most receipts accrue to the General Treasury or to special accounts that fund future uses, rather than to the area or resource that generated the funds, or to the agency.

Criteria for Evaluating Funding Strategies

Funding strategies were evaluated using the following six criteria. These criteria are based on earlier work (Luzadis and others 2000) and were refined by suggestions from the expert panel.

- Economic and ecological effectiveness—Does the strategy provide incentives for long-term sustainable stewardship and building ecological capital?

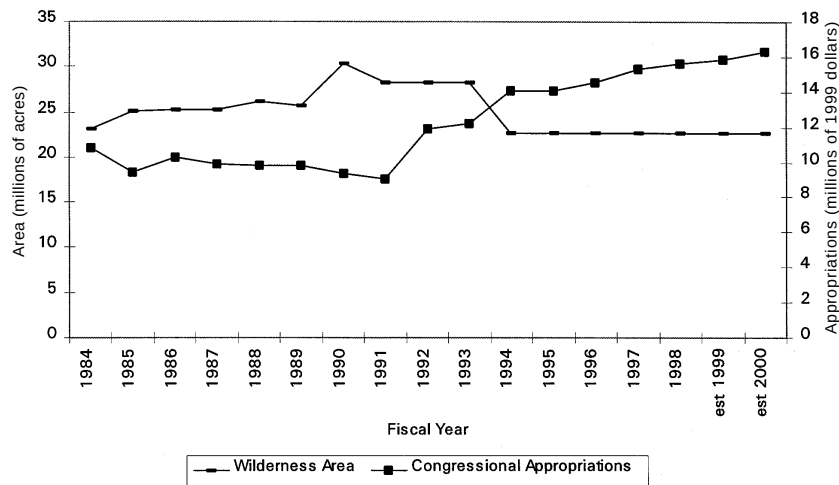


Figure 2—Bureau of Land Management Wilderness Appropriations and Area, FY 1984–2000.

- Institutional and political viability—Would implementation be feasible in the short term given existing political, legislative and institutional structures?
- Equity—Does the strategy benefit members of the current generation equally? Future generations? Can it be combined with other strategies to reduce inequities?
- Accountability—Is the strategy's outcome measurable? Are there scientifically defensible environmental performance standards?
- Predictability—Would the level of funding be predictable from year to year? Is multi-year funding possible?
- Flexibility—Is the strategy adaptable to new information, conditions and/or ideas?

Findings

Possible wilderness management funding strategies include federal funding reforms, general public funding, public investments and donations, private sector initiatives and capturing ecosystem service values. Examples of these strategies as they are being used, could be used or have been proposed for land or resource conservation are presented in table 3.

Reforms in federal funding of wilderness management would include increases in discretionary congressional appropriations, creation of a mandatory appropriation for ecosystem management, trust fund reform and redirection of receipts from other sources such as interest from resource sales or offshore oil and gas receipts. Management incentives, such as the Fish and Wildlife Service's former system of Refuge Benefit Units, are also a possible federal strategy.

The use of general public funds is a second type of funding strategy. The establishment of national parks and other areas to protect water quality, municipal investment in watersheds, taxes unrelated to environmental resources and taxes or surcharges linked to resource use are all examples of this strategy that have been widely implemented in the US and worldwide.

Public investments and donations are another potential source of wilderness management funds. Most of the national-level schemes, such as bonds and income tax donations, are still in the proposal phase. At the state level, however, contributions collected via income tax form check-offs and other systems have garnered extra funds for wildlife.

The private sector has initiated a few projects that provide money to public lands, and others have been proposed. Examples include corporate donations to public land management agencies that are based on the amount of a product sold, and donations by individuals in exchange for a good or service provided by a company. National-level corporate sponsorship of public lands has been proposed, but not enacted. (All public agencies currently accept cash and property donations from individuals or companies; proposed legislation would have permitted broader recognition for such donations.)

Ecosystem service values are an approximation of the monetary benefits that ecological processes provide to human communities. These processes can be thought of as services, and they include water supply and filtration, carbon sequestration, erosion control, natural control of insect populations and pollination vital to crops. There are several ecosystem services that, if some portion of the value could be captured, would be applicable to funding wilderness management. Perhaps the most promising are strategies that target biodiversity conservation because the sale or use of the resource is not involved. Reid (2000) notes that the economic values of water and carbon services are the most promising for funding biodiversity conservation. Although opportunities exist to capture some portion of the value associated with other ecosystem services (such as pollination, pest control, waste treatment and flood and storm protection), the capacity for using such mechanisms to financially support conservation appears to be far more limited.

Table 3—Examples of new funding strategies for wilderness.

Strategy	Description	Purpose of funds	Estimated funds	Source
Federal Funding Reforms				
Discretionary Appropriations	Increase annual congressional appropriations.	Operational needs such as staffing, maintenance, visitor services, interpretation, and park protection.		Buccino and others 1997.
Mandatory Appropriations	Congress annually appropriates a constant level of funding; increase over total agency funding or reallocation of existing funding level. Appropriations are mandatory, indexed to inflation, with a guaranteed annual minimum.	Direct funding of ecosystem management and restoration activities.		Luzadis and others 2000.
Trust Fund Reform	Eliminate trust fund accounts funded by receipts from resource sales, transfer balance to Treasury, use interest to fund ecosystem restoration and protection.	Ecosystem management.		Luzadis and others 2000.
Appropriate from Other Receipts: Offshore Oil and Gas	Congress to commit offshore oil and gas receipts to issue bonds. Funding the National Park System from Outer Continental Shelf revenues. Establishment of a Wildlife Conservation and Restoration Account in the Federal Aid to Wildlife Restoration fund in the Treasury with credits equal to 7 percent of Outer Continental Shelf revenues (10 percent in H.R. 701).	Capital improvements. To states for wildlife conservation and restoration programs, including non-game, and recreation, education, and law enforcement.	\$250 million annually for 20 years would raise \$4 billion for the capital improvement fund.	Buccino and others 1997. S. 819, "Act to Sustain the National Parks," Sen. Graham (April 15), S. 25 and H.R. 701, "Conservation and Reinvestment Act of 1999," Sen. Landrieu, (January 19) and Rep. Young (February 10).
Management Incentives: Refuge Benefit Units	Value weights assigned to each unit of planned or produced output of National Wildlife Refuges. (For example, hours of recreational use, by activity; number of wildlife species; and natural areas preserved).	Aggregated and used for allocating funds and staff, evaluating program and refuge effectiveness, determining priorities, and other purposes.	not applicable.	USDI Bureau of Sport Fisheries and Wildlife 1972.
General Public Funding				
Establish Protected Areas	Establishment of National Parks and other protected areas in part for protection of water quality or quantity, watershed protection.	In US, watershed protection is occurring as part of larger "open space protection" initiatives.	In US, typically funded by income or property tax. In 1996, voters approved conservation-finance ballot initiatives amounting to \$4 billion for state and local funding for parks, open space, and environmental revitalization.	Reid 2000.
Municipal Investment in Watershed Protection: Catskill Watershed, New York	Protect and manage watershed so surface water meets water quality standards under Safe Drinking Water Act regulations.	Municipal drinking water; to avoid installation of water filtration plant.	New York City, state and federal government committed \$1.4 billion (city's \$1.2 billion included land acquisition). Filtration would cost \$4 to \$6 billion, plus \$300 million annual operating expenses.	Reid 2000 [also cites Portland, Maine; Rhode Island; Connecticut; Portland, Oregon; and Caroni river basin, Venezuela].

(con.)

Table 3—(Con.)

Strategy	Description	Purpose of funds	Estimated funds	Source
General Public Funding (con.)				
Taxes: Value Added Tax (VAT) Parana, Brazil	Five percent of VAT is designated for the environment, of which half goes to municipalities that maintain watersheds. Municipalities receive funds in proportion to the relative progress they are making to improve water quality in the conservation units that they manage.			Reid 2000.
Municipal or Utility Tax or Surcharge	Dade County, Florida, imposes a 3 percent surcharge on water bills.	Watershed protection.		Reid 2000.
	Spokane, Washington, residents pay \$15 per year for aquifer protection.	Aquifer protection.		Reid 2000.
	Rhode Island imposes 2.594 per 100-gallon surcharge on water use with nearly half retained by utilities. Balance supports various state water programs.	Utilities required to spend at least 55% on land acquisition.		Reid 2000.
Excise Tax: Fish and Wildlife Diversity Funding Initiative ("Teaming With Wildlife")	An excise tax (up to 5% of manufacturer's price) on outdoor recreational equipment, including backpacks, binoculars, cameras, field guides, and recreational vehicles.	To State wildlife agencies for non-game wildlife habitat conservation, recreation facilities, education programs. Would supplement existing funding to promote comprehensive wildlife conservation.	\$350 million annually.	International Association of Fish and Wildlife Agencies, The Wildlife Society.
Public Investments/Donations				
Bonds: National Park Capital Improvement Fund	Fund created and financed through the sale of National Park federal agency bonds insured by the federal government. Similar to capital improvement funds created by state and local governments and some private organizations.	One-time or periodic projects such as resource inventories, monitoring systems, and educational and interpretative programs. Investments in resource stewardship. Protection of park resources.		Buccino and others 1997.
National Park Bond	Congress establishes the National Park Authority, a fully guaranteed federal agency (similar to FHA), to issue National Park bonds. All revenues generated by the park system to be dedicated to paying principal and interest to investors.	Priority park projects and activities. Leverage revenues to take care of current needs, thereby increasing present and future value of park assets.	Assuming a 7 percent interest rate with a 15 to 20-year term, park bonds could raise between \$1.2 and \$1.4 billion for the capital fund.	Buccino and others 1997.
Income Tax Donations: Federal	National Park Bond (\$25, for example) sold to American public at a certain interest rate.	Revenue to finance repairs at National Parks.	Goal is to raise the \$4.5 billion needed to repair highways, roads and buildings in the park system.	Associated Press 1997.
	Allow individuals to designate any portion of their income tax overpayments, and to make other contributions, for the benefit of units of the National Park System.			H.R. 1154, Rep. Duncan (March 17, 1999).
				(con.)

Table 3—(Con.)

Strategy	Description	Purpose of funds	Estimated funds	Source
Public Investments/Donations (con.)				
State Tax-Form Check-off	Voluntary contributions on income tax form.	Idaho: to nongame Wildlife/Endangered Species Fund; Colorado: to Colorado Division of Wildlife.	Idaho: \$58 million in 1990. Colorado: \$184,000 for tax year 1994.	
Resource Sponsorship: Save-A-Tree	Individuals may buy a large fir or pine on a private woodlot in eastern Oregon. They receive a certificate of ownership and map showing the tree's location. The tree will never be logged.	To preserve forests from logging and other commercial uses that might impact adversely on the natural environment.	Minimum \$50 per tree.	Marston 1998 and www.saveatree.com.
Magazine	National Parks magazine to be sold at Park entrances.	To fund maintenance backlog (\$5.4 billion).	\$45 million in first five years, then \$10 to \$12 million annually.	Hughes 1998.
Stamps	Annual National Park Stamp, similar to Fish and Wildlife Service Migratory Bird Hunting and Conservation Stamp. For display on windshield or bumper. Could be a popular collector's series.			Buccino and others 1997.
Private Sector Initiatives				
Corporate Incentives: Horizon Air/Spanish Peaks Brewing Company	Spanish Peaks donated 10 cents for each case of Black Dog Ale sold to Horizon to the Foundation from July through October 1998. Black Dog Ale was complimentary on all Horizon Air flights during that time. Brewery also donated 10 cents for every case and \$1 for every keg sold in Montana, Washington and Oregon.	Yellowstone Park Foundation.		Sorini 1998.
Profit Sharing: Grand Teton Alpine Spring Water and Yellowstone Springs Spring Water	Owners of bottled water company send profits from natural spring water bottled from west Yellowstone region (Teton, Idaho) to two national parks: Grand Teton and Yellowstone. Regional distributors also make a direct contribution to the parks.	Generate revenues for necessary projects in the two national parks (not for salaries or administrative costs).	First profits were deposited in accounts for the parks in 1998. Yellowstone National Park received \$1,100 and Grand Teton \$600.	Simpson 1998.
Landowner Incentives: Costa Rica	Private hydro-electricity company, Energia Global, offers landowners in its watersheds \$10 per hectare per year to maintain or restore forest cover on their plots.	Watershed protection.		Reid 2000.
Corporate Sponsorship	Grants the National Park Foundation the authority to license others to use Foundation trademarks, slogans, etc., to promote or advertise that the individual or company is an official supporter of the National Park Service.	Requires all net income derived from the licenses and authorizations to be expended on programs, projects or activities that benefit the National Park Service.		S. 1703 and H.R. 3819, "A Bill to Amend the Act Establishing the National Park Foundation, 1996," Sen. Murkowski (April 25) and Rep. Hansen (July 16).
Capture Ecosystem Service Values				
Water Quantity and Quality: Water-Use Payments	Diversion tax on water paid by beneficiaries of both the water-supply system and watershed management. Similar to severance taxes on minerals and yield taxes on timber.	For expanded watershed and restoration activities. A trust fund or conservancy could finance watershed improvements and monitoring throughout the Sierra Nevada.	Taxes on diverted water as low as \$1-\$10 per acre-foot would generate from \$20 million to \$200 million for stable long-term funding.	Sierra Nevada Ecosystem Project (SNEP) Science Team 1996.

(con.)

Table 3—(Con.)

Strategy	Description	Purpose of funds	Estimated funds	Source
Capture Ecosystem Service Values (con.)				
Water Markets: Environmental Resources Trust (ERT) and Bonneville Power Administration (BPA), Pacific Northwest US	ERT (non-profit organization affiliated with Environmental Defense Fund), in alliance with BPA, serves as broker for four types of power that benefit fish through increased river flows. ERT earns a fee for every unit of electricity it sells and uses 75% of fees to support environmental restoration in the Pacific northwest.	Enables the sale or lease of water rights and creates opportunities for market-based mechanisms to shift water back into rivers in order to enhance habitat for freshwater biodiversity.		Reid 2000.
Instream Water Right Donations	Donations of water rights from federal agencies (e.g., Bureau of Reclamation), state agencies, or private organizations through water market transfers.	Protect or improve quality or flow of streams and rivers for fish and wildlife habitat, scenic and aesthetic values, and communities.	Benefit valued at average of \$30/acre-foot (lease) or \$397/acre-foot (purchase).	Landry 1998.
Annual Payment	Del Oro S.A., a Costa Rican orange growing corporation, pays Guanacaste Conservation Area (GCA) \$5 per hectare per year for water supply and watershed protection for the portion of the catchment area of the river serving as the plantation's water source that is within the GCA (1,169 hectares). (One hectare = 2.471 acres) [see also Natural Pest Control].	Forestland acquisition (see Estimated Funds).	Total value of 20-year contract is \$480,000, or \$24,000 per year. In lieu of cash, payment is donation of 1,200 acres of forested land to GCA.	Reid 2000.
Carbon Sequestration: Markets	Markets for the carbon sequestration value of forests are developing through both intergovernmental agreements and private sector initiatives.			Freese 1998.
Kyoto Protocol (agreed 1997) Trading Mechanisms	Net changes in removals or emissions of carbon dioxide related to afforestation, reforestation, and deforestation will count towards countries' negotiated emission caps.			Reid 2000.
United Nations Framework Convention on Climate Change (in force 1993)	Under UNFCCC countries could include actions to sequester carbon through land use changes as contributions to achieving voluntary commitments.			Reid 2000.
Certifiable Tradable Offsets (CTO), Costa Rica	Greenhouse Gas Fund to promote joint implementation projects under UNFCCC. Investors seeking to offset carbon emissions contribute to the fund in exchange for CTOs. The government anticipates these CTOs may be used as credits against greenhouse gas emissions.	Finance forest conservation.		
Natural Pest Control and Pollination: Annual Payments	Del Oro S.A., a Costa Rican orange growing corporation, pays Guanacaste Conservation Area (GCA) \$1 per hectare per year for supplying natural pest control services to the 1,685 hectare orange plantation the company established adjacent to the conservation area. [see also Water Supply and Watershed Protection].	Forest land acquisition (see Estimated Funds).	Total value of 20-year contract is \$480,000, or \$24,000 per year. In lieu of cash, payment is donation of 1,200 acres of forested land to GCA.	Reid 2000.

(con.)

Table 3—(Con.)

Strategy	Description	Purpose of funds	Estimated funds	Source
Capture Ecosystem Service Values (con.)				
Waste Treatment and Water Purification: Natural and Artificial Wetlands	Natural and artificial wetlands are often capable of providing wastewater treatment (at a fraction of the cost of a new wastewater treatment facility) and several hundred are used in this manner in the US and Canada.	n.a.; cost of new wastewater treatment facility avoided.		Reid 2000.
Natural Mangroves	Shrimp aquaculture projects are being developed inland from mangrove forests because effluent from the aquaculture system can then be purified by the mangroves. The success of the aquaculture system is dependent on high coastal water quality.		Cost of treating wastewater now treated by Fiji's mangroves with a conventional treatment facility is about \$5,820 per hectare per year.	Reid 2000.
Storm and Flood Protection: Natural Wetlands, Mangroves, and Coral Reefs	The US Corps of Engineers advocated retention of wetlands along the Charles River outside Boston because of the flood control service it provided. For preserving natural flood storage, 8,500 acres of wetland were to be acquired.	n.a.; cost of channelizing river avoided.	The alternative to wetland acquisition would be channelizing 10 miles of the Charles River at a cost of \$30 million.	Reid 2000.

Evaluation

Funding strategies were evaluated according to the criteria presented; results are displayed in table 4. Variations in the extent to which the strategies met the criteria are briefly discussed below; strategies are presented in the order in which they best met the evaluation criteria.

All of the strategies could be designed to provide incentives for long-term ecological stewardship but—except for strategies to capture ecosystem service values—do not necessarily include incentives. And although there are scientifically defensible measures of ecological conditions, the comprehensiveness and accuracy of these measures—and monitoring—vary across agencies. Therefore, ecological and economic effectiveness and accountability are not addressed individually, except as they relate to ecosystem service value strategies.

Methods of capturing ecosystem service values best meet the criteria presented. Because of the link between resource management and consequent funding levels, there is an incentive to make investments that improve resource conditions and productivity over the long term. The magnitude of funding also serves as a measure for accountability. This strategy can be designed so that terms may be modified to new conditions and information, and it is particularly suited to pilot studies. Implementation of ecosystem service valuation systems could involve institutional changes such as cross-jurisdictional arrangements (for example, cooperation among counties) or public-private partnerships at various (local community, county and/or state) levels. Watershed organizations, which have formed across the country, are an example of this latter partnership. If ecosystems can provide services at lower cost than human-created facilities, everyone should be better off, regardless of whether they value wilderness. Furthermore, this strategy provides incentives to conserve resources for future generations. The predictability of funding is limited by the fact that receipts depend on both market prices and ecological outputs, which to some extent depend on climate and weather.

Public investment and donation strategies are also amenable to modifications if new information becomes available or ecological conditions change. They could be structured to promote long-term ecological sustainability. The majority would require federal or state legislation, so this strategy is not currently viable. Equity would be greater than other strategies because investment and contributions would be

entirely voluntary; those who value wilderness would pay an amount commensurate with that value. The magnitude and timing of funding would not be predictable because it would depend on the public's willingness to invest and/or corporate motivation to plan a donation scheme.

The existence of private sector initiatives suggests that this strategy is currently viable. Because the initiatives are modified within a private organization, this strategy would be more flexible than those where later modifications would involve the public sector. They also could be structured to promote long-term ecological sustainability. As above, equity would be greater than other strategies because investment and contributions would be entirely voluntary; those who value wilderness would pay. As with public investments and donations, the magnitude and timing of funding would not be predictable because it would depend on private sector motivation and the public's willingness to spend.

Federal funding reforms and general public funding strategies would both result in constituents that believe their interests are well served (those who value wilderness) and those opposed to the use of their tax dollars for wilderness-related activities. Neither explicitly benefits future generations, although current actions could benefit the future if they are not revoked. Federal reform and reallocation of public funds would require (federal or state) legislation and are therefore not currently viable. Depending on the prevailing political priorities, however, it may be easier to institute changes in general public funding strategies at the county and state level than to reform at the federal level. The predictability of funding levels would depend on how the strategy is structured—whether it allows for multi-funding and accounts for inflation, for example. Neither strategy would be particularly adaptable to new information or conditions because changes would likely require legislative and/or agency action.

Conclusion

There are many promising wilderness management funding strategies to supplement federal appropriations. For any region of the country or wilderness area, there is most likely more than one strategy that would be effective; a combination of strategies, depending on regional opportunities and constraints (social, economic, political) and the wilderness management concern.

Table 4—Evaluation of wilderness funding strategies.

Strategy	Economic and ecological effectiveness	Viability	Equity	Accountability	Predictability	Flexibility
Capture ecosystem service values	0	+	+	0	+	0
Public investments and donations	+	—	0	+	—	0
Private sector initiatives	+	0	0	+	—	0
Federal funding reforms	+	—	+	+	+	—
General public funding	+	—	+	+	+	—

+ = High
0 = Medium
— = Low

The next step in furthering implementation of supplemental funding is to identify key organizations and other entities that could facilitate further development of potential strategies and help build constituencies for them. A range of potential areas for pilot studies could be identified for various combinations of strategies.

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The Triumph of Politics Over Wilderness Science

Craig W. Allin

Abstract—The National Wilderness Preservation System reflects the triumph of politics over science. The history of wilderness allocation has reflected political rather than scientific sensibilities. The preeminence of politics over science extends to wilderness management as well and is illustrated here by representative examples from the modern history of Yellowstone National Park. To Americans, who don't think very highly of politics, the triumph of politics over science appears lamentable, but it is not so much lamentable as inevitable. As a discipline, science cannot address the fundamental questions of wilderness management, but citizen scientists must.

The history of wilderness management is replete with episodes that appear to pit politics against wilderness science. Time and again politics appears to triumph. To Americans, who don't think very highly of politics, the result appears lamentable. It is not so much lamentable as inevitable.

In the following pages, I will introduce two ways of evaluating wilderness and suggest that our wilderness system reflects political rather than scientific sensibilities. I will suggest that the preeminence of politics over science extends to wilderness management and illustrate this thesis with five examples selected from the modern history of Yellowstone National Park. Finally, I will assert that the triumph of politics over wilderness science is logically inevitable, and that the role of wilderness science must be distinguished from the role of the wilderness scientist.

The Triumph of Politics in Wilderness Allocation

Science and politics approach the issues of wilderness allocation differently. From the perspective of science, a good wilderness area is an ecosystem where nature takes its course without human manipulation or interference. For that to happen, you have to have all the ecosystem's natural plants and animals, and you have to have them in numbers great enough to support healthy genetic diversity. If a good wilderness area is complete and undisturbed, a good wilderness system includes representative examples of each ecosystem type. In short, individual wilderness areas should be

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Craig W. Allin is Professor of Political Science, Cornell College, 600 First Street West, Mount Vernon, Iowa 52314-1098 U.S.A., telephone: (319) 895-4278, e-mail: CAllin@Cornell-Iowa.edu

natural. The composite wilderness system should be ecologically representative.

From the perspective of politics, a good wilderness area is one that garners more support if preserved in a relatively natural state than if devoted to some other use. A good wilderness is an area that has high value for primitive recreation and scenic appreciation, and low value for alternative uses like mining, power generation, farming, timber harvest, livestock grazing and golf. From the perspective of politics, a good wilderness system includes those areas which are more valuable when preserved as wilderness than when devoted to some other use.

So, which kind wilderness system do we have? The scientists' representative sample of complete natural ecosystems? Or the politicians' collection of areas not very valuable for anything else? To anyone acquainted with the National Wilderness Preservation System, the answer is obvious. Some years ago, George Davis, a leading advocate of ecological representation in the wilderness system, answered the question with some precision. Davis found the wilderness system adequately represented 81 of the nation's 233 ecosystems (Davis 1984). In their state-of-knowledge presentation, "The Contribution of Wilderness Areas to Conservation Goals—Now and in the Future," Barbara L. Dugelby and Dave Forman, reported that 157 of 261 ecosystems are now represented in the wilderness system, but only 50 of them in wilderness areas greater than 100,000 hectares. These data all confirm what history teaches: Wilderness areas have been designated from what is left over after areas valuable for other purposes have been exploited. As a result, our National Wilderness Preservation System is anything but systematic in its representation of American geology and biology. In short, wilderness allocation in the United States reflects the prescriptions of politics over the sensibilities of science.

The Triumph of Politics in Wilderness Management

The same thing is true of wilderness management. Science and politics value different things, and—when science and politics conflict—politics generally wins.

Management of Yellowstone National Park in the modern era provides numerous examples, five of which are discussed below. These examples do not constitute formal proof of my thesis, but they are both illustrative and representative of the apparent conflicts between science and politics in Yellowstone and elsewhere in the wilderness system.

Elk Management

Let's begin with a classic controversy: management of the Yellowstone elk. In the early years of Yellowstone Park, the

elk were hunted for food and sport, both inside the Park and in the surrounding area. Yellowstone was closed to hunting in 1894, but both hunting and development proceeded outside its boundaries. Within the Park, elk populations grew—eventually reaching levels considered dangerous by the Park Service. As a result, from 1934 to 1967 Park personnel removed elk to keep the herd from destroying its habitat. Some elk were trapped to restock other areas, but, as time passed there was less need for elk elsewhere, and many were simply shot (Haines 1977; Wright 1992).

Elk reduction became an issue in the 1960s, quite possibly because that was the first decade when Americans could watch it on television. However necessary, the spectacle of elk slaughter was an unappetizing accompaniment to dinner. The public discomfort with shooting put Interior Secretary Stewart Udall in a difficult situation. To defuse the issue, he established a blue ribbon panel of independent wildlife scientists to study elk reduction. The panel, chaired by A. Starker Leopold, issued its report in 1963. It concurred with Park scientists that overgrazing by elk was damaging the Park, and agreed that population reductions needed to continue—by shooting if necessary (Leopold and others 1963). Leopold made the report available to the public, and Secretary Udall declared it the official policy of the National Park Service (Sellars 1997).

Then, suddenly, in 1967, the shooting stopped, and the Yellowstone elk herd resumed its rapid growth (Boyce 1991). What happened? The Park Service eventually justified its new hands-off policy with language that sounds a lot like the scientific perspective on wilderness described above. The policy was called “natural regulation.” Its central arguments were that Yellowstone National Park is a complete ecosystem and that nature knows best. It followed that any action by Park personnel to manipulate the size of the elk herd was likely to be wrong (Boyce 1991). This argument had impressive historical support. In the 1920s, national park personnel had shot wolves and cougars on sight; for decades, they had fed garbage to grizzlies (Albright 1929; Albright and Taylor 1986; Wright 1992). The park managers who implemented these policies thought they were doing the right thing, but, by the 1960s, these earlier policies were perceived as perverse.

The policy of natural regulation has produced a tremendous scientific debate, but whatever the merits of the intellectual argument, it wasn't new science that brought a halt to the elk slaughter in Yellowstone. It was politics. The killing ended March 11, 1967, and was announced to the world at a congressional hearing that same day. In 140 pages of subsequent testimony and submissions—including statements by National Park Service Director George Hartzog, A. Starker Leopold and representatives of Wyoming and Montana fish and game commissions—no one spoke the words “natural regulation,” and no one representing any governmental agency disputed the proposition that sound wildlife management required active reduction of the Yellowstone elk herd (U.S. Senate. Committee on Appropriations 1967). The theory of natural regulation came later, although just how much later is hard to ascertain. Various experts place its beginnings in 1967 (Chadde and Kay 1991), 1968 (Coughenour and Singer 1991) or 1969 (Houston 1982). Its scientific merit is still hotly disputed, but its political merit is apparent. It gave scientific legitimacy to a policy decision

that had already been made. The interesting question is what motivated the policy shift? What really happened to change Park policy in 1967?

Despite the scientific consensus, there were two powerful interests very much opposed to killing elk in the Park. The first was the animal rights movement, ascendent and militant in the 1960s, opposed to killing on moral grounds and organized in national nonprofit associations like the Fund for Animals. The second interest was sport hunting. Hunters objected strenuously to the killing of elk by anyone other than themselves. Short of being allowed to hunt in the Park, they preferred that the Park serve as a nursery, producing surplus elk to populate surrounding areas. Politics makes strange bedfellows. Hunters and animal rights activists were agreed: the Park Service should not shoot elk.

The animal rights movement had the power to generate media attention, which it did, but by itself it did not have the political clout to change park policy. Hunters, however, had political clout beyond their numbers. They had support from state fish and game departments, whose budgets depended on hunting license fees, and from the local politicians in whose constituencies they lived and voted.

In October 1966, Yellowstone Park Superintendent John McLaughlin announced that the elk herd would be reduced by 3,000 animals, of which 600 would be killed by rangers (New York Times 1967b). Protests arose from animal rights advocates, hunters, and official friends of hunters including Wyoming's governor and state legislature, state game officials, and Wyoming's two senators (New York Times 1967a).

United States Senator Clifford Hansen introduced legislation in Congress to prohibit direct reduction of the Yellowstone elk, but passage was unlikely. Senator Gale McGee had better leverage. As chairman of the Interior Appropriations Subcommittee, he threatened to cut off funding unless the culling stopped (U.S. Senate. Committee on Appropriations 1967). The Interior Department was beaten. Secretary Udall had big plans for Park System expansion, and he could not afford to alienate McGee (Blair 1967). On March 11, Senator McGee announced that Secretary Udall and the Park Service Director George Hartzog had agreed to stop the shooting immediately (U.S. Senate. Committee on Appropriations 1967; New York Times 1967c). There can be little doubt that politics triumphed over science.

National Park Service historian Richard West Sellars (1997) has written: “The agreement to end the reduction program thus provided a quick solution to increasingly difficult problems: the angry crossfire of public alarm over shooting elk, the demands of hunters to participate in the reduction, and rising concern in Congress.”

Nor is this case an aberration. Additional examples are plentiful. I'll review four in reduced detail.

Grizzly Bear Recovery

In the 1970s and 1980s, Park scientists were very concerned about the continued survival of grizzly bears in the Yellowstone ecosystem. Their numbers were low, and so was their rate of reproduction. There was a very real possibility that fatalities exceeded births. Without any effective means to increase reproduction rates, any sensible plan to save the Yellowstone grizzlies required minimizing bear fatalities. That, in turn, required a degree of separation between bears

and tourists. Some wild areas were closed to backpackers and hikers. But the biggest problem was not in the backcountry; it was at Fishing Bridge (USDI-NPS. Yellowstone NP 1983).

Fishing Bridge was a major tourist destination at the outlet of Yellowstone Lake. There were a visitor center, a picnic area, an amphitheater, a store, a gas station and automobile repair facility, a 310-unit campground, a 360-unit RV park and other facilities—all located at what Park scientists then believed to be a kind of superhighway interchange in terms of grizzly bear travel. Giving priority to the needs of the bears, scientists from the Park Service and the Fish and Wildlife Service and the Park service Director all concluded that the public facilities at Fishing Bridge should be removed (USDI-NPS. Yellowstone NP 1984; Marston 1985; USDI-NPS. Yellowstone NP 1994).

However, Fishing Bridge was the most convenient tourist complex for visitors entering Yellowstone from the east through Cody, Wyoming. Cody merchants feared that substituting another complex for Fishing Bridge would discourage use of the Park's east entrance at the expense of Cody. The Cody Chamber of Commerce organized an assault on the Park Service's plan to close Fishing Bridge. The Wyoming congressional delegation intervened on behalf of Cody, and the Park Service agreed to prepare a formal environmental impact statement (EIS) before proceeding. By the time a full-fledged EIS had been drafted in 1987, however, the plans for Fishing Bridge had been compromised to the degree that they were praised as a "sound compromise" in a letter signed by the congressmen who had championed Cody's economic concerns (Barker 1987). The compromise called for closing the campground, gas station and auto repair shop but left the 360-unit RV park, visitor center, picnic area and amphitheater in place (High Country News 1988; USDI-NPS. Yellowstone NP 1994). Economic development interests around the Park had effectively trumped the habitat requirements of the Park's largest predator. Superintendent Robert Barbee admitted as much: "The political bottom line was underestimated. It's as simple as that. The parks are very much the children of politics. It is naive to think that politics doesn't have an influence on policy" (Barker 1987).

Wolf Reintroduction

During most of the 20th century, Americans have classified wildlife as good, bad, or irrelevant. The good species were hunted for food and sport, and we called them—tellingly—game. The bad species were—like us—hunters. They competed with us for game and preyed on our domesticated livestock as well. We called them varmints, offered bounties, and did what we could to shoot, trap and poison them into extinction (Albright 1929). For a time, even national parks hired hunters to kill predators, and by 1924 the last wolf had vanished from Yellowstone (Wright 1992). By the 1930s the Park Service had achieved a more enlightened attitude. The director announced that predators would not ordinarily be killed (Albright 1931). Of course, by then, there were no wolves left to benefit from this shift in park policy.

Forty years later, public opinion regarding wildlife had changed. Biological diversity was beginning to be recognized

as desirable and species extinction as something to be avoided. In 1973, the Endangered Species Act was passed, and the gray wolf was listed as endangered throughout most of its previous range. Scientists began studying the possibility of wolf reintroduction in Yellowstone. Wildlife scientists were unanimous that wolves belonged in Yellowstone. Indeed, wolves were the only native mammal not present in the Park. Their restoration would make the Park's ecosystem more natural and more complete. As the historic top predators in the Yellowstone Ecosystem, their return could help reduce excessive elk and bison populations. The only real issue was how wolves ought to return (McNamee 1997).

Environmental purists argued that, given enough time and the protection of the Endangered Species Act, a natural population of wolves from Canada would migrate down the Rocky Mountain chain and resettle Yellowstone much as they had already resettled Glacier National Park. Environmental pragmatists argued that an experimental population of wolves should be transplanted directly into the Park. In 1995, after two decades of study, 160,000 comments from the public and recommendations from wolf experts in and out of government, Canadian wolves were transplanted in Yellowstone (McNamee 1997).

To calm the fears of nearby ranchers, the reintroduction plan allowed them to shoot wolves that left the Park and attacked livestock and compensated them for livestock lost. In a tactic that makes sense only in the world of politics, the Wyoming Farm Bureau Federation filed suit to stop the wolf reintroduction on the grounds that the plan, which allowed its members to shoot wolves, failed to provide the wolves with all the protection to which they were entitled under the Endangered Species Act. In December of 1997, a federal district court judge agreed: Because the reintroduced wolves were not being well enough protected, they were required to be destroyed (Wyoming Farm Bureau Federation, et. al. v. Bruce Babbitt, et al. 1997). Appeals by the government and the Friends of Wildlife are pending, but whatever the result, it will be a triumph of politics. (January 13, 2000, the 10th Circuit Court of Appeals overturned the 1997 decision and allowed the wolves to remain in Yellowstone.)

Natural Fire

For most of the 20th century, government officials and the public agreed that wildfires were bad. If anyone doubted that conclusion, they had both Smokey the Bear and Bambi to set them straight. As taxpayers, we spent millions of dollars every year to detect and suppress fires. We built fire towers, flew aerial reconnaissance, and trained smoke jumpers. As technology developed, we got better at putting fires out, but we often seemed to be doing more harm than good. Forest and grassland ecosystems were becoming clogged with brush, and fires were getting worse (Pyne 1984).

In the 1970s and 1980s, government scientists across the West concluded that fire was a natural and, in many cases, a necessary part of ecosystems (Leopold and others 1963; Kilgore and Heinselman 1990). In national parks and wilderness areas, where naturalness is supposed to prevail, government forest managers increasingly concluded that natural fires should be allowed to burn as long as they did not threaten resources outside the wilderness (USDI-NPS 1968; Parsons and others 1986). In Yellowstone National Park and

the surrounding national forest wilderness areas, fire management plans were adopted that allowed natural fires to burn themselves out as long as they didn't get too large (van Wagtenonk 1978). President Reagan's Interior Secretary Donald Hodel supported this "natural fire" or "let burn" policy (Wuerthner 1988).

Then, in 1988, after years of inconsequential fires, significant fires began in and around Yellowstone. Over the course of the summer, they became national news. Reporters found the cataclysmic lamentations of motel owners in Cooke City and West Yellowstone to be far better copy than the dry pronouncements of Park scientists. As a result, the media portrayed the fires as destroying Yellowstone. The major news weekly, *Time Magazine*, reported as a matter of fact that "The fires have *ruined* 1.2 million acres of Yellowstone and adjoining national forests" (Time 1988, emphasis added). *Time* was one among many.

Like most other Americans, President Reagan heard about the natural fire policy from the news media. Like most other Americans, Reagan undoubtedly loved Yellowstone National Park, and he was not about to see it burned down. He proclaimed the natural fire policy "a cockamamie idea," and his political subordinates scrambled for cover (Satchell and Dworkin 1988). For his part, former natural fire supporter, Interior Secretary Hodel denounced the natural fire policy on ABC's *Nightline*. Then—after having publicly condemned the policy of Park scientists—he boarded a plane for a fact-finding mission to Yellowstone (Shabecoff 1988). Politics had defeated science yet again, although, in the case of the 1988 fires, nature probably defeated them both.

Bison and Brucellosis

No creature is more strongly associated with the pre-Columbian Great Plains than the bison or American buffalo. It has been depicted in Western art, on United States coins, and on the official seal and various logos of the Department of the Interior. It ranks second only to the bald eagle as a symbol of the American nation. It ranks second only to the passenger pigeon as a symbol of America's wanton destruction of its wildlife. In the 19th century, market hunting nearly extinguished the bison, and agitation on its behalf constituted an early episode in the politics of wildlife conservation (Trefethen 1975).

Buffalo were numerous in Yellowstone at the time the Park was created. Today's Buffalo Plateau, north of the Lamar River, received its name because "thousands of buffalo" were found grazing there in 1870 (Haines 1977). Thirty years later, the survival of the Yellowstone buffalo was very much in doubt. All figures are estimates, but the population was almost certainly less than 50. The buffalo crisis prompted vigorous action against poachers, as well as establishment of a captive herd of domesticated plains buffalo. The latter, of course, would be regarded as an exotic species today. The native bison survived, but they interbred with the exotics, creating the hybrid species that populates the Park today. Now well protected within the Park, the bison herd has flourished. There may well be too many for the range. When they attempt to leave the Park, however, they have been shot on sight, either by or with the approval of Montana State game officials.

The issue is brucellosis, a disease common to buffalo and cattle, which causes cows to abort their fetuses. The disease is so threatening to livestock that the Department of Agriculture requires cattle shipped in interstate commerce to be certified as brucellosis free. That means either testing, which is expensive, or a ranching operation within a state that has been certified as brucellosis free. Most scientists who have examined the issue have concluded that the risk of transmission from buffalo to cattle is small, but—since the consequences would be catastrophic—cattlemen, the Agriculture Department's Animal and Plant Health Inspection Service (APHIS) and the neighboring states are understandably adverse to even the slightest risk. Rigidity has been a common posture among the contestants. Indeed, public officials have come to blows over this issue (Rezendes 1997).

The Animal and Plant Health Inspection Service provoked the most recent crisis. In December 1994 it informed Montana that its brucellosis-free status would be downgraded unless action was taken against brucellosis-infected bison within its boundaries. The following month, Montana filed suit in federal court contending its brucellosis-free status was threatened by the conflicting policies of the Park Service and APHIS. To settle the suit, the participants agreed to an interim management regime, which allowed the State of Montana to eradicate any buffalo that intrude on areas of Montana used by cattle. The practical result was a great border buffalo slaughter: In the winter of 1996-1997, more than one thousand animals were slain or removed, perhaps one-third of the previous population (Rezendes 1997; Crosson 1997).

The slaughter of the bison was as poorly understood and as unpopular as the elk slaughter had been three decades earlier, and the Interior Secretary reacted in much the same way. Bruce Babbitt called for an investigation by the National Academy of Sciences and asked Montana to halt the shooting. Under pressure from the Interior Department, the Agriculture Department reduced its pressure on Montana, but the killing continued (Allen 1997). The National Parks and Conservation Association began a "Bison Belong" campaign aimed at tourist-dependent businesses (Crosson 1997). In June 1997, federal and state officials tentatively agreed on a management plan that includes live-capture, hunting of bison in certain situations, vaccination of bison when a reliable vaccine becomes available, and acquisition of additional winter range outside the Park from willing sellers (Rezendes 1997). As with wolf reintroduction, the controversy continues. Politics will decide.

The Triumph of Politics Is Inevitable

So our parks and wilderness areas are governed more by politics than science. This conclusion comes as no surprise to a political scientist, and it is probably no surprise to people who work in federal land management. This conclusion probably would surprise the millions of Americans who love their public lands but learn most of what they know about them at visitor centers and campfire talks, where rangers rarely discourse on how the Park Service got steam-rolled by the hunters, or the ranchers, or the business leaders of Cody, Cooke City or West Yellowstone.

Politics has routinely triumphed over wilderness science, and, in the rather unsophisticated sense in which I have used these words up to this point, that result may appear lamentable. In a somewhat more sophisticated view, the triumph of politics over wilderness science is not so much lamentable as inevitable. It is not in the nature of science to make the decisions I have been describing. Science asks and answers empirical questions, but the most fundamental questions about wilderness management are inevitably normative.

So, in the case of Yellowstone, science can tell us that an increase in the population of elk will reduce aspen, willow and beaver. It can even tell us that killing elk would produce a more natural biological balance. But science cannot tell us whether naturalness is more valuable than the sport of hunters or the sensibilities of animal lovers.

Science can tell us that closing the Fishing Bridge commercial complex will help preserve the grizzly bear, but it cannot answer the question: Which is more valuable, the preservation of the grizzly bear or the economic prosperity of Cody's merchants?

Science can tell us that the wolf is the historic top predator in the Yellowstone Ecosystem, that its reintroduction will make the ecosystem more complete, but it can't tell us that achieving that completeness is more important than the mental health of ranchers who fear and loathe the wolf as a threat to their livestock and their way of life.

Science can tell us that the Yellowstone National Park we know and love was created by fire, that lodgepole pine forests depend upon fire to recycle nutrients and to open their seed-bearing cones. Science can tell us that the historical pattern of fire in Yellowstone has been huge conflagrations spaced 200 to 400 years apart. But it cannot tell us whether we should prefer to see that pattern repeated. It cannot tell us whether we should cherish naturalness more highly than the beauty of an unburned forest.

Science can tell us that the risk of cattle contracting brucellosis from bison is small and that elk also carry the disease. It cannot tell us that a relatively natural, free-ranging bison herd in the Greater Yellowstone Ecosystem should be valued more highly than the cost savings and economic security afforded to cattle ranchers by Montana's certification as a brucellosis-free state.

In the final analysis, the real conflict is not between science and politics. It is between people with different attitudes, values and interests. It is most often between two identifiable constituencies: a national constituency that thinks about Yellowstone primarily in aesthetic and philosophical terms and generally supports the preservation of its wildness, and a local constituency that thinks about Yellowstone primarily in economic terms and prefers prosperity to wildness.

For the most part, the triumphs of politics over science described here are more accurately described as triumphs of local economic interests over national preservation interests. The Park's local constituents are a militant minority. They win because they care passionately, they work hard, their interests are easy to conceptualize and to quantify, they see themselves as having a lot to lose, and they command support from locally elected officials. These are precisely the characteristics rewarded in our political system.

The Park's national constituents are a vast and far-flung tribe, not nearly so well informed. As absentee landlords, they assume that Park Service experts are in charge and that nature is being served. They are a silent majority, only partially represented by the national environmental lobby, and that is a poor recipe for political success.

Local politics will always serve parochial economic interests. In the end, preservation of naturalness in Yellowstone and elsewhere requires that her vast national constituency find its voice. Science has no formal role in this process, but scientists do. Science, as a discipline, cannot answer the fundamental normative questions, but scientists are also citizens. Scientists should be educators and leaders and active participants in the political debate. The triumph of politics is inevitable, and in a democracy, it is appropriate. With the active participation of scientists, our politics has the potential to be elevated, informed and inclusive. If scientists opt out, our politics is doomed to be debased, ignorant and parochial.

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Tourism and Wilderness: Dancing With the Messy Monster

Ralf Buckley

Abstract—Currently, tourism offers one of the best prospects for conserving remaining areas of unprotected wilderness in most parts of the world. Tourism produces environmental impacts, and in heavily-visited protected areas these impacts may be a significant threat to conservation values and a major management issue; along with other anthropogenic impacts such as weeds, pests, pathogens, and pollution. The impacts of tourism are generally far less than those of other industry sectors such as forestry, farming, mining or commercial fisheries, however, so if tourism can displace these land uses, there is a net gain for wilderness despite the impacts of tourism itself. Tourism is not an ideal tool for conservation, but in most of the world, and at least in the short term, it is perhaps the only one with sufficient political and economic clout to be effective.

The human economy behaves like a rather messy monster which creates impacts on the global environment not only by consuming raw materials and excreting waste products, but by accidental damage caused through messy habits, clumsiness and inattention. The monster's size is increasing much faster than its manners, and its tentacles are probing further into every corner of its habitat. Using tourism and recreation as a tool for wilderness conservation is like dancing with the messy monster in a crowded cage: risky, but unavoidable.

The aim of this contribution is to argue that tourism is important for the conservation of wilderness. In wilderness areas which are already protected, commercial tourism is growing in scale, and in some cases has become a significant source of anthropogenic impact, and a major logistic and financial issue for land managers. For wilderness outside protected areas, tourism offers an economically valuable land use whose environmental impacts, though by no means negligible, are far less than those of alternative land uses such as logging, farming and fisheries. Tourism is hence a very important tool for wilderness conservation, albeit one whose use is fraught with danger.

The Human Economy as a Messy Monster

The traditional model of neoclassical economic theory is to view the human economy as a closed loop which cycles

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Ralf Buckley, Director, International Centre for Ecotourism Research, School of Environmental and Applied Science, Griffith University, Parklands Drive, Southport, Queensland, 4217, Australia. Telephone: 61 7 55 948675, Fax: 61 7 55 948895, e-mail: r.buckley@mailbox.gu.edu.au

money between producers and consumers. Environmental economists have drawn attention to the deficiencies of this model, preferring Herman Daly's analogy of the human economy as a gut which consumes raw materials and converts them to waste products, the so-called externalities of the neoclassical model. Even the gut analogy, however, misses one important aspect of the human economy; many of its most serious impacts are accidental. More species, surely, have become extinct as an incidental consequence of habitat destruction, than through deliberate consumption of that particular species. If the human economy is a gut, it is one which feeds messily, excretes heedlessly, and blunders around both carelessly and clumsily: a messy monster. This model includes the resource economist's view of the natural environment as a commodity warehouse for human societies, as well as the environmental economist's view of the natural environment as the unwilling trashcan for human waste products. It also recognizes that damage to the natural environment can occur as an inadvertent consequence of human economic activity, as well as a deliberate one.

Wilderness as the Kitchen Cupboard

As the messy monster grows it has less and less space to play in. Already it is often eating food contaminated by its own crap. From the monster's own perspective, the critical significance of wilderness is that it contains the ingredients for future meals—clean air and water for immediate consumption, and biological diversity at both species and genetic levels, which provide the raw ingredients for the many recipes of agricultural production. As wilderness shrinks, so too do the future options available to the agricultural, forestry and fisheries industries. The messy monster needs wilderness, places where it treads lightly on the tips of its tentacles, simply so that the global ecosystem can continue to function and keep the monster fed. This is not to belittle the intrinsic value of wilderness, or its significance for the rights of other species, or its importance for human personal growth. Even for individuals, however, who ascribe little significance to these issues, wilderness is still the kitchen cupboard for the human economy. "In wilderness is the salvation of the world"—not just figuratively or philosophically, but quite immediately and literally.

Why Study the Messy Monster?

The innumerable ways in which the human economy depends on natural environments, their biological components and ecosystem functions, are the province of the natural sciences. If wilderness is to be protected, however,

practical steps must be taken within existing political systems; and this is the domain of the social sciences. Natural sciences show us why wilderness must be protected; social sciences show us how.

Is the Messy Monster Learning Manners?

The most serious threats to wilderness and other undisturbed natural environments are from large-scale habitat destruction, and air and water pollution, from the major primary and secondary industry sectors. All of these sectors are taking steps towards better environmental management, which might be seen as improving the messy monster's manners. To date, however, this improvement has occurred only for some companies, in some countries. It has been rather marginal and cosmetic in most cases (Beder 1997), and has certainly not compensated for growth in the overall size of the human economy. Whilst some industry sectors have adopted voluntary environmental initiatives, these have generally been rather weak and seem to be aimed principally at influencing public opinion and staving off government regulation (Beder 1997). Significant reductions in impacts seem to occur only when governments enact and enforce relatively stringent environmental standards and laws, with penalties that apply to individuals as well as corporations, and when the courts are prepared to enforce them. The ability of individual governments to introduce more powerful environmental legislation, however, is greatly restricted by international trade agreements, particularly the General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO). The structures of international trade agreements reflect the interests of large transnational corporations, and are therefore unlikely to encourage more effective environmental legislation.

Messy Monster Martial Arts

Even if the fabric of international trade agreements were more representative of social opinion overall, it seems that this rarely achieves consensus, and in any event, changes very slowly. If we rely on public environmental concern to change first the GATT, then national environmental laws, and finally the actions of individual corporations, wilderness will all be long gone.

Instead, we must search for an existing social institution which can move fast. Markets are the obvious candidate. When new information reaches stock markets, they react in seconds, not decades. Because wilderness conservation needs rapid action, we need to enlist markets to lead the way.

Most emphatically, this does not mean that we should privatize wilderness, or let markets decide outcomes. It simply means that we should use markets to move society, to influence human behavior. Entrepreneurs do not wait for social consensus. They ignore it, or change it. To conserve our few remaining areas of wilderness will be a battle. And if it's a battle, we should steal the enemy's weapons.

Giving Wilderness a Recognized Value

To use markets, we must first give wilderness a value which is recognized in existing social systems, without destroying it in the process. The issue of recognition is critical. Wilderness already has value in human societies. If they can't get it for free, people are prepared to trade other things for it. But they are used to play without pay. It's like the difference between unpaid housework and a paid job. They have equal value to society, but one has far greater recognition.

Note also that in the democratic western nations whose economic and social values dominate most of the world, there are two recognized classes of value — money and votes. The exchange rate between these varies; and of course in most electoral systems, not all votes have the same value. Sometimes votes can be obtained directly. Stankey (this conference) referred to this as "Voice"—enlisting the assistance of people experienced in operating political systems. I have referred to this previously as "grey power" (Buckley 1988), a much less compelling term.

Value Through Tourism: Dancing With the Monster

By far the most promising opportunity to provide recognized values for wilderness, comparable to those ascribed to other land uses, is through tourism, recreation, and possibly real estate. These approaches all involve risks and costs. The question is how to stitch up deals with tourism interests which will protect as much wilderness as possible at the lowest price.

There is a crucial issue of timing. Globally, tourism is expanding in geographic scope and in economic scale and significance. Wilderness is declining in both area and quality, and tourism and recreation in wilderness areas is increasing even faster than tourism as a whole. The value of wilderness to the tourism industry is therefore increasing — an argument to delay any deals as long as possible. On the other hand, wilderness is being lost to other land uses at an ever-increasing rate, and its value for tourism is then vastly diminished. This provides an argument to make deals as quickly as possible.

Of course, no one scenario applies universally. For wilderness areas in imminent danger of destruction through logging, land clearance, overfishing, or large-scale mining and mineral processing, the best option will generally be to encourage the rapid growth of a large and politically powerful tourism industry. In areas where threats are more distant, or which are already protected, there is more opportunity to restrict tourism development to low-impact, high-value activities, closely integrated with conservation planning. Hence, tourism is a conservation tool principally for wilderness outside protected areas, where it has less impact than logging or livestock, whether in developed or developing nations.

Tourism in Protected Areas

Inside protected areas, tourism has more environmental impacts than conservation alone, and tourism and recreation need to be managed to maintain the primary conservation value of the area concerned. Note, however, that tourism is often not the most serious source of anthropogenic impacts in protected areas. Weeds, pathogens, feral animals and pollution from external sources are at least as significant in many areas (Worboys 1997). In addition, tourism and recreation are one justification for the declaration of protected areas. And finally, there is the ever-present hope that tourism in protected areas will motivate people to vote or pay to conserve wilderness and increase the protected area estate.

Commercial tourism in wilderness and protected areas, including commercial outdoor sport, is growing faster than individual recreation, including outdoor education (Buckley 1998a, Watson this conference). This may probably be ascribed to three broad social trends. The main one is the increasing urbanization of the richer western societies, so that fewer and fewer people learn even basic backcountry skills during childhood. They see natural outdoor environments on television, so they know that these areas exist. They have less and less experience of these environments in their everyday life, so they want to visit them whilst on holiday. They don't know what to do when they get there, so they want an experienced guide. They have more money and less time, so they will pay to be taken directly to places which might take some time to find on their own. In addition, as more and more people begin to treat outdoor activities as holiday experiences rather than everyday recreation, there is a trend for them to try different types of activities and different holidays, rather than sticking to one. Since outdoor recreational equipment is becoming increasingly sophisticated and hence expensive, it makes sense for people to rent equipment as well as hire a guide. The overall effect is that outdoor recreation is perceived as a purchasable product, available to the unskilled and unequipped through commercial tour operators.

What difference does this make? What difference does it make to wilderness areas or land managers if visitors come as commercial tourists rather than private individuals? It makes a big difference. Whilst private individuals may form recreational clubs and associations, and may complain about restrictions imposed by land managers, they rarely have sufficient political power to oppose the authority of the land managers. In addition, they rarely ask for land managers to provide facilities. Their attitude is "let us in and leave us alone". Commercial tourism, in contrast, is part of very large industry sector which, though politically disorganized in the past, is fast becoming a powerful and vocal lobby group. And they lobby not only for access, but for facilities provided at the public expense, such as carparks and formed tracks and toilets and litter bins. Particularly where they have paid permit fees, they expect these fees and more to be spent on providing them with facilities. They often expect the right to construct private accommodation, and they may argue for preferential or exclusive use rights. They may expect land managers to provide rescue services and liability indemnities. Commercial tourism is not necessarily good or bad, but it is different from private recreation.

Environmental Impacts and Management Tools

Different recreational activities have different impacts in different ecosystems, and different impacts have a different ecological significance in different ecosystems. To use an oft-quoted example (Buckley 1998b, 2000, in press), trampling can cause significant and long-lasting damage to soils and vegetation in ecosystems such as alpine scree fields or arid areas with cryptogamic crusts, but has far less impact in tropical or subtropical rainforest with a dense understory filled with stinging trees and thorny vines. Weeds, pathogens and human voices, in contrast, are unlikely to have lasting impacts in extreme environments such as alpine mountain tops, but can have major impacts in temperate and tropical ecosystems.

In general, the environmental impacts produced by different types of recreational activities are known only at a qualitative level. Although a large number of quantitative and experimental studies have been conducted (Cole 1995), they have focused very heavily on one or two types of impact, particularly trampling; and though this is easy to measure, it is rarely of great ecological significance.

Historically, considerable effort has been devoted to quantifying the environmental impacts of trampling, probably because it is easy to measure experimentally. The most comprehensive review of visitor impacts currently available (Liddle 1997), for example, is devoted largely to the impacts of trampling. These include effects on the physical environment, such as changes in soil compaction, bulk density, penetrability, infiltration rate, moisture content and microflora. They also include effects on the biological environment, such as changes in plant biomass, cover, height, growth form, phenology, physiology and flowering, and behavioral and population changes in burrowing animals, animals moving above ground, and animals moving under snow.

The major conclusions from all this work seem to be: (a) we still don't have enough information to predict or model the types and intensities of impacts from different types of trampling in different types of ecosystem in any general sense; (b) the sensitivities of different ecosystems to trampling vary enormously; (c) if trampling is heavy enough in any ecosystem, plant cover will die and local soil erosion, sometimes to considerable depth, will occur; (d) if trampling ceases, soil and vegetation will generally recover at least to some degree, over various timescales which may be very long; (e) 4WD vehicles, trailbikes, mountain bikes and particularly horses cause vastly greater impacts than hikers; and (f) with few exceptions as noted below, the direct impacts of trampling itself do not extend far beyond the actual track, and if trampling ceases, they do not continue to expand.

The main exception to the last of these is that in some soils, steep downhill tracks may continue to erode even if the track is no longer used. Even taking this into account, however, the overall conclusion is that the total area of soil and vegetation affected by trampling on tracks is a minuscule proportion of the total area of wilderness.

Of far greater ecological concern, therefore, are a number of related but less obvious impacts. These may include impacts on populations of rare or endangered animal species,

whether through noise, visual disturbance, barriers to movement, or the introduction of pathogens, which may occur over a far greater area than the tracks themselves. Another example is the introduction of weeds, soil pathogens and waterborne pathogens, which can also spread well beyond the extent of the tracks themselves, and which are generally impossible to eradicate once introduced (Buckley and Pannell 1990, Buckley 1998b, 2000, in press).

Quantitative studies of more critical impacts are still very sparse, and more are urgently needed. In particular, such studies need to investigate whether there is a threshold level of the activity concerned, beyond which impacts become effectively irreversible. In addition, they need to quantify the types and intensities of anthropogenic stresses, related to tourist activities, as well as the types and degrees of impact on different environmental indicator parameters in different ecosystems.

Such approaches require detailed scientific studies with adequate controls, replication, and sampling and measurement techniques, but this is expensive. Land management agencies rarely have adequate funding to support scientific research. The tourism industry has little interest in quantifying its own impacts, and government granting agencies for scientific research typically accord low priority to applied studies of this nature. The current shortage of quantitative data on the critical environmental impacts of tourism and recreation in protected areas is therefore likely to persist.

Even less quantitative information is available on the effectiveness of visitor management tools used by protected area agencies. Such tools include regulatory approaches such as quotas, zoning, permits, and restrictions of various types; economic instruments such as charges and fees to restrict numbers or particular activities; physical infrastructure to harden areas against human impacts; and education and interpretation programs to encourage minimal-impact behavior. In general the tourism industry tends to favor hardening, especially if carried out at the park's expense. It also favors education, but only if it is free and perceived as adding value to tours. It sometimes supports quotas, but only if they are grandfathered to existing operators and serve to reduce competition.

Information Requirements

Broadly speaking, the information which wilderness and protected area agencies need to manage tourism falls into three main categories. The first is the long-standing category of land and visitor management tools and indicators, as outlined above. The second category is economic. Land managers often want to know how much their land is worth

for tourism, in order to lobby more effectively for government funding. They also want to know how much they can charge visitors and commercial tour operators, to make up the shortfall in their operational budgets when government funding is inadequate, as it nearly always is. The third category relates to operational management for parks which do allow commercial tourism operations. Three specific issues in this category are attracting particular attention at present: (a) accreditation, screening and auditing of individual operators; (b) potential liabilities of the management agency and tour operators to each other and to clients under various circumstances; and (c) requirements for minimal-impact equipment, education and practices. Most of this research is still in its infancy.

Conclusions

I have argued above that those who value wilderness conservation need to join forces with the tourism industry to gain political and market power before it is too late. Such partnerships will not always be easy. If we are to dance with the messy monster, we must do so with decorum and at arm's length, because there will be no chaperone. The fundamental reason for conserving wilderness is to prevent the collapse of the planetary ecosystem, not to provide a tourist playground. For wilderness conservation, tourism is a means, not an end.

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Wilderness in Australia: What's Happening in a World Context

Ralf Buckley

Abstract—Wilderness in Australia has no formal legal designation at a national level as it does in the United States. In addition, new federal environmental legislation abdicates responsibility almost entirely to the States. A national wilderness inventory has recently been completed, but abandoned by the current federal government. Almost all wilderness recreation in Australia is in national parks, which are in fact a State designation, and in World Heritage areas. Private recreation and commercial tourism are growing rapidly in these areas, pushing into backcountry wilderness as well as frontcountry, increasing impacts and consuming an ever greater proportion of diminishing management budgets. Park managers are seeking funds from tourism to contribute to operating costs, and examining tour operator accreditation schemes to reduce *per capita* impacts.

There are no national forests in Australia, only State forests, and these are managed almost entirely for logging. The Regional Forest Agreements, a joint federal-state political process supposed to allocate public forests appropriately between production forests and new parks, has led to accelerated logging in wilderness areas of high conservation value, minuscule increases in the protected area estate, and little or no increase in management budgets. The tourism industry is now sufficiently concerned at this decrease in scenic destinations that it has begun, albeit barely, to lobby in concert with conservation groups for a form of tourism land tenure or recreation reserve, analogous to the wilderness areas managed by the United States Forest Service.

There is no legislated national wilderness designation in Australia, though wilderness is a component of protected-area planning in particular States. Wilderness is hence largely a descriptive rather than a legal term. Wilderness is an important concept in Australia environmental and land management policy, however. Indeed, one of the country's four principal nongovernment organizations is named The Wilderness Society.

My aim here is not to review the history of wilderness science and politics in Australia, but simply to summarize major current issues and controversies. These fall into three principal categories:

- the National Wilderness Inventory
- recreational pressures on wilderness in protected areas
- political controversy over future management of wilderness in public forests

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Ralf Buckley, Director, International Centre for Ecotourism Research, School of Environmental and Applied Science, Griffith University, Parklands Drive, Southport, Queensland, 4217, Australia. Telephone: 61 7 55 948675, Fax: 61 7 55 948895, e-mail: r.buckley@mailbox.gu.edu.au

National Wilderness Inventory

The federal government has for some years been compiling a national inventory of wilderness throughout Australia, including an inventory of wild and scenic rivers. This has been a large-scale exercise involving the compilation of data from all possible sources including new studies commissioned specifically for the NWI. Information has been available on the Environment Australia Website www.ea.gov.au, but only in summary form: the detailed information compiled during the NWI has not been published. Recently, the NWI has culminated in the Wilderness Delineation Project, where expert teams have carried out aerial and ground surveys of areas identified by the NWI as of highest wilderness quality. These surveys focused initially on core areas, adjusting wilderness rankings where appropriate. They then examined the edges of each area, delineating practical boundaries which could potentially be gazetted or at least identified through a series of national wilderness maps.

At the end of June 1999, however, the current federal government cut all funding to the National Wilderness Inventory, the Wilderness Delineation Project and the Wild and Scenic Rivers Branch of Environment Australia. There appears to be no mechanism or commitment to publish the considerable volume of data collected and analyzed to date. Nor, apparently, is there any intention to proceed to the logical next step, which would be to negotiate some form of joint federal-state wilderness agreement and legislation.

Such an agreement could give formal recognition to wilderness areas identified in the Wilderness Delineation Project. Their national significance could be recognized, and they could be branded as National Wilderness for tourism marketing. They could also be identified as priority areas for conservation, with restrictions on activities which would reduce wilderness values, such as vegetation clearance, construction of roads or powerlines, and so on.

The Commonwealth decision to close down the wilderness component of Environment Australia might be seen as simply a step from federal research to state implementation, were it not for two critical factors. In some States many of the areas identified in the NWI, such as military training areas, are in fact under Commonwealth control. Other areas, such as World Heritage, are under joint Commonwealth-State control. In either case, the States cannot proceed without Commonwealth consent and involvement. Even for land under State tenure, State governments cannot proceed unilaterally because they have no information on which to act—the detailed data from the NWI and WDP has not been made public even to State governments.

This situation is particularly ironic in view of recent history. When the Commonwealth first proposed the designation of areas such as South-West Tasmania, the Wet Tropics of Queensland, and Kakadu National Park as World

Heritage, the State Governments opposed the nominations and withheld data which the Commonwealth wished to use.

Wilderness in Parks: The Growth of Tourism

Historically, national parks in Australia have been perceived as areas where fauna and flora, water quality and wilderness quality are all protected for posterity. Certainly, parks are for people too, and recreation has long been a significant land use in particular parks. In Australia, however, recreation has always been secondary to the primary conservation purpose of the parks. In most parks, high-intensity recreational activity has largely been restricted to relatively small sacrifice zones near roadheads and other entrances. Currently, however, there is a worldwide trend to increased use of conservation reserves for commercial nature, eco and adventure tourism (NEAT) as well as private outdoor recreation. Parks are being managed more as playgrounds than preserves. Plant and animal species, airsheds and water catchments, whose security was supposedly assured through inclusion in protected areas, may now be threatened by tourism and recreation inside those reserves.

In addition to an increase in the total number of visitors to national parks, there is also an increase in the proportion visiting as commercial tourists rather than private individuals. This trend to commercial tourism is important for wilderness management, because tourism is a large and powerful industry with considerable political power. Some members of the industry view commercial tourism operations in national parks as a right. This view is not held by environmental groups and park management agencies. Quite apart from philosophical and legal concerns over the primary purpose of conservation reserves, there are concerns about the ability of park services to manage protected areas for conservation, if management for tourism were given a higher priority.

If governments believe that parks can meet their management costs by levying the tourism industry, they may fail to provide the basic resources required for fundamental conservation management, e.g., for control of weeds, pests, pathogens, feral animals and fire, and for monitoring and management of endangered species populations.

If the tourism industry believes that any financial contributions it makes to park management should be used for tourism infrastructure, such as carparks, tracks and toilets, then park management agencies will be left without the resources for basic conservation management. If parks obtain their funding through their value for commercial tourism rather than their value for conservation and private recreation, it seems likely that park management agendas will be modified to reflect the priorities of commercial tourism. This would apply whether funding is derived directly from tour operators or from governments which treat parks primarily as a basis for short-term economic returns through tourism, rather than longer-term economic, social and environmental returns through conservation.

This is not an argument against commercial tourism in national parks, but a question of priority and perspective. In Australia, parks are legally designated for conservation first, and private recreation second. Commercial tourism is

potentially a valuable adjunct to either or both in so far as it adds economic and social value without reducing the environmental and social value of the conservation estate. These priorities, of course, are not solely the view of conservation groups: they are specified by the statutes under which national parks were established in most countries.

In Australia, attitudes to commercial nature tourism in national parks are currently divided and ambiguous. Several states have produced strategies or draft strategies for nature tourism or ecotourism, but these have been produced by different government agencies and have met with varied receptions. Queensland, for example, has an Ecotourism Plan, but this was produced by the tourism portfolio rather than the park management agency, and is a general document not confined to the conservation estate (Queensland 1997). Implementation is the responsibility of an environmental group in the state tourism portfolio, relying largely on public communication rather than a statutory approach.

In New South Wales, the parks management agency produced a Draft Nature Tourism Strategy in response to large increases in visitor numbers and the growth of commercial tourism (Worboys 1997). It has not been adopted to date, however, because of public perception that it would constitute a *de facto* grant of rights to commercial tourism in public national parks. Western Australia has a Nature Tourism Strategy (Western Australia 1997) which has apparently been adopted by both the tourism and land management portfolios.

In some states at least, funding for basic park management is perilously low, and park management agencies are looking closely at nature tourism as a potential source of operating revenue. Most states already charge park entrance fee and operator permit fees, at least in the more heavily visited parks. Some are considering quite substantial increases in fees for commercial tour operators.

One model which might be adopted more widely is that used by the Western Australian Department of Conservation and Land Management for Purnululu National Park in the Kimberley region. This agency issues a single licence for the exclusive right to run helicopter overflights over the Park's famed beehive-shaped sandstone domes. The licence is allocated by tender, and the successful tenderer reputedly pays substantially for the privilege—enough to meet the entire management costs for the park. Because of the fragility of the sandstone domes, the management agency has a deliberate policy to encourage overflights rather than on-ground visitors, even though noise from helicopter and light aircraft causes considerable impacts on backcountry hikers, and perhaps also on native birds.

Wilderness Tourism in State Forests and Other Public Lands

Australia has a federal system of government, but its public forest management agencies are at a state government rather than a federal level. In Australia, tourism is only now being recognized as an important land use in public forests. Historically, because of public concern and controversy over logging and woodchipping, state forestry agencies have completely banned the public from some areas, with special legislation in some cases. In other areas,

however, state forests are used extensively for private recreation, principally by people who want to travel in 4WD vehicles, light fires, carry firearms, bring pets, and other activities generally restricted or banned in national parks. Because this is largely private recreation rather than commercial tourism, however, it has largely been ignored in land use policy. Its social economic value as measured by travel costs, however, is an order of magnitude higher than gross income from logging and woodchipping (Driml 1997, Ward 2000), even without taking into account the far higher environmental costs of logging.

In cases where land use has actually changed from logging to conservation and tourism, as in the Queensland Wet Tropics, actual income also increased by an order of magnitude (Driml 1997). In areas of southeast Australia, where logging has historically been subsidized by the public purse and woodchips are still sold for as little as 9 cents a tonne, the relative economic gain from changing to tourism as a principal land use would be even greater.

While state forests are very important from a wilderness conservation perspective, forests make up a relatively small proportion of total land area in Australia. There are large tracts of public wilderness land in the arid zone. Some of this is in national parks, but much is in Aboriginal reserves or vacant Crown land. Most is under pastoral lease. Since cattle are restricted to areas around waterholes and stock bores, however, even pastoral leases may contain wilderness areas several thousand square kilometers in extent. Both tourism and oil exploration are increasing in the arid zone, but the impacts are far smaller than those of logging in state forests.

Regional Forest Agreements

Until a few years ago there were a number of federal environmental controls on logging. Logging and woodchipping licences were granted by state government agencies, but most woodchipping is for export, which gives the federal government the constitutional right to trigger its own environmental legislation. This backstop, however, has been opposed vigorously by the forestry industries and at least some state forestry agencies, for many years.

Both the current right-wing federal government and its left-wing predecessor have successively abandoned their environmental powers to the state governments, firstly under the federal-state Inter-Governmental Agreement on the Environment, and more recently through abolishing the Register of the National Estate, removing export controls as a trigger for federal EIA, and greatly weakening both the triggers and substance for federal EIA and conservation law. Some state governments, such as Queensland, have simultaneously weakened their own EIA and nature conservation law. Protection for wilderness in Australia through planning and endangered-species legislation, therefore, is currently at a very low ebb.

In addition, during the last couple of years, again in response to lobbying from the timber industry and state forestry agencies, federal and state governments have embarked on a series of so-called Regional Forest Agreements. The intention is that all public forests throughout Australia should be subject to so-called Comprehensive Regional Assessments; those of high conservation value,

including wilderness, should be converted to national parks; and the remainder should be allocated to production forestry essentially free of environmental controls.

This might appear to be a reasonable enough approach if carried out competently, with adequate time, resources, expertise, and public participation, and without political bias. In practice, however, it is a highly political exercise aimed at removing environmental controls from logging and woodchipping in Australia's few remaining stands of old-growth forests, even though this will only prolong the current lifestyle of rural timber towns by a few years at most, whilst destroying their future opportunities for long-term livelihood from nature tourism. No doubt this story sounds remarkably familiar to those from the U.S.A.

The RFA process has proceeded separately in each state. When it started it was perceived as a political contest between logging and conservation. The tourism industry and private recreation received little mention. As the process has proceeded, tourism and recreation have emerged as a critical component. This has occurred principally through representations from individuals in research institutions and government agencies, environmental groups, and specialist organizations such as the Ecotourism Association of Australia, off-road vehicle associations etc. Until very recently the mainstream tourism industry, including national associations, state government agencies and large tourism corporations, has taken little or no part in the Regional Forest Agreement process.

Concerns and claims raised by environmental groups about the conduct of the RFA process in different states include the following:

- information on the conservation values of state forests is very scanty, with new species still being discovered at intervals, and the Comprehensive Regional Assessments have been written up largely without time or resources to carry out adequate baseline surveys;
- public involvement has been very limited, and often restricted to noncontroversial aspects such as European cultural heritage;
- land with no trees of interest to the logging or woodchip industries has been added to the forestry estate specifically so it can then be allocated for conservation, leaving all the forested or timbered areas for logging and chipping;
- even after the forestry and parks agencies reached agreement on a state RFA, secret political deals at ministerial level led to key areas, scheduled for conservation, being reallocated to production forestry;
- continued logging and woodchipping in Australia's few remaining stands of old-growth forests could only prolong the current lifestyle of rural timber towns by a few years at most, whilst destroying their future opportunities for long term livelihood from nature tourism.

The RFA process may well have helped to raise public awareness of the conservation, wilderness and tourism value of old growth forests in Australia. Perhaps the most impressive demonstration of this occurred in Western Australia, where several hundred prominent members of the right-wing political party which currently holds government in that state, staged a media event in which they

simultaneously telephoned the State Premier on their mobile phones in order to protest the continued logging of forests in the southwestern part of the state. In Western Australia, the forests and parks were managed by the same government agency, which has invested in infrastructure for forest tourism in some areas and is well aware of its economic value. This agency has now been split again (2000).

It is possible, and indeed quite likely, that public concerns may lead to the repeal of Regional Forest Agreements during the next decade. By then, however, it will be too late. The areas will already have been logged. Historically, whenever suggestions have been made that an area of forest might be converted to national park, the rate of logging has intensified dramatically; so that by the time the area is designated as park, most of its forest cover has been cleared (Ward 2000).

Whilst individual staff in the State Forestry Commissions now recognize the importance of conserving old growth and wilderness areas as a resource for nature tourism, the agencies as a whole seem to believe that they will be able to profit from tourism without changing current logging practices. Meanwhile, environmental groups argue that a national process which was supposed to protect forest areas of high conservation value has in fact removed existing environmental controls and hastened the rate of clearing. They argue that this has occurred not only in areas with tall trees and high-value sawlogs, but also in areas which are clear-felled simply to sell woodchips at bargain basement prices.

In July 1999, tourism and conservation interests joined forces to lobby the Queensland State government in regard to the South-East Queensland RFA. Private tour companies, two tourism research organizations, and the Queensland state branch of the peak national tourism industry association joined as signatories to an open letter to the State Premier by environmental groups. The Premier of Queensland was quoted as follows: "The Federal Government has promised \$10 million at the end of the RFA process which we will forego if we opt out. \$10 million is a very small percentage of the money involved in this process and we stand to gain far more from a sensible forest management scheme" (Beattie 1999). On 16 September 1999, the Queensland Government, timber interests and environmental groups signed the South East Queensland Forests Agreement. As of March 2000, this has not been ratified by the federal government and is hence not an RFA. The Premier, however, has stated that the State will proceed independently, irrespective of Commonwealth endorsement (Keto and Scott 1999).

Research Needs for Wilderness Tourism in Australia

Australia's Cooperative Research Centre for Sustainable Tourism (CRC Tourism), recently carried out a three-stage

survey of nature tourism research priorities held by relevant land management agencies and tourism associations in all states and nationally. This included forestry agencies as well as parks and heritage agencies. Economic issues received strong emphasis, in addition to long-standing research requirements for land and visitor management, and more recent concerns in relation to risk and liability.

Research priorities put forward by different agencies fell into three broad categories. The first category is economic and market issues. These issues include the size of the nature tourism sector, its contribution to regional economies, the value of public lands in contributing to this sector, infrastructure and asset management costs, and mechanisms for funding ongoing management costs, both through public sector budget processes and through private investment.

The second category relates to commercial operations management. This includes arrangements between land managers and tour operators, permitting and licensing, accreditation, liability and insurance, environmental management systems and performance, cooperative research programs, and guide training programs.

The third category covers land and visitor management: that is, management tools and indicators for assessing and maintaining the quality of the natural environment and visitor experience. This includes effectiveness of visitor education and other visitor management tools, design of environmental monitoring programs, relative significance of tourism or other conservation management issues such as weeds, pests, feral animals and fire, and management issues for new and emerging land uses and recreational activities.

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Economic Growth, Ecological Economics, and Wilderness Preservation

Brian Czech

Abstract—Economic growth is a perennial national goal. Perpetual economic growth and wilderness preservation are mutually exclusive. Wilderness scholarship has not addressed this conflict. The economics profession is unlikely to contribute to resolution, because the neoclassical paradigm holds that there is no limit to economic growth. A corollary of the paradigm is that wilderness can be preserved in a perpetually growing economy. The alternative, ecological economics paradigm faces a formidable struggle for credibility in the policy arena. Wilderness scholars are encouraged to develop research programs that dovetail with ecological economics, and wilderness managers are encouraged to become conversant with macroeconomic policy implications.

Economic growth is an increase in the production and consumption of goods and services. It refers primarily to national economies and is usually measured in terms of gross domestic or gross national product (GNP). Economic growth is achieved via increasing population, per capita consumption or both. It is highly valued by the American public and is a goal of the United States government.

Economic growth has also been identified as the limiting factor for wildlife conservation at the national level, because virtually all cases of species endangerment are a function of economic growth (Czech 1997; Czech and Krausman 1997a; Czech and others 2000; Wilcove and others 1998). Economic growth entails the liquidation of natural capital such as forests, aquifers, and mineral deposits (Czech 2000a; Jansson and others 1994). Many of the economic developments that threaten species simultaneously threaten wilderness, and economic growth may be considered the ultimate challenge to wilderness preservation.

An argument that is commonly employed against this view states that economic growth is necessary to produce institutions that preserve wilderness. Proponents of this argument point to the lack of wilderness designations in developing countries, and they contrast that lack with the relatively outstanding wilderness preservation system in the highly developed United States. However, this argument overlooks three anomalous characteristics of the United States.

First, the United States contains vast tracts of rugged landscape that have been resistant to development. One would not expect the United States to be a bastion of

wilderness preservation if, for example, it consisted entirely of arable land. The lack of tallgrass or Palouse wilderness is evidence for the susceptibility of arable lands to development, as is the high percentage of designated wilderness that is rugged, arid or otherwise difficult to develop.

Second, the United States contains an unrivalled wealth and diversity of natural resources. Few of these resources were employed at the dawn of American history, partly because the Native American tribes had been decimated by diseases that swept the continent ahead of the European immigrants (Stannard 1992). The extremely high ratio of natural resources (including acreage) to humans allowed the new American civilization to quickly amass vast amounts of money, which could then be spent on wilderness preservation and other “amenities.” While this history supports the notion that economic growth once contributed to wilderness preservation, it does not support the argument that it still does. The ratio of natural resources (especially acreage) to people that existed during frontier America cannot be replicated today, especially as technology has made it possible to develop previously uninhabitable environments. The marginal returns to wilderness preservation provided by economic growth are diminishing.

Third, the United States has been successful in exploiting foreign labor and injecting its economy with money liquidated from foreign natural capital. This has had the effect of shifting wilderness preservation potential from other nations to the United States.

In addition to the anomalous nature of the United States as a wilderness preserver, the argument that economic growth is necessary for wilderness preservation commits the “fighting fire fallacy.” One may fallaciously argue that the cause of a disastrous fire can be traced to the lack of a promptly employed backfire, without acknowledging that the backfire would have never been needed were it not for the original fire. Neither economic growth nor anything else would be necessary to protect wilderness, were it not for the threat to wilderness originally posed by economic growth.

Congress implicitly acknowledged the impact of economic growth on wilderness when it passed the Wilderness Act of 1964 (Public Law 88-577):

In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring source of wilderness.

Despite the primacy of economic growth as a threat to wilderness, wilderness scholarship has been nearly silent about economic growth. This silence may result from several phenomena. First, it probably reflects a lack of interest.

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Brian Czech is Conservation Biologist, U. S. Fish and Wildlife Service, 4401 N. Fairfax Drive, Room 670, Arlington VA 22203 U.S.A.

Wilderness scholars and managers presumably have more interest in natural history, ecology and outdoor recreation. In any profession, some people practice primarily for the enjoyment derived from working with the subject. The fact that economic growth is the limiting factor for wilderness preservation may be overlooked by those preoccupied with enjoying wilderness while it lasts.

Second, the silence probably reflects wilderness scholars' lack of macroeconomic expertise. Many wilderness scholars are concerned with the threat of economic growth to wilderness, but they feel powerless to address this threat because they have studied neither the history nor the theory of economic growth. Scholars work in a peer-reviewed world where expertise is essential for making assertions, and they seldom conduct research on topics not covered in their graduate curricula. Alternatively, scholars with limited macroeconomic expertise may naively subscribe to the aforementioned argument that economic growth is prerequisite to wilderness preservation.

Some wilderness scholars may avoid the economic growth problem because they perceive it as self-evident. They may be concerned about economic growth but assume that the problem is so obvious that it merits neither research nor discussion. They are evidently unaware of the content and influence of neoclassical economic growth theory (as discussed below).

Finally, others may avoid the topic because they think solutions are unattainable. They may hope that economic growth will taper off in time for the sake of wilderness preservation, but fatalism prevents them from believing that their research or management can be used to affect the outcome.

The purpose of this paper is to familiarize wilderness scholars and personnel with the issue of economic growth vs. wilderness preservation, so that they may enter into more productive macroeconomic dialogue with economists, policymakers and the public. My objectives are to summarize the literature on economic growth and wilderness, describe the institutionalization of economic growth in the United States, outline competing theories of economic growth, introduce the nascent field of ecological economics, and provide recommendations for conducting and applying ecological economics research to wilderness preservation.

Economic Growth in the Wilderness Literature

I used the University of Arizona's Sabio □ literature referencing system and found 2,775 entries indexed with the key word "wilderness." I added the keyword "economic," and the list was reduced to 15 articles, then to three articles when I added the keyword "growth." All were book chapters: one description of wilderness valuation in Scotland (Hanley and Craig 1991), one third-world critique of wilderness preservation (Guha 1995), and one discussion of the threats of the property rights movement to wilderness (Chisholm 1996). None of these chapters (or any of the other 12 indexed under "wilderness" and "economic") was primarily about the threat of economic growth to wilderness, much less possible solutions. These chapters were revealed by the literature search

simply because they were found in books that contained other chapters related to economic growth.

International Journal of Wilderness (IJW), the only academic journal devoted to wilderness issues, is not indexed by Sabio. I therefore reviewed the 137 articles that have been published in IJW since the inaugural issue. The only one that focused technically on economic growth provided a confusing message about its propriety. Power (1996) disputed the argument of some anti-wilderness interests that wilderness designation tends to dampen the economic development of surrounding areas. He noted that economies neighboring wilderness have more potential for growth because workers and businesses are attracted to beautiful and natural surroundings. He identified a resulting conundrum: "The economic problem we need to be focusing upon is how to keep attractive natural environments from being destroyed by the growth they stimulate, not how to fight economic depression caused by protecting natural areas and wilderness." But he provided no suggestions as to how this problem might be addressed and proffered instead, "The point is that people care where they live... This is important to the future development of our nonmetropolitan areas. In the competition to attract both new residents and new businesses, the quality of the natural and social environment is going to be important. Wilderness protection, by granting permanent protection to those landscapes that are most unique in a region, can be an integral part of such an economic development strategy." These statements are consistent with the view that continued economic development around wilderness is appropriate (as were a series of presentations delivered at a 1989 wilderness conference; Lime 1990). As to the "permanent protection" afforded by wilderness designation, the Director of the National Park Service provided a pivotal point: "The same democracy that raised the wilderness system can also raze it" (Kennedy 1996).

Democracies and other governments that lack the aforementioned anomalies of American history may raze the wilderness before wilderness systems are ever raised. In Namibia, for example, "Wilderness must be planned in a way that ensures that its total economic value, realizable by both local land holders and society as a whole in Namibia, is higher than the value of alternative nonwilderness land uses. Failure to ensure this will mean that, as demand for rural land and income generation grows, wilderness will be converted to these other uses" (Barnes 1998). In other words, because Namibians lack the high standard of living enjoyed by Americans, Namibian wilderness preservation is already dependent on a market favorable to it. But Barnes (1998) explored neither the possibility that economic growth eventually drives the value of alternative land uses beyond "realizable" wilderness value nor that realizable wilderness value in a growing economy will eventually be extracted at an intensity high enough to "de-wild" the wilderness.

The only other IJW author who explicitly addressed economic growth was Clugston (1998), who noted that "A preoccupation with economic growth and consumption is fundamentally contrary to awakening the ecological sensibility that we are striving to cultivate." As a solution, Clugston (1998) proposed spiritual transcendence. Similarly, Oelschlaeger (1995) spoke of the "folly of sustainable development" and claimed, "But there is an alternative to

sustainable development, one that places wildness at its center.” The alternative was a biocentric spiritual plane, and the recommendation for reaching it was devoid of research and policy recommendations. Neither Oelschlaeger nor Clugston proposed economic alternatives to economic growth.

In stark contrast to Oelschlaeger (1995), Faries and Cervigni (1998) took neither a spiritual approach nor denied the validity of sustainable development. Curiously for an IJW article, Faries and Cervigni (1998) never used the term wilderness either, as if to acknowledge that the “parallel goals of sustainable development and increased investment in biological capital” led simultaneously to economic usurpation of wilderness. Like Barnes (1998), they suggested that integrating ecological values with the market economy was the key to conservation. Whereas Barnes thought that the market could operate to conserve wilderness, however, Faries and Cervigni settled for applying the goal of conservation to “biological resources.”

Several IJW articles that did not address economic growth nevertheless held implications therefor. For example, Roush (1995) classified population growth as the biggest threat to wilderness. Roush also acknowledged the importance of economic growth implicitly by stating, “Surely, we could reduce our consumption and stretch the world’s resources,” but concluded, “The problem finally is numbers.”

Population is an important factor indeed, because it complements per capita consumption as one of the primary components of economic growth. Were it not for the economic activity associated with each human life, however, the raw abstraction of human numbers would threaten nothing. Furthermore, even if the American population were stable, technological development would enable it to liquidate an increasing acreage of wilderness for economic purposes. While population growth is problematic, it makes little sense to view it as more problematic than per capita consumption; both threaten wilderness, and either may increase regardless of the other. The concept that embodies the synthesized impacts of population and per capita consumption is economic growth.

Kelson and Lilieholm (1997) inventoried land activities that were deemed problematic by managers when conducted adjacent to wilderness areas. Their list included logging, road construction and maintenance, livestock production, pollution, urbanization, fire management and various forms of recreation. All of these categories were noted by Czech and Krausman (1997a, 2000) and Czech and others (2000) as major causes of species endangerment in the United States. The remaining categories reported by Kelson and Lilieholm could be rearranged and renamed to mirror the other causes of species endangerment summarized by Czech and Krausman. Kelson and Lilieholm, however, drew no inference to economic growth, and stated that, “Only a few activities were consistently thought to have serious impacts on wilderness... Some high-profile activities, such as industry smoke plumes and oil and gas extraction, are perceived to have little impact on wilderness.”

Kelson’s and Lilieholm’s assessment obscures the fact that industry (including petroleum extraction and refining), whether adjacent to wilderness or not, occurs for the purpose of fueling the very activities (among others) that do occur near wilderness and do diminish wilderness values. Instead of pointing to the perils of economic growth, Kelson

and Lilieholm essentially supported the argument that economic growth is not a problem as long as the right sectors grow. That commonly employed argument fails to acknowledge the complex integration of the economy as a system that expands and contracts more or less as a whole (Boulding 1993), with various sectors only gradually fading in significance.

Managers also appear reticent on economic growth. In a special IJW report on the status and prospects for wilderness in the United States, leading wilderness officials from the four major wilderness managing agencies provided their views of the future (Henry 1996; Jarvis 1996; Jerome 1996; Stokes 1996). None of them even mentioned economic growth. Barnes (1997) reported the results from the Sixth National Wilderness Conference in Santa Fe, where managers joined with academicians in 1994 “to develop consensus on the actions needed to guide wilderness stewardship over the next decade.” Broad categories included policy, administration, cooperation and education. Economic growth was neither a category nor mentioned under any of the categories.

This critical review does not imply that the aforementioned authors were unreasonable in their assessments. The purely spiritual approaches of Clugston (1998) and Oelschlaeger (1995), for example, were appropriate because each wrote for IJW’s “Soul of the Wilderness” feature. Given more room, Barnes (1998) may very well have elaborated on the limitations of marketing conservation in a perpetually growing economy. Power’s (1996) development-accommodating article nevertheless identified economic growth as the real challenge to wilderness. Roush’s (1995) neglect of economic growth per se does not negate the fact that population growth is a crucial challenge to wilderness. While these few authors contributed some important points, this critical review suggests that economic growth constitutes an almost negligible topic in the wilderness literature. Even when the topic is broached, practical recommendations are rarely produced. From the perspective of economic growth as the limiting factor for wilderness preservation, the literature gives the appearance that wilderness professionals have been laboring in futility.

Economic Growth as an American Institution

Despite many clear attempts to alleviate problems caused by economic growth in the legislative and executive branches of government (including the formation and administration of the National Wilderness Preservation System), there has been no coordinated program to slow economic growth, much less to establish a stable gross national product. Politicians and high-level executives jockey to convince constituencies that they will produce the most growth. During the nationally televised vice presidential debate of 9 October 1996, Republican candidate Jack Kemp exhorted, “We should double the rate of growth, and we should double the size of the American economy” (Washington Post 1996). Vice President Al Gore, who authored the ecologically economic *Earth in the Balance* (1992), nevertheless sanctioned the growth race by replying, “Well, the economy is growing very strongly right now... The average growth rate is also coming up. It is

higher than in either of the last two Republican administrations” (Washington Post 1996).

In her annual report for fiscal year 1992, the Republican Secretary of Commerce, Barbara Hackman Franklin (1992) reported that her department had adopted “a seven point agenda for fostering economic growth.” In his annual report for fiscal year 1994, the Democratic Secretary of Commerce, the late Ronald Brown (1994), characterized the activities of his department as “promoting economic growth through [a variety of measures].”

Even in agencies that play an active role in natural resource conservation, economic growth may supersede. The Army Corps of Engineers is the oldest natural resource agency in the federal government and is responsible for much of the nation’s water quality and wetlands conservation. Since the 1970s, the Corps has defined its mission in terms of four programs; National Economic Development, Regional Economic Development, Environmental Quality, and Social Well-Being. In 1983, consistent with President Reagan’s emphasis on regulatory impact assessment, the Corps prioritized economic development (Graves 1995).

One politically popular concept is “sustainable development.” As used in government programs, nationally and internationally, “development” has long been a cryptic term that highlights the measurable benefits of economic growth while ignoring the unaccounted costs (Robinson 1993; Willers 1994). It is the proverbial win-win solution, suggesting that we can have economic growth and ecological sustainability. According to its February 1999 Internet site, “The Department of Commerce promotes job creation, economic growth, sustainable development, and improved living standards for all Americans...” (<http://204.193.243.2/public.nsf/docs/mis-sion-statement>). Yet sustainable development as process is an oxymoron (Botkin 1990). The only legitimate “sustainable development” is one in which development is a noun, where the process of development has ceased, and where a steady state of maintenance has commenced (Czech and Krausman 2000).

The embrace of economic growth by politicians and high-level administrators is readily understandable in light of three interrelated phenomena. First, Americans value economic growth highly; as much as property rights and species conservation (Czech and Krausman 1999). Second, nearly all American noneconomists with a rudimentary education in economics have been taught that economic growth is one of the primary goals of macroeconomic policy (Czech 2000b). For example, in their introductory textbook, Ekelund and Tollison (1988) taught, “The overall goal of macroeconomic policy is the achievement of economic stabilization... to attain maximum economic growth in the present and future.” Third, industry relies on economic growth for increasing profits, so corporate lobbies defend neoclassical teachings about the propriety and perpetuity of economic growth.

There is no reason to view the institutionalization of economic growth as an insurmountable obstacle, however. Slavery and segregation are examples of deeply entrenched American institutions that have been overcome or greatly alleviated as norms evolved. Caucasian women, Native Americans, and African Americans eventually obtained suffrage. Economic sectors from market hunting to organochlorine manufacture have virtually been terminated. Disposal of the public domain officially ended in 1976. The underlying

motivation in each case was the recognition, first by an enlightened few and then by the many, of the great damage done by the erstwhile institutions. The American public values the availability of resources for posterity more than it does democracy, economic growth or property rights (Czech and Krausman 1999). Economic growth is not impervious to a paradigm shift, but the amount of wilderness to be preserved is a function of how soon that shift transpires.

Competing Theories of Economic Growth

Economic growth theory has been through three major episodes (Czech 2000b). During late 18th-century France, an influential academic movement called physiocracy held that agriculture was the foundation of all economic growth. This was a politically motivated theory; its proponents were the landed nobility who were accumulating the ire of the bourgeoisie. Nevertheless, physiocracy contained elements of profound common sense. Among other things, it implied that economic growth was limited by the availability of land. Few physiocrats would have claimed that wilderness could be preserved in a perpetually growing economy.

After Adam Smith’s *Wealth of Nations* was published, physiocracy rapidly lost influence. Land was identified as only one factor of production, and its primacy was not clear. The importance of labor and especially capital could be seen firsthand in the midst of the Industrial Revolution. This new economics would eventually become “classical.” Adam Smith entertained the notion of an end to economic growth, but had no reason to dwell thereon. Thomas Malthus and, to a lesser extent, David Ricardo did dwell on it, but their agriculture-based theories were refuted by the evidence of industrialization and ultimately disregarded. John Stuart Mill’s vision of the “stationary state” failed to ring with the masses like Marx’s alternative utopia. With capitalism and socialism vying for world domination, at a time when natural resources were relatively plentiful, the competition between economic systems was largely about producing faster growth.

From 1885 to 1908, Alfred Marshall synthesized classical economics and modified it with theories of cost, value, distribution and marginal utility. *Principles of Economics* (1890) became one of the most influential textbooks of all time, and Marshall’s tenure at Cambridge University is identified as the dawn of “neoclassical” economics. There have been no widely accepted paradigm shifts in the economics discipline since then, unless one so classifies John Maynard Keynes’ departure from *laissez faire*.

Economic growth was not a major topic of neoclassical economics in its early stages. After the Depression and the wide acceptance of Keynesian macroeconomic manipulation, however, economic growth became a relatively major subdiscipline. One of today’s most widely cited models was developed by Nobel laureate Robert Solow (1970). Solow’s focus was “human capital,” that is, intelligence, education, training and experience embodied in ideas, technology and processes. He saw no reason why human capital could not perpetually substitute for natural resources or, therefore, why economic growth could not continue perpetually.

Observations like this, in the context of species endangerment and wilderness disappearance, led many noneconomists

to doubt the validity of neoclassical theory. When the Club of Rome produced *The Limits to Growth* (Meadows and Club of Rome 1972), critique of neoclassical economics came into vogue. *The Limits to Growth* itself has not held up well to economic scrutiny, but an increasing cadre of professional and amateur economists argue that economic growth is indeed limited. These economists generally fall under the rubric of “ecological economics.” While their practice is relatively new, there already exists an International Society for Ecological Economics (ISEE, Solomons, Maryland) that encourages the integration of economics and ecology into a transdiscipline focused on sustainability.

In contrast to neoclassical economics, ecological economics offers a model of economic growth consistent with wilderness preservation (Czech 2000b). It incorporates the natural sciences, especially physics and ecology, to conclude that unchecked economic growth will lead to widespread ecological and therefore economic damage. Essentially, ecological economics builds a model of human economy consistent with the wildlife biologist’s concept of animal population growth (and, in many respects, with physiocracy and classical economics). While natural resources are plentiful, the human economy will grow rapidly. As resources, including space, become scarce, the economy may behave either like a K-selected or an r-selected species. It may either speed past carrying capacity and crash amidst a wasted environment, or it may gradually equilibrate around carrying capacity. For wilderness conservationists, neither of these scenarios is desirable. Wilderness requires that humans engineer an economy that equilibrates at a level sufficiently below carrying capacity to accommodate undeveloped areas.

Research Recommendations

For researchers who intend to produce knowledge “for its own sake,” recommendations beyond those of scientific methodology are impertinent. In selecting research topics that can help build knowledge to assist in wilderness conservation efforts, however, researchers should identify threats to wilderness and then design research that will enable society to address those threats. Threats to wilderness may be proximate or ultimate. Encroaching subdivisions, intensifying ecotourism and infrastructural developments threaten many wilderness areas proximately. Traditional ecological research results may readily be used by managers to reduce or mitigate the effects of these threats. However, reduction and mitigation of impacts does little to affect the occurrence of proximate threats, much less the ultimate threat of economic growth. As Reed and others (1990) noted, “Wilderness will not be preserved if managers adopt a policy of curing rather than preventing problems.”

Wilderness preservation may depend on creative, transdisciplinary research that addresses economic growth as the ultimate threat. The first, most general recommendation is for wilderness scholars to become versed in basic macroeconomics, with a focus on economic growth theory. Wilderness scholars should be familiar with the contrast between neoclassical and ecological economics, particularly their visions of economic growth and the limits thereto. Because ecological economics is a nascent transdiscipline, there is an opportunity for wilderness scholars versed in the

natural sciences to participate in constructing a more ecologically informed economics. ISEE, with its journal *Ecological Economics*, may help facilitate this contribution.

One promising topic for wilderness scholars is the relationship of gross national product to wilderness loss in the United States and other nations. The importance of this topic inheres in its ability to document and illuminate a relationship that has been largely a theoretical construct. Lack of a statistical analysis of this relationship has opened the door for neoclassical adherents like Simon (1996) to claim that wildland acreage in America has actually increased with economic growth (supposedly because the economy has become more urbanized).

Another promising area for study was revealed by Barnes (1998): “For direct use values there is likely to be an optimal size for a wilderness area, beyond which the values per unit of land from recreation and consumptive uses begin to diminish.” Barnes mentioned that this economically optimal size depends on ecological characteristics and on surrounding land use practices, implying that optimal size would change over time. Presumably optimal size decreases as a function of economic growth in the surroundings because wilderness uses comprise a luxury in an economy based on the extraction of natural capital and requiring space for expansion (as all economies ultimately are and do, respectively). Development of models that display this relationship would be helpful for predicting the wilderness impacts to be caused by economic growth. Such predictions would assist wilderness preservation advocates in local policy arenas.

Research that would fall under the rubric of “environmental economics,” which may be classified as a branch of neoclassical economics that specializes in natural resources, may also be useful for wilderness preservation. Valuation of natural capital is the endeavor in which environmental and ecological economics overlap the most, philosophically and methodologically. In some cases, valuation of wilderness amenities can help wilderness advocates in defending the designation and retention of wilderness.

Wilderness values may derive from use or nonuse. Use values derive from direct and indirect use. Virtually by definition, few types of direct use value inhere in wilderness. The best example of direct use value would be equivalent to the amount expended on access fees, which typically do not exist on public lands. The cost of wilderness hunting and fishing permits, guiding fees and other in-wilderness services also qualify as direct use value. From a local government’s perspective, a nearby wilderness can be directly “used” to procure federal payments in lieu of taxes, depending on the management agency involved. In cases where livestock grazing is allowed, grazing fees can be classified as direct use value, but this value results only from compromising wilderness integrity. Loomis (this volume) discusses wilderness direct use value.

Given the relative paucity of direct use values that derive from wilderness, economic defense of wilderness depends heavily on valuation of indirect use and nonuse. Indirect values include costs incurred in traveling to the wilderness, goods purchased for purposes of wilderness use, nearby lodging fees and other services procured around the wilderness.

For direct or indirect use values, costs incurred often underestimate wilderness value. Because public land

management is generally funded through federal taxes, users are not asked to pay market value. Travel costs also tend to be less than wilderness visitors would be willing to pay. Willingness-to-pay studies can help researchers estimate actual use values. Loomis (this volume) provides state-of-the-art information on such studies and additional recommendations for research.

Nonuse values include option, bequest and existence value (Barnes 1998). Theoretically, these too may be estimated with shadow pricing techniques, especially contingent valuation (Loomis this volume), but the propriety of using any type of pricing system for expressing these values is questionable. Valuation research can backfire if it gives the impression that the merit of wilderness designation is to be judged exclusively or even primarily by real or shadow prices. One of the incentives this impression gives wilderness managers, especially in a growing economy, is to promote wilderness use. Increasing demand for wilderness use provides wilderness with higher economic value, but if the demand is realized, wilderness is increasingly impacted. Wilderness preservation will probably always entail defending values that evade monetary pricing.

One approach to a nonmonetary valuation of wilderness is the relative importance method, where respondents rate entities along an importance spectrum. Czech and Krausman (1997b, 1999, 2000) and Czech and others (1998, 2000) used this technique to "value" (relative to each other in nonmonetary terms) such institutions and concepts as democracy, economic growth, property rights, ecosystem health and species conservation. Publics may similarly be asked to rate the importance of wilderness preservation relative to economic growth. More specific studies may address the relative importance placed by the public on preserving a specific acreage of a particular wilderness vs. increasing the scale of a particular local economy a specific amount.

In a functional democracy, wilderness preservation depends on the extent to which a majority comes to value wilderness more than economic growth. For example, if retaining X hectares of wilderness (holding the ecological integrity of the wilderness constant) were more important to the majority than growing the economy past Z trillion dollars gross national product, the majority would mobilize to protect wilderness and would force the economy to stabilize at Z. In economic terms, if the marginal disutility of economic growth to wilderness and other values exceeded the marginal utility of economic growth to material welfare, economic growth would cease. The gradual erosion of wilderness values, in other words, is evidence that additional economic growth is valued more than the current level of wilderness preservation (unless the market is dysfunctional for wilderness preservation—a distinct possibility). Meanwhile, wilderness scholars have established a tradition of public education research. *International Journal of Wilderness*, for example, hosts a regular section on education. Research designed to determine what the public knows about economic growth, why it values economic growth so highly, and how best to impart the principles of ecological economics would be useful for educators and wilderness managers.

Because research on ecological economics education is a new field for exploration, the first studies should attempt to answer very basic questions, like how versed the public is in

economic growth and ecological economics terms. For example, it seems plausible that a majority is aware that economic growth is a function of population size and per capita consumption. If this assumption were errant, however, some very basic education would be required to establish a cogent public discussion on wilderness/economic growth issues. On the other hand, if research revealed that people were already familiar with, for example, the concept of steady state economy, education efforts would more productively commence at a higher level of sophistication.

Finally, research on economic growth theory has tremendous implications for wilderness. While ecological economics has come far in constructing theory and compiling evidence for the existence of an economic carrying capacity, it has not provided an integrated model that is intellectually accessible to the public. If a model was developed that showed clearly, concisely, and inarguably that economic growth was limited and that the problems caused by approaching that limit were already accumulating, the probability that concerned citizens would support a steady state economy would increase (Czech 2000b). As long as the neoclassical model of unlimited economic growth is credible among the public and in policy circles, efforts to curb economic growth are unlikely. Research on economic growth theory is beyond the call of even the most conscientious wilderness scholars, however, and therefore poses a special challenge to natural resources economists or other economists with an interest in wilderness preservation.

Management Recommendations _____

Wilderness managers should also become versed in ecological economics and economic growth theory. This will enable them to refute the misguided claims of politicians and other policymakers who, intellectually or for the sake of political expedience, subscribe to the neoclassical theory of economic growth. Although managers are obligated to deal with everyday proximate threats to wilderness, they should maintain an awareness of the ultimate threat lurking in the background. Maintaining this awareness will produce opportunities for educating the public and policy makers about the perils of perpetual economic growth. Such opportunities may arise via the Internet, newspaper columns, advocacy group meetings, public hearings, and briefings with government officials. Finally, managers can encourage researchers to redirect their efforts to addressing the challenge of economic growth.

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Knowledge of and Attitudes Toward Wilderness in the Southern Appalachian Ecoregion

J. Mark Fly
Robert Emmet Jones
H. Ken Cordell

Abstract—Using two measures of knowledge of wilderness management practices, the general public does not appear to be very knowledgeable about activities allowed in federally designated wilderness areas. This lack of knowledge was found across all of the basic socio-demographic groups. Although two out of three people support setting aside more public lands as wilderness, only a small percent (14%) express strong support. People with a high school education or less, those employed in a natural resource-related job, rural residents and minorities were less supportive than their respective counterparts.

The southern Appalachian ecoregion (SAE) consists of the Appalachian Mountains and Shenandoah Valley, extending southward from the Potomac River on the northern boundaries of Virginia and West Virginia to northern Georgia and the northeastern corner of Alabama. This area includes 135 counties and 37 million acres. It is the source of much of the drinking water for the southeastern region of the United States and is the headwaters of nine major rivers. Southern Appalachia is also home to eight national forests, the Great Smoky Mountains and Shenandoah National Parks, the Blue Ridge Parkway and the Appalachian Trail. Together, these areas form the largest contiguous block of public lands east of the Mississippi River (Cordell and others, 1996). There are 49 federally designated wilderness areas in the southern Appalachian ecoregion, totaling approximately 476,654 acres. The total wilderness acreage in the SAE is about half the size of the Bob Marshall Wilderness. Virginia has the largest number of wilderness areas in the SAE (16) with a total of 166,641 acres, followed by Tennessee with 10 (61,853 acres), Georgia with 8 (86,589 acres), North Carolina with 8 (70,615 acres), West Virginia with 6 (80,852 acres), Alabama with 1 (7,245 acres) and South Carolina with 1 (2,859 acres).

The region has been going through a fairly rapid transformation over the past few decades as its residents try to preserve the region's unique cultural and environmental

heritage in the face of strong socioeconomic, demographic and technological forces impacting the region. More than two million people left the region between 1950 and 1970 because of hard times caused by a loss of jobs to rapid mechanization of the coal mining industry, sharp declines in agriculture and manufacturing and a major shift from rail to highway transportation. The majority of the outmigrants were young, white males with above-average education. Most left the region to seek better job opportunities in Ohio, Michigan and Illinois (Cordell and others, 1996; Helton and Allen, 1996; Isserman, 1997; United States Department of Agriculture, 1986).

The region still has few metropolitan areas and remains relatively rural in nature but many conditions have significantly improved since the 1970s. The population is growing fairly rapidly, much of it attributable to the arrival of recent immigrants attracted to the region's rural mystique, rich history, expanding and diverse economy and range of environmental amenities and outdoor recreation opportunities. Many have sought refuge in the small towns, gateway communities and rural areas surrounding the region's national parks, lakes and forests. Although only 10 percent of those living in the SAE today make their livelihoods directly from the land, about one-half of the residents still live in rural areas, and many maintain active outdoor lifestyles (Cordell and others, 1996; Helton and Allen, 1996; Isserman, 1997; United States Department of Agriculture, 1986).

As this region grows, we are seeing increased fragmentation of private lands and forests and greater recreation demand on national forests and parks. The purpose of this paper is to assess public knowledge of wilderness practices and current sentiment toward the need to designate more wilderness areas. The following research questions are addressed: 1) What is the level of knowledge of selected wilderness management practices in the southern Appalachian ecoregion? 2) How does this knowledge vary by socio-demographic characteristics? 3) What are the attitudes toward setting aside more public land as wilderness? 4) How do these attitudes vary by socio-demographic characteristics?

Methods

Telephone interviews were conducted by the Human Dimensions Research Lab in the Department of Forestry, Wildlife and Fisheries at the University of Tennessee from August 10 to September 21, 1995. Survey participants were selected through random-digit dialing using telephone numbers purchased from Survey Sampling Inc. of Fairfield, Connecticut. Using a stratified sample design, 135 counties

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J. Mark Fly is an Associate Professor, Department of Forestry, Wildlife and Fisheries, P.O. Box 1071 Knoxville, TN 37701-1071 U.S.A., e-mail: markfly@utk.edu. Robert Emmet Jones, Assistant Professor, Department of Sociology, 901 McClung Tower, Knoxville, TN 37996-0490 U.S.A. H. Ken Cordell, Project Leader, USDA Forest Service, Southern Research Station, 320 Green St., Athens, GA 30602-2044 U.S.A.

were selected from seven states (Virginia, West Virginia, North Carolina, South Carolina, Tennessee, Georgia and Alabama). These counties conform to the boundaries of the Southern Appalachian International Biosphere Reserve and have unique characteristics based on biogeographic and ecological conditions. The counties were divided into four geographic subregions (Northern Ridge and Valley, Blue Ridge, Southern Ridge and Valley, Southern Mountain-Piedmont) that run primarily north and south along the Appalachian Mountains (Cordell and others, 1996). Each section was divided into rural and urban segments using rural-urban codes for metro and nonmetro counties developed by Butler and Bealer (1994), resulting in eight strata. A sample quota of 150 participants per strata (a total of 1,200) was used to ensure an equal sample size for rural and urban residents and to represent the geographic distribution of residents across the ecoregion.

A total of 2,829 households were contacted, with a raw response rate (including 1,239 completes and 50 partial completes) of 46 percent and a final response rate (completes only) of 44 percent. Final sample size was 1,239 with a margin of error of +/- 3 percent. The sample had slightly more females and were better educated than the general population.

Questionnaire Content and Measures

The questionnaire was part of a comprehensive biophysical and social assessment of the southern Appalachian ecoregion. It included questions designed to gauge cognitive and behavioral indicators of environmentalism and to identify the socio-demographic characteristics of households and survey respondents.

Knowledge of Wilderness Management Practices—

An environmental knowledge index composed of true/false items was developed in cooperation with representatives of state and federal resource management agencies in southern Appalachia. Items included general questions about wildlife, endangered species, forests and water pollution, as well as more specific questions on these issues framed within a regional context. Questions ranged from difficult to easy. There were two questions that pertained specifically to

wilderness: 1) timber harvesting is permitted in federally designated wilderness areas in southern Appalachia (false), and 2) motor vehicles are permitted in federally designated wilderness areas in southern Appalachia (false). For summary analysis, answers were considered incorrect if respondents answered incorrectly or indicated that they “did not know” the answer.

Attitudes Toward Setting Aside More Public Land as Wilderness—

An environmental attitudes index that addressed issues in southern Appalachia was also developed in cooperation with resource management agencies in the region (Cordell and others, 1996). The index covered items such as timber harvesting, fire management, endangered species, air and water quality and wilderness. Each participant was presented with a statement about an issue and asked to respond using the following five-point Likert scale: strongly agree, agree, neither agree nor disagree, disagree, or strongly disagree. The one item concerning wilderness was, “More public lands should be set aside as wilderness.”

Design of Analysis

Chi square tests were used to determine levels of statistical significance.

Findings

Knowledge of Wilderness Management Practices

Responses to the two questions concerning wilderness management practices suggest that the public has a limited knowledge of wilderness management practices in federally designated wilderness areas. Less than 20% of the survey participants indicated correctly that timber harvesting (17.6%) and motor vehicles (17.3%) are not permitted in wilderness areas (table 1). Using combined scores, less than 10 percent (6.7%) answered both questions correctly (table 1). Knowledge of wilderness management practices also varied little across different socio-demographic groups. Regardless of income, education, gender, ethnic origin, rural/urban

Table 1—Knowledge of wilderness management practices in the Southern Appalachian Ecoregion.

Wilderness management questions	Answered incorrectly	Don't know	Answered correctly
Timber harvesting is permitted in federally designated wilderness areas	50.8%	31.6%	17.6%
Motor vehicles are permitted in federally designated wilderness areas	59.7%	23.0%	17.3%
	None correct*	One correct	Both correct
Combined answers	71.8%	21.5%	6.7%

* Includes “Don’t Know.”
n = 1220

residence, whether or not they were employed in a natural resource related job or indicated they were conservative or liberal, less than 10 percent responded correctly to both questions concerning wilderness management practices (table 2). The one socio-demographic group that had a statistically significant difference was gender, although the actual difference was only five percent. Males were more likely to answer both items correctly (9.8%) than females (4.7%). The percent with neither item correct ranged from 63.4% (non-Caucasian) to 78.4% (incomes greater than \$75,000).

Attitudes Toward Setting Aside More Public Land as Wilderness

When asked if more public lands should be set aside as wilderness, a considerable majority of the survey participants agreed (68.6%), while approximately one in four (24.3%) did not believe that more public land should be designated as wilderness (table 3). A small percentage (7.1%) did not have an opinion either way. When examined more closely,

Table 2—Knowledge of wilderness management practices by socio-demographic characteristics.

Socio-demographic characteristics	None correct	One correct	Both correct	Statistical significance
Income				
<\$15,000	77.8%	16.1%	6.1%	—
\$15-44,999	67.7%	24.3%	8.0%	
\$45-74,999	72.2%	22.2%	5.6%	
>\$75,000	78.4%	14.8%	6.8%	
n = 1092				
Education				
High school grad	72.6%	20.0%	7.5%	—
Some college	69.6%	24.4%	6.0%	
College/post grad	73.4%	20.4%	6.3%	
n = 1215				
Gender				
Female	73.7%	21.5%	4.7%	p<.01
Male	69.0%	21.5%	9.8%	
n = 1216				
Ethnic origin				
Non-Caucasian	63.4%	29.5%	7.1%	—
Caucasian	72.7%	20.7%	6.7%	
n = 1220				
Place of residence				
Rural	69.5%	23.2%	7.4%	—
Urban	74.1%	19.8%	6.1%	
n = 1220				
Natural resource related job				
No	71.8%	21.9%	6.3%	—
Yes	70.5	20.2	9.3%	
n = 813				
Political ideology				
Conservative	71.7%	21.3%	7.1%	—
Liberal	70.6%	23.0%	6.4%	
n = 1016				

Table 3—Attitudes toward setting aside more public land as wilderness.

More public land should be set aside as wilderness			
Strongly disagree	1.3%	Disagree	24.3%
Disagree	23.1%	Neither	7.1%
Neither agree nor disagree	7.1%	Agree	68.6%
Agree	54.6%		
Strongly agree	14.0%		
n = 1183			

however, the number of people with strong opinions was fairly limited. Only 14% strongly agreed that more wilderness areas were needed, but few strongly disagreed (1.2%) (table 3).

Unlike wilderness knowledge, this category showed a number of significant differences across socio-demographic groups. People with some college education, Caucasians, urban residents and those whose job was not related to natural resources were more likely to support setting aside more public land as wilderness than their counterparts (table 4). Among these socio-demographic variables, however, support only ranged from a relative low of 64.6% (non-Caucasian) to a high of 78.2% (income greater than \$75,000). No statistically significant differences in levels of income, gender or political ideology (conservative/liberal) were found.

Summary

According to these limited measures of knowledge of wilderness management practices, the general public in the SAE region does not appear to be very knowledgeable about activities that are permitted in federally designated wilderness areas in that region. Although females were slightly less likely to have answered the two items correctly, this lack of knowledge existed across all of the basic socio-demographic groups including place of residence, natural resource employment and political ideology.

Although two out of three people support setting aside more public lands as wilderness, the degree of support appears to be only moderate. Only a relatively small percentage of the public (14%) “strongly” believe that more public land should be designated as wilderness. Certain socio-demographic subgroups were less likely to support wilderness designations: people with a high school education or less, those who have a natural resource-related job, people who live in rural areas and minorities. Support did not vary by income, gender or political ideology.

Conclusions

What does the general public know about wilderness management practices? What is their attitude toward designating more public land as wilderness? What would we like for the public to know about wilderness? These results suggest that knowledge of what constitutes a wilderness area, in terms of what is allowed, is quite limited. What should the public know about the wilderness preservation system? In terms of a broad-based wilderness education

Table 4—Attitudes toward setting aside more public land as wilderness by socio-demographic characteristics.

Socio-demographic characteristics	Agree	Disagree	Statistical significance
Income			
<\$15,000	70.1%	29.9%	—
\$15-44,999	74.8%	25.2%	
\$45-74,999	74.8%	25.2%	
>\$75,000	78.2%	21.8%	
n = 977			
Education			
High school grad	68.8%	31.2%	p<.01
Some college	77.8%	22.2%	
College/post grad	77.8%	22.2%	
n = 1094			
Gender			
Female	73.5%	26.5%	—
Male	74.2%	25.8%	
n = 1095			
Ethnic origin			
Non-Caucasian	64.6%	35.4%	p<.05
Caucasian	74.8%	25.2%	
n = 1099			
Place of residence			
Rural	69.8%	30.2%	p<.01
Urban	78.0%	22.0%	
n = 1099			
Natural resource related job			
No	77.1%	22.9%	p<.05
Yes	68.3%	31.7%	
n = 742			
Political ideology			
Conservative	71.6%	28.4%	—
Liberal	76.5%	23.5%	
n = 919			

program, what should be the content of the program? Once that is determined, how do we educate or connect with the public? And ultimately, do we need to? Are there other ways to achieve the goals of wilderness?

There is general public support for wilderness in the southern Appalachian ecoregion. It is a positive concept in the public's mind, but the results from this study suggest that most people do not have strong feelings in favor of designating more wilderness areas. Therefore, people are not likely to engage in wilderness activism and related political processes.

In future research, we need to better understand what the general public is supporting. What is the picture they have in their mind when they think about wilderness? Currently, many seem to believe that timber harvesting and motor vehicles are allowed in wilderness areas. What does constitute a wilderness to this vast majority of the population in the southern Appalachian ecoregion? Would increased levels of knowledge about wilderness, alter support for setting aside more public lands as wilderness?

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The Finnish “Social Wilderness”

Ville Hallikainen

Abstract—The cultural roots and images of the Finnish wilderness lie in its use as a source of livelihood practiced in southern and central Finland during the Middle Ages. There are statutory wilderness areas in Finland, but Finnish people consider many other areas as wilderness. It is important for management of the areas, statutory wilderness areas and the other wilderness-like areas to determine what are the features that make an area wilderness, how these areas are used and appreciated by Finnish people. Questionnaires and landscape rankings were used to determine that. Old virgin forests and open bogs are the most important features of Finnish wilderness as revealed by the mental images of Finnish people. In addition, wilderness areas have to be vast, roadless, remote, peaceful, silent and at least near their natural condition. Ponds, streams, wooden trails across bogs and old cabins for common use are consistent with the idea of Finnish wilderness. Finnish people appreciate and use our wilderness areas mostly for picking berries or mushrooms, hunting, fishing and hiking. The experience of peace and silence is the most important motive to visit wilderness.

Finnish hunters and fishermen have used the Finnish wilderness areas to make a great proportion of their living, but they may not have noticed all the wilderness values that we appreciate today (Keisteri 1990; Linkola 1985). Appreciation for Finnish wilderness landscape began to emerge at the end of the 19th century with the national romanticism movement.

There has been national parks and other nature conservation areas in Finland for almost hundred years, but the Finnish word “erämaa” (wilderness) has been used in the nature conservation discussion only for a few decades (for example Sisäasiainministeriö 1982; Virkistysaluekomitean mietintö 1973) Demand for wilderness conservation strengthened considerably about ten years ago as nature activists demonstrated to support protection (Lehtinen 1991). After that, a Wilderness Committee was formed by the Finnish government, and the Committee published its report in 1988 (Erämaakomitean mietintö 1988). After that, 12 wilderness areas have been designated by the Wilderness Act in 1991 (Erämaalaki 1991).

These statutory wilderness areas, as well as most Finnish national parks and other nature conservation areas, are situated in the northernmost Finland (Lapland) where wood processing is the most important industry for the local economy, but tourism takes the second place. These areas have a great influence on tourism income (Kauhanen 1988; Veijola 1992). Wilderness is not found in Finland only in the

statutory wilderness areas or in the other conservation areas. Many people may find their wilderness experience outside these areas, in commercial forests that are simultaneously used for timber production and outdoor activities. The joined production model in land use (Saastamoinen 1982) is typical in Finland. Traditional Finnish wilderness has always been “a storehouse of the backyard” (Hallikainen 1994). It is obvious that this cultural background can still be noticed in the Finnish social wilderness concept (the concept of social wilderness, see Hendee and others 1990; Nash 1982).

The purpose of this study is to define 1) the environmental characteristics that are consistent with the Finnish mental images of wilderness; 2) what are the forestry activities (if any) appropriate in areas considered important for wilderness experience; 3) how do Finnish people use areas, considered as wilderness, for their recreation; 4) do Finnish people appreciate Finnish wilderness areas and if they do, then why? These questions have not been studied before in Finland. The knowledge of these issues is important for natural resources management in certain statutory wilderness areas and other areas where it is important to retain wilderness character.

The Origin of the Finnish Wilderness Concept

The cultural roots of the Finnish wilderness concept lie in the source of livelihood practiced in southern and central Finland during the Middle Ages, when hunting and fishing as well as gathering berries or mushrooms were important for survival. The Finnish word ‘Erämaa’ (translated wilderness in English) has meant forest-covered hunting and fishing areas located well away from village borders and neighboring agricultural lands (Voionmaa 1947). The word “erä” has many meanings. It has meant, for example, a part or a part separated from something else. This could mean that the hunting areas or prey like game or fish were divided among hunters. Furthermore, the word could mean the areas that have been separated from the cultivated areas. Perhaps the development of agriculture, the new cultural stage, made it necessary to define the concept of “erämaa” to describe the backcountry areas that had been left outside the cultivated areas.

Materials and Methods of an Empirical Study

To help define the Finnish “social wilderness,” a mail survey was sent to 2000 randomly selected Finnish people of eighteen years or older in 1990. Source of the sample was the Population Register Centre. However, the sample was a disproportionate random sample because the country was first divided into four districts to ensure the comparability of

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Ville Hallikainen is Principal Lecturer, Rovaniemi Polytechnic, School of Forestry. Toukolantie, 97130 Hirvas, telephone: +358-16-3312684, fax: +358-16-3312400, e-mail: ville.hallikainen@ramk.fi

the districts (this was taken into account before the generalization of the results to the whole population). About 44% returned the questionnaire. A sample of the people (30 persons, selected randomly) who did not return the questionnaire was interviewed by telephone to find out if their wilderness attitudes and images were different from those of the respondents.

Questions dealt with people's mental images about wilderness. Some of the questions were based on the rankings using a five-point Likert scale of objects like different forest stands or facilities built for outdoor recreation. In the questionnaire, the forest stands and forest areas, as well as the facilities were described using deliberately chosen words (as an example, "Dense spruce forest, old and big trees, dead and fallen trees"). Thus, the evaluations were based on the *mental images* stimulated by the descriptions. Furthermore, the respondents were asked for their wilderness usage and their attitudes toward the areas. The mental images were also measured using a definitional perception question ("What mental images do you connect with wilderness?" (see Heberlein 1982; Hummel 1982). In addition, the respondents were asked for their demographics to define possible differences between the groups of the respondents. The postal questionnaire will be called Data Set 1 in the following.

Another data set (called Data Set 2) consisted of 359 Finnish people met in fifteen organized slide shows. Groups and selection criteria of the people were the following: 1) groups of students in certain colleges were asked to participate by their teacher (three groups), 2) some "key people" working in certain organizations were asked to collect a group of volunteers among their clients (five groups), 3) visitors in certain holiday centers were asked to participate in the slide shows (seven groups). The requests were distributed via announcements, and by asking encountered people to participate. Thus, the researcher could not know beforehand who is going to take part in the slide shows, but the time and the place of a show was decided beforehand by the researcher. The slide shows were organized in different regions of Finland. The economic resources and willingness of those who organized the slide shows influenced where and when the shows were organized. The sampling like this made it impossible to generalize the results to the Finnish population, and that is why one should be very careful in interpretation of the results. The demographics of these participants were compared with the demographics in the Finnish population to define the biases, and the sample were noticed to be somewhat biased (for more details, see Hallikainen 1998).

In the slide shows, 54 forest stands was shown to the participants. The participants had to evaluate and rank three scenic characteristics of the forest landscapes: scenic beauty, suitability for outdoor recreation and wilderness character, using the ranking scale from 0 to 10 (0 means not at all, 10 means the best possible). This part of the study was focused on forest landscapes, because forests are the most dominating landscape in Finnish nature and forestry activities have changed our forest landscapes dramatically. Furthermore, the biological characteristics of the forests were measured (for example, diameter and height of the trees, volume of the stock and so on) in order to determine the interdependencies between the biological characteristics and the scenic evaluations. The participants were also asked

to fill a questionnaire similar to the questionnaire in Data Set 1 to determine their mental images about wilderness, wilderness use and wilderness attitudes as well as their demographics in order to 1) determine the biases in the sampling, 2) compare the landscape rankings between different demographic, wilderness use and attitudinal groups.

The commonly used statistical methods, such as frequency analysis, cross-tabulation, chi-square test, uncertainty coefficient, multi dimensional scaling (MDS), hierarchical cluster analysis (using Ward's methods), Varimax-rotated principal component analysis (PCA) and logistic regression analysis have been used in the computations of the results. Spearman's rank order correlation matrix or polychoric correlation matrix (Jöreskog & Sörbom 1988) were used as source data for MDS and PCA. Kruskal's least squares monotonic transformation and the Euclidean distance model were used in MDS computations.

The Results

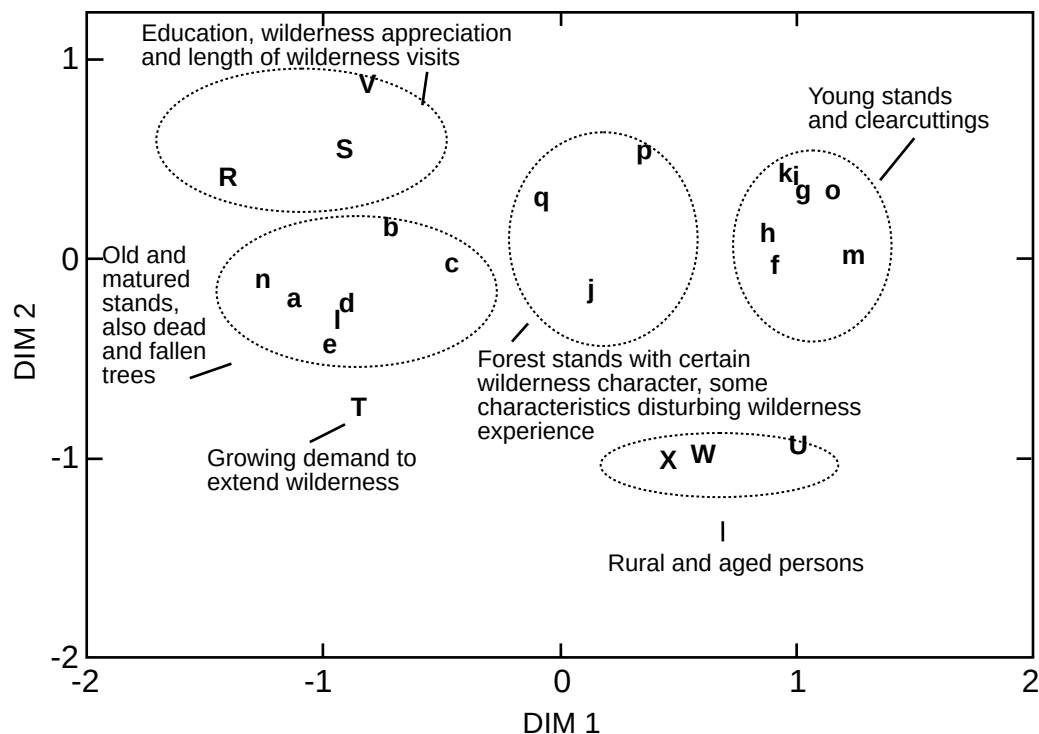
The Nature Characteristics of Finnish Wilderness

The main results of the empirical study will be briefly presented in the following. The results have been presented entirely by Hallikainen (1998, available from the author).

The responses to the open-ended *definitional perception* question in both data sets revealed that the respondents' dominant mental images of wilderness were vast, roadless, uninhabited areas covered mainly with virgin forests. Bogs, especially in their natural condition, were also mentioned fairly often. Wilderness areas had to be silent and remote from roads and inhabited areas. In general, the area should be close to its natural condition.

The expressions of people with different background were fairly similar. However, some differences between the groups of the respondents were found. For example, the images of young, highly educated and urban respondents emphasized expressions of untouched, silent and clean. Highly educated persons and city dwellers also considered wilderness as an uninhabited area more often than countryside dwellers and people with less education. On the other hand, old virgin forests and remoteness were emphasized by less educated persons and countryside dwellers. Furthermore, men emphasized old virgin forest and roadlessness, but women emphasized peace and silence as an important feature of wilderness. Furthermore, women mentioned characteristics like treeless, barren and desolate more often than men did.

The *rankings of the verbally described characteristics* revealed that old virgin forests, mires or bogs, streams, ponds, remote meadows, an old shed or old gray log cabin are appropriate in a wilderness landscape. Paths and camping places are not considered very disturbing in wilderness, but roads or young tree stands and especially clear-cuttings are considered disturbing. To encounter a milk carton or a new red cottage in the backcountry reduce a person's wilderness experience considerably. Furthermore, many constructions like signs along tracks, rubbish collection as well as management activities like fish stocking using natural fish species are well accepted in the wilderness, but restaurant services, machine-managed skiing tracks or fish stocking using rainbow trout are not (fig. 1, fig. 2, fig. 3).



VARIABLE

Dense spruce forest, old and big trees, dead and fallen trees.
 Sparse pine forest, rather old and big trees.
 Sparse birch forest, rather old and big trees.
 Sparse pine forest, old big trees, dead and fallen trees.
 Dense spruce forest, rather old and big trees.
 Dense young pine stand, height of trees about 2 m.
 Open area, fresh slash and stumps on the ground.
 Dense young spruce stand, height of trees about 2 m.
 Open area, fresh stumps, ground is burned.
 Sparse pine forest, old big trees, dead and fallen trees, road in the scenery.
 Sparse spruce forest, rather young and big trees, fresh slash and stumps on the ground.
 Dense spruce-hardwood mixed forest, old big trees, dead and fallen trees.
 Dense young birch stand, height of trees about 2 m.
 Open mire, some scattered old low pines, some of them are dead.
 Open area, fresh slash and stumps on the ground, as well as parallel furrows.
 Open mire, some scattered old low pines, some of them are dead, ditches in the scenery.
 Open area, some scattered, old and big pines.
 Opinion about the number of wilderness areas (1=Too much, 2=Enough, 3=Too few)
 Length of wilderness visits (1 =Day, 2=Weekend, 3=Longer than weekend)
 Growing demand to extent wilderness areas
 Age (1 = 40 years or younger, 2=41-59 years, 3=60 years or older)
 Education (1 =Primary school, 2=Junior high school, 3=High school graduate)
 Growing rurality (1 =City, 2=Village, 3=Countryside)
 Growing rurality during childhood (1 =City, 2=Village, 3=Countryside)

SYMBOL DIM 1 DIM 2

a -1.10 -0.15
 b -0.51 0.08
 c -0.40 -0.02
 d -0.95 -0.09
 e -0.78 -0.31
 f 1.04 0.09
 g 1.08 0.33
 h 1.05 0.10
 i 0.96 0.37
 j 0.00 -0.07
 k 0.93 0.28
 l -1.00 -0.28
 m 1.04 0.13
 n -1.04 0.00
 o 1.12 0.29
 p 0.55 0.59
 q 0.08 0.31
 R -1.23 0.39
 S -0.96 0.68
 T -0.99 -0.77
 U 0.99 -0.84
 V -0.80 0.81
 W 0.51 -0.86
 X 0.43 -1.06

Figure 1—The grouping of the verbally described forest stands based on the wilderness character of the stands, as well as some demographics of the respondents using the Multi Dimensional Scaling.

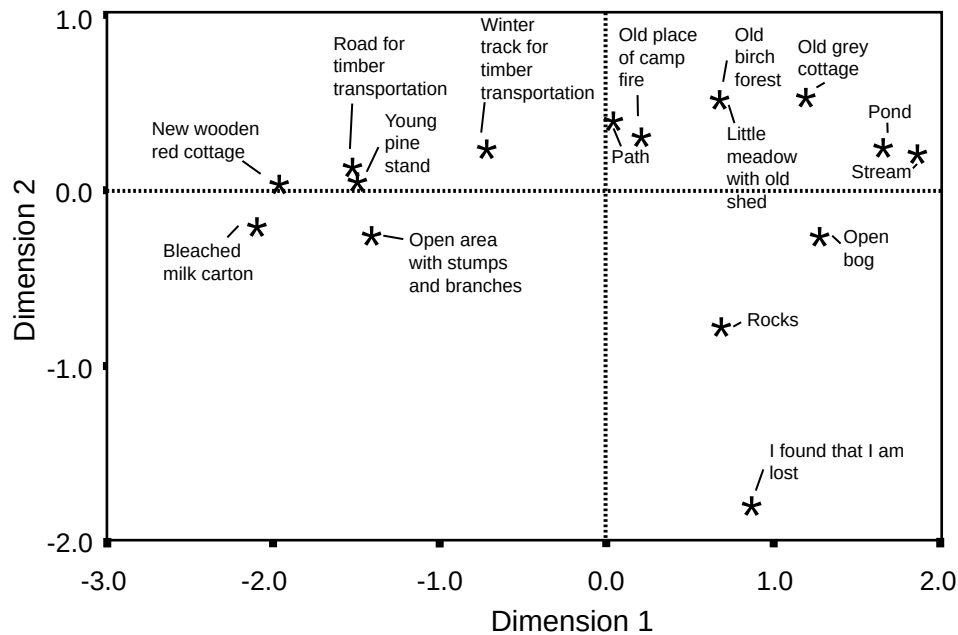


Figure 2—The grouping of the effects of some scenic characteristics which wilderness visitors encounter during wilderness visits on their wilderness experience, using the Multi Dimensional Scaling. The evaluations using a five-point Likert scale are based on the mental images of 303-320 respondents of Data Set 2. The characteristics of high rankings are on the right side and those of low rankings on the left side of the dimension number 1. The characteristics of great variation in the rankings have low values on the dimension number 2.

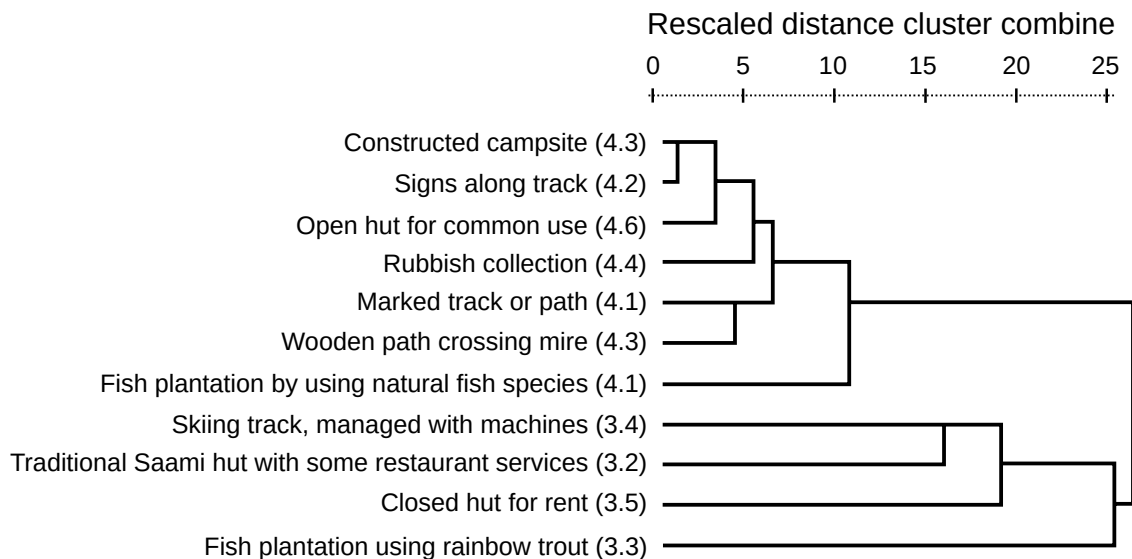


Figure 3—The cluster analysis revealing the appropriateness of some management activities and structures in the wilderness areas. The evaluations using a five-point Likert scale are based on the mental images of 311-333 respondents of Data Set 2. The mean values of the rankings are in the parenthesis.

Some differences between the groups of respondents were found. For example, the wilderness experience of the rather old and less educated respondent was not so easily disturbed by clear-cuts, plowing and mire ditching, compared with younger and more educated persons. Furthermore, old virgin forests and bogs in their natural condition had a stronger effect on the wilderness experience of the young and rather highly educated respondents, compared with the older and less educated persons. The reactions of the countryside dwellers resembled the reactions of older respondents. Old virgin forests and open bogs did not provide as strong wilderness experience for farmers and other agricultural or forestry workers as they provided to the members of other occupations.

The median values of the *scenic rankings of the 54 forest stands* (shown in the slide shows) was combined with the forest characteristic data (age of trees, number of stems etc.), and computed using principal component analysis. The results in figure 4 revealed high principal component loadings of wilderness character on many of the principal components. The highest loadings were on the principal component that describes the high age of trees, the high volume of tree stems, the high amount of epiphytic lichens and the high volume of dead tree stems. Furthermore, wilderness character had a high loading on the principal component describing spruce-hardwood mixed forests. Scenic beauty and a forest's suitability for outdoor recreation had their highest loadings on the principal component that describes pine forests. The number of stumps and the coverage of slash had strong negative loadings on principal component number three, the component of rather high positive loading on wilderness character. The loadings in the principal component number three revealed that slash and stumps impair wilderness experience remarkably, but dense undergrowth of small trees may promote the experience. The third principal component could be named forest management. These management activities did not have a very strong effect on scenic beauty and a forest's suitability for outdoor recreation, at least when there were not very many stumps and slash in the forest or the undergrowth was not very dense.

The differences between the single respondents and between the groups of the respondents in their evaluations were studied as well. The results suggested that one may find individuals with conflicting opinions about the scenic attractiveness of a forest stand, but the opinions of different groups of the respondents, expressed by median or a mean of the scores, were astonishingly similar.

Outdoor Recreation in the Finnish Wilderness Areas

The results of the mail survey (Data Set 1) suggest that 59 % of the respondents had visited wilderness. Males were keener wilderness visitors than females, and better educated persons were keener visitors than less educated persons. In addition, the respondents of northern Finland had experienced wilderness more often compared with the reference groups. Most of the white-collar employees, especially more educated white-collar employees, as well as students and entrepreneurs, had visited wilderness but a higher proportion of farmers had not.

Most of the wilderness visits were short; a typical visit of the respondents of Data Set 1 had been from two to ten hours. However, about half of the respondents had visited for one day and night or longer in wilderness during one visit. Furthermore, only little less than five percent of the respondents usually stayed seven days and nights or longer in wilderness at a time. Cross-tabulation revealed that males usually made longer visits than females. The same could be said about young or middle-aged, as well as rather highly educated respondents, compared with the respondents who had reached the age of 60 years and those who had only primary school education. Furthermore, the urban dwellers usually made longer trips in wilderness than the rural persons. A positive trend between growing urbanity rate and the length of the visit was found.

The respondents of Data Set 1 were also asked whether they stay *night over in wilderness* and, if they stay, what accommodation they prefer. Slightly more than one-fourth of the respondents who had visited wilderness did not stay overnight there. About third of the wilderness visitors preferred outdoor accommodation in a tent or an open shelter called "laavu" or "loude." The same proportion wanted to spend their wilderness nights indoors, in a hut for common use or in a hut for rent.

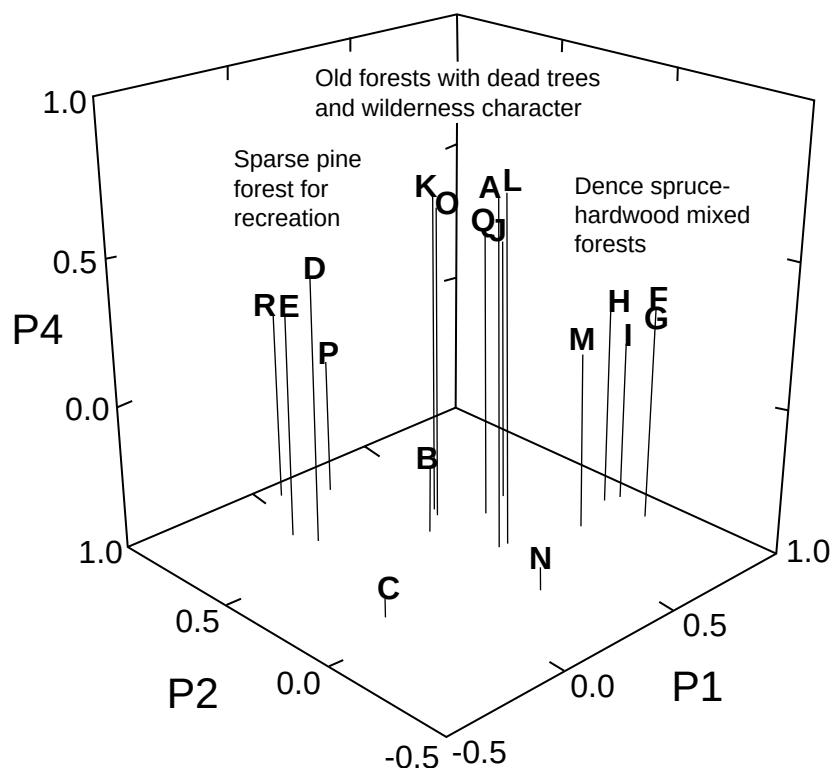
Furthermore, the respondents of Data Set 1 were asked for their *motives* to visit wilderness areas and their *activities* while in wilderness. The respondents had to choose, among given alternatives, their primary, secondary and the third important wilderness motive and activity.

The experience of peace and silence, as well as aesthetic experiences like seeing beautiful scenery, were the most important motives to wilderness visitors. The other important reasons were physical training, togetherness and obtaining natural resources like game, fish, berries and mushrooms. Self-test, solitude and adventures were important reasons only to a minority of the respondents (fig. 5).

The effect of the background of the respondents of Data Set 1 on their *motives* to visit wilderness was studied as well. The aim was to characterize the typical demographics of the respondents belonging to certain motivation groups. Besides the cross tabulations (fig. 6), logistic regression models with a certain motive as independent variable were used.

Physical training was more important to the older and less educated persons. A logistic regression model suggested that it was about three times more evident to a primary school educated person and about twice as evident to a junior high school educated respondent to seek primarily physical training in wilderness, compared with a high school graduate. The coefficients for the youngest (40 years or younger) and the oldest (60 years or older) age class were similar to the coefficient between the lowest and the highest education groups. Furthermore, it was noticed that the importance of physical training decreased with growing urbanization. The experience of peace and silence is the most important second motive and togetherness the most often mentioned third motive among the respondents belonging to this motivation group.

To test oneself in wilderness was the primary motive for few respondents and the statistically significant differences were hard to detect. However, it is obvious that this motive is more important to males and respondents who live in the countryside than to females or urban dwellers.



LABEL	VARIABLE	COMPONENT LOADINGS OF PRINCIPAL COMPONENTS (P)			
		P 1 (26.6 %)	P 2 (16.3 %)	P 3 (13.0 %)	P 4 (19.5 %)
A	Epiphytic lichens (classified)	.301	.104	.056	.754
B	Coverage of slash (% of the ground)	-.027	.045	-.870	-.018
C	Number of stumps/hectar	-.202	.077	-.747	-.418
D	Diameter of maximum pine stem (cm)	-.053	.560	-.462	.475
E	Total volume of pine stems (m ³ /ha)	-.051	.698	-.223	.286
F	Diameter of maximum spruce stem (cm)	.895	-.025	.048	.278
G	Total volume of spruce stems (m ³ /ha)	.902	-.020	.164	.242
H	Diameter of maximum deciduous stem (cm)	.862	.127	-.174	.218
I	Total volume of deciduous stems (m ³ /ha)	.907	.096	.177	.087
J	Total volume of living tree stems (m ³ /ha)	.668	.452	.090	.400
K	Age of median living tree (years)	.266	.331	-.186	.697
L	Total volume of standing dead tree stems (m ³ /ha)	.340	.095	-.008	.791
M	Number of tree stems (d _{1.3} ≥ 7 cm)/ha	.675	.072	.343	.122
N	Number of tree stems (d _{1.3} < 7 cm)/ha	.225	-.160	.557	-.396
O	Total volume of fallen dead tree stems (m ³ /ha)	.170	.216	.174	.700
P	Scenic beauty	.237	.854	.089	.006
Q	Wilderness character	.512	.367	.391	.537
R	Forest's suitability for outdoor recreation	.067	.906	-.069	.211

Figure 4—The loadings of first four principal components (P1-P4) of some forest characteristics and the scenic evaluations of 45 mineral soil forest stands. The variance explained by the principal components is in parenthesis. The total variance explained by the principal components is 75.4 %. The analysis is based on Spearman's rank order correlation matrix.

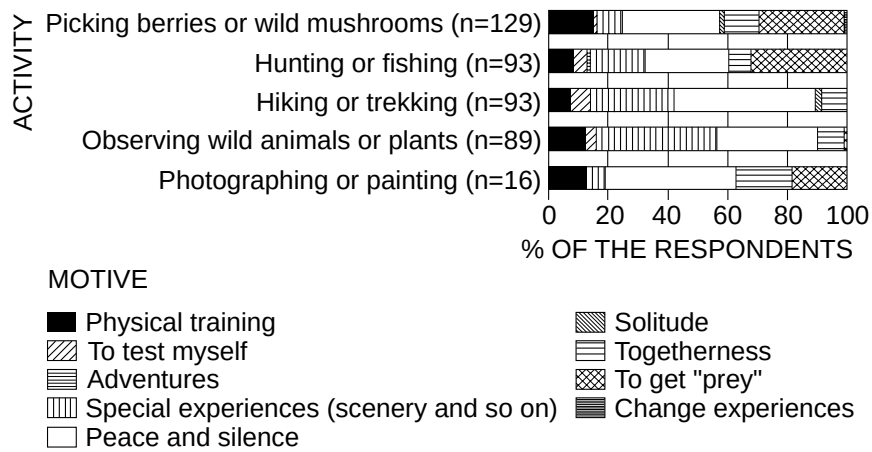


Figure 5—The interrelationship between the primary motives and primary activities of wilderness visits of the respondents of Data Set 1. The p-value of Pearson's chi test is 0.000.

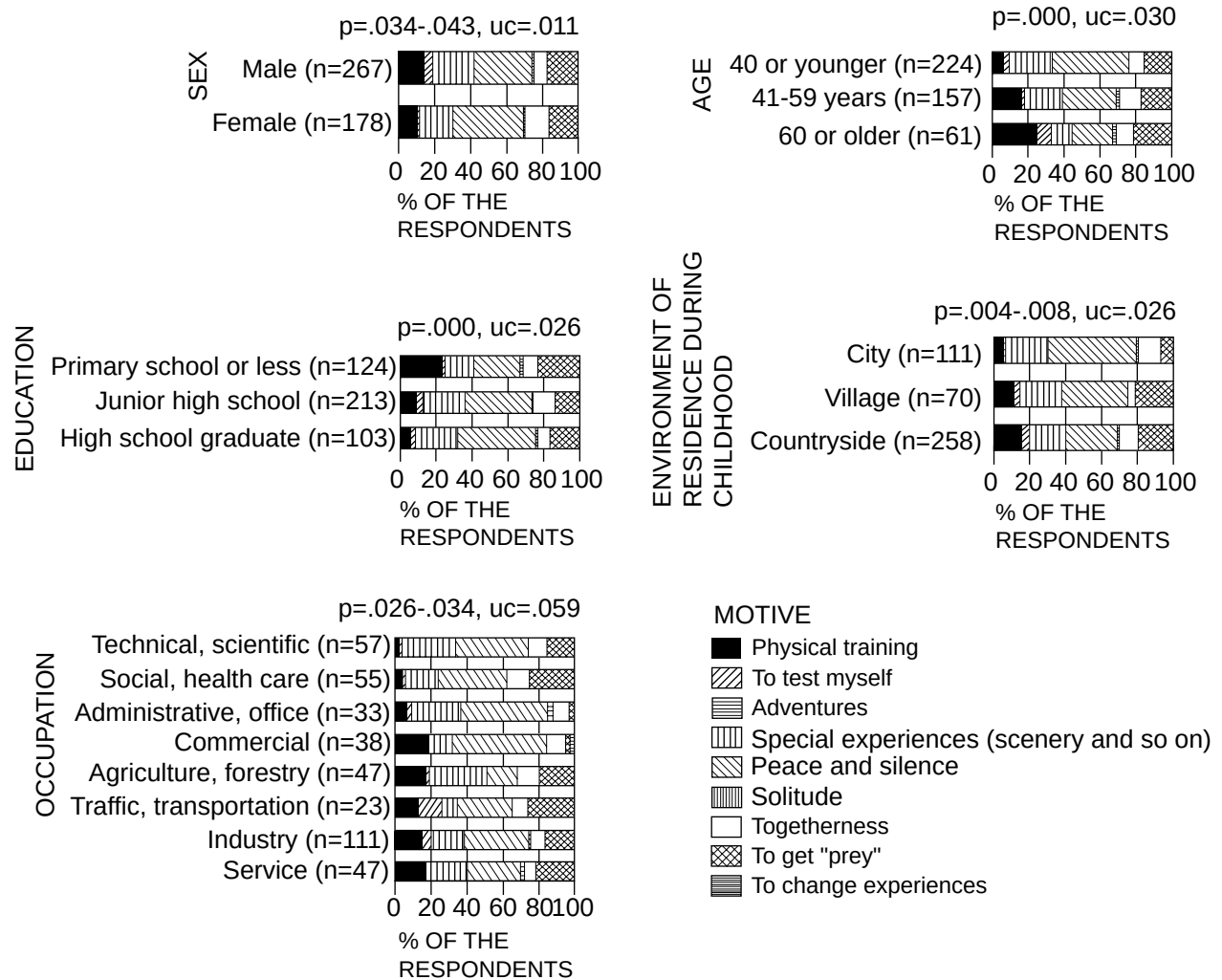


Figure 6—The distributions of the primary motives of the wilderness visits by the groups of respondents of Data Set 1. P denotes the p-value of Pearson's chi-square test and uc the uncertainty coefficient with motive (dependent).

Figure 6 suggests that the *experiences* such as beautiful scenery, seeing plants and animals or staying overnight in wilderness were more important to the young respondents than the older persons. However, the difference was not found statistically significant at 5 % risk level. The experience of peace and silence was the most often mentioned second motive and togetherness the most often mentioned third motive to the respondents belonging to this motivation group.

Peace and silence was the most important motive to visit wilderness. This experience was about three times more important to those 40 years old or younger persons than to those 60 years old or older. If we compare middle-aged respondents with the youngest age group, we notice that the experience of peace and silence was nearly two times more important to the persons belonging to the youngest group. Furthermore, the importance of this experience was closely related to increasing levels of education. Respondents who work in agriculture and forestry did not appreciate peace and silence as much as persons belonging to the other occupation groups. Furthermore, city dwellers mentioned this motive two times more often compared with the countryside dwellers. Beautiful scenery and the experience of togetherness were mentioned most often as the second and third important motive.

Obtaining natural resources (game, berries, mushrooms and so on) was about three times more important to those respondents who had spent their childhood in the countryside or villages than to those who had grown up in towns or cities. Furthermore, there were certain occupation groups, such as administrative, office or commercial persons, who may appreciate this motive less than persons belonging to the other occupation groups. The experience of peace and silence was the most often mentioned second motive.

Togetherness was about two times more important to females than to males. Peace and silence and togetherness are important to these respondents, too.

Following are the characterizations of different *activity* groups (fig. 7).

The primary activity of *observing wild organisms*, animals and plants was important to one-fifth of the respondents. The respondents who had grown up in the southern or western part of the country, represented two and half times more wilderness visitors whose main hobby was to observe wild organisms, compared with respondents who had grown up in the northern part of the country. Along with observing animals or scenery, these respondents wanted to experience peace and silence in wilderness.

Hunting or fishing was clearly the activity of young or middle-aged, less educated men. Furthermore, the respondents who were working in agriculture, forestry, transportation or industry, most of them male, were often interested in these activities. Among the countryside dwellers, these activities were about three times more popular than among the city or town dwellers. Furthermore, in the northern part of the country, these activities were about three times more popular than in the southern part of the country. Along with hunting and fishing, these respondents are often interested in picking berries or mushrooms and observing animals or plants.

Picking wild berries or edible mushrooms was the most important activity to many rather old and less educated women. The effect of sex could be seen in the distributions

between the different occupation groups, but the differences were not very clear. There were, however, many more berry or mushroom pickers among the social or health care workers, compared with the traffic or transportation workers. The respondents belonging to this activity group were also interested in hiking and trekking or observing animals or plants. Berries and mushrooms were not the only things to attract a person belonging to this activity group into wilderness. Berry or mushroom pickers also wanted to experience peace and silence in wilderness.

There were only few respondents whose main activity in wilderness was *photographing or painting*. None of the respondents belonging to the oldest group had chosen these activities as their primary activity. Among the high school graduates, there were over five times more nature painters or photographers compared with the lower educated respondents. Observing wild animals or plants, as well as hiking and trekking, were important to this group of respondents as well. The experience of peace and silence was perhaps even more important to wilderness artists than having pictures or paintings.

Hiking and trekking were the primary activities of the middle-aged respondents. Furthermore, a linear trend could be seen in the growing importance of this activity with growing education. Furthermore one may find more hikers and trekkers among the village dwellers than among the countryside dwellers. Only a few of those who work in agriculture or forestry or who had grown up in Lapland were interested in hiking and trekking, compared with the reference groups. Observing wild animals or plants and picking berries or mushrooms were important activities to hikers and trekkers. A hiker and trekker seeks, first of all, peace and silence along with scenic experiences, or other impressive experiences such as encountering wild animals or the experience of staying the night in wilderness.

The Assessment of Finnish Wilderness Areas

About 96 percent of the respondents of Data Set 1 who answered the question ($n = 837$) considered wilderness preservation and protection important. Slightly less than four percent of the respondents (34 persons) did not see any reasons for wilderness preservation. The results of both data sets were very similar.

The three most important reasons for wilderness preservation in the results of both data sets were the following: 1) the conservation of species, 2) wilderness preservation for future generations and 3) wilderness recreation. Even the order of these reasons was the same in both data sets. The respondents of Data Set 2 had, however, emphasized wilderness areas' role in preserving nature's own character, naturalness. The other frequent reasons for preservation were to ensure the function of biosphere and preservation of nature's beauty, as well as the need to keep nature clean and unpolluted. Furthermore, wilderness areas were considered important for the preservation of Finland's natural forests. Although the cultural importance of the wilderness areas was expressed directly, the idea was also reflected in the expression of originality and authenticity that wilderness areas include. The importance of wilderness areas to nature hobbies and nature education was emphasized as well.

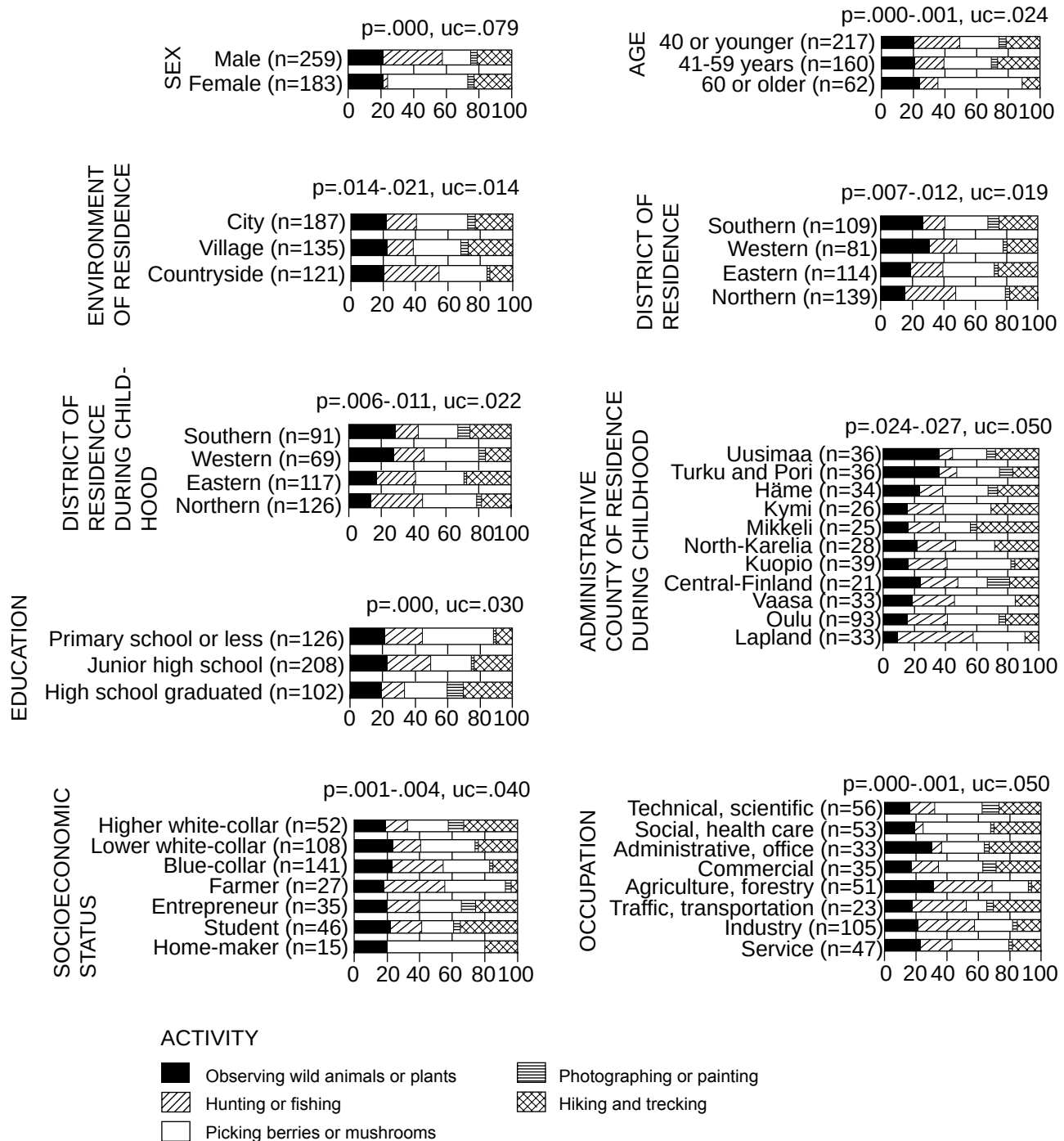


Figure 7—The distributions of the primary activities of wilderness visits by the groups of respondents of Data Set 1. P denotes the p-value of Pearson's chi-square test and uc the uncertainty coefficient with motive (dependent).

Furthermore, concern about the rarity of wilderness areas was clear. The general anthropocentric meaning of the areas was expressed by saying that human beings need original nature.

Some respondents said that wilderness areas are important to ecological research, and they are reference points for the impacted areas or represent ecological museums. Furthermore, some respondents mentioned the intrinsic values of wilderness; to preserve wilderness areas is mankind's

duty for nature itself. A couple of the respondents mentioned that wilderness areas are important to the defense of the country or as natural sources of livelihood. Some respondents had noticed that there are many countries without any wilderness areas. Thus, our duty is to preserve the areas for the people of those countries. The reasons for wilderness preservation and conservation expressed by different groups of the respondents are rather similar. Furthermore, the results from respondents who had been interviewed by

telephone were rather similar to the results from the questionnaires.

The respondents of Data Set 2 were asked for their opinion about the extent of wilderness areas in Finland and the extent of protected wilderness areas in the southern and northern part of the country. As a result, only a minority of the respondents felt that there are too many wilderness areas, or that they are too large, in Finland, and one-third wished that we would have more wilderness areas. However, about seven percent thought that the protected areas covered too much territory in northern Finland. On the other hand, nearly one-third of the respondents hoped for more protected wilderness areas in the northern part of the country. About half of the respondents hoped for more protected wilderness areas in the southern part of the country.

Another part of the study focused on what is a person like who wants more protected wilderness areas in northern Finland. The logistic regression models had been constructed to find out what demographics of the respondents best explained or predicted the differences between the respondent groups. A person's age and socioeconomic status proved to be the best independent variables. The youngest group (40 years or younger) accounted for more than twice of those who hope for more protected wilderness areas in northern Finland, compared with the oldest group (60 years or older). Furthermore, compared with farmers, there were about from three to four times more persons in the other socioeconomic groups who hope for more protected areas in the area.

The respondents were also asked for their favorite wilderness areas in Finland. Their answers revealed that most of the favorite areas were situated in the northern part of the country. However, the respondents found their favorite wilderness areas in all parts of the country. The Urho Kekkonen National Park in Lapland was the most popular area.

Finally, the respondents were asked if they want to give a money donation for wilderness preservation. About half said that they would give at least some money for the purpose. Age and socioeconomic status, as well as the administrative district of residence were the best variables to explain the differences between the groups. The coefficient between the most willing age group, 40 years or younger, and the oldest age group was about two. Compared with farmers, the members of the other socioeconomic groups were from two to six times more willing to give at least some money for the purpose. Those who lived in southern part of the country were about from two to three times more willing to give a donation compared with those who lived in Lapland. The sums of the money were rather small: 70 Finnish marks on the average (mean) and 30 Finnish marks expressed by the median value. Furthermore, about half of the respondents expressed their willingness to spend some money by traveling for their wilderness visits. The mean value of the annual wilderness visits was about thousand kilometers, the median 438 kilometers.

Discussion

The mental images of the respondents revealed by the definitional perception question (Heberlein 1982, Hummel 1982) are obviously rather spontaneous images. They do not necessarily have any spatial connections. It is remarkable

that the images appeared to be very similar in the two data sets. People's mental images about Finnish wilderness obviously carry ancient cultural meanings and values. These meanings and values have to guide wilderness management being the "standards beyond the standards" (Manning 1992). The strongest wilderness culture in Finland developed in the southern part of the country (Voionmaa 1947). The backcountry areas outside the inhabited rural areas in the Middle Ages resembled the images that were reflected in the answers of this study. Although our statutory wilderness areas and most of the other conservation areas are situated in the northernmost part of the country, where fells dominate the landscape, fells do not dominate the spontaneous wilderness images of the Finnish respondents. On the other hand, these areas stand for wilderness for most of the respondents. Our mass media, and particularly some hiking guides, strongly emphasize the role of the northern fell areas as wilderness. An interesting feature in the expressions was the proportion of positive expressions. Thus, wilderness has not been an evil or bad thing, an object to win, tame or change to something else similar to the ancient Anglo-American classicism heritage (Nash 1982; Short 1991). Moreover, Heberlein (1982) and Hummel (1982) have used definitional perception question in their studies directed at American students. Despite many similarities in the results between Finnish and American mental images, the main differences were the lack of expression of roadless and uninhabited among the most often mentioned characteristics in the American studies.

The results suggest that certain forestry activities, such as slight thinning, can be applied without losing the opportunity for certain wilderness experience. However, forest stands in the beginning of their succession do not promote the wilderness experience at all. The spruce-dominated forests have been considered as more wilderness-like than the pine-dominated forests. It is understandable because matured pine forests are full of light, and it is easier to get oriented and roam in these forests. Getting lost may be an important part of the wilderness experience. The experience of getting lost may be the Experience in the meaning of Heidegger's (1927) philosophy. The feelings of fear and homelessness (see Vattimo 1989) may come into mind when person's "mental mapping" do not work and he or she feels lost in a dense and gloomy spruce forest. Furthermore, compared with the pine forests, the spruce forests shown to the respondents in this study were characterized by the bigger volume of stock, the bigger diameter of tree stems, the smaller number of stumps and the smaller coverage of slash. These characteristics may have had an influence on the spruce forests' higher wilderness character. However, old virgin pine forests that include big dead trees are an important part of the Finnish wilderness, besides the bogs and the other wetlands. The result of the beauty and recreation value of pine-dominated forests or "pure" birch forests, compared with spruce-dominated forests, is consistent with the results of many previous Finnish studies (for example Kellomäki & Savolainen 1984; Pukkala and others 1988; Savolainen & Kellomäki 1981).

Snags and high age of trees are the features in the landscape that promote the wilderness experience. These are the features of a forest in its natural condition, at the end of the forest's natural succession. Although the concept of

naturalness is many-sided and difficult to define (see Wohlwill 1983), it is evident that the old trees, and particularly snags, are an important feature of a natural forest, and thus a wilderness. The famous Finnish forest researcher, A. K. Cajander, defined a wilderness forest very strictly. He said that he had visited a wilderness forest only once. The forest was located in an island of the Lena-River in Siberia. The forest had not been burned, and thus it was very old and full of dead trees (Keltikangas 1984). Thus, although it is evident that nearly all forestry activities reduce the wilderness experience in a certain degree, a forest manager should leave, as much as possible, the oldest trees and snags in a forest regeneration area to exemplify wilderness (the concept of exemplification, see Kalanti 1990). Thus, the management schedule of so-called joined production (Saastamoinen 1982) where timber production and the production of wilderness experiences are carried out in the same time, have got an opportunity to realize in a certain degree.

The structures, like open huts for common use, as well as wooden paths crossing bogs reflect an ancient wilderness culture. In many of our national parks, wilderness areas and the other nature conservation areas, these structures are present. Some more modern structures and other management activities, such as fish stocking have been increasingly accepted as a part of our wilderness. However, we should follow the old traditions as much as possible if nature conservation and other important reasons do not need the modern construction and management.

Most of the wilderness visits made by the respondents were rather short as found in the United States studies. (Roggenbuck & Lucas 1987). Thus, it is important to retain some small wilderness for short-time hikers. On the other hand, large wilderness areas like Urho Kekkonen National Park, are important to the short-time visitors as well (see also Saarinen 1995). Although about half of the respondents wanted to experience wilderness during the day, another half wanted to experience a night or several nights in wilderness using a tent or an open wind-shelter, called "laavu," with a campfire in front of the shelter are traditional ways to stay overnight in wilderness. On the other hand, a family cabin on the shore of a lake or sea is obviously the most preferred place to stay the night in nature, and is now an important part of the Finnish tradition and lifestyle (Vuolle 1992). A typical Finnish wilderness visitor resembles an American one, being rather young and usually a highly educated male living in a town or a city, with a high income and a professional or technical occupations. (Lucas 1990; Roggenbuck & Lucas 1987).

Higher criteria for the wilderness environment have been hardly the reason why a smaller proportion of the older, less educated respondents or the farmers experienced wilderness. A possible explanation may be that the mental images of older people have changed over the decades (Schreyer & Driver 1990). The most reliable explanation, however, is that the above mentioned respondents have not been as interested in wilderness as their recreation environment, compared with the other respondents. Nature, even "wild" nature, has been an everyday environment to many old, rural persons, related closely to their sources of livelihood (Järvikoski & Kempainen 1991).

The Finnish wilderness activities reflect ancient Finnish wilderness culture, but the motives behind activities in

wilderness changed during the centuries. To get fish, game, berries and mushrooms is still important to a big proportion of the Finnish wilderness visitors, but the other motives, especially the peace and silence, have become increasingly important. Peace and silence have been bundled into a single motive in this study. However, the concepts of peace and silence differ from each other to a certain extent. Peace is a wider concept than silence and includes a social dimension too (Saastamoinen 1996). The social dimension includes the sub-dimensions like "being voluntarily separated from the other people and noise caused by them" as well as "an escape from everyday pressures." Furthermore, peace includes a spatial dimension, to have enough space around oneself. (Saastamoinen 1996). The first mentioned sub-dimension of peace is equivalent to the motives of privacy or solitude, important motives of the wilderness recreation (see Hammitt 1982; Hammitt & Madden 1989; Roggenbuck 1990). Rossman and Ulehla (1977) mentioned wilderness as an excellent environment to experience peace and silence, as well as to obtain a different perspective on a person's own life. Peace and silence have been noticed as an important motive in other studies revealing the wilderness motives of Finnish wilderness hikers as well (Saarinen 1995; Saastamoinen 1972).

It is a little surprising that the Finnish respondents did not emphasize freedom as an important wilderness motive. The motive of freedom has not directly been emphasized in other empirical Finnish outdoor recreation studies (Sievänen 1992, 1995; Telama 1986). The motive of freedom is obviously closely connected with the wilderness privacy (Hammitt 1994; Hammitt & Madden 1989). Freedom may be closely related to the "escape from everyday pressures to nature," to a simple life without any constraints (see Fromm 1977; Kaplan & Kaplan 1989; Telama 1992).

It is obvious that there are persons, but perhaps not very many, among the Finnish people who want experience wilderness alone (Saarinen 1995; Telama 1992; Uusitalo 1993). Everyday pressures may certainly "push" a person to solitary nature, and particularly to solitary wilderness visit. As Telama (1992) believes, the motivation of "escape from everyday pressures" is closely related to the wilderness experience. However, solitude does not necessarily mean that the person must be completely alone. As Hammitt (1982) mentioned, the dimensions of solitude are: the experience of a remote nature environment, the experience of freedom, the experience of being together with friends in a little group and the experience of own personal identity ("being myself"), free from society's pressures. Thus, the motive of togetherness is not necessarily the opposite of solitude, but to be "alone in a group" (Hammitt 1982; Telama 1992). Furthermore, the importance of togetherness to nature and wilderness visitors has been noticed in previous studies (Saarinen 1995; Saastamoinen 1972; Sievänen 1992).

The reasons for wilderness preservation mentioned in this study reveal that, besides ecological and recreational values, the Finnish respondents do appreciate our wilderness areas as an important part of our national culture and lifestyle, similar to the American people do (Thompson 1987). Furthermore, as Brown and Manfredo (1987) mentioned, the cultural values attributed to wild nature are an important part of social values, and these values can be noticed in a person's ethical attitudes and in his or her other attachments.

In this work, the respondents were asked if they want more wilderness conservation areas in Finland. The results should be interpreted with caution. It is obvious that many persons answered the question without thinking about the economical or social consequences of the conservation. Particularly if the negative consequences may affect the person, his or her way of thinking may change. Järvikoski and Kemppainen (1991) have pointed out that Finnish people do not usually underestimate environmental problems, but the attitudes of people belonging to occupations that use nature for economical purposes become qualified when economical realities and environmental problems conflict. Furthermore, although the sums of money in the contingent valuation question, for example, compared with the results obtained by Krström (1989) in Sweden, were rather small, the results do not necessarily tell very much about respondent's willingness to pay, but merely about respondent's attitudes.

The respondents found their favorite wilderness areas in nearly every part of the country. Thus, a manager should take the wilderness values into account in his or her job also outside the statutory wilderness areas. Some areas like Urho Kekkonen National Park, were, however, much more popular than the others. The popularity of the Park may be due to the extra status brought to it by the famous books written by Kemppinen (1959, 1961). None of the Finnish wilderness areas have been described so widely in different publications (Häyrinen 1989). Besides the extremely beautiful and varied landscape (Häyrinen 1989), structures, good paths and tracks may have increased the popularity of the Park. Saastamoinen (1972) found that the visitors of Urho Kekkonen National Park appreciated its landscape, good opportunity for skiing and hiking, as well as the opportunity for peace and silence and the low number of other hikers in the area. Despite of the popularity of the area and increased number of visitors compared with the year 1972, peace and silence can still be found in the Park (Saarinen 1995).

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Wilderness Perception Scaling in New Zealand: An Analysis of Wilderness Perceptions Held by Users, Nonusers and International Visitors

J. E. S. Higham
G. W. Kearsley
A. D. Kliskey

Abstract—Wilderness is a concept that has both a physical and a perceptual meaning. Wilderness images have been collected by a number of researchers in recent years in an attempt to understand precisely what wilderness users consider wilderness to be. This paper sets out to analyze the original works of three researchers, studying three distinct sample populations so that wilderness perception comparisons can be made. The results of this research show striking similarities and differences of perception, between different study samples. They show that many people have a common perception of wilderness, but that they may also hold quite different images of wilderness. Some of the implications of this for management are briefly discussed.

The concept of wilderness can be defined in physical, legislative and perceptual terms. Each has a different application, and it can be argued, that for the purpose of visitor management, understanding perceptions of wilderness is particularly relevant. It has been suggested that recreationists may achieve wilderness experiences in any natural environment that they perceive to be wilderness. Such perceptions may comply with, or be far removed from legislated and designated wilderness areas. It is, therefore, likely that the majority of wilderness experiences can be accommodated in nonwilderness areas. In other words, wilderness experience can be satisfied in areas somewhat removed from (and possibly buffering) core wilderness designations. Semi-remote areas or areas that have been developed to provide for primitive recreational pursuits (for example, developments such as hut accommodation and tracks) are likely to provide wilderness experiences for all but the most purist of wilderness adventurers.

This paper examines this theory and applies it to the New Zealand wilderness recreation context. It reports on three studies that examine the wilderness perceptions held by three distinct samples: users of the New Zealand recreational backcountry, the New Zealand general public and international visitors to the New Zealand recreational

backcountry. All three studies involved the collection of primary data through the administration of questionnaires followed by the analysis of data employing the Wilderness Perception Scaling (WPS) technique (Stankey 1973). This technique allows discrete groups to be identified within each sample based on the wilderness perceptions that they hold. Labels are applied to each to illustrate the extent to which the wilderness perceptions common to each group comply with, or are increasingly removed from, legislative definitions of wilderness in New Zealand. The paper presents a detailed analysis of the qualities of wilderness sought by the members of each purism class; it then discusses the similarities and differences between them.

The New Zealand Wilderness Resource

An important part of New Zealand's tourism product is its range of natural environments and wild places. Wilderness can be found in Alpine ranges, volcanic peaks, native forests and mountain grasslands and subalpine fields. Most wilderness is protected in a system of national parks, forest parks and other reserves; the system is over a hundred years old and covers nearly a third of the country's land area. But for a small number of specially protected areas, these designations, known generically as the conservation estate, are open to unrestricted public access and use.

The conservation estate has long played a part in New Zealand's economic development. New Zealand national parks have generally been designated in areas considered to otherwise have no economic value. The designation of national parks has commonly been justified as a resource for regional economic development through tourism. The first national parks in New Zealand were alpine parks in regions offering no potential for agriculture (Hall and Higham 1998). This scenario still applies with New Zealand's most recent park designations (Paparoa and Kahurangi National Parks), providing a tourism resource base for remote communities. The same is the case for proposed additions to the national park system in the Catlins region and Stewart Island. These gazettals have been advocated on the grounds that they would serve the tourism development interests of economically marginalized regional and remote communities. The philosophy of 'economic conservation' (Hall and Higham 1998) is deeply entrenched in contemporary New Zealand. In 1993, the New Zealand Tourism Board (NZTB)

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J. E. S. Higham and G. W. Kearsley, Centre for Tourism, University of Otago, P.O. Box 56, Dunedin, New Zealand. A. D. Kliskey, Department of Geography, University of Canterbury, Private Bag 4800, Christchurch, New Zealand.

and Department of Conservation (DOC) established a policy aimed at tripling or doubling annual international tourist arrivals to New Zealand. Wilderness images have become a key resource in the promotion of New Zealand as an international destination.

In recent years, there has been a rise in domestic demand and recreational use of wilderness. This trend has been compounded by growth in demand for wilderness experiences from overseas visitors to New Zealand (Higham 1996). Coupled with this has been increasing evidence of ecological impact, crowding and displacement (Higham 1996; Higham and Kearsley 1994; Kearsley 1990, 1997, Kearsley *et al* 1996; Kearsley and O'Neill 1994). Wilderness areas are recreational environments that are vulnerable to physical impact. Crowding is experienced by all types of users and, for many, diminishes the wilderness experience. Where visitor experiences are being compromised by ecological or social impacts, New Zealand's wilderness values are also being degraded.

This scenario presents a challenge for New Zealand's Department of Conservation, which is charged with the management of the conservation estate. In meeting this challenge, the Department of Conservation can draw selectively from the North American wilderness management context. A comparison of wilderness designation and management practice in New Zealand and North America provides a range of common issues and interests. These include visitor management, physical impact management and tourism and community development issues. However, a number of widely researched wilderness management issues in North America do not apply to the same field in New Zealand. The definition of designated wilderness areas in New Zealand dictates that they should be remote and so situated to preclude day visitation. Wilderness areas in New Zealand are also designated and managed to remain free of artefactual constructs (huts, bridges, walk wires, tracks), natural resource development, commercial recreation, mechanized access or overflight and nonnative stock or introduced (exotic) fauna. These areas are buffered to protect their largely natural and relatively pristine condition. For these reasons, a number of widely researched wilderness management issues in the North American context do not apply, or apply less so, in New Zealand (for example, managing day visitors and designated camping areas, livestock, river flow, wildlife and fire management). Managing the New Zealand wilderness resource (wilderness areas and adjacent lands offering qualities of wilderness experience) centers on the need to manage qualities of remoteness, solitude and challenge in the face of increasing levels of demand and diversifying demographic and motivational profiles.

Wilderness Images

Wilderness can be defined in several ways. One approach is to define wilderness as a pristine environment free from any human impact. Vitousek (1999) confirms that by this definition, wilderness no longer exists, least of all in the Northern Hemisphere, where agricultural chemicals act as an agent of environmental change. Wilderness may also be defined in legislative terms. This approach recognizes

wilderness as an area of the earth that is affected primarily by the forces of nature. By this definition, wilderness is an area of unmodified naturalness that is of a size and remoteness that makes practical its protection from agents of change. In New Zealand, legislated areas of wilderness have been defined and designated by the Wilderness Advisory Group (1985).

This paper adopts the third approach to wilderness definition, which is based on personal perception. Wilderness is a personal construct that can be defined as an image that varies from person to person. This allows wilderness to be found in different environments by different people. If so, the most fragile places can be protected by directing people to the environments where their wilderness expectations may be satisfied. Just as attitudes to wilderness have varied over time by culture and society (Glacken 1967; Hall 1992; Kearsley 1997; Nash 1982; Oelschlaeger 1991; Shultis 1991), so too have individual perceptions of wilderness. While wilderness environments have an objective reality as physical places, what makes that reality 'wilderness' rests very much upon personal cognition, emotion, values and experiences. As Stankey and Schreyer (1987) point out, a wilderness environment does not so much 'give' a wilderness experience as act as a catalyst for what are essentially inherent emotional states. Wilderness, then, has no commonly agreed physical reality, but it exists where personal cognitions dictate; different people perceive wilderness in different ways and in different places, but, for each of them, wilderness exists in that place, although it might not for others.

Many attempts have been made to explore the dimensions of the wilderness image (for example, Beaulieu 1984; Heberlein 1973; Hendee, *et al* 1968; Lucas 1964; Stankey 1973). In New Zealand, Wilson (1979) showed that the general public and regular backcountry users held similar views about how wilderness might be described. Both groups generally considered wilderness to be natural and unspoiled, wild and challenging. However, the two groups diverged when their views about what activities are permissible in a wilderness environment were analyzed. Among trampers, purists did not believe it possible to have wilderness where there was any sign of people or their artifacts, whereas the public exhibited a much broader range of tolerance. Most of them, and, indeed, some trampers, believed that there was no inconsistency between a wilderness experience and the presence of such facilities as huts, tracks, swing bridges and even toilets and picnic sites. Both samples generally agreed that vehicular access or any evidence of overt commercialization is unacceptable in wilderness. Thus, it appears that the highly purist required a pristine ecological wilderness, but the majority could find wilderness values in places that had been developed in part. Clearly, many of those seeking to experience wilderness may find satisfaction in areas unacceptable to the purist minority. It is necessary, therefore, for wilderness managers to understand the quality of wilderness sought by different groups of users, and the extent to which those experiences can be achieved in lands buffering core wilderness areas.

The notion that wilderness can be encountered by various people in environments that are more or less developed was advanced in a number of subsequent studies (Higham 1996; Kearsley 1982; Kearsley 1990; Kearsley 1997; Shultis 1991;

Shultis and Kearsley 1988). These have provided a detailed appreciation of the perceptions of wilderness held by users, the general public and international visitors to the Conservation Estate. Members of these groups were asked to state the extent to which they accepted various developments or specific attributes in wilderness environments. These included physical facilities such as huts, tracks and bridges, attributes such as remoteness and solitude, or physical developments, including exotic forests and mining, in wilderness areas. Kliskey (1992) and Kliskey and Kearsley (1993) show how responses to such a question may be used to group people into discrete purism classes and to plot the extent to which specific environments provide wilderness for those groups.

Methodology

Three studies are included in this paper, the first of which is the sample used by Kliskey in his original analysis. In this, he used data collected by Shultis in late 1987 (Shultis 1991, Shultis and Kearsley 1988). This was a sample of 233 backcountry users, collected with an on-site survey in natural areas throughout New Zealand. The second sample was collected by Higham in 1994 (Higham 1996) and is composed of 336 international backcountry users. The final group is derived from 250 members of the general public whose views on wilderness were collected by Kearsley in 1995. This paper reports on the key findings of each study and compares and contrasts the results generated from each sample.

All three studies collected data that could be analyzed employing the Wilderness Perception Scaling (WPS) technique (Stankey 1973). WPS measures the extent of a persons perceptions of wilderness and makes possible a classification of wilderness users based on their levels of perception. This methodology involves four stages, as follows:

1. The development of a 21 variable list that functions as a list of indicators for the delineation of wilderness.

2. The collection of quantitative data that allows respondents to indicate the acceptability of each variable (based on their personal perception of wilderness) on a five-point Likert scale.

3. The aggregation of responses (1-5) to provide a total purism score ranging from 21-105 (21 variables)

4. The clustering of the sample into four purism classes, the membership of each sharing common perceptions of wilderness.

All three studies were able to identify four discrete purism classes, confirming that a range of wilderness perception do exist. In each study, the respective wilderness perception classes were labeled non purists, neutralists, moderate purists and strong purists. The ways in which the members of each purism class perceive wilderness are set out in table 1.

The results presented in table 1 can be examined in two ways. First, column (vertical) analysis within each of the three samples confirms that clear differences in perception differentiate each wilderness purism class. It is apparent, for example, that non purists (NP) generally consider most listed variables to be consistent with the images of wilderness that they hold. At the opposite end of the wilderness purism scale, strong purists (SP) see the same variables as unacceptable in wilderness. In between the poles of the scale, neutralists (N) and moderate purists (MP) are also distinguished on the basis of their wilderness perceptions, particularly when considering aspects of artifactualism (human constructs in wilderness environments, such as campsites, road access, tracks and bridges). The former tend to be accepting or neutral when considering these variables, whereas the latter are more likely to be neutral or unacceptable.

Alternatively, row (horizontal) analysis (table 1) allows similarities and differences in perceptions across purism classes and samples to be identified. So, for example, most agree that the term wilderness describes extensive (size) and remote natural environments. A general consensus is

Table 1—Comparison of wilderness perceptions: domestic and international users and the general public.

Wilderness perceptions variable list	Domestic tourists (Shultis 1991; Kliskey 1992)				International tourists (Higham 1996)				General public (Kearsley 1995)			
	NP	N	MP	SP	NP	N	MP	SP	NP	N	MP	SP
Campsites	+	+	-	-	+	/	/	-	+	/	-	-
Exotics	/	/	-	-	+	+	+	-	-	-	-	-
Road access	+	+	+	-	+	+	/	-	+	+	/	-
Commercial recreation	+	/	-	-	+	-	-	-	+	/	-	-
Maintained tracks	+	+	+	-	+	+	/	-	+	+	/	-
Bridges	+	+	+	-	+	+	/	-	+	+	/	-
Hunting	+	+	/	-	/	-	-	-	/	-	-	-
Logging	/	/	/	/	/	-	-	-	-	-	-	-
Motorised travel	/	-	-	-	+	/	-	-	/	-	-	-
Huts/shelters	+	+	+	-	+	+	/	-	+	+	-	-
Hydro	/	-	-	-	/	-	-	-	-	-	-	-
Mining	-	-	-	-	/	-	-	-	-	-	-	-
Solitude	-	+	+	+	/	/	/	/	+	+	+	+
Remoteness	+	+	+	+	+	+	+	+	+	+	+	+
Little human impact	+	+	+	+	+	-	-	-	+	+	+	+
Size	+	+	+	+	+	+	+	+	+	+	+	+

NP = Non purists, N = Neutralists, MP = Moderate Purists, SP = Strong Purists.
+ = acceptable, / = neutral, - = unacceptable.

achieved when respondents consider the acceptability of commercial developments (such as mining, hydroelectric, logging) and commercial recreation in wilderness. These were seen to be unacceptable by most. The same applies to perceptions of hunting and motorized transport which, but for one or two exceptions, are seen to be contrary to the image of wilderness.

Row analysis also allows the identification of variables toward which the views of various purism groups are substantially different. Most particularly, differences in wilderness perceptions relate to human developments in wilderness areas. Road access, maintained tracks and campsites, bridges and walk wires, huts and shelters are viewed quite differently by the members of different purism groups. Non purists are most accepting of these developments, and many consider them essential to the wilderness experience. Indeed, some of the more extreme members of this group considered further developments such as flush toilets and hot water consistent with their personal views of wilderness. By contrast, neutralists tend to be generally accepting of facility development, moderate purists selective but generally neutral, and strong purists wholly opposed to any such facility developments. These variables most clearly differentiate between the membership of different wilderness purism classes. Wilderness purism groups can also be distinguished on the basis of perceptions of solitude. New Zealanders (both domestic wilderness users and the general public) agree that solitude is an important aspect of the wilderness experience. International visitors to New Zealand are, by contrast, neutral towards solitude as a quality of wilderness experience. It is important to note that these results tell only of perceptions of solitude, without identifying precisely what sample units consider solitude to be; it is possible that different respondents have quite different feelings about solitude.

These results serve to illustrate that different purism groups are not necessarily in accord with the views of wilderness held by other groups. However, while contrasts exist within each sample, the fact that the relative size of purism classes varies between samples is also noteworthy. Table 2 illustrates that purism class membership varies considerably, with the general public, perhaps unsurprisingly, tending to be much less strict in their perceptions than either of the other two groups. Some 83.3% of Kearsley's public sample are neutral or non purist, compared with 48.0% of domestic wilderness users and only 33.1% of international visitors. By contrast, over half of

backcountry users (52.0%) fall into the moderate and strong purist classes and fractionally over two thirds (66.9%) of international visitors. Again, it is clear that there are wide divergences in wilderness perception among differing groups.

Conclusions

In New Zealand, as in many other countries, difficult decisions regarding the designation of wilderness areas and rights of access need to be made if the resource base is not to be further impaired. While government and tourism organizations such as the New Zealand Tourism Board continue to focus on encouraging visitation, insufficient attention is being given to maintaining the wilderness resource. This paper focuses on the demand-side of wilderness management. It draws together samples from three distinct studies and confirms that different groups of wilderness users cannot be viewed or treated as homogenous by wilderness managers. Several qualities of wilderness are viewed quite similarly by members of different purism classes, across different samples. Remoteness was seen by most to be fundamental to wilderness, and commercial development, commercial recreation and motorized transport were viewed as generally unacceptable. On the other hand, perceptions of wilderness may vary most strikingly across purism classes and study samples. This is particularly the case in terms of facility development.

This paper also confirms that the relative membership of discrete purism classes varies considerably between samples. Wilderness users, both domestic and international, proved to be more purist in the wilderness perceptions that they hold (international users slightly more so than domestic), while the non purists and neutralist classes were more strongly represented in the general public sample. This all serves to emphasize that wilderness perceptions vary among individuals. This fact must be recognized by wilderness managers and reflected in the management of different environments to meet the wilderness interests and demands of different active and latent user groups. The perceptual approach to wilderness management should serve the additional function of protecting designated wilderness areas from overuse by meeting the majority of wilderness recreation demand in non wilderness environments.

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Table 2—Purism class memberships: New Zealand backcountry users, New Zealand general public and New Zealand international tourists (%).

Sample	Non purists	Neutralists	Moderate purists	Strong purists
Backcountry users (Shultis 1991; Kliskey 1992)	11.0	37.0	34.0	18.0
General public (Kearsley 1995)	40.4	42.9	15.9	0.8
International tourists (Higham 1996)	4.4	28.7	45.0	21.9

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Biological Science in Conservation

David M. Johns

Abstract—Large-scale wildlands reserve systems offer one of the best hopes for slowing, if not reversing, the loss of biodiversity and wilderness. Establishing such reserves requires both sound biology and effective advocacy. Attempts by The Wildlands Project and its cooperators to meld science and advocacy in the service of conservation is working, but is not without some problems. Scientists and advocates have differences in methods of work, different understandings of the origins and place of values in conservation, and differing expectations about the efficacy of biological information in achieving protection. Despite these differences, successful relationships can be forged where these differences are recognized and made part of the conservation planning process.

Albert Einstein was asked one day by a friend “Do you believe that absolutely everything can be expressed scientifically?” “Yes, it would be possible,” he replied, “but it would make no sense. It would be description without meaning—as if you described a Beethoven symphony as a variation in wave pressure.” (Clark 1971)

If nature is the symphony, and conservationists are those who love it and want it to remain alive and intact, what can biological science contribute? Perhaps not a perfect analogy. Nature is more complex and sublime than a symphony, even one of Beethoven’s. But it does suggest that while science is central, it also has limitations. These limitations are understood differently by scientists and advocates, often confounding cooperation between the two groups. I will examine below the experience of The Wildlands Project and its cooperators in attempting to marry science and advocacy to achieve large-scale conservation goals. (I use the term “science” throughout this paper to mean the biological sciences, especially conservation biology. Cooperators includes dozens of grassroots groups and networks of such groups; scientists; local chapters of national groups; and national and international conservation groups; and others.)

The Wildlands Project (TWP) was founded in 1991 by prominent conservation biologists such as Michael Soule and Reed Noss and activists such as Dave Foreman, Jamie Sayen and Mitch Friedman. Both groups had come to realize that existing protected areas—given the historic criteria for their selection and their increasing islandization—were proving inadequate to stem the loss of biodiversity in the face of burgeoning human numbers and consumption (Foreman 1992). The Wildlands Project set out to design and implement a series of regional reserve systems across North

America (from Alaska and Greenland to Panama) that would achieve the following conservation goals: 1) the protection or recovery of all indigenous species in natural patterns of abundance, emphasizing top predators, 2) the protection of all ecosystem types and ecological processes in a healthy state, 3) the unencumbered operation of natural disturbance regimes such as fire, and 4) resilience in the face of anthropogenic change, such as global climate change (Noss 1992).

For a reserve system to achieve these goals, it would need to be science-based. Just as conservation biology, ecology and island biogeography had helped to identify the causes for biological decline of species and the unraveling of ecosystems, so they could contribute to the design of solutions. The biological sciences, in the view of TWP, could answer questions such as: What areas need to be protected? How much needs to be protected? How should protected areas be connected to maintain genetic and other flows? What management regimes should govern protected areas and connections?

To answer these questions, scientific findings would at least inform and at best be the basis for, a concrete vision of what the conservation movement needed to advocate to realize its goals. Advocates and their organizations would provide the political muscle to make the reserve systems a reality.

This marriage of science and advocacy has been successful in many respects—several science-based large-scale reserve designs are in the final stages of peer-review (Wild Earth 2000). All marriages have problems, however, and simple in concept doesn’t mean simple in practice. Partners come to this relationship with differing expectations, backgrounds, training and experience, but their goals and motives are much the same: a love of the natural world and a desire to protect it (Foreman 1992, Society for Conservation Biology 1999). The problems TWP and its cooperators have experienced in integrating science and advocacy fall into three categories: 1) differences between scientists and advocates in methods of work, 2) differences in understanding the origins and place of values, and 3) differences in expectations about the efficacy of biological information in the political world.

These abstract categories translate into complaints like the following: “Advocates treat scientists like lawyers, looking for quick answers and easy certitude.” “Scientists take too long and cost too much; all you really need to do is draw a circle in the dirt and fight like hell for it.”

I will look at each category, exploring the sources of friction and how these have been addressed in the field. The findings are limited to English-speaking North America. Although TWP works in Spanish-speaking North America, project work is less developed there and the nature of advocacy is different than in English-speaking North America (Riding 1985). What the findings suggest is that if these differences between scientists and advocates are ignored,

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David M. Johns is Assistant Professor of Political Science, Hatfield School of Government, Portland State University, and a founder and director of The Wildlands Project, P.O. Box 725 McMinnville, OR 97128-0725 U.S.A., e-mail: djohns@viclink.com

progress in conservation planning can be confusing and slow. Where the differences are addressed directly, it is much easier to achieve clarity of vision and purpose, and conservation work is thereby more effective and timely. Given the human onslaught against the natural world, time is critical.

Methods of Work

Scientists and advocates have different methods of work. Mission-oriented sciences like conservation biology are not essentially different than “pure” science—they aim to adhere to generally accepted standards of investigation and analysis (Shrader-Frechette 1996). Biologists, like other scientists, generally aim to avoid type-I errors, or false positives. Avoidance of finding an effect when there isn’t one is considered a conservative approach—best serving the development of a reliable body of knowledge. But for advocates—and increasingly for many conservation biologists—being conservative means something else. Because species loss and much ecosystem damage is irreversible, it is better (from a policy standpoint) to assume there is an effect and place the burden on developers, road builders and others who seek to alter the world to prove their actions will have no adverse biological effect. This precautionary approach provides the same sort of safety for species and ecosystems the U.S. Food and Drug Administration tries to ensure for people by not allowing drugs to be sold until they’ve been tested.

Other examples of important differences can be identified by the statements of activists and biologists involved in conservation planning. Advocates grumble about scientists’ skepticism, and sometimes see their pointed questions as hostile. Some advocates are wary of science generally with its history of Cartesian dualism, reductionism, mechanism, and ties to institutions (business and government) that have destroyed or degraded much of the natural world. Many agree with David Ehrenfeld’s critique of the Enlightenment assumptions of science: he argues that the belief that we can always solve problems is false, and in fact each problem “solved” creates many new and more difficult ones (Ehrenfeld 1978). Reality suggests that we are not smart enough to model the complexities of nature and successfully manage it. Our minds are not good substitutes for the evolutionary process. Advocates are often used to acting with partial information—it is the political process not the scientific process that sets the timetable. Much scientific work seems needlessly complex or time-consuming. And at times it is intimidating.

Biologists and ecologists also have their complaints. Aside from a (healthy) dislike for politics in general, many fear that their work will not be understood in its complexity or used properly. They fear a different sort of reductionism as their findings are transformed into “sound bites” for a broader public. Biologists have complained of being treated as “hired guns” by advocates, rather than as full partners in the conservation planning process. There is also fear that by being associated with advocates their scientific credibility will be hurt with peers, funders, employers and other institutions. This fear exists despite their wish that the results of their work have a positive impact on policy.

Some differences between scientists and advocates result from constraints imposed by institutions or forces external to the conservation planning relationship: universities, the press or legislatures. Funders or tenure committees may punish scientists for activism, the press does demand sound bites, and Congress operates on *its* schedule. Conservationists must accommodate these factors. In other cases differences are about matters internal to the conservation planning process. Perceptions and behaviors can be explored and changed because they are under the control of the participants. In either case the successful development of a conservation plan requires that these issues be placed on the agenda in each region and addressed. Resolution does not occur in one meeting, but over time, as trust is built and as issues are dealt with concretely in an ongoing process. Issues seemingly once resolved resurface and need to be addressed again. Sometimes this is due to new participants; other times it is due to the difficulty in overcoming long held beliefs or habits.

Resolution of these differences and complaints rest upon the shared goals of the work: to create reserve systems that have a high probability of restoring and protecting natural systems. Only biologically-based reserve design can provide a concrete vision for attaining the goals of large-scale conservation outlined above. Biologically-based reserve design does take time and can be complex, although methods are being developed that allow reserve design to be accomplished more quickly and less expensively. While the science is never complete, at some point it becomes defensible—perfection is not required (Shrader-Frechette 1996). There will be times, however, when action must be taken before the science is defensible, simply because opportunities exist. Educated scientific guesses with a healthy dose of the precautionary principle are often the best that conservationists can do at a particular time. In such cases biological work continues, so conservationists can identify or anticipate, and fix any problems.

Biological work is not the be-all and end-all of conservation—rather it helps to establish the floor for protection. Beyond biological criteria there are other bases for protecting additional areas: for wilderness values per se (e.g. solitude, aesthetics), for primitive recreation, to preserve sacred sites.

Advocates ultimately do recognize the advantage of asking the hard questions internally first. This opportunity strengthens the case for a protection proposal before going into the public arena where conservation opponents will attack it.

The role of biologists in conservation planning and implementation will vary. A number of factors play a role, from the comfort level of particular scientists with advocacy, to well-founded concerns about the reaction of peers and funders. Some are needed in the trenches doing battle; others are needed to speak at a distance from the fray. Their primary task in conservation planning, however, is investigation and analysis that results in recommendations based on clearly articulated and shared conservation objectives.

Science as an institution (and scientists) does carry baggage that has historically been antithetical to conservation (Merchant 1983, Berman 1983). It is well to remember that conservation is fundamentally about values, not science.

Values

For conservationists the evolutionary process, biodiversity, and ecological processes are good things. Public and private policy should reflect and value this goodness. Einstein stated that science is driven by the notion that knowledge is good—a judgment or value he regarded as outside the ability of science to falsify (Barry and Oelschaeger 1996). Since both science and conservation are driven (proximately, if not ultimately) by values, some advocates look to science to generate or provide justification for the values underlying conservation. Some advocates look to science to not only tell them what lands need to be protected to ensure the survival of grizzlies, but also to say that protecting grizzlies is good.

The relation of science—and specifically the biological sciences—to values is a broad discussion. In this paper I seek to explore only that part of the discussion directly pertinent to large-scale conservation and wildlands planning.

Science does not generate values, although the knowledge it generates may influence values. Certainly many discoveries in cosmology (Galileo) and evolutionary biology (Darwin) have had an enormous influence on how humans think and feel about the world they inhabit, including what they consider important and valuable. Knowing we share more than 98% of our DNA with chimps may influence our values, but such knowledge does not directly require us to love chimps as family. Values are products of the human heart and mind and the many social, cultural, and biological forces that shape heart and mind.

Science does not stand apart from values. Scientists have values and these values are part of what draws them to a life in science in the first place. Values shape the questions scientists have an interest in investigating. Other values also shape research and the direction of science, including the values and interests of those who pay for it (mostly government and business), faculty tenure and promotion committees, peers who review the work of a particular scientist, and other elements of society like the media. (Science as an institution or process consisting of thousands of individuals, universities, and research labs will therefore evince values that are often in conflict with each other. Within most disciplines, however, there is general agreement on central values most of the time.)

It is unavoidable and appropriate that values do influence the questions being asked. It is also appropriate that these values be made explicit and be discussed (Conservation Biology 1996). However this is too often not the case.

Discussions among those involved in large-scale conservation planning are fortunate that conservation biologists have been addressing these issues for some time and bring much to the table (Conservation Biology 1997, 1998). As a mission-oriented science, conservation biology has been compared to medicine. Both have explicit goals: in the case of medicine to heal or prevent disease and injury, and in the case of conservation biology to protect and restore biodiversity and ecosystem function (Soulé 1986, Ehrenfeld 1989, Primack 1995). While both disciplines debate values—and the role of their practitioners as advocates in the political process—they are explicit about being mission oriented, value driven, and acknowledge that these values are not the product of science per se (Conservation Biology 1996).

Whether mission oriented or not, science aims to minimize how these motivating values might bias results. Values rightly shape the questions. But they must not distort the answers to those questions. So the design of research, the observation of results, and the analysis of results and conclusions are subject, in the scientific process, to various forms of review or testing. These include peer review, replication, or the ability of findings to predict future outcomes in the world. It is this aspect of science that must be assessed for bias and degree of objectivity.

Thus, mission and values rightly influence questions science seeks to answer. (And getting the questions right is critical to the success of conservation.) However, the process of investigation, testing hypotheses, and seeking answers requires that the motivating values be compartmentalized so that defensibility of findings can be ensured. This critical distinction is finding widespread acceptance as it becomes understood.

Having a good understanding of the need for compartmentalization does not mean either advocates or scientists always agree about the need for scientists to speak out about values. Many believe scientists need to do more than state the case for their findings. Because scientists have credibility with the public and policy makers, the reasoning goes, their value statements will carry more weight than those of ordinary citizens. Scientists debate this, concerned about the loss of individual credibility and the long-term erosion of collective credibility. Credibility here is seen as being based on the public perception of objectivity. Concerns about credibility are not easily resolved in the general or the abstract, but case by case. It is clear that some scientists, especially those with public stature, can authoritatively speak out about what moves them as well as about their findings. The popularity of the work of E. O. Wilson and Paul Ehrlich are two good examples of scientists that have entered the public debate and had significant acceptance and influence (Wilson 1992, 1993, 1996, Ehrlich 1970, 1980, 1990). Both also have their critics.

But not all scientists want to, or can successfully contribute to the debate. Nor is the role of advocate or public spokesperson one they are usually trained for. The experience of wildlands conservation planners is that the main burden will continue to fall on advocates. They need to formulate and advance the value and interest based arguments that will persuade people to accept the underpinnings of conservation biology as they do the underpinnings of medicine. Advocacy is primarily about making a case for values, not just providing information or data. Policy-making is about choices among values. (The values espoused by differing interests.) The public debate is largely about values: what is good, what is bad, what is, and what ought to be. Advocates are trained, experienced and hopefully suited to these tasks.

Biology and Advocacy

Biologists have been disappointed that “speaking truth to power” doesn’t have much impact on policy. Advocates have been disappointed that biological findings haven’t improved their success rate with Congress or other policy makers. If

science can't help improve policy, just what is its value in conservation?

In the previous two sections I've suggested one important role: informing conservationists about what needs to be done. The experience of The Wildlands Project and its cooperators suggests that scientific findings and scientists also have a role to play in legal and administrative processes and in combating disinformation. Finally, science and scientists do have a role—albeit limited—in influencing decision makers.

Science Informing Activism

If science cannot tell us it is good to try to save all of creation, it can tell us that if we don't save at least substantial parts of the earth in a healthy condition, we may not be able to save ourselves (Bahn and Flenley 1992). But most conservationists, and perhaps most of the public, know that. Conservationists are interested in saving more than just what is necessary to keep humanity going in some minimal way. Conservation is about human needs, certainly: the need for solitude, for spiritual renewal, for protecting areas as a baseline for how nature works, and so on. Conserving wildness may be important for our survival in other ways: Paul Shepherd (1990) has argued that human beings do not mature apart from wild things and wilderness. Insofar as our survival depends on maturity and the wisdom that attends it, wilderness is extremely important. Conservation may also simply be about loving nature, which is after all our first home.

Conservation is about much more than humankind, however. Many conservationists recognize that we are but one species among millions and we do not have the right to destroy life for the sake of human convenience. In this view, all life is intrinsically valuable, as is that which sustains it—mountains, rivers, oceans, prairies, the great web of interconnection. It is this connection that gives life meaning. Love is about connection—connection to other living things and life-sustaining things. Everything else—including the accumulation of stuff—is a poor substitute.

Many conservationists—activists and scientists alike—do not believe we can constrain anytime soon the machinery that is destroying nature. There are now six billion humans and we are asking the earth to support another 80 million people a year. Our factories, mines, freeways, subdivisions and shopping malls feed like cancer on healthy tissue. Although these issues must be addressed, we cannot wait on their solution. In the interim vast areas of the earth must be set aside, off limits to industrial and agricultural activity, where whole systems can recover and flourish.

Since we can't protect every place we much choose. What places will best ensure functioning ecosystems and healthy populations of all native species into perpetuity? What places will allow the recovery of top predators so essential to ecosystem regulation, and allow disturbance regimes and succession to operate unencumbered? If habitat and fragmentation are problems, what habitat and connections do we need to recover and rewild places? What sorts of human uses are compatible in multiple-use or transition zones lying between human settlements and protected areas? Conservation biology, island biogeography, and ecology have helped to recognize and define the problems associated with species

and ecosystem decline. They are also in a position, along with restoration ecology and other disciplines, to help define the solutions.

The single most important use of science in conservation is providing guidance to the protection movement about what must be done on the ground. Without that guidance we would not know what or how to protect. Even with guidance the precautionary principle must be incorporated into our reserve designs and campaigns for protection.

Science Informing Judicial and Administrative Processes

In countries with effective legal systems such as the U.S., Canada, and Costa Rica, scientific information is important before courts of law and in administrative rule and decision making. Keiter and Locke (1996) surveyed laws that might be used to protect carnivores in the Rocky Mountains of the U.S. and Canada, including the U.S. Endangered Species Act (1973). Laws like the ESA set goals and general standards that agencies—and in many cases private entities—must adhere to. Scientific findings and the testimony of scientists have been important in numerous lawsuits to bring agencies and others to task for failing to list a species, failing to develop adequate recovery plans, or failure to properly administer them. Findings and testimony are critical in establishing whether or not agencies or others are complying with the law.

Science is important in other settings. The standards and goals set by the U.S. Congress are typically general. The agencies that administer them must develop more detailed standards and processes to carry out these mandates. Here again scientific findings and the testimony of scientists can make a difference in shaping what standards are adopted in agency rules. What is the standard for determining if a species is threatened or endangered? What constitutes the taking of an endangered or threatened species? Science is no magic bullet, and courts give great deference to agencies, which in any case are required only to have some basis in the record for their decision. Agencies are not required to listen to the “best” scientists, or the majority of scientists, and can ignore the best and the majority.

Scientific findings can fare somewhat better in conflicts over the proper application of those standards. Is a species, in fact, recovering? Was a species properly listed? Even in this circumstance sound science can be ignored. This is especially true when powerful interest groups and their Congressional allies—often with budget or other authority over an agency—dispute the logical policy implications of science (Wilkinson 1998). However, in this circumstance—which is quasi-judicial, rather than quasi-legislative—the courts are much less shy about overturning agency decisions (Strauss and others 1995).

Science and Disinformation

Scientists may differ in their views and predispositions. This can affect not only the questions they ask but how they interpret findings. These differences may themselves drive further research in an effort to resolve disputes. The generation and testing of hypotheses is part of the normal work of

science. However, as previously stated, views, values and predispositions of scientists must not affect their findings. In some cases they do.

Conservation work has generated a backlash, especially from those that profit from the destruction of the natural world. The Ehrlichs (1997), in their book *Betrayal of Science and Reason*, have termed this a “brownlash.” “(T)he brownlash has produced what amounts to a body of anti-science—a twisting of the findings of empirical science—to bolster a predetermined worldview and to support a political agenda.” Such accusations are made against conservationists by brownlashers as well.

That both sides make similar accusations does not leave us in some relativistic swamp, however (Soulé and Lease 1994). There is a real distinction between good science and the “anti-science” of the brownlash. Good science is peer reviewed, makes clear its methodology and the data supporting its conclusions, relies on generally accepted methodologies, does not use data selectively to support a conclusion, does not rely on fabricated “data”, and is generally acknowledged to be good science even by those in the scientific community who may disagree with its conclusions. It does not allow bias to influence findings (Ehrlich and Ehrlich 1997). Personal attacks are also typical of purveyors of “anti-science.” (Flattau 1998) Examples of anti-science include claims that biodiversity is not threatened, extractive industries are benign, risks from toxic substances are grossly exaggerated, ozone depletion is a hoax (Ehrlich and Ehrlich 1997); Ray’s defense of the nuclear industry and others (1993); Julian Simon’s (a direct marketing economist) attempt to explain a dolphin die-off on the Atlantic coast without regard to marine biology (Flattau 1998); and efforts by non-climatologists to dispute the findings of climatologists on global warming. In the last case the (U.S.) National Academy of Sciences took the unusual step of formally and publicly disassociating itself from an unpublished article and petition being circulated with it. The unpublished article, which claimed greenhouse gases were a “wonderful and unexpected gift from the Industrial Revolution”, was printed to look like an offprint from the Academy journal. (New York Times, 22 April 1998)

The public does not read scientific journals. It gets news from television, radio, and to a lesser extent from the print media. Proponents of the brownlash have made a concerted effort to use the popular media and have been effective in getting many of their views out to the public. If the popular media is abandoned to such views, the public—increasingly misinformed by the endless repetition of falsehoods—can be expected to support policies that flow from such falsehoods. Paul Ehrlich, Thomas Lovejoy, Norman Myers, Reed Noss, Peter Raven, Michael Soulé, E.O. Wilson, and many others have argued persuasively that scientists must speak out publicly about the crisis of biodiversity, and what must be done to avert it (Lovejoy 1989; Noss 1993; Soulé 1986; Wilson 1992). To be effective with the public and policy makers their voices cannot be restricted to professional journals. They must engage the media that people rely on. Scientists do enjoy significant prestige with both media and public, but it means little if it is not used. Two things would encourage scientists to speak out more: recognition by peers and employers for contributions to the popular press, and

knowledge that they do not stand alone (Society for Conservation Biology Annual Business Meeting, 1995).

The broader culture (especially more educated segments) does absorb scientific findings. Over time this information can affect general perceptions and assumptions. It can shape future reactions to policy initiatives affecting conservation. Public awareness of the consequences of smoking and poor diet are two good examples, as are the billions spent on public relations and advertising (Paletz 1997, Paletz and Entman 1981).

No amount of knowledge is a substitute for biophilic feelings and values. Communicating with important constituencies about values is essential. But it is not enough. If the public lacks a good general understanding of how science works or what its findings are, lies and half-truths can flourish.

To reach the widest audiences, scientific findings need to be incorporated into the stories we all live by. We are storytelling animals and most of us understand the world best through metaphor—the currency of art more than science. Many scientists who write for a larger audience, such as Stephen Jay Gould in *Natural History* and Lewis Thomas (1974), spin a good story and deserve emulation.

Science and Decisionmakers

The ability to persuade decisionmakers can also be seen as the ability to make your problems their problems. Can scientists and scientific findings help with this? *Yes, but, their role in influencing legislators and other policy-makers is decidedly mixed.*

The Wildlands Project and cooperators are just completing several conservation plans. Implementation has started, but has not been undertaken in a broad way. The tools for implementation are not new and those involved have much experience using them to protect public and private lands. Based on that experience, including recent successes in changing management regimes and protecting some new areas, several themes have emerged.

For scientific information to have influence with legislators one or more of a number of factors need to be present. 1) Legislators have to care about the issue. They need to share some of the underlying values or at least the goals of conservationists. If, for example, a legislator does not care about protecting grizzly bears, the best scientific information about what habitat these bears need will not be persuasive. If, on the other hand, legislators do care, then having that information can play a role in shaping proposed solutions, as it did in refinement of boundaries for the proposed Northern Rockies Ecosystem Protection Act and the now existing Muskwa-Kechika Protected Area and Special Management Areas. 2) Legislators must feel that their constituents care about the goals that conservationists advance. Constituents may be voters back in the district, organized interests that have a presence in the district, opinion leaders, or campaign contributors inside or outside the district. Those groups traditionally supportive of the legislator and that already have ties will fare better, but swing groups are also important. In short, where political muscle is adequate to gain legislative attention and support, science then has a window through which it can enter the process. Legislators

can appear to hang their hat on “the facts.” 3) If legislation has been introduced and a vote is pending, then legislators must make a decision. Concentrated pressure by a number of forces, including prominent scientists, can be important. So can the use of findings that resonate with constituent values. 4) Other factors also exist that create space for scientific influence in the legislative process. One conservationist proposal may be anathema to a legislator, but another proposal may be worse. In some cases legislators will support proposals because they believe later in the process—in rule-making or subsequent appropriation cycles, they can effectively undermine it. At other times, when values fade into the background because they are widely shared or cannot be challenged, information can make a difference. Legislators are often looking for issues and scientific findings can provide a hook (Allin 1982, Cohen 1992, Bryner 1993, Bimber 1997). In short, science has influence when legislators are receptive due to shared values or goals with those offering the information, or when science has power on its side and legislators have to pay attention. A proverb says that evil will triumph if good is merely good, and not also strong.

Scientific arguments that rest on assumptions about the value of biodiversity will not persuade those who do not share these assumptions, or if they don’t have some other reason for going along, such as pleasing constituents, or staying in office.

Many decisionmakers rely on the kind of “anti-science” described above in the subsection on disinformation. Scientists and scientific findings can be important in debunking that “anti-science.” The role of sound science in undermining the credibility of cigarette executives and their Congressional allies is a good example of how this can work. But it is also an example of the limits of science when it confronts those with more economic and political power.

Scientists and scientific findings can play a role in informing the critical mass needed to move elected and other decisionmakers. Important constituent groups and key elements of the public are mobilized by value-based arguments, arguments that touch their feelings, and appeal to self-interest, but good information is important in framing persuasive and sound solutions. Successful wildlands conservation requires support that is both deep and informed: people need to feel intensely about wildlands and also to understand why, for example, roads and oil exploration don’t mix with wildlands.

In working with private landowners good science can be important, but as in other cases, absent shared values or some other interest supporting shared goals, it doesn’t carry much weight.

In the business sector decision-making is also about power. It is not the scientific evidence that persuades, but estimates of pain and gain. Bad press with the public, falling sales or falling stock prices, threats of litigation, civil disobedience—all of these can be persuasive (Johns 1998; Careless 1997). Science can help inform our arguments and debunk theirs if they rely on bad information. And when economic actors do support conservation—based on values or some other interest—science can be persuasive in framing solutions.

Summary

To protect and rewild much of the planet requires at root a passionate commitment to life—to the beauty, spontaneity and creativity of the evolutionary process. But our love must not only be deep. It must be an informed love, an intelligent love. The primary role of science is to make us informed.

Protection requires all the political muscle advocates can muster and sustain over the long haul. The biological sciences are essential as well: to understand the problem and in fashioning solutions, to combat disinformation, and to operate effectively before agencies and in the courts. They are one tool among many in making persuasive arguments. Scientists bring credibility to some fights in some fora.

Differences among scientists and advocates are real. Differing methods of work, of understanding the role of values, and of how science works in the political process are a potential source of friction. The less energy we have to put into correcting misunderstandings, the more effective we are. In the scheme of things, the problems I’ve discussed are small; too much is at stake for divorce to be an option.

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Population Growth, Economic Security, and Cultural Change in Wilderness Counties

Paul A. Lorah

Abstract—A familiar version of the “jobs versus the environment” argument asserts that wilderness areas limit economic growth by locking up potentially productive natural resources. Analysis of the development paths of rural Western counties shows that this is unlikely: the presence of Wilderness is correlated with income, employment and population growth. Similarly, Wilderness seems to be a catalyst promoting the transition from stagnating extractive economies to relatively competitive amenity economies. As the relationship between local economies and the environment shifts from a reliance on extraction to a reliance on amenities, many local communities struggle to deal with the resulting cultural change.

Federal lands comprise approximately 48% of the acreage of the 11 Western states, and management of these lands often affects the development of nearby communities (Byers 1996). Because of this, policies governing the use of federal lands are both important and controversial. One of the most contentious debates over the use of federal lands focuses on wilderness areas.

The Wilderness Debate

Many in the rural west view wilderness as an economic liability. They claim that extractive industries—farming, ranching, logging and mining—fuel economic growth in rural areas. Consequently, they argue that locking up potentially productive resources in wilderness areas jeopardizes economic security by limiting the growth of both jobs and tax revenues. Others worry about the supply of raw materials. “(T)he needs of Americans for products from forests and other wildland cannot be met affordably and in sufficient quantity if lands are increasingly set aside solely for recreational enjoyment and nature worship” (Patric and Harbin 1988).

Others claim that the majority of the income in the rural West is no longer derived from extractive industries. Instead, natural amenities, desirable lifestyles and a relatively high quality of life give some communities an advantage in attracting and benefiting from tourists (bringing travelers checks), retirees (bringing social security payments and investment income), and footloose entrepreneurs (bringing additional employment). Because of this, environmental amenities such as wilderness act as a catalyst in the transformation of stagnating extractive economies into diversified, relatively

competitive amenity economies (Johnson and Rasker 1993, Power 1991, Power 1995, Rasker 1994, Rudzitis and Johansen 1989, Williams and Sofranko 1979). In other words, “Our natural landscapes no longer generate new jobs and incomes primarily by being warehouses from which loggers, farmers, fishermen, and miners extract commercial products. In today’s world, these landscapes often may generate more new jobs and income by providing the natural resource amenities—water and air quality, recreational opportunities, scenic beauty and the fish and wildlife—that make the . . . [area] an attractive place to live, work, and do business” (Power 1995, ii).

This paper provides empirical evidence for the latter argument in two ways. First, it dispels the jobs versus the environment myth that wilderness limits economic growth. It accomplishes this by demonstrating that the presence of wilderness is associated with population growth, income growth, and employment growth. Second, it focuses on the role wilderness plays in transforming the structure of local economies. This is accomplished by mapping the diffusion of amenity economies (and the retreat of extractive economies). Analysis of the resulting map demonstrates that the presence of wilderness influences when and where local economies shift from an Old West reliance on extraction to a New West reliance on unearned income. Finally, the paper explores some of the environmental and cultural challenges faced by wilderness communities.

Wilderness and Growth

Two themes underlie the economic history of the rural west: the region’s role as a supplier of raw materials (Worster 1992), and its vulnerability to cycles of explosive economic growth followed by rapid decline and stagnation (Gulliford 1989). This boom and bust pattern is a result of the fact that the majority of local rural economies depended on a single export oriented, extractive industry (Limerick 1987; Power 1991). Economic growth occurred where commercially exploitable natural resources were found, and successive waves of economic speculation (based on beaver pelts, then minerals, agricultural lands, timber and energy) brought growth to previously undeveloped regions. Similarly, economic decline was associated with the loss of mines and timber mills. With this history, it is understandable that residents of towns with names like Leadville, Golden, Silverton, Silver City and Marble often equate extraction with economic security, and view wilderness as a barrier to growth.

However, this is not an accurate picture of contemporary economic reality. A number of researchers have demonstrated that income generated by the export of raw materials is no longer the foundation for economic security in the region (Power 1991, Rasker 1993, Rudzitis 1993, Freudenburg and Grambling 1994, Lorah 1996). One typical study, for

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Paul A. Lorah is a Professor in the Department of Geography, University of St. Thomas, St. Paul, MN 55105 U.S.A., e-mail: Palorah@stthomas.edu

example, quantified the declining economic importance of extractive industries in rural counties of Colorado, Idaho, Montana and Wyoming from 1969 to 1993. During this period, 97% of the new jobs in this region were created in nonextractive sectors. Similarly, 92% of the growth in income during the study period occurred in non-extractive sectors (Lorah 1996).

Despite the fact that virtually all of the region's extractive industries are in decline (Gulliford 1989), the economies and populations of some rural counties in the West are experiencing rapid economic growth. This apparent contradiction indicates that a fundamental change in the nature of the region's economy has taken place. The environment still supports local economies, not as a "warehouse of raw materials," but as a magnet attracting amenity-seeking tourists, migrants, and small business owners. In places where this transition has occurred, local economies have navigated from dependency on a few natural-resource industries to a modern, diversified, service-oriented economy. An increasing number of researchers (including the 34 endorsing Power 1995) feel that the West's economic future lies not in extractive industries, but in industries that benefit from the presence of environmental amenities such as wilderness.

If this is the case, the jobs versus the environment argument that wilderness harms local economies is wrong. *Instead, counties with relatively high percentages of land devoted to wilderness should have relatively high rates of income growth, employment growth, and population growth.*

Study Area

This hypothesis was tested in a study area consisting of 113 rural (no places with populations of 2,500 or more) Western counties. Because the hypothesis focused on the relationship between local economies and wilderness, metropolitan and urban counties were excluded. This exclusion was based on the fact that the primary economic sectors of urban counties are negligible, and their economic performance is largely decoupled from the nature and quality of their immediate natural resource base (Hardy and Ross 1990). Since even the economies of rural counties can be heavily influenced by nearby urban areas (Butler 1990), rural counties were divided into two groups: *rural adjacent counties* (counties that are physically adjacent to at least one Metropolitan Statistical Area with more than two percent of the employed labor force commutes to jobs in metro counties) and *rural non-adjacent counties* which were both rural and relatively distant from metropolitan areas. The Western U.S. was chosen because it contains relatively high percentage of land devoted to wilderness. Counties were chosen as the unit of analysis, since they are the smallest unit at which detailed demographic and economic information is systematically enumerated and made available. The study area appears in figure 1.

Data

Data on the location and extent of federal lands were obtained from the Federal and Indian Lands Map Layer of the U.S. Geologic Survey's National Atlas of the United

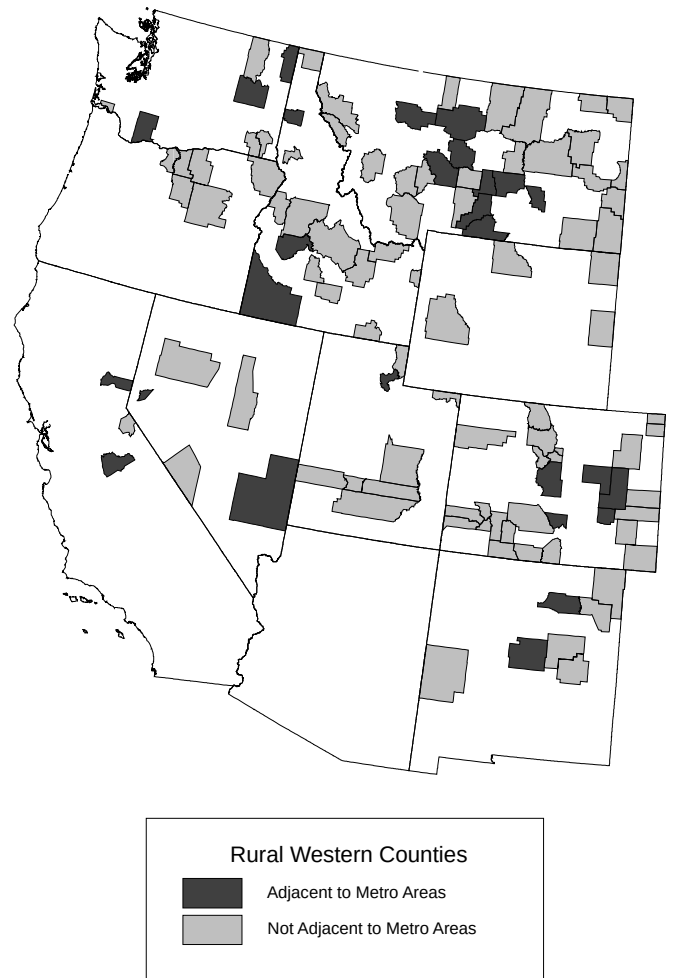


Figure 1—Study area: rural counties in the 11 Western United States.

States (1997), and figure 2 is a map of high amenity federal lands, including wilderness areas. Data on employment, income and population were obtained from the Department of Commerce's Regional Economic Information System CD-ROM (1998). The rural-urban continuum codes for metro and nonmetro counties were acquired from the Agriculture and Rural Economy Division of the Economic Research Service (Beale 1998), and the time period under consideration 1969-1996, was the longest possible, given data availability.

Analysis

The hypothesis that counties with relatively large proportions of land in wilderness experience relatively rapid growth is easily tested. First, a Geographic Information System (GIS) was used to calculate the percentage of acreage devoted to wilderness in each rural Western county. Second, the growth rates of employment, total income, per capita income and total population were calculated for each rural Western county for the period 1969-1996. Third, once these economic development indicators and the percentage of land in wilderness were calculated for each county, this

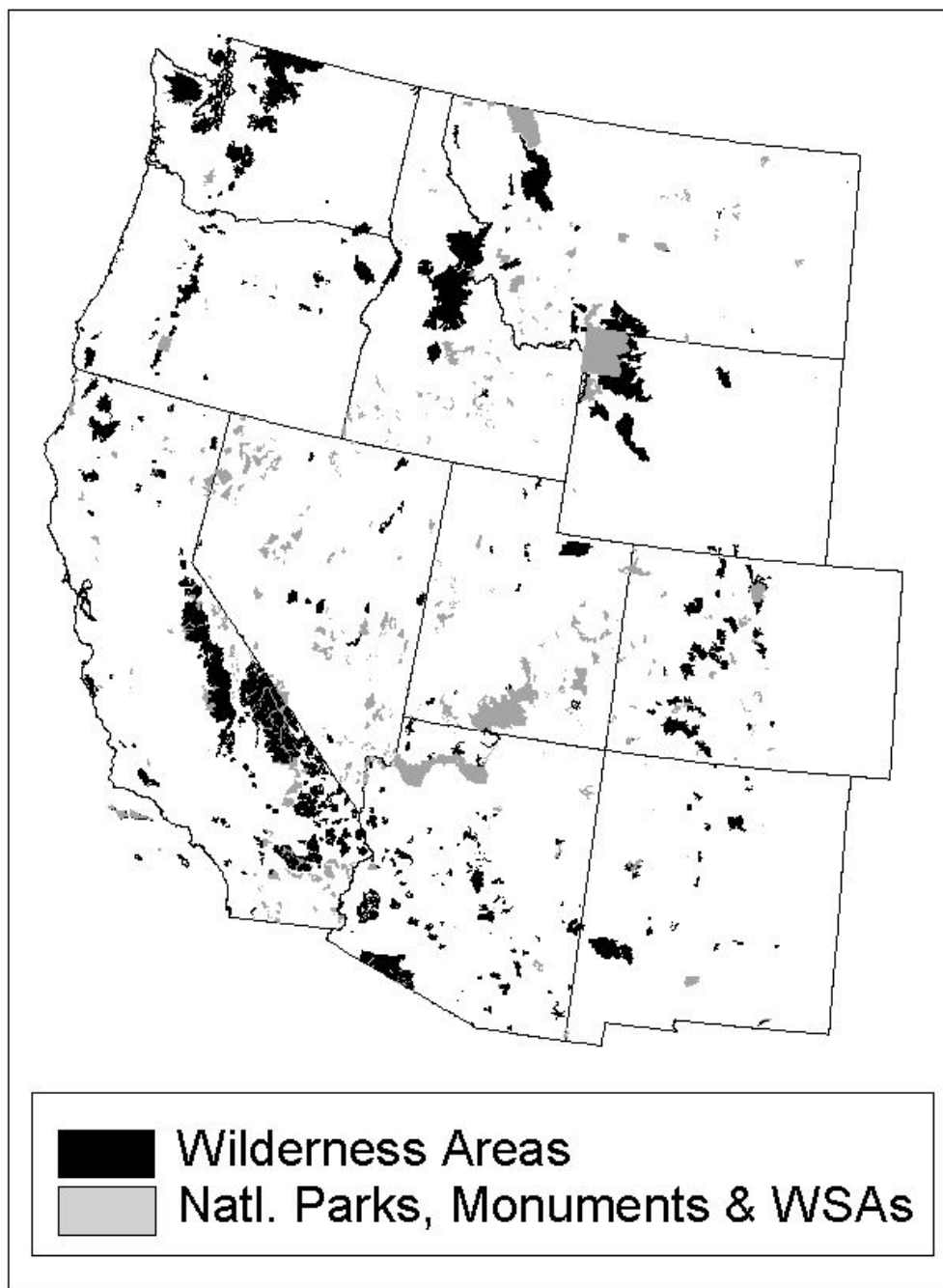


Figure 2—Wilderness, National Parks, National Monuments, and Wilderness study areas.

information was used to calculate Pearson's correlation coefficients for the relationship between the percent of land devoted to wilderness in each county and that county's population growth and economic growth. Because some rural counties in the study area are adjacent to metropolitan areas, their development paths may be affected by income generated by residents commuting to jobs outside the county. In order to focus more directly on the relationship between local environmental amenities and local economies, a second calculation was made using only rural counties that

are not adjacent to metropolitan areas. The results of both calculations appear in table 1.

These calculations indicate that the presence of wilderness does not limit economic growth. Instead, the correlation between the percentage of land devoted to wilderness and each measure of growth is positive and statistically significant. In other words, counties with higher percentages of wilderness have faster total income, employment, per capita income and population growth rates than counties without wilderness. These results indicate that the jobs verses the

Table 1—The correspondence between the percent of land devoted to wilderness and economic development indicators in rural Western counties.

	Employment growth 1969-1996	Per Capita income growth 1969-1996	Total income growth 1969-1996	Population growth 1969-1996
All rural counties (N = 113)	382*	0.253*	0.341*	0.337*
Rural counties not adjacent to metro areas (N = 83)	0.443*	0.289*	0.406*	0.453*

*P = 0.001.

environment argument is seriously flawed: protecting land as wilderness does not seem to limit the growth of local economies in the rural West. Similarly, despite the fact that relatively isolated economies are thought to rely more on local natural resources (Deavers and Brown 1985, Freudenburg and Grambling 1994) the relationship between wilderness and growth is strongest in rural counties that are not adjacent to metropolitan areas.

Wilderness areas are only one source of environmental amenities in the West. Because it seems likely that a broad range of environmental amenities promote economic security, a second set of calculations was undertaken. These calculations were based not only on wilderness, but also on national parks, wilderness study areas and national monuments. The results appear in table 2. As expected, when the definition of environmental amenities was expanded to include wilderness, national parks, wilderness study areas and national monuments, the correlation between environmental amenities and measures of growth was even stronger. Additionally, the correlation between amenities and growth was again significant and stronger in the most isolated rural counties that were not adjacent to metropolitan areas.

This analysis shows that the presence of wilderness is *associated* with population growth and with economic growth. It does not prove that wilderness *causes* growth. Perhaps limited access to natural resources in wilderness counties hinders the development of less competitive, cyclical, single-sector extractive economies. Either way, informed commentators may find it difficult to claim that the presence of wilderness limits long-term economic growth.

Wilderness and the Transformation of Rural Economies

The role logging, mining and agriculture play in supporting rural economies is declining. At the same time, counties rich in environmental amenities are growing relatively rapidly. Taken together, this suggests that environmental amenities act as a catalyst in the transition from stagnating extractive industries to relatively diversified amenity economies that attract tourists, retirees and small business owners. If this is the case, the presence of wilderness should influence when and where local economies shift from a reliance on extraction to a reliance on amenities. In other words, *the location of wilderness should coincide with the location of the first counties to make the transition from extractive economies to amenity economies.*

In order to test this hypothesis, it is necessary to classify the counties in the study area as having either extractive economies or amenity economies. Rasker (1992) points out that as the traditional resource-dependent, extractive economies of the rural West become increasingly diversified and service oriented, new forms of economic dependency appear. Increasingly, one of the largest sources of income is nonlabor income, which consists of government transfer payments and dividends, interest and rent (DIRE). In fact, in some rural counties, the amount of income from DIRE alone has grown larger than the income created by all of the jobs in extractive industries combined.

Figure 3 shows the transition from extraction to DIRE in Ouray, Colorado. It shows that extractive income declined

Table 2—The correspondence between the percent of land devoted to environmental amenities (wilderness, national parks, national monuments, and wilderness study areas) and economic development indicators in rural Western counties.

	Employment growth 1969-1996	Per capita income growth 1969-1996	Total income growth 1969-1996	Population growth 1969-1996
All rural counties (N = 113)	0.429*	0.372*	0.305*	0.361*
Rural counties not adjacent to metro areas (N = 83)	0.520*	0.378*	0.458*	0.497*

*P = 0.001.

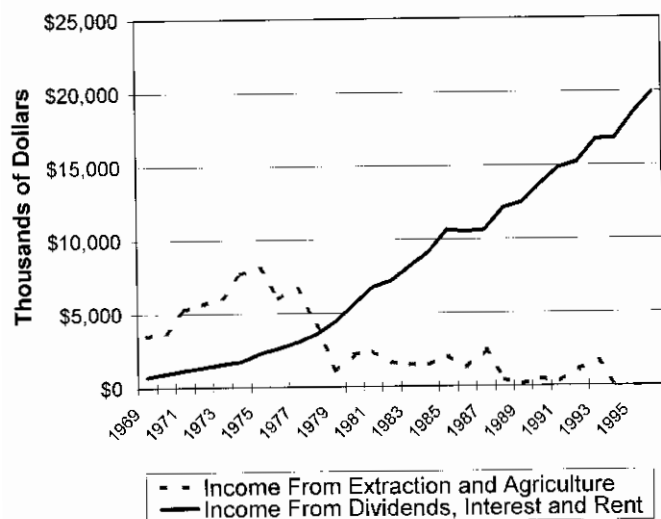


Figure 3—The transition from extraction to unearned income in 1978 in Ouray, Colorado.

dramatically between 1969 and 1996, and was eclipsed by the relatively rapid growth of DIRE in 1978. When these two lines cross in 1978, the economy can no longer be said to be an extractive economy. This is an important change. Jobs in extractive industries were long thought to be the foundation of rural economies. They shaped the region's self-image as a place of honest, physical labor, where miners, loggers and ranchers produced vast quantities of minerals, energy, timber and beef. Yet in Ouray County after 1978, all of these jobs together contributed less to local income than money earned by passively collecting interest from bank accounts, dividends from investments, checks from renters and royalties from patents. Consequently, when income from DIRE eclipses income from extraction, the local resource base no longer supports local economies through extraction, and a fundamental shift in the structure of the economy has taken place.

Counties in the study area were classified as either amenity economies or extractive economies on the basis of whether or not income from DIRE surpassed income from extraction. Next, the transition dates were calculated for all amenity economies. (In some counties, the relative importance of DIRE and extraction shifted several times. When this happened, the most recent date at which DIRE grew larger than extraction was used as the transition date). The results of these calculations show that counties in the study region fall into three groups. The first is a core group of counties that were already amenity economies in 1969, the second group became amenity economies during the study period, and the third group remained dependent on extraction in 1996.

With this information, it was possible to map the diffusion of amenity economies in Western counties (figure 4). This map shows an expanding frontier of amenity economies in rural counties. The frontier spreads from several core areas containing counties that made the transition to amenity economies prior to 1969. This diffusion is spatially uneven, however, as pockets of extraction persist and amenity economies experience less resistance elsewhere and spread beyond and around them.

If wilderness is a catalyst in the shift from extraction to amenities, the uneven diffusion of amenity economies is to be expected. This is because wilderness is also unevenly distributed throughout the study area. Consequently, the location of wilderness should coincide with the locations of counties that make the transition from extraction to amenity economies relatively early. This turns out to be the case. Table 3 contains the correlation coefficients for the relationship between the percent of land devoted to wilderness and the time of transition from extraction to amenities. Again, the calculation was made for all rural counties in the study area and for rural non-adjacent counties. In both cases, the correlation was statistically significant. The negative correlation suggests that, as expected, later transition dates are correlated with less wilderness, and earlier transitions are correlated with more wilderness. Again, the correlation coefficient was highest in the most isolated rural counties that were not adjacent to metropolitan areas.

When the definition of environmental amenities is again broadened to include national parks, wilderness study areas and national monuments in addition to wilderness, similar results are found (table 4). Again, the correlation was statistically significant, and the correlation coefficient for non-adjacent rural counties was higher than that of rural counties.

These results support the assertion that environmental amenities play a role in shaping the economic structure of rural counties. Where environmental amenities such as wilderness exist, local economies are more likely to have moved beyond a narrow reliance on extraction. Counties without the benefit of environmental amenities are at a competitive disadvantage in attracting tourists, immigrants, and employers. Consequently, they may suffer from an inability to achieve long-term growth as a result of their continued reliance on relatively stagnant extractive industries.

Other research also found that the economic structure of wilderness counties differs from that of non-wilderness counties. In a study of nonmetropolitan counties in Colorado, Idaho, Montana and Wyoming, the development paths of wilderness and non-wilderness counties during the period 1969–1993 were contrasted (Lorah 1996). Total employment in wilderness counties grew 65 percent faster than total employment in non-wilderness counties. When employment growth was disaggregated into individual sectors, the biggest differences between growth rates in wilderness and non-wilderness counties appear in those sectors benefiting from a shift to an amenity economy. Employment in wilderness counties grew faster in construction (151 percent faster), services (129 percent), finance, insurance, real estate (115 percent) and trade (93 percent). In fact, employment growth lagged only in primary sectors. In non-wilderness counties, mining and manufacturing were relatively important components of employment growth, while the number of farming jobs actually declined.

The decline of extractive industries in the rural West is offset by economic growth in wilderness counties. In addition to experiencing relatively rapid growth, wilderness counties also have relatively diversified economies that are no longer dominated by environmentally damaging extractive activities. Wilderness counties appear to be in a win-win situation, where environmental protection and economic security are mutually dependent. Still, the shift to an amenity economy has created both new challenges and new opportunities.

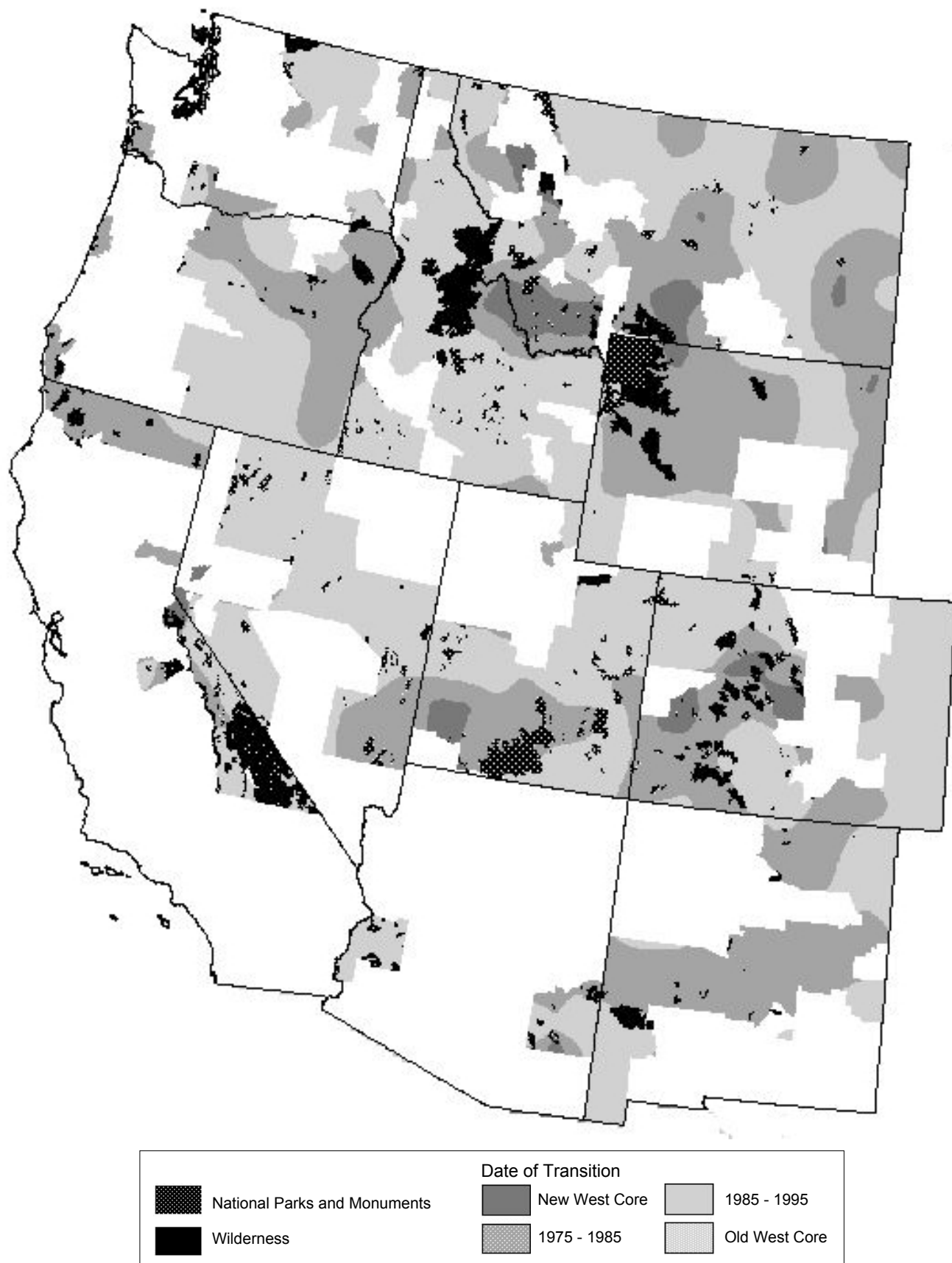


Figure 4—The spatial diffusion of the economy of the New West. The transition from the Old West to the New West occurs when the amount of unearned income (dividends, interest, and rent) grows larger than the amount of income generated by extraction and agriculture.

One of the most pressing challenges wilderness counties face involves finding ways to effectively deal with the rapid pace of growth and cultural change. Because wilderness counties are growing relatively rapidly, and because they were among the first to switch from extraction to amenities, their development paths may hold cautionary lessons for other Western counties.

Growing Pains in the New West

The rural West is currently in the throes of profound cultural change. In many high-amenity counties, economic and demographic changes are undermining local traditions to such an extent that many rural Westerners, especially those still involved in extraction, feel increasingly disenfranchised and powerless in their own communities. Many cattle ranches, for example, are hemmed in by the growth of subdivisions. In some cases, ranchers need police escorts for their cattle drives. "People are so impatient" one rancher said. "They start to honk their horns and gun their engines. They think 'I'm late for my appointment' and charge right through. (Newcomers) don't know how to handle a herd of cattle" (Foster 1996). Even police protection will not save traditional rural lifestyles. Springs on the Crandalls' ranch have gone dry as subdivisions appropriate more and more water. Homeowners also clog irrigation ditches with grass clippings, all-terrain vehicles spook cattle, elk hunters cut

barb-wire fences, hikers leave gates open, and water tanks are shot through with bullet holes (Foster 1996).

Even Westerners not directly involved in extractive industries feel threatened by the upheavals caused by rapid development. Rico, Colorado (population 150), is the "last undeveloped town in the San Juan Mountains" (Verhovek 1995). This situation is likely to change, however. An investment group represented by a high-powered Manhattan tax shelter lawyer recently bought roughly three-quarters of the town and announced plans to sell subdivided lots, redesign the main street and encourage the growth of hotels, boutiques, and a mining museum, all in an attempt to create a "colony of urban refugees (and) telecommuters" (Verhovek 1995). Locals, refusing to see their town as a mere investment opportunity, appointed a 28-year-old candle maker and former squatter as the chairman of the town's planning council. Although he favors a moratorium on new construction, he concedes that some houses may be built—as long as they have composting toilets (Verhovek 1995).

Although many Western traditions survive where primary economies remain dominant, in counties where the shift from extraction to services has taken place, ski racks now outnumber gun racks, cowboy coffee has given way to latte, realtors outnumber ranchers, carbon framed mountain bikes are crowding pack horses off of back-country trails, and long time locals complain that their towns are becoming mere islands in the "lycra archipelago" (Rasker and Glick 1994).

Amenity Economies and Environmental Change: "The Second Conquest"

As rural Western economies increasingly rely on income generated by tourists, retirees, and footloose entrepreneurs the short-term success of amenity economies may lead to long-term environmental problems. Rapid development in wilderness counties promotes new forms of environmental degradation. Although the scars of deforestation, strip mining and overgrazing remain in many regions, the environment can recover from many extractive activities, given time. For example, photos of Aspen, taken during the gold boom in the late 1800s, reveal a denuded landscape. Most of the valley's trees were cut for fuel and construction, and the hillsides were strewn with mine tailings. Nearly a century later, Aspen's environment has recovered to the point that it attracts visitors from around the world. The environmental degradation associated with the amenity boom in wilderness counties, however, takes a different form, and the Western environment may prove to be more vulnerable to subdivision, construction and paving than to extractive activities in the long run (Gersh, 1996).

The New West and the Potential for Sustainable Development

As the economies of many rural Western counties increase their reliance on amenity-dependent activities, the role exporting raw materials plays in promoting economic security should continue to decline. The prevalence of fax

Table 3—The correspondence between the percent of land devoted to wilderness and the date of transition from extractive economies to amenity economies in rural Western counties.

	Transition date
All rural counties (N = 113)	−0.348*
Rural counties not adjacent to metro areas (N = 83)	−0.421*

*P = 0.001.

Table 4—The correspondence between the percent of land devoted to environmental amenities (wilderness, national parks, national monuments and wilderness study areas) and the date of transition from extractive economies to amenity economies in rural Western counties.

	Transition date
All rural counties (N = 113)	−0.347*
Rural counties not adjacent to metro areas (N = 83)	−0.426*

*P = 0.001.

machines, modems, regional airlines and the Internet, in combination with improvements in the transportation networks and an increasing acceptance of telecommuting, are rapidly eliminating many of the barriers to the growth of high-quality quaternary jobs in the rural West. Because of declining friction of distance, amenity-rich counties in the West need no longer serve as a resource colony (Kittredge 1996).

This does not necessarily mean that extractive activities will always be inappropriate if they are managed in a sustainable manner and if they do not cause degradation that endangers amenity-dependent sectors. Part of the lure of some destination resorts (i.e., Steamboat, Colorado, and Jackson, Wyoming) is that they are marketed as links to the Old West—places where ranchers, cowhands and miners might still be found. For the less competitive non-wilderness counties unwilling or unable to make the transition from extraction, efforts to promote economic security should focus on ensuring that potentially renewable resources are harvested sustainably, on encouraging economic diversification to buffer the effects of boom and bust cycles and the depletion of nonrenewables, and on promoting the growth of value-added activities.

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Wildland Economics: Theory and Practice

Pete Morton

Abstract—Since passage of the Wilderness Act, economists have derived the total economic valuation framework for estimating wildland benefits. Over the same time period, policies adopted by public land management agencies have been slow to internalize wilderness economics into management decisions. The lack of spatial resolution and modeler bias associated with the FORPLAN model, combined with asymmetrical budget shortfalls, procedural errors and the overestimation of stumpage prices have contributed to a commodity bias in public land allocation decisions. This bias has spurred some economists to advocate privatization of public land management. Market forces cannot, however, be relied upon to adequately supply wilderness resources, and non-market alternatives are preferable for addressing the shortcomings identified.

The 1964 Wilderness Act (Section 4b) recognizes the multiple benefits of wilderness areas: “wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical uses.” While the act provides a basic framework of wilderness uses, it does not begin to enumerate all of the uses and benefits of wilderness areas (Driver and others 1987; Reed 1989; Rolston 1986). Since passage of the Wilderness Act, economists have expanded and refined their methods for estimating the total economic benefits of wilderness. Unfortunately, public land managers have undervalued wildland resources resulting in a bias toward commodity production in both land and resource allocation decisions. The paper begins by examining wilderness economic research and how that research has been applied in practice on the public estate. Following a discussion of free markets, market failure and the role of public lands in sustaining our wildland resources, the paper ends with nonmarket recommendations for internalizing wilderness benefits into public land management.

Wilderness Economics in Theory

Wildland ecosystems represent natural capital capable of producing a wide range of goods and services for society. Some of these outputs, such as timber, are freely exchanged in formal markets. Value is determined in these markets through exchange and quantified in terms of price. However, many other outputs—watershed protection, carbon storage,

scenic beauty, trophy caliber wildlife and native fish, for example—contribute to our quality of life and support our market economy, but are without formal markets and therefore without prices.

The fact that wilderness benefits are not priced does not mean they lack value, only that market indicators of the value do not exist. Economists must therefore estimate the nonmarket benefits of the goods and services jointly produced by wildlands when consumers are unable to express their preferences and willingness to pay via the marketplace. Nonmarket benefits should be included in the economic analysis used to inform public land management decisions. An economic analysis must account for nonpriced benefits and costs, as well as those more readily observed and measured in market prices (Loomis and Walsh 1992; Pearse 1990). An economic analysis is conducted from the viewpoint of society, which should also be the viewpoint of managers of the public estate. In contrast, a financial analysis only examines costs and benefits as measured by market price; it is the viewpoint of private industry and is more concerned with profits or losses.

To account for the full array of goods and services generated by wildlands, economists have derived the total economic valuation framework (Loomis and Walsh 1992; Peterson and Sorg 1987; Randall and Stoll 1983). A total economic valuation framework is the appropriate measure when comparing wilderness benefits to its opportunity costs (Loomis and Walsh 1992). The total economic benefits generated by wildlands are conceptually summarized in figure 1, based mostly on research by Driver and others (1987), Krutilla (1967), McCloskey (1990), Rolston (1986), and Walsh and Loomis (1989). The seven categories of wildland benefits include direct use, community, scientific, off-site, biodiversity conservation, ecological services and passive use benefits (Morton 1999a).

Wildland recreation results in a variety of individual and social benefits including: personal development (spiritual growth, improved physical fitness, self-esteem, self-confidence and leadership abilities); social bonding (greater family cohesiveness and higher quality of family life); therapeutic and healing benefits (stress reduction helping to increase worker productivity and reduce illness and absenteeism at work); and social benefits (increased national pride) (Driver 1976; Driver and Brown 1986; Haas and others 1980; West 1986; Williams and others 1989). Wilderness is a place for spiritual experiences and has inspired the creation of art, photography, literature, poetry and music. Wilderness is also a place to restore mental and physical health, stimulate creativity, achieve self-realization and improve group leadership skills (McCloskey 1990). Wildlands provide current and future generations of Americans with a frontier-like environment to reclaim their cultural identity and feed their soul (McCloskey 1989; Reed 1989).

In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Pete Morton is a Resource Economist with The Wilderness Society, 7475 Dakin St., Suite 410, Denver, CO 80221 U.S.A., pete_morton@twso.org

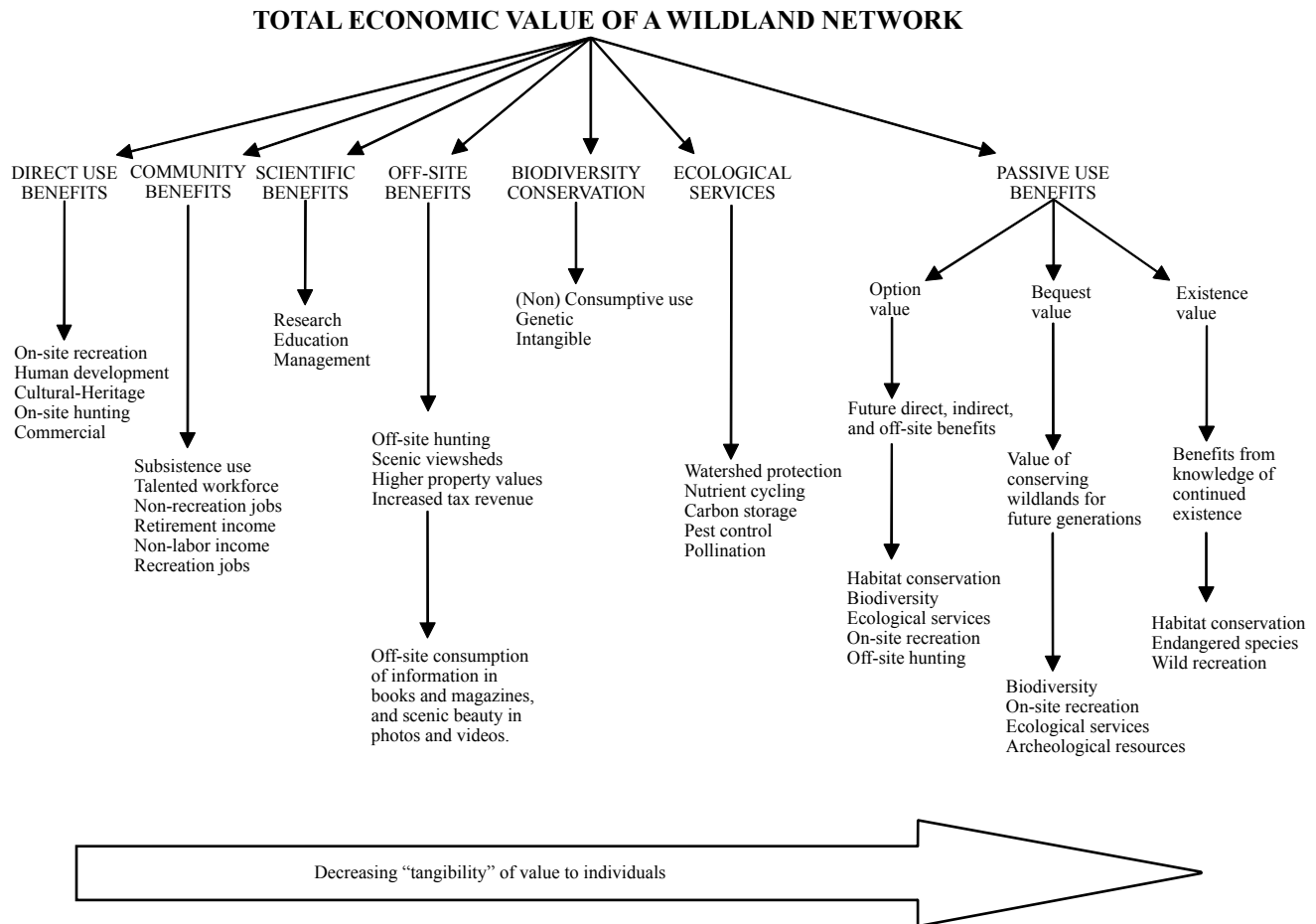


Figure 1—A total economic valuation framework for estimating wilderness benefits based on seven categories arranged from left to right in order of decreasing tangibility to humans.

The amenity-based development occurring throughout the American West is partially based on the environmental, recreational and scenic amenity resources generated by public wildlands (Power 1996; Rasker 1994, 1995; Rudzitis and Johansen 1989,1991; Whitelaw and Niemi 1989). Wildlands enhance the quality of life for local residents and indirectly benefit rural communities by attracting and retaining nonrecreation businesses and retirees (Decker and Crompton 1990; Johnson and Rasker 1995; Lorah in press). Hunting and fishing outfitters gain commercial benefits from wildlands by providing a primitive environment for their clients. Wildlands also directly create jobs for wilderness rangers, agency planners and administrators, as well as agency and university researchers (Rudzitis and Johnson in press).

There is also growing recognition of the scientific and management value of a network of wildlands (Stankey 1987). By limiting motorized access, wildlands provide valuable protection of archeological and paleontological resources for future scholars. Wildland vegetation is rich in historical information on disturbance regimes, composition, structure and function of natural communities—information that is prerequisite for successful ecosystem management. Wildlands generate off-site benefits by providing habitat for mountain lion, black bear and other charismatic megafauna that may be hunted or viewed outside wildlands (Loomis

1992). Wildlands also serve as valuable scenic backdrops for resorts and residences on adjacent lands – enhancing property values and tax revenues (Phillips in press).

Wildlands help conserve biological diversity, which includes the full array of native species, the genetic information they contain, the communities they form and the landscapes they inhabit. Genetic diversity allows increases in the productivity and disease resistance of crops and the generation of new medicinal products. Wild plant and animal species are estimated to account for 4.5 percent of the nation's gross domestic product (Prescott-Allen and Prescott-Allen 1986).

Wildlands generate ecological services, including climate moderation, pollination, seed dispersal, watershed protection, natural pest control services and carbon sequestration (Ecological Society of America 1997). Wildland watersheds protect private property from floods and lowers water treatment and reservoir maintenance costs for downstream communities. Watershed protection is an important role for public lands because wildlands contain the headwaters of many of America's rivers, and controlling development, road construction and hence erosion on private lands is more difficult due to concerns over private property rights.

Sustaining public wildlands with habitat for natural predators is economically rational (Morton and others 1994) as

natural predation plays an important role in ending and lengthening the time between pest outbreaks (Ecological Society of America 1997), and natural predation contributes \$17 billion per year to the United States economy (Pimental and others 1997). Another service of wildland ecosystems is the storage of carbon; a service necessary to address scientific concerns over atmospheric carbon dioxide levels. Although older forests have lower growth rates, higher mortality rates favor accumulation of woody debris and increased carbon storage in the litter layers (Turner and others 1995). The economic benefits of storing carbon in a wildland network could play a significant role in protecting the temperate rain forests—on the Tongass National Forest, for example, where up to 75 percent of forest carbon is stored in the soils (Joyce 1995). Protected by the forest canopy, soil carbon can be stored indefinitely (subject to fluctuations caused by natural disturbances) if these forests are reserved in a wildland network. If the forests are logged, however, the soils can quickly decompose and lose their carbon through exposure to increased sunlight, temperature and wind.

Economists and the courts have also recognized that wildlands generate substantial passive use benefits, including option, existence and bequest values (Clawson and Knetsch 1966; Walsh and Loomis 1989). Option value is like an insurance premium that people are willing to pay over and above their expected recreation benefits to maintain the option, for themselves or for their children, of visiting wildlands in the future (Krutilla 1967; Weisbrod 1964). Existence value is the psychic value a person enjoys from just knowing that wildlands exist—regardless of whether the person will ever visit an area (Krutilla and Fisher 1985). Bequest value represents what the current generation might be willing to pay to bequest wildlands to future generations. Researchers have found that the passive use benefits of wilderness are typically greater than the other benefits included in the total economic valuation framework (Walsh and Loomis 1989; Walsh and others 1984; Walsh and others 1996).

Wilderness Benefits in Practice

The 1974 Forest and Rangeland Renewable Resources Planning Act (RPA) required that preparation of the RPA Assessment, used by planners developing management plans, include willingness-to-pay estimates for nonmarket resources. The 1976 National Forest Management Act (NFMA) legislatively acknowledged wilderness as a multiple-use resource. Agency regulations developed in response to NFMA include an explicit management objective for the national forests to maximize net public benefits (Loomis 1993; Swanson and Loomis 1996). Net public benefits are defined as “the overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not” (USDA Forest Service 1982).

Under the rules established pursuant to NFMA, the Forest Service adopted a three-stage process to determine the land allocation that maximizes net public benefits. In the first stage, the agency identifies land withdrawn from or that is physically unsuitable for timber production. The remaining land is termed the tentatively suitable timber

base. In the second stage planners analyze and rank stands based on the financial return from timber production. The actual land allocation, however, does not occur until the third stage where the agency relies on the FORPLAN model to estimate the suitable timber base that maximizes net public benefits.

FORPLAN Follies

The ability of wildlands to simultaneously produce more than one output—habitat for endangered species, scenic beauty and watershed protection, for example—is termed joint production. During the first round of forest planning, which started in 1979, the Forest Service modeled joint production with FORPLAN, a constrained optimization model that estimates how land and resources should be allocated in order to maximize net public benefits. Net public benefits were estimated using timber prices derived from market information and nonmarket estimates of consumers’ willingness to pay for wilderness, recreation and other nonmarket resources.

The workings of FORPLAN can be explained graphically using a simple joint production example (figure 2; de Steiguer and others 1989; Pearse 1990). The area under the production possibility curve PP represents all possible combinations of timber and wilderness that can be produced on a national forest given natural resources and the planned budget. The optimal allocation occurs at point E, where the

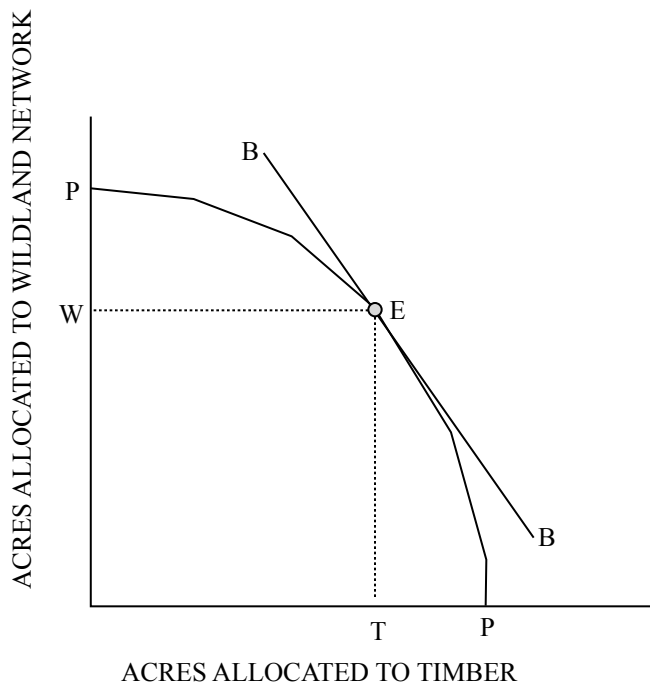


Figure 2—The workings of the FORPLAN model illustrated with a production possibility curve. The allocation of land and resources that maximizes net public benefits occurs at the tangency point E—since no other possible combination yields higher total benefits. At this tangency point the slope of the benefits line (BB) is equal to the slope of the production possibility curve (PP).

total benefits line (BB) is tangent to the production possibility curve (PP)—since no other possible combination will yield higher total benefits—and results in the production of T acres of timber and W acres of wilderness. While the FORPLAN models run by national forest planners are much more complex than illustrated here, the basic concept is the same. Whether FORPLAN actually maximizes net public benefits is subject to debate. The new version of FORPLAN is called SPECTRUM and will be available to forest planners during the second round of forest planning. SPECTRUM, while an improvement over FORPLAN, still suffers from many of the same problems identified below.

FORPLAN Is a Non-Spatial Model—One of the most significant problems with FORPLAN is the lack of attention to spatial details, making it nearly impossible to implement the FORPLAN-generated management plan. This is a significant shortcoming, as the arrangement of an ecosystem's pieces in time and space profoundly affects the values and benefits that can be derived from the landscape (Crow 1993). For example, the juxtaposition of wildlife forage, hiding cover, thermal cover and birthing areas is critical to the viability of wildlife populations. The use of a non-spatial model also leads to inaccurate predictions of forest growth and yield which lead to unsound decisions, especially the overestimation of sustainable harvest levels. The lack of attention to spatial relations in SPECTRUM is now widely understood to be a fatal flaw in historical approaches to modeling forest outputs. The Office of Technology Assessment (1992) concluded:

...[L]imited spatial details lead FORPLAN (and all other optimization models) to overestimate the feasible outputs. This happens because implementation requires local adjustments and site-specific tradeoffs that cannot be included in FORPLAN ...the use of FORPLAN to establish output targets in the forest plan can lead to planned targets that exceed the feasible productive capacity of the forest.

The importance of spatial detail for evaluating the benefits from conserving biodiversity and ecological services, combined with the potential to overestimate sustainable output levels draws into question whether net public benefits can be maximized with a nonspatially explicit optimization model.

Structural Problems—The FORPLAN model optimizes an objective function subject to a set of constraints. During the first round of planning, agency officials chose not to include nonmarket benefits in the objective function. Instead they ran FORPLAN with an objective function that maximized net present value of marketable commodities subject to constraints reflecting concern for nonmarket resources. Including nonmarket resources only as constraints on production implies that sustaining ecosystems is a constraint and not a goal for managing our national forests (U.S. Congress Office of Technology Assessment 1992). Thus, the basic structure of FORPLAN used during forest planning was a questionable approach for maximizing net public benefits.

Coefficients Difficult to Estimate—The data required to develop a FORPLAN model are also suspect—especially for coefficients estimating the impact of management actions on nonmarket, wildland resources. FORPLAN requires information on: 1) the response of aquatic populations

to sediment loading of streams; 2) the response of wildlife populations to forest fragmentation; 3) the impact of logging on watershed protection, carbon sequestration, visual quality and existence value. Insufficient research on basic ecological, economic and sociological responses to forest management activities make model coefficients particularly difficult to estimate—and they are frequently left out of the model.

Wildland Recreation Benefits Reduced—As part of the 1985 RPA Assessment, Sorg and Loomis (1984) conducted a meta-analysis of the nonmarket literature to generate average willingness-to-pay values for wildland resources. A panel of reviewers assisted them in developing procedures and reviewing results. After publication of the report, Forest Service administrators decided the recreation values were too high and that a downward adjustment of approximately 45 percent was needed (Duffield 1989). The procedures used by the Forest Service to make the downward adjustment in the RPA values appear to be at odds with basic economic theory and practice. As Duffield (1989) concluded: “The overall picture appears to be one of higher echelon administrators determined to reduce the values assigned to recreation.”

Reducing wilderness recreation benefits can bias the allocation of land and resources in the FORPLAN model (figure 3) by shifting the total benefits line and changing the production mix against wilderness. The shift in the total benefits line is illustrated by line segment B'B' and a new point of tangency E'. Lowering the value of wilderness recreation results in the allocation of more acres to timber production (T') and fewer acres to wilderness (W').

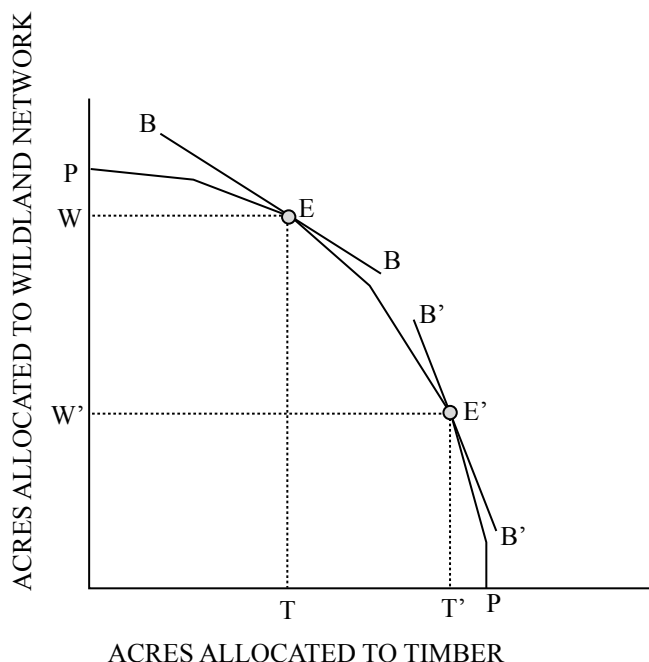


Figure 3—The change in land and resource allocation by the FORPLAN model resulting from a lowering of wilderness recreation benefits. Lowering wilderness recreation benefits shifts the total benefits line (from BB to B'B') and results in the allocation of fewer acres to a wildland network.

Modeler Bias Influenced the “Optimal” Solution—

Botkin and Devine (1988) analyzed the sensitivity of the FORPLAN model used by planners on the Chattahoochee National Forest by doubling demand for semi-primitive recreation and increasing the willingness to pay for semi-primitive recreation by a factor of 10. Results of their sensitivity analysis revealed no significant change in the land and resource allocation that maximized net public benefits. The researchers concluded that “the basic FORPLAN management choices were determined by one initial decision: whether to harvest timber” (that is, meet the timber target). In this case, modelers decided not to include a decision variable allowing semi-primitive, non-motorized acres to increase by closing and obliterating existing roads. FORPLAN was insensitive to increases in demand and willingness to pay for semi-primitive recreation, even though the forest had an excess of roaded lands and a shortage of semi-primitive lands (Botkin and Devine 1988).

Asymmetrical Budget Shortfalls—While funding received by the USDA Forest Service has been less than the budgets required to fully implement forest plans (U.S. Government Accounting Office 1991), the budget shortfall has not been passed on to resource programs in a symmetrical manner. For example, the recreation programs on the southern Appalachian national forests received approximately 47 percent of the planned budget. In contrast, the timber program received 97 percent of the planned budget (Morton 1997). The lower-than-planned recreation funding led to a significant backlog of trail construction, reconstruction and maintenance on most national forests.

Although budget shortfalls reduce net public benefits, this reduction was not reflected when net public benefits were estimated with FORPLAN during the first round of forest planning because budget constraints were not included in the model. Budget shortfalls shift the production possibility curve in toward the origin (line segment P’P’ in figure 4), resulting in the production of less timber (T’ to T) and fewer acres of wild recreation (W’ to W). Without acknowledgment of budget constraints and the asymmetrical reduction in programmatic budgets, the net public benefits estimated with FORPLAN were illusory. The shortfall in predicted production created public dissatisfaction when national forest recreational opportunities and timber supplies were less than planned. The failure to consider budgets constraints during the first round of forest planning probably exacerbated the tension between the agency, loggers and environmentalists (Morton 1997).

Nonmarket Benefits and Costs Lack Credibility

Forest Service policy decisions continue to exclude the passive-use benefits associated with wildland conservation (Loomis 1995; Morton 1994), despite the growing body of literature suggesting that these benefits are significant (Loomis and Walsh 1992). An environmental impact statement (EIS) recently prepared by Forest Service planners in Idaho and Washington provided the following justification for not considering nonmarket benefits and costs in economic analyses (USDA Forest Service 1999):

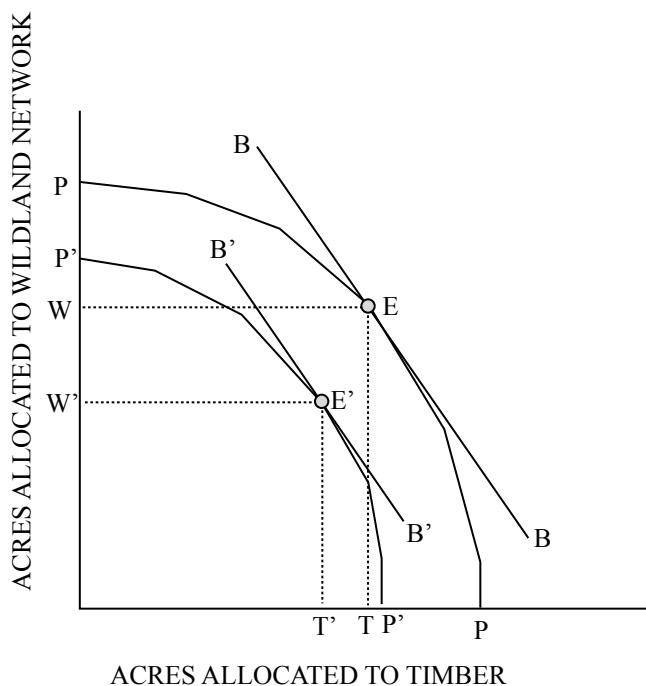


Figure 4—The change in land and resource allocation by the FORPLAN model when budgets are less than planned. Budget shortfalls shift the production possibility curve in toward the origin resulting in the production of less timber (T to T’) and fewer wildland acres (W to W’) than predicted in national forest management plans.

Non-commodity values were not included in this analysis. Title 40, Code of Federal Regulations for NEPA (40 CFR 1502.23) indicated that “For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations.

Despite this claim, the NEPA Compliance Manual (Freeman and others 1994) describes quantitative impacts as impacts that can be measured. Title 40, therefore, may not relieve the agency from quantifying the impacts of proposed management alternative on noncommodity values because many of these impacts are quantifiable.

Technical and Procedural Errors Occurred

Past Forest Service procedures for estimating wilderness benefits failed to account for the higher valued recreation activities (such as hunting, fishing) jointly produced by wilderness areas (Loomis 1987, 1992). As a result, wilderness benefits were significantly underestimated, generally resulting in biases against wilderness designation (Langer 1992). Botkin and Devine (1989), Loomis (1987) and Morton (1992) reported technical errors in agency procedures that resulted in the underestimation of wilderness benefits. Public land management agencies also lack systematic and accurate visitor counts (Loomis in press), especially for wilderness (Morton 1994).

Stumpage Price Trends Overestimated

The pressure to financially justify elevated timber targets provides planners with an incentive to inflate future stumpage prices (the value of standing timber) in order to increase the financial return from expanding the suitable timber base. For example, pressure to inflate stumpage prices was evident on the Nantahala-Pisgah National Forest (NPNF) when, after ignoring the conclusions of de Steiguer and others (1988), agency officials made a policy decision to use a regression equation, calibrated with timber sale data from a 13-year period of largely declining stumpage prices, to project increasing stumpage prices for 50 years (figure 5). Besides being highly optimistic, the confidence interval of the regression became increasingly wide after 13 years (the data range used to calibrate the regression), resulting in too much variation to accurately forecast 50-year price trends (Morton 1994). The agency has a history of overestimating stumpage price trends (Clawson 1979; Hagenstein 1990; O'Toole 1992, 1997)—a history that has provided financial justification for road building and logging in thousands of acres of potential wilderness.

Discussion

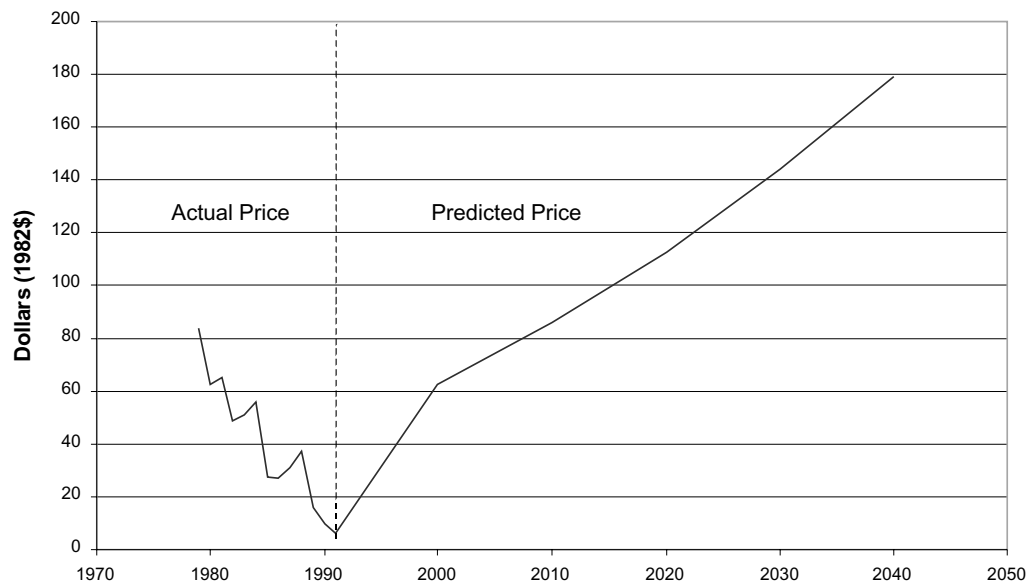
While examples from only a few national forests were presented here, there appears to be a disconnect between research and application, as the economic analyses completed to help inform national forest policy decisions do not fully account for wilderness benefits. This is consistent with observations by Duffield (1992):

In the past, economic valuation of natural resource policy or specific developmental projects has sometimes been more of a justification for market uses rather than a comprehensive and valid economic comparison of alternatives.

As Loomis and Walsh (1992) note:

“While the theory that wilderness preservation provides more than just on-site recreation benefits is over 25 years old... the U.S. Forest Service continues to economically value only the recreation use. This practice exists despite empirical demonstration that recreation is less than 50 percent of the total economic value of wilderness nearly seven years ago.”

By solely relying on recreation use values, the total economic value of wilderness will be severely underestimated during



Source: 1992 Draft Supplemental to the Final EIS for the Nantahala-Pisgah National Forest

Figure 5—Actual (1979-1991) and predicted (1992-2040) stumpage price trends for low valued hardwoods on the Nantahala-Pisgah National Forest. Overly optimistic projections of stumpage prices provide financial justification for increasing the suitable timber base by road building and logging in potential wilderness areas.

the national forest planning process (Langer 1992). In general, the Forest Service's planning process is biased towards timber, ignores nonmarket values and gives little attention to sustaining ecosystems (U.S. Congress Office of Technology Assessment 1992).

While this article focused on past failings of the Forest Service, the Bureau of Land Management is arguably in worse shape. The 1999 Final EIS for the Grand Staircase-Escalante National Monument suffered many of the problems identified here, including no budget constraints, no economic analysis of nonmarket benefits and costs, underestimated projections of wildland visitation, and biases against non-motorized recreation in the economic impact analysis (The Wilderness Society 1999). The failings identified in the EIS are of some concern, as this will be the first national monument managed by the BLM and not the National Park Service, and monument status mandates a high level of protection for wildland resources.

A Market Solution to Government Failure?

The historic commodity biases present in public land management agencies have prompted some economists to advocate a "market solution", or the privatization of public land management (Anderson and Leal 1991; Stroup and Baden 1983). While market forces can be harnessed to improve government efficiency, an overreliance on markets is not in the best interest of wilderness. "Free-marketeers" often point to the downfall of the former Soviet Union and its transition to a market economy as proof that central planning is doomed to fail and that market solutions are best for public land management (O'Toole 1999). However, privatizing the management of public lands will probably generate significant "transaction costs," similar to the fraud and corruption occurring in the former USSR as it makes the transition to a market economy. Recent and past problems with the Forest Service's land exchange program only underscore these problems (High Country News 1999). One of the key factors that originally lead society to advocate retention of the public estate was concern over abuses and fraud associated with land disposal programs (Loomis 1993). A market approach to public land management is fraught with other problems—problems that were also recognized long ago. The original decision to invest in the public estate was motivated by public outrage at the shortsighted destruction of the forested landscape by logging companies responding to market forces (Loomis 1993). While there are many economic reasons for advocating public ownership of wildlands, the overarching reason is market failure: the failure of markets to adequately supply wilderness resources.

Market Failure: The Economic Justification for Public Wildlands

The growing scarcity of wildland resources has increased the public's desire to protect what remains, while the relative abundance and low prices of wood products have left the public indifferent to concerns about timber supply. The abundant timber supply is a result of private financial investments in the southeast United States, New Zealand

and Brazil, for example, in response to higher growth rates and projections of higher lumber prices.

Market adjustments to projections of rising lumber prices include: 1) investment in private timberland; 2) the use of substitutes by producers—e.g. kenaf, hemp; 3) consumer preference shifts toward recycled products; and 4) technological advances in efficiency of the wood products industry. Past projections of higher stumpage prices were not realized because markets, adjusting to price signals, stretched the timber supply and moderated price increases (Hyde and Newman 1991). In contrast, wildland resources lack market price information, and market adjustments in response to increasing scarcity are unlikely.

Resource economists recognize the weakness of markets because many wildland goods and services have characteristics that make them unprofitable for private enterprises to produce. The aesthetic value of a wilderness viewshed, for example, would be difficult to divide up and sell to individual consumers, and to exclude "free riders"—people who consume the scenic beauty but are unwilling to pay for it (Pearse 1990). As such, private firms have little incentive to produce wildland viewsheds.

While biodiversity is our "green infrastructure," our living natural capital necessary to sustain our life-support systems, it is undervalued by private markets because of inadequate information (Randall 1986). Without adequate information, prices and market demands are misleading or unrevealing about economic values. Market value (price) depends on accurate information and knowledge, which is currently very limited for biological resources. Information failure makes it difficult to quantify the benefits of biodiversity, let alone the long-term costs to future generations from the irreversible loss of that diversity.

Market adjustments are also less likely to occur for wildland resources because technological advances are not symmetrical: Technology is biased toward commodity extraction and marketable goods and services (Krutilla and Fisher 1985). While technology can be expected to increase the supply of timber, technology is unlikely to increase the supply of wilderness (Krutilla and Fisher 1985). While restoration activities (if properly funded) can potentially increase the supply of wildlands, a prudent policy decision is to view a reduction in wildlands as virtually irreversible.

Markets failing to adjust to the increasing scarcity of wildland resources results in what economists call market failure. A market failure occurs when incentives created in the market system fail to adequately reflect the present and future economic interests of consumers or society as a whole (Randall 1983). In the presence of a market failure, price breaks down as an efficient measure of social values, financial profits do not reflect net social benefits, and markets do not allocate resources in an economically efficient manner (McCollum and others 1992). Markets diverge in so many ways from the conditions necessary to achieve maximum social benefit that we cannot rely solely on them to determine the allocation of forest resources (Pearse 1990). As Cubbage and others (1993) note:

When one analyzes markets in forestry, virtually every neoclassical economic assumption that underlies the superiority of a pure market system is violated to some degree. All the identifiable problems with market distribution of goods

and services occur in natural resources. Wildlife and pollution have common-pool characteristics, timber markets are dominated by a few buyers, producers lack complete information, and current and future externalities abound.

In the wilderness debate, the benefits of active management are perceived to be large, while the benefits of protection are typically underestimated. As a result of the incorrect signals from the market, an incorrect decision is made—that is, not to provide adequate protection of wildland resources (Dixon and Sherman 1990)—even though additional wilderness may be economically rational and socially desirable. Although highly valued by society, the benefits of conserving nonmarket goods and services are typically underestimated in production and consumption decisions—that is, they are underproduced by private markets (Bergstrom 1989; Loomis 1993; Musgrave and Musgrave 1976). The underproduction of wildland goods and services is partially due to private industry conducting a financial analysis rather than an economic analysis. It is for these reasons that Krutilla and Haigh (1978) argue that relying on market forces to guide management of public lands will actually lead to economic inefficiency.

When markets fail to adequately produce public goods and services, society as a whole is less wealthy, and many of us as individuals are worse off (Peterson 1991). When a market failure occurs, some economic correction device is required. One such device is government intervention—government provision of the goods and services underproduced in the market but desired by society. Western industrial nations have turned increasingly to governments to correct or offset weaknesses in their market economies (Pearse 1990). The underproduction of nonmarket resources provides economic justification for public ownership of a wildland network.

Nonmarket Alternatives

The failure of markets to adequately produce wildland resources suggests that nonmarket solutions will not only avoid large transaction costs, they will provide more long-term conservation than the myopic whims of market forces. The following nonmarket alternatives may help internalize wildland benefits and costs into public land management as the Forest Service enters the second round of forest planning.

Improve Accuracy of Wildland Visitation Information—Spatially and temporally accurate visitation data are the foundation for tracking recreational impacts, examining carrying capacity issues, adapting management and estimating wildland recreation benefits. Site-specific visitation data, if made available to the public via a Forest Service website, may help redirect use away from crowded areas by providing wildland visitors with information on where to go to avoid crowds. Visitation information, if widely disseminated, provides a nonmarket alternative to user fees for redistributing recreation use.

Design Wildland Network Before Running FORPLAN—The 1976 NFMA requires planners to complete a suitability analysis during national forest planning. The three-stage process adopted by the Forest Service estimates land suitable for timber production, not land suitable for ensuring the sustainability of wildland resources. Under the current interpretation, the de facto wildland network is

the residual: Land leftover after the suitable timber base is determined in the third stage with FORPLAN. This approach is an inefficient procedure for conserving wildland resources on public land. The suitability process should be reversed: Select suitable wildlands first, and let timberland be the residual—the land leftover after conserving a network of wildlands.

The lack of spatial resolution and the difficulties encountered when estimating linear coefficients for nonlinear ecological relationships, when combined with all the other problems previously noted, provide justification for establishing a wildland network and estimating the benefits before running FORPLAN. While research by Hof and Joyce (1992) and Bevers and Hof (1999) provides improved modeling techniques for addressing the spatial shortcomings of FORPLAN, these highly complex research models are unlikely to be implemented by agency planners. Rather than modeling wildland benefits as constraints in FORPLAN, identifying a wildland network and conserving the benefits would become the goal of the suitability analysis. FORPLAN could then be used to schedule activities outside the reserves and to estimate the opportunity costs of alternative wildland reserve designs. The opportunity costs should be estimated with several metrics, including the net present value for timber harvesting currently estimated in stage 2 of the NFMA suitability analysis, per acre revenue-loss figures estimated from Forest Service accounting reports, and the estimated returns from future timber production (soil expectation value). Spatially displaying the opportunity cost metrics would provide useful information for evaluating the economics of alternative wildland reserve designs.

Expand Wilderness System to Conserve Unique Resources—Federal lands have the potential to conserve unique recreation opportunities and/or biological resources that cannot survive in the market-driven, fragmented landscape on private lands. Expanding wilderness areas (using Land and Water Conservation funds when needed) to include unrepresented habitats, rare communities, important migratory corridors or unique recreation opportunities would have high economic value to society.

Improve Economic Impact Analysis—Agency economists should consider the indirect role of wildlands in attracting a talented workforce, non-recreational businesses and retirees when completing the economic impact analysis (jobs, income, etc.) of management alternatives. This can be accomplished by combining survey work (Johnson and Rasker 1995; Kask and Morton 1998) with trend analysis of total personal income (including retirement and investment income) and employment to provide a historical perspective on job and income growth-decline in various industries (Rasker and others 1994).

Include Budget-Cost Analyses in Management Plans and EISs—Forest Service policies do not require planners to include budget constraints in FORPLAN, even though budget constraints are recommended by Driver and others (1994), and budget constraints can easily be included in FORPLAN-type models. Successful organizations can rarely afford to ignore budgets when developing long-term plans. According to a Council of Environmental Quality memorandum on NEPA requirements [cited in Freeman and others 1994).

[T]o ensure that environmental effects of a proposed action are fairly assessed, the probability of the mitigation measure being implemented must also be discussed. Thus the EIS and the Record of Decision should indicate the likelihood that such measures will be adopted or enforced by the responsible agencies. (Section 1502.16(h), and 1505.2)

The “probability of mitigation measures being implemented” is directly related to how the costs of mitigation compare to the expected budget. An “unlimited budget assumption” allows planners to disregard potential environmental damage to wildland resources by assuming that all mitigation activities will be fully funded, when history suggests that this will not be the case. Programmatic funding levels directly reflect the priorities of public agencies. These priorities should be presented to the public by including a comparative analysis of management-mitigation costs with expected budgets in EAs, EISs and management plans.

Increase Programmatic Budgets for Wildland Research and Management—Public land management agencies do not have specific budgets dedicated to wilderness research (Alkire in press). As global leaders in natural resource management, public land management agencies should take a leading research role in valuing the goods and services produced by wildlands. Past wildland research suggests that passive use benefits are significant, while the benefits from ecological services are vastly unexplored. Costanza and others (1997) estimated the benefits of global ecosystem services to be \$33 trillion. The magnitude of this estimate suggests that the benefits of sustaining wildland ecological services may match or exceed the passive use benefits from wildland conservation. Public investments in research that examines the benefits of sustaining the ecological services generated by wildlands will help test this hypothesis and should be an agency priority.

Whereas the timber industry has a financial incentive to fund traditional timber research, no such incentive exists for

wildland research. The benefits of wildland research will never be fully captured in market prices, and the research will rarely, if ever be, funded by private industry. In other words, a market failure exists for funding wildlands research. Taxpayer supported research should therefore focus on wildland research and increasing our knowledge on nonmarket goods and services, while we can more readily rely on market forces to fund research on the production of timber and other marketable commodities.

Increased investment in wildland research also has the potential to produce global economic benefits if, for example, transferring information on the economic importance of conserving wildland watersheds results in policy changes that reduce road building and logging in tropical forests. Investing in wildland economic research is also consistent with the encouraging changes being implemented under the current leadership of Forest Service Chief Michael Dombeck.

Improve the Economic Analysis Completed—Passive use values should be internalized (via the RPA values, for example) into the economic analysis completed by public land management agencies. This is supported by the conclusion of a blue ribbon panel, including two Nobel Prize-winning economists, that carefully designed contingent valuation studies will produce reliable information for judicial and administrative decisions involving passive-use or existence values (Arrow and others 1993; Loomis 1995). Economic analysis by agency economists must keep up with research (much of it by agency researchers) and internalize the benefits (costs) associated with wildland conservation (damage). As Haynes and Horne (1997) note, “...recent advances in the field of economic valuation make it possible to include in a resource valuation many outputs and conditions that were once considered unquantifiable.” Potential techniques available to quantify and value ecosystem goods, services, functions, and conditions are listed in table 1. The benefits of conserving and the costs of degrading nonmarket

Table 1—Examples of the ecosystem goods and services produced by public lands, and potential valuation-quantification techniques for estimating economic benefits or costs.

Ecosystem good or service	Valuation-quantification technique
Biodiversity	Opportunity cost, cost-effectiveness, replacement cost
Carbon storage	Replacement cost, capitalized value
Cultural/historical	Travel cost, contingent valuation
Ecosystem services	Change in productivity, opportunity cost, preventive measures
Fire danger	Fire behavior simulation models
Fish	Change in recreation benefits and willingness-to-pay, natural capitalization analysis, change in production, preventive expenditures
Game	Change in recreation benefits and willingness-to-pay, natural capitalization analysis, preventive expenditures, replacement costs
Minerals	Net mineral value
Passive use benefits (option, bequest, existence)	Contingent valuation surveys
Range	Net market value
Recreation	Travel cost model, contingent valuation surveys
Soil productivity	Replacement cost, soil ecosystem simulation modeling
Special forest and range products	Market prices where available, replacement costs
Timber	Net stumpage value
Visibility/aesthetics	Contingent valuation surveys, property value or wage differential
Water quality	Change in treatment costs, preventive expenditures, replacement costs

resources can be quantitatively estimated and should be internalized into the economic analysis evaluating management alternatives as part of the NEPA process (Morton 1999b). Quantifying the nonmarket benefits of wildland conservation may help the agency economically justify the needed increases in congressional appropriations for public land management in times of declining timber harvest levels.

Symmetrical Application of Short Term Price-Benefit Trends—Technological changes in the timber industry have stretched the supply and kept stumpage prices consistently lower than projected by the Forest Service. Agency planners should therefore avoid using long-term stumpage price trends. In contrast, the asymmetric influence of technology is likely to increase wildland benefits relative to commodity values. In fact, many economists believe that nonmarket resources, not timber, will be the scarce resources of the future (Hyde and Newman 1991; Krutilla 1967; Smith 1974, 1979), suggesting that positive price-benefit trends are more justified for wilderness resources than for timber resources. If planners use short term price-benefit trends, they should be applied symmetrically to all resources, not just timber.

Conclusion

Economics provides information useful for policy discussions, but economics alone is not sufficient to promulgate policies. Economic efficiency is only one consideration when allocating multiple public resources; fairness of the process and equity considerations play more important roles (Bowes and Krutilla 1989). This is consistent with the MUSYA and NFMA definition of multiple-use that states the optimum policy is “not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output” (Culhane and Friesema 1979).

Although wildlands are highly valued by society, the benefits of wildland conservation are difficult to quantify in financial terms without formal markets. As a result, nonmarket wildland benefits are typically underestimated in private land management decisions. This is a serious shortcoming, as certain functions of nature, although they have no market value and their benefits are only partially understood, are necessary to keep the market economy running. Public lands can help correct these market failures by sustaining wildlands that cannot survive the market forces driving private land use decisions.

Forest Service employees were early leaders in recognizing the importance of wilderness as a land use designation. In 1919, Arthur Carhart convinced Forest Service managers not to develop Colorado's Trappers Lake; in 1924, Aldo Leopold pushed the agency to classify 574,000 acres of Gila National Forest as wilderness; and in 1939, Bob Marshall issued U Regulations for wilderness management. These and other accomplishments in wilderness management were probably made without formally quantifying the economic benefits of wildlands and can be attributed principally to the dedication of wilderness managers, seasonal rangers and volunteers “working with minimum budgets and, for the most part, lacking strong support from the higher levels of agency hierarchies” (McCool and Lucas 1990).

While the Forest Service was once a leader in wildland conservation, over the past 35 years, the policies and procedures adopted by the agency have failed to adequately internalize wilderness benefits into the national forest planning process. Over the same time period, academic and agency economists have made great advances in developing methods to value wildland goods and services. Many heretofore unquantifiable wildland benefits and costs are now quantifiable and available to agency officials responsible for developing the policies and procedures for guiding public land management. The nonmarket recommendations offered here may not be sufficient to conserve public wildlands, but they at least take a step in the right direction simply by reframing the questions asked and improving the analysis completed by public land management agencies. If changes are not made, support for privatizing the management of the public estate may increase, which will be detrimental to wildland resources in the long run. The recent acknowledgment by Forest Service researchers on the economic importance of protecting wildlands is hopefully a sign of positive change on the horizon. Haynes and Horne (1997) conclude that “the existence of unroaded areas is by far the most valuable output from FS and BLM-administrated lands in the [Interior Columbia] basin today, and will continue to be so in the year 2045.” The same is likely true for public wildlands across the nation.

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A Political Cultural Map to Future Wilderness, Monument and Park Designation

M. A. Nie

Abstract—This research examines western American political (sub)culture as it pertains to past and future wilderness, monument and park designation. It thus provides a sort of rough map, or cultural compass, in determining the most likely political obstacles (other than political institutions) and detours in the creation of new nonmultiple use areas. It explores landmarks such as Western environmental public opinion, the Western federal presence, the West seen as plundered province, bumper-sticker economics, differences between de facto and de jure wilderness designation, and others. Like all maps, it also attempts to point the way towards the least bumpy, unobstructed and democratic route that future wilderness proponents may want to take.

Wilderness science, it could be argued, has a richer understanding of the ecological foundation of various wilderness areas—its natural state—than it often does about the political and cultural dimensions that determine whether such places will or will not be officially designated and protected. If one is to understand the foundation on which so many wilderness, monument and park conflicts are built, one must head West—the most coveted but contested of American terrain. It is within this “geography of hope” that the American environment-culture relationship can perhaps be best understood. It is only after the political and cultural foundation of Western-based environmental conflict is put into perspective, that the region, as Wallace Stegner once hoped, can “create a society to match its scenery.” Given that the American West is largely held in common due to the disproportionate amount of public lands in the area, visions of the region necessarily involve disparate and often dissenting political cultural assumptions, beliefs, values and objectives.

This research summary provides a type of rough cultural map in determining the most likely political obstacles and suggested detours in the creation of new nonmultiple use areas in the American West—and, to a certain extent, in suitable areas east of the Rockies. While many of these cultural contours and cleavages have been analyzed in an historical context and are thus well known, this synopsis updates their relevance and applies new findings to future wilderness and monument designation (findings and themes that will be applicable to future park conflicts as well). The

paper is best seen as a summary of selected findings from a larger and more inclusive research project examining the intersection between western American political culture and natural resource politics and policy; thus, there is a curious lack of detail throughout, and readers are encouraged to contact the author for additional information, data and references. The research also draws heavily on case study fieldwork conducted shortly after President Bill Clinton proclaimed 1.7 million acres of southern Utah as the Grand Staircase-Escalante National Monument; it enlarges this debate to cover the ongoing struggle over additional southern Utah wilderness designation.

Methods and Utility

Historical analysis and case study field research were used to assess the region’s political culture and roots of contemporary wilderness dissension. The field research was developed using semi-structured interviews, which allow respondents to answer freely and casually. The study population was chosen from names that appeared most frequently in the press and various organizational handouts and by using a chain-referral snowball sample. Much of the research was originally conducted as part of a much larger project focusing on the incongruity of Western environmental public opinion and Western political representation—“the great divide.” I found the use of the political culture concept helpful in describing the western American political cultural terrain as it applies to natural resource policy, but not helpful in explaining such an important democratic fissure.

A Cultural Compass

Legend

Political culture is an inclusive concept that helps shape, through a society’s social history and present situation, the way in which it interprets itself and the factors affecting it. Due to this inclusivity, the concept of political culture and subcultures can use such elements as history, myth, geography, demography, the environment and the economy to show (conceptually) how culture can help shape politics and policy. Like unwritten rules of a game, a region’s or community’s political culture can sometimes unknowingly constrain its participants; it can be seen as a pair of political blinders or bifocals that either constrict or magnify one’s view of the political world.

A regional subculture can be thought of as a region that has enough unique characteristics to merit isolated study.

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M. A. Nie is assistant professor of political science-environmental policy, Department of Political Science, University of Minnesota, Duluth, MN 55812-2496 U.S.A.

There are a number of historical and contemporary factors that can be isolated and explored. Scholars have often divided and subdivided the U.S. into various regions for analytical purposes (Elazar 1972, 1994; Garreau 1981). When considering future land set-asides in the American West, there are five broad cultural landmarks that wilderness, monument and park proponents need to be aware of: 1) the often incongruous relationship between Western political representation and environmental public opinion (the great divide); 2) The federal presence in the West and its cultural ramifications (environmental backlash); 3) Western parochialism and perceptions of out-of-region exploitation; 4) "bumper sticker economics;" and 5) perceived differences between *de facto* and *de jure* wilderness.

The Great Divide

An empirical assessment of Intermountain West (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming) political representation and environmental public opinion reveals a great divide and important democratic dilemma. A number of sources were used to evaluate the Western state's public policies and political leadership regarding environmental protection including Green Index ratings (Hall and Kerr 1991), State of the States ratings (Ridley 1987), EPA's Toxic Release Inventory (1996) and a longitudinal interest group rating comparison using League of Conservation Voters' and League of Private Property Voters' data and scorecards. Using these limited data sources, the larger study concludes that the Intermountain West ranks poorly in its efforts to protect the environment and its natural resources.

On the other side of this great divide lies a strong, positive, pervasive, but qualified Western environmental public opinion. Dozens of state and regional environmental surveys focusing on such issues as wilderness designation, forest management and species reintroduction have been collected and analyzed in a sort of meta-analysis or research note (Nie 1999). Survey findings on a number of environmental issues in the states of Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Washington and Wyoming, as well as one county-level approach are included in the review. This extensive public opinion review shows that residents of the Far and Intermountain West support a number of environmental issues and protections, including strong wilderness support (see Pope and Jones 1990; Richer 1995; Rudzitis and Johansen 1991). Thus, the expectation that a unique Western political culture will foster environmentally hostile attitudes, when investigated at the citizen level of analysis, is fundamentally flawed. While Western political representatives may use their unique regional context as a reason to be environmentally antagonistic, the Western public-at-large does not.

The Federal Presence

The largest landowner in the United States is the Federal Government, and the majority of its land is in the West. Eighty-two percent of Nevada, 66 percent of Alaska, 62 percent of Idaho and 64 percent of Utah is owned by the U.S. Government; in comparison, little land in the Midwest,

South and East is federally owned (for example, 1.2 percent in Iowa, 3.3 percent in Alabama, and 0.4 percent in Connecticut). Federally designated wilderness is also a particularly Western phenomenon, with more than 95 percent of designated wilderness located in the 12 states (excluding Hawaii) fully west of the one-hundredth meridian (99,332,644 out of 103,754,595, Congressional Research Service 1995). Given this ubiquitous federal presence, it is important to distinguish between dimensions of federalism and those of environmentalism—federal support versus environmental support.

A predominant theme in the debate over southern Utah Monument and Wilderness designation, for example, is the amount of land in the area that is already owned and operated by the Federal Government. Simply put, preservationists believe that this federal presence is necessary to ensure these public lands can be enjoyed by a public that goes beyond southern Utah. The canyons of Utah, says writer and wilderness supporter Stephen Trimble (1996), "Belong not to an elite cadre of backpackers, not to the cattle-raising families of Escalante and Kanab, not to the Utah state legislature, not to the Bureau of Land Management. They belong to all citizens of the United States. In truth, they belong to no one."

According to Southern Utah Wilderness Alliance's (SUWA) Mike Matz, public ownership is necessary to ensure that non-Westerners—those who have long subsidized Western growth and development, are taken into account when land use decisions are being made. Underlying this support of federal control is a distrust among preservationists of what southern Utah communities would do to the land if given the opportunity. Matz (1997) maintains that "this land is owned by you and me. But if special interests and local politicians have their way, it is a land that could be lost to us forever."

The local response to this extensive federal presence is an angry and culturally based one. According to Garfield County (Utah) commissioner Louise Liston (1995), whose county is comprised of less than two percent of private land: "The truth is, massive federal ownership of lands in Utah and the West with its accompanying laws, regulations and policies, is destroying the custom, culture and economic stability of rural America, [and] wilderness is perceived as yet one more nail in the coffin."

This federal presence is cause for concern for many in the area. Clinton's use of the Antiquities Act, done without meaningful state consultation and proclaimed from the south rim of the Grand Canyon in Arizona not Utah, angered Utah political representatives and provides an example for some of just how out of touch the Federal Government has become with some Western communities. According to Utah Senator Orrin Hatch, this "mother of all land grabs" is a clear example of "the arrogance of federal power" (Siegal 1996).

This antipathy towards the Federal Government stems partly from the belief that those closest to the area's natural resources know how to manage them best. In one survey of 602 respondents in southwestern Utah, a largely rural area including the cities of St. George, Hurricane, La Verkin, Toquerville and Virgin, residents expressed the most satisfaction with the job that state (65 percent) and local (66 percent) governments are doing to manage the area's natural resources, while they expressed the lowest satisfaction with Federal Government management (48 percent, Northern Arizona University 1997). Such concerns, moreover, did

not appear isolated to Utah, but were an important thread in the larger survey review (Nie 1999).

Local Knowledge and Community Input

Closely related to this antagonism is the feeling among many in southern Utah that they are continually slighted by an overcentralized, technocratic and out-of-touch Federal Government. The President's proclamation, made without meaningful Utah consultation, angered those who believe that they have the most at stake in protecting the area's resources and natural amenities. These sorts of feelings are pervasive in southern Utah, and while most are comfortable with the status quo of BLM multiple-use management (of which environmentalists and others are quite critical), most express a desire for greater consultation and community collaboration.

Many in the region also believe that they are vilified by those outside southern Utah and receive no credit for keeping the beauty of the area intact. Karla Johnson, a rancher in Kanab, Utah, likens the situation to a neighbor who, after admiring another neighbor's home and upkeep, demands to take over its management, although they have never put any work or effort into its maintenance. Thus, there is a feeling among some in the region, many from families who have lived in the area for generations, that local knowledge is not appreciated nor taken into account by environmental decision-makers.

The West as Plundered Province

The western United States has historically been interpreted as a colonial region—what historian Bernard DeVoto once poignantly labeled a “plundered province.” The vast, people-sparse and resource-rich Western landscape was largely dominated by Eastern capital and a business elite during this period. Whether it be the discriminatory policies of Eastern-owned railroad companies, Frederick Weyerhaeuser's logging operations or the mining practices of Kennecott, Phelps Dodge or Anaconda (owned by the New York based Guggenheim family and onetime owner of much of Montana), the West once had a decidedly Eastern and monopolistic flavor during the later 19th and early 20th centuries. This “colonial” history left a sour taste in many Western mouths and ultimately set the stage for dissent; examples include President Carter's Western water project “hit list,” the Great Basin as Cold War testing grounds, the Sagebrush Rebellion, Wise Use and Land Rights movement (Brick and Cawley 1996; Cawley 1993; Lamm and McCarthy 1982; Switzer 1997).

Many contemporary leaders and representatives from the West still interpret (at least in their rhetoric) the region as being exploited, colonized or at least controlled by non-Westerners. The lack of relative wealth in the region is also an issue. For example, out of the 500 wealthiest companies in the United States, according to *Fortune* magazine, only 24, not including California, are headquartered in the West. Excluding California (58 headquartered companies), Oregon (six), and Washington (eight), the Intermountain West houses only 10 of the wealthiest 500 American companies. Whether it be for coal, copper or Western oil, the capital

needed to mine these resources most often comes from outside the region.

In an interesting twist, some Westerners, particularly in the more rural parts of the region, now feel they are being subject to a new environmental colonialism, in which some Western jobs are being sacrificed by what Alaska Republican Representative Don Young (1994) calls the “leisure lobby.” Young contends that “those who care more about what people do with their leisure time on the weekends than what workers do for a living continue to push legislation that locks up more of our nation's resource base.” According to former Wyoming Republican Senator Alan Simpson (1996), elite environmentalists—“greenies...as they are sitting there having a little Chardonnay by the campfire” pose a threat to the West—not those who use its land to make a living. Those such as Western attorney and wise-use author William Perry Pendley (1995) go so far as to believe that there is a war on the West. He sees Western-based natural resource industries as besieged by environmental elitists who seek to “turn everything from the 100th meridian to the Cascade Mountains into a vast park.”

Many environmental organizations based either in a Western metropolitan area or in Washington, D.C. are sometimes perceived as representing non-Western interests, for example, Easterners making a trip to Yellowstone or Grand Canyon National Parks once a year, not those that are closest and most familiar with a Western landscape or treasure. Although the validity of this supposed environmental colonialism is debatable, primarily due to the fact that so much environmental support originates within the West, it does illustrate the lineage of such a cultural interpretation and political strategy. It also illustrates how many of those aligned with wise-use have tried to tap what they perceive as Western political (rural) culture for political language and symbolism.

Several individuals in southern Utah, for example, believe that increased wilderness designation and monument support comes from people outside the area who are either completely unfamiliar with the region or use it solely as a playground. Much of this criticism is directed towards Eastern and California political representatives who want to dictate how land, which they are not responsible or accountable for, is managed. On the other hand, due to instances such as the hanging of Interior Secretary Bruce Babbitt in effigy, and “Black Wednesday” in which some Utah residents wore black ribbons and released black balloons to commemorate Clinton's Monument proclamation, these “outsiders” are apt to see locals as environmentally hostile and thus untrustworthy caretakers of this national treasure.

Non-Western support for H.R. 1500 (the Redrock Wilderness Protection Act), for example, is very strong. Of the 82 cosponsors of the bill, and excluding California, only five are from the West (and only seven are Republicans). This Eastern support, especially from people such as early sponsor Maurice Hinchey of New York and former Senator Bill Bradley of New Jersey, is resented by some Western congressional representatives. According to Utah Senator Orrin Hatch, “They don't even know what wilderness is. We do [and] we've got plenty in Utah” (Associated Press 1996). Partially responsible, says Hatch, are powerful national environmental lobbies: “The fact is that we are being sandbagged not so much by our colleagues but by a

well-orchestrated and well-financed campaign staged by huge, huge *national* environmental lobbies who are pursuing their own *national* agenda [emphasis added]" (Southern Utah Wilderness Alliance 1996). Another example of non-Western animosity is provided by Utah representative, Jim Hansen who steered his House Resources Subcommittee on National Parks, Forests and Land, to approve funding for protection of New Jersey's 17,500 acre Sterling Forest, but only if it was first declared as wilderness.

The debate over southern Utah wilderness has been framed in national terms, so a national strategy has been adopted. Since three-quarters of SUWA's members are from outside Utah, including 23 of the 36 members on its board of directors and advisory committee, and since the acreage in question is federal and not state-owned land, the approach seems logical. As happened during the struggle over Echo Park and Glen Canyon, full-page ads in the *New York Times* and *USA Today* are meant to target a larger and more sympathetic American audience.

A rural-urban dichotomy is also evident in the debate, with those living in places such as Salt Lake City perceived as being more pro-wilderness than those in rural Utah. While environmental support is strong in the urban and rural West (with limited evidence for the latter), there are also isolated pockets of anti-environmental sentiment in the region (Nie 1999). Recognizing where pro-wilderness support is strongest, groups such as SUWA are headquartered in Salt Lake City and not in the more rural parts of the state. Many in the area feel indignant, however, about this vocal urban and non-Western wilderness support. The outside strategy has polarized much of Utah, with the preservationist agenda being equated with non-rural beliefs, values, and concerns. There is a sense that urbanites interpret southern Utah as a place where wilderness should be championed while human occupation is discouraged—even though it is the preserved records of early human occupation that makes the area such a valued anthropological and archaeological place of study.

Bumper Sticker Economics

The Western economy is embedded within larger cultural and historical forces and is best understood by distinguishing the unique characteristics of California (one of the world's largest economies), the Far West and the Intermountain West, as well as comparing the rural-urban dichotomy of the region. It is also critical to be clear about which Western economy one is talking about—the old or the new. Perhaps most important when discussing the Western economy, however, is trying to separate Western perception from reality (Power 1996).

The crucial role of natural resources and extractive industry is often the most common element of the Western economy discussed. The structure of many Western states' extractive economies leaves them more vulnerable to external forces and cycles of boom and bust and more dependent on Federal Government contracting and decision-making. Notwithstanding some recent economic changes, the West is still more dependent on extractive industries than are other regions of the country. The farming, mining, timber and ranching industries of the West are still relatively important

economic sectors and are the economic mainstay of many rural Western communities.

Although in absolute terms, the importance of agriculture, forestry, fishing and mining in the West is limited, they are a relatively larger and more important part of the economy compared to many other states (Alampi 1994). In states such as Montana and Wyoming, where many of these industries are economically significant, employing thousands of residents and injecting money into state coffers, extractive industry is seen as an essential part of the state economy and its cultural heritage. Many in the West, including political representatives, see the extractive or livestock based regional economy as serving an important cultural function. According to Alaska Senator Frank Murkowski (1996), "In the lower 48 states, however, livestock grazing is a part of Western society. It is part of the history, and the heritage, of the American West. And it's a part of the social fabric of the West and a cornerstone of the Western economy." It is interesting to note, however, that despite the relative importance of extractive industry in the Western states, a larger percentage of Westerners are employed by the Federal Government than by extractive industries.

The West has not been very well vertically integrated in the past. That is, it has provided only one part of the entire economic production process—supplying raw resources. Generally, timber cut in the Pacific Northwest or minerals mined in Montana were not usually processed in-state, or even in-region, but were instead sent to better equipped or cheaper labor force states. Much of the region has also been susceptible to the well-documented boom-and-bust economy. Because of the West's dependence on natural resources, the region also found itself more dependent on external circumstances and decision-making. Whether it be timber in the Pacific Northwest, coal in Montana, copper in Arizona or beef in Colorado, many Western economies were more dependent on international and national trends than other regions. A drop in beef prices, for example, would reverberate more loudly in the West than in a more diversified regional economy.

The role of the economy in the Western political culture-environmental politics relationship is a pivotal but contested one. Thus, it is important to distinguish between how the Western economy is often popularly portrayed and politically used, and the current, actual economic reality (Power 1996). Although some advocates of Western custom and culture view the "environmental juggernaut" in the region as the cause of needless unemployment and economic stagnation, most evidence points to the contrary. Studies done at the national level, for instance, show environmental regulations have not resulted in any significant overall job losses (Templett 1995). In fact, the amount of effort taken by a state to protect the environment through government regulations is positively correlated with a state's gross product, total employment and labor productivity (Meyer 1992).

A study endorsed by more than 30 economists, almost all in the West, also paints a contradictory picture, showing environmental protection in the Pacific Northwest (defined here as Idaho, Montana, Oregon and Washington) being positively related to economic growth in the region (Power and others 1995). Recognizing how commonplace it is in the region and nation as a whole to assume that environmental

protection causes unemployment, these economists have shown how environmental quality has a positive effect on local economies because people care where they live and its quality of life, water and air quality, and recreational opportunities, and because businesses care where people choose to live. Many of these economists also recognize how integral natural resources have been and still are to many Western communities, while also realizing how the new economic benefits associated with a more diverse economy are not evenly dispersed. Nevertheless, say the authors, it would be ill-advised and in the end futile, to try to turn back the economic clock to a time of natural resource dependency.

Despite the emergence of this new, more diversified regional economy, coupled with the decline of the natural resource industry, the belief that extractive industry is the economic essence of the West is still pervasive. According to University of Montana economist Thomas Michael Power (1996), this “view through the rearview mirror” poses a dangerous threat to the economic health of local communities. Folk economics—the belief that the extraction and processing of natural resources is the heart of the economic system—is a powerful but misleading myth, says Power, that should not dictate current or future economic policy in the region. Whatever the importance of the natural resource industry may be, in absolute or relative terms, the economic “view through the rearview mirror” remains an integral part of Western political culture.

The economic value and opportunity costs associated with wilderness and monument designation in southern Utah is also a central theme in this public lands controversy. Larger wilderness designation bills are opposed by most rural county officials because they are seen as a loss of revenue, either from lost payments-in-lieu of taxes or mineral leases. Although some such as SUWA cite this as a red herring, the loss of possible revenue produced by school and institutional trust lands—acreage owned by Utah for the purpose of generating revenue for education—is another reason put forth by Utah county representatives to oppose a larger wilderness bill.

Some southern Utah county representatives believe that additional wilderness will jeopardize the economic and social stability of the region, while preservationists believe it will spur economic growth in wilderness-related service sectors—while also protecting the environment. County representatives point to the small percent of privately owned land in Utah and the economic ramifications of this federal presence. It is private property, not federal land, they say, that generates revenue to pay for such services as education, infrastructure, law enforcement, emergency services, fire protection and, ironically, a host of other tourist needs and services.

The assumption that the wilderness-related service sector will provide an economically and environmentally sound alternative is also considered suspect by many in the region. However, SUWA and related organizations doubt the economic arguments made by the counties and others who favor less wilderness. The supposed economic opportunity costs of increased wilderness are fallacious, according to the Alliance. Not only are several existing uses respected by the 1964 Wilderness Act, but the Alliance contends that global economic trends, changing energy markets, increased automation, and the increasing importance of the service sector,

among other factors, are changing national as well as rural Utah employment patterns. Using logic supported by Power and other economists, the Alliance contends that wilderness presents the possibility of abandoning the boom-and-bust economy symbolic of the West in favor of a more sustainable and ecologically sensitive one.

These differing interpretations of the southern Utah economy are evident in other parts of the West and are perhaps best illustrated by a bumper sticker wryly asking “Are you an environmentalist or do you work for a living?” Keeping with the bumper-sticker dialogue, environmentalists have responded—“Don’t like environmentalists, put them out of work.” In other words, environmentalists, including those in Utah, are often perceived by rural residents as condemning all work in nature, or sentimentalizing certain archaic forms of it. They are viewed as being unaware of the nature that supports them, whether it be the wood that heats their homes, the dammed water they drink or the electricity that runs their computers (White 1996).

[W]ilderness Versus wilderness

One of the most consistent themes in the debate over land in Southern Utah is the difference between *de jure* and *de facto* wilderness, that is, whether or not officially recognized wilderness will be beneficial or detrimental to the land. According to Ken Sizemore, a community and economic development director for the Utah Association of Governments and a member of the Grand Staircase-Escalante Monument planning team, preservationists want officially recognized and managed wilderness (wilderness with a capital W), while locals believe that it is this official designation, or the newly established Monument designation, that will ruin and not preserve the area. According to Steve Crosby, commissioner of Kane County, Utah, environmentalists need to know that it does not have to have a wilderness stamp on it to be wilderness. Hence, while one side emphasizes human restrictions, the other side focuses on human impact.

Some feel wilderness or monument status, along with national park status, poses a greater environmental threat than the status quo. Boulder, Utah, Mayor Julee Lyman sees the newly created Monument as potentially harmful: “Now it’s going to become more destroyed, because people destroy the land faster than animals do” (Ryckman 1996). The specter arises of another Moab, the symbol to many of a “trinketized” West, a new recreation and service-based economy benefiting those owning hotels, restaurants and trinket shops, but not providing enough economic stability to keep young people from leaving the area. Some also worry that wilderness or monument designation is a prelude to adding yet another national park in the region; thus, more visitors and more impact, as was the case with the former Capitol Reef National Monument.

Some people in southern Utah also believe that wilderness in the area will simply always remain wilderness—with or without official recognition. Crosby believes the land in question is self-preserving and will not be developed because of its rugged terrain and notorious lack of rainfall. Many believe that the fear among preservationists like SUWA’s Matz, that the area will be developed if it is not officially set

aside, is unfounded given its past conservation record and natural limitations. Environmentalists, on the other hand, simply point to recent drilling developments as an indicator of what will happen without official designation and protection.

Selling Wild in the West

Those advocating future land set-asides in the American West, or the continued protection of already designated areas, are well served by stretching their ecological knowledge to include a better understanding of the political/cultural context in which such lands will or will not be protected. It is important to unearth the cultural roots of the current Western lands debate and to provide a foundation for a common definition of the problem(s)—to show that culture matters. This study points the way to more culturally based environmental strategies because wilderness is ultimately affected by the western American political culture. Those seeking additional land set-asides and/or continued protection of existing wilderness may wish to adopt an environmental strategy that is more compatible with this study's conception of this regional culture. In addition to litigation, interest group liberalism, Washington mobilization, the best use of science, voter education and various other political strategies; wilderness proponents could utilize Western history, folklore and culture to better understand and thus protect such areas. The wise use and land rights contingent has tried to mine the rural Western psyche (historically grounded or not) for symbolism and policy "framing" language; environmentalists, in my estimation, have failed to do so. There are several possible places to begin such an environmental approach that is more culturally informed. However useful they may prove to be, they hopefully will generate the type of serious dialogue about political strategy that will be necessary to democratically save Western wilderness.

Such a political/cultural analysis also suggests the need, more important than political strategy, for a more participatory and democratic environmental politics that goes beyond the Beltway and the 12 Western state capitals—a Western civic environmentalism (John 1994; Kemmis 1990). Although there are problems and shortcomings with this local participatory environmental strategy, mainly due to national ownership of Western lands and resources and various political/resource inequities, it is bound to be more acceptable to those living in the West. As illustrated throughout this research summary, the ways and means by which Western wilderness is protected is often as important to Westerners, and all democratic citizens, as the final outcome itself.

Those fighting to protect wilderness areas, moreover, should be aware that these struggles often transcend questions of acreage and use. Instead, a panoply of other political and cultural issues often rise during the boil. Participants, on all sides of the debate, need to critically assess these non-tangential issues and political/cultural concerns. It is also important to recognize that as in many policy debates, participants sometimes agree on the ultimate objectives of public policy while disagreeing on the means by which to reach them.

The West has always occupied a special place in the American imagination. "Heading West" may still carry connotations similar to those of a frontier ago, while also conjuring up all sorts of grandiose landscapes and panoramas—ones that are becoming increasingly rare in this country. But the West is no longer just a place to go to, it is now a place to live in and protect. Perhaps Westerners can apply the same degree of fortitude and ingenuity shown by settlers, and those already settled there, and find a way to democratically save and protect Western wilderness.

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Windfalls for Wilderness: Land Protection and Land Value in the Green Mountains

Spencer Phillips

Abstract—Land is a composite good, the price of which varies with its characteristics, including proximity to amenities. Using data from sales of land near Green Mountain National Forest wilderness areas in a hedonic price model, a positive relationship between proximity to protected wilderness and market values is revealed. The applications of this result include improved consideration of the positive economic impacts of land conservation and new mechanisms for financing land conservation.

Nature's grace in the East offers the most important kind of hope, not only to a region that has been given a second chance to decide how to inhabit itself, but to a world in terrible need of models.

- Bill McKibben

The paucity of information about the effect of land protection on rural land values hampers the development of cost-effective solutions to Northern Forest—the 26 million acre northern tier of Maine, New Hampshire, Vermont and New York—land management issues. For better or for worse, policy proposals addressing those issues are moving forward at local, state and federal levels. Among them, proposals for additional public land ownership and conservation-oriented management, while popular by many measures, are bound to be opposed, in part, out of fear that such management will erode private land values. Even the most modest land protection proposals, if and when accepted politically, would require significant increases in appropriations through established public land funding mechanisms—increases that may be unlikely in the near term and unsustainable in the longer term. (For elaboration on the conditions from which the issues arise, please see a longer version of this paper forthcoming from The Wilderness Society as Volume 3 of “The Northern Forest: Strategies for Sustainability.”)

The Conservation Challenge

While the discipline of economics has long been concerned with certain determinants of land prices (e.g. soil productivity, commuting time to a central business district), it has not produced either information or policy tools for connecting rural land prices to the conservation of areas in a wild condition. To fill this gap in the context of immediate conservation needs in the Northern Forest I provide: 1) evidence,

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Spencer Phillips is Resource Economist, The Wilderness Society, P.O. Box 25, Craftsbury Common, VT 05827 U.S.A., srp@sover.net

based on an analysis of land prices, of the enhancement value of publicly protected wildlands; and 2) an overview of possible programs for capturing such enhancement value in order to fund land protection.

Amenity, Scarcity and Rent

The notion that the characteristics and location of a parcel of land can influence its price is as old as economics itself, with David Ricardo and Johann von Thünen credited with organizing a theory of land rent. In their construction, as now, rent is the unearned portion of the price of an asset. Ricardo focused on the fertility or agricultural productivity of parcels, which in his day was generally not earnable in the sense that farmers or landlords could affect fertility through the application of labor. Instead, site productivity came to landowners as an endowment from nature. Sites with the greatest endowment are the first ones brought into production, for returns are highest on these sites. As demand for agricultural produce increases, bringing progressively less fertile land into production becomes financially feasible.

Von Thünen enriches Ricardo's model by considering characteristics of different agricultural production systems and their spatial distribution on the landscape. In von Thünen's model, the salient characteristic is the cost of transporting agricultural goods to market in the central city. Agricultural systems for which transportation costs were high (dairy, for instance) would locate nearer the market, while lower-transportation-cost systems would occupy land farther away. (See Brooks 1987 for a more complete introduction to these concepts and models.)

Land Protection and Rent

Ricardo and von Thünen's farmers and landlords located production systems to maximize the returns from production. Freed from the limits of organic soil productivity and the slow pace of animal-powered transportation, agricultural production is now much more footloose—it need not locate particularly near markets for their produce or on the most fertile soil. Other considerations, such as minimizing land acquisition costs or satisfying preferences unrelated to farms' cost structure, can play a larger role in determining agricultural land use. (Indeed, authors including Alig (1986), Phillips (1991) and Alig, White & Murray (1988) find that returns from farm operations are seldom found to play a strong role at all.)

The same is increasingly true of non-agricultural production. New technologies, services and infrastructure, from the fax/modem and Federal Express to the Internet and Interstate Highway System have freed more and more industries from their former need to be close to either input supplies or output markets.

Overnight package delivery service allowed Numberall, a machine tool manufacturer, to move from Long Island, New York, to Guilford, Maine, for the latter's pace of life, small town atmosphere and opportunities for backcountry recreation. Similarly, Essex Junction, Vermont, boasts a large IBM facility located there due to a key IBM manager's enthusiasm for Vermont skiing. Beyond such anecdotes, economic development researchers have concluded that rural job creation occurs not so much as a result of firms locating where costs are low, but from the entrepreneurial activity of managers and others choosing locations where amenity values are high (Johnson and Rasker 1995; Knapp and Graves 1989, Rasker 1994; and Rasker and Glick 1994).

As Rasker and Glick note, while so-called "amenity-based growth" does alleviate rural unemployment and other problems associated with declines in resource extraction industries, it often brings its own set of problems, not the least of which are manifest in land markets.

Scarce housing goes to the highest bidder—often the big-city transplant. Gentrification is pushing many local house hunters out of the market. In Jackson Hole, for example, few employees in tourism services can afford housing in town. Land and housing prices have tripled in the last 15 years . . . In Bozeman, mid- to low-priced housing is practically nonexistent, and the competition for such properties is fierce. A "feeding frenzy" has ensued in the real estate market, further driving up prices . . . (Rasker and Glick 1994).

Jackson and Bozeman are gateway communities to Yellowstone National Park and its surrounding national forests. It is reasonable to speculate that their rising land prices reflect their proximity to the open space, scenic, recreational and other amenities associated with publicly protected land. Because national parks and wilderness areas are unlikely to be converted to other uses, whatever rent accrues to nearby land as a result of that protection may be greater than what would accrue if the same open space were privately owned and simply not yet developed, or if a greater portion of the national forests were open to resource extraction.

Back in the region of interest here, two recent studies examine the relationship between land conservation and property taxes—a dim reflection of property values. In New York's Adirondack Park, where towns are reimbursed for property taxes forgone on land added to the state-owned forest preserve, the first study found no relationship between tax bills and land conservation (Ad Hoc Associates 1996). This suggests that, at a minimum, land conservation does not diminish property values.

The second study, which focused on public and private conservation of land in three coastal Maine towns, found that land protection is often associated with higher tax **bills** in the short run (Ad Hoc Associates 1997). Because the study also found that tax **rates** are generally lower in towns with more open land, it is possible that the increase in tax bills are due to increases in property values, rather than conscious decisions on the part of town authorities to make up for tax revenue lost when conserved land is removed from the tax base.

For now, however, such possibilities must remain speculation, for little is known about the spatial relationship between land protection and land value in rural areas. More than 20 years of research into similar issues in urban

settings, however, does suggest that proximity to open space amenities is a significant source of location rent (Weicher and Zerbst 1973). Still more research suggests that by restricting the supply of land available for development, protecting those amenities also enhances scarcity rent. Both bodies of research identify other characteristics of land parcels and the overall land base that influence land prices.

Existing Evidence

Farmers in the Ricardo/von Thünen model sketched above exhibit a willingness to pay for a farm parcel that depends on a small set of factors, namely, the value of crops produced (net of the cost of producing them), and the cost of overcoming the parcel's distance to the market. Similarly, purchasers of land for other uses exhibit a willingness to pay that depends on their incomes (like net revenues from the sale of crops) and various characteristics of the parcel and its surroundings.

For urban office workers, commuting distance to the central business district may take the place of the farm's distance to the market. For the "modern cowboys" of the Greater Yellowstone, distance to scenic amenities may become the distance most relevant to willingness to pay for land. In the Northern Forest, whether a ski lift is nearby could be more important.

More generally, bids for land are likely to vary with the use intended for the land, the type of buildings (if any) present on the parcel, local property tax rates, the character of the community in which the parcel is located (population and housing growth rates and the level of rental and seasonal housing, for example) and owners' income. Characteristics of the land base, including its overall size and distribution among protected and unprotected uses—that is, the degree to which development is restricted—are also likely to influence land prices.

In economic parlance, the many factors that influence the price of land render it a *composite good* and the value at which it is exchanged a *hedonic price* (Rosen 1974). When the demand-relevant characteristics of a composite good are known, it becomes possible, at least conceptually, to decompose the price of the good into the marginal value of each characteristic.

More formally, Rosen describes a composite good z as the collection of its m characteristics $-z \equiv (z_1, z_2, \dots, z_m)$. The price of the composite good, then, is described by $p(z) = p(z_1, z_2, \dots, z_m)$. Products with different combinations of the m attributes will trade for different prices in the market. Researchers interested in the value of one particular attribute, say z_i , would compare prices of composite goods that differ only in that attribute. Mathematically, that means computing the first derivative of the price function with respect to the level of the attribute. Econometrically, it means regressing prices for the composite good on the level of each attribute and examining the attribute's estimated coefficient. Either way, the marginal price function, $p_i(z) = dp(z)/dz_i$, or regression coefficient, β_i , represents the value of the last unit of attribute z_i in composite good z .

Leaving the estimation of the price of land near Vermont's wilderness areas for the next section, it is now instructive to consider the range of land attributes found important in

other areas. Table 1 summarizes the most applicable results of several studies of land prices and land attributes. For each study included in the table, the attributes of most interest to this application are listed, along with the direction of each attribute's influence (+ or -) when the influence is statistically significant.

Two of the studies most clearly illuminate the effect of proximity to amenities and disamenities, such as a polluting industrial facility or other so-called "locally undesirable land use" ("LULU" in the literature), in determining land prices. The almost canonical study of land prices in suburban Boulder, Colorado, by Correll, Lillydahl and Singell

Table 1—Summary of land price influences.

Study author(s)/dependent variable selected independent variables	Direction of influence
Pollakowski and Wachter 1990 / housing price index	
zoning restrictiveness index	+
relative restrictiveness of adjacent planning areas	+
Knaap 1985 / land price	
whether land is outside urban growth boundary	-
Tang 1995 / land price	
location inside greenline	+
distance to development center	-
Hushak and Sadr 1979 / land price per acre	
parcel size	-
commercial use	+
agricultural use	-
distance to the urban center	-
distance to a highway	-
Turner, Newton & Dennis 1991 / forest land price per acre	
parcel size	not significant
portion of parcel that is not forested	+
portion of parcel with > 15% slope (which would make the parcel less suitable for timber management)	-
parcel fronts on a road	+
population growth rate for the town in which the parcel is located	+
distance to major road	-
distance to ski area	-
property tax rate	-
Chicoine 1981 / farmland price per acre	
distance to Chicago	-
distance to nearest town	not significant
distance to freeway exchange	-
soil productivity	not significant
septic tank soil limitations	-
zoned residential	not significant
zoned industrial / commercial	+
parcel size	-
Coffin 1989 / residential housing price	
size of unit	+
distance to central business district	-
location in historic district	+ in one sample not significant in another
Correll, Lillydahl and Singell 1978 / residential property price	
distance to greenbelt	-
number of rooms	+
finished square footage	+
larger than average lot size	+
neighborhood distance to city center	+
neighborhood distance to city center squared	-
Hamilton and Schwann 1995 / residential property price	
distance to electric transmission tower	-

(1978) reveals that residential property prices decline with distance from greenbelts, strips of protected open space amounting to some 8,000 acres in the city at the time. “Other things being equal,” they conclude, “there is a \$4.20 decrease in the price of a residential property for every foot one moves away from the greenbelt.”

Hamilton and Schwann (1995) explore the possibility that proximity to disamenities can reduce property values. After controlling for various site characteristics, they find that property values do decline with distance to high-voltage transmission towers, with the greatest effect evident for properties adjacent to the transmission line. The authors attribute the reduction in value to visual externalities, rather than other possible impacts of the transmission lines.

These studies support traditional notions of what influences land rents—distance from city centers and transportation networks, for example—and expand those notions to include site characteristics unrelated to agricultural, silvicultural, or even sheer residential productivity (that is, proximity of a residence to central business districts). The literature to date suggests that urban and suburban amenities, including historic districts and greenbelts, can increase nearby land values.

Turner, Newton and Dennis’ (1991) result that forest land prices decline with distance from ski areas may suggest a similar effect in rural areas. With that exception, however, little is known about the effect of amenities on rural land prices.

Enhancement Value in the Green Mountains

Empirical Model

The theory of land rent and previous statistical results reviewed in the preceding section suggest a model of land values that can be summarized as follows: Land is a composite good, the price of which varies with its characteristics. These characteristics include a parcel’s own physical attributes (size, improvements, road frontage), prevailing economic and demographic factors (income level, population density), public policy factors (tax rates, zoning restrictions) and the parcel’s proximity to land uses that may represent either a nuisance or an amenity for the parcel’s prospective owner. Given sufficient information about parcel prices and characteristics, the total price of a parcel can be decomposed econometrically into the set of prices for its individual characteristics.

Again, following Rosen (1974), the hedonic price of a parcel of land may be represented by a price function:

$$p(\mathbf{z}) = p(z_1, z_2, \dots, z_m)$$

where z_1 through z_m represent the presence or quantity of m attributes of the parcel. The price of each attribute would then be:

$$p_i(\mathbf{z}) = dp(\mathbf{z})/dz_i$$

The “ z_i ’s” of greatest interest here are those that reflect the extent to which a parcel’s purchaser might expect to enjoy amenities associated with national forest wilderness areas and/or the degree to which the allocation of land to federal

ownership and protected status restricts the supply of land for private uses. In order to distill the effect such attributes from the overall price function, the overall price function must be known. Therefore, additional parcel attributes, such as parcel size, improvements and other factors such as local population density and income levels, are considered as well.

Parcel-specific information, such as the sale price, and parcel attributes come from Vermont’s land transfer tax return data base. Because the land transfer tax is an ad valorem tax—that is, it is proportional to the value of the property—the land prices are true market prices. In addition to the prices of transferred properties, the data base contains fields describing the properties’ attributes and, in varying degrees of detail, their locations.

From an initial set of more than 300,000 tax returns reflecting transfers occurring between 1987 and 1997, I have excluded several classes of returns. These include: returns lacking key fields, such as acreage, price and location (town); returns reflecting transfers of less than full fee ownership; and those that do not represent market transactions (such as the division of property in cases of divorce or the dissolution of a business partnership, transfers to creditors to secure debt, etc.). I have also excluded transfers to government agencies and to nonprofit organizations. All together, these considerations eliminated roughly two thirds of the available transfer returns.

Two further parings of the data set yield the final group of land transfers suitable for this analysis. First, I have excluded all transfers except those of parcels to be used primarily for residential purposes after the transfer. Excluded primary uses include industrial, agricultural, timber management and commercial activities, although any one of these uses may also occur on residential parcels.

Second, to restrict the geographic area to that reasonably proximate to wilderness areas the final data set includes only those parcels in towns that contain wilderness, towns adjacent to towns that contain wilderness, and towns adjacent to the second group of towns. As illustrated in Figure 1, the study area thus comprises towns with wilderness, plus two concentric bands or rings of towns around the wilderness towns. WildTwn0, WildTwn1, and WildTwn2 indicate these on the map, respectively.

These considerations restrict the data set to 6,343 transactions. After removing 195 outliers (per-acre prices in excess of \$500,000 and one transaction involving more than 9,000 acres), the final data set includes 6,148 transactions.

Given the importance of the distance between parcels and other points on the map, the return records would ideally include very specific geocoding, such as longitude and latitude or a parcel map reference number, for each land transfer. The data base does include a field for such a reference number, but at least for the towns included in the study area, the data are not available. Many of these towns do not have parcel maps, so the necessary reference number does not exist. And even for those towns that do have maps, the reference has more often than not been omitted from the transfer tax return at the discretion of the town clerk.

For almost all records, however, the town in which the transferred property is located can be identified. Since “town” describes an area of less than 10,000 hectares and because the geographic scope of the study is large, the town

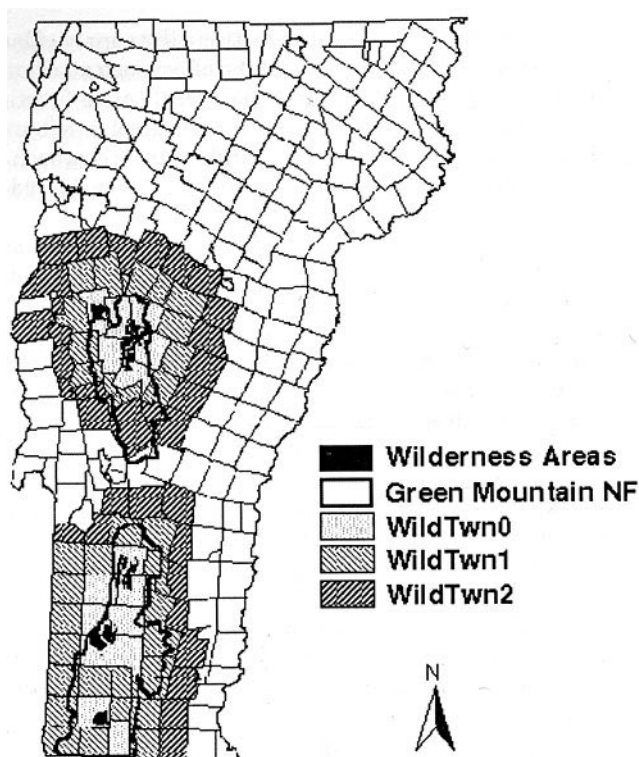


Figure 1—Study area.

identifier provides a fine enough distinction between transfers of parcels at varying distances from the wilderness areas. Note, however, that my continuous measure of proximity (DST_WILD in Table 2) does reflect the unavoidable fiction that all parcels lie at the center of town.

Table 2 lists the full set of parcel attributes incorporated into the econometric model below. The table also indicates whether the value of each field originates from parcel-level data (the land transfer tax data base) or from town level data, such as GIS layers or the Census of population and housing. Table 3 provides descriptive statistics for the fields.

Econometric Estimation and Results

Because prices per acre of land are likely to vary (inversely) with the size of the parcel being purchased, the relationship between land price per acre and potentially relevant attributes are estimated using the transcendental form (Chicoine 1981; and Hushak and Sadr 1979; and Turner, Newton and Dennis 1991). That is:

$$\text{ACREPRICE} = \beta_0 \text{ACREAGE}^{\beta_1} \exp(\sum_{i=2-n} \beta_i X_i)$$

where ACREPRICE is the purchase price per acre, ACREAGE is the total size (in acres) of the parcel and the X_i s are the other parcel attributes. The β s are the estimated coefficients. Converting this equation to logarithmic form allows estimation using ordinary least squares. Thus the estimated model is:

$$\ln(\text{ACREPRICE}) = \ln\beta_0 + \beta_1 \ln(\text{ACREAGE}) + (\sum_{i=2-n} \beta_i X_i) + \mu_i$$

where μ_i is the unexplained error.

Due to heteroskedasticity of the underlying data, the model results summarized in table 3 are estimated using White's correction procedure, which allows use of the standard errors and t-statistics generated by the OLS procedure (White 1980). Table 4 presents the estimation results. With the exception of the coefficient on $\log(\text{ACREAGE})$, coefficient estimates may be interpreted as the percentage change in price per acre with a unitary change in the explanatory variable.

The coefficients on WILDTWN0 and DST_WILD both suggest that proximity to wilderness enhances land value. Parcels located in towns that contain wilderness have per-acre sales prices that are 13 percent higher than towns without wilderness. Furthermore, the price of parcels decreases by 0.8 percent per acre with each kilometer (or, as in the table, 0.00077 percent with each meter) farther away from the nearest wilderness boundary. Other things being equal, a parcel that sells for \$1,000 per acre in a town without wilderness would be expected to sell for \$1,130 per acre if it were in a town with wilderness. Similarly, if the \$1,000/acre parcel could be moved to another town, the center of which is 10 kilometers farther away from a wilderness boundary, it would be expected to have a lower price of \$923 per acre.

Coefficients on the other explanatory variables have, for the most part, the expected signs. Per-acre price falls with parcel size, for example. Towns with higher population density, higher median household income and alpine ski areas all have higher per-acre land prices for residential property. Properties with no buildings are understandably lower-priced than those with buildings, and properties with mobile homes command lower prices than otherwise similar properties without mobile homes.

One final interesting result concerns the property tax rate. Conventional wisdom suggests that higher property tax rates drive down property values, and the regression results seem to confirm that view. However, since town governments set property tax rates to meet budgetary needs, it is possible that higher tax rates are the effect, rather than the cause of lower property values. When property values are high, towns can meet their budgets with lower tax rates. (Vermont's new state-wide school property tax would complicate this somewhat, but all of the transactions considered here preceded the new system.)

Implications and Applications

The first policy application of the results presented above is the simple observation that wilderness areas do in fact enhance, rather than diminish, nearby land values. Whether used to improve the consideration of the economic impacts of agency decisions or for bolstering the economic argument in favor of further conservation, this information can help correct common misapprehensions about the costs of conservation.

A much more interesting application, however, arises from the question of whether and how public policies can address the negative implications of enhancement value while exploiting the positive implications. That is, can policy both encourage additions to the base of conserved land and foster an equitable distribution of the value—the windfall—created by conservation?

Table 2—Data fields and sources.

Field name	Field description	Data source	Parcel/town
log(ACREPRICE)	log of parcel sale price per acre	Land Transfer Tax Returns	parcel
log(ACREAGE)	log of parcel size, in acres	Land Transfer Tax Returns	parcel
WILDTWN0	dummy for whether town contains wilderness	Town and Green Mountain National Forest GIS layers	town
DST_WILD	distance from town center to nearest wilderness area boundary (meters)	Town and Green Mountain National Forest GIS layers	town
ALP_SKI	dummy for whether town contains an alpine ski area	Various maps	town
MHINC_90	median household income in 1990 (dollars)	Census of Population and housing, 1990	town
GROWTH_N	population growth rate, 1980 – 1990	Census of Population and housing, 1980 and 1990	town
NDENS_90	population density (persons per acre), 1990	Census of Population and housing, 1990	town
B_NONE	dummy for whether parcel includes no buildings	Land Transfer Tax Returns	parcel
B_HOUSE	dummy for whether parcel includes a house	Land Transfer Tax Returns	parcel
B_VAC	dummy for whether parcel includes a vacation home	Land Transfer Tax Returns	parcel
B_BARN	dummy for whether parcel includes a barn	Land Transfer Tax Returns	parcel
B_APT	dummy for whether parcel includes a apartment	Land Transfer Tax Returns	parcel
B_MOBILE	dummy for whether parcel includes a mobile home	Land Transfer Tax Returns	parcel
B_CONDO	dummy for whether parcel includes a condominium	Land Transfer Tax Returns	parcel
B_STORE	dummy for whether parcel includes a store	Land Transfer Tax Returns	parcel
CPI_HSNQ	Consumer Price Index for housing in year of transfer	Bureau of Labor Statistics	n/a
TAXRATE	property tax rate (\$ per \$100 assessed value)	Vermont Department of Taxes	town

Windfalls for Wilderness

Hagman and Misczynski (1978) coined the term “Windfalls for Wipeouts” and explored the concept in their 1978 book of the same name. The concept is based on a recognition that when the public takes some action affecting land, such as siting an interstate exchange, someone gets a windfall (the landowner just down the road from the exchange), and someone gets wiped out (the landowner with a cloverleaf for a front porch). In the parlance of the Ricardo and von Thünen model sketched above, such government actions create rent for some landowners and reduce it for others. Note that the value created is pure rent—the landowners need not have done anything to create the added value. (It is possible that owners would lobby public agencies to take actions likely to

enhance the value of their property. This practice is aptly termed “rent-seeking behavior” by public choice literature.)

The case at hand differs in two respects. First, wilderness designations occur only on land already owned by the Federal Government. Therefore, selecting parcels for wilderness designation does not entail a “wipeout” in the sense that the current owner would lose any value. Second, when the Forest Service or other agencies acquire land, including wilderness inholdings, they are generally required to pay fair market value, although determination of fair market value may not consider potential future enhancement due to other agency decisions.

Nevertheless, owners selling land to government agencies may sell for prices below what they might receive were they to keep the parcel and the land around them were conserved

Table 3—Descriptive statistics for data fields.

Field	Minimum	Maximum	Mean	Median	Std. dev.
ACREPRICE	8.33	497,500.00	91,325.37	50,000.91	103,579.30
LOG(ACREPRICE)	2.1203	13.1174	10.6837	10.8198	1.4024
ACREAGE	0.10	464.00	6.52	1.80	21.64
LOG(ACREAGE)	-2.3026	6.1399	0.6792	0.5878	1.3912
WILDTWN0	0	1	0.2511	0.0000	0.4337
DST_WILD	1	16,526	9,392	10,872	4,585.3220
ALP_SKI	0	1	0.0551	0.0000	0.2283
MHINC_90	21,875	37,847	29,720	29,608	3,338.8940
GROWTH_N	-0.0288	0.0426	0.0112	0.0126	0.0085
NDENS_90	0.0042	0.6083	0.1539	0.0796	0.1765
TAXRATE	0.34	5.80	2.01	2.00	0.7086
CPI_HSNG	114.2	156.8	134.3	133.6	14.1
B_NONE	0	1	0.0151	0.0000	0.1221
B_HOUSE	0	1	0.8653	1.0000	0.3414
B_VAC	0	1	0.0316	0.0000	0.1748
B_BARN	0	1	0.0577	0.0000	0.2333
B_APT	0	1	0.0228	0.0000	0.1492
B_MOBILE	0	1	0.0608	0.0000	0.2390
B_CONDO	0	1	0.0028	0.0000	0.0525
B_STORE	0	1	0.0011	0.0000	0.0337

Table 4—Regression results.

Dependent Variable: LOG(ACREPRICE)				
Variable	Coefficient	Std. error	T-statistic	Prob.
C	9.0730910	0.1536	59.0682	0.0000
LOG(ACREAGE)	-0.8316180	0.0066	-125.9302	0.0000
WILDTWN0	0.1318010	0.0418	3.1527	0.0016
DST_WILD	-0.0000077	0.0000	-2.0928	0.0364
ALP_SKI	0.1086500	0.0448	2.4229	0.0154
MHINC_90	0.0000470	0.0000	15.9325	0.0000
GROWTH_N	-7.6812770	1.3416	-5.7254	0.0000
NDENS_90	0.8750110	0.0589	14.8483	0.0000
TAXRATE	-0.0760860	0.0149	-5.1017	0.0000
CPI_HSNG	0.0042650	0.0006	7.1201	0.0000
B_NONE	-0.9562130	0.1384	-6.9085	0.0000
B_HOUSE	0.4349630	0.0816	5.3299	0.0000
B_VAC	0.1334710	0.0931	1.4340	0.1516
B_BARN	0.0908820	0.0448	2.0296	0.0424
B_APT	0.4017520	0.0866	4.6378	0.0000
B_MOBILE	-0.6447300	0.0829	-7.7780	0.0000
B_CONDO	0.6684000	0.1258	5.3150	0.0000
B_STORE	0.5827050	0.1691	3.4451	0.0006
R-squared	0.8026	Mean dependent var		10.6837
Adjusted R-squared	0.8021	S.D. dependent var		1.4024
S.E. of regression	0.6239	Akaike info criterion		-0.9405
Sum squared resid	2386.4580	Schwarz criterion		-0.9208
Log likelihood	-5814.6560	F-statistic		1466.1680
Durbin-Watson stat	1.7474	Prob(F-statistic)		0.0000

through public ownership. The lower price could occur due to good will on the part of the owner, tax advantages of bargain sales, or simply the government agency's relative monopoly power—that is, few other buyers exist—when it comes to purchasing land within a proclamation boundary.

While policies with the potential for either compensating the wiped-out or capturing value from the windfalls have been used in a variety of settings, a balanced system for using captured windfalls to cover the costs of associated wipeouts remains a sort of holy grail to land use planning. It is possible, however, that the Northern Forest might be the place to make such elusive solutions a part of standard land protection practice for the 21st century. One possible solution is sketched below in the context of existing Vermont policy and coming conservation opportunities.

Existing Vermont Programs—The State of Vermont has several programs directly related to land transactions, land taxes and conservation. Briefly, these include:

- Land Transfer Tax. The purchaser pays this ad valorem tax to the state at the time of the land transfer. It is the land transfer tax that generated the data employed in the above econometric model.
- Land Gains Tax. This is an additional tax paid on the capital gain from selling land held for fewer than six years. It is designed to reduce speculative purchase of land and dampen existing incentives for conversion of open space to more highly developed uses.
- Town and (now) statewide property taxes. The statewide property tax now finances local educational expenditures. Its rate is set by the state, and revenues are returned to towns on a per-pupil basis. Town property taxes vary from town to town and finance non-educational expenditures as well as educational expenditures over and above the state per-pupil grant. (The town-to-town revenue sharing provision that apply to such local increments remains very controversial within the state, and further revisions to the system are likely. That state property tax policy remains in flux may provide an opportunity for further adjustments to accommodate conservation-generated land value enhancement.)
- Housing and Conservation Trust Fund. Financed from land transfer tax receipts and other sources, the fund provides money for low income housing and fee and conservation easement purchases by the State.

Enhancement value associated with wilderness areas results in higher revenues from the three taxes and more possible expenditure from the Housing and Conservation Trust Fund. Because different people pay the taxes, and because the enhancement value is unevenly distributed, an effective, equitable and acceptable policy response should consider who pays the various taxes and who collects the enhancement windfall.

The purchaser pays the Land Transfer Tax. He or she would pay a percentage of the higher, conservation-enhanced parcel value. Proximity to the wilderness or other conservation area is simply another attribute of the property considered by the purchaser in making an offer. The higher tax, therefore would not be a surprise and there does not seem to be an argument for relieving purchasers from that increase.

The Land Gains Tax, on the other hand, is paid by the seller. A property acquired prior to the creation of a new conservation unit would experience higher than normal gains due to the creation of a new unit. Landowners who hold such properties for less than six years would therefore be faced with a land gains tax bill that is higher than would have been expected in the absence of the new conservation unit. One might therefore argue that it is unfair to collect that additional portion of the land gain from such landowners. At the same time, it is these same landowners who, by selling their property, realize the enhancement value of the nearby newly protected land.

Property taxes are perhaps another matter. Paid annually by current landowners, property taxes are difficult to avoid, except through enrollment in use-value or “current use” programs. Creation of a new conservation unit would increase property tax bills proportionate to each parcel's enhanced value. Because that enhancement would occur without respect to whether the parcels' owners supported or opposed the new conservation unit, one could argue that existing owners should be shielded from the resulting increase in property tax bills.

Towns may, of course, reduce local property tax rates to keep revenues and expenditures in balance. In addition, open space conservation is often associated with lower local public service costs, so it is also possible that the overall town budget will decrease, or at least not rise as fast, after creation of the conservation unit (American Farmland Trust 1992; Commonwealth Research Group, Inc. 1995; Lerner and Pool 1999; Tibbetts 1998; and U.S. National Park Service, Rivers, Trails and Conservation Assistance 1995). There does remain, however, the state-wide portion of property taxes, so there is a limit to the relief that can be provided by fiscal policy changes at the town level.

Addressing the property tax impacts is particularly important. Increases in land carrying costs due to conservation-related enhancement could prove a burden to owners of working farm and forest land (even if enrolled in use-value-taxation programs) as well as on those on fixed incomes or otherwise “land rich and cash poor.” In addition to the issue of distributional equity, an increase in property tax burden could accelerate the conversion of farms, woodlots and other open space to more highly developed uses.

The final consideration is the impact on housing affordability for existing and new residents noted by Rasker and Glick (1994) in the passage quoted above. New conservation units could enhance the value of local land right out of the price range of long-time residents, their children and grandchildren.

A Policy Option—Each of the programs and considerations just described play a critical role in the design of a hypothetical “Windfalls for wilderness” policy. One additional element which does not currently exist in the State of Vermont, but which is quite common elsewhere, is public bonds for conservation purchases.

While the Housing and Conservation Trust Fund addresses current conservation funding needs, taking advantage of future conservation opportunities may require additional sources of funds. Issuing tax-exempt bonds is one way for states to increase available funds in the short term while deferring expenditures until current revenue can service the

bond debt. Because of lags between expenditures to establish conservation units and the realization of increased land-based tax revenue, such bonds would be particularly well-suited to the purpose at hand.

In order to finance additional land protection, the State of Vermont could issue bonds in an amount sufficient to cover land or easement acquisition costs and associated short-term management costs. The coupon rate of these bonds would be set according to expectations about future increased revenue from the Land Transfer and Land Gains taxes. A simulation based on the land price model presented above and enhanced to cover different classes of land could assist the State bonding authority in setting an appropriate rate. These bonds would then be sold to investors in the usual fashion, but some bonds would be withheld for a special offering to current residents of towns containing or near new proposed conservation units. For example, the state could give residents bonds, or it could give residents an option to purchase bonds in the future at the current market price.

Meanwhile, towns containing new conservation units would be allowed and encouraged to cap the inflation-adjusted assessed value of existing landowners' parcels at the level current at the time of the unit's establishment. (Under the new statewide school funding law, reassessment is mandatory when assessed value falls below a certain percentage of market value.) This would shield landowners from property tax increase-induced incentives to subdivide or convert land from less developed to more developed uses. Needless to say, federal and/or state payment in lieu of tax programs should be fully funded and implemented to offset the reduced tax base associated with new public ownership.

In addition, the Housing and Conservation Trust Fund would direct additional funds to support the construction and repair of affordable housing in towns containing the new conservation units. Both by providing lower cost units and by increasing the overall housing stock, this measure would help ensure that existing residents would not be priced out of the market.

Finally, the expenditures implied by these measures—debt service, property tax abatement, and increases in affordable housing would be paid for by increased revenue generated by the Land Transfer and Land Gains tax programs. To the extent that all Vermont residents benefit to some degree from land protection anywhere in the state, it would be reasonable to simply leave the Land Gains and Land Transfer tax rates at their current levels. In that way, all Vermont taxpayers would share in the cost of additional conservation.

However, because landowners nearest newly protected units realize the greatest direct financial gain, it would also be reasonable to adjust the Land Gains Tax to reflect and capture a portion of the incremental land rent created by the conservation action. Such adjustments could include an increase in the Land Gains Tax rate, an extension of the period after purchase during which it applies, or both.

Other policy responses to the increases in land rent associated with proximity to protected land are possible. The program sketched above, however, would address the key political and fiscal hurdles to further additions to Vermont's conserved lands.

The analysis and policy options presented here are intended to guide the development of new instruments to take advantage of land conservation opportunities now present in the Northern Forest. In so doing, the region could provide a model for conservation across the nation, particularly in areas with mixed ownerships.

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The Relationship Between Debt-for-Nature Swaps and Protected Area Tourism: A Plausible Strategy for Developing Countries

Brijesh Thapa

Abstract—There is a positive correlation between the debt crisis of the early 1980s and environmental degradation in developing countries. To combat the crisis, Lovejoy (1984) introduced the debt-for-nature swap process that involves a mechanism of exchange in which a certain amount of the debtor's foreign debt is cancelled or forgiven, in return for local currency from the debtor government to be invested in domestic environmental projects such as designation and management of protected areas. Currently, in excess of \$1.5 billion in transactions have occurred among 19+ countries. The demand for nature-based tourism is on the rise, and developing countries should subscribe to such swaps.

In the 1970s developing countries witnessed an era of economic growth, as well as debt accumulation, as they borrowed extensively from Western banks for development projects such as investment in new industries, upgrading old plants, improvements in the agricultural sector (production), building infrastructure, dams and roads, etc. However, due to economic stagnation in the West in the early 1980s, developing countries experienced a decline in foreign exchange earnings because of a lack of demand for their goods. In addition, the rise in interest rates in Western countries perpetuated debt accumulation, which further exacerbated the inability of developing countries to service their debts. The escalation of the debt dilemma peaked in 1982 when Mexico, one of the largest developing debtor nation, announced that they were unable to pay interests on their foreign debt (US\$ 80 billion). The total accumulated debt for developing countries in 1982 was US\$ 850 billion. It was at this stage that analysts officially labeled the "debt crisis." Other countries shortly followed suit, and 43 developing countries were in arrears with their foreign debt by 1983 (Greener 1991; Moran 1992; Vaggi 1993; Wagner 1990).

Various strategies to combat the debt crisis were implemented by the International Monetary Fund, The World Bank, creditor commercial banks and various western countries. However, austerity measures such as devaluation in local currencies, increase in exports of cash crops, decrease in government spending as well as imports and elimination of subsidies of basic necessities were mandated by the IMF/World Bank before new loans were financed. Also, an

International Secondary Market for "bad debt" came into existence to trade developing countries' debt at deeply discounted rates. Another tool used for debt reduction was debt-for-equity swaps. This concept involves trading foreign debt for local currency of the debtor country, which in turn is used as equity investments in the firms of the debtor countries (Thapa 1998). The US government also largely played a role to combat the debt crisis, especially in Latin America. Due to the globalization of the economy, much was at stake for the US as one-third of the total trade package was involved with developing countries. It was estimated that within one year in 1985, 800,000 jobs were lost as imports declined, and companies downsized to stay competitive (Moran 1992). The US implemented the Baker Plan, the Brady Plan, and the Enterprise for the Americas Initiative (EAI) in the late eighties to help stimulate economies of developing countries. The strategy was to negotiate some form of debt relief so that economic progress could be rejuvenated, and also for the encouragement and implementation of new lending practices. Some success was marginally experienced, however the EAI is still in operation and is gaining momentum (Thapa 1998).

There is a positive correlation between the debt crisis of the early 1980s and environmental degradation in developing countries (Greener 1991). This is largely attributed to the austerity programs mandated by the International Monetary Fund (IMF) and the World Bank which severely affected tropical forests as wood was exported to generate revenue and the lands were used to cultivate cash crops. However, deforestation of tropical forests is still an occurring phenomenon. The austerity measures contributed to increased poverty, as "monocropping" of export crops and elimination of subsidies of basic necessities resulted in more expensive food (Moran 1992). The potential consequences of deforestation has many irreversible effects. Some of the areas of concern are global warming, dramatic changes in local climate, rise in temperature and decrease in rainfall precipitation. Deforestation also threatens genetic diversity, as these forests are home to 50% of all plant and animal species (Hamlin 1989).

In Latin America, "environmental destruction has been the result of measures to meet the most basic human needs for shelter, food, and a rudimentary livelihood" (Wagner 1990). The environmental crisis catalyzed by the debt crisis in developing countries will continue because the natural resources these countries depend on continue to be stripped and depleted (Dogse and von Droste 1990; Greener 1991; Moran 1992). However, since the debt and environmental crisis are intertwined, elimination of the debt and investment capital does not guarantee environmental emancipation, as development in developing countries is inevitable (Dogse and von Droste 1990; Hrynik 1990).

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Brijesh Thapa is an Assistant Professor in the Department of Recreation, Parks, and Tourism. He is also associated with the Center for Tourism Research and Development, Box 118208, 300 Florida Gym, University of Florida, Gainesville, FL 32611-8208 U.S.A.

To combat the symbiotic relationship of the debt and environmental crisis, debt-for-nature swaps derived from debt-for-equity transactions were proposed in 1984 by Dr. Thomas E. Lovejoy (then the vice president for science with the World Wildlife Fund for Nature). Basically, this stepwise process involves a mechanism of exchange in which a certain amount of the debtor's foreign debt is canceled or forgiven, in return for local currency from the debtor government to invest in a domestic environmental protection project. Projects may include conservation, natural resource management, designation and management of protected areas, park personnel training and environmental education programs and activities.

In 1987, the first swap facilitated between Bolivia and Conservation International (USA-INGO-International Non-Governmental Organization), involved cancellation of \$650,000 Bolivian foreign debt in exchange for \$100,000 of local currency to be used towards protection of the Beni Biosphere (Occhiolini 1990; Sadler 1990). Since the first swap, in excess of \$1.5 billion in transactions has been involved in swaps among 19 or more countries, and the figures and participants are expected to steadily increase (Deacon & Murphy 1997). The countries involved have ranged from Costa Rica, to the Philippines, Madagascar to Poland. The swaps have generated more than \$100 million in funds for domestic environmental protection projects (von Moltke 1991). More recently, Mexico has been actively involved in swaps having converted \$3.7 million via 9 different transactions (Table 1) (Global Development Finance 1998).

Important components of every swap should be reduction of a country's debt and renewed commitment to provide increased resources for conservation purposes (Conservation International 1989; Hrynik 1990; Page 1990). Tropical countries with a diverse array of endangered species are more likely to undertake swap practices. Concomitantly, countries with high debt burdens are more likely than countries with low debt burdens to utilize the swap process (Deacon & Murphy 1997).

Debt-for-Nature Swaps: Functionality

The functional mechanism of debt-for-nature swaps entails certain steps, and may involve two governments (bilateral-official debt), or in most cases, governments are aided by an International Non-governmental Organization (INGO) (trilateral-official and private debt). Official debt is between two governments, while private debt refers to commercial (bank) debt. However, the INGO must have a local contact with a domestic Non-governmental Organization (NGO) in the debtor country to be responsible for the administration and operational facilitation of the swap project. Nonetheless, in some cases, a mutually established committee can also administer the coordinator's role (Thapa 1998). The INGOs have typically been based in the United States, although some European agencies have also been active. Three of the principal U.S. organizations involved are Conservation International, The World Wildlife Fund for Nature and Conservation and The Nature Conservancy (Deacon & Murphy 1997).

The initial initiative for the swap lies with the sponsoring INGO to establish dialogue with the debtor country's government and, eventually, the debtor country's central bank and a domestic NGO. Once approval is given, negotiations are undertaken and mutual agreements are reached about the mechanism of funding the 'potential project.' The sponsoring agency (INGO) normally locates a potential donor, which may include governments, banks, organizations and private foundations (Greener 1991; Sadler 1990). The International Secondary debt markets for second-hand debts are also investigated for discount levels. The secondary market for bad debt originated in 1982 as a resort for lending agencies to salvage or minimize their losses. Debt could be bought for deep discounts; for example, a US\$ 10 million debt could be bought for US\$ 5 million (Mahony 1992). However, when a match is met, the sponsoring agency will either buy the discounted debt, receive it as a donation from banks or governments or receive money from foundations to buy the discounted debt in exchange for investment of local currency by the debtor country in the stated environmental project. Local funding can also be issued by the debtor country in the form of issuing currency or bonds, in which the interest's from the bonds is used for daily operations. As indicated earlier, the coordination and daily operations of the project are normally undertaken by a domestic NGO and/or institutions mutually agreed to by both parties (Dogse and von Droste 1990; Greener 1991; Sadler 1990).

Swaps and Protected Area Tourism

Debt swaps have been seen as a beneficial tool for the conservation and protection of natural resources and debt reduction. Swaps have also been recommended as a sustainable development tool (Jaeger, 1990). Swaps will not alleviate the debt burden of developing countries (US\$ 2 trillion, current estimate) but they provide a small solution to a big problem that also aims to protect the environment. It has been noted that swaps, if rapidly implemented among developing countries might reduce the overall debt burden by US\$ 200 million per year (Wagner 1990). In addition, swaps help to increase funds for environmental organizations. For example, World Wildlife Fund's swap with Ecuador established a fund yield that is twice the size of the current parks and reserves budget, and it is expected to increase (Patterson 1990). In fact, in Ecuador, every dollar of acquired debt resulted in excess of eight dollars worth of local currency used for conservation (Fuller 1989). On a similar note, Costa Rica's Minister of Natural Resources, Energy and Mines remarked that although swaps represents a small dent in the overall debt burden, the interest alone from the swaps is several times greater than the annual budget allocated to the country's Park Service (Reilly 1990).

Costa Rica has been actively involved in swap practices to protect its natural environment. It is a leading country, in terms of conservation, and 12% of its total land-mass is designated as national parks or protected biological reserves. Costa Rica has been proactive and has been able to get U.S. and European INGOs and private foundations to aid in reforestation and/or park projects via swap practices.

Table 1—Debt-for-nature swap transactions (1987-1997) (In US \$ millions).

Year	Country	Purchaser	Face Value	Cost	Conservation Funds
1997	Mexico	CI	0.31	0.24	0.30
1997	Mexico	CI	0.27	0.19	0.24
1996	Mexico	CI	0.67	0.44	0.56
1996	Mexico	CI	0.50	0.33	0.44
1996	Mexico	CI	0.39	0.19	0.25
1995	Mexico	CI	0.49	0.25	0.34
1994	Mexico	CI	0.29	0.25	0.29
1994	Mexico	CI	0.48	0.40	0.48
1994	Mexico	CI	0.28	0.24	0.28
1994	Madagascar ^a	CI/WWF	2.00	0.05	2.00
1993	Madagascar	CI/WWF	5.00	3.20	5.00
1993	Philippines	WWF	19.00	13.00	17.70
1993	Mexico	CI	0.25	0.28	0.25
1992	Ecuador	Japan	n.a.	n.a.	1.00
1992	Brazil	TNC	2.20	0.75	2.20
1992	Chile	EAI	15.90	n.a.	1.40
1992	Bolivia ^a	TNC/WWF	11.50	0.00	2.80
1992	Guatemala	CI/USAID	1.30	1.20	1.30
1992	Panama	TNC	30.00	7.50	30.00
1992	Ecuador	WWF	1.00	n.a.	n.a.
1992	Philippines ^b	WWF	9.90	5.00	8.80
1992	Mexico	CI/USAID	0.44	0.36	0.44
1992	Poland	Paris Club	3000.00	n.a.	n.a.
1991	Ghana ^c	DDC/CI/SI	1.00	0.25	1.00
1991	Jamaica	TNC/USAID	0.44	0.30	0.44
1991	Guatemala ^d	TNC	0.10	0.08	0.09
1991	Mexico ^e	CI	0.25	0.00	0.25
1991	Nigeria	NCF	0.15	0.07	0.09
1991	Philippines	USAID/WWF	n.a.	n.a.	8.00
1991	Mexico ^{e, f}	CI	0.25	0.18	0.25
1991	Costa Rica ^{d, g}	Rainforest Alliance	0.60	0.36	0.54
1991	Madagascar ^h	CI/UNDP	0.12	0.06	0.12
1991	Bolivia	EAI	38.40	n.a.	1.80
1991	Jamaica	EAI	271.00	n.a.	9.20
1990	Madagascar	WWF	0.92	0.45	0.92
1990	Philippines	WWF	0.90	0.44	0.90
1990	Madagascar	CI	5.00	n.a.	5.00
1990	Costa Rica	WWF/TNC/Sweden	10.80	1.90	9.60
1990	Dominican Rep.	TNC/PRCT	0.58	0.12	0.58
1990	Poland	WWF	0.05	0.10	0.05
1989	Zambia	WWF	2.30	0.45	2.30
1989	Madagascar	WWF	2.10	0.95	2.10
1989	Ecuador	WWF/TNC/MBG	9.00	1.10	9.00
1989	Costa Rica	Sweden	24.50	3.50	17.10
1989	Costa Rica	TNC	5.60	0.78	1.70
1989	Philippines ⁱ	WWF	0.39	0.20	0.39
1988	Costa Rica ^j	Holland	33.00	5.00	9.90
1988	Costa Rica	NPF	5.40	0.92	5.40
1987	Ecuador	WWF	1.00	0.35	1.00
1987	Bolivia	CI	0.65	0.10	0.25

n.a Not applicable.

CI= Conservation International; DDC= Debt for Development Coalition; EAI= Enterprise for the American Initiative; MGB= Missouri Botanical Gardens; NPF= National Park Foundation of Costa Rica; PRCT= Conservation Trust of Puerto Rico; SI= Smithsonian Institute; TNC= The Nature Conservancy; UNDP= United Nations Development Programme; USAID= U.S. Agency for International Aid Development; WWF= World Wildlife Fund.

^aDebt donated by JP Morgan.

^bFace Value of debt includes \$200,000 debt donation by Bank of Tokyo.

^cInvolves buying blocked local currency funds from multinational organizations; includes Midwest universities, Consortium for International Activities, and U.S. Committee of the International Council on Monuments and Sites.

^dPurchase of Central American Bank for Economic Integration debt.

^eTotal amount of program is \$4 million.

^fDebt donated by Bank of America.

^gWWF contributed \$1.5 million on top of the swap.

^hTotal amount of program is \$5 million.

ⁱTotal amount of agreement is \$3 million.

^jIncludes \$250,000 donated by Fleet National Bank of Rhode Island.

Source: Deacon and Murphy (1997); Global Development Finance (1998); World Debt Tables (1996).

Between 1988 and 1990, US\$ 10 million was generated in donations to help retire the face value of US\$ 69 million of the country's foreign debt. Simultaneously, this has enabled Costa Rica to raise US\$ 33 million in local currency bonds, which support parks and protected areas, reforestation projects, etc. Although this represented a retirement of about 5% or more to the overall debt burden, it was still a positive experience in terms of both debt reduction and environmental protection (Page 1990).

Debt-for-nature swaps have been responsible for the creation and/or addition of protected areas in countries where swaps have been undertaken. A majority of the protected areas created through swaps have incorporated nature-based tourism/ecotourism and other forms of environmental and culturally based tourism. With more countries joining the swap movement, the future of protected area tourism looks bright. Nature based tourism has experienced a 10% to 30% increase per year, which is about two to five times faster than the growth rate for tourism in general (Wright 1996). Also, "environmental awareness" is becoming the collective consensus among the general populace in developed countries, so, protected areas in developing countries can anticipate an influx of nature-based tourists or ecotourists. For example, Costa Rica, is one of the world's most coveted ecotourism destination of the 1990s, experienced 781, 000 tourist arrivals in 1996, and approximately 66% of all visitors visited a natural protected area.

Along with the promotion of sustainable use of natural resources, swaps have the inherent possibility of creating jobs and income in remote regions via protected area tourism. Lindberg (1996) best summarizes the impacts of protected areas in general: "Protected areas, and nature conservation generally, provide many benefits to society, including preservation of biodiversity, maintenance of watersheds, and so on. Unfortunately, many of these benefits are intangible. However, the benefits associated with recreation and tourism in protected areas tend to be tangible. For example, divers at a marine park spend money on lodging, food, and other goods and services, thereby providing employment for local and non-local residents. These positive economic impacts can lead to increased support for the protected areas with which they are associated. This is one reason why ecotourism has been embraced as a means for enhancing conservation of natural resources."

Brown (1998) argues that swaps are likely to activate investment in international tourism via 'park restoration, sustainable wildlife preservation and forest protection.' Moreover, in the context of the African continent, he states that swaps that help create protected areas/parks would increase the influx of tourists, thereby simultaneously increasing foreign exchange earnings (Brown 1998).

There is a positive relationship between debt-for-nature swaps and protected area tourism, in which swaps are employed as a sustainable development tool facilitated by protected area tourism. Swaps objective are to reduce the debt burden, protect the environment, and aid in sustainable development programs to generate local jobs and income which in turn can be facilitated by protected area tourism (figure 1). Tourism and protected areas have a beneficial symbiosis, in which a protected area provides experiences for tourists, while the revenue generated (entrance fees...) aids in the daily operation and maintenance of

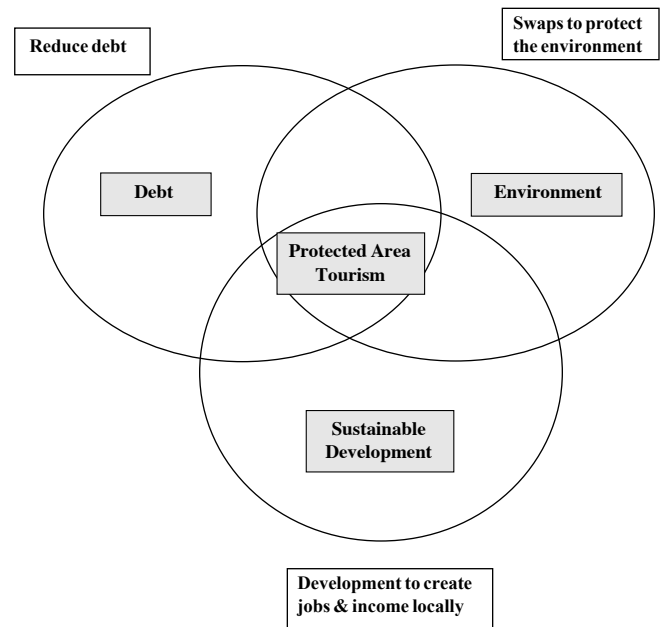


Figure 1—Relationship between Debt-for-Nature Swap and Protected Area Tourism.

the protected area. Locals are employed, and the local economy is rejuvenated in remote regions.

Conclusions

Realistically, the US \$2 trillion debt burden of developing countries will never decrease dramatically. Costa Rica, the largest player and also the most successful environmental protection country, has managed to eliminate only 5% of its overall debt, in spite of multiple swaps. Debt-for-nature swaps may not have a major impact on the debt burden or the environment of developing countries, but they can provide additional funding to ailing environmental organizations in developing countries, raise a sense of awareness about environmental protection. Some environments like Costa Rica is benefiting from such a process and is reaping foreign exchange, job creation and other associated benefits due to the immense success of protected area tourism.

There is a positive link between the debt crisis and environmental degradation. Solving the debt crisis will not unilaterally solve the environmental crisis. However, debt-for-nature swaps can help secure the natural environment for the present as well as future generations; in other words they provide a mechanism for sustainability, promoting sustainable use of natural resources, an essential component of economic development. This concept is a plausible strategy for developing countries that are proactive in environmental issues and can achieve some degree of success via protected area tourism. There are only a few countries namely Costa Rica, Ecuador, Mexico, the Philippines and Madagascar that are actively involved in such a process. Largely, Latin American countries have been targeted. However, progress has been documented in Europe. Recently, Switzerland decided to forgive SF 20 million in

exchange for the equivalent local currency to be spent on environmental protection and cleanup in Bulgaria (Environment Bulletin 1996). The largest debt swap occurred in 1992, when Poland (debtor country) and the Paris Club (17 wealthy creditor countries) decided to swap debt for environmental concessions at amounts estimated up to US\$ 3 billion (Deacon & Murphy 1997).

However, each swap should have site specific agreements, and should include locals living within or around the vicinity in the planning process, because local commitments and trust are mandatory to ensure any degree of success. For example, in the Ghana swap, Conservation International is looking at alternative income producing opportunities for village residents who reside within the vicinity of the park as a way to prevent poaching; local guides and camping lodges operated by locals are being considered (Brown 1998). Most importantly, site-specific standard monitoring and enforcement programs must be implemented, as the objectives of the swaps are highly dependent on the success of such programs.

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Southern by the Grace of God: Wilderness Framing in the Heart of Dixie

Bryan K. Walton

Abstract—Wilderness advocacy in Alabama is as unique as the cultural flavor of the South. This paper documents how the most recent wave of wilderness activism in Alabama, embodied in the Alabama Wilderness Alliance, Wild Alabama, and WildLaw, have sought to place themselves within the cultural roots and heritage of the American South. In this paper, the efforts and impacts of these organizations are examined. The author concludes that by separating themselves from the larger environmental movement, these groups have staked out their own course of action, with their own emphases, successfully framing the preservation of wild places as a cherished Southern tradition, as central to daily life as college football and prayer meetings.

So it is with the National Forests in Alabama, our wild rivers, our hunting lands. They are all in jeopardy. We call on every red-blooded son and daughter of the Southland to stand up and defend your heritage. Defy the Evil Shadow that is growing in lengths as the Cold Winter of Corporate Enslavement slips over the world (Marshall 1996).

The framing efforts of three prominent environmental organizations in Alabama are examined in this paper. The Alabama Wilderness Alliance (AWA), Wild Alabama, and WildLaw focus on efforts to preserve Alabama's remaining wild places. This paper examines their efforts to promote wilderness preservation through a variety of methods, some of which might be considered atypical. Rather than pursuing a more traditional approach to preservation, using scientific arguments, these organizations pursue a strategy built around the region's biological and cultural heritage. Furthermore, they have distanced themselves from the stereotypical notion of wilderness preservation as a hobby of the rich, eco-liberals or other privileged elite groups. By utilizing a powerful legacy of Southern populism, combined with rich cultural histories, these activists have created a concept of wilderness linked to cherished Southern traditions, as central to daily life as college football and prayer meetings.

Background

Citizens in Alabama have consistently shown that they are concerned about environmental quality. Bailey and others (1989) surveyed citizen attitudes and found that the public had high levels of concern over most environmental

issues. Bliss (1994) polled the public in the South about forest issues. He found that citizens of Alabama maintain strong concerns about the forests of the state. For example, he found that when dealing with public lands such as national forests, 86% of the respondents felt that clear-cutting should not be allowed (Bliss 1994). He says, "For over two decades of polling there has been this trend of growing environmentalism. If anybody in the '90s still thinks that Alabamians have been left behind in the environmental movement, that just isn't true" (Bouma 1994:9).

Alabama has a colorful legacy of independent-minded populism. One of the most interesting examples of this occurred during the American Civil War. Winston County is a hill county in the northwestern corner of the state. Containing the majority of what is now the Bankhead National Forest, it was a county with a high concentration of whites, and between 90% and 100% of them favored continued cooperation with the Union (Flynt 1989). A meeting on July 4, 1861, attended by more than 2,500 people, passed three resolutions that led to "The Free State of Winston." The central issue was reluctance on the part of hill farmers to fight for the right of large farmers in the lowlands to maintain a workforce of slaves (Weaver 1960). The conflicting interests of "the common man" and wealthy plantation owners, or their contemporary counterparts, are a constant refrain in Alabama politics.

Alabama is one of the most biologically diverse states in the United States. The Appalachian Mountain chain terminates in the Talladega National Forest. Along with this, there are the Tuskegee, Conecuh and William B. Bankhead National Forests. Roughly 68% of the state is forested land. However, only 5% of this, equal to about 643,000 acres (260,208 ha) is owned by the public. There are only three federally protected wilderness areas in the state. The Sipsey and Cheaha Wilderness areas combined equal 33,231 acres (13,448). The Dugger Mountain Wilderness area, 9,200 acres (3,723 ha), was designated by Congress in December of 1999. The presence of an emerging ecological conscience, when combined with the cultural richness of the region and the small amount of public lands in the state, has led to a growing concern over how the national forests in Alabama are managed. In a state with such few public lands, many people feel that it is undesirable to manage these forests for timber. Many practices considered unhealthy and unnecessary in the eyes of the public, such as clearcutting and herbicide spraying, have been used on public lands and are considered detrimental to wilderness preservation and forest-based recreation.

Central Actors

This atmosphere of public concern provides the context for the emergence of the three groups that are the central focus

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Bryan K. Walton is Graduate Student of Sociology, Department of Agricultural Economics and Rural Sociology, Auburn University, AL 36849 U.S.A., e-mail: bryan@bryansweb.com

of this paper: the AWA, Wild Alabama and WildLaw. Lamar Marshall, an engineer by training, had a past that involved designing paper mills and nuclear power plants. A longtime resident of the area housing the Bankhead National Forest, Lamar Marshall grew tired of his favorite places being clearcut. In 1991, the USDA Forest Service (USFS) outraged many local residents when it clearcut Indian Tomb Hollow, a sacred Native American site in the Bankhead National Forest. Together with members of the Blue Clan of the Echota Cherokee, Lamar Marshall formed a grassroots forest-watch organization called The Bankhead Monitor.

Simultaneously, the AWA and WildLaw were in their early stages of development. The lead attorney for WildLaw, Ray Vaughan, was beginning his environmental law practice in Alabama. A former assistant state attorney general for Alabama, Vaughan converted his private practice in 1997 into a nonprofit law firm known as WildLaw. In 1991, Vaughan represented the Alabama Conservancy in a suit seeking to reduce the dioxin flowing into state rivers from pulp and paper mills. It was during this suit that he met Ned Mudd.

Mudd, the creative energy behind the AWA and also the Chair of the Board of the Biodiversity Legal Foundation, was representing a single plaintiff in that dioxin suit. They decided to pool their talents and have been working together since. Originally, Mudd practiced family law in Birmingham. But in his spare time, he was producing a video of a baby gorilla at the Birmingham Zoo. Believing that the Birmingham Zoo was mistreating the gorilla, he waged a media campaign for better treatment for it, and this led him into the environmental arena.

Within a year, the three individuals had joined forces and have since emerged as three of the most active environmentalists in Alabama, and arguably in the region. These wilderness advocates, along with their respective organizations, have turned the management of Alabama's public lands upside down. Their style is irreverent and engaging, deeply critical and funny, but also multifaceted and increasingly effective.

From the beginning, these wilderness advocates have endured a strained relationship with the Forest Service, the timber industry and even other environmental organizations. The Forest Service and the advocates have fought incessantly. With the belief that the national forests in Alabama are some of the most "traditionally" managed forests in the country, with their emphasis on production of timber for harvest, clearcutting and herbicide spraying to eradicate indigenous hardwood species, the two sides have become polarized. In 1991, Lamar Marshall was given a warning by a Forest Service ranger for passing out newsletters at the entrance to the Sipsey Wilderness (Lowe 1991). James Ramey, former district ranger of the Bankhead National Forest, has taken a disparaging view of his critics:

The Bankhead Monitor represents the opinion of its editors and they represent a special interest. And a lot of their objectives right now are in opposition to Forest Service management. . . . Most of the information I've found in it is either incorrect or a half-truth (Lowe 1992).

At times, the criticisms have turned personal, with scathing attacks on Forest Service employees in the form of cartoons and satire in the publications of the wilderness groups. However, there is more to these relationships than personal

attacks. Fundamental issues are at stake, regarding whether the public forests in the state will continue to be primarily seen as sources of timber, or whether the new emphasis upon preservation and recreation will supplant it in the future.

This emphasis upon preservation and recreation is a growing force to be reckoned with in Alabama and is reflected in the growing popularity and success of the wilderness advocates. The Bankhead Monitor has grown from a small grassroots organization in 1991, to one that now has more than 1000 members and a glossy magazine printing about 10,000 copies with each new issue (Marshall 1999). This growth in circulation is occurring rapidly, with a 43% increase in the past 10 months. The organization has a 1999 budget of \$300,000, a 100% increase in the last five years. In 1997, The Bankhead Monitor changed the name of both the organization and its similarly named publication to Wild Alabama to reflect not only its growth and statewide presence, but its emphasis upon the importance of wild places and a wild Alabama. Lamar Marshall has also evolved from being an angry redneck woodsman (Wapner 1996) to a participant at the 1998 National Wilderness Conference in Seattle. He was a keynote speaker at the conference of 450 people sponsored by such groups as The Wilderness Society, Sierra Club, National Audubon Society and the World Wildlife Fund.

WildLaw also has flourished in recent years, reflecting the success of this group in the courtroom as a not-for-profit legal firm. WildLaw brought in \$80,020 in 1997. In its second year, 1998, the firm brought in \$278,142, a 348% percent increase (WildLaw, 1999). This growth in support has allowed for recent expansion and an increase in the number of cases handled by the firm. It has added two attorneys in its main office, and in the fall of 1999, it opened branches in North Carolina and Minnesota. WildLaw has also attracted prominent national wilderness advocates to sit on the WildLaw board, including Dave Foreman, founder of Earth First! and the Wildlands Project; Reed Noss, conservation biologist and editor of *Conservation Biology*, the journal of the Society for Conservation Biology; and James Redfield, author of the best seller, *The Celestine Prophecy*.

The AWA also has become increasingly effective and has set an ambitious agenda of increasing wilderness areas in Alabama by 940% before the year 2000. The AWA is pushing legislation in the Alabama Legislature that will enable the creation of protected wilderness on the state level. The Alabama State Wilderness Bill, written by the AWA, has been introduced into the State House by Representative Jack Page and is making its way to the full House for a vote.

Sociologists have applied the concept of *frames* to social movement activity to understand how the ideas and meanings of individual participants become joined with movement ideologies. By using the concept of framing, we can see in the following section how these organizations are presenting issues and problems in order to galvanize their supporters, discourage their opponents, and generate public sympathy for their work.

Frames

David Snow and others (Snow and Benford 1988; 1992; Snow and others 1986) have built upon the work of Erving Goffman (1974) to understand how people come to see

injustices present in society and to determine what they can do about such problems. These authors have applied the idea of *frames* to social movements to understand how the ideas and meanings of individual participants become joined with movement ideologies.

Social movement framing is a vital link between the visions, ideas and understanding of social movement actors and those various individuals, organizations and agencies that they seek to attract and influence. As Snow and Benford (1988) state, the creation of frames refers to how social movements

assign meaning to and interpret, relevant events and conditions in ways that are intended to mobilize potential adherents and constituents, to garner bystander support, and to demobilize antagonists (Snow and Benford 1998).

Snow and others (1986) argue that the success of a social movement depends on the presence of an impressive and powerful master frame. Obviously not all frames succeed, and movements can learn from both the failings of other movements and their efforts to frame issues. By utilizing optimal frames, the likelihood of movement success can increase due to a greater potential that the frame will resonate with those that the movement seeks to influence (Snow and others 1986; Snow and Benford 1988). I will discuss two sets of frames in this paper. The first consists of two frames pertaining to the relationship between wilderness and those who seek to preserve wilderness. The second set looks at two frames regarding reasons for wilderness preservation.

Diagnostic, Prognostic, and Motivational Frames

To achieve a higher degree of frame resonance and to ensure success of the social movement, Snow and Benford (1988) argue that there are three main framing tasks for any social movement: 1) realizing that something is wrong and needs to be changed and identifying the blame for the problem, what is called diagnostic framing; 2) creating a solution for changing that wrong, what they call prognostic framing; and 3) successfully recruiting others to join in fighting the wrong, what the authors describe as motivational framing (Snow and Benford 1988). In this section, I will analyze how these wilderness advocates have challenged the traditional concepts of wilderness and in so doing, are fulfilling the three tasks laid out Snow and Benford.

Diagnostic Framing—The various framing tasks laid out by Snow and Benford (1988) have been employed by these wilderness advocates in preserving wild places in Alabama. To them, the problem is clear: There is little wilderness in Alabama, and the few remaining wild places are being destroyed at an alarming pace. Increasingly, they are fighting an agency (the Forest Service) in Alabama that is seen by them and their supporters as out of touch with the interests of the citizens of the state. To them, the agency seems determined to destroy the few wild places remaining for the common folk of the state. Because of this, the Forest Service is viewed as a threat to the cultural heritage of the citizens of Alabama. Other citizen environmental groups in Alabama seem incapable of effectively opposing the Forest

Service due to their adherence to more traditional and elitist approaches to wilderness preservation. The wilderness advocates in this study believe that neither the Forest Service nor the other environmental groups in Alabama are effective advocates for wilderness. Rather than mimicking these two entities, the wilderness advocates of the AWA, Wild Alabama and WildLaw are challenging them both through a radically different framing of wilderness issues in Alabama.

Prognostic and Motivational Framing: Populist and Elitist Wilderness Frames—With the problem identified, these wilderness advocates have sought to instill in the public conscience the idea that wilderness belongs to everyone. While the history of wilderness preservation may not be filled with such images, such an idea does have precedent.

Robert Gottlieb (1993), in the first chapter of his history of the American environmental movement, analyzes the social view of wilderness in the American psyche. He examines the role of Bob Marshall who, working in various capacities for the Forest Service, argued that wilderness belonged to all people. He believed that, while elites may have the greatest opportunity for a wilderness experience, “people cannot live generation after generation in the city without serious retrogression, physical, moral and mental, and the time will come when the most destitute of the city population will be able to get a vacation in the forest” (Marshall 1925).

Bob Marshall, a founder of The Wilderness Society, sought to inject this populist idea of wilderness into the approach and perspective of that group. Other influential actors within The Wilderness Society, however, feared that Marshall’s emphasis on a “wilderness for the people” might undermine the idea of preservation. Gottlieb cites Olaus Murie, a major player in The Wilderness Society, as evidence of an elitist view of wilderness. Murie wrote, “wilderness is for those who appreciate” and that if the masses were brought into the backcountry without really understanding it, “there would be an insistent and effective demand for more and more facilities, and we would find ourselves losing our wilderness and having these areas reduced to the commonplace” (Gottlieb 1993).

The struggle over framing wilderness as an expression of elite versus populist values is reflected in the historical split between the preservationist and the “hook-and-bullet” crowds. William Hornaday, the executive director of the New York Zoological Society, referred to the latter as those who “sordidly shoot for the frying pan” (Gottlieb 1993). Other factors are the inability of many environmentalists to successfully reach out to the working class — especially those working with natural resources. The struggles of Earth First! in the late 1980s and early 1990s to build coalitions with loggers have been well documented (Scarce 1990; Zakin 1993). Whatever the reasons, the idea of wilderness as reserved for economic and intellectual elites has remained a prevalent frame in the environmental arena. A recent issue of *Outside* magazine (1999), describes The Wilderness Society in the following terms: “Hemorrhaging funds and members for most of the decade, this group became a sad-eyed poster child for the bloated nationals: too dependent on the whimsy of foundations, too removed from Main Street USA, and too entrenched in its image as a group of eighties-style elitists pushing an unpeopled wilderness agenda.”

The AWA, Wild Alabama and WildLaw represent the antithesis of the elitist view of wilderness, establishing a strongly populist (verging on a prototypically “redneck”) stance reflecting the rights of common Alabamians to enjoy the wilderness. While these wilderness advocates do express concerns about overuse of wilderness areas, they are quick to point out that the solution is not less people, but more wilderness (Woolf 1998). These wilderness advocates characterize the Forest Service and some environmental groups as fundamentally elitist in restricting access to forest land to either the forest products industry or to small numbers of urban elites who can afford to enjoy the small parcels of wilderness allowed to remain.

Increasingly, the wilderness advocates in this study are presenting themselves as in sync with the conservative political and cultural climate of Alabama and the South. Recognizing that the Deep South is one of the most culturally, socially and politically conservative regions of the country, these activists have realized that any preservation efforts that put them in the mold of “environmental radicals” will threaten their success. Separating themselves from all stereotypical notions of environmentalists, these activists are gun lovers and heavy consumers of beer and hard liquor, and they remain willing to flirt with things not considered politically correct (Lamar Marshall professes to being a member of the John Birch Society). As such, one is likely to find them considering an Earth Day celebration in a strip club, entering a restaurant carrying several handguns (with permits), or playing music with members of the Allman Brothers Band. By placing themselves squarely within this conservative realm, they can argue that the Forest Service and the forest products industry are the real radicals.

Prognostic and Motivational Framing: Cultural Heritage and Science-Frames—Wilderness advocates utilizing science-based frameworks seek to protect wild places when science informs them that such action is needed. Much of our current wilderness preservation debate is driven by such science. Because feelings and emotion are missing, or at least secondary, in this framework, both the Forest Service and many environmental groups can argue they are backed by modern science. Roderick Nash (1982) argues that before the onset of modern science, the preservation of the natural world was based on aesthetic and sentimental feelings, rather than scientific logic and reasoning. Concern over the management and preservation of wild places in Alabama in the past has been driven by such science-based frames. An emphasis on science does not, however, provide the necessary motivation for mass support for preservation. In Alabama, the wilderness advocates who are the focus of this study have reconnected wilderness preservation with its aesthetic and sentimental feelings, linked to physical landscape and socio-historical space.

The cultural heritage framework, unlike the science-based framework, views the human histories and cultures woven into the fabric of wild places as vital and essential for the successful preservation of wild places. Wilderness preservation is presented as being essential as a means of honoring memories and traditions, of parents and grandparents, as well as ancestors of the more distant past. As such, the cultural heritage framework uses a strong emotional element, rather than a faith in science, that draws people to support the need for wilderness preservation. The success of

the cultural heritage frame lies in its clear diagnostic frame: Environmental injustices are being perpetrated by governmental and corporate actors, and these injustices are directed at the citizenry—not against a tiny endangered organism such as the snail darter. Despite Alabama’s emerging ecological consciousness, concern over endangered species remains an eco-liberal elitist preoccupation unlikely to win widespread public support. Instead, these wilderness advocates have created an alternative frame oriented around reverence for the past and a love of place where our forbearers roamed.

These wilderness advocates believe that the Forest Service represents a serious threat to wilderness because the agency values forest land primarily as a source of timber. As such, the Forest Service endangers the idea of the forest as a keeper of cultural heritage and tradition. As Lamar Marshall has stated,

the image promoted by the US Forest Service and the timber industry is one that equates National Forests primarily as sources of timber production with a secondary recreational use by the public. . . . We want to replace the idea of National Forests as sources of boards with one of a Cultural Heritage area, a representative of Original America, Ancestral or Cultural Landscape, etc. (Marshall 1997).

When wilderness is characterized as a thoroughly Southern cultural tradition, threats posed by the Forest Service to wilderness and wild areas are characterized as attacks on the Southern history and way of life. As such, the Forest Service has been positioned as an outsider within the state, as a metaphorical agency of Yankee carpetbaggers.

The emphasis of these wilderness advocates on populist wilderness and cultural heritage frameworks, while present since their early days, has increased in the past several years and may have contributed to the growth in their support from a diversity of sources, ranging from local Cherokee Indians to E.O. Wilson, the Harvard biologist. Advertising space in *Wild Alabama* is filled by everything from sporting equipment and barbeque to lingerie stores and dentists. Similarly, WildLaw is finding support for its legal efforts coming not only from small individual donors, but from corporations such as Patagonia. The Alabama Wilderness Alliance’s support extends from Dave Foreman and The Wildlands Project, all the way to State Representative Jack Page, home-grown deer hunter pushing the AWA’s State Wilderness Bill through the legislature.

Impact of Wilderness Groups on Forest Service Policy

If the populist wilderness and cultural heritage frameworks guide the efforts of these wilderness advocates in their preservation efforts, what have been the results? An analysis of their efforts to preserve wild places around the state reveals much success, often backed by the force of law.

As stated earlier, Wild Alabama (then The Bankhead Monitor) emerged in a conflict mode, visibly outraged over a Forest Service clearcut of Indian Tomb Hollow, a sacred site in the Bankhead National Forest. From this beginning, the relationship between these organizations and the Forest Service has remained strained. Wild Alabama’s publications, *Wild Alabama* and previously, *The Bankhead Monitor*, have

at times included rough treatment of district rangers and forest supervisors in Alabama. Lamar Marshall argues that the lampooning is necessary. He says that if someone is going to destroy the forest, his cultural heritage, then Wild Alabama is going to destroy that person's reputation (Marshall 1998a). It should not be construed that these groups are content to work only in this fashion. In a letter to Elizabeth Estill, the Southern Regional Forester of the Forest Service, WildLaw attorney Ray Vaughan wrote,

Please do not think that our actions or words are personal attacks upon you or your staff. We may sometimes speak harshly about what we dislike about Forest Service actions, but what we are doing is not a job or a career to us; it is our life's passion. We love these forests; I have been using the Alabama Forests for 30 years. So long as the Forest Service continues to treat the wild places we love and revere as resources to be micro-managed and manipulated endlessly, we will be at odds and often in direct conflict. Still, that does not mean that we cannot be cordial and friendly in person, as we understand that you have a job to do with many demands, some often conflicting. But the demands on us are not conflicting, and our vision and purpose are clear (Vaughan 1998).

This approach has resulted in frequently strained relationships between these groups and the Forest Service. In an interview the Estill, she said that the reality regarding the agency's relationship with these groups is that there are some damaged relationships at the local level. Because of this, litigation often becomes the only form of interaction. It is here, in the litigation phase, that these wilderness advocates have had considerable success.

In 1999, all timber sales on the National Forests of Alabama were shut down. A criminal investigation discovered "irregularities" in timber sales in a portion of the Talladega National Forest. As a result, officials stopped awarding timber sales in all districts of Alabama as they looked for more "irregularities." Furthermore, there were two resignations in the wake of the investigation, involving the Forest Supervisor and a District Ranger. Regarding the shut down of all timber sales in Alabama, the wilderness advocates released a press release asserting that "WildLaw and its Executive Director Ray Vaughan have worked on protecting the National Forests in Alabama since the mid-1980s; since the early 1990s, that work has been on behalf of Wild Alabama and the Alabama Wilderness Alliance....Since 1995, legal work by WildLaw and Wild Alabama have halted timber sales on more than 55,000 acres of public lands in the National Forests in Alabama" (Vaughan 1999).

The emphasis on legal confrontation between these wilderness advocates and the Forest Service reflects a conscious choice made by these wilderness advocates, a decision to adopt an approach closer to the "No Compromise in Defense of Mother Earth" stance of Earth First! activists than to the strategy of compromise adopted by mainstream environmental groups. This more confrontational approach is consistent with the more emotionally charged cultural heritage and populist frames developed by these advocates. Policy dialogue is not their game; instead they have adopted the All-American motto, "Sue the Bastards."

Conclusions

The adoption of both cultural heritage and populist wilderness frameworks has had significant impact upon the popularity of the AWA, Wild Alabama and WildLaw, both inside and outside the environmental community. Adoption of these frames has led to a shift away from emphasis on the scientific approach to preservation efforts, and toward a focus on culturally and socially significant relationships to wild places. As Lamar Marshall stated in his speech to the 1998 National Wilderness Conference, "I don't believe we will ever save much wilderness on the merit of it being a priceless biological reserve, even though it is. The American public at large just doesn't care about tiny living organisms vanishing. But they care that the mountain about to be razed is where their ancestors lived, died, and maybe are buried" (Marshall 1998b).

These wilderness advocates are increasingly concentrating their efforts on saving wild places through emphasis on the region's cultural heritage, blended with the idea that wilderness is a cherished part of the Southern way of life. This blend of frameworks (with its emotional appeal) is backed up by science and (especially) law. Rather than focus solely on these secondary tools for influencing public opinion and policy (biological reserve and legal frameworks), these organizations use them to support the core emotional, cultural, historical, and personal claims made on behalf of their preservation efforts. Far from being starry-eyed idealists, they match their vision to a proven ability to successfully play legal hardball, with the USDA Forest Service when needed.

Given the success of these wilderness advocates in Alabama, it remains to be seen whether the framing efforts of these organizations are the precursors to a trend among environmental groups regionally and nationwide. Lamar Marshall has argued the merits of such a path in at least two speeches to other environmentalists: the 1997 meeting of the Southern Appalachian Forest Coalition (a coalition of 16 environmental groups in the southeastern United States) and the 1998 National Wilderness Conference. As this research is only a case study of one set of organizations, a broader study looking for the existence of populist wilderness and cultural heritage frames among other environmental groups working on preservation of wild places would give a better understanding of the power of this approach.

Meanwhile, it seems that the populist wilderness and cultural heritage frameworks are working with the citizenry in Alabama. During an interview with Lamar Marshall at the Wild Alabama Trading Post in Wren, Alabama, there was a constant flow of people in and out of the store. Some of these people were looking at maps, trying to find an old burial ground in the Bankhead National Forest, hoping to find a buried loved one. Others just wanted to get some camping supplies. But one woman who works at an area poultry processing plant told him as she walked out the door, "You know I will always give you my support." Defending wild places is supposed to be the pastime of the rich, upper class. Apparently, someone forgot to inform this woman that this is not her struggle.

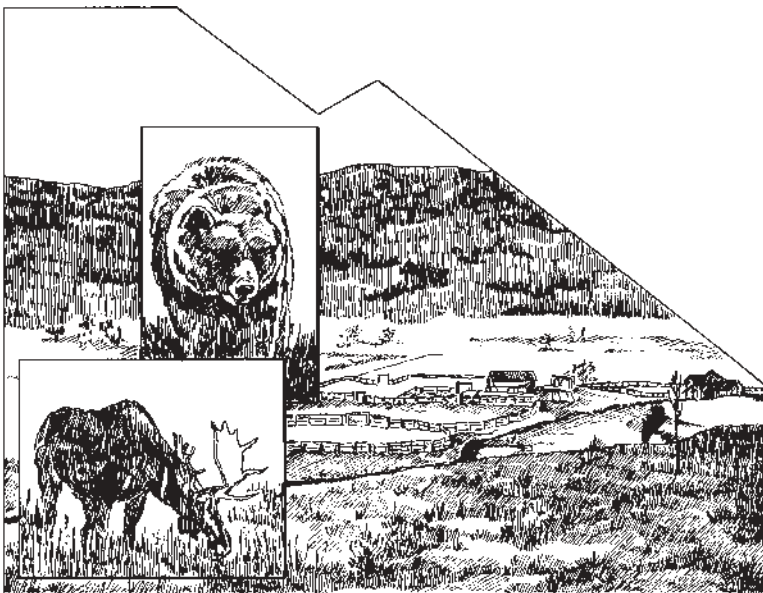
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5. Dialogue Session Summaries



From Confrontation to Conservation: The Banff National Park Experience

Douglas W. Hodgins
Jeffrey E. Green
Gail Harrison
Jillian Roulet

Abstract—Banff National Park, the flagship of the Canadian national park system, has become the focus of debate over park use versus protected area conservation. In response to the debate, the Minister of Canadian Heritage commissioned an independent review. The resulting Banff-Bow Valley Study report and Banff National Park Management Plan are landmark documents. The work was a blend of science and public policy review and an innovative approach to public involvement. This paper summarizes the Banff-Bow Valley Study, Parks Canada response and the influence of the overall process on Parks Canada policy and program.

Banff National Park is the flagship of the Canadian national park system. Created in 1885, the Park was born as a “public park and pleasure grounds for the people of Canada” (Lothian 1977). In the early years, the emphasis was on encouraging recreation and tourism development. By 1912, more than 70,000 people visited the Park, compared with four million in 1995. Throughout its history, debate over the management of the Park has focused on the classic struggle of preservation vs development. Throughout the 1980s and early 1990s, the debate escalated to the point that the Minister of Canadian Heritage, responsible for Parks Canada, commissioned an independent review—the Banff Bow Valley Study (BBVS). This paper describes the basic findings of the study and reviews the public involvement process. It also describes in greater detail three major challenges—how science was integrated into decisions, challenges of human use management and regional integration—and how they were dealt with in the BBVS, the park management plan process and in management of the Park over the last few years. It concludes with some of the key lessons learned throughout and since the study.

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Douglas W. Hodgins is Project Manager, Legislation and Policy Branch, Parks Canada Agency, Room 414, 25 Eddy Street, Hull, Quebec, Canada K1A 0M5, e-mail: doug_hodgins@pch.gc.ca. Jeffrey E. Green is Vice President, AXYS Environmental Consulting Ltd., P.O. Box 2219, 2045 Mills Road, Sidney, British Columbia, Canada V8L 3S8, e-mail: jgreen@axys.net. Gail Harrison is Manager, Ecosystem Services, Western Canada Service Center, Parks Canada, Room 550, 220 4th Avenue S.E., Calgary, Alberta, Canada T2G 4X3, e-mail: gail_harrison@pch.gc.ca. Jillian Roulet is Land Use Planner, Banff National Park, P.O. Box 900, Banff, Alberta, Canada T0L 0C0, e-mail: jillian_roulet@pch.gc.ca

Background

Banff National Park is located in the western portion of the province of Alberta, Canada, 100 km (60 miles) west of Calgary and about 400 km (250 miles) north of the Alberta/Montana border. It lies at the heart of the Central Rockies Ecosystem that straddles the Continental Divide. Banff, along with Kootenay, Yoho and Jasper National Parks and several British Columbia provincial parks, forms the Rocky Mountain World Heritage Site.

The Park has three major life zones—alpine, subalpine, and montane. The most critical of these, the montane ecoregion, generally occupies the valley bottoms below the 1,300 metre (4,300 foot) elevation level. It occupies the smallest portion (less than four percent) of the Park and is its most biologically diverse. It provides prime habitat for a wide range of wildlife, including birds, large carnivores, ungulates, small mammals and herptiles. The montane is also the focus of the majority of development and human use in the park.

Banff National Park is an icon of the Canadian national park system. Images of the Park can be found around the world, making it a major tourism destination. This is placing ever-increasing demand on park services and resources. The Park encompasses an area of 6,640 km² and has over four million visitors annually. The number of visitors to the Park has tripled since 1970. To put this in perspective, Banff is about 75% the size of Yellowstone National Park, which had 2.4 million visitors in 1998 (Street 1998).

The Park has an enormous amount of tourism and other infrastructure. There are two communities (Banff and Lake Louise) with almost 10,000 year-round residents. The four-lane Trans-Canada Highway (TCH) bisects the full length of the Bow Valley, as does the Canadian Pacific Railway mainline, the busiest east-west freight line in the country. Beyond the four million visitors to the Park each year, the highway attracts an additional four million people who are passing through on their way to other destinations. Summer use on the TCH averages more than 20,000 vehicles per day.

There are three downhill ski areas, numerous campgrounds, picnic and other day use areas. Popular day use areas, such as Lake Louise, record more than 10,000 people per day. The Park has more than 1,500 km (almost 1,000 miles) of designated trails. These trails attract 18,000 to 20,000 backcountry hikers and horseback rider-nights a year.

Major commercial infrastructure such as the Banff Springs Hotel and the Chateau Lake Louise date back to

the early years of the Park. Many other major hotels and retail developments have followed these early pioneers. The resulting economic engine generates more than \$873 million annually in visitor expenditures and more than 22,000 person years of employment (Alberta Economic Development and Tourism 1994).

The Banff-Bow Valley Study

The struggle between the forces of preservation and development has centered on the Bow Valley since the Park was created. Escalating concerns and opposing perceptions over irreversible damage to the Park and growth in business development and infrastructure that was out of control resulted in the Canadian government commissioning the Banff-Bow Valley Study.

The Minister of Canadian Heritage set three objectives:

- ↑ develop a vision and set of goals for the valley
- ↑ complete a comprehensive analysis of existing and future information needs
- ↑ provide direction for the management of human use and development

A five-member, independent task force carried out the study. A five-person secretariat, together with a large number of scientists, consultants, park staff and other members of the public, assisted the task force. The study took two years to complete and cost \$2.8 million (Canadian). The study resulted in a 430-page technical report, *Banff-Bow Valley: At the Crossroads* (Banff-Bow Valley Study 1996), which contained over 500 recommendations. A summary report, for wider public distribution, was produced. More than 20 other project reports and analyses and a variety of modeling and other analytical tools were developed.

Outcomes—A Case for Change

Shortly following the midpoint of the study, the task force compiled its “Case for Change.” These were the major issues that had to be addressed if Banff National Park was to continue to be ecologically sound. The Case for Change became the 14-point framework for the deliberations of the study over the next 16 months and ultimately became the foundation for the development of the study’s recommendations.

1. While Parks Canada has had clear and comprehensive legislation and policies, Banff National Park has suffered from inconsistent application of the *National Parks Act* and Parks Canada’s Policy. Some of the explanation lies in the evolution of Banff National Park, some in ad hoc decision-making and some in weak political will in the face of a range of interest-based lobbying. The Banff Townsite, for example, would not have been permitted to develop to the extent that it has under the current *National Park Act*. But at the turn of the century, the development of this townsite was viewed as progress. In fact, the administration of the day granted perpetual leases to attract residents and visitor services.

2. Despite the fact that ecological integrity is the primary focus of the present-day *National Parks Act* and Parks Canada’s Policy, ecological integrity has been, and continues to be, increasingly compromised. Park management, human use, commercial development, the

Trans-Canada Highway and the railway have contributed to this situation, despite well-intended remedial actions. Regional development, particularly in the previous decade, has and continues to fragment critical habitat and compromise existing wildlife movement corridors beyond the Park boundaries.

3. Multiple converging lines of scientific evidence support the previous conclusion. However, a significant percentage of the population, which has not been exposed to or does not appreciate the significance of the scientific evidence, find it difficult, based on what they had observe, to understand the ecological impacts that have occurred. With green slopes, abundant elk and sheep and sparkling waters, what could possibly be wrong? Perception is and continues to be difficult to overcome.

4. The rates of growth in visitor numbers and development, if allowed to continue, will cause serious, and irreversible, harm to Banff National Park’s ecological integrity. The Park has sustained a compounded annual growth in visitation of 5.46% (Pacas 1996). Growth also threatens the Park’s cultural resources and its ability to inspire not only artists, but also all Canadians. The built heritage that gives the Town of Banff its cottage atmosphere is fast disappearing under the pressure for new construction. Clearly, stricter limits to growth than those already in place must be imposed.

5. More effective methods of managing and limiting human use are required in both the frontcountry and the backcountry. This will require ongoing adjustments by visitors, residents, the tourism industry, park management and adjacent jurisdictions. While recognizing the need to manage growth in the number of visitors, restricting access should not replace creative visitor management programs that allow more visitors to enjoy the Park, while maintaining ecological integrity.

6. To maintain natural landscapes and processes, disturbances such as fire and flooding must be restored to appropriate levels in Banff National Park.

7. There are existing anomalies in the Park, such as the Trans-Canada Highway, the Canadian Pacific Railway and the Lake Minnewanka dam. For the future of the Park, their continued existence must involve design updates in accordance with the most advanced science and ecological and engineering practices.

8. Tourism in BNP must reflect the values of the Park. The study proposed the refocusing and upgrading of the role of tourism. Towards this end, Dr. Brent Ritchie, the tourism specialist on the task force, developed the Tourism Destination Model. The model described how tourism in Banff National Park should, to a greater extent, reflect the values of the Park and contribute to the achievement of ecological integrity. At the same time, it recognized that there will continue to be many attractive and profitable economic opportunities for sustainable tourism.

9. It is clearly evident that mountain tourism in Alberta will continue to expand. To meet the huge demand, any new, related facilities must be located outside national park boundaries. In coming to this conclusion, the study was sensitive to Banff National Park’s place in the regional ecosystem and understood that these developments will affect this ecosystem. The study felt that regional coordination was essential and must start with discussions between senior officials of neighboring federal, provincial and municipal jurisdictions.

10. Current growth in the number of residents, and in the infrastructure they require, is inconsistent with the principles of a national park. At the time of the BBVS, it was important that revisions to the Community Plan for the Town of Banff address these inconsistencies and the need for limits to growth.

11. Public scepticism and lack of trust in the decision-making process has led to a polarization of opinion. New forms of broad-based public involvement, such as shared decision-making, must be utilized, with clear links to Parks Canada's decision-making and accountability processes. Such involvement will have to address national, regional and local interests.

12. Visitors must be better informed about the importance of the Park's natural and cultural heritage, the role of protected areas and the challenges that the Park will face in the third millennium. It is also important for visitors to understand both the value and the cost of ecological integrity, so as to promote feelings of greater personal responsibility and stewardship. Improvements in education, awareness and interpretation programs are required.

13. Improvements to Parks Canada's management are central to the successful future of Banff National Park. Changes are required in the planning processes, management planning and public involvement in decision-making.

14. The current allocation of funding is inadequate to meet the requirements for maintaining ecological integrity and visitor management. The study provided recommendations on developing new and unique sources of revenue to meet the specific needs associated with implementing the recommendations, enhancing and maintaining ecological integrity and meeting the Park's visitor experience goals.

This describes what Parks Canada and the Banff-Bow Valley Study faced in 1995-96.

Sharing Values

Very early in the BBVS, the task force heard from stakeholders that they were frustrated with the conventional approach to public consultation used by Parks Canada and proponents of major developments. Some members of the public did not think that it had any influence over decision-making, that many decisions were made behind closed doors and that there was no predictability to outcomes of decisions. The fact is that Parks Canada had been using a wide variety of techniques to engage the public. No one, however, saw his or her suggestions being completely adopted and therefore felt Parks Canada was not listening. Environmental Non-Government Organizations (ENGOS) felt Parks Canada was too supportive of development, and the business community felt Parks Canada was unnecessarily bureaucratic and negative in its review of development proposals.

There are many different aspects of public involvement. In fact, public involvement processes fall along a continuum (British Columbia Commission on Resources and Environment 1995). At one end are those techniques intended to simply inform constituents. Further along, are methods used to gather information (opinion surveys), consult on reaction (public meetings) and define issues and seek advice (task groups and advisory committees). Finally, one can seek consensus or delegate decision-making authority using joint planning teams and round tables.

The BBVS chose to use a number of different techniques along the entire continuum. Newspaper advertisements were used to inform the public about the study and to identify interested individuals and businesses. Newsletters, reports, public presentations and the Internet were used to deliver information on a regular basis. Public opinion surveys were conducted to gather information. Public meetings were held to hear general concerns. Workshops and one-on-one deputations were used on specific issues. A round table, or shared decision process, was used to find consensus on a vision and significant issues in the valley.

The round table was the most significant public involvement undertaking by the study. It served to bring together, arguably for the first time, all the key interests in the valley. It took 14 months from its initial formation. No other single process had brought the same groups together over such an extended consultation period.

The decision to proceed with the round table was significant. It:

- ↑ was the first round table in interest-based negotiations ever conducted in a national park in Canada
- ↑ clearly demonstrated to the public the task force's commitment to open and inclusive public involvement
- ↑ provided the study with a consistent window on many of the interests in the valley
- ↑ created a clear expectation as to some of the content of the study's final report, since the task force committed to including any consensus agreement from the round table as a recommendation in its final report

To establish the round table, the task force tentatively identified sectors of interest based on its knowledge of the constituents in the valley. It approached opinion leaders to form a sector to sit at the table. Each sector was invited to define its constituency, select a chair and establish a working committee. In the end, 14 sectors of interest, including the task force, were formed. Once the sectors were formed, they appointed an independent mediator who was directly responsible to the table, not to the task force or Parks Canada. The round table then proceeded to develop consensus procedures and retained the right to dismiss the mediator. Each sector tabled a statement of interest. This was the first time that stakeholders in the valley formally shared their interests in a written, accountable form. The round table canvassed the issues it felt were important, prioritized them and set its work plan, taking into consideration the finite timeframe given by the Minister to complete the study. The round table had several limits to its representation. Two first nations sectors withdrew from the round table because their issues were outside the mandate of the BBVS. The government of British Columbia chose not to participate. The government of Alberta participated as an observer only. Most sectors represented local or regional interests, with national representation being limited to ENGOS. Given that Banff National Park is dedicated to the people of Canada, the inability of the task force to reach more national audiences was a significant limitation.

The BBVS round table was somewhat unique. One sector, the task force, found itself in an unusual position, that of a leadership-participant paradox, specifically:

- ↑ The task force was clearly the client of the process—it would receive the recommendations from the round

table and benefit from the debate around issues. The task force agreed to ensure that any recommendation that had the full consensus of the table would be incorporated into the final report. It also agreed to reflect the range of views on issues that did not have consensus.

- ↑ It was also a participant. The task force agreed from the outset that this was a fully shared decision-making process, meaning the task force had no more or less power at the table than any other sector.
- ↑ The task force was also expected to play a leadership role to guide the table and continually reinforce the mandate of the task force whenever the discussion became confused.
- ↑ The task force was expected to be an expert advisor to the table and was regularly asked to make presentations or to identify information on specific issues.

No other sector was expected to play the leadership and participant roles. These are all quite different and potentially conflicting roles. Clearly, one must understand his or her role and the implications before entering into such a process.

One can conclude from the BBVS experience that:

- ↑ Interest-based negotiation has a role in public policy decision-making.
- ↑ A round table works best when issues are marked by a long history of user conflicts, and interests realize that the round table is a means to move forward.
- ↑ The right people are needed: opinion leaders with energy, time, interest and a willingness to represent their constituencies.
- ↑ An independent mediator is required, accountable to the table and with no real or apparent biases in dealing with the issues.
- ↑ Public openness is essential.
- ↑ Time and money must be devoted if one is to benefit from the process. Providing the round table with all of the information needs and support was a highly time-consuming process.
- ↑ National representation is a challenge for local or regionally based round tables.

Finally, perhaps the most lasting outcome of the BBVS is the increased understanding of the complexity of issues and interests among stakeholders and a cadre of stakeholders experienced in the process of shared decision-making through open, disciplined and civil debate.

Looking Beyond

The recommendations of the BBVS were extensive, and Parks Canada needed to assess its ability to use the recommendations in managing the Park. Once the BBVS report was released, the Minister responded to a variety of recommendations immediately and placed the rest before an implementation advisory committee of internal and external stakeholders to assess their implications and benefits. The balance of this paper reviews how three of the larger issues—the role of science, human use management and regional integration—were dealt with in the Banff National Park Management Plan (Canadian Heritage, Parks Canada 1997) and in subsequent management and stakeholder action.

Role of Science

In this section, the approach by the BBVS, and subsequently by Parks Canada, to the use of science is discussed, with emphasis on how scientific information should be conveyed to assist the public in understanding the environmental issues and the need for action.

As described earlier, Banff National Park's history has been marked by the struggle to balance preservation with human use and development. Because of this history, the study was faced with a complex challenge of how to assess, not only the environmental impacts that have occurred in the valley, but also the social, cultural and economic changes and the factors that caused these changes.

During the two decades prior to the BBVS, the results of biophysical research in and adjacent to the Park were often met with skepticism and, in some cases, strong challenges. As in many public debates, a common tactic was to attack controversial recommendations by questioning the information base for the conclusion - the "my science is better than your science" syndrome. In particular, there was distrust about the significance of the effects of human activities and development on park ecosystems.

Knowing this, the study recognized that it needed to silence the "information debate" if the discussion was to move to defining and resolving issues. To achieve this, it was recognized that a substantial effort would have to be made to communicate scientific information and scientific methods to the public - leveling the playing field of information, so to speak. The following initiatives were used.

- ↑ Several workshops were held, including a workshop where stakeholders actively participated in the scoping of the environmental and socioeconomic assessment.
- ↑ The round table was provided with a compendium of baseline information on the park ecosystems, and its social and economic conditions (Pacas and others 1996) and was encouraged to modify and add to it.
- ↑ Internationally respected ecologists were retained to carry out environmental and socioeconomic assessments.
- ↑ Presentations were offered to address key information needs.
- ↑ A Technical Review Committee was established, comprising representatives of many sectors, to actively participate in ongoing analyses.
- ↑ The round table sectors were asked to nominate specialists for an independent review committee called the Scientific Review Committee.

Several of these initiatives are examined in more detail below.

One of the most substantial initiatives for information dissemination was preparation of the State of the Banff Bow Valley; A Compendium of Information (Pacas and others 1996). A team of specialists assembled a compendium of all known information on the environmental, social and economic systems of the Bow Valley and adjacent region, as well as information on human use, park visitation and history. Considerable effort was made to invite the round table sectors to critique the information and to offer substantiated improvements. Over a period of some 10 months, the round table worked through a number of iterations of the report, the end goal being the acceptance of the report by all sectors.

In the end, the round table concluded that the State of the Valley Report was, "... a significant contribution to providing a source of baseline information. The document is useful in bridging communication gaps, and in developing a common understanding of the area" (Darling 1996).

A second important initiative to involve the public in the use and interpretation of scientific information was the Ecological Outlook Project (EOP) (Green and others 1996). The BBVS commissioned the EOP to develop a sound scientific basis for the development of its management recommendations. Using primarily existing information sources, the EOP attempted to focus social, economic and environmental information on the ecological issues of the valley. The challenge was how to provide this information to the public in a form that was understandable and not overly complex, while not losing key details or the public's ability to challenge the science.

The EOP consisted of two interrelated studies:

↑ The Cumulative Effects Assessment evaluated the changes that had occurred in the Park. The assessment spanned the period from 1950—a period prior to the large expansion in tourism in the Park—through a period of reasonably foreseeable new developments.

↑ The Futures Outlook used dynamic simulation modeling to assess what types of social, economic and environmental changes may occur in the future under several different growth scenarios. In this case, the round table was actively engaged in setting the growth scenarios.

The EOP was completed in a way that facilitated direct involvement of valley constituents in the study and the generation of some of the major environmental recommendations. Mechanisms employed included the scoping workshop previously mentioned and ongoing involvement of representatives from the round table in specific ecological analyses and recommendations. The round table also nominated representatives to a Scientific Review Committee that provided a peer review of the work.

Perhaps one of the key achievements of the round table was development of a vision that provided a strong basis for formulating strategic goals. The strategic goals defined the conditions that the round table wanted to see in the Park and provided a strong basis for future environmental management. An example is the goal set for grizzly bear and wolf conservation:

Maintain healthy...populations within the Banff Bow Valley and Banff National Park as part of a viable and connected population of large carnivores within the Mountain Cordillera of Canada and the United States. The...populations will serve as one of the source populations for the regional ecosystem (Darling 1996).

These may seem like simple words, but they conveyed strong direction to scientists, who in turn were able to develop quantitative objectives and actions that would fulfil these goals.

While data on environmental systems and effects were not complete, they were nonetheless very substantial. As a result of efforts by Parks Canada and other researchers, the study was able to access a wide range of scientific information on aquatic and terrestrial ecosystems and impacts of human use and development.

In contrast, because of limited social and economic research in the Park, only limited information was available on visitor uses and behaviour and on social condition and pressures in the residential communities within and adjacent to the Park. Access to some economic data, particularly those held by private business, was difficult to obtain. In some cases, access to sensitive commercial data was refused. Lastly, few attempts had been made to link ecosystem health and functions with the social and economic health and conditions in park communities. Because of this, it was difficult to demonstrate cause-effect relationships in areas such as the effects of environmental degradation on park visitation and quality of visitor experience.

The timeframe and budget of the BBVS did not permit the conduct of much original research. The study did, however, attempt to address some of the gaps for visitor use, social systems and economic effects. Although there are many statistical databases about park visitors—how many, where they are from, how they traveled, how long they stayed—little is known about what people do when they visit the Park and why they do what they do. Visitor use surveys that were completed by the BBVS included:

↑ A survey of trail users on two of the busiest trails in the Park.

↑ A survey of the recreation and leisure services that were provided by 57 of Banff National Park commercial operators and the degree to which users were satisfied with their experience.

↑ A survey of the tour operators that use the Park, what their customers do in the Park, how they encourage appropriate behaviour and the levels of visitor satisfaction.

A Tourism Outlook project (Coopers and Lybrand Consulting 1995) was also completed to help understand current trends in tourism and to assess how these trends could affect the Banff Bow Valley. Time and funding did not allow the task force to carry out the research needed to define what a quality visitor experience is or should be.

The BBVS also attempted to look well into the future to try to illustrate what could occur if certain management recommendations were or were not adopted. The Futures Outlook Project used dynamic simulation modeling to assess several different scenarios for land use and development (Cornwell and Costanza 1996). The model predicted the effects of different visitation growth rates on indicators such as the quality of life for residents, built infrastructure, linear infrastructure, economic development and several environmental parameters. Based on input from the round table, the growth rates used were -0.5%, 1%, 3% and 6%.

One of the disappointments of the BBVS was that, because of delays in essential input data, particularly economic data, these simulation models could not be used in the round table process or the BBVS to the degree that they should have. These data were available, but were withheld by the owners because they chose not to support the BBVS. Earlier negotiation with the data owners by the task force may have resulted in the data being made available earlier.

Did the study succeed in promoting public understanding of the issues and the need for certain management recommendations? For environmental areas, the answer is yes.

The knowledge level of the stakeholders was greatly increased. They became better able to integrate knowledge from multiple sources of information and therefore gained a greater appreciation of the major environmental issues. With the multiple, converging lines of evidence that were available, it was difficult for most not to accept that significant ecological impacts had and were occurring. The process of information exchange also helped participants to understand how some impacts could be reduced through mitigation, environmental protection and human use management.

The study was less successful in gaining support for some of the recommendations that affected human use and development. Reactions were most extreme from users who were most affected. The study was criticized for making recommendations for restoration of ecological integrity without fully examining social and economic impacts, and without always recommending mitigation for these social impacts. The effects of the socioeconomic data gaps was perhaps most noticeable where the study was not able to convincingly describe linkages between environmental health and the social and economic well being of park residents and businesses.

Keeping science in the forefront of public communications and park decision-making remains a critical aspect of day-to-day management. Problem definition, research and decision-making continue to use focus groups and public forums to define research problems, select objectives and options for review, define implications and communicate decisions. Annual forums report on progress in implementing the Park Management Plan and seek clarification of direction. This more integrated and open process continues to enhance trust and credibility.

Human Use

As outlined in the introduction, Banff National Park has a great complexity of users and activities. The multiple expectations and demand that result make managing use very complicated. Uses include downhill and cross country skiing, hiking and horseback riding, residential communities, park and service businesses, boating, golfing and commercial and private sightseeing.

The Park has two communities—Banff and Lake Louise—that together have almost 10,000 residents and seasonal workers. People who live and work in the Park have the opportunity to use park resources daily, so in essence representing as many as 365 user days per person per year. The Park has a variety of guest facilities, ranging from campgrounds to hotels. Summer overnight capacity is over 41,000 people.

The very high concentration of visitors in the Bow Valley is complicated further by the nature of use in the Park. Unlike many other protected areas, the Park has high use in all seasons. In the past two decades, the total number of downhill skiers has varied from 700,000 to 900,000 annually (Pacas and others 1996). Cross-country skiing and other activities such as wildlife viewing attract visitors throughout the year. This all-season use leaves little opportunity for stressed environments to recover.

Banff National Park straddles the Continental Divide between Alberta and British Columbia. Surrounding land uses include recreation, mining, forestry, oil and gas, ranching, private land, first nations' land, municipal and provincial lands and other protected areas. Another community, Canmore, is located on the east boundary of the Park. Its population in 1996 was 7,623 (BBVS 1996). This combination of human population and resource use results in a broad breadth of land use objectives, expectations, objectives and values. Resolution of fundamental issues, such as maintaining carnivore connectivity and habitat effectiveness is complicated in such heavily used areas. The majority of park visitors are from Alberta, with over half from the nearby city of Calgary. Calgary, with a population nearing 800,000 people, is a key source of park users. Areas adjacent to Banff are administered by a variety of jurisdictions that include federal, provincial, municipal and private lands. This necessitates work and possible solutions at a wide range of scales, from local to international. Both the complexity of these issues and a lack of information have hindered management and decision-making.

The biggest challenge continues to be managing day use. Many of the activities that currently exist predate ecosystem conservation and management concerns. Some, such as the highway, restrict options for controlling use. Research into ecosystem components laid out concerns and biological solutions. The polarized viewpoints on controlling use demonstrated the need to add the human perspective - both to the problem and the solutions.

Human use management must guide people, their numbers and their behaviour, activities and infrastructure needs in a way that supports the ecological and visitor experience goals. While a considerable amount of information was available to assist in defining the ecological parameters, little corresponding information was available on park users and their use patterns. By the early 1990s, Parks Canada had increased its basic demographic information on visitors, however, relatively little effort was spent on documenting how visitors and residents used the park,

Similarly, while modeling of ecological components has advanced substantially, similar tools for modeling human use have not been extensively used or developed in Banff. This was due to an emphasis on investing in ecological research at the expense of developing the Park's social science research program. As the level of park use increases and technology allows farther and faster travel into the Park, it will be essential for the Park to invest in research that will support effective human use management.

The BBVS made substantial recommendations for evaluating human use. It recommended that desired social and environmental conditions should be set at the same time and began the task by establishing an integrated vision for the Bow Valley. Indicators and guidelines for thresholds and targets were proposed. Parks Canada was encouraged to establish zoning that was based more on desired use and less on existing uses.

The Ecological Outlook Project assisted in defining the need for indicators, established a baseline and promoted the need for adaptive management. This work included the development of a human use planning framework.

Parks Canada's Response to the BBVS

Leading up to development and finalizing of the Banff Management Plan, an advisory committee was formed to review the recommendations of the study and to suggest an implementation strategy. Following public review, the Banff National Park Management Plan was finalized, and implementation began.

Human use management was a keystone of the plan. Human uses of all kinds were restricted in some areas of the Park. Development in the sensitive wildlife corridor adjacent to the highway was removed and relocated. For example, an airstrip was closed, a paddock for bison was removed, and the Park's horse corrals were relocated out of the wildlife movement corridor around the Town of Banff. An additional environmentally sensitive area was created to enhance the existing zoning near the east gate of the Park. Human use in this area was limited and will be monitored. Closures of some facilities such as roads and picnic areas were initiated. Pilot areas to develop and test human use management were identified.

The Banff National Park Management Plan committed to using indicators of success and developed many indicators from the work of the study and the round table. The plan then established strategies and targets for a number of the greatest areas of concern. The plan used themes of A Place for Nature, A Place for People, A Place for Community to emphasize the interconnectivity of the components. The plan set goals and objectives, targets and an action plan for accounting for and reporting on the success of these measures.

Specific goals were set for most of the major components, including communities, tourism, transportation and wildlife and people interactions. In particular, the plan acknowledges the value of integrated goal setting and uses the targets established for grizzly bear habitat effectiveness as measures for future success. The management plan divides the Park into five Ecological Management Areas and 27 Carnivore Management Areas (CMUs). CMUs are based on watersheds and represent the size of a home range of a single female grizzly bear. Targets are set for each CMU, based on the potential to improve habitat effectiveness and visitor experience considerations. Research is on going to measure the habitat effectiveness of each CMU and to establish suitable visitor experience goals. The intensity of human use in a few areas of the Park will continue to impair habitat effectiveness.

Residents in national park communities are faced daily with pressures of increased visitor use and balancing their community needs with those of the visitors. Growth management is essential for the quality of the community life, for the visitor experience and for the conservation of the Park's resources. This need is acknowledged by the BBVS, the Banff National Park Management Plan and through subsequent direction of the Minister to limit development in all communities within national parks. This direction is summarized in these four points:

↑ Communities will have their growth and appropriate use defined; community boundaries will be legislated;

capacity for overnight accommodation will be set; and a limit on commercial development will be set.

↑ The principle of "no net negative environmental loss" will be adopted for all communities. Key areas include the identification of environmental stressors, the measurement of their impact on the community and the measurement of their impact on the Park. Baseline measurements must be achieved in the first year of the community plan, and reassessment will be part of the plan review.

↑ Communities must work towards becoming model environmental communities, where issues such as conservation, pollution, noise, lighting, air quality and nonnative species are clearly addressed.

↑ A separate independent panel established by the Minister will develop similar guidelines for development of facilities beyond the community boundaries.

While the BBVS had recommended development of a tourism strategy, the industry representatives had taken their own initiative, prior to the study report, to enhance the industry's understanding of the values of national parks and to ensure industry practices reflected and enhanced this unique protected area experience. This included the development of a code of ethics and industry training in the values and objectives of a national park visitor experience. Because industry developed this initiative, there was a greater sense of ownership and accountability to ensure its success.

The impacts of transportation corridors have been well documented in much of Banff National Park. The emphasis of the work to date has, however, been focused on mitigation of infrastructure impacts. While some restoration work has been conducted along the Trans-Canada Highway, more work is required to reduce and eliminate impacts, develop restoration strategies and begin to utilize transportation as a tool for ecological integrity and visitor experience enhancement. This may include closing some facilities, addressing problems with access and introducing public transit systems.

Clearly, this is just the beginning. Parks Canada must continue to monitor success and adjust its course. The Park conducted its first review of its progress on management plan commitments in the winter of 1998. Adjustments to objectives and action, in particular with regard to human use, resulted from this first public accounting. What is needed is a systematic approach to analyze use and determine what is appropriate both in temporal and spatial terms. The principles from which Parks Canada will work must be defined, including, if necessary, curtailing or eliminating use in some areas of the Park.

Day use will continue to be a challenge. While intervention is most strongly required in Banff, it is a difficult place to learn how to do it. Technology and tools will be required to predict and model solutions. Research will be required on spatial and temporal visitor use patterns, trends in populations and visitors, ecosystem stressors, indicators and social carrying capacity. The BBVS recommended a wide range of options for limiting human use, but it lacked specific data and methods to provide detailed recommendations, outside of limiting human use in areas of prime carnivore habitat. Other options must be evaluated, such as trail and facility relocations and closures, public transportation, social and

ecological carrying capacity, appropriate use and human behavior modifications.

Parks Canada's focus over the past few years has been development and infrastructure issues. This has included limiting overnight accommodation and residential growth and mitigating the impacts of facility construction. Now it must focus on managing dispersed human use, particularly day use and transportation.

Regional Management

Many of the management issues in the Banff Bow Valley must be viewed in a regional or landscape context. The Bow Valley extends from the Rocky Mountains eastward through the foothills and out onto the Alberta prairies. Adjacent land management has a tremendous impact on the Park. Similarly, what happens in the Park has a direct impact on surrounding areas, in terms of tourism, development, housing, commercial accommodation, employment and ecosystems.

Two communities, Banff and Canmore, are very closely linked and have a strong influence on one another. Historically, Canmore, just 8 km east of the park gate, was a mining town and Banff was a tourism destination. Over the past 15 years, this has changed as tourism interest in the area, as a whole, has increased and the mines have closed. Demand for recreational housing by residents of the Calgary area has also stimulated housing development in Canmore. Today, Canmore provides much of the housing for staff working in Banff. More than 800 vehicles per day come through the park gate carrying people who live in Canmore and work in Banff.

Canmore has also seen recent growth in tourism. Over the past decade, there has been a flurry of development as new hotels are built to provide overnight accommodation for visitors to the national park.

Parks Canada has always had a number of coordinating mechanisms for working with managers of provincial lands. Historically, this has tended to be informal and at the working level, rather than at a management level. The relationship tended to be reactive and dealt with specific current issues. For example, Parks Canada actively participated as an intervenor in the public hearings for a huge residential land development in Canmore.

What was badly needed was a more formal and proactive mechanism to deal strategically with the issues that faced the ecoregion and the Bow Valley inside and outside the Park in particular. The BBVS process itself and the recommendations coming out of the study did a great deal to promote regional and ecosystem wide planning. Because the study was a very open and transparent process, the public and the managers of adjacent lands could see that Parks Canada was serious about seeking the input of others. The BBVS opened doors of cooperation that were not open before. It served to overcome the traditional barriers to effective interagency management.

The BBVS recommended that Parks Canada take a lead role in establishing some specific structures to coordinate multi-jurisdictional initiatives at the senior policy level, the strategic level, the science and research level and the technical working level. Parks Canada recognized the need for improvement in these areas but decided that rather than

establishing new structures, it would become more actively involved in structures that existed, were in the process of being established or were being led by other agencies (such as provincial government or nonprofit organizations). The belief was that the involvement of the federal government in local and provincial planning and land use issues would be more readily accepted if the federal government did not assume a lead role. This has proven to be a successful strategy. Three examples illustrate recent progress.

During the BBVS, the province of Alberta established the Bow Corridor Ecosystem Advisory Group (BCEAG) to coordinate some of the issues in the Bow Valley east of the Park. This group is chaired by the province and includes all provincial directors for resource management, as well as political and technical representatives from all of the municipal authorities, including the Town of Banff. Banff National Park is represented on this committee. Over the past two years, the committee has undertaken many significant projects. The level of trust and the willingness to share information and discuss issues openly has increased considerably over this time.

The Town of Canmore is very concerned about development and the impact it is having on the Bow Valley. The Town Council felt that despite environmental assessments and studies, they were not well informed and that individual developers were not making adequate use of existing available information. In some cases, information from one developer was not made available to others, or developers were unaware that certain data existed. The town and others, including Banff National Park, established the Biosphere Institute of the Bow Valley to provide a central, neutral source of information, so that knowledge of the ecosystem and the links with social and economic issues can improve.

The third example, the Central Rockies Ecosystem Interagency Liaison Group (CREILG), was actually formed well in advance of the BBVS, in 1991. It includes representatives from government agencies, including Parks Canada, Alberta and British Columbia. CREILG was formed to examine sustainable management of fish, wildlife, forest, mineral and energy resources, as well as coordinate management of human use of the lands in the various jurisdictions involved.

People want to work cooperatively with those around them. Everyone recognizes the importance of managing land from an ecosystem-based perspective. But to be successful, it is essential to do more than simply invite others to sit on a committee. Something very overt must be done to confirm true interest in working cooperatively. In the case of Banff, the BBVS did that—it opened the doors. The Park has been much more successful at influencing decisions by being part of processes or committees run by others.

Summary

The BBVS and subsequent management actions by Parks Canada underscore the following summary conclusions.

To be successful in building a constituency of understanding, it is important to:

- ↑ Effectively present facts based on credible science to get beyond the perceptions of issues.
- ↑ Define clearly the public involvement objectives and choose the appropriate tools.

- ↑ Understand the interests and values of those involved in the process.
- ↑ Avoid moving into developing solutions to problems until there is a broad understanding and acceptance of the issues.

An effective process is characterized by:

- ↑ Getting the right people early in the process.
- ↑ Building constituent support.
- ↑ Matching the process with the desired outcomes and investing accordingly.
- ↑ Prescribing results rather than solutions.
- ↑ Harnessing the imagination of others to achieve goals
- ↑ Getting involved in the processes of others.
- ↑ Benefiting from a fresh or sober second review of recommendations.
- ↑ Ensuring clear accountability for results.

The challenge of integrating science in the decision process means:

- ↑ Building a constituency behind the information base.
- ↑ Fully explaining social and economic impacts.
- ↑ Communicating scientific information in understandable terms.
- ↑ Recognizing that you often have more information than you think or that information you think you really need is not really important to the development of effective solutions. Don't get blinded by perceived data gaps.

In attempting to manage demand:

- ↑ Recognize that it is often easier to manage up front than to reverse well entrenched use patterns.
- ↑ Watch and understand trends and communicate these to public.
- ↑ Develop management tools in cooperation with public users, to help build public support.
- ↑ Recognize that demand cannot be managed only within the park. Influencing choices early in the visitor planning cycle, altering supply and marketing of alternative opportunities is more effective.

In the BBVS, as in many initiatives, timing is everything. Very often, circumstances, political will, public receptivity and scientific evidence must come together to be effective in making changes.

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Tribal Wilderness Research Needs and Issues in the United States and Canada

Dan McDonald
Tom McDonald
Leo McAvoy

Abstract—This paper represents a dialogue between tribal wilderness managers and researchers on the primary research needs of tribal wilderness in the United States and Canada. The authors identify a number of research priorities for tribal wildlands. The paper also discusses some major issues and challenges faced by researchers conducting research in areas that are culturally sensitive to tribal members. Dialogue participants provide recommendations for those wishing to initiate research in and about tribal wildland areas.

Tribal peoples in Canada and the United States had been managing their lands for eons before the arrival of settler populations, often in a state that resembles the present lands now protected as wilderness. Many government land managers are, in fact, examining indigenous practices in their continued efforts to return lands to the conditions that settlers found, and which shaped their ideas of wilderness. At the same time, tribal peoples themselves are regaining jurisdiction over portions of their traditional territories (Sanders 1990), and finding themselves managers of designated or de facto wilderness areas (McDonald 1995). A number of American Indian and First Nation tribes in the United States and Canada now manage tribal wilderness and wildland areas and ecological reserves (Stumpf 1999). Little biological or social science research has been conducted in or about these wildland areas, and there is a need for such study as these tribal wilderness areas grow in number and in importance to both tribal and nontribal members.

Recent treaty negotiations in Canada have resulted in increased aboriginal authority and control over wilderness recreational lands in British Columbia and the Northwest and Yukon Territories. For example, the Nisga'a people of northwestern British Columbia will soon have 1,992 square kilometers returned to them from provincial crown land, and a significant portion of that will be managed as wilderness or near-wilderness lands. Fifty other First Nations are presently in negotiation in British Columbia alone, and

many will see increased authority over wilderness lands. There is a need for research on the effects of management and co-management of these wilderness and ecological reserve areas (Berg 1990), especially on the efficacy of co-management by aboriginal peoples and either the federal or provincial governments.

The purpose of this paper is to engage tribal wilderness managers and wilderness researchers in a dialog about the primary research needs of tribal wilderness in the United States and Canada. This paper will describe some of the management issues that these tribal managers face, with a particular focus on those that may be unique to tribal wilderness areas. The paper will also discuss some major issues and challenges researchers face when conducting research in these culturally sensitive areas. It will provide guidance for those researchers willing to work with tribal communities to resolve these issues.

Managers from six tribal land management agencies were interviewed for this paper in an attempt to identify issues and research needs. All were in the northwest area of the continent, with five in Canada and one in the United States. The tribes vary in the degree of jurisdiction they exert over these lands, with only the Confederated Salish-Kootenai Tribes of Montana having complete management authority, in their Mission Mountain Wilderness on the Flathead Reservation. The Canadian tribes have greater or lesser control in comanagement arrangements with other governments, from the near sole authority of the Vuntut Gwitchin on the Yukon's Old Crow Flats, through the Queen Charlotte Island Haida and Kitlope valley Haisla watchmen programs, which coexist with government land managers, to the comanagement boards of the Kaska Dene in the northern Rockies of British Columbia and the Nuu-chah-nulth in Clayoquot Sound on Vancouver Island. In each of the Canadian cases, reestablishment of tribal land management has come as a result of land claims or modern treaty negotiations.

It is important to note that, for tribal land managers, these territories called wilderness by the settler population are thought of as homelands by the tribal peoples. The lands are full of evidence of long-standing continuous relationships between the tribe and the environment. A short walk in from any beach on Haida or Nuu-chah-nulth territory, one encounters culturally modified trees, often centuries old. The homeland of the Kaska Dene or Vuntut Gwitchin is full of sacred sites or markers of family-owned hunting territories. The Salish-Kootenai land still bears vegetative patterns reflective of centuries of controlled burns. In each case, their lands are far from untrammelled in tribal eyes and humans are certainly not intruders into nature (Morrison 1995).

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Dan McDonald is Chair, First Nation Studies, Malaspina University-College, Nanaimo, British Columbia, CANADA, V9V 1G8, e-mail: mcdonld@mala.bc.ca L. Tom McDonald is Wildland Recreation Program Manager, Confederated Salish & Kootenai Tribes, P.O. Box 278, Pablo, MT 59855 U.S.A. Leo McAvoy is Professor of Recreation, Park and Leisure Studies, University of Minnesota, 1900 University Ave. SE., Minneapolis, MN, 55455 U.S.A., e-mail: mcavo001@tc.umn.edu

To simplify the following discussion, examples from the Mission Mountain Tribal Wilderness, managed by the Confederated Salish-Kootenai Tribes, will be used to illustrate a number of the points presented. For most issues, examples could be as easily drawn from any of the other tribal wilderness areas studied.

Issues for Tribal Land Managers

When tribal land managers speak of their stewardship role, a notion of both physical and spiritual protection of the land emerges (McDonald & McAvoy 1996). While the physical protection of places is common to all land managers, spiritual protection is of specific importance to tribal managers (Jostad and others 1996). Tribal societies have always believed that spiritual obligation to the land is as important as physical protection. This obligation may take the form of ritual observance on the land at sacred sites, of continual conduct of the hunt of game species, and of the return to the land of the remains of plant or animal harvest after human use. These centuries old practices are considered as vital by tribal communities for continued health of the land, and of the people. A major factor in establishing the Mission Mountains Tribal Wilderness (MMTW) was the importance of the Mission Mountains to the spiritual well-being of the Salish-Kootenai people. The MMTW Management Plan and the Tribal Wilderness Ordinance establishing the Wilderness reflect this in their policy statements (Confederated Salish-Kootenai Tribes 1982). The religious practices of the Salish-Kootenai people—conducting vision quests, hunting and gathering medicinal roots and herbs—continue today in the wilderness, and these practices are being passed on to the next generation.

Tribal land managers, many trained in Western resource management schools, also speak of the need to respect traditional land management and tenure systems that have often continued to function even under the imposed land system of the settler governments (Clayoquot Sound Scientific Panel 1995). Many of these land tenure systems are organized around certain families, who have delegated responsibility to care for particular hunting areas or sacred sites. In most cases, their land management roles coexisted with their role as harvesters, unlike the Western system, which separates these functions. This integrated system, where hunters monitored their own areas, depended not on career managers but on family responsibility to the larger community.

The collective emphasis rather than individualistic emphasis of most nontribal communities also influences tribal land management. Tribal communities have always had decision mechanisms that focus on the collective, but this search for collective consent is increasingly difficult in a modern context. The unity of perspective gained by shared experiences of education, spiritual practice and pursuits on the land is no longer so evident. Communities now reflect some of the diversity that challenges decision-makers in the larger, dominant society, but they show a continued desire to make the majority of decisions collectively, rather than leaving them to individuals. There are even pressures on the very definition of community, as there are differing views about who is entitled to participate in decisions. Some tribal

communities have coexisting forms of governance, with one reflecting Western style elected municipal government and the other a continuance of a hereditary system.

In the Confederated Salish-Kootenai Tribes, many decisions on land management are made by the elected tribal council. Input from tribal programs is provided through an interdepartmental review process. Two separate cultural committees (one Salish and the other Kootenai) also provide input. Tribal members can provide input to district representatives on the Tribal Council or at public hearings. Some cases (such as the establishment of a tribal-members-only primitive area) are decided by a referendum by resident tribal members.

Since many tribal communities are also impoverished ones, there is also considerable pressure on land managers to ensure that wilderness areas provide direct economic benefit to the community. These lands have provided resources for these communities for generations, so it is not unreasonable that they would continue to look to these lands for economic benefit. Most tribal communities want to continue hunting, fishing, agriculture and gathering on wilderness lands, even if they deny such opportunity to nonmembers of their community. In many Canadian tribal communities, “country food” continues to account for a majority of the people’s diet (Collings, 1997). Many communities also want a large stake in the tourist economy that often results from the designation of wilderness and, in some cases, have legislated or negotiated preferential treatment for tribal members in hiring, contact bidding and business development.

For example, in the Confederated Salish-Kootenai Tribes (SKCT), hunting and fishing by nontribal members is regulated by tribal ordinance. This ordinance covers what can and cannot be hunted. The regulations were created with the societal, cultural, religious and economic interests of the Tribes as the driving force. In the designated primitive areas of the Reservation, commercial logging is restricted to small-scale tribal member operations only. In the wilderness and primitive areas, hunting is limited to tribal members only. Currently, the SKCT operate under a “tribal member preference” hiring and contracting policy that gives members an extra advantage in tribal government employment and contracting. The employment hiring policy is to strive for 100% member staff, which means that if a qualified (for the position) member is competing with a nonmember for a position, the member is hired. Contracting for goods or services allows a tribal member contractor or vendor to match any nonmember bid and receive the tribal business. Outfitting and guiding on the Reservation is limited to tribal member-owned businesses, with the exception of scenic cruises on Flathead Lake. The Tribal Wilderness Area is off-limits to any commercial uses, but the Wilderness Buffer Zone lands are open to tribal member horseback outfitters.

Tribal land managers also have to contend with territories that did not have exclusive usage or ownership in pre-settler times. Many adjacent tribes would often share territories or at least allowed long-standing usage by other peoples. These neighboring peoples want to have continuing or renewed access to lands now under tribal management, even though the traditional systems of reciprocity and relationship may have changed. Of course the nonaboriginal community also desires access to many of these areas,

and tribal land managers are wrestling with how to accommodate these desires and still fulfill their responsibilities to their own community.

An example of this is the Confederated Salish-Kootenai Tribes' (CSKT) policy of working closely with neighboring Columbia Basin tribes on preserving traditional places, subsistence uses and resources within the aboriginal territory of the tribes. Typical examples are working with hydropower facilities operations and mitigation plans and with the USDA Forest Service's projects and overall forest planning. Within the CSKT reservation, the Tribes have reserved certain landscape areas for their exclusive uses, including fishing, camping, solitude and spiritual activities. Currently, one-sixth of their land base is reserved in this manner, and the larger sites are referred to as primitive areas.

Much of the nonaboriginal use pressure, especially in more remote areas, comes from commercial operators and sport hunters and fishers. Many tribal communities have serious ethical concerns about the very notion of hunting for sport, yet they recognize the growing economic impact of nature-based tourism (Canadian National Aboriginal Tourism Association 1999). The issue for tribal land managers is how to accommodate this desire from the nonaboriginal community without compromising either the needs of tribal members or the beliefs that underpin the tribal approach to land management (Collings 1997). The Confederated Salish-Kootenai Tribes have a long and active fight going with the State of Montana to retain control over hunting and fishing activities within their Reservation. Because of private land holdings within the reservation, the Tribes and the state government have entered into a cooperative agreement for fish and wildlife regulation on the Reservation, which gives the Tribes overriding authority to set fish and game policy. The more sensitive items of current tribal policy are: the Tribes have reserved exclusive jurisdiction to regulate members on treaty-right fish and game harvest; the Tribes have reserved for members only the exclusive rights to hunt big game on the Reservation; and the Tribes have reserved all commercial fishing activities for members. The Tribes also permit and license all recreation, fishing and bird hunting on their lands.

Tribal land managers are also often charged with cultural interpretation of both their lands and the people who live on them. Interpreting culture is always a tricky business, but it is even more fraught with danger in tribal communities. Many nonaboriginal visitors to perceived primitive areas expect "authentic" tribal culture to be a part of that experience and their notion of authentic is usually rooted in settler reports of early contacts. Tribal communities are modern communities and do not wish to be held up to a standard of modernity that differs from other cultures. So the issue becomes one of how to portray relationship to the land in a way that does not make culture a commodity or portray it as a frozen artifact. Tourist expectations in a way shape the experience, but the land managers must wrestle with how to change that expectation without diminishing the enjoyment of the visit.

The Confederated Salish-Kootenai Tribes have long been involved with nontribal interest in gathering tribal knowledge of traditional uses of plants, animals and sites and religious practice. They have learned to be very cautious about releasing knowledge to nonmembers who could commercially or otherwise benefit from this knowledge, as has

happened in the past. Currently, the Tribes have two cultural committees of elders who review and make recommendations regarding any cultural information or material that is being considered for public dissemination. The Tribes also have established the "Peoples Center," a facility aimed at promoting, preserving and enhancing Salish and Kootenai culture. It is a museum facility with a learning and programming center, exhibit gallery, gift shop and Native education tours. These programs provide interpretation of the Tribes' cultural and natural history, tribal wildlife and natural resource management, and contemporary tribal members' lifestyles.

The last common issue raised by tribal wilderness managers was the need to preserve knowledge that is presently held by the elders of the community about the land. To pass this knowledge on to the next generation, there is a need for younger tribal members to accompany elders onto the land. The elders, in turn, need to find a land that continues to resemble the one they know, so that they can pass on knowledge of animal behavior or plant habitat. At the same time, as Western science and land management becomes more interested in traditional ecological knowledge, there is real concern in tribal communities about protection of the intellectual property rights of this community-held knowledge. Tribal land managers have to deal with who owns knowledge and who can consent to it being shared, as well as identify who it will be passed on to and thus who they will consult in the future.

The Confederated Salish-Kootenai Tribes address this preservation and passing of knowledge by striving to maintain areas in natural conditions, where traditional uses can be taught and experienced. The wilderness and primitive areas on the Reservation are classic examples of sites which can be utilized to transfer elder knowledge to younger generations. Several traditional campsites like the Agnes Vanderburg Cultural Camp are dedicated for the use of tribal elders to teach language, crafts, customs and lore of the Salish and Pond d'Oreilles peoples throughout the summer season.

A good example of inappropriate taking of knowledge occurred 25 years ago at the beginning of the Vanderburg Camp. A research botanist, under the pretense of documenting traditional uses of native plants for the cultural committees, copyrighted and published under his name the research gathered from tribal elders. This was a direct violation of the Tribes' intellectual property rights and is an example of why tribes are so cautious on the issue of tribal knowledge.

Researcher Context on Tribal Lands

Many of these issues facing tribal land managers are both immediate and pressing, and research would only aid in their resolution. However, many of these issues would also be of interest to researchers in general. If research is to be done on tribal lands, there are some important contextual issues that need to be taken into account. A number of scholars have made recommendations for researchers working with aboriginal peoples (Association of Canadian Universities for Northern Studies 1997; Conti 1997, Deloria 1991, Green 1993, Marker 1997; McDonald and McAvoy 1997, Mihesuah 1993, Peacock 1997, Wax 1991).

Researchers have to remember that the research occurs in a legal, political and cultural context when communities are still engaged in reversing the colonial intrusion of settler governments into their tribal lives. This process has often relied heavily on legal action and political resistance and, in addition to having external effects on the relationship of the tribe and the settler society, it may have also had the internal effect of politicizing and dividing the community over a variety of issues. Communities can become suspicious of outside researchers as agents of "colonial intrusion" and can view tribal members who assist the researcher as collaborators (Graham 1997). Many communities are increasingly concerned about how research findings may be used in legal proceedings. In land claim areas, research funding is increasingly directed toward producing materials that can be used as evidence.

Research proposals within the Confederated Salish-Kootenai Tribes' jurisdictional aboriginal territory are reviewed for potential conflicts with current and future litigation, in regard to water rights, hunting and fishing uses, other subsistence uses, and basic tribal governing authority. For example, a recent research proposal review identified conflicts on the potential outcome of diminished tribal member uses of national forest land, and the effect of this on aboriginal hunting and fishing rights.

Tribal communities have a very real desire to control both the gathering and the use of data (Nason 1997). In the past, many images of tribal communities have been flawed and caused considerable damage to the communities. Cultural misinterpretation has been identified as a major issue by both tribal researchers and leaders (Deloria 1991, Wax 1991). There is also the issue of intellectual property and use of cultural material by outsiders without any benefit accruing to the community. Communities are no longer interested in being the "informants" of the past and would rather provide the coresearchers and researchers of the future. The Confederated Salish-Kootenai Tribes prefer to conduct research in-house or have a tribal program become an integral part or partner in the research, with a very detailed agreement or contract in place to protect sensitive information or use of research information. One example of the current in-house research is the Tribes' Natural Resource Department, which averages 100 staff persons in several environmental divisions. The majority of the work force performs research tasks, which could have been performed by outside contract researchers.

Access to tribal areas is also an issue, both in a physical sense and in a legal sense. Physically, many tribal areas in Canada that have jurisdiction on their land are in remote areas with no summer road access. The logistics of doing research, especially in an era of shortened fieldwork, can restrict research results. Legally, the incidence of tribes implementing research licensing/permit systems is on the rise (Nason 1997). This formal process of community consent is seen as crucial by most tribes, especially since some communities have been overrun by researchers in the past. Researchers now must get formal permission from tribal councils and from cultural committees before conducting research on tribal lands and with tribal peoples. In 1987, the Confederated Salish-Kootenai Tribes initiated a data collection permit system to protect tribal interests on the Reservation. Many data-collecting procedures could impact on

tribal resources or conflict with ongoing management programs. Yet that same data collected might provide insight into better resource management. Overall, the permit system is designed to regulate scientific collection activities and to ensure all data collected is approved by and available to the Tribes. Permit requests are reviewed by the Tribes' natural resources, legal, and cultural departments and by the Tribal Council.

A more difficult area for many researchers will be the reconciliation of the cultural frameworks in the settler and tribal societies. The epistemology of indigenous peoples differs in many ways from the culture of science. Approaches seen as valid for a Western trained researcher may seem intrusive, disrespectful, unnecessary or harmful to tribal leaders and elders (Graham 1997). The reliance on oral transmission and lived experience in traditional ecological knowledge may seem suspect to the outside researcher. The possibility of miscommunication as two systems of knowing come together is very real (Conti 1997).

Two examples from the Confederated Salish-Kootenai Tribes may help illustrate the need for reconciliation of different epistemologies. The Mission Mountains Tribal Wilderness is home to a grizzly bear population. Information is needed about the behavior, habitat and food sources of these bears to ensure appropriate management that will preserve the grizzly as a lasting inhabitant of the Wilderness. A typical method of researching grizzlies is to catch them in a cable snare, administer drugs to immobilize them, and then install a radio collar to monitor their movements. Tribal members objected to this approach, saying it was not respectful of the bear. So, grizzlies in the Wilderness are now physically observed from a distance by a researcher with a spotting scope. In another case, researchers were interested in having tribal members describe a Native American land ethic. Rather than use a mailed survey, which the Tribal Natural Resource Department believed would be intrusive, the researchers used a qualitative approach, consisting of in-depth interviews with tribal members who were interested in this issue and willing to share their views with a researcher.

The other framework that may challenge researchers is related more to rights and relationships in a community. Traditional knowledge is often owned by a family, and can not be accessed or used without permission and very clear arrangements for payment (Wax 1991). Much of the data found in communities are qualitative in nature and, like attributable qualitative data in the larger society, are subject to acknowledgment and copyright. The Confederated Salish-Kootenai Tribes have created their own historic preservation office and set of guidelines in their "Cultural Resources Protection Ordinance" to deal with cultural data, data requests and land disturbance issues. The office also gathers additional traditional knowledge for the Tribes' long term use and dissemination. Researchers working with tribal entities will have to learn how information can be obtained, what information is off limits, and what payment or show of acknowledgment is expected.

Finally, researchers will have to become accustomed to constant scrutiny of their research efforts while in a tribal community. Such research can now be thought of as a process of constant consultation (Clayoquot Sound Scientific Panel 1995). Communities may decide to suspend the

study if they feel that the research methods or results may not be acceptable (Association of Canadian Universities for Northern Studies 1997).

Conclusions

It is important for wilderness researchers and managers to consider the issues of race and ethnicity (Floyd 1998). When dealing with tribal wilderness areas, researchers and managers need to develop a deeper understanding of the worldview, values and priorities of aboriginal peoples regarding wilderness and wildland areas.

Scholars conducting research in these areas must adopt methods that are sensitive to the tribal members and their spiritual and cultural traditions, and to the cultural differences that exist between tribal members and nontribal members. This can include how wildlife used for research are treated in the research process; how tribal wilderness users are contacted or questioned about their use of the wilderness; and the rationale for declaring some tribal wilderness areas used for traditional/spiritual purposes off limits for nontribal members.

The participants in this dialogue session offered a number of research priorities and issues for discussion during the session. Some of the priorities discussed included: a better understanding of how aboriginal people define or view the concept of "wilderness"; the importance of the wildlands land base to tribal members; value and sense of place related to wildlands; recreation access of nontribal members to tribal wilderness, including the expectations of both tribal and nontribal members on use of these areas; effective tourism models where tribal members are interacting with visitors for recreational use of tribal wildland areas; the cultural experience desired by nontribal member wilderness users; access to sacred sites in both tribal and nontribal wilderness; and, effective interpretation and communication methods (trailhead signs) to reach both tribal and nontribal wilderness users. The research issues discussed included: language barriers between researchers and some tribal members; how researchers can understand all the issues and concerns since tribes are so different and unique; who should be conducting this type of research, academics or land managers or tribal members trained in research methods; who should be funding this research, tribes or the Federal Government or foundations; how researchers can do their work and not exploit tribal communities; and how to deal with the lack of trust in the tribal community.

Any research on tribal wilderness areas must be conducted with respect for the cultural values and traditions of the aboriginal peoples who claim these special areas. Of primary concern is the cultural value attributed to them by tribal members. One example of that value is the ordinance that created the Mission Mountain Tribal Wilderness of the Confederated Salish-Kootenai Tribes in Montana, which states that "Wilderness has played a paramount role in shaping the character of the people and the culture of the Salish and Kootenai Tribes; it is the essence of traditional religion and has served the Indian people of these tribes...in countless ways for thousands of years" (Confederated Salish-Kootenai Tribes 1982).

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Wilderness, Natural Areas, and Ecological Reserves: Thoughts on the Politics of the Big Outside

R. McGreggor Cawley

Abstract—This essay offers some loosely organized comments on the project of preserving wilderness on the scale of the big outside. These comments are arranged around a subject that has been the topic of quite a bit of debate over the past few years—the possibility that the *nature* in our discussions about federal land and the environment is an artifact of *social construction*. The essay seeks to suggest why the notion of social construction is important in the politics of the big outside.

In order to establish a context for this essay, let me begin with two comments about the subtitle. First, I intend that “thoughts” be understood in two ways. On the one hand, what I offer here are several personal observations about the politics of wilderness preservation. On the other hand, I am also attempting to draw attention to the more general ways we think (and talk) about wilderness. Second, my use of “the big outside” is an explicit reference to Dave Foreman and Howie Wolke’s (1992) book of the same title. Originally published in 1989, this book is one of the earlier calls to rethink the scale of our wilderness preservation efforts. It also marks a shift in one branch of the radical environmental movement. While the spirit of Earth First! is certainly present in the book, in many ways, the ideas they present are far more radical than the old monkeywrenching days.

On a personal level, however, *The Big Outside*, and Earth First! more generally, point to the kinds of questions that have animated my research agenda for several years. Although I work in the federal land policy area, my research is ultimately directed at the broader goal of explaining why it is crucial to pay very close attention to political discourse. Whatever else might be said of politics, this much is surely true: Stripped to its essence, politics is the arena in which we discover (construct, invent, create) ideas about the kinds of societies we want and don’t want (Edleman 1988; Schattschneider 1975; Stone 1997). What intrigues me most about politics is the process by which seemingly radical ideas become mainstream.

As my first major foray into this business, I took on the subject of the Sagebrush Rebellion (Cawley, 1993). There was a tendency in the late 1970s to dismiss the Sagebrush Rebels, and the ideas they presented, as simply political rhetoric which masked their true agenda. What I tried to

show in my analysis was that whatever the original intent of the Sagebrush Rebels, the consequence of their activity was to bring about some rather fundamental shifts in our discourse about the federal estate. Indeed, the root idea raised by the Sagebrush Rebellion—that we might want to consider decentralizing federal land management—looks far less radical today than it did in the late 1970s (Brick and Cawley 1996; Nelson, 1995).

It seems to me that much the same can be said of Earth First! In the mid 1980s, Earth First!ers draped a sheet of black plastic down the face of Glen Canyon Dam (a symbolic “crack”) to raise the idea of tearing down the massive dams throughout the West. It would be a bit much, of course, to suggest that this idea has become mainstream (pun intended), but nevertheless, the recent experiment at the Grand Canyon and the discussion of “decommissioning” dams in the Northwest to preserve salmon populations suggest that the idea is less radical than it was in the 1980s. So too is the idea of saving wilderness on the scale of the big outside, as our conversations at this conference demonstrate.

What I offer in this essay are some loosely organized thoughts on the big outside. My central theme is a notion that has been the subject of quite a bit of debate over the past few years—the possibility that the *nature* in our discussions about federal land and the environment is an artifact of *social construction*. My intent is to suggest that viewed in some ways, this notion is less troublesome than it might otherwise appear.

On Pine Cones

Many years ago, I thought I would be a poet. In consequence, I took several classes on creative writing and was taught that good writers show their readers, they don’t tell them. Although I have since abandoned poetry, I have discovered that the lesson I learned in those writing courses is a useful bit of advice for teaching. For example, there is a game I play with the students in my environmental politics courses.

I pass around two pine cones, explaining that one came from a wilderness area and the other from campus, but not identifying which cone is which. I ask the students to look at the cones and try to identify the one from wilderness. The ensuing conversation normally elicits four basic responses. One group, usually the largest, simply shrug their shoulders and say they don’t know. Another group, usually the smallest, respond with the question of what difference does it make. Unconsciously borrowing from Gertrude Stein, they assert: “A pine cone is a pine cone is a pine cone....” The rest of the students divide into two groups. They note that one of

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R. McGreggor Cawley is Professor and Head, Department of Political Science, University of Wyoming, Laramie, WY 82071 U.S.A., e-mail: cawley@uwyo.edu

the cones is slightly larger than the other, but arrive at different interpretations for this situation. One side argues that the larger cone must come from wilderness. Their logic is essentially that trees in wilderness are “healthier” than trees in civilization. The other side picks the smaller cone as the wilderness one. Their logic is that since the trees on campus are irrigated regularly, they would produce larger cones.

The point of my game is to show students, rather than simply telling them, what I believe to be a vitally important aspect of environmental politics. Our political discussions about wilderness, and many other aspects of the environment, focus more on a socially constructed *nature*, than on the physical world itself. In order to drive home this point, I ask an apparently silly question: “Do you suppose that it makes a difference to the pine cones whether they come from a wilderness area or the campus?” Reluctantly accepting my question at face value, most of the students concede that since the pine cones are probably not conscious of the difference between campus and the wilderness, it really doesn’t matter to the cones. The students also note, however, that the difference between campus and wilderness is *meaningful* to them, even if they disagree on just what that meaning is. It is this point that opens the door for a conversation about the social construction of nature.

On Classifying Spiders

Having worked with the notion of a socially constructed nature for several years now (Cawley and Freemuth 1993; Chaloupka and Cawley 1993; Freemuth and Cawley 1993), I realize that it can be problematical. In some uses, it seems that the concept implies a denial of a physical basis for reality (Soulé and Lease 1995). Such is not my position. Instead, my view is that social construction forces us to confront the processes by which we create (and give *authority* to) meaning(s) for the physical world. To put it a bit more pointedly, the concept of social construction forces us to confront the extent to which we, humans, impose our meanings on the physical world. Consider the creature we call spider or arachnid.

The word spider is derived from an Old English word that meant spinning. Similarly, the word arachnid is of Latin and Greek origin and derived from the myth of Arachne, who was both a skillful weaver and boastful of her ability. The latter conduct put her at cross purposes with the gods, who turned her into a spider. Thus, when humans at the roots of European culture first set about the project of classifying the physical world, it was the spider’s web-building ability that attracted their attention.

At this moment in history, a key defining characteristic of spiders is that they have eight legs. Since spiders have always had eight legs, a logical question to ask is why this characteristic of the spider is more important to our current classification scheme than the spider’s web-building ability. The immediate answer to this question is relatively straightforward: All spiders have eight legs, but all spiders do not spin webs. The more elaborate answer involves the rules that structure our current classification schemes. One of these rules is that classification efforts should be based on *nonarbitrary* characteristics. Another rule is that classification efforts must be guided by phylogeny.

Thus, since all spiders have eight legs, but not all spiders spin webs, the number of legs is a better characteristic upon which to base classification. Phylogeny, in turn, suggests that eight-legged creatures share the same evolutionary branch, few of which can build webs. Taken together, these factors argue in favor of emphasizing the number of legs because it provides a *nonarbitrary* basis for classification. Yet, in an empirical sense, the number of legs is an *arbitrary* factor. At least my entomology friend assures me that to date none of the known activities of spiders require eight legs. As he suggested, if you removed legs from (or added legs to) an existing spider, it would undoubtedly create problems for the creature in carrying out its normal activities. But there is no reason to believe that if spiders originally had six or ten legs, their activities would be substantially different from eight-legged spiders. Stated differently, while eight legs is an *intrinsic* characteristic of spiders, it is apparently not an *essential* characteristic.

Moreover, the fact that spiders share the same evolutionary branch with other eight-legged animals seems to be more important to humans than to the creatures themselves. In a species sense, of course, spiders appear to understand their relationship with other spiders. Were this not the case, spiders would have disappeared from the physical world long ago. However, it seems improbable, at least to my entomology friend and myself, that spiders understand their relationship to, say, scorpions, which are another member of the *Arachnida* class.

Viewed in this way, it seems to me that the notion of a socially constructed nature need not be either problematical or threatening. Once again, based on our best available data, the project of constructing (discovering) an underlying order for the physical world appears to be a thoroughly human preoccupation. Moreover, there is a sense in which the characteristics we choose to emphasize in this project actually tell us more about the values and beliefs of the people undertaking it than they do of the physical world being described. More specifically, they help reveal our underlying assumptions about the relationships between the social and physical worlds. This point, in turn, opens up a connection between spiders and the big outside.

On Wilderness and Ecosystems

Before considering the question of preserving the big outside, we need to consider the issue of classification. Generally speaking, we have two ways of describing the big outside. On the one hand, it is *wilderness*; on the other hand, it is *ecosystem*. Moreover, tracing the course of the policy dialogue over the past 30 years suggests an effort to convert wilderness into ecosystem. It seems to me that this shift in nomenclature can be interpreted as an attempt to deal with several problems associated with the concept of wilderness.

Primary among these problems is that no matter how we might try to avoid it, there is no escaping the conclusion that discussions of wilderness are often influenced by the concept of social construction. Consider, for example, Wolke’s assertion: “Merely a few centuries ago, the land we now call the United States of America was a wilderness paradise . . . So great was the pre-Colombian American wilderness that the fragmented remnants that we today call ‘wild’ pale in

comparison" (Foreman and Wolke 1992: 15). The key phrase in this passage is "pre-Colombian." For Wolke, then, the key characteristic of wilderness is that it has escaped the colonizing influence of European culture (Knobloch 1996).

Affirming my interpretation, Wolke concedes that there was a human presence in this pre-Colombian wilderness paradise, and that these humans "set fire to forests and prairies to improve the hunting; and, in some places, grew crops" (Foreman and Wolke 1992: 18). Yet, Wolke does not classify these activities as destructive because "the wilderness was huge and diverse, and all life—including human—was subservient to the overwhelming forces of nature" (Foreman and Wolke 1992: 18).

In contrast, Roderick Nash (1982) asserts that prior to European colonization, there was no wilderness on the North American continent. As evidence in support of this assertion, Nash offers the following comment from Chief Standing Bear of the Ogalala Sioux: "We did not think of the great open plains, the beautiful rolling hills and the winding streams with tangled growth as 'wild.' Only to the white man was nature a 'wilderness'" (Nash 1982: xii). Nash's point is that wilderness was a thoroughly European concept. Indeed, the underlying project of his now classic study, *Wilderness and the American Mind*, is to trace the conversion of wilderness from an alien force needing to be conquered into a scarce resource needing to be preserved. This conversion, importantly, is not about the physical wilderness, but rather, the *idea* of wilderness.

Equally important, the language of the Wilderness Act of 1964 (PL 88-577) also suggests that wilderness is a social construction. The primary intent of the act was to set aside areas of the federal estate that would provide: (1) "contrast with those areas where man and his own works dominate the landscape;" and (2) "outstanding opportunities for solitude or a primitive and unconfined type of recreation." While the act defines a "primeval character and influence" as an intrinsic characteristic of wilderness, it does not suggest that it is an essential characteristic. For example, the act suggests that an area which "*generally appears* to have been affected by the forces of nature" (emphasis added) could be designated as wilderness. Moreover, the provision of the act that permits mining in wilderness areas requires restoration of the disturbed areas, thereby reinforcing the point that *appearance* is the most important characteristic. Indeed, there is nothing in the act which would prohibit the designation of a second- or third-growth forest as a wilderness area.

As should be obvious, these factors make it difficult to understand wilderness as anything other than a product of anthropocentric thinking, and therefore an artifact of social construction. On the face of it, the notion of ecosystem seems to be a way to avoid these kinds of problems. But upon closer examination, this is not actually the case. Once again, it is possible to identify intrinsic characteristics of ecosystems, but there is room for debate about whether or not those characteristics are essential.

As Robert McIntosh (1985: 239) notes: "Some [ecologists] treat [an ecosystem] as *the* fundamental unit and concentrate on the patterns and processes of the ecosystem as crucial to or controlling the component parts. . . . Other ecologists regard the ecosystem as the consequence of population and the interactions among them as related to the

available resources" (emphasis his). If we adopt the first view, the intrinsic characteristics of an ecosystem are also essential characteristics. The goal of maintaining the *integrity* of an ecosystem would be based on this view. However, if we adopt the second view, it is more difficult to argue that intrinsic characteristics are essential. Consider the case of wolves in the Greater Yellowstone Ecosystem (GYE).

In a press conference after helping haul the first wolves into holding pens, Secretary of Interior Bruce Babbitt declared: "At last, the wolves are coming home, and Yellowstone will be a complete ecosystem" (Milstein, 1995). Whether or not he was aware of it, Babbitt's view is derived from the first of the above views of ecosystems. The inference is that the eradication of wolves from Yellowstone disrupted the structure of the ecosystem, and the return of the wolves restored the structure. Following the contours of the second view, the project would be to describe the characteristics of the Yellowstone ecosystem with wolves and without wolves in an effort to document the changes in the ecosystem, not to make a judgment about which condition represented a *complete ecosystem*.

The GYE also reveals another situation associated with the concept of ecosystem. The general boundaries of the GYE were originally drawn as an estimate of the habitat needed by grizzly bears. More recently, the U.S. Fish and Wildlife Service, using watersheds as a point of reference, designated a portion of the GYE as part of the Upper Colombia River Basin Ecosystem. While overlapping ecosystem boundaries may not be problematical in and of themselves, it does point to the fact that ecosystems are socially constructed. As with my spider example, the definition of ecosystem boundaries tends to depend upon what characteristics—grizzly bears or watersheds—we want to emphasize.

On the Politics of the Big Outside

In arguing that wilderness and ecosystem are social constructions, I am not criticizing science. Rather, my point is that science is not well equipped to answer the kinds of questions raised by our efforts to preserve the big outside. Science might be helpful in identifying areas for consideration, and it is certainly needed for developing appropriate management regimes once an area is set aside. But the question of whether or not an area *should* be set aside simply falls beyond the scope of scientific inquiry.

Moreover, recognizing wilderness and ecosystem as social constructions suggests that our conversations about preserving the big outside are not actually about the physical world. Instead, the subject of our conversations focuses on the relative advantages and disadvantages of our social condition. These points are supported, I think, by the Wilderness Act.

Determining whether an area "generally appears to have been primarily affected by the forces of nature" and affords "opportunities for solitude" does not require scientific analysis. Determining the extent to which the character of an area *is the result of* human activity or natural processes can be addressed by science, but *appearance* is not a scientific call. Similarly, while there is certainly room for the scientific study of solitude, the link between solitude and

wilderness is primarily an implicit criticism of aspects of life in an industrial society. Indeed, it is an echo of John Muir's (1981/1901: 1) famous assertion that wilderness afforded a place for people suffering from the "vice of over-industry" could "get rid of rust and disease." In short, the crucial consideration in a wilderness designation process is a value question. Is the potential wilderness value of an area greater or less than the other potential values of the area? Although we might decide to use some (quasi)scientific method to answer this question—cost/benefit analysis, etc.—the answer is ultimately a matter of social value, not science. And what I mean by "social value" here is something more fundamental than the aggregation of individual preferences.

For the sake of the argument, let us suppose that there is an area which both fits the definition of wilderness and contains a large deposit of chromium. We could, of course, run an analysis of the relative benefits and costs associated with wilderness designation and chromium development. What we need to remember, however, is that the character of the social condition is the most important variable in this analysis. In a society that relies on high tech military weapons, chromium is a very valuable resource. In a society lacking high tech armaments, chromium is far less valuable. Thus, the same analysis on the same area would produce very different B/C ratios in these two social conditions. While this is a hypothetical example, it is nevertheless a situation anticipated by the Wilderness Act. Recognizing that a technological society would have changing mineral requirements, Section 4(d)(2) of the act directs that wilderness areas "shall be surveyed on a *planned, recurring basis* . . . by the Geological Survey and the Bureau of Mines to determine the mineral values, if any, that may be present" (emphasis added).

As noted above, there has been a tendency over the past few years to replace wilderness with ecosystem in our public dialogue about the big outside. This shift reflects, at least in part, an effort to provide a more scientific foundation for our conversations. Moreover, such a move makes sense in at least two other ways. First, it gives us a way to think about wilderness in more *tangible* terms. Stated differently, despite our disagreements about what characteristics to use in classifying ecosystems, there is agreement that the project is about *characteristics* rather than *appearances*. Second, ecosystem provides a vehicle better suited to talk about preservation on the scale of the big outside. Yet, in a curious way, our public dialogue suggests that ecosystem is a less useful approach than wilderness.

Amid all that has been written about the politics of wilderness, there is one point that I think has been underemphasized. In a policy sense, there are two areas of potential conflict over wilderness: the decision to designate an area, and the subsequent management of wilderness areas. Generally speaking, the designation process precipitates a far more intense controversy than the management process. There are some exceptions, of course. For instance, then-Interior Secretary James Watt's announced intent to begin processing mineral lease applications for wilderness areas produced a rather intense argument about the management of wilderness during the 1980s (Cawley 1988). And more recently, intriguing arguments have developed over rock climbing in wilderness as

well as the exclusion of mountain bikes from wilderness. But overall, managing wilderness is a far less contentious matter than designating wilderness.

My interpretation of this phenomenon is that regardless of its other problems, wilderness is a socially meaningful concept. As such, it is an example of successful social construction. I want to be very clear about my point here. In arguing that wilderness is a socially meaningful concept, I do not mean to imply that everyone supports wilderness. The contention over designation reminds us that such is not the case. Instead, I am arguing that there seems to be a kind of underlying agreement about what wilderness means. Whether as proponent or opponent, we understand that wilderness allows us to frame a debate about the intellectual and physical boundaries of industrial society.

At least to date, our public dialogue about ecosystem has produced far more confusion. In a policy/political context, ecosystem defined in community terms makes a great deal of sense. It presupposes that the whole of the various components (characteristics) are greater than their sum. As such, it gives us a subject that can be discussed in familiar policy terms. Ecosystems can be *destroyed* or *preserved*, and perhaps more important, they can be *managed*. Yet, as my ecology students remind me semester after semester, to discuss ecosystem in these terms is either outdated or simply inaccurate.

An ecosystem, they assure me, has intrinsic characteristics; but lacking a unifying principle, it is difficult, if not impossible, to argue that the components are essential. Elimination of components from (or addition of components to) an ecosystem will certainly change it. However, to equate *change* with either *destruction* or *improvement* is a claim that cannot be supported empirically. Once again, the elimination of wolves from the Yellowstone changed the GYE, but it did not destroy it. Indeed, even the spectacular fires of 1988 are portrayed as agents of change, not destruction. The problem here, as I see it, is that if ecosystems cannot be destroyed or preserved, it is not at all clear how they can be managed. Although a fairly self-evident point, it is nevertheless important to remember that *management* (and *planning* as well) represents a vehicle for accomplishing goals. It is not a goal unto itself. If ecosystems lack a central unifying principle, then what is the goal of management?

On Social Condition

In his essay, "The Land Ethic," Aldo Leopold (1966/1949) addressed some of the issues I have sketched out. Although he did not use phrases like social construction and social condition, they are clearly implicit in his argument. At base, his land ethic is a thoroughly human construct—it is not the physical world, but the way we think about it that animated Leopold's essay. And not unlike my spider example, Leopold's call was for us to emphasize the ecological characteristics of the big outside, rather than the commercial characteristics. Adopting a land ethic, moreover, did not mean abandoning the commercial characteristics. As he noted: "A land ethic of course cannot prevent the alteration, management, and use of these 'resources,' but it does affirm their right to continued existence, and, at least in spots, their continued existence in a natural state" (Leopold 1966/1949: 240).

There is also a sense, it seems to me, in which Leopold may have been uncomfortable with the concept of the big outside. His community metaphor was, in many respects, purposely intended to undermine the kind of thinking that presupposes there is a boundary between the inside and the outside. Stated differently, in his view, the principles of ecology applied as much to farming (inside) as to wilderness (outside). A society organized around Leopold's land ethic, then, would have far less need for the Eurocentric conception of wilderness.

At the time of its publication, "The Land Ethic" offered what were clearly radical ideas. Equally important, aside from some oblique references to "education," Leopold offered very little advice as to how we might go about the task of developing a land ethic. Indeed, read one way, Leopold seemed to argue that the land ethic was simply a step in a transcendental social evolutionary scheme. In a scientific (social or natural) context, such arguments are usually greeted with considerable skepticism. Yet a recent study conducted by various folks in the Pacific Northwest offers evidence that we may have entered into an era that looks very much like Leopold's land ethic. Reporting some of the results, Steel and Lovrich (1997: 9) note:

A majority of citizens in the national cross-section survey disagreed with the statement that "plants and animals exist primarily for human use." In addition, a majority of respondents (47.5%) disagreed with the anthropocentric statement "humankind was created to rule over the rest of nature." Most striking is the strong support registered for the biocentric statements that "humans have an ethical obligation to protect plant and animal species" and "wildlife, plants and humans have equal rights to live and develop on the earth."

There is reason, as Steel and Lovrich warn, to be cautious about these results. But as an observer of our public discourse about federal land policy and environmental politics for roughly 20 years now, I find it both curious and intriguing that questions such as these would elicit statistically significant responses in a national public attitude study.

Equally important, several of the Clinton administration's initiatives suggest that there may be a change in the character of arguments over preservation efforts. Among these initiatives are the creation of Grand Staircase-Escalante National Monument, the buy out of the New World mine outside of Yellowstone National Park and a similar deal being negotiated to save the redwood forest in California, as well as the moratorium on mineral development in the Rocky Mountain Front. And more recently there is Clinton's call to preserve the remaining roadless areas in the national forests. To be sure, these actions have not gone unchallenged, but what is important is the character of this opposition. Put most simply, these actions have not provoked a new Sagebrush Rebellion.

It could be, therefore, that the effort to preserve the big outside is much farther along than is generally recognized. But at the same time, it is not at all clear that the *nature* in the minds of many people is actually the physical world. A recent advertisement in the *Denver Post* suggests as much. "Considering the neighbors you'd have in most open spaces," the ad explains, "golfers suddenly don't seem so bad." This line is followed by a picture of a mountain lion. "Sure, you'll

also find wildlife roaming our neighborhood," the ad continues, "but it's more of the nonlife threatening variety. Deer, antelope, and maybe the occasional fox."

The subtext for this advertisement is a growing number of encounters in Colorado and elsewhere between suburbanites living at the edge of the big outside and mountain lions. Stated differently, it is a bit more difficult to sustain the belief that humans and wildlife have equal rights when you discover a mountain lion prowling about the deck of your \$500,000 home. This is an exaggerated example, of course, but it does raise an important point.

If we are truly serious about preserving the big outside, we need to be aware of the fact that increasing numbers of people will be confronting the physical world. Some of these encounters, in turn, have the potential for undermining the key premises of Leopold's land ethic. As one of my students suggested this spring: "If you get yourself between a mother grizzly and her cubs, the last thing you should be thinking about is who has and does not have rights!"

The concern I want to raise in concluding my comments is this. Embedded in the language of our current dialogue is an image of a nature that seems fragile and defenseless. In a political context, this image is quite useful. It plays on sympathy and guilt, both of which are useful tools for galvanizing public support, especially among urban dwellers who have limited contact and experience with the big outside. However, as we seek to erase the boundaries between the inside and the outside, what we may discover is that the public wants a socially constructed nature, not the physical world. They may want a neighborhood with "deer, antelope, and maybe an occasional fox," but no mountain lions and grizzly bears.

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Meaningful Community Involvement in Protected Area Issues: A Dialogue Session

Laurie Yung

Abstract—The current effort to rethink public involvement in decision-making processes for federal lands is gaining momentum. Advocates of alternative decision-making processes seek to involve communities in more meaningful ways than traditional NEPA-style public participation. These new processes take the form of citizen monitoring, partnerships, and most often, collaboration, and focus on dialogue, mutual understanding, and common ground. The following dialogue session explores the potential benefits of more participatory approaches, the challenges of conducting such processes, and their possible drawbacks and shortcomings. The trend toward collaboration has important implications for wilderness management, and wilderness science should be carefully documenting the outcomes of these new decision-making processes.

There is a growing interest in the quality of public involvement in natural resource decision-making. In the United States, the contentious, debilitating and polarized environment in which many public land management decisions occur has inspired efforts to experiment with alternative forms of public participation. However, attempts at meaningful community involvement are controversial, raising a number of questions about who participates, who decides and what gets taken into account. The fact that a little-known collaborative, the Quincy Library Group, in Plumas, California, sparked a national controversy and congressional deliberation demonstrates the timely and relevant nature of this discussion.

Many public participation processes, which too often pass for real community involvement, are being critiqued more frequently and more openly. Managers and community members are experimenting with alternative decision-making processes that might involve communities in more meaningful and democratic ways and produce better land management plans, for wilderness as well as nonwilderness public lands.

Experimentation with alternative forms of decision-making has implicitly and, at times, explicitly challenged traditional planning processes. Public participation in wilderness management decisions, mandated by the National Environmental Policy Act (1969) and the National Forest Management Act (1976), has evolved to include scoping, public hearings or meetings, written and oral comments, Environmental Assessments or Environmental Impact Statements, and decisions. Traditional public participation, where

the public comments on agency decisions, is essentially public input, with little public involvement in data collection, decision-making, and implementation (Crowfoot and Wondelleck 1990). While procedures like scoping or written comments might be necessary for effective community involvement, they may not be sufficient to truly account for community concerns. Because decisions about wilderness and protected areas occur in a highly politicized setting, characterized by diverging values and scientific uncertainty, traditional protected area planning, with its focus on expert knowledge and top down decisions, may not be ideally suited to wilderness decision-making. Fortunately for critics of traditional planning, the NEPA and NFMA mandates for public participation are sufficiently vague as to allow for flexibility for agencies and publics to experiment with different types of processes.

In the U.S., these community-based conservation and management initiatives have been focused on a number of areas, including watershed, timber and recreation management. Throughout the West, alternative decision-making processes are increasingly emerging. According to Coggins (1998) “devolution, collaboration, community, dialogue, and consensus are the latest buzzwords in federal land management policy circles.” Federal land management agencies, including the Forest Service and the Bureau of Land Management, have seen a series of mandates from Washington instructing them to pursue more participatory forms of public involvement. While these processes might take the form of citizen monitoring, consensus groups, partnerships and transactive planning, the emphasis has been primarily on collaboration or “collaboratives.” Collaboratives focus on dialogue, cooperation, civility, mutual understanding, common ground and consensus (Coggins 1998; USDA Forest Service 1993). Advocates of collaboration contend that

meaningful involvement in decision making by diverse interests can produce more effective and more widely supported outcomes. Collaborative efforts that focus on a relatively small, specific landscape tend to break down ideological differences, mistrust, and other barriers to decisions while fostering plans that are based on a shared passion for a landscape. (Propst 1999)

Proponents also argue that collaborative planning “can tap an enormous reservoir of collective energy, talent, and inspiration,” diffuse conflict, improve the working relationship between agencies and communities and provide a viable alternative to traditional top down planning (Frentz and others 1999; USDA Forest Service 1993). The idea is that collaboration might result in management plans that meet the needs of the community as well as the ecosystem. Because communities feel a sense of ownership, plans generated through collaboration might be more enduring when compared with traditional plans.

In: McCool, Stephen F.; Cole, David N.; Borrie, William T.; O'Loughlin, Jennifer, comps. 2000. Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems; 1999 May 23–27; Missoula, MT. Proceedings RMRS-P-15-VOL-2. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Laurie Yung is the Education Program Coordinator, Wilderness Institute, School of Forestry, University of Montana, Missoula, MT 59812 U.S.A.

Critics have argued, however, that these processes are not a panacea (Coggins 1998), and raised questions about the nature of communities, as well as the quality of public participation. How agencies should deal with communities of place, which are situated in a particular geographic locality, and communities of interest, who have common values and goals, has not been adequately explored. There are also lingering questions about how expert and nonexpert knowledge is legitimated by the process, how to account for the national interest in federal lands and who retains decision-making authority.

The following summarizes a dialogue session focusing on these very questions. It provides an introduction to some of the issues and questions about community involvement in protected areas. The session was opened with an introduction by the moderator and short statements by academics, agency staff, and community members with experience in public involvement processes. Their statements are followed by a summary of the ideas and challenges discussed during the remainder of the session. Because these reflect the myriad of experiences and perspectives of session participants they are necessarily contradictory in some areas. It is my hope that this dialogue session raises important questions about the nature of public participation in wilderness decision-making, and informs further experimentation, dialogue and research regarding meaningful involvement of communities.

Evolving Models of Public Participation in Wilderness and Protected Area Planning

Steve McCool

Steve McCool is a Professor of Recreation Resource Management, School of Forestry, University of Montana, Missoula, MT 59812. He is currently involved in a number of research and application projects that concern relationships between people and their natural environments, in particular the appropriateness of various approaches to natural resource planning and public participation. Many of these applications have used the Limits of Acceptable Change planning framework.

The notion of public participation in wilderness and protected area planning has come a long way since the Wilderness Act, the National Environmental Policy Act and other legislation mandating public involvement in protected area decisions passed in the United States. The idea of public participation that moves beyond what is formally required is firmly rooted, and the benefits and rationale are clearly articulated, in the literature. However, administrators of public land managing and regulatory agencies continue to have difficulty implementing credible public participation programs. One recent Forest Service administrator stated, "I don't think any of us have a clue how to do public involvement" (McMillion 1999).

The issue is exacerbated by the lack of a coherent, widely shared terminology that describes varying styles of public participation. Terms such as participation, involvement, collaboration, power sharing, consensus building and consulting are used to describe many of the same processes and

objectives, and are often used with little regard for their precise meaning. Further complicating the issue is the evolving nature of public land planning. Often, public participation is viewed as distinct from the planning process itself, and as an added cost. Yet, these perceptions have changed as notions of wilderness and protected area planning themselves have evolved.

In this paper, I briefly typologize how models of public participation have evolved over time. This may aid understanding of how the character of participation and planning have changed, but also have tended to overlap.

Models of Protected Area Planning

Public participation in wilderness and protected area planning can be viewed as evolving through four distinctive stages, with the fourth stage only now emerging. These models may be briefly described as "Expert Only," "Expert Driven," "Collaborative" and "Transactive."

The "Expert Only" model (schematically represented in fig. 1) is derived from the traditional rational-comprehensive approach to planning (Hudson 1979). In this approach, planning is perceived solely as the responsibility of experts in wilderness and protected area planning, where the public has no formal or informal role. Experts are viewed as having the only legitimate knowledge about the topic. While political processes may have driven the need for the planning, the public was excluded from the planning process, and only informed of the outcomes. Because of NEPA, this model should no longer be practiced in the U.S. However, discussions concerning a Grizzly Bear Conservation Strategy in the Yellowstone Ecosystem suggest that the inclination, if nothing else, still exists. One National Forest Supervisor was quoted as stating that it was "inappropriate, in my view, to involve the public" in the development of the strategy (McMillion 1999).

The "Expert Driven" model (fig. 2) shows public participation as mandated by NEPA. The public is included, by legislative fiat, only in the scoping and release of draft alternative stages of the planning process. In this model, the public contributes to identification of important issues, and identifies the social and political acceptability of alternatives, but it is still viewed as having little substantive knowledge to contribute to the process. It represents only a refinement of the previous model and maintains, in Yankelovich's (Yankelovich 1991) terms, the "culture of technical control" in protected area planning. Such approaches tend to be formal, divisive and disjointed (in the sense that the two stages are not specifically connected). In these two models, the planner is a technically skilled

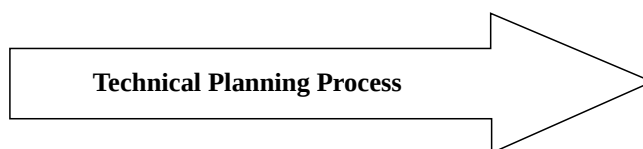


Figure 1—*Expert-Only* model schematic representation of traditional rational-comprehensive planning process. No public participation in the process is envisioned.

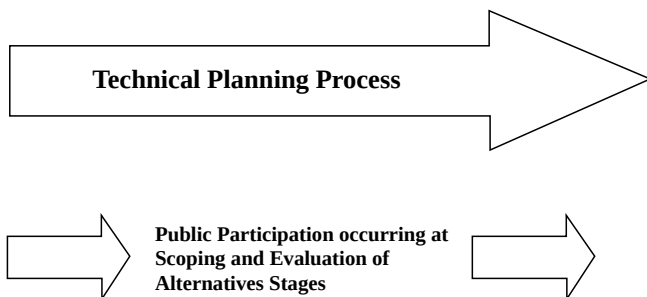


Figure 2—*Expert-Driven* model, based primarily on minimal requirements of NEPA model. Public is formally involved only at two points in the process, and those points are not necessarily connected. Agency planners remain responsible for planning process.

bureaucrat whose focus is development of technically appropriate and effective alternatives.

The first two models may have been acceptable in an era when there was often consensus on goals and scientists agreed on cause-effect relationships. These situations may be termed tame problems. However, the growing complexity and diversity of expectations of what wilderness and protected areas should produce, in terms of values and uses, bring various goals into conflict. Also, as concerns grow about consequences at longer temporal scales and larger spatial scales, managers face increasing scientific uncertainty in decisions. Learning and consensus building become important attributes of the planning processes for these wicked problems and messy situations.

The third model (fig. 3) attempts to address these concerns by developing “Collaborative” processes. Collaborative processes involve the public throughout the planning process

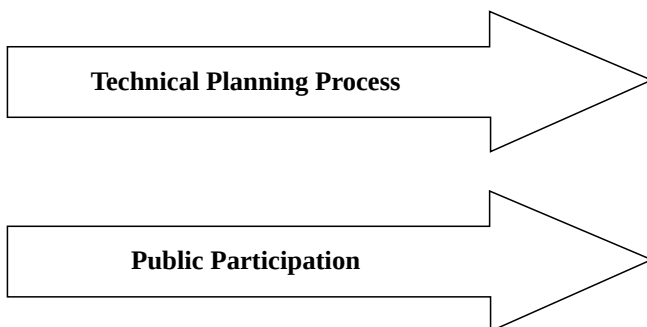


Figure 3—*Collaborative* planning model of public participation. Public maintains involvement throughout process, but in general its involvement is distinctive from agency’s technical planning process.

and bring together disparate interests to attempt a shared resolution. Collaborative processes are particularly useful in gaining consensus, and groups involved in such processes may identify alternatives to agency-developed options. Collaborative processes recognize the legitimacy of emotional and experiential knowledge, but the technical planning process may not directly incorporate these forms of knowledge. Therefore, such processes, while occurring parallel to agency planning, are distinctly separate from it. Much of the current discussion of public participation embraces the collaborative model. However, plans often remain identified with a particular agency, and are not necessarily a direct result of public participation.

A fourth model (fig. 4) is now emerging. This process is termed “Transactive” after John Friedmann’s theory of transactive planning (Friedmann 1973). This approach is represented by the double helix of DNA. One track represents the technical planning process; the other, public participation. The lines connecting the two tracks represent the planner’s role, which is largely facilitative. The double helix exemplifies the tightly integrated character of technical planning and public participation. These are so tightly integrated that it is difficult to determine what is planning and what is participation. Agency employees with technical expertise are woven into this process at a level of involvement equal to members of the public. This approach is particularly useful for messy situations in which both learning and consensus building are critical to successful planning. Both public and agency participants have “ownership” in the plan.

This model of public participation was first used in wilderness and protected area planning in the Bob Marshall Wilderness Complex of Montana (Stankey and others 1984), and has influenced processes elsewhere. A growing literature has documented both its success and limitations.

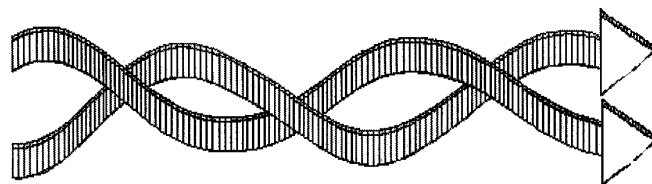


Figure 4—*Transactive* model of public participation. Public and agency technical planning processes are tightly integrated and interwoven. Public has ownership of the plan.

Conclusion

The emerging transactive model of public participation will soon characterize much of wilderness and protected area planning. While there remain important barriers to its use in the U.S. (e.g., the Federal Advisory Committee Act), it is an efficient and effective method of public participation. It ensures adequate representation of interests, learning, building relationships with and among an agency's publics, testing social and political acceptability early in the planning process, and, with the emergence of ownership in the plan, a politically astute and active constituency that will work for implementation.

Resolving Declining Goose Populations Using Effective Community Information and Education

Sue Matthews

Sue Matthews is a Wildlife Biologist and the U.S. Fish and Wildlife Service Representative, Arthur Carhart National Wilderness Training Center, 32 Campus Drive, Missoula, MT 59812. Sue was in Alaska for 20 years where she worked as the Refuge Manager for the Tetlin National Wildlife Refuge. Sue coordinated the award-winning goose information and education program for the Yukon Delta National Wildlife Refuge which made her a real supporter of working effectively with communities.

In a landmark case study of using information and education as an effective resource management tool, with extensive community involvement, an innovative information program was conducted in 56 Yup'ik Eskimo villages within the 20-million-acre Yukon Delta National Wildlife Refuge in western Alaska during the 1980s and 1990s. Four species of geese that nest in western Alaska had been experiencing severe population declines over a 40-year period. These declines were attributed to over-hunting along the entire Pacific Flyway, from Alaska to Mexico. During those 40 years, law enforcement activities had been unsuccessful in halting the decline. In 1983 and 1984, hunters from along the flyway were brought together in a series of stakeholder meetings to try to solve the problem. In 1984, an agreement was signed between hunting organizations and state and federal agencies in California and Alaska. The agreement called for an intensive information and education program to convince residents along the flyway that voluntary reduction in hunting of these species was necessary for their survival. The result was that three of the four goose populations have increased to the point that hunting is now again allowed.

The success of the information and education program hinged on five key factors:

1. The information program was designed by local residents, making the program their own effort.
2. Local residents were hired as "Refuge Information Technicians" to implement the information dissemination, again adding ownership.

3. Creative, cross-cultural products were produced for all levels of individuals, including informational posters for the hunters, an entire K-12 grade curriculum on geese on the Yukon Delta, a poster contest for school children with the winning posters featured in an annual wall calendar distributed to all households on the Yukon Delta, a culturally appropriate comic book with artwork by a local artist, bumper stickers for snow machines in the local Yup'ik Eskimo language, embroidered patches for "Goose Conservation Committees" and other related materials.
4. The project was given time to work. Leaders were patient and within five years the goose populations began to increase.
5. The team of the program involved good, committed people who could work across cultural boundaries.

This program, along with other successful community conservation programs, is described in workshop proceedings from "Building Support For Conservation In Rural Areas," produced by the Quebec Labrador Foundation/Atlantic Center for the Environment, 39 South Main Street, Ipswich, Massachusetts 01938, (617) 356-0038.

Beyond Science

Tom Parker

Tom Parker owns an outfitting business and has been working as a hunting guide in the Bob Marshall Wilderness Complex (BMWC) since 1975. Tom was a member of the Limits of Acceptable Change Task Force for the BMWC, and works closely with the Swan Valley Ad Hoc Committee. He also founded Northwest Connections, a nonprofit that works to facilitate community-based conservation and participation by community members in long term monitoring projects. He can be reached at Northwest Connections, P.O. Box 1340, Condon, MT 59826.

In order to understand wilderness ecosystems, it is important to consult local knowledge. Contemporary approaches to wilderness management, and in fact ecosystem management of any kind, tend to look to conventional scientific processes of inquiry to answer questions about how nature works. However, science is limited when it begins to address ecosystems. Because of the subtle and complex nature of normal ecological interrelationships and the compound random variables that influence any of them over time, contemporary scientific approaches by their design are limited and deficient in their ability to quantify these interactions. We need to employ knowledge that gives insight into the realm beyond the confines of the scientific approach.

Wilderness managers and scientists often overlook some of the very best sources of this kind of knowing. People who live adjacent to and work within wilderness areas often have decades of informal observations from which to draw. In Montana, these people tend to be trappers, hunters, outfitters, ranchers, loggers, and Native Americans. These very people are often not recognized as having anything meaningful to contribute to ecosystem management because of their lack of formal academic credentials. But quite often, they have credentials earned simply by time on the land. Whenever people depend on the landscape, they come to

know it. Normally, we discount those whose lives are intertwined with wilderness ecosystems as biased and one-sided. But it is these very people who, quite often, can contribute valuable insights into and appreciation for subtle interconnections and relationships that hold ecosystems together over time.

Science and local knowledge should be integrated in any attempt to understand wilderness ecosystems, in order to achieve a fuller picture of the land and its capacity for human activities of any kind. Just as important is recognition of the limitations of all human knowledge, formal and informal, bringing to the task of wilderness management a measure of humility. We will never fully understand nature's complexities; if for one moment we do, it will surely change and defy us. The predictive

capabilities we have with nature are limited, and we should act accordingly. Wilderness managers quite often want science to identify precisely the thresholds in nature so that we can use her resources right up to those thresholds. In a more humble frame of mind, we would accept that we do not fully understand those thresholds and so must act conservatively and give natural processes a wide berth for change.

Therefore, wilderness science should include and embrace local knowledge. Wilderness management should integrate scientific and informal knowledge and then act conservatively, in acknowledgement of our limited understanding of these complex systems.

Even Wilderness Is Someone's Backyard

Carol Daly

Carol Daly is the President of the Flathead Economic Policy Center, 15 Depot Park, Kalispell, MT 59901. The Flathead Economic Policy Center is a non-profit that works on collaborative problem solving for natural resource issues. Her past work with economic development led to her current interest in sustainable development which has inspired her work on problem solving and collaboration. Carol also works with the Flathead Forestry Project, and is the Vice Chair of the Communities Committee of the Seventh American Forest Congress, which works to get communities reestablished in a stewardship role.

In planning, implementing and monitoring for the management of protected areas and/or wilderness, public land managers should actively involve residents of the area. Although all citizens (local and non-local) have a legitimate interest in public land management decisions, the effects of those decisions are played out on-the-ground in or near specific communities. Residents of those areas have a special relationship with nearby public lands; they work and play on them, study them, draw spiritual strength and aesthetic enjoyment from them. Frequently, they take an active stewardship role. Their indigenous knowledge of the land — its history, vegetation, wildlife, fisheries, natural processes and flows, patterns and trends — can be a powerful and useful complement to the more formal scientific information gathered by land management agencies. All too often, local voices

are drowned out by more powerful national environmental and industry lobbies. The current community-based ecosystem management movement is a reaction to the discounting of local interests. Communities of place (as well as local environmental and industrial interests) are not asking for local control, but they are demanding a place at the table where decisions are made.

Dialogue Summary

Laurie Yung

Laurie Yung is the Education Program Coordinator, Wilderness Institute, School of Forestry, University of Montana, Missoula, MT 59812 U.S.A. She teaches in and coordinates an undergraduate Wilderness Studies program. Laurie is currently pursuing her Ph.D. focusing on community-wildlands relationships with an emphasis on the Rocky Mountain Front in Montana.

After the statements outlined above, the session was opened for general discussion. What follows is a summary of the main points of this dialogue.

Session participants discussed the challenge of getting community members involved in decision-making processes. Some of the managers suggested trying different venues, essentially reaching beyond traditional public hearings and meetings to the places where different groups of people spend time, such as schools, bars, and other community institutions. One participant suggested spending a lot of time with opposing individuals or groups, in order to learn more about their perspectives and build trust. Others suggested that the burden is on the wilderness management agencies to find the people who are not attending meetings and seek out their perspectives. There was no discussion of the potential challenges of involving more individuals with diverse perspectives in planning processes. There was, however, a general desire to ensure that people who want to be involved in decision-making have adequate opportunities. Some participants suggested, furthermore, that public meetings were useless and counterproductive because they did not help managers find common ground and, at times, exacerbated conflict.

Community members emphasized that the timing of a decision-making process is crucial. They argued that agencies need to involve the community in a meaningful way when issues are initially being identified, rather than later, when alternatives have already been formulated. Public review of alternatives does not necessarily allow for public values and objectives to be incorporated into decisions. Whereas, participants pointed out, involving communities at the beginning of the process demonstrates a sincere intention to involve their perspectives and ideas in decision-making.

Participants agreed that communities are not homogeneous and must not be treated as such. In other words, the diversity of perspectives and priorities within communities must be acknowledged and taken into consideration during the planning process. This implies a need for processes that are structured so that different values can be accounted for, as opposed to processes which facilitate win-lose outcomes and polarize individuals and groups.

Participants also discussed the meaning of consensus. While some participants felt that consensus was vague and could not be firmly defined, others cited definitions they believed captured the concept. There were many questions about whether consensus needed to include everyone who participated.

There was some discussion of the Federal Advisory Committee Act (FACA) (1972) and its potential restrictions on decision-making processes that give power to nonagency groups. Several agency employees pointed out that the only way agency personnel can be convicted of violating FACA is if they proceed directly from meetings to regulations, thereby circumventing the NEPA process. Despite this reassurance, questions about how to effectively integrate collaborative processes and NEPA remained.

How alternative decision-making processes affect the distribution of power was also discussed. Participants wondered if wilderness managing agencies give up decision-making power in community-based or collaborative processes. Some participants argued that agencies are not fulfilling their obligation to be good stewards if they do not retain decision-making authority. In other words, some managers feel that they are ultimately responsible for public lands, and that the obligation to make a good decision for a wilderness area rests largely on their shoulders. Allowing communities more of a role in decision-making might be regarded as a shirking of their duties. Other participants cited projects where they did or are currently giving up power to local communities or user groups and argued that appropriate decisions are being made. They pointed out that federal guidelines for environmental review put forth in NEPA and NFMA must still be adhered to.

In the context of power, the expert-driven culture of the federal land management agencies was discussed. Because this culture values the specialized knowledge of educated professionals, some participants felt that it hindered valuing the experiential knowledge of communities. Participants pointed out that experiential and anecdotal knowledge, as well as values and emotions, are essential to making decisions. They argued that nonexpert knowledge can only be obtained and understood through alternative decision-making processes that focus on dialogue and mutual learning. In other words, unlike traditional planning, collaborative processes value both expert and experiential knowledge and regard them as commensurable.

The question of how to incorporate national interests in community-based decision-making processes was raised. One community member suggested that the national groups, such as industry and environmental groups, need to create better vertical linkages between local chapters, members, or organizations and national institutions. She argued that with effective vertical linkages, local members could represent national perspectives. It was also suggested that federal employees could represent the national interest or national mandate. While not discussed at the session, critics argue that federal employees are a specific subculture with their own values and priorities. Therefore, they may not adequately represent national perspectives and interests.

Participants pointed out that new forms of more participatory decision-making appear to be here to stay, but that many agency employees do not have the skills or knowledge

to facilitate them. Others wondered how long these processes would take and how much they would cost. One federal employee currently involved in such a process argued that it was not less work for the agencies, but rather more work. Other managers pointed out that these processes are intensive by nature, and gave examples of the time and travel investments required. Some participants asked how managers could sustain community involvement if processes were prolonged. They also wondered if meaningful community involvement would produce plans acceptable to many interested parties, thus reducing appeals and litigation.

One person pointed out that the agencies are also trying to streamline the planning and decision-making process so that the public is involved at key times and in ways that do not slow down or stop the project. Participants wondered how this would affect the move toward collaborative decision-making, given its intensive, often lengthy, process-driven nature.

Concluding Questions and Challenges

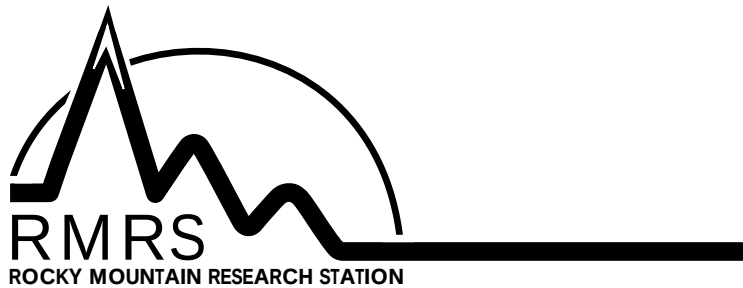
The current push toward collaborative or community-based public lands decision-making has important implications for wilderness management. Rather than a smooth transition to a new and well-defined planning framework, this trend represents a profound rethinking of the role of managers, scientists and various communities in protected area management. The result is increasing uncertainty in the planning process and a number of opportunities for experimentation. Wilderness science can play an important role by documenting the outcomes of these experiments. In doing so, they need to keep the following questions in mind:

- Who are the communities involved in these processes? Which publics are included and excluded, and why?
- How are national interests and priorities represented in processes that are often locally based? How are communities of place and communities of interest dealt with? Are local communities privileged by these processes?
- What potential benefits of these processes are being realized? Under what conditions?
- How is decision-making authority and power negotiated in alternative decision-making processes? Are decisions made by consensus and how is consensus defined?
- Is consensus always possible? Desirable? Is there always common ground to find?
- Do agencies have the time, skills, and desire to work with communities in the ways demanded by more participatory processes?
- What is the role of national environmental legislation in setting standards? How are collaborative processes integrated with NEPA public participation?
- What is the role of science, and how is scientific or expert knowledge regarded?
- Do these new decision-making processes have elements of transactive planning as well as collaboration?
- Do these processes result in better wilderness management and how is "better" defined?

In order for wilderness *and* communities to truly benefit from public participation in wilderness decision-making, we need to be clear about the real *and* potential benefits of new forms of participation, and how these benefits can best be realized. Researchers, managers, and community members have important roles in determining the respective benefits of different wilderness decision-making processes. Future experimentation with process and assessment should be clear about the challenges and trade-offs involved in choices about planning processes.

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