Wilderness and Wild Lands in the Northern Appalachian Region of North America: An Ecological Perspective

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Abstract—The ecological context of the Northern Appalachian region of North America is reviewed and general patterns of ownership and protection status of land discussed. Although there is wide variability among the states and provinces in the proportion of their land that is publicly owned, only a very small proportion, ranging from 0.1 percent to 8.0 percent, anywhere is managed as wilderness. However, a recent analysis of the Human Footprint in the region identifies a larger amount of land (35 percent) that is as yet relatively little modified by human disturbance, indicating that the amount of wild lands in the region is much higher than the amount of designated wilderness. Six challenges for wilderness and wild lands protection are identified: continuing public land acquisition; increasing the protection status of land to prioritize ecological integrity; improving incentives for private ownership of lands managed as wilderness; developing an integrated view of conservation strategies that increasingly sees wilderness protection as part of a suite of conservation tools; assessing the contribution of wilderness to the region's long-term ecological integrity; and actively using wilderness areas as ecological controls against which to compare the consequences of more manipulative land-use practices.

Regional Overview

A Consideration of Terms

Any discussion of "wilderness" must be clear on what is meant by the term. In common usage, wilderness can be in colloquial reference either to the natural character of a landscape or to a formal regulatory label. Either use offers only imprecise insight into the actual character of a landscape with respect to its place along the spectrum from human-dominated (or cultural) to natural, and both uses are open to abuses; a place colloquially referred to as wilderness can simply be, or appear to be, more natural than its surrounding landscape, and a place legally designated as wilderness can have any level of cultural modification legally allowed.

Yet the intent of both uses of the word is sound; societies benefit from being able to distinguish lands that are essentially dominated by ecological processes from those that are not, both for the insight those lands give us about the baselines for ecological normalcy and for the identification of places on a landscape intended for the conservation of species and ecosystems that are not viable within the human sphere of dominant influence.

Thus, some way to distinguish between wilderness as a condition of a landscape and wilderness as a legal designation is needed. In this paper, I refer to lands that are, at most, minimally affected by cultural modifications as "wild lands." No place on Earth is completely *unaffected* by cultural modifications if for no other reason than the changes that are occurring in the global climate as a result of greenhouse gas emissions (McKibben 1989). Yet wild lands can be identified relative to surrounding landscapes (Sanderson and others 2002) based on the degree of change in land use, land cover, human populations, transportation networks, and changes in hydrology. Further, I refer to lands that have a legal designation to be managed primarily or exclusively for the conservation of biological diversity or ecological integrity as "wilderness."

Ecological Features of the Northern Appalachian Region

The Northern Appalachian region of the northeastern United States (which includes portions of New York, Vermont, Massachusetts, New Hampshire, and Maine) and southeastern Canada (including New Brunswick, Nova Scotia, Prince Edward Island, and a portion of Quebec) represents a geographically diverse landscape united by the dominance of mixed northern hardwood (primarily maple, beech, and birch) and softwood (primarily spruce and fir) forests. Distributions of these forest types vary climatically, with the softwood forests predominant at higher latitudes and elevations.

In addition, numerous small-scale ecological types are scattered unevenly throughout this region embedded within the larger matrix forest communities. These include a wide range of wetland and non-forested upland communities, as well as rare late-successional (for example, old-growth) forest stands (Leverett 2001). Thus, complete ecological representation of the region within a system of protected areas (including wilderness areas) requires region-wide distribution.

Hydrological regimes in the Northern Appalachians are strongly linked to the North Atlantic Ocean, through the St. Lawrence River and numerous other rivers that flow directly into the Atlantic. In addition, with the exception of a few ice-free refugia, the region became free of glacial ice only between 15,000 and 10,000 years ago (Klyza and Trombulak 1999). This period of deglaciation was associated with and followed

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by higher sea levels and salt-water inundation even in the western portion of the region. Thus, aquatic biodiversity here, such as migratory Atlantic salmon (*Salmo salar*), is strongly linked to the ocean, and its conservation requires attention to complete migratory corridors from headwaters to ocean.

Ownership Patterns and Status of Protected Land in the Region

As anywhere, lands in this region are owned either publicly (for example, federal, state/provincial) or privately. Both types of ownership have different relationships to the protection and management of wilderness and wild lands. It is surprisingly hard to obtain consistent or complete information on the amount, location, and management priorities of conservation lands in the entire Northern Appalachian region; Canada, in particular, makes access to such data quite difficult. Yet despite the poor quality and availability of data, based on what is available a few general trends are clear.

The U.S. portion of this region is primarily in private ownership with relatively little of it managed to achieve conservation goals. For example, in the state of Vermont, slightly less than 13 percent of the state is publicly owned as conservation lands and only an additional 3 percent is private conservation land (Klyza and Trombulak 1999). The majority of all conservation land has GAP 3 status of conservation protection, primarily in the Green Mountain National Forest; only 1.0 percent of the state is protected as wilderness (Klyza 2001a), making it one of the lowest proportional levels of GAP 1 status in North America (DellaSala and others 2001). The other states in this region within the United States show a similar pattern, with wilderness protection (state and federal combined) ranging from 0.1 percent (Massachusetts) to 4.1 percent (New York) (table 1).

A much greater proportion of the land in the Canadian portion of this region is publicly owned. For example, in the province of New Brunswick, 45 percent of non-submerged land is Crown Land (New Brunswick Department of Natural Resources 2005). Again, as in the United States, the vast majority of public land is managed for resource extraction rather than for conservation of ecological integrity. The level of GAP 1 status land in Canada ranges from 3.6 percent (New Brunswick) to 8.0 percent (Nova Scotia) (DellaSala and others 2001), with the caveat that data are not available for Prince Edward Island.

Ecological Condition in the Region

Recently, colleagues and I have assessed the Human Footprint of the region in order to identify its major remaining wild lands (Woolmer and others, in review). Working with a resolution of 90 x 90 m, we scored each of nearly 42 million grid cells on four general parameters: human population, human land use, human access, and energy infrastructure. The scoring system for each parameter was scaled so that the greatest extent of cultural modification (for example, highest human population density, closest distance to the largest type of road) received a score of 10, and the least extent of cultural modification received a score of 0. Scores for each grid cell were summed across all parameters and reported as a Human Influence Index (HII). We designated those grid cells with cumulative HII scores <= 10 as wild lands, recognizing that wildness is a continuous and relative character.

Based on the criteria established in this analysis, 35 percent of the region is characterized as wild lands, and 8.5 percent of the area has an HII score of zero. The distribution of wild lands is uneven across the region. Large blocks of wild lands are present in the Adirondack Park region of New York (largely representing current wilderness areas), northern Maine, eastern Quebec, and northeastern New Brunswick.

Conserving and/or Restoring Ecological Integrity in the Region

Given the existing patterns of both wilderness and wild lands in the region, one can now ask what is necessary to conserve and restore ecological integrity here. Certainly, ecological integrity requires more than just wilderness and wild lands. For example, sustainable resource harvesting, control of exotic species, reintroduction of extirpated species, and minimization of pollution are all critical for maintaining and improving the ecological health of a region, including the Northern Appalachians. Moreover, the reality that human populations in this region will continue to increase into the foreseeable future demands that increasing attention be given to how urban and exurban development can proceed in such a way as to promote ecological integrity within the sphere of human influence. However, even with a strong focus on sustainable development and/or "smart growth," no

Table 1—Public conservation lands and wilderness in the United States that contribute to the Northern Appalachian region (acreage and percentage of state) (Klyza 2001a).

State	Federal conservation land	State conservation land	Federal wilderness	State wilderness
Maine	172,163 (0.9)	717,069 (3.6)	19,392 (0.1)	188,000 (0.9)
Massachusetts	65,315 (1.3)	533,624 (10.6)	2,420 (0.0)	6,000 (0.1)
New Hampshire	757,378 (13.1)	186,682 (3.2)	102,932 (1.8)	0
New York	66,839 (0.2)	4,128,534 (13.5)	1,363 (0.0)	1,261,639 (4.1)
Vermont	375,936 (6.2)	309,782 (5.2)	59,421 (1.0)	0

set of region-wide conservation strategies will be completely successful without inclusion of wilderness and wild lands.

Thus, with respect to wilderness and wild lands protection as tools in the conservation toolbox, three essential efforts are required. First, public lands must increasingly be managed at the GAP 1 level. Second, the remaining blocks of wild lands identified through the Human Footprint analysis must increasingly be the focus of future land acquisition or protection, both by government and private-sector conservation organizations. Third, the land that serves as linkages among large blocks of wilderness and wild lands must increasingly be the focus of attention for land acquisition or other conservation strategies (for example, conservation easements). These efforts would allow an integrated system of ecological reserves to maximally contribute to the ecological integrity of the region over the long term.

Successes and Failures in Establishing Wilderness and Wild Lands in the Region

Historically, two countries and nine states/provinces have been involved in creating a regulatory structure for designating wilderness in this region. One of the earliest, and still perhaps greatest, successes in wilderness designation in the Northern Appalachians was the passage of the "forever wild" clause to the New York State constitution in 1894, which declared that the lands of the state constituting the Adirondack and Catskill Forest Preserves (now forming the cores of the Adirondack and Catskill Parks) would be "forever kept as wild forest land," and timber from those lands would not be sold, removed, or destroyed (Klyza 2001b). This state-owned land remains today as the largest block of wilderness in the region.

Yet the action of the New York State legislature in the late 1800s had little *region-wide* impact on the establishment of wilderness. What was needed was a regulatory framework to emerge at the federal levels. In the United States, this came from the Wilderness Act of 1964. The original act viewed the wilderness character of an area to be a function both of its size ("of sufficient size as to make practicable its preservation and use in an unimpaired condition") and unaltered condition ("a wilderness ... is hereby recognized as an area where the earth and its community of life are untrammeled by man").

Neither of these conditions could be easily met in eastern North America as a result of the region's long history of occupancy and alteration by European colonists. Thus, the so called "Eastern Wilderness Act" of 1975 was passed, creating 15 wilderness areas that were smaller or had greater degrees of human alteration than would have been acceptable under the more stringent requirements of the original Act (Klyza 2001b). At the present time, wilderness is an established regulatory land-use designation for federal land in the eastern United States, which recognizes that not all conservation goals require large areas and that, over time, ecologically healthy conditions can be restored to areas that have experienced anthropogenic degradation.

In Canada, actual designation of wilderness areas, if it is to occur, falls under the domain of each province, and there is no such thing as federal wilderness. Land protection at the federal level is largely covered by the Canada National Parks Act. Revised in 2000, the Canada National Parks Act now stipulates that "maintenance or restoration of ecological integrity, through the protection of natural resources and natural processes, shall be the first priority [in] considering all aspects of the management of parks" (Department of Justice Canada 2004) leading national parks in Canada to now be managed in a way that captures at least some of the priorities we hold for wilderness.

Despite historical success in establishing wilderness and protecting wild lands in the Northern Appalachian region, recent setbacks have not been encouraging about the prospects for future protection efforts, especially in the United States. Perhaps the greatest problem recently has been the obstructionist position taken by a vocal minority of the public concerning even modest proposals for wild lands protection. In 1997, for example, Champion International, a privately owned timber company, put 132,000 acres (53,419 ha) of land in Vermont up for sale. A coalition of buyers, made up primarily of the U.S. Fish and Wildlife Service and the State of Vermont, purchased the land to expand an existing wildlife refuge, maintain a large amount of the forestland in timber production to support the local economies, and create a small (12,000 acre/4,856 ha) ecological reserve to protect special natural communities (Bateson and Smith 2001; Klein 2002). Although the amount of land to have been protected in the reserve was small (only 9 percent of the total area) and hunting and fishing would still have been allowed in the area, the proposed reserve was bitterly and successfully contested in large part on the grounds that the proposed management plan for the reserve would not allow the use of motorized vehicles in the area, even though the area has no permanent residents.

Similarly, a recent proposal by the Vermont Wilderness Association for the expansion of the federal wilderness system in the Green Mountain National Forest (Vermont Wilderness Association 2001) generated considerable public opposition and little support among the state's largely progressive and environmentally supportive congressional delegation in part because it would require the closure of 21 miles (34 km) of snowmobile trails (which constitute less than 0.2 percent of snowmobile trails in the state). That efforts to protect wild lands and establish wilderness areas could so spectacularly fail based on the complaints of motorized recreational vehicle users, despite the overwhelming support by the public for wilderness and ecological protection, does not speak well for the potential for significant successes in the U.S. in the immediate future. [President Bush signed the New England Wilderness Act into law on 1 December 2006, which designated 34,500 acres of land in New Hampshire and 47,000 acres in Vermont as wilderness. The amount of land in Vermont represented a political compromise from the original proposal of almost 100,000 acres in response to the controversy noted above.]

Challenges for the Future

Public Acquisition of Wild Lands

Conservation provides public benefits measured by more than just economic returns. Thus, the public, through its governments, needs to remain involved in the acquisition of

public lands to achieve conservation goals, especially lands that can be managed as wilderness (in other words, ecological reserves managed with a GAP 1 status) and lands that can serve as landscape-scale linkages between ecological reserves. The trend, noticed especially in the United States, toward privatization of public functions must not come to define our culture's philosophy on how we should meet our conservation needs and responsibilities.

Developing and Implementing New Models for Wilderness

As described above, a large amount of the land base in the United States portion of the Northern Appalachian region is currently in private ownership. One approach to overcoming the limitations imposed by this pattern of ownership is to continue public acquisition of lands for management as wilderness, as noted above. However, this approach is unlikely to be sufficient on its own to develop the kind of wilderness system necessary to achieve the broad scope of biological conservation goals; much of the most productive and biologically diverse lands, particularly at lower elevations and latitudes where the potential for human settlement and agriculture are greater, are unlikely to be put up for sale at a price the public can consistently afford. Thus, in contrast to other regions of the continent, an expansion of the wilderness system in this region will require direct inclusion of privately owned lands to a greater degree than is currently the norm anywhere.

Unfortunately, few private landowners are in a position to manage land as wild lands. Property tax rates in the northeastern region of the United States generally focus on what the land *could be* used for, not what the land *is currently being* used for, and tax support programs intended to prevent the conversion of land to development generally require that the land be subject to some kind of harvesting for eligibility.

What is needed are mechanisms to allow, if not out-right encourage, private landowners, whether they are individuals or organizations such as land trusts, to manage large areas for long-term ecological integrity without a requirement for resource extraction. So-called "current use" programs that are now in place could be supplemented with "wild lands" programs, where the emphasis in management plans on private land would be on encouraging the development of old age-classes in forest ecosystems, natural succession, and populations of native species that fluctuate through their naturally dynamic range of abundance and distribution. Such wild lands programs could also encourage large-scale conservation through incentives to enroll more acreage under a single owner or through collaboration among several owners.

Taking an Integrated View of Landscape Management

Regional land management needs to stop being viewed as the search for the optimal balance of conservation and economic development on each plot of land, a model that could be called the "living lightly everywhere" philosophy. Some conservation goals are just fundamentally incompatible with economic growth, and "living lightly everywhere" will, in a world of expanding human population size and per capita resource use, ultimately lead to the loss of these ecological elements. Instead, regional land management needs to be viewed as the search for balance in mixing dominant land uses (for example, conservation lands, stewardship lands, and high-intensity use lands) across the landscape or the "integrated dominant-use" philosophy (Trombulak 2003). Wilderness advocates need to seek allies in other conservation communities (for example, smart growth advocates, sustainable forestry and agriculture advocates) by uniting under the integrated dominant-use model.

Wilderness advocates also need to transcend the traditional views of what lands have value as wilderness, moving away from the "pristine landscapes" and "rock-and-ice landscapes" models to include lands that have great ecological value and that could be enhanced through restoration but are underrepresented in wilderness because they are neither pristine nor scenic. In the Northern Appalachian region, a greater emphasis needs to be placed in the future on protection of wild lands and restoration of potential wild lands at lower elevations, especially in lake and river valleys where agriculture and development are more prevalent than at higher elevations.

Taking a Long-Term View for Landscape Management

Establishing wilderness and protecting wild lands should not be viewed in the context of "locking up" lands in the present. Rather, these areas should be viewed in terms of their on-going contribution to creating a preferred human footprint across the entire landscape—conservation lands, stewardship lands, and high-intensity use lands—into the future. In a sense, discussions about wilderness and wild lands must evolve from a focus primarily on our desires in the present to our responsibilities and priorities for the future.

Cultural influences on the environment, whether they involve the construction of roads, development of housing or recreational facilities, or the extraction of resources, all of which are alternatives to wilderness, should be viewed in a holistic, incremental way over long (40 to 50 year) time frames and not in isolation from one another. Thus, the question should never simply be, for example, "what are the consequences of losing *this* 10 acre (4 ha) wetland *this* month?" but rather "what are the consequences of losing 10 acres per month for the next 40 years?"

The tools for comparing alternative scenarios for regulation and zoning are already well developed at the local scale through GIS-based build-out analyses. Recently, we have begun to scale these tools up to the landscape level in the Northern Appalachian region in order to look at what the potential consequences are for the region over the next 40 years for either including or not including different types of regional systems of ecological reserves (including wilderness) under different scenarios of economic development and population growth (Baldwin and others 2007). Our analyses extend the approach taken in measuring the current Human Footprint, described above, and therefore we refer to it as a Future Footprints analysis.

Although this work is still preliminary, we have been successful in modeling both the expansion of human settlements and road networks under development scenarios that range from the status quo (existing trends for the past 10 years remain true for the next 40 years) to accelerated growth (the next 40 years are characterized by the pattern of growth and development seen in the Pacific Northwest region over the past 10 years). Both models predict a dramatic decline in wild lands (as defined in the Human Footprint analysis described above) and landscape-scale linkages, with much greater losses under the scenarios of greater cultural expansion.

Through such analyses, I believe the importance of wilderness and wild lands protection is better highlighted because it becomes clear in a spatially explicit way what society stands to lose by not establishing such protected areas now while the chance remains.

Rigorously Identify the Biological Value of Wilderness and Wild Lands

Aldo Leopold spoke of wilderness as being baselines of ecological normalcy (Leopold 1966). Unfortunately, wilderness advocates have done little to demonstrate that this view is useful and that wilderness is irreplaceable as a way to understand the efficacy of land management practices carried out on stewardship lands (for example, lands where forest harvesting occurs). The vast majority of research on wilderness addresses recreational values and management tools. While important in themselves, they do not address the fundamental question of what the ecological values of wilderness are relative to, for example, lands managed for timber harvesting. In the absence of rigorous, long-term studies across numerous taxa and ecosystems comparing wilderness—lands where nature is allowed to operate in its own way and in its own time—to lands managed to achieve such culturally derived goals as resource extraction and motorized recreation, we will have no way of knowing whether sustainable forestry is, in fact, ecologically sustainable.

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