Wild EARTH

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Wild, Wild EAST

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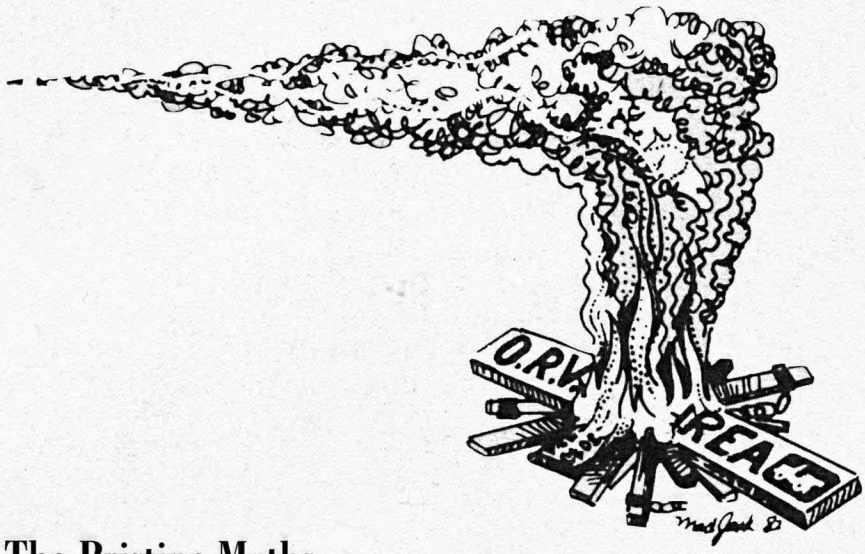
Around the Campfire

by Dave Foreman



The Pristine Myths

IN THE 1960s AND EARLY 1970s, THE UNITED STATES FOREST SERVICE PUSHED a purist definition of wilderness, essentially arguing that any past human use of an area disqualified it from designation as a Wilderness Area. James Morton Turner and Doug Scott spell out in this issue how Congress roundly rejected the Forest Service's "Pristine Myth of Wilderness." Interestingly, the postmodern deconstructionist critics (pomo-decons) of wilderness now resurrect the Forest Service's discredited purity view to argue that the wilderness idea is phony because native peoples had domesticated the American land before Europeans arrived. I can't honestly accuse the pomo-decons of cribbing from the Forest Service's thirty-year-old misinterpretation, because I don't think they actually know enough about the history of the National Wilderness Preservation System to be aware of the battle for Wilderness Areas in the East. I suspect they believe they are putting out something new. By asking two questions, however, we can show that the pomo-decons are just as clueless about Wilderness Areas as was the Forest Service three decades ago. Had natives domesticated the Americas before Columbus? Does the Pristine Myth or its deconstruction have anything to do with Wilderness Area protection?

Geographer William M. Denevan of the University of Wisconsin is the most credible researcher of what he calls "The Pristine Myth." He claims that "the Native American landscape of the early sixteenth century was a humanized landscape almost everywhere. Populations were large."[1] Denevan has suggested a total population for the New World in 1492 of 53.9 million: "3.8 million for North America, 17.2 million for Mexico, 5.6 million for Central America, 3.0 million for the Caribbean, 15.7 million for the Andes, and 8.6 million for lowland South America."[2] Others have guessed that there were as many as eight million people living north of the Rio Grande. Douglas H. Ubelaker of the Smithsonian Institution, however, believes there were only two million.[3]

continues on page 2

The opinions expressed in Campfire are my own, and do not necessarily reflect official policy of The Wildlands Project or *Wild Earth*. —*DF*

About Wild Earth *and The Wildlands Project*

Wild Earth and The Wildlands Project are closely allied nonprofit organizations dedicated to the restoration and protection of wilderness and biodiversity. We share a vision of an ecologically healthy North America—with adequate habitat for all native species, containing vibrant natural and human communities.

Through the quarterly journal *Wild Earth*, other publications, and advocacy, **Wild Earth** works to foster a culture of conservation, helping to communicate and shape the latest thinking in conservation science, philosophy, politics, and activism.

■ We make the teachings of conservation biology accessible to non-scientists, that citizen advocates may employ them in defense of biodiversity. ■ We provide a forum for dialogue within the conservation movement on the scientific, strategic, and spiritual foundations of effective conservation action. ■ We highlight the campaigns of biodiversity preservation groups and coalitions across North America, and serve as a networking tool for wilderness activists. ■ We serve as the publishing wing of The Wildlands Project. ■ We expose threats to habitat and wildlife, and regularly explore the links between human population growth and biodiversity loss. ■ We defend wilderness both as ***idea*** and as ***place***.

The Wildlands Project is the organization guiding the design of a continental wilderness recovery strategy. Through advocacy, education, scientific consultation, and cooperation with many regional groups, The Wildlands Project is working to design and implement systems of protected natural areas—wildlands networks—across the continent.

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"Spring's Promise" (detail) watercolor by Dorothy Black (©2000)

Wild, Wild East

We are grateful to Sweet Water Trust for helping to underwrite this issue's theme coverage on eastern wild forests.

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Around the Campfire *continued*

Without question, nearly 23 million people in Mexico and Central America would have been a large, often dense population. However, for North America north of the Rio Grande, Denevan's best estimate is a mere 3.8 million. Keep in mind that the combined population of Canada and the United States today is about 300 million. The pre-Columbian population was little more than one percent of that. Nor were these fewer than four million people evenly spread across the landscape. It is logical to assume that there were large regions that saw infrequent visitation from humans, much less permanent settlements, because of the small total population, uneven distribution, limited technology, lack of horses, and constant warfare and raiding. Archaeology supports this assumption.

Nonetheless, J. Baird Callicott believes that the America encountered by European explorers and colonists was heavily managed and modified by Native Americans; indeed, they had "improved" the land and caused the "incredible abundance of wildlife." He writes, "Most of temperate North America was managed actively by its aboriginal human inhabitants."[4] He further claims that "the biological wealth of North America on the eve of European landfall is more attributable to the bioregional management programs of the indigenous human population than to low numbers."[5] Other critics of Wilderness play variations on this theme. I have yet to see any scientific evidence for this romantic view, however. It is, of course, the same worn-out blather used by ranchers, loggers, and other extractive industries today to justify their continued use of the land (the pomo-decons regularly repeat the antiwilderness arguments of extractive industry).

What was the actual level of impact indigenous people had in the Americas? The obvious answer is that no one knows, precisely. The conventional wisdom until recently was that natives north of Mexico had very little effect on the landscape. New England's Puritans argued so to justify their taking of "unused" land from the Indians. The pendulum has swung the other way in recent years, with claims that even tiny populations significantly altered pre-Columbian ecosystems—especially through burning. The "Myth of Pristine America" has been replaced with the "Myth of the Humanized Landscape."[6]

The issue is not whether natives influenced the landscape, but to what degree and where. Even if certain areas were not fully self-willed land due to native burning, agriculture, and other use, it does not follow that this was the case everywhere. Because Los Angeles is paved, does this mean that everywhere in the United States is paved? Because most of Illinois is a human-created landscape, is the Bob Marshall Wilderness Area in Montana a human-created landscape? Of course not. Those early explorers and later colonists who extrapolated from the wilderness they found to argue that all of the Americas was a wilderness before Europeans arrived are now imitated by their deconstructors who extrapolate from native-modified spots to argue that all of the Americas was domesticated. Both views are silly.

The first wave of skilled hunters into the Americas roughly 12,000 years ago caused the extinction of dozens of species of large mammals inexperienced with such a predator. The Pleistocene-Holocene Extinction had profound effects that may still be reverberating through American ecosystems.[7] In certain areas of the Americas, high human population density and intensive agriculture led to severely degraded

ecosystems. However, I question whether the North American forests and prairies found by the first European explorers and colonists were primarily the result of burning by native tribes. Perhaps in localized areas American Indians had a major impact on vegetation because of anthropogenic burning. But how extensive could this manipulation have been with a population of two to eight million north of the Rio Grande in 1500? Even the high figure gives us a very low population density.

Historian Donald Worster writes:

> *Two million people spread over what is now Canada and the United States, a people armed with primitive stone tools, simply could not have truly "domesticated" the whole continent. By comparison, 300 million Americans and Canadians today, armed with far more powerful technology, have not wholly domesticated the continent yet....*[8]

A key plank in the domesticated landscape foundation is the claim that natives set fires throughout North America. However, Reed Noss points out that lightning-caused fires better explain the presence of fire-adapted vegetation than do Indian fires.[9] Ecologist Craig Allen of the US Geological Service confirms this for northern New Mexico. He writes:

> *Widespread fires occurred about every 5–20 years wherever ponderosa pine grew, with somewhat lower frequencies on the order of 15–40 years in the bracketing piñon-juniper woodlands below and mixed conifer forests above....Given our dry spring climate and frequent thunderstorms, lightning is believed to have caused the vast majority of these fires. This view is supported by the records of about 4000 lightning-caused fires documented by firefighters in the Jemez Mountains from 1909–1996, and by the over 160,000 lightning strikes recorded over the Jemez country by a lightning detection system between 1985 and 1994.*[10]

Ecological historian Emily Russell reevaluated Indian use of fire in the Northeast. In the abstract of her study, she writes, "Of the 35 documents that describe vegetation or Indian life in the 16th or 17th centuries, only half mention any use of fire except for cooking. Only six purportedly first-hand accounts might refer to purposeful, widespread, and frequent use of fire. These six are all consistent with use of fire only locally near camps or villages, or with accidentally escaped fires."[11]

University of Wisconsin geographer Thomas Vale has taken perhaps the most careful look at the claims of the humanized landscape. His 1998 article in *Natural Areas Journal* deconstructs the deconstructors. He writes, "The desire to visualize humanized landscapes in the pre-European era derives from social ideologies, rather than from careful assessment of ecological facts."[12] I think Vale has hit the nail on the head for understanding the entire pomo-decon salvo against wilderness. Social *ideology* fires those guns, not assessment of ecological *facts.*

Using archaeology, history, ecology, and logic, Vale considers claims of a humanized landscape in a specific place—Yosemite National Park. He suggests that a place can be called "natural, or 'in a wilderness condition' if the fundamental characteristics of vegetation, wildlife, landform, soil, hydrology, and climate are those that result from natural, nonhuman processes, and if these conditions would exist whether or not humans are present."[13]

Vale explains that claims of an aboriginally humanized Yosemite should not be applied outside the inhabited Yosemite Valley to include all of today's Yosemite National Park and that minor modification of vegetation or use of plants does not mean that even the valley itself was completely humanized in native times. Finally, he considers the sweeping claims made about native burning. He writes, "A more precise assessment should ask whether the human-induced ignitions were in addition to, rather than a substitution for, natural ignitions and whether or not, moreover, any fires set by Indians changed the landscape

illustration by Asher B. Durand, ca. 1860s

from that which otherwise would have existed."[14] After considering what science now knows about fire frequency and behavior in Yosemite, he concludes that "these fire frequencies varied temporally, with burning closely tracking weather conditions—an indication that natural factors, not humans, determined fire occurrence."[15]

Vale reviews literature on other regions in the United States to determine the widespreadness of heavy human impact. He concludes:

> *The general point, then, is that the pre-European landscape of the United States was not monolithically humanized, not a "managed landscape, much of its look and ecology the product of the human presence" (Flores 1997). Rather, it was a patchwork, at varying scales, of pristine and humanized conditions. A natural American wilderness—an environment fundamentally molded by nature—did exist.*[16]

Of course, native populations had changed some areas. For example, Mexican botanist Arturo Gomez-Pompa and US anthropologist Andrea Kaus assert that

> *new evidence from the Maya region suggests that the seemingly natural forests we are trying to protect from our version of civilization supported high densities of human populations and were managed by past civilizations....The Maya population of southeastern Mexico may have ranged from 150 to 500 people per km^2 in the Late Classic Period, contrasting sharply with current population densities of 4.5 to 28.1 people per km^2 in the same region....These past civilizations apparently managed the forests for food, fiber, wood, fuel, resins, and medicines.*[17]

This is probably true, but the rest of the story is that the Mayas grossly overexploited the forests, and their warlike, totalitarian civilization collapsed. For one thousand years, these forests have been recovering. Common to the writings of the wilderness revisionists is a New Pristine Myth: once touched by humans in any way, wilderness has evaporated and cannot be restored. This, of course, is the Forest Service's outdated and bogus purity view, which the agency used after the Wilderness Act passed to try to minimize the amount of land protected as Wilderness.

Denevan writes, "The pristine view is to a large extent an invention of nineteenth-century romanticist and primitivist writers...."[18] I do not disagree with this. However, I do not believe that Denevan's "pristine view" has much to do with the wilderness idea that led to the Wilderness Act or with the motivation of wilderness conservationists. In 1925, Aldo Leopold wrote that "the wilderness idea was born after, rather than before, the normal course of commercial development had begun."[19] Thus, the father of Wilderness Area protection makes it clear that his wilderness idea was a new one, coming after "motor cars" began to invade the National Forests following World War One. It had nothing to do with the Pristine Myth of "nineteenth-century romanticist and primitivist writers."

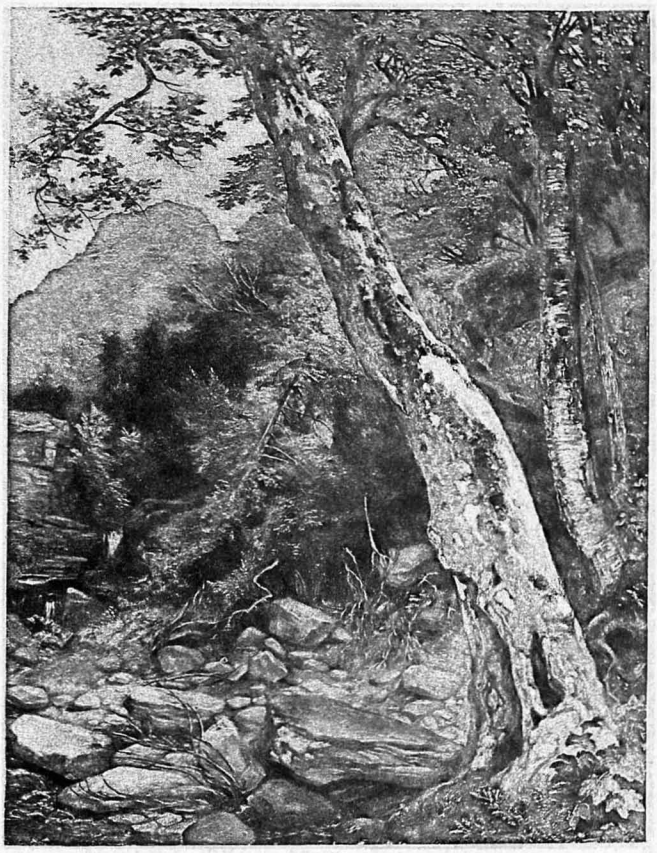


illustration by Asher B. Durand, ca. 1860s

Nor does the New Pristine Myth carry water with Wilderness Area protection today. Places do not have to be pristine to be designated as Wilderness and never have.[20] Leopold wisely explained that "in any practical program, the unit areas to be preserved must vary greatly in size and in *degree of wildness*" (emphasis added).[21] Senator Frank Church of Idaho was the floor manager in 1964 when the Wilderness Act passed. Ten years later, when the Forest Service "would have us believe that no lands ever subject to past human impact can qualify as wilderness, now or ever," Church said, "Nothing could be more contrary to the meaning and intent of the Wilderness Act."[22]

However, because most of the pomo-decon critics of wilderness know very little about the act, they perpetuate their own Pristine Myth. For example, University of Wisconsin philosophy professor Michael Nelson writes, "The [Wilderness Act] defini-

tion is further flawed in that, quite simply, there are no longer any places untouched by human influence," and "In fact, all the enemy of wilderness needs to do to destroy the possibility of an area being designated as wilderness is to deny that a proposed area meets the wilderness designation standards."[23]

Both his statements are simply false. Frank Church proved him wrong more than a quarter of a century ago when he said on the floor of the Senate, "The effect of such an interpretation [the Forest Service's purity doctrine] would be to automatically disqualify almost everything, for few if any lands on this continent—or any other—have escaped man's imprint to some degree."[24] The definition of Wilderness in the Wilderness Act fully recognizes that there are few if any places untouched by human influence; the act does not require proposed Wilderness Areas to be untouched; and time and time again, conservationists have overcome antiwilderness arguments based on lack of purity. There are now more than 600 areas totaling more than 106 million acres in the National Wilderness Preservation System. The majority of these Wilderness Areas were designated despite the arguments of opponents that they were not pure enough. So much for Nelson's "warning."

University of Wisconsin history professor William Cronon also misunderstands the Wilderness Act when he writes, "If you follow the federal government's definition, there is no wilderness in Wisconsin."[25] Wrong, wrong, wrong, wrong, wrong, wrong, on six accounts: there are in fact five designated National Forest Wilderness Areas and one National Wildlife Refuge Wilderness Area in Wisconsin—Wisconsin Islands, Blackjack Springs, Headwaters, Porcupine Lake, Rainbow Lake, Whisker Lake. They total 44,170 acres. I testified in favor of Blackjack Springs and Whisker Lake before Congress in 1978. They meet the federal government's definition of Wilderness and have been so designated. Had the good Dr. Cronon bothered to research how the people who wrote the Wilderness Act defined Wilderness, he would not have made such an unfounded statement. I can only conclude that he, like Nelson, does not know what the federal definition of Wilderness is.

Neither of the Pristine Myths—that the Americas were pristine before Europeans arrived and that only pristine areas can be considered as wilderness—have anything whatsoever to do with the Wilderness Area Idea. The 1975 Eastern Wilderness Areas Act proved the pomo-decons wrong just as it proved the Forest Service wrong. Instead of deconstructing "romanticist and primitivist" literary figures, postmodern academics would do well to read a bit of history about the National Wilderness Preservation System in the United States. I commend to them this issue of *Wild Earth* to begin their education. With teachers like Turner and Scott, they can deal in facts instead of in social ideology.

—DAVE FOREMAN
East Fork of the Jemez River

This Campfire is adapted from my finally finished book, The War on Nature. *Details on its publication will be forthcoming.*

NOTES

1. Denevan, William M., "The Pristine Myth: The Landscape of the Americas in 1492," *Annals of the Association of American Geographers,* 1992, pp. 369–385.
2. "The Pristine Myth," p. 370.
3. Ubelaker, Douglas H. "North American Indian Population Size, A.D. 1500 to 1985," *American Journal of Physical Anthropology,* Vol. 77, 1988, p. 291.
4. Callicott, J. Baird, "The Wilderness Idea Revisited: The Sustainable Development Alternative," *The Environmental Professional,* Vol. 13, 1991, p. 241.
5. "The Wilderness Idea Revisited," p. 242.
6. Vale, Thomas R., "The Myth of the Humanized Landscape: An Example from Yosemite National Park," *Natural Areas Journal,* Vol. 18 (3), 1998, pp. 231–236. Reprinted in *Wild Earth,* Fall 1999, pp. 34–40.
7. Martin, Paul S. and David A. Burney, "Bring Back the Elephants!" *Wild Earth,* Spring 1999, pp. 57–64. See also Barlow, Connie, *The Ghosts of Evolution: Nonsensical Fruits, Missing Partners, and Other Ecological Anachronisms* (Basic Books, New York, 2001).
8. Worster, Donald, "The Wilderness of History," *Wild Earth,* Fall 1997, p. 10. Worster writes, "I am using the cautious but authoritative estimate of Douglas H. Ubelaker of the Smithsonian Institution, in his article 'North American Indian Population Size, A.D. 1500 to 1985,' *American Journal of Physical Anthropology*, 77 (1988): 291."
9. Noss, Reed, "Wilderness—Now More Than Ever," *Wild Earth,* Winter 1994/95, pp. 60–63.
10. Allen, Craig D., "Where Have All the Grasslands Gone? Fires and Vegetation Change in Northern New Mexico," *The Quivira Coalition Newsletter,* May 1998.
11. Russell, Emily W.B., "Indian-set Fires in the Forests of the Northeastern United States," *Ecology,* 64(1), 1983, pp. 78–88.
12. Vale, Thomas R. "The Myth of the Humanized Landscape: An Example from Yosemite National Park," *Natural Areas Journal,* Vol. 18 (3), 1998, p. 231.
13. "The Myth of the Humanized Landscape," p. 232.
14. "The Myth of the Humanized Landscape," p. 232.
15. "The Myth of the Humanized Landscape," p. 233.
16. "The Myth of the Humanized Landscape," p. 234. The reference is to Flores, D., "The West That Was, and the West that Can Be," *High Country News,* 29(15), 1997, pp. 1, 6–7.
17. "Taming the Wilderness Myth," p. 274.
18. "The Pristine Myth," p. 369.
19. Leopold, Aldo, "The Last Stand of the Wilderness," *American Forests,* 1925, p. 603.
20. Scott, Doug, "Congress's Practical Criteria for Designating Wilderness," *Wild Earth,* this issue.
21. Leopold, Aldo, *A Sand County Almanac* (Oxford University Press, New York, 1949), p. 189.
22. Church, Frank, "The Wilderness Act Applies to the East," *Congressional Record—Senate,* January 16, 1973, p. 737.
23. Nelson, Michael, "Beyond Wilderness," *Horizons,* Sigurd Olson Environmental Institute, Northland College, Ashland, Wisconsin, Spring 1998, p. 3.
24. "The Wilderness Act Applies to the East," p. 737.
25. Cronon, William, "Landscape and Home: Environmental Traditions in Wisconsin," *Wisconsin Magazine of History,* Vol. 74, Winter 1990–91.

Tom Butler asks the rhetorical question in his editorial ["Parks and Wilderness: The Ultimate Working Landscape," summer 2000]: "What should we make of The Nature Conservancy—the world's foremost biodiversity brand name—getting into the ranching business in the West and the logging business in the East?" My answer is that we should be damn glad it is doing so! TNC continues its land acquisition efforts for preserves that will be totally protected for their natural heritage or biodiversity values. They do this in fine style and effectively in my home state of Vermont for instance. And the organization has adopted an ecoregional approach, which goes beyond its original concern with rare and endangered species or communities, to attempting acquisition that will provide for large landscape-scale matrix vegetation blocks to protect functional examples of common natural community types and to provide for area-sensitive wildlife species.

But, when large areas of so-called "working" ranches and forests suddenly come on the market, TNC does try to play a role in working with private and public partners to pool resources for acquisition of key areas, which at this stage of available funding, local concern about the economy, political will of partners, and other messy and wild-land-opposing pressures, otherwise could not come under a conservation regime. It is in these cases that TNC uses science-based methods not only to get protection for certain areas, but also to raise the level of conservation activity on the ranch or forest lands by designing conservation easements or restrictions. The alternative would be to see them transferred to other private ownership that might well continue to flog the land.

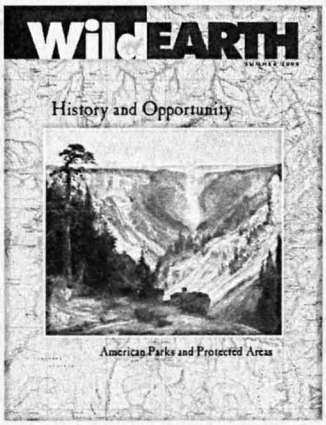
Unless there are deeper pockets to support acquisition for strict preservation, these compromises, in my opinion, are desirable and being done well by The Nature Conservancy.

LAWRENCE S. HAMILTON
Charlotte, Vermont

Larry Hamilton is a trustee of the Vermont Chapter of The Nature Conservancy.

I recently had the opportunity to read your excellent magazine for the first time. It is great to see the many articles on insect conservation and the other "little things" that are among the most essential working parts of the planet's ecosystems [fall 2000].

There are, however, two inaccuracies within May Berenbaum's fine article, "Getting to Know the Neighbors." Dr. Berenbaum incorrectly states that, at the national level, only 28 species of insects are federally listed as threatened or endangered, and recovery plans exist for only four species, all of them butterflies. As of this writing, there are in fact 39 species of insects designated as threatened or endangered under the Endangered Species Act in the United States. Moreover, 29 of the 39 species have recovery plans (at least in draft stage) and several of those are for beetle species. Indeed, the very next page of the fall issue contains the illustration that adorns the cover of the American Burying Beetle Recovery Plan, completed in 1991, and Dr. Horn's accompanying article, "Return of the American Burying Beetle," refers to the implementation of the recovery plan for this species. The Fish and Wildlife Service also has completed recovery plans for the Puritan tiger beetle (*Cicindela puritana*), the Northeastern beach tiger



beetle (*C. dorsalis*), and another plan covers seven species of karst invertebrates in Texas, including three beetle species, two species of harvestman, a spider, and a pseudoscorpion. This information is all readily available at our web site: http://endangered.fws.gov.

MICHAEL AMARAL
Concord, New Hampshire

Michael Amaral is the Senior Endangered Species Specialist in the New England Field Office of the US Fish and Wildlife Service.

Author Responds: *I thank Michael Amaral for noting that the numbers I gave for federally listed endangered invertebrates were not up-to-date. The source I used was a journal article, specifically: T. van Hook, 1997, "Insect coloration and implications for conservation,"* Florida Entomologist *80: 193–210. In retrospect, it was ill-advised to use a three-year-old print reference; I checked the web for state information*

but apparently failed to navigate the federal website correctly. The web address will be of great use to Wild Earth *readers. I castigate myself and apologize to readers for not using the most current sources. It's heartening to know that the pace of protection has been stepped up; however, the current figures that Mr. Amaral provides, although encouragingly higher than they were three years ago, still illustrate the enormity of the challenges faced by those interested in insect conservation. I'm grateful to Michael Amaral and his colleagues in federal and state agencies, as well as to well-informed and interested citizens, for their energetic efforts on behalf of the less charismatic yet no less vital species with which we share the planet.* —May Berenbaum

Professor Berenbaum heads the Department of Entomology at the University of Illinois at Urbana-Champaign.

Donald A. Windsor's letter endorsing agricultural intensification as a means of freeing up land for wild habitat [letters, fall 2000] embodied some very relevant misconceptions regarding genetically modified food. I am a farmer and an ecologist, and am not fundamentally opposed to genetic engineering research, as it may one day prove to be both beneficial *and* safe, but currently there has been no evidence to conclude either. In fact, from the information I've gathered, and from what I have observed in the field, the means by which genetically modified crops are grown produce far lower yield per square foot than even the lowest input backyard garden. The companies (and there are only a few) that market genetically modified foods make the bulk of their profits from their agrochemical sales. Sales and profits are the main objective of these companies. "Food security for the world" and "Feeding the world's population" are only sales pitches.

As much as people may want to separate agricultural land from their concept of "wilderness," it will be a lot more difficult to convince the thousands of migrating bird species that frequent farmers' fields of the distinction. Explain it to the groundhogs that eat unharvested tubers for winter feed, aerating the earth at the same time, and the beetles and insects that play an important role in pollination and rely on crop plants going to flower. A farm is a living ecosystem that needn't be cut off from the rest of the planet, outcast as some sort of scientific techno-mechanical seed breeding experiment. A farm should be diverse, providing for many species of flora and fauna.

Mr. Windsor says that "genetic manipulation is [like] playing with fire." I disagree. Fire occurs naturally. Pollen carrying genetically modified DNA drifting in our atmosphere had never occurred in human history—until the 1990s. The consequences of agricultural biotechnology—both ecological and social—are profound. On one point I definitely can agree with Windsor: "This is not a simple issue."

DAVID CATZEL
Vancouver, British Columbia, Canada

As an arts correspondent for the *Billings Gazette*, I wrote a feature article on T.H. Watkins six months before he died and am in full agreement with Terry Tempest Williams' thoughts on his significance ["Wilderness Warrior," fall 2000]. During my interview he was generous with his time, a heartily conversational, eloquent, humorous, deeply thoughtful man. What most impressed me was his commitment to sound public policy. In his recent book, *The Hungry Years*, he maintained that massive federal programs in response to the Great Depression were not some power grab by the federal government forced upon an uncomprehending public, but an expression of the will of the people who wanted the government to do something. Another thing that impressed me was his unswerving commitment to public lands as a democratic ideal and the foundation of strong conservation policy, including a comprehensive wilderness preservation policy.

T.H. Watkins was an American in his blood, bones, and heart and soul, who believed in the democratic process, who loved the land and stood in its defense. He wrote poetically about wild American landscapes, most notably southern Utah. Personally, I believe we need more than national monuments, roadless areas protection, and designated wilderness—we need to *live* the land ethic in our daily lives, we need to come home to the wild in our hearts and minds so that wilderness is not fenced out but rather permeates human civilization. But public policy is one way of putting this deeper commitment into action. We cannot "come home to the wild" if we have no foundation upon which to build that home. Mr. Watkins' work for wilderness—in words and deeds—reminds us not to be fooled into thinking otherwise.

CARL D. ESBJORNSON
Bozeman, Montana

We welcome your comments. Please send them to us at PO Box 455, Richmond, VT 05477 or e-mail to letters@wild-earth.org. Published letters may be edited for length and clarity.

A Wilderness View

To assist Nature's return to robust good health in eastern forests is to practice resurrection.

Wild, Wild East

FROM ZADOCK THOMPSON'S *NATURAL HISTORY OF VERMONT* (1853):

The beaver, though formerly a very common animal in Vermont, is probably now nearly or quite exterminated, none of them having been killed within the state, to my knowledge, for several years.

When the country was new...[white-tailed] deer was one of the most common and valuable quadrupeds found in our forests, and upon its flesh were the first settlers of the state, to a very considerable degree, dependent for food....But notwithstanding all that has been done for their preservation, their numbers have been constantly diminishing...till they have become exceedingly scarce, except in a few of the most unsettled and woody sections.

Moose were formerly very plentiful...[but] are now exterminated from all portions of the state excepting the county of Essex....

The Wild Turkey, which was formerly common throughout our whole country, has every where diminished with the advancement of settlements, and is now become exceedingly rare in all parts of New England....

[Otters] were formerly very common...particularly along the streams which fall into Lake Champlain and Lake Memphremagog. Otter Creek derives its name from the great abundance of otter, which formerly inhabited its banks. They are now become scarce, but are occasionally taken at several places within the state.

The Salmon, formerly very plentiful in nearly all the large streams in this state, is now so exceedingly rare a visitant that I have not been able to obtain a specimen taken in our waters, from which to make a description for this work. They have entirely ceased to ascend our rivers, and only straggling individuals are now met with in Lake Champlain.

spruce seedling on nurse log by Heather Lenz

Publishing is a bit like sausage making; the consumer's enjoyment of the end product could well be diminished by being privy to the process. Thus it is usually a mistake (one I'm about to commit) for a journal editor to introduce an issue by discussing what wasn't included.

Readers will look in vain herein for detailed articles on public policy or specific wilderness campaigns. The spirited dialogue within the conservation movement on such topics as public lands logging, wildlife management, taxation, ecological reserves, carnivore recovery, endangered species, conservation easements, etc. are but quiet background music to our main theme. In this *Wild Earth*, we take a respite from those necessary debates to sit quietly among the trees, survey the spring wildflowers, and *celebrate*.

The progress of—and prospect for—wild forest recovery in the East is just cause for celebration. In the century and a half since Vermont's state naturalist, Zadock Thompson, described a denuded land mostly bereft of wildlife, the northeastern landscape has remarkably transformed. With the forest's return, many species have recovered. Beaver are ubiquitous. Deer are, in many places, overabundant. Moose populations are large and growing. Wild turkey are thriving. Otters are present in healthier watersheds.

This reforestation is, of course, mostly an accident of history. As it gained steam, the industrial revolution increasingly ran on water power and fossil fuel, not cordwood. Agricultural economies changed. The thin rocky soils of New England hill farms played out. Railroad expansion—bolstered by a brutal national policy of warfare against native tribes—allowed settlers to move west. Marginal farmlands were abandoned, and the trees returned.

While natural succession made possible the recovery of wildlife populations, that revival was aided by conservationist-sponsored game laws (including bag limits and an end to market hunting) and active restoration efforts for many species. Certainly, the progress is incomplete. Wolves and cougars, already diminished in Zadock Thompson's day, were finished off by a relentless anti-predator campaign. Atlantic salmon now teeter on the precipice of extinction. Across the East, historic and modern logging practices have inflicted grave wounds on the land. Some forest types, including the longleaf pine forests of the Southeast, are almost entirely gone. Southern Appalachian forests are plagued by air pollution. But the beavers, moose, and otters remind us that wild Nature is resilient, that natural processes melded with conservation action are a powerful—and hopeful—force.

The cynical reader may scoff at such hope, noting that growing human populations and burgeoning consumption of forest products bode poorly for expanded wilderness protection in the eastern United States. Just how likely is it that sprawling suburbs will be contained, that global market pressures will be resisted enough to build viable rural economies based on low-impact forestry and value-added manufacturing? Will governments ever find the political will to address industrial forest abuses such as clearcutting, herbicide spraying, plantations, whole-log exports, and the latest and possibly most dangerous threat to truly wild forests—genetic pollution from genetically engineered "supertrees"? Most important for shy and sensitive wildlife that can't abide (or will not thrive) in a humanized landscape, will we leave enough of the land to Nature's economy, allowing natural succession to proceed and recreate beautiful, structurally diverse, wild forests?

On many days, I'd concede to the cynics: chances are slim. But this time of year—with the snowbanks melting, when any day coltsfoot will be poking up through the mud (to be followed shortly by hepatica, bloodroot, and trillium)—is no season for pessimism. One warm spring night at dusk, I'll hear the first "peeent" from our resident woodcock and take a favorite book (Wendell Berry's *Collected Poems*) out on the porch to read aloud. Turning again to "Manifesto: The Mad Farmer Liberation Front," I'll take to heart the admonition to "Be joyful though you have considered all the facts." In the fading light, I'll ponder for a time that poem's final line:

Practice resurrection.

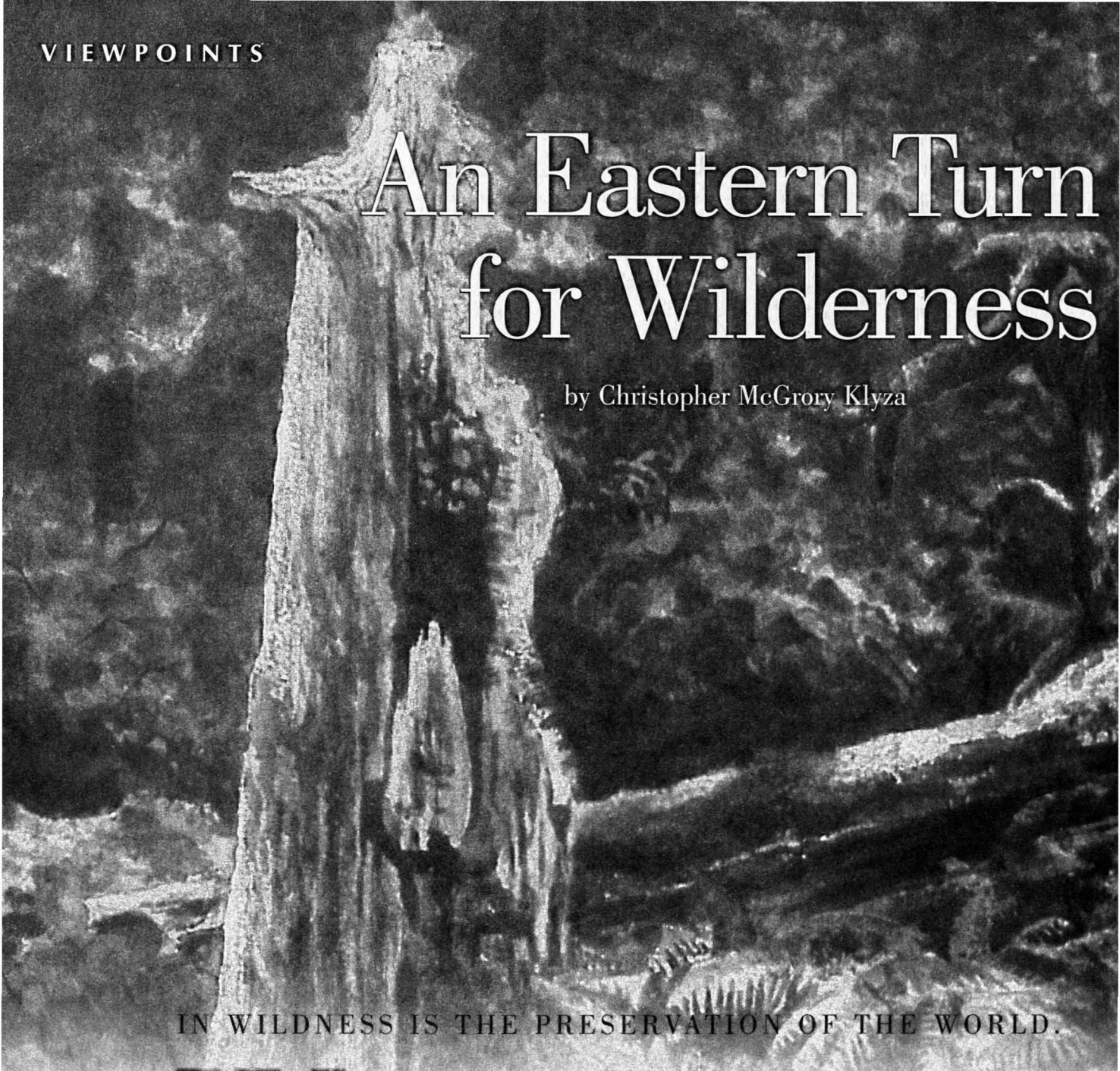
How could resurrection be *practiced*? The religious tradition of my youth taught that the resurrection comes by grace alone, regardless of human will or effort. Likewise, provided their seeds find purchase, the wildflowers rise of their own accord, the woodcocks and warblers return on their own schedule.

Maybe it is how we greet those products of grace—with indifference or affection—that joins human agency to Nature's blessings. To practice resurrection, perhaps, is to welcome grace and assist, whenever possible, in its flourishing. That is the challenge to all conservationists who love wild forests, west or east. Moreover, it is why in this *Wild Earth* we explore some of the ecological attributes of eastern forests—natural disturbance, the nature of the presettlement landscape, the prospects for cougar recovery, the extent of eastern old growth and how those relict tracts might be the seedbed of recovery for ancient forests across the East. To know a bit more about eastern forests may help us better imagine a wilder future for them. That knowledge, we can hope, is the forerunner of affection.

—TOM BUTLER

An Eastern Turn for Wilderness

by Christopher McGrory Klyza

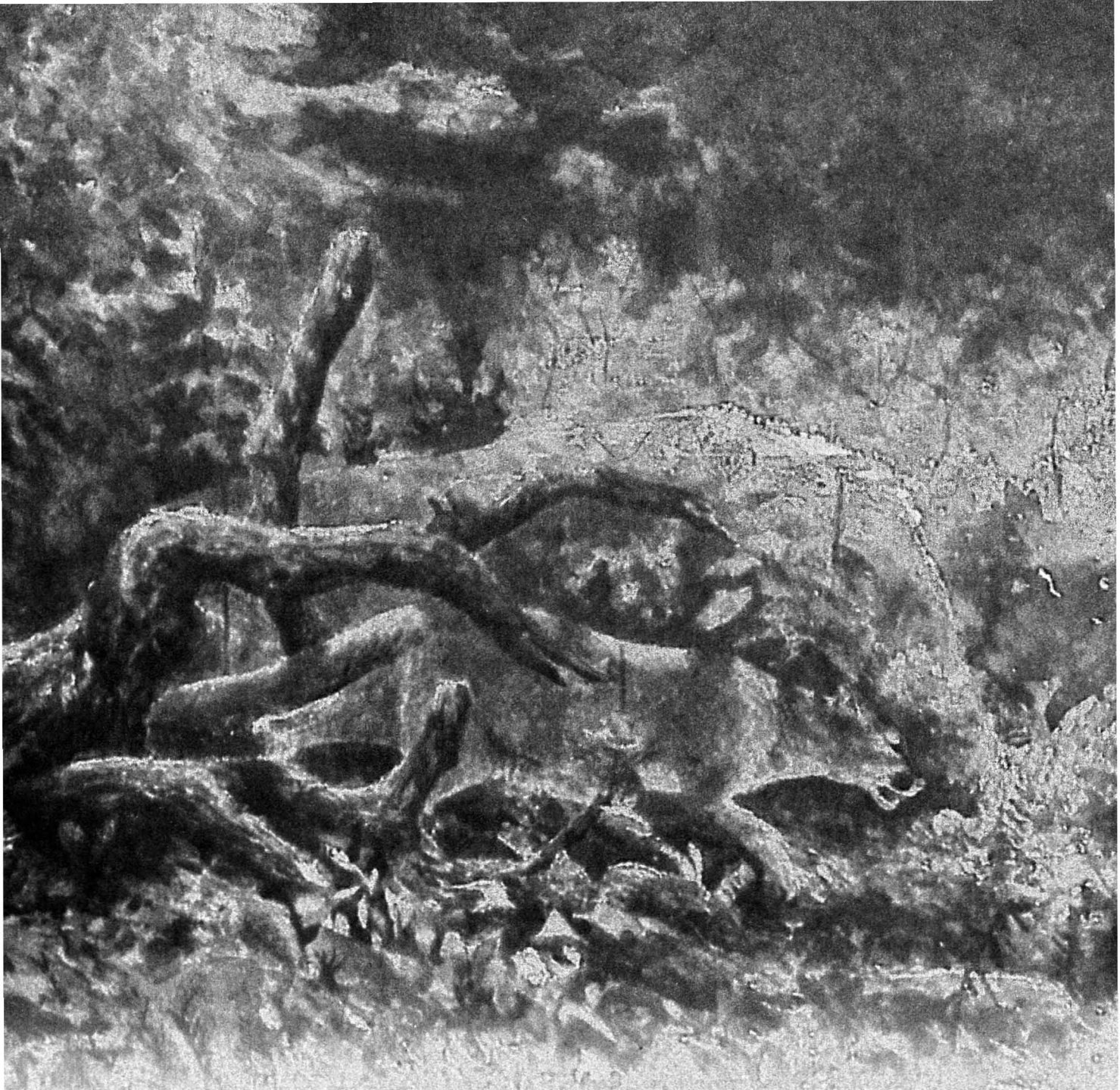


IN WILDNESS IS THE PRESERVATION OF THE WORLD.

With these words Henry David Thoreau began serious discussion about the place of wild lands in the American landscape. The wild that Thoreau writes of in his 1862 essay "Walking" is the western United States. Ever since Thoreau wrote these words—in the Northeast—American wilderness, in both theory and practice, has centered on the towering mountains, vast plains, and rich forests of the West. It is time, however, for Thoreau's native Northeast to make significant contributions to America's engagement with wilderness and the place of humans in Nature in general. Just as the forests and moose are returning to their homes in the landscape of the region, so too should the wilderness discussion return to the home of its first advocate and the country's first protected wilderness areas in the Adirondack and Catskill Mountains of New York.

My vision of northeastern wilderness is land that, although it may at one time have been significantly altered by human actions, has recovered its ecological integrity or has the potential to do so. It is land where natural processes dominate; where the influences of humans are minimized. There is no development, logging, mining, or use of mechanized vehicles on the land. It

illustration by Bob Ellis



is home to healthy populations of native species, including top-level predators. Northeastern wilderness areas would be primarily located on federal and state-owned lands, would be part of a connected regional and continental wild lands system, and would be embedded within a matrix of sustainably managed private lands.

This paradigm incorporates three core components: (1) The primary purpose of wilderness areas should be as ecological reserves for the survival of other species and the continuation of evolution. Although such wilderness areas may, as some critics argue, continue to segregate humans from Nature, such segregation is necessary until a transition to a more sustainable society occurs. Without these reserves, many species will go extinct. (2) The wilderness idea should be applied in temporally and spatially specific ways; that is, wilderness in Vermont, Alaska, and Indonesia may be implemented in different ways, just as wilderness in places relatively pristine today (Alaska) may be managed differently than in areas that have been greatly manipulated by humans yet are on their way to recovering their wildness (many areas in the northeastern United States). The com-

This article is adapted from the introductory chapter to the forthcoming book Wilderness Comes Home: Rewilding the Northeast *(edited by Christopher McGrory Klyza) to be published in spring 2001 by the University Press of New England (800-421-1561) and is used by permission.*

monality, of course, is that wilderness in every context is "self-willed" land, where natural forces prevail. (3) The wilderness idea and its supporters must be clearly and actively connected with those improving human management of nonwilderness land. The development of ecologically sustainable management schemes—in agriculture and forestry especially—must be fully connected to wilderness. This can help to reconnect humans with Nature, to make us better understand that islands of wilderness cannot survive unless the surrounding lands are better managed, and to demonstrate that wilderness proponents care greatly about the fate of humans as well as other species.

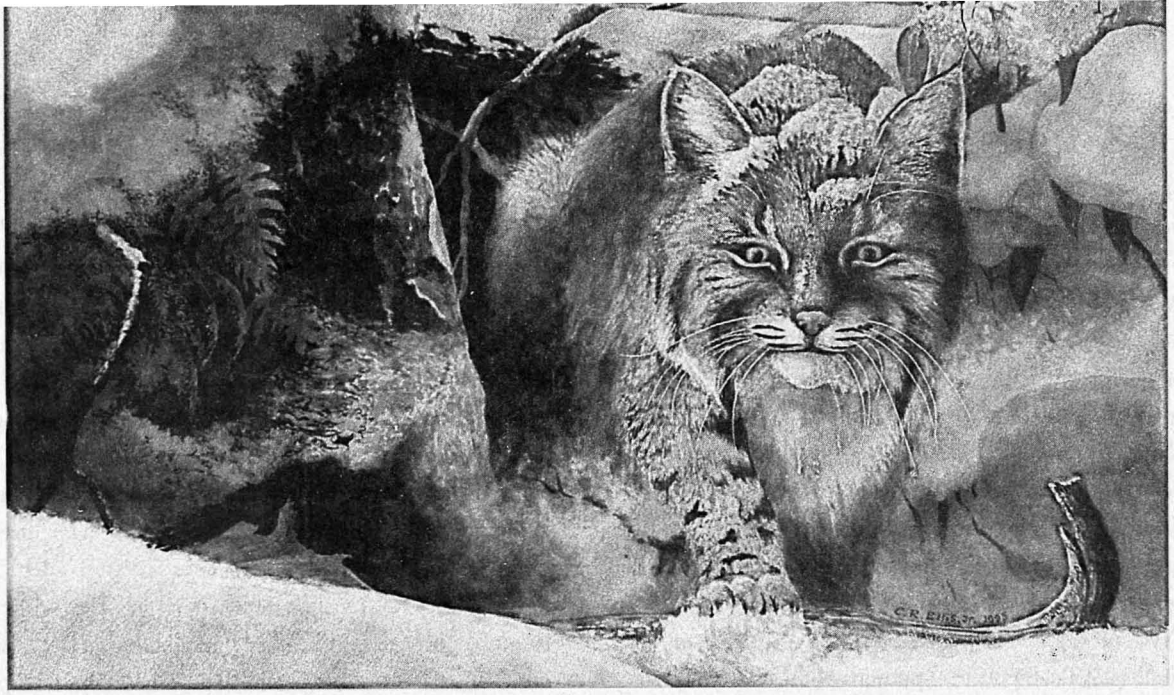
WILDERNESS, BIODIVERSITY, AND ECOLOGICAL RESERVES

Given the history of significant landscape disturbance in the Northeast, as well as the relative lack of public lands, can the ecological reserve design model of cores-connectivity-buffers be of any use in this region? The answer is an unqualified yes. In some ways, this reserve design system is even more important in the Northeast. Existing wilderness areas will serve as the first set of core reserves. Only in the Adirondacks, however, where New York State owns over 2.5 million acres of public lands protected as "forever wild" by article 14 of the state constitution, will existing wilderness land be anywhere close to sufficient for core reserves. Elsewhere, the logical choice is to examine all other public lands—state and federal—for their potential role as core reserves. State lands can play a major role, especially in New York and Pennsylvania, where each state manages millions of acres of public land. However, Pennsylvania and the other northeastern states need to establish wilderness programs for their lands. Since wilderness lands will not be managed for profit, it is unlikely that many private landowners would be willing to declare their lands as reserves. Furthermore, since the protection of biological diversity is a compelling public interest, it seems only logical that public lands should play the central role in its protection, restoration, and continuation. Existing public lands will need to be augmented, though, for they are distributed unevenly throughout the northeastern states and do not fully represent the region's natural communities.

The size of such cores will vary depending on the relevant natural community, target species, and disturbance regime. Some natural communities, such as cobble shores and talus woodlands, covered very small amounts of land at the time of European contact. Such communities typically are found in rare, localized settings, such as along rivers or at the base of cliffs. These natural communities can often be protected—and many already have been—through small public or private reserves. Although sometimes small in size, rare natural communities are crucial parts of the landscape, often home to significant biological diversity located only in these particular landscapes. At the other end of the continuum are the very large reserves, hundreds of thousands of acres in size. Such reserves are of primary importance for the restoration of large native mammals missing from all or parts of the Northeast, such as bison, elk, moose, and the top-level predators—mountain lions, timber wolves, wolverines. Such large reserves are also necessary for the establishment of expansive stretches of old-growth forest, which covered an estimated three-quarters of the pre-Columbian landscape. In such big reserves, plants and animals can interact and evolve relatively insulated from the major human activities that have wreaked havoc on their natural communities. The large size of such core reserves also ensures that these landscapes can withstand the natural disturbances that have traditionally affected the varying locales of the Northeast—disease, fire, hurricanes, insects, and windthrow.

For the buffers that surround the cores, the key is ensuring that the activities that occur within them are compatible with the mission of the cores—protecting and restoring biological diversity. Among the activities that could take place in these buffer areas are sustainable agriculture and forestry; low-intensity, nonmotorized recreation (such as cross-country skiing, fishing, hiking, and hunting); and either tightly clustered human settlements (such as traditional New England villages) or very low-density housing. One central component of all these uses is the need to limit habitat fragmentation. This means limiting road density, clearcuts, and subdivisions. Such buffer zones can be created most easily on public lands adjacent to, yet not suitable for, core wilderness reserves. Due to the lack of public lands in the Northeast, however, other lands will be necessary. A most promising avenue here is to work with land trusts that primarily have been protecting managed farmland and forestland in the region for decades. The land trusts purchase, or receive a donation of, conservation easements on land that stays in private ownership, and the conservation easements can be designed in a manner to achieve buffer land-management goals.

Once such reserve systems have been designed, they can be used to guide management of existing conservation lands and the purchase of future conservation lands, with priority going to core and connectivity lands. For areas already conserved that studies determine are crucial for cores or connectivity, management should be geared to eliminating roads, cutting trees only if necessary as part of a restoration plan, and managing exotic species as needed. Federal and state governments are constantly buying conservation lands, as are some nonprofit groups such



as The Nature Conservancy. Adopted reserve designs should serve as a guide to prioritizing land purchases for such groups. Furthermore, the vibrant land trusts of the Northeast should also follow such reserve designs to direct their acquisitions of easements—in some cases for cores and corridors, but in most cases for buffer areas. Such an approach has already been adopted in a number of places, most successfully to help guide land purchases for Florida Preservation 2000, a program begun in 1990 that has spent $3 billion to purchase well over one million acres of land for conservation and recreation purposes. In 1999, the state continued the program for another decade as Florida Forever, funded by an additional $3 billion.

In sum, wilderness designation in the Northeast should be driven by the needs of protecting and restoring biological diversity. Although this represents something of a change in the rationale for wilderness, it does not represent a change in what uses will and will not be allowed. Wilderness land should be "affected primarily by the forces of nature," with no roads, timber cutting, or human habitation. Wilderness cores and most connective corridors will be owned by federal and state governments. Buffer lands will include public lands, private lands protected by conservation easements, and other private lands managed in ecologically sensitive ways (such as green-certified timberlands or predator-friendly farms).

How much land will such a system entail? This will vary from place to place, and depend on how land is managed. Perhaps one-quarter of the landscape, perhaps one-half. We must remember, though, that assembling networks of wildlands will take many generations, and proposed reserve systems will provide an evolving conservation blueprint for hundreds of years to come. As a society we will make a big mistake if we get stuck today fighting about how many acres will be protected in 200 years. What is obvious is that we need to protect more land, and that we should get to work.

REWILDING AND RESTORATION IN THE NORTHEAST

As the idea of wilderness continues to evolve—to become more focused on enhancing, protecting, and restoring biological diversity—our applied definition of wilderness needs to become more sophisticated, complex, and contingent. More specifically, we need to develop more nuanced spatial and temporal understandings of wilderness. By spatial, I mean that wilderness in the East and Midwest—often wilderness in recovery—is something different from wilderness in the West, where there are large parts of the landscape that have been minimally affected by humans. By temporal, I mean that we need to understand more about what these landscapes looked like in the past in order to inform our thinking about wilderness today and into the future.

Since virtually the entire northeastern landscape has been significantly manipulated over the last few hundred years, wilderness of any kind in the Northeast is restored or rewilded wilderness. As soon as we begin to speak of restoration or rewilding, we need to specify what it is we are holding up as our model. What does it mean for the land to be restored? What has to return for land to be wild again? It is important at the outset to understand that we cannot restore the landscape to some pre-Columbian mythic climax forest in the Northeast. Such static climax forests really didn't exist; rather the landscape consisted of constantly shifting mosaics affected by natural disturbances and, in some places, anthropogenic disturbances. Furthermore, the activities of the colonists and their successors wrought mas-

illustration by Bob Ellis

sive changes to the land. Although we cannot return to a pre-Columbian landscape, taking stock of what that landscape was like provides us with a necessary benchmark for restoring wilderness. Even though we cannot produce a fine-grained portrait of the past, we can create a rough sketch of it.

Most significantly, although forests have returned to cover over two-thirds of the Northeast, and the tree species and the general boundaries of the major forest types are basically the same, the structure and composition of these recovering forests are significantly different from the pre-Columbian forests. The most pronounced change in the Northeast is the decline of beech, from more than 40 percent of the forest composition at sites in New York, Pennsylvania, and Vermont in 1800 to 5–13 percent in the 1960s. Significant portions of the other major terrestrial ecosystem type of the Northeast, wetlands, have been destroyed and continue to be altered. Scientists estimate that the area has lost over one-third of the wetlands present circa 1500, almost entirely due to human action.

As European settlement spread across the Northeast and beyond, the settlers affected wildlife in four basic ways:

1) The larger quadrupeds (e.g., deer, bear) disappeared due to habitat loss and overhunting.
2) The changes to the landscape favored open area and edge species (e.g., raccoon); forest interior species declined dramatically (e.g., pine marten).
3) The populations of many species of freshwater fish declined substantially due to water pollution, dams, overfishing, and the introduction of exotic species.
4) Exotic species accompanied the Europeans, both knowingly and unknowingly, establishing themselves throughout the region.

Gone forever from the Northeast are four species of birds (Carolina parakeet, great auk, Labrador duck, and passenger pigeon) and the silver trout, and potentially seven species of insects and three species of plants. A number of widely distributed vertebrate species are extirpated from the Northeast (Eskimo curlew, greater prairie chicken, mountain lion, timber wolf, wolverine, and woodland caribou). There are even more extirpations specific to states in the region (bison from New York and Pennsylvania; Henslow's sparrow from Connecticut and Rhode Island; lynx from Massachusetts, New York, Pennsylvania, and probably New Hampshire and Vermont; timber rattlesnake from Maine and Rhode Island; and a trout-perch from Massachusetts and New Jersey). A far larger number of invertebrates and plants are extirpated from the Northeast and the nine states individually. Northeastern states have lost one to five percent of their plant species (ranging from 131 plants believed to be extirpated from Pennsylvania to more than 50 in Massachusetts), most frequently those at the edge of their range or those confined to restricted habitats. Furthermore, it is likely that a number of species, especially invertebrates and plants, have disappeared that we don't know about.

With this sketch of the pre-Columbian natural landscape of the Northeast and the changes European settlement induced, some things become strikingly clear. Some species are lost forever. Passenger pigeons will never play their major ecological roles of transporting seeds and providing massive fertilization of the forest at their roosting sites. Gone, too, are the tremendous runs of native salmon and shad throughout the region, along with their significant ecological effects. The top tier predators, though not globally extinct, are absent from the region.

Nevertheless, substantial restoration—both active and passive—has already taken place in the Northeast over the last one hundred years. Thoreau wrote in 1856 that "when I consider that the nobler animals have been exterminated here,—the cougar, panther, lynx, wolverene [sic], wolf, bear, moose, deer, the beaver, the turkey, etc., etc., —I cannot but feel as if I lived in a tamed, and, as it were, emasculated country." Since that time, deer, turkey, and beaver have returned, flourishing in much of their former range; moose are recolonizing their range throughout New England and New York; and bear populations are stable throughout the region. It is only the large predators—the cougar, the wolverine, the wolf, and, in all but small pockets of Maine, the lynx—that are still missing from Thoreau's list. Much of this restoration has been passive rather than active. As Bill McKibben writes, "So far we can claim neither humility nor wisdom; our good fortune is mostly accidental." It has been changes in our economy and society that have allowed for the return of the forests of the Northeast and the creatures that live there.

We now need to think more consciously about this landscape's return to ecological health and how we can aid in it. Our goal should not be to eliminate any traces of past human use in the recovering wilderness of the Northeast—this is impossible. Instead, our goal should be to restore the primacy of natural forces to a particular landscape and to favor the flourishing of native plants and animals. Mostly, in those places we designate as wilderness, we need to let the land rewild, to let natural processes dominate the land—natural disturbances, species interaction (including predation), and the development of old-growth forests. There are at least two issues, however, that require the discussion of more active human involvement. First, for certain small, rare ecosystems, human management may be necessary, in the form of prescribed burns or removing exotic species, in order to protect

particular native species and natural communities. Second, and an issue of much larger consequence, what do we do about the absence of locally and regionally extirpated animals?

It seems clear that the Northeast will not be healthy or whole without the return of its top-level predators—the mountain lion, the timber wolf, and the wolverine. The deer and beaver are back, but without their predators they are wreaking ecological havoc in many places. A fundamental question is how these predators might return. Although sightings of mountain lions are increasingly common in the Adirondacks and northern New England, it is unlikely that a viable breeding population remains in the Northeast or eastern Canada. The nearest significant populations are in the Black Hills of South Dakota and the Florida Everglades. Hence, it's not likely that mountain lions will return to the Northeast on their own. The same is true for wolverines; the closest populations are in far northern Quebec and Labrador. Wolves, on the other hand, are abundant in Ontario and Quebec and have the capability to disperse naturally to northern New England and the Adirondacks. Reintroduction—trapping animals and releasing them elsewhere—is an extremely active form of human management. Such reintroductions, at the least, lead to trauma for the individual animals. Many reintroductions fail (roughly one-third), and the animals die. Reintroductions in the Northeast have been quite successful for beaver, deer, fisher, peregrine falcon, and wild turkey. They have been unsuccessful for caribou in Maine, elk in New Hampshire, and lynx in New York. In the western United States, wolf reintroduction has been spectacularly successful in Greater Yellowstone and central Idaho. Ongoing reintroduction projects, such as the wolf in Arizona and New Mexico and the lynx in Colorado, have been much more problematic. The reasons for the failure of reintroductions are complex; some are primarily social (e.g., humans killing released wolves because they don't want them back), some are primarily biological (e.g., inadequate habitat or prey base). What is clear is that the reintroduction of any extirpated species should not be done without significant study and preparation.

Rewilding and restoration in the northeastern landscape, then, should proceed through a series of steps. We should work to make sure that the rewilding that has occurred by good fortune is allowed to continue. This means protecting more land. On this land, we should favor natural processes as much as possible, even though we know that this will not return the landscape precisely to its pre-Columbian composition and structure. A rewilded landscape might look significantly different from the landscape of 1500; but it will be a wild landscape, home to wild creatures, a place for evolution to continue its unending journey relatively free from human constraints. We should strategically protect land for cores and connectivity as the keys for rewilding. And, finally, when biological and social conditions are fitting, we should reintroduce those species missing from the region. The mountain lion, the wolf, the wolverine—when these natives return to the Northeast, wilderness will have finally come home. It might be decades before they are thriving here again. But we mustn't rush. Just like building a wilderness ecological reserve system, this process will take generations, as it took us generations to fundamentally alter this landscape. Too often we expect results immediately; our vision is five, ten, perhaps twenty years. Our vision must be lengthened. We must learn patience and the ability to view events from the perspective of centuries. We must learn to think like mountains. Over time, even though we may still cross stone walls and see the scars on trees along old skid trails in the restored wilderness of the Northeast, these lands will meet the standards of the legal definition of wilderness in a very meaningful sense; they will be places "affected primarily by the forces of nature."

CONCLUSION

Creating a system of connected wilderness reserves in the Northeast and embedding such a system in a landscape of sustainably managed farmland and forestland may seem a radical proposal at the beginning of the twenty-first century. Yet, paradoxically, in many ways the proposal is conservative. It is about conserving Nature, about conserving ways of living on the land, and about conserving a meaningful, balanced way of life for humans in a natural setting. In the rewilded landscapes of the Northeast, a model for healthier human and natural communities applicable to wide areas of the globe can arise. The Northeast is a place where people have greatly modified Nature and that has a relatively large human population. Nevertheless, thanks to a resilient natural world, the contingencies of history, and some wise policy decisions, significant recovery has occurred. We need to act to protect these positive changes, and to make sure they can continue to unfold. ☾

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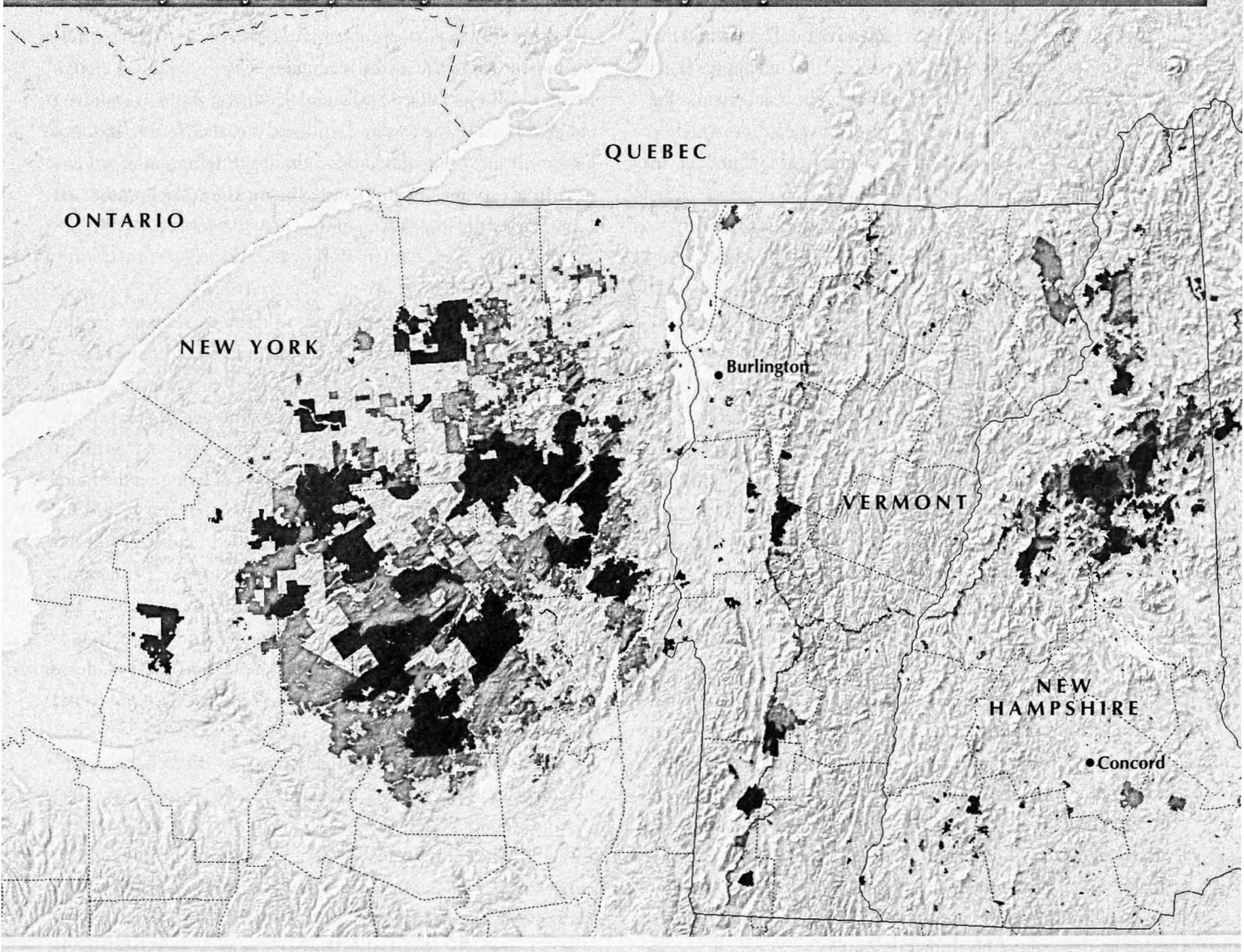
How Much Protected Land Do We Have in the Northern Forest?

by Nancy Smith and Emily Bateson

Some day—maybe in your day—there won't be any really wild areas left. —PERCIVAL BAXTER[1]

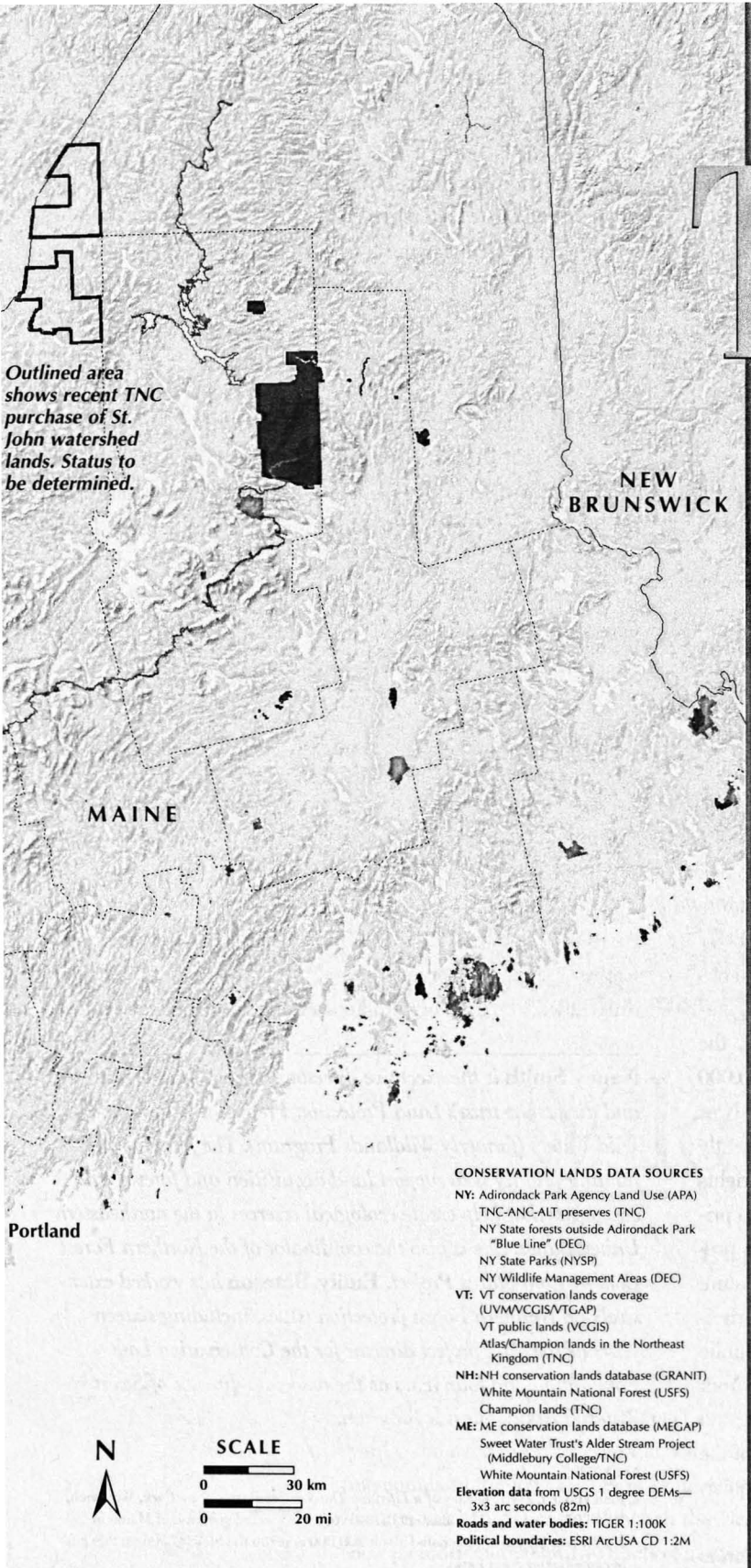


STATUS 1 A parcel totally protected from conversion of natural land cover, with a mandate and management plan to maintain land in a natural state (e.g., federal or state wilderness areas, TNC preserves). Natural processes are allowed to proceed without interference or are mimicked through management practices.

STATUS 2 A parcel totally protected from conversion of natural land cover, with a management plan to maintain a primarily natural state, but where some uses (recreation, light forestry) or suppression of natural processes may degrade the quality of existing natural communities (e.g., state parks managed for recreation, Acadia National Park).

STATUS 3 (not shown on map) A parcel protected from conversion of natural cover for more than 50% of area, but subject to extractive uses such as logging or mining (e.g, public lands subject to commercial logging, private timberlands under conservation easement that prohibits development).

Map produced by Dan Morse, The Nature Conservancy–Eastern Conservation Science GIS 3/01.



STATUS 4 (not shown on map)
A parcel with more than 50% of area planned for or in use for agriculture or as "open space" for active recreation purposes (e.g., ball fields, golf courses). Natural processes are altered or replaced by human use and management of land.

Sweet Water Trust

The Nature Conservancy®

To assess the status and progress of conservation efforts, it is important to understand that many maps of "protected" or "conserved" lands do not distinguish between commercial farms with attached conservation easements that prohibit development, managed timberlands in public or private ownership, ecological preserves, or federal or state wilderness areas—even though the levels of biological conservation vary dramatically. Often maps demarcate all municipal and state land as "open space" even when the site is a landfill, golf course, or apt to be sold by a town for revenue. Most give no indication of the ecological attributes of the land or whether maintaining natural habitat is a management goal.

In 1998, Sweet Water Trust, a Massachusetts-based foundation focused on biodiversity and wilderness protection, asked The Nature Conservancy (TNC) to analyze extensive existing data in order to create a map of the Northern Forest region showing not only what lands have been conserved but also how such conserved lands are being managed. The first draft depicted four different management status categories: wilderness (Status 1), primarily natural lands (Status 2), timberlands (Status 3), and lands without restrictions on conversion of natural habitat type or those where natural cover type has been removed (Status 4).

The most recent version of this regional map—shown here—highlights parcels protected primarily for habitat values (Status 1 and 2 lands). As always, a picture is worth a thousand words. The map is remarkably blank, particularly in the state of Maine. With the lowest percentage of public land in the Northeast at five percent, Maine has less than one percent protected wilderness lands.[2] It is at once the wildest and least protected state in the Northeast.

Examination of this map shows that the landscape-level wildlands successes of Northern Forest conservation are—so far—on public lands. The federal public lands of the Green Mountain and White Mountain National Forests afford some high-quality protection (particularly the congressionally designated wilderness areas), and nearly half of

This article is adapted and updated from the authors' chapter "Making It Happen: Protecting Wilderness on the Ground" from the forthcoming book Wilderness Comes Home: Rewilding the Northeast *(University Press of New England, 800-421-1561).*

Funded with a grant from Sweet Water Trust.

New York's six-million-acre Adirondack Park is protected as "forever wild" by a provision in the state constitution that was enacted in 1894 to stop logging abuses in the Adirondack and Catskill mountains. In Maine, the 200,000-acre Baxter State Park is the legacy of one determined and generous man: Governor Percival Baxter, who, after leaving office, purchased 6,000 acres around Mt. Katahdin which he then gave to the state for a public park. From that initial purchase in 1930 until the early 1960s, Baxter steadily added to the protected acreage. Today, activists and conservationists continue working to expand and defend these areas from management activity that would degrade wilderness qualities.

It is worth noting that most of these protected public lands were purchased after intensive logging. While they may still lack some of the ecological characteristics of old-growth forests, they are areas of great beauty, healed or healing from earlier abuses, a testament to the resilience of our lands, waters, and wildlife. Yet clearly, ongoing campaigns focused on expanding and better protecting these pivotal public lands are important for the land's continued recovery.

The Northern Forest map also shows some encouraging recent acquisitions by conservation groups. In 1998, The Nature Conservancy acquired a mix of full and partial interests in 220,000 acres along the St. John River in northern Maine and has launched a scientific process to determine the ultimate configuration and management scheme for this project. In 1999, the Conservation Fund completed its purchase of nearly 300,000 acres of land owned by Champion International in New Hampshire, Vermont, and New York.[3] The Fund subsequently resold the land: about 208,000 acres (with development rights removed and public recreational access guaranteed) went to private logging companies; about 10,500 acres will become a preserve managed by the New Hampshire chapter of The Nature Conservancy; and the remainder was transferred to public ownership. Management planning on the new federal and state public lands—roughly 77,000 acres in total, divided between New York and Vermont—is underway, and only time will tell how much, and which shade of green will be added to the map as a result of the Champion deal, as well as the St. John, and other recent acquisitions in the Northern Forest by TNC and other land trusts.

The map also suggests the extent to which conservation is located in mountainous terrain. Although protecting mountaintops traditionally allowed an uneasy truce between recreation and logging, this strategy has left many natural communities and species unprotected. Conservation science tells us we need to protect a full complement of community types and species along an elevational gradient, in areas large enough to be ecologically meaningful given migration, natural disturbance, climate change, and other factors.

In many mountainous places that have been studied to understand how species richness varies according to elevation, a biased pattern of habitat protection has been confirmed. This pattern—of conservation in high elevations, resource extraction in mid-elevations, and high-density human development and habitat fragmentation in low elevations—is particularly well documented in the western United States.[4] Too often, conservation has been predicated on economic expediency—and fertile valleys are good for growing crops, trees, highways, and houses. However, lower elevations have the greatest concentrations of biological diversity that remain unprotected. Clearly, we need to increase our land conservation efforts in these lower elevations, focusing on biologically significant and unfragmented habitats first.

Ecological information and mapping can and must inform land protection strategy—and conservation science should play a far more dominant role as we work to put more shading on the map, thus protecting biodiversity and restoring real, tangible wilderness on the ground. ☾

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NOTES

1. John Hakola, 1981, *Legacy of a Lifetime: The Story of Baxter State Park*, Woolwich, ME: TBW Books, p. 117. Baxter (1876–1969) was elected governor of Maine in 1920. Over 32 years he donated about 200,000 acres to the State of Maine; this gift became Baxter State Park.
2. Categorizing Maine's public lands into the top three status categories revealed that the state has approximately 5.12 percent public land in total, with less than two percent in Status 1 and 2 combined, and just less than one percent in Status 1 "wilderness" lands. Numbers provided by Dan Morse of the GIS Office, Eastern Conservation Science of the Eastern Resource Office of The Nature Conservancy, Boston, MA from regional GIS data (see sources for map).
3. Press release of the Conservation Fund, December 9, 1998.
4. Reed F. Noss and Allen Cooperrider, 1994, *Saving Nature's Legacy: Protecting and Restoring Biodiversity*, Washington DC: Island Press, p. 174.

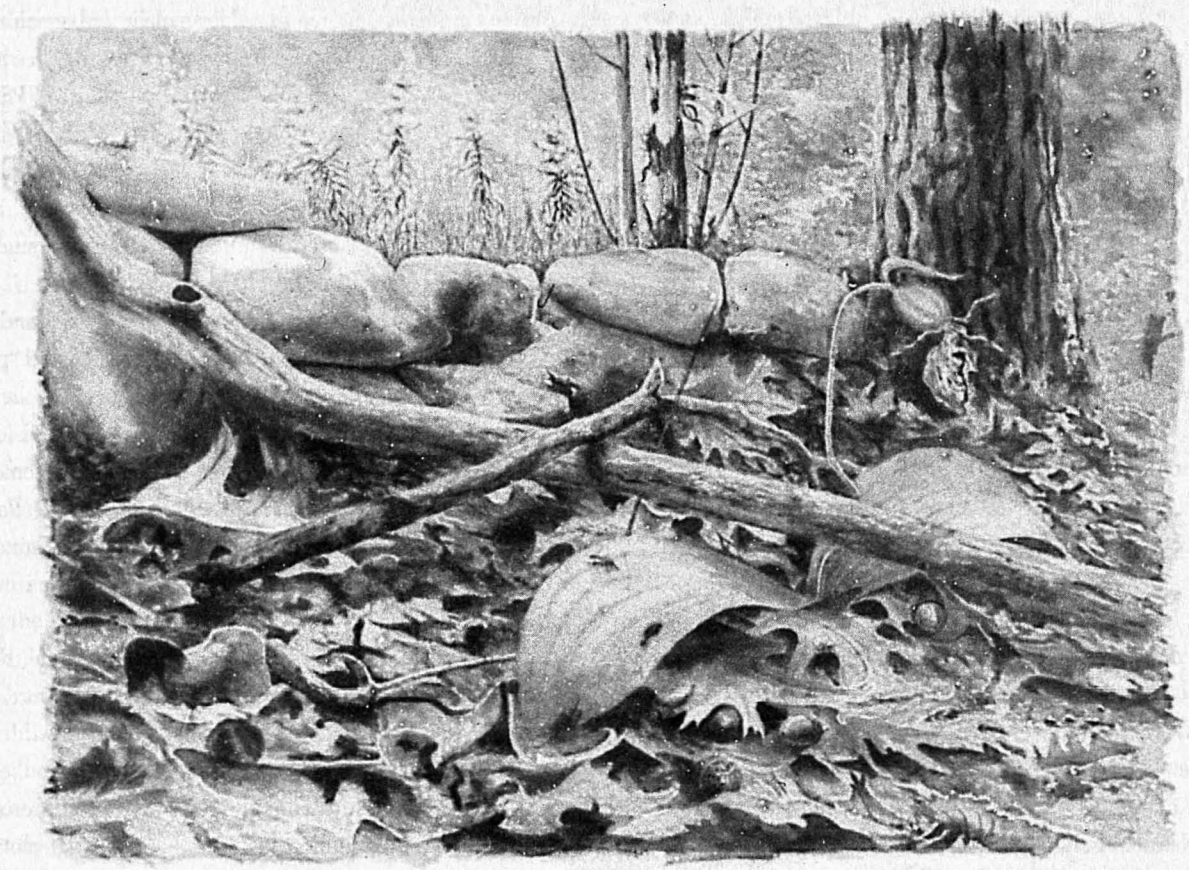

illustration by Bob Ellis

Wilderness East
Reclaiming History

by James Morton Turner

East of the Mississippi, wilderness isn't always what it seems. Century-old logging tools, graveyards, and even unexploded ordnance from World War II training maneuvers stand as rusty memorials to the long history of human use that has shaped the geography and ecology of eastern wilderness areas. Although the National Wilderness Preservation System (NWPS) now includes more than 130 tracts of land in the East, in the early 1970s the prospect of additional wilderness in the eastern national forests became a point of contention in national wilderness politics. According to the Forest Service, eastern lands, no matter how wild, fell outside the scope of the NWPS because they had been spoiled by a history of human use. The Forest Service's late-1960s wilderness policies, derided as the "purity" standards by conservationists, shored up a romantic conception of pristine Nature that threatened to limit the wilderness system to only the most remote lands of the American West. Wilderness advo-

cates, envisioning a broader system that included larger tracts of land in the West and restored lands in the East, worked to build the NWPS on a pragmatic philosophy of wilderness preservation and restoration, rather than the idealized (and limiting) tenets of the Forest Service's purity standards. Thus, in the early 1970s, even though millions of acres of wilderness lay at stake in the West, the struggle over tens of thousands of acres on national forests in the East emerged as a critical juncture in the first decade of the National Wilderness Preservation System.

IN 1964, WHEN CONGRESS PASSED THE WILDERNESS ACT, IT bestowed upon the wilderness advocacy community and the federal land agencies a complex set of tools to build a national system of wilderness areas. For eight years, Congress had riffled through the draft legislation, adding sentences, deleting phrases, and changing words, before finally making law a seven-page statute laced with ambiguity.[1] In the following decade, the federal land agencies, the courts, and local and national wilderness advocates focused on particular sections, sentences, and words in the Wilderness Act that helped them assemble various (and at times contradictory) understandings of the law. While a National Wilderness Preservation System remained the unifying goal of the Wilderness Act, sharp differences emerged in how the Department of Agriculture (Forest Service), Department of Interior (National Park Service, Fish and Wildlife Service), and wilderness activists interpreted the act's mandate. With each proposed wilderness, or lack of a proposal, the range of interpretation seemed to grow, leaving millions of acres of potential wilderness at stake. These controversies in the 1960s helped set the stage for the early-1970s eastern wilderness debate.[2]

The debate began with the Forest Service's interpretation of the Wilderness Act; the act had immediate implications for the agency, which had a tradition of administrative wilderness designation. Since 1929, the Forest Service had administratively protected some lands as *primitive,* and since 1939, more land as *wild, wilderness,* or *canoe.*[3] Congress prescribed immediate wilderness protection for the 9.1 million acres of land classified as wild, wilderness, and canoe areas. The act also required the Forest Service to review the 5.5 million acres of western primitive areas for wilderness potential over the following decade, completing one-third of the review every three years. While the management and review of these 15 million acres of already protected lands would spark some controversy, the most vexing ambiguity in the act centered on the future of 55 million additional acres of roadless areas in the national forests (and an undetermined acreage on Bureau of Land Management holdings). On this point, the Wilderness Act was mute.[4]

Faced with the immediacy of the Wilderness Act, Richard Costley, the Forest Service's Director of Recreation, assembled an administrative task force to render a clear and concise set of rules, based on the Wilderness Act, for the Forest Service regional offices to use in managing and implementing the NWPS. After nine weeks, the task force produced draft guidelines, and, as Costley remembers, "the wilderness 'debate' started all over again."[5] The task force had chosen a narrow set of tools from the Wilderness Act—it focused on phrases like "untrammeled by man," "retaining its primeval character and influence," and a minimum size of 5,000 acres that encouraged a strict and limited implementation of the act.[6] These rules, dubbed the "purity" standards by conservationists, became Forest Service policy after a nine-month review. The purity standards set forth a vision of a pristine wilderness system, permitting minimal management for fire, insect, or disease; no primitive recreation facilities; and no motorized craft, except in emergencies. As Costley explained, the task force had no interest in "half-baked" wilderness; it wanted "uncompromised wilderness."[7]

Concern over the purity standards mounted in the late 1960s. According to the Forest Service's task force, the Wilderness Act articulated a single definition for wilderness. Therefore, potential wilderness areas had to be held to the same strict guidelines by which existing wilderness areas were managed.[8] Any history of human use, whether logging, motorized recreation, or insect control, would disqualify an area from consideration. The task force claimed that only strict guidelines, for both designation and management, could guarantee the long-term integrity of the wilderness system. Conservationists, however, soon began criticizing this narrow interpretation of the Wilderness Act, arguing that the purity standards misconstrued Congress's intent and limited the potential scope of the NWPS.[9] These purity standards would emerge as the fulcrum of the eastern wilderness debate.[10]

In the late 1960s, wilderness advocacy groups followed slightly different interpretations of the Wilderness Act; representatives of the Sierra Club, Izaak Walton League, and National Wildlife Federation continued to support the Forest Service's purity standards, to various degrees, into the 1970s.[11] Other advocates—particularly those at The Wilderness Society who had been involved in drafting the Wilderness Act—eschewed the act's most limiting clauses, and focused on broader descriptions such as "*generally* appears to have been affected primarily by the forces of nature," "has five thousand acres of land *or* is of sufficient size," and "national forest lands *predominantly* of wilderness value" (emphasis added).[12] Cast in this light, the Wilderness Act framed a system that could

include wild lands of varying degrees of integrity, while managing all designated wilderness lands under the strictest regulations.

Between 1964 and 1971, Congress added thirty wilderness areas to the National Wilderness Preservation System.[13] Each new wilderness meant more than just acres saved; each area also marked wilderness advocates' growing proficiency in using the tools of the Wilderness Act, like skilled carpenters, to erect an expansive system of federal wilderness areas. As former Wilderness Society lobbyist Doug Scott recalls, "we beat up the agencies, we went above their heads, we even kidnapped [wilderness] proposals in the White House."[14]

In the late 1960s, as the national wilderness groups sorted through the Wilderness Act, local organizations also began to take advantage of the act's legislative tools.[15] Rupert Cutler, a Wilderness Society lobbyist in the mid-1960s, remembers splitting his time between Washington, DC and small towns in North Carolina and Tennessee, working both in the halls of Congress and in the living rooms of local conservationists to organize wilderness proposals.[16] Doug Scott explains, "We had this messianic, evangelical approach" to wilderness politics—"we had to go out and organize."[17] Depending on the local organization's immediate goals and which national organizations it worked with, these regional groups added to the confusion over the wilderness system's potential scope. Conservationists such as Cecil Garland from Montana, Mary Burks in Alabama, and others agitated for protecting the *de facto* wilderness areas in their states. These local advocates, working with the national organizations, helped draw attention to the *de facto* wilderness areas issue, arguing that the Wilderness Act might contain the tools necessary to protect portions of the 55 million acres of Forest Service roadless areas not explicitly covered by the Wilderness Act. These *de facto* wilderness areas, largely unlogged and unprotected, included vast tracts of western lands, such as the Lincoln-Scapegoat in Montana, as well as numerous eastern tracts, such as the Pemigewasset in New Hampshire, the Dolly Sods in West Virginia, and the Sipsey in Alabama, which shared a long history of human use.

By the late 1960s, many of the sharpest disagreements over the Wilderness Act began to coalesce around the issue of *de facto* wilderness. Several events between 1967 and 1971 helped accelerate the debate. Since 1963, the Montana Wilderness Association had lobbied the national wilderness organizations, the Forest Service, and Congress to protect the Lincoln-Scapegoat roadless area. In 1969, the Senate passed the Lincoln-Scapegoat wilderness bill over strident Forest Service opposition. After a two-year delay, the House also approved the Lincoln-Scapegoat wilderness in 1971, making it the first addition of *de facto* wilderness to the NWPS.[18] Another event in 1969 influenced the debate: a Colorado judge issued an injunction against the Forest Service, halting a timber sale on a roadless area adjacent to the Gore Range-Eagle's Nest primitive area. When the Forest Service lost the appeal in 1970, the court decision signaled the Wilderness Act's long-term implications for management of *de facto* lands.[19] Finally, passage of the National Environmental Policy Act (NEPA) in 1970 further limited the Forest Service's autonomy over *de facto* areas. Between these court cases, wilderness advocates' agitation, and congressional legislation, the Forest Service began to reassess its *de facto* land policies in the early 1970s. Under the leadership of Associate Chief John McGuire, the Forest Service decided to initiate a systematic review of *de facto* lands systemwide: the Roadless Area Review and Evaluation (later referred to as "RARE I"). And as the agency embarked on an evaluation that threatened to reveal millions of acres of potential new wilderness, the Forest Service's best tool for limiting the eventual scope of the National Wilderness Preservation System was its controversial purity standards, in place since 1965.

ALL OF THESE DECISIONS ON *DE FACTO* AREAS, COMING IN rapid succession in the late 1960s and early 1970s, sparked much confusion within the wilderness advocacy community. When the Sierra Club convened the 12th Biennial Wilderness

photograph by Pete Guenther

Conference in the fall of 1971, some participants arrived at the conference questioning their collective progress and the fate of *de facto* areas. Concern over the prospective scope of the national wilderness system, the overall pace of wilderness protection, and the possibility of parallel systems of protected wild lands all attracted debate at the conference.[20] Michael McCloskey, then the Sierra Club's executive director and a strong supporter of wilderness, even went so far as to question the Wilderness Act itself. McCloskey noted that two-thirds of the act's initial ten-year review period had passed, but Congress had added only 1.3 million of 66 million potential acres of wilderness to the NWPS, not to mention the 55 million acres of *de facto* wilderness then on the horizon. "It is apparent that the deadlines of the Wilderness Act will not be met," McCloskey warned. He further argued that without presidential intervention, "Our only option is to try to amend the Wilderness Act itself."[21] Amidst the disagreement and confusion of the early 1970s, for some wilderness advocates, not even the Wilderness Act seemed ironclad.

Within this context, wilderness on eastern national forests emerged as a key issue at the Biennial Conference. Since the mid-1960s, eastern conservationists had been calling on the Forest Service to consider wilderness areas up and down the Appalachians. At the conference, however, Associate Chief McGuire announced that "the areas with wilderness characteristics as defined in the Wilderness Act are virtually all in the West."[22] Despite the precedent offered by the act itself (which included three eastern wilderness areas in the original 9.1 million acres of the NWPS) and wilderness designations for eastern national wildlife refuges in 1968 and 1970, McGuire explained that the Forest Service's purity standards disqualified virtually all lands east of the Mississippi.[23] After seven years of consistently opposing local citizen proposals for wilderness areas on eastern national forests, McGuire's announcement marked the culmination of the Forest Service's fight for its narrow interpretation of the Wilderness Act. As would become apparent in congressional hearings in 1972 and 1973, the Forest Service stood by its purity standards in the East, fully aware that it could use the same standards to keep *de facto* wilderness in the West out of the National Wilderness Preservation System. Seeing the larger implications, the *New York Times* editorialized, "lack of protection for Eastern wilderness areas is only part of a broader failure to defend the nation's wilderness heritage."[24] Before long, an observer in *American Forests* noted, "The sound and fury about wilderness has begun [again]—this time in the East."[25]

The fight over wilderness on national forests in the East played out in the legislative arena between 1972 and 1975. Two proposals dominated the debate: the Forest Service's Wild Areas legislation and The Wilderness Society's alternative Eastern Wilderness Areas legislation. Fearing the growing momentum of citizen wilderness proposals on eastern national forests, the Forest Service jump-started the legislative process when it began championing an eastern system of "wild areas" after the Biennial Conference.[26] In 1972, Senators George Aiken (R-VT) and Herman Talmadge (D-GA) introduced the "National Forests Wild Areas Act of 1972," which had been drafted by the Forest Service, with the support of some representatives of the Izaak Walton League and the Sierra Club.[27] As the senators explained in *American Forests*, "Throughout our national forest system, nature is mending her skirts and reclaiming the primitive elegance that was once hers before the ravages of men took their toll."[28] The Wild Areas legislation followed the broad contours of the Wilderness Act, promising permanent protection for the "natural, primitive, and wild character" of the designated lands, while making them available for "primitive recreation opportunities in a spacious, scenic, and natural and wild setting removed from activities and highly developed works of man...." The Wild Areas legislation differed sharply from the Wilderness Act on two key points. First, it specifically acknowledged, "Few areas of the national forest system located in the Eastern United States...meet the criteria set forth for wilderness by the Wilderness Act of 1964 because of the past works of man...."[29] Second, it delegated jurisdiction over Wild Areas to the Senate Committee on Agriculture and Forestry, contravening the Senate Committee on Interior and Insular Affairs' usual responsibility for wilderness legislation.[30]

The fight over wilderness on national forests in the East played out in the legislative arena between 1972 and 1975. Two proposals dominated the debate: the Forest Service's Wild Areas legislation and The Wilderness Society's alternative Eastern Wilderness Areas legislation.

According to those wilderness proponents who helped draft the Wild Areas legislation, the proposed system offered greater protection than the Wilderness Act itself: it withdrew lands completely from mining and grazing, abolished the perceived 5,000-acre minimum size (a minimum not actually written into the act), and permitted condemnation of private inholdings. In arguing for Wild Areas, it became apparent that some wilderness advo-

cates continued to follow the Forest Service's narrow interpretation, envisioning a strict and pure standard for the NWPS.[31] Joseph Penfold, of the Izaak Walton League, explained that the Wilderness Act protected "wilderness as a natural ecosystem, untrammeled by man *in the past* and permitted to continue untrammeled and undisturbed by man's activities *in the future.*" Penfold worried that if Congress added second-growth eastern wildernesses to the system, "in the long run [they would] threaten the integrity of all designated wilderness."[32] Thus, Penfold made the Forest Service's argument for the agency: establishing Wild Areas in the East promised to shore up the National Wilderness Preservation System in the West.

At committee hearings in July 1972, Senator Aiken—the senior senator from Vermont and a strong proponent of eastern wilderness—warned that the sharpest opposition to Wild Areas would come from those "interested in developing and operating the resources of the various areas which might be chosen."[33] Despite Aiken's interest in eastern wild lands protection, on this point, he misjudged the debate. The most vehement opposition to the Wild Areas legislation emerged from within the wilderness community itself. As Doug Scott explains, "From day one, we viewed Wild Areas east legislation as something we had to kill."[34] Conservationists from The Wilderness Society, Friends of the Earth, Sierra Club, Appalachian Mountain Club, and others all pointed out that the Wild Areas legislation hinged on the Forest Service's consistent misinterpretation of the Wilderness Act. William Futrell, a member of the Sierra Club's Board of Directors from Alabama, stated the case clearly: "The US Forest Service has its own standard of what is wilderness. That standard is virgin land. It is our position that the Forest Service has misunderstood the Wilderness Act."[35] George Alderson, Washington representative of Friends of the Earth, called the Wild Areas legislation nothing more than "an anti-wilderness bill, which would undermine the Wilderness Act of 1964."[36]

Wilderness Society staffers, including Ernie Dickerman and Doug Scott, and colleagues from Friends of the Earth formed the vanguard in the fight against the Wild Areas legislation.[37] Immediately after Aiken introduced Wild Areas legislation in early 1972, Dickerman and Scott gathered together eleven eastern wilderness area proposals, all developed by local citizen groups, into an single omnibus wilderness bill. The bipartisan leadership of the Interior Committees in both the House and Senate introduced the Eastern Wilderness Areas Act, offering an alternative to the Wild Areas legislation. Many wilderness groups quickly rallied to this Eastern Wilderness Areas Act, referring to it repeatedly in the July hearings on the proposed Wild Areas legislation. But throughout 1972, The Wilderness Society and Friends of the Earth faced the challenge of lobbying other conservationists, trying to help unify the wilderness community around a single approach to eastern wilderness. Toward this end, The Wilderness Society invited a group of 23 citizen wilderness leaders from eastern and midwestern states to an off-the-record conference in Knoxville, Tennessee in December, 1972. For two days, The Wilderness Society and Friends of the Earth representatives laid out the implications of the Wild Areas legislation: it sanctified the purity standards, bifurcated the National Wilderness Preservation System, and threatened significant parts of the 55 million acres of *de facto* wilderness on the national forests.[38] As Doug Scott remembers, he, Dickerman, and Alderson were trying to pull groups "back from the Forest Service's unholy coalition."[39]

The debate over eastern wild lands gained momentum in early 1973. Late in 1972, the Wild Areas legislation had passed the Senate without any debate and then died when Congress adjourned.[40] In January 1973, the Forest Service released the Roadless Area Review and Evaluation report, which included only two prospective eastern wilderness areas—reinforcing the Forest Service's dogmatic purity standards.[41] During these years, the National Park Service and the Fish and Wildlife Service continued to evaluate and propose wilderness areas on eastern parks and refuges.[42] The Nixon administration voiced presidential support for eastern wild lands protection.[43] And, most important, senior senators on the Interior and Insular Affairs Committee returned to Congress well aware that the Wild Areas legislation, reintroduced by senators on the Agriculture and Forestry Committee, encroached on their senatorial turf, and that the Eastern Wilderness Areas legislation enjoyed strong grassroots support. The jurisdictional rivalry between the relatively pro-wilderness Interior Committee and the relatively anti-wilderness Agriculture Committee only deepened the congressional furor over the competing bills.

In February 1973, the Senate Interior Committee held hearings on a refined version of the Eastern Wilderness Areas Act.[44] The legislation now included 28 tracts on eastern national forests—some based on proposals by local citizen organizations (including the Sipsey in Alabama, the Dolly Sods in West Virginia, and the Presidential Range in New Hampshire) and some based on the Forest Service's proposals for Wild Areas. Speaking before the committee, Dickerman and Scott explained why the Wilderness Act applied to the eastern national forests: "It is part of the genius of the Wilderness Act that it embodies two quite separate sets of standards." One definition, in section 2(c), provides a more permissive standard for designating a wilderness; a second definition, in section 4(c), provides strict

Eastern Wilderness Areas Act
What's in a Name?

IN JANUARY 1975, President Gerald Ford signed a law designating 15 wilderness areas and 17 wilderness study areas, all on national forest lands in the eastern half of the United States. Some have called this the "Eastern Wilderness Act." But that is not its proper title, and for good reason.

There is only one Wilderness Act, enacted in 1964. That law laid the foundations and set the fundamental policies for one unified *National* Wilderness Preservation System. All subsequent wilderness laws designate additional areas based on the criteria in that original law. Using the erroneous name "Eastern Wilderness Act" creates the false impression that separate criteria apply to wilderness in the East. In fact, that is exactly what the fight over "Wild Areas East" was all about.

So what is the correct title of that 1975 law? It is the Eastern Wilderness Areas Act...and that word *Areas* makes all the difference.

In June 1972, bills were introduced to designate additional wilderness areas on national forests in the East, South, and Midwest. These were the bills that wilderness advocates pushed to counter the Forest Service–inspired "Wild Areas East" legislation. In his remarks as the Senate wilderness bill was introduced, Senator James Buckley (R-NY), a leading sponsor, said, "Though our bill is not provided with a formal title, we might wish to call it the Omnibus Eastern Wilderness Areas Act."[1] When the bill was reintroduced the following January, its lead sponsor, Senator Henry M. Jackson (D-WA), remarked that it "has become widely known as the 'Eastern Wilderness Areas Act.'"[2]

When the Senate Interior Committee, chaired by Jackson, formally approved the bill in December 1973, they made it official: Section 1 of the bill gave it the formal short title Eastern Wilderness Areas Act. Ultimately, the senators backing the Forest Service's alternative "Wild Areas East" bill worked out a deal with Jackson and his cosponsors, agreeing to follow the philosophy of the Jackson/Buckley legislation.[3] The bill passed by the Senate on May 31, 1974 was formally titled the "Eastern Wilderness Areas Act."

In the final days of that year's lame duck congressional session, the House Interior Committee reported its own somewhat different version of the legislation. As reported, the House bill simply had no section 1, the usual place for a formal short title. The bill language skips directly from the enacting clause boilerplate to section 2.

There is every reason to believe that this was a simple clerical error in the final rush of the congressional session, for while the House bill as reported has no short title, the House Committee's own formal section-by-section analysis states "The short title of the bill is 'Eastern Wilderness Areas Act.'"[4]

This version of the bill passed the House on December 18, 1974. The *Congressional Record* headlined the floor action on the bill as "Eastern Wilderness Areas Act of 1974."[5] There was no time to fix the clerical error, nor for a House/Senate conference committee to consider the many differences between the versions passed by the House and the Senate. Rather, the Senate acceded to the House version the next day, and that was the bill, errors and all, the President signed on January 3, 1975.

Today, there are nearly 200 statutorily protected wilderness areas comprising more than four million acres in 31 states east of the Rocky Mountains; the great majority of these wildernesses are on national forests. In addition, President Clinton's Roadless Area Conservation Rule protects another nearly two million acres of wilderness-quality roadless lands on national forests in the eastern half of the country. By enactment of the Eastern Wilderness *Areas* Act of 1975, these areas are protected as part of—and future eastern wilderness areas will join—one single, unified National Wilderness Preservation System.

—DOUG SCOTT

NOTES

1. Sen. Buckley, Remarks on introduction of S. 3792, 92nd Congress, 2nd Session, *Congressional Record*, June 20, 1972, p. 23606 (bound edition).
2. Sen. Jackson, Remarks on introduction of S. 316, 93rd Congress, 1st Session, *Congressional Record*, January 11, 1973, p. 754 (bound edition).
3. "Since Chairman Talmadge and Senator Aiken believed that it was not important whether the areas to be preserved are called wild areas or wilderness areas, the revised [compromise] bill followed the philosophy of S. 316—the extension of the National Wilderness Preservation System established by the Wilderness Act of 1964." *Eastern Wilderness Areas Act*, Report from the Committee on Agriculture and Forestry, S. Rept. 93-803, May 2, 1974, p. 8.
4. Furthering the purposes of the Wilderness Act by designating certain lands for inclusion in the National Wilderness Preservation System, providing for study of certain additional lands for such inclusion, and for other purposes, Report from the Committee on Interior and Insular Affairs, H. Rept. 93-1599, December 16, 1974, p. 11.
5. "Eastern Wilderness Areas Act of 1974," *Congressional Record*, December 18, 1974, p. 40853 (bound edition).

standards for managing wilderness once designated.[45] They argued that the Forest Service's purity standards conflated section 2(c) and section 4(c) of the act: the Forest Service had mistaken "the ideal concept of wilderness for the less austere, more practical definition set forth in the Wilderness Act."[46] Dickerman and Scott's interpretation of the Wilderness Act, which they attributed to its original drafters and congressional champions, helped forge an expansive set of tools for erecting the federal wilderness system; they could be used to carefully manage the system itself, to protect restored lands in the East, and to set aside a vast amount of *de facto* land in the West.[47]

The Forest Service, cognizant of the threat posed by the Eastern Wilderness Areas Act, argued for an amendment to the Wilderness Act that specifically limited restored wilderness areas to the East. John McGuire, who had become Chief of the Forest Service, urged the senators to amend the act, distinguishing "between national forest lands in the East and those areas west of the 100th meridian in the review and consideration of potential additions to the system." Senator Frank Church, a long-time champion of wilderness, asked McGuire a probing question: "The adoption of the amendment you propose...would in fact confirm the purity train, so-called, that you have been applying as a test [for wilderness]; would it not?" McGuire, hard pressed by the questioning, acknowledged, "If you extend [the Wilderness Act] to the East, you get half of the forest system qualified for wilderness."[48] Once McGuire made that admission, the subcommittee chairman, Senator Floyd Haskell (D-CO), simply responded, "I think the cat is now out of the bag."[49]

In 1973, the Senate Agriculture Committee reported the Wild Areas Act and the Senate Interior Committee reported the Eastern Wilderness Areas Act to the full Senate (in February and August, respectively). Neither bill could pass over the objections of the other bill's proponents, forcing the senators and their staffs into close negotiations. Throughout the hearings, the Wild Areas legislative sponsors emphasized their strong interest in passing legislation "offering protection to forest areas in the East where protection is urgently needed"—not undermining the wilderness system. The Agriculture Committee, closely tied to the Forest Service, also harbored several misconceptions about the potential for the Wilderness Act's applicability to eastern lands.

During the negotiations, the Agriculture Committee abandoned the Wild Areas proposal, asking for joint jurisdiction with the Senate Interior Committee over wilderness on eastern national forests.[50] This compromise accommodated the Agriculture Committee's traditional oversight of eastern national forests and the Senate Interior Committee's jurisdiction over wilderness designation. A new bill, jointly sponsored by the leaders of both committees, emerged from these negotiations in May 1974, and passed the Senate by a voice vote at the end of the same month.[51] The new bill included 19 wilderness areas and 40 wilderness study areas. Further debate in the House, however, resulted in a much-reduced bill, and with the Congress preparing to adjourn, the Senate accepted the revised House version.[52] President Gerald Ford signed the Eastern Wilderness Areas Act into law on January 3, 1975.[53] It added 15 national forest wilderness areas in the East to the wilderness system and mandated wilderness reviews of 17 more.

Compromise on the Eastern Wilderness Areas Act led the Senate Interior Committee to report, optimistically, that debate over the "definition of 'wilderness'—both generally and specifically, as it is contained in the Wilderness Act" had ended.[54] The Forest Service's Wild Areas legislation had threatened to confirm a narrow conception of wilderness: only the seemingly pristine lands of the American West would qualify. If Wild Areas had been enacted, the wilderness advocacy community would have been faced with two unequal systems of wild lands protection, undermining national organizational and lobbying strategies, and bifurcating the wilderness system. For this reason, the Eastern Wilderness Areas Act marked an important step in reaffirming the system's national scope, and reemphasizing the legislation's pragmatic philosophy: not only could the Wilderness Act preserve wild lands, it could also allow wild lands to recov-

photograph by Pete Guenther

er as part of a more expansive wilderness system and wilderness ideal. It has been this pragmatic tool set, carefully forged from the act, that has served conservationists so effectively in the last three decades. As this advocacy community has become ever more decentralized, fighting more battles at the state and local level, wilderness activists nationwide have relied upon the Wilderness Act's ironclad provisions. As Dave Foreman explains, "That is why advocates who are in the trenches turn to [the Wilderness Act] time and time again."[55]

DESPITE THE SENATE INTERIOR COMMITTEE'S OPTIMISM, the controversy over eastern wilderness hardly resolved the definition of wilderness. In the last decade, a sharp debate over the meaning of wilderness has engaged the academic and environmental communities. A recent book, titled *The Great New Wilderness Debate* (1998), gathers many of the important arguments in a single volume.[56] Taken together, the compilation offers a cogent reinterpretation of the nationalistic approach to wilderness celebrated in Roderick Nash's thrice-revised *Wilderness and the American Mind* (first published in 1967). Much of the analysis, by scholars including Ramachandra Guha, Baird Callicott, and William Cronon, gains analytical momentum by criticizing wilderness advocates' preoccupation with pristine Nature and a romantic wilderness ideal.[57] Setting these recent scholarly critiques alongside the mouldering logging tools, gravestones, and artillery shells of recovering eastern wilderness (and portions of western wilderness areas, too) poses an important question: just whose wilderness ideal have scholars spent the last decade debating? These protected eastern wild lands—laboratories of ecological succession, the product of grassroots activism, and far from pristine—undermine several of the assumptions underlying the so-called Great New Wilderness Debate. In fact, the wilderness ideal that scholars have spent a decade questioning resembles far more closely the Forest Service's purity standards than the wilderness politics of early-1970s wilderness advocates. Reclaiming this history offers scholars a reminder of a lesson wilderness proponents learned thirty years before: the pragmatism of wilderness. ☾

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Jay Turner, *a graduate student studying American history and environmental issues at Princeton University, is currently at work on a dissertation on the history of the National Wilderness Preservation System.*

NOTES

1. The historiography includes numerous excellent accounts of the fight for wilderness. For a start, see Stephen Fox, *John Muir and His Legacy: The American Conservation Movement* (Madison: University of Wisconsin, 1981), 281–89; Mark W.T. Harvey, *A Symbol of Wilderness: Echo Park and the American Conservation Movement* (Albuquerque: University of New Mexico Press, 1994), chapter 3; Roderick Nash, *Wilderness and the American Mind*, 3rd ed. (New Haven: Yale University Press, 1982), chapter 12; Hal K. Rothman *The Greening of a Nation? Environmentalism in the United States since 1945* (New York: Harcourt Brace, 1998), chapter 2.
2. For a useful introduction to the language and ambiguity of the Wilderness Act, see Mark Woods, "Federal Wilderness Preservation in the United States: The Preservation of Wilderness?" in *The Great New Wilderness Debate*, ed. J. Baird Callicott and Michael P. Nelson (Athens, GA: University of Georgia Press, 1998).
3. On the Forest Service's pre-1964 administrative protection for wild lands, see John C. Hendee, *Wilderness Management*, 2nd ed. (Golden, CO: North American Press, 1990), 100–101. For the original text of the U regulations (wild, wilderness, canoe) see Secretary of Agriculture H.A. Wallace, "Occupancy, Use, Etc., of National Forests," in *Federal Register* (Washington, DC: GPO, 1939), 3994.
4. For an account of Wilderness Act implementation in the Forest Service, National Park Service, and Fish and Wildlife Service, see Michael Frome, *Battle for the Wilderness*, 3rd ed. (Salt Lake City: University of Utah, 1997), 142–47.
5. Richard J. Costley, "Talk Given at a Seminar on Wilderness" (from Bill Worf via e-mail: orig. 1976), 7.
6. *Wilderness Act*, Public Law 88-577, 88th Congress, 2nd Session (September 3, 1964).
7. Costley, "Talk Given at a Seminar on Wilderness," 10.
8. Richard J. Costley, "An Enduring Resource," *American Forests*, June 1972, 11.
9. Frome, *Battle for the Wilderness*, 170.
10. Bill Worf, interview, February 7, 2001. For outside praise of the Forest Service's standards, see John T. Keane, "Wilderness Act as Congress Intended," *American Forests*, February 1971; for criticism, see R.W. Behan, "Wilderness Purism: Here We Go Again," *American Forests*, December 1972.
11. Although some conservation groups supported the Forest Service's purity policies, the same groups also supported the National Park Service's wilderness proposals in the Great Smoky Mountains and Shenandoah National Parks, and the Fish and Wildlife Service's proposals for wilderness areas in eastern refuges. These inconsistencies, even within the same organizations, further suggest the confusion over implementation of the Wilderness Act.
12. *Wilderness Act*.
13. For statistics on the NWPS, see the National Wilderness Preservation System Database at http://www.wilderness.net (accessed February, 2001).
14. Doug Scott, interview, February 8, 2001.
15. Frome, *Battle for the Wilderness*, chapter 10.
16. Rupert Cutler, interview, February 9, 2001.
17. Scott, interview.
18. Frome, *Battle for the Wilderness*, 157–58.
19. Ibid., 160. Note that this decision applied to roadless areas contiguous to primitive areas.
20. Keith A. Argow, "Wilderness and Natural Areas in the Southeast," in *Action for Wilderness*, ed. Elizabeth R. Gillette (San Francisco: Sierra Club, 1971); James W. Moorman, "Preserving De Facto Wilderness," in *Action for Wilderness*, 97.
21. Michael McCloskey, "Is the Wilderness Act Working?" in *Action for Wilderness*, 22–23, 27.
22. Frome, *Battle for the Wilderness*, 170–71.
23. The Department of Interior agencies, which had a (relatively) liberal approach to wilderness protection, set important precedents for eastern wilderness by considering wilderness designation on eastern national parks, such as Shenandoah and Great Smoky Mountains, and on wildlife refuges in the East, Midwest, and the Great Plains. For an overview of each agencies' approach to the NWPS, see ibid.
24. "Wilderness in the East," *New York Times*, September 27, 1971.
25. Leon S. Minckler, "Wilderness East?—Yes," *American Forests*, December 1972.

26. On the origins of the "Wild Areas" legislation in eastern Forest Service regional offices, see "Eastern Wilderness Areas Act" (Washington, DC: US Senate, 1973), 8; Dennis M. Roth, *The Wilderness Movement and the National Forests: 1964–1980* (Washington, DC: GPO, 1984), 39.
27. "The National Forest Wild Areas Act of 1972," S. 3699, 92nd Congress, 2nd Session.
28. Herman E. Talmadge and George D. Aiken, "On Regaining Paradise," *American Forests*, September 1972, 8.
29. Committee on Agriculture, *Wild Areas Act of 1972*, 92nd Congress, 2nd Session, July 24–25, 1972, 1.
30. As part of the Forest Service's agenda to minimize acreage protected as wilderness, it served their purposes to have Wild Areas controlled by a Senate committee more amenable to the Forest Service and historically hostile to the Wilderness Act. Scott, interview.
31. Specific examples of the Izaak Walton League's and (some) Sierra Club representatives' interpretations of the Wilderness Act can be found in *Wild Areas Act of 1972*, 46, 92, Agriculture and Forestry, *Wild Areas in the National Forests*, 92nd Congress, 2nd Session, July 20–21, 1972, 20.
32. J.W. Penfold, "Wilderness East—A Dilemma," *American Forests*, April 1972, 24–27.
33. *Wild Areas in the National Forests*, 20.
34. Scott, interview.
35. Testimony of William Futrell in *Wild Areas in the National Forests*, 109–10.
36. Testimony of George Alderson in *Wild Areas Act of 1972*, 56.
37. For a brief account of Ernie Dickerman's important role lobbying for eastern wilderness, see Carolyn Mann, "Granddad of the Eastern Wilderness," *Sierra*, November/December 1986.
38. Roth, *The Wilderness Movement and the National Forests: 1964–1980*, 45; Scott, interview.
39. Doug Scott, e-mail, February 5, 2001.
40. Doug Scott, "A 'Wilderness-Forever Future'" (Seattle, WA: Pew Wilderness Center, 2001), 12.
41. Frome, *Battle for the Wilderness*, 162–3.
42. Interior and Insular Affairs, *Seashore, National Park, and Wilderness Areas*, 93rd Congress, 1st Session, July 24, 1973.
43. Richard Nixon, Special message to the Congress outlining the 1972 Environmental Program in *Public Papers of the Presidents, Richard Nixon* (Washington DC: GPO, 1972). Richard Nixon, State of the Union message to Congress on Natural Resources and the Environment in *Public Papers of the Presidents, Richard Nixon* (Washington DC: GPO, 1973).
44. S. 316, 93rd Congress, introduced January 11, 1973.
45. Testimony of Ernest P. Dickerman and Doug Scott in Committee on Interior and Insular Affairs, *Eastern Wilderness Areas*, 93rd Congress, 1st Session, February 21, 1973, 49–50.
46. Testimony of Ernest P. Dickerman and Doug Scott in ibid., 46.
47. During the hearings, a few industry groups and motorized recreation organizations voiced general opposition to eastern wild lands preservation. They faulted eastern wilderness for catering to elite recreationists, leading to forest mismanagement, and undermining local economies—arguments long-familiar to wilderness advocates. See ibid., 379, 83, 426; *Wild Areas Act of 1972*, 11, 18; Fred C. Simmons, "Wilderness East?—No," *American Forests*, July 1972.
48. Testimony of John McGuire in *Eastern Wilderness Areas*, 32.
49. Ibid., 25–32.
50. Ibid., 358–59.
51. S. 3433, 93rd Congress, introduced May 2, 1974, passed the Senate May 31, 1974.
52. The House amended the Senate-passed bill with its own substitute version, which it passed on December 18, 1974.
53. *Eastern Wilderness Areas Act*, Public Law 93-622, 93rd Congress (January 3, 1975).
54. "Eastern Wilderness Areas Act" (Washington, DC: US Senate, 1973), 8.
55. Dave Foreman, "Wilderness Areas Are for Real," in *The Great New Wilderness Debate*, 397–99.
56. Callicott and Nelson, eds., *The Great New Wilderness Debate*. For a sharp assessment of the debate, see David W. Orr, "The Not-So-Great Wilderness Debate...Continued," *Wild Earth* (vol. 9, no. 2, summer 1999), 74–80.
57. J. Baird Callicott, "The Wilderness Idea Revisited: The Sustainable Development Alternative," in *The Great New Wilderness Debate*; William Cronon, "The Trouble with Wilderness; or, Getting Back to the Wrong Nature," in *Uncommon Ground: Rethinking the Human Place in Nature*, ed. William Cronon (New York: Norton, 1995); Ramachandra Guha, "Radical American Environmentalism and Wilderness Preservation: A Third World Critique," in *The Great New Wilderness Debate.*

Meltlines

The clouds are wedges of peach, salmon
running. They brood
& swell,
distinct, now indistinct

above the valley whose
walls slough
in great fans
of talus & scree. Upriver

the light walks on its hands,
feeling the water's pulse. Evening
is clouded emerald,
tungsten. Here

the continent reinvents
itself each day; I become
what the glacier lets
go of, & what

it takes along,
nothing but lines, long
& broken,
that connect even

as they tear away. Lines
of sediment, drainage
& horizon lines,
and the shapes

within, an emptiness
of lines
& a comprehension.
How at home my bones

feel here among
the lines, future a nibble
of rain on the neck, the river
swirling me in its mouth.

—Thorpe Moeckel

Congress's Practical Criteria

by Douglas W. Scott

When, in 1971, the Forest Service pronounced, "areas with wilderness characteristics as defined in the Wilderness Act are virtually all in the West," they were really announcing a new and deliberate misinterpretation of the 1964 Wilderness Act—that no lands with any history of extractive human use, east or west, could qualify as wilderness.[1]

At that point, seven years after the Wilderness Act became law, wilderness advocates were unimpressed by the Forest Service's newfound "purity" dogma. They knew this was not the meaning of the designation criteria of the Wilderness Act as intended by its drafters—their own colleagues—or by its congressional champions.

How can we know the original meaning and intent of the Wilderness Act on the question of once-abused lands? Consider four kinds of first-hand evidence:

■ First, how was the wilderness bill interpreted by its congressional champions, both contemporaneously and after the bill became law?

It is important to know that the wording of the designation criteria of the act, found in the second sentence of the subsection 2(c) wilderness definition, remained virtually unchanged from the time this sentence first appeared (in a revised version of the wilderness bill introduced in the Senate in mid-1960) until the otherwise much-altered legislation was signed into law.[2] That wilderness definition remained unchanged because nearly everyone involved shared an understanding of what the definition meant. This shared understanding was made tangible by the first statutory wilderness areas, those included for immediate designation in the Wilderness Act itself.

Throughout consideration of the wilderness bill, the most protracted debate centered on the procedures for future designation of the 34 existing national forest "primitive areas." Beyond those specific areas, proponents and opponents alike understood that wilderness designation for any additional national forest lands—what became known as *de facto* wilderness and, more recently, "roadless areas"—would require enactment of future bills adding them to the National Wilderness Preservation System. Making that point during the 1961 Senate floor debate on the legislation, Senator Thomas Kuchel (R-CA) pointedly specified that *de facto* wilderness areas in the eastern national forests could indeed be designated as wilderness:

> *The distinguished Senator from Florida [Mr. Holland] has suggested that if the proposed legislation were enacted into law, there would be some reason for fear or trepidation on the part of Senators representing Eastern States that forest areas within their States not created from the public domain and under the jurisdiction of the Department of Agriculture, could not...become a part of the wilderness system. I deny it....*
>
> *If the distinguished senior Senator from Florida wishes to introduce proposed legislation creating a wilderness out of any of the area owned by the Government of the United States in his own State, let him do so. That would be what would be required of him if he so desired. That would be precisely what would be required of him if the proposed wilderness legislation were enacted into law....*[3]

Another authoritative voice on the intent of the Wilderness Act was Senator Frank Church (D-ID), the floor manager for the legislation when it passed the Senate. In a 1973 Senate speech, Church pointed out that the Wilderness Act itself "placed three eastern areas into the National Wilderness Preservation System [that]...had a former history of some past land abuse." Church

Author's Note: I do not pretend to be a dispassionate historian on this subject. From 1967 onward I was an increasingly active participant, first as a Sierra Club chapter leader, then as a volunteer and summer employee of The Wilderness Society, and later as a full-time wilderness lobbyist (for The Wilderness Society through 1973 and then for the Sierra Club). But I have attempted to be a careful student of the detailed conceptual and legislative history of the Wilderness Act itself, an after-the-fact acolyte of its guiding genius, Howard Zahniser, and a faithful participant in and historian of its post-1964 implementation. —*DS*

for Designating Wilderness

illustration by Dorothy Black

THE WILDERNESS ACT
Section 2 (c)
Definition of Wilderness

A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act 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.

explained: "This was by no means a so-called grandfathering arrangement. It was, and is, a standing and intentional precedent to encourage such areas to be found and designated under the act in other eastern locations."[4]

■ Second, what evidence do those three eastern national forest areas that were designated as wilderness on passage of the 1964 Wilderness Act provide? The case of the Shining Rock Wilderness in North Carolina—established virtually on the eve of enactment of the Wilderness Act—is particularly instructive.

The Chief of the Forest Service administratively designated Shining Rock as a 13,400-acre "wild area" in May 1964. In those final years before the Wilderness Act became law, the chair of the House Interior Committee, Representative Wayne Aspinall (D-CO), insisted that he and his staff be briefed on and approve each new "wilderness" or "wild" area the Forest Service proposed to administratively designate.[5] This was because the Wilderness Act would sweep those administratively designated national forest "wilderness" and "wild" areas into the new National Wilderness Preservation System, as indeed it did with the Shining Rock Wilderness.[6] When the Wilderness Act passed the House at the end of July 1964, Chairman Aspinall told his colleagues that in statutorily designating these first wilderness areas, "the committee, in effect, was reviewing each of these areas individually," finding that each had been defined with precision and met all of the criteria of the soon-to-be-enacted Wilderness Act.[7]

Thus Forest Service Chief Edward Cliff designated the new Shining Rock Wild Area knowing it would soon be swept into the National Wilderness Preservation System. The Forest Service press release explained that "A Forest Service Wild Area is a small wilderness, ranging in size from 5,000 to 100,000 acres in which the primitive environment is protected and preserved."[8] Obviously, Chief Cliff had determined that the Shining Rock area was such a "primitive environment," notwithstanding the area's history of extensive railroad logging—and a huge logging slash fire—between 1906 and 1926, before it became national forest land.[9]

In fact, the Forest Service knew that some of the logging within its proposed wild area had been very recent indeed. In the published Shining Rock Wild Area proposal, the Forest Service noted that

> *In determining the best and most logical boundaries for the Wild Area, it was necessary to include a portion of the drainage of Ugly Creek covered by a timber sale contract which expires December 20, 1963. About 500 MBF are left to be cut and the operation will be completed this year. The skid trails and log landings will be revegetated and otherwise treated as necessary to hasten natural recovery and prevent vehicular access.*[10]

So, on the very eve of the enactment of the Wilderness Act, the Forest Service was well aware that historically logged land—even heavily and recently cut-over—was being administratively designated and would be included as wilderness under the new law.[11] Such lands were within their conception of the kinds of lands that could qualify for designation as wilderness. Chairman Aspinall and the Congress reviewed the proposal and agreed.

■ Third, what did the leaders of wilderness advocacy organizations think, back then, about this view of what could or could not qualify as wilderness under the legislation they'd been working to enact for so long?

Early in the consideration of the Shining Rock Wild Area proposal, in the spring of 1962, Wilderness Society leader Harvey Broome joined a Forest Service field trip to review the Shining Rock area. During the trip, the Forest Supervisor asked Broome, who was a founder of The Wilderness Society and one of the handful of key advisors with whom Howard Zahniser consulted in drafting and revising the original wilderness bill, for the reaction of conservationists to the designation of a "wild area" from cut-over and burned-over land.[12]

In the decades before the Wilderness Act was enacted and the years when it was being debated in Congress, the Forest Service and wilderness advocates shared a pragmatic view of what kinds of lands could be designated as wilderness.

Broome wrote back to the Forest Supervisor in May 1962, reporting that he had discussed the question with "a number of local conservationists here in Knoxville and...been in touch with Howard Zahniser in Washington."[13] He was being cautious, Broome confided in a letter that same day to a correspondent outside the Forest Service, "to see whether the wild area classification for an area which had suffered so badly from logging and fire would embarrass our work for wilderness....I am happy to report—the area fits our definitions (no roads, no

mechanization and over 5000 acres) and we can support it wholeheartedly."[14]

In reporting this conclusion to the Forest Supervisor, Broome wrote that he had reviewed the

> *definition of wild area promulgated by the Forest Service and I can see no clash there. A wild area is not necessarily a virgin area, but is one without roads and mechanized means of transportation.*
>
> *The fact that it has been cut-over and burned-over is unfortunate, but areas of this size are limited in number in the east and...it is desirable to set such aside as there is opportunity. Each of the conservationists to whom I talked feels that the need is so great in the east and southeast that it is fortunate that Shining Rock is being considered as a wild area, and in fifty or one hundred years it will reach a high degree of restoration.*[15]

As these contemporary sources demonstrate, in the decades before the Wilderness Act was enacted and the years when it was being debated in Congress, the Forest Service and wilderness advocates shared a pragmatic view of what kinds of lands could be designated as wilderness. Of course, they sought pristine, "virgin" lands wherever they could find them, but their concept was not so anthropocentric or purist.

Congress and wilderness proponents well understood that the "wilderness" and "wild" areas that had been administratively chosen by the Forest Service and were being designated by the Wilderness Act itself constituted type-specimens of the kind of lands that met the designation criteria of the act. They knew that portions of these areas, in the West as well as in the East, had a history of land abuse.

Only later, for its own political reasons, did the Forest Service evolve its "purity" interpretation, asserting that no lands with a history of human disturbance, east or west, could qualify as wilderness under the Wilderness Act.[16] As one of the prime architects of that act, Senator Church responded, "Nothing could be more contrary to the meaning and intent of the Wilderness Act. The effect of such an interpretation would be to automatically disqualify almost everything, for few if any lands on this continent—or any other—have escaped man's imprint to some degree."[17]

The fight over national forest wilderness in the East was about fundamentals. Had the Forest Service won this fight in the East, one result would have been, in effect, the reinterpretation of the Wilderness Act in a way that would have greatly curtailed the boundaries of wilderness areas in the western national forests, where lower-elevation valleys often had some history of human abuse.

■ Finally, how did the Congress apply its own understanding of the Wilderness Act's designation criteria in the decisions it made with the earliest areas it added to the National Wilderness Preservation System? Two cases are worth considering:

The road in the Great Swamp Wilderness. The third wilderness area designated by Congress after 1964 was within Great Swamp National Wildlife Refuge, located in New Jersey, just 30 miles from Times Square. In approving this, the first wilderness area created on federal lands under Interior Department jurisdiction, Chairman Aspinall's committee was very alert to the precedent it was setting. His committee's formal report to the House of Representatives noted, "From the testimony presented to the committee, it became evident that careful consideration had to be given to...[the question]: did the area itself have all the characteristics of wilderness as that term is defined in the statute?"[18]

As proposed by the President and the Department of the Interior, there would have been two units, 2,400 acres and 1,250 acres respectively, separated only by a township road (a two-lane paved road with ditches, shoulders, several bridges, and several suburban homes on private inholdings). At the hearings, Chairman Aspinall himself took exception to this division into two smaller wilderness units, whereupon the local townships immediately agreed that the road would be closed. Aspinall's committee answered its own question as to whether the area had "all the characteristics of wilderness as the term is defined in the statute" by concluding:

> *The...concern of the committee was satisfactorily answered by the agreement of the townships of Passaic and Harding to close the existing road that now separates the [two] units. The closure of the dividing road, in the opinion of the committee, is absolutely essential if this area is to be considered for wilderness designation. It is with this understanding, as well as the full assurance of the two townships involved that the road will be closed, that this committee favorably recommends the area for wilderness designation.*[19]

illustration by Dorothy Black

Horse logging in the Aldo Leopold Wilderness. The controversy over wilderness designation criteria had profound implications for the extent of wilderness areas in the western national forests, as the Forest Service well understood. There, too, the practical criteria intended and used by Congress sharply differed from the agency's "purity" dogma.

The lead sponsor of the Wilderness Act in the final years of the congressional debate was Senator Clinton Anderson (D-NM), a former Secretary of Agriculture. In 1972, as the debate over eastern wilderness was heating up, Senator Anderson filed the Senate Interior Committee's formal report on a bill to designate the Aldo Leopold Wilderness in New Mexico. In that report, the Committee overruled the recommendation of the Forest Service on one part of the boundary:

> *In the committee's view, exclusion 6, containing 894 acres along Morgan Creek, is suitable for [wilderness]....The evidence of the past timber-harvesting activities occurred in the late 19th century, and was accomplished with horses and oxen. As a result, disturbances are virtually unnoticeable today.*
>
> *In such instances as this, where time is rapidly erasing man's handiwork and the disturbance is slight, the committee believes Congress should designate the area if it otherwise meets wilderness criteria.*[20]

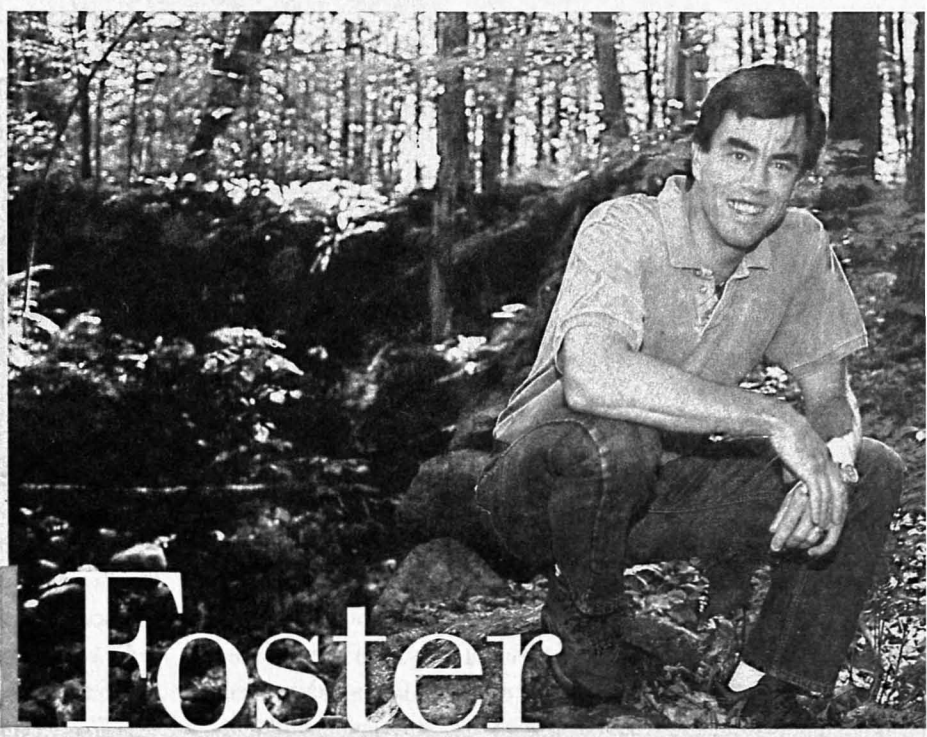
This, then, was the practical, real-world standard that Congress used, intentionally, in writing the Wilderness Act, building on the criteria the Forest Service itself used when it designated "wilderness" and "wild" areas prior to passage of the act. This practical standard admitted areas of varying degrees of "pristine" natural quality. Once designated, all these lands came under one straightforward statutory command: that the agencies administer them in order to preserve their "wilderness character."[21] In many wilderness areas, east and west, "time is rapidly erasing man's handiwork," and, in the words of Harvey Broome, "in fifty or one hundred years it will reach a high degree of restoration." ☾

Doug Scott *(doug@pewwildernesscenter.org) is a veteran wilderness advocate with decades of conservation experienee. He has worked as a lobbyist for The Wilderness Society and the Sierra Club, and is now policy director of the Pew Wilderness Center.*

NOTES

1. Associate Chief John McGuire, speaking before the Sierra Club's Biennial Wilderness Conference, September 24, 1971, quoted in Dennis M. Roth, *The Wilderness Movement and the National Forests*, Intaglio Press, 1988, p. 39.
2. S. 3809, 86th Congress, introduced by Sen. James Murray (D-MT), July 2, 1960. The second sentence of what became subsection 2(c) was added, Senator Murray explained, "in response to requests for additional and more concrete details in defining areas of wilderness." *Congressional Record*, July 2, 1960, p. 14454 (bound edition).
3. Sen. Thomas Kuchel, "Establishment of National Wilderness Preservation System," *Congressional Record*, September 5, 1961, p. 16919 (bound edition). Sen. Kuchel spoke with particular authority, as he was one of the 10 original cosponsors of the wilderness bill in June 1956; the second most senior Republican member of the Committee on Interior and Insular Affairs which approved the bill in 1961 (and the Ranking Member when it re-approved the bill in 1963); and the Republican Whip of the US Senate.
4. Sen. Frank Church, "The Wilderness Act Applies to the East," *Congressional Record*, January 16, 1973, p. S738 (daily edition; pagination may differ in the bound edition).
5. "Parenthetically, I note for the record that 2 years ago when our Committee on Interior and Insular Affairs was considering wilderness legislation there were only 6,822,400 acres of land designated as 'wilderness,' 'wild' and 'canoe' and that the increase of 2,317,321 acres that has taken place since then has been accomplished by the Department of Agriculture after coordination with the Committee on Interior and Insular Affairs." Rep. Wayne Aspinall, "National Wilderness Preservation System," *Congressional Record*, July 30, 1964, p. 16846 (bound edition).
6. When the House of Representatives debated and passed the Wilderness Act (by a vote of 373-to-1), on July 30, 1964, Shining Rock was included in a tabulation of the acreage of the wilderness areas to be immediately protected. Chairman Aspinall noted that the table he had printed in the *Congressional Record* included those areas "administratively designated as having wilderness characteristics." Ibid.
7. Ibid., p. 16845.
8. "New Wild Area Established in North Carolina," US Forest Service press release, May 13, 1964, Atlanta.
9. "Area History," text on Forest Service map, "Shining Rock Wilderness and Middle Prong Wilderness, Pisgah National Forest, North Carolina," Recreational Guide R8-RG 23, Revised June 1993.
10. "Shining Rock Wild Area—North Carolina: Proposal," Southern Region, US Forest Service, p. 3. This report is undated, but the Forest Service press release announcing designation of the wild area noted that "The plans for making this a wild area were released in September 1963."
11. The Wilderness Act also required study of all roadless areas in National Park System and National Wildlife Refuge System areas, and numerous formerly abused areas were expressly listed during the congressional debates as subject to this study requirement. Indeed, as first introduced in June 1956, the bill that became the Wilderness Act named specific park and refuge areas to be protected as wilderness, including Shenandoah and five other national parks in the East, and Okefenokee, Seney, and seven other national wildlife refuges in the eastern half of the country, all of which had varying degrees of significant past human use and habitation. S. 4013, 84th Congress, 2nd Session, June 7, 1956.
12. In his letter to the Forest Supervisor, Broome referred to the trip having been "nearly three weeks ago." Harvey Broome to Peter J. Hanlon, May 18, 1962, blind carbon copy in Howard Zahniser's files, The Wilderness Society (and in the author's files).
13. Ibid. I am all but certain that Ernie Dickerman, later a key leader in the fight over the Eastern Wilderness Areas Act, was among those local conservationists in Knoxville with whom Broome conferred.
14. Harvey Broome to Roger V. Morrow, May 18, 1962, blind carbon copy in Howard Zahniser's files, The Wilderness Society (and in the author's files). As finally enacted, the Wilderness Act did not set 5,000 acres as a minimum size and Congress has subsequently designated numerous wilderness areas smaller than 5,000 acres.
15. Broome to Hanlon, May 18,1962.
16. That this interpretation was consciously evolved was acknowledged by Forest Service leader Richard Costley, a leading figure in that evolution. See Richard J. Costley, "An Enduring Resource," *American Forests*, June 1972, p. 8.
17. Church, "The Wilderness Act Applies to the East," p. S737.
18. *Designating Certain Lands in the Great Swamp National Wildlife Refuge, Morris County, NJ, as Wilderness*, H. Rept. 90-1813, July 26, 1968, p. 2.
19. The road was promptly closed, the bridges, pavement, and gravel bed removed. Today, the old road stubs provide trailhead parking for hikers, most of whom would not recognize that this part of the well-loved trail system in this small gem of wilderness was a paved highway until 32 years ago, when Chairman Aspinall decided it, too, should be wilderness. Ibid.
20. *Designating the Aldo Leopold Wilderness, Gila National Forest, N. Mexico*, S. Rept. 92-1132, September 15, 1972, p. 2. Final enactment of the Aldo Leopold Wilderness took a few more years of congressional deliberation, culminating in P.L. 96-550, December 19, 1980.
21. The author will elaborate on the legislative history and meaning of the Wilderness Act's fundamental management command, to "preserve its wilderness character," in a forthcoming *Wild Earth* article focused on the background of the word "untrammeled" as it is used in the Wilderness Act.

David Foster



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David has a Ph.D. in ecology from the University of Minnesota and has conducted studies in the boreal forests of Labrador, Sweden, and Norway and the tropical forests of Puerto Rico and the Yucatan, in addition to his primary research on landscape dynamics in New England. He serves on the boards of the Conservation Research Foundation and Highstead Arboretum, and the editorial boards of the journals Ecosystems, Progress in Physical Geography, *and* Northeastern Naturalist. *A widely published author in both technical and popular journals, his books include* Thoreau's Country: Journey Through a Transformed Landscape *and* New England Forests Through Time.

Interviewer JAMIE SAYEN *visited with David Foster at the Harvard Forest on January 16, 2001, where they discussed the intersection of history and ecology, the presettlement landscape of New England, forest conservation strategies, and other topics. The following edited interview is but a small part of that wide-ranging conversation. A longer version of the interview will appear in a forthcoming issue of the* Northern Forest Forum, *the invaluable publication of the Northern Appalachian Restoration Project (PO Box 6, Lancaster, NH 03584). Jamie Sayen is a long-time conservation activist, publisher of the* Northern Forest Forum, *and writer, whose current book-in-progress explores the ecological and cultural history of the Northern Forest region.*

photograph by Jim Gipe, courtesy Harvard Forest

JAMIE SAYEN: *You've spent a good deal of time and effort studying the pre-European settlement forest. What is the value of that research in terms of land management or preservation of biological diversity?*

DAVID FOSTER: As an ecologist interested in modern landscapes and the possibilities for their future management, either directly or indirectly, I want to understand what kinds of processes have shaped what we currently have, and to understand the ways that ecosystems respond to different kinds of disturbances. In order to do that, you have to understand both the nature of the impacts and where the landscapes of the particular ecosystems are coming from. Doing that in forest time means taking a very long-term perspective, something on the order of a thousand years, so that you can actually look at forest change within the context of both the frequency of the processes that affect those forests and the time frame on which forests respond.

In New England we have this incredible change that's been wrought upon the landscape in the last 200–300 years from the arrival of European civilization. In order to assess the impact of that activity, we have to understand what was the prevailing forest condition and disturbance cycle for the landscape at that point. And, to know something about the pre-European settlement landscape gives us a sense of what types of changes to expect if we were to reduce the intensity of our logging, and the extent of our clearing, and back off of that landscape a bit.

Would you describe in general terms that pre-European settlement forest?

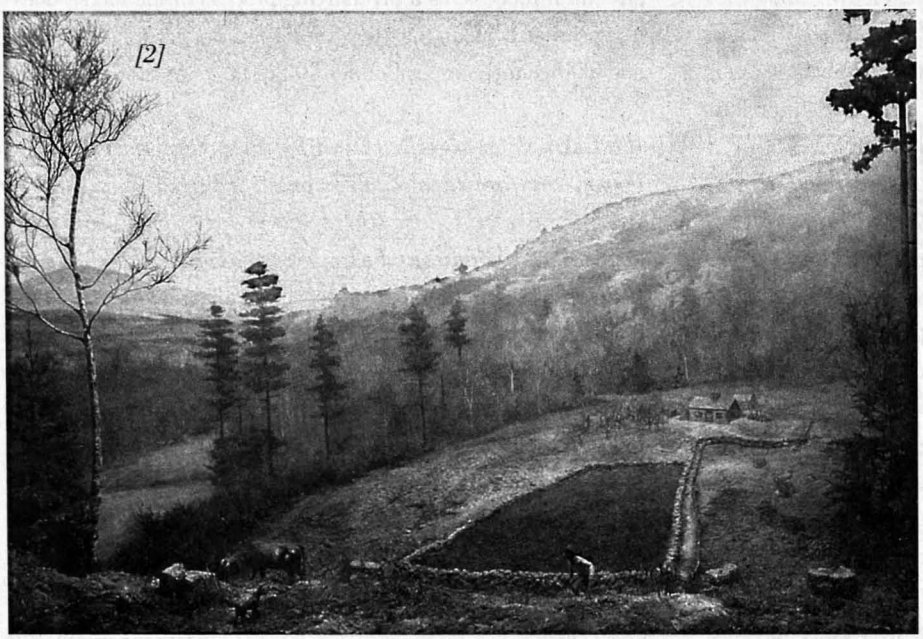
We've done a lot of paleoecological work in which we've looked at many sites in relatively small areas...and what that research suggests is that there's much more variation within small areas than ecologists have normally assumed. So, to generalize even about central Massachusetts is quite challenging because as you go from the Connecticut River Valley to the uplands of Massachusetts, for example, you see a fair amount of variation in major tree species that are dominating the forest. The same thing is true in Cape Cod. We think of Cape Cod as pine and oak forest. But there's considerable variation within inner Cape Cod in the relative abundance of pine versus oak, and between inner Cape Cod and outer Cape Cod in those abundances also. Presumably, you've got a lot more variation related to soils and disturbance processes, perhaps including people and fire, but certainly including wind. That is a general comment about pattern. Forests were not monolithic across New England, but they were also not monolithic within relatively small geographic areas.

Generally, I see the pre-European landscape of New England as being dominated by physical process, physical climate, and natural disturbance processes such as wind. That gives a view of the landscape in which there's a fair amount of variation because of gradients from south to north, the relative importance of hurricanes and other storms, and differences in bedrock geology and climate. But overall, we had a largely forested landscape that contained a relative abundance of big old trees, and forests that were driven by relatively infrequent disturbances interjected into a landscape controlled by broad physical and biological processes. That view doesn't argue for extensive grasslands, shrublands, heathlands, and other kinds of open landscapes other than those that are generated on a very local scale by small numbers of mobile people and by animals—beavers and some of the larger grazing animals that would certainly have had an impact on the structure of the vegetation.

I understand that the Indian population density of southern New England was roughly five to ten times greater than in northern New England, and that along some of the coastal areas and rivers there was Indian activity, including corn, beans, and squash agriculture. In southern New England there wouldn't have been the settled communities you'd expect in Central America or some other parts of the United States, but there was this kind of patchy, migratory economy in which corn played a role. It didn't displace the hunting and gathering, but it supplemented the diet far more than up north. Is that correct?

I think that is correct and begs the question, What's the actual level of that activity? What's the size of that indigenous human population? I think there are very few archaeologists who would give you any numbers. But the general sense is that, even in southern New England, it's small. It's small groups that are moving, that do not set up large established villages. There isn't good evidence for corn playing a major role in diets or a major role in terms of landscape modification. The only place where it seems like there's room for argument is in the major river valleys, like the Connecticut River Valley. But even there, there are no archaeological sites that support the notion of large established sedentary villages. And there are no archaeological sites that support the notion of major fields of maize.

Elizabeth Chilton, an archaeologist at Harvard who has studied Native American sites in the Connecticut Valley and on Martha's Vineyard, has written a recent article where she describes a different model of Indian land use—what she terms a mobile farmer. Her notion is that a variety of crops, including maize, were planted by mobile people who would not tend the



These seven dioramas (continuing on next page), housed in the Fisher Museum at Harvard Forest, form a historical series that depicts changes in the New England landscape over the past 300 years at one location in central Massachusetts.

1] Presettlement forest, 1700

2] Clearing of a homestead by an early settler, 1740

plants as established fields, but would leave and come back toward the end of the season. In this case, corn becomes a supplemental food that is being gathered much in the way that native foods are gathered. If the crop survives, it is available. But if animals have gotten to it or the crop is not particularly large, then, because it's not such a major part of the subsistence, there's not a huge impact. That puts people very much in the landscape and affecting the landscape—gathering materials and hunting—but puts their activities in a much more dispersed and low-intensity mode. That activity wouldn't generate any major signatures that we would, for example, sense through pollen analysis. Similarly, the charcoal record does not support the notion of widespread and frequent Native American management of the land with fire.

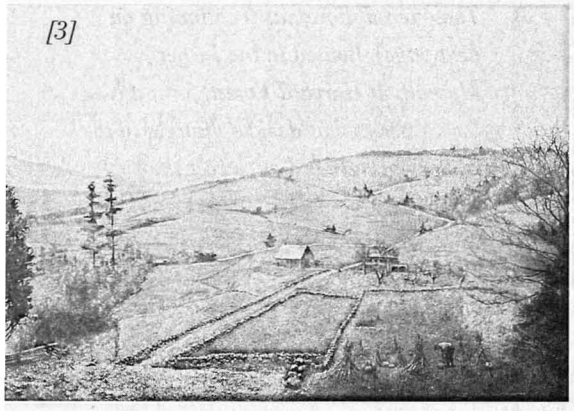
You said earlier that in general the pre-European forest had a lot of big old trees, infrequent big disturbance events, and not a lot of huge openings. So, I take it most disturbance events were small—single trees, small groups, caused by disease, wind, ice, or fire?

That's the way I would think of the landscape. Most big disturbance events don't generate much change in terms of the broad pattern of composition in the vegetation. So if you take a forest that is dominated by old-growth trees and run a hurricane through it, you don't necessarily generate a wholesale change in the composition of the vegetation.

It's more a change in the age...

...and structure...

images: Harvard Forest Dioramas, Fisher Museum, Harvard Forest, Petersham, MA; photos by John Green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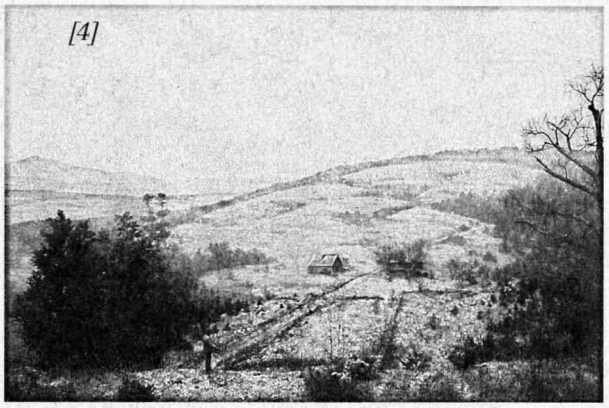
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...and structure of the locality, but in the end it's pretty much the same community, just at a different stage of development.

Yes, and that's why we paleoecologists have always struggled with interpreting New England's hurricane history. We know that there was a big hurricane in 1635, another one in 1815, and another one in 1938 that came through and had an impact on southern and southeastern New England. We can therefore assume that hurricanes on a 100–300-year frequency were important for millennia before European settlement. And yet, even with the finest grained pollen analysis, we don't see big changes in vegetation that mark known or pre-European events. Even though those storms have a large effect on the *structure* of the vegetation and create many large openings, they don't have an overwhelming impact on forest *composition*.

So you don't see a great infusion of plant species that you hadn't seen before, whereas after European agriculture comes in you do see a great change.

Sure, because the nature and scale of the disturbance is just so much greater. It is useful to remember that many of the disturbance processes that were operative, like fire, don't have to occur very frequently to have a subtle but influential and long-lasting effect on vegetation. For example, in southern New England, we talk about regional change in composition from, say, northern hardwoods to more of a southern hardwoods forest dominated by oak and chestnut, and maybe hickory, being controlled by climate and perhaps, locally, by fire. How do you maintain a chestnut forest? How do you maintain an oak forest over great lengths of time? How do you maintain a pitch pine forest through time? Well, it may be that fire is important in the maintenance of some of those vegetation types. But it doesn't necessarily mean fire has to occur every five years or ten years or even twenty or thirty years. It doesn't take frequent fire, for instance, to keep hemlock from becoming dominant in the forest; maybe fire every 50–200 years is adequate.

There has been a tendency in natural history and ecology to overplay the importance of some disturbances. Certainly I've been involved in this as much as anybody else. To say that a disturbance is important doesn't say that it is necessarily all that frequent. That's true of fire. To say that hurricanes are vital as a structural process, as a diversifying process in the forest, doesn't necessarily mean that they flatten continuous areas of forests and change the composition for 50 or 100 years afterward.

What are the significant differences between the pre-European forests and the forests of today that have returned over the past 100 to 150 years after having been cleared and maintained as open agricultural land?

Let me talk about that in terms of different scales of vegetation. If you look at a broad regional scale across New England, there's been a major shift in the relative abundance of different tree species—from those species that are longer lived, shade tolerant, more typical of mature forest conditions—to shorter-lived, less tolerant, more rapidly growing, weedy and successional species. And also species that are favored in the sense that they sprout easily, so they regrow vegetatively after the kinds of disturbances—cutting, fire, land clearance—that we imposed on these sites.

At a subregional scale, human activity has homogenized the vegetation. If we look to one example that we have a lot of information for—central Massachusetts—we see that there used to be a fair range in compositional variation across that area as a result of relatively subtle variation in climate and elevation. Across that region, land use has been broadly similar and has selected for species that respond well to that particular use. Across that subtle climatic gradient there is no longer much variation in terms of major tree species.

When you look a bit closer, to the landscape level, you're looking at a much more stark mosaic of types. The vegetation is much more heterogeneous at a landscape scale because adjoining parcels of land, which at one point might have had quite similar vegetation and might have graded from one to another, now shift abruptly. At the most local scale, the story is different.

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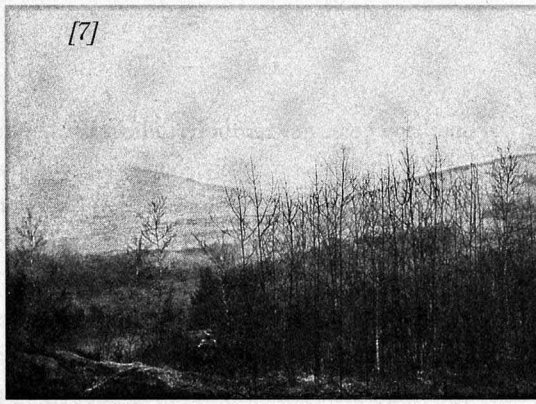

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Harvard Forest Dioramas, continued

3] Height of agriculture, 1830
4] Farm abandonment, 1850
5] "Old-field" white pine on abandoned land, 1910
6] White pine is succeeded by hardwoods, 1915
7] An aggrading forest of hardwoods, 1930

Within a given stand, because the treatment has been relatively uniform, it's probably true that individual stands are more homogeneous. At different scales we have different impacts.

I think if you looked at the soils in a given forest that have been in pasture, or have been plowed, they're probably more homogeneous than they were before European settlement. So the whole stand is probably more homogeneous. Within the landscape that that forest stand sits in, things are more heterogeneous; in the subregion that that landscape fits in, the pattern is more homogeneous. And then broadly across the entire region we've seen a major shift in the relative abundance of different species.

Do you see sharper edges than was the case in the pre-European forest?
Yes—at the landscape scale we see sharp transitions and sharp borders, from a pine forest to a hardwood forest, or a spruce-fir forest to a paper birch forest.

And this is where the history is helpful in saying: oh, this stand, because it's got old hemlock, was probably never plowed or pastured but remained as a forest, whereas that stand, which is dominated by pine probably was plowed?
Yes, and that is the scale where we can collect natural history information in great detail and apply it easily, where we actually see the direct consequences of a fire or a clearcut, or past clearing of a forest, and reestablishment of forest with agricultural abandonment. But then the consequences of history as we go up in larger and larger spatial scales play out very differently across the entire region.

Overall, the other impact of our land-use history is structural. Obviously, the region's forests today are much younger, much more unimodal in terms of age structure than the presettlement forest. Not only are they more densely packed with smaller and younger stems, but many key structural elements—such as windthrow mounds and coarse woody debris, which are important parts of both forests and aquatic ecosystems—are missing.

What have we lost?
Clearly there are major things that we have lost, and our systems are depauperate in many ways for having lost them. The big species that aren't here anymore, as well as many little species. Think of the missing tree species and the altered structure in our forests. Virtually every stream is missing one of its most important structural components—a great, huge log that's pushing the stream around and changing the system energetics completely. We don't notice that; we don't pause to think about it, yet fundamentally, that stream is completely different, the biota substantially changed. And yet at some impressive level, our forests and our streams are functioning ecosystems. But they don't have passenger pigeons whizzing through them, we don't have chestnuts anymore, and we don't have all the large mammals. We note these ways in which our forests are not what they were, and yet we can still see value in protecting them.

What about mycorrhizal fungi?
There's mycorrhizae all over our landscape. In and of itself, is it the same as it was? Are there associations that are no longer persisting? I have no idea. Probably no one does.

Do you have any sense of land that was plowed versus adjacent land that wasn't plowed—over time, are those soils becoming more similar or is this a qualitative difference that we're going to be stuck with for a really long time?
There are different dimensions to that question because you've got chemical characteristics, physical characteristics, and biological characteristics. In terms of chemistry, it takes decades to

images: Harvard Forest Dioramas, Fisher Museum, Harvard Forest, Petersham, MA; photos by John Green

perhaps centuries for these soils to become modified back to a similar condition to what they were. The physical imprint, in terms of actual coloration of the soil—we don't know how long that takes, but we've got forests that are a hundred years old and have perfectly clear plow horizons in them. Biologically, there's almost no information. We don't know much about the loss and additions of different worm species and invertebrates, let alone the fungal and bacterial and other kinds of changes.

Is it likely that over time these forests will become more heterogeneous? If so, what sort of time frames are we talking about, and what sort of human management or non-management is that going to require?

I think we can restore a lot of the forest process at both a local scale and a broad scale by removing the heavy hand of human disturbance and influence. Clearly, there are two ways of doing that. We can remove ourselves from the landscape and as the forest grows, it will gradually assume, over a period of decades to hundreds of years, much of the structure that is typical of a natural old-growth forest. Or we can attempt to nudge it in that direction by management. I think both approaches have merit. However, I'm always a little bit wary of managing for natural conditions.

Do you see a role for ecological restoration that would be different from more active economically oriented management? If economics weren't interfering with our thinking, are there things that we could do that would be productive in nudging it, or are we better off just leaving it alone?

Oftentimes we're better off leaving it alone. There's a great tendency now in conservation to "manage" everything. Frequently we do that before we think through the management very clearly, and before we gather the background information that we need; in many cases we would be better off doing nothing than jumping quickly into management. Having said that, I think that there are plenty of cases where you can show that restoration—that is, direct management activity—can achieve conservation objectives more effectively and more rapidly than just leaving things alone.

Would restoration be more appropriate if you're dealing with a plantation rather than a forest that came back after agricultural clearing? Or would you still argue to let the plantation fall down of its own accord?

I'm a great proponent of cutting down plantations to move them in the direction of more natural conditions. We do that here on the Harvard Forest. I've recommended doing that on Martha's Vineyard, at the Manuel F. Correllus State Forest, where there's a perfectly intact native vegetation underneath the plantations. However, it is very difficult to generalize about management; it has to be put into the context of the particular situation and system. I have this general sense, though, that there's a great movement in many circles to manage, whether with "natural process," like fire, or attempting to move a stand in the direction of desired old-growth conditions more rapidly by cutting trees, rather than just letting the forest grow.

Isn't there also a hidden assumption that is the antithesis of thinking in forest time? In other words, there is an assumption that speeding things up a little is not going to have a major impact on the forest system. Whereas, in fact, it may be that a leisurely succession process is a critical component in the recovery of forest ecosystems.

Yes. Again it varies by the system. The argument of many silviculturists in this business is that you can generate bigger trees more rapidly by removing a few of the other trees around them. That's undoubtedly the case. And so if your benchmark is big trees and some of the structure that they provide, you can probably do that more rapidly through some judicious thinning. On the other hand, that forest will, in a pretty reasonable time, generate a mature forest condition if left by itself. And we can accomplish that over a much larger area than we can effectively manage.

The biggest problem with our management is that it usually doesn't have three characteristics—and this is true of our economically oriented management as well as our conservation-based management. It doesn't have a thorough understanding of the system and its history, a thorough articulation of what the objectives are and how those are going to be achieved through management, and then a thorough, scientifically based system of assessment and reconfiguration of the management activities based on that assessment. Much meaningful re-assessment should be done on the time scale of 5–10 years, but there often isn't the institutional will, the political will, and the financial wherewithal to actually follow through with monitoring. Management is easy if you don't have to do those three things.

Let's assume we come up with a truly ecologically informed method of superb commercial forest management. Suppose we then proposed that the best way to preserve biodiversity on a regionwide scale is to practice this ecological forestry throughout the landscape, as opposed to having some unmanaged wilderness reserves. Is there a fallacy in that kind of thinking? Do we lose something by not having unmanaged areas?

If you could come up with a dependable, extractive activity that would satisfy your ecological and conservation criteria, that sus-

tains biodiversity and meets all your other objectives, you still would want to argue for major reserves in which you did nothing. You'd want to do that at the very least because you'd want to have a big control area for actually testing this method and its results. Of course any extraction is going to alter ecological processes. You can't mimic all ecological processes by taking things out. So, I'd reject the notion initially that you would accomplish the same thing in this extractive area as you would in a reserve. But, even if you thought you were mimicking most of the key processes, you'd still want the reserve as a control, and as a safety net in case you were wrong. You're not going to know you were wrong unless you've got the control. And you're not going to be able to go back unless you've got the safety net.

Have you tried to speculate what the forest will look like in another 500 or 1000 years?

The details of that obviously vary with the area. By and large, if left alone, in a much shorter period of time than 500 years you'd end up with very natural-appearing forests. They may not be functioning precisely like mature old-growth forests in a scientific sense, and they certainly won't be the forests that grew on those sites 500 years earlier, but they would have many of the appearances of the natural condition and very few of the apparent legacies of human activity.

So, the heterogeneity that you found in the pre-European forest would begin to reassert itself, and some of the homogeneity that you found would start to break up?

Again, it depends upon scale. On the scale of a forest stand you would generate those conditions in a relatively short period of time. Erasing the kinds of landscape-level and regional-level patterns that have been generated by human activity is a long undertaking, because we're talking about plants, many of which have long generation times and move relatively slowly, spreading and reassembling over large distances. I don't think you're going to see Nature erase the legacies of human activity in the landscape over a few hundred years. But that's not the important point.

I do research in the Yucatan Peninsula where in some places it's been 500–1000 years since the heavy hand of agriculturally based people shaped the land; the area has now been functioning as a forested landscape for many hundreds of years. To what extent can a knowledgeable ecologist walk in that forest and identify factors that make it a secondary forest as opposed to a primary forest? There are many artifacts of human activity scattered through the landscape—old terraces, house mounds, temples, and stone walls—so we're quite aware of the fact that it has that human history. The archaeologists can document it. But what is it about the structure and function of the forest that screams out at us that it is secondary? My guess is that there isn't much.

In setting priorities for state or regional conservation initiatives, I wonder how much emphasis we want to place on saving these small, potentially ephemeral (in geological time) natural communities versus something that is going to have a more enduring legacy—protected landscapes and processes. We convinced the public, the government agencies, and the politicians (at least some of them) of the need to save endangered species. I don't think we've done as good a job explaining landscape function, the integrity of systems, and the need to devise conservation strategies that preserve the integrity of these systems.

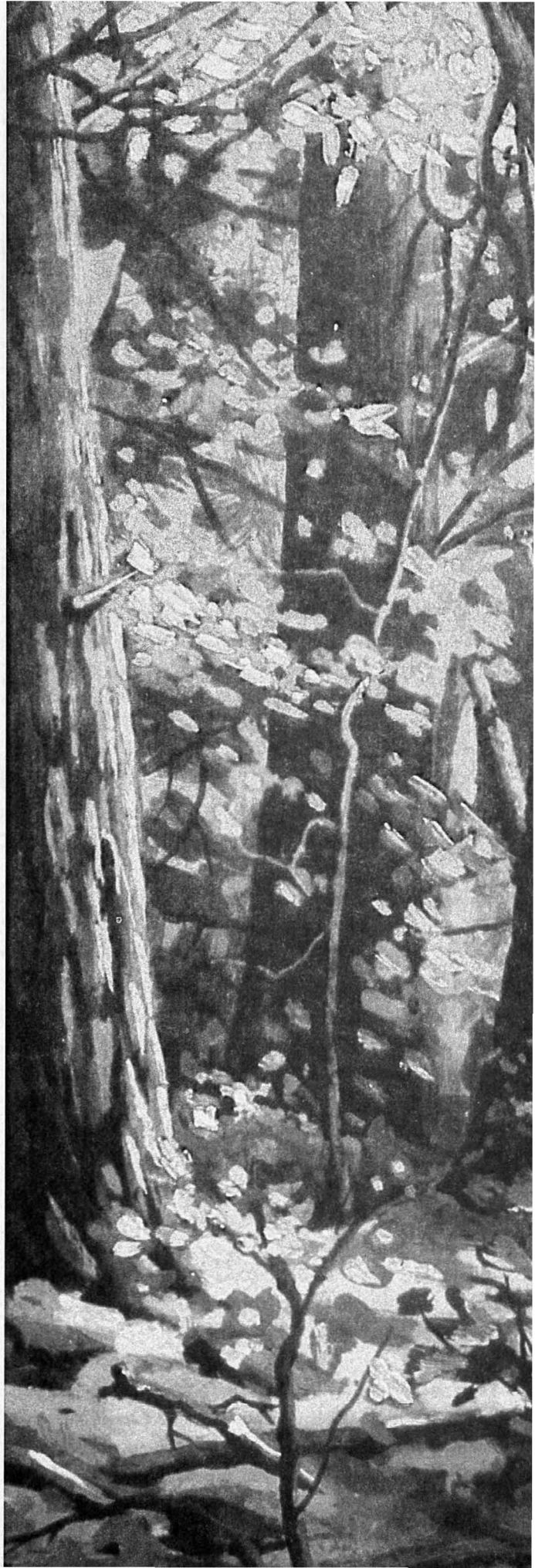
That's true. Of course some of the complexities of those systems and species and assemblages are not known to us. Some of the embedded history is similarly unknown. Many special assemblages, as well as some incredible landscapes, are very strongly tied to human activity. To my mind that doesn't lessen their value or lessen my interest in them. But to many people it would.

I strongly agree with your point that conservationists and policy-makers have not paid anywhere near enough attention to the really common, general, broad things that are out there. I'm speaking about landscapes where there's nothing particularly special from a species-based conservation perspective.

A big swath of northern hardwoods, say, that doesn't have any endangered species?

Yes. I'm sitting in the middle of a big region [central Massachusetts] which has relatively low biodiversity, that has not been intensively threatened, and so has been a low priority for major conservation action. The same thing can be said of many areas of northern New England. Oh, sure, there are the little gems and the jewels that people want to protect, but it's the broad, functioning landscape with processes and species that need big areas of pretty plain stuff that are really underappreciated—these places have not been the focus of adequate conservation activity.

We're hearing new discussion of protecting matrix areas. My fear is that one of the major ways that people are proposing to protect those areas is by harvesting them. So, in other words, we convince people that those areas are now important, and we'll protect them by managing them with our more ecologically informed approaches to silviculture. That is fine. But I think that there's actually a big need to take a large chunk of our common New England landscape and just hang on to it. Let it be wild.... ☾



What was the forest like originally?

Who among us, as we've hiked the Green or White Mountains, gazed from the traprock ridges across the Connecticut River Valley, or trudged across the sandplains of Cape Cod and the coastal islands, has not posed this question and used our imagination to remove the modern sights and sounds and allow the pre-European landscape to emerge? Certainly our predecessors did. From writers like James Fenimore Cooper to scholars like Timothy Dwight, a former Yale president who documented the early-nineteenth-century variation in New England's landscape, there has been a preoccupation with defining the region's primeval Nature. Perhaps Henry Thoreau framed the issue most succinctly when he wrote in the 1860s, "no one has yet described for me the difference between the wild forest which once occupied our oldest townships, and the tame one which I find there today. It is a difference that would be worth attending to."

Although nostalgia and a fascination with wilderness frequently motivate this quest, there are important practical considerations as well (Foster 1999). Ecologists have long recognized that landscape history affords remarkable insights into the variation in Nature, the range of responses of plants and animals to natural and human disturbance, and the ecological processes that have controlled landscape patterns through time. In similar fashion, conservationists have looked to the past—both to establish goals and to identify processes that are critical to the functioning of natural areas—as they have sought to restore species, communities, and landscapes (Foster et al. 1990, 1996). Thus ecologists, foresters, wildlife biologists, and conservationists have employed a wide array of tools and approaches to reconstruct historical and pre-European environments. These include

New England's FOREST PRIMEVAL

by David R. Foster

explorers' and travelers' accounts, early surveys and maps, archaeological and tree-ring studies, and paleoecological analyses in which the vegetation, environment, and disturbance history can be inferred from the fossil remains of pollen, other plant material, and physical and chemical evidence like charcoal. Although there is an inclination to study old-growth forests as "remnants" of original vegetation (in New England especially), these stands are generally too small and unusual to provide much perspective into the broad landscape (Dunwiddie et al. 1996, Orwig et al. 2000).

With regard to regional patterns of variation at the time of European arrival, we have considerable insight and fairly broad consensus. It is when we turn to details within these patterns and their dependence upon human and natural disturbance processes that the records thin and the opportunities for speculation, disagreement, and future research emerge.

Four hundred years ago New England was predominantly forested, with the broad-scale variation in dominant tree species driven by climate and soils (Cogbill 2000). Although mean annual temperature and growing season generally decline to the north, the considerable variation in elevation provided by major north-south trending valleys and mountains, as well as the moderating influence of the ocean, produced a complex geographic pattern in vegetation. Patches of treeless tundra undoubtedly occurred on the highest mountains, but the northern and higher-elevation areas were dominated by spruce and balsam fir intermixed primarily with paper birch. Interestingly, although conifer species are associated with fire across much of the boreal region and the West, there is little evidence that fire was common or important in the moister New England conifer forests.

Broad areas of Maine, Vermont, New Hampshire, western Massachusetts, and northwestern Connecticut were covered with northern hardwoods—hemlock forest, dominated by long-lived shade-tolerant species such as beech, yellow birch, and sugar maple (C. Cogbill and Harvard Forest, unpubl. data). Paper birch was locally common along with white pine, pin cherry, white ash, and black cherry, especially on disturbed sites. To the south and at lower elevations the oaks increased, first red, then black, and lastly white. Geographic variation in species abundance and broad forest types were finely controlled by climate. In central Massachusetts, from the Connecticut Valley up across the Central Uplands and down onto the Eastern Lowlands towards Boston—a region incorporating only 200 meters in elevational relief and 1.5°C difference in mean annual temperature—the vegetation varied from oak-dominated to northern hardwoods-hemlock-white pine-oak and back to oak (Foster et al. 1998b). These forests of oak and hickory increased to the south across much of Connecticut, Rhode Island, and eastern Massachusetts.

One intriguing question about this pre-European landscape that generates considerable inquiry and speculation is: How much did vegetation patterns vary through time and across local landscapes? The evidence suggests that substantial change in broad-scale forest composition did occur in the centuries before European settlement. Most notably, 500–1000 years ago dominant species including beech and hemlock commenced to decline, and red spruce, and in some cases oak or birch, increased from Massachusetts to Maine (Fuller et al. 1998). The scale and timing of this change implicate the so-called Little Ice Age, a globally cool period of variable growing season. Since this period extended through the mid-nineteenth century, some

illustrations by Tim Yearington

of the vegetation changes that we attribute to settlement activity were undoubtedly initiated by shifts in global climate. Equally important, colonial settlement from Plymouth to Roanoke and Jamestown occurred under variable climatic conditions that posed severe challenges to successful crop production and human survival.

The Little Ice Age was not an isolated event. Pollen records indicate that vegetation and climate change have been continuous, though variable, over past millennia. For example, new records from the Quabbin Reservation in central Massachusetts depict a major shift from oak to chestnut composition and an increase in fire associated with drier conditions (lowered precipitation or warmer temperatures) approximately 1500 years ago (Foster et al. 2001). The long-term record completely dispels the myth of one "original" and stable vegetation, a single "primeval" forest. Instead we can appreciate the scene encountered in 1620 as part of an endlessly unfolding and dynamic picture.

Geographically, other factors, especially soils, modified broad forest patterns. Extensive coastal areas across southeastern New England, Cape Cod, and the coastal islands are largely formed of sandy outwash plains laid down by the glaciers. Here, and on more localized sandplains in the Connecticut and other valleys, oaks, pitch pine, white pine, and ericaceous plants such as huckleberry dominated (Motzkin et al. 1996, 1999a, Foster and Motzkin 1999). Meanwhile, the finer soils of the old glacial lake beds and extensive flood plains supported a mesic and specialized tree and herbaceous vegetation. Bedrock geology was also a key factor affecting vegetative distribution, as shown by the greater abundance of species like sugar maple on rich soils of the Berkshires, Green Mountains, and traprock ridges.

Natural disturbance also shaped the landscape. Early surveyors encountered windthrown forests, some of which were extensive and presumably generated by hurricanes or downbursts. Especially notable was the great hurricane of 1635, described by Governor William Bradford on the Massachusetts coast:

> *It began in the morning a little before day, and grew not by degrees but came with violence in the beginning, to the great amazement of many....It blew down many hundred thousands of trees, turning up the stronger by the roots and breaking the higher pine trees off in the middle. And the tall young oaks and the walnut trees of good bigness were wound like a withe, very strange and fearful to behold.*

Using similarly detailed eyewitness and newspaper accounts, meteorological descriptions, and a simple model of tropical storm meteorology, Harvard Forest ecologists have reconstructed the wind and damage patterns for all New England hurricanes since 1620 (Boose et al. 1993, 2001). The results show a strong gradient in hurricane frequency and intensity from southeastern New England to northern Vermont, New Hampshire, and Maine. Extreme storms, including hurricanes in 1635, 1788, 1815, and 1938, were experienced roughly every 85 years in the southeast, 150 years across western Connecticut to southeastern New Hampshire, and never (at least in recorded history) much farther to the north. Equally important was the incidence of weaker storms, which are critical to forest and wildlife dynamics because they create small openings (Foster and Boose 1994). These occurred every 5–10 years in the southeast, 10–25 years in central New England, and 75–200 years in the north.

Presumably, landscape-level patterns in forest structure would have resulted from the tendency for the strongest winds in New England hurricanes to come from the east and southeast (Foster et al. 1998a). On exposed level areas or east-facing slopes, intense winds would have initiated patches of younger, dense forest strewn with mounds resulting from the roots of downed trees and decaying wood (Foster 1988). In narrow valleys and on leeward westerly slopes, extremely long intervals without such damage would have led to predominantly old-growth conditions. The actual compositional effects of hurricanes on forests were probably minor. In fact, there is no signal for a pre-European hurricane in the pollen record of vegetation change.

In contrast, fires have left a definitive record in the form of charcoal and associated vegetation change in wetland and lake sediments. Using such records we can begin to develop a history of fire effects that greatly extends the limited ethnographic and historical references from the sixteenth and seventeenth centuries that have generated much speculation and disagreement. Fire in New England is generally interpreted as resulting from purposeful burning by Indians to improve hunting and village sites. Fire also is the major means by which a relatively small population of perhaps 90,000 individuals, lacking domesticated animals or widespread agricultural practices, could exert an extensive impact upon the landscape; fire and local human activity are primary means by which young and open vegetation and its associated early-successional plant and animal species may have been maintained in a largely forested landscape. Based on a handful of early quotes from Thomas Morton, William Wood, and others from a very few localities, extreme pictures of Indian activity and the resulting vegetation have been depicted: frequent to annual burning creating open, park-like forests, savannas of grass and interspersed trees, extensive sandplain grasslands, and mosaics of

Given the extent of old and multi-aged forest that would have predominated across most of New England four hundred years ago, many features that are now uncommon in our landscape would be widespread. Most obvious and abundant would have been the structural elements of old and deep woods—massive windthrow mounds and pits, large decaying boles of fallen trees, and dense jumbles of coarse woody debris in brooks, streams, and rivers.

illustrations by Tim Yearington

active agriculture and successional vegetation on fallow fields and abandoned villages (Cronon 1983).

The paleoecological record provides no support for these visions and when coupled with other historical data instead paints a very different picture of the broad landscape (Foster et al. 1998b, Patterson and Backman 1988). Sites from the central Massachusetts uplands do record fires and associated vegetation dynamics, but only at intervals of centuries to millennia. Although infrequent, fire did still modify this forested landscape, as sprouting and successional species such as birch, chestnut, and oak prevailed for more than 250 years after each fire (Foster and Zebryk 1993). In the Berkshires and the uplands of northern Vermont an even lower frequency of fire is recorded, presumably due to wetter conditions and lower Indian populations. Fire and human activity increased in the Connecticut Valley, to the south, and in coastal areas (Fuller et al. 1998). Higher fire frequency in these regions is associated with greater oak and pine, but even on the driest sandplains in the Connecticut Valley where fire may have been most frequent, forests of pitch pine and oak prevailed and, not infrequently, reached old-growth status (Motzkin et al. 1996). On the Cape and coastal islands, Native American populations and fire frequency were high and apparently created a mosaic of oak or pine forests with huckleberry, blueberry, and scrub oak understories. However, there is still no conclusive historical evidence for early-settlement scrub oak barrens, sandplain grasslands, heathlands, or savannas (Foster and Motzkin 1998, 1999). These hotspots of biodiversity, rarity, and modern conservation interest are

much more likely the product of European land use (as they are, in fact, in Europe) than relicts of an aboriginal landscape.

Given the extent of old and multi-aged forest that would have predominated across most of New England four hundred years ago, many features that are now uncommon in our landscape would have been widespread. Most obvious and abundant would have been the structural elements of old and deep woods—massive windthrow mounds and pits, large decaying boles of fallen trees, and dense jumbles of coarse woody debris in brooks, streams, and rivers (Foster and O'Keefe 2000). All of these would have added to "the wild, damp and shaggy look" envisioned by Thoreau. Also common was woodland wildlife, part of which—bears, moose, beaver, turkey, and fisher—we have recently recovered. However, many other important species, such as wolf, cougar, and passenger pigeon, are regionally or globally extinct. Meanwhile, many common successional and open-land species of plants, insects, and birds that surround us today would have been uncommon, clinging to ridge tops, cliffs, and bluffs, or the edges of Native American villages where harsh environments or disturbance kept sites open and dynamic.

Thus, as we look backwards to the time before European arrival and the transformation of the New England landscape, we learn much about Nature. The forests were changing, though at a slower rate than today, and were varied, though less sharply and more along landscape lines than according to the arbitrary divisions of ownership and land use that drive many modern patterns (Motzkin et al. 1999b). The land was also occupied and influenced by people, wildlife, and natural processes that are mostly lost to us and about which we have much more to learn. But even though many changes in the environment, landscape, and biota are largely irreversible, the tremendous extent of forest as well as the diversity of cultural landscapes, ranging from fields to heathlands to sandplain grasslands, provide us with remarkable opportunities to preserve new wildlands and manage other reserves for biodiversity (McLachlan et al. 1999).

Nonetheless, in our efforts to interpret and conserve Nature, it is important that we take lessons from the past and use them to understand the present as we set off to shape the future. For, as Henry David Thoreau reflected in 1860, "if we attended more to the history of our [wood] lots we should manage them more wisely." ☾

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Revisiting the Northwoods

A LESSON IN BIOTIC HOMOGENIZATION

by Tom Rooney, Don Waller, and Shannon Wiegmann

In his essay "Song of the North," Sigurd Olson claimed to be drawn to the Northwoods the way a salmon is drawn to the stream where it was born. The song Olson heard was not the solitary call of a loon or a wood thrush, but of the land itself, of the forests he wandered and the chains of lakes he canoed. Like Olson, we too feel called by this region of forests and waters. The Northwoods have become a laboratory where we spend our field seasons collecting data and learning more about the plants that call this place home.

In northern Sawyer County, Wisconsin, lies our study site 3118. At first glance, it appears like many other forest stands in the region. The canopy of second-growth red maple, sugar maple, and red oak covers the undulating topography. Here and there, a lone red or white pine stands amid these hardwoods. The soil has a sandy texture. Perhaps as few as fifty years ago, this stand was an old-growth red pine-white pine ecosystem. These Great Lakes "pineries" are now recognized as one of the most endangered ecosystem types in the United States (Noss and Peters 1995). The stand we see today originated from intensive logging of one such pinery about five decades ago.

illustration by Dorothy Black

Logging over the past 150 years has dramatically altered the Northwoods. One of the more conspicuous changes can be seen in the relative abundance of particular tree species. Aspen and paper birch are now common throughout the landscape, though they were historically confined to areas that had recently experienced fire or some other stand-replacing disturbance. In contrast, some late-successional species such as eastern hemlock and white pine have declined precipitously. Past logging operations changed the tree composition of the Northwoods, but forestry is not the only agent of change, and tree composition is not the only ecosystem component that is changing. In recent decades, precipitation has become more acidic, UV-B radiation levels have increased, numerous exotic species have invaded, deer densities have increased, and vacation homes have appeared in the woods and along lakeshores. Taking the broad view, we are witnessing a collision between humans and Nature. This collision heralds a mass extinction event, much like the one brought on by the meteorite that fell from the sky 65 million years ago. In geological time, mass extinction events appear instantaneous. From the human perspective, however, the current mass extinction is largely imperceptible. While we can infer rates of extinction by combining rates of habitat destruction with the species-area relationship, we still see the same plant and animal species we saw ten years ago. Ecologist John Magnuson (1990) calls this paradox "the invisible present." He recognizes that we are limited in our ability to perceive changes that take place over decades.

The problem of the invisible present can be clarified if we understand today's patterns as trends over time. Consider, for example, the cerulean warbler. In the 1999 North American Breeding Bird Survey, there was an average of 0.2 birds per route. By contrast, the black-throated green warbler averaged 3.0 birds per route, much more abundant than the cerulean warbler. Since these numbers represent single points in time, they have no historical context. If we were satisfied to say that there are probably fifteen times more black-throated greens than cerulean warblers in the world, we would miss a far more important trend: populations of cerulean warblers declined at the rate of 4% per year since 1966, whereas populations of black-throated greens remained relatively constant (Sauer et al. 2000). The broader temporal perspective gives context to observations made in the invisible present. North American birds represent the taxonomic group for which we have the best long-term data. In Wisconsin, frog and toad populations have been monitored since the 1980s (and most species are declining). But birds, frogs, and toads represent an exception to the rule—what we know about most species is veiled by the invisible present. This is particularly true for the smaller and less conspicuous species and for regions not yet hosting long lists of endangered species.

At site 3045 in Brunet Island State Park, amid the buzzing of orbiting deer flies and the incessant chatter of a red-eyed vireo in the canopy, come the calls of species tallies: "Quad 18. *Carex pennsylvanica, Maianthemum canadense, Trientalis borealis, Uvularia*—no, *Polyganatum pubescens*." Members of our field team are on their hands and knees, identifying and recording seedlings, shrubs, and herbaceous plants. This forest understory contains most of the forest's plant diversity. An acre of forest that might have ten species of trees often has a hundred or more herbaceous and small shrub species. These species, too, reside in the invisible present. One way to chart the changes in plant diversity in the woods is to establish study plots and monitor species changes in the understory layer over time. This exercise will take time to yield insights into vegetative change, and such studies may not tell us much if the area has already been degraded. Alternatively, we can seek out old but reliable plant survey records and revisit those sites to determine which species have declined in abundance and which have increased.

We are fortunate to inherit a legacy left behind by Wisconsin ecologist John Curtis and his students and colleagues. For 16 years in the 1940s and 1950s, they combed the state's forests, prairies, savannas, and swamps, systematically recording the plant species they encountered. These efforts culminated in Curtis's landmark 1959 book, *The Vegetation of Wisconsin*, which provided a comprehensive picture of the state's botanical diversity and helped change the way ecologists think about ecological communities. Curtis hardly anticipated, however, how valuable these data would prove as a baseline to document statewide changes over the last fifty years. We are now using his records to assess the widespread, but mostly invisible, changes occurring in the Northwoods. Perhaps if the results are dramatic enough, they may influence the way people think about conservation.

Leach and Givnish (1996) have already tapped Curtis's extensive data to study patterns of species loss across the small and scattered patches of remnant native prairie. They revisited 54 prairies, and found extinction rates varied from 0.45% per year in dry prairies to 1.03% per year in wet prairies. The species-area relationship was a good predictor of the number of species that remained in these small patches, but there was more to the story. The species that disappeared from the prairies were small-statured, had small seeds, or formed a symbiotic relationship with nitrogen-fixing bacteria. In other words, extinction was concentrated in plants that depended on periodic fires for their persistence, and smaller areas are prone to reduced fire rates as well as species loss.

A ranger informed us that in the 1980s, *Trillium grandiflorum* was common in the stand. Today, there are no trilliums to be found, and the forest floor is dominated by grasses and sedges, looking more like a neighborhood lawn than a forest understory.

In the summer of 2000, we began re-surveying Curtis's northern hardwood stands to document patterns of understory extinction and colonization through time. While we have only begun to analyze the data, what we have observed in the field has been sobering. An amateur naturalist visiting Brunet Island State Park might be charmed by the large hemlocks, basswoods, red oaks, and sugar maples that line the Timber Trail. What may go unnoticed, however, is the herbaceous understory beneath the trees. A ranger informed us that in the 1980s, *Trillium grandiflorum* was common in the stand. He also told us that in recent times the area had too many deer (aided, sometimes, by unwitting human accomplices; local news once lauded the efforts of an area woman to feed over seven tons of corn to wintering deer). Today, there are no trilliums to be found, and the forest floor is dominated by grasses and sedges (collectively termed graminoids), looking more like a neighborhood lawn than a forest understory. When Curtis surveyed the stand in 1949, he found 25 understory species in an area of 20 square meters. When we returned to the site in the summer of 2000, we found 16 species in a more extensive survey area of 120 square meters. There has been at least a 36% loss in understory plant diversity. The understory species composition is converging into a few resistant groups, namely the graminoids.

Our current work is a logical extension of "then and now" comparisons of temperate forest understories conducted elsewhere. Warren Woods is an old-growth beech-sugar maple forest in southwestern Michigan; between 1933 and 1974, there was a 15% decline in the number of herbaceous understory species present (Brewer 1980). In Europe, Poland's Bialowieza forest is an old-growth oak forest that lost 45% of its 133 understory species between 1969 and 1992 (Kwiatkowska 1994). Middlesex Fells, a now-isolated 400-hectare woodland park in Boston, lost 37% of its 422 original species between 1894 and 1993, while 64 new species appeared (Drayton and Primack 1996). Most of these new species were exotics. The most startling data comes from areas where deer populations are large. Heart's Content is an old-growth hemlock-beech stand in northwestern Pennsylvania; between 1929 and 1995, one portion of

Trillium grandiflorum by Dorothy Black

the stand had lost 59% of its flora, while the other had lost 80% of its flora. All told, the diversity of plant families declined from 27 to 10 between the two censuses (Rooney and Dress 1997). Piney Point is one of the few remaining ancient red pine-white pine stands in northern Wisconsin. Between 1949 and 1999, the stand lost 48% of its 27 original understory species (Rooney and Millam 2000). While we strongly suspect such losses are occurring elsewhere, sets of baseline data are rare.

So far, we have revisited 59 of Curtis's original hardwood forest stands, sampling each more intensively than he did to be sure that missing species do not reflect inadequate sampling. At this stage, we have more questions than answers. We think species loss will be highest at sites where deer browsing intensity is greatest. We also suspect species loss will be highest at sites invaded by exotic plants. We anticipate certain species will be more vulnerable to local extinction than others. If we are correct, we expect (based in part on metapopulation theory) plants with restricted seed dispersal to be more vulnerable to local extinction than plants with seeds that are widely dispersed (and hence have greater colonizing abilities). Also, because they are more vulnerable to deer browsing, we expect plants in the lily and orchid families to be more prone to local extinction than the graminoids. If our general line of thinking is correct, we foresee different forest communities converging in their species composition. In other words, we will start to see the same plants in an oak-maple stand that we find in a hemlock-beech forest, indicating that our regional flora is becoming more homogenous.

WORLDWIDE, MANY SPECIES ARE SPIRALING TOWARD extinction. As Hobbs and Mooney (1998) point out, extinction is only the end of a process involving the progressive loss of local populations. For most species, we know little about this process, but can learn more by studying patterns of loss and biotic processes—such as shifts in disturbance regimes or the abundance of associated competitors, herbivores, and diseases. Some of these processes may be catalytic or irreversible. For example, the loss of an ant species could doom populations of violets or Dutchman's breeches that depend on these ants for dispersal. Declines in these spring ephemerals, in turn, could open up habitats to the invasion of exotics like garlic mustard, leading to further declines in native plants. Such processes are often obscure and difficult to predict, though clearly, weedy, widespread species that benefit from human disturbance are increasing in abundance.

Thus, we can classify species as losers or winners, depending on how they respond to human-driven environmental change. In the Indonesian rainforest, 22–33% of bird species were found to be intolerant of selective logging, while 11% benefited (Marsden 1998). In Wyoming river drainages, 46% of all fish have declined since the 1960s, and 14% have increased (Patton et al. 1998). In the Sierra Nevada mountains, 88% of the frogs and toads declined since 1915, and 12% became more abundant (Drost and Fellers 1996). In each case, the causes of population declines differ, but the general pattern remains the same. If present trends continue, numerous native and often locally distributed species will be replaced by a few widespread, weedy species (McKinney and Lockwood 1999). We are on a trajectory towards an homogenized biosphere.

As these trends continue, we find ourselves living increasingly on what David Quammen (1991, 1998) has termed a "planet of weeds." Many, perhaps most, of the losers will not disappear entirely. Instead, they will simply disappear from many of their current haunts, but still thrive here and there for reasons unknown. The winners will expand their ranges and move into communities vacated by the losers. The complexity and time-delays inherent in ecosystems ensure that our biota will continue to change even after we have acted to preserve it, often for reasons that won't be apparent without careful study. In his essay "The Land Ethic," Leopold (1949) described how the land has adjusted to humans in western Europe. Over thousands of years, swamps were converted into pasture, and forests were converted to fields and towns. Plants and animals that could not cope with these transformations retreated to the wildest areas or were extirpated.

Thus, it comes as no surprise that many of North America's weeds first emerged as winners in Europe's historic biotic homogenization. The latest unanticipated threat to Northwoods plant communities appears to be massive soil disturbance resulting from advancing waves of exotic earthworms. Who would have predicted that fishermen discarding nightcrawlers could be contributing to the simplification and restructuring of Northwoods plant communities?

Thankfully, trend is not destiny. We have a formula to halt and reverse the process of biotic homogenization. Parks and reserves are needed, but they alone are not sufficient. We also need restoration and rewilding (Soulé and Noss 1998). We need to preserve or restore the important biotic interactions that have maintained biodiversity since time immemorial. We need to limit the emissions of pollutants to the level where production equals the rate at which ecosystems can absorb, degrade, or assimilate them. This is the task of biological conservation.

In his essay "Hard Times for Diversity," David Ehrenfeld (1993) suggests that if we, as a society, relearn to value plants and animals for their own sake instead of their instrumental or utilitarian value, we will discover that we are no longer destroying the

world. *Streptopus amplexifolius* (the clasp-leaf twisted stalk) has all but disappeared from mainland Wisconsin. This plant is not a keystone species. To our knowledge, it lacks specialist pollinators or herbivores. The species was never common, though it is growing increasingly rare due to deer herbivory. To find this plant today, botanists travel to deer-free islands in Lake Superior. A hundred years from now, should biological conservation succeed, *Streptopus amplexifolius* populations may again inhabit the mainland. Biologists will tell the story of how the species was almost lost, not because we did not know how to maintain populations, but because we did not have the will to do so. ☾

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POETRY

All Green

All green
things
are grateful
all fungi
rejoice
bark
shines
puddles
jump
in rain.

—Elizabeth Caffrey

illustration by Dorothy Black

Restoring the Large Mammal Fauna in the East

What Follows

BY DAVID S. MAEHR

Elk (*Cervus elaphus*) in the eastern United States are nothing new. They were a part of the impressive Pleistocene fauna, which included 40 other species of large mammals that went extinct a mere 10,000–15,000 years ago. They survived the colonization of North America by primitive human cultures and were still a part of the large mammal fauna when Daniel Boone trekked through the Cumberland Gap. Now, 150 years after the extermination of the eastern subspecies by modern humans, elk populations are being restored from Pennsylvania to Arkansas.

Here in Kentucky we are studying the largest elk restoration ever attempted. A partnership among the Rocky Mountain Elk Foundation, the Kentucky Department of Fish and Wildlife Resources, the University of Kentucky, and private landowners is nearly halfway to the goal of importing roughly 2,000 animals from wild western populations. Relocated elk have had their share of logistical difficulties and accidents that have led to some unexpected movements and mortality, but by and large they are doing well (Maehr et al. 1999): most animals stay near release sites that are dominated by reclaimed surface mines (some of these sites look amazingly western in their juxtaposition of grassland and forest); females appear to produce twins at rates that are higher than expected in long-established western populations; and yearling males not only grow impressive antlers but are capable breeders in herds that often lack adult males. Poaching has, so far, been uncommon, and a few animals have moved hundreds of kilometers, demonstrating impressive colonization potential. All the indicators suggest that elk restoration in Kentucky will be so successful that constraining the population's growth may soon become an important management concern.

In most parts of the East, elk restoration is viewed in two ways that are not mutually exclusive. A self-sustaining herd is an attraction for hunters and wildlife watchers alike. During the Kentucky reintroduction effort's first three years, guided elk-viewing tours have been popular with the public, and the first legal hunt will occur in late 2001. Such activities will create income in a perpetually economically depressed region. Elk will also return ecological processes and evolutionary relations that have been absent for nearly two centuries. Grazing and browsing in forest edges and behavioral observations that indicate elk are clearly dominant over white-tailed deer (*Odocoileus virginianus*) promise to alter the regional distribution of plants and animals, even if only subtly. Thus, the Kentucky elk herd possesses both utilitarian and intrinsic values.

This ecological restoration will be a test of elk resiliency and of human tolerance for an animal that has the potential to be a garden pest, a road hazard, and a target of poachers. But one might also speculate about the other missing members of a large mammal fauna that recently included bison (*Bison bison*), wolf (*Canis lupus*), black bear (*Ursus americanus*), and mountain lion (*Puma concolor*). Given the ability of elk populations to grow quickly and to become accustomed to human activity, are all of the ecological components in place to facilitate a naturally regulated herd? If elk restoration is to be promoted as ecological, what other work is left for us to do?

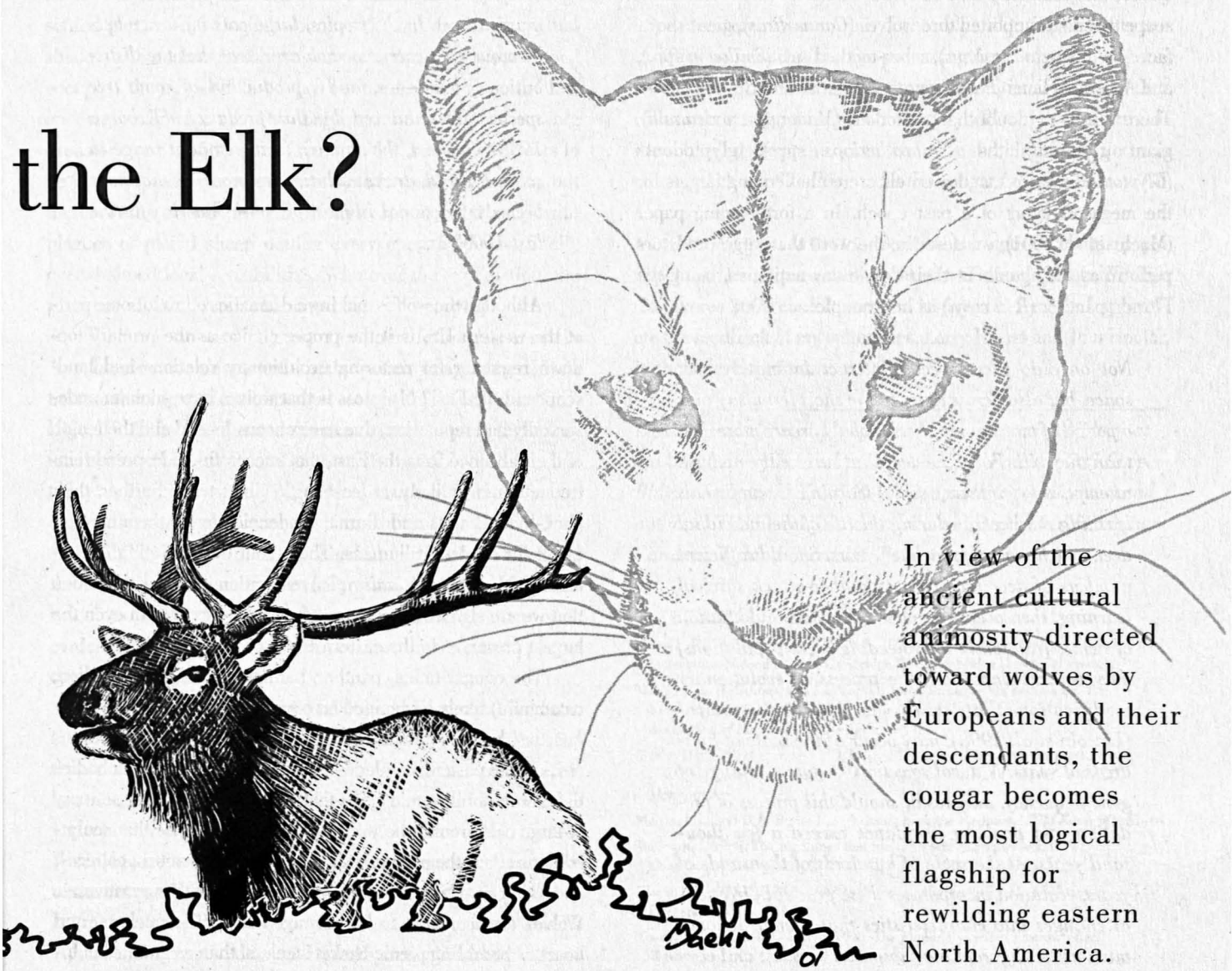
THE WORK THAT SPECIES DO

For species restoration to be truly ecological, the taxonomic choices must make sense from both geographic and community points of view. We can justify elk reintroduction in the eastern United States because they are a native species, components of the pre- and post-Columbian vertebrate fauna. As a species that

is behaviorally dominant over the much smaller and sometimes overabundant white-tailed deer, elk restoration can be justified because it adds community complexity, and returns an interspecific tension that leads to ecological separation. It also returns a grazing and browsing influence that is different from that imposed by the primarily forest-dwelling, browsing white-tail. The elk both modify deer behavior and consume plants and plant parts that are uneaten or otherwise out of the reach of deer. These influences, given sufficient elk numbers, time, and space, will result in measurable changes across the landscape. This is the work of elk in Kentucky and elsewhere in the East.

But can this work be considered complete without the additional complexities and regulatory potential imparted by large carnivores that regularly kill and consume an animal as large as an elk, and that might limit the ecological changes that could be caused by unchecked and widespread herbivory? Certainly the black bear—which is distributed throughout the East—can be a capable predator. But in a botanically diverse and highly productive region, this classic omnivore thrives on a diet containing no meat other than the opportunistic carcass that it stumbles upon when traveling from one berry patch to another. Although the black bear moves primarily to find sessile food resources,

the Elk?



In view of the ancient cultural animosity directed toward wolves by Europeans and their descendants, the cougar becomes the most logical flagship for rewilding eastern North America.

illustrations by the author

there is nothing about its nature that demands huge home ranges. A bear might be perfectly content spending its life in a one-acre forest provided that sufficient food, cover, and mates are available. The black bear in Appalachia may be wonderfully adapted to the landscape, its climate, and primary productivity, but it does not exert a selective force on large, sympatric ungulates such as deer and elk. This fact is made even more apparent by the black bear's obligation to spend four to six months in hibernation during a time of the year that would otherwise necessitate the consumption of large quantities of animal protein.

Whereas a passing black bear likely was worth no more than a glance by a browsing elk, for the better part of the last ten millennia, large ungulates in the East were kept on a daily, year-round alert by at least two carnivores that engaged them in an evolutionary tug-of-war: wolves and cougars. Until the early 1800s, this relation was a carry-over from a Pleistocene landscape that also supported dire wolves (*Canus dirus*), giant short-faced bears (*Arctodus simus*), saber-toothed cats (*Smilodon* spp.), and American lions (*Panthera atrox*) (Martin and Burney 1999). There can be no doubt that mastodons (*Mammut americanum*), giant ground sloths (*Nothrotheriops* spp.), glyptodonts (*Glyptotherium* spp.), and even elk were challenging targets for the mega-predators of a past epoch. In a forthcoming paper (Maehr et al. 2001), we describe the work that large predators perform as they go about their day-to-day activities, using the Florida panther (*P. c. coryi*) as an example:

> *Not only do these species interact intimately over space, but also across time. In the short term, say over a period of months, panthers probably scare more deer than they kill. For those deer that survive the ambush attempts of panthers, some learning occurs. This learning may accrue during the life of the individual deer, which may approach ten years. Should sufficient numbers of deer incorporate panther-attack survival learning, then over the course of decades habituation of demes [randomly interbreeding local populations] may occur. Adaptation, the process of evolutionary modification that results in improved survival (Lincoln et al. 1998), may occur at the scale of hundreds of years. Natural selection, by forced change of gene frequency, may result should this process of predation and predator avoidance exceed a few thousand years. At the scale of hundreds of thousands of years, evolution incorporates these gradual directional changes into characteristics that human taxonomists use to differentiate subspecies, species, and even genera. The effects of predation are becoming increasingly appreciated as large carnivores are intensively studied and restoration efforts take hold. The work of reintroduced gray wolves* (Canis lupus) *in Yellowstone National Park has been widely reported in the popular media as scientists observe the return of a vertebrate community keystone. As wolf packs have expanded in the park, coyote numbers have decreased as the result of interference competition, the availability of large ungulate carcasses has increased as the result of predation, and local populations of grizzly bear* (Ursus arctos), *bald eagle* (Haliaeetus leucocephalus), *and common raven* (Corvus corax) *have benefited from new sources of high-protein carrion provided by the wolves (K. Murphy, Yellowstone National Park, personal communication). In the tropics, large cats influence herbivorous seed eaters to such an extent that the distribution, abundance, and reproduction of some tree species are enhanced by this predation (Terborgh 1988). In short, the panther, in its remnant range in south Florida, drives evolutionary processes that have been dysfunctional in most of North America for the last 100 years.*

Although the wolf is making a dramatic return to some parts of the western US, is it the proper choice as the primary top-down regulator for restoring evolutionary relations and landscapes in the East? My guess is that wolves have such an undeservedly bad reputation, due to erroneous legend and the length of their absence from the East, that successful widespread reintroduction is unlikely, at least in the short term. Further, their pack-living habits and diurnal tendencies make them an easy target for intolerant humans. The recent disappointing experiments with red wolf (*Canis rufus*) restoration reinforce the notion that we are still a very long way from wolf recovery in even the largest preserves in the eastern United States.

The cougar (a.k.a. panther, painter, puma, mountain lion, catamount) likely has gained an equally bad reputation in many quarters, but it is fundamentally different from the wolf in terms of its behavior and its place in folklore. This animal embodies the power, nobility, and grace that are often captured in statuary of large cats around the world. It is no coincidence that sculpted lions adorn the entryways of embassies, fraternities, colleges, and other institutions more often than do other carnivores. Wolves are more apt to be portrayed as child-snatchers, and bears as bumbling picnic basket stealers, than as granite sculp-

tures that celebrate desirable human qualities. Thus, while big cats might be scary if rarely dangerous, we hold them in higher esteem than their carnivorous canid and ursid relatives.

Also in the cougar's favor is the fact that many people believe that they are already present. Strange noises, disappearing pets, spectral shadows, and smudged pugmarks are accepted in many parts of the East as evidence of resident populations despite scant evidence to support that view. This phenomenon has been taken to an even higher level in western Great Britain where the Queen has called out the night-vision-equipped Royal Air Force to hunt down and kill a plague of cougars and leopards that reportedly roam an open, hedgerowed, and denatured landscape covered with sheep, highways, and people. Contact with the quarry was never made. In a recent visit with nature writer Scott Weidensaul, we were amazed at the blithe acceptance of mythical big cats in Devon, Bodmin, and Surrey—long-settled parts of the English countryside that are in the virtual shadow of Stonehenge. Although wolves and brown bears once occupied the British Isles, it has been centuries since the last one was exterminated. The English have lived without big predators for over 500 years (Young 1946), but there appears to be a widespread desire to have *something* big and scary out there. Perhaps the pastoral lifestyle, punctuated only with plagues of placid sheep dotting every open field, has finally overwhelmed local sensibilities. Whatever the explanation, the presence of (nonexistent) big cats has been accepted.

While I do not suggest that our fellow citizens in Appalachia have developed similarly rich imaginations, I do believe that big cats are important sociologically as well as ecologically. Although rare and secretive, cougars were legendary for their stealthfulness, and tales of the animals remain alive today. A Kentucky family legend claims that "painters" were especially attracted to pregnant women, and former US Fish and Wildlife Service biologist Wendell Neal is fond of telling the legend of southeastern panthers and their use of "holler holes" to deceive their prospective prey. Although there is no evidence to support such fanciful claims, they remain a part of our cultural tapestry.

The classic texts by Young (1946) and Young and Goldman (1946) indicate that both wolf and cougar were widespread throughout the East at the time of European settlement. Wolves, however, suffered a greater degree of persecution. Perhaps this was a holdover from centuries of conflict with the wolf in the Old World, but it likely was also because of the more secretive nature of the cougar. It is this more retiring character that is suggested by many to explain how cougars might still exist in remote Appalachian forests. Although I am skeptical about the existence of breeding populations outside of Florida today, the early settlers and naturalists were certainly correct about the differences in canid and felid behavior. The cougar is the co-evolutionary partner of the white-tailed deer, and it quickly learned to prey on elk after the latter colonized North America during the Pleistocene. Young and Goldman noted that with the 1830s disappearance of elk in Indiana, the cougar was soon to follow.

With these characteristics of North American predators in mind, and in view of the ancient cultural animosity directed toward wolves by Europeans and their descendants, the cougar becomes the most logical flagship for rewilding eastern North America. The return of elk to the East is an important but insufficient step toward recreating the community dynamics under which many of our remaining plants and animals evolved. Herbivory without predation will demand increasing attention from managers as forests suffer the consequences of a missing large carnivore. Human vanity or strictly utilitarian purposes are insufficient justifications for promoting large mammal restoration. Cougars in the East will return an evolutionary tension; they will restore ecological services; and they will enrich a culture that was chiseled from the mountains. We have jump-started the process with elk. Is it time to let the cougar get back to work? ☾

ACKNOWLEDGMENTS Some of the notions in this paper appeared in a presentation at the Defenders of Wildlife Carnivores 2000 conference held last year in Denver. I appreciate the feedback of my colleagues, Larry Harris and Tom Hoctor, in their development.

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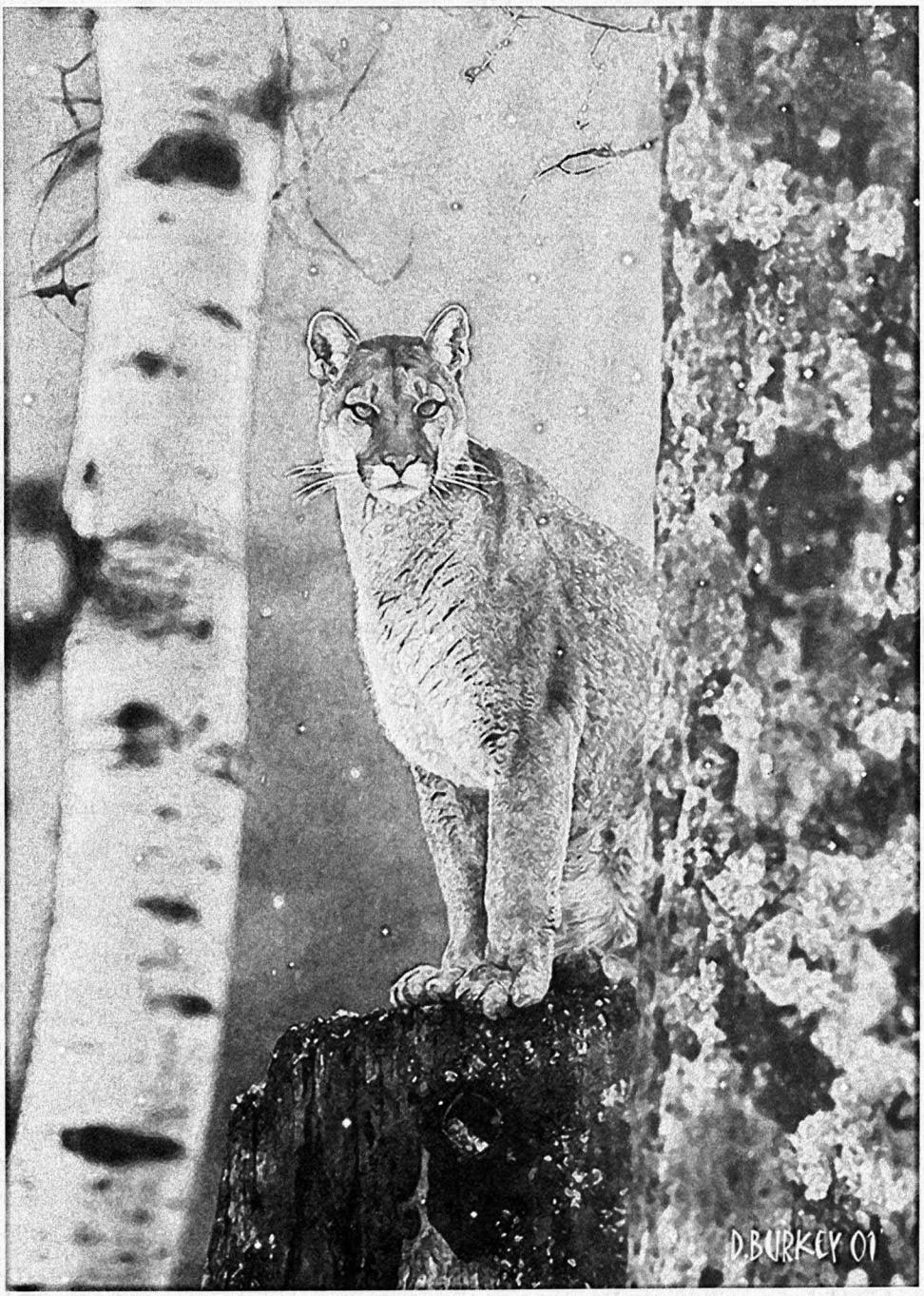


Confirming Eastern Cougar Presence

by Chris Bolgiano

illustration by Darren Burkey

THE EASTERN COUGAR FOUNDATION

Confirmed physical field evidence of cougars living wild in several regions of eastern North America is beginning to accumulate. Related issues of legal status, habitat management, and social acceptance are also emerging. The Eastern Cougar Foundation, a nonprofit educational and advocacy organization, was founded by independent researcher Todd Lester in 1998 to compile the accumulating evidence and to grapple with these issues.

Written confirmation from recognized authorities is the only validation of cougar presence that the Eastern Cougar Foundation will accept. To date, we have documented twelve instances in which various items of field evidence have been confirmed by biologists: three cases involving either a live animal, dead body, or body part; four cases of scats; three cases of tracks; and two videos. The geographic range of these incidents is New Brunswick to Missouri; the date range is 1976–2000. DNA analysis conducted in several of these cases indicated cougars of the North American genotype; one cougar whose entire body was recovered showed no signs of prior captivity. (Many captive cougars are declawed and/or have tattoos.)

Confirmed reports form three general clusters: New England and New Brunswick; southern Appalachia (with its seven-million-plus acres of public lands); and eastern Missouri/western Illinois. It seems unlikely that cougars would cross the wide, busy Mississippi River, but such a scenario cannot be completely ruled out, given the remarkable capacities of this cat.

Possible sources of these animals include remnant natives, escaped or released captives, and colonizers from

This article is a brief adaptation of a paper, "Field Evidence of Cougars in Eastern North America" by Chris Bolgiano, Todd Lester, Donald W. Linzey, and David S. Maehr, which was presented at the 6th Mountain Lion Workshop in San Antonio, Texas, in December 2000. The full paper including references will appear in the conference proceedings, edited by Louis A. Harveson (Dept. of Natural Resource Management, Sul Ross State University, PO Box C-110, Alpine, TX 79832), to be published in fall 2001 by the Texas Parks and Wildlife Department.

TODD LESTER is a third generation coal miner in Wyoming County, West Virginia. In 1983, when he was seventeen, he glimpsed a large, tawny, long-tailed cat one dusk while he was out coon hunting. "When we made eye contact, the cat captured a piece of my heart," he said. Gradually, the certainty that cougars still inhabited the woods around him changed his life. He began to go out looking for confirmation of their presence.

He distributed a flyer with his phone number, then headed out for the field whenever anyone called him with a promising lead. Nowadays his wife and young daughter sometimes go along. Their house has become an archive of plaster track casts, hair samples, photos of kills, videos, field notes, and notebooks of sightings. But state game officials refused to acknowledge his efforts, much less help him ferret out what might be true cougar sign from the blur of background scratchings.

Then Todd started an eastern cougar e-mail listserv, and set up a website with photos of his most promising track casts. Dr. Lee Fitzhugh, a cooperative extension agent at the University of California–Davis, who specializes in cougar tracks, found the site and downloaded and analyzed the photos by a quantitative system of measuring angles of intersecting lines from toes and heel pads. At least one set of Todd's tracks, he concluded, was definitely cougar.

The news galvanized Todd. In 1999, recognizing that only an organized group would have enough clout to influence the officials who formulate wildlife policy, he established the nonprofit Eastern Cougar Foundation. The foundation's mission is "to promote the recognition and the protection of the large cats known as cougar, panther, mountain lion and puma, living wild in the eastern United States."

With a couple of sympathetic friends, Todd put together an organizational board of directors that includes such distinguished scientists as Dr. David Maehr, former director of field research for the Florida panther recovery project and now a biologist at the University of Kentucky; Dr. Melanie Culver, a feline geneticist whose research may prompt a revision of cougar taxonomy; Robert Downing, the retired US Fish and Wildlife biologist who in the 1980s carried out the only official field survey for eastern cougars; and Dr. Donald Linzey, well known for his extensive writings on mammals in Virginia.

continues next page

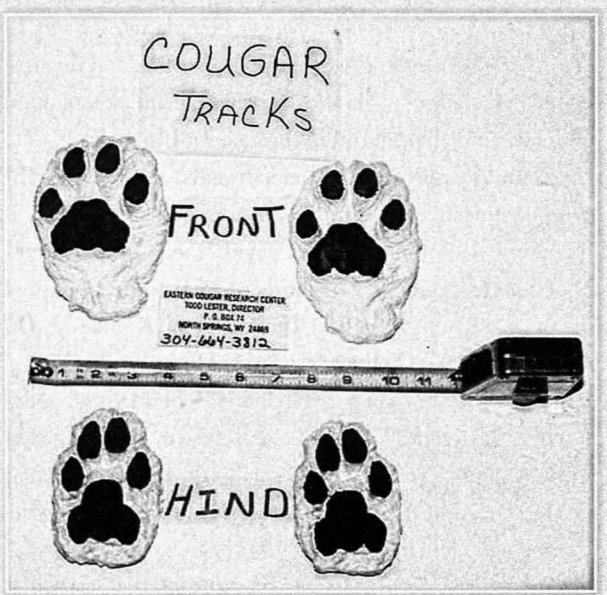
With a grant from the Sierra Club, the Eastern Cougar Foundation has created and is distributing widely a one-page, informative handout on eastern cougars and is compiling a file of documented confirmations of cougar presence in the East. Recently, the organization petitioned former Secretary of the Interior Bruce Babbitt to "make it the explicit policy of the US Fish and Wildlife Service staff to clearly state that all cougars living wild in the east are protected under the Endangered Species Act regardless of origins."

This may seem obvious, but in fact the Fish and Wildlife Service has deliberately muddied the legal status of cougars by claiming that the sole source of cougars in the East is escaped and released pets that are not the same subspecies as the eastern natives listed under the act.

Todd Lester lives near a town called Panther. His great-grandmother had a panther follow her down the hollow. Todd thinks that cougars never totally disappeared, and if some cats from parts unknown have swelled their number, "So what?" he says. The Eastern Cougar Foundation's official position is that any cougar capable of living wild deserves full protection to do so.

—CHRIS BOLGIANO

Annual membership in the Eastern Cougar Foundation is $10. To join, report cougar sightings, request free copies of the eastern cougar flyer, or contribute financially to the organization's work, contact the Eastern Cougar Foundation, PO Box 91, North Spring, WV 24869; 304-664-3812; scb01489@mail.wvnet.edu. Visit the ECF website at www.geocities.com/rainforest/vines/1318.



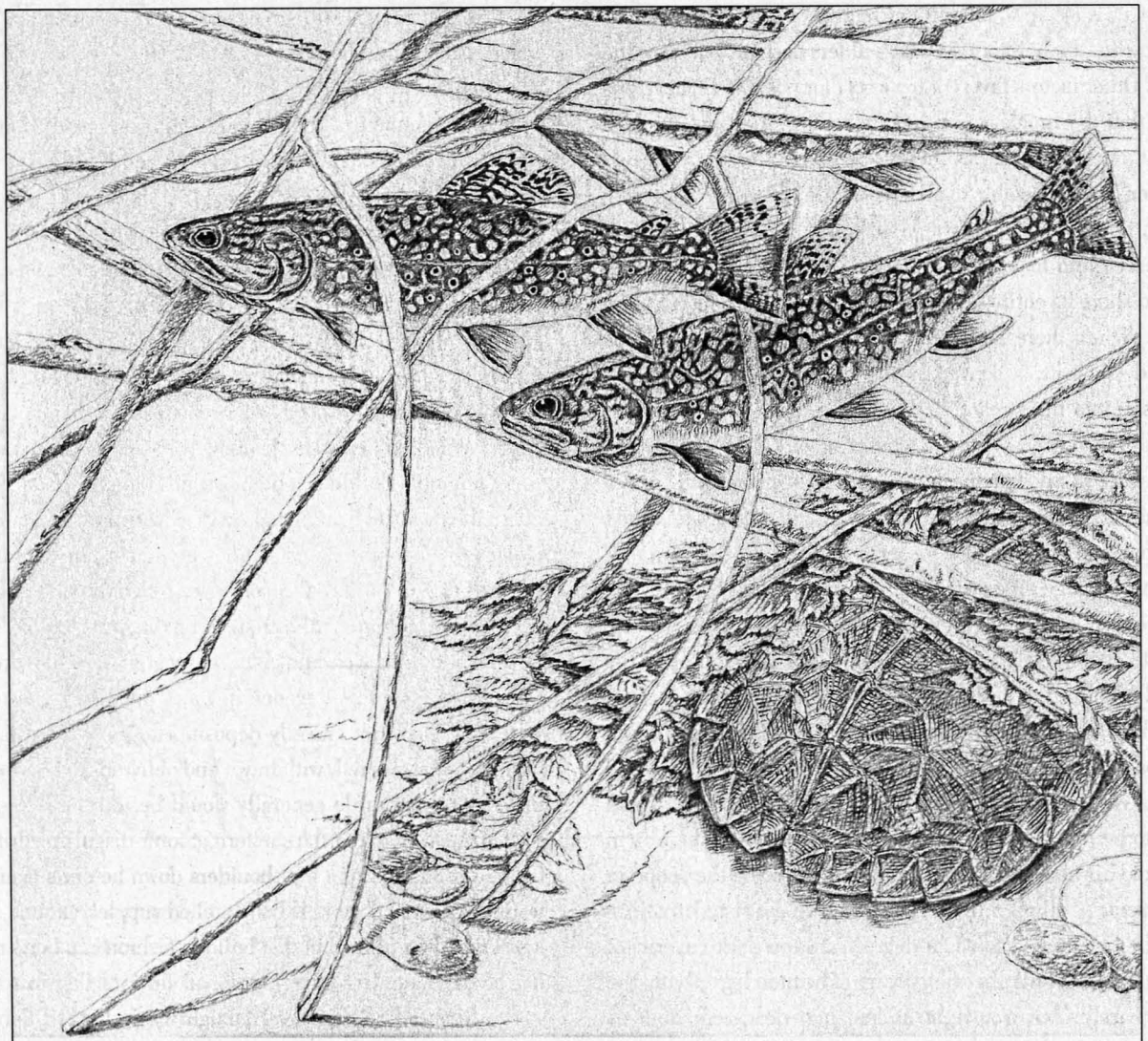
known cougar populations in Florida, Texas, the western United States, and Canada. Since spring of 1998 at least three radio-collared Florida panthers have crossed north of the Caloosahatchee River for the first time since fieldwork on the species began 20 years ago. Considerable evidence also indicates that cougars in western North America are moving eastward to reclaim old ranges in the Plains states, and perhaps moving into new territory. It may never be possible to entirely resolve the question of cougar origins even with DNA testing, because of the low genetic variability of North American cougars, and perhaps more importantly because of the small sample size of known eastern cougars.

Given the widespread regrowth of forest cover and the resurgence of deer herds across the East, it is likely that human—rather than biological—constraints will limit the establishment of viable cougar populations. However, there is the potential for positive public reaction to the animals as well as growing conservationist support of cougar recovery. Fifty-six conservation groups across the East endorsed the recent Eastern Cougar Foundation request that the US Fish and Wildlife Service expand the Similarity of Appearances rule of the Endangered Species Act from Florida throughout the East. That request was denied pending documentation of a breeding population.

If viable cougar populations with their potential for depredations are to be tolerated, however, much educational outreach remains to be done in rural communities, especially near public lands. It may be possible to persuade hunters to accept perceived cougar competition for deer, and simultaneously to reduce the possibilities of cougar attacks on humans and livestock, by allowing non-consumptive chasing with dogs in restricted areas as a means of aversive conditioning. There may also be possibilities for significant economic development based on cougar-related ecotourism. Most importantly, recovering a viable cougar population throughout much of the species' historic range would return a native predator to the East, providing ecosystem benefits such as a natural selection force and population check on currently overabundant deer. ☾

Chris Bolgiano *is vice president of the Eastern Cougar Foundation and a freelance writer. Her books include* The Appalachian Forest: A Search for Roots and Renewal *and* Mountain Lion: An Unnatural History of Pumas and People, *which has just been reissued in paperback. She is presently working on a book about sustainable forestry that profiles Todd Lester in a chapter on cougars, coal, and the commons.*

plaster track casts, photograph by Todd Lester



Deadfalls, Turtles, & Trout

BY DAVID M. CARROLL

Mist and drizzle, mild day in the midst of a January thaw; taking advantage of the balmy temperature, I walk to Alder Brook in my neoprene waders and old sneakers, to see if there is open water. I sink mid-calf deep in rain-softened snow, and begin to wonder if I should have worn my snowshoes. From its high eastern bank I see that the brook is more free of ice than I thought it would be. It is edged with shoreline-clinging shelves ranging from one to three feet wide; crusty, granular snow-coated ice, sharply white against dark water on a dark day. I walk to a cut in the bank,

wintering brook trout and wood turtle, illustration by the author

where access to the water will not require skiing on wet sneakers, and with the help of rain-black alders ease my way into the stream. Other factors favoring my quest for my first January turtle are that the brook is just below bankful, and that it slides along at a moderate rate. If there were sun to light my way into the water, I might be able to make a sighting of an overwintering wood turtle from up on the streambank.

There is no looking into the brook when it is frozen over shore-to-shore its entire length, as is usually the case at this time of year. When there are openings in the ice, there is almost always deep, swift, broken water rushing by, making it impossible to see into the stream. Today I bring a new implement to grant me visual access into the interior brook and its streambed: a waterscope, a wooden, megaphone-like construction about two and a half feet long, with a one foot square pane of glass sealed at the bottom. This scope represents the height of my swamp-walker technology, an instrument given me in exchange for some turtle fieldwork I conducted in the summer.

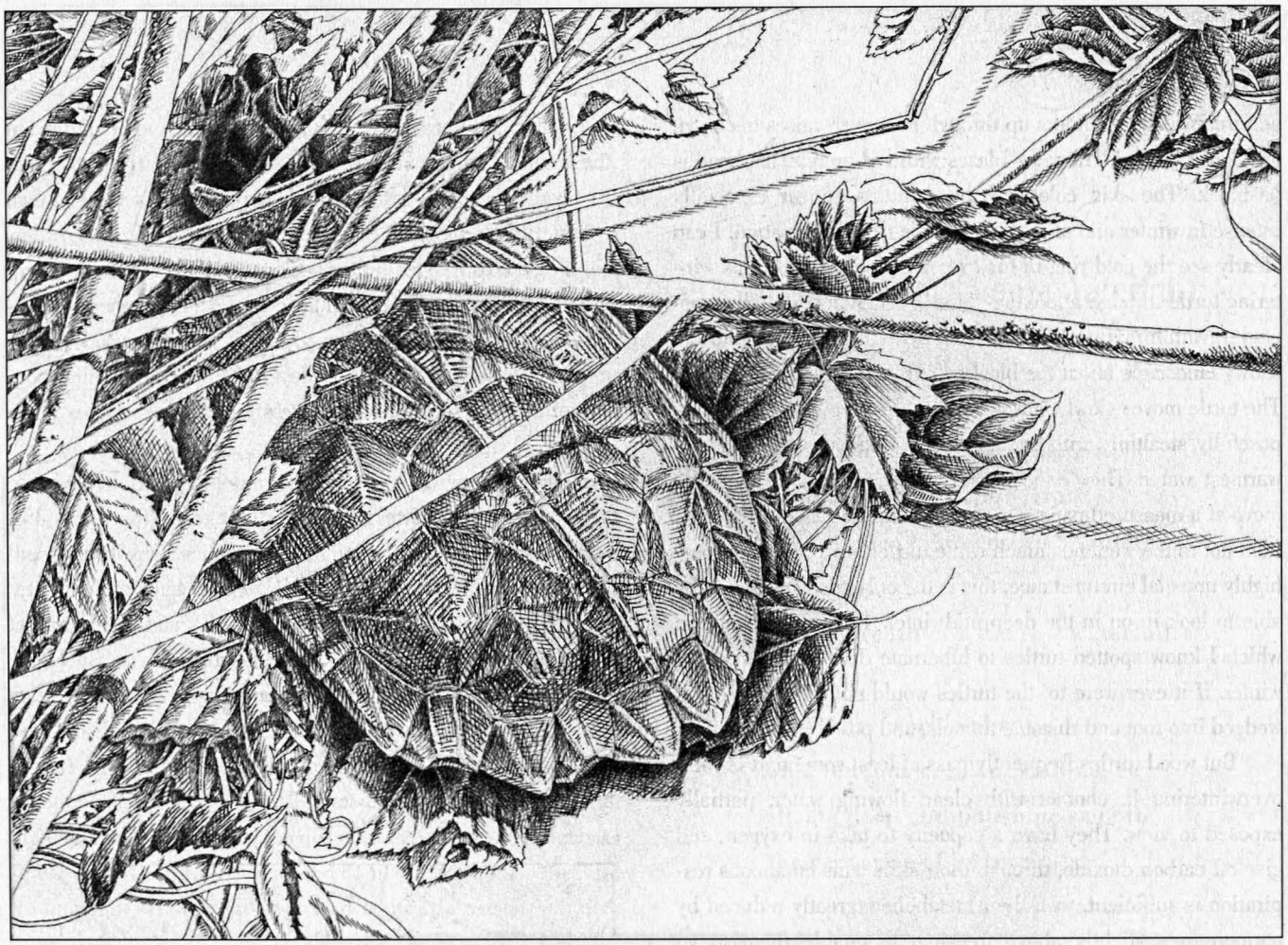
I steady myself in a bit of a race below a riffled drop in the wooded brook's run, and push the waterscope through opaque and reflecting braids of light and dark, through which I would never be able to see unaided. I press my head in place, and see that I have a wonderful window into the winter brook. There seems to be more light in the streaming water than there is in the muted air above it. I get used to maneuvering the scope in the current, angling it in order to look into twisted rootings along the banks, and to some degree into the dark caverns of undercuts. It is still the very heart of winter here, with the stream barely above or right at freezing, dead-zero degrees Celsius, not turning into ice only because it is flowing. The water temperature does not vary much more than three degrees or so Celsius (or five degrees Fahrenheit) from November through late March or early April, a relative environmental constant, while air temperatures careen from occasional mild 50 degrees Fahrenheit and above to more than 20 degrees Fahrenheit below zero. In the embrace of this essentially unvarying medium, the aquatic life of the stream survives the temperature extremes of winter.

I search fallen branch tangles and the debris drifts and leaf packs they hold against the current, as well as similar aggregations that have settled into quiet edgewaters along the banks. These sunken logs and gatherings of stone are the favored lodging and hiding places of hibernating wood turtles. I have seen them during bank searches, from ice-out until the turtles first come up onto the banks to bask. Radio-tracking studies have shown that they also spend periods of time completely out of sight, deep in bank undercuts and underwater burrows of bank-dwelling muskrats. I will not be able to find any that are in such inaccessible winterholds.

But the turtles shift about. They are usually tucked into some cover, although I have seen them lying openly on the bottom, on a bed of sand or gravel, shouldered against a stone less than half the size of their carapaces, while swift clear water streamed over them. It is remarkable to see the still waters alongside the steady rush of the brook through its main channel. A sunken leaf loosened from somewhere upstream spins and swirls by, barely an inch away from layerings of sunken leaves on a bankslope out of the current that are as unmoving as if they were lying on a forest floor on a breathless autumn day.

Beneath broken water just below a debris dam, in a curl of water around a building cobble bar, just off a deep, dark undercut in the opposite bank, I make a discovery. Partially concealed beneath a sunken log, in a setting very much like one in which I would expect to find a wood turtle, I sight a wintering brook trout. It is intriguing...the trout is holding, not unlike a wood turtle, under a sunken branch or root that is worn like driftwood from its lengthy submergence in the swift water. The wood is well imbedded in a gravelly deposit. The brook trout is not so wedged and anchored, withdrawn and oblivious to his surroundings, as a wood turtle generally would be. But he is resolutely settled, head-in under the sheltering, form-disguising driftwood, facing upstream. From his shoulders down he curls against his water-weathered cover, his body arched supplely around it, with his pectoral fin braced in that bulldog-fashion of a bottom-holding brook trout. His wavering dorsal fin is a flag in a watery world, his pelvic fin stiff and straight back, his tail flared. He rocks frequently in the rushing water. Now and again he firms up his anchorage, with sudden, body-length shudderings, to keep his place. This is not a holding lie. He does not seem likely to dart out at prey in water this cold and brisk, and essentially devoid of living things. It is a holdfast, an overwintering niche.

I could never get this close to a brook trout in a stream during his active season. The brilliant fish is surely aware of me, and evidently reluctant to flee his winter cover. When I take my face away from the waterscope, he is completely invisible. I cannot even see his driftwood cover through the incessant rush of wildly broken surface water that issues from the debris dam and passes over his hideaway. But I have a stunningly clear view of the seven-to-eight-inch trout through my underwater window. Even as I maneuver the scope awkwardly in the surge of the water and overhanging deadfall red maple branches near the surface, I do not frighten the fish away. He has taken his heart-of-winter place, and wants to keep it. I am able to see in great detail the handsome trout's vermiculated pattern (so matched to



broken surface water, webbings of lights and darks within the water), the scarlet in his fins, especially his braced right pectoral, with its edging of ebony and ivory.

It is hard to leave the living image of the vibrant trout in vibrant winter water (I have never had such a sustained look at one of these fish), but an inevitable chill creeps in. It is, in fact, January, and even in neoprene chest-waders and an extra sweater, polar fleece vest and gloves, there is only so long I can stay in the brook. The trout has tolerated uncommonly close inspection, but would not be likely to hold still if I were to wade by him, so I back down stream, struggle onto the cobble bar, and make a detour through the alders.

After giving wide berth to the brook trout's winter refuge and warming up a bit, I re-enter the stream where the slide of water is slower, and the surface calmer, along a forty-yard reach that lies like an extended pool, about five yards wide, an avenue of the brook lined by upreaching and overhanging speckled alder and silky dogwood. At the lower end of this run, the horizontally inclined shrubs are intergrown across the surface. I have to separate them, raise and bow beneath them, as I work my way upstream, waist-deep in icewater. This channel, with a deep pool under red maple at its foot, and a cut, sandbar, and trough under royal fern mounds at its head, is the place in which I have had more wood-turtle sightings than anywhere else in this stream. It appears to be a favored overwintering area. In this watery aisle of the wood turtle, I am soon rewarded with my first January turtle. Out of the main passage of the current, which keeps the central channel bed washed clear all winter long, I see the shell of a large wood turtle. He is head-in, under a criss-crossing of sunken alder stems drifted with leaf litter, just up from the stream bottom on a silty bankslope.

Nearly all of his carapace is in view, beautifully sculpted, well camouflaged, the color of leaf-drift and sunken wood. This ground color is flecked and streaked with the golden-yellow patterning that is brought out when these turtles are in the water, to blend with the glintings of their sand-strewn streambeds. This same decorating mimics sunken and floating sprays of shed white-pine needles, and, like the markings on the back of a brook trout, becomes undecipherable beneath broken water. Out of the stream, the fine gold striations become subdued in an overall leaf-and-shadow umbering that blends with the shaded, leaf-strewn floorings of alder carrs and other riparian habitats, as well as terrestrial oldfields, shrub hedges, and woods.

I am certain that the turtle is not aware of me. But as I

wood turtle, illustration by the author

admire him, he shoulders up through his cover, raises his head, and looks around. His neck blazes with red-orange, his head is jet-black. The skin colors of these turtles appear especially intense in winter and at first emergence from hibernation. I can clearly see the gold ring in his eye. My observation of this wintering turtle through a looking-glass is deceiving. Visually closeted in with him, two and a half feet deep in his brook, with the snowy landscape about me blocked out, it could be any season. The turtle moves slowly, but these creatures typically move purposefully, stealthily, with frequent freeze-frame poses even in the warmest water. They endeavor to pass unseen, and generally move at a measured pace. This is a remarkable moment for me. I am not in the wetlands much while turtles sleep. Barring some highly unusual circumstance, this is the only species I would be able to look in on in the deep midwinter. The shrub swamp in which I know spotted turtles to hibernate does not open up in winter. If it ever were to, the turtles would still be out of sight, wedged into root and rhizome tunnels, and possibly muck.

But wood turtles frequently pass at least some part of their overwintering in contact with clear, flowing water, partially exposed to view. They have a capacity to take in oxygen, and give off carbon dioxide, through their skin. This cutaneous respiration is sufficient, with their metabolism greatly reduced by temperatures slightly above freezing, to enable them to go through long northern winters without access to air breathing. Sandy, gravelly streambeds are a critical feature of their overwintering ecology, as oxygenating water constantly sifts through this substrate. This same ecological parameter is vital to the eggs of brook trout, which must have a constant upwelling of cold, well-oxygenated water throughout their winter development. The upwelling water, in addition to oxygenating, prevents a silting-in that would suffocate trout eggs. A layer of muck as thin as 1/32" creates an anaerobic environment that would smother trout eggs and newly hatched young, called alevins. It could cause difficulty for hibernating wood turtles.

The male wood turtle looks around unconcernedly as I back away. I cannot help wondering how he escapes the notice of mink and otter, two active and voracious predators of this brook, even when it is icebound.

MY PARTICULAR FOCUS ON SUNKEN BRANCHES HAS rewarded me with sightings of two cryptic stream animals who are all the more elusive in their wintering modes. Woody debris, from massive deadfalls to thin screens of submersed twigs and sunken bits of bark, are critical habitats for much stream life in all seasons. This, and the varied mineralwork of the streambed, from clay to boulders, provides essential cover during the cold season. In addition to providing cover, forage, and anchorage in the mutable environment of flowing waters, large and small woody debris influences the morphology and flow rates of stream channels, helping to shape undercuts, and to form pools, riffles, aerating spillways, deadwater pockets, and all the other dynamic features that engineer habitat complexity and thereby contribute significantly to biodiversity in a waterway. Woody debris importantly serves to impede access by humans and their accoutrements; the effects of such access to stream ecologies range from problematic to devastating. Humans have an overwhelming tendency to remove impediments, and bring this behavior to bear on rivers and streams, where their relentless removal of obstacles to vistas, recreation, and commerce wittingly and unwittingly replaces habitat complexity with habitat simplicity.

While conducting fieldwork with turtles and their blend of riverine, riparian, and adjacent upland habitats as an aspect of a "Wild and Scenic River" designation study a number of years ago, I extolled the many virtues of a tremendous jumble of fallen trees to a colleague. The fallen trees, some long-dead, bleached and sloughed of bark, others still in full green leaf, formed a

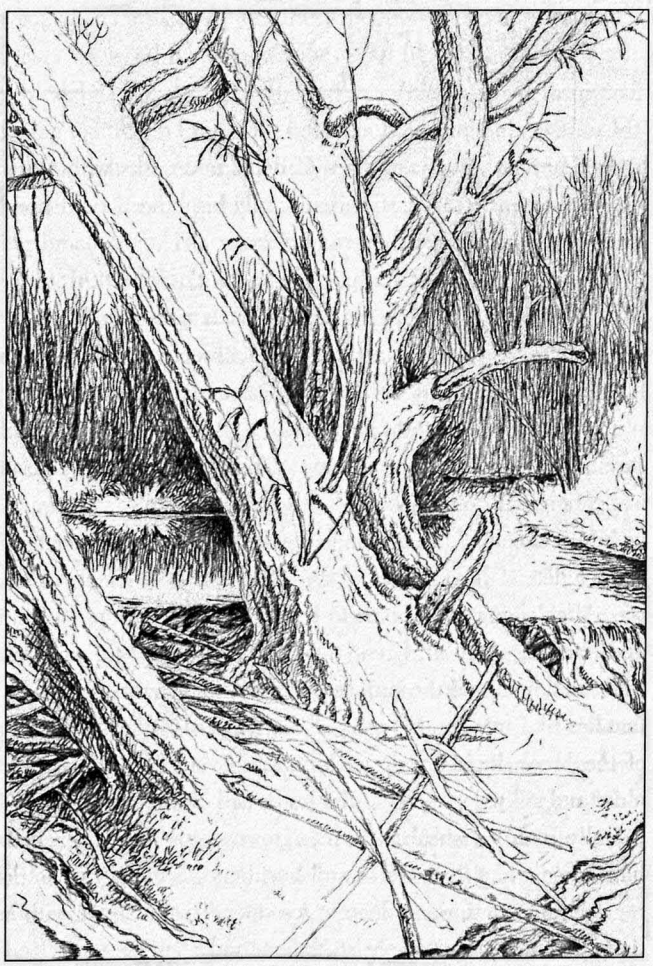


illustration by the author

river-bridging debris dam. It was all the more fortuitous that this complex configuration was situated between two ecologically splendid floodplain forests. Even better, the floodplains on both sides of the river were posted against trespassing and therefore maintained a broad corridor of sanctuary along a river that was already subject to considerable human activity and manipulation, and due for more encroachment in the near term.

One of the properties had been exempt from public haunt for a century and a half, although some selective cutting had been done in a red maple swamp in recent decades. I pointed out the extraordinary value of the woody debris to the apparently small, and I suspected declining, colony of wood turtles I had been investigating along this reach. We both understood how critical such an impressive instream habitat feature would be to a range of riverine life, from protozoans to duckweed, waterfowl, wood turtles, and river otter.

Three days later I walked the bank on another survey and was stunned to see sawed-off butts of trees. I had thought the huge girth and heavy structure of the felled beech, red oak, and silver maple would foil attempts at clean-up. But the channel had been cleared of great tangles of finer canopy branchings as well as enormous trunks. I looked on in disbelief, then grief and resignation. My waning hopes for wood turtle persistence here were dealt a heavy blow, another reality check that I chided myself for not foreseeing. After all my years of acquaintance with landscapes of loss, I can still think some things inviolable.

Later on I reported this finding to my colleague, and asked who could have done this.

"The Conservation Commission."

"The Conservation Commission?!" I nearly shouted with incredulity, "Why?"

"They're getting ready for next spring's canoe races."

Wild and scenic? Part of the river's very heart had been cut away. And what of the wild hearts beating within it? The structure of their riverine environment, the very architecture of their coevolution, had been taken away...not just here, but for miles along the river corridor. Where to shift for shelter? Where, when autumn deepens once more and cold intensifies in the water, will wild trout and winter-slowed wood turtles withdraw for their critical abiding, their long wait for thaw and spring? ☾

Naturalist, writer, and artist **David M. Carroll** *has spent fifty years exploring wetlands and the creatures who live there. His latest book,* Swampwalker's Journal: A Wetlands Year, *was awarded the John Burroughs medal for 2001. Carroll is also the author of* The Year of the Turtle *and* Trout Reflections. *His essay here is drawn from a work-in-progress about brooks and streams.*

Last Time at Coop's Waterfall

(for J, R, & N)

A slender leaf, cobweb-caught,
spins and bounces upright
in the space between two boulders,
twirls mid-air
on the breath of a narrow waterfall.

Miniature worlds abound
on a tenuous creek of snowmelt
slicing deep and polishing smooth
the centuries of bedrock:
this box elder tree abloom
with a thousand tiny tassels;
this rippling light reflected
on the patterned bark of cottonwood.

The ravine is barely wide enough
for sunlight, and the old man's footpath
(overgrown with peppermint
and shiny vinca vines),
and, now, the survey markers.

One last look:
that periwinkle blossom on the water.

—***Suzanne Freeman***

ABANDONMENT

On Beaver Ecology and Recovery

by Tom Wessels

From my house, a ten-minute walk takes me through a young pine woods to the crest of a high, open meadow, then down into a valley that supports the most extensive beaver ponds within the range of my wanderings. Two large ponds form the heart of the area, the bigger pond lying farther back at the base of the rugged, aptly named Rocky Ridge. Beavers have inhabited this once forested valley for over three decades, moving alternately from one pond to the other. Because of its wild appearance, created by hundreds of standing dead snags, the area is an all-season magnet for my explorations.

Although only a few minutes from my home, the ponds, particularly the farther one, create the strongest sense of wilderness that I have encountered in the region. Standing on skis at midnight, alone under a January full moon, surrounded by large spruce and pine snags, my feeling of seclusion is as great as any I've ever experienced. Yet this is far from an untouched environment. It is a highly manipulated ecosystem, one that has been dramatically altered to suit the needs of a single species—the beaver. Beavers are the only animals, other than humans, that will create entirely new ecosystems for their own use. And often, like humans, once they have depleted an area's resources, they will abandon their holdings and move on.

The etching shown here does not depict one of the ponds near my home, but it does show an abandoned beaver pond, a common sight in central New England. How can we tell that this pond is abandoned? How long ago did the beaver leave this pond? What was the quality of the habitat for the beavers when they created the pond? These questions are the focus of this essay; however, before we attempt to find the answers, we need more information on the life history of the beaver.

Beavers flood forests and create ponds for two reasons. The first is safety. Slow on land, especially in snow, beavers are easy prey for large predators, but in the sanctity of a pond, they are almost completely free from predation. The second is that ponds foster the development of their summertime food supply. Aquatic plants like water lilies, pickerelweed, and cattails are

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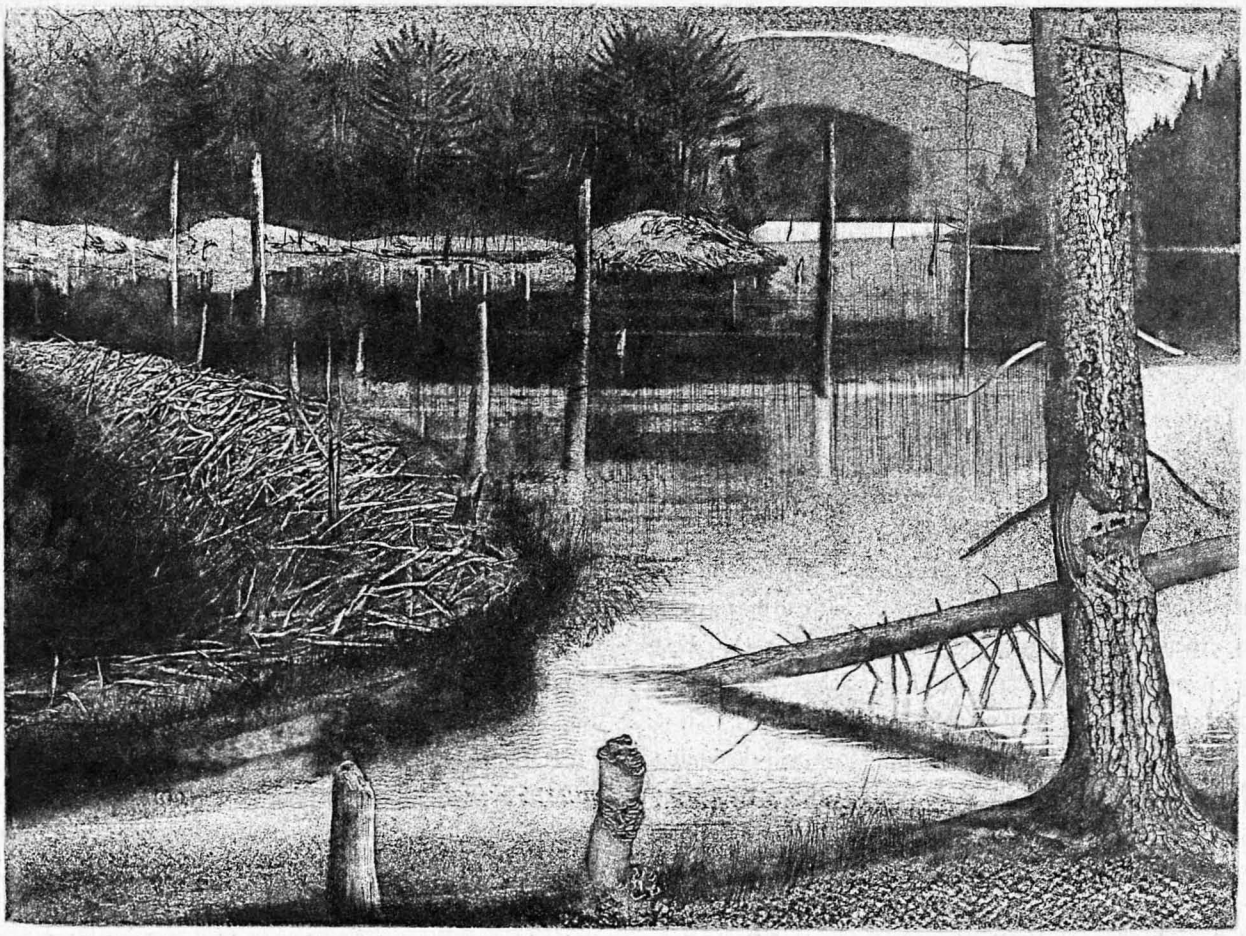


common summer staples. During the winter their diet shifts to the bark of trees. If they are successful in storing a large enough supply of limbs in their pond during the fall, they may never need to leave the protected confines of their watery home for an entire winter season.

The dams beavers construct to create their ponds are composed of a combination of sticks and mud. Although they can deplete the trees around their ponds, these animals are true conservationists when it comes to recycling. All of the sticks, whose bark supported the beavers through the winter, are reused to build the dam and lodge. A truly impressive dam can reach a height of over ten feet. At this dimension the dam often takes on a concave form, bowing into the pond and gaining added strength from its horizontal, archlike structure. When I first moved to Vermont, I came upon an impressive dam like this one in the town of Dummerston. The downstream side was a vaulted nest of smooth gray sticks that rose to meet the pond's surface at the very top of the dam. The dam spanned forty feet, and from its base—in the former streambed—it rose eleven feet.

Odds are that if you encounter a beaver pond, it will be abandoned like the one in the etching. Most beavers will inhabit a pond for only five to twenty years, but abandoned ponds can last for many decades. Because beavers invest both time and energy in the construction of their dam and lodge, why would they choose to leave the pond? The chief reason for abandonment is a depleted winter food supply. Because beavers are more susceptible to predation on land, they rarely travel more than two hundred feet from their pond margin. In marshy areas they dig canals that radiate from the pond's perimeter to gain access to more distant woodlands. But once all their preferred species of trees have been cut and consumed within a couple hundred feet of the pond margin or canal terminus, beavers will abandon the pond in favor of a new home.

Beavers have a distinct hierarchy among the species of trees they harvest for winter food. Most preferred in central New England are members of the willow family, including aspens and the cottonwood, all of which have bark that is easily digestible and high in protein. Next come the oaks and ashes, followed by sugar maple and speckled alder. Members of the rose family, such as apples and cherries, are also important. Of moderate interest are members of the birch family, especially musclewood, black birch, and paper birch. Gray birch, yellow birch, hop hornbeam, beech, and red maple are low on the beaver's food preference list, and conifers like pine and hemlock lie at

illustration by Brian Cohen

the very bottom. When we see conifers being cut and their bark consumed, it is a sign that the beavers will likely be abandoning the pond within a year's passing. (This, however, should not be confused with girdling activity. To encourage the growth of their preferred trees, beavers often girdle and kill young pines and hemlock. Girdled trees are never felled; they have their bark removed all the way around the base with little evidence that the wood has been chewed.)

Beavers have preferences not only for certain species, but for trees of certain sizes, as well. Imagine yourself a beaver: What size trees would you seek to fell, cut up into manageable lengths, and haul back to the pond? From the perspective of a beaver, pole-sized trees, those four to six inches in diameter, provide a better food supply than either larger or smaller trees. This is because the amount of bark offered by a pole-sized tree, relative to the beaver's energy expenditure in cutting and hauling it, makes it the best choice. A beaver's dreamscape would be a forest of pole-sized aspens; its nightmare, a stand of mature hemlocks.

The composition of the surrounding forest will determine how long a beaver pond will be active, but the pond's topographic setting is important, too. Given two ponds surrounded by similar forests, which type of topographic setting will support an active beaver pond for a longer period of time, one sited in a broad, flat valley or one that lies in a narrow ravine? Each year, as beavers cut more trees, they use the debarked limbs to increase the height of their dam. This causes the pond to expand the area of its coverage. In a broad valley, as trees are depleted around the pond, increasing the dam height by only a foot may flood the denuded forest and extend the two-hundred-foot zone to new harvestable trees. Increasing dam height in a ravine, on the other hand, will do little to enlarge the pond and thus will not increase access to new trees. All things being the same, beaver ponds in broad, flat valleys are active for longer periods of time.

As previously mentioned, the pond in the etching (on the previous page) is abandoned. From the evidence at hand, how can this be surmised? Can we tell how many years ago the beaver left? Is it possible to assess the quality of the pond's original beaver habitat to develop a rough estimate of how long the pond was inhabited? The etching holds the answers to all these questions.

DATING ABANDONMENT

The very first sign that beavers are no longer in residence can be observed about two weeks after their leaving. The water level in the pond will drop one-half to one foot. Without the beavers' daily attention to the dam, numerous leaks develop. Unless there is a drought, an active pond maintains its water level right at the top of the dam.

When beavers emerge from their lodge to begin their nocturnal activities, the first order of business is to examine the dam. Their inspection is auditory in nature. If the noise of running water is low, a little bit of mudding on the pond side of the dam may be in order. Beavers scoop mud from the pond bottom and carry it between their chin and forelegs to be used to patch small leaks. (Contrary to cartoon impersonations, their tails play no role in mudding. The major use of the tail is for fat storage, which helps carry beavers through long winters.) But if beavers hear the sound of rushing water, dam-building activity is stimulated. It is such a strong stimulus that researchers have been able to get beavers to build dams on dry land in response to the sound of rushing water on a tape recorder. Without this nightly repair work, the pond's water level begins to drop.

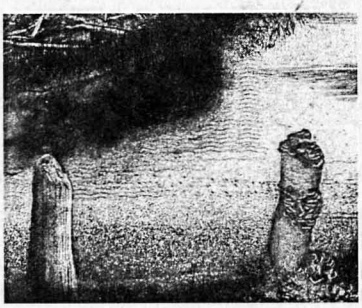
The lowered water exposes the rich moist mud on the pond side of the dam. During the growing season it takes only about one to two months for this area to become vegetated with herbaceous plants. Since the stream side of the dam is not mudded, little herbaceous growth will occur on an active dam; however, this side may support shrubs on older, maintained dams. The pond in the etching displays a lowered water level and herbaceous growth on the pond side of the dam. Does this suggest that it has been abandoned only for a couple of months?

There is other evidence that points to a longer period of vacancy. The stumps left by beaver activity are the next detail to examine when dating beaver pond abandonment. A tree that has been cut within one year's time leaves a stump with blond-colored wood. Numerous blond-colored stumps surrounding an abandoned pond date the beavers' departure at less than a year. If there are just a couple of these stumps, it is most likely the result of another beaver wandering through in search of suitable habitat following the pond's abandonment. The foreground of the etching shows two stumps, neither of which is blond.

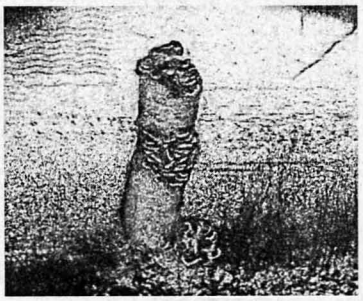
girdled hemlock

Of these two stumps, one has gray wood, which dates its cutting to more than a year ago; the other supports the growth of turkey tails, a species of shelf fungus that grows on decaying wood and is never visible on stumps less than three years old. Without any other evidence at hand, we would need to walk around the pond examining stumps and age the pond's abandon-

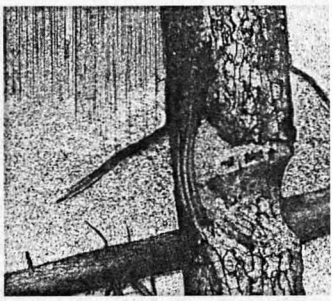
concave form of beaver dam



stumps in foreground



turkey tails



hemlock showing wound and bark growth rings

ment based on the proportion of blond to gray to turkey tailed. If few blond stumps were found and most were gray and turkey tail–free, we'd guess one to three years had passed since the beavers' departure. If few stumps were free of turkey tails, we'd guess more than three years had passed. Luckily, there is one more piece of evidence in the etching that will allow us to put a more definitive date on abandonment.

The bark that forms on hemlock wounds shows visible annual growth rings. Any wound on a hemlock, whether from the rubbing of a stag's antlers during rutting season or from the gnawing of a beaver whose preferred winter food supply has been exhausted, can be accurately dated. The hemlock on the right-hand side of the etching clearly displays three growth rings in the bark surrounding a beaver gnawing. This hemlock was not girdled, but sampled as a possible food tree. We can surmise this because the bark was not cut all the way around the hemlock and some of the wood was gnawed. When beavers start sampling hemlocks in this fashion, it is a sure sign that they are having a difficult time finding enough trees to supply their winter needs. In this case, it is also strong evidence that this pond was abandoned two to three years ago due to a depleted supply of winter trees.

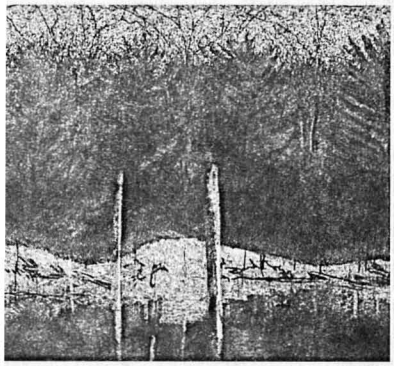
Now that we have a sense of when the pond was abandoned, let's turn our questions to the quality of habitat when the beavers arrived. The pond is surrounded by conifers. Does this suggest that the original quality of habitat for the beavers was poor, since their preferred species of trees are missing? Not necessarily, for a coniferous border, like the one in the etching, is a fairly common feature of old or abandoned ponds. The cutting of hardwoods and the recutting of their stump-sprouts eventually leave the residual pines and hemlocks and their seedlings to flourish in openings, free from hardwood competition, creating a band of conifers that surrounds the pond. So how can we assess the quality of habitat at the time when beavers first invaded the area? The answer lies in the pond's standing dead snags.

Because flooding, and the associated lack of oxygen, keeps the roots of dead trees from rotting, beaver pond snags will stand for decades following abandonment. The etching shows few snags emerging from the pond. If the area was originally forest, what does this suggest? It indicates that most of the trees were cut by the beavers and that, therefore, the original forest was probably composed of preferred species. This, in turn, suggests that the beavers inhabited this pond for a good number of years, as the area supported an ample winter food supply. A pond with numerous standing dead snags suggests that the original forest was dominated by conifers or yellow birch, trees rarely felled by beavers.

Beavers begin their search for new ponds in the spring. Not only do adults abandon old ponds at this time, but also all two-year-old kits are chased out of their family ponds by their parents to search for their own places of residence. Because beavers have annual broods, forcing out the two-year-olds is necessary to make room for the young. A two-year apprenticeship is enough for a young beaver to learn all the skills involved in tree felling, hauling, dam and lodge construction, and canal making. Beavers don't reach reproductive age until their third year, which slows population growth rates for the species. This is an unusual strategy in the rodent family, but one that makes sense for an animal with such large resource needs and complex skills development.

Beavers begin their search for a new home by moving up or down the watershed. Ponds already established by beavers have scent posts—piles of leaves, mud, and small sticks—on

illustrations by Brian Cohen



coniferous border of pond

pond with snags

which the animals leave their scent to alert newcomers that the pond is inhabited. If one of the pond's mated pair has died, the scent post announces the vacancy through the absence of one gender's scent. If the newcomer happens to be of the "vacant" gender, he or she will move in to complete the monogamous pairing.

If beavers find no suitable habitat in their own watershed, they migrate to new watersheds. This usually involves some significant travel on land, making this the most dangerous period of a beaver's life. More dead beavers are seen on roadsides in April and May than at any other time of year—the majority of them two-year-olds in search of new homes.

CHANGES IN OLD PONDS

Once a pond is abandoned, it undergoes changes in vegetation. The condition of the dam is primarily responsible for influencing the successional outcomes. If the dam is strong and continues to hold water, the pond will evolve—as it continues to fill with stream-borne sediment—toward a marsh or "beaver meadow," a wetland dominated by sedges, rushes, and cattails. In time, as decaying plant material builds up in the marsh, wetland shrubs like willows, alders, dogwoods, and viburnums find acceptable sites for germination and convert the marsh into a shrubby swamp. Through the annual decay of their leaves, shrubs add to the buildup of organic matter in the wetland, eventually creating conditions dry enough for trees to establish themselves. Red maple is very tolerant of saturated substrates and often dominates wetlands that have developed to this stage. Given enough time, the swamp may fill and dry to the point that a wet-sited forest develops.

If the dam is breached and the pond drains, a forest can develop much more quickly. Grasses and other herbaceous plants will first colonize the rich, exposed sediments of the pond bottom. But trees may move in quickly. Depending on the seed source from surrounding trees or a coinciding mast year for a particular species, the composition of the drained pond's future forest could be almost anything. Whichever route succession takes, either through a progression of wetlands or through more direct forest establishment, in some period of time a winter food supply for beavers will be regenerated, and the process of beaver impoundment will start all over again, in some cases with a new dam being built directly on the site of an old one.

This cyclic pattern of successional change created by beaver activity adds a wonderfully diverse mosaic to any landscape in which these creatures are found. Without beaver impoundments—in all states of activity and abandonment—our regional ecosystem would be impoverished. Although beavers do deplete their local resources and move on, the depletion is temporary and results in a parade of varied ecosystems that create critical habitat for numerous species of plants and wildlife. So the next time you encounter an abandoned beaver meadow, don't be afraid to get your feet wet. Walk in and contemplate the fact that beneath you lie deposits, layer upon layer, from the beaver ponds that have cycled there through the millennia.

A LOOK BACK

Although beavers have been an important component of the central New England landscape for thousands of years, less than a century ago it was impossible to find one active impoundment in the region. Trapping to provide furs for European hat markets led to the beavers' extermination by the early 1800s. With the exception of northern Maine, where some were spared, all of New England's beavers were eliminated in less than two centuries.

beaver scent post

Beaver trapping in central New England, a major component of the fur trade with the British, began with the establishment of William Pynchon's

illustrations by Brian Cohen

trading post in Springfield, Massachusetts, in 1636. This post served as the major clearinghouse for furs throughout central New England. Ironically, the development of commercial trapping, and the ultimate extirpation of the beaver, was directly related to the decline of another New England population. The epidemics that decimated Native peoples created conditions that made a commercial fur trade viable by tearing great holes in the social fabric of tribal culture.

Prior to the introduction of European diseases, tribal leadership developed in orderly ways, often through lineage. The epidemics changed this orderly progression. Tribes were broken, scattered, and constantly reconfigured as illness wiped out village after village. Ascension to leadership positions was no longer based solely on an individual's record of service to the tribe. Individuals who were ascribed as carrying prestige filled leadership roles, and the British created conditions where prestige did not have to be earned; it could be traded for. It could be gained in the form of *wampum.*

Colored, cylindrical beads fashioned from the shells of whelks and quahogs, wampum were highly revered by Native people, and they were usually worn in very modest amounts, only by people of high status. The use of wampum by the British as currency, during a period of profoundly unstable tribal life, spawned a fur trade of great proportions. Among Native people, what had once been self-reliant trapping of furbearers for indigenous use became market trapping for wampum and the heightened prestige that it brought.

Beavers were the preferred prey due to their sedentary nature and the high value the British placed on their pelts. The ease with which trappers could find their lodges, and the beavers' predictable behavior, made them the most easily trapped of all furbearers. With their low reproductive rates, it is not surprising that the number of beavers trapped in central New England had dropped precipitously by 1670. By 1700, trade in beaver pelts was almost nonexistent. During the eighteenth century, the last remnants of the beaver population were swept from the region, to be found only in the northern reaches of Maine, New Hampshire, and Vermont. Extermination from the latter two states occurred by 1850.

The reintroduction of the beaver to central New England was just as rapid as its extirpation. First occurring in southern Vermont in 1921, by 1940 beavers had established populations in all central New England states. In the last half century, beavers have vigorously reclaimed their territory throughout New England. This is truly a story of success for the well-being of our regional landscape, because beaver activity fosters biodiversity through the array of habitats it creates.

Yet the removal and associated reintroduction of beavers were not free of short-term, negative side effects. By the middle of the nineteenth century, farm abandonment was at record rates. Lowland areas that formerly had been in cultivation, used as mowings or pasture, were let go. Other lowland areas that had not been cleared also underwent successional processes in the absence of beavers. At the point of their reintroduction, beavers found ample forest habitat, much of it the same successional age. With freedom from trapping and the absence of large predators, they quickly expanded their population in the region and began to exploit their regional habitat in a synchronized fashion, meaning that at some time in the future, most of their habitat would be in the same degraded state.

In my explorations of southeastern Vermont and southwestern New Hampshire, beaver habitat with a winter food supply that can support an active colony for many years is hard to find. The vast majority of it has already been utilized by beavers and abandoned, and I have great difficulty finding impoundments that have been active for more than just a few years. I have also seen new ponds being established late in the summer and sometimes even early fall, an indication that beavers are needing to search far longer for future homes. Often these new impoundments are developed in the most marginal areas in terms of winter food supply. It is evidence of a last-ditch stand after a long summer of searching with no success. The residents of such sites rarely make it through the winter before succumbing to starvation. On a positive note, I am convinced that this situation is merely a small blip and that, in time, asynchrony will again develop in the grand cycle of beaver impoundment and abandonment.

The beaver should be revered as the creator of a landscape mosaic—a rich assortment of varied wetland ecosystems. No other creature fashions such an array of habitats on which so many other species are dependent. How poor our countryside would become if this species were again to be lost. Thankfully, unless humans again interfere, beavers are sure to remain an important component of our New England landscape. ☾

Tom Wessels *is an ecologist and the director of the Environmental Biology Program at Antioch New England Graduate School. His book* Reading the Forested Landscape: A Natural History of New England, *from which this essay is excerpted, traces disturbance patterns in New England forests from precolonial days to the present.*

Using Lichens to Assess the Relative Age of Northeastern Forests

BY STEVE SELVA

For some of us, a familiarity with lichens is as the little "trees" in a model train set. Others may know them as an ingredient in Tom's of Maine natural deodorant, or as the source of the organic dye, litmus, that we used in a high school chemistry class to determine the acidity or alkalinity of a solution. For me, it's the lichens that I encounter in forests that have captured my attention. Whether it's the old man's beard hanging off the branches of a red spruce, the leafy lungwort on the trunk of an old sugar maple, or my favorites, the "stubble lichens," lichens are an extremely fascinating group of organisms. They are not only beautiful to look at, with their varied coloration and structure, but play an important role in providing shelter for countless forest invertebrates and serving as a source of food for deer and of nesting materials for birds. As a forest gets older, they are indispensable suppliers of nitrogen. Moreover, lichens are useful indicators of the relative age of forest stands; lichen diversity reaches its apex in old-growth forests.

Lichens have been described as a stable, self-supporting association of a fungus and an alga, or cyanobacterium, in which the resulting life form and behavior differ markedly from those of either of the partners growing alone. The lichen association is recognized as a "lifestyle"—equivalent to saprophytism or parasitism—by which a fungus can satisfy its need for carbon. By thus relying on a photosynthetic symbiont, the lichenized fungus can colonize bare rock or even hitch a ride on the back of a tortoise. For, unlike its saprophytic or parasitic counterparts, the lichenized fungus takes nothing from the substrate upon which it grows; once established, it survives on nutrients that wash over it or are deposited daily upon it from the atmosphere (Selva 1994, 1996).

The effectiveness of lichenization as a nutritional option is evidenced by the fact that approximately 13,500, or one in five, species of ascomycetous fungi are

lichenized. (A fungus is classified as an ascomycete if the sexual spores, called ascospores, are found within a sac-like cell called an ascus. In approximately 98 percent of all lichens, the fungal partner is an ascomycete. In the majority of the remaining two percent of all lichens, the fungal partner is a basidiomycete. Here the sexual spores, called basidiospores, are attached to the top of a club-like cell called a basidium.) Under the rules of the International Code of Botanical Nomenclature, the names given to lichens refer to the fungal partner while the algal partner keeps its own name. In the British soldier lichen, for example, the scientific name *Cladonia cristatella* refers to a particular fungus known only in the lichenized state. The algal partner in this species (*Trebouxia erici*) might also be found in a nearby pond or as the photosynthetic partner in other species of lichens—thereby further expanding its distribution into habitats not generally colonized by aquatic organisms.

Most of what one sees and calls a lichen is fungal. The algal partner is found inside, usually appearing as a green layer just below the upper surface. New lichens can arise from old when a spore from the fungal partner blows to a new location and "captures" a compatible alga. More typically, however, lichens reproduce by cloning, when a few fungal strands and algal cells detach from the surface of the lichen and are washed or blown to a new location.

illustrations by Darren Burkey

Plant communities dominated by lichens and mosses have been less well studied than those consisting mainly of seed plants. The distribution of lichens is governed by microclimatic factors that influence higher plants in different ways or not at all. Newly dispersed lichen propagules must attach themselves to an appropriate substrate, survive to maturity, and be able to reproduce successfully. In addition to competition, the development of lichen assemblages on bark and wood substrates is determined by such factors as age, corrugation, pH, moisture-holding capacity and nutrient status of the substrate, degree of illumination and humidity of the microenvironment, inclination of surfaces, aspect, air pollution, and stand continuity.

While the most ubiquitous lichen species tend to become established early on in forest succession, it may take hundreds of years before a forest acquires the full complement of microhabitats suitable for the colonization of rarer species. This suggests that the diversity of lichens at a particular site can be expected to increase over time, with a disproportionate number of rare species being restricted to very old stands (i.e, ancient forests). It is the presence or absence of these rarer species that often provides the evidence as to whether a forest that *looks* old actually *is* old and has been little disturbed over a long period of time (Selva 1994, 1996).

WHEN I CAME TO MAINE FROM CALIFORNIA IN 1976, I brought with me fond memories of a course I took in lichenology while an undergraduate at Humboldt State University. It was the first time the course had been offered, and the requirement that each student submit a collection of fifty named specimens came with the incentive that extra credit would be awarded for any species new to the herbarium. Well, didn't we search the nooks and crannies of the Pacific Northwest for the most obscure lichens we could find in hopes of earning a few extra credit points! Among the specimens I submitted—and which earned me extra credit—were two species belonging to the Order Caliciales, a group commonly known as the stubble lichens because their appearance is similar to beard stubble. At only one to two millimeters tall, the lichens in this group are frequently overlooked by collectors and as a result often go unreported. I went on to pursue other interests in graduate school, but the ecology of lichens—particularly the stubble lichens—recaptured my attention when I came to Maine. As I gained a better under-

standing of the microhabitat requirements of these species, I became adept at finding them and soon realized that older forests were yielding a greater diversity of species than younger ones.

Several years earlier, Francis Rose (1976), studying all lichens, including the Caliciales, had drawn similar conclusions after comparative studies of the lichens present in 102 oak and beech woodlands in the British Isles. Rose found a definite positive correlation between lichen diversity and stand age. Woodlands known to be very old usually contained between 120 and 150 lichen species per square kilometer, and often many more, while woodlands known to be of recent origin typically had totals of 40 or fewer species. Moreover, Rose showed that some lichens were found only at sites that had contained mature trees for many centuries, and he wondered if the presence or absence of these species could be used to assess environmental continuity (or disturbance) in these environments. By concentrating on those taxa that appeared to be almost (or entirely) "faithful" to ancient woodland sites, Rose constructed an Index of Ecological Continuity (IEC) that could be used to assess the relative age of a particular woodland:

$$IEC = \frac{N}{20} \times 100,$$

where N is the number of ancient forest indicator species present at a site out of a list of 30. Because these 30 species are not all widespread in Britain—hence unlikely to all occur together at any one site—Rose argued that the presence of 20 taxa (IEC = 100) indicates a very high probability that the site is an ancient one. Thus, the higher the IEC value, the more ancient the site, and vice versa (Selva 1994, 1996).

Reasoning that the methods developed by Rose could also be used to assess the continuity of forest ecosystems here in northeastern North America, I set out in 1986 to design indices of ecological continuity for the forests in northern New England and western New Brunswick. While each lichen species is distributed according to its own microhabitat requirements, there is a tendency for gymnosperms (softwoods) and angiosperms (hardwoods) to host quite dissimilar epiphyte communities. This has led to the development of two indices: one for sites dominated by gymnosperms (i.e., spruce-fir forest types); and the other for sites dominated by angiosperms (i.e., northern hardwoods forest types).

By 1994, indices had been formulated and the continuity of 33 northern hardwoods and spruce-fir stands in Maine, New Hampshire, Vermont, and western New Brunswick had been assessed. The stands were ranked according to decreasing IEC values (Selva 1994, 1996):

Northern Hardwoods (angiosperm-dominated stands)

Location	*Total Lichens*	*Lichens on Angiosperms*	*IEC*
Big Reed Preserve (ME)	136	103	155
Musquacook (ME)	105	94	150
Yankeetuladi Hardwoods (ME)	97	89	120
Hedgehog Mountain (ME)	79	77	120
The Bowl (NH)	101	91	115
Mount Bailey (NB)	106	101	115
Big Brook (NB)	89	85	110
Mountain Pond (NH)	82	77	100
The Cape (VT)	83	80	90
Lunksoos Mountain (ME)	78	78	90
Gifford Woods (VT)	80	76	80
Morrison Mountain (ME)	60	60	75
Township 19 Range 11 (ME)	58	52	45
Township 4 Range 7 (ME)	46	46	40
Chandler Ridge (VT)	53	49	35
Pennington Pond (ME)	48	48	5
Smith Road (ME)	41	38	5
Charette Hill (ME)	40	36	5

Spruce-Fir (gymnosperm-dominated stands)

Location	*Total Lichens*	*Lichens on Gymnosperms*	*IEC*
Big Reed Preserve (ME)	115	80	105
Norton Pool (NH)	77	72	105
Nancy Brook (NH)	71	69	100
Gibbs Brook (NH)	89	78	95
Dry Town (ME)	84	63	90
Township 8 Range 9 (ME)	74	57	75
Sagamook Mountain (NB)	70	55	65
Cross Lake (ME)	54	52	55
Bartlett Stream (ME)	60	56	50
Number Nine Mountain (ME)	68	56	40
Mount Carleton (NB)	69	53	35
Township D Range 2 (ME)	57	42	30
Yankeetuladi Softwoods (ME)	50	48	30
Timoney Mountain (ME)	43	43	25
Nixon Siding (ME)	55	53	20

Based on the assumption that the presence of 20 lichen indicator species is evidence that a forest is ancient, 11 of the stands included in this study can be classified as ancient forest sites (IEC ≥ 100). These are the northern hardwoods stands at Big Reed Preserve, Musquacook, Yankeetuladi, Hedgehog Mountain, The Bowl, Mount Bailey, Big Brook, and

Mountain Pond and the spruce-fir stands at Big Reed Preserve, Norton Pool, and Nancy Brook. Those sites with IEC values of 90 and 95 might also lay claim to such status.

With regard to the historically documented old-growth northern hardwoods stand at Gifford Woods (IEC = 80), the data here only confirm what has been written in unpublished Vermont Natural Heritage Program reports, namely that "its small size, multiple uses, and its roadside location are all deterrents to the continued health of this forest and to its continued credibility as a natural area." In small stands such as this, where the temperature, humidity, and degree of illumination of forest microhabitats may no longer be conducive to colonization by certain rarer species, and in stands where the lichens are negatively impacted by air pollution, an assessment using an index of ecological continuity is no longer a measure of continuity as much as it is a measure of ecological integrity.

The remainder of the stands received IEC scores ranging from a low of 5 to a high of 75. While the presence of a few index lichen species at a site may have little significance, except perhaps to suggest that the stand is probably older than other nearby stands, values over 50 may indicate an early medieval origin (i.e., approximately 1500 years old) and those up to 75 may indicate recent disturbance of an ancient site. For those stands assigned scores of 50 or less in the data recorded above, these values are considered accurate reflections of the much modified or secondary nature of these communities as recorded in site descriptions (Selva 1994, 1996).

Given the wide variety of potential microhabitats that characterize aging forests, and the fact that an analysis of ecological continuity using the methods described by Rose (1976) is only as valid as species inventories are complete, such investigations are often as daunting as they are time consuming. A more efficient method, and the direction my research has been heading since the publication of the data presented above, is suggested by the fact that not only do epiphytic lichen floras become richer over time—with older stands harboring more rare species—but that the *total* number of calicioid lichens and fungi (i.e., the stubble lichens) collected at a site is, itself, an indicator of continuity.

All but the most common calicioid species were included as old-forest indicators in the indices I formulated for the forests of northeastern North America. This is not particularly surprising considering that the calicioid lichens and fungi are "very sensitive to changes in forest climate, and most species indeed seem to depend on the occurrence of mature forests containing trees of different ages and a varied light and humidity regime" (Tibell 1980). As perhaps our most sensitive biomonitors of forest ecosystem health, the calicioid lichens and fungi can be found growing in more forest microhabitats than any other group of species. Consequently, an assessment of ecological continuity based on the total number of calicioid taxa recorded at a site is at least as descriptive as an assessment following the methods of Rose (1976). As a natural unit of investigation, the calicioid lichens and fungi are also a manageable group to work with—24 species is the most I've recorded at any one site, so an ecological assessment can be carried out in a lot less time.

Inasmuch as documentary evidence of antiquity is often not available, an assessment of continuity using lichen indices can provide valuable evidence of great age (or otherwise). Twenty years' experience teaching a field course in lichenology and searching for lichens in the Northeast has convinced me that, armed with a familiarity of lichens' microhabitat requirements, and being ever mindful of "thinking small" and of leaving no nook or cranny unexplored, almost anyone can participate in our effort to identify and document the region's remaining ancient forests. Although their beauty and historic significance are reason enough for an effort to identify some examples of old growth, these stands also define the baseline conditions for a variety of scientific investigations, can serve as a guide for managing stands of the same forest type, and, as a contact with the past, are an invaluable source of information on climate change, wildfire frequency, and insect outbreaks. ☾

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The mountains of western North Carolina and eastern Tennessee hold the most peaks over 6,000 feet in the eastern United States. Western North Carolina also has numerous sites with rough and steep topography. The metamorphic geology of the region created steep mountainsides, gorges, walls, cliffs, massifs, sharp ridge slopes, and remote valley slopes that became barriers to some early logging operations. To a considerable degree, the high percentage of remaining old-growth forests in the Nantahala-Pisgah National Forest can be attributed to this geologic history.

Stalking Ancient Forests in the Southern Appalachians

by Robert Messick

Old Growth in the Nantahala-Pisgah National Forest

illustration by the author

A newly completed, comprehensive survey of this national forest has documented 77,418 acres of delineated old-growth forests. It shows that the Nantahala-Pisgah National Forest contains a truly substantial area of old growth in the ecologically diminished southeastern US—second only to the Great Smoky Mountains National Park. (See Table 1.)

This survey—the accumulated work of numerous professional and amateur researchers over nearly ten years—demonstrates that 7.5% of the land base of the Nantahala-Pisgah National Forest is known to be old-growth forest. This figure represents 133 delineated sites with 30 forest communities in three old-growth classes. Given the large number of additional candidate areas worthy of a site visit (267 in the complete site catalog), it is likely the actual percentage of old growth on the Nantahala-Pisgah land base is 8%.

These findings gain import when viewed in a global, national, and regional context. It is estimated that 22% of the world's old-growth forests remain.[1] Only 4% or less of forests in the United States have escaped logging. For the eastern United States the situation is even more dire with only .006 (six tenths of one percent) of forests considered primary. Within this fraction, about 652,000 acres are in Minnesota, approximately 500,000 acres occur in the Adirondacks, and the Blue Ridge Province of the southern Appalachians contains at least 256,992 acres.[2]

Considering these minute numbers, it is crucial that the US Forest Service give interim protection for these rare ancient forests until more permanent protection can be developed in the next round of forest plan revisions. Clearly, old-growth forests are exceedingly rare in the eastern United States. Commercial logging should not be allowed in the last bastions of uncut forests on public land.

Only 37% of the old-growth acreage that was found in our survey falls within the inventoried roadless areas covered by the Clinton administration's roadless areas protection rule. Currently, only 22.5% of the old-growth forest delineated in this survey has permanent protected status in Wilderness or Research Natural Areas. (See Table 2.) Even if protection for the inventoried roadless areas is not blocked by the Bush administration, 40.5% of the old-growth acreage identified in the survey would still have no permanent protection.

Looking at US Forest Service practices in the region since 1960, it seems the agency has adopted an "ignorance is bliss" policy with regard to the old-growth issue. By either ignoring or denying that unlogged forests were part of early land acquisitions in the Nantahala-Pisgah National Forest, the agency gave itself an invitation to cut old growth with little public involvement. In many cases the agency has tried to define old growth out of existence so that it can be logged as if it were second-generation forest.

Further, the reckless logging activity of the 1980s shows how the National Forest Management Act (NFMA) and the National Environmental Policy Act (NEPA) did not, and still do not, protect old-growth forests and other rare habitats. Numerous cases of stands clearcut from old-growth forests in the 1970s or 1980s were found in the course of our survey.

OUR STATISTICS ARE BASED ON EXTENSIVE FIELDWORK. They represent over five hundred outings, coordinated by the Western North Carolina Alliance, with help from the Southern Appalachian Forest Coalition and the North Carolina chapter of the Sierra Club, into the remote and least humanly disturbed forests of the Nantahala-Pisgah National Forest. Our numbers include the findings of previous researchers—such as Don McLeod, Alan Smith, Paul Carlson, and Bob Zahner—who have been verifying old-growth forests throughout the 1990s and before. Methods used to verify old growth were adopted from these researchers and the experiences of the Great Smoky Mountains National Park Old Growth Team. These methods involved taking core samples to determine tree age and looking for signs of human disturbance to know where past logging operations ended.

TABLE 1. Total Old Growth in the Blue Ridge Province of the Southern Appalachians

Great Smoky Mountains National Park	*175,000 acres**
Nantahala-Pisgah National Forest	***77,418 acres***
Cherokee National Forest	*4,574 acres*
Total	256,992 acres

*roughly one-third of the park

TABLE 2. Permanently Protected Old Growth in the Nantahala-Pisgah National Forest

Linville Gorge Wilderness	*10,039 acres*
Joyce Kilmer Wilderness	*5,926 acres*
Ellicott Rock Wilderness	*185 acres*
Middle Creek Research Natural Area	*1,296 acres*
Walker Cove Research Natural Area	*45 acres*
Total	17,491 acres (22.5%)

This article is drawn from Old-Growth Forest Communities in the Nantahala-Pisgah National Forest, *compiled by Rob Messick and published in May 2000. This report was funded by the Western North Carolina Alliance, Southern Appalachian Forest Coalition, and the Sierra Club. It provides a more complete inventory of the old growth described here, including methods, sources, and additional detail. For a copy contact the Western North Carolina Alliance at 828-258-8737.*

The great diversity of forests in the East has made efforts to define old growth difficult, yet there appears to be universal agreement among forest ecologists that any set of definitions needs to be keyed to a specific region and further clarified by community typing within a specific region. In our work, we placed sites into one of five categories as described in Table 3. Within these definitions, the focus of our survey was to determine the landscape-scale distribution of old-growth forests in the Nantahala-Pisgah National Forest. Mid-elevation forests were studied most, yet "islanded" high-elevation forests were also explored.[3]

The Grandfather District, in Pisgah National Forest, has the most old-growth acreage found in the survey: 38,937 acres. Remarkably rough topography associated with the geologically unique Blue Ridge Wall probably explains many of the occurrences of old growth in this area. The second largest assemblage of old-growth acreage was found in the Nantahala National Forest within the variegated mountain ranges near Topton, North Carolina (16,827 acres). The Unicoi and Black Mountains clusters come next in importance. These clusters have less acreage than the Grandfather or Topton areas, as well as a less complete representation of the region's major forest types that are found in old growth. The Southern Nantahala, Highlands, and Mount Pisgah clusters also have important sites, yet, similarly, have a less complete representation of the region's major forest types.

In 1995, Peter S. White laid out a plan for protecting old-growth forests in the southern Appalachians.[4] His plan foreshadowed conclusions that emerged from our fieldwork. We strongly agree with his explanation of why old-growth areas outside of the Great Smoky Mountains National Park (GSMNP) are of ecological importance:

> *While the [Park] contains more than 90% of the region's high-peak common plant species and 70% of the total native flora, it has less than 20% of the region's rare narrow endemics (species restricted in their range to small geographic areas)....Moreover, the GSMNP lacks several habitats unique to the southern Appalachians—for example, mountain bogs and Carolina hemlock forests. The truth is that the conservation of biological diversity cannot depend on a single national park; rather, it requires a dispersed network of sites across the region.*

There is significant representation of numerous mid-elevation forest types in primary condition at a landscape scale in the Nantahala-Pisgah National Forest. These mid-elevation old-growth forests form a kind of loose spectrum between higher elevation areas and lower elevation areas. It is true that the majority of old-growth sites are located in the steep upper section of watersheds. This has prompted assertions that upland slopes, and the forest types found on them, are over-represented in existing old-growth forests. This perception should be overhauled: the reality is that major mid-elevation forest types range from 4,000 feet to below 2,000 feet, and primary forests have been found in all of these ranges. Seven forest types with old-growth occurrences fit this pattern, showing that old growth is not restricted to higher elevation areas in the Nantahala-Pisgah National Forest.

Massive fragmentation from roads and past US Forest Service logging activities separate numerous large, medium, and small old-growth sites. In order for these isolated sites to contribute fully to the conservation of biological diversity in the region, they need to be connected wherever possible. Buffering these sites should also be considered, mainly to protect core areas from edge effects.

Large sites pose a real challenge to old-growth classification schemes, due to the way forest age dynamics are naturally distributed across the landscape, and to differences in forest structure and disturbance patterns that exist between forest communities. Our best chance to understand landscape-scale dynamics of this kind is to protect all remaining old-growth forests and the natural processes that shape landscape diversity.

The accumulated results of our work offer an opportunity to secure widely distributed primary forests at a landscape scale. One of the most surprising findings was that seventeen old-growth sites in the Nantahala-Pisgah National Forest are 1,000 acres or more. Still, small old-growth sites should not be overlooked—when taken in a landscape context, these small sites may be part of an elevational spectrum of occurrences for a given forest type, and may be connected with other sites in the future.

Ephemeral streams at the head of watersheds are one of the most important places to have intact forests. There is a strong correlation between these ephemeral streams and the water quality found downstream. Cascading effects of erosion and siltation can occur if ephemeral tributaries are logged and roaded. In this regard upland areas deserve the most protection from commercial logging activities. Allowing natural forest processes to return to these areas should be a priority, yet in many cases old-growth forests are already present. Protecting these upland areas has an added advantage of providing a connection to ridge systems that may serve as temporary or permanent corridors between old-growth sites. The significance of protecting upland areas for old-growth habitat and headwaters ecology is reinforced by these observations.

With land-use pressures increasing on private lands in the

TABLE 3. Classification System for Old-Growth Forest Communities of the Nantahala-Pisgah National Forest

Class A. Old-growth forests where no significant signs of human disturbance to the forest canopy or understory could be determined. Canopies are dominated by older trees generally over 150 years of age. (One hundred and fifty years is considered an appropriate coarse filter for old-growth candidacy as this corresponds to a period when logging was limited to areas near early settlement sites.)

Class B+. Old-growth forests that have both class A and class B characteristics. Sites in this class tend to be large, with numerous forest communities, making it difficult to categorize the whole site. Uncut forests with canopy trees at or above 150 years may be present in these sites, yet the effects of disturbances such as blow-downs, American chestnut blight, or fire may be present in other forest communities within the site.

Class B. Old-growth forests exhibiting one of two different conditions: 1) The canopy is dominated by old-growth trees, yet signs of past human disturbance to the forest canopy or understory were found (generally dating to a half century ago or longer). These stands have often been heavily impacted by chestnut blight. Culling may also have occurred; 2) No sign of past human disturbance could be confirmed, yet the forest canopy is dominated by younger forest. These stands can range from 100 to 150 years in age and were possibly affected by natural disturbances.

Class C. Forests with obvious signs of past human disturbance, yet containing appreciable old trees in the canopy or higher tree diversity than surrounding forests. Forests in this class are suitable for old-growth recovery. This includes small sites, sites in unique forest types, isolated sites near cascades, and sites that form buffers for class A, B+, or B old growth. (In our survey, forests in this class usually did not have extensive fieldwork done in them due to time constraints.)

Candidate Sites. These sites are considered worthy of a visit due to a nomination, steep topography, or lack of access. Often these sites show up as large stands in US Forest Service data (which may not have been inventoried).

Classes A, B+, and B are considered existing old-growth forest. Class C and candidate sites are not. Class B old growth is distinct from second generation forest.

Blue Ridge Province it is important to remember that biological conservation on public land is critical. Only 12 to 14% of the region is public land, and even if commercial logging ended on all this acreage it would not be enough to restore a measure of the region's habitat integrity at a landscape scale.[5] The 7.5% of the Nantahala-Pisgah land base that is delineated old growth could serve, along with roadless areas, as core areas to start a restoration process.

Intact is a relative term when describing the forests of the southern Appalachians. Fragmentation, roads, American chestnut blight, other diseases, the loss of top-level predators, depleted food webs, air pollution, and numerous other disruptions threaten the forests of the region. As we work to successfully restore natural ecosystem processes to the forest, it is clear that nearly all old-growth sites have some importance, either as genetic reservoirs or as representations of a particular forest community at a given elevation.

Remaining old-growth forests are a living link to climatic, geological, and biological processes that have shaped and continue to shape this mountain region. They are important gene pools full of plants, animals, fungi, and microbes. Protecting the life support systems that forests provide means protecting true wealth. Hauling off valuable tree biomass from headwater slopes on public land for the gain of timber companies and few others does not benefit the region in the long run. It interferes with the life support processes of the forest, and provides little benefit to local economies as the wood rolls away to distant places.

Trees rise and fall in the context of soil cemeteries. They resemble individuals that are born and die in human societies. The individual does not survive, but cultural ways might. Ancestral forest processes contain non-human stories that extend from geologic time and find expression in what we feebly call old-growth forests. Allowing the last vestiges of native forests in our region to continue to be fragmented, roaded, and logged would be similar to burning libraries. A unique heritage would be lost. We have an opportunity—now—to protect large tracts of essential forests in the southern Appalachians. We must not miss it. ☾

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NOTES

1. Bryant, Dirk. 1997. *The Last Frontier Forests: Ecosystems and Economies on the Edge.* World Resources Institute. Statistics from this book may also be viewed at: http://www.wri.org/wri/ffi/lff-eng/table-01.htm
2. Mary Byrd Davis estimated in 1995 that 1,970,000 acres of primary forest existed in the eastern United States. A conservative update of work since then brings the total to 2,416,700 acres. The total of forested land in the East is estimated by the US Forest Service to be 380,330,000 acres. See Mary Byrd Davis, ed. 1996. *Eastern Old-Growth Forests.* Washington DC: Island Press. p. 31. For statistics on old growth in the Adirondacks, see Barbara McMartin. 1999. *The Adirondack Park: A Wildlands Quilt.* Syracuse, NY: Syracuse University Press.
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Preserving Our Old-Growth Forest Heritage

by Mary Byrd Davis

As Robert Zahner has rightly stated, old-growth forests hold the key to protecting native biodiversity.[1] These forests help preserve the gene pool, provide habitat for native species, demonstrate natural processes, and can serve as cores for future large wilderness areas. Yet the East's old growth is a fragile asset. How much old growth actually remains in the East and how well is it protected?

In *Eastern Old-Growth Forests: Prospects for Rediscovery and Recovery,* compiled in 1995, I estimated that the East has 1,970,000 acres of known primary forest, 0.5% of the forested land.[2] Grouping the states according to the system that the United States Forest Service (USFS) uses for its resource studies, we found that the North-central region was the leader in primary forest (950,000 acres), followed by the Southeastern region (482,000),

illustration by Tim Yearington

the Northeastern region (346,000), and the South-central region (194,000).[3]

The Eastern Old Growth Clearinghouse is currently in the midst of revising *Old Growth in the East: A Survey*, first published in 1993. The survey is a descriptive inventory of forests, woodlands, and savannas that have experienced only minimal disruption by EuroAmericans and that still look much as they did when colonists arrived. The revision will include accounts of primary forest described since 1995. Below are highlights from our findings.

NEW DISCOVERIES OF OLD GROWTH

In New England, much of the fieldwork in recent years has been conducted in New Hampshire and Massachusetts. The Forest Service has been delineating areas in the White Mountain National Forest. Among the results is a proposed extension to the Bowl Research Natural Area that would encompass 919 acres of old growth.[4] Elsewhere in New Hampshire, Chris Kane has rediscovered more than 150 acres of old-growth northern hardwood and spruce forest on Mount Sunapee in Sunapee State Park;[5] and Rick Van de Poll has identified 76 acres of old-growth northern hardwoods and red oak and 185 acres of northern hardwoods, spruce, and hemlock on private land.[6] In Massachusetts, Robert Leverett and colleagues in Friends of Mohawk Trail State Forest have now delineated a total of 2,081 acres of old growth at 45 sites,[7] a nearly four-fold increase in total acreage for the state since 1993. A discovery in Rhode Island is small but exciting, because the 20-acre mixed old-growth forest at Oakland Farms, verified by Robert Leverett,[8] is the first confirmed old growth in that state.

Outside New England, but still in what the Forest Service refers to as the Northeast, the largest gains in known old-growth acreage since 1995 have been made in New York, New Jersey (in percentage of increase), and Maryland. In New York, David Hunt has identified 2,000 acres of old-growth floodplain forest on the Raquette River in Adirondack Park;[9] Michael Kudish has delineated more than 6,000 acres in the Catskills to bring his total for that area to over 60,000 acres;[10] and Bruce Kershner and colleagues have identified, among other finds, 600 acres (400 acres on public land; 200 on private land) of old growth in the rugged, 18-mile-long Zoar Valley canyon in Erie and Cattaraugus Counties.[11] In New Jersey, Bruce Kershner has explored 14 new and old sites to more than double the state's acres, to a total of 650.[12] In Maryland's Savage River State Forest, Durland Shumway and colleagues are delineating some 200 acres of old growth on Big Savage Mountain. Looking to West Virginia, The Wilderness Society's 1999 publication, "Virginia's Mountain Treasures: The Unprotected Wildlands of the Jefferson National Forest," refers to 60,000 acres of possible old growth divided among numerous sites. This information is from a preliminary old-growth inventory conducted by the Forest Service and based on computer records and on a study of aerial photographs by agency biologist Jesse Overcash.[13]

The Southeast, in the USFS grouping, includes only the five states along the Atlantic Ocean. Nevertheless, the Southeast can boast the premier find in the entire eastern United States, the 77,418 acres of old growth delineated by Rob Messick and colleagues in North Carolina's Nantahala and Pisgah National Forests (see Messick's article in this issue). Virginia's finds include Robert Leverett's discovery of as much as 600 acres of old growth on Apple Orchard Mountain on the Blue Ridge Parkway.[14] In South Carolina's Sumter National Forest, L.L. Gaddy conducted a preliminary survey of the Lower Chauga River Basin for South Carolina Forest Watch. He identified 16 old-growth and 61 potential old-growth stands representing 18 forest types.[15] Florida discoveries reported to the Clearinghouse include stands of old-growth Choctawhatchee sand pine and Ocala sand pine. Kenneth Outcalt of the Forest Service states that areas of Ocala National Forest and the Starkey Tract in the South Florida Water Management District are essentially undisturbed Ocala sand pine scrub.[16]

In the Great Lake States, part of the North-central region, scattered discoveries have also occurred, although they have not been significant enough to change Lee Frelich's general estimate of 912,000 acres of primary forest for the three states.[17] In Michigan, recent finds include at least a hundred acres of mature and old-growth beech-maple forest (with scattered hemlock and large pine) at Leelanau State Park in Leelanau County,[18] and a 60-acre floodplain forest in Lower Huron Metropark in southeastern Michigan's Wayne County.[19] In Minnesota an inventory of old growth on state land has suffered; a lack of funding has led to the checking of candidate stands in each region by local teams that may have had little experience in identifying primary forest. However, verification at the local level has had its rewards. In 1996, Bruce Dayton and his wife Ruth Stricker donated to the state a 150-acre site that the County Biological Survey had identified as old growth. These acres are a remarkable remnant of the Big Woods that once covered more than two million acres of east-central Minnesota.[20] Additionally, Lee Frelich recently pointed out that ancient cedars occur on bluffs and rocky land around the Great Lakes, including the Boundary Waters Canoe Area Wilderness, the North Shore of Minnesota, and the Niagara Escarpment on the Door and Bruce Peninsulas.[21]

In the South-central region, extensive finds have been or are being made in several states, the largest in Oklahoma. David Stahle and coworkers at the University of Arkansas Tree Ring Laboratory have identified 35 square miles or 22,400 acres of probable ancient Cross Timbers forest and savanna in southern Osage County by using a predictive model. (The Cross Timbers are the post oak and blackjack oak woodlands of Texas, Oklahoma, and southeastern Kansas.) They are now systematically surveying six counties in east-central Oklahoma for ancient Cross Timbers.[22] In Tennessee's Cherokee National Forest, Dean Whitworth, Dana Eglinton, Kevin Caldwell, and Paul Myers have discovered through their fieldwork 4,574 acres of old growth.[23] Also in Tennessee, Chris Haney and Jason Lydic found 2,000–2,500 acres of mixed pine-hardwood old growth in Savage Gulf State Natural Area on the Cumberland Plateau.[24] Additions in Louisiana include one thousand or more acres of mesic old growth within Sicily Island Hills Wildlife Management Area (Catahoula Parish);[25] a 300-acre climax upland hardwood forest in Louisiana State Arboretum (Evangeline Parish);[26] and 240 acres of wet longleaf pine savanna in Persimmon Gulley, owned by The Nature Conservancy (Calcasieu Parish).[27] Alabama contributes, among other discoveries, a near virgin forest of tulip poplar, white oak, and hemlock in Buck Rough Canyon and an impressive old-growth hemlock-beech forest in Turkey Creek Canyon of the Bankhead National Forest's Sipsey Wilderness.[28] To the Texas listing can be added old-growth ashe-juniper at Balcones Canyonlands National Wildlife Refuge (Travis and Williamson Counties), Fort Hood (Bell and Coryell counties), and Garner State Park (Uvalde County), among other locations.[29]

PROTECTION FOR OLD GROWTH

What will our gleanings tell us about the extent of remaining primary forest in the East? They will not allow us to arrive at a definitive total. The fieldwork that would make such a figure possible has not been carried out.[30] Nevertheless, taking the additions together with subtractions, we anticipate that the primary forest discovered or rediscovered in the years from 1996 through 2000 will result in an addition of 250,000 acres or less to the 1995 estimate. An increase of 250,000 acres would bring the percentage of total old-growth forestland in the East to 0.58%. Looking at general trends, the South is catching up to the North, and the South-central region may not continue to rank last among the regions in acreage of identified primary forest and savanna—if it can preserve its old growth. This brings us to our second question: How well protected are these ancient forests?

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illustration by Tim Yearington

On state land, the degree of protection afforded to old growth varies from park to park as well as from state to state, as would be expected. Old growth on public land in New York's Adirondack and Catskill Forest Preserves could be logged only after an amendment to the state constitution, which protects these public lands as "forever wild." However, old growth in Allegany State Park and on public land in Zoar Valley owes its protection only to informal commitments that could evaporate when current New York Governor George Pataki leaves office.[31] The Western Maryland Chapter of the Sierra Club has launched a campaign to preserve the old growth on Savage River State Forest and to make it the heart of a wildlands preserve. As for old growth owned by individuals—and most of the ancient Cross Timbers woodlands are in this category—we can hope that public education and the renewed emphasis on wildlands philanthropy will have an influence.

For the national forests, we can venture figures. The Eastern Old Growth Clearinghouse estimated this past summer that the national forests in the eastern United States contain some 660,000 acres of identified old growth, of which 34% is not protected in designated wilderness areas or research natural areas. The breakdown between Region 9, the northeastern and north-central United States, and Region 8, the southeastern and south-central United States, is instructive. Region 9 has approximately 420,000 acres of old growth in national forests, 4% of which is not in a wilderness area or research natural area. Region 8 has approximately 240,000 acres, 86% of which is not so protected.[32]

If the new roadless area policy put in place by former President Clinton remains in force as expected, it will protect a portion of formerly unprotected old growth. To create a general picture of the impact of the policy, Hugh Irwin of the Southern Appalachian Forest Coalition matched a GIS map of roadless areas with a GIS map of the Southern Appalachian Assessment (SAA)'s old-growth estimates. He found that of the 831,989 acres of old growth in the SAA inventory, 194,928 acres, only 23%, are in designated roadless areas.[33] We should also remember that there are exceptions to the protection afforded by the roadless areas policy.

In a speech delivered to the Landscape Legacies Conference in January of this year, Forest Service Chief Mike Dombeck pledged to complete the protection of old growth in the national forests: "In the future, the Forest Service will manage old-growth forests specifically to maintain and enhance old-growth values and characteristics. We will develop manual direction that directs individual forests to: Inventory and map remaining old-growth forests; Protect, sustain and enhance existing old-growth forests as an element of ecosystem diversity...." To hear this point of view from the top official at the Forest Service is heartening. But will this policy direction last for long, in view of the fact that President Bush is expected to have replaced Chief Dombeck by the end of May? Furthermore, even if the inventorying does take place, conservationists will need to remain on the alert.

The devil can be in the details. In the Southeast, Forest Service managers claim to be following the protection standards for old growth for various forest types set out in "Guidance for Conserving and Restoring Old-Growth Forest Communities on National Forests in the Southern Region," a USFS document issued by Region 8 in 1997. However, the results to date leave much to be desired. To give one example, the planner for the Chattahoochee and Oconee National Forests in Georgia told the Old Growth Clearinghouse that observers were sent out to look at old stands that the USFS had identified by means of computer records. Unfortunately, the planner went on to assert that, "technically speaking," the Georgia forests "have no old growth." They have only "potential old growth." This, in spite of the fact that Paul Carlson, under a contract with the Forest Service, had earlier identified actual old growth in the Chattahoochee.

Are the old growth conservation guidelines for the southern region too rigid? Lucy Tyrrell, working for USFS's Region 9, deliberately avoided setting any fixed standards for the forest types that she covered, because she did not want to regulate any old growth out of existence.[34] Chris Haney and Jason Lydic noted one way in which Region 8's guidelines may go astray. Stands of oak-pine forest in Savage Gulf meet Forest Service requirements for old growth in some respects, but they have lower snag density and fewer canopy openings than the agency believes characterize an old-growth oak-pine community. Haney and Lydic suggest that prior damage caused by the southern pine beetle may have caused the Forest Service to inadvertently inflate criteria for these characteristics.[35] Since the "Guidance" document will apparently determine what is logged, it needs to be reviewed by experienced field researchers outside the agency. Furthermore, national forests without well-trained and experienced old-growth researchers on their staffs should cooperate regularly with field researchers from outside the agency when they are inventorying old growth.

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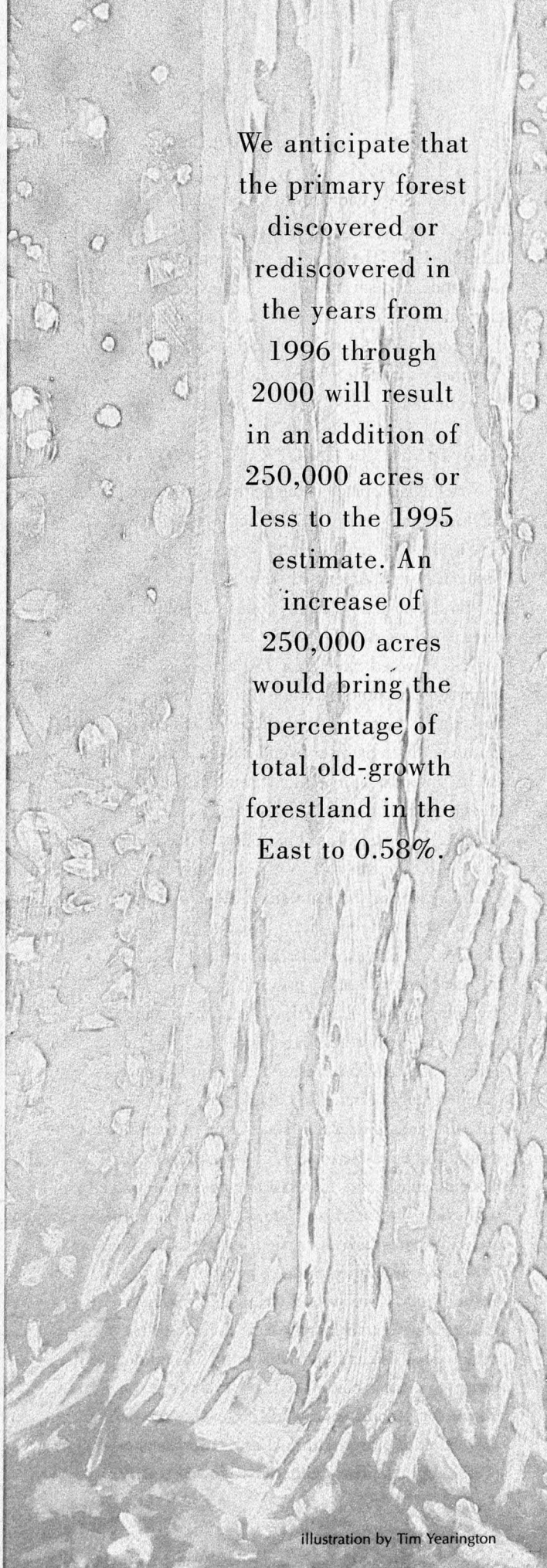

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much prowling, and exploring of our eastern forests, both for science and just for pleasure, can we honestly recognize that gut feeling of yes!—this is an old-growth forest."[36]

If we are to preserve our remaining tracts of primary forest, we need more people who are willing to put in the time to gain the field experience about which Robert Zahner speaks, and we need sources of financial support for training and research. Unless the nation is willing to entirely end resource extraction on our public lands, we cannot protect the old growth thereon without knowing exactly where it is located.

We also need people and organizations to fight to protect of the ancient forest that has been identified. In many of the national forests of the East, revision of forest management plans is under way.[37] Becoming involved in the planning process for a national forest is a good place to begin to help save our old-growth forest heritage. ☾

Mary Byrd Davis *is the founder of the Eastern Old Growth Clearinghouse and the Igdrassil Institute. She compiled the first inventory of relict primary forests in the East,* Eastern Old Growth: A Survey, *and edited the anthology* Eastern Old-Growth Forests: Prospects for Rediscovery and Recovery *(Island Press, 1995).*

NOTES

1. Robert Zahner, "How Much Old Growth Is Enough," in *Eastern Old-Growth Forests: Prospects for Rediscovery and Recovery*, ed. Mary Byrd Davis (Washington, DC: Island Press, 1996).
2. The term "primary forest" is sometimes used interchangeably with "old growth." However, it includes, as "old growth" may not, forests that have been only minimally disrupted by EuroAmericans but that do not contain big or old trees. Under "primary forest," in this article, I include savanna and woodlands. In its statistics, the Forest Service defines forest land as land that is at least 10% stocked by forest trees. Thus it also includes woodland and savanna.
3. There is, necessarily, a provisional quality to these statistics. As the state of the science in identifying old growth develops, as old-growth classification schemes are revised and refined, as sites are destroyed and new sites discovered, the precise number of identified old-growth acres will change.
4. Stephen Fay, Forest Soil Scientist/Ecologist, USFS, letter to author, July 12, 2000.
5. Chris Kane, "The Rediscovery of Ancient Forest on Mt. Sunapee," *Eastern Old-Growth Notes*, Spring 1998.
6. Rick D. Van de Poll, e-mail to author, January 22, 2001.
7. Inventory of Massachusetts Old Growth Forests on Public and Private Lands. Submitted by Friends of Mohawk Trail State Forest to Eastern Old Growth Clearinghouse, January 2001.
8. Robert T. Leverett, Report on the Old Growth Stand at Oakland Farms, Portsmouth, Rhode Island. Prepared for the Oakland Forest Preservation Project, December 1999.
9. Adirondack Nature Conservancy and Adirondack Land Trust Newsletter, Winter 1997.
10. Michael Kudish, letter to author, April 30, 1998.
11. Bruce Kershner, *Eastern Old-Growth Notes*, Fall/Winter 1998/99, pp. 11–13; e-mail to author, February 6, 2001.
12. Bruce Kershner, e-mail to author, February 6, 2001.
13. Shireen Parsons, *Virginia's Mountain Treasures: The Unprotected Wildlands of the Jefferson National Forest* (Washington, DC: The Wilderness Society, 1999).
14. Robert Leverett, e-mail to author, January 21, 2001.
15. L.L. Gaddy, Old-growth and Potential Old-growth Forests of the Chauga River Basin, Andrew Pickens District, Sumter National Forest, Oconee County, South Carolina. Prepared for South Carolina Forest Watch. 1998.
16. Kenneth W. Outcalt, An Old-Growth Definition for Sand Pine Forests, General Technical Report SRS-12, Southern Research Station of the United States Forest Service; Kenneth W. Outcalt, phone call to author, April 6, 1998.
17. Lee E. Frelich, "Old Forest in the Lake States Today and Before European Settlement," *Natural Areas Journal*, vol. 15, no. 2, 1995.
18. Ernest Ostuno, e-mail to author, September 13, 2000.
19. Joseph Bogaard, "Golf Course Threatens a Remnant Old Growth Floodplain Forest in Southeastern Michigan," press release, December 11, 1995 and printed material, faxed to author February 14, 1998 by the Clinton-Huron Ecosystem Coalition. A spokesperson for Lower Huron Metropark confirmed in a phone call, January 31, 2001, that the tract has not been developed.
20. Dean Rebuffoni, "Preserving the Big Woods," *Star Tribune*, October 31, 1996, p. 1A.
21. Lee Frelich, communication to Trees internet list, January 30, 2001.
22. www.uark.edu/misc/xtimber/summary.html, accessed January 20, 2001.
23. Rob Messick, Old-Growth Forest Communities in the Nantahala-Pisgah National Forest, May 2000, cites the figure for the Cherokee National Forest.
24. J. Christopher Haney and Jason Lydic, "Avifauna and Vegetation Structure in an Old-Growth Oak-Pine Forest on the Cumberland Plateau, Tennessee," *Natural Areas Journal*, vol. 19, no. 3, July 1999, p. 200.
25. Latimore Smith, Ecologist, Louisiana Natural Heritage Program, phone call to author, March 8, 2000.
26. Charles M. Allen et al., "Analysis of the Woody Vegetation of a Beech Forest Area in the Louisiana Arboretum," *The Louisiana Environmental Professional*, vol. 10 and 11, no. 1, Fall 1994, pp. 17–26; Jim Robinson, Director, Louisiana Arboretum, phone call to author, March 8, 2000.
27. Rick Martin, Director of Science, Louisiana Field Office of The Nature Conservancy, phone call to author, June 12, 1998.
28. Ken Wills, Alabama Environmental Council, fax, January 15, 1999.
29. David H. Diamond, An Old-Growth Definition for Western Juniper Woodlands: Texas Ashe Juniper Dominated or Codominated Communities, Southern Research Station, United States Forest Service, General Technical Report SRS-15.
30. The lack of complete inventories of Adirondack Park, Great Smoky Mountains National Park, and the Boundary Waters Canoe Area Wilderness, the areas with the largest concentrations of old growth, are particularly troublesome. A change of only 20% in the estimated old growth for any one of these areas would substantially change the total for the East. Another obstacle to reaching an accurate total is definitions of old growth—what is to be counted in the calculations.
31. Bruce Kershner, phone call to author, January 2001 and e-mail to author, February 6, 2001.
32. Rob Messick calculated the various totals for "Old-Growth Forests on National Forest Land in the Eastern United States," compiled by Mary Byrd Davis and Rob Messick, August 9, 2000. Region 9 is composed of the states in the North-central and Northeastern assessment categories and Region 8 of the South-central and Southeast assessment categories.
33. Continuous Inventory of Stand Conditions (CISC) data has been found to be generally unreliable as an indicator of old growth. We used it in this case, because the information was available in GIS form and would allow a rough comparison.
34. Lucy E. Tyrrell et al., Information about Old Growth for Selected Forest Type Groups in the Eastern United States, United States Forest Service, North Central Forest Experiment Station, General Technical Report NC-197. Lucy Tyrrell deserves much credit for the fact that the need to protect actual old growth is better honored in Region 9 as a whole than it is in Region 8 as a whole.
35. Haney and Lydic, "Avifauna."
36. Robert Zahner, in "Evolving Definitions," *Eastern Old-Growth Notes*, Summer 1998.
37. Planning is underway or about to begin in the national forests of Alabama, Georgia, Kentucky, Mississippi, South Carolina, Tennessee, Illinois, Minnesota, New Hampshire, Pennsylvania, and Wisconsin. In Virginia, only the Jefferson National Forest plan is under review; the revision for the George Washington National Forest was completed in 1993.

Dunnfield Creek

for Shinzen Young

from the mountain trail it is a depth
rumbling, a vague distance &
ferns declining into fog

thought provides only so much
seeing you must descend
scraggy ages in rock, life springing
from fractured places
and note each step taken: each distraction
that trips; pain
in legs, in the back burdened with all you carry
in the ass that sits and slides
deeper on momentum of scree
until your whole being passes through, soaked
by the fog & only then
the stream

Appalachian Trail, Delaware Water Gap

—Dana Garrett

photograph by Pete Guenther

Puc Puggy Lives!

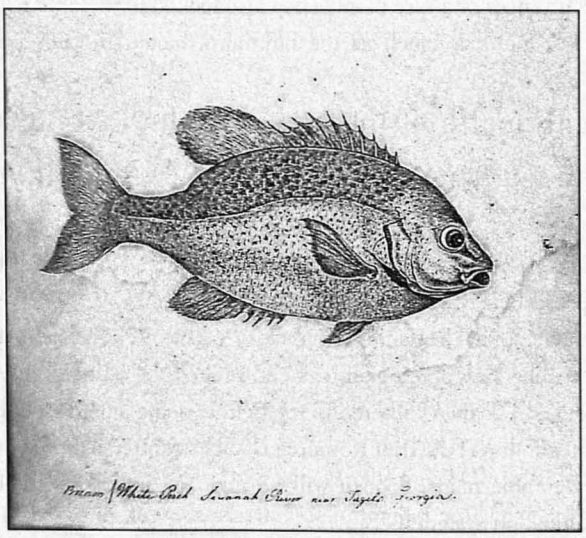
In the footsteps of William Bartram, a corps of scientists and volunteers surveys the biodiversity of the Appalachian Trail

BY CHRIS REITER

In the spring of 1773, the naturalist William Bartram embarked on a five-year, six-thousand-mile journey to study the plants and animals of the American South. While most colonial citizens on the eastern frontier were busy clearing and settling the land, Bartram traveled, mostly on foot, through South Carolina, Georgia, Florida, North Carolina, and Alabama drawing, cataloging, and celebrating the life of the southern forests. His journals of the trip—an unprecedented blend of scientific and ecstatic observation—would make him famous. But before the world knew Bartram, he was known among the Seminoles simply as Puc Puggy, the Flower Hunter.

On the Appalachian Trail (AT), modern-day flower hunters have been following in Bartram's footsteps. While it's possible to literally retrace his path through North Carolina's Nantahala Mountains on the AT, today's Puc Puggys, a group of scientists and volunteers, have embraced the spirit of Bartram's travels: After more than a decade of work, they have completed a comprehensive inventory of the natural communities and the rare, threatened, and endangered species along the entire length of the 2,167-mile trail.

The effort, the Appalachian Trail Natural Heritage Inventory and Monitoring Program, is the first of its kind. Begun in 1989 by the AT's managers, the nonprofit Appalachian Trail Conference (ATC) and the National Park Service, the inventory was designed to gather accurate field data to help effectively preserve the ecology of the trail corridor. Working closely with state Natural Heritage Programs and grassroots trail clubs, ATC and the Park Service have combined the skills of botanists, zoologists, and entomologists, who analyzed and inventoried significant ecological sites, with those of trained volunteers who act as long-term site monitors.



field drawings by William Bartram, ca. 1770s

Together, they are providing news from the field on the health of the forests, streams, and wild creatures along the ridgeline trail.

The inventory and the ongoing monitoring of the Appalachian ridgeline reflect an evolving vision for the AT built on its oldest traditions. Since Benton MacKaye first proposed the idea for an Appalachian footpath in 1921, the care and protection of the trail has been achieved through the coupling of a regional vision with practical partnerships between land managers and local volunteers. While the ATC worked to protect the trail corridor from Maine's Mt. Katahdin to Springer Mountain in Georgia, local hiking clubs planned, built, and maintained the trail. For years, preserving a narrow corridor and building a continuous footpath were the goals that defined the AT. But MacKaye and other Appalachian Trail advocates always imagined something more. "A realm and not merely a trail marks the full aim of our efforts," he wrote. Now, with all but a few miles of the trail corridor protected, ATC, the Park Service, and a corps of volunteers are turning their attention to "the realm" of the wild Appalachians.

AN APPALACHIAN WILDERNESS

To some, the pinched and popular ridges of the Appalachians don't pass for wild country. But the protected corridor of the Appalachian Trail preserves not just a place to hike but an ecological treasure, a 270,000-acre swath of land bearing the biodiversity and natural history of the entire region.

Take, for instance, the story of the mountains. They are ancient, the oldest range on Earth. There are rocks in the Appalachians, geologists say, that are a billion years old. Walking the trail, you may tread upon granite that was thrust into parallel ridgelines of up to 20,000 feet by the repeated collisions of the continental plates along the East Coast hundreds of millions of years ago. Imagine a range of Denalis with foothills like Rainier. Imagine those lofty peaks eroding slowly into the lowlands, making soil for a vast forest that once carpeted the Appalachian ridges and valleys from the coastal plain to the Mississippi River.

Though small and fragmented today, remnants of that great forest are some of the most diverse natural communities in North America. In fact, writes long-time Appalachian resident Chris Bolgiano, the highland forest of the Southern Appalachians is "the richest temperate forest on the planet, rivaled only by its close relatives in a few sections of Asia."

"In the coves of southern Appalachia," she writes, "are fifteen hundred species of flowering plants, including more kinds of trees than in all of northern Europe. Here are bewildering nuances of biodiversity, with mosses, fungi, spiders, salamanders, mussels, fish, birds, and peoples like none other on earth."

Through this rich landscape, the Appalachian Trail crosses the ridgeline. In many places, it is because of the trail that the forest survives. Walking the protected lands along the footpath, you may still see, as Bartram did, a hillside on fire with blooming flame azalea, or a mountaintop blessed with the "pleasing wildness and freedom" of the rose-flowering locust.

Along with profusions of healthy species, the AT corridor also shelters small, isolated populations of threatened and endangered plants and animals, many of which require old-growth conditions to survive. Inventories of 530 sites in the 14 states the trail passes through have found 2,040 occurrences of these sensitive species. The rarest plants found along the trail include globally rare and federally endangered species such as Roan Mountain bluet and small whorled pogonia. The rarest animals discovered were Shenandoah salamanders, peregrine falcons, and two species of flying squirrel.

The AT corridor also serves as a friendly, albeit narrow, north-south route for migratory species, and as a refuge for displaced species that migrated up the Appalachian ridges when their traditional, lower-elevation habitats were developed. Given some breathing room by ongoing land acquisitions, many plants and animals along the trail could seed the renewal of a widened corridor by recolonizing native habitat.

But the conditions for the survival of species both rare and plentiful are far from secure. Development pressures, invasive species, and a host of other problems all threaten the Appalachian ecosystem. The AT inventory, trail managers hope, will help guide the effort to preserve it. By providing an accurate picture of the biological health of the corridor, the inventory and the monitoring program provide a tool for assessing environmental threats, managing the use of sensitive areas, educating hikers and trail crews, and planning land protection.

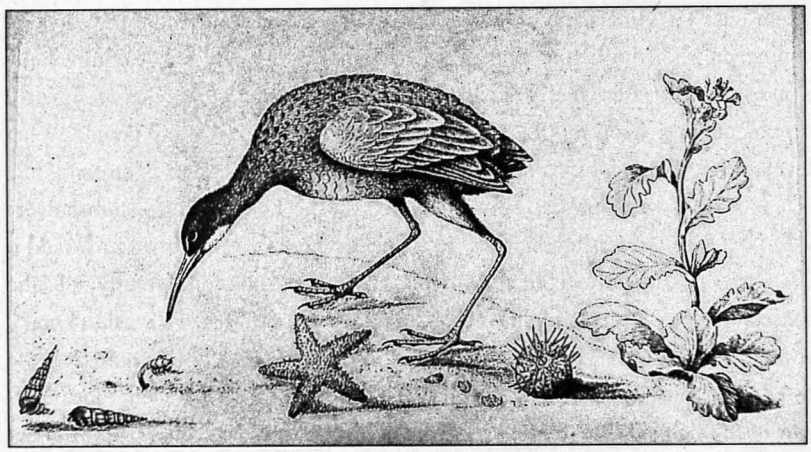
FIELDWORK FOR THE FUTURE

All this, of course, depends on an accurate inventory. The ATC's study is built on a standardized system of field survey methods and data storage developed by The Nature Conservancy (TNC). Using this system, TNC has developed the Natural Heritage Network, an extensive database on the distribution, habitat, and status of all recorded species in the United States and in the nations of the Caribbean and Latin America. Linked to the network are ongoing Natural Heritage Programs in each state, which regularly update the international database. The AT inventory has been conducted by personnel from these state programs and by contract scientists, often assisted by volunteers from local trail clubs.

Before heading into the field, surveyors searched the natural heritage database to identify sites where they were likely to find rare or threatened species. They also searched historical records, museum collections, scientific documents, and satellite imagery, or interviewed people familiar with a prospective site. Once on the trail, the research team closely surveyed a selected site, attempting to verify previous field studies and discover new occurrences of a rare plant. They also looked for notable natural communities, such as the hawthorn, mountain laurel, and chokecherry that associate in rocky glades along the Appalachian Trail.

Using the standard vocabulary of the TNC system, the researchers recorded sightings and ranked the vulnerability of species. The data gathered in the field is being stored electronically in the ATC's Trail Resource Database and transferred onto topographic maps. Soon it will be digitized into a geographic information system (GIS).

By providing an accurate picture of the biological health of the corridor, the inventory and assessing environmental threats, managing the use of sensitive areas, educating hikers and



Trained volunteers pick up where the scientists leave off, hiking to sites once or twice a year to monitor the health of a particular plant or animal. Along the AT in Shenandoah National Park, for instance, site monitors count the flowers of three-toothed cinquefoil, a rare and endangered wildflower that grows in clusters on the rocky outcroppings at the summit of Hawksbill Mountain. At another site on Hawksbill, monitors survey balsam firs, noting evidence of infestation by the balsam woolly adelgid, an exotic insect that defoliates and kills the trees.

NEW THREATS, AN EVOLVING VISION

Monitoring the presence of the balsam woolly adelgid along the Appalachian Trail illustrates how protecting the realm has become a complex endeavor. At one time, not so very long ago, an easement or acquisition preserved enough land to keep the trail from being overrun by development. But in recent years, ecological threats immune to the traditional remedies of land protection have mounted. The balsam woolly adelgid, just one of a rash of pests threatening Appalachian forests, has no respect for the boundaries between public and private land. Nor does air pollution. In the Southern Appalachians, where Bartram once saw ridges "rising grand and sublimely one above and beyond another," summertime visibility is less than one-quarter the natural range of 90–120 miles. Ozone in the Great Smoky Mountains is visibly damaging thirty different tree species, and acid rain poisons forest soils and mountain streams from the Blue Ridge to the Green Mountains. In the face of these threats, ATC has had to broaden the definition of trail protection. Without laying aside the traditional work of maintaining the footpath, it is considering pressing legislative action to curb air pollution and acid deposition, and adding conservation science and planning to its toolbox.

the monitoring program provide a tool for trail crews, and planning land protection.

The inventory and monitoring program, in fact, is a model for an emerging plan to use the trail as a focal point in a broad assessment of the Appalachian environment. Charles Foster and Karen Filipovich of Harvard University's John F. Kennedy School of Government have been working with ATC leaders and the National Park Service to design a collaborative initiative that would monitor air and water quality and assess the impacts of invasive species, air pollution, acid deposition, and climate change. Following the proven model of the AT's cooperative management plan, some trail managers are suggesting that the environmental monitoring program be carried out by a corps of volunteers trained and organized by universities and scientific field stations along the trail. The Hubbard Brook Foundation, Southern Appalachian Man and the Biosphere Program, The Nature Conservancy, Williams College, and the US Forest Service have all joined Appalachian Trail Conference, the Park Service, and Harvard in discussions of the project. If the program comes to fruition, it could make the AT a local classroom for environmental science while yielding critical findings on the health of the Appalachian environment. It would be an extraordinary contribution to the protection of the eastern mountain ecosystem.

Indeed, the natural heritage inventory and the environmental monitoring program are conceived to help guide land protection along the Appalachian Trail. The ATC's land acquisition arm, the Appalachian Trail Conference Land Trust, has acquired or participated in the preservation of more than 50,000 acres of land since it was established in 1982. With the completion of corridor protection in sight, the Trust has been reviewing land purchases that would augment the sometimes narrow trailway.

"I view what we're doing as being broader than protecting the corridor," said Trust director Bob Williams. As inventory and monitoring data become available on GIS, he said, they "will help identify high priority areas outside the corridor." Data that reveal the presence of a rare plant or evidence of a threatened wildlife habitat, for example, along with other values that contribute to the experience of being on the Appalachian Trail, "will help define what's important to us to protect."

Since ATC will not in the near term have the capacity to do extensive inventories of Appalachian lands outside the trail cor-

ridor, Williams said, it is seeking a partner to carry them out. The National Park's AT office, meanwhile, is developing an Appalachian Regional Information System, a database on existing scientific information on the eastern mountain environment. Both initiatives could prove extremely valuable in developing land protection priorities on the Appalachian Trail.

A WILDLANDS NETWORK?

Given ATC's growing attention to ecology, it's not a great leap to imagine the trail as the foundation of a wildlands network. To Benton MacKaye, it was always so. MacKaye dreamt of "not merely a footpath *through* the wilderness but a footpath *of* the wilderness." He called for the preservation of local wildlands and of extended "wilderness belts."

In the spirit of MacKaye, contemporary wilderness thinkers are seeing the trail through the lens of conservation biology. Nearly fifteen years ago, New Hampshire wilderness activist and historian Jamie Sayen began to write of the possibility of a well-buffered AT corridor becoming the backbone of a regional system of linked preserves that could help restore big wilderness in the East. More recently, Ed Zahniser, exploring the roots of wildlands network planning, observed in *Wild Earth* (summer 2000) that "the Appalachian Trail—as conceived by MacKaye—symbolizes wildlands connectivity."

ATC board member Glenn Scherer thinks the trail could become more than a "symbol" of connectivity. In the pages of hiking magazines and within the ATC, Scherer—a trail maintainer in New Jersey and an environmental journalist—has been building a bridge between the traditional concerns of trail advocates and the world of contemporary conservation biology.

"The Appalachian Trail would not exist without the grassroots maintainers, and we will never abandon our mission as caretakers of the trail," Scherer said. "But we also know that caring for the trail in the midst of today's environmental threats requires a bioregional vision. Part of that vision is looking at how the AT can bind together fragmented natural landscapes."

The trail already links large national parks and forests all along the Appalachian chain, but "in many places the protected corridor is just too thin to function as a migration corridor for plants and wildlife," said Scherer. "And yet in New Jersey, for example, we are fairly sure that black bears are using the AT corridor to get from the Highlands to the Ridge and Valley province across the Wallkill Valley, which is a fairly well-developed area."

Scherer is cautiously optimistic. "The big question we are facing," he said, "is whether trails and wildlife corridors are compatible. According to landscape ecologists, 'yes, sometimes,' seems to be the answer. Certainly, the wider the corridor, the better. But given the limits of our ability to acquire land, there really needs to be more study and a great deal of creative teamwork between landscape ecologists and trail people. What if, for instance, we built a land bridge—a wildlife crossing like the one recently completed on the Florida Trail—across every interstate highway crossing on the AT. Would it work? Would it really contribute to protecting the biodiversity of the Appalachians? Those are the kinds of things we need to know."

The answers, at least in part, will very likely come from the Appalachian Trail itself. Already, the trail is a model for building the long-term partnerships between nonprofits, government agencies, and researchers that are crucial to regional planning. It has also shown how local communities can participate meaningfully in a regional conservation effort. Now, as the ATC considers expanding its monitoring efforts, conservation science may begin to play a larger role not just in trail management, but also in the ongoing discovery of how we may best protect and restore the eastern mountain ecosystem. As always, much of what we learn about the wild Appalachians, and much of our inspiration, will come from exploring the Appalachian Trail.

Both Bartram and MacKaye would probably find today's vision for the trail a joyous marriage of science and wilderness experience. As a child, MacKaye formed a Rambling Boys Club "to give to the members an education of the lay of the land in which they live, also of other lands, taking in the Geography, Geology, Zoology, and Botany of them." Bartram, a consummate long-distance hiker, was as passionate about "compound panicles" and "pinnated leaves" as he was about the luscious color of ripe strawberries. In fact, he wrote so lovingly of all that he saw, he seems to have seen no division between the scientific and the sublime. Walking the Appalachian Trail in search of the Roan Mountain bluet, or simply strolling through a ridgeline grove, we all follow in the footsteps of these two brilliant trailblazers—on the trail, after all, there's a rambler and a flower-hunter in all of us. ☾

Chris Reiter *writes about conservation, natural history, and the arts and is the founding editor of Blue Ridge Press, a syndicated column service distributing commentary on environmental issues to the newspapers of the Southeast. After doing research for this essay, he became a volunteer rare plant site monitor on the Appalachian Trail.*

An earlier version of this article, written with research assistance from Holly Buchanan, originally appeared in American Hiker, *the magazine of the American Hiking Society.*

Beeswax for Biodiversity

Roxanne Quimby puts her money where her values are

by Phyllis Austin

When Burt's Bees Inc. outgrew its manufacturing space and moved from Maine to North Carolina seven years ago, it was "bound for glory," predicted owner Roxanne Quimby. She was right. Sales of the nature-friendly bath, beauty, and skin care products company leapt forty to sixty percent a year, reaching $13.8 million in 1999. The shower of profits is letting Quimby fulfill a new dream—North Woods philanthropist.

Through Burt's Bees, she contributed $2 million to help The Nature Conservancy (TNC) acquire 40 miles of riverfront on Maine's renowned upper St. John River, the longest free-flowing river east of the Mississippi.* Most recently, Quimby saved nearly 8,200 acres of forestland in two northern Maine townships from heavy logging. She bought the two parcels and plans to donate them to the proposed Maine Woods National Park and Preserve, if the campaign to create a new national park is successful. In the meantime, Quimby will protect the land in its natural state. Other similar conservation purchases are likely, she said.

Quimby's foray into wildlands philanthropy puts her in good company, and continues a venerable Maine tradition. The state's two most beloved natural areas, Acadia National Park and Baxter State Park, both have their genesis in philanthropic largesse, when private conservationists (principally George Dorr and John D. Rockefeller Jr. in the former case, Governor Percival Baxter in the latter) used their financial resources to acquire land that would be transferred to public ownership for parks.

Using wealth to protect wildlands is "paying our harmonic debt," said Quimby, who was part of the back-to-the-land movement and lived for a time in a tent with her children near Guilford, Maine. "There is no greater good than to heal the planet" through conservation, she said. "I just happen to have the money to do it now."

Quimby, who recently turned fifty, views her path from scarcity to affluence with a sense of humor and appreciation for spontaneity. Otherwise, she might not have opened the door to Burt Shavitz's honey house and seen the creative possibilities for all that beeswax he had been saving for years. From extremely humble beginnings—selling beeswax candles at craft fairs—the new partners built a business that would ride the wave of consumer interest in natural products.

Burt's Bees' line of products has expanded far beyond candles to salts, lotions, deodorants, cremes, fragrances, and more—made with ingredients like herbs, flowers, botanical and essential oils, beeswax, and clay. Quimby expects sales to climb to $22 million or more this year, and the company continues to "remain debt-free," said Quimby. "It's the Yankee 'don't spend it til you got it' approach."

"I never left Maine in my heart," said Quimby, referring to her short-term stay in North Carolina. She lasted three years, and Burt, just three months. He permanently retired to Parkman, Maine, south of Guilford. "He has been going on tour for the company," said Quimby. "People ask, 'Is there a Burt?' He works three or four days a month doing public relations...such as signing t-shirts." Otherwise, she said, "Burt is a nature lover, lives in a little cabin with no electricity and goes outside to pee. He has a very rural lifestyle."

Modern communications technology and monthly two- or

***Editor's note:** In 1998 the Maine Chapter of The Nature Conservancy (TNC) announced an agreement with International Paper Company to purchase 185,000 acres of industrial forest land in northern Maine containing extensive frontage along the upper St. John River. TNC subsequently commenced a planning process for the lands and a campaign to raise the $35 million purchase price, which was successfully completed ahead of schedule. Roxanne Quimby's contribution was one of the earliest and largest donations to the campaign. A notable example of wildlands philanthropy, the St. John Project is a great victory for conservation in northern New England (and the endangered Furbish louseworts along the banks of the St. John River). Although the final status of the lands is still unclear, TNC is designating some of the acreage as ecological reserves, logging other portions, and swapping upland parcels to secure additional river frontage. The total area in the St. John watershed with some conservation protection is now over 225,000 acres, including 60 miles of shoreland along the river. —*TB*

> The St. John donation showed me what the true mission of Burt's Bees was.
>
> ROXANNE QUIMBY

three-day trips to company headquarters in North Carolina allow Quimby to oversee marketing and research and development from her coastal home in Winter Harbor, Maine. She has bought out Shavitz's interest and now owns one hundred percent of the business. Burt's Bees products are sold in 4,000 stores across the country, and growth has been so fast that the company is "beginning to make a flicker on the scene" of the personal care products sector, Quimby said.

"I was floundering with what to do with the profits," continued Quimby. "I had satisfied the kids' needs with college and a home." She reflected on her years living close to the bone and said earning so much money in recent years made her question what motivated her; "Why stick with it now that the initial buzz is over?" she asked.

Then came along Kent Wommack, head of the Maine chapter of The Nature Conservancy. "He had to round up $10 million in a month, so I said, sure, I'll chip in." Quimby believes that the success of the $35 million project to protect the Upper St. John River shows "there are so many already on the verge [of giving to important conservation campaigns], ready to do it."

Burt's Bees was already in the environmentally friendly groove—using nature-based ingredients, not artificial preservatives or petroleum oils. Stressing reuse and recycling has been a priority in production, as well as marketing. But Quimby began to think it was not enough. "Returning profits right back into the land...was a closing of the circle," she said. "[The St. John donation] showed me what the true mission of Burt's Bees was."

The idea for a 3.2-million-acre Maine Woods National Park and Preserve, conceived by the organization RESTORE: The North Woods, caught her imagination, and Quimby has recently taken a seat on the conservation group's board of directors. "It's a great idea," she said. "It could be the crown jewel of the East Coast...and millions of acres of land in northern Maine are up for grabs."

Last year, while land hunting with a Bangor realtor who was handling several large properties, she became interested in two different parcels. The 2,350-acre Elliottsville Township parcel was "in my own neighborhood" near Guilford, she said; the other, 5,800-acre tract was also "within the boundaries of the proposed national park," located north of Baxter State Park in an unorganized township near Munsungan Lake.

Quimby took a plane ride over the land. "I needed to think about this overnight," she remembered. "Then I said to myself, I just have to do this." Part of the larger parcel, owned by logging contractor Herb Haynes, was slated to be logged; skidders were about to start harvesting a portion of the land sheltering a white-cedar swamp. Quimby agreed to pay a higher price to prevent the cutting and purchased the entire piece from Haynes in August 2000.

Nearby, The Nature Conservancy worked out a deal with the Pingree family, which owns several thousand acres in the southern half of the township, to eliminate cutting in exchange for a $1.5 million contribution to the Pingree Partnership, the conservation easement project that proposes to set aside from development 745,000 acres of the family's ownership in the North Woods. The Quimby and TNC/Pingree transactions added major buffering protection to already conserved lands in the adjacent township—the 4,800-acre Big Reed Preserve, New England's largest remaining tract of old-growth forest.

Quimby said the other property she bought, 2,350 acres of gently rolling terrain in Elliottsville Township, "had been cut-over harder and more recently, and train tracks run through [a corner of] it." Part of the land borders Big Wilson Stream and is in the neighborhood of Audubon's Borestone Mountain Sanctuary. Quimby's vision is to build tree houses connected by rope bridges and create a visitor's center on her land. "It is my feeling that if visitors can get the perspective of a tree, perhaps they would be more inclined to save them from the destruction of development and ruthless harvesting," she said. "Each tree house would cover some aspect of the North Maine Woods, including its history starting with Native American life and culture, the logging and paper industry, the flora and fauna of the region, the recreational use of the woods. Since the proposed center is quite close to the Appalachian Trail, we would also like to offer showers and other amenities to thru-hikers." (Her twins hiked the Georgia-to-Maine trail the year they graduated from high school.)

"My imagination works overtime, but since Maine represents the only place left on the Eastern seaboard where a project like the national park is even possible, it is an inspiring goal to work on," Quimby said. "My heart connection with the Earth is very strong....I need to do this [land conservation] as my service work." Quimby understands that no single person alone can protect a wild river like the St. John or create a new national park in the Maine Woods, but that such long-term conservation objectives can be achieved through effective private-public partnerships. She continued, "The pendulum is about to swing, and I think we can unite to save and heal the part of the Earth that's left [free of human development]. I'm going to stump for the cause whenever I can." ☾

Veteran reporter **Phyllis Austin** *has been covering conservation issues and environmental policy in Maine for many years. She is senior writer for the* Maine Times, *a weekly newspaper based in Bangor.*

Book Reviews

Reviewed in this issue

George Perkins Marsh: Prophet of Conservation

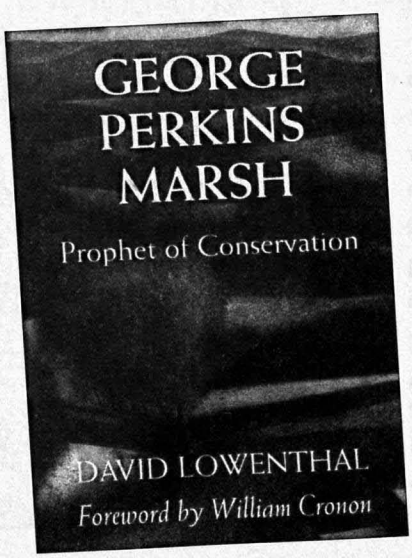
by David Lowenthal, foreword by William Cronon
University of Washington Press (Seattle, WA), 2000 ■ 605 pages, $40 cloth

The life of George Perkins Marsh spanned most of the nineteenth century. On few aspects of his era did he leave no mark. Lawyer, farmer, manufacturer, congressman, diplomat par excellence, Marsh was the broadest scholar of his day. He was at home in twenty languages, became America's prime master of Scandinavian and English literature and linguistics, made signal advances in comparative philology, helped to found and foster the Smithsonian Institution, spearheaded corporate railroad curbs and irrigation control, was a wonted arbiter of public taste in art and architecture, shone fresh light on the history of everyday life. Above all, his ecological insights pioneered alertness to human impacts on the earth, inspiring conservation zeal in his day and in ours. Next to Darwin's On the Origin of Species, *Marsh's* Man and Nature *of 1864 was the most influential text of its time to link culture with nature, science with society, landscape with history. Its influence endures.*

So begins David Lowenthal's richly textured biography, *George Perkins Marsh: Prophet of Conservation.* Lowenthal, an American professor emeritus of geography at University College London, published his first biography of Marsh in 1958. He explains that five factors "crucially reshaped" his earlier work on Marsh (additional primary sources, new historical understanding, altered biographical expectations, changes in his own thinking, and a fundamentally different environmental awareness in society), "making this in most ways a new book."

Lowenthal is right on every count. Forty-two years of additional scholarship make this new biography much deeper and more relevant than the first. From this point forward, serious students of conservation in the United States will read Lowenthal's *Prophet of Conservation* alongside Marsh's *Man and Nature* as the essential guide to understanding and appreciating Marsh and his writings in the context of his time and our own.

Lowenthal's book takes us from the birth of George Perkins Marsh in Woodstock, Vermont on the Ides of March, 1801 to his burial in "the Protestant cemetery in Rome, not far from the graves of Keats and Shelley" on July 25, 1882. En route, Lowenthal describes well Marsh's many accomplishments and provides countless examples of his altruism, genius, and genuine humility.



Lowenthal's final two chapters—*Retrospect: Forming a Life* and *Prospect: Reforming Nature*—provide the most illuminating discussions in the book. The retrospective provides valuable insights into Marsh's philosophies on public service, religion, democracy, leadership, women's rights, and corporations. Marsh was an active feminist who advocated for women's rights to education and suffrage, and "wondered why men were so fearful of women as equals." As for corporations, Marsh felt that "joint-stock companies have no souls; their managers...no consciences."

The concluding chapter provides a modern context for Marsh's thinking and answers the question: "Why bother with this diplomat-linguist's 1864 *Man and Nature,* a book 'full of facts that have since been shown to be erroneous [and] conclusions that went sour?'" There are many good reasons, but perhaps most important for wilderness advocates is to understand that Marsh was not the strict utilitarian, dominion-over-Nature conservationist that he is often portrayed to be.

Lowenthal explains that pioneer conservationists, looking for cheap and easy solutions, "adopted only half of Marsh's analysis and a fraction of his reforms.

Gleaning what they wanted from *Man and Nature*, they welcomed his positive messages—reforms that were clear-cut, widely beneficial, and allied with productive growth. They ignored or forgot his negative admonitions—watershed protection, inviolate woodlands, irrigation cautions, and warnings of irreparable damage from unintended impacts."

Few people today think of George Perkins Marsh as having been an advocate for "inviolate woodlands." Instead, he is most often portrayed as the "wise-use" counterpoint to "preservationists" like Henry David Thoreau and John Muir. Fortunately, Lowenthal dispels that myth: "'Only in the unviolated sanctuaries of nature,' wrote Marsh, out-Muiring Muir, could one gain 'that special training of the heart and intellect' indispensable to the human spirit." Moreover, he notes that Marsh read aloud the "exquisitely poetic" Thoreau, and also that Muir keenly admired Marsh and used Marsh's writings to support his own arguments for protecting Yosemite's watersheds.

Lowenthal describes Marsh's "early and active" advocacy for establishing wilderness in the Adirondack Park, and his profound regret twenty years later when faced with the impending "total destruction" of Adirondack forests. Making clear his belief that both responsible stewardship of forests and wilderness preservation were needed, Marsh wrote:

Some large and easily accessible region of American soil should remain, as far as possible, in its primitive condition, at once a museum for the instruction of the student, a garden for the recreation of the lover of nature, and an asylum where indigenous tree, and humble plant that loves the shade, and fish and fowl and four-footed beast, may dwell and perpetuate their kind.

In this year, the two-hundredth anniversary of George Perkins Marsh's birth, tension remains within the conservation movement between those who emphasize stewardship and kindly ("wise") resource use, and those who emphasize preservation of wild Nature and the ecological processes that shape biodiversity. Conservationists of every stripe would be wise to read Lowenthal's new biography, and look afresh at Marsh's classic work. Much wisdom can be found in these two monumental volumes—not the least of which is the notion that these two important streams in conservation history are natural complements. Both must succeed if the natural and cultural landscape is to regain and maintain good health.

Reviewed by **JIM NORTHUP**, *executive director of Forest Watch, a regional forest advocacy organization based in Montpelier, Vermont*

The Return of the Wolf:
Reflections on the Future of Wolves in the Northeast

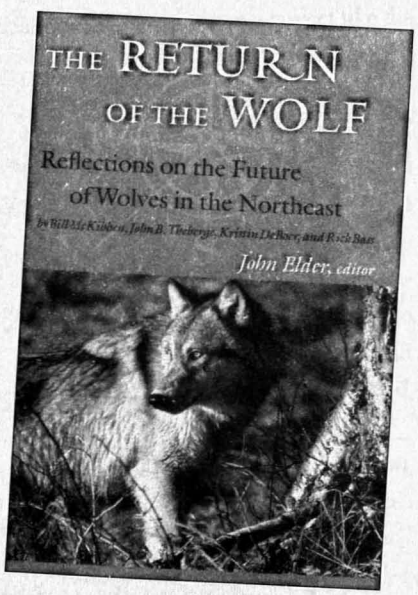
by Bill McKibben, John B. Theberge, Kristin DeBoer, and Rick Bass
edited by John Elder
Middlebury College Press/University Press of New England, 2000
175 pages, $24.95

In 1897, the last known wolf in the Northeast was killed and now stands stuffed in the Adirondack Museum. Its death was a concluding chapter in the grim tale of anti-predator campaigns that extirpated wolves throughout the region.

Times change. In 1974, wolves were protected under the Endangered Species Act. Today, wolf recovery is attainable in the eastern landscape. With an outpouring of public support for the restoration of wolves and a commitment from the US Fish and Wildlife Service to begin considering the Northern Forest as a potential wolf recovery area, the process of bringing back this top predator to a portion of its historical range has begun.

The Return of the Wolf: Reflections on the Future of Wolves in the Northeast, a collection of four essays edited by John Elder, is a thought-provoking and excellent introduction to many of the controversies and questions inspired by efforts to restore wolves to northern New England and New York.

Perhaps the first question that comes to mind about wolf reintroduction is, Why should we do it? In "Human Restoration," Bill McKibben has a clear answer: "It's not wolves that stand in need of restoration; wolves, though chased to the fringes of the continent, have managed to retain their essence....People on the other hand..." have a need for these wild creatures. The Northeast, a place of "suburb and highway culture," is ironically also a landscape of returning forest and wilderness. Perhaps,



McKibben muses, we should take this second growth as a second chance. Perhaps the howl of the wolf can help restore a culture that is capable of less selfish interactions with the natural world.

While we need wolves, so too do forests. "To restore the wolf is an ecological imperative," writes Kristin DeBoer in "Dreams of Wolves." The unplanned recovery of the eastern forests has created large areas of relatively unbroken habitat. Despite large human populations, the Northeast has excellent habitat for wolves. In return, the wolf, a keystone species, could restore biological integrity to the region, an area where white-tailed deer, moose, and beaver abound.

However, John B. Theberge, who has spent years observing wolf packs in Algonquin Park in Canada, is no more than cautiously optimistic. In his essay, "An Ecologist's Perspective," he worries that while the wolf is "a plastic" species, capable of adapting to a variety of habitats as long as there is an ample food supply, it is very susceptible to human interference. Theberge has seen many wolves killed after leaving the protective boundaries of the park, and he is right to be concerned about the potential human impacts on any wolves that are reintroduced to the northern woods. If people need wolves, then, conversely, wolves need people to protect them.

Like the other three authors, Rick Bass in "Vermont as Montana" insists that large areas of contiguous wilderness should be protected in the Northeast to keep the wolves safe from human persecution. This requires more than an understanding of wolves in ecosystems; it requires engagement with forest owners. Bass is a tired optimist, exhausted by the struggle to protect his beloved Yaak Valley in Montana from large timber interests but, nevertheless, buoyed by the possibilities in the Northeast to protect second and third generation forests and restore a missing piece of their biological fabric. Bass implores the reader to work toward a "more economically and culturally sustainable model of forestry," without which the "mere presence of wolves will offer little lasting benefit to the region." With the greater part of the northern forests in private ownership, and the current trend in Maine for large-scale forest liquidation, Montana's mistakes can serve as warning for the Northeast.

There are many questions about northeastern wolf recovery. How will wolves be returned? (Bass is convinced by DeBoer that wolves could not cross wide swaths of agricultural and developed land—and the Saint Lawrence Seaway—to make the journey from existing parks in Canada to the US.) Whose interests are being served by the US Fish and Wildlife Service's proposal to downlist the wolf's status in the Northeast under the Endangered Species Act from endangered to threatened? And if wolves are to be reintroduced to the Northeast, *what* wolf should be returned? The genetic identity of the animal that once lived in this region is a hotly contested issue.

The Height of Our Mountains:

Nature Writing from Virginia's Blue Ridge Mountains and Shenandoah Valley

edited by Michael P. Branch and Daniel J. Philippon, foreword by John Elder
Johns Hopkins University Press, 1998
448 pages, 30 illustrations ■ $39.95 hardcover, $18.95 paperback

STUDENTS OF regional nature writing and of Appalachian lore alike will find much of interest in this anthology edited by two scholars who met as graduate students at the University of Virginia, almost literally in the shadow of the Blue Ridge Mountains. Defining "nature writing" broadly, Branch and Philippon have selected seventy excerpts from travel narratives, geographical descriptions, and fiction as well as from the naturalists' accounts and personal essays more usually associated with the genre. Geographically, the anthology covers the northern Blue Ridge in Virginia and the Great Valley to its immediate west; in time it ranges from the earliest European settlers to essayists of the 1990s. The famous sit here among the relatively obscure: Thomas Jefferson, John Burroughs, and Annie Dillard share these pages with Robert Hugh Martin, Alexander S. Paxton, and Lynn Dickerson. Some familiar names take on novelty from unexpected connection with the region. Admirers of Theodore Roosevelt will enjoy his sketch of presidential birding vacations in Albemarle County, Virginia; a selection from Willa Cather's late novel, *Sapphiria and the Slave Girl,* reminds us that Cather lived her first nine years near Winchester, in the northern Shenandoah Valley.

The collection is expertly edited, annotated, and indexed. Two appendices, "Bibliographical Essay" and "Further Reading," point the way to hundreds of other resources. The foreword by John Elder and the editors' substantial introduction constitute a deliberate and important contribution to contemporary thinking about nature writing, regionalism, and the environment.

Reviewed by **JAY KARDAN**, *a writer and conservation activist from Palmyra, Virginia*

The Return of the Wolf does not have pat answers to these questions or attempt to be a blueprint for the future of wolves in the Northeast. It does successfully open sightlines on the varied social, ecological, and economic dimensions nested within this complicated issue.

This past January, I saw a wolf. It stepped from the cover of a pine stand, hesitating for a few seconds in the evening light. As it moved onto the snow-covered slope, four more followed. I held my breath as they stopped beside a rocky outcrop. Their howls were high and full, rising past my expectations. This was in Yellowstone National Park, a long way from my home in Vermont. But perhaps the two are getting closer.

Reviewed by **LISA OSBORN** *(losborn@defenders.org), the Northeastern Representative for Defenders of Wildlife*

Environment, Scarcity, and Violence

by Thomas F. Homer-Dixon
Princeton University Press
(Princeton, NJ), 1999
253 pages, $32.50

If people are unconcerned about the natural world because they don't feel a connection to it, perhaps their self-interest will draw them to care about the fate of wild Nature. If this appeal to self-interest is true in principle, it's unlikely that the narrow scope of *Environment, Scarcity, and Violence* will provide the stimulus needed.

The book is clearly written and its thesis is simple: environmental scarcity—defined as shortages of renewable resources like water, crop lands, fish, and fuel wood—contributes indirectly to violence within societies where these resources are important. While acknowledging that limits are real, Thomas Homer-Dixon argues that human ingenuity can often overcome these limits. But, he notes, ingenuity can be constrained by many of the forces that contribute to poverty in the first place, such as corrupt and ineffective politics.

There is little to argue with in Homer-Dixon's analysis—to a point. Strife over water, land, and firewood is real. Corruption and the irrationality in politics are real. And as he warns, there is a non-linearity to all this that makes precise prediction impossible. Societies, like ecosystems, may sustain many injuries and still function. But which next injury will precipitate the loss of important functions or bloom into violence? It's a useful warning to policy makers, but unlikely to be heeded.

There are also serious flaws in Homer-Dixon's focus on the Third World and renewable resource conflicts. While he notes that there has been much violence over non-renewable resources like oil, he nevertheless argues that if ingenuity could triumph and if the Third World could graduate from firewood to oil, much violence could be avoided. This hope rests on the observation that oil-based societies offer more adaptive flexibility.

But did ingenuity make the developed world? Perhaps in part. But more than ingenuity, it was the Third World that made the First World. The bloody conquest and subjugation of peoples and "new" lands and the resulting transfer of wealth—of labor, metals, and other resources—from the Third World to the First fueled the creation of these "more adaptive societies." The developed nations continue to be sustained by unequal terms of trade and the domination of trilateral corporations backed up with First World armed force, i.e., violence. Where is the Third World going to find a Third World to exploit?

The political structures that hamper ingenuity in the Third World also cannot be divorced from the First World. While it is nonsense to blame every problem in the poorer countries on the rich countries, the latter have much to account for. Even with the end of the Cold War, the rich countries continue to support regimes that protect their material interests, without much concern for justice except as it might affect stability and therefore their investments. Violence in the Third World is often a matter of proxy, with First World fingerprints everywhere.

And where ingenuity does win out? Homer-Dixon cites as an example of ingenuity Malaysia's decision to liquidate its tropical forests and use the cash to invest in goods and services for the global market. Such an action is bad for Nature and unlikely in the long run to be good for people—we need oxygen for starters, and we benefit in countless other ways from real forests (as opposed to tree farms). It was George Bush (the elder), who as President, told the Brazilians they needed to protect the Amazon so the world could breathe—never mind that the United States had logged more than 90% of its native forests and continued to log ancient forests on federal public lands.

And, as Brazil, China, and some other poorer countries struggle to industrialize, how much faster will the hydrocarbon supplies grow scarce and lead to conflict? Does living off energy stocks rather than flows, while perhaps allowing for adaptability in the short run, really provide a solution to scarcity? This type of "ingenuity"

seems contradictory at best—the sort David Ehrenfeld has so eloquently warned us against.

Homer-Dixon is aware that unchained ingenuity creates its own vast problems. But by focusing on the Third World, he ignores how the overdeveloped countries (whose economies drive Third World economies) have sacrificed so much to the "needs" of ingenuity, i.e., of capital. In the United States it is increasingly as if the whole universe exists to serve the needs of accumulation. Increasing profits is good and should be our guiding principle, because profit benefits us all—or so the argument goes. However, profits do not benefit all. But all are asked to trade away our forests and communities so that the 10 percent that already own 90 percent can grow yet richer. As Herman Daly reminds us, ever increasing accumulation of human capital at the expense of natural capital creates irreversible losses. Natural capital is unique, often living, and extremely complex, while human-made capital is relatively simple and often fungible.

Finally, while *Environment, Scarcity, and Violence* is well researched, its analysis of the factors that do and do not contribute to violence, as well as the options for navigating the waters around or through violence, could benefit enormously from a greater familiarity with the anthropological literature on politics, ecology, change, and development, including writings by Marvin Harris, Julian Steward, Elman Service, Morton Fried, and many others. This is not new ground, and the past makes plain the limits of ingenuity.

Reviewed by **DAVID JOHNS**, *who teaches political science at Portland State University*

illustration by Heather Lenz

Reading the Eastern Forest

Some recent titles of interest

Planning a Wilderness: Regenerating the Great Lakes Cutover Region *by James Kates, 2001, University of Minnesota Press, 208 pages, 20 black-and-white photos, $29.95* ~ Industrial forestry had largely scalped the forests of the Great Lakes region by the turn of the last century. This is a grand tale of how conservationists and planners, with a vision of restored forest health, launched a campaign to recreate a piece of the North Woods.

Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont *by Elizabeth H. Thompson, Eric R. Sorenson, illustrated by Libby Davidson, Betsy Brigham, and Darien McElwain, 2000, University Press of New England, 420 pages, $19.95 paper* ~ Sets a high standard for regional field guides. Natural communities provide a common language for reading the landscape from geology to botany. This book provides well-organized sections that range from subalpine krummholz to buttonbush swamp.

Adirondack Explorations: Nature Writings of Verplanck Colvin *edited by Paul Schaefer, 2000, Syracuse University Press, 234 pages, $19.95 paper* ~ For twenty-eight years Verplanck Colvin (1847–1920) served as the superintendent of the Topographical Survey of the Adirondack Mountains. This collection of Colvin's essays and talks gives a clear view of a pioneer for preservation and Colvin's pivotal role in the development of the "forever wild" statute that protects the Adirondack Forest Preserve today.

New England Forests Through Time: Insights from the Harvard Forest Dioramas *by David R. Foster and John F. O'Keefe, photographs by John Green, 2000, Harvard University Press, 70 pages, 49 color illustrations, $9.95 paper* ~ Over the past 300 years New England's landscape has shifted from forest to field and back again. This book presents this natural and human history through photos of the remarkable dioramas at Harvard's Fisher Museum woven together with a lively, informed narrative.

Eastern Deciduous Forest, Second Edition: Ecology and Wildlife Conservation *by Richard H. Yahner, 2000, University of Minnesota Press, $19.95 paper* ~ A useful textbook. New research findings have been added to this second edition.

Reflections in Bullough's Pond: Economy and Ecosystem in New England *by Diana Muir, 2000, University Press of New England, 312 pages, $26 hardcover* ~ A useful exploration of New England's intersecting cultural and ecological history.

The Wild Heart of Florida: Florida Writers on Florida's Wildlands *edited by Jeff Ripple and Susan Cerulean, contributions by Bill Belleville and Archie Carr, 1999, University Press of Florida, 224 pages, $19.95 paper* ~ Eighteen passionate essays show Florida's wild side and evoke a state still thick with pinewoods, alligators, and palmetto scrub. All royalties from the book are being donated to the Florida chapter of The Nature Conservancy.

continues next page

Ecology of a Cracker Childhood *by Janisse Ray, 1999, Milkweed Editions, 293 pages, $14.95 paper* ~ An elegantly written natural history of the southern long-leaf pine ecosystem and an impassioned plea for its protection and recovery—woven together with a memoir of growing up poor in a Georgia junkyard.

The Illustrated Book of Trees: The Comprehensive Field Guide to More Than 250 Trees of Eastern North America *by William Carey Grimm, 1999, Stackpole Books, 512 pages, $22.95 paper* ~ An update of a well loved field guide. Well organized to help the reader key in to family and then to species. Includes drawings of leaves, twigs, fruits, buds, and leaf scars. Not for those hoping to carry a light backpack.

The Northeast's Changing Forest *by Lloyd C. Irland, 1999, Harvard University Press, 416 pages, $50 hardcover* ~ Provides detailed exploration of five forest types: industrial, recreational, suburban, rural, and wild. Contains useful details and statistics for conservationists, but the book comes close to saying, "we can have our forests and cut them too."

Pine Barrens: Ecosystem and Landscape *edited by Richard T.T. Forman, 1998, Rutgers University Press, 684 pages, $30 paper* ~ Thirty-three ecologically informed, scientific, essays on the unique New Jersey pine barrens—from soils to the trees themselves. Forman is one of the foremost figures in the development of landscape ecology.

The Appalachian Forest: A Search for Roots and Renewal *by Chris Bolgiano, 1998, Stackpole Books, 288 pages, $25 hardcover* ~ From the glaciers and mastodons to logging and tourism, from primeval forest to chestnut blight and acid rain, this book provides both a natural and cultural history of a beleaguered forest—and searches for the keys to its preservation.

An Appalachian Tragedy: Air Pollution and Tree Death in the Eastern Forests of North America *edited by Harvard Ayers, Charles E.*

ANNOUNCEMENTS

Predator Tour "Wild Traditions of the Northeast: A Look at Forest Predators of the North Woods," a series of slide shows and discussions, will tour from New Jersey to Maine in April and May, 2001. The program features the wolf, black bear, lynx, wolverine, fisher, marten, northern goshawk and mountain lion. For program dates and locations, contact Kate Wright at Predator Conservation Alliance, PO Box 6733, Bozeman, MT 59771, 406-587-3389, www.predatorconservation.org.

Small Watershed Conference The National Watershed Coalition will offer a conference, May 20–23, Richmond, VA, on upstream small watershed programs including flood damage reduction, fish and wildlife habitat development, and water conservation. Contact John Peterson, 703-455-6886, jwpeterson@erols.com.

Forest Guardians Conference The annual Forest Guardians Conference will be held June 1–3, at the Black Range Lodge, Kingston, NM. Hikes and workshops. Call 505-988-9126.

Rachel Carson Conference A writers' conference and workshop honoring Rachel Carson is offered June 12–15, 2001, Boothbay Harbor, ME. Contact 910-630-7047, www.new-cue.org.

EarthSpirit Conference "EarthSpirit Rising: A Conference on Ecology, Spirituality and the Great Work," is offered June 15–17, Bellarmine College, Louisville, KY. Presenters include Brian Swimme, Matthew Fox, Sr. Miriam Therese MacGillis, Paul Winter, Connie Barlow, John Seed, and Ruth Rosenhek. Contact Catherine Browning or Jim Schenk, 513-921-5124, Imago@one.net.

Marine Symposium A Symposium on Marine Conservation Biology will be held in San Francisco, June 21–26, 2001. Topics include public policy issues, the new presidential executive order on marine protected areas, and presentation of new research data and case studies. Includes San Francisco Estuary aquatic aliens tour and other field trips. Contact Julie Morrison, PO Box 786, Missoula, MT 59801, 877-712-3777, www.mcbi.org.

Natural History Field Camp Dakubetede Environmental Education Programs presents the East Siskiyou Natural Field Camp and Wilderness Writers Conference, June 22–25, Dakubetede Wilderness Campus, near Ashland, OR. Contact Chant Thomas 541-899-1712, www.deepwild.org.

SCB Meeting The 15th Annual Meeting of the Society for Conservation Biology will be held at the University of Hawaii, Hilo, July 29–August 1, 2001. "Ecological Lessons from Islands" is the theme. Visit www.uhh.hawaii.edu/~scb.

Rivers Conference "Managing River Flows for Biodiversity" brings together government agencies, conservation organizations, and the electric power industry, July 30–August 2, 2001, Colorado State University, Fort Collins, CO. Topics include the conflict between ecosystem needs and human demands for water, ecological science of the flows required to protect biodiversity, and case studies on river conflicts and potential solutions. Visit www.freshwaters.org/conference.

Little, and Jenny Hager, 1998, Sierra Club Books, 240 pages, $45 hardcover ~ Essays by T.H. Watkins, Orie L. Loucks, Mary Hufford, Philip Shabecoff, and others that document the choking of the Appalachian forest by power plants, cars, and the host of tree-killing air pollutants.

Field Notes from the Northern Forest *by Curt Stager, illustrated by Anne E. Lacy, 1998, Syracuse University Press, 136 pages, $26.95 hardcover* ~ These twenty, friendly natural history essays were drawn from Stager's weekly public radio program. Ground bees, favorite trees, beavers, and other northern forest inhabitants are profiled.

ESA Meeting in Madison

The Ecological Society of America's 2001 Annual Meeting will be held in Madison, Wisconsin, August 6–10, 2001. The theme, "Keeping All the Parts: Sustaining and Restoring Complex Ecosystems," was chosen as a tribute to one of Madison's best-known sons, Aldo Leopold, who was president of ESA when he died in 1948. For information visit http://esa.sdsc.edu/madison/.

Glen Canyon Dam Report

Glen Canyon Institute has released their Citizen's Environmental Assessment on Glen Canyon Dam and Powell Reservoir. The report documents the ecological impacts of the dam on the Colorado River system and builds the scientific case for a full Environmental Impact Study that would consider decommissioning. Free copies are available from the Institute, PO Box 1925, Flagstaff, AZ, 86002, 520-556-9311, cea@glencanyon.org.

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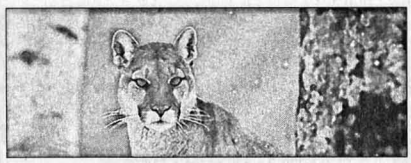

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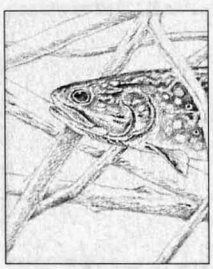

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We list here only each issue's major articles, by partial title or subject. For a more complete listing, request a comprehensive Back Issues List (see form, next page). Note: (✖) = issue is sold out, but photocopies of articles available.

BACK ISSUES

1/Spring 1991 • Ecological Foundations for Big Wilderness, Howie Wolke on The Impoverished Landscape, Reed Noss on Florida Ecosystem Restoration, Biodiversity & Corridors in Klamath Mtns., Earth First! Wilderness Preserve System, GYE Marshall Plan, Dolores LaChapelle on Wild Humans, Dave Foreman "Around the Campfire," and Bill McCormick's Is Population Control Genocide?

2/Summer 1991 • Dave Foreman on the New Conservation Movement, Ancient Forests: The Perpetual Crisis, Wolke on The Wild Rockies, Grizzly Hunting in Montana, Noss on What Wilderness Can Do for Biodiversity, Mendocino NF Reserve Proposal, Christopher Manes on the Cenozoic Era, and Part 2 of McCormick's Is Population Control Genocide?

3/Fall 1991 • (✖) The New Conservation Movement continued. Farley Mowat on James Bay, George Washington National Forest, the Red Wolf, George Wuerthner on the Yellowstone Elk Controversy, The Problems of Post Modern Wilderness by Michael P. Cohen and Part 3 of McCormick's Is Population Control Genocide?

4/Winter 1991/92 • (✖) Devastation in the North, Rod Nash on Island Civilization, North American Wilderness Recovery Strategy, Wilderness in Canada, Canadian National Parks, Hidden Costs of Natural Gas Development, A View of James Bay from Quebec, Noss on Biologists and Biophiles, BLM Wilderness in AZ, Wilderness Around the Finger Lakes: A Vision, National ORV Task Force

5/Spring 1992 • Foreman on ranching, Ecological Costs of Livestock, Wuerthner on Gunning Down Bison, Mollie Matteson on Devotion to Trout and Habitat, Walden, The Northeast Kingdom, Southern Rockies Ecosystem Protection, Conservation is Good Work by Wendell Berry, Representing the Lives of Plants and Animals by Gary Paul Nabhan, and The Reinvention of the American Frontier by Frank and Deborah Popper

6/Summer 1992 • The Need for Politically Active Biologists, US Endangered Species Crisis Primer, Wuerthner on Forest Health, Ancient Forest Legislation Dialogue, Toward Realistic Appeals and Lawsuits, Naomi Rachel on Civil Disobedience, Victor Rozek on The Cost of Compromise, The Practical Relevance of Deep Ecology, and An Ecofeminist's Quandary

7/Fall 1992 • How to Save the Nationals, The Backlash Against the ESA, Saving Grandfather Mountain, Conserving Diversity in the 20th Century, Southern California Biodiversity, Old Growth in the Adirondacks, Practicing Bioregionalism, Biodiversity Conservation Areas in AZ and NM, Big Bend Ecosystem Proposal, George Sessions on Radical Environmentalism in the 90s, Max Oelschlaeger on Mountains that Walk, and Mollie Matteson on The Dignity of Wild Things

8/Winter 1992/93 • Critique of Patriarchal Management, Mary O'Brien's Risk Assessment in the Northern Rockies, Is it Un-Biocentric to Manage?, Reef Ecosystems and Resources, Grassroots Resistance in Developing Nations, Wuerthner's Greater Desert Wildlands Proposal, Wolke on Bad Science, Homo Carcinomicus, Natural Law and Human Population Growth, Excerpts from *Tracking & the Art of Seeing* and *Ghost Bears*

Wildlands Project Special Issue #1 • TWP (North American Wilderness Recovery Strategy) Mission Statement, Noss's Wildlands Conservation Strategy, Foreman on Developing a Regional Wilderness Recovery Plan, Primeval Adirondacks, Southern Appalachians Proposal, National Roadless Area Map, NREPA, Gary Snyder's Coming into the Watershed, Regenerating Scotland's Caledonian Forest, Geographic Information Systems

9/Spring 1993 • The Unpredictable as a Source of Hope, Why Glenn Parton is a Primitivist, Hydro-Quebec Construction Continues, RESTORE: The North Woods, Temperate Forest Networks, The Mitigation Scam, Bill McKibben's Proposal for a Park Without Fences, Arne Naess on the Breadth and Limits of the Deep Ecology Movement, Mary de La Valette says Malthus Was Right, Noss's Preliminary Biodiversity Plan for the Oregon Coast, Eco-Porn and the Manipulation of Desire

10/Summer 1993 • Greg McNamee questions Arizona's Floating Desert, Foreman on Eastern Forest Recovery, Is Ozone Affecting our Forests?, Wolke on the Greater Salmon/Selway Project, Deep Ecology in the Former Soviet Union, Topophilia, Ray Vaughan and Nedd Mudd advocate Alabama Wildlands, Incorporating Bear, The Presence of the Absence of Nature, Facing the Immigration Issue

11/Fall 1993 • Crawling by Gary Snyder, Dave Willis challenges handicapped access developments, Biodiversity in the Selkirk Mtns., Monocultures Worth Preserving, Partial Solutions to Road Impacts, Kittatinny Raptor Corridor, Changing State Forestry Laws, Wild & Scenic Rivers Act, Wuerthner Envisions Wildland Restoration, Toward [Population] Policy That Does Least Harm, Dolores LaChappelle's Rhizome Connection

12/Winter 1993/94 • A Plea for Biological Honesty, A Plea for Political Honesty, Endangered Invertebrates and How to Worry About Them, Faith Thompson Campbell on Exotic Pests of American Forests, Mitch Lansky on The Northern Forest, Human Fear Diminishes Diversity in Rocky Mtn. Forests, Gonzo Law #2: The Freedom of Information Act, Foreman on NREPA and the Evolving Wilderness Area Model, Rocky Mtn. Nat. Park Reserve Proposal, Harvey Locke on Yellowstone to Yukon campaign

13/Spring 1994 • Ed Abbey posthumously decries The Enemy, David Clarke Burks's Place of the Wild, Ecosystem Mismanagement in Southern Appalachia, Mohawk Park Proposal, RESTORE vs. Whole-Tree Logging, Noss & Cooperrider on Saving Aquatic Biodiversity, Atlantic Canada Regional Report, Paul Watson on Neptune's Navy, The Restoration Alternative, Intercontinental Forest Defense, Failures of Babbitt and Clinton, Chris McGrory-Klyza outlines Lessons from Vermont Wilderness

14/Summer 1994 • Bil Alverson's Habitat Island of Dr. Moreau, Bob Leverett's Eastern Old Growth Definitional Dilemma, Wolke against Butchering the Big Wild, FWS Experiments on Endangered Species, Serpentine Biodiversity, Andy Kerr promotes Hemp to Save the Forests, Mapping the Terrain of Hope, A Walk Down Camp Branch by Wendell Berry, Carrying Capacity and the Death of a Culture by William Catton Jr., Industrial Culture vs. Trout

15/Fall 1994 • BC Raincoast Wilderness, Algoma Highlands, Helping Protect Canada's Forests, Central Appalachian Forests Activist Guide, Reconsidering Fish Stocking of High Wilderness Lakes, Using General Land Office Survey Notes in Ecosystem Mapping, Gonzo Law #4: Finding Your Own Lawyer, The Role of Radio in Spreading the Biodiversity Message, Jamie Sayen and Rudy Engholm's Thoreau Wilderness Proposal

16/Winter 1994/95 • Ecosystem Management Cannot Work, Great Lakes Biodiversity, Peregrine Falcons in Urban Environments, State Complicity in Wildlife Losses, How to Burn Your Favorite Forest, ROAD-RIPort #2, Recovery of the Common Lands, A Critique and Defenses of the Wilderness Idea by J. Baird Callicott, Dave Foreman, and Reed Noss

17/Spring 1995 • Christopher Manes pits Free Marketeers vs. Traditional Environmentalists, Last Chance for the Prairie Dog, interview with tracker Susan Morse, Befriending a Central Hardwood Forest part 1, Economics for the Community of Life: Part 1, Minnesota Biosphere Recovery, Michael Frome insists Wilderness Does Work, Dave Foreman looks at electoral politics, Wilderness or Biosphere Reserve: Is That a Question?, Deep Grammar by J. Baird Callicott

18/Summer 1995 • (✖) Wolke on Loss of Place, Dick Carter on Utah Wilderness: The First Decade, *WE* Reader Survey Results, Ecological Differences Between Logging and Wildfire, Bernd Heinrich on Bumblebee Ecology, Michael Soulé on the Health Implications of Global Warming, Peter Brussard on Nevada Biodiversity Initiative, Preliminary Columbia Mtns. Conservation Plan, Foreman on advocacy politics, Environmental Consequences of Having a Baby in the US

19/Fall 1995 • (✖) Wendell Berry on Private Property and the Common Wealth, Eastside Forest Restoration, Global Warming and The Wildlands Project, Paul J. Kalisz on Sustainable Silviculture in Eastern Hardwood Forests, Old Growth in the Catskills and Adirondacks, Threatened Eastern Old Growth, Andy Kerr on Cow Cops, Dave Foreman on libertarianism, Fending of SLAPPS, Using Conservation Easements to save wildlands, David Orton on Wilderness and First Nations

20/Winter 1995/96 • ***TWP Special Issue #2.*** Testimony from Terry Tempest Williams, Foreman's Wilderness: From Scenery to Strategy, Noss on Science Grounding Strategy and The Role of Endangered Ecosystems in TWP, Roz McClellan explains how Mapping Reserves Wins Commitments, Second Chance for the Northern Forest: Headwaters Proposal, Klamath/Siskiyou Biodiversity Conservation Plan, Wilderness Areas and National Parks in Wildland Proposal, ROAD-RIP and TWP, Steve Trombulak, Jim Strittholt, and Reed Noss confront Obstacles to Implementing TWP Vision

21/Spring 1996 • (✖) Bill McKibben on Finding Common Ground with Conservatives, Public Naturalization Projects, the Complexities of Zero-cut, Curt Steger on Ecological Condition of Adirondack Lakes, Acid Rain in the Adirondacks, Bob Mueller on Central Appalachian Plant Distribution, Brian Tokar on Biotechnology vs. Biodiversity, Stephanie Mills on Leopold's Shack, Soulé asks Are Ecosystem Processes Enough?, Poems for the Wild Earth, Limitations of Conservation Easements, Kerr on Environmental Groups and Political Organization

22/Summer 1996 • McKibben on Text, Civility, Conservation and Community, Eastside Forest Restoration Forum, Grazing and Forest Health, debut of Landscape Stories department, Friends of the Boundary Waters Wilderness, Foreman on Public Lands Conservation, Private Lands in Ecological Reserves, Public Institutions Twisting the Ear of Congress, Laura Westra's Ecosystem Integrity and the Fish Wars, Caribou Commons Wilderness Proposal for Manitoba

23/Fall 1996 Religion and Biodiversity, Eastern Old Growth: Big Tree Update, Gary Nabhan on Pollinators and Predators, South African Biodiversity, Dave Foreman praises Paul Shepard, NPS Prescribed Fires in the Post-Yellowstone Era, Alaska: the Wildlands Model, Mad Cows and Montanans, Humans as Cancer, Wildlands Recovery in Pennsylvania

24/Winter 1996/97 • (✖) Opposing Wilderness Deconstruction: Gary Snyder, Dave Foreman, George Sessions, Don Waller, Michael McCloskey respond to attacks on wilderness. The Aldo Leopold Foundation, Grand Fir Mosaic, eastern old-growth report, environmental leadership. Andy Robinson on grassroots fundraising, Edward Grumbine on Using Biodiversity as a Justification for Nature Protection, Rick Bass on the Yaak Valley, Bill McCormick on Reproductive Sanity, and portrait of a Blunt-nosed Leopard Lizard

25/Spring 1997 • (✖) Perceiving the Diversity of Life: David Abram's Returning to Our Animal Senses, Stephanie Kaza on Shedding Stereotypes, Jerry Mander on Technologies of Globalization, Christopher Manes's Contact and the Solid Earth, Connie Barlow Re-Stories Biodiversity by Way of Science, Imperiled Freshwater Clams, WildWaters Project, eastern old-growth report, American Sycamore, Kathleen Dean Moore's Traveling the Logging Road, Mollie Matteson's Wolf Re-storyation, Maxine McCloskey on Protected Areas on the High Seas

26/Summer 1997 • (✖) Doug Peacock on the Yellowstone Bison Slaughter, Reed Noss on Endangered Major Ecosys-

tems of the United States, Dave Foreman challenges abiologists, Hugh Iltis challenges abiologists, Virginia Abernethy explains How Population Growth Discourages Environmentally Sound Behavior. Gaian Ecology and Environmentalism, The Bottom Line on Option Nine, Eastern Old Growth Report, How Government Tax Subsidies Destroy Habitat, Geology in Reserve Design, part 2 of NPS Prescribed Fires in the Post-Yellowstone Era

27/Fall 1997 • (✖) Bill McKibben discusses Job and Wilderness, Anne LaBastille values Silence, Allen Cooperrider and David Johnston discuss Changes in the Desert, Donald Worster on The Wilderness of History, Nancy Smith on Forever Wild Easements in New England, Foreman explores fear and loathing of wilderness, George Wuerthner on Subdivisions and Extractive Industries, More Threatened Eastern Old Growth, part 2, the Precautionary Principle, North and South Carolina's Jocasse Gorges, Effects of Climate Change on Butterflies, the Northern Right Whale, Integrating Conservation and Community in the San Juan Mtns., Las Vegas Leopard Frog

28/Winter 1997/98 • ***Overpopulation Issue*** explores the factors of the I=PAT model: Gretchen Daily & Paul Ehrlich on Population Extinction and the Biodiversity Crisis, Stephanie Mills revisits nulliparity, Alexandra Morton on the impacts of salmon farming, Sandy Irvine punctures pronatalist myths, William Catton Jr. on carrying capacity, Virginia Abernethy considers premodern population planning, Stephanie Kaza on affluence and the costs of consumption, Kirkpatrick Sale criticizes the Technological Imperative, McKibben addresses overpopulation One (Child) Family at a Time, Foreman on left-wing cornucopianism, Interview with Stuart Pimm, Resources for Population Publications & Overpopulation Action, Spotlight on Ebola Virus

29/Spring 1998 • (✖) Interview with David Brower, Anthony Ricciardi on the Exotic Species Problem and Freshwater Conservation, George Wuerthner explores the Myths We Live By, Dave Foreman critique of "environment," forum on ballot initiatives, John Clark & Alexis Lathem consider Electric Restructuring, Paul Faulstich on Geophilia, critiques of motorized wreckreation, Mitch Friedman's Earth in the Balance Sheet, Anne Woiwode on Pittman Robinson, Peter Friederici's Tracks, Eastern Old Growth, Connie Barlow's Abstainers

30/Summer 1998 • ***Wildlands Philanthropy*** tradition discussed by Robin Winks, John Davis on Private Wealth Protecting Public Values, Doug Tompkins on Philanthropy, Cultural Decadence, & Wild Nature, Sweet Water Trust saves wildlands in New England, A Time Line of Land Protection in the US, Rupert Cutler on Land Trusts and Wildlands Protection, profiles of conservation heroes Howard Zahniser, Ernie Dickerman, & Mardy Murie, Michael Frome recollects the wilderness wars, David Carle explores early conservation activism and National Parks, and Barry Lopez on The Language of Animals

31/Fall 1998 • ***Agriculture & Biodiversity*** (✖) examined by Paul Shepard, Catherine Badgley, Wes Jackson, and Frieda Knobloch, Scott Russell Sanders on Landscape and Imagination, Amy Seidl addresses exotics, Steve Trombulak on the Language of Despoilment, George Wuerthner & Andy Kerr on livestock grazing, **Rewilding** paper by Michael Soulé & Reed Noss, Gary Nabhan critiques the Terminals of Seduction, Noss asks whether conservation biology needs natural history, Y2Y part 2, profile of Dan Luten

32/Winter 1998/99 • ***A Wilderness Revival*** perspectives from Bill Meadows on the American Heart, Juri Peepre on Canada, Jamie Sayen on the Northern Appalachians, and John Elder on the edge of wilderness, Louisa Willcox on grizzlies, politics from Carl Pope, Ken Rait's Heritage Forests, Jim Jontz's Big Wilderness Legislative Strategy, Debbie Sease & Melanie Griffin's stormy political forecast, Dave Foreman on the River Wild as metaphor, Mike Matz's Domino Theory, Wilderness campaign updates from Oregon, California, Nevada, Grand Canyon, New Mexico, Colorado, and Utah, NREPA, focal species paper by Brian Miller et al.

33/Spring 1999 • ***Coming Home to the Wild*** Flo Shepard, Paul Rezendes, Glendon Brunk, and Kelpie Wilson imagine rewilding ourselves, Paul Martin and David Burney suggest we Bring Back the Elephants! and Connie Barlow discusses Rewilding for Evolution, Freeman House on restoring salmon, John Davis on Anchoring the Millennial Ark, Chris Genovali exposes risks to Canada's Great Bear Rainforest, Madsen and Peepre on saving Yukon's rivers, Bryan Bird on roads and snags, George Wuerthner on population growth, Brock Evans uses wild language, Dave Foreman studies the word wilderness, and John Terborgh and Michael Soulé's "Why We Need Megareserves: Large-scale Networks and How to Design Them"

34/Summer 1999 • ***Carnivore Ecology and Recovery*** "The Role of Top Carnivores in Regulating Terrestrial Ecosystems" by Terborgh et al., Todd Wilkinson on the Yellowstone Grizzlies Delisting Dilemma, Wolves for Oregon, Carnivores Rewilding Texas, fire ecologist Tim Ingalsbee suggests we Learn from the Burn, David Orr continues the Not-So-Great Wilderness Debate, Tom Fleischner on Revitalizing Natural History, Jim Northup remembers Wildlands Philanthropist Joseph Battell, the Continuing Story of the American Chestnut

35/Fall 1999 • Nina Leopold Bradley, David Ehrenfeld, Terry Tempest Williams, and Curt Meine celebrate Leopold's legacy, wildlands philanthropy saves forests in Washington & California, Thomas Vale dispels the Myth of the Humanized Landscape, articles on Indigenous Knowledge and Conservation Policy in Papua New Guinea and threats to northwest Siberia's cultural & biological diversity, Janisse Ray takes us to the Land of the Longleaf, Robert Hunter Jones critiques NPS fire policy at Crater Lake, State of the Southern Rockies and the Grand Canyon Ecoregions, Sizing Up Sprawl

36/Winter 1999/2000 • ***Vision*** Jamie Sayen compares abolitionism and preservationism, Winona LaDuke rethinks the Constitution, Donella Meadows on shaping our future, Deborah & Frank Popper explore the Buffalo Commons, and Michael Soulé on networks of people and wildlands; Dave Foreman puts our extinction crisis in a 40,000-year context, Gary Paul Nabhan update on monarch butterflies and transgenic corn, David Maehr on South Florida carnivores, Michael Robinson discusses politics of jaguars and wolves in the Southwest, Reed Noss reserve design for the Klamath-Siskiyou, Andy Kerr's Big Wild legislative strategy, George Wuerthner on local control, Roger Kaye explores the Arctic National Wildlife Refuge

37/ Spring 2000 • ***The Wildlands Project Special Issue*** E.O. Wilson offers a personal brief for TWP, Harvey Locke suggests a balanced approach to sharing North America. Sky Islands (AZ, NM) section: 4 articles on the Sky Islands Wildlands Network by Dave Foreman et al. address the elements of a conservation plan, healing the wounds, and implementation, color map of the draft proposal, Wildlands Project efforts in Mexico's Sierra Madre Occidental, David Petersen's "Baboquivari!", Leopold's legacy in New Mexico. Wildlands networks proposals for the Central Coast of British Columbia by M.A. Sanjayan et al. & the Wild San Juans of Colorado by Mark Pearson. Mike Phillips on conserving biodiversity on & beyond the Turner lands, the economy of Y2Y, roadless area protection by Jim Jontz

38/Summer 2000 • ***American Parks and Protected Areas*** Foreman on resourcism vs. will-of-the-land, historical perspectives from John Muir & Gifford Pinchot, Richard West Sellars on the history of national park management, American environmentalism 1890–1920, David Carle calls for expanding national parks by shrinking national forests, Andy Kerr & Mark Salvo critique livestock grazing in parks and wilderness, Sonoran Desert National Park proposal, David Rothenberg and Michael Kellett debate on Maine Woods National Park, wildlands proposals for Maine and connectivity between Algonquin and Adirondack parks, Brad Meiklejohn retires cows from Great Basin, southwest New Hampshire wildlands, a Maine land trust, viewpoints on biodiversity conservation and "nature as amusement park," Thomas Berry interview

39/Fall 2000 • ***Little Things*** Resurrection Ecology by Robert Michael Pyle, Tom Eisner interview, Microcosmos, Return of the American Burying Beetle, Forgotten Pollinators, Laurie Garrett on the Coming Plague, Tom Watkins tribute by Terry Tempest Williams, Hunting & Nature Conservation in the Neotropics, Rockefeller's Philanthropy and the Struggle for Jackson Hole, critique of land exchanges, A Wilder Vision for the Texas Hill Country, Central Texas Forest Restoration, Fiction Folio: Dave Foreman's Lobo Outback Funeral Home

40/ Winter 2000/2001 • ***10th Anniversary Edition*** Exceptional excerpts from Wild Earth's first decade, the wilderness legacy of Robert Marshall, philanthropy aids rewilding in Florida, Michael Soulé asks if sustainable development helps Nature, Dave Foreman & Kathy Daly's ecological approach to wilderness area design, Connie Barlow sees ghosts of evolution, the dilemma of ecological restoration in wilderness, Sprawl vs. Nature by Mike Matz

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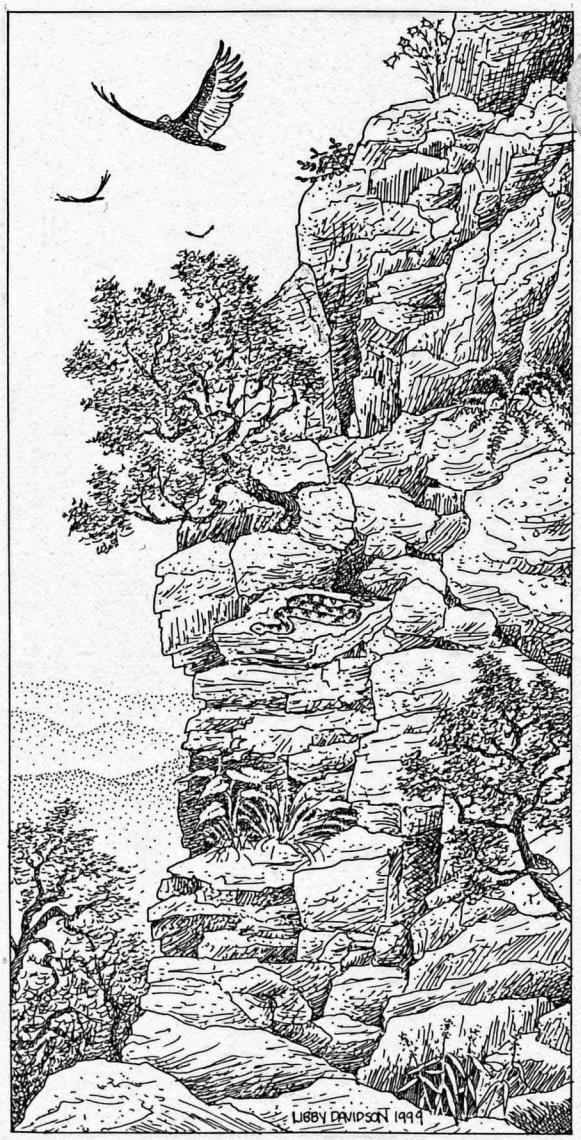

TEMPERATE CALCAREOUS Cliff

Liz Thompson *is an ecologist with The Nature Conservancy and an instructor at the University of Vermont.* **Eric Sorenson** *is an ecologist for the Vermont Agency of Natural Resources' Nongame and Natural Heritage Program. Illustrator* **Libby Davidson** *created pen and ink depictions of every natural community described in the book, 80 in all. She is a long-time contributor to* Wild Earth.

This natural community spotlight is adapted from the superb new field guide Wetland, Woodland, Wildland: A Guide to the Natural Communities of Vermont *(see "Reading the Eastern Forest," p. 93).*

Distribution/Abundance. Temperate Calcareous Cliffs are found in the limestone regions of Vermont. The largest and best examples are found in the Champlain Valley. Outside Vermont, similar communities are found in the St. Lawrence Lowlands, south into Massachusetts, Connecticut, and New York and west into the Great Lakes region.

Ecology and Physical Setting. These are calcareous (limestone, marble, dolomite, or calcareous schist) cliffs at lower elevations and in the warmer regions of the state. They are generally found at elevations below 2,000 feet and most are lower. In physical characteristics and vegetative physiognomy they are very similar to other kinds of cliffs: they are vertical or nearly vertical and are sparsely vegetated. But calcium-rich rocks weather faster than other kinds of rock, so there is greater potential for soil development in cracks and on ledges. Temperate Calcareous Cliffs vary in moisture availability and shade but have many characteristic plants that distinguish them from acidic or boreal cliffs.

Vegetation. Temperate Calcareous Cliffs are favorite places for early spring botanizing since their overall diversity is high and several conspicuous and interesting plants grow on them or in the talus below them. They also tend to harbor plant species that flower early in the spring in this warm, sunny setting. Small trees grow occasionally on ledges or in cracks where soil has accumulated, along with scattered low shrubs. Herbs are more prominent members of the community, growing in such tiny amounts of soil that they appear to be growing out of bare rock. Mosses, liverworts, and lichens grow on Temperate Calcareous Cliffs. Some mosses and liverworts prefer moist, shaded areas, but others can withstand extended periods of desiccation.

Animals. Turkey vultures may nest on these cliffs. Ledges on the cliffs are favorite sunning places for snakes, including garter snake, black rat snake, and, rarely, eastern timber rattlesnake.

Conservation Status and Management Considerations. Rock climbing can be a threat to this natural community, as can recreational wildflower hunting. Temperate Calcareous Cliffs should be viewed from a distance or from their bases. No plants should be collected from these sites. ☾

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