Wild EARTH

SUMMER 2001

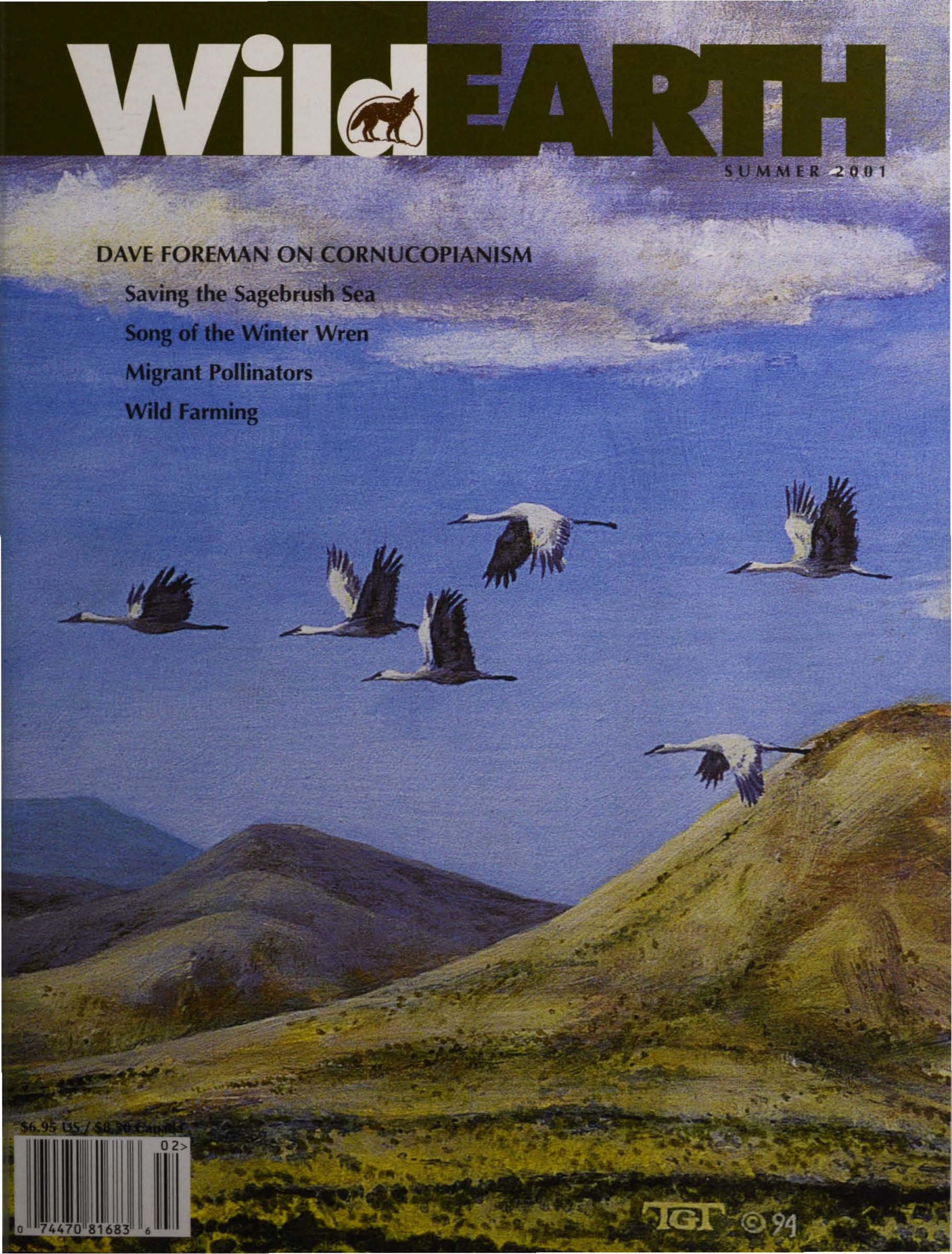
DAVE FOREMAN ON CORNUCOPIANISM

Saving the Sagebrush Sea

Song of the Winter Wren

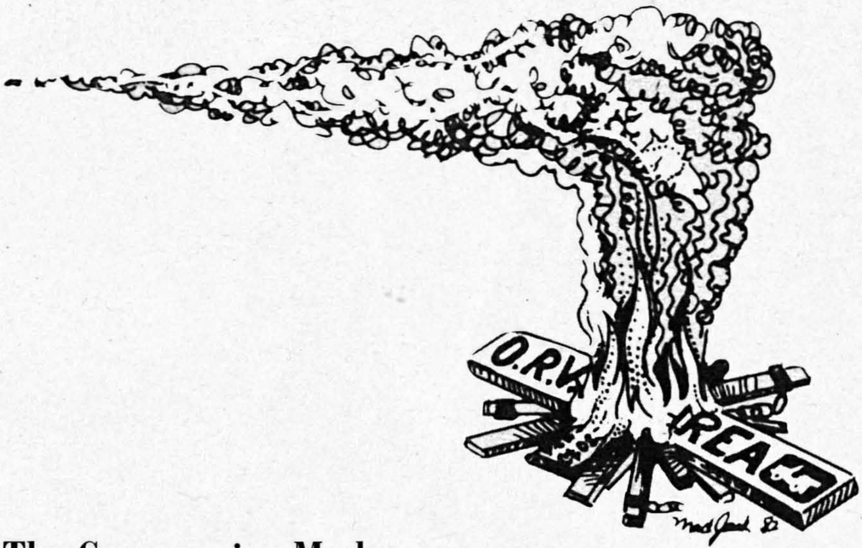
Migrant Pollinators

Wild Farming



Around the Campfire

by Dave Foreman



The Cornucopian Myth

A GENERATION AGO, the American establishment was caught up in "the golden optimism of the 1950s." One report funded by the Rockefeller Brothers foresaw, "New technologies, more efficient extraction processes, new uses may open up new worlds. Even now we can discern the outlines of a future in which, through the use of the split atom, our resources of both power and raw materials will be limitless...."[1]

In 1966, *Time* magazine predicted that everyone in the US would be independently wealthy by 2000 and that only 10 percent of the population would have to work. *Time* quoted Rand Corporation scientists, who described how "Huge fields of kelp and other kinds of seaweed will be tended by undersea 'farmers'—frogmen who will live for months at a time in submerged bunkhouses....This will provide at least a 'partial answer' to doomsdayers who worry about the prospects of starvation for a burgeoning world population."[2]

In 1967, *Time* made the "25 and Under" generation "Man of the Year," predicting, "He is the man who will land on the moon, cure cancer and the common cold, lay out blight-proof, smog-free cities, enrich the underdeveloped world and, no doubt, write finis to poverty and war."[3] Well, "he" did land on the moon.[4]

In 1974, Nobel Laureate in Economics Robert Solow wrote, "It is very easy to substitute other factors for natural resources, then....The world can, in effect, get along without natural resources, so exhaustion is just an event, not a catastrophe."[5] I wonder if he would have changed his opinion had he stepped out of the abstract and into the real. I suppose he would have regarded dying of thirst as an event, not a catastrophe.

For those who believe we will soon be able to shoot our surplus population off into space to settle unknown planets, Garrett Hardin provides a few scientific details that show how absurd such a notion is.[6] He summarizes the silliness by writing, "As of 1991 more than a quarter of a million people would have had to be shot off the earth *each day* just to keep earth's population constant at 5.3 billion."[7]

continues on page 2

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

Wild Earth

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The Wildlands Project

Networks of People Protecting Networks of Land

WE ARE AMBITIOUS. We live for the day when grizzlies in Chihuahua have an unbroken connection to grizzlies in Alaska; when wolf populations are restored from Mexico to the Yukon to Maine; when vast forests and flowing prairies again thrive and support their full range of native plants and animals; when humans dwell on the land with respect, humility, and affection.

Toward this end, The Wildlands Project is working to restore and protect the natural heritage of North America. Through advocacy, education, scientific consultation, and cooperation with many partners, we are designing and helping create systems of interconnected wilderness areas that can sustain the diversity of life.

Wild Earth—the quarterly publication of The Wildlands Project—inspires effective action for wild Nature by communicating the latest thinking in conservation science, philosophy, policy, and activism, and serves as a forum for diverse views within the conservation movement.

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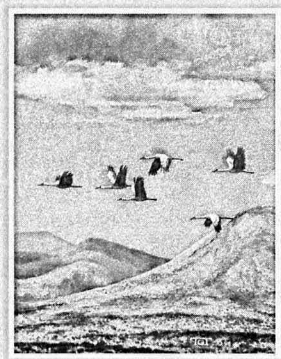

cover art
sandhill cranes (detail), oil by Todd Telander, ©1994

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Around the Campfire *continued*

A number of writers dismiss any notion of human overpopulation by pointing to Paul Ehrlich's 1968 book *The Population Bomb* and saying that because his warnings about future mass famine did not come true, fear about overpopulation is discredited. (Why do today's "commentators" not hold the cornucopians to their cheery forecasts the way they hold Paul Ehrlich to the dreary forecasts they claim he made?) Well, first of all, such critics manufacture supposed predictions from *The Population Bomb* to disprove. Few books have ever been more misquoted or misunderstood. Second, cornucopians claim Ehrlich was making hard predictions when he was only offering a variety of possible scenarios for the future. Third, famine *has* struck. Remember Ethiopia? Remember Somalia? How about North Korea? In truth, between 1968 and 1996, 250 million people died from starvation. That is roughly equivalent to the population of the United States. Nearly 10 million children a year have died from "hunger and hunger-related diseases" since *The Population Bomb* was written.[8] More than fifty countries that had fed themselves in the 1930s were net importers of food by the 1980s.[9]

The cornucopian perspective was well summed up by economist George Gilder in 1981 when he wrote, "The United States must overcome the materialistic fallacy: the illusion that resources and capital are essentially things which can run out...." A more rational economist, Allen Kneese, recognized in 1988 that this kind of economics was "a perpetual motion machine."[10] After the 1972 United Nations Conference on the Human Environment in Stockholm, Paul Ehrlich wrote about discussions there on sustainability between economists and scientists: "As each new perpetual-motion-machine was propounded, one of the biologists or physicists would simply point out that it violated the second law. Finally, in frustration, one of the economists blurted out, 'Who knows what the second law of thermodynamics will be like in a hundred years?'"[11] Not only do neoclassical economists not believe in biology, they do not even believe in physics!

Or, as Kenneth Boulding, once president of the American Economic Association, said, "Only madmen and economists believe in perpetual exponential growth."[12]

Those on the left like to claim sustainability is just a matter of redistributing wealth. However, Sandy Irvine writes, "Studies in Guatemala, for example, show that the benefits of land redistribution would disappear within a generation simply because of population growth."[13]

Hardin turns the tables on the social justice opponents of population stabilization:

> *Promoters of "ethnic power" love to scold rich countries for urging a lower birth rate in poor countries; the ethnics call this "genocide." But if a country is poor and powerless because it already has too many children for its resources, it will become even poorer and more powerless if it breeds more. If ethnic pronatalists have their way, poor countries will be ruined.*[14]

Hardin further warns, "Exponential growth is kept under control by misery."[15] One needs only to see population decline in Russia today with its ruined economy and despair for the future.

Maybe the very idea of scarcity is a problem. Hardin writes, "The idea of scarcity also needs examining, if we are not to be bewitched by words. The problem of poverty is almost invariably seen as one of *shortages*—shortages of supply. But note: poverty can just as logically be seen as a problem of *longages*—longages of demand."[16]

The late Julian Simon's careless assertion, "We now have in our hands—in our libraries, really—the technology to feed, clothe, and supply energy to an ever-growing population for the next 7 billion years,"[17] is the clearest expression of irrational exuberance among cornucopians. It is particularly astonishing because one would presume that economists would understand something about arithmetic. Seven billion years, he said. *Seven billion years.* The planet Earth came into being only about 4.5 billion years ago. Life first developed about 4 billion years ago. Animals evolved less than 600 million years ago and hominids split off from chimpanzees about 5 million years ago. Agriculture was not developed until 10,000 years ago. Yet, Simon believed that human population could continue to grow for 7 billion years.

In 1994, world population was doubling every 43 years. A simple calculation shows that at this rate, in a mere 774 years, there would be "*ten human beings for each square meter of* ice-free land on the planet," according to Paul and Anne Ehrlich. Do the math yourself. Furthermore, "After 1900 years at this growth rate, the mass of the human population would be equal to the mass of the Earth; after 6000 years, the mass of the human population would equal the mass of the universe."[18] I know the Ehrlichs and they are exceedingly generous and fair people. So, they cut marketing professor Simon a great deal of slack and calculated with a growth rate "*one million times* smaller than the actual 1994 value—that is, if it were only an infinitesimal 0.0000016 percent per year—Earth's population would still reach a mass exceeding that of the universe before the end of the 7-billion-year period Simon mentioned."[19]

Retired University of Colorado physics professor Al Bartlett writes that some of his friends contacted Julian Simon after his 7-billion-year pronouncement and Simon backtracked to claim that he meant only 7 million years. (Be glad this guy wasn't doing your taxes!) Bartlett whipped out his calculator and figured out what would happen if we grew only one percent for 7 million years. He got 2.3×10^{30410}. Bartlett says, "This is a fairly large number!" He goes on to calculate the total number of atoms in the universe—about 3×10^{85}. The first number is 30 kilo-orders of magnitude larger than the total number of atoms in the universe. So, if Simon only wanted the total number of people to equal the total number of atoms in the universe, how long would it take to get there at a growth rate of one percent? A mere 17,000 years.[20]

Were you to hear some bedraggled street corner prophet telling a lamp post that we could continue to grow for 7 billion years, you would chuckle and keep moving. However, Julian Simon was not a homeless schizophrenic. He was (and remains) the most lauded no-limits-to-growth economist for the *Wall Street Journal* crowd.

Let us not think, however, that only right-wing Republican economists like Simon believe in perpetual growth. Democrats

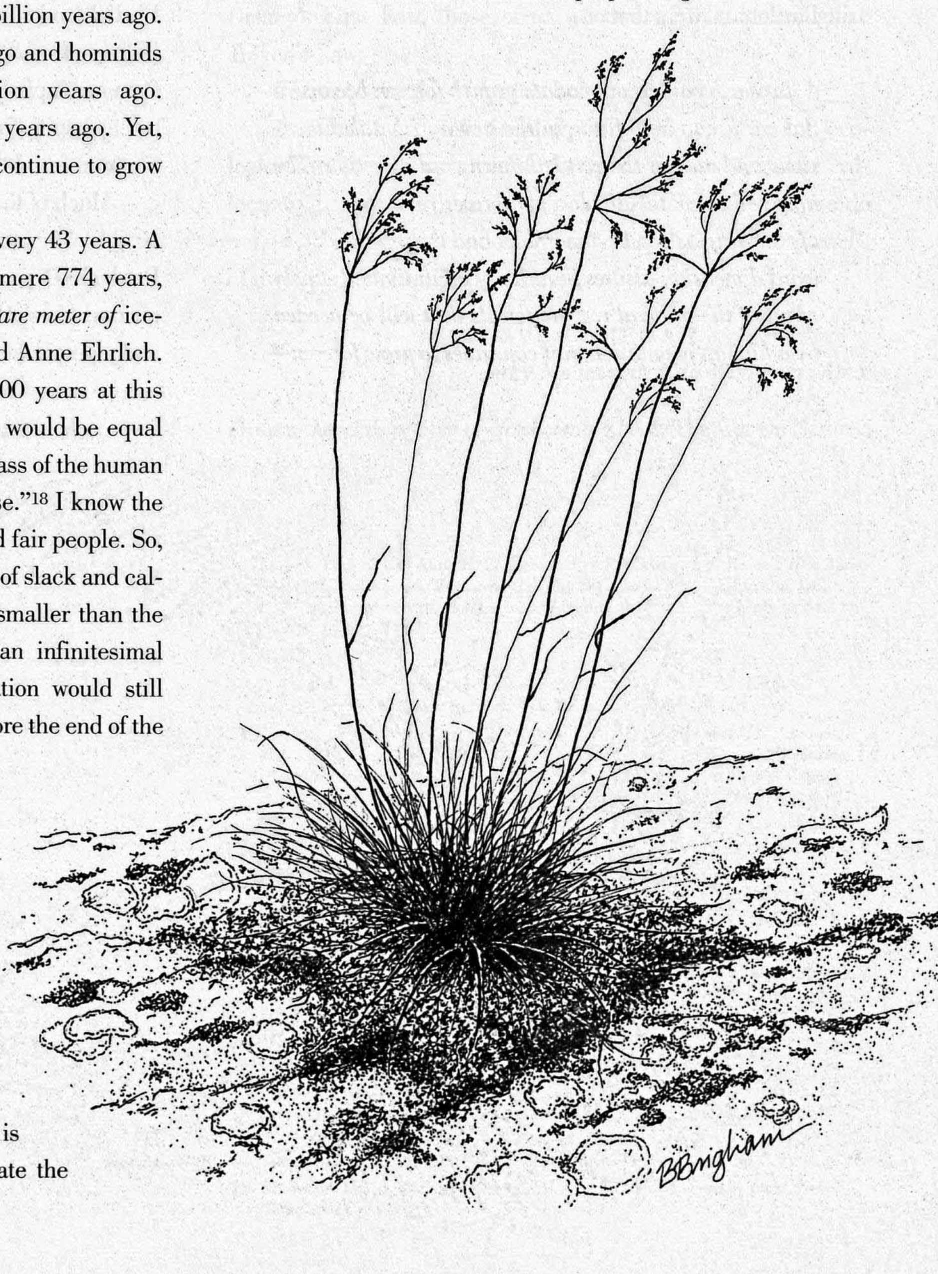

illustration by Betsy Brigham

do, too. When he was chief economist for the World Bank, Lawrence Summers, later Secretary of the Treasury for President Clinton, said, "There are no…limits to carrying capacity of the Earth that are likely to bind at any time in the foreseeable future.…The idea that we should put limits on growth because of some natural limit is a profound error."[21]

Let me admit that I am no whiz at math. However, even I can understand Al Bartlett when he tries to explain simple math to the cornucopians. Bartlett explains that a round Earth presents a problem because a "sphere is bounded and hence is finite." He sees "a new paradigm…emerging which seems to be a return to the wisdom of the ancients." "The pro-growth people say that perpetual growth on this earth is possible. If the pro-growth people are correct, what kind of earth are we living on?"

Bartlett answers that:

> *A flat earth can accommodate growth forever, because a flat earth can be infinite in the two horizontal dimensions and also in the vertical downward direction. The infinite horizontal dimensions forever remove any fear of crowding as population grows, and the infinite downward dimension assures humans of an unlimited supply of all of the mineral raw materials that will be needed by a human population that continues to grow forever.*[22]

Al Bartlett does an excellent job of describing the various kinds of anti-Malthusians in his essay "Malthus Marginalized." He suggests that many of them are not scientists and "put their faith in Walt Disney's First Law: wishing will make it so."[23] He also warns of the Flying Leap Syndrome: jumping from a high building, an anti-Malthusian is exhilarated and, after a couple of seconds, assumes that everything will be fine forever. The ground is the boundary the jumper ignored.[24]

Julian Simon has made other nonsensical claims, such as, "Every measure of material and environmental welfare in the United States and in the world has improved rather than deteriorated. All long-run trends point in exactly the opposite direction from the projections of the doomsayers."[25] Simon was so sure of himself that he offered to bet on his assertion. Paul Ehrlich and climatologist Stephen Schneider took Simon's challenge and made 15 predictions of things getting worse, ranging from per capita cropland decline to buildup of greenhouse gases to per capita firewood decline to extinction to AIDS deaths.[26] Simon refused the bet.

Much of the problem in explaining population growth is the terrible ignorance of Americans today. John Dunning Jr. at Purdue's Department of Forestry and Natural Resources has quizzed his students about world population. He asks them how many people are on Earth, and how many are added each year.

illustration by Betsy Brigham

The answers are stunning. For total world population, his students (freshmen to seniors) answered between 5 million to 9 quadrillion, with a mean of 15.2 trillion! Only 36 percent gave a more or less accurate number (5–6 billion in 1997). For the annual number of new people, he got answers from 2,000 to 27.5 trillion, with a mean of about 47 billion. Only 7 percent were close to correct (90–100 million). He found little improvement in scores between freshmen and seniors. Dunning sees two problems with these answers: first, "students have no concept of how large a billion or a trillion really is"; second are the gross overestimates. He asks, "How do you convince someone that 5.7 billion people is a problem when their guess of the current population is in the hundreds of billions or trillions?" He is now trying to get his students to understand how many a billion is by explaining that four football fields have about a billion blades of grass.[27]

Fred Charles Iklé has impeccable conservative credentials as undersecretary of defense for Ronald Reagan. Writing in *National Review* in 1994, he warned against the "Utopia of Perpetual Growth":

Thus, the utopianism is unmasked as a gigantic, global Ponzi scheme, where each generation can collect its growth entitlement only if a compliant and larger generation steps into the queue behind it. Should we conservatives let this utopianism dominate our movement, nobody would be left to stop the fraud and the whole pyramid would eventually collapse, engulfing everyone in vast misery. The cause of this collapse would not be a shortage of material goods but the destruction of society's conservative conscience by our Jacobins of growth.[28]

A fundamental error that cornucopians make is to believe that humans are in control. Biologist David Ehrenfeld exploded this fantasy with *The Arrogance of Humanism*—a book that should be read by every thinking person. He warned that "human-designed systems of great power and complexity will always have accidents, as our emotional judgment rightly warns us, and no application of rational control systems, however carefully and skillfully engineered, can possibly prevent them from happening."[29]

While cornucopians of the right, left, and middle believe in Disney's First Law, those of us who warn of limits recognize Traven's Law:

This is the real world, muchachos, and you are in it.

It is our task to use the sharp pin of logic, facts, and ecological understanding to prick the cornucopians' fantastic balloon emblazoned with Jiminy Cricket and Tinkerbell. If we do not, all of us will be condemned to live with the consequences of dwelling in a flat Earth universe.

—**DAVE FOREMAN**
Jerky Mountains, Gila Wilderness Area

(Yet another excerpt from my forthcoming book, The War On Nature.*)*

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8. Ehrlich, Paul R. and Anne H. Ehrlich, *Betrayal of Science and Reason: How Anti-Environmental Rhetoric Threatens Our Future* (Island Press, Washington, DC, 1996), pp. 71–76.
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13. Irvine, Sandy, "The Great Denial: Puncturing Pro-natalist Myths," *Wild Earth*, Winter 1997/98, p. 12.
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18. Ehrlich, Paul R. and Anne H. Ehrlich, *Betrayal of Science and Reason: How Anti-Environmental Rhetoric Threatens Our Future* (Island Press, Washington, DC, 1996), p. 66. In case you don't want to do the math yourself, the Ehrlichs do it on page 264.
19. *Ibid.*, pp. 66–67.
20. Bartlett, Albert A., "The Exponential Function, XI: The New Flat Earth Society," *Focus*, Carrying Capacity Network, Vol. 7, No. 1, 1997, pp. 34–36.
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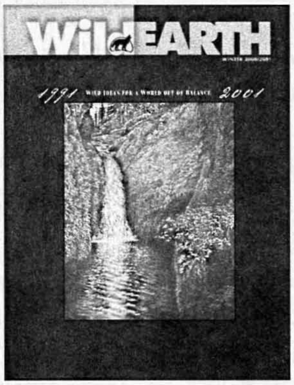


Fallen Giants

David Brower (1912–2000) I have a framed photo above my desk. In it, an old man sits, looking past the camera, his fists clenched in emphasizing a point; beside him sits a somewhat younger man, raptly listening. I am that younger man. The older man is Dave Brower.

This picture was taken in 1994 at the National Wilderness Conference. When the photographer, a friend, showed me the proofs, I said, "This man is a hero of mine! Could you blow up a copy of this for me?" She did one better. She sent the photo to Brower, who inscribed it: "For Chris Barns—Persevere! —David R. Brower."

You cannot imagine how proud I was. Or maybe you can, if one of your heroes has called you to carry on his work. Four years later, I met Brower again, this time at a book signing. We talked for a few minutes, and I realized he had absolutely no idea who I was. When he inscribed my book, he misspelled my name, and wrote: "Persevere! —David R. Brower."

Clearly, Brower told *everyone* to "Persevere!" For a few moments, I must confess to a certain disappointment that he hadn't meant that word for me alone, that I apparently was not a chosen successor. As quickly as the letdown came it was replaced by a realization: that's how it should be!

After all, *I* am not important. Nor are you. Nor was Dave. It is the perseverance of every spirited defender of the wilderness that was, is, and always will be important. We are *all* his chosen successors. And that is a good thing, because now that Dave has gone, it will take all of us to carry on in his stead.

CHRISTOPHER V. BARNS
Missoula, Montana
Chris Barns is the BLM Representative at the Arthur Carhart National Wilderness Training Center.

Paul Fritz (1929–2000) Wild things lost a dear, tenacious, and brilliant friend when Paul Fritz died December 24, 2000. Fritz—as he was called by friends and himself—had a unique power that resulted from being both a visionary and front-line slugger. He was one of the earliest supporters of The Wildlands Project and his support never flagged despite some tough bouts with illness in his later years. Paul worked with countless groups in the interior American West: as an inspiration, advisor, donor, board member, and all-around leader. Always ahead of his time, Fritz long ago saw the need to make protected area boundaries biologically based.

For over twenty-five years, Fritz devoted himself to conservation through his work, briefly in the US Forest Service and for most of that time in the National Park Service. He was central to the creation of Redwood National Park and the creation and expansion of many other preserves, including Wrangell-St. Elias National Park in Alaska. At one time or another Fritz's passion, feistiness, administrative skills, and political acumen guided Idaho's Craters of the Moon National Monument, Lassen National Park in California, and Utah's Natural Bridges National Monument. He drew the original boundaries for the yet to be created Hells Canyon/Chief Joseph National Park and Preserve.

Those of us who had the honor to work with Paul Fritz and receive the benefit of his great experience and the pleasure of his friendship will always remember him as undaunted and unafraid. He was more than a tireless defender of wildlands—he knew that the best defense is a good offense.

Long after the servants and sycophants of the Earth's domestication are buried and forgotten, Fritz will be missed and looked to as a model. The true measure of Fritz's gifts is that they live in more than transient human memory; his gifts abide in a living Earth. Because of Fritz, some wild places live on that would not otherwise be. What more sublime thing could any human give?

DAVID JOHNS
McMinnville, Oregon
David Johns serves on the board of directors of The Wildlands Project.

Wilderness Restoration

Two articles in the Winter 2000/2001 *Wild Earth* concern me greatly. "Naturalness and Wildness" by Peter Landres, Mark W. Brunson, and Linda Merigiliano and "Would Ecological Landscape Restoration Make the Bandelier Wilderness More or Less of a Wilderness?" by Charisse A. Sydoriak, Craig D. Allen, and Brian F.

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.

Jacobs propose altering the Wilderness Act, not by Congressional action, but by individual interpretation. This is very troubling.

I believe the so-called dichotomy between "naturalness and wildness" in wilderness is a red herring. It appears there are scientists and land managers who are itching to manipulate wilderness areas just like we have manipulated most of the Earth. The very essence of wilderness, what makes it different, is its *wildness*. In wilderness we do not exert control, we are visitors only, we play second fiddle to Nature, we humble ourselves before the wild, we do not interfere, we do not decide for wilderness what we think it should be, and we do not decide how wilderness will evolve. Manipulating wilderness on the scale the that two articles suggest looks a lot like playing God to me.

Humans are not educated enough, let alone humble enough, to fully understand ecosystems. We have not even been able to save all the pieces, as Aldo Leopold so eloquently said. Yet here we are saying we know enough to manipulate these ecosystems and predict what will occur from this manipulation. We say we know what this will mean for plant and animal species, humankind, and wilderness. Pardon me but someone's arrogance is showing.

BRANDT MANNCHEN
Bellaire, Texas

Editor's note: *A spirited debate over active ecological restoration in designated wilderness areas is ongoing among wilderness advocates.* Wild Earth *will continue to cover that debate, and help foster dialogue between conservationists with different viewpoints; see articles by Stephen Barrett (p. 60) and George Nickas and Gary Macfarlane (p. 62) in this issue.*

Heal-all *(Prunella vulgaris)*

**Heal-all, spiked indifference, what do you salve in me?
Your purple cloak of deep summer leaves
recalls the springing splendor you marched out
first upon the lawn, green before
crabgrass and wood sorrel, before mosses
firmed and launched periscopes to the air.**

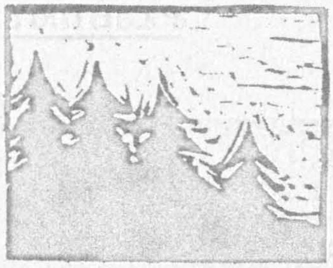
**Through a world of diminution I crawl, fondle
your flowerless nape. You are shoulders now,
bare and round, safe place to press my palms, damp
cheek, you drink sun and rain, equally, even
the mower, scourge of other volunteers, poses
no threat to your dense-packed guard.**

**For once cut, you refused to grow again
those proud stalks, whorled flowers of mint,
measured struts delight. As if defiant
to that first cut, you won't tempt another.
My boy goes round you, flat weed, unnecessary
work. You have trained the laziness into him.**

**Teach me that, self-heal, to find another form,
lower to the ground but not diminished, to bend
another's will around my own. What energy
you used in stretching skyward, spread now, extending
crowding out both timothy and cinquefoil.
My wound comes not in asking for the sky. But I am drawn**

**by your persistence, how you go on, and on in summer's heat
without a flower to your name. I make of you nothing more
than you can give, a bracing tea
with bugleweed and rosemary, without which
I am nothing, a world that will not grow, mown
by sharper blade, words of another, failure of words.**

—Susan Edwards Richmond

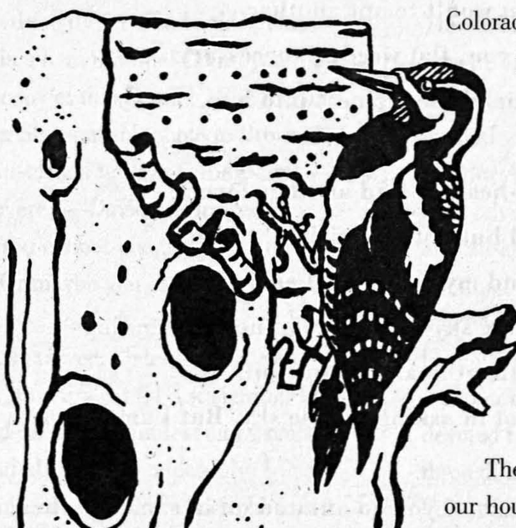


A Wilderness View

Smart Growth and Sapsuckers

This spring I've been watching two families build homes in my rural neighborhood. One of the building sites is emblematic of modern residential construction. Hired contractors cleared trees with chainsaws and bulldozers, drilled a well, and installed a septic system. An excavator dug the cellar hole and a convoy of concrete trucks rolled up the road to pour the foundation. Then several massive, plastic-covered sections of the factory-built house were delivered to the site; a crane lifted them into place, they were bolted together, and in a day, a large, two-story house with attached garage appeared.

The house is big—but probably not much above average for new housing in the United States. (By Third World standards it would be a palace.) Like all conventional housing, it was extremely resource intensive to manufacture; concrete, lumber, glass, copper wiring, asphalt shingles, etc. use large quantities of energy to produce and transport. Except for the concrete and gravel, it's likely that the materials came from outside the region: framing lumber from British Columbia, perhaps; particle-board sheathing from aspens clearcut and chipped in Colorado; copper mined in New Mexico; foam insulation whose petroleum base was pumped in the Middle East. The global economy allows for the new house's ecological foot to stretch across the globe. (Fortunately, the house site was adjacent to an existing development, required no new road construction, and did not further fragment significant wildlife habitat, as new residential development so often does.)



By contrast, the second couple hired no general contractor and went about building their new dwelling the old-fashioned way. They worked cooperatively, used natural materials, and employed only muscle-power for their excavating work. When their new home was complete, they immediately started a family. Of course, as yellow-bellied sapsuckers, their space requirements are considerably more modest than those of a human family. Their nest is a small cavity about 20 feet up an aspen tree in the woods behind our house. At this writing, the chicks have hatched and the male and female sapsuckers are diligently feeding the hungry nestlings, which soon will fledge. (This may be the same pair of woodpeckers who successfully raised chicks last summer in another aspen a few yards nearer our spring, where tadpoles are now busy growing legs.)

Watching these two families—human and avian—commence home-building operations has me thinking about the trendy phrase "smart growth," which has always struck me as an oxymoron. As Dave Foreman notes in his Campfire this issue, even a modest rate of growth is impossible to sustain forever on a finite planet, despite the wishful thinking of cornucopians.

The insight that, over time, incremental gains in production or efficient use of resources

yellow-bellied sapsucker by Tim Yearington cannot keep pace with an exponentially expanding population is hardly new. That point was well made by the Reverend Thomas Malthus in "An Essay on the Principle of Population" written in 1798, and a veritable mountain of population-related literature has risen from this idea. Nonetheless, the orthodoxy that undergirds our economic and political decision-making assumes perpetual economic expansion and discounts the grave problems posed by human overpopulation. It ignores biological and physical reality, as well as the profound social disruptions resulting from the drive for endless growth.

Substantive discussion of human population growth's negative effects on natural and human communities is rare in the mainstream media. Little of the extensive coverage given to sprawl and urban growth issues highlights the causative factor of rapidly expanding numbers of Americans that must be fed, educated, and entertained, and whose wastes must be managed and disposed. How many of the stories on California's current energy "crisis" have focused on that state's population explosion, which is driven in large part by legal and illegal immigration?[1] Have you seen a single news story on the president's proposed national energy policy that made the logical link to the need for a national *population* policy? Probably not—for the dominant view, echoed by the current administration, says that the solution to more people using more electricity is simple: bring a new power plant on line this week and next week and so on for ten or twenty years. That's supply-side energy policy, and the trickle-down effects will be severe for wildlife, air and water quality, and public lands.

Just how many Americans *should* there be? What kinds of reasonable, humane social policies can move us toward that number? It is simply nonsensical to hope that we might adequately plan for future energy, transportation, housing, and other infrastructure needs without an informed discussion on how many people this continent can support—at a decent standard of living—while leaving plenty of room for woodpeckers and wolves. By any measure that leaves space enough for wild Nature to flourish, we have already greatly surpassed the land's carrying capacity, and thus truly smart growth would be *negative* growth.

Yet the demographic steamroller is gaining steam: When my father was born in 1935, the US population was 127 million. Today, it's nearly 285 million. Roughly 80 million Americans have been added since the first Earth Day in 1970, and in my daughter's lifetime,[2] the US population is projected to reach *half a billion*. These numbers are abstractions, but the consequences of tripling the domestic population in my immediate family's lifetimes are very real and wholly negative—for people and sapsuckers.

This journal is something of an anomaly because it regularly covers the links between overpopulation and biodiversity loss. In recent decades there has been a growing balkanization between activists who address population and consumption issues, and those who work for land conservation. Isn't that odd? If the statistics are so grim and the prospects for functioning wild ecosystems so dire, why has the environmental movement abandoned US population stabilization (let alone reduction) as a primary goal? In this issue of *Wild Earth*, Roy Beck and Leon Kolankiewicz consider this irony in a condensed version of their superb article "The Environmental Movement's Retreat from Advocating U.S. Population Stabilization (1970–1998)," which appeared in the *Journal of Policy History* last year.[3]

Wildlands advocates should read the authors' astute analysis of this recent history and consider how these divisions might be overcome and an inclusive, effective campaign for reversing overpopulation (and "overimmigration," to borrow the late David Brower's term) be initiated. Moreover, every conservationist working for expanded wilderness or endangered species protection, and every environmentalist fighting toxic pollution and corporate welfare, should periodically remind themselves that all our efforts to create a political and social landscape that accommodates home sites for every family—human and wild—may be washed away by the rising river of human population and consumption. That old slogan, "whatever your cause, it will be a lost cause without population control," may be out of fashion—even among conservationists—but it has never been more relevant.

—TOM BUTLER

P.S. In the five minutes it took to read this essay, the global population increased by 900 people.

NOTES

1. Legal immigration now adds about a million new people to the US population every year, a rate roughly four times higher than the historic average. Immigration—and the higher fertility rate of foreign-born Americans—is the primary factor driving US population growth. But even among progressive conservationists who recognize the ecological toll of overpopulation and overconsumption, who value cultural diversity, and who acknowledge some US culpability in the problems of the developing world, very few are willing to endorse immigration reform for fear of being branded racist or xenophobic.
2. The US Census Bureau prepares low, middle, and high series projections for future population growth. If the mid-range projections are accurate, and my one-year-old daughter Grace lives to an age typical for females in our family, she'll see the US population surpass 500 million as a vital octogenarian. If the high projections are correct, she will be 45 years old when domestic population surges past half a billion in the year 2044.
3. Roy Beck and Leon Kolankiewicz, "The Environmental Movement's Retreat from Advocating U.S. Population Stabilization (1970–1998)," 2000, *Journal of Policy History* 12(1):123–156.

Speaking with One Voice

BY DAVID M. OLSON

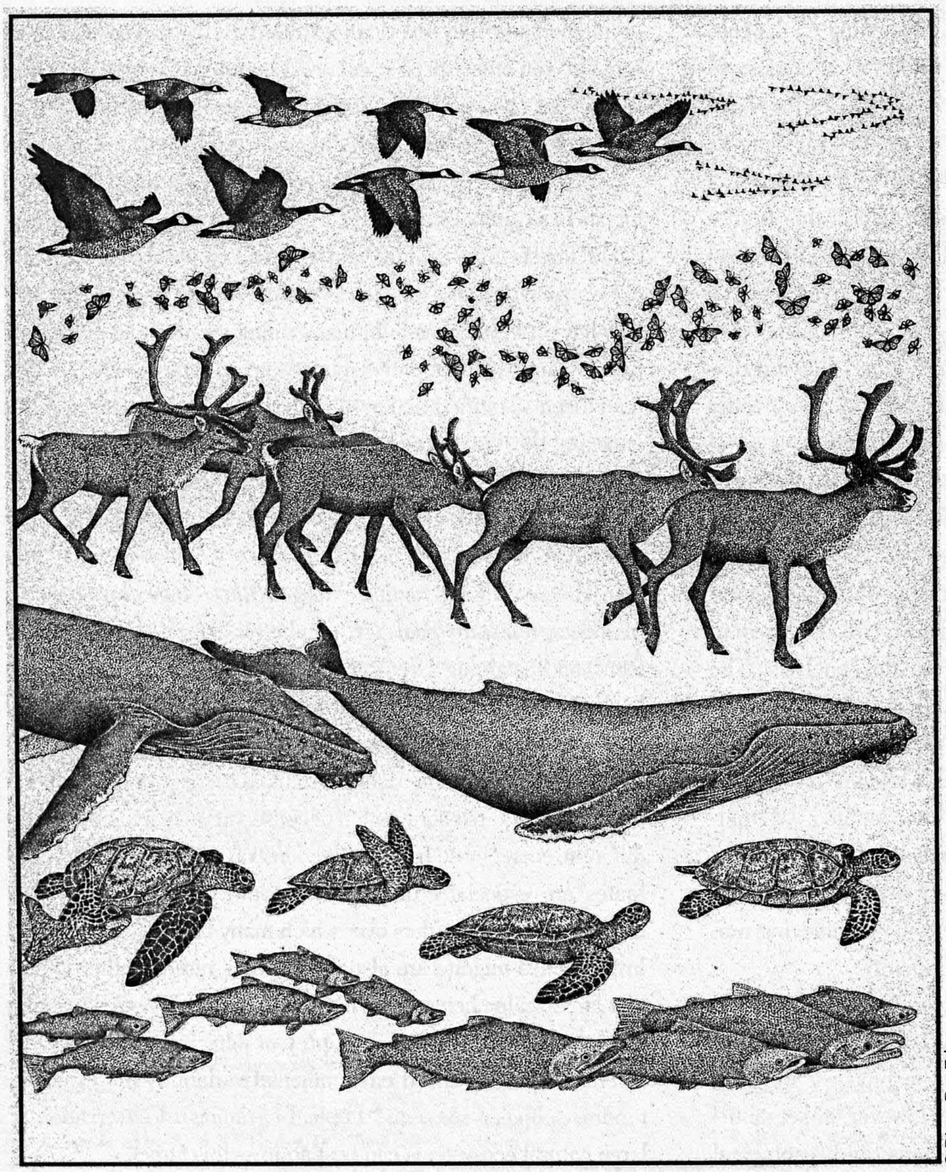
A chief executive of one of the world's largest logging corporations recently asked a group of conservationists assembled at the World Bank, "Do you all agree on conservation priorities?" Glances around the room were followed by a murmured "yes." We all, thankfully, recognized that solidarity at that moment was more important than advancing the party line of one's organization. However, the variety of conservation priority schemes—from Endemic Bird Areas[1] and Frontier Forests[2] to Hotspots[3] and the Global 200[4]—can be confusing to anyone not trained in conservation biology. Even worse, multiple priorities, some seemingly in conflict, can create an appearance of uncertainty, discord, and impotence among conservation groups in the minds of industry, governments, and conservation donors.

Organizations do differ on the issues they choose to emphasize and in their views of how best to achieve conservation, but they all share the overarching goal of conserving the Earth's biological diversity. Collaboration and coordination are important,[5] but so is having a common message of conservation goals and targets. While we may differ on the details, agreement on the broad goals of biodiversity conservation will greatly enhance not only the credibility of the conservation community but, more importantly, its effectiveness.

Everyone involved in biodiversity protection should take a moment to consider the full range of conservation goals and targets, and place their personal or institutional endeavors within this broader context. One should mentally prepare a persuasive response to the inevitable questions of donors and representatives of industry, the government, and the public, namely, "Why are the priority areas different in different analyses?" and "Why should we believe any of these priority schemes if they are all saying different things?" Savvy advocates will understand the bigger picture and know when and how to succinctly place their specific issues within a broader context to strengthen or defend their argument. Here I present one possible response to such questions about global-scale priorities for protecting the diversity of life. These concepts are equally relevant for regional, ecoregional, and site-scale strategies.

GOALS

Four goals of biodiversity conservation can be applied globally to all manner of ecosystems and scales.[6] First, we should represent all distinct natural communities within conservation landscapes or aquascapes (i.e., representation). Second, we aim to maintain viable populations of all native species. Third, we must conserve the ecological and evolutionary processes that sustain populations



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While we may differ on the details, agreement on the broad goals of biodiversity conservation will greatly enhance not only the credibility of the conservation community but, more importantly, its effectiveness.

and create biodiversity. Fourth, we must protect areas of natural habitat that are sufficiently large to confer resiliency and resistance to large-scale disturbances and short- and long-term changes. These goals have become widely adopted as the foundation of the science of conservation biology and they help shape the overarching vision for conservation strategies.

TARGETS

The concept of biodiversity covers the full expression of life on the planet, not only species, but also genes, ecological interactions and phenomena, and even whole ecosystems. The four goals cast a wide net and effectively capture this spectrum of biodiversity features. However, we have found that elaborating more specific kinds of biodiversity targets (hereafter, targets), each of which can be linked to one or more of the four fundamental goals, can be useful for establishing priorities and implementing conservation strategies. In many situations, specific targets are more easily defined and measured by conservation planners, and may be better understood by policy-makers. Both the goals and targets discussed here address biological phenomena and biodiversity above the level of species, features that reflect important advances in conservation thinking.

Biodiversity is important to conserve everywhere. However, biodiversity is not distributed evenly around the world. Some areas harbor biodiversity that is far more distinctive or threatened than that of others. Setting priorities for conservation is necessary to ensure that we do not lose irreplaceable elements and to enhance the efficacy of conservation investments given limited

migrating species by D.D. Tyler

resources and growing threats. Some priority-setting efforts concentrate on one of the following targets, while others emphasize multiple targets. For example, conservation strategies for whole ecoregions should consider the full set of targets to some degree.[7]

Six kinds of targets are described below with examples of how existing priority-setting approaches fit within this framework. This particular set of targets has been selected because they collectively address a broad range of biodiversity features and can be identified, mapped, and measured with relative ease.

Target 1. *Representation of distinct units of biodiversity (representation goal).* Distinct units of biodiversity are broadly defined, ranging from genes, species, and higher taxa to seral stages, communities, and types of ecosystems. Several global analyses strive to "save all the pieces."[8] For example, the Global 200 initiative emphasizes conserving representative ecoregions for each biome in each biogeographic realm where it occurs.[9] Different kinds of ecosystems and distinct assemblages of species and higher taxa are promoted in this analysis. The Hotspots analysis identifies larger regions that harbor exceptional concentrations of distinct (endemic) and threatened species.[10] The Endemic Bird Areas approach maps regions around the world where locally endemic birds are concentrated.[11] Equal-area grid analyses, complementarity analyses, irreplaceability analyses, distinctiveness measures, gap analyses, and special element approaches are all generally focused on achieving representation of species, higher taxa, or communities.

Target 2. *Conservation of large expanses of intact habitats (populations, processes, resiliency goals).* Large areas of intact natural habitat are best for conserving the broadest range of species, habitats, and natural processes. However, intact natural ecosystems where species populations and ecological processes still fluctuate within their natural range of variation are increasingly rare around the world. Even rarer than intact habitats are intact biotas, where original assemblages of larger vertebrates still persist in natural abundances. Top predators and other area-sensitive species are disappearing rapidly in most ecoregions, as human activities convert and fragment natural habitats and exterminate populations of vulnerable species. Several priority-setting approaches that emphasize intact habitats and, indirectly, intact biotas include Frontier Forests, Major Tropical Wilderness Areas, Wildlands landscape strategies (which emphasize both intact landscapes and biotas), and roadless area analyses.[12] Because of the vanishing phenomenon of intact biotas, this is a target that deserves much greater recognition and attention.

Target 3. *Conservation of keystone ecosystems, habitats, species, or phenomena (processes goal).* Certain habitats, species, or phenomena may exert an extraordinarily strong ecological influence on other species and ecosystems considering their limited extent or abundance. For example, mangroves have strong ecological linkages to surrounding terrestrial, marine, and freshwater communities. Other keystone habitats include gallery forests in savannas, coral reefs, freshwater springs in deserts, and cloud forests that capture and regulate water for downstream ecosystems. Phenomena such as natural fires or flood events may also have a keystone role in maintaining species and communities. Jaguars, fig trees, and elephants are examples of species that have been identified as keystone because of their strong influence on the structure and integrity of natural communities. Programs specifically aimed at conserving wetlands, mangroves, coral reefs, elephants, and cloud forests are examples of those that target, in part, keystone features.

Target 4. *Conservation of large-scale ecological phenomena (processes, resiliency goals).* A number of conservation programs focus on sustaining large-scale migrations of animals such as birds, turtles, butterflies, cetaceans, caribou, and wildebeests; such programs include Wings Over the Americas, Ramsar, and Wetlands International. Many migrations occur over hemispheric scales and require coordination of conservation activities in many different ecoregions. Intact migrations of large terrestrial vertebrates are especially threatened worldwide. Intact lowland to montane habitat corridors over which many birds, mammals, and invertebrates migrate are also increasingly rare. Another important large-scale phenomenon is the movement of species tracking patchy resources such as forage, prey, or water in ecoregions characterized by pronounced environmental variability (for example, tundra, subpolar seas, and tropical savannas). Conservation of large natural ecosystems can best address this target.

Target 5. *Protection of species of special concern (representation, populations goals).* Some species require a concerted conservation effort because they are particularly sensitive to hunting or other human activities, and habitat conservation programs alone may be insufficient for their survival. Focused actions for conserving tigers, mountain gorillas, rhinoceroses, pandas, parrots, whales, and cacti are examples. Conservation efforts such as TRAFFIC (the wildlife trade monitoring program of the World Wildlife Fund and the World Conservation Union), CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), and the World Conservation Union's Red Data Lists generally fall under this target. Species of special concern are often addressed under special element, focal species, and other species targets of ecoregion strategies.[13]

Target 6. *Maintaining native assemblages of species (populations, processes, resiliency goals).* We should strive to protect natural communities that are relatively free of impacts of alien species on the structure and function of native communities or the survival of native species. This is a particularly prominent target for freshwater and island ecosystems that are highly sensitive to the intrusion of exotic species.

TAKEN TOGETHER, THIS SET OF TARGETS HAS WIDE application because it encompasses biodiversity features that exist over a broad range of scales and that occur in all ecosystems and biogeographic regions. This simple framework of goals and targets can be used to structure any conservation priority-setting effort, implementation strategy, or monitoring program. Conservation priorities can be identified by evaluating these biodiversity features with other important priority-setting discriminators, such as the degree of threat, opportunity, and cost-effectiveness. Biodiversity targets can easily be integrated with utility goals such as maintaining ecosystem services, genetic resources, and sustainable natural resources[14] for justifying conservation efforts and garnering support. The targets can also help assess the impact of global threats to biodiversity, such as climate change or commercial logging. Combined with climate change and pollution issues, these targets can be used to form the foundation of a global biodiversity conservation strategy aimed at achieving the four goals.

FINDING OUR VOICE

Mapping major global priority-setting schemes together on a single map can produce a confusing picture of what the conservation community wants to achieve, with the exception of some tropical regions where a high degree of overlap occurs. However, interpreting this overlay map within the context of the proposed biological targets can 1) help emphasize the complementarity of the different approaches, and 2) clarify their particular contribution to a comprehensive global strategy.

Certainly, one can find many ways to communicate what conservationists value and are trying to save. And diversity in ideas and approach can be a great ally in our conservation struggle. The challenge is to quickly balance our diverse agendas with the imperative to present a single—and very loud—voice for protecting the Earth's extraordinary natural diversity. Becoming well versed and well armed with a broad perspective on conservation goals and targets helps good conservationists be great advocates. ☾

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Bat

Gently the water is kissed.
By moonlight,
the courting
of saguaro blossoms.

Nanakmel

Ṣu:dagĭ 'am si al cendad.
Ge cuhug eḍa 'am ha-nanmek
g ha:ṣañ hiosig.

Murcielago

Gentilmente
bajo la luna
un beso breve—
cortejo de cacto en flor.

by Carlos Martínez del Rio

poems by Ofelia Zepeda, O'odham poet and linguist / Spanish translations by Gary Nabhan, Carlos Martínez del Rio, and Axhel Muñoz / illustrations of migrant pollinators (bat, dove, butterfly, hummingbird) by Kay Sather

Long-Nosed Bats & White-Winged Doves

Travels and Tribulations of Two Migrant Pollinators

I grew up in a place where wintering warblers fed on flowers and very rarely sang. Yellow-rumped and orange-crowned warblers sipped nectar among the red flowers of coral-bean trees. The warblers' heads were covered with pollen—so much pollen that they were often hard to identify. They defended territories with furious energy and loud chips and they flitted from flower to flower, behaving a lot like hummingbirds. Later in life, during my first visit to the forests of Maine, I discovered with astonishment that in the summer my old cantankerous friends fed on insects. Perhaps more surprisingly, I also found that instead of chipping, they sang. I had a Mesoamerican perspective of warblers, but they had dual citizenship!

Because, like them, I traveled north, I now realize that the birds with which I grew up play different ecological roles in summer and winter. In the summer they are typical insectivorous warblers, whereas in the winter they are frequently nectarivorous. Moreover, they are often the main pollinators of many plants. Recently I have encountered another migratory species that—like many warblers—changes its behavior in its breeding and wintering grounds. White-winged doves are pollinators while breeding in the Sonoran Desert and become typical grain-eating doves in the winter in western Mexico.

Billions of migratory pollinators, representing hundreds of species, fly across the Earth to populate regions that are habitable only seasonally. In the spring, they travel to take advantage of the long days and biological productivity of high latitudes. In the fall, they move to lower latitudes to avoid the cold and less-productive winter. One critical, albeit relatively neglected, consequence of migration is that many migrant animals keep distant areas ecologically connected by acting as pollinators. Events that affect the populations of migrant birds and bats in one place can have biological consequences for the plants that they pollinate thousands of kilometers away. Migratory pollinators are the glue that binds distant wild lands.

I choose to write about lesser long-nosed bats (*Leptonycteris curasoae*) and white-winged doves (*Zenaida asiatica*) not necessarily because they are the most important or best-known migrant pollinators, but because they are animals that have shaped my life. In my feral youth I hunted white-winged doves wintering in western Mexico. They fed on the fruit of guava trees gone wild. I chased them with a slingshot and later with an ancient .410 single-shot shotgun. They were delicious grilled in a stick fire, spiced with ashes and accompanied by hard green guavas and cold water. Later, as a budding naturalist, I spent hours sitting on the branches of a calabash tree (*Crescentia alata*), studying its pollination—watching stingless bees steal pollen from the huge fleshy flowers and counting the soft hovering visits of bats. One evening a jaguar wandered under my tree. It stopped to watch me before ambling into the forest, its curiosity satisfied. I was paralyzed with joy and fear until the velvet wings of a bat brushed my face. A shiver brought me back to my task. I kept measuring and counting, but at dawn I ran to the field station singing, stinking like a calabash blossom, blessed by bats and the sacred cat.

Dove

She is the first one.
She is the first one.
The one who tastes the beautiful fruit.
See here, see here, she breathes clouds of wetness.

'Okokoi

Ḍ 'o si we:pegkam.
Ḍ 'o si we:pegkam.
Hegai mo an je:k g s-ke:g bahidag.
Ñia'a, ñia'a, s-wa'usim cewagĭ 'o i:bhe.

Paloma Pitayera

Ella es la primera,
ella es la primera,
paloma pitayera
quién está colorada
con el fruto primero
del gran saguaro.
Mira, mira, ella respira
nubes de humedad.

NECTAR-FEEDING BATS AND THEIR NECTAR CORRIDORS

Long distance migration is common among birds but is much less common among bats. Almost half of all North American north-temperate songbirds migrate to the tropics. In contrast, most species of north-temperate bats migrate only short distances; they evade the harsh winter by hibernating. In North America only three bat species are documented to migrate long distances. Two species, hoary bats (*Lasiurus cinereus*) and Mexican free-tailed bats (*Tadarida brasiliensis*), feed on insects. The third species, lesser long-nosed bats (*Leptonycteris curasoae*) feeds on nectar, pollen, and fruit.* Lesser long-nosed bats form maternity roosts in the Sonoran Desert and spend the fall and winter in south-central Mexico. Their morphology and physiology reflect their specialized diet of pollen, nectar, and fruit. Nectar-feeding bats have long snouts, a long brush-tipped

* Two other species of nectar-feeding bats—Mexican long-nosed bats (*L. nivalis*) and Mexican long-tongued bats (*Choeronycteris mexicana*)—may migrate long distances, but data on their seasonal movements is scanty.

tongue well suited to sop up nectar, and very few tiny teeth. They seem to rely more on vision than echolocation to find flowers, and therefore have relatively large eyes.

Bats get thoroughly dusted with pollen while feeding on flowers. As they move from flower to flower, they fertilize them. In the spring and early summer, migratory lesser long-nosed bats feed on the flowers of desert columnar cacti such as cardon (*Pachycereus pringlei*), saguaro (*Carnegeia gigantea*), and organ pipe (*Stenocereus thurberi*). In the early to late summer they literally feed on the fruit of their labor. They eat the nutritious juicy fruit of the same columnar cacti whose flowers they pollinated. Bats have gentle guts. After assimilating the fruit pulp, they defecate the cactus seeds intact. Migratory bats are not only important pollinators, they are also significant seed dispersers. Seasonally, when the abundance of cactus flowers and fruit declines in the Sonoran Desert, the bats move south, feeding on the nectar and pollen of several species of paniculate century plants (*Agave* spp.). These plants appear to bloom in a southward progression in the foothills and western flank of the Sierra Madre Occidental. Biologist Ted Fleming has speculated that lesser long-nosed bats fuel their spring migration with columnar cacti that bloom in a northward progression. In the fall they fuel their migration with agave nectar and pollen. Migrant nectar-feeding bats seem to follow broad paths of blooming plants. Fleming has called these paths nectar corridors. In the absence of migrant bats, it is likely that many plants along these corridors would suffer from reduced reproduction.

Although lesser long-nosed bats are listed as endangered in the United States, they maintain fairly large populations on both sides of the border. As a species they are probably relatively secure. However, their migration from south-central Mexico to the Sonoran Desert may be a phenomenon at risk, for it hinges on the existence of safe roosts and habitats with sufficient densities of food plants along the migratory route. Both roosts and plants are far from secure. Lesser long-nosed bats are very picky about roost sites. They prefer large, hot (warmer than roughly 30°C), and humid caves that are safe from predators and human disturbances. Such caves are rare. A few key roosting sites in Mexico and the United States are protected. However, we know little about the location and vulnerability of the roosts used by bats along their migratory route. In Mexico, bat roosts are often at risk because of misguided vampire bat eradication programs. Ranchers sometimes use fire, and even dynamite, to drive bats away from roosting caves. Bat Conservation International and a Mexican partner (PCMM, Programa Para la Conservación de Murcielagos Migratorios) are now conducting a massive—and very effective—educational program that stresses the beneficial aspects of most bats.

Safe roost sites are essential to conserve migratory bats, but they are not sufficient. Migratory bats must find adequate density of food plants during their journey. Threats to columnar cacti and paniculate agaves include the familiar catalogue of agents that fragment and destroy wildlands: agriculture, intensive recreation, and urban development—all of which are in full swing in western Mexico. The importance of large areas containing food plants is illustrated by Ted Fleming's study of a smallish transient roost (7,000 individuals) on the coast of Sonora, where bats spend three to four weeks before moving north. At this site the radius of the foraging area used by the bats is probably larger than 30 kilometers. Because lesser long-nosed bats take their time to get from winter to summer roosts, finding and protecting their transient roosts and safeguarding the plants around them is critical for their conservation.

WHITE-WINGED DOVES, SAGUAROS, AND PEOPLE: AN UNEASY PARTNERSHIP

The song of white-winged doves is the lusty sound of summer in the Sonoran Desert. With Egyptian blue eyeliner and iridescent breast feathers, males belt their sonorous "who-cooks-for-you!" from the top of saguaros all through the season. Images of doves plunging their heads into saguaro flowers and messily eating the bright red pulp of saguaro fruit adorn postcards, magazine covers, and even children's books. Their natural history is full of quirks and contradictions. Although doves are dearly loved, hordes of hunters kill them by the thousands. The species' relationship with the mighty saguaro is very tight, but also ambiguous. The doves are saguaro mutualistic pollinators, but also parasitic seed predators.

There is little doubt that white-winged doves were the primary pollinators of saguaros in the past. Now they share the pollination of saguaro flowers with introduced feral honeybees and to a lesser extent with long-nosed and long-tongued bats. Their importance as saguaro pollinators may increase in the future if, as predicted, the population of feral honeybees decreases in the desert as a result of mite infections. Although saguaros receive significant pollination services from doves, the birds feed on saguaro fruit and destroy an enormous number of saguaro seeds. Unlike nectar-feeding bats, doves have powerful guts—no saguaro seeds survive the passage through their gizzard. The dual nature of doves as saguaro mutualistic partners and seed parasites highlights an ecological lesson: The canvas of biological interactions is not painted in black and white. Although the balance sheet of the saguaro-dove interaction is mixed for saguaros, desert doves are crucially dependent on the mighty cactus. Doves arrive in Arizona in early to mid-April and they start to breed by early May when the desert is getting really hot and when water is the most scarce. Why do white-winged doves migrate into a sweltering subtropical desert to breed at the hottest and most stressful time of the year? The answer seems to be that the dove's breeding cycle is synchronized with the reproductive cycle of the saguaro. Doves appear in the desert as the saguaros start blooming. They feed extensively at their flowers and when saguaro fruit is available they eat it almost exclusively. Doves can breed in the desert because saguaros provide them with nectar and fruit pulp, which are both watery and nutritious.

This century, white-winged dove populations in Arizona have experienced dramatic fluctuations. Before 1940, they were managed as pests. Squabs were plucked from nests and adults were hunted in a long and loosely enforced season. Overhunting and destruction of nesting habitat led to a dramatic population collapse before World War II. Wildlife biologists feared that white-wings were at the brink of extinction and tightened hunting regulations. Those regulations and the development of citrus groves that provided nesting sites allowed doves to increase again. Jack O'Connor, an old-time desert hunter, described the morning feeding flights of white-winged doves as one of the great natural wonders of Arizona. These flights are now gone. By 1968, the population began a slide that still continues. Apparently as a result of nesting habitat loss and a reduction in cereal production, the population has declined exponentially over the last 30 years. The number of birds killed by hunters has dropped precipitously from 700,000 in 1968 to less than 100,000 in 1980. Recent population data on white-winged doves are unavailable, but the numbers of birds killed by hunters in Arizona remain low.

When I began to study the interaction between saguaros and doves, I was convinced that desert doves were gravely imperiled. The observations of Russ Haughey, an astute desert wildlife biologist, have eased my mind. Arizona white-winged doves are peculiar in that two demographic and behavioral forms seem to have coexisted throughout this century. One strategy can be called "agricultural" and the other "desert nesting." I do not mean to suggest that these two forms are genetically distinct and non-interacting. I simply mean that the species has enough behavioral plasticity to adopt two strategies. Agricultural birds live in close association with cereal fields and riparian thickets. They feed gregariously and form raucous and very productive colonies in which each pair can fledge two egg clutches. In Arizona, agricultural white-winged doves are definitely in trouble. Cereal production is almost defunct and the mesquite bosques and citrus plantations that sustained their colonies are all but gone. So are the magnificent, albeit human-induced, dove flights that filled the desert sky with birds—and the hotels of Gila Bend and Tucson with hunters. A few small dove colonies still hang on precariously in salt cedar thickets along the Gila River, subsidized by agricultural fields planted by the state game and fish department.

The large population fluctuations exhibited by white-winged doves can only be explained by a very productive population that depended strongly on clumped abundant resources and that had large tracts of dense nesting habitat. As noted by Russ Haughey, these are not the characteristics of desert-nesting doves. During the breeding season, most of the diet of the desert-dwelling birds is saguaro fruit, not cereals. Although saguaro groves can produce a lot of fruit, the productivity of saguaro is slight compared with irrigated cereal fields. Desert doves feed singly or in pairs on dispersed saguaro fruit clumps. Desert dove nests are scattered rather than clumped in colonies, and desert-nesting doves produce only one clutch per season. White-winged doves in Arizona may be unique in that, at least during this century, a colonially nesting population that fed on cultivated grain coexisted with a solitary nesting population that fed primarily on the fruit and nectar of a single plant species.

It is highly likely that desert-dwelling white-winged doves were spared the demographic turmoil that their agricultural relatives experienced—but this does not mean that all is fine with them. Because they are scattered and much harder to hunt, wildlife biologists have paid less attention to their long-term population trends. We have just begun to understand their complex interaction with saguaros, and hence with the varied coterie of insects, birds, and mammals that rely on these keystone giants for food, water, and shelter. Hunting in the United States probably has a minimal effect on their populations. Not only are they hard to shoot, but by the time the early dove-hunting season starts on September 1, the majority of doves have left for Mexico. Most of the birds banded in Arizona spend the winter in the Pacific coastal plains and foothills from southern Sinaloa to Guerrero and Oaxaca. They appear to winter in deciduous and subdeciduous tropical woodland and thorn scrub, although they also probably use expanding pockets of agriculture and secondary vegetation. Native forests in western Mexico are being rapidly cleared into agricultural fields and pasturelands and white-winged doves are hunted there by both subsistence and sport hunters. Is habitat destruction and hunting in Mexico having a negative effect on saguaro doves? No one knows.

One of the lessons that migratory nectar-feeding bats and doves offer to conservationists is that effective conservation requires scientific research and international cooperation. It is clear that we will not be able to fully protect the migration of nectar-feeding bats along the Sierra Madre Occidental until we understand it much better. The migration of lesser long-nosed bats illustrates the need for detailed knowledge of the natural history of an organism—and indeed, of a natural phenomenon—to inform conservation strategies. It will be necessary to identify the transient roosts used by nectar-feeding bats on their spring and fall migration, and then to garner the political will to protect extensive areas around these roosts.

Our knowledge of white-winged doves is even more rudimentary. Given the game status of the species and its importance in saguaro pollination, a program of population monitoring in Arizona is needed. Interpreting the population trends in Arizona will depend on gathering information also in Mexico; we need data on the habitats and resources that the doves use in the winter, as well as details on the numbers of birds killed by Mexican hunters. The populations of migratory animals, like white-winged doves and long-nosed bats, depend on conditions at both the breeding and wintering areas. Like other migratory animals, pollinators remind us of the biological wholeness of this continent. Their conservation and management demand that we abandon isolationist delusions and embrace international cooperation.

On conservation issues, I tend to be a purist. I believe in conserving as much wilderness as possible. Using the words "wilderness" and "management" in the same sentence makes me uneasy. But thinking about migratory nectar-feeding doves and bats has tempered my views. In their yearly travels, doves and bats use a huge area that is a complex tapestry of wild, semi-wild, and domesticated lands. The populations of both species can be injured by human activities, yet both bats and doves can take advantage of human-produced resources when

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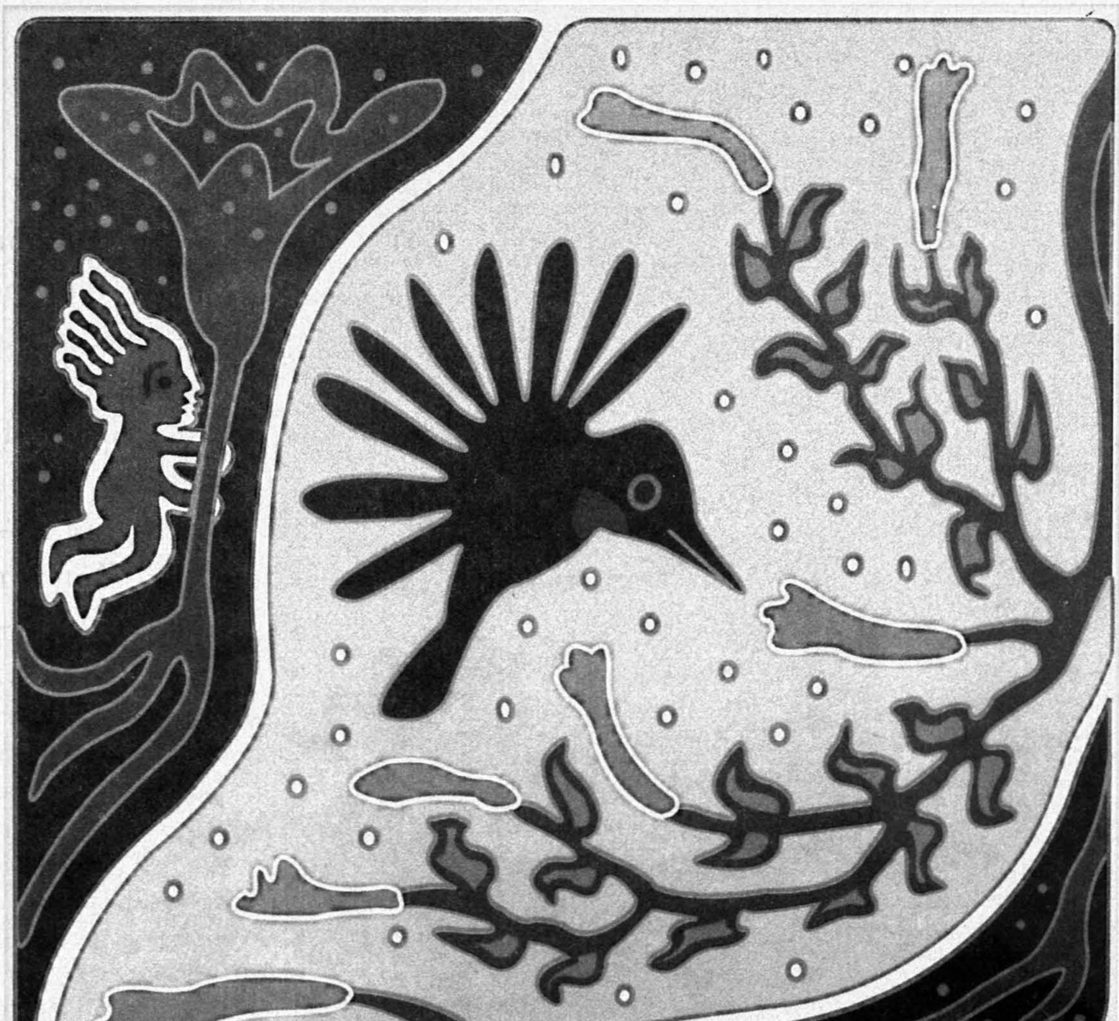
these are available. Doves are capable of adjusting their feeding and reproductive behavior in response to human land uses. Given the level of land destruction in western Mexico, I would be very surprised if wintering desert white-wings rely solely on pristine forests.

Similarly, long-nosed bats often use abandoned mine shafts to roost and to reproduce. I suspect that banana monocultures are objectionable to most conservationists. In western Mexico, however, they can be great places to catch lesser long-nosed bats. Banana plants produce huge amounts of nectar, pollen, and fruit—and bats feed on them. When I have suggested to conservation audiences the possibility that banana plantations in western Mexico might play a positive role for nectar-feeding bats, I have always felt a ripple of distaste. Of course I do not advocate bulldozing forests to plant bananas, but it is likely that some long-nosed bat roosts rely on banana plantations. Under some conditions, maintaining a viable roost in a heavily agricultural area might require subsidizing it by favoring banana plantations over other land uses. Conserving migratory pollinators demands pragmatism and letting the organisms show us what their needs are in the sometimes degraded environment in which they live and travel. We must face the ironic possibility that the bats and doves that are central to the ecological integrity of the most pristine and isolated corners of the Sonoran Desert may rely on semi-wild or even agricultural habitats in the winter.

Bats and white-winged doves and offer another supremely important lesson: Our best-protected areas are not isolated from external influences. The populations of some key species inhabiting protected areas (such as saguaros) are intertwined with the populations of other species whose fates depend on land management and conservation outside of parks and



reserves (such as doves and bats). The doves that pollinate the flowers and crush the seeds of saguaros in Organ Pipe National Monument and Cabeza Prieta National Wildlife Refuge are hunted as soon as they leave the monument or refuge boundaries. And they all do—every year on their way south. Parks are not self-sufficient biological islands. The dual status of white-winged doves—as game and ecologically vital members of desert communities—poses some difficult questions. White-wings will be hunted on both sides of the border whether we wish it or not. The challenge for conservation biologists and wildlife managers is to define levels of hunting in Mexico and Arizona that are compatible with a population of doves that can fulfill its ecosystem role.

This is not a trivial problem. It is one that accents our profound ignorance. For too long we have adopted a curious dichotomy: For species that are rare and endangered, management plans attempt to maintain populations at the *minimal* level that allows persistence. For game species, management plans attempt to sustain population levels that *maximize* hunter harvest. Both these strategies are clearly inappropriate for animals that play important roles in biological communities. For these species, the goal of conservation-minded managers should be to ensure the existence of populations that are large enough to fulfill their ecological vocation in natural ecosystems.

Unlike some conservationists, I think that there is a role for management in conservation biology. The doves and the bats have convinced me of this. Every time I encounter an invasive exotic in a remote wilderness area, my conviction strengthens. However, because we know so little, developing a biocentric wildlife management discipline is not a simple enterprise. Perhaps the central difference in conservation (biocentric) management of wildlife and control (anthropocentric) management for recreation and profit is one of values. Biocentric wildlife managers will intervene only when absolutely necessary, and then they will do so with the scientific humbleness of adaptive management. Their goal will be to uphold the function of interacting populations in living landscapes.

Human activity is widespread and penetrating. No ecosystem is free from it. It makes intervention almost inevitable. The biocentric manager will intervene not for us only, but for the saguaros, the bats, and the doves. ☾

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RECOMMENDED READING AND SOURCES For readers interested in general introductions to migration I recommend two books: the volume edited by Ken Able (1999), and Peter Berthold's (1993) comprehensive survey. Every informed conservationist must read Steve Buchmann and Gary Nabhan's lovely book *The Forgotten Pollinators*. A technical review of the pollination crisis with a superb literature review was written by Kearns et al. (1998). The papers by Ted Fleming and his collaborators are probably the best available guides to the natural history of long-nosed bats (Fleming and Sosa 1994, Fleming et al. 1996, and Wilkinson and Fleming 1996). The interaction between white-winged doves and saguaros is described in Wolf and Martínez del Rio (2000) and Martínez del Rio et al. (in press). The rocky history of white-winged dove populations is chronicled by Brown (1989) and Alcock (1993).

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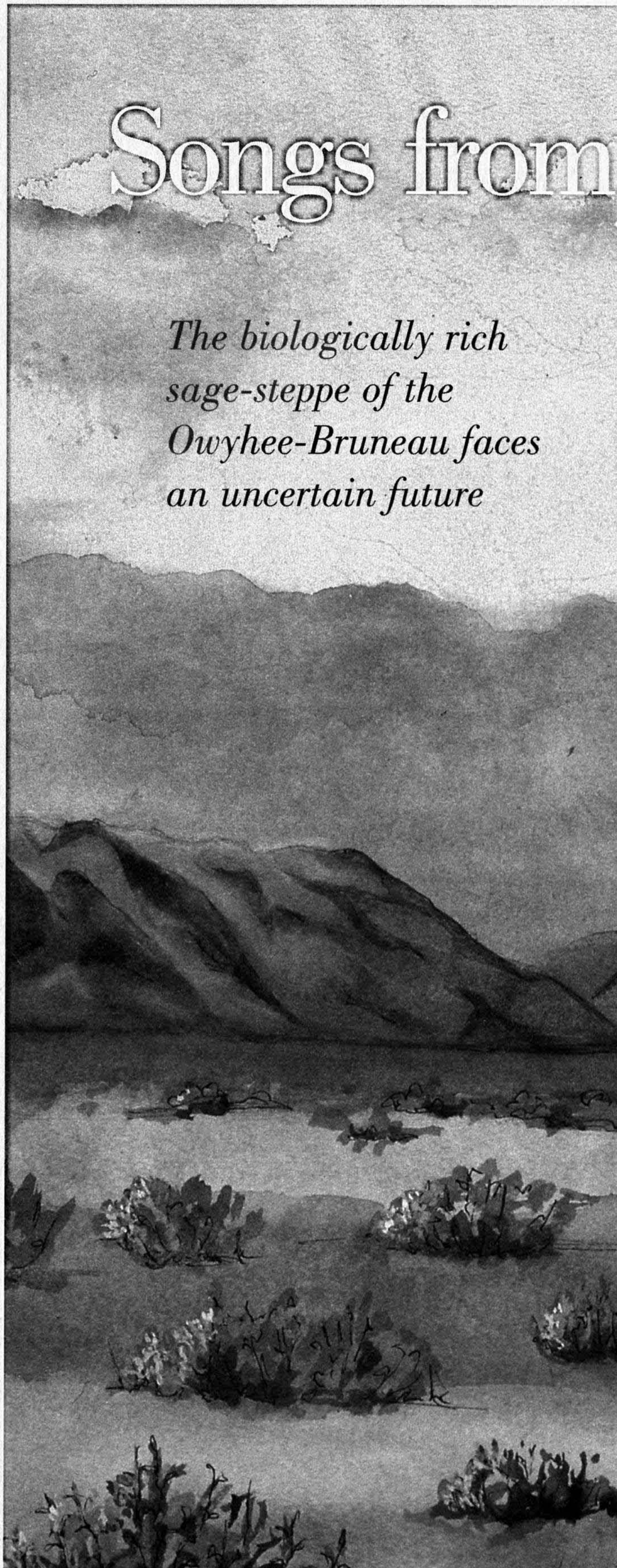
Songs from

The biologically rich sage-steppe of the Owyhee-Bruneau faces an uncertain future



—the wideness, the
foolish loving spaces

full of heart.

—GARY SNYDER
Mountains and Rivers Without End

If you drive south out of Boise—hurtling along the power strip of I-84, then cruising past the rows of car dealerships in Mountain Home—the noise of booming technology begins to fade as you roll down Idaho 51 and enter the bosom of the Owyhee and Bruneau Deserts. This landscape exerts a primeval, yet subtle, pull. Soon, even dirt roads dry up, and you walk into the midst of the largest sagebrush sea left on the continent, over nine million acres of sage-steppe and steep canyons. The horizon surrounds you and birdsong rings out through thickets of desert shrubs. Insurmountable distances seem to extend underfoot, then something takes on significance: a bitterroot in bloom, an ancient arrowhead, the sudden and gaping expanse of a canyon, the fluttering wings of a sage grouse. Seemingly endless space makes this place compelling, not just for solitude and discovery, but on a deeper level as our last great enclave of high desert biodiversity.

In 1936, when Bob Marshall inventoried the last remaining roadless areas in the United States, he identified the Owyhee-Bruneau Canyonlands as the nation's second largest wilderness desert—just behind the Colorado Plateau—with more than 4.6 million acres of uninterrupted roadless land. Today, this lonely corner where Idaho, Oregon, and Nevada meet is still the largest remaining unprotected wild landscape left in the Lower 48: a unique ecoregion of Great Basin habitats situated on a high desert plateau whose rivers flow into the Pacific. In *The Big Wild*, Dave Foreman and Howie Wolke (1989) recommended the creation of a wilderness park of eight to ten million acres in the

BY DOUGLAS SCHNITZSPAHN

the Heart of the Sagebrush Sea

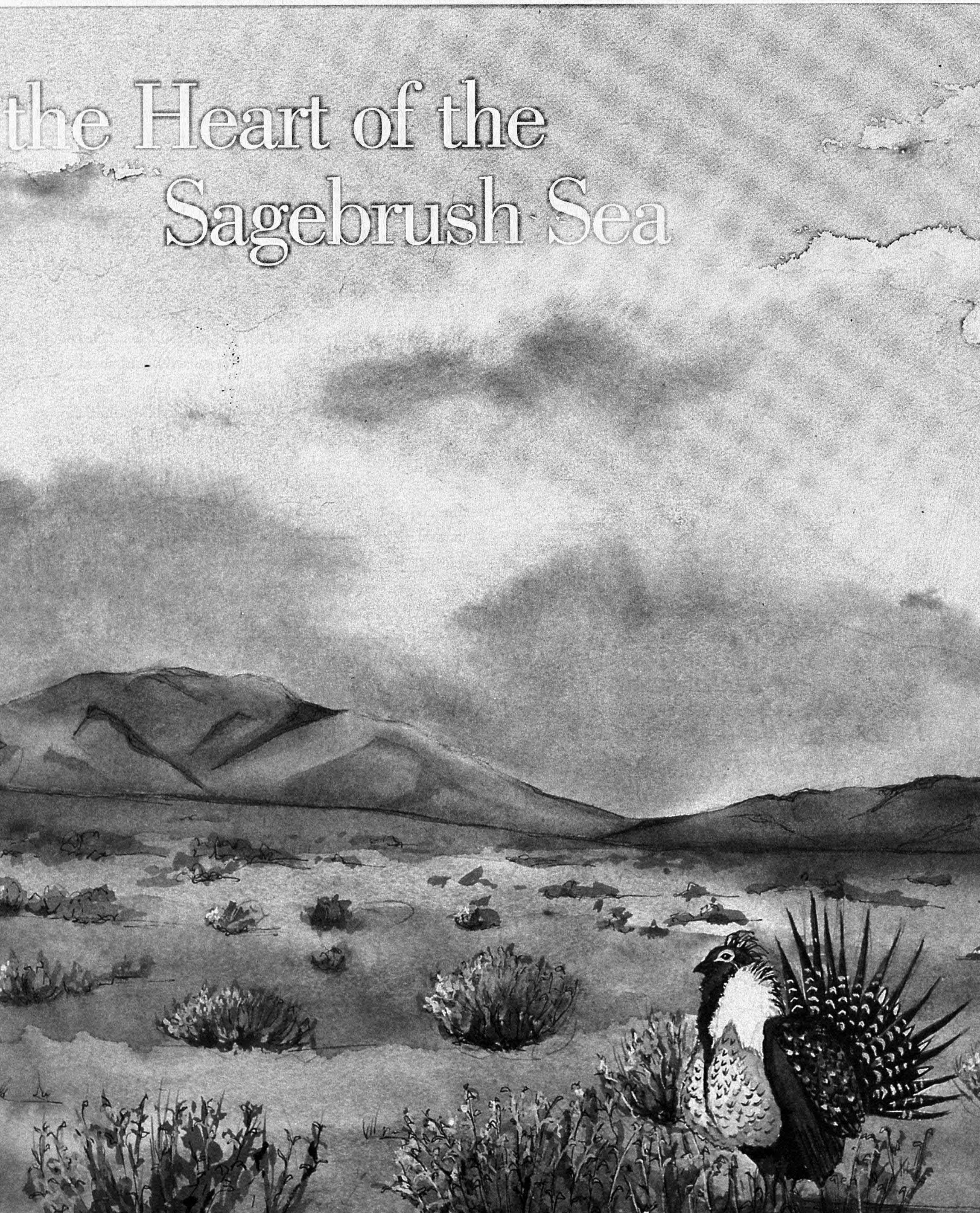
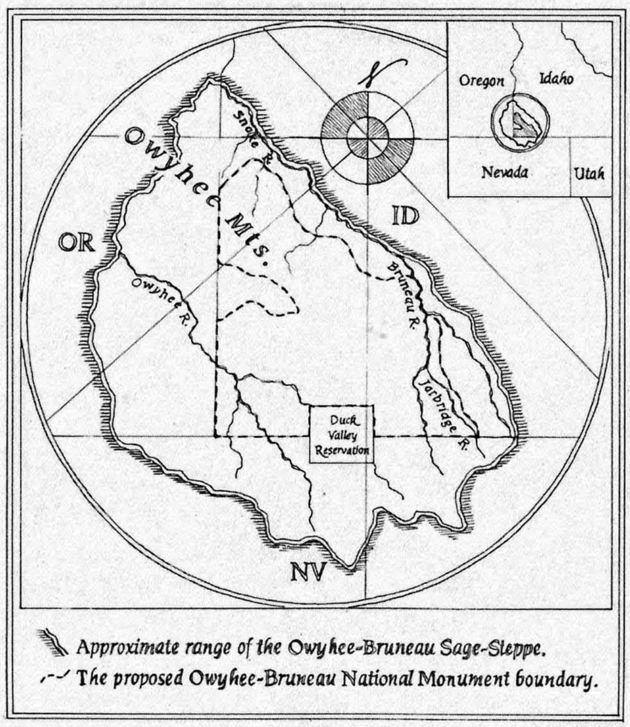


illustration by Lezle Williams



Owyhee-Bruneau Canyonlands, and a report by the Idaho Forest, Wildlife and Range Policy Analysis Group concluded that the Owyhee Canyonlands "appear to be nationally significant, and may be suitable and feasible for National Park Status" (MacCracken and O'Laughlin 1992). Yet, few people outside of Idaho have ever heard of the place.

The labyrinthine canyons of the Owyhee and Bruneau-Jarbidge river systems qualify as natural treasures on par with any other canyonlands in the West. According to Boise State University geologist Spencer Wood, a similar extensive network of deep rhyolite canyons with such excellent exposure is found nowhere else in the world. But, despite the allure of the canyons, it's the unheralded sage-steppe—which separates and lends perspective to the deep geomorphic mazes—that makes the Owyhee-Bruneau Canyonlands the last truly monumental unprotected landscape in the West. Any overarching protective plan for the Owyhee-Bruneau Canyonlands must safeguard this sagebrush terrain—the most important biologically intact enclave in the entire 145-million-acre Interior Columbia Basin.

THE SAGEBRUSH OCEAN

Sagebrush and grasslands have been ignored for too long in our conception of wilderness, but the contiguous expanse of the Owyhee sage-steppe epitomizes the highest ideals of wild lands, solitude, and biodiversity. Naturalist Steven Trimble (1989) has argued for a reexamination of our understanding of high desert ecosystems, dubbing the sage-steppe communities of the Great Basin a "complex and dynamic sea." In biological surveys—ironically conducted as part of a bombing range Environmental Impact Statement—the US Air Force noted the "intricate mosaic" formed by diverse Owyhee sagebrush communities, a vast landscape of shrubs that have all but disappeared from the high deserts of the Intermountain West (US Air Force 1993, BLM 1983). Indeed, the Nature Conservancy has pinpointed the Owyhee-Bruneau Canyonlands as the poster child of intact shrub-steppe habitat within the Columbia Plateau, "a control site for what sage steppe habitat can, could, and should look like" (TNC 2000). And, the Owyhee Uplands claims three of only seven shrub-steppe basins in the entire 145-million-acre Interior Columbia Basin ranked as exhibiting high ecological integrity (Quigley et al. 1996).

Sweeping expanses of big and low sagebrush spattered with diverse overstory shrubs and understory bunchgrasses (Vander Schaaf 1996) interlock to form the tesserae of this sage-steppe mosaic. The Idaho Conservation Data Center has identified 36 woody sagebrush community types within the Owyhee-Bruneau Canyonlands, and the shallow soils of the Owyhee Plateau support 17 low sagebrush plant communities (Rust and Moseley 1999). But the diversity of the Owyhee sagebrush sea is preserved only by its uninterrupted continuity; like all oceans, the Owyhee's power rests in its massive size.

Kipukas

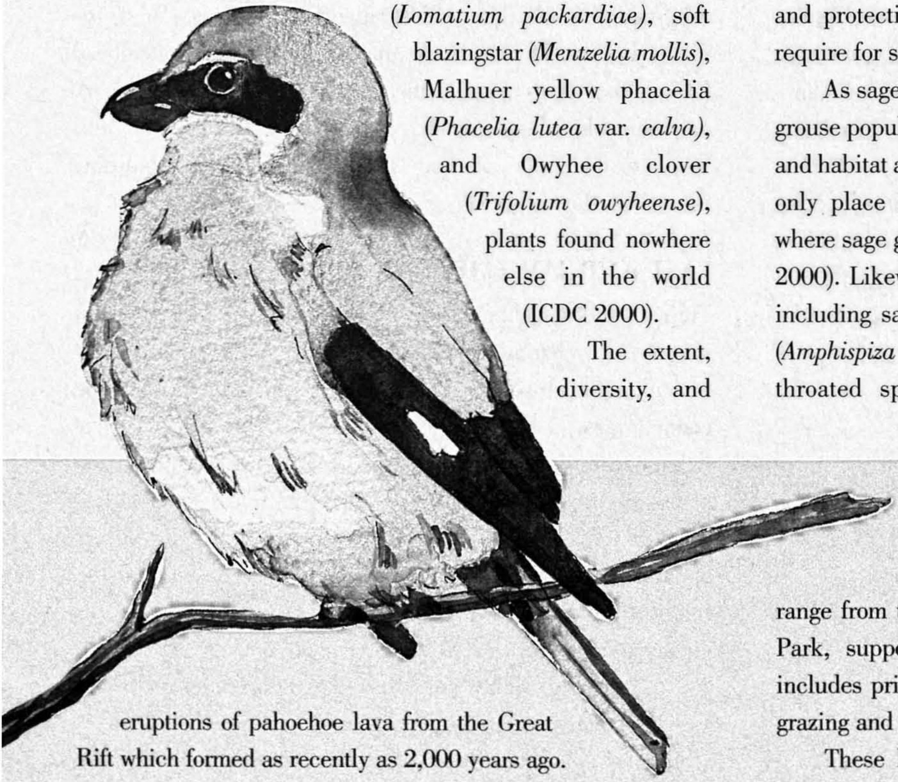
Sagebrush Islands in a Lava Sea

IN NOVEMBER OF 2000, the Clinton administration took a small step towards preserving Interior Columbia Basin shrub-steppe by expanding Craters of the Moon National Monument in Idaho from a 55,440-acre postage stamp to a 715,440-acre comprehensive landscape including 250,775 acres of sagebrush and grassland habitat (NPS 2000). Here the sagebrush sea survives in *kipukas* (the word means *window* in Hawaiian)—islands of sage-steppe on the raised remnants of older lava flows that escaped the oozing

Within the swells of the Owyhee sagebrush sea lie reefs and currents of even more specialized biological communities. The globally rare and endemic Owyhee sagebrush (*Artemisia papposa*) community thrives along the isolated bends of the intermittent Little Owyhee River. On the plateaus, vernal pools and tiny slickspots that break the sagebrush expanse shelter rare mustards like Davis' peppergrass (*Lepidium davisii*) and slickspot peppergrass (*Lepidium papilliferum*), a candidate for listing under the Endangered Species Act. Sequestered in deep canyons or perilously exposed in high meadows, the riparian zones of the Owyhee support an extensive flora, with six communities considered rare throughout their range (BLM 1999, Moseley 1999). In the springtime, the ash beds along Succor Creek and Leslie Gulch in the Owyhee Front flame to new life in blooms of barren milkvetch (*Lomatium packardiae*), soft blazingstar (*Mentzelia mollis*), Malhuer yellow phacelia (*Phacelia lutea* var. *calva*), and Owyhee clover (*Trifolium owyheense*), plants found nowhere else in the world (ICDC 2000).

The extent, diversity, and complexity of the Owyhee-Bruneau mosaic of sagebrush communities provides critical habitat for sage grouse, migratory songbirds, raptors, pronghorn antelope, pygmy rabbits, and other sagebrush-obligate species. The Owyhee-Bruneau Canyonlands currently boast one of the best populations of sage grouse (*Centrocercus urophasianus*) in the United States (Connelly and Braun 1997), and other sagebrush and shrubland bird species of concern rely on its unfragmented tracts of sagebrush/grassland habitat for survival. No animal better represents the ancient and open reaches of this landscape than the sage grouse, with its spiky plumage, surreal mating call, and ritual lekking dance, yet the bird is flirting with endangered species listing. Only hundreds of thousands of acres of sagebrush/grass habitat like those found in the Owyhee can provide sage grouse with the diversity of forbs, residual herbaceous nesting cover, and protection during lekking and nesting periods that they require for survival (IDFG 1999, 1997).

As sagebrush habitat disappears throughout the West, sage grouse populations are plummeting (Connelly and Braun 1997), and habitat analysis suggests that the Owyhee sage-steppe is the only place in the 145-million-acre Interior Columbia Basin where sage grouse will exist in a hundred years (Rich and Saab 2000). Likewise, other sensitive migratory shrub-steppe birds, including sage thrasher (*Oreoscoptes montanus*), sage sparrow (*Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), black-throated sparrow (*Amphispiza bilineata*), gray flycatcher



eruptions of pahoehoe lava from the Great Rift which formed as recently as 2,000 years ago.

Since the rugged lava rocks surrounding the kipukas make them so difficult for humans to reach, they shelter native shrub-steppe vegetation including communities of bluebunch wheatgrass, basin big sagebrush, three tip sagebrush, and needlegrass. These windows on historic Snake River Plains grassland provide habitat for sage grouse and sensitive shrub-steppe migratory birds such as the black-throated sparrow, sage sparrow, green-tailed towhee, and loggerhead shrike, as well other sagebrush obligates such as pygmy rabbit and kit fox, species whose populations have dropped as shrub-steppe has been decimated across the Snake River Plain. The kipukas range from the relatively untouched Carey Kipuka to Laidlaw Park, supposedly the largest kipuka in the world, which includes private lands and has suffered the ill effects of overgrazing and non-native crested wheatgrass seedings.

These kipukas can serve as scientific windows, control sites, and natural laboratories that will help conservationists understand and restore native shrub-steppe in the Snake River Plains (Blakesley and Wright 1988). However, while the lava rocks of the expanded monument will be managed by the National Park Service, most of the grasslands will continue to be overseen by the Bureau of Land Management and will permit grazing and all of its devastating effects on native shrub-steppe communities. And, for sage-steppe to truly remain a diverse and functioning system supporting sage-obligate species, instead of a remnant scientific curiosity, it needs the type of contiguous acreage found in the Owyhee-Bruneau Canyonlands. **—DS**

map by Todd Cummings / loggerhead shrike by Lezle Williams

(*Epidonax wrightii*), and green-tailed towhee (*Pipilo chlorurus*), rely on the dense concentrations of adjoining riparian areas within the Owyhee-Bruneau Canyonlands (Saab and Rich 1997, Paige and Ritter 1999). Since shrub-steppe habitat is vanishing at an alarming rate, threatening the continued existence of these birds, preservation of the Owyhee sagebrush sea, which once seemed so dull and ordinary, has taken on local, national, and international biological significance. Conservation of large core areas in the Owyhee-Bruneau Canyonlands is the only means to provide long-term habitat suitability and provide anchor points for restoration, corridor connections, and other key functions of landscape management for sage grouse and other migratory shrub-steppe birds (Wisdom et al. 1998).

Within the sage-steppe mosaic, other specialized habitats shelter sensitive fauna. The rolling, continuous low sagebrush plant communities of the Owyhee Plateau offer essential birthing and bedding sites for a large population of pronghorn antelope (*Antilocapra americana*), and adjacent wet meadows provide critical nursery areas (US Air Force 1996). Salt desert shrub communities in the lower elevations of the Owyhee Front—generally more open than sagebrush-dominated communities—provide habitat for migratory songbirds including loggerhead shrike (*Lanius ludovicianus*), sage sparrow, and black-throated sparrow, as well as kit fox (*Vulpes macrotis*) at the northern periphery of their range. And, GAP analysis shows that the Owyhee Front boasts the highest species richness of reptiles in Idaho, twice the number found in any other portion of the state (Groves 1994).

With an eye on not only preserving but also restoring the biotic integrity of sage-steppe, the intact core of the Owyhee-Bruneau Canyonlands offers an ideal base for the restoration of extirpated native species. According to BLM studies (1991, 1982), sharp-tailed grouse (*Tympanuchus phasianellus*) and mountain quail (*Oreotyx pictus*) could be returned to historic habitats in the Owyhee. The Interior Columbia Basin Ecosystem Management Project identified the Owyhee Uplands as source habitat for gray wolf (Wisdom et al. 1998, USDA/USDI 2000), and the nine-million-acre Owyhee, replete with its contiguous, isolated chunks of roadless land, could conceivably support the reintroduction of these wide-ranging carnivores. With the removal of dams on the Snake and Columbia Rivers, steelhead (*Oncorhynchus mykiss*), Pacific lamprey (*Lampetra tridentata*), and chinook salmon (*Oncorhynchus tshawytscha*) could also return to the waters of their traditional high-desert spawning grounds in the Owyhee.

LAST AND LONELIEST

Throughout the Columbia Basin, rampant overgrazing, off-road vehicle use, chaining, road-building, military expansion, and agricultural encroachments are wiping out complex sage-steppe communities, so that only the Owyhee Plateau remains the "veritable ocean of sagebrush" that pioneer Arabella Fulton gazed across in 1864 when she first beheld the Snake River Plains (Yensen 1982). Shrub-steppe has experienced the greatest loss of all habitats within the Interior Columbia Basin, and the Interior Columbia Basin Ecosystem Management Project predicts decline under all of its management themes (Quigley et al. 1996, Saab and Rich 1997). Reacting to this loss of habitat, sagebrush and shrubland bird species have shown the most consistent population declines in the nation over the past 30 years and even with aggressive restoration themes, "the deterioration and loss of sagebrush habitat will outpace restoration success" (Saab and Rich 1997). Cultural sites throughout the Owyhee Uplands, most of them unsurveyed, are being lost daily as looters unearth them, and road-building, agriculture, and development gobble up the desert.

In order to retain its biological richness and intrinsic sense of space, the diverse mosaic of the Owyhee's sage-steppe must remain unfragmented. Spanning an area far larger than Yellowstone National Park, the Owyhee-Bruneau Canyonlands could be our last chance at saving a massive, virtually undis-

kit fox by Lezle Williams

Recovering the Sage-Steppe's Wild Sheep

BIGHORN SHEEP were well established in western North America by about 12,000 years ago (Toweill and Geist 1999). The race of bighorns that occupied low-elevation habitats of the Great Basin (including areas of Idaho) and higher elevations in California's Sierra Nevada Range are known as "California bighorn sheep." They were mostly extirpated by 1940, and remnant populations found in the basin country of south-central British Columbia (see Sugden 1961) provided the parent stock for most California bighorn sheep roaming North America today (Toweill and Geist 1999).

Historic records indicate that bighorn sheep may have been the most abundant large ungulate in Idaho at the beginning of European exploration of western North America soon after 1800. Archeological evidence and abundant rock art depicting bighorns demonstrates their historic importance to native Americans, and records of early trappers and settlers indicate that bighorns were avidly sought for food. California bighorns' typical low-elevation habitats left them particularly vulnerable to hunters.

However, limited evidence indicates that the greatest threat to California bighorns was from competition with domestic livestock. By the late 1880s, up to 150,000 sheep and 100,000 cattle grazed in Owyhee County. It is believed that diseases introduced by livestock had a devastating impact on native herds of bighorn sheep. In 1884–85 a die-off was attributed to scabies and in 1902 a further die-off in the drainages of the East Fork Owyhee River was recorded (Bailey 1936).

Restoration in Owyhee County began with 19 California bighorn sheep reintroduced to the East Fork Owyhee River in 1963, 9 more in 1965, 10 in 1966 (Drewek 1970, Toweill 1985), and 12 to Little Jacks Creek in 1967 (Toweill 1985, Oldenburg and Nellis 1994). With the herds expanding at 20–25 percent per year, some of the animals were moved to the West Fork Bruneau from the East Fork Owyhee. By 1990, they were supplemented by 40 additional sheep, and efforts to restore the bighorns were deemed a success; by 1997, they numbered 1,440 (Toweill and Geist 1999).

California bighorn sheep herds quickly became established in Owyhee County (Drewek 1970) and grew at very high rates through the early 1990s in a manner typical of population growth in an unlimited environment. However, beginning in 1993 bighorn sheep populations throughout Owyhee County began to experience an apparent decline in population size (Toweill 2000). In some areas, herds dropped to just over 100 animals, considered the threshold for a minimally viable population. The simultaneous decline in herds established at widely different times and in separate areas makes it unlikely that population decreases were associated with herd-specific events, such as disease.

Although the underlying reasons for the population dips remain unknown, it should be noted that Owyhee County experienced an extended drought associated with El Niño weather patterns between 1987 and 1993. I hypothesize that California bighorn sheep were forced by relocation or declining forage availability to range more widely for food as a result of the drought. These transplanted herds experienced an initial period of population growth followed by declines associated with decreases in range productivity. The observed drop in annual lamb survival is consistent with this hypothesis. If the hypothesis of drought-related influences on bighorn sheep numbers is correct, populations should rebound as conditions improve.

Maintaining this restored native species is a high priority for Idaho citizens and the Idaho Department of Fish and Game. An understanding of the mechanisms of population growth and the range of variation in herd size from year to year is essential if the bighorn sheep population is to persist within the long-term carrying capacity of the area.

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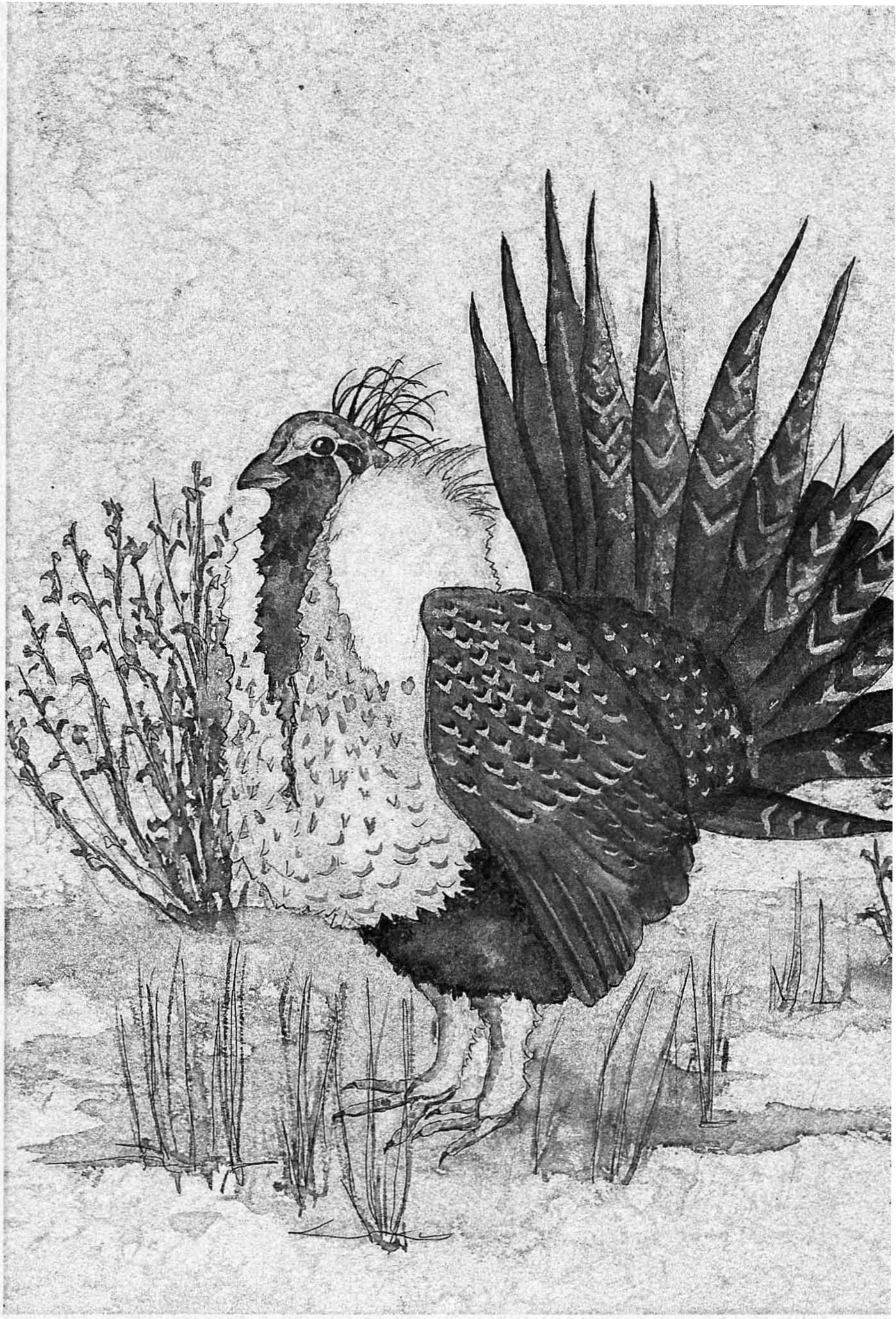
turbed, and heretofore unprotected landscape within the continental United States. This singing sagebrush sea offers the vast space and potency that can nurture, and even restore, its rich biotic communities and our own hearts. However, plans for the protection of the Owyhee-Bruneau Canyonlands have fallen flat.

Cowed by the political might of Idaho's legislators, the Clinton administration ignored calls for a 2.7-million-acre Owyhee-Bruneau Canyonlands National Monument in the fall of 2000, despite monument endorsement by the conservative *Idaho Statesman* (1999) and polls confirming that 80 percent of Idahoans support a multiple-use monument (Nokkentved 2000). Other possible protective designations in the Owyhee are woefully inadequate. The nearly one million acres of Wilderness Study Areas recommended by the BLM (1991) within the Owyhee-Bruneau Canyonlands omit more than two million acres of uninventoried roadless lands.

Without a spirited national constituency for its protection, future proposals for national monuments, national parks, wilderness areas, or other overarching protection for the Owyhee will surely choke on road dust. Faced with fragmentation and declining habitat, this sagebrush sea could dry up. Ironically, the vast sage-steppe of the Owyhee-Bruneau Canyonlands might not just be the last and loneliest landscape left in the West, but also the most forsaken. ☾



sage grouse by Lezle Williams

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The American Lands Sage Grouse Conservation Project

THE GREATER SAGE-GROUSE (*Centrocercus urophasianus*) is a widely ranged, sparsely distributed species that inhabits the vast sagebrush sea of the western United States and Canada. The aptly named sage grouse derives its food and shelter from the shrub. The grouse also uses different habitats throughout the year (always near sagebrush) foraging on grasses, wildflowers, insects, and of course—sagebrush, particularly in winter. The charismatic, brown-and-white mottled birds are known for their spring courtship displays, when males gather on traditional dancing grounds—called "leks"—to strut for potential mates.

Settlement of the West exacted a heavy toll on the rolling sagebrush steppe and mountain foothills that are the sage grouse's domain. Over the past 200 years sagebrush habitat has been fragmented, damaged, and eliminated by human activities, including livestock grazing; agricultural and urban conversion (including suburbanization and "ex-urbanization"—the establishment of new communities far outside of existing urban areas); invasive exotic species (especially cheatgrass); application of herbicides and pesticides; altered fire regimes; oil and gas development; off-road vehicle use; and the placement and construction of utility corridors, roads, and fences. The Bureau of Land Management estimates that the historical extent of sagebrush country—approximately 220 million acres—has been reduced to 150 million acres of mostly degraded habitat across the West.

Sage grouse have declined with the loss of sagebrush habitat; since 1980 populations have been reduced by an estimated 35 to 80 percent. Sage grouse no longer occur in Arizona, British Columbia, Kansas, Nebraska, New Mexico, and Oklahoma. The present size of the greater sage-grouse breeding population is estimated at 140,000 individuals scattered in two Canadian provinces and eleven western states. A second species, of much smaller range and smaller physical size is the Gunnison sage-grouse (*Centrocercus minimus gunnisonii*). There are approximately 4,000 Gunnison sage-grouse in southwestern Colorado and southeastern Utah.

American Lands and our partners have identified sage grouse as important indicator, umbrella, and flagship species for sagebrush ecosystems, and have developed a conservation strategy centered on the birds. In January 2000 American Lands and our partners filed a petition to list the Gunnison sage-grouse as endangered under the Endangered Species Act (ESA). The US Fish and Wildlife Service failed to respond to the petition. As litigation proceeds on the Gunnison sage-grouse petition, we are preparing a petition to also list the wider-ranged greater or "northern" sage-grouse under the ESA. American Lands is also coordinating a public education campaign and media and legal strategies to protect both species of sage grouse and their habitat.

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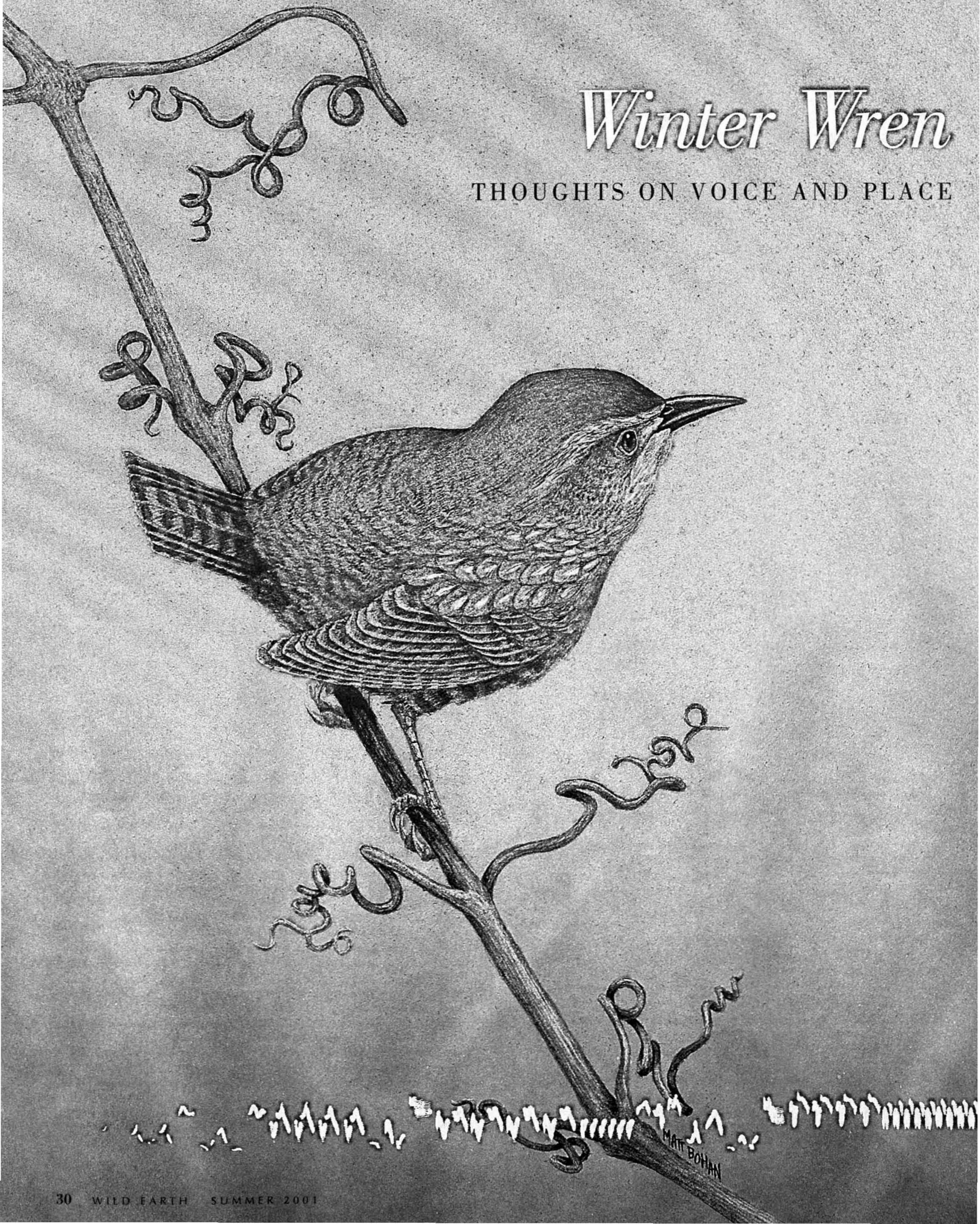
Winter Wren

THOUGHTS ON VOICE AND PLACE



by Lyanda Lynn Haupt

Listening to the voice of the winter wren rise from the forest floor, I am bewitched by a sincere belief that the song is very long. Minutes long. If someone asked how long I believe the song to be, and to speak my answer out loud, I might reconsider. Perhaps my imagination has lengthened the song in my mind. I suppose I would say that the wren sings in 40-second bouts.

The winter wren sings one of the most complex songs known to ornithological science. It is a waterfall of a song, bubbling upward from the forest understory, a series of phrases and trills piled on top of one another. It is loud and reaching, and the singer is as small and brown as a mouse.

I take my sister into the forest. I know where two different male wrens sing. Kelly is both a physicist and a volleyball coach, so she is very good with a stopwatch. She times the songs while we each make our own count of the wild, rapidly changing phrases.

"Fifteen phrases." Kelly announces her count after the timing of the first song.

"Thirteen," I say.

Kelly counts sixteen in the next song, I count twelve, then I get fourteen while Kelly has twelve, then we both get the same. Fourteen.

It's not that we can't count. The wren is singing so quickly, we cannot think the numbers, cannot attach them to the phrases in our minds. *One, two, three*, this is much too slow, no matter how fast we whisper the numbers, or tick them off on our fingers and toes. We attach clumps of numbers to groups of wren phrases. It is like counting a flock of birds in flight.

We might record the song, slow it down, play it back, and count more accurately. But ours is a low-tech experiment, designed to satisfy simple curiosity. We just want a general idea.

Now we have a list of song-lengths. The average is eight and a half seconds. Kelly and I are stunned. How can this be? The song runs on and on, it changes over and over, it lasts, it rings. Eight and a half seconds? Clearly the song suspends and expands time, meandering within its own created space. The watch says eight seconds, though the wren was singing for a long minute. There is no explaining it, the mystery of winter wren song.

While listening for the wren, we turn our ears downward, and our backs to the rest of this moist, Northwest forest, a world of rustling ferns, unknown insects, the rasping of Steller's jays, an invisible breeze that keeps every branch moving just a little, the quiet whispers of each and every tree. It seems even the mosses have a voice. Now that we are finished focusing on the wren, we take our hands away from our ears, and the other forest voices come fully around us.

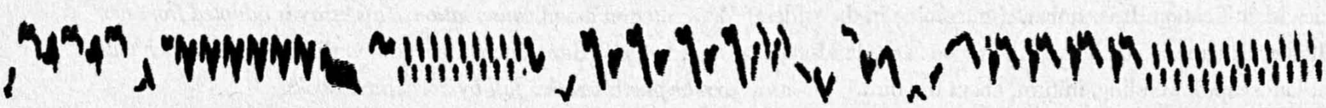
Birds utilize a spectrum of vocalizations, the most obvious, lengthy, and distinctive of these being their songs. During the breeding season, songs are used to establish territory and pair bonds. Typically, they are sung by the male, though females of a few species do sing, and they are usually seasonal, though some birds sing all year. Each species sings a unique song, with variations emerging in regional populations, and even individual birds.

Ornithologists typically study avian vocalizations bird-by-bird. Individual songs are recorded and represented graphically by the jagged, inky lines of a sonogram. The sonograms may be analyzed to reveal subtle differences between species, subspecies, various populations, individuals.

As a master field-recording engineer, Bernie Krause has long been involved in the recording of individual birds and other creatures. In his memoir, *Into a Wild Sanctuary: A Life in Music and Natural Sound*, Krause tells the story of how he began to record ambient sound—the sound of whole systems—out of boredom. When the creatures he hoped to be recording refused to make themselves heard, Krause would just sit around. He turned on his recording equipment to see what would turn up, and to keep his mind occupied while waiting for the "real" creature sounds. What he learned could turn our sense of animal voices on its head. When heard in context with each other, all the voices in a primary ecosystem ring in concert to tell a wide, wide story. Krause's life work inspired him to create a beautiful new word:

BIOPHONY—n. the combined sound that whole groups of living organisms produce in any given biome.

In any primary ecological system—one not interrupted by habitat destruction, an increasingly difficult sort of place to find—there is a range of background noise. This is ambient sound, an orchestra of insect voices and botanical movement occupying a



winter wren by Matt Bohan / sonogram courtesy of the Cornell Lab of Ornithology

The voice of a bird, a single bird that we can pick out of the forest, is not a disembodied element of its mating strategy, breeding biology, and territorial nature....It is an articulation of the species' place in the landscape, and that landscape's wending, in turn, about the bird.

unique band defined by Hertz frequency. What Krause's research shows is that in an apparent effort to claim an effective voice in the landscape, certain birds sing at a frequency above or below this band, at a "place" unoccupied by the ambient sound. Their songs occupy an actual *aural* niche, a vocal equivalent of the ecological niche that has become so familiar to students of natural history. In every unaltered habitat he researched, Krause discovered that animals—not just birds, but many mammals and amphibians as well—have learned to vocalize in these vacant niches, unimpeded by the ever-present background voices of insects and plants. Birds speak with meaning in an "animal orchestra," as Krause calls it, a wild and vital biophony.

The implications of this research are, in many ways, still beyond our understanding. It implies, at least, another dimension of evolutionary complexity—vocalizations that have been shaped around a developing landscape for as long, presumably, as a species has existed. It points to deeper meaning in the relentless alteration of habitat that seems to be the human mission on modern Earth. If many bird voices have evolved to carry upon a specific frequency, changes in the landscape will alter the interaction between the ambient sound and the songs of the birds. Species survival in the long term might be compromised, as the function of song in gender relations and territorial management is impeded. Though a song sounds perfectly normal to us, it may not be received within an altered landscape in a way that makes sense to the bird, and to all the creatures that its single life brushes. The birds, though singing, may not be fully heard.

In itself, *voice* is a layered word. It is not only an indication of the ability to make a sensible sound, but the continuation of that sound onto another plane. A voice has form, and further, it has weight. It has the propensity to interact with a world beyond its origin, and to have effect and purpose in that world. Krause's findings suggest a deep twining between song and place, between an animal's voice, and the integrity of the landscape. In this light, the voice of a bird, a single bird that we can pick out of the forest, is not a disembodied element of its mating strategy, breeding biology, and territorial nature. It is not simply a clue to species identification. It is, rather, a true voice in the widest sense. It is an articulation of the species' place in the landscape, and that landscape's wending, in turn, about the bird.

THE WINTER WREN IS A CURIOUS BIRD, CURIOUS LIKE a cat. It rarely strays far from the ground, and so we lie in each other's sphere, zero to six feet from the earth. When I hear the *kip-kip-kip* call note of the wren, and search beneath the vine maples, and into the ferns, I often find that the wren is already peering out at me, or more often, that it has scurried silent and vole-like across the trail, and watches me from a perch shoulder-high. It turns its head sideways, as if listening for something. It stays.

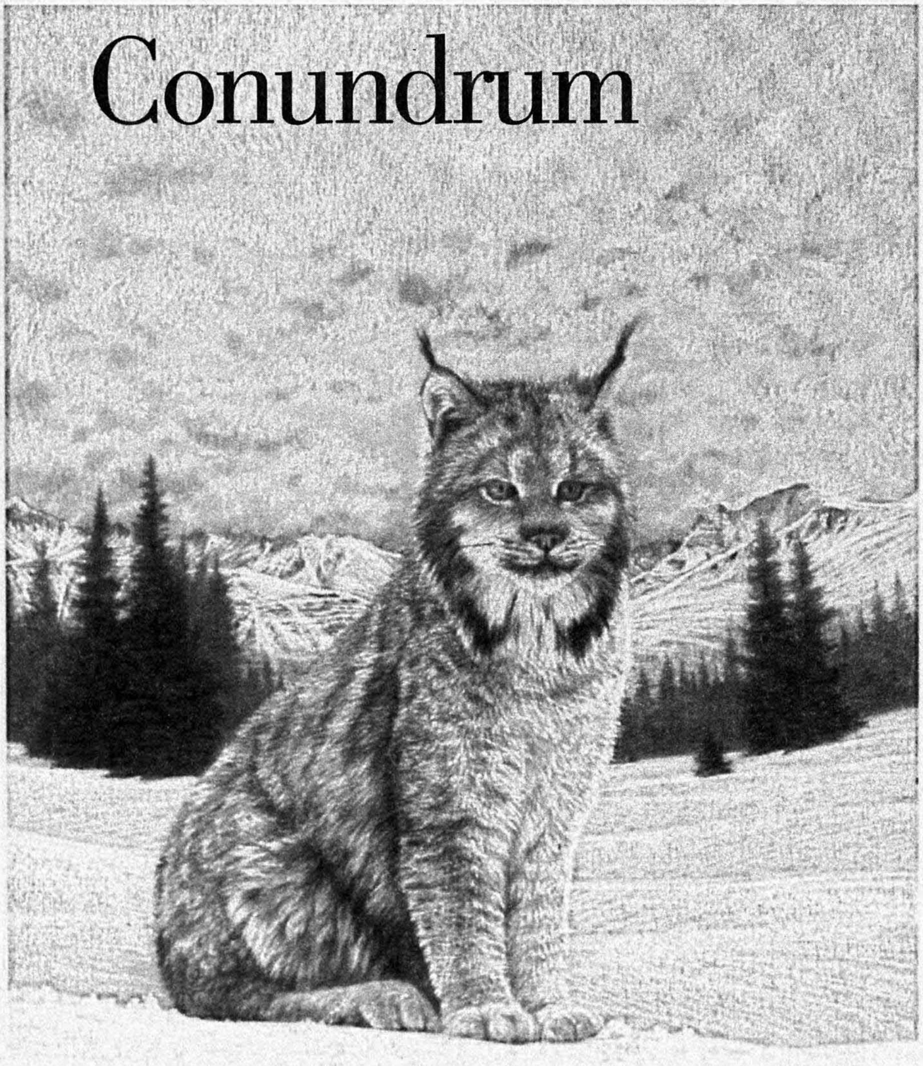
The winter wren's song is a sudden bursting forth, as though it were pent up so intensely that this tiniest bird could keep silent no longer. I love to watch a wren in the moment after his singing, surrounded by a fresh silence, a jubilant calm.

Here in the Pacific Northwest, the understory of ancient forests is preferred by the winter wren, though good, mature second-growth with a vibrant understory is tolerated. The song, with its mystery in time, begins and rises, and carries and ends. Beyond the singing, the forest is falling by the acre, by the mile, every day. Even the more ecologically sensitive logging practices, those that do not create the chaotic scars of a clear-cut, will change the physical nature of a wild place, will interrupt the tightly evolved relationship between physical forest and landscape sound. We have no idea what this will mean.

It is possible that the "aural niche" is not of any significant import for birds. It is possible that ecological changes affecting vocalizations may be perceived by a species, and somehow accommodated over time. It is possible that our drastic alteration of the landscape will, over an unnaturally short period of only one or two thousand years, press a once-common bird, like the winter wren, into a hopeless rarity. We cannot know. But we can know this, that every bird song we hear, every call and utterance, speaks beyond the biological needs and instinct of the individual singer, joining the forest's own voice for integrity, peace, and continuation. ☾

Lyanda Haupt, *a Seattle-based writer and naturalist, last wrote for* Wild Earth *in 1996. An avid birder, her writings often center on avian conservation. This essay is adapted from her new book,* Rare Encounters with Ordinary Birds, *which will be published this fall by Sasquatch Books.*

A Checkerboard Conundrum



A Conservation Partnership Raises Funds to Link the Cascades

by Mitch Friedman

The most ambitious conservation campaign in Pacific Northwest history is aimed at protecting a landscape-level wildlife corridor. The campaign is enjoying tremendous success, demonstrating that landscape connectivity is an idea whose time has arrived.

The Cascades Conservation Partnership is a Seattle-based coalition working to raise $125 million over three years—$25 million from private donors to leverage at least $100 million from the federal Land and Water Conservation Fund, managed by Congress—to bring 75,000 acres of mostly industrial timber land into public ownership. Adding these lands to the Wenatchee and Mt. Baker–Snoqualmie National Forests is essential to protecting vital links between the vast areas of public lands in the greater North Cascades and Central Cascades ecosystems.

lynx by Martin Ring

The conservation partnership is solving a century-old problem. Massive land grants to the Northern Pacific railroad during Abe Lincoln's time diced a path of intermittent private ownership across the northern tier of the West, including the heart of Washington's Cascade Mountains. Consequently, this area is the narrowest bottleneck of public lands in the Cascade Range along its entire length from southern British Columbia to northern California. Development is encroaching on private lands from the east and west, and within this hour-glass constriction public and private lands are mixed in a checkerboard pattern very familiar to anyone who has driven (or flown) the route of Interstate 90 over Snoqualmie Pass, between Cle Elum and North Bend. The checkerboard blares out its presence in giant 640-acre (one-square-mile) clearcuts that are the legacy of this boondoggle.

Few ecosystems in the Lower 48 have so much potential for large-scale ecological recovery. The Cascades already have millions of acres in designated wilderness areas and two national parks (North Cascades and Mt. Rainier), and conservationists have made good progress in adding protections for public lands during the past decade. But the checkerboard lands threaten to bisect that potential, impeding ecological connectivity and wildlife movement between the half-million-acre Alpine Lakes Wilderness Area and Mt. Rainier National Park.

Simply put, if we fail to address this threat, it is virtually inconceivable that sustainable populations of grizzly bear or lynx will occur in the Central or South Cascades a century from now, or that spotted owl or fisher will be viable in the North Cascades.

Two unrelated events brought the prospect into focus. First, the Loomis Forest Fund was wrapping up its landmark campaign which raised over $18 million dollars in less than a year to buy protection for 25,000 wild acres of state lands (managed largely to generate revenue for school construction) in central Washington, along the Canadian border [see "Forest Green: How Private Money Saved Loomis Forest Wildlands," fall 1999 *Wild Earth*]. This effort demonstrated that the region's new wealth, juiced by high-tech industry, could be brought to bear on an audacious conservation venture. The Loomis Fund also pioneered new approaches to capital fundraising campaigns that offered continued promise.

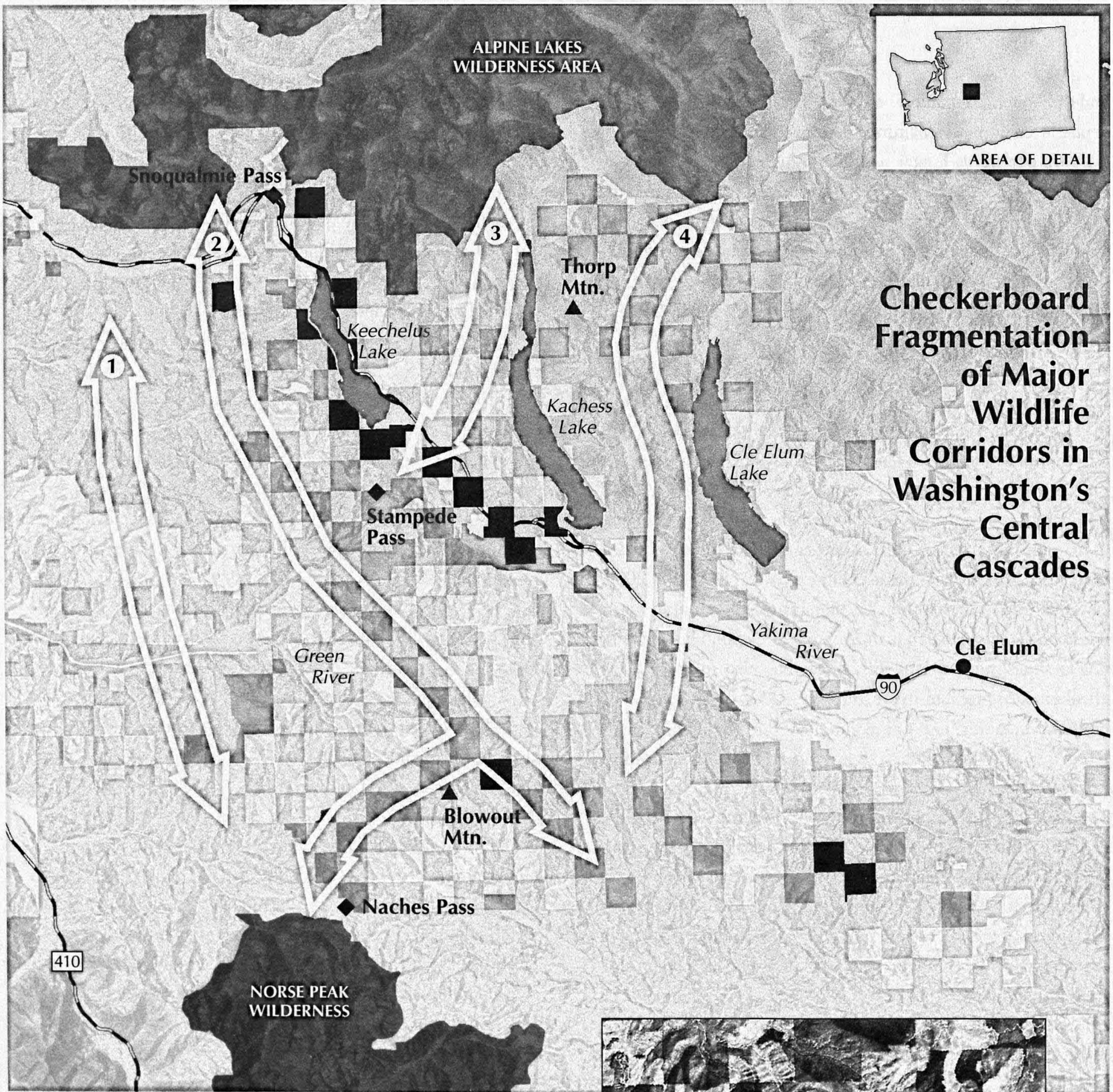
Second, the Forest Service was completing a massive land swap in the Cascades checkerboard country with Plum Creek Timber Company, the descendent of the railroad land grants. The land exchange offered a way to create coherent blocks of ownership, but was limited both by the amount of "expendable" land the Forest Service could part with and by growing distrust of and opposition to federal land trades. The controversy culminated with protests in southern Washington, where tree-sitters occupied giant Douglas-fir and western redcedar in areas around Watch Mountain and Fossil Creek; the activists were actually supported by the nearby community of Randal—until recently a logging town—where local sentiment opposed the Plum Creek land swap.

This battle split the conservation movement, as the checkerboard contingent saw a net benefit in the land exchange

DAWNING OF A SOLUTION

For decades conservationists have strained synapses attempting to develop legal or political strategies to address the checkerboard. The Alpine Lakes Preservation Society, Sierra Club's Checkerboard Project, Inland Empire Public Lands Council (now The Lands Council), and others have led the charge in various ways. Diligent effort was sustained and incremental victories achieved, but an ultimate solution remained elusive until 1999.

Charlie Rain



- *Saved Lands*
- *Target Lands*
- *National Forest and other public lands*

Wildlife corridors (white arrows)
1. *Kelly Butte*
2. *Cascade Crest*
3. *Keechelus Ridge*
4. *Easton Ridge*

RIGHT: *Satellite image from the south-central portion of the map, just north of the Norse Peak Wilderness. The dark areas indicate mature forest, in many cases late-successional forest. The light areas indicate clearcuts. The square-mile checkerboard ownership pattern from the map is evident in the alternating blocks of forest cutting visible in the satellite image.*
LEFT: *One of the square-mile clearcut sections, near Green Pass, Green River watershed. This block within the Mt. Baker-Snoqualmie National Forest is owned by Plum Creek Timber Co.*

The Wilderness Society / image processing by Janice Thomson

map by CommEn *Space* (www.commenspace.org) and the Watch Mountain/Fossil Creek contingent saw an unacceptable compromise of rural old-growth fragments to benefit Seattle's backyard. Finger pointing and accusations traded on front pages threatened to blow up the whole deal. Instead, the sides found a way to come together in the faith that a unified strategy might achieve all our objectives while an internal battle could only assure that one side's or the other's trees would fall. Ironically, a SLAPP suit (Strategic Lawsuit Against Public Participation—litigation filed by a powerful interest to harass grassroots opponents) by Plum Creek offered a venue for resolution. Negotiations shrunk the land exchange on both sides, while the Forest Service retained options to tens of thousands of acres of withdrawn Plum Creek land, but got only one to three years to find the money to buy their protection.

At the time, nobody anticipated the natural partnership that would form out of the Loomis campaign and the healed fragments of the checkerboard land exchange. In May of 2000, The Cascades Conservation Partnership went public to apply the Loomis tactics to acquiring not only the option lands residual to the shrunken land exchange, but also to solving the checkerboard problem in Washington's Central Cascades once and for all.

THE COALITION

The Cascades Conservation Partnership is administered by the Northwest Ecosystem Alliance, which spearheaded the campaign that saved the wildlands of the Loomis State Forest. It is governed by a steering committee comprised mostly of representatives from the core groups in the coalition, including Alpine Lakes Preservation Society, Sierra Club, The Wilderness Society, and others.

The driving theory behind the partnership is that the legitimacy of our cause, backed up by dedicated citizen support—and demonstrated through private contributions—can generate the media attention and political influence needed to obtain sufficient federal funding. This is a dangerous tactical mix; capital campaigns are typically run with mild, non-controversial messages to woo conservative donors. Advocacy campaigns usually bring out the whips and chains needed to fire up the grassroots and threaten political damage. Seattle's new wealth breaks that generalization by being accustomed and attracted to risk, as the Loomis experience revealed. Nonetheless, the partnership has threaded this strategic needle by intermittent boldness, innovation, restraint, and savvy, all on a solid foundation of experience.

The proof is in the pudding. In the half-year from mid-May 2000 to the elections, The Cascades Conservation Partnership raised $5.5 million in more than 3,400 private contributions, and brought home more than $26 million from Congress, more than double any other commitment from the Land and Water Conservation Fund (LWCF) last year. This $26 million in federal funds in our first year is even more stunning when you realize that most of the 177 requests for LWCF funds that year were in the $1 million to $5 million range, and had sat on a list for four or five years before even being considered for funding.

The federal dollars allowed purchase of about 10,000 acres under option with Plum Creek, including checkerboard squares around the Yakima River and the aforementioned Fossil Creek. With private money we have already bought 640 acres, much of it old growth, in the North Fork Taneum River Valley, and passed it on in the largest donation of private land to the Forest Service in Washington since the 1920s. So far in 2001, we have added 3,000 new donors and raised $5.5 million private dollars, including $3.5 million from philanthropist and Microsoft co-founder Paul Allen.

The partnership is near to closing on a deal that will allow us to donate to the Forest Service over 1,200 acres, much of it old-growth Ponderosa pine, in the largely roadless Negro Creek Valley adjoining the Alpine Lakes Wilderness Area. This, the largest land donation in state history, will consolidate new and existing public lands and keep Negro Creek wild forever. Other exciting deals are also pending.

Our prospects for federal funding this year appear challenging. With the new administration and new chairs of appropriations committees in both the House and Senate, it's a different ballgame. We have a long way to go to our goal of $100 million federal dollars, and our private fundraising (more than $13 million still to raise) relies on showing donors that we are adding the value of federal funds to their gifts. But we stand by our original theory, which is that if we present a good case—biologically and socially—and back it up with a strong showing of public support, we stand a great chance of success.

RECIPES FOR SUCCESS

The Cascades Conservation Partnership has already made large gains. I discern three important elements to our progress:

- linking concrete objectives to a big vision is compelling to potential supporters;
- people understand and support the goal of a protected wildlife corridor;
- effective campaign tactics and implementation are fundamental.

As noted, Seattle's new wealth is attracted to risk and vision, but the partnership also had to prove its merit to

Congress. Granted, the chair of the key Senate subcommittee at the time was Slade Gorton, Washington's powerful senior senator who was facing a tough re-election (which he ultimately lost). A cynic might say that Gorton helped give us the largest slice of the LWCF pie only to provide himself green cover for November. There is no denying that electoral politics played a role, but I also firmly believe that the project had substantive appeal for the former senator.

Slade Gorton was a tough audience for our initial meeting on this issue. He has never been a friend of the environment or a pork barrel spender. Yet the meeting went extremely well. Gorton was genuinely impressed that we were aiming to solve the problem rather than continue to nip at the edges of it. Although he didn't place much value on our biological objectives, he did appreciate the recreational and consequent social and economic benefits of the plan. Throughout the rest of the year, as the partnership reported increasing private donations, our public appropriations grew in an indirect but fairly linear relationship. The *Seattle Post-Intelligencer* reported late in the year, "Gorton said he was willing to go to bat for the Cascades money in part because the Cascades Conservation Partnership is trying to raise $25 million in private money to help leverage $100 million in federal money."

The partnership received critical political support from a powerful skeptic not only because of cynical electoral motives, but because of the audacity of its vision and demonstrated public support. Other powerful politicians, including some that will dictate our success this and next year, have similarly stated that they are impressed by the approach the partnership has adopted.

Moreover, the campaign has lots of superlatives to work with: the 75,000 acres we aim to protect include 15,000 acres of old growth, 22,000 roadless acres, 15 alpine lakes, 30 miles of salmon spawning habitat, and about 50 miles of hiking trails, all in Seattle's backyard—in many cases, within an hour's drive.

But our package also has some drawbacks. We included tens of thousands of acres of clearcuts and plantations in the hope that they will in time be restored to provide habitat suitable for wildlife dispersal. And the 75,000 acres are comprised of disparate chunks. There is no place-based mystique to this campaign, as our "place" is a patchwork of squares strewn upon a map.

What binds the project together isn't big trees, salmon, hiking, or even heritage. It is *connectivity*. The partnership's land targets were selected with substantial scientific advice based on recent studies of wildlife movements and landscape connectivity in the area. Our supporters have been convinced not only that we chose the right lands to solve the problem, but that the problem of fragmented wildlife habitat is important to solve.

I don't know of another example of a major public campaign that has pitched a habitat linkage between two large ecosystems. There was reason to be skeptical that the message would sell. In the modern tradition, we convened focus groups to explore and refine our message. I was impressed by how easily our groups—comprised of suburban independent voters of mixed ages who generally lacked much connection to Nature—comprehended the meaning and logic of the phrase "wildlife corridors." Specifically, most of the participants found an important element of our project to be "connecting existing National Forest lands with nearby private lands owned by timber and other companies to create a permanent undeveloped wildlife corridor."

People do frequently ask, however, what value it is to save the forested part of the wildlife corridor if the critters are likely to be smacked as they cross the interstate. Fortunately, Washington's Department of Transportation is considering major structural changes that would include the types of underpasses and overpasses that have proved helpful to wildlife in other areas. Empirical research on wildlife movement patterns that was conducted to inform potential road modification has been of great value to the partnership both in establishing our land priorities and in arguing our case.

Of course, having a good case doesn't by itself save the world. The Cascades Conservation Partnership has a talented team that translates the positive value of the Cascades wildlife linkage into positive press, great campaign materials, and thousands of donors. We undertake direct mail, house parties, direct solicitations, outreach events, and other techniques. We also have a top-flight (expensive, but worth it) lobby team. Solid campaigning involves a lot of work, and without it our message alone would likely strike with a thud. But isn't it nice to know that, given the chance, people are moved to spend generously on a large-scale ecological function like connectivity?

The completed Loomis Forest campaign and the ongoing Cascades Conservation Partnership represent tangible examples of creative, participatory wildlands philanthropy. Their success clearly shows that the American people value wildlands and wildlife—and while we expect government to do its part, we care enough to sacrifice our own dollars for the public good of healthy ecosystems and our wilderness heritage. ☾

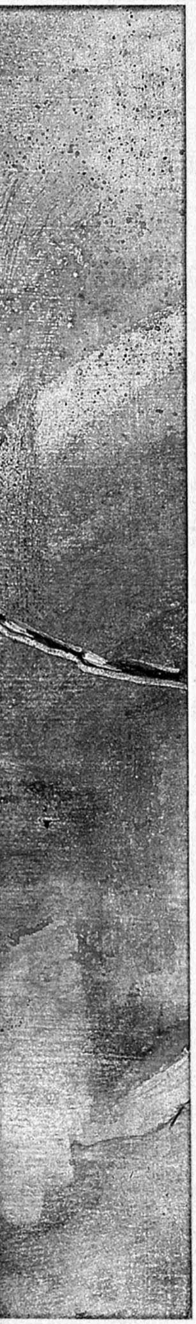
Mitch Friedman *is executive director of the Northwest Ecosystem Alliance (1421 Cornwall, Suite 201, Bellingham, WA 98225; 360-671-9950; www.ecosystem.org). For more information on The Cascades Conservation Partnership visit www.cascadespartners.org.*

Battling BIOINVASION

Prevention is the Best Defense Against Invasive Exotics

BY FAITH THOMPSON CAMPBELL

Asian longhorned beetle *(Anoplophora glabripennis)* by Adelaide Murphy Tyrol



A PLAGUE OF EXOTIC SPECIES

In some areas of the United States, it is difficult to find a native organism. Numerous ecosystems are under assault by invading exotic species ranging from pathogenic fungi to pigs. For example, more than 230 exotic species—and perhaps twice that number—have become established in the ecosystem formed by San Francisco Bay and the Sacramento Delta. This bioinvasion has dramatically reduced some native populations and altered habitat structure and energy flows (NISC 2001). Pressure from introduced species was at least partly responsible for the decline of an estimated two-thirds of the native fish that have become extinct in the US and more than half of the fish species listed under the Endangered Species Act (Luoma 1992).

Approximately 4,000 species of exotic plants (USGS 1998, Kartesz 1999) are growing outside cultivation in the United States; at least 10% of these species have been identified as damaging invaders in one or more ecosystems (Plant Conservation Alliance). A mere dozen of the invasive exotic plants together occupy an area nearly as large as California—105 million acres; if one considers all the plant invaders, the total area is probably larger than Texas—171 million acres. The areas infested and the plants' impacts on economic activity and biodiversity are best documented for grassland ecosystems (especially the Intermountain West and Great Plains) and for wetlands. Deciduous forests are also heavily invaded, although scientific documentation lags.

NATIVE FORESTS ARE UNDER ATTACK

This article will focus on a particularly damaging group of invaders, the exotic fungi and insects that attack native tree species. About one-third of the United States is forested. These forests—including the continental, tropical, and subtropical ones—are made up of more than 600 species of trees and many additional thousands of species of smaller plants and animals. More than 400 exotic insects and 24 exotic pathogens are established in these forests. Five percent of these insects and half the pathogens "threaten the health, productivity…and even the very existence of some trees and forests" (USDA APHIS and Forest Service 2000). Among the ravaged tree species are the American chestnut, American elm, several five-needle (white) pines, butternut, Port-Orford-cedar, and Fraser fir. Less drastic but still severe damage has been done to American beech, eastern or flowering dogwood, eastern hemlock, and eastern oaks. The combined effect has been to maim much of the 272 million acres of deciduous forests in the East. If the Asian longhorned beetle escapes eradication efforts and becomes established, it would destroy the maple-dominated forests of the Northeast and the aspen-poplar forests of the upper Midwest and the Rocky Mountain states—an area greater than 60 million acres. With the exceptions of the narrowly endemic Fraser fir and Port-Orford-cedar, these trees have large ranges—but that has failed to protect them from the invaders' impacts.

While conservationists support scientists' struggle to find effective tools to minimize the impacts of the established forest pests, we should also make every effort to ensure that new plant pests do not enter the country. Each new pest adds to the already enormous ecological burden, further overwhelms over-stretched resource agencies, and results in wider use of pesticides and other environmentally suspicious control measures. Prevention is the best defense.

Preventing introductions of plant pests is the responsibility of the Animal and Plant Health Inspection Service (APHIS), an agency of the US Department of Agriculture. APHIS's task is difficult—annually inspecting more than 410,000 planes and 53,000 ships (Berenbaum 2000), and probably 30 million cargo containers (Kanter pers. comm.). The job grows bigger each year as trade and international travel grow. People who buy imported goods or travel to foreign countries should support strong safeguards to minimize the likelihood that exotic species will be introduced as a result of their activities.

Unfortunately, APHIS has not done this difficult job as well as it should; America's forests and other ecosystems suffer needlessly higher levels of damage from bioinvasion as a result. I see two major problems undermining APHIS's effectiveness. First, the agency has long avoided its responsibility to protect natural ecosystems (as distinct from agriculture). It puts a much lower priority on keeping out exotic organisms that attack forest trees compared to those that threaten fruit trees or grain. Second, APHIS clings to an outmoded approach which is so labor-intensive and error-prone that it virtually guarantees that new pests will evade attempts to prevent their introduction. Despite these flaws, APHIS largely escapes conservationists' critical attention.

There is growing agreement that the solution to the first problem—APHIS placing a low priority on protecting natural ecosystems—is to assign responsibility for "natural area" pests and weeds to some other government entity. There is not yet agreement on how to structure this change. The Fish and Wildlife Service operates a small inspection program at US borders, but that program is focused on regulating trade in species listed under the Endangered Species Act or the Convention on International Trade in Endangered Species of Wild Fauna and Flora. The Fish and Wildlife Service lacks the expertise and staff to regulate imports that might vector plant pests. Perhaps Congress could grant existing conservation agencies formal authority to work with APHIS to develop procedures to protect native biodiversity.

The solution to the second problem—its outmoded approach—is for APHIS to abandon its "detection/interdiction" model. Instead, a "pathway approach" should be adopted. Under the current system, APHIS inspectors examine incoming shipments; if the inspectors find an insect or other organism, they attempt to identify the species and evaluate what kind of damage it could cause. If the inspector believes that the potential damage is sufficient, APHIS tries to halt the pest's entry by treating the shipment.

However, APHIS can't possibly inspect all imports; overall, it looks at only 2% of incoming shipments (US GAO 1997). Furthermore, even thorough inspections are likely to miss many of the hitchhiking pests, especially fungi (USDA APHIS and Forest Service 2000)—and many of the most damaging exotic pests have been fungal pathogens. Finally, no scientist can predict accurately whether an introduced species might threaten one or more species in any of the myriad plant communities in the United States (Wallner in press, Carroll 1998).

It is as if we tried to keep malarial mosquitoes out of our house not by putting screens over the windows, but by trying to catch each insect that flies in, deciding whether it is the kind of mosquito that transmits malaria, and then killing only that group of mosquitoes.

APHIS is slowly shifting its focus from individual species to the pathways by which invaders travel. Major pathways for forest pests include raw logs, other untreated wood products including crates and pallets, and imports of living plants (the nursery trade). APHIS's new approach is more likely to be successful—but only if the pathways are regulated stringently. Unfortunately, this is not assured.

Wood Imports

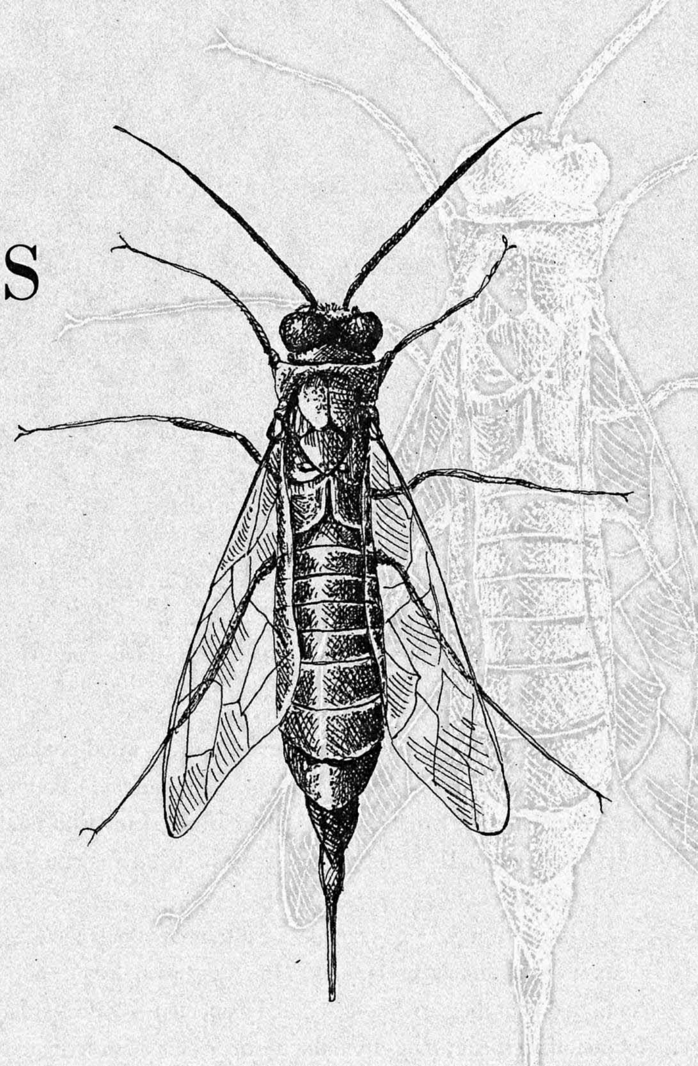
IN 1996, US imports of softwoods equaled about one-third of national softwood production (USDA APHIS Federal Register, June 11, 1999, Vol. 64 No. 112). Canada provided more than 70% of these imports in 1998 (International Trade Commission 2000). The following countries each supplied about 3% of US wood imports in recent years: Mexico, China, Chile, and Finland (World Trade Atlas 1997). Brazil and New Zealand supply smaller amounts. No one knows the quantity of wood packaging imported into the US each year. A random survey by APHIS found that 52% of maritime shipments and 9% of air shipments have wood packaging (USDA APHIS and Forest Service 2000).

REGULATING WOOD IMPORTS

US Department of Agriculture scientists urged regulation of wood imports for 20 years (Williams and La Fage 1979) before APHIS adopted such measures in 1995 (see 7 Code of Federal Regulations Part 319, subpart 40). Unfortunately, the 1995 regulations fall short of providing adequate protection in almost all respects. APHIS is strengthening the regulations in some, but not all, of these areas. (See "Gallery" for brief descriptions of some of the alien pests that threaten America's forests as a result of weak regulations.)

The 1995 regulations don't require treatment of wood packaging—crates, pallets, etc.—to render it inhospitable to deep-wood pests such as wood-boring beetles. Furthermore, shippers often violate the 1995 regulations' requirement that they strip the

Gallery of Potential INVADERS



CERTAIN KINDS OF PESTS cause damage that plants cannot repair or overcome easily (USDA APHIS and Forest Service 2000). These particularly harmful pests are:

1) wood-invading beetles and fungi found in the inner bark and sapwood of roots, root crowns, and main stems;

2) pests that can trigger defense reactions that shut down tissues: nematodes, true aphids, adelgids; and

3) any herbivore that transmits or acts as vector for plant pathogenic fungi, bacteria, phytoplasms, and viruses.

DEEP-WOOD PESTS

Asian longhorned beetle. The Asian longhorned beetle (*Anoplophora glabripennis*) was discovered in summer 1996 feeding on trees in two locations in New York City. Additional infestations were found in Chicago in the summer of 1998. A total of nine separate sites are now known. The beetle's larvae are transported to this country in wood packaging from China. USDA scientists believe the beetle had been in this country for perhaps 10 years before it was detected. The Asian longhorned beetle and relatives with which it can be confused had been detected by APHIS inspectors more than 28 times before 1996. The beetle has repeatedly entered North America (USDA APHIS and Forest Service 2000).

The Asian longhorned beetle feeds on many hardwood tree species, including maples (*Acer*), poplars (*Populus*), black locust (*Robinia pseudoacacia*), willow (*Salix*), and elm (*Ulmus*). The beetle threatens the 48 million acres of maple-beech-birch forests found from New England to the Midwest, with additional range in Canada. It also threatens the poplar and aspen forests of the Upper Midwest, Canada, the Rocky Mountains, and the Pacific Northwest. This invasive species has the potential to alter North American ecosystems across the continent by altering dominant species composition and age structure. It could also harm wetlands by damaging willows (USDA APHIS and Forest Service 2000).

It is not yet known whether destruction of trees in New York and Chicago at a cost of $25.1 million so far (USDA APHIS and Forest Service 2000) will be successful in eradicating the beetle.

Woodwasp-*Amylostereum* complex. The woodwasp *Sirex noctilio* and associated fungus *Amylostereum areolatum* is native to Eurasia and North Africa (USDA APHIS and Forest Service 2000); it has been introduced in New Zealand, Australia, and South America (USDA Forest Service 1992). The woodwasp threatens any pine in the lower 48 states, especially Monterey pine (*Pinus radiata*) and loblolly pine (*P. taeda*) (USDA APHIS and Forest Service 2000). The wasp can spread rapidly by natural means (USDA Forest Service 1992).

There is a high likelihood that *Sirex noctilio* larvae will be in wood packaging or other wood articles from both its native and introduced range; the insect is commonly intercepted. Once established, the wasp-fungus combination could change stand composition and might exacerbate populations of other destructive pests such as bark beetles or root rots. An efficient biocontrol agent has been identified (USDA APHIS and Forest Service 2000).

Pine wood nematodes. Several Asian species of pine wood nematode, including *Bursaphelenchus mucronatus* and *B. kolymensis*, threaten Jeffrey (*Pinus jeffreyi*) and ponderosa pines (*P. ponderosa*) and other hard pines (USDA Forest Service 1991). Ponderosa pine occupies nearly 5.7 million acres from British Columbia south into Mexico (Skilling et al. 1986).

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woodwasp *(Sirex noctilio)* by Adelaide Murphy Tyrol bark from wood (Dawson et al. 1997, USDA APHIS and Forest Service 2000). Approximately 90% of the potential forest pests detected by APHIS over the years have been found on wood packaging (Williams and La Fage 1979, Haack and Cavey 1997, USDA APHIS and Forest Service 2000), which is an especially dangerous vector because (USDA APHIS and Forest Service 2000):

- APHIS cannot predict which of millions of shipments contain wood packaging;
- even when the wood packaging is inspected, pests often escape detection;
- once in the country, the wood packaging and any pests hitchhiking on it go to the final destination—anywhere;
- storing and recycling of wood packaging provides additional opportunities for pests to escape.

APHIS requires Chinese exporters to treat wood packaging. The agency has begun developing both regulations and an international standard to require all trading partners to treat wood packaging. These broader measures might be adopted in 2002 or 2003.

The 1995 regulations compel heat treatment of some logs, but there are many exceptions. Most hardwood logs can be imported after they are fumigated and inspected—"safeguards" of doubtful efficacy. Logs from the Mexican states bordering the US can be imported without any phytosanitary precautions. APHIS has proposed improved procedures for the logs from the Mexican states (USDA APHIS 1999) but implementation has been delayed. As a result, forests throughout most of the contiguous 48 states (USDA Forest Service 1998) remain exposed to potentially damaging pests.

Lumber, railroad ties, and smaller wood articles coming from most of China and all of Siberia must be heat-treated prior to importation. However, lumber and railroad ties from other temperate regions and Mexico can be imported "raw" and treated 30 days later. The wood may be shipped anywhere during that interval; at least one load traveled from a port on the Atlantic to Oregon (Hilburn et al. 1998). The delay in treatment allows pests to escape—as happened in the 1930s, when Dutch elm disease spread from infested logs transported on open railroad cars. APHIS has proposed amendments to the rule for railroad ties, but the changes do not limit the distance they can be shipped.

Some Invasive Forest Pests Introduced on Imported Nursery Stock

chestnut blight *Cryphonectria parasitica*
white pine blister rust *Cronartium ribicola*
Port-Orford-cedar root rot *Phytophthora lateralis*
balsam wooly adelgid *Adelges piceae*
larch casebearer *Coleophora laricella*
beech scale *Cryptococcus fagisuga*
dogwood anthracnose *Discula destructiva*
pine pitch canker in California
Fusarium subglutinans f. sp. pini

IMPORTED PLANTS

The United States imports more than 600 million living plants annually (Sponaugle, pers. comm.). These plants pose a double danger: they might be invasive, and they can be "a living, growing reservoir for plant pests" (National Plant Board 1999). Indeed, since 1900, numerous disastrous forest pests have been imported on nursery stock (see box at left). This year, for example, scientists discovered that the fungus causing Sudden Oak Death in California is the same as the one harming rhododendrons in Europe. Some scientists believe that the fungus might have reached America on imported rhododendrons (Stone pers. comm.). Congress has ordered APHIS to study better ways to prevent introduction of plant pathogens traveling on plants or plant products. The report is due in 2002. In the meantime, regulations governing imports of living plants are relatively lax (National Plant Board 1999) and—despite the danger—APHIS is relaxing them further.*

INTERNATIONAL TRADE AND TRADE POLICY

As Chris Bright of the WorldWatch Institute aptly says, global trade "leaks" invasive species. In their enthusiasm to promote trade, political leaders adopt international trade policies that impede effective phytosanitary safeguards.

The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement)—which is enforced by the World Trade Organization (see www.wto.org)—and the related International Plant Protection Convention (IPPC), an arm of the United Nations Food and Agriculture Organization, further hamstring APHIS's limited efforts to protect native species. These two agreements restrict APHIS's authority to exclude

* A 1999 decision on azaleas (Federal Register, November 30, 1999, Vol. 64, No. 229) exposes more than 150 native species of blueberries, cranberries, rhododendrons, and azaleas, and *Arctostaphylos* (i.e., manzanita) to new pests. Seven of these taxa are listed by the US Fish and Wildlife Service as endangered or threatened.

Gallery *[continued]*

DAMAGING PATHOGENS AND THEIR BEETLE VECTORS

Spruce bark beetle. Found across Europe and Asia, *Ips typographus* is a spruce beetle that has caused considerable damage both in its native range and in Japan, where it has been introduced (USDA APHIS and Forest Service 2000). This beetle is one of the most commonly detected pests traveling on wood packaging, both before (Haack and Cavey 1997) and after adoption of the 1995 regulations requiring stripping of bark from wood packaging (USDA APHIS and Forest Service 2000). Several times, the beetle has been found in ports after escaping detection by inspectors (USDA APHIS and Forest Service 2000). Eradication programs have apparently worked each time. If this pest were to become established, it could affect spruce forests across the continent (USDA Forest Service 1991). In the Pacific Northwest and Alaska it could threaten the ecological position of Sitka (*Picae sitchensis*) and Engelmann spruces (*P. engelmannii*) (USDA APHIS and Forest Service 2000).

Ips typographus carries various fungi, some of which (e.g., *Ceratocystis polonica*) are extremely pathogenic. If introduced beetles were accompanied by a virulent fungus, and native beetles also spread the fungus, "it could...be as disastrous to North American spruce as the Dutch elm disease was to elms" (USDA Forest Service 1991).

Stain and wilt fungi. Stains and wilts in the *Ophiostoma* and *Ceratocystis* genera constitute a very large group with an overall worldwide distribution. They attack numerous conifers and hardwoods. There is an extremely high likelihood that the fungi and associated vectors will be present on insufficiently treated wood articles; they cannot be detected by regulatory inspection systems. While most *Ophiostoma* species are apparently weak pathogens, a few—such as those that cause Dutch elm disease—are devastating. *Ophiostoma* fungi spread easily. While the *Ceratocystis* fungi spread less easily, all are virulent pathogens (USDA APHIS and Forest Service 2000).

Mediterranean pine engraver beetle. The Mediterranean pine engraver beetle (*Orthotomicus erosus*) is found on pines around the Mediterranean region and in China; it has been introduced into several countries, including Britain and Chile. The engraver beetle transmits several fungi, including one that is pathogenic on Monterey pine. (USDA APHIS and Forest Service 2000).

Pine pitch canker. The pathogenic fungus pine pitch canker (*Fusarium subglutinans f. sp. pini*) is found in the southeastern US, Mexico, and Haiti. It has been introduced in some parts of California, where it is damaging the narrowly endemic Monterey and Torrey pines. The fungus is transported by insects. Pitch canker might cause "devastating" damage to pines if it reaches and flourishes in the Sierra Nevada or Cascades (USDA Forest Service 1998).

European oak bark beetle. The European oak bark beetle (*Scolytus intricatus*) is found around the Mediterranean and across Europe. Adults feed on shoots of stressed oaks, birch, chestnuts, beech, poplars, willows, and elms. The oak bark beetle might be an efficient vector of the North American oak wilt fungus *Ceratocystis fagacearum*. In the US, oaks are found in all of the lower 48 states. The European oak bark beetle has been intercepted several times by APHIS, including on lumber and living plants as well as wood packaging.

PESTS THAT STIMULATE "OVERREACTIONS" THAT KILL THE TREE

A number of adelgids in the *Pineus* and *Adelges* genera that attack both pines and firs are found in Mexico but not the United States. They could cause "high" environmental damage if introduced (USDA Forest Service 1998). (Already, two exotic Eurasian adelgids have decimated Fraser fir and threaten eastern hemlocks.)

DEFOLIATORS

Asian gypsy moth. The Asian strain of the gypsy moth (which belongs to the same species—*Lymantria dispar*—as the European insect) feeds upon more than 500 species of plants (USDA APHIS and Forest Service 2000), including many conifers and hardwood species. The Asian gypsy moth is likely to kill hardwood tree species in stressed forests. It might be equally destructive in coniferous forests. Unlike the European gypsy moth, the female Asian moth can disperse by flight (USDA Forest Service 1991).

The Asian gypsy moth is now also found in Europe because of human transport of infested material. It has reached North America several times as egg masses on ships. Each time, emergency control programs have apparently succeeded in eradicating the moth. New introductions of Asian gypsy moth appear inevitable; infestations would probably be extremely difficult to control.

Nun moth. The nun moth (*Lymantria monacha*) is found from Portugal to Japan. In Eurasia, it can kill spruce, pine, and deciduous trees (USDA APHIS and Forest Service 2000). If introduced, it is likely to attack all western conifers except pines. Tree mortality "is likely to be high" (USDA Forest Service

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"new" pests and weeds not yet introduced to the United States. In short, they threaten to enshrine the lowest protective standard in any US environmental law as a ceiling; no phytosanitary rule that imposed more stringent protections would be allowed.

If the US adopts regulations for wood packaging that are stronger than the international standard—as conservationists should hope it will—exporting countries could challenge the rules. Such a challenge could test whether the SPS Agreement will allow countries to apply "pathway" controls to protect themselves from bioinvasion. Already, APHIS finds it difficult to "balance" its conflicting obligations under the Montreal Protocol on Ozone-Depleting Chemicals and the SPS Agreement (see box below).

THE INVASIVE SPECIES EXECUTIVE ORDER AND MANAGEMENT PLAN

In 1999, responding to an appeal from more than 500 scientists, President Clinton issued Executive Order 13112 on invasive species (www.invasivespecies.gov). The Executive Order obliged government agencies to take certain actions, established the National Invasive Species Council, and invited "stakeholders" to help develop a detailed plan. The plan was finalized in January 2001, just before George W. Bush took office. Unfortunately, the transition to the new administration will mean months of delay in implementation of the plan. Worse, the Bush Administration is likely to be chary of calls for stronger regulations.

Regardless of the Bush Administration's response to this plan, governmental actions and the plan itself fall short of the need. For example, despite funding increases for some agencies, the Forest Service's research program on alien species is practically defunct. No agency has yet carried out its obligation under the Executive Order to halt actions that are likely to promote the introduction or spread of invasive species. Such actions include deliberate introduction of plants and stocking of exotic fish species; development of trade policies; and resource extraction programs that disturb soils, vegetation canopies, and water regimes and thus open opportunities for invaders.

APHIS continues to shun its obligations to prevent introduction of forest pests and weeds. APHIS and the US Trade Representative continue setting international trade rules without adequate input from agencies concerned about invaders of natural areas.

To successfully protect America's forests from biological invaders, the US must confront such questions as: How should the US balance international trade against "pest exclusion" priorities and policies? How can government increase its workload and improve its effectiveness in the face of pressures to cut staff and budgets and minimize regulation? If APHIS will not accept responsibility for pests and weeds that damage natural ecosystems, which agency will? In addition, the Congress must be energized to act decisively to address the grave threats to American ecosystems from bioinvasion; this will require sustained, vigorous advocacy from citizens and scientists. Clearly, conservationists must play a more aggressive role in building pressure for substantive action to counter these threats. ☾

Methyl Bromide

POUND FOR POUND, methyl bromide is 50 times more powerful than chlorofluorocarbons (CFCs) in destroying the stratospheric ozone layer which protects Earth from damaging ultraviolet rays. Although the US is allowed, under both the Montreal Protocol on Ozone-Depleting Chemicals and 1998 amendments to the Clean Air Act, to continue using methyl bromide for phytosanitary purposes, the US has pledged to minimize such use. Furthermore, other, more effective measures can be used to kill pests in wood. (Methyl bromide does not kill pests deep inside wood or piles of wood chips.) Nevertheless, APHIS has proposed to expand use of methyl bromide fumigation for several types of wood imports: wood packaging from China (in response to the Asian longhorned beetle emergency), logs and lumber from Mexico, and railroad ties.

While APHIS argues that these uses of methyl bromide fumigation constitute a small increase with no significant impact on the "ozone hole," that would clearly not be true if it adopted regulations requiring all countries to treat wood packaging and allowed methyl bromide fumigation as one of the treatments.

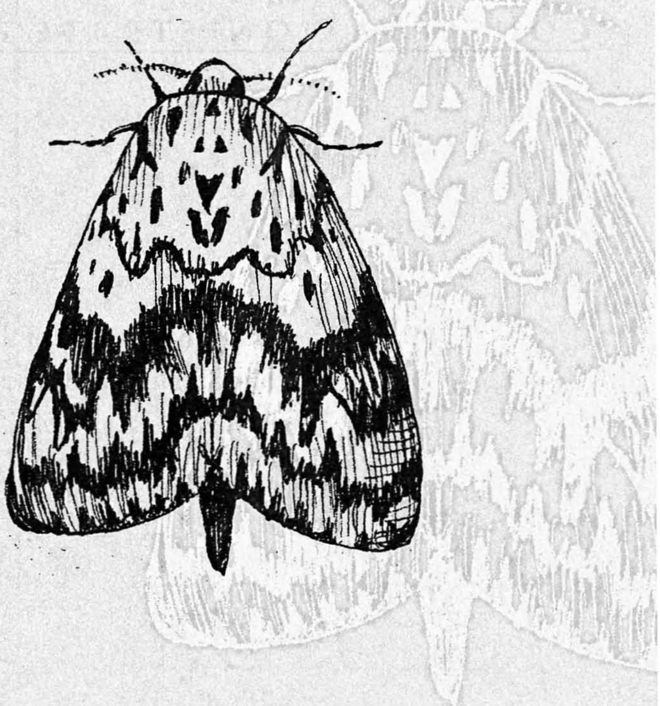
Faith Campbell *has worked as a conservation advocate since 1976, focusing on protection of rare plants and fending off invasive exotic species. She holds a PhD in politics from Princeton University and heads the Invasive Species Program at the American Lands Alliance. To receive more information about American Lands' campaign to protect our forests, contact Dr. Campbell at phytodoer@aol.com or 202-547-9120.*

Gallery *[continued]*

1991). Nun moth attacks could increase the damage caused by other pests, especially bark beetles (USDA APHIS and Forest Service 2000). The potential area affected includes 172 million acres in the US and additional acreage in Canada (USDA Forest Service 1991).

La grilleta. The grasshopper la grilleta (*Pteropylla beltrani*) is found in the Mexican states bordering the US. It defoliates maples, elms, dogwood, oaks, and pines. Its environmental impact was predicted to be moderate (USDA Forest Service 1998) although most of these tree genera are already stressed by exotic pests.

Pine flat bug. The pine flat bug (*Aradus cinnamomeus*) is found in temperate regions of the Old World. In addition to pines, it feeds on living tissue of young birch, juniper, larch, spruce, and willows. Potential hosts in the US include lodgepole, Jeffrey, ponderosa, sugar, western white, radiata, red, digger, eastern white, Scotch, and Virginia pines (USDA APHIS and Forest Service 2000).



TROPICAL PATHOGENS

Brown root rot (*Phellinus noxius*) and pink disease (*Erythricium salmonicolor*) are fungi found on a wide range of tropical woody perennials. If introduced to Hawaii or Puerto Rico, they could cause serious damage to their remnant native forests (USDA APHIS and Forest Service 2000). —**FTC**

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nun moth *(Lymantria monacha)* by Adelaide Murphy Tyrol

Question to the Director of the Forest Biotechnology Group at North Carolina State University: "*When you imagine the best outcomes from your research, say 10 or 50 years out from now, what do you see?*"

Answer: "*Well, we're not sure what trees will look like.*"[1]

On the western slopes of the Sierra Nevada in California, as three thousand generations of forest floor ferns and ephemerals have popped up and faded, as a thousand generations of warblers have taken residence, as a hundred generations of humans have transformed from spear hunters to cell phone users—single sequoia trees have persisted. And these old trees are upstarts, merely the latest members of a North American tree family whose ancestors stood 200 million years ago, riding and retreating in front of waves of glacial ice.

Leave the sequoias and head north to Oregon. Here you will find some much more recent stands of trees. In straight rows, young Roundup Ready® cottonwoods are being tested at Oregon State University's Tree Genetic Engineering Research Cooperative. These trees have been genetically altered to resist repeated sprayings of Monsanto Corporation's proprietary brand of glyphosate herbicide, while pesky understory plants are killed. Combined with a new gene for fast growth, trees like these could be heading to the paper mill on a six-year rotation.

Today, there are genetically engineered cottonwoods that grow ten feet per year.[2] In a revolution that seems to be reaching the public ear like a whisper, the DNA and life strategies of dozens of tree species (sequoia is not yet on the list) are being reshaped through genetic engineering (GE). At greenhouses and test plots in Oregon, North Carolina, Washington, and other states (see Table 1), as well as numerous countries from Argentina to New Zealand and China to Canada, wild tree species are being drawn under the yoke of domestication and transformed into a short-lived, fast-growing crop.

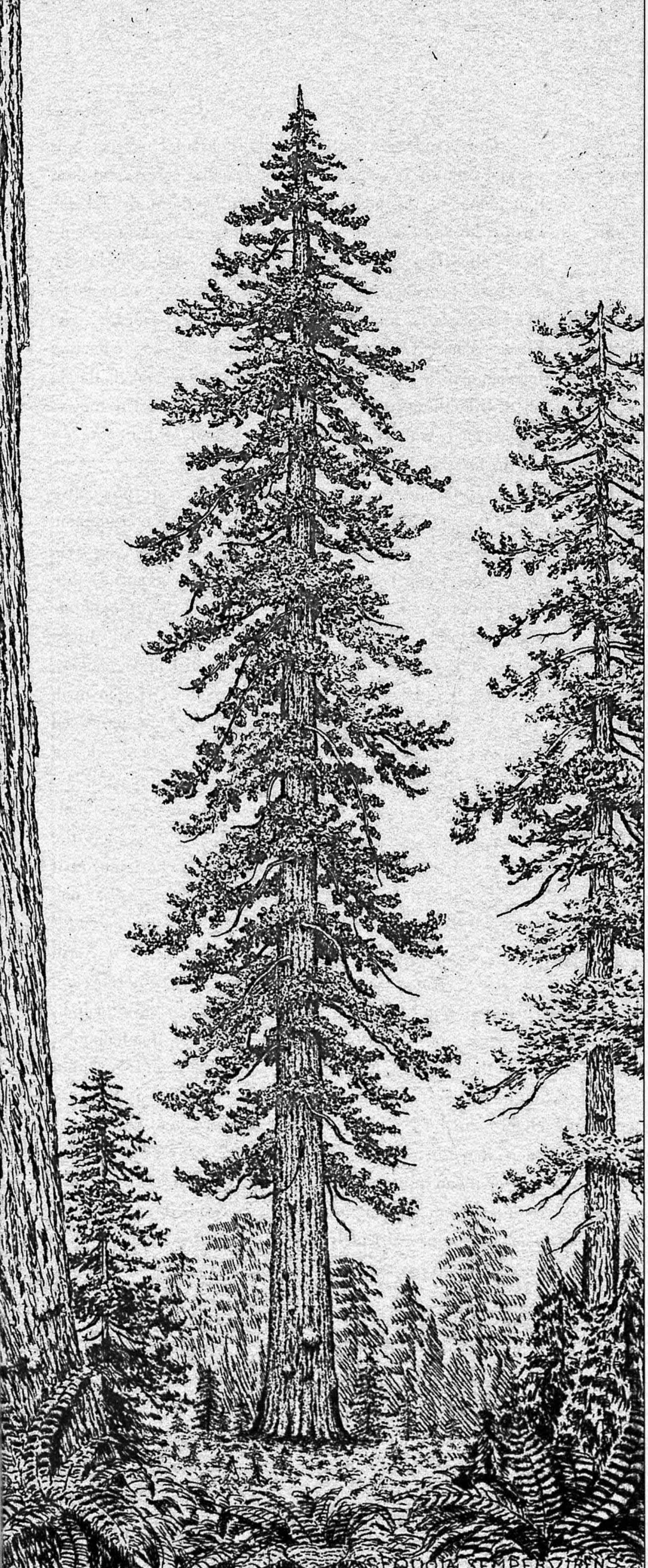
SILENT WOODS?

These "super trees" are likely to have a superficial resemblance to the trees of memory, but they may be sterile, never producing flowers, pollen, nectar, or seeds; they may be wobbly and prone to snap in the wind with their lignin removed;[3] they may be broadly toxic, pumping foreign pesticides out of their own cells; they may be viable for only three years. Birds, butterflies, and many other forest dwellers may find little to eat, or call home—or may even be poisoned—in their strange branches.

Imagining these silent woods forces the question: what is the essence—genetic, ecological, economic, mythic—of a tree? Throwing trees into the same category as soybeans will be a hard cultural pill to swallow. It is not merely for the poets to wonder whether the definition of "long-standing" is under assault. While there is nothing simple about the growing list of choices presented by genetic engineering, the current headlong development of industrial super trees may present a threat to wild trees and the ecological health of native forests.

So, why are these trees being developed? Current efforts to splice and reconfigure tree genes, via recombinant DNA technologies, are mostly in aid of the pulp and paper industries and their drive for fast-growing, profitable tree plantations. Each year, 400 billion dollars are exchanged in the global wood products industry. Worldwide demand for paper fiber and other forest products is expected to grow 50% by 2020.[4] Trees are big money. It should come as no surprise that an economic scramble is underway to develop tree modification techniques in first-world laboratories to use in the cheap and largely unregulated global South.

sequoia by Claus Sievert



LOSING the FOREST for the (Genetically Engineered) TREES

by Joshua Brown

To better envision one possible future for trees, visit one of the thousands of fields across the United States planted to genetically engineered corn. There, rows of herbicide-tolerant plants, waiting for the combine, use the genetic instructions from an introduced strip of bacterial DNA to self-manufacture *Bacillus thuringiensis* (Bt) pesticides. Genetically engineered tree plantations will be much the same. Bt trees are currently in development and, in keeping with the logic of industrial agriculture, sights are set on manufacturing poplars, larch, Douglas-fir, eucalyptus, willow, white pine, and many other woody species that will be as easy to grow, harvest, and process as corn.

DOWN ON THE PLANTATION

Of course, monoculture tree plantations are no more a forest than a cornfield is a prairie, and genetic engineers are willing to say so. At Oregon State, scientists have identified their key goal as increasing "productivity of short-rotation tree plantations to enable the growing world demands for wood products to be met while large areas of natural forests are reserved from intensive harvesting."[5] But are genetically engineered tree plantations a good swap, or at least the only option, for protecting forests?

If the past provides any lessons, the answer is no. The problems of tree plantations are legion and genetic engineering seems likely to add to these problems, accelerating the destruction of natural forests. As Brazil's 10 million acres of commercial eucalyptus and Indonesia's millions of acres of palm oil plantations make clear, when the profitability of industrial forestry practices increases, native forests are removed, traditional land-use practices are swept aside, and forest reserves are eyed hungrily.[6] There is little precedent to believe that greater agricultural intensification—in this case of tree crops—will be a boon to native biodiversity. Perhaps a new era is coming where effective land-use control policies can be developed to siphon pressures on native forests onto GE tree plantations. A more likely outcome is that "tree plantations may finance and justify clearing of even more native forest," as policy analyst Faith Campbell has argued, "on the heels of centuries of such clearing spurred by other forms of agriculture."[7]

There is reason to doubt that the very corporations and universities that are investing heavily in a new tool for plantation forestry—and that are built upon mechanical models of short-term resource extraction—will turn around to form a bulwark of techniques or policy to protect native forests and their inhabitants. It's the industrial foxes guarding the wild chickens. For example, Oregon State's Tree Genetic Engineering Research Cooperative proudly announces that its "industrial members" provide direct funding and collaborate on projects. These members include: Alberta Pacific, Boise Cascade, Electric Power Research Institute, Fort James, Georgia Pacific, International Paper, MacMillan Bloedel, Monsanto, Potlatch, Shell, Union Camp, Westvaco, and Weyerhaeuser. These companies, many with awful conservation records, will be protecting the forests?

Also, the assertion that plantations are more productive than a forest—either of wood products for human consumption or of broader ecosystem benefits—is not true in the long view. In an ecosystem, mutual interdependence of organisms produces diversity and true biological efficiency. The waste of one is the lunch of another. The numerous tree species and various layers of a natural forest produce a remarkable economy. Ecologist Bernd Heinrich puts holes in the plantation myth when he asks, "how can an ecosystem *not* produce more wood and potentially more valuable wood in the *long term*—than a uniform monolayer imposed on a nonuniform environment?"[8]

Today, there are no commercial plantations of genetically engineered trees in the US or Canada, although the Canadian Forest Service identifies "deployment strategies for genetically improved trees" as one of its top priorities.[9] Nevertheless, estimates for the commercial release of GE trees in North America range from five to ten or more years. This gives conservationists the opportunity to bring to light the major problems of ongoing development of this technology. At the top of the list are "leaks" of foreign transgenes into natural ecosystems and the specter of GE trees as the next chapter in the troubling tale of exotic species. Engineered genes may threaten the vitality of America's forests like acid rain or clearcutting. Without greater caution and scientific inquiry, genetically engineered trees may one day be counted among the ranks of Dutch elm disease, gypsy moths, purple loosestrife, and kudzu.

Genetically engineered trees may one day be counted among the ranks of Dutch elm disease, gypsy moths, purple loosestrife, and kudzu.

GENETIC POLLUTION

It was a windy, hot, spring day. I was walking in a mixed stand of white and red pine trees along a dirt road on the coast of Maine, watching great plumes and sheets of yellow pine pollen move through the air. It settled on the road in pale, swirling lines and curves. It rose on updrafts in sudden surges and mingled with the sunshine. I imagined it passing over the tree canopies in clouds, lifting into the faster-moving air above and rushing away toward the North Woods.

That tree pollen can travel many miles is a problem. Not for trees of course, but for genetic engineers working to create self-contained plantations where industrial species are not supposed to cross-pollinate with native forests. There are troubling precedents. *AgBiotech Reporter*, a biotechnology industry newsletter, notes that in the case of canola, "pollen mediated outcrossing can easily carry…[genetically engineered] traits to other…plants."[10] Tree engineers are worried enough about this issue that they have proposed to make GE trees sterile (and, perhaps more to the point, sterile trees also grow up to 30% faster than those putting energy into reproduction). As philosopher Jack Turner has noted, this "solution" is the *reductio ad absurdum* of a living forest.[11] If this technique proves to be reliable (and how long should the trial period be in long-lived species?) it may protect native ecosystems from disruptive genetic outcrossing, but the standard of reliability needs to be very high. If even a low percentage of ostensibly sterile trees prove to be fertile, then alien transgenes can mix with the native gene pool as fast as the wind.[12]

Likewise, there is an inherent problem with Bt trees (or Bt-producing anything, for that matter). If pesticide-producing trees are kept together in large plantations, separated from forests, evolutionary theory suggests that pests preying on the engineered trees will quickly develop resistance to Bt. Pesticides are a strong agent of selection. On the other hand, if GE trees are planted in a matrix of natural forest (as a number of researchers are proposing[13]), then the opportunities for genetic leaks become many.

Should genetically manufactured traits move out in large number into the gene pool of forest ecosystems, nobody knows what will happen. Scientists do know that the Bt endotoxin is "effective against Lepidoptera, Coleoptera, Diptera, and nematodes."[14] In other words, it is poisonous to a broad group of insect families that have worldwide distribution. Researchers have shown that the introduction of the Bt gene is possible in transgenic poplar, spruce, and larch, and also that it confers tolerance to target insects for these trees. How the residents, relatives, and consumers of these trees will fare is anyone's guess.

If, as articles in *Nature* and other sources report,[15] Bt from genetically engineered corn is threatening

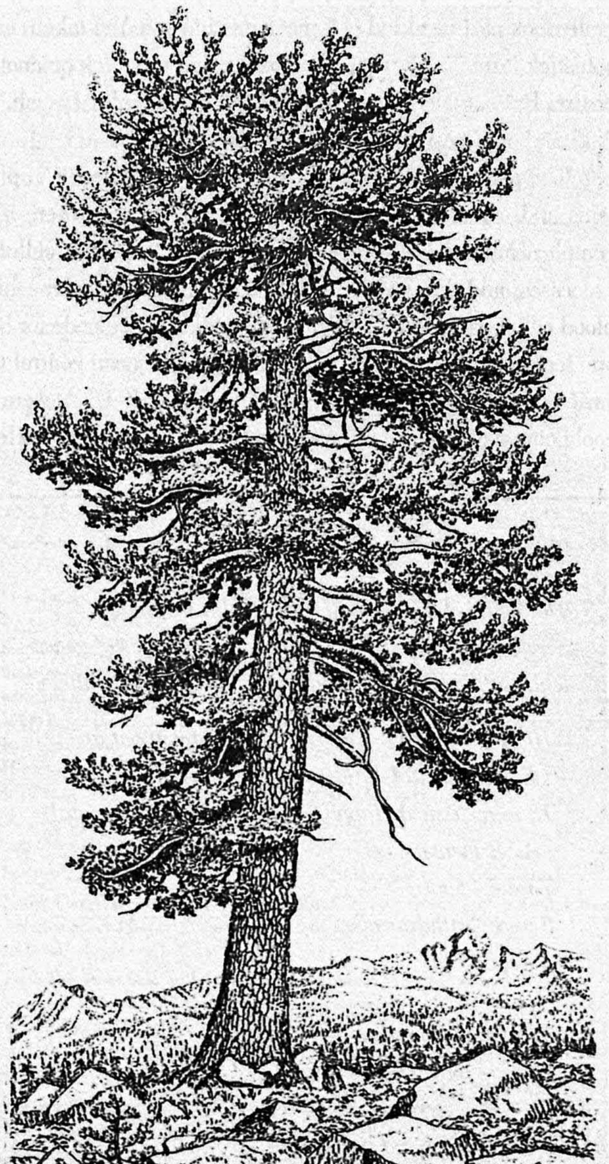


TABLE 1

Approved US Locations for Test Plots of Genetically Engineered Trees (each may include multiple plots)

Oregon	*36*
South Carolina	*24*
California	*21*
Washington	*16*
New York	*12*
Georgia	*5*
West Virginia	*4*
Virginia	*4*
Texas	*4*
Wisconsin	*3*
Iowa	*2*
Michigan	*2*
Minnesota	*2*
Florida	*1*
Kentucky	*1*
North Carolina	*1*
Mississippi	*1*
TOTAL	139

source: USDA Animal and Plant Health Inspection Service as reported by the Native Forest Network (Burlington, VT), www.nativeforest.org

western white pine by Claus Sievert

monarch butterflies, what might it do to other insects, soil microorganisms, and on up the food chain? Nobody knows. Nevertheless, there is "evidence of bioaccumulation of Bt," reports American Lands Alliance, although "there is disagreement among the scientists about whether there is much risk to soil organisms."[16] If soil organisms start to blink out in large numbers, the Endangered Species Act may not be much help.

Some ecologists are concerned that super trees will bully out native trees, after their DNA has been changed to give them competitive advantages, such as faster growth rate, cold tolerance, or pest resistance. The capacity of these exotic trees, should they get out of their fenced plantations and university test plots, to march quickly through the wider world, away from the eyes of regulators and the teeth of chainsaws, upsetting ecosystems as they go, is referred to as "weediness." Trees are quite difficult to remove with a hoe.

Without a more informed stance by federal regulators, based on (as yet incomplete) ecological research, here comes a new category of exotic species. But this one will be of our own making, with the potential to either "swamp" the gene pool of closely related native tree species or simply replace them.

GE IS NOT TRADITIONAL BREEDING

Although gene splicing—inserting a gene that codes for a desired trait from one organism into another organism—may appear to be a harmless improvement on the long-standing practice of plant breeding and selection, there are radical differences. In all natural systems there is some gene flow between subpopulations, but the rate is slow and the flow is usually limited to a single species. Traditional agricultural breeding accentuates and accelerates this process, but does not overcome limitations engendered by millennia of evolution through natural selection.

In genetic engineering, gene splices across different phyla and kingdoms of organisms are possible. Trees have been injected with genes from flounder. The long-term changes and results of this genetic mixing are, at best, poorly understood. Rebecca Goldburg, a member of the National Academy of Sciences committee considering genetically engineered crops, notes, "Genetic engineers still can't control very well where a gene is inserted or how many copies are inserted....And if you plant a new gene in the middle of some existing genetic material, you can screw up the function or change the way the gene works."[17] Despite the heroic language of the Human Genome Project, there is a large measure of murkiness about what happens to organisms when their genes are altered by current methods of gene splicing such as "biolistic" bombardment and bacterial carriers. In particular, the current level of understanding of tree genetics in relationship to whole forest ecosystem dynamics is low; it is breathtakingly low in comparison to the ease with which the federal agency (the Department of Agriculture's Animal and Plant Health Inspection Service) in charge of regulating release of GE trees is granting permits for field trials (see Table 2).[18]

If inserting a new gene might create problems, then so, too, may removing one. As Sharon Friedman, a US Forest Service geneticist, mused on the phone: "Are we doing something—by taking [a gene] out—that changes some other aspect of the whole system? The way that people [who do such research] generally look at it is a kind of a mechanistic view. You take it out, you stick it in; it's like a car. You lose a tire, you stick on another tire. But actually the whole genome is a complex system."[19] And a whole forest is orders of magnitude more so.

The genetic code does not simply tap out a series of proteins and, voila!, a baby or tree is formed. Instead, there is a complex, multicausal interaction between DNA, other cellular processes, and the environment. We don't produce extra white blood cells until we need them. Nor does one gene code for but one feature. Instead, genes are pleiotropic: they can control for various features depending on the situation. If DNA were a cookbook, page ten might provide instructions to make omelets

TABLE 2

The USDA Animal and Plant Health Inspection Service, as of May 30, 2001, had 140 records of genetically engineered tree field trial applications. Of these,

108 were "acknowledged" (approved without an Environmental Assessment)
18 were "issued" (approved with an Environmental Assessment)
7 were "denied"
5 were "withdrawn"
2 were "void"

34 were for herbicide tolerance
28 were for insect resistance
6 were for sterility
1 was for reduced lignin
(There were additional applications for other traits not included here.)

source: see Table 1

in the morning and for the afternoon birthday party show you how to make chocolate cake. If you decide to rip the page out because you don't have time to bother with cake you'll end up with no breakfast either.

In a similar way, tree scientists refer to "unexpected pleiotropic effects." These are the changes to trees that may not show up for hundreds of years—when there is climate change, say, or a new pathogen—and the tree is looking for a way to cope. These unexpected effects are more likely to be problematic in transgenic trees since the new genes have not evolved with the rest of the genome in that organism.

The potential impact of genetically engineered trees—like the whole welter of biotechnology—is unclear. This technology may help to sop up greenhouse gases;[20] it may allow reclamation of degraded and salty land (indeed the Chinese are already growing large-scale GE tree plantations on degraded agricultural land[21]); it may even be able to, Lazarus-like, bring back forest ghosts, such as the American chestnut. But it is unknown how these trees will fare in the long run—the true long run of numerous tree generations and climate changes—nor is it clear what impacts they will have on ecosystem dynamics.

Aldo Leopold has written, "...the land mechanism is too complex to be understood, and probably always will be."[22] Until he is proven wrong, the precautionary principle should guide policy on GE trees. Yes, it is a risky, changing world and we can't just stay under the covers. But the precautionary principle doesn't mean rejecting available scientific knowledge or relative risk assessments. Instead, it calls for a reversal of the burden of proof on ecosystem tinkering, in light of our partial, fragmentary understanding. Rather than the current mode where "defenders of habitats and ecosystems [have] to prove a high likelihood of damage or extirpation before an activity will be halted,"[23] the precautionary principle calls for reasonable proof that long-lasting human alterations of species and habitats will not cause undo harm. The current state of research in genetically engineered trees is a far distance from reaching this standard. Until a broad, scientific consensus has been reached, the conservative position is to support a moratorium on commercial release of genetically engineered trees.

Leopold also encouraged thinking like a mountain; perhaps the explosion of arboreal genetic engineering calls for, at least, thinking like a sequoia. ☾

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NOTES

1. Ron Sederoff, Director, Forest Biotechnology Group, North Carolina State University, telephone interview, February 1, 2001.
2. Jack Turner, "Modern Forests," *Made Not Born* (San Francisco: Sierra Club Books, 2000), 75.
3. Sterility is, like the containment dome of a nuclear reactor, intended to prevent these trees (or their genes) from spreading into Nature, but the risk of this feature not proving stable over the long life a tree must be weighed. Lignin reduction, as an aid to paper production, may also mean these trees are selected against in a natural environment since trees that fall over compete poorly against wild stock. Assuming, of course, that this wobbly feature does not spread to wild trees.
4. Rick Weiss, "Genetically Modified Trees: A Blessing or Danger for the World?" *Washington Post* News Service, August 4, 2000, posted at http://forests.org/archive/general/genmodt2.htm.
5. See the Oregon State University web site: http://www.fsl.orst.edu/tgerc/intro.htm.
6. Native Forest Network, "Genetically Modified Trees: A Global Threat, Eastern North America Special Report," March 2000 (Burlington, VT), 2. See www.nativeforest.org.
7. Faith Thompson Campbell, "Genetically Engineered Trees: Questions Without Answers" (Washington DC: American Lands Alliance), July 2000, ii. See www.americanlands.org.
8. Bernd Heinrich, *The Trees in My Forest* (New York: Cliff Street Books, Harper Collins, 1997), 226.
9. For more on the Canadian Forest Service's plans for genetically engineered trees see http://dendrome.ucdavis.edu/Newsletter/atlantic.html.
10. *AgBiotech Reporter*, July 1999, 2.
11. Turner, 77.
12. Some ecologists are also concerned about what would happen should this sterility feature itself escape into Nature; it could be bad for wild plants that also become sterile or less fit. Of course natural selection would act swiftly against plants with reduced fertility or fitness, but disruptions to natural systems might still occur.
13. For example, Armand Seguin, Gilles LaPointe, and Pierre J. Charest assert that "strategies...to use mosaics of transgenic and non-transformed trees are more environmentally sound," in "Transgenic Trees," *Forest Products Biotechnology* (London: Taylor and Francis, 1998), 287–304.
14. Seguin, 287–304.
15. John E. Losey, Linda S. Raynor, and Maureen E. Carter, "Transgenic pollen harms monarch larvae," 1999, *Nature*, 399(6733):214; Gary Paul Nabhan, "The killing fields: Monarchs and transgenic corn," *Wild Earth*, winter 1999/2000, 49–52.
16. Campbell, 19.
17. As quoted in "Seeds of Change," *Consumer Reports*, Sept. 1999, 42.
18. For more on the GE regulatory structure, its loopholes, and the roles of the Animal and Plant Health Inspection Service and the Environmental Protection Agency, see Campbell's report cited above.
19. Sharon Friedman, US Forest Service, telephone interview, March 31, 2001. Friedman, a geneticist and Chair of the Forest Science and Technology Board at the Society of American Foresters, made an additional unsettling observation, "actually the genome of a single organism may be, in reality, a system as complex as an ecosystem. It's just that the people who generally study them do not conceive of them that way."
20. Even this apparent benefit may be bogus; Anne Petermann, at the Native Forest Network (Burlington, VT), argued that climate-protecting trees are unlikely to be successful and would probably be a dodge for emissions regulations and treaties, telephone interview, June 7, 2001.
21. *AgBiotech Reporter*, "GM Poplars Thrive in Saline Soil," January 2001, 23.
22. Aldo Leopold, (1944) "Conservation: In Whole or In Part?" *The River of the Mother of God*, Susan Flader and J. Baird Callicott, eds. (Madison: University of Wisconsin Press, 1991), 310.
23. Walter Kuhlmann, "Can the Precautionary Principle Protect us from Imperial Ecology?" *Wild Earth*, fall 1997, 67–71.

Farming with the *Wild*

Reconnecting Food Systems with Ecosystems

by Paula MacKay

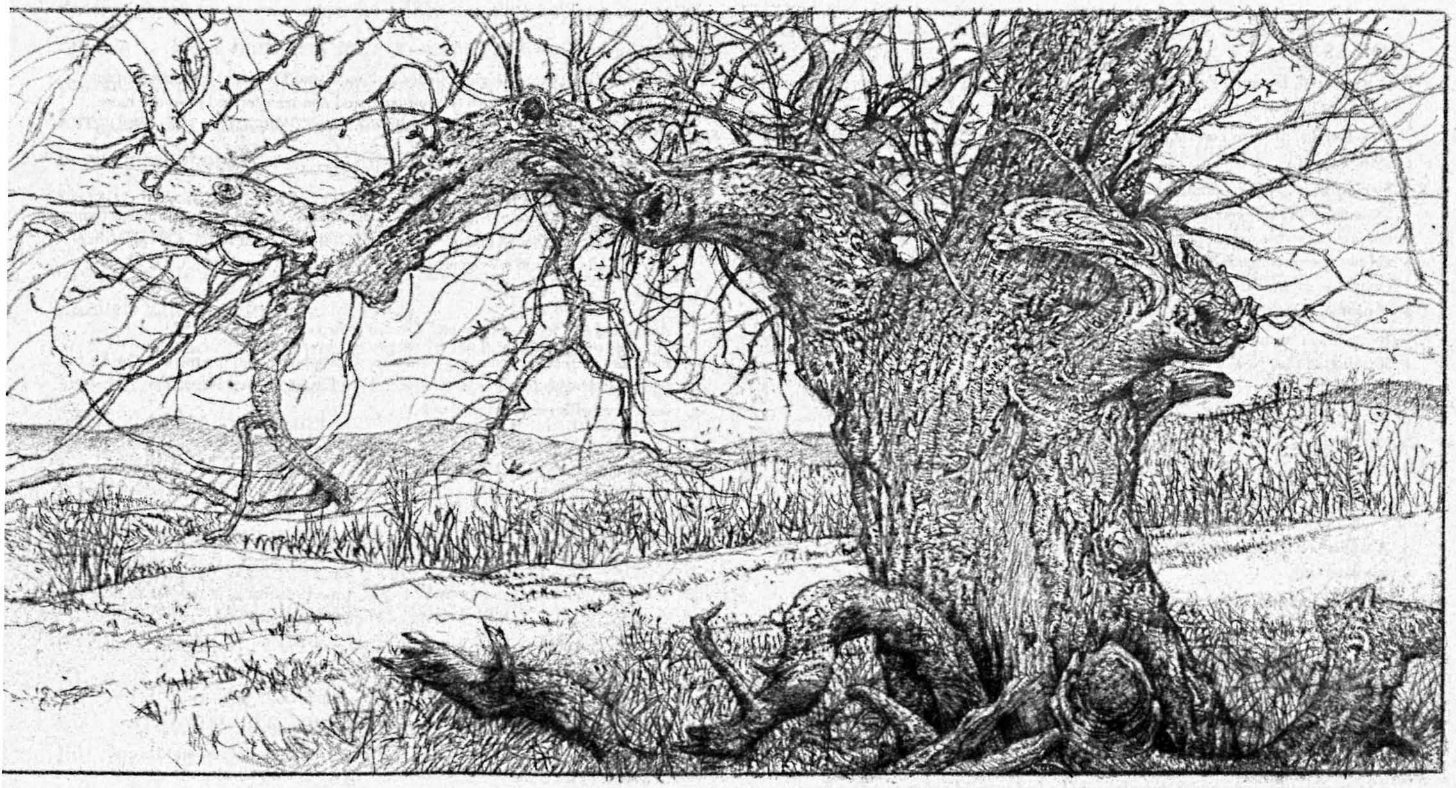


illustration by Davis Te Selle

Despite a shared love for the land and a common commitment to protecting it from development, wildlands advocates and the sustainable farming community tend to overlook one another as natural and necessary allies. Indeed, conservationists are prone to repudiate agriculture as a leading cause of the biodiversity crisis, and to blithely disregard and undervalue the sources of their food and fiber. Meanwhile, farmers too often view conservation as yet another threat to their livelihood. Ideologies aside, however, self-preservation in the context of ecological preservation demands that we embrace both wildlands and stewardship farming as essential elements to protecting the larger landscape. Thus, the Wild Farm Alliance was founded in 2000 as a network of farmers, conservationists, and consumers who promote agriculture that helps protect and restore wild Nature.

THE MANDATE FOR CHANGE

Agriculture has been identified as the primary cause of habitat loss—the principal foe to biodiversity (Wilcove et al. 1998). Habitat destruction and fragmentation, the displacement of native species and the introduction of exotic species, pollution of terrestrial and aquatic ecosystems, soil erosion, the persecution of predators, the release of genetically modified organisms, and the overexploitation of nonrenewable resources for food production and distribution are among the many ecologically devastating consequences of modern agricultural practices. These impacts are best understood from the perspective of agriculture's dominance on the landscape. In the United States excluding Alaska, approximately half of the private land base is managed as cropland, pastureland, or rangeland (Heard et al. 2000). Coupled with grazing on public lands, a total of 65 to 75% of the US land area (in the Lower 48) is directly affected by agriculture (Wuerthner 2000). Given this magnitude of scale, it is not surprising that agriculture has contributed to the plight of at least 42% of the species listed under the Endangered Species Act (USDA 1997), with livestock grazing culpable for one-third of imperiled plant species (Wilcove et al. 1998).

Of course, the ecological footprint of agriculture extends well beyond its immediate geographical footprint, as is dramatically exemplified by water development. In the last two centuries, land under irrigation has increased thirtyfold (Leslie 2000), with 40% of the world's food currently produced from irrigated land (Brown et al. 1999). Globally, more than 35% of accessible freshwater is used in agriculture (Vitousek et al. 1997). In addition to the profound ecological repercussions of such intensive water use (e.g., myriad damming effects, pollution, aquifer depletion, climate change), the resulting scarcity of water is predicted to become the most important factor limiting agricultural production in the future (Leslie 2000).

In essence, industrial agriculture has become an affront to Nature's complexity and integrity, as monopolistic control increasingly results in input-dependent food and fiber systems. According to agroecologist Miguel Altieri (1999): "Modern agriculture implies the simplification of the structure of the environment over vast areas, replacing nature's diversity with a small number of cultivated plants and domesticated animals." Altieri notes that no more than 70 plant species are grown on roughly 1.5 billion hectares of cropland worldwide. By comparison, consider the 40,000 species of flora that occur on just 2% of the world's land surface encompassed by Colombia, Ecuador, and Peru (Wilson 1992).

The ubiquity of animal-based agriculture adds insult to injury. More than 800 million acres of American pastureland, rangeland, and forest are grazed for livestock production (Wuerthner 2000). An additional 200 million acres of cropland are annually dedicated to growing grains, alfalfa, and grass for livestock, which consume more than 70% of the grain grown in the United States (Rifkin 1992). Circling back to water development, the production of one ton of beef requires from 15,000 to 70,000 tons of water (Leslie 2000). Clearly, our current level of meat consumption is taking a major toll on the land and its resources.

In the United States and abroad, small-scale farmers who strive to manage farmland responsibly are under extreme pressure to maximize production in order to compensate for deflated prices. Trends in globalization have exacerbated this crisis, as farmers are forced to compete in an export-driven economy (the United States alone supplies roughly half of the world's grain exports; Brown et al. 1999). Farmers are increasingly compelled to specialize in whichever commodity they can produce most cheaply and to offer their products on global markets—a system that favors large, monocultural farms employing heavy and costly machinery (Gorelick 2000). Small, community-based farms are driven under, while foods consumed locally are brought in from elsewhere.

The few winners in this scenario—including the five agribusinesses that account for nearly two-thirds of the global pesticide market, almost one-quarter of the global seed market, and virtually the entire transgenic seed market (Gorelick 2000)—are profoundly outnumbered by its human and nonhuman losers.* Indian scholar and activist Vandana Shiva cau-

* These five agribusinesses are AstraZeneca, DuPont, Monsanto, Novartis, and Aventis.

tions that "Industrial agriculture has not produced more food. It has destroyed diverse sources of food, and it has stolen food from other species to bring larger quantities of specific commodities to the market, using huge quantities of fossil fuels and water and toxic chemicals in the process" (Shiva 2000).

BRIDGING THE GAP BETWEEN WILDLANDS AND AGRICULTURE

In recent years, forward-thinking conservation activists and biologists have set forth a bold vision of large-scale wilderness recovery based on restoring interconnected functional ecosystems across North America. A growing body of scientific literature supports the need for large protected areas to reverse the dramatic trends in biodiversity loss (Frankel and Soulé 1981, Noss and Cooperrider 1994, Soulé and Noss 1998). But if landscape-level conservation planning is to be effective, the capacity of agricultural lands to help maintain biodiversity and ecological processes must be increased. Reciprocally, sustainable food systems depend upon the ecosystem services provided by biodiversity, such as the recycling of nutrients, the regulation of local hydrological processes, and the detoxification of noxious chemicals (Altieri 1999).

There are perhaps no better ambassadors for farming with the wild than pollinators. This diverse assemblage of insects, birds, bats, and a few other mammals are critical to the effective pollination of both cultivated and wild plants, yet, alarmingly, more than 200 species of wild vertebrate pollinators and innumerable invertebrates are on the verge of extinction (Allen-Wardell et al. 1998). In addition to the obvious implications for crop yield, the ecological ramifications are palpable:

> *It now appears that the majority of plants studied to date show evidence of natural pollinator limitation. That is to say, under natural conditions, 62 percent of some 258 kinds of plants studied in detail suffer limited fruit set from too few visits by effective pollinators. If this condition is the norm in the natural world, to what extent is the regeneration of plants jeopardized by human disruption of the interactions between plants and their pollinators?* (Buchmann and Nabhan 1996)

Organic farmers have done pioneering work in managing the farm as a natural system by demonstrating that superior and healthy crops can be grown without chemical inputs. The marketing of organics has also dramatically heightened public awareness about the link between food and the environment. But organic production alone cannot and does not address the landscape-level threats agriculture poses to biodiversity. North

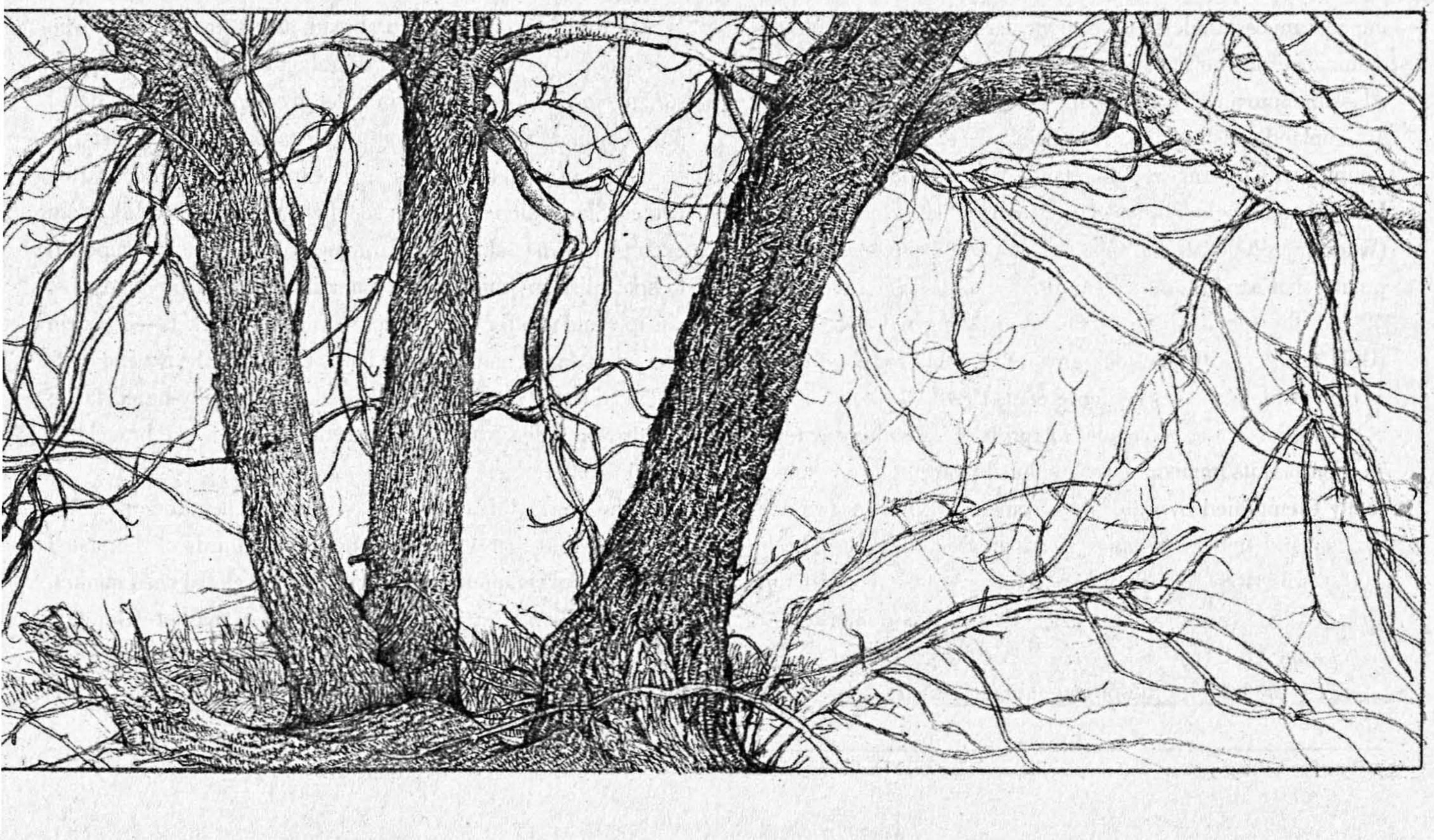


illustration by Davis Te Selle

Dakota wheat farmer Frederick Kirschenmann and co-author David Gould (2000) conclude that "we cannot have healthy 'organic' farms inside degraded landscapes. Quite apart from the problem of 'drift'—whether chemical or genetic—there is the fact that the biodiversity necessary to produce the ecosystem services on which our organic farms depend can only be restored and maintained at the ecosystem level."

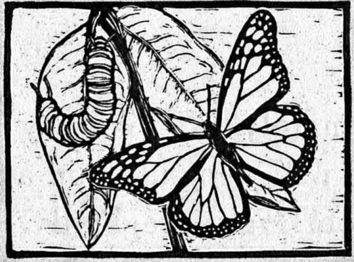
Accordingly, we need to raise the bar for organic production such that sustainable agriculture is equated with true *ecological* sustainability, and cannot be co-opted by industrial agriculture. To achieve this goal, we must rethink organic agriculture at the landscape level and reform food and fiber systems from the ground up.

CULTIVATING A FUTURE FOR BIODIVERSITY

Fortunately, humankind does have the capacity to confront the apparent paradox evoked by modern agriculture: "that we depend upon what we are endangered by" (Berry 1987). As stated in the Vancouver Statement on the Globalization and Industrialization of Agriculture (1998):

> *We know that there are non-toxic and non-destructive alternatives to global industrial agriculture, and we know that these alternatives can provide more food. Farmers around the world are farming in ways that respect their unique ecological and cultural communities. Building on their wisdom, all farms of the twenty-first century can be ecologically regenerative, community sustaining, biologically and culturally diverse, as well as energy conserving. We must not only build upon the existing knowledge and vision of farmers, but we must expand partnerships and create coalitions that serve to re-empower them.*

Stewardship practices such as establishing riparian buffers, diversifying land use, minimizing disturbance of soil biota and structure, timing farming activities to avoid disturbance of nesting birds, eliminating synthetic herbicides and pesticides, rotational grazing, and maintaining wildlife refugia on the farm have already shown ecological promise. In order for such practices to succeed in the long run, however, they must make economic sense for the farmer. Strategies for enhancing the market value of good stewardship are beginning to emerge. A growing number of certification and ecolabeling programs, for example, are attempting to create market-based incentives to address species-specific and regional conservation issues. Through such third-party verification programs, consumers can identify and directly support farmers who help protect biodiversity.



monarch and milkweed by Suzanne DeJohn

Statement of Purpose

RECOGNIZING THAT the capacity of rural landscapes to help sustain biodiversity and ecosystem services must be dramatically improved, the Wild Farm Alliance shall:

- Serve as a clearinghouse for current knowledge about farming and ranching practices that accommodate biodiversity.
- Advance the development and implementation of agricultural practices compatible with the preservation of wild habitat and native species, including large carnivores.
- Forge new alliances between stewardship farmers, consumers, and conservationists.
- Advocate for small growers who care about and live on the land such that they can succeed economically while farming ecologically.
- Promote market-based and other private and public incentives that compensate farmers for their stewardship efforts.
- Educate consumers about the ecological issues surrounding food and fiber production and distribution.
- Help inspire a paradigm shift that considers farming within the context of the entire ecological landscape in which it functions.
- Encourage and support local and regional food and fiber systems.
- Initiate on-the-ground, working models for farming with the wild.
- Support existing efforts to establish a continental wildlands network in which large, protected wildlands are functionally interconnected via wildlife movement corridors and are complemented by compatibly managed farms and forests.

Ultimately, the viability of farming with the wild will depend upon a societal commitment to supporting ecologically sustainable agriculture.

In the last two decades, several federal cost-share programs have also been initiated under the Farm Bill to encourage stewardship on private agricultural lands. For instance, the Wildlife Habitat Incentives Program (WHIP) was created in 1996 to help landowners plan and pay for wildlife habitat restoration and management activities. In 1998 and 1999, $50 million in WHIP funds supported more than 8,000 projects affecting well over one million acres of land (Hackett 2000). While farmer and rancher demand for such incentive programs continues to increase dramatically, most requests for federal assistance are rejected due to inadequate funding. Last year, Congress designated $32 billion in federal farm spending, less than 10% of which was dedicated to conservation programs (Faber 2001). In fact, public financial commitment to conservation on private lands is well below the level of 60 years ago (USDA 1997). Current government subsidies for destructive agricultural practices should be eliminated, and associated funds redirected into programs that reward farmers and ranchers who implement practices aimed at protecting natural habitat, water quality, and wildlife.

Ultimately, the viability of farming with the wild will depend upon a societal commitment to supporting ecologically sustainable agriculture. Many billions of dollars are exchanged annually for food and fiber; consumers can exercise their spending power to keep stewardship farmers and biodiversity in business. Every farm, every rural landscape, should help provide connectivity—through clear and free-flowing streams, through woodlots, grasslands, and wetlands—to self-willed lands beyond the hands of human control. Only together can farmers, conservationists, and consumers cultivate a future in which farms and ranches are seamlessly integrated into landscapes that support a full range of native species, from butterflies and bats to wolverines and wolves. ☾

Paula MacKay *is on the steering committee of the Wild Farm Alliance and is The Wildlands Project's communications coordinator. The Wild Farm Alliance (406 Main St., Suite 213, Watsonville, CA 95076; 831-761-8408; fax 831-761-8103; wildfarms@earthlink.net) is a project of the Tides Center.*

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Eco-Labeling
and Other Initiatives to Advance Wild Farming

by Dan Imhoff

"THE IDEA that organic farms are enclaves of purity—that everything within their boundaries is God-like and everything that lies outside is evil—is a patch ecology perspective that must be reconsidered," says Fred Kirschenmann, long-time organic farmer and director of the Leopold Center for Sustainable Agriculture at Iowa State University. Kirschenmann points to chemical and genetic drift as just two examples of why farms, no matter how innovatively managed, can't be isolated from the larger landscape. Looking ahead, he foresees the day when landscapes or regions rather than individual farms could be certified as wild or organic.

Fortunately, individual farmers and conservation organizations have been slowly moving in this direction for more than a decade. Many initiatives—such as the re-establishment of native plant hedgerows and shelterbelts in numerous California farm communities, pollinator habitat restoration in New Mexico's San Pedro River Valley, specific timing of cultivation practices to accommodate migratory waterfowl, the promotion of shade-based agroforestry, and the gradual revival of the Buffalo Commons—are small but significant steps toward a wild farm paradigm. As small organic farms find themselves becoming endangered by the industrialization of the organic movement (now described by some critics as "neo-conventional" agriculture), on-farm conservation efforts may provide the opportunity to offer added value to customers—and added revenue to farmers.

Without technical and financial assistance in the form of incentives and cost-share programs, consumer-supported eco-labels, and land trust collaborations, wild farming at the landscape level might remain limited to wealthy landowners and isolated conservation initiatives. Ultimately, success must come through collaboration and the articulation of a new vision for agriculture: consumers who support local producers because they are protecting biodiversity; skilled ecologists who can point the way toward restoration; local resource conservation districts, transportation departments, and other programs that promote and practice restoration in rural areas; and financial mechanisms that ensure long-term protection of wildlife corridors. Once initially funded and established, there is good reason to believe that there are economic as well as ecological benefits to restoring native vegetation and habitat within and beyond the boundaries of farms and ranches. The "services" of pollinators and beneficial insects are just one such example of the agricultural benefits of protecting native habitat.

Still, the challenge of making agriculture more harmonious with biodiversity conjures more questions than ready answers. After decades of working in relative isolation, however, conservationists, farmers, sustainable farming activists, and others are beginning to view agricultural areas and food systems as critical terrain in the effort to restore large and healthy ecosystems. Here are four examples of agricultural projects that aim to promote an ecological ethic.

SHADE-GROWN COFFEE

Shade-grown coffee programs are perhaps the best-established and well-publicized eco-labeling efforts attempting to set standards and independent certification for on-farm biodiversity criteria. The coffee-growing region that spans the Caribbean and Central and South America is extremely rich biologically, and shaded farms provide remnant habitat for many species, including endangered orioles, warblers, and other feathered migrants. Rapid deforestation has been largely driven by the industrialization of coffee farming, which radically transformed produc-

ECO-O.K.
Rainforest Alliance
CERTIFIED™

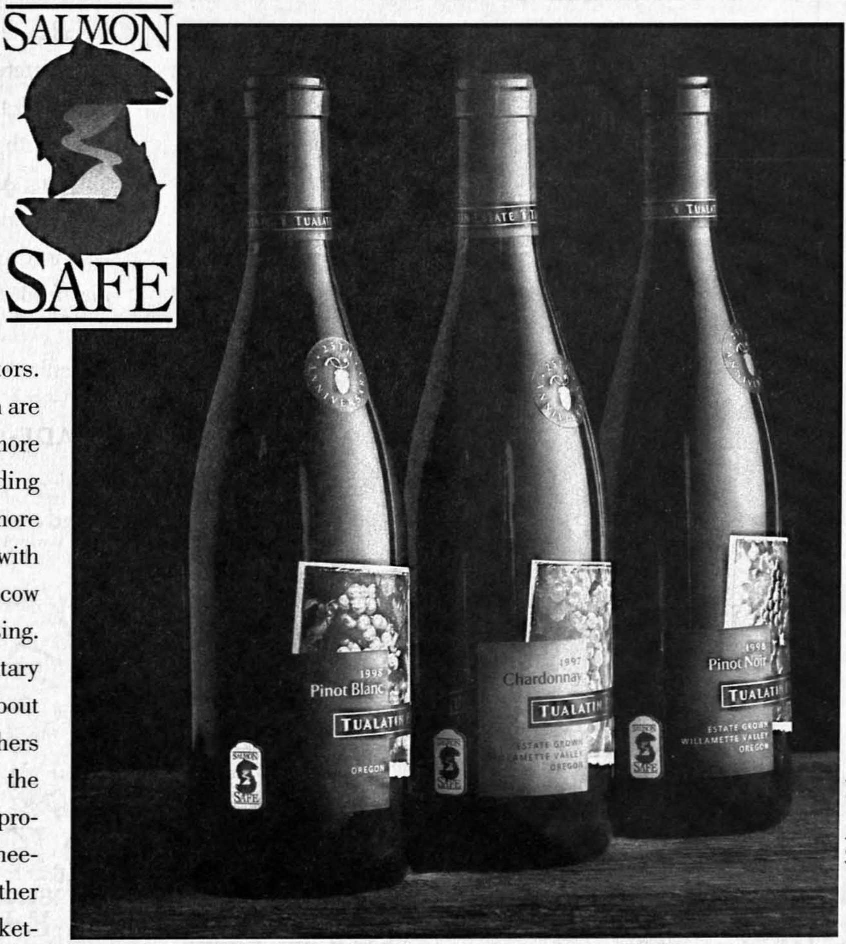
tion from forest farms to chemical-intensive "sun plantations." The Smithsonian Migratory Bird Center's "Bird Friendly" and the Rainforest Alliance Conservation Agriculture Network's "ECO-O.K." are among several labeling programs started by organizations that work closely with farmers to require suitable habitat as a basis for certification. According to the Smithsonian's Russell Greenburg, natural or rustic forests support the highest degree of diversity. Farms with intentionally planted shade trees harbor less wildlife. As the level of shade diminishes to mono-layer operations, then to canopy-less sun coffee plantations, species diversity declines. Water quality during processing is also an issue considered under the above programs. Banana and cacao producers are being certified for biodiversity protection efforts throughout the region as well.

NON-LETHAL PREDATOR CONTROL

Across the American West, at least two organizations encourage the use of alternatives to killing wolves, cougars, and other predators in order to protect livestock. The Montana-based Predator Friendly Wool program is slowly building consumer support for wool textiles and organically raised meat that carry their label. According to Becky Weed of Thirteen Mile Ranch in Belgrade, Montana, the USDA's "Wildlife Services" annual taxpayer-supported "animal damage control" campaigns cost significantly more than the value of livestock actually lost to predators. Ranchers in the Predator Friendly Wool program are using guard animals, better fencing, and more hands-on management to prevent losses. According to Weed, the Predator Friendly label needs more consumer awareness, but she also reports that with fears escalating about foot-and-mouth and mad-cow disease outbreaks, interest in organic meat is rising. The organic label, then, becomes a complementary and door-opening opportunity for education about predator-friendly practices. Sheep and goat ranchers in Tibet and Nepal who suffer predation from the snow leopard have contacted Weed about the program, as have ranchers from Namibia, where cheetah attacks on livestock are not uncommon. Another eco-labeling program, Wolf Country Beef, is marketing meat from Arizona and New Mexico ranches that accommodate wild predators. Rancher Jim Winder, who runs one of the operations producing Wolf Country Beef, publicly supported reintroduction of Mexican wolves to the Southwest. Financial losses ranchers experience due to predation are directly compensated by Defenders of Wildlife. The Nature Conservancy has launched a Conservation Beef program as well.

WILD HARVESTED, ORGANICALLY PROCESSED

Eco-labels based on practices that reduce agriculture's impacts on endangered salmon and steelhead habitat have been established for a few years, most notably the Pacific Rivers Council's Salmon Safe program in Portland, Oregon and Fish-Friendly farming in Sonoma County, California. Both efforts are directed at reducing a farm's sediment and agrochemical runoff into the local watershed, as well as engaging consumers in supporting regional conservation



courtesy of Salmon Safe

efforts. In a more controversial move, Farm Verified Organic certified the 1999 salmon catch in Bristol Bay, Alaska as "Certified Wild." According to David Gould of Farm Verified Organic, local communities who have been living and fishing in this remote Bering Sea ecosystem for centuries are now losing their livelihood to the fish farming industry. The harvest of the salmon—which Farm Verified Organic decided was identifiable, non-contaminated, and inspectable, among other variables—was certified as wild, and the processing was certified as organic. Additional products that could be considered for wild certification include honey, wild rice, berries, mushrooms, and herbs.

THE ADIRONDACK COAST

For the past five years, conservationists in the eastern Adirondacks have been working to protect the Split Rock Wildway, a wildlife corridor linking Lake Champlain and its valley with the Adirondack mountains to the west. A key partner in the effort, the Eddy Foundation, has purchased approximately 1,500 acres in this area, most of which will be secured under a forever wild easement. More than a hundred acres are fields that have been in agricultural production for many decades. Some of those fields will be allowed to return to forest to broaden and strengthen Split Rock Wildway. Fields owned by the Eddy Foundation outside of the wildway will be diversified to help meet the needs of the local community as well as to provide a haven for native pollinators, grassland birds, raptors, and small mammals. Historically, these fields have been barriers to movement for most wildlife and have produced little more than milk and hay. In the future, these same fields will be set in a matrix of wild forest, allowing free flow of wildlife and criss-crossed by broad hedgerows of native early-succession and fruit-bearing species. They will also produce a diversity of fruits, vegetables, herbs, mushrooms, grains, and fibers—all organic and for local and regional consumption. ☾

Dan Imhoff *is a freelance writer and publisher of SimpleLife Books. To learn more about eco-labels and projects described here, visit the following websites.*

- ■ Eco-labels: *www.eco-labels.org* ■ Shade-grown coffee: *www.rainforestalliance.org; www.si.edu/smbc*
- ■ Ranching programs: *www.lambandwool.com*
- ■ Fish programs: *www.salmonsafe.org; www.nswg.org*

One Life

for Robert Moody

When young, hide & listen
to the old ones, then
teach the youngsters.
Write the history
of your place.
Roof the barn, draw
the cellar walls
back into line.
Tend your land and
take the children
for wildflower walks
on the hillside.
Argue with the man
who would log it off.
Where will the children go?
At the dispersal
of your household I buy
one chipped cup which
you may have used.

—*Stephen Lewandowski*

This poem also appears in One Life, *a chapbook by Stephen Lewandowski (©2001), released by Wood Thrush Books, 85 Aldis Street, Saint Albans, VT 05478, wtbooks@sover.net.*

by Stephen W. Barrett

Burning WILDERNESS

The Case for Manager-Ignited Fire

Controversy has arisen over a recent Forest Service proposal to ignite fires in central Idaho's Salmon River Canyon. About 60% of the two-million-acre planning area is so-called multiple-use land, while the rest is in the Frank Church-River of No Return Wilderness. Over the next ten years, the agency plans to burn a number of drainages that have been heavily impacted by fire exclusion. Predictably, the agency has taken heat from loggers upset about "wasting timber" under the new plan. Perhaps more surprising, some wilderness activists also oppose the plan.

For many years, fires have been promptly extinguished in much of Salmon River Canyon (especially near agency infrastructure and private inholdings in federally designated wilderness). It is ironic that ignitions often can be readily extinguished in forests that naturally carry a light fuel load due to frequent burning. As a result, forests—such as old-growth ponderosa pine—that are the most ecologically dependent on frequent fires have seen their life cycles interrupted and their fuel loads burgeon.

The project Environmental Impact Statement was based largely on my fire history studies, begun in 1983. The results should be alarming to anyone concerned about natural forest ecosystems. Although many acres have burned in the Salmon River Canyon in recent decades, the data still show a fourfold reduction in area fire occurrence. Data from 76 stands in the "nonlethal" fire regime (i.e., where most trees survive regular low-intensity fires) suggest that, whereas in past centuries underburns (i.e., fires confined to the forest understory) occurred about every 17 years, the stands have not burned for the past 84 years, on average. And, whereas 50% of the canyon's forests experienced frequent low-severity fires before 1900, that total has declined to 33% in recent years. By contrast, the "stand replacement" fire regime—very hot and lethal to numerous mature trees—has increased from 20% of the area historically to 50% today.

These results clearly bode ill for old-growth ponderosa pines and associated species. Yet some wilderness activists seem to view these devastating fires as normal. For example, the organization Wilderness Watch recently said that it had "failed to turn up a single bit of evidence that any fire in the last 20 years has burned outside the projected range of natural variability" (Nickas 1998–99). I beg to differ. Consider these large, stand replacing fires since 1985: Corral Fire (118,000 acres),

illustration by Evan Cantor

Chicken Fire (108,000 acres), Sliver Fire (54,000 acres), Ladder/Hida (49,000 acres), Long Tom (30,000 acres), French Creek (15,000 acres). Although these fires often are labeled "prescribed natural fires" in wilderness, all of them caused unnaturally heavy mortality. Because the recent fires often destroyed diverse vegetation mosaics, large portions of the Frank Church Wilderness have been drastically altered, possibly for centuries.

Rafting down the Salmon River, you can see these changes. Along the way, you'll pass through the seemingly endless Hida Point fire. I call it the "nuclear shrub zone." In fact, the fire destroyed several of my past sample stands, where old trees had revealed a 300- to 500-year-long record of frequent low-severity fires. Fire has long been part of the ecological fabric of the area—but not this kind of devastating event.

Nevertheless, Wilderness Watch says that the occurrence of the "Great 1910 Burn," largely in northern Idaho and northwest Montana, proves that severe fires were not unprecedented. But that is faulty reasoning. Although stand replacing fires have long been common to those regions, recurrent holocaustic fires between 1889 and 1934 were akin to a "1000-year flood"—extremely unusual and not fairly used as a benchmark for regular fire activity. Those fires occurred during the most severe long-term drought recorded by tree rings since the late 1600s. Some of them, such as in 1910, also were the result of mass lightning ignitions merging because of strong winds. The vast shrub fields that persist in northern Idaho today, which are prime elk habitat, resulted from those severe "reburns."

By contrast, the recent wildfires in central Idaho are a different type of phenomenon—a bit like having a 1000-year flood every year. For example, the recent fires occurred during average to above average burning conditions—no doubt similar to those that spawned low-severity fires before 1900—but the result was high-severity fires. And because that area's lower-elevation forests did not evolve with severe fires, it's unclear how today's heavily burned communities will respond. Logic alone suggests they will not support the same array of species as before 1900.

Today, many wilderness managers and ecologists think it might be wise to intervene with manager-ignited prescribed fire in some locations. The goal is not to supplant lightning fires. Rather, manager-ignited fires could help ease the inevitable return of lightning fires to low-elevation drainages that have built up large fuel loads over many decades of fire suppression. These managed fires could allow a gradual return to a truly normal range of variability and natural disturbance regimes—rather than allowing unprecedented fires, and wholesale ecosystem degradation, in the name of purist wilderness management.

Some argue that setting fires in wilderness is "highly impactive." Again, I disagree. Returning fires to a fire-dependent ecosystem just isn't comparable to highly artificial intervention, such as liming lakes to offset acid rain. It's more like returning wolves to their former native habitat—the long-term goal is to let the population be self-regulating, but in the short term intensive management likely will be required.

Such controversy stems, in large part, from differing philosophies about wilderness. The 1964 enabling law provides little management direction, other than vague wording like "untrammeled." That word implies "do not control," but fire exclusion—whether the fire exclusion of the past century or the current effort of some wilderness activists to block manager-ignited fires—may be the epitome of human attempts to control Nature. To me, wilderness means fostering natural communities that evolved over thousands of years, not tolerating "mutant" ecosystems of our own making. Ultimately, if wilderness is to be nothing more than pretty scenery, then many species surely will continue to decline. ☾

Since 1979, consulting fire ecologist **Steve Barrett** *has studied fire history in many areas of the Northern Rockies, including Glacier, Yellowstone, and Waterton Lakes National Parks, Frank Church-River of No Return Wilderness, Selway-Bitterroot Wilderness, and on most of the region's national forests. He lives in Kalispell, Montana.*

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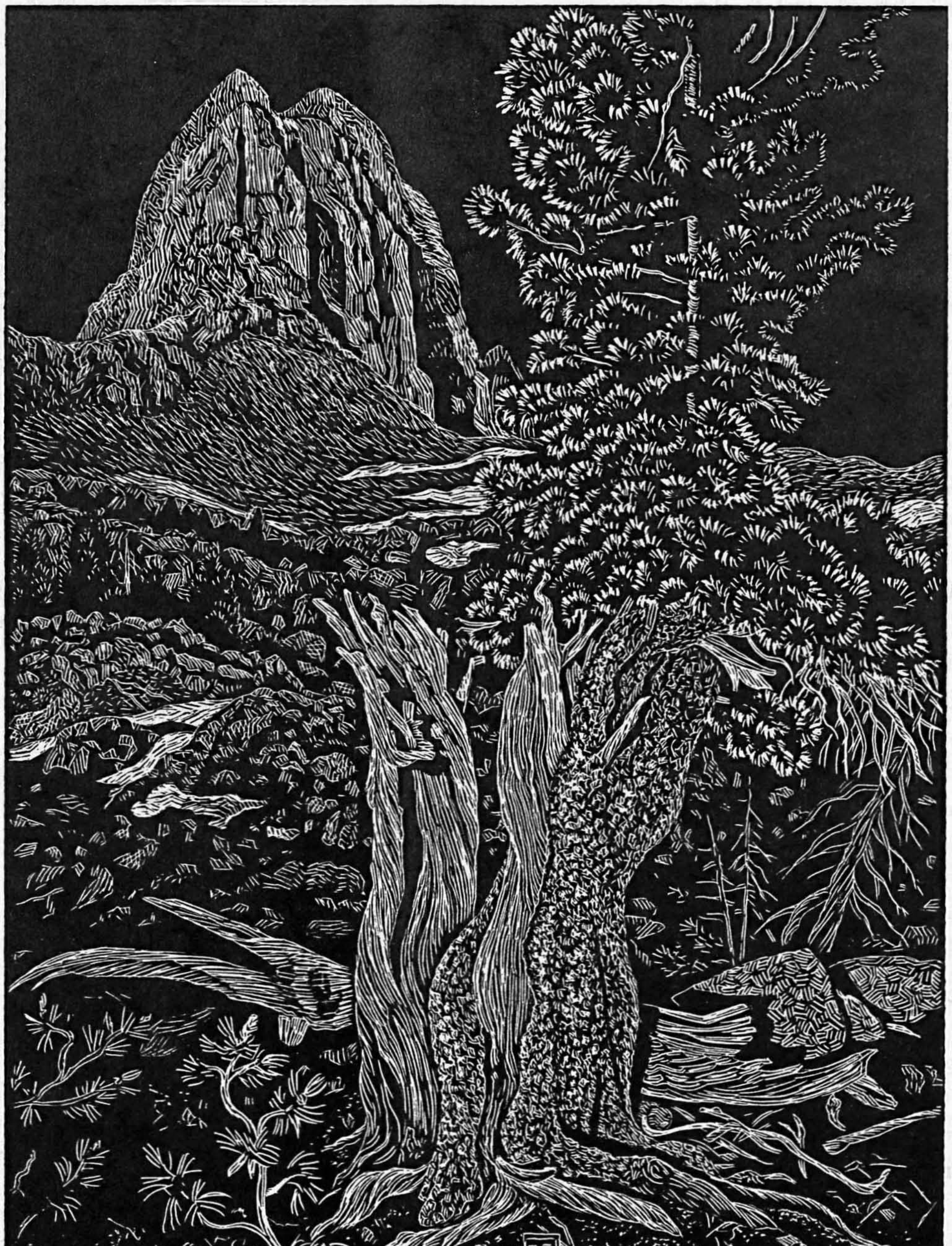
Wilderness
KEEP IT WILD!

by George Nickas
and Gary Macfarlane



Alaska Basin, Jedediah Smith Wilderness, Wyoming by Evan Cantor

Long before the 1964 Wilderness Act became law, wilderness and the allied value of *wildness* were under threat from modern society. This threat has not diminished in the intervening years. A growing number of "wise use" advocates, wilderness revisionists, environmental philosophers, federal land administrators, and some conservationists and researchers are challenging the concept of self-willed land. Even those who profess support for wilderness suggest that the act itself is flawed, that it has set up conflicting goals between preserving an *untrammeled* or *wild* wilderness versus managing to achieve *natural or pristine conditions* (Cole 1996), and that managers must choose one or the other (Cole 2000). Others suggest that the goal for wilderness is both naturalness and wildness, but that managers will often have to compromise the latter to achieve the former. This perceived conflict is what drives most calls for management-induced restoration today.

A different view suggests that there is no such conflict. The Wilderness Act does not mandate a "pristine" condition; rather, there is a mandate to allow natural processes to operate freely (Worf 1997). Fire behavior, for example, might be different had fire suppression never been practiced in a particular wilderness or in the surrounding terrain, but by designating an area as wilderness we have decided that from that point forward natural processes will determine the conditions within that area. We recognize that some unexpected changes may occur. But wilderness must be allowed to play the cards it's dealt (Nickas 1999).

We believe the suggested dichotomy between protecting an *untrammeled* wilderness and preserving its *natural conditions* is a straw-man, used by some to diminish the extraordinary ideal expressed by the Wilderness Act. The result will be a gaping loophole, called restoration, through which managers will inflict their will on lands deemed by the American people through the Wilderness Act to be self-willed lands. Some of those engaged in this high-stakes game do it with the best of intentions; yet many use these ideas as carte blanche authority to finally bring the remaining wilderness *under management*. Indeed, most ecological manipulation and restoration efforts in wilderness areas are little more than attempts to produce resources, create conditions desired by humans, make-work projects, or all of the above, and have nothing to do with protecting wild Nature.

Evidence is everywhere. Typical of restoration efforts are two examples from the Frank Church-River of No Return Wilderness in central Idaho, the largest wilderness area in the national forest system. While managers continue to suppress the vast majority of lightning-ignited fires, they've embarked on plans for tens of thousands of acres of manager-ignited fire projects of dubious purpose. The first of these, the Elkhorn-Jersey Project, was initially proposed to increase winter range for elk. When that justification was challenged, the rationale shifted toward protecting the adjacent Cove-Mallard timber sales. When that rationale fell flat, the project became ecological restoration to prevent catastrophic and unnatural damage from natural fires. A Freedom of Information Act inquiry from Friends of the Clearwater and Wilderness Watch to the Forest Service requesting all post-fire data and assessments for the past several decades failed to turn up a stitch of evidence that a single acre has ever suffered such a catastrophic fate in the Frank Church-River of No Return Wilderness. Despite all of this, the project went forward unchanged.

In that same wilderness area, the Forest Service has launched a major herbicide spraying effort to "control" non-native plants (while the agency simultaneously allows stocking of wilderness lakes with non-native fish), predominantly spotted knapweed and rush skeletonweed. Much of the habitat where the target species are found is dominated by a non-target alien, cheatgrass (*Bromus tectorum*). Cheat is an invader that replaces native grasses through competition and by altering natural fire regimes. Rather than face the difficult question of whether the "natural" ecosystem can be restored in light of the preponderance of cheatgrass, the Forest Service has instead declared herbicidal war on two non-native species, while declaring cheat a "naturalized" species no longer in need of control. Removing a few thousand acres of knapweed and rush skeletonweed will do little to restore more than 300,000 acres now invaded by cheat. The result will be neither *natural* nor *wild*, but rather a managed landscape that expresses the personal biases of present-day managers.

This is to say nothing of the wholesale damage done throughout the federal wilderness system by managers engaged in predator control, fish stocking, fire suppression,

Most ecological manipulation and restoration efforts in wilderness areas are little more than attempts to produce resources, create conditions desired by humans, make-work projects, or all of the above, and have nothing to do with protecting wild Nature.

non-native wildlife introduction, and wild "game" population manipulation. Every one of these intentional, wilderness-harming practices continues to be widely used today, often (if not in every instance) in the very wilderness areas where managers argue other manipulative actions are necessary to restore "natural conditions."

In light of the evidence, we don't believe that the vast majority of restoration and manipulation is about wilderness at all. Instead, these actions are more of the same old management paradigm, selectively practiced to produce certain conditions and resources that are desired by individual managers.

A LEGAL CONTEXT

The fundamental charge of wilderness stewards is to preserve wilderness character, which is defined in the Wilderness Act as "an area where the earth and its community of life are untrammeled by man...retaining its primeval character and influence...managed so as to preserve its natural conditions." Michael McCloskey (1999) puts these descriptive phrases in context:

> *The section referring to "natural conditions" follows the key initial point about it being untrammeled....Any meaning given to the phrase "natural conditions" should be consistent with the key idea of not "trammeling" these areas. This interpretation is favored because this language comes first and, in accordance with rules of statutory construction, it avoids any unnecessary implication of conflict between provisions....Thus, the community of life in wilderness should not be subdued, or put under the domination of man.*

McCloskey is right. The act can and should be read such that the goal of an untrammeled wilderness managed to preserve its natural conditions is not self-conflicting. It requires recognizing that "natural conditions" refers to a set of interacting influences or processes rather than any particular point-in-time condition. Wilderness character is about fire, wind, rain, avalanche, blizzard, shadow, sunlight, heat, cold, predator, prey, hurricane, and flood. It's not about the number of ponderosa pine per acre, elk per square mile, acres of old growth, or acres burned per year.

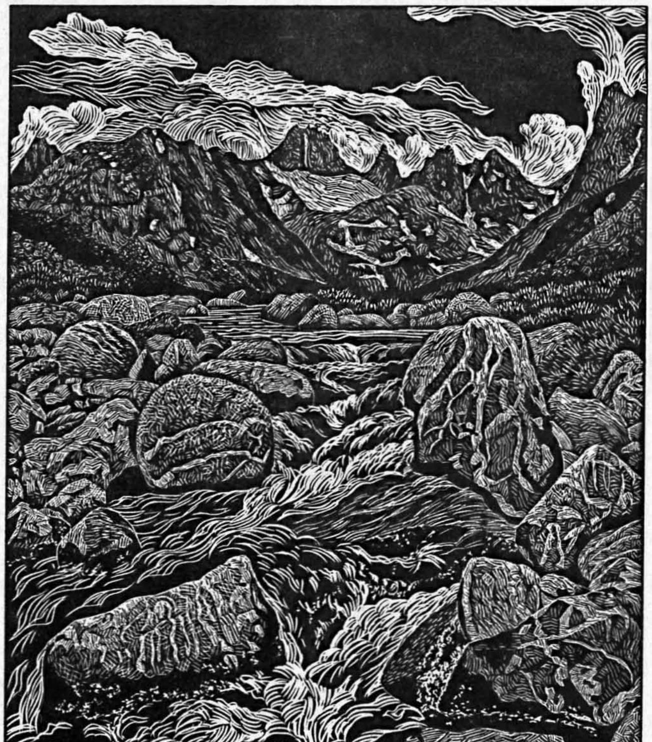
Moreover, trying to interpret the meaning of "natural condition" as a stand-alone phrase raises all sorts of dilemmas. Since humans are natural, wouldn't anything we create be a *natural condition*? By proclaiming a conflict between natural and wild, any management action can be justified on this basis.

Admittedly, any reliance on the ideal of untrammeled or self-willed land has to be qualified. In part, this is because virtually no wilderness is immune to outside, human-caused influences. Even the largest wildernesses can't escape the consequences of disrupted wildlife migration routes, acid rain, human-caused global climate change, or exotic species migration. There is little that wilderness stewards can do about these disturbances except to allow wilderness to respond in its own way. Trusting Nature might make us uneasy at times, but it has a track record unmatched by humans.

A REAL RESTORATION AGENDA

Given this charge to keep wilderness wild, are there times when the mandate for an untrammeled wilderness can legitimately be compromised? Leaving aside relatively uncontroversial actions such as restoring a damaged campsite or stream crossing, we believe there are times, albeit very limited, when restoration or manipulation is both appropriate and consistent with the limits imposed by the Wilderness Act.

Recovering a threatened or endangered species is one of these. It can be argued that tension exists between the Wilderness Act's hands-off approach and the interventionist



Titcomb Basin, Bridger Wilderness, Wyoming by Evan Cantor bent of the Endangered Species Act (ESA). That may be true. In those cases where managers may have to choose between conflicting statutes, the balance of harms, if not the explicit requirements of the ESA, seems to favor recovering the species.

In some cases, even though it may not be right, it is legal to manipulate wilderness. Fire suppression and perhaps even management-ignited fire are two examples. Though we believe both should be used sparingly, if at all, the Wilderness Act does provide managers with discretion "in the control of fire, insects and diseases" (Section 4(d)(1)). Where manager-ignited fire is used, the goal must be to create conditions that will allow a natural fire regime to operate in the future.

The converse is also true: There are instances where it may seem advisable, but legally questionable, to allow direct, intentional manipulation. Trying to eradicate established populations of non-native species—such as brook or rainbow trout in most western waters, chukars in the Southwest, mountain goats in Utah, or weeds almost everywhere—is a situation that comes to mind. While we aren't judging whether such actions should be taken, we believe these issues should be openly debated and discussed in advance.

It seems to us, however, that before humans undertake efforts to further work our will—in the name of restoration—on wilderness, we should first stop doing harm. No more fish stocking or introducing other non-indigenous wildlife, no more artificial watering sources to favor "game," no more packing in hay and other weeds, and no more suppressing most wildfires.

Second, conservationists, researchers, and managers must acknowledge that the *management* paradigm that is so ingrained in our public land management institutions has no place in wilderness. The current path of active restoration is linear and ultimately leads to the elimination of wilderness itself.

Third, we should build a new wildlife management paradigm "where the forces of natural selection and survival rather than human actions determine which and what numbers of wildlife species will exist" (USDA Forest Service 1990). Nothing would do more to restore wilderness (untrammeled and natural) than to end the current fish and game production mentality that dominates wildlife management.

Fourth, manage lands adjacent to wilderness to complement wilderness protection. Restore natural migration corridors for wildlife. Bring adjacent lands into wilderness fire management plans so that the legal line boundary is permeable to fires that start within and outside wilderness areas. Focus weed removal on adjacent lands, trailheads, etc., and restrict or eliminate those activities that promote weeds on adjacent lands.

Fifth, before launching down the path of restoration, the wilderness community needs to openly discuss and try to agree on a set of principles that will govern if, when, and where active restoration is appropriate. For example, is a one-time intervention, such as removing fish from a naturally fishless lake, appropriate and distinguishable from manipulation that requires ongoing treatments, such as maintaining a fire-dependent ecosystem with regularly scheduled manager-ignited blazes? We may conclude that there are reasons to engage in overt trammeling of wilderness. If so, then we should ask Congress to codify those carefully considered exceptions. This will avoid the quagmire of having hundreds of individual managers making their own judgements about how much manipulation is okay within each wilderness area. As Reed Noss has warned, "our desire to manage everything is exceedingly arrogant given our ignorance of how nature works. In many cases, what needs to be managed is not nature, but rather our own consumptive, manipulative, and destructive behavior" (Noss 1991).

Finally, let's move cautiously. *Wild, untrammeled* wilderness is what attracts millions of Americans to the wilderness cause. The desire to have places where humans aren't in control is what keeps the wilderness dream alive and insures its survival both in our minds and on the land. We would do well to remember the words of Howard Zahniser, the Wilderness Act's author: "We must remember always that the essential quality of the wilderness is wildness" (Zahniser 1992). ☾

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Whatever Happened to US Population Stabilization?

by Roy Beck
and Leon Kolankiewicz

The years surrounding 1970, the year of the first Earth Day, marked the coming of age of the modern environmental movement. As that movement enters its fourth decade, perhaps the most striking change is its abandonment of US population stabilization as an active goal.

Most environmental and conservation groups have cast aside what environmentalists 30 years ago understood to be the task before them. Their "foundational formula" at that time held that total environmental impact is the product of average individual impact (a combination of consumption factors) multiplied by the number of people. Many environmental groups saw population growth in this country (because of the size of individual consumption rates) as the most important to stop. By working on both US population and consumption, the movement of the 1960s and 1970s had a comprehensive approach toward environmental protection and restoration.

Therefore it is striking that a survey has found that no national environmental group today works for an end to US population growth. Yet the effects of constant growth are among the most contentious issues in local communities: sprawl, congestion, overcrowded schools, habitat loss, destruction of open spaces. Since 1970 (population 203 million), more than 73 million Americans have been added to our cities and countryside. The Census Bureau now projects that, under current federal policies and cultural trends, we will surpass half a billion in this century, with no peak in sight.

The *Journal of Policy History* recently asked us to explore this radical change in the environmental movement and make suggestions to future historians about where they might look for the causes. Here is what we found:

Dropping Fertility. By 1972, the fertility rate in the United States had declined to a level low enough to eventually produce zero population growth (ZPG), as long as immigration remained reasonably low. Many Americans, including environmentalists, apparently confused "replacement-level" fertility with ZPG. They mistakenly concluded that the overpopulation problem was solved. With ZPG supposedly achieved, support for organizations and programs focused on population began to drift away.

Anti-Abortion Politics. To the Catholic hierarchy and the "pro-life" movement, legalized abortion and population stabilization have been inextricably linked. In the 1990s, it was still difficult for a pro-stabilization person or group to get a hearing from Catholic or "pro-life" groups without being considered an abortion apologist.

A number of leaders of philanthropic organizations involved with population efforts in the 1970s have said that active measures by US Catholic bishops and the Vatican were the greatest barrier to advancing population measures and to setting a national policy. The population movement began to be tarred as anti-Catholic. Environmental groups seeking membership funds and support from a wide spectrum of Americans had

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good reason to steer clear of population issues altogether, rather than risk offending current and potential members who were also members of America's largest religious denomination.

Women's Issues. Population groups have grown apart from environmental groups. During the late 1960s, the environmentalist angle on reproductive issues tended to be pushed out front as environmentalism reached mass popularity. But as environmentalists abandoned population issues, the population groups de-emphasized environmental motives in favor of feminist motives. The 1994 United Nations conference in Cairo, for example, issued hundreds of recommendations about women's rights but made no mention of the connections between population growth and environmental ills (which had been a key focus of earlier UN conferences).

Rift Between Conservationist and New Left Roots. The modern environmental movement includes at least three roots. Two of these go back a century—the wilderness preservation movement and the resource conservation movement. These roots tend to be philosophically inclined to accept the proposition that, with humans as with other organisms, greater population size inflicts greater impacts on the environment. A third root of modern environmentalism is much younger. Emerging only in the 1960s, it was an outgrowth of what was called New Left politics. It came to focus more on urban and health issues such as air and water pollution and toxic contamination, especially as they related to race, poverty, and the defects of capitalism. The "environmental justice" movement and Green political parties grew out of this root. The leaders of the New Left have forcefully downplayed the role of population growth as a cause of environmental problems. By the 1990s, this third root had grown so strong in many organizations that it forced an end to their population stabilization policies and later defeated efforts by conservationists and preservationists to reinstate them.

Immigration as a Growth Factor. Modifications to immigration law in 1965 inadvertently set in motion an increase in immigration through extended family members. During the 1970s, at the same time that American fertility declines were beginning to put population stabilization within reach, immigration was rising rapidly to three or four times traditional levels. For the first decade some groups urged that immigration be set at a level consistent with US environmental needs. However, that advocacy ceased over the next quarter-century for a variety of reasons:

■ Fear that immigration reduction would alienate "progressive" allies and be seen as racially insensitive. Because earlier immigrants were mostly non-European, immigration advocacy groups labeled efforts to reduce numbers as being racially motivated. Today, more than 60 percent of US population growth comes from immigrants and their children.

■ The transformation of population and the environment into global issues needing global solutions. Under this new thinking, the population size of individual countries was not nearly as important as the size of the total global population.

■ Influence of human rights organizations. By the 1990s, environmental groups had conceded higher moral ground to those human rights groups defending the rights of poor workers and their families to cross national borders if they could improve their standard of living.

■ Triumph of the ethics of globalism over ethics of nationalism/internationalism. Many environmental elites now believe immigration pressures on US population growth are best relieved by addressing the root factors that compel people to leave their homes and families and emigrate. Under this view it would be unethical and impractical to stabilize US population while population and poverty expand in less-developed countries.

■ Fear of demographic trends. Some environmental leaders express fear that if they are perceived as "anti-immigrant," a backlash against environmentalists could develop among immigrants and their US-born descendants. This fear has been fanned by threats from leaders of certain ethnic groups whose numbers are expanded by immigration.

■ The power of money. Shifts in population emphasis might have had more to do with the funding of environmental groups than any other factor. Many grantmaking foundations have a mix of directors that include left-leaning globalists and right-leaning representatives of multinational corporations. For separate—even disparate—reasons, both groups are strongly inclined toward high immigration levels.

FOR ALL OF THESE REASONS, THE ENVIRONMENTAL establishment has dropped the goal of US population stabilization. But the scientific rationale underlying the need for stabilization is as valid as ever. Virtually every aspect of US environmental protection—and the quality of life for Americans—will be eroded unless annual immigration quotas are cut back and illegal immigration halted. ☾

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Book *Reviews*

Reviewed in this issue

Salmon Without Rivers: A History of the Pacific Salmon Crisis

by Jim Lichatowich
Island Press, 1999 ■ 333 pages, $27.50 hardcover

Messages from Frank's Landing: A Story of Salmon, Treaties, and the Indian Way

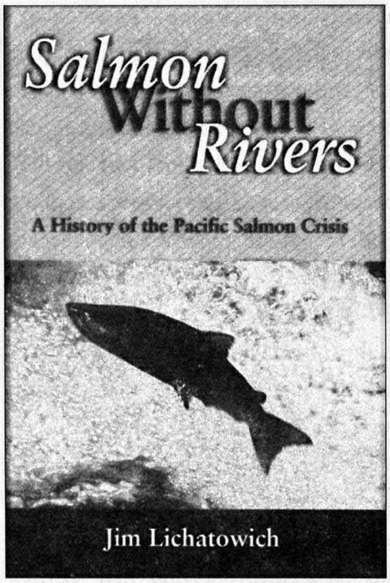
by Charles Wilkinson
University of Washington Press, 2000 ■ 128 pages, $22.50 hardcover

Three thousand miles east of my family home on a floodplain that a younger, wilder Columbia River scoured through Cascade foothills, I listen on the phone as friends describe the driest winter in memory, and I cannot help but think of the salmon. Because many mountains this year wear only half their normal snowpack, river levels will fall as spring melts into summer. Less water to spin the turbines of the region's hydroelectric dams means trouble up and down the coast, and priorities shift in times of hardship: "With rolling black-outs come health and safety concerns that are more important than implementing the full salmon recovery efforts," an official from the Bonneville Power Administration explains. Healthy salmon populations are apparently a luxury we can no longer afford when our right to cheap electricity is threatened.

This notion that salmon runs are less important than energy production illustrates the central point of Jim Lichatowich's *Salmon Without Rivers*. A fisheries biologist from the Olympic Peninsula, Lichatowich argues that the current salmon crisis—the fish are extinct in 40% of their Northwestern habitat and at risk in nearly half of what remains—results from a distorted worldview that "defines ecosystems as warehouses for the storage and production of commodities, insists that humans stand apart from those ecosystems, and demands that they control, manipulate, and 'improve' them." In a region where agriculture, mining, logging, and hydroelectric power are built upon the destruction of salmon habitat, this worldview has the weight of gospel.

Salmon Without Rivers begins with evolutionary histories of both salmon and the region, and Lichatowich insists that salmon are so tightly woven into their habitat that the two elements "have to be considered as a single unit." Salmon not only reflect the health of Northwestern ecosystems, but they contribute to the well being of inland biota by transferring nutrients from the sea up into watersheds. Moreover, while salmon directly nourish some two-dozen species, even their own descendents benefit from their consumption and decay: "When a bear pulls a salmon from the river and leaves its partially eaten body under a cedar tree," explains Lichatowich, "the fish fertilizes the cedar, which in turn shades the stream and keeps it cool for the juvenile salmon."

Early North American cultures learned to fit into this natural economy by restricting their fishing practices to avoid over-harvesting salmon populations, but when Euro-Americans brought a commodity-based economy to the Northwest, habitat destruction began almost immediately. In several graphic chapters, Lichatowich carefully documents a succession of commercial impacts on salmon, from beaver trapping to dam construction. Salmon face a variety of threats to their existence, he emphasizes, at each stage of their migration: "logging and mining in the headwaters, agriculture in the rivers' lower elevations, cities and industry in the broad alluvial plains and estuaries, and finally pollution and large-scale fishing in the oceans."



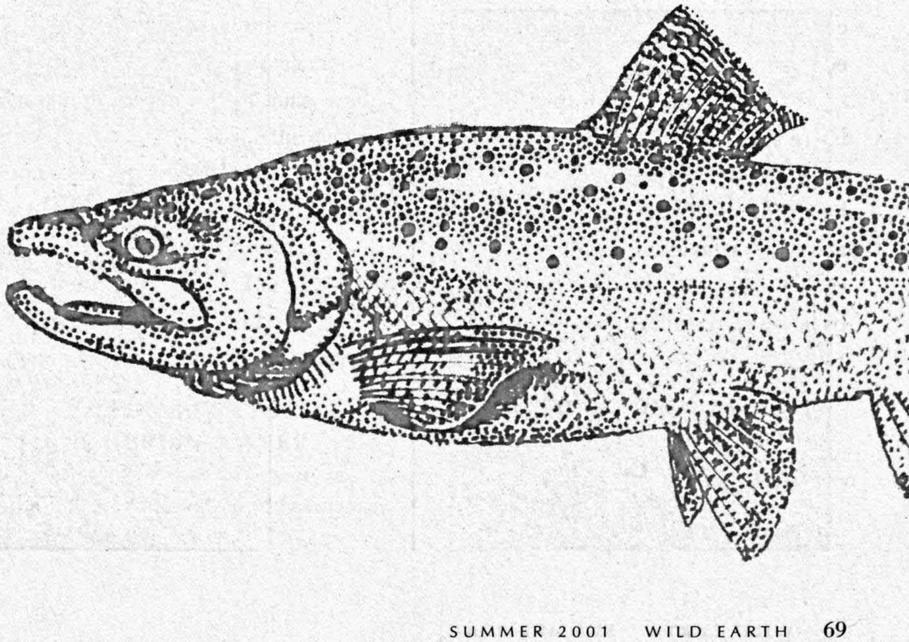
But while industry's role in the decline of salmon populations is obvious, Lichatowich also has harsh words for hatcheries. In addition to shuffling populations that have evolved to fit very specific ecosystems, fish culture has diverted attention from habitat destruction and over-fishing. Indeed, the more we rely on hatcheries, the less we seem to require healthy watersheds, as the book's title suggests. Yet, as Lichatowich concludes, "it's not just the salmon that need healthy rivers. We do too. We live in the same ecosystems as the salmon, so we cannot stand apart, manipulate, control, and simplify these ecosystems without at some fundamental level diminishing ourselves."

BILLY FRANK, A NISQUALLY INDIAN from Puget Sound, would certainly agree. Frank—a leader in the fight for native fishing rights—is the central character of Charles Wilkinson's *Messages from Frank's Landing*. Whereas Lichatowich thoroughly surveys the history of human impacts on salmon throughout the Pacific Northwest, Wilkinson focuses more narrowly on the history of Indian fishing rights on the Nisqually River, which drains Mount Rainier into Puget Sound.

Wilkinson opens in the 1850s—later than some readers might prefer—exploring the conflicts that shadowed American settlement of Puget Sound. A treaty that left the Nisqually people no immediate access to their river led to the Leschi War of 1855, but a second treaty allowed them to remain on its banks, even after the establishment of Fort Lewis pushed them upriver in 1917. Although federal treaties had guaranteed the Nisqually the right to fish "at all usual and accustomed grounds and stations," by the mid-twentieth century Indian fishers were regularly being arrested for violating state fishing regulations. In the 1960s, these "Fish Wars" joined Alabama marches and urban riots as a vivid symbol of the nation's struggle over civil rights.

Wilkinson, who teaches law at the University of Colorado, seems most at home discussing court decisions that resulted from state challenges to treaty rights. The federal government has consistently ruled against state interference in Indian fishing—indeed, a 1905 US Supreme Court decision recognized that access to fish was "not much less necessary to the existence of the Indians than the atmosphere they breathed"—and it continued to do so in the political tinderbox of the late sixties. In 1969 a federal judge reaffirmed the right of native tribes to a "fair share of harvestable salmon," and in 1974 Judge George H. Boldt surprised all parties by defining that fair share as 50 percent.

Despite this unexpected victory, salmon runs continued to decline, and so the Nisqually took steps to help boost salmon populations. In an unlikely collaboration, Billy Frank and others convinced the army to allow a hatchery within the boundaries of Fort Lewis. With the legal affirmation of Nisqually fishing rights and the success of the Clear Creek Fish Hatchery, which opened in 1991, came something of a tribal renaissance, and in their traditions Wilkinson finds a model of ecocentrism. "'We have ceremonies for the first salmon of each run,'" as Billy Frank explains. "'When we eat the



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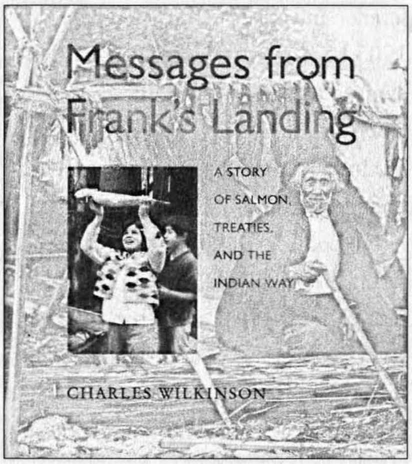


salmon we give our offerings to the fish and the river. We're not separate from the river.'"

Messages from Frank's Landing is lovingly written and thickly illustrated with photographs and Diane Sylvain's hand-drawn maps. Despite his focus on legal history, Wilkinson clearly was moved by his time at Frank's Landing, and the result is a deeply personal book.

Likewise, biologist Jim Lichatowich is not afraid to let emotion into his carefully researched history of the salmon crisis. Moving past the abstractions that guide so much of fisheries management, Lichatowich writes with grace and precision as a concerned inhabitant of a wounded ecosystem.

A cultural climate in which lawyers and scientists promote an ecocentric worldview cannot be wholly lacking in hope. Whether the salmon and their communities can wait for such a worldview to evolve more widely, however, remains to be seen.

Reviewed by **LAIRD CHRISTENSEN,** *assistant professor of English literature at Green Mountain College, an environmental liberal arts college in Poultney, Vermont*

Carnivores in Ecosystems:
The Yellowstone Experience

edited by Tim Clark, Payton Curlee, Steven Minta, and Peter Karieva
Yale University Press, 1999
426 pages, $37.50 hardcover

Evidence is mounting rapidly that carnivores play crucial roles in maintaining healthy ecosystems. The act of predation changes the number and behavior of prey and smaller predators. Because herbivorous prey are consumers of plants and seeds, the predatory activity of carnivores ripples through an ecosystem, affecting distribution and abundance of plants, mammals, birds, and insects. Even though we might typically think of a carnivore as merely affecting its prey species, such linear thought does not do justice to the function of predation. Predation actually creates a wave of indirect effects that cascade through the trophic levels of a system and also affect competitive interactions within each level. When carnivores are lost, species diversity, ecological processes, and evolutionary functions are degraded.

Carnivores in Ecosystems: The Yellowstone Experience is a useful collection of essays that examines the status, role, management, and conservation of carnivores in one of America's most celebrated natural areas, the Greater Yellowstone Ecosystem. The book blends chapters on individual species of carnivores and their prey, wolf restoration, changing attitudes toward carnivores, an evaluation of the role of carnivores in Yellowstone, and a model for carnivore conservation. I most enjoyed the beginning and ending groups of chapters, the jewel being the last one, "Carnivore Research and

illustration by Tracy Brooks

Conservation: Learning from History and Theory," by Steven Minta and his colleagues. The volume, informed by a 40-year base of data from the Greater Yellowstone Ecosystem, proposes strategies for carnivore conservation that are applicable beyond the boundaries of that region.

Such strategies are critically important. Historically, the dominant wildlife management paradigm centered on game species and embraced the concept that systems were controlled by the amount of resources available; i.e., managers held a "bottom-up" view of ecosystems. Under this scenario, carnivores were not thought to play a primary role in ecosystem function. Game management, combined with philosophies of bottom-up regulation, allowed agencies to promote artificially high numbers of ungulates and low numbers of carnivores. This was politically easy and economically beneficial to agencies funded by sale of hunting licenses. We are now starting to realize the cost of such strategies and the need for greater understanding of "top-down" ecosystem regulation.

Despite the importance of carnivores, they have not been well studied. Wildlife biologist George Schaller notes that only 15% of terrestrial carnivores have been the subject of even one field investigation. This is not by chance. The present range of large carnivores has been severely reduced, and many currently reside in remote places. Even where carnivores persist, they often live in artificially low numbers that mask their true ecological effects. Because carnivores are typically secretive, nocturnal, and wide-ranging, conducting research is a lengthy and costly process. All of these challenges amplify the need for books such as *Carnivores in Ecosystems.*

Furthermore, the use of existing knowledge has been impeded by the overheated political landscape within which carnivore management is forged. Wolves, cougars, bears, and other carnivores are at the center of an emotional battle between several segments of society, and this has reduced the role of science in the decision-making process. As conservation biologist Reed Noss has noted, scientific issues are often obscured when humans separate Nature into individual segments, making it difficult to see the value of a species to the ecological processes supporting life. When a species is viewed as merely an individual entity, the value assigned to it is usually economic—not ecological. Species that produce revenue are "good," even if they are exotic to the region. On the other hand, species that conflict with development are "bad," even if they play a key role in the evolution and maintenance of a particular type of habitat.

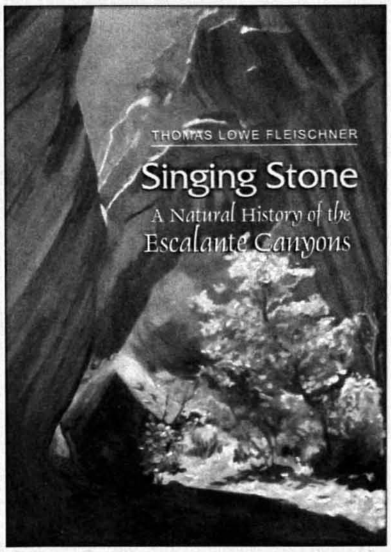
Carnivores and people can live together—if we desire to do so. To return missing carnivores to their rightful places in the landscape, conservation planning needs to be coordinated over large areas across local, regional, national, and continental levels. We need to better understand the social forces that have produced human attitudes and management decisions. And, we need to better appreciate the contribution of carnivores to the natural processes, evolutionary function, and species diversity of an ecosystem. *Carnivores in Ecosystems: The Yellowstone Experience* will be an important piece in solving that puzzle.

Reviewed by **BRIAN MILLER,** *a carnivore biologist at the Denver Zoological Society and a board member of The Wildlands Project*

Singing Stone: A Natural History of the Escalante Canyons

by Thomas Lowe Fleischner
The University of Utah Press, 1999
212 pages, $17.95 paper

Thomas Lowe Fleischner's book on the Escalante Canyons may have been produced by a conservation biologist, but it is written from the gut. By breathing fire into his facts, this Prescott College professor of environmental studies articulates the intuitive response many of us have to the red rock canyons found in the belly of Utah's Grand Staircase-Escalante National Monument. Fleischner's prose conveys not just the science of wilderness, but also the sensibilities of wildness. He finds the music in the trill of the red-spotted toad (C minor, he says), and ponders with his young son how snakes might kiss. A man committed to giving his students an education in the field, he recounts a harrowing group traverse of the Escalante River, suddenly swollen with spring snowmelt from a distant Boulder Mountain. Amid his discussions of riparian areas, biodiversity,



and ecosystems, these narrative gifts stir our appetites for the wild.

Rescuing us from the abstract terrain of so many natural histories, he writes life onto the page when he finds a white-throated swift shivering in the mud. "The visceral connection between the bird's fluttering heartbeat and the nerve-tips in my fingers focuses me on this animal as an individual being, not a member of a species." For him, it is not merely the recognition nor the naming of the natural world around us, but the "intimacy and repeated interaction" with an exact place that allows us to know it—indeed, to protect it too.

The chapters read like the striated layers of sandstone on the Colorado Plateau, each telling the story of a different era. In a section titled "The Terrain of Delight," Fleischner walks (although one could see him waltzing) through the canyons' geologic history, concocting analogies for our small minds to comprehend the immense scale of time and events. He rightly notes that a view of humanity's exceedingly brief presence on the timeline is "an antidote to hubris." Shrinking our importance even further, "The Texture of Life" highlights the dialogue between plants and animals of the canyons, and touches on the significance of the Escalante River as one of the last undammed rivers in the Southwest. Flowing free, the river and its canyon provide the context for an ageless non-human conversation.

In the chapters "Walking Upright" and "Home on the Range?" Fleischner first traces the mysteries of ancient human cultures in the canyons before charting the arrival of Europeans, and then Mormons. The latter two sagas—made up primarily of a peculiar Christian faith and cows—are central to understanding contemporary rural Utah and its disavowal of efforts to protect southern Utah's public lands. Many local Utahans still see these lands as theirs for the taking—including the sinuous sandstone labyrinths of the Escalante. Fleischner accurately describes, with simultaneous empathy and criticism, how Mormons were persecuted both by eastern gentiles and by the federal government, who, among other things, didn't like the number of wives Mormon men had accrued. To this day, the last bastion of sagebrush rebels has given the finger to any sort of conservation effort or government regulation, including the 1996 monument designation. For example, when livestock grazing during a recent drought threatened long-term damage to vegetation on the remote Kaiparowits Plateau deep in the monument and adjacent to

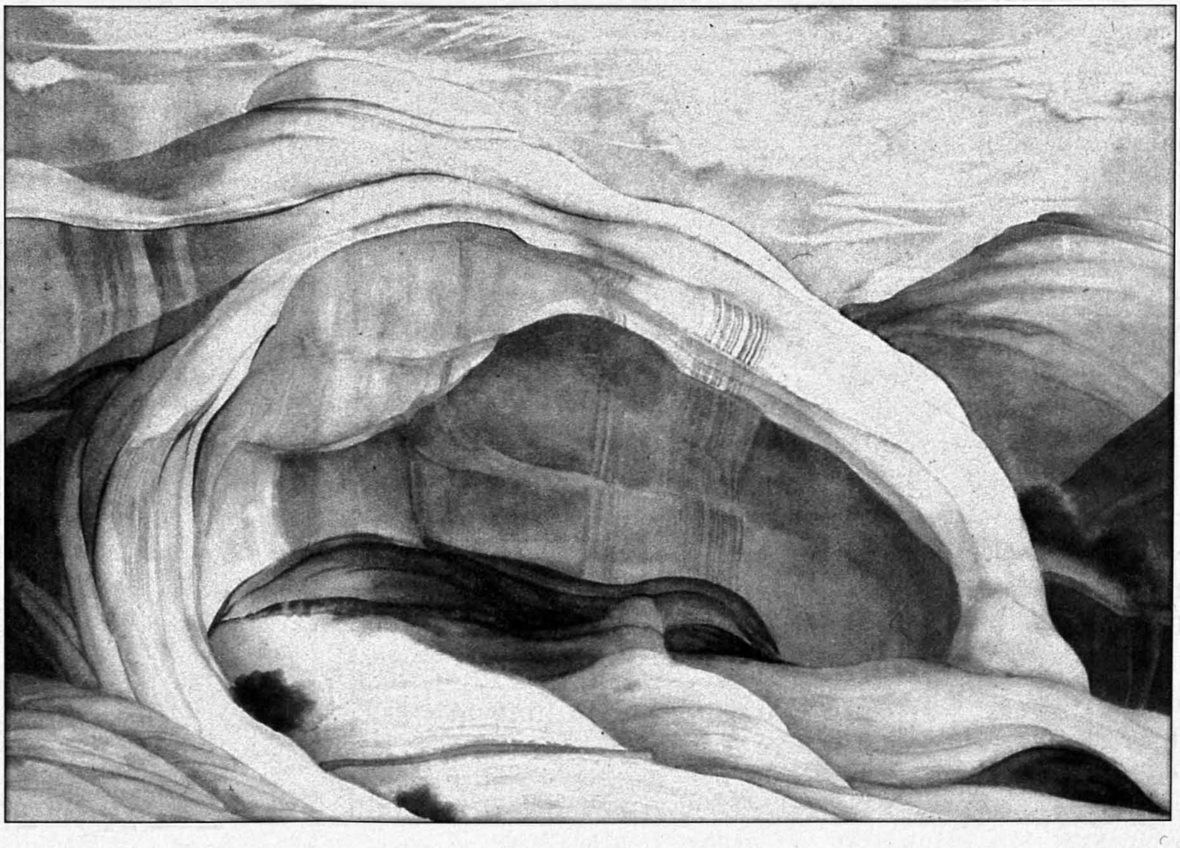


illustration by Serena Supplee

the Escalante Canyons, one rancher shot his cows rather than complying with the Bureau of Land Management's order to move them. Another rancher, whose cattle were impounded after she refused to comply with the same order, stormed the corral at BLM headquarters with the aid of the local sheriff and set her cows free.

Finally, in "Hungry for Fun," Fleischner catalogues how booming recreation and tourism now jeopardize this delicate canyon ecosystem—despite monument status—every bit as much as coal mining and cattle. Unfortunately the chapter ignores off-road vehicles, one of the gravest threats to Escalante and Utah's other remote areas. Yes, even slickrock canyon bottoms are at risk. Here the book has a slightly dry, academic tone as the author embarks upon a necessary discussion of public lands policy and the modern events that have shaped it. His discussion culminates with the current struggle to protect permanently the Escalante Canyons as wilderness under the 1964 Wilderness Act.

In its entirety, *Singing Stone* is an impressive piece of grassroots advocacy, baiting our appetites for wilderness—and wildness—by offering us tastes of an extraordinary place. And admirably, thankfully, it is intentionally *not* a guidebook to direct more hoards to its most delicious spots.

Scientists, aesthetes, and red rock desert rats alike, rejoice! *Singing Stone* is both history and science, as well as an intimate encounter with a wild desert land.

Reviewed by **AMY IRVINE,** *who works for the Southern Utah Wilderness Alliance and has just completed a book of conservation success stories,* Making a Difference *(The Globe/Pequot Press)*

A River Running West:
The Life of John Wesley Powell

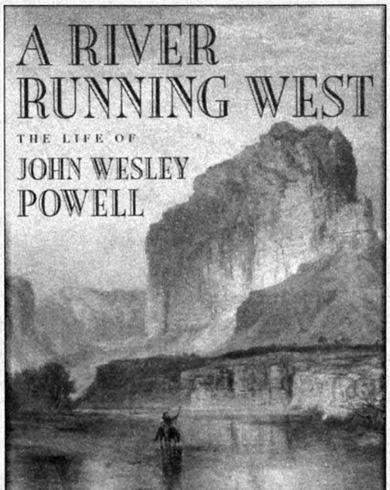
by Donald Worster
Oxford University Press, 2001
647 pages, $35

On May 24, 1869, John Wesley Powell and his crew of ten men launched four small wooden boats on the lazy currents of the Green River in present-day Utah. The crew's contract covered a full year of exploration. The southern-flowing waters of the Green soon merged with the roiling Colorado, and 69 days later Powell and crew emerged from the Grand Canyon, 900 miles downstream, short two boats, a few hundred pounds of scientific equipment, and five men.

Since then, Powell's first journey through the Grand Canyon has been elevated alongside Lewis and Clark's travels in the annals of American exploration. Despite the daring of Powell and his crew, in Powell's mind the journey down the Colorado was first and foremost a scientific expedition. In his new biography of Powell, *A River Running West*, Donald Worster reveals the depth of Powell's life in precise and engaging prose, rendering his exploration of the Colorado as but one chapter in a rich life dedicated to the scientific reckoning of the American West.

Powell came of age in an America united in its westward course. Yet, in the mid-nineteenth century, the nation remained divided by a growing economy, evangelical religion, an emerging secular worldview rooted in the natural sciences, and most important, slavery. No one is better suited to situate Powell in these shifting currents of American history than Worster, an eminent historian of the American West and environmental thought. Worster's breadth of historical knowledge is apparent from the biography's beginning, as he skillfully weaves Powell's formative experiences—child of Methodist missionaries, amateur natural historian, engineer in the Civil War—into the fabric of nineteenth-century America, placing Powell on the leading edge of the post–Civil War exploration and settlement of the West.

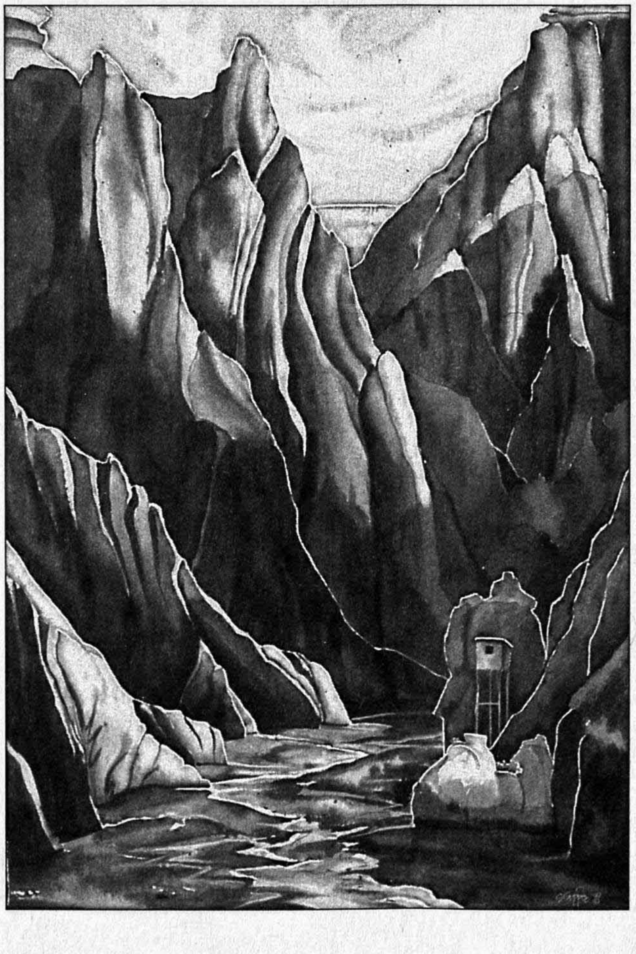
Though Powell may have achieved fame exploring the Colorado, the journey served as the starting point for his life-long study of the ecological and political realities of the American West. Unlike Frederick Jackson Turner, who saw American democracy forged on the western frontier, Powell surveyed the West with the calculating eye of a scientist, and on the arid lands of the Colorado Plateau, he foresaw a fundamental challenge to the nation's agrarian underpinnings. Worster's patient analysis reveals Powell as a thoughtful and complex proponent of American democracy. Powell defined the West in equal measure by its aridity, which limited agriculture, and its complex cultural heritage, shaped by



Native Americans, Mormons, and a rising tide of Americans.

In the 1870s, Powell's river journeys flowered into one of the great western surveys. Under Powell's leadership, the survey of the Colorado Plateau went beyond delineating the region's topography and resources to include important studies of the region's ecology and ethnology. By Worster's measure, "Powell had a visionary zeal, a wide-ranging intellect, and a prodigious energy that drew men like a warm campfire on a winter range." Worster's exacting scholarly research documents the contradictions that underlaid Powell's intellectual enthusiasm. While he maintained a remarkable openness toward Native Americans, viewing them as whites without science, he also helped the federal government confine Indians to reservations. And despite Powell's appreciation of the Colorado Plateau, Worster gives full attention to Powell's interest in developing the arid West, which meant harnessing its rivers to the region's economy with dams.

Worster describes nineteenth-century America as a "river in floodtide," flowing west with "more power and force, much of it destructive, than any river of nature." As Powell increasingly tried to influence that westward flow, he began gravitating towards the East, where he became enmeshed in the politics of Washington, DC. By 1880, Powell made his home in the capital, where he simultaneously served as the director of the newly formed Bureau of Ethnology (1879–1892) and the second director of the United States Geological Survey (1881–1894), reflecting the two dominant intellectual currents of his own life. His leadership of the Geological Survey, however, with its implications for the public domain, mining claims, and the reclamation and irrigation of the West, sparked the most controversy in a nation determined to capitalize on the remaining public domain. It is this chapter of Powell's life which garners Worster's closest analysis.



Settling the West depended upon water. More than any other American of his day, Powell anticipated the formative role that water would play in the political economy of the American West. Under his guidance, the US Geological Survey produced an irrigation survey in the 1880s that proposed the watershed as a planning unit, small dams on the tributaries of many western rivers, and cooperative management of water rights by groups of individual farmers. As envisioned, Powell's plan outlined a democratic West where people, rather than corporations, would control the region's limited water supply. Worster describes Powell's West as "a mosaic of independent, self-determining commonwealths where water, land and forest were united in the body politic." His decidedly populist agrarian politics, however, led him into a vitriolic feud with western senators, notably William Stewart of Nevada, which was his political undoing in the 1890s.

Although Powell's vision of the West and appreciation for Indians never quite meshed with the America of his day, Worster reveals Powell's pivotal role in forging a place for the public scientist in American polity. In fact, Powell approached science with the same zeal with which his own father had once spread the Methodist gospel on the midwestern frontier. Ultimately, *A River Running West* is the work of one of our most skilled environmental historians taking measure of one of the great scientific minds of the nineteenth century. It is a rich account of a complex man, the problem of the arid West, and the enduring tensions between a progressive society and the limits of the land.

Reviewed by **JAMES MORTON TURNER**, *a graduate student in history at Princeton University, whose latest article for* Wild Earth *appeared in the spring issue*

Colorado River, Grand Canyon by Serena Supplee

Gatherings

Conservation Conference

The Soil and Water Conservation Society's annual conference takes up the theme "Conservation from the mountains to the sea," August 4–8, in Myrtle Beach, South Carolina. Major topics include climate change, coastal regions, and water supply. Contact the Society at 7515 NE Ankeny Rd, Ankeny, IA, 50021 or visit their website, www.swcs.org.

ESA Meeting

The Ecological Society of America's 86th Annual Meeting will be held August 5–10, in Madison, Wisconsin, under the title, "Keeping all the Parts: Preserving, Restoring, and Sustaining Complex Ecosystems." Visit http://esa.sdsc.edu/ or call 202-833-8773.

Rachel Carson Symposium

The US Fish and Wildlife Service will hold a symposium, "Rachel Carson and the Conservation Movement: Past, Present, and Future," August 10–12, at the National Conservation Training Center in Shepherdstown, West Virginia. The gathering will celebrate the 60th anniversary of Carson's first published book, *Under the Sea Wind,* and the 40th anniversary (next year) of *Silent Spring.* Speakers include Linda Lear, Barry Lopez, and others. Visit www.nctc.fws.gov/history/carson2001.html or call 304-876-7276.

Prairie Festival

This year's annual Prairie Festival, to be held September 29–30, in Salina, Kansas, celebrates The Land Institute's 25th year of work to develop ecological agricultural practices. For more information, visit www.landinstitute.org or call 785-823-5376.

Land Trust Rally

The National Land Trust Rally, September 29–October 2, in Baltimore, Maryland, addresses natural area protection, agricultural lands, trails, urban open space, and watersheds. Day-long seminars and field trips will be held on September 29 and 30, followed by workshops on October 1 and 2. Topics will cover land transactions, conservation easements, stewardship, fundraising, and community outreach. Contact 202-638-4725, www.lta.org/training/rally.htm.

Ecological Restoration Conference

"Restoration Across Borders" is the theme of the Society for Ecological Restoration's 13th annual international conference, October 4–6, Niagara Falls, Ontario, Canada. Sessions will focus on the Great Lakes ecosystem, agriculture, public lands restoration, invasive species control, and river restoration. Email ser2001@niagrac.on.ca or visit www.ser.org.

Journalists' Conference

The Society of Environmental Journalists' annual conference will be held October 17–21, in Portland, Oregon. The agenda includes tours of Mount Saint Helens, salmon runs, and the Pacific coast; sessions on business and the environment, and the Bush administration; keynote by Russell Mittermeier. Contact 215-884-8174, www.sej.org/go/conference.htm.

Publications

Eastern Forests Report

"A Vision for Restoring and Protecting Eastern Forests" was recently published by the American Lands Alliance. The paper highlights the history of and threats to forests in the East and provides policy recommendations. To receive a copy, visit www.americanlands.org/forestweb/eastern_white_paper.htm or contact Kristen Sykes, 202-547-9134.

Invasive Plant Handbook

The Nature Conservancy's Wildland Invasive Species Program has released an online publication, "Weed Control Methods Handbook." Seven chapters review manual, grazing, fire, biocontrol, and herbicide techniques. This free handbook is available at http://tncweeds.ucdavis.edu.

Adirondacks Report

The Residents' Committee to Protect the Adirondacks has released "Growth in the Adirondack Park: Analysis and Patterns of Development." This 133-page report traces development trends in the 1990s, local government readiness, and provides recommendations for future protection with extensive charts and maps. Contact RCPA, PO Box 27, North Creek, NY 12853, 518-251-4257, rcpa@netheaven.com.

Soil Biology Booklet

"Soil Biology Primer," an introduction to the living components of soil, includes chapters on bacteria, fungi, protozoa, nematodes, arthropods, and earthworms. Copies are available from the Soil and Water Conservation Society, 515-289-2331, www.swcs.org.

Northwest Guide

Using the martial art of aikido as a metaphor, "This Place on Earth 2001: Guide to a Sustainable Northwest" describes best practices in building livable cities, redirecting markets toward ecological values, curbing governmental subsidies to polluters, slowing population growth, and "greening" the tax code in the Pacific Northwest. For a copy, contact Northwest Environment Watch, 206-447-1880, www.northwestwatch.org.

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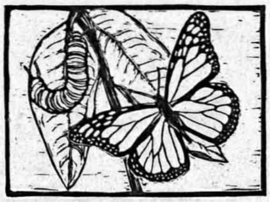

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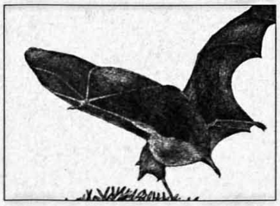

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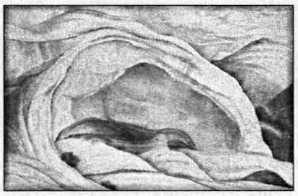

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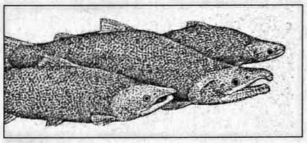

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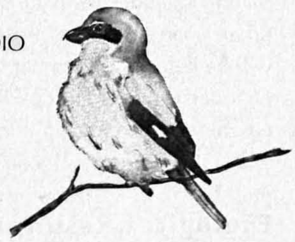

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BACK ISSUES

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.

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, Hydró-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 Ecosystems 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

41/ Spring 2001 • ***Wild, Wild East*** Dave Foreman on "Pristine Myths," an Eastern turn for wilderness, Eastern Wilderness Areas Act legislative history, Doug Scott reviews Congress's criteria for wilderness, David Foster interview, biotic homogenization in the Northwoods, eastern cougar recovery, David Carroll on turtles and trout, Tom Wessels on beaver recovery, lichens and ancient forests, biodiversity on the Appalachian Trail, wildlands philanthropy in Maine

Additional *Wild Earth* Publications

Old Growth in the East: A Survey by Mary Byrd Davis

Special Paper #2: *While Mapping Wildlands, Don't Forget the Aliens* by Faith T. Campbell

Special Paper #3: *A Citizen's Guide to Ecosystem Management* by Reed Noss

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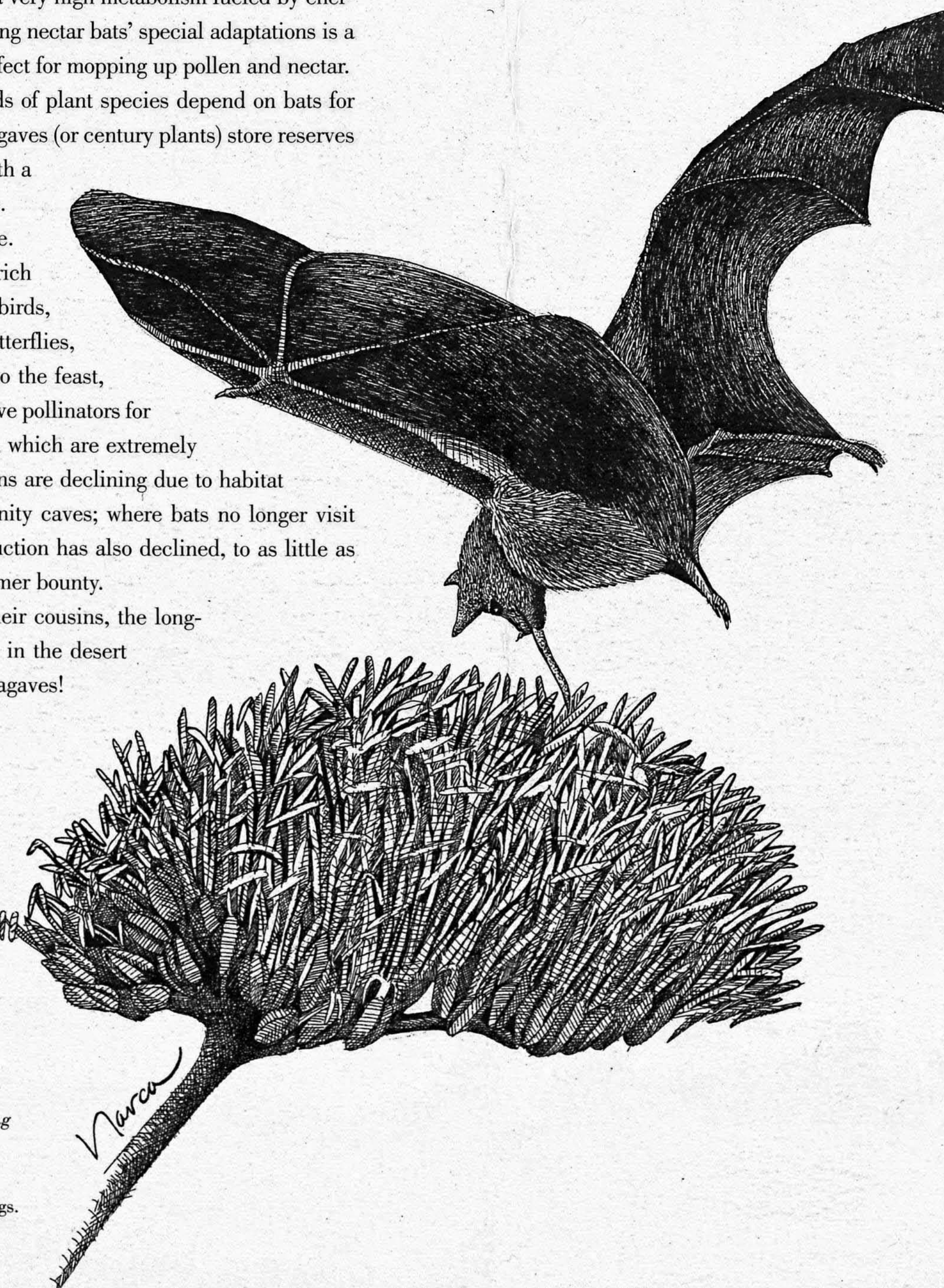
Of Nectar Bats *and Agaves*

In the southwestern United States, the Mexican long-tongued bat is one of three nectar-feeding bat species that migrate annually from Mexico along a corridor of flowering cacti and agaves. Some moonlit August evening in southern Arizona or in New Mexico's bootheel, hike to a stand of agaves in full and prodigious flower. You may feel about you the whisper of wings as nectar bats arrive to feast, sometimes carrying suckling young.

Ecologically, nectar bats are the nocturnal equivalent of hummingbirds. Like hummingbirds, they are the only of their kind capable of hovering. Both groups have a very high metabolism fueled by energy-rich nectar and pollen. Among nectar bats' special adaptations is a long, bristle-tipped tongue, perfect for mopping up pollen and nectar.

Worldwide, many hundreds of plant species depend on bats for pollination or fruit dispersal. Agaves (or century plants) store reserves for decades before shooting forth a single immense inflorescence. They bloom once, then die. Although nectar- and pollen-rich agave flowers lure hummingbirds, orioles, hawk moths, bees, butterflies, and a host of smaller insects to the feast, most of the diners aren't effective pollinators for the agave—unlike nectar bats, which are extremely effective. Nectar bat populations are declining due to habitat loss and disturbance of maternity caves; where bats no longer visit agaves, the agaves' seed production has also declined, to as little as one three-thousandth of its former bounty.

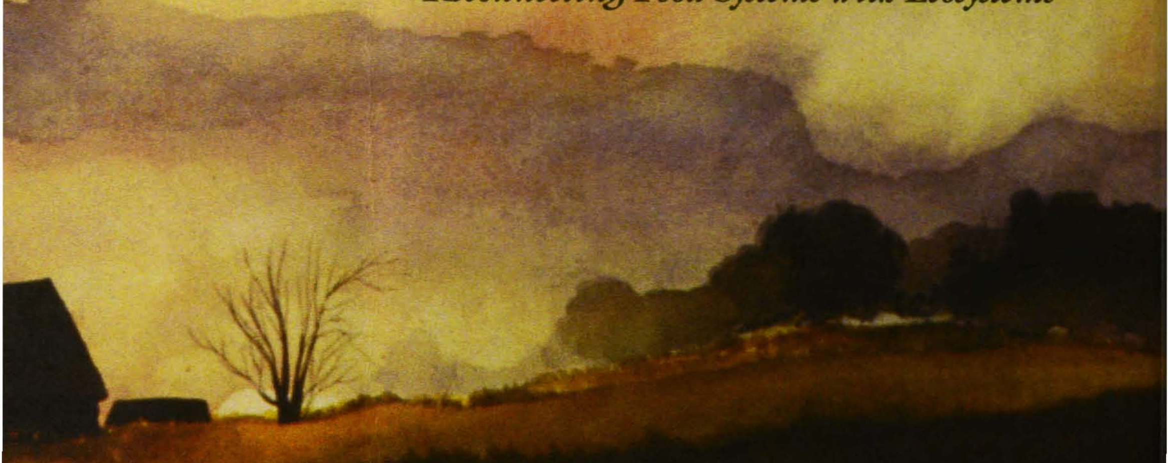
Long-tongued bats and their cousins, the long-nosed bats, enliven the nights in the desert Southwest—and pollinate the agaves!



Text and illustration by
Narca Moore-Craig,
who harbors a passion for exploring the wilds and sharing her discoveries through art and through leading natural history and birding tours to six continents. A past president of Western Field Ornithologists, Narca's award-winning art appears in A Natural History of the Sonoran Desert *and* A Guide to Southern Arizona Bird Nests and Eggs.

Farming with the Wild

Reconnecting Food Systems with Ecosystems



The food you eat connects you to a place—a place whose wild inhabitants need clean air and water, healthy soil, and ample habitat to survive. And with two-thirds of the land in the United States used for raising crops and livestock, modern agriculture plays a pivotal role in deciding the fate of wildlands and wildlife.

Unfortunately, many community-based farmers who care about the ecological landscape in which they farm are struggling to make a living as they compete against industrial agriculture and international markets. It's time we re-think food systems from the ground up and support agriculture that is compatible with conservation.

The Wild Farm Alliance was recently founded by a group of conservationists and ecological farming advocates who recognize the need for collaboration on behalf of biodiversity. Together, we're bridging the gap between stewardship farming and wildlands conservation by promoting agriculture that helps protect and restore wild Nature. Only together can we create a future in which ecologically sustainable, economically viable farms and ranches are integrated into landscapes that accommodate the full range of native species and natural processes.

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The Wild Farm Alliance is a project of the Tides Center.

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