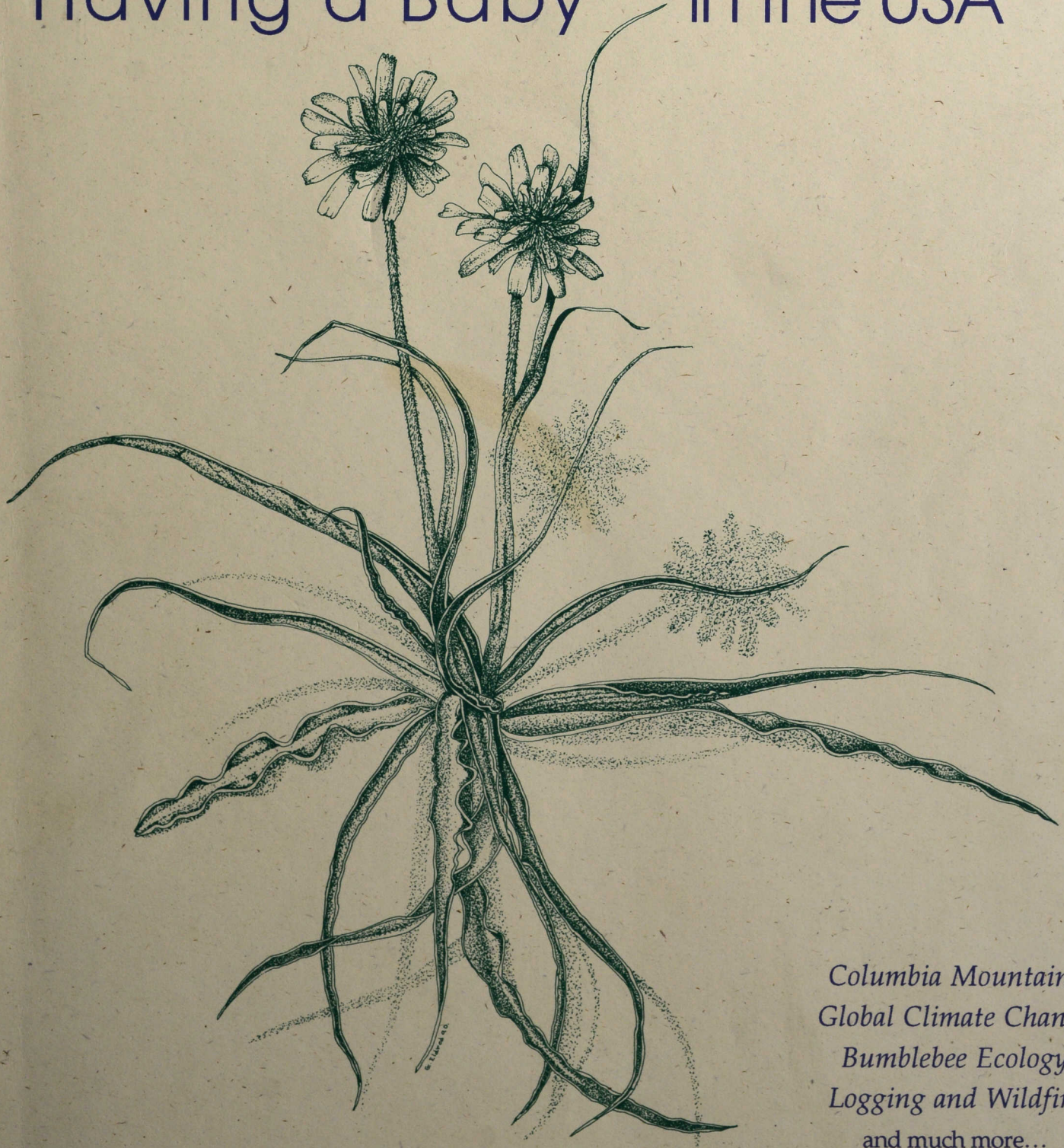
Wild EARTH

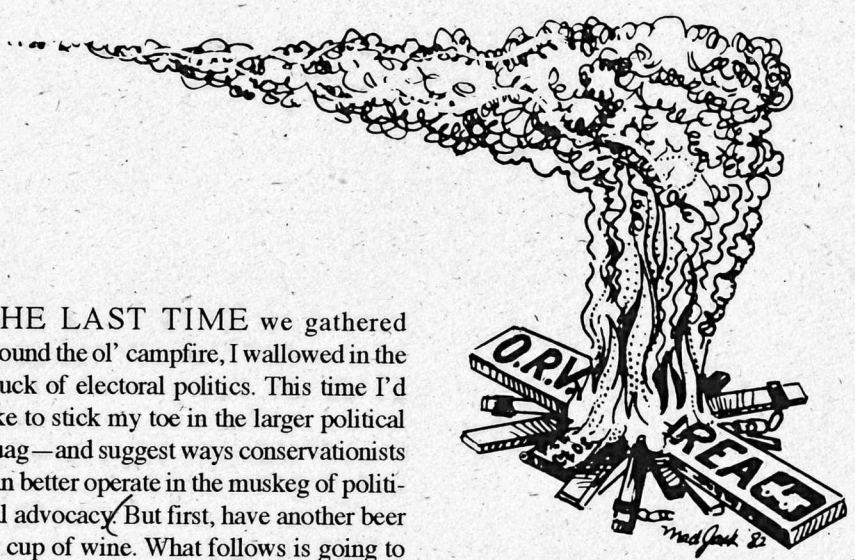
Summer 1995
$4.95 US

Environmental Consequences of Having a Baby in the USA



Columbia Mountains
Global Climate Change
Bumblebee Ecology
Logging and Wildfire
and much more...

Around the Campfire



THE LAST TIME we gathered around the ol' campfire, I wallowed in the muck of electoral politics. This time I'd like to stick my toe in the larger political quag—and suggest ways conservationists can better operate in the muskeg of political advocacy. But first, have another beer or cup of wine. What follows is going to be howling heresy to a lot of folks, maybe including you.

When I began in the conservation wars a quarter of a century ago, I was blessed with some extraordinary mentors. Clif Merritt, Harry Crandell, Stewart Brandborg, and Ernie Dickerman were veterans of the campaign for the Wilderness Act and wise in the ways of Washington. Along with these hoary old war-horses (who, I suppose, were actually not much older than I am today—or, gawd, even younger) were five younger, but still experienced, staffers for The Wilderness Society and Sierra Club: Susan Morgan, Brant Calkin, Jerry Mallett, John McComb, and Doug Scott.

I learned from these and other conservationists the bedrock necessity of mobilizing a constituency for Wilderness Area proposals, conservation legislation, and good public lands management. They had learned it from their mentors, Howard Zahniser and David Brower. Brock Evans, who became a mentor of mine later, is fond of saying that the way to win is through "endless pressure, endlessly applied." I learned that this pressure is most effectively applied by citizen activists, not by professional lobbyists for conservation groups.

I was quite effective, I think, back in the 1970s lobbying New Mexico's Senator Pete Domenici and Representative Manuel Lujan (both Republicans) to support Wilderness Areas and the Alaska Lands Act. But the reason I had clout with them was because I made sure they had received a stack of letters from New Mexico citizens before I ever walked into their offices to discuss a particular area or issue.

Mobilizing a grassroots constituency was central to the efforts of the conservation movement back in the 1960s and 1970s. It still should be; and, as I've noted in my last couple Campfires, the failures of today's movement are inevitable results of our abdication of grassroots organizing to the unwise users. Mobilizing support, however, is not the whole shootin' match. We must also think about our message and how to present it.

With that in mind, let's look at some ways of operating more effectively in the arena of public advocacy. The conservation movement, as measured in number of organizations, memberships of organizations, and income, has never been larger than it has been in recent years. Yet, never before (at least in my conservation lifetime) has the conservation movement been less effective in articulating and fighting for its position. We have been out-maneuvered, out-organized, out-thought, and out-marketed by our opponents.

continued on p. 2

This is a clear reversal from 'ephemeral' emphasis

WILD EARTH

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The enemies of wilderness and wolves, of wetlands and warblers, of wild rivers and wild forests have been more effective with the media, politicians, and bureaucrats than we have...

In recent years, the enemies of wilderness and wolves, of wetlands and warblers, of wild rivers and wild forests have been more effective with the media, politicians, and bureaucrats than we have—in spite of consistent public support for wolves, parks, and forest protection. Mind you, I am not singling out DC lobbyists or big national groups for criticism. *The entire movement—from the largest "mainstream" national organizations to the smallest "uncompromising" local groups—has done a poor job of presenting our case.* We have been blind to the larger political changes whirling about us. We've been unconscious of how we are perceived (and are being portrayed). We haven't had a strategy worthy of the name. I include myself in this criticism.

Indeed, in the last couple years, memberships and incomes of most large conservation/environmental organizations have declined. These declines should not be brushed off as vagaries of charitable giving, but should be seen as evidence of something wrong with the marketing of our message and proposed solutions. The conservation movement must begin to build a winning strategy that will enable us to go toe-to-toe with property zealots, clearcutters, welfare ranchers, and fast-buck land speculators. The phony wise use movement and the religious right have adopted our old organizing techniques. We must take them back and we must also study the effective strategy the wacko right wing* has used to capture control of the debate and to create the false impression of a ground swell of public opinion for their extreme positions.

We need to professionally investigate how the conservation movement is perceived by the public, the media, and decision makers. Then we need a coherent strategy to restore and deepen grassroots support for public lands, protection of Endangered Species, reintroduction of wolves, designation of larger Wilderness Areas, clean air and water, an end to commercial logging on public lands, and so on.

Following are some tentative thoughts on what may go into such a campaign strategy.

1) **Think Long Term.** When Barry Goldwater was defeated for president in 1964, the right did not curl up to whimper and lick its wounds. Some very bright, dedicated people sat down and developed a long-term strategy to take over the United States. By doing so, they became the source for ideas in American politics (forget for the moment whether they were good ideas or not), and became more effective than their liberal opponents at mobilizing a constituency. Moderates and liberals of both parties put up lame and uninspired resistance at best. It took sixteen years to elect Ronald Reagan and twenty-eight years to elect the Gingrich Congress, but the right-wing revolution in American politics can be traced back to the long-term strategizing after Goldwater's defeat. I know. I was there. I saw it begin. (Unfortunately, it was not a Goldwater-style conservatism that took over, but that is beside the point here.)

2) **Seek Alternatives to Federal Government Regulation.** There is a true grassroots rebellion against what is perceived to be heavy-handed regulation by federal bureaucrats. Never mind that some rebels are motivated by greed or by a crackpot "rugged individualism," or that clever demagogues have magnified anti-fed feelings. Many honest, sincere, well-meaning people (who are not necessarily against Wilderness and Endangered Species) feel that the federal government is a bully and is too omnipresent and inflexible. Our opponents have cleverly and often successfully portrayed conservation and environmental organizations as one of many special interest groups wedded to big government bureaucracy.

In many cases strong federal laws and subsequent regulations are vital to protect the biological diversity and scenic beauty of the United States, and the health and happiness of its citizens. We should be steadfast and unyielding in defending those laws and regulations and in working to strengthen them where necessary. However, in many cases there are alternatives such as voluntary agreements, market forces, or state and local laws and regulations. The conservation movement needs to be in the forefront of exploring and advocating these alternatives (but we must not allow this to be an excuse for compromising!).

While some unfunded federal mandates are necessary and reasonable, others are an unfair, unwarranted imposition on state and local government. The conservation movement must be careful in deciding which are necessary and which are not. We should also be careful to evaluate the impact of what appear to be justifiable rules—do they cause more resentment and long-term political damage than the good they accomplish? Government regulations and standards should be reasonable, user-friendly, and as non-bureaucratic as possible. The paperwork avalanche and petty requirements on small businesses—generated by OSHA and EPA and other federal agencies through worker safety and smoking restrictions, among others—are major reasons for small businesspeople being in the forefront of the right-wing

* I call it the "wacko right wing" because I still consider myself to be a conservative, but I despair at some of the positions taken by the right today. Conspiracy theories straight out of the John Birch Society, twisted libertarianism based on greed without responsibility, and theocratic social policies have no place in real conservatism.

revolution. Countless examples of counterproductive social engineering could be cited. Do-gooders need to know the limits of the good they try to do.

3) **Acknowledge that Cost-Benefit Analyses Are Sometimes Valid.** Without allowing economic considerations (and particularly narrowly-defined business-profit considerations) to dominate decisions about land management or pollution control, cost-benefit analyses are sometimes valid. In many cases they support conservation. Had fair cost-benefit analysis been done, many dams choking our rivers would never have been built. Honest cost-benefit analysis would argue against most logging and grazing on public lands. Cost-benefit considerations would scream for radical reform of our mining laws. Wide-ranging cost-benefit analysis would kill much development—considering the infrastructure cost to bring another hundred thousand residents to Albuquerque, for example. How much does increased crime, pollution, sprawl, and such from new development cost current residents? What are the health costs of pollution?

On the other hand, sometimes it is legitimate to consider costs before demanding the cleanup of past pollution or toxics—asbestos and certain superfund sites, for example. And can we really afford some of the incredibly expensive urban National Parks? Could that money be better spent for biodiversity elsewhere? Is the Park Service the proper agency to run urban parks? We must honestly ask such questions. We *are* in an age of limits. That is a keystone part of the conservation message. Dollars available for cleaning up past mistakes or for conservation purposes are not unlimited.

While cost-benefit analysis may sometimes be useful or unavoidable, conservationists must constantly argue that we cannot measure natural values in dollars, that economics are not the most important standard for decision-making.

4) **Listen to Our Opponents.** We should carefully listen to our opponents and analyze how they criticize us or attempt to refute our arguments. This analysis should cover the whole range of conservation and environmental naysayers, from cynical reporters to well-meaning "realists" to principled opponents to greedhead exploiters to crybaby-cowboys to corrupt demagogues to wacko paranoids.

No, I'm not talking about taking their prescriptions, but about listening to their diagnoses. Some of their criticisms of the conservation and environmental movements are on target. Listening to them can help us put our house in order. They attack us on our weakest arguments; by letting them identify those arguments for us, we can improve our message.

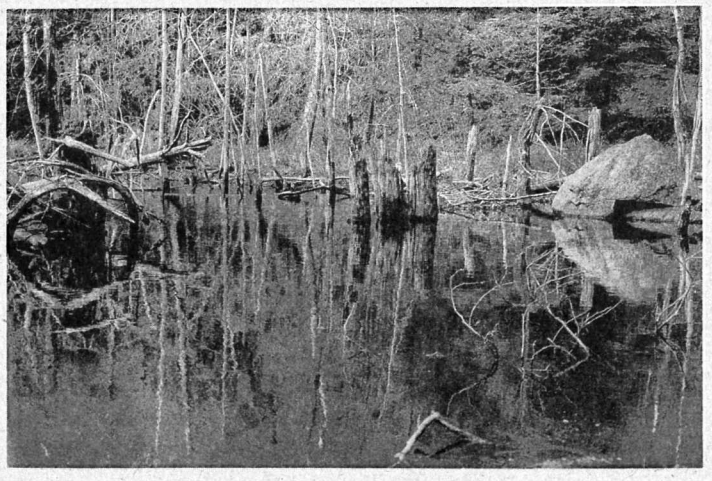
5) **Don't Exaggerate.** I make no apologies for being a doomsayer. Evidence of ecological collapse is everywhere. We should not shy away from presenting it to the public. But we do not need to exaggerate. The reality is bad enough. When we exaggerate—about asbestos, about Alar, about species that are not truly endangered, and sometimes even about the effects of logging or grazing—we damage our credibility with the public and give phony "scientists" like the late, unlamented Dixie Lee Ray ammunition to discredit us.

On complex issues like global warming and loss of the ozone layer, we need to make our case on widely accepted scientific evidence. We also must be careful about offering speculative future scenarios which may be construed as hard predictions.

6) **Celebrate Our Successes.** Environmental Pollyannas like Gregg Easterbrook have a point. The environmental and conservation movements have achieved some notable successes. I see one every day from my backyard as I look across the city of Albuquerque to Mt. Taylor 66 miles distant. The air *is* cleaner. Federal laws and regulations for clean air and clean water have been generally successful. Let's acknowledge it. Let's celebrate it. Let's make it abundantly clear that the reason airsheds and rivers have gotten cleaner since the horror days of the burning Cuyahoga and eye-tearing smog in major cities is *federal* legislation.

Let's proudly point to the American Alligator, the Brown Pelican, the Bald Eagle, and the Gray Wolf in Minnesota as successes of the Endangered Species Act. And, yes, to the reintroduction of wolves in Yellowstone and Idaho. The Endangered Species Act works! It is a winning example of the love Americans have for other species, for the natural world; it is a tribute to our character as a people.

If we don't point to successes from decades of federal environmental and conservation legislation, how can



© Jonathan Blake

photo by Jonathan Blake

we defend the importance of federal efforts in the future? Don't twist my words. There is much yet to do. There have been monumental failures of federal action—rather, *inaction*—but by not celebrating our successes we undercut our future campaigns.

7) **Avoid Politically-Damaging Linkages.** Fairly or unfairly, but somewhat successfully, our enemies have portrayed the conservation and environmental movements as part of the politically-correct Left. We are characterized as one more special interest group seeking to extend government interference in the lives and pocketbooks of citizens. The wacko right in the last election successfully capitalized on the fears of many people to gain their vote. While voting for less government interference, these people unintentionally also voted for the backwards social agenda of the religious right and for the rape-and-scrape ideology of the fast-buck wing of the GOP. Many conservationists individually support gay rights, animal rights, affirmative action, gun control, and generous social services, and oppose the death penalty and military intervention abroad; but the conservation movement should stay focused on its main issues and not link itself to these other social causes. Conversely, the conservation movement should not campaign against gun control or for school prayer and the balanced budget amendment. Through partisan linkages, we add very few activists to the conservation cause and risk alienating many more. The job of the conservation movement is to defend wildlife and wildlands. Our job as individual citizens may be considerably broader.

8) **Reach Out to Other Groups.** Without creating linkages on non-conservation issues, we should still reach out to other groups to find common ground on conservation issues. Hunters and fishers are a natural constituency, despite slob sportspeople and the anti-conservation stance of the NRA. Religious groups, even fundamentalist Christians, can be appealed to with thoughtful conservation arguments and talk of responsible stewardship and valuing God's creation. Budget hawks are natural allies against deficit timber sales, mining law giveaways, below-market-value grazing permits, subsidized irrigation water, and corporate welfare. The interests of conservationists coincide with those of Native Americans on many issues and with African-Americans and members of other ethnic groups on pollution issues in their communities.

9) **Accept Diversity in the Conservation Movement.** We need a vibrant, diverse conservation movement. Different groups should emphasize different issues. They may have different tactics, approaches, and even policies on some issues. We need that diversity, and we need to experiment to find more effective approaches. A sad irony is that oftentimes those who most trumpet social diversity are the least tolerant of diversity in the conservation movement. Let's accept our differences, work together when we share common ground, and agree to disagree when we don't.

10) **Appeal to Traditional American Values.** There is much in American history of which to be proud from a conservation perspective (in spite of current ecological problems). We can defend our views and policies with traditional American values. We can also turn our enemies' own rhetoric against them. When fast-buck subdividers or ranchers prattle about private property rights, we should calmly discuss the responsibilities that go with property ownership. When right-wingers rail against welfare dependency and sermonize about how it corrupts character, we should point out the generational welfare dependency of public lands ranchers, loggers, miners, and of agribusiness and other subsidized industries.

We should appeal to Americans' values and character. What kind of people, we should ask, would cause the extinction of other species? What does it say about our worth as individuals and as a society if we cannot draw our vital resources from the land and water without polluting, without destroying, without impairing long-term productivity, without damaging ecological integrity? We should place shame on those who abuse their land, just as shame is being touted as a remedy for graffiti and teenaged pregnancy.

11) **Favor Users' Fees.** The new emphasis on fiscal responsibility and reducing the federal deficit has a multitude of repercussions on conservation programs and public land management. On one hand we are seeing and will continue to see budgets cut for the Park Service, Fish & Wildlife Service, and other land management agencies; funds will dry up for new National Park purchases and for Endangered Species recovery. On the other hand, the budget crunch argues against continued subsidies for timber, mining, and grazing industries.

Conservationists can gain more money for conservation programs and gain stature for arguing against welfare for the cowboys and timber beasts by demanding the privilege of paying more for the outdoor recreation and wildlife viewing we enjoy. I recently purchased a Golden Eagle Pass for 1995. This $25 investment allows me unlimited free entry to all National Parks and Wildlife Refuges for one year. What a bargain! It should cost at least a hundred bucks. Fees should be charged for Wilderness and Wild River permits (some Wild Rivers do charge for float trips). There should be a special sales tax on backpacking equipment and another on bird seed and binoculars. Agencies should be allowed to keep all their recreation fees for land protection. The sales tax on bird seed and binoculars should go to fund the Endangered Species program of the Fish & Wildlife Service. If we want our favorite government programs funded, be they Endangered Species or Wilderness management or land purchases, we—conservationists and outdoor recreationists—should be willing to pay for them.

12) **Do Not Compromise at the Outset.** Too often, conservationists who wish to be accepted as legitimate players in the political debate compromise at the outset to gain credibility. This only gains contempt from our opponents

and from those we wish to influence, and defeat for our values. Sometimes it is necessary to compromise. Sometimes it is necessary to be intransigent. It is always necessary to fight hard and smart. Compromising at the outset is neither. It is a sign of weakness.

13) **Play Rough.** We should be scrupulously honest and fair. But we are fighting for things of ineffable value against enemies who are stronger than we are and who often have no compunctions about being dishonest or even violent if that's what it takes to win. We must be tough and even ruthless in this fight. What are the weaknesses in our enemies' positions or in their characters? The wise use movement has skeletons galore in its closet; it's time we paraded them out.

We should decry the violence and intimidation they use. Chuck Cashman has no second thoughts trying to saddle the conservation movement with the blowing up of a Forest Service office in Nevada (probably done by ranching extremists). Let's demand FBI operations against those in the wise use movement who have threatened federal officers. Let's banner the crackpot religious and political powers behind the wise use movement—the Reverend (sic) Moon and Lyndon LaRouche. Let's disrupt the wise guys' cozy facade of togetherness by exploiting differences between snake oil salesmen like Cashman and Arnold, and by letting the People for the West rank and file know that their leaders are New Left pinkos. Let's constantly hammer at their Achilles' heel of welfare ranchers, welfare loggers, welfare miners, and welfare subdividers.

14) **Marketing.** The American public and even members of conservation groups are woefully ignorant about biodiversity and public lands. Conservation groups need to direct more of their outreach away from fundraising and membership recruitment to basic education (of course, this can aid fundraising and membership). We need plainly written but compelling brochures for free mass distribution on public lands, Wilderness, Endangered Species, resource subsidies, and private land rights and responsibilities. We have not been getting our message out to the public. We need to use the best people in the business to market our ideas to the public and decision makers.

15) **Change Perceptions.** Politicians, bureaucrats, the media, the public, and even conservationists develop their perceptions of public views on the *appearance* of public views. Three simple but extremely effective ways perceptions are formed are bumper stickers, letters to the editor of newspapers and magazines, and (I hear) by radio and TV talk shows. Driving around Albuquerque, I receive the impression that the public loves fetuses, Jesus, and hot air balloons. Reading the local letters to the editor, I develop the impression that most people have jobs dependent on "growth" and want more bridges over the Rio Grande, and think ranchers already pay too high grazing fees. Goodness only knows what perceptions I would develop if I ever listened to talk radio. I'd probably commit suicide.

We, as conservationists, must get back in this arena of creating the appearance of public opinion. Every conservation group should send a free bumper sticker to each of its members every year. We should use expert marketing consultants to select the simple, effective slogans, perhaps: The Endangered Species Act Works; I Like Wilderness; They're Stealing Your National Forests; Save the Wolf. Sierra Club and Audubon local groups should organize teams of letter-to-the-editor writers. Not only should every letter from the other side be answered, but we should initiate discussion on our issues. The same tactic should be employed in countering talk show nonsense.

16) **Mobilize.** I've written about it before, I'll write about it again. The conservation movement must put a premium on mobilizing its members to express their opinions in a variety of ways to opinion makers and decision makers. Conservation groups need to hire lawyers, biologists, economists, and policy wonks—but they must hire grassroots organizers, too.

It's war out there, kids. It's time to fight as if we were serious.

—Dave Foreman

Kenai National Wildlife Refuge, Alaska

illustration by Brush Wolf

Not a Digression: The Best Defense is a Good Offense

by David Johns

April 1995

Just as disappointment in the United States over the conservation record of the Clinton Administration was reaching new lows, a new Congress came to town. Garrison Keillor commented that there was actually little genuinely new about this crowd: "The same old fraternity boys, geezers in golf pants, cheese merchants, cat stranglers, corporate shills, Bible beaters, swamp developers, amateur cops and old gasbags that we have known since time immemorial." The course of US politics and conservation policy seems to go from bad to worse, back to bad to for awhile, and then worse again.

Thoughout North America, economics and politics seem to be conspiring against friends of the natural world. The Mexican peso's dive makes the US dollar's fall seem like a minor perturbation. Combined with a huge debt, internal political pressures, and NAFTA, this currency devaluation is a major impetus to exploit undeveloped lands. In Canada, where deficits have grown massively in recent years, some of the provincial governments can't seem to sell their natural heritage quickly enough. They are attempting to balance the books on the back of nature.

What has all this grim news to do with The Wildlands Project? Everything. There is a strong tendency in times like these for conservationists, including many of the staunchest, to back off from our demands, regroup, and get ready for the onslaught by organizing our defenses. It is a grave mistake, however, for either us or the "new" US Congress to think they have a mandate to trash wilderness and overturn laws like the Endangered Species Act.

Their claim to have such a mandate is belied by the manner of their attack on conservation—it is done indirectly. It must be done that way because the public overwhelmingly supports conservation laws and policies. Proposing "takings" legislation and whining over "unfunded mandates" are attempts to reverse previous policies to protect the Earth's life. Only by defining the issues in non-conservation terms can they prevail. They will lose when their games are unmasked.

In Arizona the state legislature passed a "takings" bill similar to the one Gingrich pushed through the US House. It was designed to cripple conservation laws and regulations by making them too costly. In a referendum following the adoption of the "takings" law, Arizona voters overturned it by a 3 to 2 margin. The message was clear. The public is not willing to pay landowners for doing what they should be doing: acting as responsible land stewards; with rights come responsibilities, and requiring people to act responsibly is not a taking. (The courts have long held regulations governing the use of land are not a taking within the meaning of the US Constitution.)

The point is this: we must not back off. We must not retreat to a defensive posture. Now is not the time to diminish our claims on behalf of wildlife; we must continue to demand nothing less than what is needed: protection and restoration of wildlife and wildlands throughout North America.

Although this Congress is even less friendly than the last, we must go beyond simply responding. We must continue to try to redefine the debate. The Wildlands Project mission—to create a vision of a wild and healthy North America—remains vital.

Dave Foreman has been reminding us of the many problems resulting from conservationists failing to emphasize grassroots work. (See his Around the Campfire columns.) I want to raise a related concern. No one summed it up more succinctly than Interior Secretary Bruce Babbitt when he said: Don't expect me to do the right thing; make me do the right thing.

We often think that when those sympathetic to conservation are in office, we can relax. Nothing could be further from the truth. Regardless of who is in office, those who seek to turn every bit of the wild into money and power are never out of office; the pressure they put on policy makers and on society directly through control of private institutions never ceases. We, on the other hand, often do quite well when things look bleakest, but relax our guard when there's a break in the storm. We should know it's not the big waves that make the lasting difference, but the constant pounding. We must be as tireless as the tides.

THE ACTUAL UPDATE

In January, Wildlands workshops were held in Florida, for the Southeastern Seaboard and Gulf Coastal Plain, and near Moab, Utah for the Colorado Plateau. This brings to fourteen the number of workshops held, in as many regions. Workshops are being organized for the Ohio Valley and Ozarks and for the Southern and Central Appalachians. Two workshops for Mexico are in the planning stages.

A committee of the board and some of the staff met in February to sum up the experiences of the workshops and to identify the next steps for project staff working with the regions on reserve design. We've been hearing from many of you that you need us to spend more time following up on the workshops, helping to get regional efforts under way. The February meeting was to decide how to do that.

The status of Wildlands work in each region of North America was discussed. It became clear that work could only be meaningfully evaluated at the subregional level—within regions there is usually a great deal of difference in the degree of focus on wildlands work. We also discussed a framework for cooperation between the project and collaborators, including lists of mutual responsibilities and available resources.

The need for setting priorities has long been recognized for two reasons: By completing work in some areas first, we can apply the lessons and so work smarter in other areas; and doing so keeps us from stretching ourselves too thin.

After assessing the status of Wildlands work those areas where reserve design could be completed soonest were given the highest priority for immediate staff focus. These areas are:

Alaska Rainforest & Aleutians
Yukon
Boundary Waters/Northwoods Minnesota
Wisconsin Northwoods
Michigan Upper Peninsula
Maine/New Brunswick
Eastern New York, Vermont, New Hampshire
Southern Appalachia
NE Oregon/Hells Canyon
Oregon Coast
Alberta–Northern Rockies
Southern Rockies
British Columbia–Northern Rockies
British Columbia–Rainforest
British Columbia–Washington–Cascades
Oregon High Desert
British Columbia–Columbia Mountains
Oregon Great Basin
Klamath/Siskiyou
Northern California Coast
Central California Coast
South Sierra Nevada
Magollon Rim/Sky Islands
Florida

While emphasizing these areas over the next several months, support will be available to all regions and subregions. We also recognize circumstances change, often quickly. We will change the list as needed.

This was written in April; you are reading it in June or July. In the interim, project staff will be contacting people in every region where workshops have been held to talk about the next steps. Rod Mondt, Program Manager, and Jim Strittholt, Staff Ecologist, will have primary responsibility for finding out from you what is needed to move ahead. Dave Foreman and I will also be talking to many of you. We'll be calling about data acquisition, ground-truthing, strategies for involving people, standards for mapping, and funding.

We will systematize these contacts with you, checking in on a regular basis. Of course, you shouldn't hesitate to call us if you need something.

The first newsletter was mailed in early April to all those who have participated in workshops. The newsletter will pro-

continued on p.91

A Wilderness of Scars

by John Elder

Scars blaze a way into this wilderness. Large barkless patches, stretched, weathered gray, and elevated in a double row, look inward from the trunks of maples and beech. They mark the route where log trucks and skidders once scraped their way into the woods. Beanpole popples now crowd the right-of-way, stiff leaves spangling in the lightest breeze. Though over twelve feet high, these pioneers are still yellow-green and smooth. They rise together thickly like a plantation of grass, bend together like stems of grass whenever the forest draws slow breath. Even with weaving in and out among the popples, I find the going much easier on this ghost-road than it would be just a few feet to either side. The loggers drove along the natural terracing of the slope, steering around the outcrops and erratics that punctuate the syntax of the forest. Walking on this vestigial track, I also avoid the shattered trunks and fallen branches that elsewhere tilt together into hiker-halting barricades. So I always keep an eye out for the scars.

Bristol Cliffs Wilderness Area was established under the Eastern Wilderness Areas Act of 1975. But this road had fallen out of use long before that year. The terrain was simply too rugged to repay the mechanized techniques of modern logging. Just below the sign announcing the official boundary of the Wilderness, where the slope suddenly tilts upward in a truck-toppling ascent and smooth gray boulders arch through the soil on every side like the backs of sounding whales, the blazes disappear. When this occurs, I must keep moving forward in the faith that I will find a certain large, charred stump.

Bristol Cliffs, *wood engraving by Suzanne DeJohn*

This stump is a relic, perhaps as much as sixty years old according to the County Forester, David Brynn, from one of the fires fed by logging slash. It rises now to a delicate black point, attenuated by the shuttling seasons of rain and snow that have also leached away almost all of its internal substance. Only a delicate design of wafered carbon remains, radiating from the center of the stump like the secret gills that fan, invisible from above, around a mushroom's central bole. When I reach this bearing-stump, I turn due east and cast around for my second charcoal monument. There it is, standing on its own small rise, surrounded by four rocks similar to it in size. Peering past, I spot a slimy ash log tilting up and disappearing into a burst of pale, blue-green jewelweed, summer's last explosion in the woods. I hike on in the direction that it indicates, my boots disappearing beneath the low cloud of foliage so that I stumble on the broken ground. But rising through confusion, I soon arrive again at the more sustained instruction of a trail.

The going is much clearer here than on the logging road below. I was bewildered by this inversion until Ted Lylis, whose property is just down from here on the Lower Notch Road, told me that the elevated trail was originally part of a track constructed in the mid-nineteenth century. Long before motorized skidders plied the down-slope woods, this was the path for bringing teams of oxen into the heights. Extensive leveling was necessary to bend a sturdy dogleg trail from Bristol Flats up to the talus-spilling brow of Bristol Cliffs. In the intervening years, though the way has narrowed to a footpath, the walking remains firm on black earth packed in the crevices between cobbles. Where the northeast-climbing trail ricochets sharply upward to the south, an iron cable dangles down, one end embedded deep in the trunk of an ancient birch. It was placed here so that the ox-drivers could temporarily run the cable through the harness of their animals. That way, as Ted said to me, if they did lose their footing "they still wouldn't end up at the bottom as tenderized beef."

Even when I do finally make it to the top, a raddled plateau rising much more gradually east toward the town of Lincoln, there are traces of long-vanished human livelihoods. Stone walls stalk through the trees, marking the pastures where sheep were put to graze after the first great deforestation. But the woods growing here when the European settlers arrived were often cut less for the sake of clearing farmland or milling lumber than to feed the kilns producing charcoal for the iron furnaces and forges of Bristol, Monkton, and Vergennes. The Barker Kiln operated just south of where I'm hiking now. Not so much a structure as a site, this was the ledge where huge piles of logs were reared into a pyramid, within which a carefully regulated, low-oxygen fire produced crisp, hot charcoal for the bloomery furnaces below.

Bristol Cliffs Wilderness Area certainly could not be described as "vast," "untrammeled," or "pristine"—the defining adjectives from the 1964 Wilderness Act. The thick woods that frame the Cliffs today are not even *second*-growth. They are the third distinct forest community to flourish in this region since the Wisconsin Glacier slipped northward over 12,000 years ago. The arboreal succession mirrors a larger pattern of constant and momentous change in the local landscape, beginning long before Vermonters of European descent established themselves here. The first big alteration of our present interglacial period, after the mile-thick ice had scoured Bristol Cliffs down to its resistant bedrock of Cheshire quartzite, came when sub-arctic species like the spruces and willows re-pioneered the slopes. They were followed, as the climate warmed, by more southerly species like beech and maple, chestnut, hickory, and oak. Wilderness here has always been a vector, never a steady state.

Enormous mammals wandered through the newly opened land—giant buffalo and beaver, Wooly Mammoths, Dire Wolves, and Short-faced Bears. But as paths thawed through the Canadian ice-shield, allowing paleolithic hunters to forge southward from the Siberian landbridge, these stupendous creatures began to disappear. Fossil records indicate that they were extinct in most areas of North and South America within half a century of humans' first arrival in a given locale—about the same span of time it later took the European settlers to shear away the forests from these slopes. Some researchers believe those first human ancestors in America killed the largest denizens of their new home faster than they could eat them. Who needs to finish butchering or to cure old meat when there is an endless fresh supply? "Food" was a dream of perfect plenty for these early Vermont hunters, like "Iron" or "Land" for their booted, ax-handling successors. What defense against such annihilating fantasies could there have been for people newly arrived and without the stories, fitted to this place, that might have made them feel at home? The stories of home come later, arising through misapprehension and disaster, and also through unforeseen connections between our individual lives, our communities, and the grandeur of the land.

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By the time Zadock Thompson wrote his *Natural History of Vermont* in 1854, the Green Mountains had become biologically impoverished, while the human communities they supported were also on the verge of economic collapse. Mountain Lions and wolves had practically vanished, and even our scaled-down beaver and White-tailed Deer were considered extinct in much of Vermont. The early iron-mines had not produced a pure enough grade of ore to compete with the diggings on the western side of Lake Champlain—which had the added advantage of being closer than Vermont to the canals and other new commercial routes. The boom in merino sheep was about to go bust, too, as the western states and Australia established much vaster, more profitable operations. Between the Revolution and the Civil War, Vermont had been the fastest growing state in the Union, and our early entrepreneurs established enough mills and forges along our rivers, enough limestone and charcoal kilns in our mountains, to place Vermont in the forefront of the industrial revolution. But after the Civil War there was one of the dramatic reversals that bend through our history like the doglegs of a rugged mountain trail. For most of the next century we were the slowest growing state. Whole communities of hillfarmers headed out for the newly opened territories of the Midwest, eager to sail their plows over the deep topsoil of the heartland after years of scraping through the shoals of these glaciated highlands. Such failures and departures heralded a strong comeback for the forests, though, in this wet land so good at growing trees. Between the Civil War and the present, Vermont has reverted from being about 80% cleared to about 80% rewooded.

After the merinos had lit out for the territories, Eastern White Pines crowded into their abandoned pastures. They thrived in the full sun and readily germinated in the grassy carpet covering what was recently pasture for sheep. Once they had shaded the ground with a dark new canopy, few new White Pine seedlings were able to sprout. But the existing ones continued to rise in lofty groves until, at the turn of the present

The reforested East helps us to think about wilderness everywhere, confirming that it can grow as well as shrink.

century, New England's loggers too arose in force to harvest the bonus crop of prime softwood. For the several decades this bonanza lasted, Bristol Notch had a thriving settlement, inhabited by the families of sawyers and millhands. Large-scale logging pretty much played out near Bristol Cliffs by 1925, however, and at that point some of the houses in the Notch were sold for deer-camps while others simply collapsed into the forest floor.

The present forest of mixed northern hardwoods has thus developed largely since 1925. While spruce, fir, and birch still dominate above 2500 feet in the Green Mountains, these mountains have also once again produced beech, oak, hickory, White and Red Pine, and most notably the multitudes of maples coloring our land each fall. Durable kernels from the deciduous trees had bided their time for many years in the buried seed pool, ready to burst upward from the torn, no longer grassy, ground bequeathed by the completed logging. A renewed autumnal vividness was thus one legacy of the eradicated White Pine forest—a recoil to loveliness, like the reddening of the maple leaves themselves, kindled by the match-scratch withdrawal of their *green* as nitrogen forsakes the trees' extremities with the onset of the cold.

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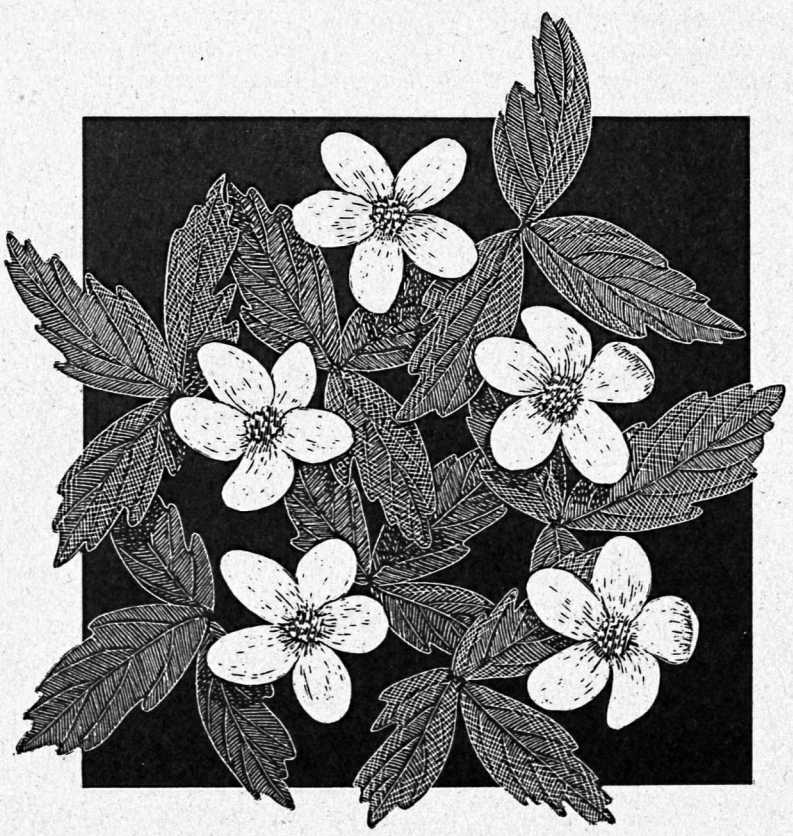
The Eastern Wilderness Areas Act of 1975 sought to acknowledge and protect pockets of recovered wildness like Bristol Cliffs, one of the first two Wilderness Areas designated in Vermont under the new Act. Although this is no pristine landscape, we can perhaps learn to appreciate it even more as a *providential* one. Relics, human and arboreal, germinate in the forest floor, and an inadvertent beauty rises through abandonment.

In the vast wildernesses of the West, like Glacier National Park or Gates of the Arctic, one can leave behind all sight or sound of other humans, wandering into roadless areas with no visible record of past settlements. Bristol Cliffs, in contrast, though protected by a similar Congressional mandate, is only 3740 acres in all. Standing on the highest ridge, one can still hear the heavy rigs bowling up Route 7 and the chainsaws whining and sputtering in woodlots just off the Notch Road. Tumbledown stone walls run from one side of the wilderness to the other; majestic stumps are bedded damply amid dark green star-moss and emerald sphagnum. Such vestiges insist that wilderness is no stable artifact beyond the human grasp or withered by the human touch but, rather, a bundle of *stories*. The import of this tattered little scrap of Eastern wilderness is far-reaching. Even so grand a National Park as Yellowstone is finally no stable and perpetual scene of "nature," as the inevitable though long-deferred fires in the summer of 1988 revealed. The reforested East helps us to think about wilderness everywhere, confirming that it can grow as well as shrink. What it never can do is stay the same, and our human calling is less preservation in a distanced, magisterial sense than participation in its living web of stories.

I've often pored over the topographic maps for Bristol Cliffs, trying to memorize the features of this bewilderingly intricate terrain. The green shape of the Wilderness Area as shown on the Forest Service map suggests a rapidly basted-up patchwork quilt, with square parcels stacked up on each other along a wobbly border, and even one little white block reserved from Wilderness within the larger collage. This irregular shape has been an *accommodation* for wilderness, negotiated with evident difficulty, within the dominant realm of surveyors and real estate. "Wilderness Boundary" is printed over and over in the thick gray band marking the area's edge. This is especially appropriate since, in contrast to much of America's Western wilderness, Bristol Cliffs is a landscape where it is impossible to forget the prevalence of edges—edges between private land and protected Wilderness, but also between human history and the rest of nature.

Ecologists speak of the meeting between two ecosystems as an "ecotone," partaking of some of the physical attributes of each constituent environment and containing some of the organisms from



Wood Anemone, *scratchboard by Suzanne DeJohn*

each. Within such a meeting-ground, "edge-effects" prevail, in the diversity of species which exceeds those of the separate ecosystems as well as in the relative density of individual organisms. An edge is a risky opportunity, offering new sources of food for creatures venturing out from the relative safety of familiar ground but also exposing them as potential sources of nourishment for fellow opportunists creeping in from the opposite side.

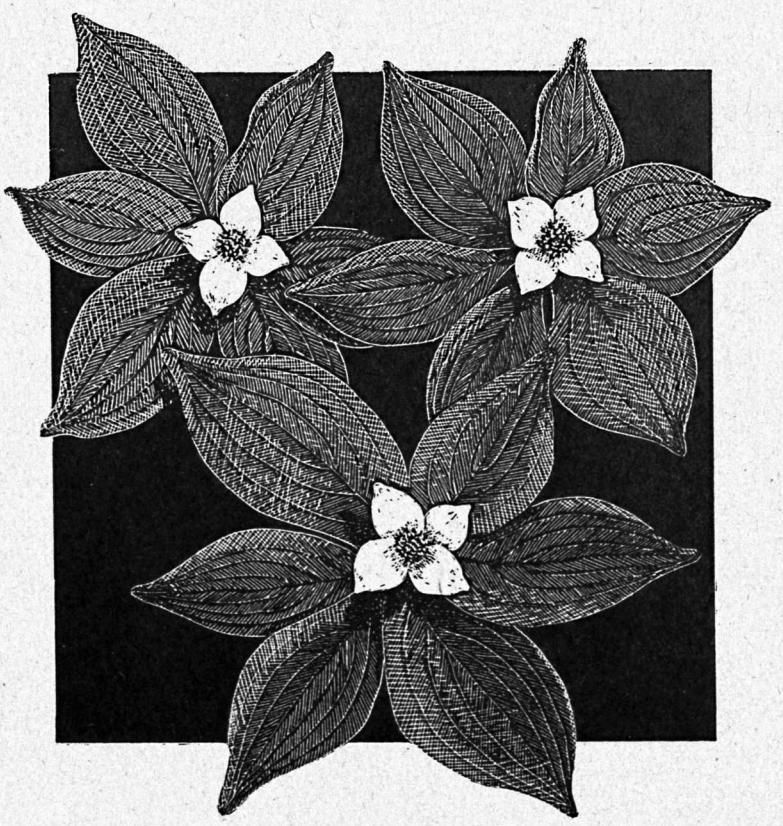
The light green composite patched together on the topo registers a dramatic return of wildness. As the logging roads fade, game-trails proliferate. Circumabulating Bristol Cliffs' boggy mountaintop jewel called North Pond, I follow enormous mooseprints in the mud, pass huge areas where Moose crumpled the bracken flat to snooze through a summer's night. Bear prints sometimes linger in this soft black agar too; clawmarks are scored deeply down the rinds of nearby beech; and in crossing an upland meadow laden with blueberries, I've often passed an invisible line beyond which bears have exercised their patience and their expertise to remove every last berry from among the leathery leaves. The standing snags of this abandoned timber yard nourish Pileated Woodpeckers who can disclose a book-sized cavity in the corky deadwood within a single afternoon of flying chips. All day a tenured faculty of corvids shout across the pond, blessedly unintelligible to me at least, while at night owls float forth in silent speculation.

John Muir, as much as he admired Henry David Thoreau (propping his picture on the mantel of his Martinez ranch house), mocked this Massachusetts forerunner's sense that there could be anything wild in the huckleberry and puckerbrush thickets around Concord. For Thoreau's famous dictum from the essay "Walking"—"In wildness is the preservation of the world"—Muir substituted his own formulation—"In God's wilderness is the preservation of the world." Muir's life and writing inspired the Western wilderness movement, with its orientation to sublime religious visions in mountains so much loftier and more monolithic than these rounded, tree-wrapped ridges. Muir contributed to our current association of wildness with tremendous expanses of wilderness largely free of any European settlement. Robert Frost—a poet of Vermont, for whom Wordsworth and Thoreau, and before them Virgil, were the chosen ancestors—put the premium on wildness at the *edge* and in the *midst* of civilization; not as a factor of extent or separation, but rather as a quality of mindful attentiveness promoted by vivid, sensually impressive contrasts. Thoreau loved the wetlands not apart from but in relation to the cultivated lands, as a revitalizing element within the entire region.

The topo map of Bristol Cliffs reveals the intricate brokenness of the terrain within this little reservation. Contour lines radiate outward and downward from the high point (2325 feet) just above North Pond. But rather than inscribing smooth concentrics they resemble the jagged ripples in a mountain kettle hole—fanning out across a glassy surface constantly pierced by rocks, stumps, and the rigid stems of sedge. Implicated lines lean out around each interrupting point, then snap back to the next obstacle around the edge. For a hiker *in* the map, this landscape's bouldery scour impedes the straightforward, peak-grabbing stride invited by the often broad and level trails of Western wilderness. Stumbling through gullies, one often doesn't know which way is up. The best course is to take a long pause, and to regard the unmapped, monumental, riven boulders set amid ferns, each transcending the asymmetrical elegance of Kyoto's rock-gardens.

At the western side of Bristol Cliffs, brown contour lines shadow the map's pale green like an etcher's fine cross-hatching, as the cliffs themselves rise 1200 feet in less than half a mile. But here, too, the mountain's upward thrust is constantly side-tracked. It flickers through secret dripping swales, limns ledges broad and flat as a dance floor, talus brusquely clearing off the dominance of spruce. Bristol Cliffs Wilderness possesses neither spatial extensiveness nor the lofty canopy and park-like floor of old-growth. Its amplitude comes instead from bad footing in an unruly, third-growth forest within walking distance of the homes in Bristol village.

What it never can do is stay the same, and our human calling is less preservation in a distanced, magisterial sense than participation in its living web of stories.

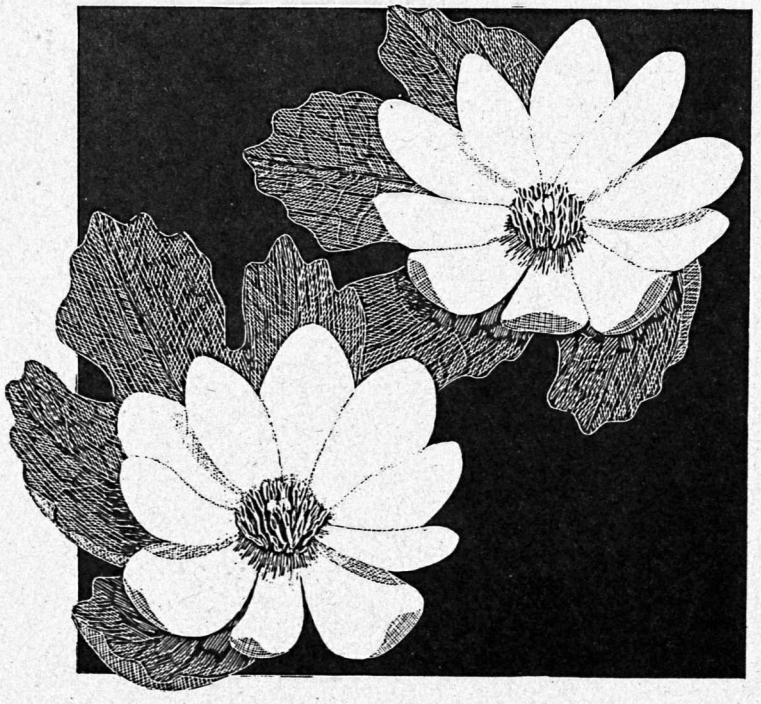


Bunchberry, *scratchboard by Suzanne DeJohn*

But if the sublime is an experience of having our little human agendas and expectations obliterated, then non-stop stumbling can be a version thereof. And one does see the most arresting sights in Bristol Cliffs. As an amateur naturalist trying to atone for my liberal education, I dutifully carry a little stack of field-guides with me on my hikes. Yet on the western face of Bristol Cliffs, the relationship of the trees to the topography always bewildered me until Alicia Daniel of the Field Naturalist Program at University of Vermont gave me a copy of Michael Shepherd's Master's project. He had studied forest development above and below several New England talus slopes, with a special emphasis upon Bristol Cliffs. Surprisingly, the species of trees one would expect to find highest up the slope, like Red Spruce and Paper Birch, were dominant below the talus, while deciduous species one might have looked for decidedly below those trees in elevation, like Red Maple, Butternut, and Eastern Hophornbeam, grew at the top. It turns out that this inversion of the anticipated order results from an unusual set of circumstances: as snow melts on sunny days it runs downslope under the rocks and refreezes on the shaded ground below. Sphagnum moss, adapted to the cooler zone, further insulates the accumulated ice-pack, keeping the temperature as much as eight degrees Celsius lower than that prevailing in the deciduous zone above. Environmental overlaps like this *thicken* the topo map, and the woods it represents. Thwarted expectations prolong my expeditions in Bristol Cliffs, so that some Saturday outings, during which I've been dead lost just six miles from my home, have truly seemed high-peak adventures. They make this little covenanted patch, tucked up into the corner of our county, worthy of that expansive word "wilderness."

Planners in the National Forests of the West often take pains to preserve a "beauty strip" along highways and scenic rivers, a wall of trees obscuring the rapacity of clearcuts that churn the earth for mile after mile behind that fringe. From an airplane closing in on Portland or Seattle, though, the devastation is exposed. Those forests are like a patchwork quilt whose green *border* remains but whose lovingly quilted *center* has been shorn away square by square. In this regard, too, Bristol Cliffs Wilderness offers an inversion. It only touches the road briefly in the gap where Route 116 parallels the New Haven River and again for a few hundred yards along Briggs Hill Road in Lincoln. There is no direct access to the Wilderness Area from the south or on the side below the western cliffs. I gain the log road that whispers hoarsely upward to the old ox-path by first marching up a long driveway and asking permission of Mrs. Kilbourne, the landowner, to cross her back lot. Looking upward from the log cabins and ranch houses of the Notch Road, everything in these mountains might seem parcelled out and saleable. The dynamic ruggedness and the protected status of the area beyond come as a surprise to one who penetrates this fringe of settlement. Just so, one who looks down from a small plane crossing almost any part of northern New England or the Adirondacks is impressed by the dark forests absolutely dominating this entire region of the country, divided and obscured by narrow strips of settlement along the roads or rivers.

We walk up the trail of scars; we read the topo map like a palimpsest of ice and trees; sometimes we may regard the watershed from a temporary point of vantage in the sky. We find wildness deeply rooted in our region, just as our settlements are grounded, surrounded, and sustained by it. Green life perpetually encroaches on the gray jumble of daily routine, and a cool exhalation flows into the mountain valleys from the heights.



John Elder is a professor of English and Environmental Studies at Middlebury College (Middlebury, VT 05753). His books include Imagining the Earth: Poetry and the Vision of Nature; The Norton Book of Nature Writing *(co-editor, with Robert Finch);* Following the Brush: An American Encounter with Classical Japanese Culture; Spirit and Nature: Why the Environment is a Religious Issue *(co-editor, with Stephen Rockefeller); and* Family of Earth and Sky: Indigenous Tales of Nature from Around the World *(co-editor, with Hertha Wong).*

Bloodroot, *scratchboard by Suzanne DeJohn*

Loss of Place

by Howie Wolke

FOR MANY OF US, some places are just a bit more special than all others. One of my special, *sacred* places is within a rough-hewn land of long ridges, rounded hills, cliffs, lakes, peaks, and plunging river canyons. It's a raw asymmetrical land, lacking the scenic appeal of colorful Colorado's alpine peaks. It's a land clothed in a quiltwork of Lodgepole Pine, spruce-fir, and Douglas-fir, with heroic patches of Alpine Larch and Whitebark Pine hugging the highest rockiest slopes and basins. Old-growth Ponderosa Pine, Grand Fir, and other montane species grace the nearby canyons of the Main Salmon and upper Selway Rivers. Scattered meadows and a few low elevation grasslands are the other major biotic communities.

This is the Big Wild, the heart of the Greater Salmon-Selway Ecosystem, mostly in central Idaho far from the nearest potato field. Though it's not my only sacred country, it's my first and foremost. Within that country is an extra special place. It is an isolated lake basin a thousand feet below tree line deep within this contorted land. Near as I can tell, this is the center of the universe.

The clear emerald-hued lake is surrounded by Alpine Larch, Whitebark Pine, Subalpine Fir, a few spruce, and big chunks of metamorphosed granities plunging into the icy water. Larch and boulder-strewn slopes of Beargrass rise above the inlet to a 9000 foot peak. The outlet plunges over cliffs into the great green blanket of mystery that defines the Salmon-Selway. Just north of the basin's lip is an open slope with a clear view into an ancient world of conifers, part of the biggest remaining expanse of virgin forest left in temperate North America. That's where I sit, gazing at the real world as I jot down these words on my lap-top notepad.

This morning I climbed the peak above the lake. From its summit, no towns, ranches, roads, reservoirs, or powerlines can be seen. Forested mountain wilderness sprawls in every direction. To the southeast are the Bighorn Crags, rising 7000 feet above the Salmon River's Middle Fork. Far to the east, on the Continental Divide, is the jagged top of the Beaverhead Range, which segregates Idaho and Montana. To the northeast the Bitterroots are monoliths of naked granite belying the lush hybrid forests of Pacific and Rock Mountain biota that cover their lower slopes, canyons, and basins. Well over a hundred miles north is the southern terminus of the Mis-

illustration by Peter Lucchetti

sion Range. Northwest is an endless sprawl of forested ridges of the Selway. To the west, across virtually unbroken forest, is the isolated Gospel Hump, and farther southwest is the still wild Payette Crest. To the south, more mountains: rolling and occasionally near alpine, stretching into the eternal blue today of an unusually hot, late July noon. Despite the archipelago of alpine peak clusters scattered around the compass and rising above the forested ridge and canyon matrix, the real theme here is habitat, not alpine scenery. On a more basic level, my sacred lake basin speaks of a wildness found nowhere else in the US south of Alaska.

There's been no rain for two weeks, and it's been hot. To the south, big cumuli build and bulge against the cobalt-blue sky. They float slowly north. To the west, mares' tails slowly encroach, foretelling a possible Pacific front. Will the building storm cells set the woods ablaze in a fury of thunder and lightning before a Pacific storm can soak the desiccated duff? As I write under the darkening sky, the verdict is out. I root for neither water nor fire, content with either. Who am I to say which is better? Both just are. We humans can judge by our own peculiar standards, but these standards are irrelevant to nature's forces. This forest is shaped by periodic fire, but nurtured by water in a landscape created by molten magma, flowing water, and glacial ice. The geologic story of the Idaho Batholith is overshadowed now, though, by the story of today's humans who surround it. For it is they who determine its fate.

From the summit of my peak in the Frank Church River of No Return Wilderness (RNR), until now there was no visual evidence of human idiocy, except for a few tiny fire lookout buildings atop scattered summits visible only to the trained eye. But a Nez Perce National Forest Supervisor named Tom Kovalicky (now retired and masquerading as a conservationist Forest Service reformer) ended that peace. By signing a legal document called "Decision Notice, Cove and Mallard Timber Sales," Kovalicky condemned the heart of the Big Wild to a massive invasion of bulldozers and chainsaws, roads and clearcuts. The Cove and Mallard roadless areas are in an unprotected enclave formerly called Jersey Jack, 40 miles west of my sacred lake basin. Cove-Mallard abuts the RNR and Gospel Hump Wilderness Areas, and it is just over the canyon rim of the Main Salmon River. Cove and Mallard may be the worst timber sales in the sordid history of the US Forest Service.

I visit the summit of my sacred peak once or twice each year, sometimes with a small group. I tell no one that this is the center of the universe. But atop the mountain this morning, the center of the universe shattered into the pieces of a broken heart. This happened because in 1978, Cove and Mallard were denied Wilderness status when conservationists cut a political deal: protection for the high ridges of the Gospel Hump and standard multiple abuse for the forested enclave just to the east, which is within the true, small w, River of No Return wilderness. This compromise, orchestrated by a now retired Sierra Club and Wilderness Society careerist named Douglas Scott, set the stage for the infamous Cove and Mallard timber sales.

Atop the mountain this morning I was gazing across melting patches of snow into the green-blue ridges to the west when I spotted the distant squares in the unprotected enclave. I counted eight new clearcuts.

This cannot be, I thought. Hoping I was wrong, I turned around, confused. My feelings became a tangle of overwhelming loss, sorrow, and raging anger. The anger quickly overtook all else. Images of green-uniformed bureaucrats lined up for execution flashed before me. Rational thought be damned. I wanted to *get* the responsible bastards. Of course, retaliation isn't the answer. But neither is pretending that conservation is an intellectual crap shoot. This is the real world; coursing through my veins is real blood. If anger—and even violent thoughts—aren't appropriate at times like this, then we humans are truly worthless, and we may as well curl up and die. For despite the distance to the clearcuts, the center of the universe is cheapened, made a bit more like every other human-gouged place on Earth, more mediocre, less special.

It is rare, in this society, to find people who grieve for loss of *place*. We grieve for the loss of loved ones, but not for loss of place, or for the loss of the essence of place. Why don't we?

COVE-MALLARD UPDATE

The destruction continues and the situation changes rapidly. A court injunction halting logging and road-building has been lifted. Logging of the Noble Timber Sale resumed but is temporarily halted, through spring, as the county forbids logging trucks on dirt roads during mud season. Environmental mitigation measures also forbid logging during Elk calving season. However, logging will soon resume. The Idaho Sporting Congress and Alliance for the Wild Rockies have appealed the lifting of the injunction. They may also file a lawsuit against the National Marine Fisheries Service's biological opinion that is allowing logging to take place in Cove-Mallard despite dangers it poses to salmon listed under the Endangered Species Act. The Cove/Mallard Coalition (POB 8968, Moscow, ID 83843) is using civil disobedience to try to stop the cutting, and several activists were recently arrested for a road blockade. When conservationists finally stop this travesty, the impacted area needs to be managed as a wilderness recovery area, with all roads reclaimed, re-contoured and re-seeded, so that Cove-Mallard can be added, as it should have been in 1978, to the Frank Church River of No Return Wilderness.

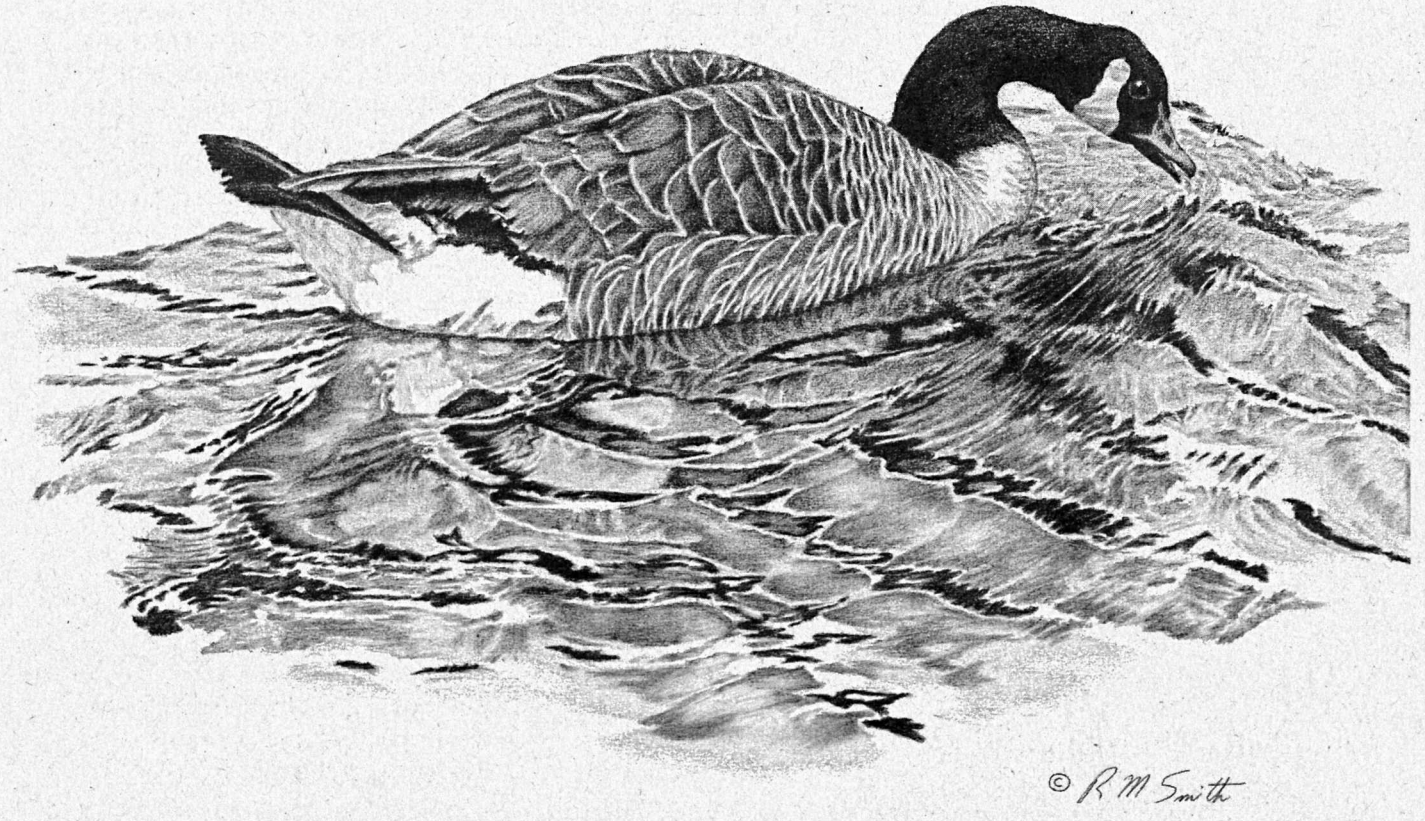
True, my lake basin remains intact, buffered from the bulldozer and chainsaw by a few million acres of designated Wilderness, still silent, alive, and wild. This basin still commands the wonderful view of the surrounding Salmon-Selway wilds, where few humans have trod. As I write I hear a Northern Pygmy Owl. On the quartz-striated ridge above, Bighorn and maybe even Wolverine hide in the larches. Do the Lynx and the Golden Eagle sense the travesty?

Cove and Mallard are 40 miles distant, yes, and the loss of a chance to gaze at unspoiled wilderness for 360 degrees from a favorite mountain pales when compared with the biological impacts of the butchering of the forest: habitat fragmentation, erosion, fewer salmon, wolves, Fisher, Marten, Lynx, Varied Thrushes, Townsend's Warblers, Golden Eagles; less old growth... But for now, I simply grieve for this loss of place, mourn the loss of some of the essence of my center of the universe. It's a loss that heroes tried to prevent, and it is a loss that is duplicated throughout the West, across America, and around the globe. As the US Forest Service and other agencies and multinational corporations mow down the public domain, how many others also mourn the loss of the irreplacable, the wasting of something that cannot be retrieved?

Wilderness must survive for its own sake. Insofar as anything, including humans, has a "right" to thrive, so does wilderness and all of its dependent life. Intrinsic worth. Inherent value. I grasp hold of these phrases like a falling cat might grasp the limb of a dying tree. Such biocentrism is the only view that makes sense to me. Nonetheless, I cannot help but wonder: What becomes of a people who continue to destroy the irreplacable, the sacred? In the temperate United States there simply is no other place where so much unbroken wilderness can be seen at once. Yet it was desecrated with relatively little fanfare, just business as usual for the Forest Service. Strange.

Lightning bolts belt the distant ridgetops. Processes carry on. Blue sky tops the basin's edge. Fire will likely win and that's OK; there is little rain in today's sky. I feel despair, and now, hours and pages later, tempered anger. I feel lost and I grieve by writing this essay. I don't know what else to do. Perhaps when we, as a people, learn to mourn the loss of place, we will halt the losses and render the phrase "nothing is sacred" to be meaningless.

Howie Wolke, who co-founded Earth First! in 1980, is the author of Wilderness on the Rocks *and co-author, with Dave Foreman, of* The Big Outside. *He operates his wilderness guiding service, Wild Horizons Expeditions, out of his home in the Bitterroot Valley of Montana.*



Canada Goose (Branta canadensis)*, brushed charcoal by Robert M. Smith*

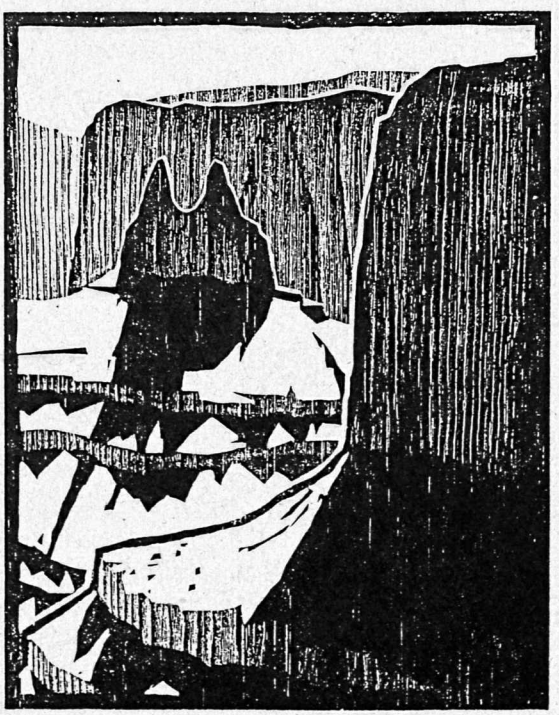
Utah Wilderness: The First Decade!

by Dick Carter

THE WILDERNESS ACT was a wise document. It stretched our vision, engaged the profound debate as to our role on the planet, highlighted the debate about what is and isn't natural, and recognized life as a community, not a mere collection of disjunct entities.

Some cynics have tried to suggest the Wilderness Act defined a resource that cannot exist because human beings have disturbed almost every land and seascape on this planet. This was argued throughout the eight year debate prior to passage of the act. It was never contended by environmentalists or ecologists that wilderness should be a place separate from humanity or our cultures. Wilderness was perceived as a part of the community of life where human beings don't dominate that community, as we have not throughout most of our evolutionary history.

While any legislative definition of wilderness is bound to be muddled, it is clear that wilderness in this context is different but not separate from what we may call "culture," and that wilderness is a community of life primarily influenced by the forces of nature (including what are today often referred to as "disturbance regimes") which incidentally provides a high risk, primeval, recreational opportunity for human beings. Some cynics have suggested the primary purpose of wilderness is to provide a backcountry recreational experience of relative security. That wilderness was seen as providing a recreational opportunity is dramatically different from being established for a kind of backcountry recreation.



The process used to designate wilderness was also wise. It ignited a crucial public debate, gave birth to the modern day environmental movement, created thousands of grassroots activists who learned and imparted knowledge of wild plants and animals, which in turn invigorated investigations into ecosystem integrity. Designating wilderness has made us look at many of our scientific, technological, and ethical assumptions.

Somehow the wisdom of the Wilderness Act is more easily understood when looking at the spirit of its proponents. Though we all know the names of Muir and Thoreau, the impetus to engage a fundamental debate on whether wilderness could ever become a meaningful concept in public land decisions came from the love of wildness shared by Bob Marshall, Aldo Leopold, Sigurd Olson, Harvey Broome, Benton MacKay, Howard Zahniser (the relentless pragmatist who died just prior to his Wilderness Act becoming law but knowing it would happen), Stewart Brandborg, Mike Frome, Clif Merrit, the Craigheads and many others. The Wilderness Act does have its problems and its often muddled philosophy, but we celebrate it because of these remarkable people, the legions of activists who have continued to reflect and understand with greater depth the value of wilderness.

Canyon Shadows, *woodcut by Patrick Dengate*

In 1964 the Wilderness Act designated slightly over nine million acres of Wilderness. In 1994 our nation harbors over 96 million acres of Wilderness in 562 areas. It is clearly established as an icon. It is ponderable. It defines value as broader than "us," a fact many relish and some loathe. Wilderness is at the base of our dialogue with the planet. Wilderness gives us the opportunity to become Leopold's "plain member." ("In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it.") Wilderness forces a core change in our perceptions—a new paradigm. A wilderness isn't for something else. It is moment to moment. Thunder to lightning. Warm sun to cool breeze.

So the Wilderness Act charted for us a path, a very bumpy path. After three decades, the debate has both broadened and deepened. A new generation of wilderness thought is evolving. Does wilderness describe a place or a process or both? Is it an abstract concept only existing because it was defined in the Wilderness Act? Has the 96 million acres of designated Wilderness contributed to the preservation of ecosystems? How big should wildernesses be if they are to preserve the natural disturbance regimes (forces of nature) necessary to allow them to be self-regulating? Should we be stocking non-native Rainbow Trout in wilderness lakes at the expense of the indigenous salamanders and frogs? Should Gray Wolves and Cougars get the "surplus" Elk at the expense of the outfitted hunter? Should the Grizzly Bear be welcomed back even though it might restrict our access to a relatively "secure" wilderness experience? Is there any point in designating wilderness islands, surrounded by intensively developed lands? What is the difference between wilderness and wildness?

The Wilderness Act still harbors the strength to guide us. Whether we have the strength and vision to live with and as a part of wilderness and its process, wildness, remains to be seen. Where environmentalists have often seen wilderness as the puzzle itself, defined by how many Wildernesses can be designated by Congress, we now understand wilderness as a piece, a "keystone" piece, of a larger puzzle. It is not simply an abstract concept with its importance moving up and down some cultural ladder. Wilderness is necessary to maintain biodiversity, *the base of our dialogue with the planet.*

The Wilderness Act contemplated wilderness as a place—"a place of wild beasts"—and as a process—wildness. Wilderness is for Fisher, Wolverine, Pine Marten, Wolf, Grizzly, Cougar, Bighorn Sheep, Goshawk, and a host of other species dependent upon environments lacking human permanence. Jack Turner, a Wyoming writer, in his essay, "Mountain Lion," suggested wilderness is very real for the big cats. It is their home and we have slowly taken it from them. Describing a Mountain Lion caged in a zoo, Turner writes, "Her suffering was obscene, the solution simple: she needed to get home. To run along rims through pinon and cedar and crouch and leap and dance on her toes side-ways, her tail curled high in the air to seduce a mate and then hunt with him in the moonlight and eat deer and cows and sheep and make little pumas and die of old age on warm sandstone by a clear spring at the end of a gulch dense with cottonwood and box elder." This is the "peaceful covenant" Turner argues we need to establish with wild animals.

Unfortunately, designating Wilderness is not enough. This was made exceedingly clear by one small but profound 1987 article in *Nature*, which showed many western National Parks are simply too small to maintain the native wildlife found there at the time of Park establishment. The whole issue of how big a wild reserve must be to preserve native flora and fauna is only now being broached and is one of the most critical discussions encouraged by wilderness advocacy.

Ed Grumbine, an ecologist at the University of California at Santa Cruz, discusses this issue in his book, *Ghost Bears, Exploring the Biodiversity Crisis* and in a recent article in the journal *Environmental Ethics*: "The biodiversity crisis is challenging the fundamental logic of pristine wilderness set-asides surrounded by intensely managed multiple-use lands."

To focus on wilderness, with a capital 'W' or not, won't be enough. We must also focus on ecosystem management and extensive rehabilitation and restoration efforts. Ecological integrity is a fundamental component of the wilderness discussion.

Ninety-six million acres of Wilderness has not stemmed the tide of environmental degradation. We must look still deeper and broader. Ed Grumbine suggests, "The upshot of the radical Western split between people and nature is that *both* resource conservationists and wilderness preservationists, as long as they view nature as a collection of resources for humans, inhabit a world that categorically denies the full range of symbiotic relationships that may exist between people and wilderness."

THE UTAH WILDERNESS ACT

In 1979 the Utah Wilderness Association set out to obtain a wilderness bill for Utah. A powerful handful of folks said NO! By 1983 the bill was introduced and was steadily improved. The High Uintas were dramatically enlarged, Mt. Naomi was doubled in size, the Stansbury Mountains were inserted into the legislation as was Mt. Nebo. It was a tough battle and rhetoric all too often displaced substantive discussion.

The Utah Wilderness Act became Public Law 98-428 on 28 September 1984. To some it was the beginning of Wilderness designation. To a few it was the end. It set in motion Utah's first significant Wilderness designation effort; in one long hard swoop, Utah's single Wilderness, Lone Peak, was augmented by twelve new Forest Service Wildernesses.

Serious omissions exist and UWA's herculean effort at passing the Utah Wilderness Act has been matched by our efforts to assure the preservation of contiguous roadless lands. We insisted on a wilderness bill back in 1984, not at any cost, but to get beyond zero. We now have a history of wilderness preservation upon which to expand.

FOREST SERVICE WILDERNESS IN UTAH

High Uintas Wilderness, ≈460,000 acres *

The flagship of Utah wilderness, six peaks here surpass 13,000' (Kings Peak is Utah's pinnacle at 13,528'). Massive glacial basins harboring dozens of lakes and hundreds of miles of streams, large basins, parklands and dense forests of fir, spruce, and Lodgepole Pine make this one of the most diverse areas in Utah. Moose, Elk, Osprey, Goshawk, Wolverine, Black Bear, Cougar, Bighorn Sheep, Pine Marten, and Great Gray Owls call this place home.

Yet it is incomplete. It is surrounded by mid-elevation forests of Lodgepole Pine, aspen and spruce on the Main, Stillwater and East Forks of the Bear River, now threatened with oil development. The Middle Fork, one of the wildest regions on the North Slope of the Uintas, is threatened by timber harvesting, as is the West Fork of Beaver Creek. The high elevation drainages of Sheep Creek, Whiterocks and Dry Forks on the eastern end of the Uintas, the "bollies," were left out of the Wilderness for no discernible reason. These unroaded areas must become part of the High Uintas Wilderness to counter the intense development that surrounds the range's core.

Mt. Naomi Wilderness, ≈45,000 acres

This is a rugged region of steep canyons, limestone sinks, large basins, parklands and subalpine peaks. It is important habitat for Elk, Cougar, and Goshawks with a few Wolverine tucked in the deepest and wildest corners.

Unfortunately the lower reaches of Cottonwood Canyon, one of the longest canyons in the Wilderness, as well as Blind Hollow, were inadvertently left out of the legislation. With the passage of the Utah Land Exchange Bill, the Forest Service now manages the Franklin Basin area which includes significant unroaded terrain in White Pine and Steep Hollow, classic sub-alpine drainages with Moose and Elk.

Wellsville Mts. Wilderness, ≈23,000 acres

The Wellsvilles rise 5000' above Cache Valley. The mountain is dotted with small basins filled with aspen and Douglas-fir. The razor ridge of this phenomenally steep range is crossed annually by one of the largest migrations of birds of prey in the western United States.

Mt. Olympus Wilderness, ≈15,000 acres

Paramount watershed for Salt Lake City, this area rests between Millcreek and Big Cottonwood Canyons. The area is dominated by Mt. Olympus, Gobblers Knob, and Mt. Raymond. Douglas-fir/Quaking Aspen forests dominate the steep canyons and small parklands.

At the base of Gobblers Knob rests 1500 acre Alexander Basin, the largest basin in the wilderness. It was left out of the middle of the Wilderness, like a doughnut hole, to accommodate helicopter skiers. It is essential that this area be added back to the Wilderness along with Desolation/Dog Lake and Mill D North Fork Valley. Lush riparian areas enrich this large drainage area.

Twin Peaks Wilderness, ≈13,000 acres

Dominated by Twin and Dromedary Peaks, this is the high alpine country of the Wasatch. While a few scattered stands of aspen, spruce and Douglas-fir dot the small basin, most of this region is at 11,000 feet and hosts Golden Eagles and Yellow-bellied Marmots.

Lone Peak Wilderness, ≈30,000 acres

This was Utah's first designated Wilderness, entering the National Wilderness Preservation System in 1978 as part of the American Endangered Wilderness Act. It is the heart of the Wasatch alpine country. Spruce stands dominate the glacial slopes, where Black Bear and Cougars roam, and numerous small alpine lakes grace the highest basins. The most powerful peaks on the Wasatch dominate this skyline.

One major drainage, White Pine, was left out of the wilderness for helicopter skiers' use. Snowbird covets this undeveloped drainage for ski facility expansion.

Timpanogos Wilderness, ≈11,000 acres

Hanging valleys, waterfalls, year round snowfields, and large glacial cirques dress this classic alpine peak—the second highest in the Wasatch.

Mt. Nebo Wilderness, ≈28,000 acres

The highest peak on the Wasatch and one of the wildest mountains in Utah, Mt. Nebo has Bighorn Sheep, Cougars, Black Bear, eagles and Elk. Beautiful hanging valleys dot the upper reaches with dense forest. The west slope is critical Elk winter range.

Some of the most crucial low and middle elevation wildlife habitat was not designated Wilderness. Inclusion of the Salt Creek and Bear Creek Canyons on the south and White Pine and Calkens Hollow on the north would integrate the Wilderness.

Deseret Peak Wilderness, ≈25,000 acres

Deseret Peak rises to over 11,000' in the Great Basin's Stansbury Mountains. Pockets of Limber Pine and Douglas-fir dominate the upper basins and join aspen in the lower reaches. This lightly used Wilderness is as rugged as any place in Utah and is inhabited by many Mule Deer and Cougar.

As much as any Wilderness designated by the Utah Wilderness Act, this place took a big "hit" when almost 20,000 acres the Forest Service proposed was left out. The unroaded wild country surrounding the core of Deseret Peak is twice as large as that which was designated. All should be in the Wilderness.

Dark Canyon Wilderness, ≈45,000 acres

Dark Canyon is comprised of massive canyon walls, springs, arches and archeological treasures. Home to Desert Bighorn Sheep, Black Bear, Cougar and Peregrine Falcon, its vegetation ranges from aspen and Ponderosa Pine forests to desert shrublands and rich riparian areas.

The Forest Service wilderness is adjacent to a large BLM and National Park Service wilderness proposal, making this part of southeastern Utah one of the wildest regions in the lower

* Acreages represent FS lands already designated as Wilderness.

48. An old route down Peavine Canyon was cherrystemmed out of the wilderness; it should be added back.

Ashdown Gorge Wilderness, ≈7000 acres

This rugged region of pink spires and deep canyons is adjacent to Cedar Breaks National Monument.

Box-Death Hollow Wilderness, ≈26,000 acres

The high, convoluted, slickrock headwaters of the Escalante River is home to Desert Bighorn Sheep, Black Bear, and Cougar. It is adjacent to BLM and National Park wilderness proposals.

Pine Valley Mountains Wilderness, ≈50,000 acres

This verdant, geographically isolated mountain range rises 6000' above the Sonoran Desert. It is biologically rich with an equal display of landforms: coniferous slopes, large meadows and parklands, broad riparian areas and small streams. Spruce, aspen, Ponderosa, Limber, even Bristlecone Pine dot the mountains. Abert Squirrel, Cougar, indigenous Wild Turkeys, productive native fisheries and Black Bear grace this mountainous region.

Large mid-elevation regions were left out of this Wilderness and should be added. Sandy Creek, South Ash Creek, Maple Hollow, and Leap Creek are areas of Ponderosa, oak and maple forests and deep canyons.

○

Numerous other crucial Forest Service administered areas belong in the Wilderness System and may get a second chance because of UWA's vigilance in protecting roadless values over the last decade. Immense public support will be needed to round out the extant Wildernesses and add new areas to the National Wilderness Preservation System.

The proposed Mt. Watson addition would round out the High Uintas Wilderness complex. Headwaters of the Weber and Provo River drainages, it is some of the wildest country in Utah. Pine Marten, Elk, Moose, Black Bear, and Cougar all inhabit the dense spruce and fir forests and subalpine parklands. Half a dozen peaks tower over 11,000'. Undisturbed river systems provide potential habitat for native Cutthroat Trout.

WATER FROM THE HEART

I knelt there, below the high wall
of pink stone, columbine and moss,
cupping in my hands a cold pool
of the headwaters. Sunlight sparkled
on the dripping lozenge.
In the sudden scry I saw deep
into the heart of the wilderness—
the stoop of a falcon at pine dark,
the hollowness of bone of mountain birds,
the caterwaul of a midnight lion,
and thousands of years
in a tiny curly forest of lichen.
Rusty, smoky whorls
of wooden tesserae
crackling from ponderosa pine,
yellow ribbed canoes
of hellebore's autumn leaves,
the fringed thimbles of purple gentian,
vole-gnawed tines of bleached antler,
tangled in the weepy sedge of a sandbar,
rock-rollers in sparkling, granular
jackets, measuring their world
in centimeters of golden pebbles—
all these appeared in the scry,
a seer's glass into quartzite.
Hawk! Hovers over krummholz,
hovers over ledges, drops
downcliff into spruce and pine,
where bear moves among the trees,
turning rocks in the darkness,
in the darkness, scooping grubs,
putting cubs up a stout pine
when needle white, electric light
flickers through the limbs.
It is all, it is all wilderness,
wild-dēor-ness, place of wild beasts,
where I, no body, no house,
no purpose, move with will
of September wind.

—Margaret Pettis
Utah Poet of the Year 1993

Other areas that should be part of Utah's wilderness heritage include Steep Creek, a crucial part of the Escalante drainage; Hammond and Arch Canyons near Dark Canyon; Casto Bluff, massive and rugged plateau-like country crucial to Black Bear and Cougar in south-central Utah; the LaSals near Moab, the Abajos near Monticello, and the Tushars, Utah's second highest mountain range; Golden Ridge, critical wildlife habitat east of Mt. Nebo; the Pahvants and Beehive Peak east of Fillmore; the Beaver ponds of Fish Creek; and the untouched wildness of upper Muddy Creek.

DEFENDING THE DESERT: BUREAU OF LAND MANAGEMENT WILDERNESS

The debate over proposed BLM wilderness in Utah has generated an inordinate amount of emotion. Among many complex reasons, the land is physically unmatched. It has been carved by wind and rain, lifted, dropped, and scorched, and has formed canyons and cliffs, bridges and arches, fins, buttes, and mesas stained in red, buff, yellow, and purple that all change with the rising, setting, and seasonal angle of the sun.

It is also massive. The Great Basin—stretching across western Utah, almost all of Nevada, and northward—is the size of France. The Colorado Plateau of southern Utah, western Colorado, northern Arizona, and northwestern New Mexico encompasses some 130,000 square miles.

Although undeniably wild, southern Utah does not match the traditional view of wilderness—no lakes or mountains, only scrubby forests and rangelands managed for cows. Culturally, our focus in designating Wilderness has been on high, snow-covered peaks. Our image of wilderness was not that of a native southwestern American; rather it was the image, both real and romantic, of a native European.

Not until 1976, with the passage of the Federal Land Policy and Management Act (FLPMA), was this image ameliorated. Congress had been convinced that the BLM needed an opportunity to identify lands that might qualify as Wilderness.

This wilderness review, started in the late 1970s, utilized a multi-step process beginning with a "quick" initial inventory to delete lands clearly lacking wilderness values. The second step was an intensive inventory to define wilderness study areas (WSAs). This step was nothing but a more detailed initial inventory using the very specific criteria in the Wilderness Act: naturalness, outstanding opportunities for solitude and primitive and unconfined recreation, and other special values. Not until the third step, an actual study, did Congress instruct BLM to weigh these WSAs for other land uses, and determine whether they would be suitable or unsuitable for Wilderness recommendation.

In a challenge led by the Utah Wilderness Association, the 1980 Intensive Inventory was appealed to the BLM's adjudication board, the Interior Board of Land Appeals. The IBLA agreed with the environmental objections, remanding over 825,000 acres of the 900,000+ acres appealed back to BLM for further study.

A VISION OF BLM WILDERNESS

The West Desert

The Great Basin vastness of Utah's west desert is punctuated by a series of mountain ranges rising steeply from the wide valleys. The Deep Creek Mountains, for example, are as spectacular as Great Basin National Park in Nevada. The high alpine country is drained by perennial streams that harbor relic Cutthroat Trout. Rare stands of Bristlecone Pine and ancient cave pictographs can be found.

Zion/Canaan Mountain

The beauty of southwestern Utah is characterized by Zion National Park, but this corner of Utah is actually a transition zone for four major bioregions—the Great Basin, the Mojave Desert, the Sonoran Desert, and the Colorado Plateau. Joshua Trees, Gila Monsters, and the endangered Desert Tortoise are found nowhere else in Utah. The Zion/Canaan Mountain proposal reflects such diversity and is highlighted by Parunuweap Canyon and Canaan Mountain.

Desolation/Book Cliffs

Desolation Canyon of the Green River has often been compared to the Grand Canyon in scale—from the plateaus to the river is over a mile deep! The Book and Roan Cliffs are among the world's longest and most spectacular escarpments, rising to over 9000'. The tops are forested with Ponderosa Pine, aspen, and Douglas-fir. This is some of the most important wildlife habitat in Utah.

San Rafael

The San Rafael region is like a composite of all of Utah's National Parks. Indeed, it has long been under consideration as an addition to the National Park system. The region harbors massive sandstone monoliths, narrow, winding river corridors, uplifted reefs, arches, slot canyons, and knobs. It is crucial Desert Bighorn Sheep habitat and provides a haven for about a dozen rare and endangered plant species.

Kaiparowits Plateau

The Kaiparowits is a tremendous expanse of wild country stretching from the Paria River on the west to the Straight Cliffs, fifty miles east. Remote canyon systems, sweeping vistas, and significant archeological and paleontological resources characterize the area. Fifty Mile Mountain, adjacent to National Park Service-proposed wilderness in Glen Canyon National Recreation Area, is a vast mesa bordered by the Straight Cliffs on one side and cut by dozens of canyons on the other. BLM identified over 300 archeological sites. The Kaiparowits faces the threat of coal mining.

The Escalante

The last-discovered river in the contiguous United States, the Escalante remains hidden in its unspoiled redrock canyons, but has become renowned for outstanding wilderness values. The network of tributary canyons is filled with massive arches and alcoves, waterfalls, prehistoric rock art, and deposits of petrified wood. Phipps-Death Hollow is a continuation of the existing Box-Death Hollow Wilderness in the Dixie National

Forest. Phipps is known for the upper and lower Calf Creek Falls and five natural bridges and arches.

The Henry Mountains

The Henrys rise like islands surrounded by the harsh desert, and the badlands of the Blue Hills complete the illusion by resembling the waves on a stormy sea. The summit of Mt. Ellen floats 11,500' above sea level and provides breathtaking views for a good 60-70 miles in any direction. The Henrys provide habitat for a free-roaming Bison herd.

Dirty Devil/Canyonland

This region is centered on Canyonlands National Park and spreads out along the canyons of the Colorado, Green, and Dirty Devil Rivers. Dark Canyon, a BLM primitive area since 1970, is a complex of three major canyon systems adjacent to the Dark Canyon Wilderness. The canyon walls tower as high as 1400', yet the resident Desert Bighorn Sheep bound up the talus slopes with ease. Fable Valley, in the upper reaches of Gypsum Canyon, holds spectacular cliff dwellings left by the Anasazi. The Dirty Devil includes over 100 miles of the West's most remote canyon country.

Grand Gulch

The BLM Grand Gulch Primitive Area forms the heart of this region, a series of canyons that flow into the San Juan River and contain southeastern Utah's largest concentration of Anasazi cliff dwellings and rock art. The entire region is an outdoor museum of Anasazi culture from Whirlwind Draw on the west to Johns Canyon on the east—over 200 miles of canyons.

A UTAH WILDERNESS ASSOCIATION WILDERNESS VISION

Some have argued that wilderness is nothing but a cultural construct with benefits for the elite. When viewed as only an aesthetic/recreation resource as it has been for far too long, even by environmentalists, then wilderness can be reduced to an abstract concept.

But as our perceptions of the natural world have matured, it has become increasingly clear that *wilderness*, if it is to survive, is not *for* us. Rather, wilderness has inherent value and we must become part of it. If we fail to recognize this, then wilderness will be transformed into another human-defined "resource," assuring its exploitation and eventual loss.

BLM wilderness should be for Bighorn Sheep, not hunting Bighorn Sheep—which raises another dilemma. Bighorn Sheep, Cougar, Black Bear and dozens of other sensitive species found on wildland require very real wilderness to survive; but they don't recognize Wilderness boundaries. Research efforts by conservation biologists are consistently showing that few, if any, remaining undeveloped regions, parks, or wildernesses, designated or not, are able to provide enough habitat for long-term survival of native fauna. In part, biodiversity is in decline because we have surrounded our wildernesses by intensively managed multiple use lands.

The Utah Wilderness Association's position on the short-range issue of designating BLM Wilderness in Utah is that Congress should designate as much Wilderness as is politically feasible. At the same time, UWA believes that preservation and sustainability of ecosystems must be our primary focus. Sustainability of ecological systems should not stop at the Wilderness boundary. It is time for a far broader and more complex view where public lands are not conveniently divided into Wilderness and development. The preoccupation with drawing politically motivated lines around Wilderness may, in fact, have damaged the wildness Thoreau commemorated: "In wildness is the preservation of the world." While proponents and opponents of *Wilderness designation* wage their acreage battles, ecosystems continue to disintegrate, sometimes because of that very preoccupation with Wilderness as a cure for the abuse we've laid on this planet.

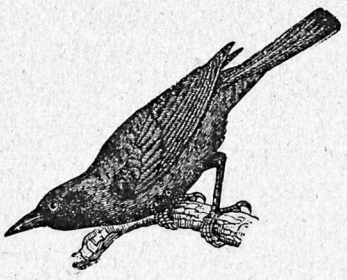
Sky and Butte, *woodcut by Patrick Dengate*

Our view must be broadened. Wilderness is a paramount concern, but we must begin to focus on the broader ecosystems which include lands surrounding wildernesses. The Wilderness/nonwilderness dichotomy must be blurred a bit to assure sustainability of ecosystems. If all that we value is continuously forced into Wilderness, we will soon have little left to value.

Thus the gross acreage of wilderness proposals becomes far less important than protecting large intact regions and assuring both Wilderness and nonwilderness lands are managed in the context of Aldo Leopold's wisdom in *A Sand County Almanac:* "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."

Dick Carter (Coordinator, Utah Wilderness Association, 455 East 400 South #205, Salt Lake City, UT 84111) founded Utah Wilderness Association in 1979. A native Utahn and forester from Utah State University, Carter is a former wilderness ranger with the US Forest Service in Idaho and Utah, and served as Utah-Nevada regional representative with The Wilderness Society from 1975-1979.

Letters



Sound Legal Philosophy Needed

Having scanned the sparse legal literature relating to preservation, I, like Christopher Manes, was intrigued, though a bit disappointed, by Eric Freyfogle's survey of American legal philosophy toward land in *Justice and the Earth*. [Readings, Winter 1994/95] Its value, as Manes points out, is in establishing a context for debate concerning the proper ethical-legal basis for land preservation. In that respect it is somewhat revolutionary.

Wild Earth's philosophical and scientific articles documenting the need to preserve and reclaim the wild inspire action. But what, as a practical matter, do we do? Because I am a lawyer these practical problems are close to my heart. While *Wild Earth* has provided guidance for the important task of challenging governmental decisions to destroy wilderness, I have not yet seen a positive scheme for carrying out the goals of The Wildlands Project by public persuasion and legal activity.

Articulating a sound legal philosophy and a workable strategy is critical to the goal of preservation. Given the modern political climate and the dominant world view, our society will never agree to limit development, an essential prerequisite to promoting wilderness. Though its supporters may agree that The Wildlands Project is a virtuous undertaking from every ethical, philosophical, scientific, and religious perspective, probably less than one percent of even thinking Americans agree. As Ed Abbey observed, we are considered sick by society. That society needs a fundamental ethical paradigm shift, which would ultimately be reflected in our laws.

This is the most significant role the law can play. As important as they are, challenges to timber sales or even legislative proposals to designate new wilderness are insufficient. Instead, we must change the basis of our legal view of property from the legacy of the landed English gentry to one based on acknowledgment of our impermanent relation to the land. May I suggest that the older Jewish tradition, in which man recognizes that he is a mere tenant on God's land, provides the model which should guide us in advocating a revolution in American jurisprudence regarding property.

I, too, welcome the opportunity to begin the debate on this essential issue. If we don't articulate that new and comprehensive legal-ethical basis for our relationship to the land, we can kiss the wilderness goodbye.

—Michael Martin, 9818 Hampton Lane, Fairfax, VA 22030

Statement of Purpose

Wild Earth is a non-profit periodical serving ecocentric grassroots groups within the conservation movement. We advocate the restoration and protection of all natural elements of biodiversity. Our effort to strengthen the conservation movement involves the following:

- We provide a voice for the many effective but little-known regional and ad hoc wilderness groups and coalitions in North America.
- We serve as a networking tool for grassroots wilderness activists.
- We help develop and publish wilderness proposals from throughout the continent.
- We render accessible the teachings of conservation biology, that activists may employ them in defense of biodiversity.
- We expose threats to habitat and wildlife, and offer activists means of combatting the threats.
- We facilitate discussion on ways to end and reverse the human population explosion.
- We defend wilderness both as *concept* and as *place.*
- We are the publishing voice of The Wildlands Project: the North American Wilderness Recovery Strategy.

Another Letter on Letters

I saw Louise Young's letter a few minutes after reading Dave's latest campfire talk in the Spring '95 *WE*. This letter is sort of an indirect reaction to both writings.

It seems to me that letter writing is fairly hopeless when you have borderline fascists in Congress "representing" you. Having been through the same mill Louise has been through, although a few years ago—when I did get letters, they were canned responses that "respect my viewpoint" but go on to say that "these views are not for the greater good of the country"—I pretty much gave up on government except when election day rolled around. Recently (i.e., early last November), I decided that I should probably be doing a bit more than voting. So, I've

been pondering a couple avenues of possible involvement that I'd like to offer to *WE* readers, in hope that they are useful and/or generate some feedback in my direction.

First, it seems to me that Congressfolk are always looking for information. Instead of writing letters on the issues you feel are important, how about offering yourself as a "free consultant" to your Congresspeople? Obviously, it will help to be some sort of professional or academic for this to actually work, as a formal education and a "good job" seem to be a prerequisite for respect from these people. But if it does work, think of how much more impact you can have. Remember—be honest and open about anything you are asked about; providing selective information could make you lose credibility, and therefore your link to DC.

Second, politicians are transitory; land agencies are not (for now, anyway). Forest Service, BLM, and so on, are always short of the data they feel they need to manage their (our) lands. How about finding a local conservation biologist, botany or wildlife professor, or an oletime naturalist who knows your area, hooking him or her up with a local conservation group, and having some ecological field methodology classes? Just find out what the agencies want to know about, organize your training to fit, and go collect some data! This has worked with respect to the Forest Service in the San Juans of Colorado, and the group I work with (Round River Conservation Studies) has seemingly gained respect in their eyes because we are not perceived as "environmental whiners," who only want to complain about management strategies. And like Cactus Ed once said, "Sentiment without action is the ruin of the soul."

Third, I've heard that a lot of the big environmental groups within the DC beltway got blindsided by the last election. Inbreeding, methinks. These folks were (and are) too focused on a "Crisis of the Week," and have almost completely lost sight of the larger picture. This means that everything they think is bad gets sent to their members under the heading: "SEND LETTERS NOW!!!!" A few dozen warnings like that, and you begin to feel like Chicken Little—and since the sky hasn't fallen yet, after a few letters a week for years, the politicians feel (and are correct given their planning horizon) that "Crisis of the Week" letters are not worthy of response. They may think that if these letters were true, the sky should have fallen a long time ago. The problem is that an orientation to a crisis of the week means that we waste time and effort putting out little fires when the sky really is about to fall on us (OK, warm up or something). We need to look instead at the big picture; what is *really* threatening life as we know it (life; that's biodiversity, not standard of living)? Maybe letter writing campaigns should be organized to the big environmental groups instead?!?

Finally, I'd like to agree with Dave that Republicans are not automatically the enemy, and can be (at least right now) the most important factor in politics. Small government and environmental protection are not automatically in opposition, which I think most of the big groups have lost sight of. Getting involved with Republican politicians perhaps can realign bipartisan conservation, and help shake up some of the environmental inbreeding inside DC. And it could bring democracy back to a more Jeffersonian ideal, by reacquainting politicians with us "common folk" (I can dream, can't I?).

So where letter writing may not work, direct involvement may. It's worth a shot.

—Dwight Barry, c/o Round River Conservation Studies, POB 6159, Salt Lake City, Utah 84106

Park Science at Risk

Little mention has been made in the mainstream press about the impending demise of conservation biology in our national parks. Few people seem to know that an initial effort by Interior Secretary Bruce Babbitt to enhance study and protection of wildlife nationally has badly diminished natural resource protection and staffs in national parks and other federal lands.

Early in the Clinton administration, Babbitt formed the National Biological Survey. Modeled after the US Geological Survey (a vastly successful agency), the NBS drew much of its expertise from the resources management staffs of national parks and monuments. But the NBS was immediately caught in the private property rights and anti-Endangered Species Act backlash. Babbitt changed its name to the National Biological Service and its budget has been falling precipitously since.

The consequences of this decay for the national parks and other public lands, particularly wilderness areas, are immediate and serious. With many top scientists from national park units being drawn away from their home parks by NBS assignments, the parks have lost much of their scientific staff. Budget cuts, coupled with confusion from the recent botched National Park Service reorganization, have left many parks stranded without their science staffs and with little or no money to reestablish the park based science staffs that existed before. As a result, the whole basis for progressive ecosystem restoration and resources management in the national park system is gravely at risk.

Unless the public takes an interest in this problem soon, decades of effort to establish a scientific basis for resources management in the national parks will be lost. This science has redirected park management from its early century archaic state to the ecological restoration efforts most NPS units are embarked on today. The scientific understandings gained by

NPS scientists have spilled over to other land agencies and begun to revolutionize management in important areas such as wildfire.

Either the National Biological Service should be abandoned and its staff returned with funding to their previous posts, or Babbitt must defend this new entity and the generation of expertise and commitment it represents.

—Tom Ribe, POB 789, Los Alamos, NM 87544

Beware the New Right

Wake up and smell the stale beer, Dave. It's not the same Grand Old Party we used to hold in high regard. The agenda of the New Republican majority bears no resemblance to traditional conservative thinking. Their openly anti-wilderness agenda is only one of many that is untenable from a traditional conservative perspective. To call them conservatives is an Orwellian perversion of the English language that I, for one, cannot abide.

Yes Newt Gingrich has been in favor of wilderness. Has been; but isn't anymore. He has a backbone even less substantial than tofu-spined Willie.

The adversarial relationship is not of our doing; it is the choice of the new Republican majority. Rather than attempt appeasement, we should take advantage of having, for once, a clearly defined adversary.

It hurts me to draw these conclusions. I used to be proud to call myself a conservative Republican. It is especially troubling to confront the unavoidable task of holding accountable those whose consent allowed the ascension of the new right. I work with them, drink with them, my father is one of them.

Of course, we must proceed with grace and honor. We are gentlemen, and gentlewomen. We must show them respect and allow them room to change their minds. But never should we weaken our resolve, especially in the face of such a direct attack.

The present political order with its ruthless arrogance and smarter-than-God attitude is doomed to collapse. Better to put some distance between the New Conservation Movement and the New Republican Majority than to risk loss of credibility by accepting an unnatural association with the latter.

As usual, my comments are meant to be constructive criticism and should not be construed otherwise. I am grateful for all you have done and I am grateful for all that other people have done in defense of the natural world, regardless of their political affiliation. And, I am grateful for your consideration of my thoughts.

—Henry Bruse, 235 Travis Dr., Wisconsin Rapids, WI 54495

Executive Editor's note: Henry, I agree with your criticisms of the new Republican conservatives. I think you were reading a bit too much into my last Campfire. —DF

Expanding Outreach and Wildlands

Reading through the Spring '95 issue, I note a letter from Tom Ribe urging "our movement" to not only broaden its base, but engage in field trips as well, in an effort to revive and reconnect. This reminded me of an interesting idea that would seem to have something to say to those concerned with movement "outreach," especially those interested in integrating the human presence into the wildlands model of buffer-zone-surrounding-core-reserve.

Suppose a parcel of land abutting a wilderness area is placed on the market. It has a ranch house, outbuildings, a gravel road and several hunting lodges, all on its outer periphery, with the remainder being near-wild, similar to that nearby which is protected as wilderness. Let's say the parcel is something under a thousand acres, all told, and the asking price is something over $1 million.

The Nature Conservancy is not interested, as there are few significant biotic communities present. State and federal entities are also uninterested or incapable of action. Leaving what as the land's likely fate? A second home, a hunting club's private haven, a religious sect's outpost, a gobbling up by a larger ranch? Or perhaps the setting for a seed that once planted could grow into a powerful tool for advocating The Wildlands Project's goals.

Perhaps a single foundation, Hollywood personality, rock star, or philanthropist could be the benefactor, or perhaps several thousand people pledging an average $10 a week. Or even more likely, a combination of these sources might be capable of raising the $1 million.

Once purchased, the ranch house could be turned into a visitor's center, where luke-warm movement types could come to observe, work and indirectly pay for land restoration, general stewardship and most importantly, expansion. While environmental ardor is rekindled by myriad projects involving science, play, artistry, recreation, and spiritual renewal, some proceeds would be directed toward the purchase of a second location, using some form of non-profit corporation or other disinterested vehicle.

Gradually, as additional sites were added, a groundswell of financial support would likely carry the project well beyond its seed-planting stage. The distant future might in fact see significant land areas used in this way for what would in effect be a slice of the recreation industry's pie. Eventually, entire environmental trouble-spots could be reattached to their wild origins.

Such an effort would best be accomplished using a democratically elected governing board and explicit mandate. Voting members would be those who had pledged what they could. Perhaps pledges could be rewarded with a user's coupon, good at any stewardship site.

By grounding the movement in a specific location, with exciting demonstration projects, wildland interpreters, rustic lodgings and opportunities for expansion nearby and afar, it might be easier to broaden our base as Mr. Ribe suggests.

—Jared Scarborough, RR1 Box 160, Payson, IL 62360-9743

Wild Earth Readers Survey Results

We offer heart-felt thanks to the many *Wild Earth* readers who took the time to fill out and return our survey forms. Your responses have been most instructive.

As much as space permits, we'll try to summarize here the general tenor of your responses. I should confess at the outset one bias: I discount illegible writing. At least among our readers, women tend to have better hand-writing than men, so their comments may be weighted a bit more heavily here. That acknowledged, let's briefly go through the questions one by one (leaving the business questions for Marcia):

3) Other periodicals read by many *WE* readers include *Sierra*, *Audubon*, *Wilderness*, *High Country News*, *Wild Forest Review*, *Earth First!*, *Conservation Biology*, *Natural Areas Journal*, *E*, and *Nature Conservancy*. Various journals of erudition were also mentioned (*Spectrometry Today*?!), as was *Four Wheeler* (by a self-avowed anti-environmental activist). The vast majority of you feel that *WE* does not duplicate other periodicals.

4) Most of you like most of our departments. The one scoring lowest was our most occasional department—Movement Mutterings—which has been intended to provide space for constructive criticism within the conservation community (typically, complaints from grassroots activists about mainstream environmental groups). Apparently, many find such criticism counter-productive, so this department may play an even smaller part in the future of *Wild Earth*.

The most controversial department appears to be Population Problems. Some of you think it should be reduced; more of you think it should be expanded. We favor majority rule.

Poetry also got mixed marks: Some readers want more; a few said toss it all. We'll aim to please both—we'll toss more and run more. Poetry Editors Art Goodtimes and Gary Lawless have been sending a much greater number of recommended poems than *WE* can accommodate. So we've asked a friend here in Vermont, English professor and poet Sheila McGrory-Klyza, to help us further winnow down the selections. Also, Gary and Art are compiling a book, *Poems for a Wild Earth*, which will help fill the demand for wild poetry.

Biodiversity is popular among almost all our readers. Land Ethics faired less well, but has some insistent supporters. Very few readers called for the elimination of any department. Several of you mentioned that you'd like to see more follow-through. Having agreed with you before even you made your request, we started an Updates department in our winter 94 issue, which we'll work to expand in the future. (Writers of Biodiversity reports and Wilderness Proposals please note: we want updates from you as your issue or proposal advances.)

5) Among favorite *WE* writers are Dave Foreman, Reed Noss, George Wuerthner, Bob Leverett, Terry Tempest Williams, Dolores LaChapelle, Gary Snyder, Gary Nabhan, Mollie Matteson, Wendell Berry, and several writers who have never written for us but whose work we're glad to take credit for (we're quite proud of Doug Peacock's *Grizzly Years*, for instance, but I've so far extracted from Doug only tentative promises, no typed papers).

6) Those few readers who thought we should set a maximum page length for *WE* articles inclined toward the upper end of the scale, 10–14 pages. We seldom run articles longer than that anyway.

7) Most said *Wild Earth* is easy to read, though many added that some scientific articles are challenging—and should be. In other words, *WE* is serious and should remain so.

8&9) Most subscribers want to read *Wild Earth* cover to cover, but only a minority has time. This leads me to a lengthy aside—some words on the surfeit of words.

Your survey responses seem to be saying (to grossly oversimplify): Wild Earth *is great; keep it as it is. Don't soften it to attract more subscribers. Four 100-page issues a year is about as much as we can handle; for we're 40 something, highly educated, financially secure but not affluent, al-*

ready committed (to wildland advocacy), and therefore facing a glut of reading material.

Especially since reading your responses, as well as Dave's last few Campfires and Michael Frome's response to Callicott last issue, I've begun to fear that wilderness proponents are putting too much time into publications, too little time into real grassroots organizing. Wilderness advocates may be allotting too much of their energy (and sacrificing too many trees) to publishing their ideas, and too little to talking with local people. Oughtn't we preach to the unconverted, rather than just writing for audiences that already share our ideals?

Thus, we've decided not to produce extra issues of *WE* as we'd previously pondered. Instead, we'll occasionally publish as monographs those manuscripts of lasting but focused import (long regional wilderness proposals, for instance), which some subscribers won't want and some non-subscribers will want.

10) Largely for this reason—too much to read, too little time—many readers would like to see "Noteworthy Articles" revived. I will aim, therefore, to make space for this column, in hopes of directing you to key published works you might otherwise miss. Given the rising heap of noteworthy articles, however—of both the sort we want to place in *Wild Earth* as space permits and the sort appearing elsewhere but deserving our readers' attention—I've decided to make "Noteworthy" more general and occasional than it was before I axed it to make room for backlogged articles. "Noteworthy Articles" will probably become "Noteworthy Publications" ("Notable Pubs" for short) and will likely appear two or three times a year. More than highlighting particular articles, I'll note outstanding journals, as well as special papers—including our incipient monograph series. Always this will be a sampler, not a compendium, so no editor or writer should feel slighted if not included.

11) You liked our "adjectives ... to describe WE." That is, you drew big circles around timely, creative, informative, attractive, and so on, as well as (necessarily, you hastened to add) depressing, dense, and alarming.

12) WE needs more art, possibly cartoons, and humor. (You send it, then; we surely do not aim to be a dire and dour publication!). Refreshingly, a supernumerary proportion of our readers say *Wild Earth* needs more big words. Granted, that supernumerary number is less than ten, but you called vociferously, forthrightly, adscititiously, perspicaciously ... One of you big word advocates said *WE* is contumacious (bringing to mind a slogan to attract more subscribers: *Wild Earth*—the contumacious conservation quarterly)!

—John Davis

Our readers are mostly male (78%), between the ages of 37–48 and very loyal. 1) Forty-one percent have been subscribers from the beginning and 2) most people heard about *Wild Earth* through a friend. So please keep sharing your copy—it really does help us.

13) Almost all readers responding to the survey feel that our subscription renewal notices are timely and easy to understand. 14) You also feel that three renewal notices are too many. We agree, yet changing from a two to a three renewal notice system has increased our average renewal rate from 50% to over 70%. Obviously some people rely on many notices before they renew. We would send only one notice if everyone who is planning on renewing responded to the first notice. If you renew (or cancel) with the first notice, you will not receive the second or the third notice. This saves paper, time and money.

People who wait for the third (and final) notice to renew their subscription have already missed an issue and have been taken off of the mailing list. When we receive their renewal, to continue their subscription uninterrupted, we send the magazine they missed by 3rd class bulk mail. To send issues out by bulk mail, we need a minimum of 100 magazines, which take time to collect. Also 3rd class mail is slow and the magazine often arrives tattered: another reason to renew with the first notice.

15) Another option that saves paper is renewing by credit card over the phone. Most people do not use this option (maybe because most of you do not use credit cards), but it is available, and I encourage readers to call even before you receive notification that your subscription will lapse. The date that you see on your mailing label is the date of the last issue of your subscription. If you have 10/95 on your label that indicates the last issue to your current subscription is Fall 1995. Expiration dates follow our publication dates: January, April, July, and October of a given year.

We also ask that folks who are moving please notify us of the address change as soon as possible, preferably at least one month before the publication dates. The Postal Service does not forward 2nd class mail. They cut the mailing label off the magazine and send it back to us. The rest of the magazine is wasted. Unfortunately, we cannot replace the magazine you missed without charging you a postage and handling fee of $3.

16) Most respondents were willing to pay slightly more for a *Wild Earth* subscription to cover the cost of using a tree-free paper. However, switching to hemp or kenaf paper at present would increase our production costs substantially—significantly more than could be offset by a slight increase in the price of a subscription. In the near-term, we'll continue to print *Wild Earth* on 100% recycled paper while continuing to research a possible conversion to tree-free paper.

20) Because a majority of our readers do not want their names traded in a mailing list exchange, we have decided to return to our old policy which restricts us from trading our mailing list to anyone except our sister group, The Wildlands Project. To help conservation groups reach our readers, we can run announcements for upcoming events, as well as articles. Contact Erin O'Donnell for more information and deadlines for the Announcements section.

—Marcia Cary

Buy Back The Dacks Fund

by Jeff Muse

HAD IT NOT BEEN for a handful of concerned citizens shortly after World War I, New York state's highest peak might rise only as a denuded rock. Although the Adirondack Park had existed for nearly thirty years, 5344´ Mt. Marcy remained privately owned and scheduled for heavy lumbering. Fortunately, a private campaign to save the mountain ended with Mt. Marcy's addition to the Adirondack Forest Preserve in 1926. As a result of the success, countless trees and an alpine ecosystem populated with rare and endangered plants were secured for future generations.

The Adirondack Park is storied with many heroic struggles for preservation, and well it should be. It contains six million acres, an area larger than Yellowstone, Yosemite, Grand Canyon, and Olympic National Parks combined. Within its borders lie 2800 lakes and ponds, one million acres of wetlands, and more old-growth forest than anywhere else in the northeastern United States. From its 2000 mountain peaks well thirty major rivers, including the mighty Hudson and tributaries of the St. Lawrence. Nine out of ten plant and animal species found in the Northeast call the Adirondacks home. Most remarkable, however, is that 90% of all designated Wilderness east of the Mississippi and north of the Smokies is in the Adirondack Park.

Unfortunately, the Blue Line—a political boundary separating the Park from "civilization"—does not ensure the environmental protection most people associate with parks. Only 42% of the Park is owned and protected by the State of New York as "forever wild" Forest Preserve; and of this 2.6 million acres, less than half is classified as Wilderness, prohibiting commercial use and motor vehicles while encouraging low-impact recreation. Privately owned, more than three million acres of the Park are vulnerable to development. (A mere ten owners, mostly lumber companies, possess one million acres of private parkland.)

Despite comparatively strong zoning laws, the Adirondack Park has a development rate three times faster than the state average. Over a thousand new houses are built annually within the Blue Line, and current regulations allow for as many as 400,000 more buildings. Roughly 130,000 people live year-round in or near the Park's 108 towns and villages; fair weather brings an additional 80,000 residents. Within a day's drive of seventy million people, the Adirondacks endure the fuming engines and lug soles of more than nine million visitors every year.

A Georgia land speculator's purchase in 1988 of 96,000 acres of Adirondack land released by Diamond International lumber company highlights the precarious future of the Park. Wildlife habitat can be secured for as little as $100-500 per acre, but New York State fails to keep pace with developers. Legislation that would tax short-term real estate profits, set aside sufficient funds to purchase private parkland, and enact tougher restrictions on subdividing and building within the Park continues to be blocked by pro-development state politicians, especially Senator Ronald Stafford from Plattsburgh. In fact, Stafford seeks to abolish the regulating Adirondack Park Agency and to remove from the Park private land within its boundaries. Like-minded constituents argue that Adirondack forests are "going to ruin" and should be open to logging.

Fortunately, there are people working to protect the Adirondack Park. Leading the way is the Adirondack Nature Conservancy/Adirondack Land Trust (ANC/ALT), a non-profit partnership devoted to preserving plants, animals, and natural communities through direct, permanent land-saving action. The 1988 merger of the Adirondack Nature Conservancy and Adirondack Land Trust, established in 1971 and 1984 respectively, combined the Conservancy's mission of preserving biodiversity with the Land Trust's skill in saving agricultural, forest, and open space lands. ANC/ALT also supports both research and public education.

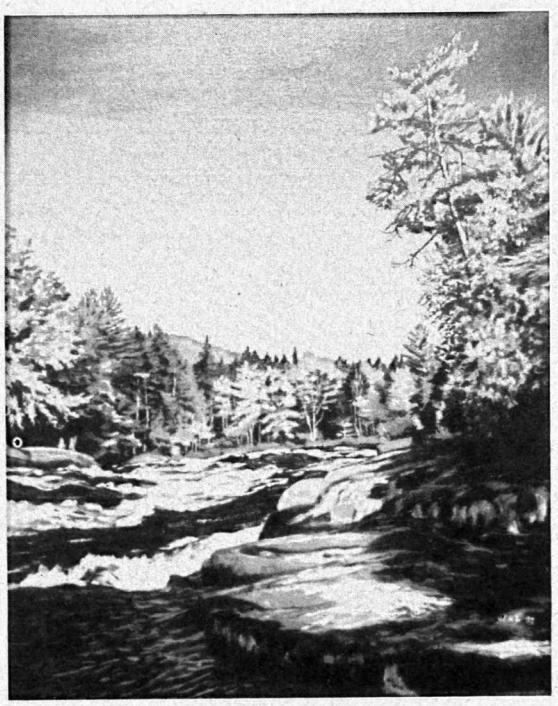
Focusing on endangered natural areas contiguous to Adirondack Forest Preserve, ANC/ALT has protected over 217,000 acres in the Park by working directly with private landowners and the state. Through thirty-two management agreements and/or conservation easements, ANC/ALT currently helps Adirondack landowners protect over 64,000 acres. Also, in fourteen preserves managed much like state-designated Wilderness, ANC/ALT independently owns and manages 6600 acres in the Adirondack Park. (Incidentally, these "preserve" lands, representing only .1% of the

woodcut by Patrick Dengate

Park's six million acres, are the only properties on which the non-profit ANC/ALT does not pay taxes. The complaint of some Park residents that non-profit tax exemption puts an economic stranglehold on Adirondack towns and villages is groundless.) Unless a special type of management is needed (e.g., prescribed burns), ANC/ALT generally seeks to transfer their properties to the Adirondack Forest Preserve. New York State ownership ensures both "forever wild" protection and state-payed taxes for Adirondack communities.

In 1992, *Wild Earth*, now just across Lake Champlain from the Adirondacks, recognized the effectiveness of ANC/ALT in protecting the Northeast's crown jewel. The staff launched *Buy Back The Dacks*, a fund dedicated to keeping the Adirondacks "forever wild." Calling upon individuals, businesses, and environmental groups, *Buy Back The Dacks* encourages active involvement in Adirondack conservation issues and raises money through fund-raisers and media advertisements. All of the money is transferred to ANC/ALT and used solely for the purchase of imperiled land within the Adirondack Park.

In the true spirit of grassroots activism, *Buy Back The Dacks* donors have given thousands of dollars for the preservation of two significant areas. The first is the 200-acre core of the Clintonville Pine Barrens, an unusual natural community whose plant and animal species have adapted to dry, sandy soils. The home of two rare moths, *Lithopane lepida lepida* and *Xylena thoracica*, and two rare plants, Prairie Redroot and Houghton's Umbrella Sedge, this fragile ecosystem is the best hope for a fully functioning pine/heath barren in the Adirondacks. Unfortunately, 900 surrounding acres of the pine barrens remain threatened by development. Purchasing and protecting the remaining acreage is a top priority of ANC/ALT, as the pine barrens will require periodic burns—one of the reasons a large, intact preserve is essential. ANC/ALT plans to retain ownership and management responsibility of the pine barrens since the state's constitution prohibits the burning of Adirondack Forest Preserve.



The second area is Canoe Carry East, a 377-acre parcel that includes 1.5 miles of shoreline on Forked Lake and 1200 feet of frontage on the Raquette River. Biologically and recreationally significant, the property secures Forked Lake as an undisturbed wildlife refuge and serves as a wildland corridor for paddlers. The State of New York has signed a Letter of Intent to acquire Canoe Carry East from ANC/ALT when funds become available.

In a time when too much of America is leveled and paved by developers, the Adirondack Park sprouts encouraging buds of conservation success. (Good news?!) There *are* organizations like ANC/ALT, campaigns like *Buy Back The Dacks*, and citizens willing to put time, money, and passion into keeping wild America wild and making more of it so. We should support them, follow their examples, and glean from them as much inspiration as we can. A legacy of preservation in the Adirondacks, or anywhere for that matter, requires more than tenacious commitment and unrelenting faith. We must remember to celebrate, too. Like those who saved Mt. Marcy from the sawblade decades ago, we should be proud of our success.

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Jeff Muse recently earned a M.S. in Environmental Education from Audubon Expedition Institute. While doing an internship with Wild Earth *in Winter 1995, he developed a promotional plan for Buy Back The Dacks.*

untitled Adirondack landscape (acrylic) by Bill Amidon

TWP EDUCATION PROGRAM

Eight months of intern sweat and blood finally paid off this last month in the first installment of The Wildlands Project's teachers' workshop. Twenty teachers (ranging from kindergarten up to high school) and two Arizona State Park rangers gathered at Camp Cooper Environmental Center outside Tucson to hear Rod Mondt and Jim Strittholt talk about the need for big wilderness and the efforts of The Wildlands Project. The three session workshop was a raging success. (During our brief field trip into the Tucson Mountains we were lucky enough to see two Bobcats!) We turned out twenty teachers equipped and inspired to bring activities focusing on biocentric biology, reserve design, and ethics clarification into their classrooms.

Now the easy part is over. After a bit of revision, the package of activities and the workshop guidelines will be available for workshops in other regions. Our goal is to have similar teachers' workshops available throughout the United States, Canada, and Mexico. We will need the help of local activists and teachers to make it happen. Because locals know their own region better than the folks in Tucson or McMinnville, a certain amount of the workshop content will need to be adapted to adequately address the unique characteristics and challenges of wildlands conservation for each of the regions where the workshop is presented. From our end, we hope to supply The Wildlands Project slide show, the film *Anima Mundi*, a qualified instructor (we will either enlist the aid of a qualified local or else supply one of TWP's biologists), and a packet of ten classroom activities and source materials for teachers. I say "hope to supply" because our grant schedule is just a wee bit behind. (Anyone know any wealthy individuals who want to fund a very worthwhile education project?)

For more information on the education program contact The Wildlands Project Tucson office at: 1955 West Grant, Suite 148A, Tucson, Arizona 85745; (602) 884-0875 or fax (602) 884-0962.

TWP is also looking for interns to help with education and outreach efforts. If interested please send a resume to Rod Mondt or Andy Miller at the above address.

—*Andrew Miller, Education Intern*

PRAIRIE DOG ECOSYSTEMS UPDATE: BLF SUES GOVERNMENT FOR SWIFT FOX

February 15, the Biodiversity Legal Foundation (BLF) and biologist Jon Sharps filed suit in federal court against Secretary of the Interior Bruce Babbitt and the US Fish and Wildlife Service (FWS) for their failure to issue a final ruling on a petition to list and protect the Swift Fox in the Great Plains under the Endangered Species Act. The Fish and Wildlife Service received a petition to list the Swift Fox as an Endangered species on 3 March 1992, and on 1 June 1994 the agency published a notice in the *Federal Register* that listing the fox as Threatened or Endangered "may be warranted" throughout the Swift Fox's historic range.

The ESA requires that within 12 months of receiving a petition found to present substantial scientific information indicating that the petitioned action may be warranted, the Secretary of the Interior must publish in the *Federal Register* a finding that the listing is warranted or not warranted. This required decision is now almost one year overdue.

Swift Fox have been reduced to fragmented and isolated remnant populations. Their preferred habitat has been severely reduced by the conversion of native prairie to agriculture and other human developments. Prey species that were normally available to the Swift Fox have likewise been seriously reduced by native prairie conversion. Swift Fox numbers have also been depleted by predator and rodent control programs, trapping, hunting, and dogs. The Swift Fox is close to extirpation in the northern Great Plains.

BLF decries FWS's current trend toward avoiding the required application of the ESA to protect and recover endangered species and their ecosystems. Under intensive political and economic pressure from various states, FWS appears to be illegally substituting unenforceable state recovery plans and conservation agreements for ESA listings. Under the ESA, only biological information can lawfully be considered when making a decision on whether or not to list a species.

The Swift Fox is closely tied to the prairie dog. Prairie dogs provide the fox with both a year-round prey base and an abundance of burrows. Tragically, state and federal land management agencies continue policies that destroy prairie dog habitat throughout the West, endangering not only the Swift Fox, but also the 163 known vertebrate species associated with the prairie dog ecosystem. As the US Forest Service continues its war against the prairie dog ecosystem on the National Grasslands, species such as the Burrowing Owl are becoming increasingly imperiled.

BLF plans to legally challenge any not-warranted finding by FWS, since the fox is clearly biologically threatened in almost all of its known historic range. BLF also continues to pursue legal means of protecting the prairie dogs themselves.

For information contact the Biodiversity Legal Foundation, POB 18327, Boulder, CO 80308-8327. BLF welcomes contributions.

Young Black-tailed Prarie Dogs *by Evan Cantor*

"Greening" the Military in Three Central American Nations

Wildlife smuggling from Central America to fulfill the demands of the exotic pet trade in Europe, the United States, and Asia is a lucrative and dangerous business. In Nicaragua, for instance, wildlife inspectors receive death threats and must carry guns to defend themselves while carrying out their duties.

Three Central American nations, with the guidance of the World Society for the Protection of Animals (WSPA), have established a unified plan to combat this illegal traffic in wildlife from the region. Representatives from Nicaragua, Honduras, and El Salvador have agreed to implement a multi-nation strategy that includes the tactical support of military personnel.

The agreement follows an undercover WSPA investigation conducted in 1993, which made clear that action was needed to restrict the flow of exotic animals out of Central America to markets across the northern hemisphere. This investigation was conducted at the express invitation of the Wildlife Department in El Salvador. The WSPA team examined the entire trade route, beginning in Nicaragua and passing through Honduras into El Salvador before the animals are finally smuggled out of the region completely. The WSPA Regional Director for Central America, Gerardo Huertas, estimated that smugglers transport as many as 5000 animals per day during their peak season of operation.

Condemning the illegal trade, WSPA and the Salvadoran Wildlife Department said that "the country was being used as a springboard to the European and American market for exotic pets." Soon after the results of the investigation were publicized in El Salvador, the Wildlife Department stepped up its enforcement, which included placing greater controls over wildlife ranches in the country, establishing a formal agreement on sanctions, tagging fertile females, keeping records of juveniles, and conducting surprise inspections of facilities.

El Salvador's Wildlife Department now has an agreement with all of the country's wildlife ranches to initiate a census and registry of captive iguanas, which includes use of a secret identification stock code that will be known only to the breeders and officials from CITES (Convention on International Trade in Endangered Species). This will help regulate the flow of iguanas from the country and protect the legal trade. Prior to this agreement, the WSPA investigation revealed that many of the wildlife ranches were taking iguanas out of the wild and laundering them through the ranches as captive-bred animals.

The WSPA investigation also proved to be the impetus for the passage of the first piece of national legislation in El Salvador's history for the protection of wildlife. WSPA, with the help of the El Salvador Zoological Foundation, conducted an exhaustive lobbying effort in the El Salvador Congress to promote passage of this legislation.

Meanwhile, authorities in Nicaragua began to take steps to curb the illegal shipment of animals from their country. In the city of Chimandega, the home and facilities of one of the animal dealers, identified by the WSPA investigators, were raided by the police and Wildlife Department. The dealer's CITES permit to collect juvenile reptiles for export was revoked. Intelligence work was conducted on suspected dealers. Two customs inspectors in Nicaragua were fired after it was determined that they were involved in smuggling to Honduras four Yellow-napped Parrots, which had previously been confiscated from a bus that originated in El Salvador.

WSPA convened a meeting of representatives from all three nations in Managua, February 1994, to share information about their mutual problems concerning wildlife trafficking and to formulate a unified solution to stop it. There, Dr. Jaime Incer, Nicaragua's former Minister of the Environment and Natural Resources, urged the delegates to "think and act as if this region was one country."

An inter-institutional agreement was also signed in El Salvador between police, customs, animal quarantine, and wildlife officials to integrate their efforts against wildlife dealers. "All of the manpower and resources have been pulled together and coordinated for the prompt return of seized animals to their native, jungle homes," Huertas said.

illustration by Becca Cunningham

As part of the long-term strategy to combat the smuggling of wildlife from Central America, WSPA conducted the first training seminar for wildlife inspectors, customs officials, and Sandinista Army officials in Managua during January, 1995. These training seminars are an outgrowth of an official agreement signed by Incer and then Commander-in-Chief of the Popular Sandinista Army, General Humberto Ortega Saavedra, this past October with WSPA, outlining their plan to work together to combat the illegal wildlife trade. General Ortega was recently replaced as head of the Nicaraguan army by General Joaquín Cuadra, who recently met with WSPA staff members and endorsed the program.

WSPA has developed a curriculum for the training seminars. Both government officials and soldiers will learn about and discuss local ecology issues, species identification including threatened and endangered species, current legislation aimed at protecting animals, as well as information about the tactics and routes that are typically used by the smugglers. WSPA will arm its new trainees with posters and leaflets containing basic wildlife information that they need to know at all times.

WSPA has provided wildlife officers in Nicaragua with radio communications equipment, establishing a direct line of communication with the military. In this way, joint operations for the seizure of animals will be coordinated with the backing of armed military personnel. The Central American strategy will lead to increased intelligence activities by the armies to monitor the illicit animal trade.

According to Huertas, the armies and police forces of all three nations have offered patrolling vehicles and ships, radio communications, and human resources to actively protect their frontiers, both inland and in the Gulf of Fonseca on the Pacific side. In the future, the militaries may carry out their own "wildlife patrols," taking an active role in protecting the region's wildlife. The "greening" of the military in Nicaragua and Honduras, and of the newly formed Civil Police in El Salvador, is a first step toward protecting the region's diverse natural heritage.

To support WSPA's ongoing efforts to protect wildlife all over the world, send donations to: WSPA, POB 190, Boston, MA 02130, or call (617) 522-7000 for more information.

—Jason Black, Communications Officer, World Society for the Protection of Animals

Finland—A Country of Forests turned into a Country of Plantations

Eighty-seven percent of all land in Finland is officially classified as forest, and forests have always been the backbone of the Finnish cultural identity and economy. Yet today only 2% of this is natural, old forest; 98% of the original old growth has been logged and replaced by monocultures consisting of even-aged stands (mainly Scots Pine or Norwegian Spruce). Despite this, Finland has been advertising itself as a model country for sustainable forestry on the basis that for each tree felled, two more are planted. This famous slogan hides the truth about the destruction of old, natural forest. Half of all endangered animal and fungi species in Finland (some 700 species) are endangered because of forestry practices, like clearcutting, and particularly because scarcely any habitats remain for species requiring old-growth forests.

Finnish forests are used for the production of pulp and paper that ultimately find their way into magazines and disposable tissue products all over the world. That's why this issue also concerns YOU. Finnish forestry can probably be regarded as financially sustainable, but in environmental terms this is meaningless. The last 2% of the old-growth forests are STILL being logged!

The logging has led to conflicts between forest activists and different institutions owning the forests, which forced the authorities to start an old-growth survey. The inventory began in southern Finland and is still under way in northern Finland, arousing fierce opposition from the local forest industry.

The hottest forest conflict in Finland is currently in Kuusamo in the northeastern part of the country. In spring 1994, forest activists from the Nature League studying satellite images noticed three previously "unknown" pristine forest areas, totaling 23,500 hectares (235 square kilometers; about 58,000 acres). Not only are the areas covered by old-growth forest but also they are free of roads—very remarkable in a country where forestry roads cover more land area than all nature reserves combined.

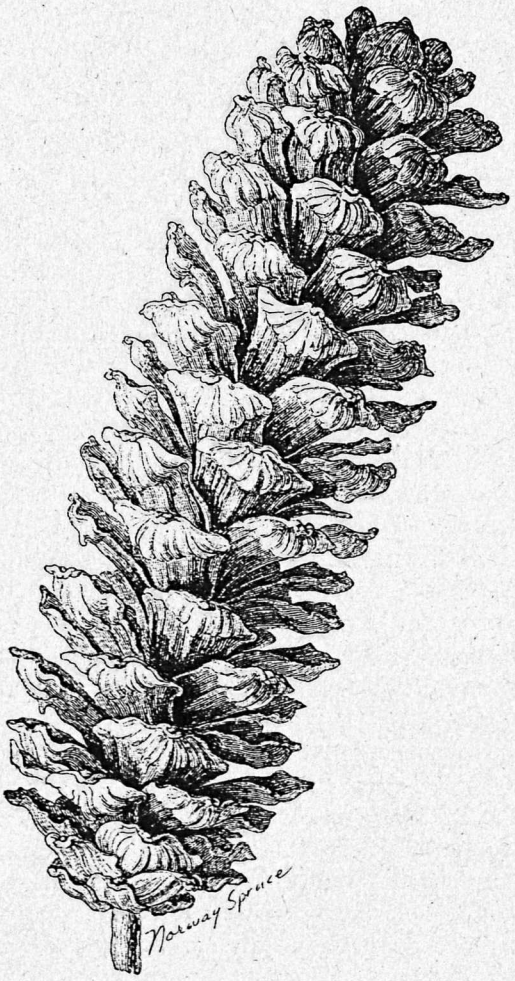
All three areas are owned by Kuusamo Forest Common, in which the ownership is held by some 6000 share-owners. Kuusamo Forest Common is known for its extensive clearcuts and its very negative attitude toward nature conservation and "new forestry" practices. It owns 90,000 hectares of forest land, one-third of which is old growth and the rest clearcut areas or young plantations. The three controversial areas are Romevaara (4500 hectares), Naranganvaara-Virmajoki (14,400 hectares) and Pajupuronsuo (4600 hectares).

The Nature League announced the findings to the media in October 1994 and demanded the areas be protected. The economic value of the forests has been estimated to be 500,000,000 FIM ($100,000,000 USD) which is two or three times the annual budget of the Ministry of Environment for buying new reserves. Finland has no endangered species act, so to protect an area the state must buy it. Forest activists have demanded that the forest industry pay its share for conservation as a percentage from wood trade, since the industry benefits from protection in the form of a better reputation abroad.

Open conflict broke out when Kuusamo Forest Common logged some 100 hectares in the northern part of the area. Some of the wood was bought by two paper companies, Metsa-Botnia and Veitsiluoto. Nature League forest activists marked the rest of the logs with "pristine forest" stamps ("aarniometsaa"). The Forest Common answered by blocking activists (and a TV crew!) in the area, piling logs and parking logging machines on the road.

Since then the authorities have been trying to negotiate a resolution and the Forest Common has been breaking one deal after another. As of February 1995, some 1000 hectares had already been given over for logging, and the Forest Common had built over 25 kilometers of new access roads.

The major wood users of the area, paper companies Veitsiluoto and Metsa-Botnia, have said they would not buy wood from old-growth forests, yet this hasn't stopped them from buying wood from Kuusamo Forest Common, whenever the environmentalists haven't been quick enough to mark the cut logs. Veitsiluoto is the largest wood buyer in northern Finland, and hence its wood procurement policy toward old-growth forest inventory areas determines in practice the future of these forests. As a state-owned company, it should be a forerunner for the rest of the forest industry. Instead, the chairman of their board stated in January 1995: "The total area of protected forest areas in northern Finland must not be further expanded. If new areas for protection are defined, an equivalent area must be released from the existing protected areas."



This is what you can do:

Most important, put pressure on companies and make them feel responsible for the source of their raw material. In this way, international consumers play crucial roles.

Write to the Finnish Prime Minister, who is also the chairman of the Finnish Committee for Sustainable Development reporting to the UN, and to Veitsiluoto Ltd. (Please send us at the Nature League copies of your letters.)

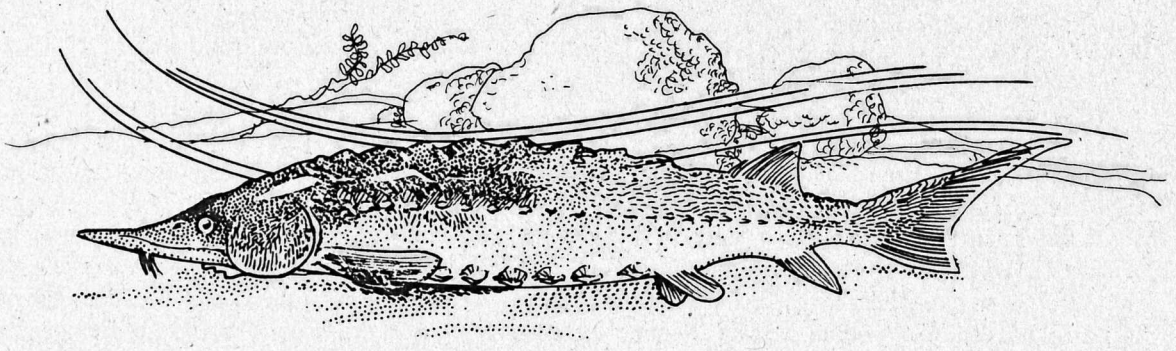
- Express your deep concern for the remaining old-growth forests in Finland, naming the Kuusamo forests as particularly in need of protection.
- Ask the Prime Minister what he will do as Chair of the Sustainable Development Committee to stop the remaining old forests from being cut.
- Urge the state company Veitsiluoto to keep its promise of not buying old growth.
- Read 'New Scientist,' Feb. 11, 1995: "Death by a Thousand Cuts" for more information.

addresses:

Prime Minister Esko Aho, Aleksanterinkatu 3 D, 00170 Helsinki, Finland
Kauko Parviainen/Veitsiluoto, Puistotie 12, 94839 Kemi, Finland
Nature League/Forest Group, P.O. Box 226, 00151 Helsinki, Finland

—Kaisa Raitio and Bruce Forbes, University of Lapland, Rovaniemi, Finland

Audubon Chapter Sues to Protect Gulf Sturgeon and Pearl River



On 23 January 1995, the Orleans Audubon Society sued the US Army Corps of Engineers and the US Fish and Wildlife Service (FWS) to stop the proposed dredging of the West Pearl River in southeastern Louisiana. The dredging would destroy one of the last three populations of the Gulf Sturgeon (*Acipenser oxyrhynchus desotoi*), a Threatened subspecies of Atlantic Sturgeon. The New Orleans office of the Sierra Club Legal Defense Fund filed the suit on Orleans Audubon's behalf.

The Gulf Sturgeon, which can live over 40 years and weigh as much as 600 pounds, has all but been eliminated over the past 50 years by destruction of its spawning beds and overfishing. An anadromous fish with a strong home stream imprint, the Gulf Sturgeon migrates in spring from the Gulf up its natal stream seeking spawning habitat. Water quality deterioration, dam construction, and dredging for navigation have deprived the sturgeon of most of its freshwater habitat. Originally inhabiting coastal rivers and the waters of the Gulf of Mexico from west of the Mississippi River east to Florida Bay, it now is found only in the Pearl River system and the Apalachicola and Suwannee Rivers in Florida.

The West Pearl River Navigation Project jeopardizes the survival of the Gulf Sturgeon in the Pearl River Basin. Congress authorized a navigational project for the West Pearl River in 1935: a seven-foot channel running 58 miles upstream from the mouth of the river. In 1975 the project was abandoned as uneconomical; but in the late 1980s, the Corps proposed to resume dredging to reopen the river to barge traffic. The EIS contemplates annual removal of 1.4 million cubic yards of sediment during spring dredging to be disposed of in-river or in spoil banks. Although projected to bestow economic benefits in excess of its $25 million costs, the Corps has refused to release the data upon which the benefit estimates are based.

map and Acipenser oxyrhynchus *illustration by Chuck Ouray*

In the final EIS, signed 16 December 1994, the Corps said the dredging "is engineeringly feasible, economically justified and in the overall public interest." The Corps had planned to begin dredging in May 1995. However, just as suit was filed, FWS rescinded its Biological Opinion that the project would not jeopardize the continued existence of the Gulf Sturgeon in the wild, and reinitiated consultation with the Corps. It remains to be seen whether the Corps and FWS can work out the project's flaws.

The navigation project threatens not only the Gulf Sturgeon, but the general health of the Pearl River Basin. The river traverses the Honey Island Swamp, one of the largest contiguous bottomland hardwood swamps remaining along the coast of the Gulf of Mexico. The Pearl River Basin includes three state and federal wildlife refuges, and is important habitat for many rare species, including Bald Eagle, Brown Pelican, Ringed Sawback turtle, and Paddlefish.

—Frank LeBlanc, President, Orleans Audubon Society, POB 4162, New Orleans, LA 70178

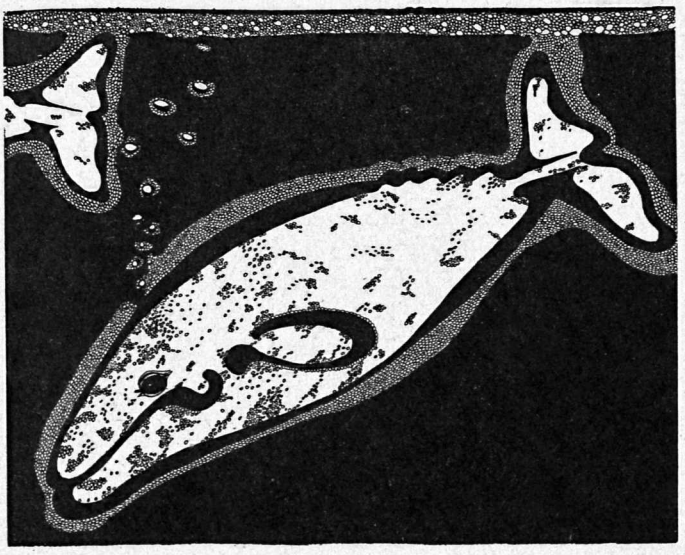
Sonar Project Threatens Marine Habitats

While mysterious songs of Humpback Whales grace the Pacific Ocean near the Hawaiian island of Kauai, and Sperm Whales dive making click-like vocalizations to identify each other in the subsea canyons of Monterey Bay, California, a new noise manufactured by humans may soon infiltrate this great expanse of water. The sound, neither song nor communication within the web of life beneath the ocean, would be part of the undersea sonar project, Acoustic Thermometry of Ocean Climate (ATOC). This project not only has the potential to disturb a sensitive and magnificent body of water, the Pacific Ocean, but in time may harass marine life in all the world's oceans.

ATOC is funded by the Department of Defense (DOD). In the past, similarly designed sonar projects were intended to "floodlight" the deep ocean to reveal enemy submarine activity. Perhaps the focus of such projects shifted due to political changes around the globe. Public support weakened for additional defense spending on research with such focus.

Currently the Advanced Research Projects Agency (ARPA) administers ATOC. ARPA is the central research arm of the DOD. Researchers from Scripps Institution of Oceanography were selected to head the project's scientific team. The sonar project would be used to monitor long-term ocean climate changes on a global scale.

The basic principle behind ATOC is simple. It would use acoustic sound paths in the sea's deep "sound channel" to precisely measure average ocean temperatures. Project researchers theorize that sound travels in water according to variable rates based on temperature, faster in warm water than in cold water. Members of the scientific community involved with ATOC feel that the deep sea "sound channel" is more likely to give an accurate temperature of the ocean than are other data-collecting devices such as satellites.



If the project is approved, ATOC scientists will use transmitters to send digitized signals through this channel and the noise will be picked up in New Zealand. There, computers will interpret the data and researchers will monitor changes over a two-year trial period. According to ATOC scientists, if sound begins to travel faster over time they would use such temperature data to show that a warming trend exists within the deep ocean. If data collection is determined to be successful, the project will continue for 10 years, with similar sonar projects slated for all the Earth's oceans.

Average ocean temperatures collected by ATOC scientists will be used to validate global climate computer models currently maintained to answer the question of whether the Earth is warming as a result of the "greenhouse" effect. If the bathyal ocean is warming, ATOC scientists assume, so too is the Earth.

However, the ATOC program is dubious as planned. Troublesome aspects of the sonar project include the conjectural nature of such experimentation, using sensitive marine habitats for placement of the transmitters, and risks of the sound to marine life.

Whether ATOC data will indeed be useful in measuring global climate change is uncertain. Project planners have yet to detail exactly how ATOC data will resolve the uncertainties over global warming. ATOC's designers suggest the sonar project will be the best source of climatological data, thus eliminating reliance upon other, challenged computerized climate models. To date, though, the sizeable amount of data collected on changes in global climate has done little to change stubborn resistance. It is unlikely that ATOC will sway adversaries to accept the global warming theory.

There is also controversy over ATOC scientists' reliance upon the sound channel for the experiment. In brief, the sound channel is an area where the speed of sound is at a minimum. At depths of 850 meters, or 3000 feet below sea surface, sound is refracted from above and below, due to faster speeds of sound in those areas caused by pressure (below) and warm temperatures (above), creating a "channel." ATOC scientists hypothesize that within this channel sound is efficiently transmitted for long distances.

However, ocean movements from tides, currents, internal waves, eddies, and other oceanographic features affect acoustic transmissions. Traveling long distances, sounds could be scattered, distorted or otherwise rendered unusable.

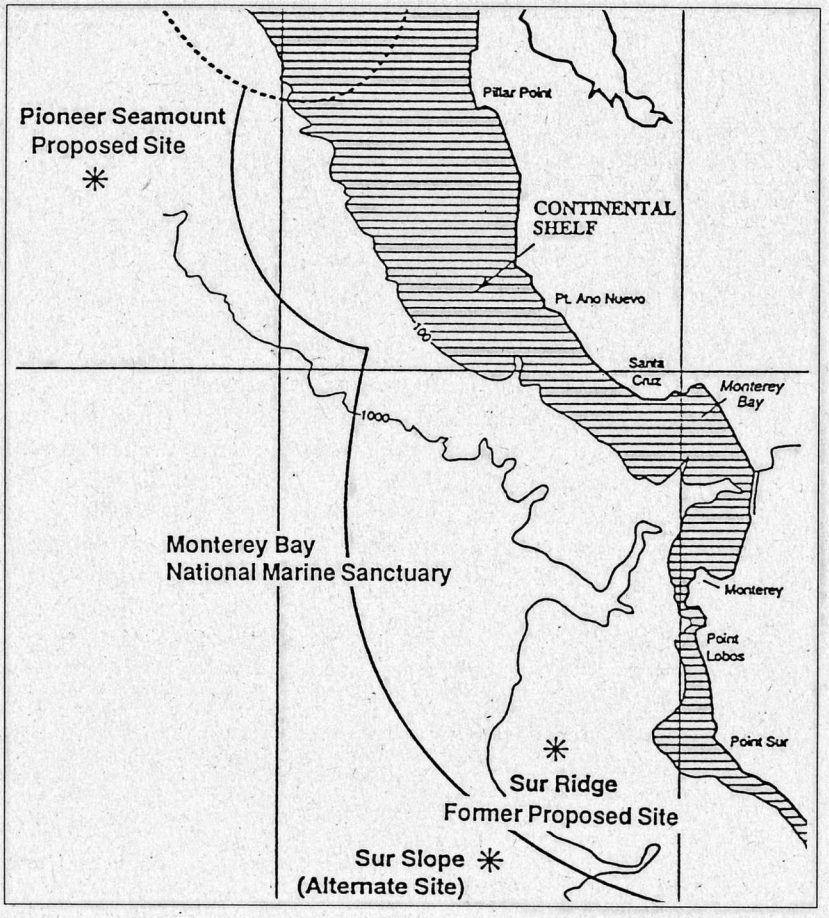
From an ecological perspective, perhaps the biggest problem with ATOC is where scientists plan to place transmitters.

illustration by Jim Nollman

The sites being considered for the sound sources are near the Monterey Bay, Gulf of the Farallons, and Hawaiian Islands Humpback Whale National Marine Sanctuaries. These are biologically rich and highly sensitive marine environments.

The twentieth century has been menaced by well-intentioned scientific experiments that turned adversarial and became problems for many plants and animals. Although the ATOC is a well-meant project, it raises deep concerns about long-term effects of artificial noise on life beneath the sea. Scientists do not know how any animal may be affected by ATOC. Nor will the proposed six-month-long marine mammal study enable them to gauge the effects.

Man-made sound is increasingly a threat to the oceanic world. A barrage of noise from tanker traffic, offshore drilling rigs, recreational vehicles, construction, and explosive testing already pollutes open ocean and coastal areas. Many scientists fear these sounds are affecting marine life in ways we do not understand.



EIS / EIR study area and ATOC alternate sites

Biologists have documented harms caused by noise to a wide variety of sea life, including species abundant within the areas designated for use by ATOC scientists. Risks from sound intrusion in the oceans include masking (obscuring sounds of interest by stronger interfering sounds) and causing adverse changes within the food web. The range of marine life that may be harmed includes plankton, jellyfish, crustaceans, sea turtles, many fish species, sharks, seals and whales, some of which are listed as Threatened or Endangered.

ATOC could disrupt predator-prey relationships. Sharks, known to have highly developed prey detection skills, employ hearing to interpret vibrations emitted by prey. Fish near the ATOC source during its active cycle may signal distress, thereby attracting predatory species.

Species abandonment from areas near the ATOC sound source is another danger. In addition, sound affects egg viability and growth rates of some fish species.

Sound similar to that proposed for transmittal by ATOC has been found to cause problems for several whale species. Whales near the experimental sound source may react with changes in course of migration, breathing, and communication. Whales emit intricate patterns of acoustic signals to locate each other, study their surroundings, and attract mates. Blue Whales found in and around the Monterey Bay National Marine Sanctuary during summer use low-frequency moans, possibly with their own regional dialect, to identify one another over long distances. Gray Whales, also found throughout the region, make knocks and pulsing noises as they migrate along the California Coast. These may be used to determine where they are in their migration and the location of other herds. Off the coast of Kauai, the mysterious songs of the Humpbacks—their chirps, yups and grunts—may be to attract mates. Yet, many whale species fall silent when they sense unusual sounds near their herd.

Scientists opposed to ATOC warn that reductions in the radii of whale communication could occur as a result of noise transmitted by ATOC. Sound levels made by whales, ranges of those sounds, and their ability to sense them are not known.

ATOC supporters theorize that because of the sound's relatively short duration during the day, and its ramp-up period (the transmitted sound starts out soft then gets louder), marine animals will have time to swim away or become immune. Although animals may over time begin to cope with the intense sound, chronic exposure could lead to harmful physiological effects. Some animals will leave the site of the ATOC sound source and never return.

While Marine Sanctuaries and surrounding areas are useful to researchers, many feel risks imposed by ATOC are too great or too uncertain to be permitted within Sanctuary waters. Recently, the National Oceanic and Atmospheric Administration concluded that it was inappropriate to locate the ATOC sound source within the Monterey Bay National Marine Sanctuary. Several organizations concerned about use of Sanctuaries are interested in additional marine mammal research that

may affect policy and regulation of noise, but do not feel ATOC's preliminary Marine Mammal Research Project is appropriate as planned. At recent public hearings, citizens expressed opinions that the $35 million scheduled for the project could be used on less risky and intrusive projects, or pro-active projects that may lessen the threat of global climate change rather than further document it.

Moreover, the current site proposed for ATOC—at Pillar Point off Half Moon Bay, near the Monterey Bay and Gulf of the Farallons Marine Sanctuaries—poses new problems. Although the site is not within a Sanctuary, it is only a few miles from boundaries of two Marine Sanctuaries. Conservationists have expressed concern that Sanctuaries not be treated as islands, with a free-for-all outside their boundaries. Similar to problems noted in National Parks, such as the abundant toxic agricultural runoff and heavy development nearby Everglades National Park, placing ATOC close to a Sanctuary could harm sensitive wildlife therein.

The sea is a landscape resonant with mystery. We must identify and protect those regions still largely undisturbed by human technology. The ocean needs your help.

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LGL Ecological Research Associates, Inc., Effects of Noise on Marine Mammals, February, 1991.

Advanced Research Projects Agency, Draft Environmental Impact Statement for the Kauai Acoustic Thermometry of Ocean Climate Project and its associated Marine Mammal Research Project, Vols. 1 & 2, December, 1994.

—Charles Clover (230 Karls Dell Rd., Scotts Valley, CA 95066) is an environmental issues writer. He resides in the Santa Cruz Mountains of California and is working on numerous environmentally related writing projects including an anthology of short stories, called Deep Woods.

What You Can Do:

1) Contact your representatives and senators and push for stringent policies to *prevent* global warming, rather than pay for more research to prove its existence. Also, call for legislation requiring reduction of human-made noise levels in oceans.

2) Contact government officials involved with the project. Ask them to prevent ATOC from being placed anywhere near National Marine Sanctuaries, specifically in this case, the Monterey Bay, Gulf of the Farallons, and Hawaiian Islands Humpback Whale National Marine Sanctuaries.

- California State Senator Henry Mello, 701 Ocean Street, Santa Cruz, CA 95060
- Congressman Sam Farr, US House of Representatives, Washington, DC 20515
- Senators Barbara Boxer (CA), Dianne Feinstein (CA), Daniel K. Inouye (HI), and Daniel K. Akaka (HI), US Senate, Washington, DC 20510

3) Contact Scripps Institution of Oceanography and ask it to drop the planned ATOC project and instead conduct research projects more pro-active in averting anthropogenic climate change and less intrusive in the ocean environment.

Cindy Rogers
Scripps Institution of Oceanography
University of California at San Diego
9500 Gilman Drive
La Jolla, California, 92093-0225

4) Contact Vicki Nichols at the grassroots organization Save Our Shores to learn more about the impacts of ATOC on the nation's largest marine sanctuary.

Save Our Shores
PO Box 1560
Santa Cruz, CA 95061

Emergency Feed Exposed

Sometimes it seems that welfare ranching has no limits. A recent *New York Times* article by Karl Hess Jr. and Jerry Holechek ("Subsidized Drought," 12-12-95) describes the USDA's "emergency feed" program, which doles out $100 million to $500 million annually to US ranchers. The program is open to all stockmen, public and private, and provides free corn plus 50% of the cost of extra livestock feed used in lean years, when range forage growth is at least 40% below normal.

Predictably, the *Times* article reports that this federal project is widely exploited by Western ranchers. It explains that "emergency drought relief" payments have minimal relation to the weather and have become annual income for many. In New Mexico, for example, where more than half of all ranchers use the feed program, precipitation has been above normal five of the past six years, yet so has federal relief. Cash payments there amount to about 15% of net ranching income. Oregon's participants pull in an average of more than $11,000 a year each, cash. Even the validity of the determination that forage is "at least 40% below normal" is often doubtful. Moreover, most of the program's recipients are medium to big-time stockmen.

As it further stuffs the already horribly bloated welfare ranching industry with more of our tax dollars, the federal emergency feed program further degrades the environment. Since ranchers can obtain free to cheap supplement feed via the government whenever range forage falls at least 40% below normal—in other words, whenever they allow their livestock to "create a drought" by overgrazing the range to 40% or below normal—they have no incentive to minimize overgrazing.

This is particularly true of private ranges, which are subject to even fewer environmental safeguards than are public lands. Though it rarely happens, grazing on public lands can be reduced or temporarily suspended in response to drought. Private lands have precious little protection other than the conscience of the individual rancher. The pathetic condition of most private ranchland indicates where most stockmen's priorities lie.

The emergency feed payments are based on herd size, so stockmen are in effect encouraged to enlarge their herds, even though nearly all herds already are many times too large to avoid extensive environmental damage. Even studies by ranching-friendly agriculture schools conclude that ranges are being significantly overstocked due to the USDA program. With additional overstocking, forage production further declines, ranchers depend even more on the supplemental feed program to keep herd numbers artificially high, which keeps ranges deteriorating, and so on. According to the *Times* article, "It's a vicious and degrading downward spiral, one whose burden falls most heavily on private rangelands, which make up 40% of the total."

The informative *Times* article then takes a crooked but all-too common twist. Instead of holding stockmen responsible for subsidy abuse and overgrazing, Hess and Holechek suggest that government is to blame because it "seduces," "entices," and then "victimizes" graziers with this irresistible yet ill-conceived program. As if it is some federal plot to entrap unsuspecting cowfolks, affix them to the welfare breast, and force them to "hammer the range to dust in expectation of a federal lifeline." In our cowboy-crazed culture it seems that we are all ranching apologists.

The inescapable truth is, however, that throughout the West ranchers have been hammering the range to dust for more than a century. And they did it just as well without as with the literally hundreds of federal, state, and local government hand-outs now available for their exclusive benefit. While the emergency feed program undoubtedly does exacerbate ranchers' already deplorable treatment of the land, the scores of subsidies nearly all stockmen take advantage of are no more responsible for range degradation than litter is responsible for littering.

If Western stockmen really are the rugged, self-sufficient individuals they fancy themselves, then they should expect to be treated like responsible adults—not spoiled, pampered children, hiding from scrutiny behind their John Wayne and Gabby Hayes masks.

Any possibility of serious ranching reform must address realities, not images. The reality of the Western rancher is that he is primarily a profit-and-power oriented businessman, not a materialized ideal from Western mythology. And the reality of the sparse, dry, rugged Western range is that little, if any, of it is suited to practical livestock production. These are the reasons why our myriad efforts to "save" the Western rancher and his "cherished way of life" prove misguided and wasteful. These are why our hundreds of government-sponsored efforts produce nothing but more degraded ecosystems and more whining ranchers. And these are why the federal "emergency feed" program will not work.

For more than 100 years Western stockmen, with help from their many politicians, lawyers, and others in power, have developed and promoted welfare ranching for their own benefit. (Indeed, in much of the rural West ranchers and their assistants basically *are* the government.) To claim that they are now being victimized by being subsidized is backwards logic, and it fails to recognize that they are "victims" more of their own arrogance and avarice than of government mistreatment. More to the point, to suggest that they are actually suffering in any real sense from these subsidies is simply false. As usual, ranchers, comfortably cloaked in Western romance, get far more sympathy than the real victims—the public and the land.

To express your opinion on USDA's emergency feed program, contact:

- your Congressional representatives: senators, US Senate, Washington, DC 20510; representative, US House of Representatives, Washington, DC 20515
- Secretary, US Department of Agriculture, USDA Administrative Building, Washington, DC 20250
- USDA Consolidated Farm Services Agency, Emergency Operations, Livestock Program Division, Washington, DC 20260

—Lynn Jacobs (POB 5784, Tucson, AZ 85703), author of Waste of the West: Public Lands Ranching

The reality of the sparse, dry, rugged Western range is that little, if any, of it is suited to practical livestock production.

illustration by Susan Pedicord

Big Logs, Big Fish

by Mitch Friedman

"MOST WETLANDS aren't worth the spit it took to fill them." So says the most vocal building industry flak in Whatcom County, Washington. His cynical message is striking a chord for too many people. Most do not understand or feel the allure of wetlands or even rivers. Swamps, for example, lack the obvious grandeur of, say, big old trees. One noted environmental pundit, Andy Kerr, wished that wetlands were instead called ancient meadow ecosystems.

I fear the problem is more than semantic. People do not comprehend the former wildness and power of an area that has been largely gutted. For instance, many of the controversial wetlands of western Washington's Nooksack River are not usually wet. They are instead delineated by plants that grow there due to seasonal saturation. It is a matter of function, not form.

I have flown over the length of the Nooksack. The upper watershed is in the Mount Baker-Snoqualmie National Forest and, while fragmented, is mostly forested. This river was designed for forest passage. It looks right and proper flowing through trees. Not just a few alders and red-cedars along the bank, but trees all up and down its tributaries; trees in the uplands connected to trees in the floodplain.

The lower watershed is not so lucky. A pathetic strand of hardwoods is all that tracks the flow in many places, providing little buffer from dairy farm, gravel pit, or town.

Recently, on a drive through British Columbia's southern Interior, I was transported back in time by the Columbia River marshes. I was keeping an eye out for Mastodon, not to mention Moose, along a 100 mile-or-so stretch of BC-95 that parallels the undammed portion of the upper Columbia, between Roosevelt Reservoir and Kinbasket Reservoir. It was a confusing sight, the river channel indiscernible from its lush duck-filled marshes (not just wetlands), eagles and herons roosting in maples and cottonwoods knee-deep in drink. The Columbia River—downstream dammed, dredged, engineered, and barely able to sustain a salmon run anymore—here is as alive and verdant and everywhere wet as a Central American rainforest river. It felt paleolithic. Its wildness and power were palpable.

Then they spawned, died, and rotted on site.

This is the way that Northwest big rivers are meant to be. Flat reaches slowly meandering between broad banks, saving energy, keeping the path open for later floods. Real rivers with real wetlands providing real ecological and hydrological functions. Real wetlands; not just diked-off moist spots struggling to percolate a pool from last year's flood or to support the last of this or that vegetable. The reason we struggle to protect such seemingly marginal wetlands today is that the good stuff is gone.

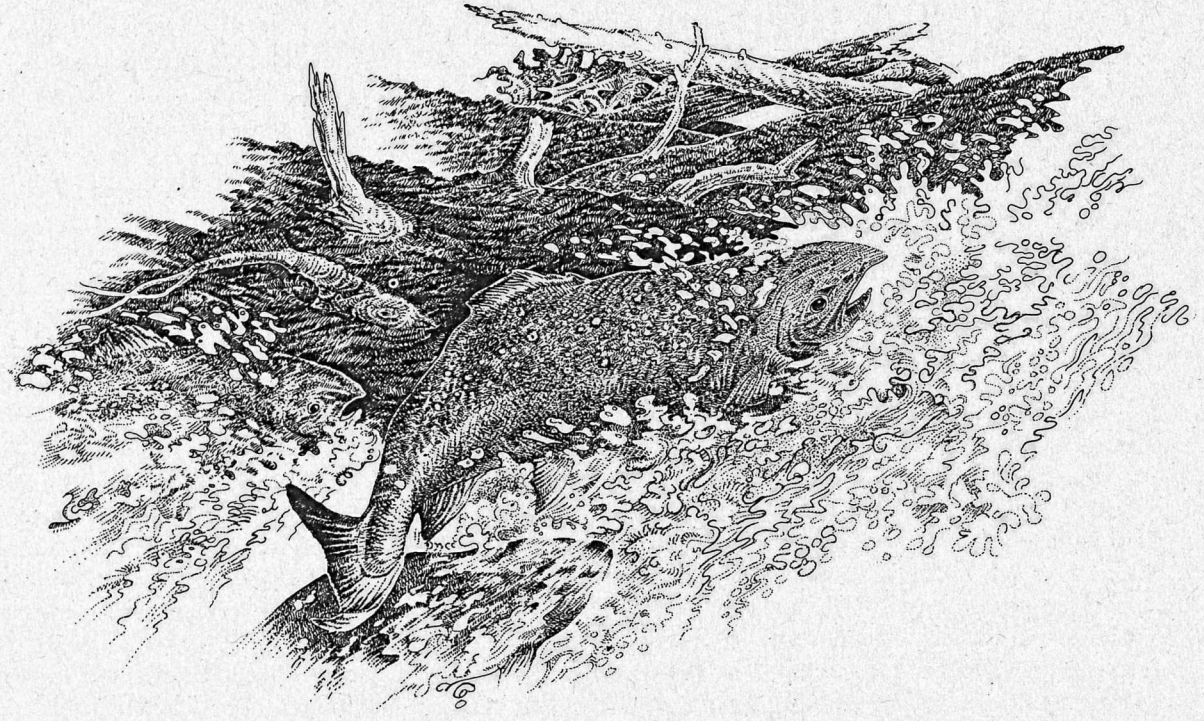
Northwest rivers are also supposed to be choked with logs. Big logs, from big trees, tangled together by torn-up roots into massive jams. Before settlers blew them out in the 1870s, two colossal log jams spanned the lower Skagit River (30 miles south of the Nooksack) between Mt. Vernon and Concrete. They stretched from bank to bank, one extending upstream for a mile or more, growing every year. Brackish pools between logs stashed salmon.

The jams had been there for so long that giant Douglas-fir trees, four feet or more across and centuries old, grew living from the mossy, rotting bulk. I know this because I read it from a yellowing newspaper article, shellacked and framed on a wall inside the power house of the Gorge Dam in Newhalem, Washington.

Oregon's Willamette River Valley was likewise a sloppy mess. Although five or more main channels of the pre-European Willamette have been delineated, no channel was apparent among many of the standing marshes that spanned the floodplain.

Salmon are made for these conditions. All that rotting wood is structural habitat for salmon. Swimming through a mile-long log jam became possible during spring and autumn high flows. At these times, the logs would float up off the river bottom enough for squirming squeezing salmon to slide past.

They slid past in droves, these salmon. The Columbia had annual runs of over 19 million late last century. The Nooksack, Skagit, Willamette, and every other Northwest river was loaded with salmon fully capable of navigating an ancient-forested river. Salmon that had to migrate thousands of miles, like Salmon River Spring Chinook, or scale booming



torrents, like the Elwha's legendary Tyee Chinook, evolved to pack a massive load of muscle, one hundred pounds or more. They found ways to get to their natal streams.

Then they spawned, died, and rotted on site.

Try to let a million salmon rot upriver today and you will have problems with the Department of Ecology. Rotting salmon stink; you can smell a ripe one from a distance of two river bends. A million would make you cry. But their rotting flesh is food for eagle, raccoon, bear, and countless little aquatic invertebrates which themselves make nice meals for young salmon. Rotting salmon, along with floating leaves, twigs, and logs, fed the shredders and chewers and munchers, all turning clean, clear glacial runoff into soup.

Such was the condition of many Northwest rivers. They stored their energy and flood potential in meanders and wetlands, pounding incessantly against banks anchored strong with living roots. They cycled nutrients in the seasonal pulse of salmon: native children that migrated to sea, then returned with bodies fat and rich, which they volunteered back to the river, its wildlife, and even upslope forest soils.

Today the rivers are comparatively sterile. The big trees and big logs are gone, the real wetlands drained. Clearcuts and roads shed rain too fast, and there are fewer river structures to store and contain the floods. The fetid stench of rotting salmon is now a rare November pleasure. Part of the reason for the salmon's demise may be the lower nutrient levels of the neo-rivers themselves.

Well if you can't have the real thing, may as well design a surrogate, right? Wrong! Hatchery fish are chickens among eagles, cows among bison, poodles among wolves. Hatchery fry are fed fish meal (actually consuming more harvested fish protein than they produce) instead of the tiny invertebrates that gorged on last year's festering carcasses. Once released, they compete with, prey on, and in other ways harm the last of the remaining wild fish.

Opportunistic politicians, engineers, and other pragmatists still call for more hatcheries to replace the salmon, and for more dams, dikes, and dredges to clear passage for their android fish. Cynical developers and their right-wing private property rights shock troops whine about wetlands not worth the spit that is in them. And today's public, having never seen a real Northwest river with real wetlands and real salmon, understandably gets confused.

It will take a long time to restore what we have lost. You can't have log jams of big trees until the big trees grow back and fall into the river. Until then, our rivers and estuaries will remain mere shadows of their former complexity, supporting less than inspiring and scarcely viable runs of salmon and Steelhead.

Restoring the understanding of what is a healthy river may be even more challenging than restoring the river itself. But there is a mystique to the wild and powerful. Dinosaurs have managed to captivate our interest across a span of a hundred million years. Perhaps wild rivers and wild salmon can do the same.

Joni Mitchell sang, "You don't know what you've got till its gone." In a functional sense, the real rivers and salmon are gone from the Northwest landscape. It is time to want them back. Through the healing of time and the resiliency of nature, if we want them and let them, they will return. WERF

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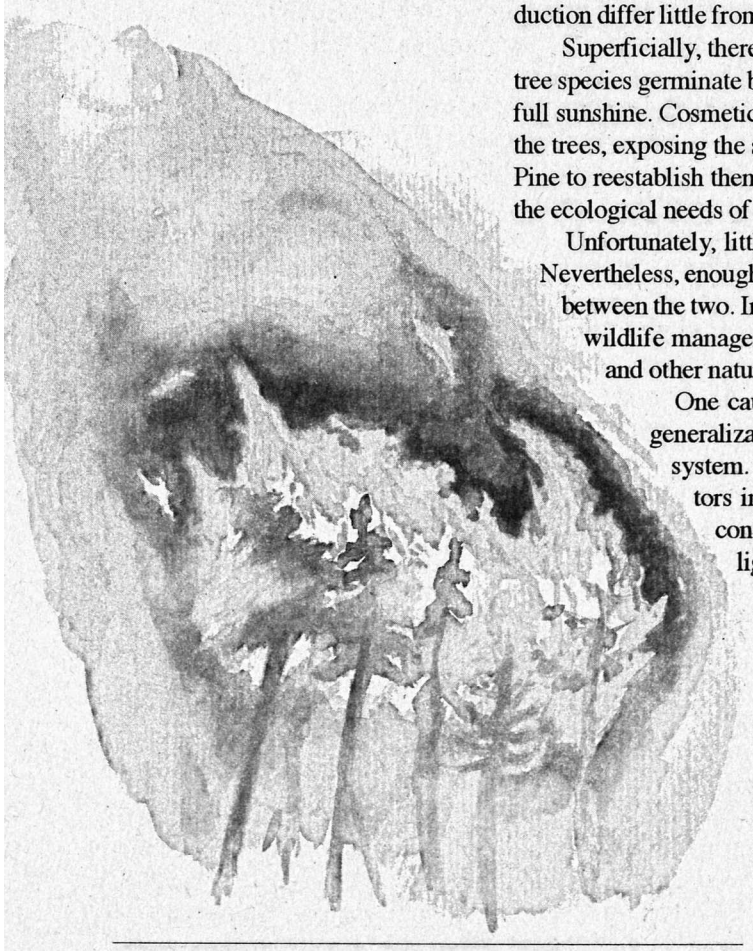
illustration by Davis Te Selle

Ecological Differences Between Logging and Wildfire

and The Need to Preserve Large Fires



by George Wuerthner

INTRODUCTION

Fire, whether from natural ignition sources like lightning or a result of humans, has been a major influence on many ecosystems around the world. In the native plant communities of the western United States, fires have probably played a more important role in shaping ecosystems than any other disturbance type. As a result of human fire suppression, however, the influence of natural fire—and probably even human ignitions—has been significantly reduced.

In the past few decades in much of the western United States, timber harvest has replaced fire in ecological significance, but not in ecological effect. Timber companies and many foresters are quick to assert that logging, particularly clearcutting, emulates such natural disturbances as wildfires. Foresters claim that woodlands managed for timber production differ little from unmanaged forests dominated by natural processes like wildfire.

Superficially, there is some scientific basis for these claims. Seeds of many Western tree species germinate best on bare mineral soil. Seedlings of these species grow fastest in full sunshine. Cosmetically, clearcutting shares some similarities with fire. Both remove the trees, exposing the soil to sunshine and allowing sun-tolerant species like Lodgepole Pine to reestablish themselves in even-aged stands. However, exposed soil is just one of the ecological needs of fire-adapted tree species.

Unfortunately, little research has been done to compare fire and logging impacts. Nevertheless, enough is known about each to suggest substantial ecological differences between the two. In making the assertion that logging emulates fire, foresters are like wildlife managers who compare modern human hunting techniques to predation and other natural causes of mortality. They are not the same.

One cautionary note to preface this comparison of wildfire to logging: generalizations generally fall short within the parameters of a particular ecosystem. What is true for one region may not apply to another. Many factors influence the intensity of a burn, including fuel loading, weather conditions, time of year, kind of ecosystem and past fire history. A light, "cool" fire that creeps through a forest understory, merely burning grass and shrubs without killing the canopy, is different from a stand-replacing, hot fire which may entirely consume a forest and volatilize nutrients in the soil.

On the other side of the ledger, the effects of logging on ecosystem processes will vary with the amount of roading, type of terrain, size of cutting units, tree species involved, soils, climate, and a host of other factors.

FIRE ECOLOGY PRINCIPLES

Most Western forest ecosystems evolved with regimes of periodic forest fires. This is partly a result of the characteristic summer drought conditions that dominate many parts of the West. Even the Pacific Northwest, where precipitation falls al-

illustration by Eva-Lena Rehnmark

most daily in winter, tends to have nearly rainless summers. Indeed, the old-growth Douglas-fir temperate "rainforests" get their start during fires that develop after the region experiences prolonged severe drought. Such stand-replacement fires in Douglas-fir forests may occur only once or twice a millennium, but that is frequent enough to maintain the dominance of this long-lived species on a site.

In much of the West, temperatures tend to be warmest when conditions are driest. Hot dry conditions are unfavorable for biological decomposition by bacteria, fungi, and other decomposers. In many parts of the West, decomposition is often extremely slow. As a result, litter on the forest floor gradually builds up. Nutrients are "locked up" (just like environmentalists do with wilderness). Fire, more than any other factor in the West, is responsible for recycling nutrients in dead plant material. Without periodic fires, most Western ecosystems gradually decline in productivity as soil nutrient availability declines.

DIFFERENCES IN FIRE INTERVALS

Fire periodicity varies from ecosystem to ecosystem. For instance, in dry, low-elevation Ponderosa Pine forests of the West, fires formerly burned every three to twenty years. Sometimes the higher frequency was a consequence of human ignitions. Native Americans often purposely set fires to reduce brush encroachment and favor grasses and other forage that attracted large herbivores like Elk and deer. No doubt, some fires began unintentionally when campfires and signal fires escaped and caused larger conflagrations. Even a few escaped campfires in years of drought could become a major forest or range fire, profoundly influencing plant community composition.

On the other hand, in high, cold, snowy places like the Yellowstone Plateau, where the normally deep snowpack ensures that wet conditions persist well into summer, human ignitions may not have had any significant effect. Conditions favorable to burns are restricted here to a tiny window of opportunity, typically opening in late summer—if at all.

Litter accumulates much more slowly at higher elevations due to the limits on plant growth imposed by the severe climatic conditions. As a result, the normal fire return interval in Yellowstone's higher elevations is on the order of 200-400 years or longer. Similar long intervals are characteristic of sub-alpine forests throughout the West, as well as the wetter forest belts of the Pacific Northwest coast.

Fires in these higher elevation forests tend to be episodic stand replacement fires that often burn hundreds of thousands of acres. Due to the long time intervals between major burns in these ecosystems, fire suppression may not have yet substantially influenced normal fire frequency or fuel loading.

Even within the same range, however, fire frequencies may differ substantially. For instance, the lower-mid elevations of the Sierra Nevada burned on a frequent basis, often every ten or twenty years, maintaining open, park-like stands. In contrast, the higher sub-alpine forests of the Sierra experienced fires only infrequently due to the extensive amounts of bare rock that acted as fuel breaks, along with the typically wet conditions that extend well into summer.

Again, though, we must be wary of generalizations. Fire frequency estimates are based on averages, and averages do not determine the ecological setting. In Montana where I used to live, the average temperature in September was 68 degrees. Yet the below freezing temperatures that invariably come at this time of year set the parameters for growing vegetables in the garden. Infrequent but extreme events are often more important in shaping ecological systems than "average" circumstances.

Even where fires were relatively frequent, stand replacement fires still occurred at longer time intervals and were in many parts of the West the major ecological parameter under which forests evolved. To suggest that "catastrophic" fires are abnormal may be misleading. In most Western regions, the vast majority of acreage burned in any one year burns in a few very large fires. Numerous small light fires do not equal the effect of one or two single large fires that may happen once every century or two. Although hundreds of small fires may burn across a few thousand acres in any hundred year period, one very large fire occurring in the same period may blaze across a million acres, and have a far greater influence upon the forest composition than the cumulative effect of all small fires.

Long before fire suppression had any influence upon fuel loading, there were huge forest fires in the West. In 1910, more than 3.5 million acres burned in northern Idaho and western Montana, and this included many low elevation areas characterized by frequent, low intensity fires.

The conditions for a major burn have at least as much to do with drought, wind, and ignition sources as with fuels. Indeed, the young forests that characterize recently reforested clearcuts or even regrowth after a burn may be the most flammable fuels under conditions of extreme drought since green trees, with their incendiary resins, may burn hotter than dead trees. Since young trees have poorly developed root systems, plus tend to grow on hotter, droughty sites due to the lack of canopy shade, they are among the first to experience drought stress, and become excellent kindling when they die. Thus clearcutting and "salvage" logging may actually increase the likelihood of major fires, by increasing the amount of forest regrowth.

To reiterate, large fires set the ecological parameters of many Western ecosystems. Small prescribed burns, and even "salvage" logging to reduce fuel loading, may have little effect upon large fires, and this would not be desirable anyway. We should be encouraging, not discouraging, large fires. Current forestry policies of fire suppression, road-building to facilitate suppression, and fuel reduction all fragment fire habitat, threatening wild fire with extinction as an ecological force.

We need to preserve big fires and areas large enough to support big fires just as we must preserve habitat for wide-ranging species like Grizzly Bears and Gray Wolves. When you consider the negative effects of fire suppression, as well as of logging, it becomes clear that a policy of salvage logging is both ineffective and undesirable.

ECOSYSTEM FUNCTIONS PERFORMED BY FIRES

Natural fires perform a variety of ecosystem services which are not normally associated with logging. For example, fires cleanse a forest. Heat from fires can kill forest pathogens in the soil including root rots, as well as insects and fungi that may be found in fallen trees or snags.

Heating and subsequent rapid cooling of rocks and boulders cracks and breaks them apart. Repeated numerous times over the centuries, this is an important soil building process. Logging provides no such benefits.

The influence of fires often extends beyond the blaze perimeter. Laboratory studies have demonstrated that smoke from fires kills certain arboreal forest pathogens, reducing, for a time, the influence of some tree diseases. Again, such benefits are not associated with timber harvest unless the logged site is burned after the timber is removed; even then, the amount and duration of smoke produced would be less than with most natural burns.

Fires also change nutrient flows. Dead litter burns and turns to ash. The heat and combustion change the chemical composition of soils. Depending on how hot they burn, fires can volatilize certain nutrients like nitrogen which are lost as gases into the atmosphere. However, nitrogen is quickly replaced in the soil through nitrogen fixation by bacteria which usually increase significantly after a burn. Studies have shown that bacteria and other nitrogen fixers typically make up all the losses to volatilization within two years of a burn. Other important nutrients, including phosphorus and calcium, are released from litter by fires and leached into the soil horizon. Despite some losses to waterways and the atmosphere, the overall effect of all but the most intense fires is the redistribution of nutrients from the forest canopy and floor into the soil, thus increasing soil fertility.

This fertilization process stimulates growth of plants including many nitrogen-fixing legumes such as lupine, which take atmospheric nitrogen and chemically convert it into a form usable by other plant species. The early successional nitrogen-fixing stage may last for a few decades, restoring soil nitrogen levels.

Nutrients may also wind up in waterways by directly washing into a stream or lake or settling as ash from the air. Periodic nutrient enrichment from fires may be necessary for the maintenance of some aquatic ecosystems, particularly those at higher elevations which tend to be low in nutrient inputs.

By contrast, timber harvest removes nutrients from the ecosystem since trees are transported out of the area. The severity of this removal depends upon the logging practices employed. Most nutrients in a coniferous forest are stored in the trees' branches and needles; thus the more slash left on site, the less actual nutrient removal. Nevertheless, to replace the nutrients lost even when only the boles are extracted takes longer than the timber rotation period on many sites. Over time, then, repeated timber harvest may gradually deplete a site of important nutrients.

Nutrient loss is one of the factors thought to be responsible for the susceptibility of Europe's forests to air pollution, disease, and other environmental stress even though these woodlands have been under "sustained yield" management for several centuries. Short rotations, with trees harvested as or just after they reach peak growth rates, do not allow sufficient time for nutrient replacement. "Scientific sustained yield forestry" as now practiced is probably not sustainable from a biological point of view, whether or not it is from an economic perspective.

By removing forest canopies and increasing the ground's exposure to sunlight, logging may stimulate the growth of nitrogen-fixing plants, but usually not enough to match the quantities that grow after a fire. Furthermore, foresters usually attempt to truncate such early successional stages in order to hasten the restocking of forests with commercial species. For instance, in the Pacific Northwest where Red Alder is an important nitrogen-fixing species that invades burned or logged areas, it is standard practice to treat such sites with herbicides to kill off the alder and other hardwoods so that commercially-preferred conifers can quickly regenerate.

In many forests another important source of nitrogen input is arboreal lichens. Nitrogen-fixing lichen species are common on the branches and bark of large old trees. Rainwater percolating through these lichen-covered branches leaches and transports nitrogen to the soil. Since the rotational age when trees are cut is usually far shorter than the age when they might otherwise burn, managed forests have substantially less old timber than natural forests, reducing the potential input of nitrogen from lichens. How important such contributions may be to forest productivity and health is unknown.

Logging may provide a temporary flush of nutrients, but this is often accompanied by a flush of sediment as well. True, heavy rains will at times wash high sediment loads from fire-bared slopes into river systems, particularly if they occur immediately after a burn. On most sites, however, within a year or two of a fire, vegetation recloaks the ground, since fires typically do not kill underground tubers or seeds in the soil.

Also the dead snags left on a burnt site often fall across the slope, creating thousands of check dams that slow erosion and reduce sediment yield to streams. Again, logging—especially "salvage" logging—removes such snags hence increasing problems.

In addition, the soil disturbance caused by logging—in particular, heavy equipment use—strips away soil horizons and the buried seeds and roots that might otherwise sprout and quickly cover a slope. Logging roads are notorious for generating high sediment loads, even higher than typically found on the logged slopes themselves.

Of course, whether due to fire or logging, the amount of sedimentation is largely determined by soil type, gradient, seasonality of run-off and timing of periodic natural floods. Nonetheless, logging nearly always produces higher levels of sedimentation than are associated with most burns. High sedi-

mentation kills aquatic insects and fish, and changes stream channel patterns.

Fires may temporarily reduce the amount of organic matter in aquatic ecosystems to the detriment of aquatic invertebrates, particularly in smaller streams. However, within a few years, the flush of new vegetation begins to compensate for these losses.

Unless the blaze is extremely hot, a fire does not totally consume a forest. Typically, hundreds of snags per acre remain. Snags serve important ecological functions. Many of these standing fire-killed trees are invaded by wood eating beetles and other insects. The insects provide an abundant food source for insect feeders, including woodpeckers, which in turn carve cavities in the snags which subsequently provide homes for many bird and mammal species such as bluebirds and nuthatches. Some species like the Three-toed Woodpecker show tremendous increases for three or four years after a fire, then decline. This woodpecker is one of several species that may depend on fire-shaped landscapes to maintain adequate population levels. Populations of Three-toed Woodpecker do not increase on logged sites since few standing dead trees are left after harvest. Snags also offer perching sites for flycatchers, swallows, and raptors.

Dead trees continue to play important ecological roles even after they fall over. On the ground they provide habitat and hiding cover for a mostly different suite of invertebrates, as well as rabbits, voles, shrews and other small mammals. These animals in turn provide a food source for predators like Pine Marten and Lynx. In addition, as these fallen snags molder and rot, they gradually add organic matter to the soil which increases its fertility and water holding capacity.

Trees that fall into waterways are important to aquatic ecosystems. Fallen logs create pools and riffles which provide habitat for aquatic invertebrates and fish. Logs help stabilize streambanks, deflecting or reducing the erosive force of water. Furthermore, since submerged logs rot slowly, they are important long-term sources of nutrients for aquatic ecosystems.

Finally, though naturally a live forest provides more cover than the snags left after a blaze, dead tree boles still provide some thermal and hiding cover—much more than found in a clearcut. A burned area thus has far more value as security cover to big game and other hunted species than a logged area. Since snags typically remain for 50-100 years after a blaze, they commonly survive until the new forest has a chance to mature sufficiently to provide new hiding and thermal cover.

IMPACTS ASSOCIATED WITH LOGGING

Logging, particularly clearcutting, leaves few or no snags. Even when snag trees are intentionally left on a site, typically only one or two per acre are spared—considerably fewer than needed for cavity nesting animals and long-term nutrient supply.

The activities associated with logging, including the coming and going of workers and vehicles, can displace animals sensitive to human presence. This disturbance is semi-permanent when logging roads remain open for subsequent timber harvest or public access. Human activity along roads has been shown to reduce habitat use by Elk for up to half a mile on either side. A recent study by the Montana Department of Fish, Wildlife and Parks found that Grizzly Bears avoid roaded areas, often for years after timber activities cease. A severe loss of suitable habitat may ensue even if the amount of land directly disturbed is quite small. Increased access for human trappers and hunters also changes population structure in species sought. Poaching may increase. Road closures can mitigate some but usually not all of these impacts. Research has shown that no road is better than a closed road.

The physical impact of logging upon site topography and soil profile constitutes another difference between fires and timber harvest. Heavy logging equipment compacts soils. Studies done by the Forest Service have demonstrated that compaction inhibits forest regeneration and slows growth of tree seedlings that do manage to emerge. Fires, on the other hand, often provide ideal seed beds for the reestablishment of plant cover.

Weed invasion is another problem often associated with timber harvest. Seeds of Spotted Knapweed and many other problem species are carried on the chassis of logging trucks to new locations. If the logging roads are left open for public access after a logging operation, other vehicles may also disperse weed seed. And the disturbed soils along bulldozed roads provide ideal habitat for the proliferation of weed species. Although fires may open habitat for weed establishment, regrowth of native species frequently eliminates opportunities for aliens within a few years. Weeds seldom become established in large natural forests with wild fires and no logging, because of the lack of nearby weed sources.

Wildfire mosaics maintain natural curves and lines, whereas logging introduces abrupt edges and scars from logging roads and skid trails that take decades to heal. Edge effects are generally more severe with logging than with fire.

In terms of stand succession, the timing of fires differs substantially from that of clearcuts. In many managed forests, older trees are eliminated to favor faster growing young ones. The loss of old-growth structural features in a managed forest has many ecological ramifications including changes in nutrient flows and storage, and wildlife habitat parameters. Though fires do occasionally burn up substantial acreages of old growth, in many ecosystems, old-growth stands are relatively fire-proof except under extreme conditions such as severe drought. Since standard forestry management practice is to cut trees at or shortly after they reach peak wood production efficiency, most managed timber stands will never possess old-growth features.

Some of the above negative features associated with logging can perhaps be mitigated or reduced by changing timber harvest methods, but one characteristic that almost certainly cannot be emulated by foresters is the randomness of fire disturbance. Though fire ecologists make predictions about fire frequency and "average" size, wildfires are essentially unpredictable. Logging does not emulate this randomness and we

do not know how important it may be to ecosystem integrity and function.

As we learned in Yellowstone during the summer of 1988, fires do not burn everywhere with equal intensity. Fires create random mosaic burn patterns.

Fires may occasionally fragment wildlife habitat into patches so small they can't be used by some species, but not nearly to the extent that roads and clearcuts do. With logging the impacts of fragmentation are worsened by human access reducing the effectiveness of remaining habitat patches for wildlife sensitive to human intrusions.

Furthermore, "leave strips" (areas where timber is not cut) between clearcuts may funnel animals into narrow corridors where they are more vulnerable to predation as well as human hunters and trappers who can focus their attention on these travel strips. Due to the random nature of fires, unburned habitat patches are more likely to remain connected by broader corridors.

Finally, fire performs many of the above ecological services at no economic cost unless, of course, it threatens human life or habitation. Foresters claim that timber harvest can achieve the same ends, but frequently it costs far more to taxpayers per treated acre—particularly in places like the Rocky Mountains where the value of timber is low—than can be recouped from the timber sales. Often it is more expensive to get the trees out of the woods than agencies like the Forest Service can sell them for. The agency routinely loses hundreds of thousands of dollars on individual timber sales. In contrast, a prescribed natural burn policy is very cost-effective—only pennies per acre burned in monitoring costs.

SUMMARY

Wildfire is an important ecological process not emulated by logging practices. Timber sales are not a replacement for natural fire regimes. Acknowledging that many people have inappropriately built towns and homes in what is the fire equivalent of a flood plain does not necessarily lead to the conclusion that we have no choice but to suppress fires. Indeed, a wise course of action is to make a few areas defensible against fires by frequent prescribed burning and limited selective timber harvest. These management activities should be concentrated along existing roads and around towns and other structures deemed worthy of protection. In the rest of the forested areas, fires should be permitted to burn unsuppressed.

Large wildfires have many of the same characteristics as large carnivores. They range widely, occur in relatively small numbers, are often in conflict with human exploitation schemes, and thus can only exist in large wildlands. A wilderness without large episodic fires is as ecologically impoverished as one without Grizzlies and wolves. Without them all, our wildlands are no longer truly wild, nor ecologically intact. WERF

George Wuerthner (POB 3975, Eugene, Oregon 97403) is a wilderness explorer and writer. His latest book (due to be published this summer by American and World Geographic) is about northern Idaho.

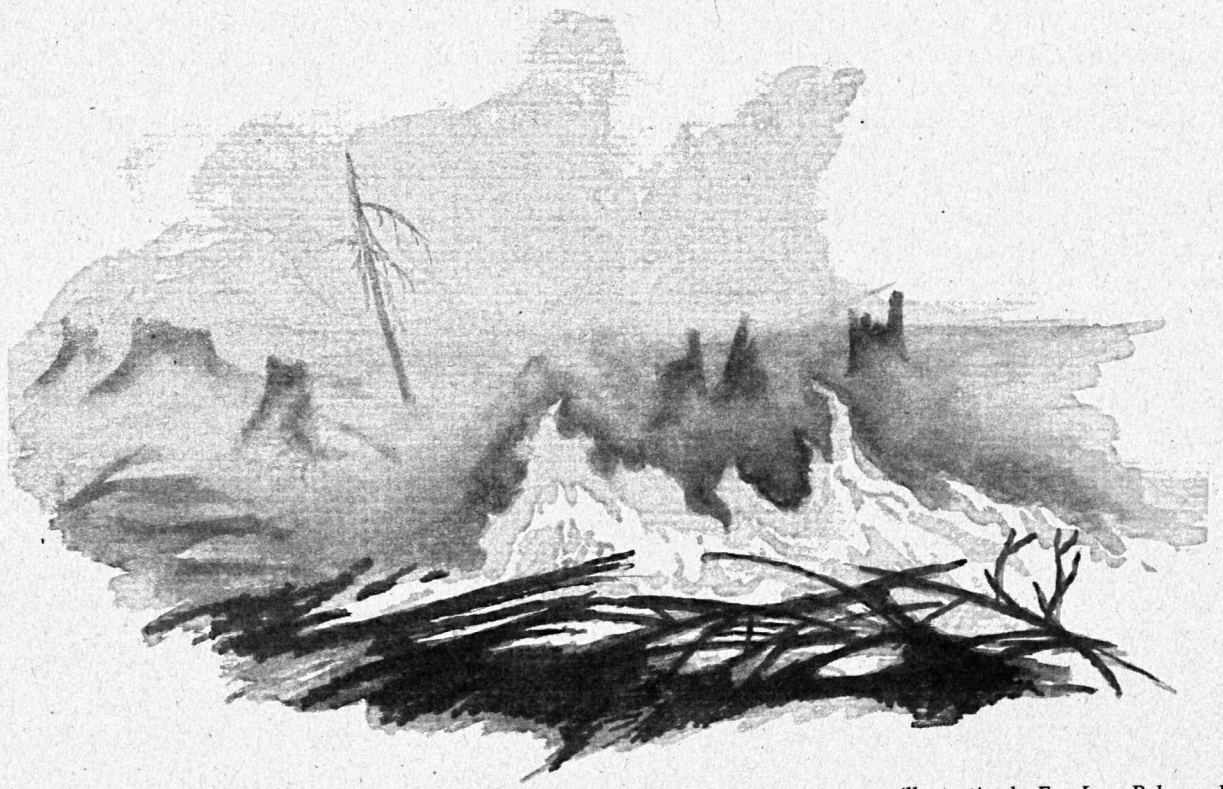


illustration by Eva-Lena Rehnmark

Bumblebee Ecology

by Bernd Heinrich

WHILE GROWING UP in central Maine, I spent much time out of doors with old-timers who taught me the fascinating art of "lining" bees. That a honeybee (an exotic introduced from Europe, originally called "White man's flies" by the Indians) we had fed a mile from its hive could communicate to others the location of our honey-baited bee-box was an incomparable wonder and left a deep impression. No less impressive were the big hollow bee-trees in the forest, and the buckets full of honeycomb we pulled out as the blue autumn sky was crisscrossed, like a kaleidoscope, by thousands of humming bees.

Almost twenty years later, I returned to our family farm in Maine with a Ph.D. in zoology from UCLA and an electric thermometer, rather than a bee-box, with which to pursue bees. I quickly put the device to use measuring the body temperatures of bumblebees, the most common native bee pollinators. The neighbors were skeptical; they said they didn't know bees had a temperature! I also examined the bees' honey-crop contents to assess their foraging success on various flowers. Once, while I was pulling the abdomens off bees picked from flowers to measure honey harvest, a stranger in overalls and suspenders demanded: "*What* in the *hell* are *you* doing?" "Killing bumblebees," I replied. "Oh," he paused, "for a minute there I thought you were one of them damn biologists; they'll do almost anything." Back in Berkeley where I was then a professor of entomology, one of my colleagues asked me the same question, leaving the expletive unspoken. I told him I was studying foraging behavior. To this he responded, "Oh—you mean you want to find out if they go to where there is more nectar?" Of course, there is considerable truth in both assertions. But the first is possibly a slight exaggeration, while the second is definitely a flagrant oversimplification.

Early in my studies, it became clear that the bee's physiology is related to energy balance, and that energy balance is tied to pollination and the reproduction of plants. Bumblebees are very often in an energy crisis of far greater magnitude that anything humans ordinarily experience. Energy economics is a major factor governing much of their biology.

Few aspects of bumblebee life, or human life, can escape the pervasive influence of economics. Economics can be defined as the study of the acquisition or production, distribution, and consumption of goods and services. But what makes economics so compelling a science is that resources, or goods and services, seldom, if ever, exceed or even keep up with wants, especially in bumblebees, where all profits are immediately gobbled up for reproduction to make more workers of even greater energy demands.

In bumblebees, each colony of up to several hundred workers is started by a single overwintering queen; all the

illustration by Bernd Heinrich

Bombus polaris *and arctic willow catkins, illustration by Bernd Heinrich*

BEE CONSERVATION

Wild bee conservation is a complex topic. Humans have aided some wild bees by cultivating crops and introducing many weeds onto cleared land. Humans have also introduced honeybees (a non-native species that, except for the Africanized variety, has perhaps been around long enough to have achieved citizenship status). Honeybees compete with the native wild bees wherever they exist. They take the nectar and pollen that would otherwise produce wild bees and thereby depress the native populations.

The major enemy of wild bees is agriculture, especially where spraying is used to manage insect pests. The sprays do not distinguish between pests and pollinators. In general, the pollinators are wiped out before the pests. Ironically, the usual "solution" to this problem is to bring in exotics to do the pollinating; domestic honeybees can be closed up safely inside their hives during the spray cycle, then released again when the danger is past.

Large-scale agriculture also adversely affects wild pollinators by destroying nest sites. Many species of solitary bees need undisturbed soil in which to make their nest burrows. Bumblebees need wild land with rotten stumps, matted decaying grass, and populations of rodents, and birds. Bumblebees frequently occupy tree holes (or bird houses) that contain bird nests from the previous summer.

More information on the ecological role of bumblebees and how to identify and rear them is provided in *Bumblebee Economics* (Harvard U. Press, 1979). A group working for conservation of invertebrates in general is Xerces Society, 10 Southwest Ash St., Portland, OR 97204.

—Bernd Heinrich

other bees die by fall. The better the bees are at foraging, the more resources are brought into the colony, and the more new queens are produced for overwintering in the fall, to start new colonies the next year.

Bumblebees forage from flowers of many shapes, scents, and colors, which offer the bees their nectar, pollen, both nectar and pollen, or nothing at all. Individual bees from a colony never know what will be available to them as they enter the field for the first time. But they have evolved a program of survival whereby each independently learns how to manipulate the various flowers that offer the most reward. This specialization allows the individuals of a colony collectively to forage at almost all the different flowers, whenever they may bloom. Hence bumblebees can be active at any time of the summer and wherever the colony is located relative to local flora.

The cost of potentially having everything is that initially the bees have very little. They make mistakes. At first the naive young bees may visit some flowers and get no rewards; they many approach bright objects that are not even flowers; and they may handle some flowers clumsily. Through experience, however, they learn like careful shoppers to restrict themselves to the best bargains available, and they become skilled flower handlers at the most common and remunerative food sources.

Unlike honeybees and many other bees, bumblebees often forage from before daylight till after dusk, at low air temperatures as well as high. They generally live from hand to mouth, immediately converting their food surplus into babies, although they may put aside moderate stores of honey and pollen that can tide them over a few days of rainy weather. Being able to forage on most days and in a wide range of weather conditions, bumblebees have a steady income and have no need to save for the future, particularly when the accumulated profits would invite potential robbers such as skunks and foxes. Further, unlike honeybees, they need not lay up stores to tide them through the winter.

Bumblebees are widely distributed throughout Europe, Asia, and from the Arctic Circle, 880 km south of the North Pole, to Tierra del Fuego, the southernmost tip of South America. They occur in Africa north of the Sahara, and they have been introduced as pollinators of clover into Australia, New Zealand, the Philippines, and South Africa. They are scarce in deserts and hot climates, where solitary bees may be abundant, but are often numerous in cool temperate regions and on the summits of mountains in tropical areas. There are possibly 400 species worldwide; 50 of these occur in the United States. There are probably close to 20,000 species of other kinds of bees in the world, including almost 4000 species in North America.

Bumblebee nests, commonly subterranean in refurbished rodent nests, are usually sparsely distributed and difficult to find, though skunks appear to have little trouble in locating them, digging them up, and robbing them. Bumblebees are associated with sunshine, with colorful and fragrant flowers

of damp meadows, scenic mountaintops, and boreal spruce-fringed bogs bordering sluggish brooks or quiet ponds. These bogs have mysterious associations of living things. Typically much of a bog is a floating mat of vegetation held together by labyrinthine interdigitations of roots from small flowering shrubs, sedges, orchids, mosses, and pitcher plants. Sleek Brook Trout with bright red spots lurk under the floating edges. A pair of Common Loons patrols the water surface. And each bog almost invariably has one Olive-sided Flycatcher calling loudly from the tip of a stunted spruce in springtime.

The association of bogs and bumblebees is not fortuitous. Bumblebees are tundra-adapted insects, and the bogs are post-ice-age islands of tundra-like vegetation with which bumblebees have probably been associated for millions of years. Again, though, because they are flower generalists (unlike some specialist species of solitary bees), bumblebees are also found in roadsides, burn areas, mountain tops, and other types of open areas.

During the bumblebee colony cycle, the willows, Leatherleaves, rhododendrons, blueberries, cranberries, Northern Winterberries, Black Chokeberries, roses, Field Spireas, and other plants flower in an orderly progression from spring to fall. Each is pollinated largely by bees, particularly bumblebees, and sets fruit. The fruit produced by the blueberry bushes in the bog is generally picked as soon as it ripens in the fall by robins, thrushes, and waxwings. The winterberry, rose, and chokeberry fruits remain on the twigs, sticking up out of the snow in winter. Grouse and late migrant songbirds feed on them. The cranberries are the last to ripen. They sweeten after remaining under a blanket of snow and provide nourishment to birds the following spring. The birds, in turn, carry the undigested seeds, spreading them throughout their travels. In this way, the plants are able to occupy new territory and spread to niches as they become available. In the bog, the bees, birds, and plants are all functionally interrelated.

Bernd Heinrich (University of Vermont, Dept. of Biology, Burlington, VT 05405) is a biologist, ecologist, author, and runner. His books include Bumblebee Economics, Ravens in Winter, In a Patch of Fireweed, One Man's Owl, The Hot-blooded Insects, *and (most recently)* A Year in the Maine Woods. *His records include fastest time in the US in the 100 kilometer run.*

Cut Narcissus

Pumicing the air
  incongruous in winter
    this throng of birdscreech
      memory, this squall

of idol high-pitched
  yellow, this smearing scent
    of hunger and myth
      we jerk our faces into

out of like the pheasants,
  who in the salt-soiled boredom
    of the stall, bloody
      up against the wire

near the cock's inviolable
  rip-cry—
    is proof we forage
      into pain and come out

chaotic, unlike the arabesque
  trilling of doves
    whose long notes
      drip like hourglasses...

desire on its haunches
  is a garment of particles,
    not unlike pollen
      whose weightless fluttering

yolk-dust is the semen
  blur, the silt
    on our hands and hair,
      the incandescent

riffraff, the striations
  of what is always
    the godforsaken and gnawing
      in us all.

—*Leonore Wilson*

Narcissus, *illustration by Laura Luzzi*

Befriending a Central Hardwood Forest

Part 2 of 4

SPYING OUT INTO THE CENTRAL HARDWOODS deciduous forest is another way of comprehending the matrix in which our small Indiana forest grows. That's what forest activists did in the late 1980s when the smoke cleared from firefights on their home National Forests: the Mark Twain in Missouri, the Shawnee in Illinois, the Daniel Boone in Kentucky, the Wayne in Ohio, the Monongahela in West Virginia, and the Hoosier in Indiana. Activists suddenly felt much less beleaguered upon realizing they were all loose in the same woods.

The central hardwood region extends from the western slopes of the Appalachian Mountains to the Great Plains and from just below the Great Lakes to well south of the Ohio River Basin. Andy Mahler, co-founder of Heartwood, a regional coalition of these Midwestern forest activists, lives down south surrounded "on all nine sides by Hoosier National Forest." Mahler claims kinship to all trees and has penned his own description of the forest:

The native forests that once blanketed West Virginia, Ohio, Indiana, southern Illinois, eastern Iowa, Kentucky, Missouri, Tennessee, and portions of surrounding states contained over seventy species of hardwood trees and supported a great variety of plant and animal life. The rich bottomlands nourished black walnut trees that grew up to eight feet in diameter. White oak trees growing mostly on the south-facing slopes grew over thirteen feet in diameter. American chestnut trees, often ten feet in diameter and one hundred and twenty feet tall, dominated the ridgetops. One tulip poplar tree was measured to be twenty-five feet in circumference, one hundred and ninety-five feet tall and ninety-one feet to the first limb.

Wood bison, migrating by the thousands from the great Illinois prairie to the salt licks of the Ohio River valley, wore travelways called "traces" through the forests and seemingly endless flocks of passenger pigeons darkened the skies above the huge trees.

The best way, finally, to know the forest is to get out into those patches of green. I can't claim Thoreau's Indian wisdom, but over the last few years I've trekked into the woods with the ever-accommodating Forest Service staffers and with watchful activists to whom the foresters graciously refer as their "interested publics." I've explored a patch of old-growth forest, scouted for neotropical migrant songbirds, and tramped the hotly controversial burns on the barrens and dry forest communities. These outings all underscore the fragmented nature of the Hoosier. How much of the forest will be allowed to mature to old growth, whether there is adequate habitat for interior for-

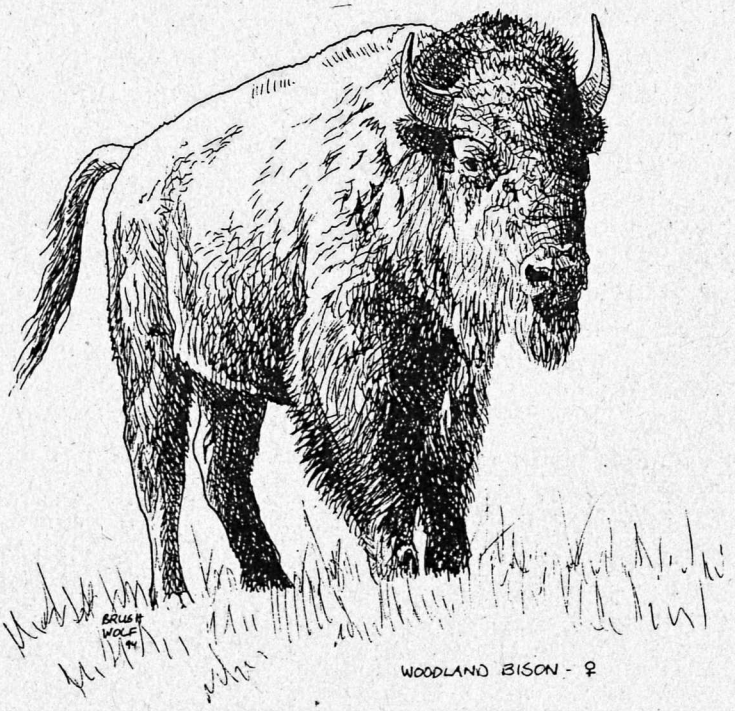


illustration by Martin Ring

by Sidney Collins

est birds, and whether or not burning is a legitimate restoration tool are perennially sticky issues between the Forest Service and the citizen/scientists.

Certainly, in the HNF, the Forest Service of the 1990s is a morally resuscitated entity in comparison to the 1980s when the tenure of then-Supervisor Harold Godlevske was referred to as "the reign of Godlevske." The Forest Service staff at Bedford no longer goes flakking for the Indiana timber industry, and Supervisor Frank Voytas's "ecological parameters" run concurrent with Hoosier environmentalists' concerns: big old trees, songbirds, and openland communities.

Protect Our Woods, southern Indiana's bastion of grassroots activism, is not sanguine, though, about ecosystem management. The spring 1993 newsletter proposes that the Forest Service put the lid on the pork barrel and return to its original police mission of protecting the forest. But I find the Forest Service staff in a passionate posture of protection. Can the small Hoosier, a remnant of the central hardwoods deciduous forest now regenerating from cutover and denuded land, bear the managerial heft of the plan?

Most people had never heard the term old-growth forest until the late 1980s when a diminutive raptor, the Northern Spotted Owl, was selected to stand in for all the animal inhabitants of the Pacific Northwest forests. Formally declared a Threatened species, the owl swooped through the headlines, caught pet shop mice on the evening news, and was pitted against loggers and loggers' jobs by the conventions of conflict-driven journalism. The science relevant to understanding old-growth forests, so necessary in the absence of native wisdom, is only about twenty years old; and most of the research has been done in the "Spotted Owl" forests of the Pacific Northwest. When the researchers began to suggest the wisdom of saving a great deal of valuable timberland from chainsaws to preserve biological diversity, few knew what they were talking about.

Some of those few, people who felt desperate about the final assault on our native forests, began to sleuth for old growth east of the Mississippi, wondering if the saws and the plows had skipped over a patch here or there. "These are the pieces," writes poet Gary Snyder, "saved from all the land that was once known and lived on by the original people, the little bits left as they were, shrines to the watershed of Earth, the last places where intrinsic nature wails, blooms, nests, glints away." Here in Indiana, fewer than two thousand acres of the state's original twenty million acres of forest survived pioneering determination. We have 27 sites of old growth thanks to a few families who chose to protect their woods. Only one of the patches is owned by the Forest Service—Pioneer Mothers Memorial Forest down in Orange County, a few miles south of Paoli. "Whatever the nature of the power possessed by trees," says New England sleuth Robert Leverett, "old growth forest concentrates and distills the elixir."

Last summer with a friend, an amateur mycologist hoping to see elfin stands of mushrooms on the forest floor, I drove down Highway 37 to Pioneer Mothers. On the way, before drinking in the heady and humid elixir of an Indiana old-growth patch, I recollected that textbookish phrase, biological diversity, and its shortened form, biodiversity. My favorite definition is a solid grounding for adding science to poetic appreciation. It is from *Natural Diversity in Forest Ecosystems* by Hal Salwasser and Jack Ward Thomas (the new Forest Service Chief), Forest Service ecologists:

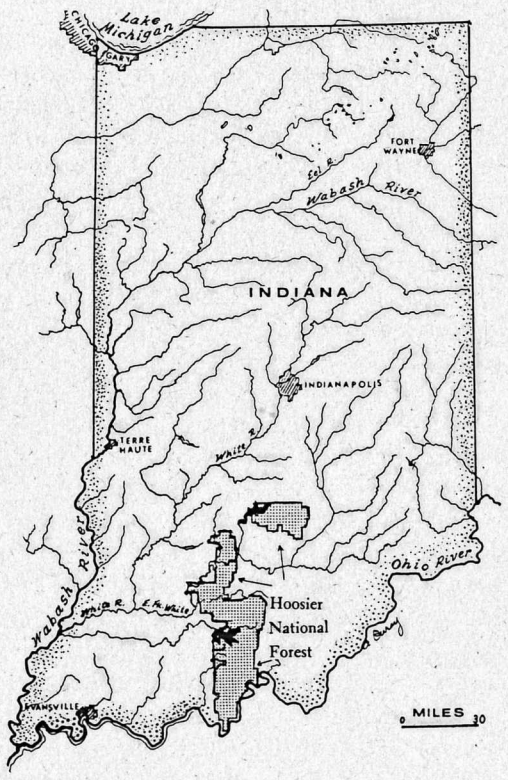
...the variety of life and its myriad of processes in an area. It includes all life forms, from one-celled bacteria, protozoa, and fungi, to complex organisms such as plants, insects, fishes, and mammals...And it includes the countless millions of processes, pathways, and cycles that link organisms into populations, ecosystems, and ultimately the entire biosphere.

A more succinct definition? Biodiversity—The Real Life of the Planet.

Lloran Johnson, an affable Texan who is a neighbor to the woods and a wildlife biologist in the employ of the Forest Service, was waiting for us. I ducked into the cool early-morning shade by the edge of the woods and pulled on hiking boots while savoring the sweet nutty smell that wafts up from the floor of a hardwood forest. I'd been in these woods before and was already homing in on my favorite tree farther down the path, a massive broken White Oak somewhere between three and six hundred years old. I usually say about the tree: "There's this oak tree down in Pioneer Mothers, an old warrior; I swear it's wide as a Volkswagen." Now, sometimes the trunk looks that wide and sometimes it doesn't. My memory and imagination are as elastic when it comes to big trees as the recollections of fish story spinners. Tree trunks and fish tend to expand.

Our guide is talking about old-growth forests and the Hoosier, spicing up his delivery with standard Forest Service boiler-plate about maintaining openings for early successional habitat. We will have a longer conversation about these holes in the forest, the sticky wicket between the Forest Service and environmentalists, when we get deeper into the woods. I'm here to find out how much of the Hoosier will be allowed to grow into big trees. Lloran fetches a handout on old growth from his truck, emphasizing that these are "flexible, working definitions." I will see later that only two of the six designations feature the word "unmanaged," meaning areas that will be "maintained in perpetuity as old growth subject to natural forces." Areas falling under the other four designations will be subject to "vegetative manipulations," including timber harvest—more of those holes. Leaving off chatter of forest acreage managed this way and that, we slip into the woods. It is moist and greenly fecund.

Is nature indeed wailing and glinting away here in Pioneer Mothers? Well, yes and no. The yes has to do with the abundant flora, and the no has to do with absent fauna. The flora, survivors of a forest that the Indians knew, surely do overwhelm. Almost immediately we see a huge, just huge, Black Walnut tree. Elsewhere in Pioneer Mothers is a grove of these giants. The trees induce such solemnity that the grouping is called The Walnut Cathedral. We won't see them today. The



cathedral is not visible from the trail when the trees are in leaf. Pioneer Mothers is a Research Natural Area so Lloran herds all visitors carefully along the trail. Neither may we pick wildflowers or mushrooms or haul anything else out of this forest, although hunting and gathering are permitted elsewhere on the Hoosier.

Over there is a silver-gray American Beech so thick and so old that it has formed buttresses, anchoring structures such as gigantic trees have in tropical rainforests. But there is more to ogle than the big trees. Our guide is sweeping his arms around to show us the four layers of cover in an old-growth forest. He starts with "the low-growing stuff," rich and diverse herbaceous growth. My friend finds a delicate orchid as I exclaim over the velvety leaves of wild ginger.

"The low mid-story is not going to change much," Lloran explains, "unless it finds a spot in the sun. But you can see what the mid-story is doing. It's really ripping on up there, trying to get sunlight. Look at that long straight stem, how quickly it's grown up." Trees that find their spot in the sun and grow to maturity form the top layer, the overstory, the forest canopy. The trees' free-for-all search for the sun, with plants adapted to shadiness growing beneath in profusion, is typical of old growth.

There is no single universally accepted definition for old growth and it is probably not possible to achieve consensus on one. The definition preferred by Mary Byrd Davis, the *Wild Earth* associate editor who has compiled a descriptive inventory of old-growth forest tracts east of the Great Plains, comes from the Yule 1989 issue of *Earth First! Journal.* It is Robert Zahner's: "Old-growth forests are forests having a long, uninterrupted period of development, or scientifically speaking, they are at the end point of an ecosystem's development without disturbance by modern man...An old-growth forest always contains trees in all stages of aging, including senescence, as well as dying, standing dead, and fallen trees." Davis points out that this definition includes old second-growth forests uncut and ungrazed during their development. I'd like to scrap the term virgin and use instead pre-Columbian or native forests to name lands never cut by the pioneers nor grazed by their animals. Mary Davis's inventory lists tracts of forest that look largely as they would had Europeans not settled the continent. Pioneer Mothers certainly preserves 88 acres of well-qualified memory. I've heard it tagged with the virgin claim but Lloran tells us that Farmer Cox surely ran hogs in the forest. (It was known as Cox Woods before being rescued from the saw by a spirited civic campaign.) "All farmers back in those days put not only their milk cows and plow horses in the forest, but three or four pigs."

"Which ate all those acorns and chestnuts," says the mycologist, who finds a deadly amonita mushroom and entertains us with tales of death by liver failure for humans who mistakenly nibble. Turtles, however, may taste the amonita without turning yellow and requiring liver transplants.

"And lizards, salamanders and frogs," added Lloran. No wonder the pioneers' pork was exceedingly well-fattened. Somehow I've never juxtaposed hogs and this museum piece of woods but then I'm a post-pioneer hearkening back to native inhabitation and cocking an ear to the opinions and findings of conservation biologists. All at the same time. It makes for a considerable journey. Without claiming that I would have behaved more benignly, I've never come to Pioneer Mothers without sensing that I walk among ghosts. Mountain Lion. Gray Wolf. Black Bear. River Otter. Elk. Woodland Bison. And what creatures fled on their coattails? "We won't ever know what humbler species were lost," wrote Chris Bogliano in *American Forest* magazine in the summer of 1989, "what secretive salamanders, what shade-loving shrubs were trampled in the rush, just as unnamed species are being lost in rain forests today." Lois Crister in *Arctic Wild* said that wilderness without animals is dead scenery. That sounds abrupt; but Reed Noss, editor of *Conservation Biology,* writes, "Large carnivores are symbolic and authentic indicators of healthy land..." In the late '80s, Noss, one of the most vigorous proponents for the establishment of large evolutionary reserves, wrote on the losses in *Natural Areas Journal:* "The present condition of the eastern deciduous forest, missing important components such as wolves, panthers, elk and passenger pigeons, is one of the great tragedies in the history of the New World." The current ratio of protected to exploited land in the United States is a lopsided 5:95. Noss suggests 50:50 as a reasonable compromise.

Knowing how "radical" it would seem for Hoosiers to readmit big animals into their lightened presence, I ask our guide, "Do you ever imagine how a bear living here would affect the forest? I mean, bears do shit in the woods." I refer colloquially to what ecologists call nutrient cycling. Lloran points to a big tree fallen on the forest floor and addresses the

map by Chuck Ouray

habits of bears in a lively way. "Down logs melt very fast in bear country. The bears rip them to pieces. As soon as the termites hit them the bears take the logs apart, to lick up the termites. And they also dig, very rapidly, for chipmunks, that sort of thing. And most likely a bear would dig a den under a large fallen tree." I can almost hear the bear snuffling about, grubbing in this big log gone punky and soft from the forest's legion of small decomposers: wood borers, wood ants, carpenter bees, and centipedes, as well as lichens, fungi, and microorganisms.

Research in the tropics has shown that the loss of big animals from forests has severe negative effects. I sense that we're in a slowly unraveling ecosystem, and yet Pioneer Mothers is immensely valuable as a node of biodiversity in a potential future system of old growth linked by corridors to other reserves. One more thing about the bears: When I first became acquainted with the Hoosier, a forester at Bedford told me about New England bears. I said I supposed we couldn't have bears back in Indiana because they would be a danger to humans. "Oh no," said the forester, "the danger is to the bears. The people would shoot them."

On down the path, the mycologist points to some curious charcoal black protuberances beside a rotting log. About two inches high, they are called dead man's fingers. If there is to be forest management, the mycologist declaims, then let it be for mushrooms and old-growth lichens. But Lloran has seized an opportunity to deliver the rationale for the forest openings program. With the forest bereft of large animals, the Forest Service is charged with providing habitat for everything left, he begins.

"We need some areas of early successional habitat, low to mid-story growth. That's accomplished by cutting, select cutting or small clearcuts, so that sunlight can get to the ground. There are species that need that type of habitat and they are not just game species." The mycologist clambers on to a long stone wall, a famous cultural artifact commemorating the saving of Cox Woods and dedicating it to the greater glory of all pioneer mothers, one supposes wherever they may rest.

"What about the idea that that kind of habitat is extremely plentiful on private land?" she asks Lloran.

"Except that it's not," he insists. "Look at the private land. It's farmland. The predominant habitat outside the forest is field or pasture that provides row crops for us and grazing for cattle. Look right on the edge of Pioneer Mothers. You see fescue grass. The only thing that's good for is cows. Land in cultivation is only available for food during the growing season. Wintertime is critical. For the most part, unless a farmer sows a winter crop, and that is not common around here, the land lies fallow till spring and there is nothing there."

"Do your inholders and neighbors have woodlots?" asks the mycologist.

"Some do. If they cut timber it creates habitat. But clearcuts become unusable for the low ground-dwelling animals within twelve to fifteen years."

Who are these animals to whom Lloran charmingly refers as beasties and whose habitat needs he zealously advocates? At lower trophic levels, shrews, rodents, rabbits; Ruffed Grouse, Turkey; White-tailed Deer. Predators of rodents and shrews include snakes and the mid-sized mammals—Bobcat, Raccoon, and Coyote. Hunting from above are the Red-tailed Hawk, Cooper's Hawk, and Sharp-shin Hawk; Great Horned Owl, Barred Owl, and Screech Owl.

Nature, states the ecologists' principle, is more complex than we know and more complex than we can know. The consequence of our ignorance is contention. And the consequence of our pioneering in the native landscape on a massive scale is a dearth of habitat for flora and fauna.

Is there no survey of land use practices within the purchase area of the forest? How many acres of farmland? How many of woodlots? Roads and built structures? Waterways? A concerted inter-agency land-survey project, the Geographical Information System, or GIS, is under way. Supposedly it will illuminate the question of forest openings when it is completed in 1996. Meanwhile, Lloran Johnson says there is no figure available from the Forest Service on how much of the Hoosier may end up as old-growth sanctuary.

Lloran, the mycologist, and I are just past the famous oak that looks... well, it looks even more bulgy than a Volkswagen today. The scraggly crown has dropped another huge bough since I last saw it. When it dies, even after the last leafing out, one-third of its useful existence will remain, as a standing dead tree (a snag) or a fallen tree, both of which are altered states of the live tree. Lloran thinks this old graybeard is six hundred years old. It escaped fire, tornado, flood, windthrow, disease, mudslide—the whole gamut of "perturbations" as ecologists call these natural disturbances. And it escaped the crosscut saw. It is a remnant of The Great Forest.

I'll leave the last word on remnants to Wendell Berry, a Kentuckian whose writings are as grave and stately as the King James Bible. If Berry cannot impel us to recover a sense of the sacred and know when we are hacking in sacred groves, then recovery may not be possible.

It is presumptuous, personally and historically, to assume that one is a part of a "saving remnant." One had better doubt that one deserves such a distinction, and had better understand that there may, after all, be nothing left to save. Even so, if one wishes to save anything not protected by the present economy—topsoil, groves of old trees, the possibility of the goodness or health of anything, even the economic relevance of the biblical tradition—one is part of a remnant, and a dwindling remnant too, though not without hope, and not without the necessary instructions, the most pertinent of which, perhaps, is this, also from Revelations: "Be watchful, and strengthen the things which remain, that are ready to die." ▮

Sidney Collins (323 N. Hillsdale Dr., Bloomington, IN 47408) recently earned a masters degree in journalism at Indiana University to celebrate turning 50. She was present at the creation of Heartwood *and serves on the* Protect Our Woods *board.*

Will Blozan and the Big Trees of the Great Smokies

by Robert Leverett

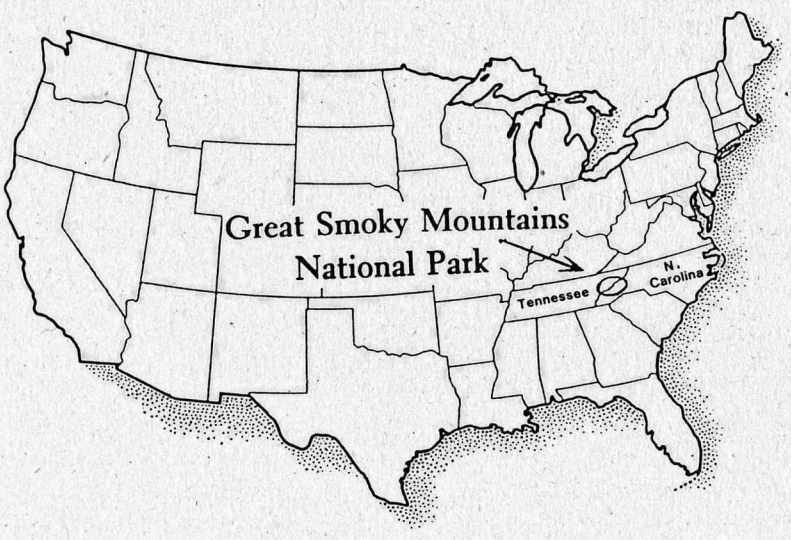
OUR ICONS

All important religious, political, social, and environmental movements have their icons. Forest preservation is no exception. For me, one person embodied the principles that guide us—the late Richard St. Barbe Baker. An internationally renowned forester, St. Barbe became known as the "Man of the Trees." In Africa and Asia, his accomplishments are legendary. Though he received little publicity in the United States, he had a profound influence on the thinking of Franklin D. Roosevelt and played an important role in the preservation of some of the great redwood stands. Transcending his profession's propensity to convert forests into plantations, St. Barbe was a visionary, manager, conserver, and preserver rolled into one.

I don't know what St. Barbe and other icons like Thoreau, Muir, and Leopold would think of the status of the forest preservation movement in the United States today. Perhaps they would think that we're not doing enough or that our efforts are too fragmented. I think they would be pleased, though, with the small army of scientists studying natural forest ecosystems, and with the progress we have made in locating and preserving ancient forest remnants in the eastern United States. On balance, considering where we were 25 years ago, I think they might conclude that we have made important progress.

The credit must go to the many instead of the few. Hundreds of scientists, naturalists, and grassroots and mainstream environmentalists have dedicated themselves to saving forests. Most are relatively unknown. All deserve our eternal gratitude. I'm not looking to create new icons, but would like to see the spotlight shared as much as possible. One individual comes to mind as deserving special attention for some unusual discoveries he has made among the mist enshrouded peaks of the Great Smoky Mountains. I speak of my friend Will Blozan, the new "Man of the Trees."

illustration by Rob Messick



map by Chuck Ouray

EMERGENCE OF THE MISSION

Will recently concluded his part of a three-year study in the Great Smoky Mountain National Park to locate, inventory, map, and establish monitoring plots within the Park's sizeable tracts of old-growth forest. Will admits to having begun the study with little idea of what to expect from the Smoky Mountain forests. He had prior experience in tropical rainforests and had visited North Carolina's Joyce Kilmer Memorial Forest. There he witnessed what many consider the quintessential Southern Appalachian old-growth cove forest. Joyce Kilmer Forest is a diverse woodland populated by huge trees of great age, creating the cathedral effect that so inspires us mortals. Their feet are adorned by a rich layer of herbaceous plants that explode into a profusion of blooms each spring. In the anthropocentric view, the Little Santeetlah Creek forest seems fitting as a memorial to the composer of "Trees," but I believe Joyce Kilmer would have considered himself the honored one to be associated with this incomparable grove. The Kilmer Forest gave Will one of many baselines needed for comparison.

Once into the Smoky Mountain old-growth project, Will recognized what has not always been easy for others to grasp: that natural forests are very diverse; that in them we find expressions of the extremes, the means, and all gradations between; that over time Mother Nature tries out all the combinations. Using his scientific training and senses calibrated for detailed observation, Will found both the rule and the exceptions to the common conceptions about the composition and structure of Eastern old-growth forests.

Will's field experience has provided him with direct confirmation of the shifting mosaic of plant communities and age structures in natural forests. While he recognizes that stands of older trees are an essential ingredient of old forest ecosystems, he finds that old-growth forests have many age distributions, including large areas of younger forest. He speaks of long-term forest stand dynamics, short and long-term disturbance regimes, and disturbance recovery time frames. He sees the concurrent documentation of fauna and flora, identification of old-growth obligates and indicator species, and analyses of soil composition and forest structural characteristics as necessary precursors to the more illusive challenges of such heady subjects as patch dynamics, long-term stand dynamics, and nutrient recycling. Will's understanding of old-growth grows from practical field knowledge guided by intuition. Here are some of his thoughts on the subject:

I'm going to stick my neck out more and propose that there was never the "unbroken, ancient forest cloaking the East"—much sought after as examples of our "primeval natural heritage." For example, a common criterion for old-growth is, "a forest of ancient trees representing a 'climax' (or stable) community, usually composed of many (i.e. diverse) self-perpetuating species of various ages." ...this idea alone would eliminate much eastern old-growth from consideration, and is much too general... in our surveys we often come upon forests lacking nearly all the criteria mentioned above; in transition to another forest type given the current regeneration dynamics. Suppose one of these forests was 170 years old, had large trees, and other old-growth characteristics—I'd bet few researchers would hesitate to call it old-growth. However, if we were standing there 170 years ago, amidst, perhaps, a fire or blow-down, would we still say it was old-growth? Keep in mind that no human disturbance occurred—doesn't this meet the basic premise of primeval landscapes—arguably a "prerequisite" for old-growth forests? Other examples abound in fire dependent communities, exposed ridge crests, some floodplains, and most other forests characterized by "arrested succession." All of these are examples of non-commercial forests which were not cut to begin with...

Will's partially latent talents needed a concentrated exercising. The Smoky Mountain project was just the testing ground he needed. What emerged was a natural sensitivity to structural features and states of forest succession, but something else manifested itself as well. Will discovered an uncanny sensitivity to exceptional trees. Will's own words express best this sixth sense.

I don't believe that I am just lucky and "stumble" into the trees, because big trees are not common; in fact in most cases they are the exception. Instead, I feel I am intuitively drawn to the trees, something to the point of sensing the species prior to encounter. This may partly come from familiarity with the forests, but this doesn't explain the strong pull to go to a specific area.

Will's intuition has led to discoveries that carry implications beyond the novelty of locating huge trees for the rest of us to cheer about. For it is incumbent on those of us advocating the need for natural forests—real forests—to provide the

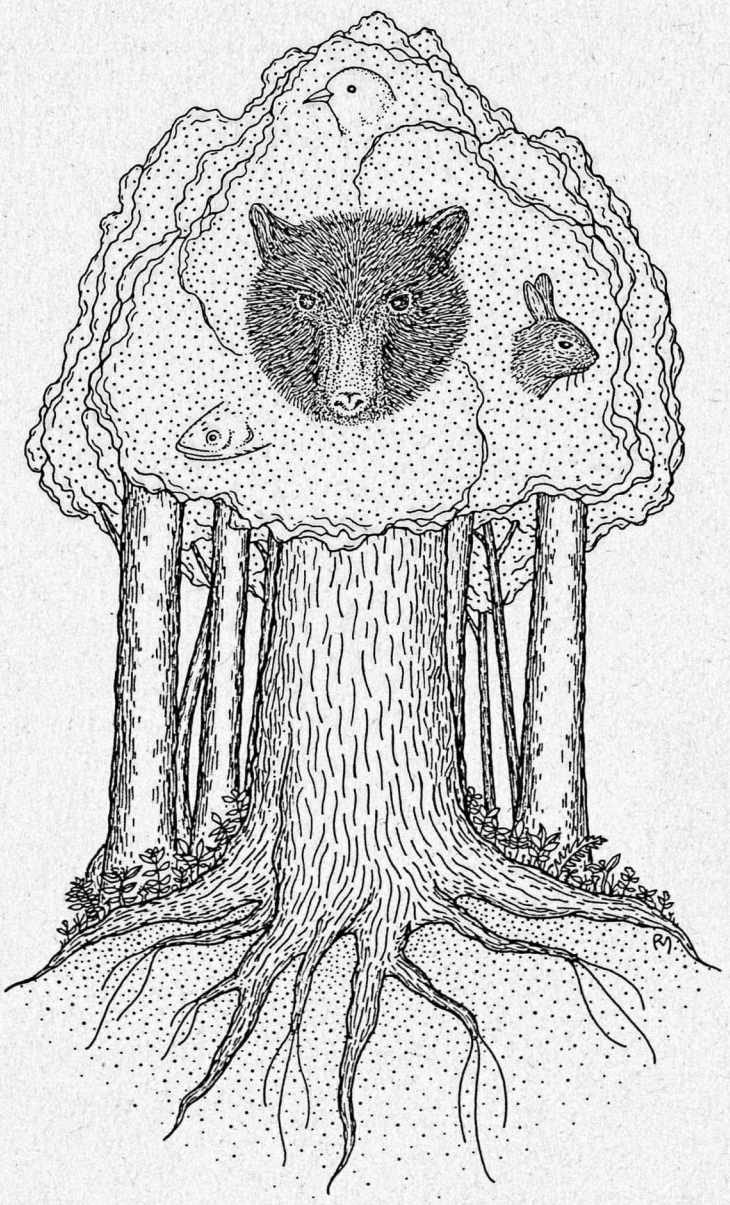


illustration by Rob Messick

justification. This is not difficult to do. Science has a growing list of well-researched reasons why we need natural forests. The one on everybody's list is biological diversity.

Documenting the diversity of natural forests and showing that such diversity is not replicated in managed forests involves many avenues of approach and ways of defining diversity. Simple composition and distribution studies are necessary but not sufficient; for diversity encompasses far more than a rudimentary count of individual species. An important part of diversity is variation within species. It is here that natural forests best demonstrate Mother Nature's fecundity. Managed forests are coaxed into uniformity, robbed of their potential. Small, isolated natural sites aren't able to pick up the load, but in large natural areas such as Smoky Mountain Park, we witness a magnificent unfolding.

Documenting or even recognizing the unfolding requires dedicated people—like Will Blozan. He is locating and documenting the big trees of the Smokies as no other before him. Most of us had thought the Smoky Mountain big trees had been covered exhaustively. The Park's great naturalist, Arthur Stupka, made a sizeable dent; but Will's finds are showing that when given the elbow room, Mother Nature endows her species with variability on a scale unknown even to most "tree knowledgeable" people.

EXTRAORDINARY SMOKY MOUNTAIN TREES

Will has discovered trees that most of us doubted could still exist anywhere in the eastern United States. The Great Smoky Mountains have always been known for their outstanding trees, and have recorded at one time or another the state or national champions for over two dozen species. The impressive numbers led most of us to accept the conventional wisdom that all the biggest trees had been found. Not so! Will discovered that the known big trees are almost always near established trails. Easy pickings. Few went off trail until Will came along. I well understand this.

I have walked countless miles in the Smokies, but as a rule I do not stray far from trails because the rhododendron, mountain laurel, and dog hobble form an almost impenetrable barrier—to say nothing of the large logs that crisscross to further complicate forward progress. Will's off-trail excursions have proven that many treasures are still waiting to be found. Will has located new champions for the Black Cherry, Yellow Buckeye, White Ash, Red

Maple, Striped Maple, Northern Red Oak, Chestnut Oak, Eastern Hemlock, Silverbell, Red Spruce, and Devil's Walking Stick—11 species. Before he is finished, this number will likely double; but even more important, Will has discovered two and sometimes three trees of the same species that exceed the prior park champion. The old-growth forests of the Smokies simply overwhelm all other Eastern forest competitors in terms of big trees.

What are some of Will's discoveries? Four species stand out as especially significant: Red Maple, Black Cherry, Red Spruce, and Silverbell. Will's discovery of the giant Red Maple 23 feet 4 inches in circumference and several other specimens over 17 feet around were reported in my last *Wild Earth* article. Almost as significant are Will's Black Cherries. This species is listed as reaching 2 to 3 feet in diameter and 60 to 80 feet in height, which fits the best of what one sees in the New England woods. Maxima for the Black Cherry are usually put at 5 feet in diameter and 100 feet in height. The Smoky Mountain trees are on a different scale. Will has found several Black Cherries reaching nearly 6 feet in diameter. The tallest ones likely top 130 feet.

Large Red Spruces in the Northeast reach 7 to 9 feet in circumference and 80 to 100 feet in height. Such figures are modest for the Smokies. Will found a Red Spruce 14 feet 11 inches in girth. The former park champion measured 14 feet 1 inch. Will tells me there is promise of a stand of huge spruce on the north side of Mount Guyot with several specimens in the 14-foot-around class. The heights of the Smoky Mountain spruces are no less impressive. Many top 130 feet. I've seen groves with every tree well above 100. Some spruces exceed 150 and one has been measured to 162. A baseline for comparison is needed. Imagine that stately 80 foot maple on your street. Now imagine a great spruce towering over your maple, double its height.

The Silverbell is often described as a small tree up to 40 feet in height and not much over a foot in diameter. The Smoky Mountain Silverbells have long been recognized as exceptional. They commonly reach 80 to 100 feet in height and 2 to 3 feet in diameter. Will has located a new champion Silverbell measuring 13 feet 2 inches around.

Northern Red Oaks are big trees in many regions of the East. Specimens growing inside the forest on favorable sites have little trouble reaching 3 to 4 feet in diameter and 90 to 120 feet in height. Will has found a new champion Northern Red Oak 18 feet 1 inch in girth. Its great columnar trunk supports a crown that Will estimates spreads out at about 150 feet above ground level. That would be quite a sight for timber managers who think of Northern Red Oaks as "overmature" at 3 feet in diameter. There is reason to believe the Smokies harbor other Northern Red Oaks in the range of 14-18 feet in circumference. An oak in the Cataloochee District of the Park has been quoted as being 170 feet tall. That tops all White Pines I've measured in New England. However, Will is confident that White Pines in at least two areas of the Park exceed 175 feet.

What of the Tuliptree, showpiece of the Appalachian cove forests? The largest of Will's new Tuliptree finds just exceeds 19 feet in circumference. As for height, our best measurements indicate that the tallest of the Smoky Mountain Tuliptrees reach into the 160 to 180 foot range. Amazingly, some of the hickories may match the Tuliptrees in this category.

The big tree (and shrub) list goes on. A Mountain Laurel 53 inches around, an Eastern Hemlock 17 feet 3 inches around, a Chestnut Oak 17 feet 7 inches around. Are these trees anomalies? Do they reflect unusual growing conditions? Climatic, topographic, and geologic factors are involved, but the indispensable ingredient is time. The "virgin" forests of the Great Smoky Mountains reflect the culmination of forest building processes that do not express themselves in 80 or 100 years, or even 200 years. It requires half to three quarters of a millennium to produce the composition and structure of the old-growth forests of the Smokies with their diversity and distribution of fauna and flora. This should not be surprising, since 750 years is not even two life cycles of the oldest trees dated by Will Blozan.

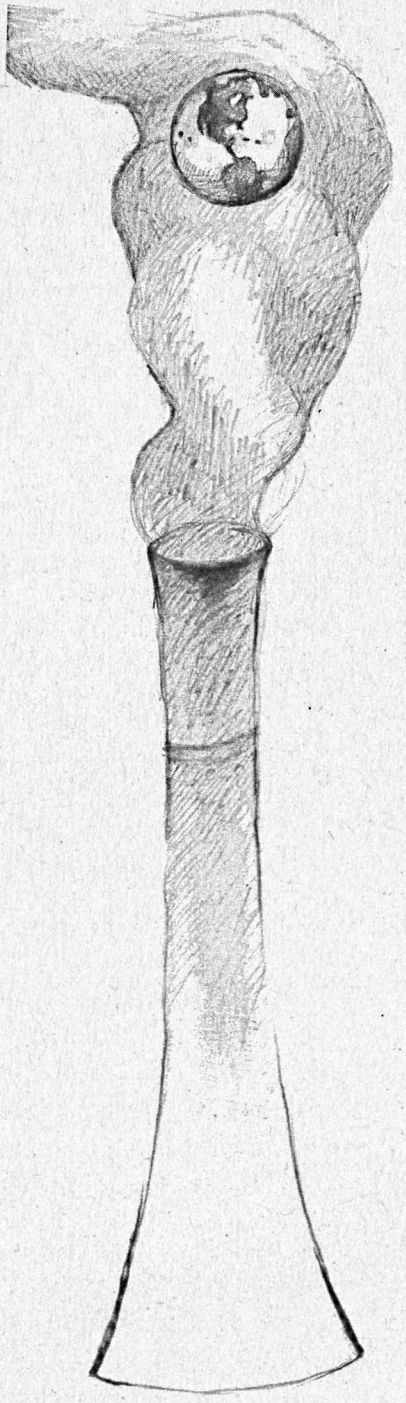
Along with big trees, Will is discovering truly ancient trees. A hemlock barely 20 inches in diameter that fell across the trail and was cut proved to have been 535 years in age. Trail cut specimens of Black Cherry and Red Spruce have been dated to over 400 years and modest sized Tuliptrees to almost 400. Some White Oaks likewise supply ample evidence that the Smoky Mountain forests are ancient. It is little wonder that the David Duffy and Albert Meier study clearly showed that logged forests do not quickly regain their original plant compositions and distributions as timber managers maintain. Duffy and Meier found that logged over areas weren't coming back even after 80 and more years. That shouldn't surprise anyone with minimal powers of observation. What amazed me was the yell of disapproval that went up from the forestry schools and the Forest Service, but wounded pride and dollar signs have a way of giving one tunnel vision. Those criticizing the Duffy and Meier conclusions must either have never visited places like the Great Smokies or have become blind from too much sawdust.

Will Blozan and I have discussed combining forces to begin mapping, measuring, and documenting exceptional stands of old-growth forest throughout the East, as our time and resources permit. As I see it now, we would make *Wild Earth* the repository of our data. This is a project that would probably go on for years and has multiple objectives—some scientific, some just fun. Membership is open. Anyone caring to pitch in with us, please send your name to me: Bob Leverett, 52 Fairfield Ave., Holyoke, MA 01040; or call me at (413) 538-8631.

Robert Leverett, the East's preeminent old-growth missionary, is now working with fellow devotees on two books about Eastern old growth.

Health Implications of Global Warming and the Onslaught of Alien Species

by Michael Soulé



ABSTRACT

Our species is engaged in an uncontrolled experiment in planetary heating. Each decade the concentration of CO_2, methane, and other greenhouse gases in the atmosphere is increasing by about 4%. All signs point toward unprecedented rates of warming and climate change. Many plant and animal species living in natural ecosystems will perish because they will be unable to keep up with shifting climate zones. Warming exacerbates another problem—the influx of alien animals, plants, and pathogens. These introduced species, many from the tropics, will increase the variety and incidence of tropical diseases.

key words: greenhouse effect, global warming, climate change, exotic species, tropical disease, wilderness, public health

ANTHROPOGENIC CLIMATE CHANGE

The planet appears to be heating up (e.g., Flavin 1990), and for the first time in evolutionary history the source of the heat is a single species—*Homo sapiens*. Human activities such as the burning of fossil fuels and forests, the cultivation of methane-producing rice paddies, and the husbandry of methane-belching livestock are injecting more greenhouse gases into the atmosphere than can be removed by photosynthesis and other natural phenomena. These byproducts of human agriculture and commerce are analogous to a thickening atmospheric blanket that allows sunlight in but traps the heat radiated back from the planet's surface.

Given the youth of the atmospheric sciences, it is almost impossible to prove that the recent warming trend is linked to the greenhouse effect, but most climate modelers are convinced by the available evidence. They predict an increase in average surface temperature of 1-3°C by the year 2030 (Ramanathan et al. 1985, Schneider 1989), although predictions span a much broader range (Hansen 1988). These estimates are based on the current rates of production of greenhouse gases such as CO_2, methane (CH_4), nitrous oxide (N_2O), and chlorofluorocarbons (CFCs). Studies of gas bubbles trapped in glacial and polar ice show large increases in CO_2 following the inventions of agriculture and industrial technologies, including the burning of fossil fuels. Pre-modern levels were about 275 ppmv, compared with 1987 levels of 375 ppmv (Pearman 1988). Carbon dioxide is now increasing at about 1.5 ppmv per year (Pearman 1988), or about 4% per decade. Reversal of the warming trend would require an environmental negative feedback mechanism dependent on complex oceanic/atmospheric processes. There is no evidence for such a mechanism. Failing a last minute rescue, the signs point toward climatic change on a scale that humans haven't witnessed since the end of the last ice age, about 10,000 years ago.

illustration by Eva-Lena Rehnmark

The planet will not warm uniformly; temperatures will increase least in the tropics and most in the arctic. It is expected that warming will continue for many decades, partly because of the thermal inertia of the ocean, and the continuing releases of greenhouse gases. One should not ignore the uncertainty in these predictions—there are still many questions, especially about positive and negative feedbacks. Nevertheless, public policy ought to be based on the best information and judgement available. At this time, the consensus is that we can expect rapid warming.

Precipitation patterns are expected to change as well, but resolution in the models is too coarse, and confidence limits too broad, to justify local predictions. Globally, however, mean precipitation may increase by 3-11%; the tropics will probably be wetter, but all we can say about the mid-latitudes is that the distribution of rainfall and snowfall will be different. Tropical storms are likely to increase in intensity, perhaps by 30-60%, and shift poleward by 200 to 400 km. Sea levels will also rise from about 0.25 to 1.0 m in the next century. (See Schneider 1989, for an overview of these effects.)

Global effects of this magnitude will in turn cause major changes in the distributions of organisms. As climatic regimes shift at historically unprecedented rates, some species will not be able to track them, and will be extinguished. Other species, including undesirable tropical disease vectors, will become established in places that were previously too cold for them.

CHANGING DISTRIBUTIONS OF SPECIES

Historical shifts in average temperature have been very slow, e.g. 1°C per 2000–3000 years (De Decker et al. 1988). This rate is about 100 times less than the rate of greenhouse heating predicted for the current anthropogenic episode. How did biological communities respond to the more sedate heating events in the past? From the work of palynologists and vertebrate paleontologists we know that in the past species have shifted their geographic ranges hundreds or even thousands of kilometers (Davis et al. 1986, Webb 1987, Huntley and Webb 1989). But there are limits to how fast organisms, especially sedentary ones, can migrate. Those unable to move will have to adapt genetically to heating and drying climates or perish. The vast majority of plant and animal species are adapted to quite narrow ranges of climate. Except for microorganisms and some invertebrates such as insects with short generation times and large population sizes, evolutionary adjustment to these rapid changes will be difficult or impossible.

Consider trees: The range of temperature and precipitation in which tree and other plants reproduce effectively (in contrast to just surviving) is usually quite narrow. Even if climate change does not kill plants outright, affected plants will often be unable to produce viable seedlings.

How fast will they need to move in the near future? An increase of 1°C is equivalent to a latitudinal shift of an isotherm poleward of 150 km or an isothermic elevation climb of 250 m (MacArthur 1972). A 1°C increase over 20 years in North America would require a northward shift of about 7.5 km per year. According to Roberts (1989), forest fronts can move as much as 2 km per year. In reality vegetation often lags behind climate by hundreds of years, even when the rate of climate change is one-hundredth of that anticipated during the next century (Davis and Botkin 1985, Davis et al. 1986). Within the next few decades we should begin to see evidence of forest dieoffs from heat and desiccation effects at the lower elevational limits of the ranges of many tree species.

The implications for wildlife communities are grave (Peters and Darling 1985, Peters in press, Hobbs and Hopkins in press). Not only is the climate shifting out from under many organisms, but even if they could track these rapid changes, the non-flying organisms are blocked by human-made barriers such as highways, reservoirs, farms, cities and other landscape "improvements." The exceptions will include reserves in mountainous regions; mountains provide organisms with a variety of climatic regimes accessible over relatively short distances.

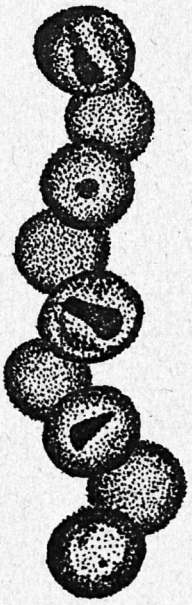
HUMAN TRANSPORT OF SPECIES

Global warming is only one of many current problems eroding biological diversity. Others factors include (1) the loss and fragmentation of habitats, particularly forests; (2) pollution, including toxics in rivers and lakes, acid precipitation, and ozone-thinning CFCs causing higher fluxes of ultraviolet radiation; (3) poaching of rare and endangered species; and (4) the introduction of non-native species. This paper emphasizes the latter problem because influxes of exotic species will interact with and be exacerbated by global warming. In other words, these two factors, greenhouse warming and the transport of species, act synergistically on nature and human health.

Even without warming, we would be witnessing the biggest biological diaspora in the history of life. This diaspora is mostly passive, occurring in suitcases and backpacks. People are moving plants and animals around the world at an unprecedented rate. In their travels, people and their commodities are accompanied by domesticated plants and animals, weed seeds, commensal vermin (e.g., fleas, cockroaches, rats), pets, (fish, reptiles, birds, etc.), and the pathogens and parasites harbored by all of these organisms. The result is a universal flood of non-native species. (The terms "introduced," "exotic," and "alien" are used almost interchangeably by biologists for non-natives.) For example, in Kruger National Park in the northern Transvaal, the number of alien plant species listed in 1937 was six. A detailed survey in the 1950s recorded 43; today, the number is more than 160 (MacDonald and Gerbenbach 1988).

The Hawaiian Islands offer another example. They have 4600 species of exotic plants—three times the number of indigenous species (St. John 1973). The native Hawaiian plants and animals have been extirpated from the lowlands, and virtually all the plants and birds that the average tourist sees (except in the highlands of some islands) were introduced. One of the reasons there are almost no native birds below 1500 m is the introduction of exotic pathogens, including those that

If the climate becomes more favorable for the vectors of these diseases, we may expect colonization of new regions and new hosts, including ourselves.



cause avian malaria and avian pox (van Riper et al. 1986). The vectors of these diseases are introduced mosquitoes; the reservoirs of the plasmodium are mostly introduced birds (Scott et al. 1988).

While most introduced species never adapt well to local conditions, some are successful, often overwhelming the native flora and fauna and leading to many kinds of unpredictable, deleterious consequences. Prominent among these invasive exotics are weedy annual grasses. In North America, Hawaii, Australia, and elsewhere, these grasses are outcompeting native bunch grasses. Because the exotic grasses reproduce faster, burn hotter, and conduct fire better than the native species, the aliens are causing vast changes in plant communities. Fires caused by humans and natural events sweep through savannas and woodlands, extirpating fire-sensitive plants and animals. Among the hundreds of invasive exotics are paperbark trees (*Melaleuca sp.*) in the Everglades, pampas grass in coastal habitats, ice plant on sand dunes in coastal California, Nile perch in Lake Victoria, and starlings in North America.

The intercontinental traffic of exotic organisms, including their associated pathogens, will grow with the increasing mobility of people and commodities. At the same time, the distributions of many human-associated species will continue to expand within their native continents, as we are seeing already in North America with coyotes, red foxes, opossums, gulls (*Laridae*), giardia (*Giardia lamblia*), prickly pear (*Opuntia spp*) and cattail (*Typha spp*).

Most of these biological invasions will be random, unplanned events. Among the exceptions are conscious introductions of biological control agents. Entomologists sometimes introduce ichneumonid and other parasitoid wasps for the control of native or exotic insect pests. Public health officials also introduce control agents, including *Gambusia* (mosquito fish), to control disease vectors.

Another group of species actively introduced is the large and rare vertebrates, particularly tropical and subtropical forms. Many such species will be unable to persist in their homelands, especially Africa, because of the human usurpation of their habitats. Such sensitive species may find their only semi-wild salvation in places like the American Southwest and Great Basin. In a decade or two, naturalists in Texas or Utah may record mountain lions feeding on introduced endangered species, such as oryx and adax.

HEALTH IMPLICATIONS OF BIOLOGICAL INVASIONS

What are some of the medical, particularly epidemiological, implications of species invasions, and how are these affected by global warming? This question was reviewed recently by Dobson and Carper (1992). Here, I have used a few of their examples and embellished where appropriate.

Anyone who thumbs through a parasitology text has to be struck by the diversity of parasites in the warm, tropical parts of the world. The appalling photographs in such books testify to the suffering caused by these agents. Implicit, but usually unstated, are the social and economic burdens that these parasites and pathogens impose on tropical societies. Climate is the major barrier to invasions of northern regions by these agents of misery. If the climate becomes more favorable for the vectors of these diseases, we may expect colonization of new regions and new hosts, including ourselves.

Domesticated animals provide some useful examples. Interactions between temperature and humidity are often important factors in limiting the distribution of pathogens that infect livestock. These interactions can be expressed graphically by plotting the ranges of temperatures and precipitation over which a pathogen or parasite is (1) able to persist without becoming epidemic, and (2) able to undergo epidemic outbreaks. Such graphs are called "bioclimatographs."

Figure 1 is a bioclimatograph for a nematode parasite, *Haemonchus contortus* (Barber's pole worm), of sheep at two localities in Australia (Gordon 1948). The bioclimatograph is constructed by plotting the mean monthly temperature and rainfall for each locality. *H. contortus* can just persist at 11°C (51°F) and 2.10 inches rainfall. Epidemic outbreaks are probable above 14°C (57°F) and 2.60 inches of rainfall. In other words, a small increase in temperature and rainfall can precipitate a change from a persistent, low-level disease to an epidemic. Threshold phenomena like this are not uncommon in host-parasite and environment-parasite interactions.

Figure 2 provides another example of a threshold, or non-linear ecological interaction, with possible epidemiological implications. The mosquito *Aedes aegypti*, a vector of malaria, cannot initiate egg development until it has a blood meal. At 27°C, egg development in the ovary of a recently fed female is relatively slow, requiring about 48 hours or more; by then it is too late to

illustration by Sarah Lauterbach

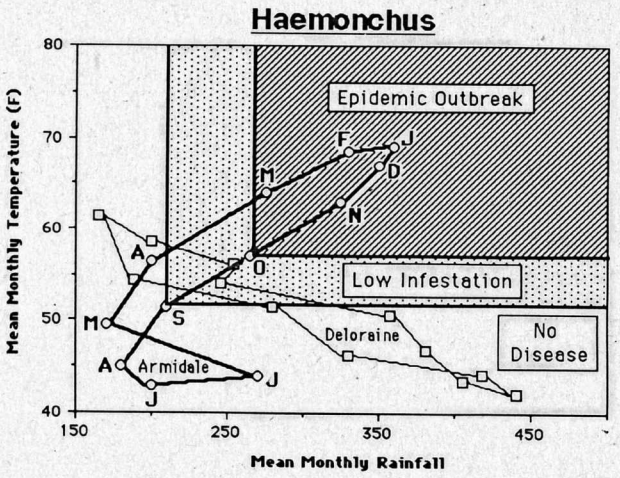


Figure 1. Bioclimatograph for *Haemonchus contortus* for two regions in Australia (after Gordon 1948 and Dobson & Carter 1992). See text. The letters J, F, M, etc. indicate the mean monthly temperature and rainfall for January, February, March, etc., in Armidale in northern New South Wales. At the other locality, Deloraine (Tasmania), the necessary combination of simultaneous high temperature and rainfall rarely occur, and outbreaks of *H. contortus* are rare.

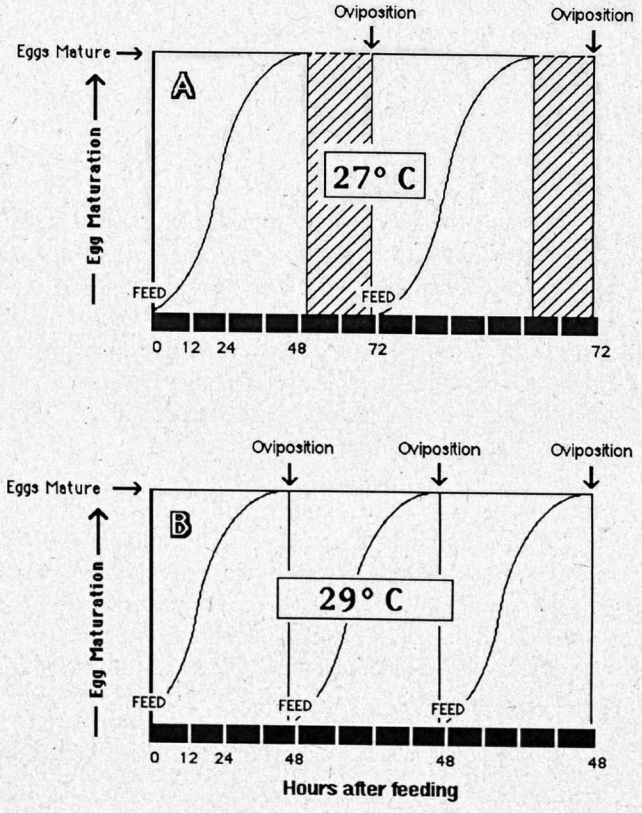


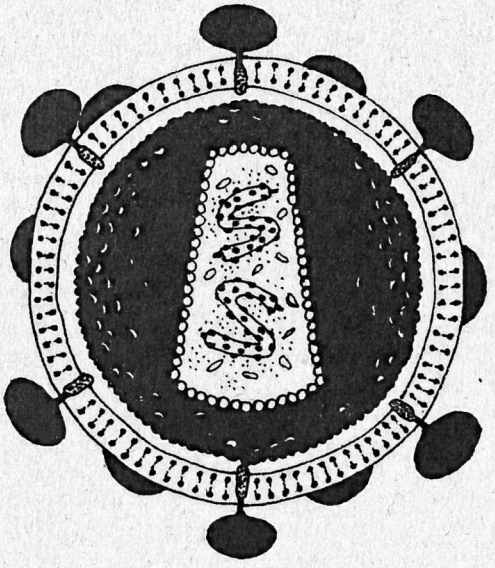
Figure 2. Egg (oocyte) development and oviposition intervals for the mosquito *Aedes aegypti*. **A**. At 27 °C eggs are not fully developed in time (before 48 hours) to be oviposited by the second activity period, so oviposition is delayed (cross-hatching) until the subsequent activity period, about 70 hours after the blood meal. **B**. At 29°C eggs are fully developed at 48 h, just in time for oviposition during the second activity period after a blood meal (after Gillett 1975).

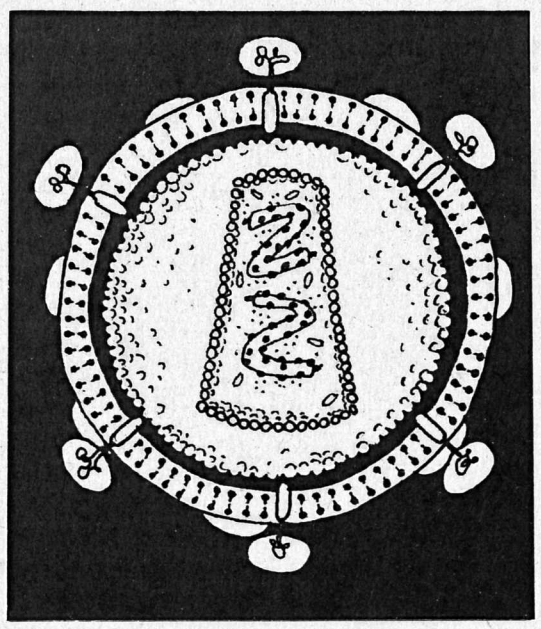
deposit her eggs, and oviposition cannot occur until the following evening. At 29°C or above, however, egg development is faster, and oviposition occurs during the second activity period following her meal. As pointed out by Gillett (1973) and Dobson and Carper (1992), this difference in egg-laying interval can be critical ecologically—*Aedes* populations will be larger and much more resilient at slightly higher temperatures. The point is that long-term increases in temperature are likely to cause the expansion of geographic ranges and higher rates of population growth for many tropical and sub-tropical arthropod vectors.

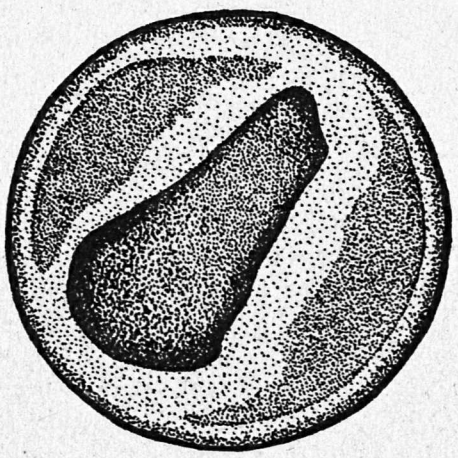
Another factor contributing to the spread of pathogens and parasites is the high population density of hosts. Most parasitic diseases become epidemic when the density of hosts reaches a certain threshold (Anderson and May 1979, May and Anderson 1979, Dobson 1988). Humans in many parts of the planet are at record high densities (Ehrlich and Ehrlich 1990).

Drug or vaccine resistance is another concern (Dobson and Carper 1992). Troubling levels of resistance are now developing to many antihelminthic and anti-malarial drugs. It is not at all certain that molecular approaches such as recombinant DNA will be any more successful than traditional ones. We can anticipate some of the same problems with these modern approaches that medical science has experienced with antibiotics and that agriculture has discovered with pesticides—Darwinian natural selection can mount effective counter-attacks against almost any technological blow we humans may deliver to our biological enemies.

The public health and economic challenges implied by biological invasions are formidable (May 1989). For example, mosquitoes such as *Aedes albopictus* and *A. aegypti*, the former already established in the Southeast, will spread as the climate warms. These mosquitoes can vector dengue fever, yellow fever, equine encephalitis, filariasis, and the viruses that cause hemorrhagic fevers.







The interaction of climate warming, rapidly increasing flows of humans from the tropics, and biological invasions may also lead to higher risks of hookworm (*Anclyostoma* and *Necator*) infection, an increase in distribution and number of species of chiggers, including some tropical ones such as *Trombicula batatus*, and the introduction of additional tick and mite borne diseases. Malaria, carried by *Anopheles*, is also likely to become a problem again in the US.

Other diptera also have the potential to inflict new dimensions of hardship. Tropical biting midges of the genus *Culicoides* are already on our southern doorstep. Sandflies of the genus *Phlebotomus* —which serve as vectors of sandfly fever, kala-azar, other forms of leishmaniasis, and serious diseases such as bartonellosis—might invade the southern US from southern Europe or Mexico as tropical conditions push northward.

An example of what could happen is the case of the parasite *Borrelia burgdorferi*, a spirochaete that in recent years has become epidemic in the tick *Ixodes dammini* and its relatives, which in turn are external parasites of deer and rodents such as deer mice. When the infected tick bites humans, the result is Lyme disease. According to Paul Etkind of the Massachusetts Department of Public Health, "Lyme disease is second only to AIDS in public interest and concern." Could HIV (from tropical Africa) and Lyme disease be the thin edge of the wedge? Increased mobility of humans, their pets, and smuggled wildlife, in combination with climate change, may bring about a costly epidemiological onslaught. Another possible effect of global warming is that dogs, cats, and pet birds may fall into disrepute because they or their external parasites might be found to be intermediate hosts of increasing numbers of human parasites and pathogens.

RECREATIONAL IMPLICATIONS

What are the implications of these real and potential problems for the seeker of physical, aesthetic and spiritual renewal in wilderness? The enjoyment of mountain, forest, and gorge will diminish in stepwise fashion as pests, vectors, and diseases are added. One of the greatest pleasures of being outside has already been foreclosed in most of North America. This is the simple act of drinking from a mountain stream. The trans-species spread of *Giardia lamblia* from humans to wild hosts such as Beaver and Elk imposes the cumbersome filter pumps or iodine pills on hikers, rafters and climbers. Children born today will never know the joy of spontaneously drinking from mountain streams.

Soon, other kinds of armament may be required before venturing outdoors. Backcountry enthusiasts will be less keen to be in wilderness when they can't drink the water because of parasites, can't risk exposure to the sun because of increased fluxes of ultraviolet radiation, and can't wear shorts for fear of disease-bearing ticks and flies, not to mention fire ants and killer bees.

PUBLIC POLICY CONFLICTS

How will government agencies react to the onslaught of noxious species and disease vectors? If recent history is a guide, there will be calls for the widespread application of herbicides, insecticides and rodenticides, as we witness in California with attempts to control the Mediterranean fruit fly. Avoiding shotgun approaches will depend on the existence of integrated pest management programs, which in turn will depend on continuing research. In the meantime, anxious public health

illustrations by Sarah Lauterbach

officials and farmers will demand the chemical eradication of pests. They will be opposed by outraged citizens protesting the use of pesticides.

Another area of conflict is that between the animal rights community and conservationists. In their efforts to control both expanding native species and destructive aliens, public health officials, ecologists and conservationists will be thwarted by animal rightists and welfarists. For example, we can expect animal protectionists to protest the poisoning of rodents that may be reservoirs of plague.

Conservationists have already been in the ring with animal protectionists. One case involves the red fox. Its geographic range expanded into wetlands in California following its escape from a breeding farm. The effects of foxes on ground-nesting birds such as the endangered light-footed clapper rail and the least tern have been devastating, but animal rightists have successfully sued the California Department of Fish and Game to prevent fox control. Many similar stories could be told. Better communication is essential between conservationists and the animal rights movement.

CONCLUSIONS AND RECOMMENDATIONS

Is there any good news? Maybe not, but the control of exotics and the prevention and cure of tropical diseases certainly will be a growth industry. More grant funds may flow to those who study the epidemiology, genetics, and ecology of exotic organisms.

What can concerned people do to help? The two-thirds of American households that donate to charities give about 2.5% (an average of $800) of their gross income. More than 98% of this is given to churches and to organizations that benefit people (health related charities, cultural institutions, etc.). Only about 1% is given to habitat and non-consumable species protection. Those with different priorities or with a longer view of public welfare might consider giving 2.5% to environmental causes, especially to those organizations that support energy conservation, voluntary family planning, and research in conservation biology.

Americans add more carbon to the atmosphere, on both gross and per capita bases, than any other nation (Flavin 1990). Most environmentalists believe that the current energy policy of the United States administration is flawed, and that humanity and nature would be better served by establishing targets for decreasing the releases of greenhouse gases, giving support for an international climate treaty, and returning to policies that favor energy efficiency over intensive oil drilling in Alaska and elsewhere. We can also consider becoming examples to our peers by adopting life styles that are less wasteful and energy-consumptive.

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Integrating Conservation Science with Management of Public Lands:

The Nevada Biodiversity Research and Conservation Initiative

THE MOST PRESSING land management challenge in Nevada is simultaneously to conserve the state's unique biotic diversity and provide for economic growth and other needs of its citizens. The Nevada Biodiversity Research and Conservation Initiative (NBI) was developed to this end. NBI is a partnership among the Biological Resources Research Center at the University of Nevada, Reno, the Center for Conservation Biology at Stanford University, the Nevada Division of Wildlife (NDOW), the Nevada Natural Heritage Program, the US Fish and Wildlife Service (FWS), the US Forest Service (FS), the US Bureau of Land Management (BLM), and several other cooperating agencies.

NBI strives to meet five goals by 1998: (1) to articulate and to clarify the value of biotic diversity and healthy ecosystems to Nevada residents; (2) to communicate clearly the objectives of NBI to governmental agencies, environmental groups, and the general public; (3) to obtain accurate, current information on biotic diversity within the state and compile these data in an accessible, computerized format; (4) to conduct research on public lands management practices that facilitate the retention of both biotic diversity and economic potential; and (5) to work with local, state, and federal agencies toward incorporating biotic diversity conservation into their planning processes.

Three standing committees currently participate in organization and implementation of NBI's goals. Open communication among NBI partners and other natural resource agencies is encouraged by the Coordinating Committee whose members include leadership from each partner group. A Public Advisory Committee, representing business, agricultural, and mining communities; environmental and sportsmen's organizations; and the public at large, gathers input from and provides a voice for citizens concerned with environmental issues. A Scientific Advisory Board consisting of University of Nevada faculty and researchers from other academic institutions and agencies insures the relevance and scientific credibility of NBI-sponsored research.

NBI focuses on research and planning efforts vital to preserve the distinct biotic diversity of the Great Basin.

NBI focuses on research and planning efforts vital to preserve the distinct biotic diversity of the Great Basin. A large number of endemic species and subspecies have evolved in response to the Great Basin's physiography and climate. Many terrestrial plants and animals have circumscribed ranges or occupy rare habitats, placing them at extraordinary hazard of extinction. Moreover, the desiccation of once-extensive pluvial lakes in the Great Basin created numerous isolated wetlands that now harbor a tremendous diversity of endemic fish and other aquatic organisms. The vulnerability of these habitats, compounded by the current rate of resource consumption in the nation's fastest growing state, is resulting in regional declines of biotic diversity at an unprecedented pace. Nevada currently ranks among the top ten states in the number of its native species that have either gone extinct or are threatened with extinction.

Because maintenance of biotic diversity requires management at all ecological scales—from integrated management of whole ecosystems to stewardship of individual species—NBI's scientific agenda includes research at levels ranging from landscapes to the genetics of single species. In addition, NBI will sponsor quantitative

by Peter Brussard

accounts of human influences on Nevada's natural ecosystems, evaluating the extent of past extinctions, changes in natural vegetation, land-use transformations, and the impacts of exotic species and native predator community modification.

Two of Nevada's habitats sustain a majority of the state's biotic diversity: riparian areas and seasonal wetlands that support ephemeral resources and transient species. Clearly, both of these ecosystems are utterly dependent on water availability—a need shared with Nevada's rapidly expanding urban population. Because sustainable management of watersheds demands a landscape-level approach, NBI is employing Geographic Information Systems (GIS) to map watersheds and their constituent flora and fauna, as well as to monitor critical water basins. Certain features of Nevada's terrestrial landscape, including land ownership, vegetation cover, species distributions, and climatic variables (essential for indicating the susceptibility of a region to environmental changes such as desertification), will also be mapped via GIS following the FWS state Gap Analysis Program. The completed computer database, which will be made available to agencies and the general public, will allow generation of maps of species richness and identification of landscape corridors connecting areas of high biotic diversity.

Insuring the survival of the Great Basin bioregion's flora and fauna is a significant long-term challenge. Unfortunately, many species in Nevada are under immediate threat of extinction and urgently require conservation strategies. Ranking species according to their vulnerability to extirpation may enable us to categorize habitats by allowable land uses, and thus act sufficiently early to prevent future endangered species listings.

The Nevada Biodiversity Research and Conservation Initiative provides a means for academic and agency scientists, land managers, and the general public to interact constructively on environmental issues and avoid conflicts at the nexus of conservation and development. NBI's framework of applying sound conservation biology to ecosystem management planning will prevent many species from becoming threatened or endangered, thus saving listing and recovery costs, and thereby reducing land use regulations where such species occur.

Peter Brussard (University of Nevada, Biodiversity Research Center, Biology Dept., Reno, NV 89557) is President of the Society for Conservation Biology.

Aubade

Then the song begins to climb
inside of you— you who pray
to be round and whole— wanting
what is already there
beneath your skin.

You must lie down. Listen
to the insect you cannot name.
Hidden high in the Maple, hear it
turn the ratchet that brings
another cord of light into morning.
It won't be long
before you feel a strength
weaving around itself.

Early this morning
I thought of everything
that might fill you.
Now a voice tells me this
would be a fine ending:
my hand on your shoulder,
large, warm and alembic.

—Luke Treat

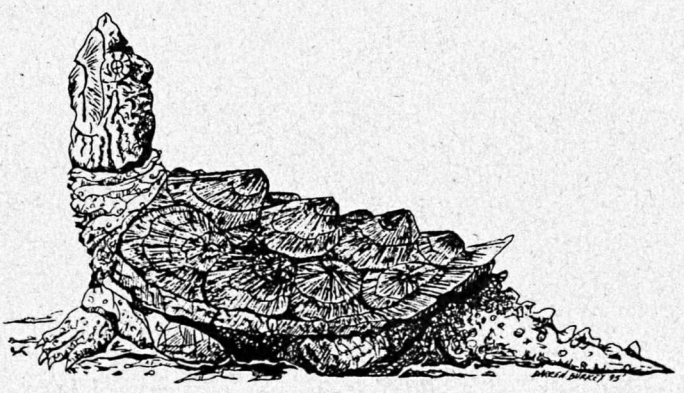


illustration by Darren Burkey

A Preliminary* Conservation Plan for the Columbia Mountains

by Evan Frost

INTRODUCTION

The primary goal of this study is to 1) assess the current landscape conditions and patterns of biological diversity in the Columbia Mountains, 2) identify areas of critical importance for maintaining or restoring native biodiversity, and 3) develop a scientifically based plan for a regional reserve network that, if established, has a high likelihood of sustaining all elements of diversity and ecosystem integrity over the long term. Our approach is based on the growing scientific evidence that a network of relatively large, interconnected reserves is required in order to fully protect biodiversity and functional ecosystems. Although several recent and ongoing studies have attempted to address regional land use issues in the Columbias, none has examined what it might take to sustain healthy natural landscapes and viable populations of all native species over decades and centuries. Such a study is long overdue.

THE STUDY AREA

Geography

The Columbia Mountains are a complex of distinct ranges, valleys, and rugged highlands that traverse the international border in southeastern British Columbia, northeastern Washington, northern Idaho, and northwestern Montana. As defined here, the Columbias extend from the Cariboo Mountains in the north, south to the Columbia Plateau, east to the Rocky Mountain Trench, and west to the Okanogan Valley (Figure 1). The triangular-shaped region covers roughly 125,000 square kilometers, and includes the Okanogan Highlands, Monashee, Selkirk, and Purcell mountain ranges in their entirety.

Due to similarities in climate and physiography, the Columbia Mountains have long been recognized as a distinct "ecoregion" within the Rocky Mountains Physiographic Province (Fenneman 1931, Holland 1976, Bailey 1980, Arno & Hammerly 1984, Omernik 1986, Habeck 1987, Franklin & Dyrness 1988, Demarchi et al. 1990). The region is topographically diverse, with elevations ranging from 500 meters (about 1700 feet) in the major river valleys to over 3500 m (about 11,600 feet) on the highest peaks. The primary drainage systems are the Upper Columbia, Kootenai, Okanogan, and Pend Oreille Rivers and their tributaries. Intermontane valleys of these rivers divide the Columbia Mountains into distinct ranges, and include the basins for numerous long, deep lakes, including Kootenay, Arrow, Okanogan, and Slocan Lakes. Landforms vary from level river valleys to precipitous mountain slopes.

Pika (Ochotona princeps) *by Evan Cantor*

* The results of this study should be viewed as preliminary in that to date we have completed our ecological assessment and land use plan only for the Canadian side of the Columbia Mountains Ecosystem. Similar analysis on the US side has been hampered by a lack of the necessary map-based information. Completion of our analysis and conservation plan for the entire transboundary region will occur when missing data are made available, and may suggest refinement of reserve locations and boundaries as proposed in this report. Our preliminary report and proposal have been peer-reviewed by a group of conservation biologists, including Gordon Orians, Ed Grumbine, Carlos Galindo, Philip Burton, and Reed Noss. A second, more formal peer-review process is also planned.

In the north and central areas, the Columbia Mountains are high and spectacularly rugged. Mt. Sir Sanford in the northern Selkirks is the highest peak with an elevation of 3522 m. Over fifty summits exceed 3000 m (Holland 1976). Classic features of both continental and alpine glaciation are evident in the landscape. Most peaks are ringed with cirques containing active glaciers, while intermontane valleys have been deepened and widened into classic broad, U-shaped forms.

The southern Columbia Mountains, below roughly 50° N latitude, differ markedly from the more rugged, steeper topography found in the north. Summits and ridge crests are typically rounded or gently undulating, the range of elevational relief is smaller, and terrain is generally moderate. The highest peaks range from 2400 to 2800 m, reaching 2865 m on Snowcrest Mountain in the southern Purcells.

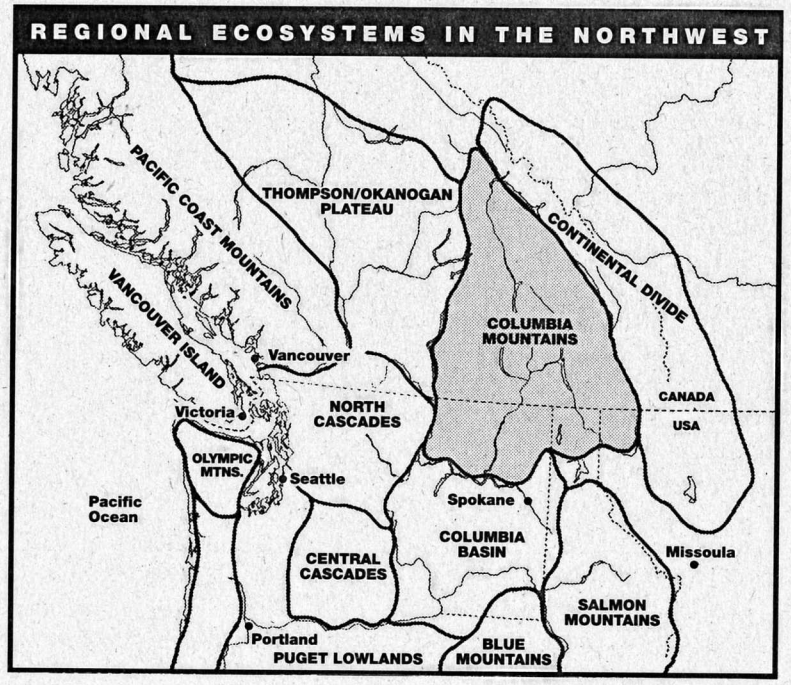


Figure 1

However, it is important to recognize that any set of regional boundaries is to some extent artificial, since ecosystems are not closed systems and gradual transitions exist. Of greatest importance is that the analysis, management, and conservation of biodiversity occur at the landscape scale, a planning perspective that has generally not received sufficient attention in the past (Noss 1983, Povilitis 1994). Identification of regions with broad similarities in topography, vegetation, and climate helps reduce nature's complexity to more manageable proportions.

Geology

Geologically, the Columbia Mountains include a mix of igneous, sedimentary, and metamorphic rocks, with formations dating from the Paleozoic era to recent. Predominant bedrock types are Proterozoic and Paleozoic sedimentary and metamorphic rock, gneiss of igneous origin, late Paleozoic and Mesozoic sedimentary and volcanic rocks, granitic intrusions and batholiths of Cretaceous and Tertiary ages (Holland 1976, Douglas et al. 1970). In the southern part of the region, much of the terrain is composed of rocks from the Late Precambrian age, known as the Belt and Purcell Supergroups (McKee 1972).

The Columbia Mountains complex is older than the ranges of the Continental Divide, and the longer period of erosion of the tilted and faulted Precambrian and Paleozoic sediments has exposed granitic cores and later igneous intrusions. Virtually the entire region above 2000 m was repeatedly covered by glacial ice during the Pleistocene epoch, and there are many characteristic surface features such as moraines, terraces, and lake basins. Alpine glaciers persisted on the high peaks long after continental ice receded, and still cover significant areas in the north. The southern boundary of the Columbia Mountains coincides with the limit of continental glaciation, where the gentle, rolling topography descends into the arid lowlands of the Columbia Plateau.

Extreme variability in parent materials combines with effects of extensive glaciation to produce a bewilderingly complex soil pattern in the Columbia Mountains; at least 100 types (soil series or subgroups) have been described (Lacelle 1990, Valentine et al. 1978). Most soils are derived from mixed glacial, colluvial, and fluvial deposits. The most common subgroups at lower and middle elevations are Orthic Dystric Brunisols, Brunisolic Gray Luvisols where parent materials are fine textured, and Orthic Eutric Brunisols on calcareous parent materials. At higher elevations, Orthic Humo-Ferric Podzols and Podzolic Gray Luvisols dominate, along with exposed bedrock.

Climate

The dominant climatic influence in the Columbia Mountains is the prevailing westerly winds which carry warm, moisture-laden air masses from the northern Pacific Ocean toward the Rocky Mountains. Mild and wet weather prevails from October to April as Pacific coastal storm tracks penetrate eastward (Arno & Hammerly 1984). Winter and spring weather is characterized by prolonged gentle rains, deep snow accumulations at higher elevations, with abundant cloudiness, fog, and high humidity. Most river valleys receive well over 50 cm of annual precipitation, although some areas in localized rainshadows may average 40 cm or less. Winter temperatures are 8° to 14° C warmer than more continental locations of the same latitude. Warm, dry weather usually prevails in summer and early fall.

Because of the well-developed oceanic influence, the Columbias have often been referred to as the Inland Maritime Ranges or the "Interior Wet Belt," a distinct region within the larger Rocky Mountains Province (Kirkwood 1922, Daubenmire 1943, Lassoie et al. 1985, Arno & Hammerly 1984). This "inland maritime" climate occurs from the Cariboo Mountains in central BC to the Clearwater River in central

Idaho, its intensity gradually decreasing north to south across the study area. A gradient of decreasing maritime influence also exists west to east as successive mountain ranges deplete the moisture.

The Columbia Mountains have been further subdivided into three major climatic subregions: 1) a warm, dry subregion occupying rainshadows of the Cascade and Selkirk Ranges, namely the Okanogan Highlands in the southwestern portion of the region, and the eastern flank of the Purcell Mountains down to the Rocky Mountain Trench, 2) a moist climate subregion that occupies the area between and north of the dry climate region, and 3) a cool, wet subregion encompassing the northern half of the study area, where the mountains are higher, resulting in greater precipitation (Braumandl & Curran 1992).

Vegetation zones and wildlife

Dramatic changes in climate, soils, and topography create a complex, diverse pattern of vegetation in the Columbia Mountains ranging from semi-arid grasslands to interior rainforests to alpine tundra. A nearly continuous mantle of conifer forest covers most landscapes in the region, stratified into distinct zones based on elevation and moisture. From wet to dry, the major forest zones in the Columbia Mountains are the cedar/hemlock, spruce/fir, Douglas-fir, and Ponderosa Pine zones.

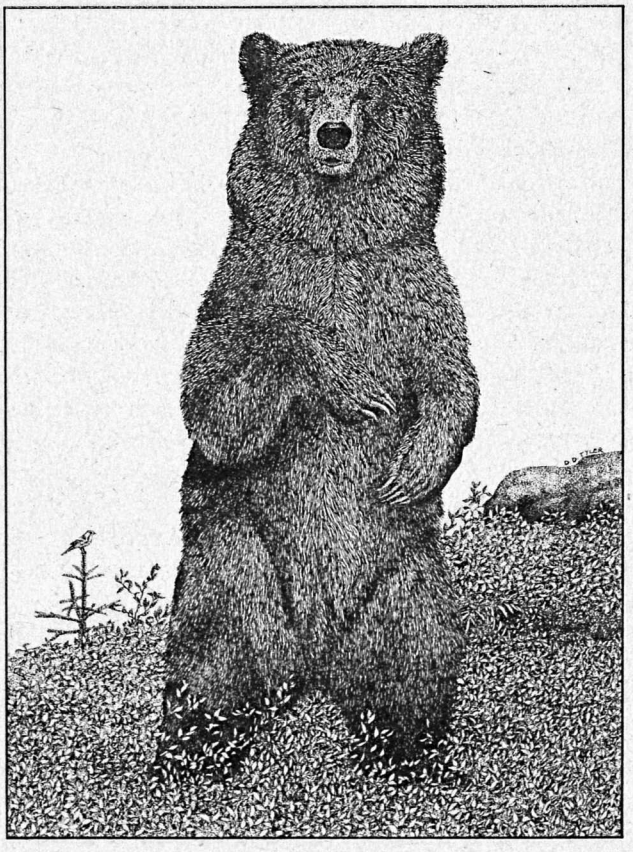
In the moist valley bottoms, a luxuriant, highly productive "interior rainforest" occurs. These forests resemble in many ways those found on the western slopes of the Pacific coast mountains in Washington and British Columbia (Daubenmire & Daubenmire 1968, Habeck 1987), characterized by large tree sizes, large amounts of coarse woody debris, and abundant moisture-loving shrubs and herbs on the forest floor. Coastal tree species present include Western Redcedar, Western Hemlock, Pacific Yew, and Grand Fir, amidst numerous species of coastal shrubs, herbs, and non-vascular plants (Layser 1980). Douglas-fir and Western Larch are important constituents in the early stages of successional development following disturbance.

Occurring above the cedar/hemlock zone, Subalpine Fir/White or Engelmann Spruce forests become dominant where winter snow accumulations are heavy. These forests cover extensive areas in the Columbia Mountains, occasionally mixed with Subalpine Larch, Mountain Hemlock, and Whitebark Pine on dry ridges and exposed rocky slopes. Avalanche tracks covered with dense thickets of broadleaf trees and shrubs are also common. At higher elevations, spruce/fir forests are intermixed with lush herbaceous meadows and open parklands, supporting many species characteristic of more northern latitudes (Arno & Hammerly 1984). Timberline in these ranges typically occurs at elevations between 2100-2400 m; however, it may occur below 2000 m in areas of deep snow accumulation. Alpine tundra is dominated by grass-sedge meadows, talus fields, rocky ridges, and glaciers.

In the southern parts of the region, the maritime influence diminishes and the climate becomes drier. Coastal tree and understory plant species are largely absent, replaced by a dry, open forest type where Douglas-fir is the climax species. Western Larch, Ponderosa Pine, and Western White Pine are important constituents of these open, park-like forests. At middle and upper elevations, past fires have perpetuated extensive areas dominated by early seral stands of Lodgepole Pine and Quaking Aspen (Arno & Hammerly 1984).

Below the Douglas-fir belt, a transition from forest to savanna, grassland, and shrubland vegetation types takes place. In the driest areas, receiving only 25-40 cm of precipitation, particularly in the Okanogan Valley and Rocky Mountain Trench, a mosaic of open Ponderosa Pine woodlands, sagebrush steppe and bunchgrass vegetation is found (Tisdale 1947, Tisdale & McLean 1957). Important species in the Ponderosa Pine and bunchgrass zones include Bluebunch Wheatgrass, Idaho Fescue, and Big Sagebrush. Along perennial stream courses, deciduous woodlands dominated by Black Cottonwood, Water Birch, willow, and Trembling Aspen occur, with a lush understory of shrubs and herbs.

Consistent with the tremendous range of vegetation types, the Columbia Mountains also support an incredible abundance and diversity of wildlife. The region contains the only breeding location of Forster's Tern in Canada, and one of the highest breeding concentrations of Ospreys in the world (Demarchi et al. 1990). Extensive water bodies and wetland complexes associated with the Columbia River and its tributaries are internationally significant staging areas for numerous species of



Grizzly Bear in Huckleberry Bushes *by D.D. Tyler*

migratory waterfowl. The eastern section of the Columbias is unique in supporting seven native ungulate species, many of which inhabit the same winter ranges (Demarchi 1986). Populations of all native wide-ranging carnivores are still present, including Gray Wolf, Grizzly Bear, Mountain Lion, Lynx, Fisher, Pine Marten, Bobcat, and Wolverine.

In terms of aquatic diversity, the upper Columbia River basin contains one of the most distinctive fish faunas in North America (McPhail & Carveth 1992). Significant wetlands along the upper Columbia and Kootenay Rivers support an exceedingly high density of waterfowl, fish, and riparian-dependent species. The Columbia Mountains also support a number of geographically disjunct (e.g., Pacific Giant Salamander, Tailed Frog, Kootenay River White Sturgeon) and endemic (e.g., Coeur d'Alene Salamander, Gerrard Rainbow Trout) species.

Land ownership patterns

The Columbia Mountains are under mixed public (provincial, federal, state) and private land ownership. On the US side, federal and state lands cover approximately half the area, including all or parts of four National Forests (Okanogan, Colville, Idaho Panhandle, and Kootenai), two National Wildlife Refuges (Little Pend Oreille, Kootenai), and the Priest Lake State Forest in northern Idaho. The one protected area in the region, the Salmo-Priest Wilderness in northeastern Washington, covers only 16,184 hectares. Large blocks of private land are found at lower elevations, and in some areas are intermixed with federal and state ownerships.

North of the international border, approximately 90% of the land is provincial (Crown) land. The largest land management agency is the BC Ministry of Forests, including the majority of the Nelson and parts of the Kamloops and Prince George Forest Regions. Protected areas total approximately 400,000 ha, including seven small to medium-sized provincial parks (St. Marys, Valhalla, Kokanee Glacier, Okanogan Mountain, Monashee, Champion Lakes, and Stagleap), two national parks (Mt. Revelstoke, Glacier), and one wilderness conservancy (Purcell). Most of these protected lands are above timberline and of limited value for maintaining biodiversity. As in the US, private lands are located in valley bottoms and lower foothills.

Biodiversity decline in the Columbia Mountains

The status of biological diversity in the Columbia Mountains Ecosystem might best be described as a condition of both crisis and opportunity. Compared to many other regions in North America, the Columbia Mountains appear relatively intact. All native mammal species known to occur here at the time of European settlement are still present, including a number of sensitive species (e.g., Grizzly Bear, Gray Wolf, Woodland Caribou) that have disappeared over much of their pre-settlement ranges. Due to the high proportion of publicly owned lands, the region retains much of its native vegetation cover, and some landscapes are still relatively undisturbed. Few equally good opportunities exist anywhere in the temperate world for conserving biodiversity at all levels—genes, species, ecosystems, and landscapes—as currently exist in the Columbia Mountains.

Despite these optimistic perspectives, indicators of biotic impoverishment in the Columbia Mountains are numerous and increasing. Distinctive populations of plant and animal species have been lost, numbers and distributions have been reduced, and many elements of diversity in both terrestrial and aquatic habitats are now at moderate to high risk of extinction. Available evidence suggests that biodiversity is being lost in the Columbias at an accelerating rate, across multiple scales and a broad range of taxonomic groups.

On the British Columbian side of the ecosystem, a total of 79 animal species are currently listed as "at risk," threatened, or endangered provincially: 48 birds, 18 mammals, and 13 reptiles and amphibians (Harper et al. 1992). As of 1993, 83 plant species and 8 plant communities in the Columbia Mountains are also considered vulnerable or at risk of extinction (BC Conservation Data Centre 1993). Fifty-eight percent of all threatened and endangered species in British Columbia are found within the Okanogan Valley, considered to be one of the most ecologically diverse places in Canada (Hlady 1990). Both Sage and Sharp-tailed Grouse have been extirpated from the region due to the loss of shrub-steppe habitats.

On the US side, the number of species at risk of extinction is even higher. Seven vertebrate species in the Columbias are formally listed as Threatened or Endangered by the US Fish & Wildlife Service, including Grizzly Bear, Gray Wolf, and Woodland Caribou. Many other species including Lynx, Wolverine, and Pacific Fisher are currently being considered for listing. An additional 174 species across a broad range of taxonomic groups are considered vulnerable or at risk of extinction (WA Dept. of Wildlife 1991, Mosely & Groves 1992, MT Natural Heritage Program 1993). Available evidence suggests that populations of many songbirds and raptors have declined significantly in recent years (Sharp 1992, Paulson 1992). The current status of many smaller but ecologically important species, especially invertebrates, is poorly known.

Numerous aquatic species are also threatened or endangered in the Columbia Mountains. Fish species that are sensitive to habitat degradation—Bull, Redband, and Westslope Cutthroat Trout, Kokanee Salmon, White Sturgeon, and several sculpin species—are in precipitous decline. Dramatic reductions in native fish populations have been reported in Okanogan and Kootenay Lakes (BC Ministry of Environment 1993), and at least five fish species are known to be at risk of extinction in the upper Columbia River basin (Peden 1994). The Kootenay River White Sturgeon has recently been listed as an Endangered species in the US, and may be followed soon by the Bull and Interior Redband Trout. Numerous native salmon stocks of the upper Columbia River and its major tributaries have already gone extinct as a result of impassable hydroelectric dams, representing a significant loss of ecological

and economic wealth from the region (Peden 1994, Frissell 1993, Oregon Trout 1990).

Not just species, but entire ecosystems are at risk in the Columbia Mountains; some are nearly gone. For example, the dry intermontane grasslands have been decimated by human development in the last hundred years (Pitt & Hooper 1994). Most were overgrazed by the turn of the century, and since then thousands of hectares have been converted to agriculture and housing developments, or lost due to fire suppression. The grasslands of the Okanogan region have been particularly reduced, with less than 10% of the historical area covered by this habitat remaining in a relatively natural state (Redpath 1990, Hlady 1990).

Many other productive and biologically diverse habitats have suffered disproportionate losses in the Columbia Mountains. Livestock grazing, logging, agricultural and hydroelectric development have reduced or severely degraded many wetlands and riparian areas, in some areas by as much as 85% of their pre-European extent (Harper et al. 1992). In total, over 40 plant communities are designated as "at risk" or sensitive in the region. (BC Conservation Data Centre 1993, WA, ID, and MT Natural Heritage Programs 1993).

The geographical extent of old-growth forests in the Columbia Mountains has also been dramatically reduced during the twentieth century, particularly those fire-adapted types dominated by Ponderosa Pine, Western White Pine, and Western Larch (Karr et al. 1994, Habeck 1990, Everett et al. 1993). In British Columbia, the Nelson Region is the only Forest Region out of six in the province where the area of immature forests exceeds mature forest cover, primarily due to excessive logging (Harding 1994). According to Quesnel (1993), 32 forest types in different parts of the region are of immediate concern because they currently have less than 10% or 1000 total hectares of their productive land in a mature or old-growth condition. Although no formal inventories have yet been conducted in the Inland Northwest states, it is estimated that less than 15% of the late-successional forests on National Forest lands remain (Yanishevsky 1994, Karr et al. 1994). Continued logging of remaining old-growth forests will jeopardize unknown numbers of additional species.

The long-term prospects for sustaining even current levels of diversity are not high, as land management activities continue to harm ecosystems and their associated species. Logging and road-building remain the biggest threats to biodiversity in the region. The 5–10 year development plans for public forestlands in both the US and Canada call for thousands of hectares of logging and road-building in many of the most critical remaining wildlands. The Idaho Panhandle National Forests alone have proposed to double their already excessive forest road network to over 13,000 miles (USDA Forest Service 1987). Mining, livestock grazing, hydroelectric development, and increased human settlement pose additional dangers.

ECOSYSTEM CONSERVATION GOALS AND APPROACHES

Clearly, our current system of protected areas and our land management practices are not capable of sustaining biodiversity in the Columbia Mountains. To successfully maintain biological diversity over the long term, scientific evidence is overwhelmingly pointing to the need for 1) creation of an expanded system of large, interconnected reserves, and 2) adoption of more ecologically based management practices on integrated or multiple-use lands (DellaSala et al. 1994, Noss & Cooperider 1994, Hammond 1993).

Recent discussion among ecologists and conservation biologists has led to the development of a generally accepted set of overarching objectives for the design of reserves: 1) Represent, in a system of reserves, all native ecosystem types across their natural range of variation. 2) Maintain viable populations of all native species. 3) Maintain evolutionary and ecological processes, such as disturbance regimes and predator/prey interactions. 4) Allow for short and long-term environmental change to occur without losing elements of biodiversity (Noss 1993, Grumbine 1994). Meeting these goals will require a fundamental shift in our thinking about protected areas, from emphasizing scenery and recreation to emphasizing biodiversity conservation.

Based on our current understanding of how ecosystems function, a generally accepted model for regional reserve design has been developed which offers the greatest potential for meeting biodiversity objectives in the Columbia Mountains. This model consists of the following components: 1) a system of *core reserves*, managed primarily for their biodiversity values; 2) a gradation of *buffer zones* that surround reserves and insulate them from intensive land use activities, while still permitting compatible uses within; 3) *landscape linkages* (or habitat corridors) that allow for the movement of organisms and processes between reserves; and 4) an overall *regional management plan* that integrates these various elements (see Reed Noss's conservation and reserve design article in *Wild Earth*'s Special Issue on The Wildlands Project, 1992).

The basic task of this study was to identify areas of high conservation value in the Columbia Mountains, from which the boundaries of a regional reserve network could be designed. A relatively unsophisticated mapping system covering the entire region was developed to assist in this evaluation process. "Hot spots" of biodiversity identified from this landscape analysis are recognized as the building blocks for creation of a network of potential core reserves, buffer zones, and linkages that will have a high probability of providing for all native species.

METHODS

The landscape analysis conducted as part of this study involved several steps. The first step was to collect and transform existing information relating to biodiversity into a series of maps that can be overlaid on standard 1:250,000 scale to-

pographic base maps. The second step was to use this map-based information to evaluate current landscape conditions on a watershed basis, and identify areas of high value for conserving regional biodiversity. The third step was to delineate the boundaries for a long-term reserve network, including core reserves, linkages, and buffer zones. The final step was to develop general guidelines and priorities for managing and restoring lands within the proposed reserve system.

The landscape analysis approach used here is similar to that employed by the Interagency Scientific Committee for the Northern Spotted Owl (Murphy & Noon 1992), the Scientific Panel on Late-Successional Forest Ecosystems (Johnson et al. 1991), the Forest Ecosystem Management and Assessment Team (USDA Forest Service 1993), and Noss (1993b) for the Coast Range of Oregon. Similar regional conservation assessments are now under way in the US for the Interior Columbia River Basin (USDA Forest Service 1994), the Sierra Nevada Mountains in California (SNEP 1994), and the North Cascades in Washington and southwestern British Columbia (Frost 1994).

Step 1: Data mapping

The analysis involved overlaying various sets of biological data onto base maps showing topography, land ownership, and major geographic features. The base maps were 1:250,000 scale standard topographic map sheets produced by the Canadian Department of Energy, Mines, and Resources, of which nine were required to cover the entire region: Penticton (82E), Nelson (82F), Fernie (82G), Kananaskis Lakes (82J), Lardeau (82K), Vernon (82L), Seymour Arm (82M), Golden (82N), and Canoe River (83D).

The following major data layers were overlaid onto base maps to evaluate current landscape conditions: 1) roadless lands, 2) element occurrences (locations of rare species and communities), 3) development status of watersheds, 4) ecosystem types, 5) probable wildlife barriers and corridors, 6) late-successional/old-growth forests, and 7) past timber harvest. Each of these data sets is discussed in detail in the full-length version of this conservation proposal, available from GEA.

Step 2: Conservation evaluation

Given that reserve designation and other conservation measures are likely to be implemented on only a portion of a region's total land area, planners and decision-makers must make choices about which areas are of greatest importance for protection. Whereas past evaluations have focused mainly on scenic or recreational values, numerous ecologically based evaluation methods have been developed in recent years (Spellerberg 1992, Anselin et al. 1989, Usher 1986, Roome 1984). However, despite extensive discussion in the biological conservation literature, no generally accepted methodology for evaluating natural areas exists.

The evaluation system developed for this study is similar to those created for other regional conservation assessments (Margules & Usher 1981, Duever & Noss 1990), and is based on coarse-filter criteria that incorporate considerations of both site content and context. Our approach is different in that we chose to stratify the region into watersheds as the basic units of evaluation. Since watersheds can be scaled to different sizes and are easily delineated based on topography, they can be used as the basis for subdividing large areas into smaller units for analysis and planning (USDA Forest Service 1993).

There are a number of reasons why watersheds are the most appropriate ecological units for conservation evaluation:

- Watersheds are naturally connected landscape units, and can be scaled to different sizes depending on stream order.
- Protection of entire watersheds is most likely to maintain important ecological and physical processes, like hydrological flows and nutrient cycling.
- Because watersheds are inherently diverse in terms of topography, elevation, and climate, protection of complete watershed units effectively conserves ecosystem patterns and processes that occur across environmental gradients.
- Watersheds act as natural movement pathways for many wide-ranging wildlife species that use riparian or ridgetop corridors.
- Protection of watersheds is the most effective means by which to conserve aquatic as well as terrestrial species.
- Topographical features associated with watershed boundaries can help to limit human intrusion, and therefore afford greater protection to species that require habitat security.
- Intact watersheds are likely to provide undisturbed areas of sufficient size such that they can act as natural benchmarks for comparison with areas altered by various human activities.

Based on these advantages, a number of research ecologists have come to the conclusion that conserving intact watershed units will capture elements of biodiversity and sustain ecosystem processes more effectively than will the protection of pieces of a landscape fragmented by human development (Lertzman et al. 1992, Doppelt et al. 1993, Reeves & Sedell 1992).

The evaluation system used in this study involves scoring watershed units on a ten point scale according to each of six criteria: watershed condition, roadless lands, ecosystem diversity, element occurrences, late-successional/old-growth forests, and landscape connectivity. All watershed units were ranked for each of the six criteria on a scale of 0 to 10, from least to greatest importance for maintaining biodiversity.

Numerical scores were assigned by comparing mapped characteristics of individual watershed units to the descriptions associated with each score. Evaluations were not entirely objective because two of the ranking criteria (connectivity, late-successional forests) were not easily quantifiable. Assigned scores are relative values only, designed to indicate the importance of a watershed unit compared with other areas.

Scores for individual criteria were then summed to produce an overall rank for each watershed. Although some individual criteria could be emphasized over others in such a ranking process, we chose to weight each of the six criteria

equally. By standardizing the range of possible scores for each of the criteria, no one factor is overwhelmingly important in determining the overall rank. From this information, we developed an annotated database of 504 watersheds in the Columbia Mountains, analyzed according to these criteria.

Step 3: Reserve design

The results of the conservation evaluation (summarized in Appendix 1 of full-length report) provide practical direction for the selection of areas to be included within a regional reserve system. To facilitate conservation planning, a decision matrix was developed to group watersheds into high, medium, and low priority categories, with an overall rank of 0–20 being considered least desirable for inclusion in a reserve network, 21–30 receiving consideration for inclusion in a reserve network, and 31 or higher most desirable for protection.

Based on these groupings, all watershed units with medium and high biodiversity value were mapped on a separate mylar overlay for visual inspection. The boundaries of reserves, linkages, and buffer zones were drawn from this layer to form a regional network that offers a high potential of sustaining biodiversity and ecosystem integrity in the Columbia Mountains. Reserves were centered around clusters of watershed units that had high or medium overall scores.

Surrounding and intervening areas of lesser (but still significant) ecological value were used as the basis for delineating linkage and buffer zones. Linkage zones were designed to provide connectivity between high priority sites within the region, or to link proposed reserves in the Columbia Mountains with those in adjacent regions. Boundaries were drawn to include a wide variety of habitats that occur regularly in the landscape, such that they might provide for the dispersal and movement needs of a broad range of species.

Wherever possible, reserves and linkages were located in areas that have experienced the least degree of human development and disturbance. However, developed areas with significant biodiversity values are proposed for restoration and protection in cases where no other workable options remain. If managed appropriately, these disturbed areas could eventually recover to a more natural state. In total, five land designation categories were developed as a part of this plan: Class IA, Class I, and Class II Reserves, Linkage/Buffer Zones, and Matrix.

RESULTS

The conservation evaluation and reserve design process yielded 34 Class IA and I reserves and 30 Class II reserves embedded in a nearly continuous network of linkage and buffer zones located throughout the Columbia Mountains (Figure 2). Basic information on these proposed reserves is provided in Table 1.

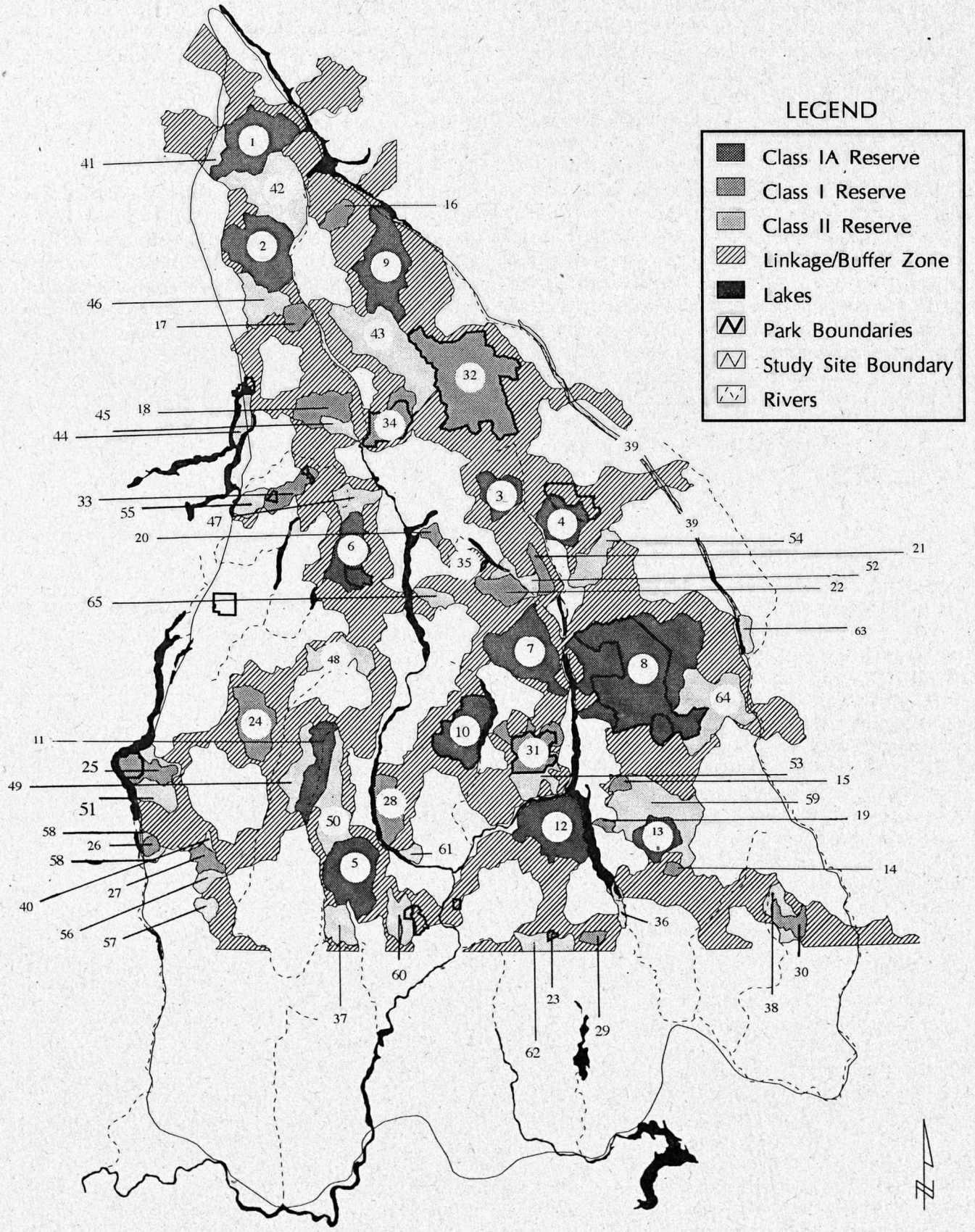
Class IA reserves

Relatively large (29,059–242,547 ha), undeveloped areas comprised of single large or multiple adjacent watershed units with high or medium biodiversity value were selected as Class IA core reserves. These reserves are sufficiently large and environmentally diverse that they can maintain most native species and ecological processes within their borders in the face of natural change, and thereby form the "anchors" of the regional conservation plan. In this proposal, 16 Class IA reserves

Table 1.
Class IA, I, and II reserves proposed in this study as part of a regional reserve network in the Columbia Mountains. Reserve numbers correlate with those shown in the adjacent map, and are for identification purposes only. They do not represent a ranking of areas for protection.

Reserve Class	Reserve Number	Name	Size (ha)
IA	1	North Monashee Range	71,074
IA	2	Scrip Range	76,877
IA	3	Westfall River/Laidlaw Ck.	29,059
IA	4	East/Geigerich Creeks	34,913
IA	5	Mt. Faith/Gladstone	64,946
IA	6	Gold Range	45,779
IA	7	Goat Range	74,201
IA	8	Central Purcells	242,547
IA	9	Windy Range/Upper Goldstream	74,492
IA	10	Valhalla Range	50,490
IA	11	Upper Granby River	39,424
IA	12	West Arm	68,516
IA	13	Upper Goat/Kianuko Creek	28,768
I	14	Cameron Creek	4334
I	15	Baribeau Creek	5067
I	16	Louis Lee Creek	13,011
I	17	Liberty/Fissure Creeks	12,235
I	18	Jordan River/Bews Creek	30,894
I	19	Lockhart Creek	3893
I	20	Hall/McKenzie Creeks	5992
I	21	Lake Creek	11,582
I	22	Mobbs/Tenderloin Creeks	20,675
I	23	Stagleap Provincial Park	1152
I	24	West Kettle River Headwaters	43,500
I	25	Okanogan Mountain	24,520
I	26	Mt. Christie	5594
I	27	Goat Creek	12,315
I	28	Valkyr Range	29,216
I	29	Corn Creek	5683
I	30	Gilnockie Creek (core)	13,326
I	31	Kokanee Glacier	41,872
I	32	Glacier National Park	135,508
I	33	Hunters Range	20,845
I	34	Mt. Revelstoke	33,897
I	35	Lew Creek	815
II	36	Creston Marshes	8184
II	37	Gilpin grasslands	20,339
II	38	Gilnockie Creek addition	15,430
II	39	Columbia River marshes	32,968
II	40	Goat Creek addition	2456
II	41	Lower Bone Creek addition	12,196
II	42	Soards/Pat/Nagle Creeks	74,449
II	43	Serenity Peaks	90,787
II	44	Shuswap Arm	11,545
II	45	Lower Jordan River	9655
II	46	Upper Seymour River	29,004
II	47	Blanket/Greenbush Creeks	19,522
II	48	Whatshan Range	29,012
II	49	West Flank Granby River	25,589
II	50	East Flank Granby River	45,209
II	51	Okanogan Mtn. extension	25,205
II	52	Lower Lardeau River	13,190
II	53	Kokanee/Sitkum Creeks	19,693
II	54	Howser Creek	27,692
II	55	Mt. Mara	12,726
II	56	Kelly River	8160
II	57	Upper Rock Creek	8449
II	58	Mt. Christie extension	5279
II	59	Redding/Meachen Creeks	76,537
II	60	Big Sheep Creek	23,192
II	61	Syringa Creek	5954
II	62	South Salmo/Priest Rivers	17,524
II	63	Columbia Lake grasslands	8360
II	64	Skookumchuck Creek	67,105
II	65	St. Leon Creek	10,532

Figure 2. Proposed regional reserve network; the numbers cross-reference to the descriptions provided in Table 1.



map courtesy of Evan Frost (GEA) and Jim Strittholt (TWP)

are widely distributed throughout the region and capture the majority of ecosystem types and landscape patterns. These reserves are also capable of maintaining well-distributed subpopulations of wide-ranging wildlife species (e.g., Grizzly Bear, Woodland Caribou). The proposed boundaries of core reserves frequently follow topographic breaks (ridgelines, watershed boundaries, etc.).

Class I reserves

Class IA reserves alone are not sufficient to create a fully representative, ecologically functional network of protected areas. Class I reserves fill deficiencies in coverage in terms of 1) under-represented ecosystem types, 2) adequate distribution of protected areas throughout the region, and 3) incorporation of existing protected areas that help satisfy some biodiversity protection goals. In a number of cases, these reserves are based on existing protected areas, including Okanogan Mountain and Stagleap Provincial Parks, Mt. Revelstoke and Glacier National Parks. Class I are generally similar to Class IA reserves, but tend to be smaller (1152–135,508 ha), and allow more forms of human activity, including pre-existing road access in some cases.

Class II reserves

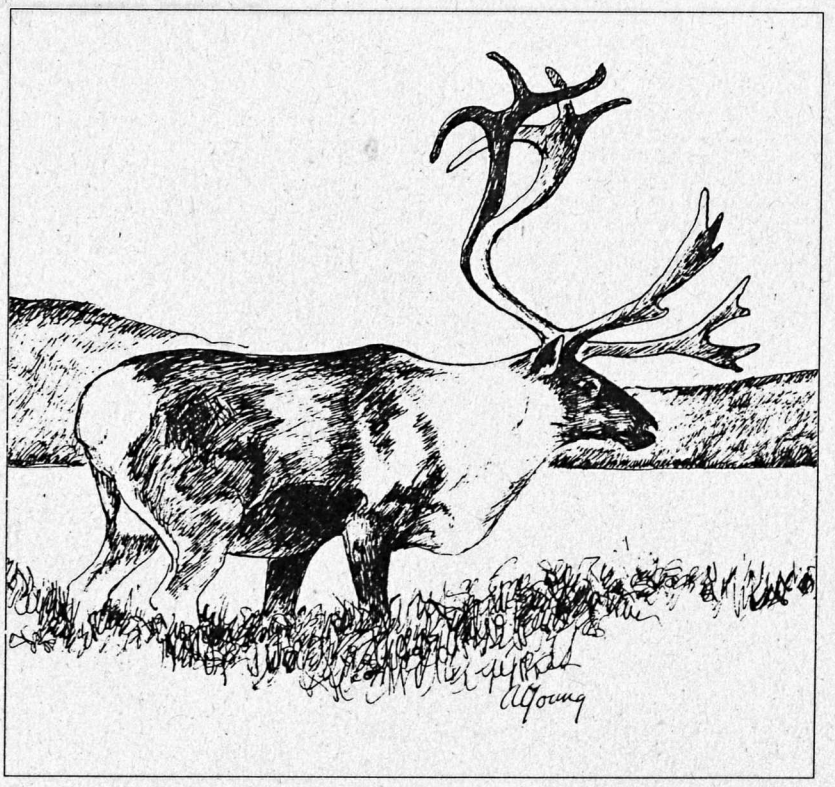
Variable in size (2456–90,787 ha), Class II reserves were necessary to fulfill a number of diverse functions in the regional network, such as protecting areas that: 1) have already been impacted by development, but are critically important to sustaining biodiversity (e.g., low-elevation forests); 2) are integrally connected to Class IA and I reserves, and greatly enhance their ability to sustain functional ecosystem units (e.g., parts of same watersheds); or 3) have high value for maintaining connectivity between reserves. Although past resource extraction activities may have compromised some ecological values, these areas are recoverable. Emphasis of future management in Class II reserves will be on restoration, including reducing road densities, revegetating disturbed sites, and controlling excessive sediment sources.

In total, the 13 Class IA and 21 Class I reserves proposed in this study cover 1,376,186 ha, or 18% of the Columbia Mountains. The total area covered by the 30 Class II Reserves is 755,940 ha, or 10% of the region. Buffer and linkage zones cover an additional 2.3 million ha (30%). Together, these four classes of conservation lands offer a high likelihood of maintaining biodiversity within the region while minimizing negative impacts to and from surrounding lands. Furthermore, the entire network is proposed to be similarly linked to adjacent regions (Continental Divide, Cariboo Mountains, North Cascades, Okanogan Plateau), thereby allowing for movement of species and processes across the entire Inland Northwest. Restored linkages to the south will be critical for the recovery of threatened carnivores and other wide-ranging species (e.g., Woodland Caribou) in the US.

A fifth designation category, the matrix, comprises lands outside the proposed reserve network that will continue to be devoted primarily to human uses, but where more sustainable, ecologically based land management practices should be applied. Within the matrix, a network of smaller "satellite" reserves, corridors, and forest use zones will need to be identified and delineated in order to maintain critical ecosystem structures and processes within managed landscapes (USDA Forest Service 1993, Hammond 1993, DellaSala et al. 1994). Sub-regional landscape plans consistent with the objectives of this study are being developed in the Columbia Mountains by the Silva Forest Foundation. These plans will provide a framework for integrating conservation planning at the regional and local levels, and will offer ecologically based models for sustainable human economies. Such a plan for the Slocan Valley, located in the central Columbias, is due to be released by the end of 1995.

Management guidelines

Development of management guidelines for proposed or existing reserves is a critical element of conservation planning,



Caribou illustration by Ann Young

but mostly beyond the scope of this study. Conditions vary greatly across the region, and management guidelines will need to be tailored to match specific sites and different circumstances. Table 2 lists some general guidelines for the land designation categories proposed in this report. These guidelines will need to be expounded upon and refined through further analysis to better fit various conditions using an adaptive management approach. Any management approach adopted should be viewed as an experiment and rigorously monitored so that management can be adjusted to reflect new knowledge (Holling 1978, Walters 1986).

Although some management changes proposed here can occur gradually over time, others should be implemented immediately. Clearly the first step is to cease all adverse habitat modifications associated with development (particularly logging and road-building) in proposed reserves. Many of these areas are under immediate threat, and failure to promptly protect them will irretrievably foreclose many options. Other actions, such as road closures, eradication of exotics, and stream restoration can take place over time, as regional and local priorities are determined and resources to carry out these projects are made available.

The Columbia Mountains Ecosystem is a transboundary region, and must be managed as such. Experience has shown that even the best designed conservation plan will fail if it does not include an effective means by which to work across multiple ownership boundaries and agency jurisdictions (Goldstein 1992). A mechanism for cooperative, international management will be essential to effectively carry out this plan. Some progress toward coordinated management in the region has been made. Interagency committees in charge of management programs for Grizzly Bears and Woodland Caribou have been established which include both American and Canadian representatives. These efforts must be broadened in the future to encompass all aspects of ecosystem management.

Table 2. General management guidelines for five land designation classes developed as part of the regional conservation plan for the Columbia Mountains.

Class IA Reserves

No logging, mining, road construction, or livestock grazing.
Limited trail systems and other access (follow typical Wilderness Area standards).
No motorized vehicles.
No collection of plants or other natural objects for commercial purposes.
Eliminate exotic species, as feasible.
Fire suppression to be determined on a case-by-case basis, but generally discouraged.
Hunting to be determined on a species-by-species basis, but generally no hunting of predators or any other species sensitive to population declines.
Light-impact recreation, environmental education, and non-manipulative research encouraged.

Class I Reserves

Same as above, but more opportunities provided for recreational access and non-extractive uses.
Trail systems more extensive than in Class IA reserves, but limited enough to provide habitat security for sensitive species.
Prompt closure of all roads except major highways and other roads necessary to maintain major access points (trailheads, campgrounds, etc.).

Class II Reserves

Non-commercial timber cutting permitted only in plantations and other previously logged areas to facilitate restoration of natural forest structure and composition.
No new road construction or re-construction. Prompt closure of unnecessary roads with obliteration and revegetation of roadbeds. Gradual reduction of overall road density to no more than 0.5 kilometers of road per square kilometer.

Buffer/linkage zones

Some level of timber cutting permitted, but emphasizing "new forestry" selection logging techniques, long (150-200+ year) rotations, and other ecologically based silvicultural systems that seek to emulate forest stand and landscape patterns created by natural disturbance regimes.
Restoration forestry and sustainable forestry experiments encouraged. Minimum levels of late-successional/old-growth forests to be determined for each climatic sub-region in the Columbia Mountains.
Reduce road density to no more than 1 km/sq km. New road construction is strongly discouraged, but when shown to be necessary, will follow strict guidelines that minimize environmental impacts.
Strong protection of all riparian areas and other sensitive sites, to be identified by a landscape or watershed-based analysis conducted prior to any new management activity.

Matrix

Conduct "fine-filter" landscape analyses to identify and protect a network of satellite reserves, corridors, riparian zones, and other sensitive sites.
Protect at least minimum levels of important ecological structures (e.g., large-diameter trees, snags, down logs, etc.) and allow natural processes to continue.
Practice sustainable resource production.

DISCUSSION

This report constitutes a blueprint for a long-term conservation plan in the Columbia Mountains based on the principles of conservation biology and landscape ecology. The major objectives of this regional conservation plan are to: 1) maintain and restore biological diversity and ecological processes at all levels of organization, and 2) ensure the sustainable use of species and ecosystems upon which long-term human survival and economic well-being depend. This proposal identifies 64 reserves totalling 2,132,126 ha embedded in a network of multiple-use lands that, if properly conserved and managed, would likely accomplish these goals.

Many of the areas of highest conservation priority identified by this analysis were similarly recognized in earlier studies of potential new protected areas in the province (BC PAS 1993, BC Ministry of Forests 1987, 1990, 1992b, BC Parks 1990). Although these studies utilized different evaluation methods and were restricted to propose only 12% of the region for protection, their recommendations for new reserves closely parallel our own conservation assessment. The results of our study also agree with "popular judgement" in that many areas previously pro-

posed as parks or wilderness (e.g., West Arm, Granby River, Serenity Peaks, Lockhart Creek) are also recommended for protection here. We predict that any additional ecological analyses of biodiversity conservation priorities in the Columbia Mountains will support the recommendations made here.

Additional analyses will be necessary in the Columbia Mountains to ensure that important "fine filter" elements of biodiversity (e.g., species, populations, and localized habitats that are at risk) not captured by this proposal are identified and protected. Finer scale conservation evaluations are particularly needed in the Okanogan Valley and Rocky Mountain Trench (for example, see Harper et al. 1992). These sub-regions support numerous imperiled elements of biodiversity that will require special management if they are to persist. While revision of the boundaries of these proposed reserves may be appropriate in some cases, revisions must be consistent with the basic principles underlying this plan: the full expression of biodiversity and ecological integrity throughout the region must be maintained over time.

One recognized limitation of this study is that it is based only on currently available information. More complete data on the distribution of rare and sensitive species, critical wildlife habitats, and other criteria would likely lead to a more refined land use plan. However, collection of this information would require considerable time and resources; the data are not likely to be available in the near future. The analysis presented here offers the benefit of quickly determining priorities for protecting biological diversity in this region, while such opportunities still remain. Delay to "study the issue further" is likely to result in reduced options and further loss of biodiversity as uncontrolled development continues.

Given the current condition of biological resources and continued adverse impacts of development, it appears that less than a decade remains in which to implement a land use plan in the Columbia Mountains that will successfully maintain the rich biological diversity of this region. Decisions regarding the protection of many critical natural areas need to be made soon, and land management practices on multiple-use lands must become much more ecologically sensitive. Failure to make changes soon would likely result in a future for the region that is biologically and economically impoverished for decades, if not centuries. We hope that the people, institutions, and governments of our respective countries can muster the will to successfully carry out this important work.

In Canada, a large complex of wilderness areas can and should be kept...It will be contended, of course, that no deliberate planning to this end is necessary; that adequate areas will survive anyhow. All recent history belies so comforting an assumption...To what extent Canadians will be able to see and grasp their opportunities is anybody's guess.

—Aldo Leopold
A Sand County Almanac, 1949

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Columbia Conservation Covenant Clashes with Provincial Politics

(and how to avoid such conflict in your region)

by Candace Batycki

WHEN GEA EMBARKED on the Conservation Covenant project we had high hopes for far-reaching effects on the conservation agenda in the region. We hoped for a boldly expanded, scientifically credible vision, embraced by empowered activists.

Two years later, with the project in final draft form, I wish we could report that all our dreams have come true. Our project has helped achieve significant gains in activist understanding and use of conservation biology concepts, and in broadening land-use planning agendas. The long-term effects of the project will only reveal themselves over time. But we have also encountered problems of timing, cost, and political opposition within the environmental movement. I hope an honest evaluation of our experience will protect other Wildlands Project proponents from similar pitfalls.

Mapping such a huge region was a very ambitious task, both scientifically and politically. We wanted to present a new paradigm, long-term and visionary, which inevitably means challenging old paradigms. Sure, every conservationist thinks protecting 50% of the landscape is a great idea, but is it still a great idea when the objective process does not back up protection of someone's favorite place? There are also difficult trade-offs between restoring vital or unique habitats versus protecting wilder areas. We took a lot of flack because we included in our proposal grassland areas that, though impacted by grazing and roading, are all that's left to provide habitat for certain endangered species. Science alone will not save us. There must be careful consideration of the social and political context necessary to translate wildland visions into reality, lest The Wildlands Project become merely an expensive exercise in elitist biophilia.

I would recommend initiating such projects only in areas where you already have history and connections; building the necessary trust is difficult when you parachute in. Our difficulty was compounded by GEA being a US-based group coming into Canada. Another strategy may be to establish at the outset a support committee to act as liaison into various communities (academic, activist, agencies). This committee could channel feedback and communications, and boost the project's profile and credibility. We relied on one person in the region (me) to explain a technical, complicated project to people who in some cases had already made up their minds about our supposed agenda.

Developing a credible proposal is a huge job. The vast amount of data needed for such an exhaustive process slowed us down. However, it was at the early, data-gathering stage that I feel we did our best outreach and education work. We were able to engage many activists in color-coding forest cover maps, which gave people "hands-on" ownership of the project, and provided an ongoing forum for education on conservation biology concepts. This firm knowledge base has endured and helped us through some very rocky political times.

The analysis stage was then done in Bellingham, Washington, 500 miles away. People in the region lost touch with the project. BC activists were grappling with the mother of all land-use processes, the BC government's Commission On Resources and Environment (CORE), which asked all "stakeholders," from environmentalists to forest industry majors, to sit down and be nice and figure out how to divide the "pie." You have to stay in touch if you want people to see your project as relevant to their work.

Add to this the ridiculous BC government goal of protecting 12% of the province. The 12% figure is arbitrary and meaningless. We did a pretty good job of debunking it but it still will not go away. The political context was changing, we were out of the loop, and aspects of our project were seen by some as inhibiting environmentalists "getting the most" out of the 12% problem. Suddenly asking for 50%, and including some impacted areas, was seen by some as political suicide. We'll only get 12%, went the cry, let's get the "pristine" areas first and then deal with the "restoration zones." People wanted us to change our maps for political reasons, not understanding that one of the key strengths of TWP-type efforts is scientific credibility. To change lines on our maps based on political desires, or data that was too localized, would have jeopardized the process of passing academic peer review. Without that stamp of academic credibility, we would be just another pack of "pie in the sky" visionaries, largely irrelevant.

(As an aside, we may have overestimated how important peer review and scientific credibility are in BC anyway. Very little of the wildlife research done here is ever peer reviewed. BC is a province rife with cliquishness, nepotism, and seat-of-the-pants science.)

I would also warn that to do this research properly is very expensive. It is crucial to be realistic about costs. You don't want to run out of money before the promotional stage.

Despite these warnings, I do not want to paint too dire a picture. Our work is well-respected by the majority of the activist and scientific community. We can be proud of the educational work done by Evan Frost, whose slideshow tours at the early stages helped educate activists and the general public on concepts of conservation biology. We have helped set the stage for broad public acceptance of ecosystem-based planning. Some of the strongest support for this work has come from progressive individuals within government agencies, particularly BC Parks and Parks Canada. These agencies want ecosystem-based planning, but as budgets shrink, they are increasingly turning to the activist community to take these concepts to the streets. There are also moves within the BC Ministry of Environment to increase the use of conservation biology in land-use planning. Even the provincial government is talking about connecting corridors now. While we can hardly take credit for this, we have helped influence it.

So continue. But lay your groundwork carefully, and be realistic about timelines and budgets, and strategic in your political and community work. If you can't afford to do it right, don't do it at all. And call us if you want to talk.

Candace Batycki is the BC Coordinator for the Greater Ecosystem Alliance (POB 2813, Bellingham, WA 98227).

"All of us at Exxon deeply regret..."

My sister's rage can't reach the surface yet,
and hangs, submerged, but lurking, in her speech.
"We are still grieving for Prince William Sound,
salmon, otter, bald eagles. The body counts are high
but meaningless. When they die, they sink.
We see the ones who are still dying."
There is no measure for measure, no way
to pay them back in their own coin.
"It's spring. The Kodiak bears are on the banks,
digging up clams. It'll be years before we know."
She would have the oil men as wretched
and sickened as she is. Her heart aches
with sorrow, loss and what to do.
"Last week we drove the kids down to Homer,
The sand and rocks and water were still clean,
—we rented a boat, fished, dug clams on shore.
The oil hung out a ways in Kachemak Bay—
Just to see it one more time, to say goodbye."

—Marty Williams, 2325 Roosevelt Ave., Berkeley, CA 94703

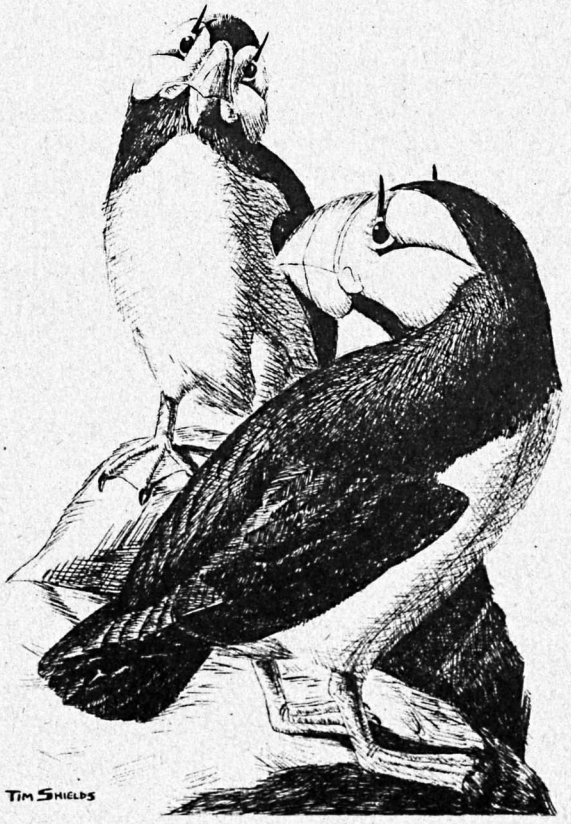


illustration by Tim Shields

The Environmental Consequences of Having a Baby in the United States

by Charles A.S. Hall, R. Gil Pontius Jr., Lisa Coleman, and Jae-Young Ko

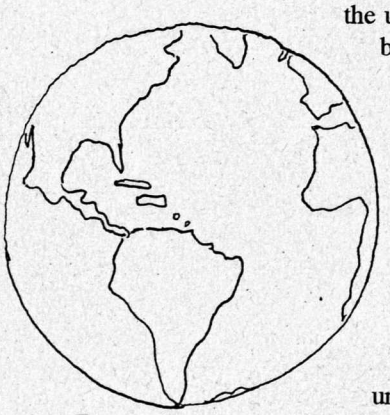
ABSTRACT

This paper gives crude estimates of the environmental consequences associated with the birth of one baby in the United States. Our purpose is to emphasize the role of population growth in the creation of environmental problems, and to make potential parents aware of their ability to affect the global environment. We conclude that one especially effective way for individuals to protect the national and global environment, and hence protect the well-being of all existing people, is to stop creating more humans.

INTRODUCTION

The United States' National Environmental Policy Act (NEPA) requires federal agencies to include a detailed statement of likely environmental impacts in proposals for major actions, such as the creation of new power plants. The idea of a formal environmental impact statement has been adopted by many states to cover private projects such as shopping malls. But what induces developers to propose projects that may damage the environment? The initiating force behind any large project generally is the desire to service or to extract profit from a human population. Therefore, environmental impacts that NEPA ostensibly attributes to development projects are attributable equally to the collective demand or desire of individual consumers. Thus, we view the environmental impacts of specific facilities as the product of the number of consumers and their per capita consumption rate.

It follows that, given a nation's level of affluence and technology, the nation's population size is closely associated with its aggregate environmental impacts. For example, at the 1990 living standard, a United States of 250 million people would cause roughly double the environmental impact of a United States of 125 million people. (The United States began 1994 with a population of 259.2 million persons and grows at an annual rate of 1.1%.) In some sense, then, the ultimate environmental impact occurs with the birth of each new human being, for a whole suite of production and consumption activities commence with that birth.



We provide here a first crude attempt to develop an environmental impact statement for the birth of one baby in the 1990s in the United States (an "American" for the purposes of this paper). We estimate the magnitude of one hundred environmental impacts that one American born today will cause over an expected lifetime. The impacts are grouped under five headings: 1) waste generation, 2) min-

illustrations by Andrew Paschetto

eral consumption, 3) energy consumption, 4) food consumption, and 5) ecosystem alteration. We also consider, but do not quantify, extinctions of species and indigenous cultures.

Our purpose is to refocus attention on the role of population growth in the creation of environmental problems. We believe the environmental impact should be one component (added to the many other legitimate criteria, such as emotional and economic) in the important decision a couple makes to create or not to create a child, and in the population policy a government chooses to follow. Although we report only detrimental environmental impacts, we do not wish to imply that humans create exclusively detrimental impacts, for obviously people do many good things toward other humans. To the contrary, we wish to protect the quality of life for all humans present and future, for we believe that everyone's quality of life is threatened by continued population growth.

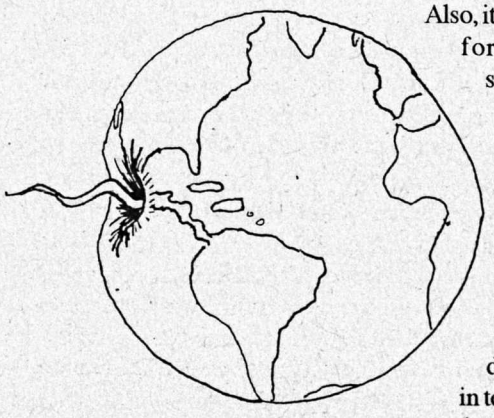
Many authors agree that environmental impacts are related closely to population growth (Ehrlich & Ehrlich 1990). Others have argued that technology offers a solution to environmental problems, and that population growth can make positive contributions to solving the world's problems (Simon & Kahn 1984). For us, the fundamental issue is stated best by Ehrlich et al. (1977), who developed a formula that expresses environmental impacts as a product of population, per capita consumption, and environmental impact per unit consumed, that is:

$$I = P \times (C/P) \times (I/C) \quad (1)$$

where

I = total environmental impact,
P = population,
C/P = resource units consumed per capita (i.e., affluence), and
I/C = environmental impact per resource unit consumed (i.e., residual efficiency).

Other things being equal, more people will generate more pollution. Of course, not all other things are equal. Some environmental groups have argued that humans should reduce affluence, but their perspective has had little or no noticeable effect at the national level. Also, it is immoral to call for reduced consumption in those societies or sectors where per capita incomes are at or below poverty level. Others, such as Fickett et al. (1990), predict that increases in technology will reduce substantially the rate at which humans produce pollution per unit of goods and services (Reddy & Goldemberg 1990). While we believe that technological advances have reduced and can reduce further the rate at which humans produce pollution, we believe also that technology has not been extremely successful in reducing overall national pollution, since very substantial pollution still exists and in some cases is increasing in the United States (U.S. Census Bureau 1991). Hall and Hall (1992) examined technological improvement empirically in developing countries, and found little or no evidence for increased efficiency over the past 30 years. They argued that any improvements in efficiency appear to be countered by factors such as ongoing decreases in the quality of raw materials associated with the effects of soil erosion, petroleum depletion, and other resource declines. Similarly, Nilsson (1993) found *decreasing* energy efficiencies in developing countries.



Many argue that pollution will decrease in the future as a consequence of the commitment of technology to pollution cleanup. Certainly, during the past 20 years some indices of pollution (including water pollution) in the United States have declined while the population and economy have grown. But during the same time new environmental problems, such as the impacts of hydrocarbons on ozone and widespread deforestation, have greatly intensified; and continued mining has further disturbed ecosystems, as mineral use has expanded and lower grade ores have been exploited increasingly (US Census; Hall et al. 1986). A related component, pointed out by the classical economist David Ricardo (Sraffa 1951), is that as populations expand, humans face diminishing returns on the efficiency with which they create goods, as it becomes necessary to use ever lower quality resources, such as lower grade ores and farmland on poorer soils and steeper slopes. In the future, humans will have to increase the quantity of environmental disturbance in order to compensate for the decreases in resource quality; thus population increase almost certainly increases the per capita environmental disturbance. While there is some evidence that the United States has become more efficient in its use of energy (Hall & Hall 1992), it is not clear at all that this is true for the rest of the world with which the United States increasingly trades. The technologically optimistic reader may choose to cut the impacts given in the tables in half (or by some other fraction) to reflect the possibility of technology's ability to reduce the impacts.

In short, efficiency improvement is greatly desired and may have great potential, but its impact to date is much less than many authors claim. In our analysis, we extrapolate present consumption levels because we are uncertain whether efficiencies will improve or decline, and because we do not know which way present levels of per capita consumption will change.

Moreover, if efficiency were to improve, fewer people would mean an even greater improvement in environmental quality. Hence we believe that the first term, population, in equation (1) has a critical role, even when the other terms are also important.

METHODS

It is extremely difficult to create a logically and statistically sound analysis to predict the environmental impacts caused by one individual. Nevertheless, this sort of analytical approach is required for people to see environmental problems in a new and personal light. With the help of a few simplifying assumptions, we analyze the available data to estimate the magnitudes of the environmental impacts. Our methods are straightforward; we use standard sources to predict total US impacts and from those values we derive per capita values.

We consider impacts to arise from both *effluents* and *consumption* (hence depletion of nonrenewable resources). We express the magnitude of each of one hundred environmental impacts in three different ways: 1) the annual aggregate impact produced by the entire United States; 2) the annual impact caused by an individual American today, which we calculate by dividing the first estimate by the appropriate year's US population; 3) the cumulative impact caused by an individual American over a lifetime, which we derive by multiplying the second estimate by the expected lifetime of a US citizen (presently 75 years; the impact would be larger if life span increases as expected).

RESULTS

An American born in the 1990s will produce in a lifetime about one million kilograms of atmospheric wastes, 10 million kilograms of liquid wastes, and one million kilograms of solid wastes.* An American will consume 700,000 kilograms of minerals, and 24 billion BTUs of energy, which is equivalent to 4000 barrels of oil. In a lifetime, an average American will eat 25,000 kilograms of animal products, provided in part by slaughtering 2000 animals.

TABLE 1

United States Waste Generation (Kilograms)

Item	National 10^6/Year	Per Capita Annual	Per Capita Lifetime	Source
AIR				
CO2	4,610,800	18,902	1,417,647	1
CO	61,400	252	18,878	2
SOx	20,400	84	6,272	2
Volatile Organic Compounds	19,600	80	6,026	2
NOx	19,500	80	5,995	2
Particulates	7,000	29	2,152	2
CFC	197	0.82	61	3
Lead	8	0.03	2	2
LIQUID				
Waste Water	33,679,000	138,064	10,354,837	4
Sewage Sludge	8,400	36	2,683	5
Waste Oil	4,900	21	1,581	5
Waste Solvents	3,000	13	978	5
SOLID				
MUNICIPAL WASTE				
Paper	42,400	175	13,152	2
Yard Wastes	23,900	99	7,426	2
Metals	10,600	44	3,288	2
Food Wastes	10,600	44	3,288	2
Glass	10,000	41	3,103	2
Plastics	8,700	36	2,697	2
Wood	4,900	20	1,515	2
Rubber and Leather	3,300	14	1,034	2
Textiles	2,400	10	739	2
Other	2,100	9	665	2
WASTE FROM MANUFACTURING				
Agriculture	1,400,000	5,851	438,818	5
Mining (not coal)	1,300,000	5,591	419,319	5
Industrial	628,000	2,625	196,841	5
Hazardous Waste	265,000	1,107	83,062	3
Demolition	97,960	409	30,705	5
Energy Production	72,000	304	22,785	5
Concentrated Acid	2,738	11	858	5
Uranium Discharge	2	0.07	0.5	2

Sources:
1. Boden, Thomas A., Kanciruk, P., and Farrell, M. (1990). *TRENDS '90: A Compendium of Data on Global Change*. Oak Ridge TN: ORNL.
2. U.S. Bureau of the Census (1990). *Statistical Abstract of the United States: 1990*, 110th edition. Washington: GPO.
3. The World Resource Institute (1990). *World Resources 1990-91*. New York: Oxford University Press.
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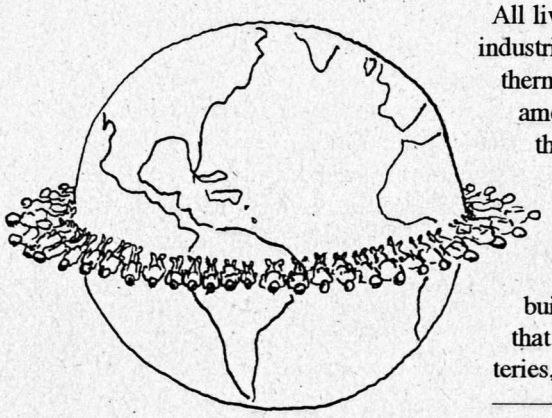
5. Organization for Economic Co-operation and Development (1989). *Environmental Data Compendium 1989*. Paris: OECD.

WASTE GENERATION



All living things produce waste, but human activity is a particular problem because industrial applications of modern chemistry often produce nonbiodegradable waste. Furthermore, increases in affluence and changes in lifestyles have increased the per capita amount of waste. For example, the municipal solid waste production per capita in the United States increased from 2.7 pounds per day in 1965 to 4.0 pounds per day in 1988 (US Census Bureau 1991). Table 1 shows waste production estimates classified by air, liquid, and solid. We subclassify solid wastes into two groups according to their source, municipal and industrial.

Municipal waste is post-consumer waste generated at residences, commercial buildings, and institutions (e.g., hospitals, schools, government offices). It is the waste that the final consumer produces directly. Discarded paper, food remnants, dead batteries, and yard wastes are all municipal solid wastes (US Congress 1989). The public

* A kilogram, or kg, is roughly 2.2 pounds.

TABLE 2

United States Mineral Consumption (Kilograms)

Item	National 10^6/Year	Per Capita Annual	Per Capita Lifetime
Stone	1,090,000	4,466	334,985
Sand & Gravel	837,000	3,431	257,362
Cement	85,000	349	26,187
Pig Iron	45,000	186	13,946
Clays	40,000	165	12,373
Salt	38,000	154	11,622
Phosphate Rock	36,000	146	10,971
Gypsum	24,000	98	7,376
Lime	14,000	59	4,434
Nitrogen (ammonia)	14,000	57	4,238
Sulfur	11,000	46	3,481
Soda Ash	6,000	25	1,911
Aluminum	5,000	22	1,681
Potash	5,000	21	1,564
Bauxite	4,000	15	1,096
Copper	2,000	9	675
Lead	1,000	5	370
Zinc	1,000	4	311
Feldspar	649	3	199
Fluorspar	644	3	198
Manganese	628	3	193
Magnesium	608	2	187
Silicon	508	2	156
Nickel	172	0.70	53
Mica	117	0.48	36
Tin	58	0.24	18
Titanium	18	0.07	6
Cobalt	8	0.03	2
Tungsten	6	0.02	2

Source: U.S. Department of Interior, U.S. Bureau of Mines (1990), *Mineral Commodity Summaries 1990*. Washington: GPO.
Note: Rounding is the source of apparent inconsistencies in table.

may think that municipal waste is the only waste for which we are responsible, but that is incorrect because industry produces wastes on our behalf.

Industrial wastes are those produced in manufacturing processes. In particular, industrial plants that produce electricity, refined minerals, and consumer goods also produce air pollution, waste water, and hazardous wastes (World Resources Institute 1990). These industrial wastes are by-products of consumer demands.

The following example illustrates how an individual generates municipal and industrial wastes. In 1990, Americans bought 660 million rolls of 35 millimeter film (*Syracuse Herald Journal* 1991). In 1989, the Kodak company dumped more than 9 million kilograms of toxic chemicals into the New York state environment (*The Post-Standard* 1991). Although the quantity of waste per roll of film is decreasing, more rolls of film are used over time.

MINERAL CONSUMPTION

Humans mine an increasing volume of minerals to satisfy the increasing per capita demands of an increasing number of humans. To obtain the minerals, mining companies initially exploited high grade ores, then lower grade ores. For example, over the past 100 years the mean grade of copper ore dropped from 4% to 0.5% (Hall et al. 1986). When miners exploit low grade ores, they disturb a proportionately larger amount of land compared to when high grade ores are mined.

ENERGY CONSUMPTION

One view of the relationship between economic activity and environmental impact is that each time a person spends a US dollar approximately 3000-4000 kcal of energy (about 15 Joules, or the equivalent of one half liter of oil) are extracted from the earth and burned to produce the goods or services purchased by that dollar (Hall et al. 1986). Producers of goods and services use the energy in many ways. For example, industries consume fuel to change low grade energy such as coal into more useful energy forms such as electricity. The industrial sector then uses electricity to manufacture goods. Farmers use energy directly in tractors and indirectly in fertilizers, so that almost four liters of oil are used each day to feed an American (Hall et al. 1986).

Energy consumption causes resource depletion, hence in time humans will exhaust the useful energy resources and those particular energy impacts will be eliminated. Although there is considerable debate in scientific circles about how much energy remains, the techniques for determining the amount of remaining oil (the most important energy resource) are well developed, and estimates of ultimately recoverable reserves have changed little over time (Hubbert 1974; Hall et al. 1986). For example, Hubbert predicted in 1955 that US oil production would peak in 1970, which it did. Hubbert predicted in 1968 that the lower 48 States would ultimately produce a maximum of 200 million barrels. By 1990, the US had produced and consumed about 130 million barrels of oil, which is about two-thirds of its original oil resources. There is little evidence that the United States will ever extract more oil than Hubbert predicted. While there is a great deal of oil in the rest of the world, perhaps enough to last one hundred years at present rates of gross consumption, or

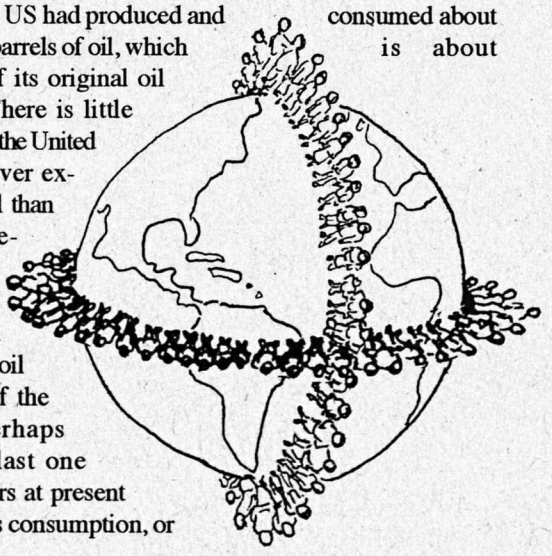


TABLE 3

United States Energy Consumption (British Thermal Units)

Item	National 10^{12}/Year	Per Capita 10^{6}/Year	Per Capita 10^{6}/Lifetime
Petroleum	32,900	130	10,100
Coal	18,000	74	5,500
Natural Gas	17,700	73	5,400
Nuclear	4,900	20	1,500
Hydroelectric	3,100	13	900
Geothermal and Other	300	1	90
Total	76,800	315	23,610

Source: U.S. Burearu of Census (1990). *Statistical Abstract of the United States: 1990*, 110th edition. Washington: GPO.
Note: Items do not sum due to independent rounding.

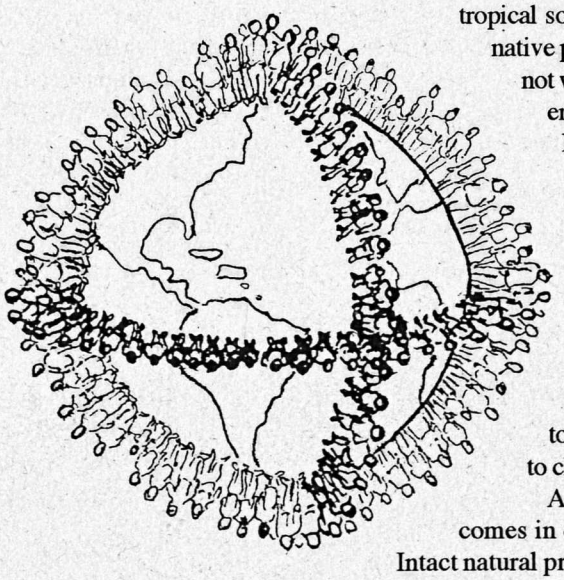
perhaps one-third of that if consumption rates continue to grow, the energy and monetary cost to locate, extract, and refine new energy supplies has increased greatly as humans have depleted the most accessible resources (Hall & Cleveland 1981; Cleveland 1992). The world will not run out of oil within the next few decades, but in less than a generation most oil outside of the Persian Gulf region and perhaps Russia will be gone. Obviously, humans should not take for granted that the people who live in oil-rich regions will allow others access to the bulk of that oil, especially as the oil producers' needs increase. One issue related to environmental impacts is, when the inevitable depletion of global oil occurs, will humans use less energy or instead turn to fuels with greater environmental impact, such as coal?

FOOD CONSUMPTION

The environmental impact of an American's food consumption is a function of the American diet and food production methods. In the United States, food production is as industrialized as most other aspects of US society. For example, to produce one kilocalorie of food requires, on average, about 10 kilocalories of oil (Hall et al. 1986).

The high rate of meat consumption in the United States is particularly significant. The natural resource degradation entailed is related in part to the large amount of energy required to produce meat. For beef cattle fattened in feedlots, production starts with planting, irrigating, fertilizing, harvesting, transporting, storing, and processing feed. Farmers fatten cattle on large feedlots where the concentration of feed and cattle produces enormous amounts of waste. Feedlots also deplete and pollute water supplies.** The consumption of beef reflects US energy use, as it takes about five to ten times more energy to produce meat than to produce an equivalent food-energy amount of grain (Pimentel & Pimentel 1979; Steinhart & Steinhart 1974).

Furthermore, some of the beef consumed in the United States is produced on fragile tropical soils, which have been cleared of native vegetation, and sometimes of the native peoples (Myers 1981). Many of the tropical areas on which cattle graze are not well-suited ecologically for cattle ranching. Joseph Tosi of the Tropical Sciences Center at San Jose, Costa Rica, estimates that in some areas of Costa Rica, 100 kilograms of topsoil wash down the rivers for every kilogram of beef produced. Although Central America supplies only 1% of US beef consumption, the United States consumes 90% of the beef produced on recently cleared forest land in Central America (Burger 1987).



ECOSYSTEM ALTERATION

Humans are changing the face of the earth more rapidly than ever before and currently utilize about 40% of potential terrestrial net primary productivity on this planet (Vitousek et al. 1986). Humans have the tools to cut down in a few hours a forest that took hundreds of years to grow, and to change highly diverse meadows to a single-species crop.

All types of ecosystems are affected by humans, but the largest change comes in conversion of forests and natural grasslands to cropland and pastures. Intact natural prairies in the United States are less than 1% of their original area (World

** Probably more destructive than feedlots are "free-roaming" cattle on arid and semi-arid lands of the West, which are responsible for desertification and loss of native biodiversity. —*Science Editor*

Resources Institute 1990). Only about half the original forest area remains. In the Eastern US forests, are in some ways recovering, but the recovered forests are different and often less diverse than "virgin" forests. Moreover, about one and one half hectares of land is kept in a state of deforestation for each US citizen (Terborgh 1989).

Americans also alter wetlands, presently at a rate of between 300,000 and 500,000 acres per year (Feierabend & Zelazny 1991; *Christian Science Monitor* 1991). Wetlands are turned into housing developments, shopping malls, and especially, agricultural land. As the amount of land in each ecosystem decreases, it affects the species that reside there. An amount of fertilizer equal to an average American's weight is used per person per year.

TABLE 4

United States Food Consumption

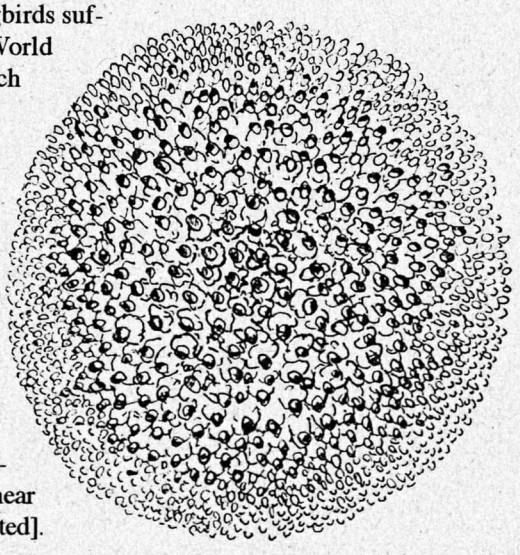
Item	National 10^6/Year	Per Capita Annual	Per Capita Lifetime
	(Killograms)		
PLANT			
Vegetables	18,900	77	5,797
Sweeteners	16,800	69	5,151
Wheat Flour	14,200	58	4,355
Fresh Fruit	10,900	45	3,354
Potatoes	8,400	34	2,586
Citrus Juice	5,100	21	1,582
Milled Rice	1,500	6	456
Coffee	1,100	5	347
Canned Fruit	960	4	296
Beans	870	4	269
Peanuts	700	3	214
Cocoa	540	2	169
Dried Fruit	340	1	105
ANIMAL			
Milk	66,200	271	20,351
Beef	8,100	33	2,497
Chicken	6,900	28	2,133
Pork	6,600	27	2,014
Fish	1,700	7	524
Turkey	1,700	7	514
Offals	950	4	293
Veal	170	0.7	51
Lamb and Mutton	140	0.6	44
	(Head)		
Chicken	5,381	22	1,654
Turkey	240	1	74
Pork	81	0.33	25
Beef	36	0.15	11
Lamb and Mutton	5	0.02	2
Veal	3	0.01	1
Eggs (#)	60,740	249	18,675

Source: U.S. Bureau of Census (1990). *Statistical Abstract of the United States: 1990*, 110th edition. Washington: GPO.

SPECIES EXTINCTION

According to various sources, the Earth is losing from 10,000 to 100,000 species per year, a rate hundreds of times higher than the natural rate (Lugo 1988). Americans affect the species extinction rate in many ways. When Americans alter ecosystems directly (or indirectly through their purchases), almost all the species in that ecosystem are affected, some for better, most for worse. For example, when an American purchases a wooden house, at least some of the lumber is probably from Pacific Coastal forests, home to the threatened Northern Spotted Owl (and many other species!). When a section of that forest is clearcut, the canopy is opened, and new and different predators move in. One such predator is the Great Horned Owl, which preys upon the Spotted Owl. Other species may be affected in more complex ways.

Humans also cause species extinction through urbanization and habitat fragmentation. As the countryside is divided into smaller plots, many types of songbirds suffer because the songbirds need unbroken habitats in which to breed (World Resources Institute 1990). Such unbroken habitats are becoming much scarcer in the eastern United States. Deforestation from timber production and pasture development in the tropical countries where they overwinter further impacts these birds (World Resources Institute 1990). Many songbird populations are disappearing slowly as the habitat needed for breeding decreases (Terborgh 1989).



The United States is home to perhaps 500,000 species. Some 6000 of these species (including subspecies) are considered rare or endangered, or have been proposed for that listing. In one opinion, three quarters of these 6000 species are likely to go extinct in the next 75 years (Brussard, personal communication). Principal reasons are thought to be the growing human population in the United States and Americans' increasingly affluent lifestyle (Brussard, personal communication). On the other hand, some species, such as deer and geese, do better near humans [so long as basic habitat requirements are met and hunting is regulated].

EXTINCTION OF INDIGENOUS CULTURES

Consumers in industrialized countries affect indigenous cultures in other nations. Most obviously the exploitation and settlement of North America by Europeans reduced the native population from perhaps 10 million individuals to fewer than 1 million (Zinn 1980). While today's impact on native North Americans is less directly lethal, indirect impacts continue.

Although it is impossible to quantify the impact of resource consumption in the United States on indigenous cultures, one may illustrate how US economic activity affects them. We calculated the amount of Brazilian iron ore Americans consume, and focused on the impacts of its source, the Grand Carajas iron mines in the Amazon. The Grand Carajas mines enable Brazil to maintain its position as the leading exporter of iron ore. Charcoal obtained from nearby forests fuels the mines, hence the forests around the mine will last no more than 20 years (Treece 1989). Brazil is planning to build new dams to supply additional power for the mines and other export-driven industries. One of the dams will create the world's largest artificial lake, which will affect both the land inundated and the land downstream, which will be disturbed by the dam's irregular water discharges. If completed, the whole Greater Carajas Development Project will directly disturb in excess of one million square kilometers (Forrest 1991), more than the area of France and the United Kingdom combined. This area is more than one-fifth of Brazil's Legal Amazon (World Resources Institute 1990).

The estimate for the number of tribal or indigenous people on Earth is about 250 million (Burger 1990). One-fifth of the global total are thought to live in rainforests. About 120 tribes, or distinct cultures, inhabit the lowland Amazon (Burger 1987), and 40 of these (totaling 13,000 people) inhabit the area of the Grand Carajas mines (Treece 1987). Thus, the Carajas mines will displace at least 13,000 indigenous people.

The United States in 1989 imported from Brazil 5.1 million long tons of iron ore, which is more than one quarter of US iron ore imports for that year (US Census Bureau 1991). The US imports about 3% of Brazil's mining output (Economist Intelligence Unit 1989) and is thus implicated in about 3% of the environmental impacts caused by the Carajas iron ore mines, including extinction of indigenous Amazonian cultures. This percentage is a lower bound because we have not considered the amount of the mines' output that other countries use to create products for the US market, nor the amount Americans consume of other Brazilian resources.

And recently, a very large displacement of Cree Indians in Quebec, Canada, has occurred in large part to supply electricity to the eastern United States. This US demand for foreign electricity exists in part because of cancellations of proposed power plants on the Hudson River. These cancellations were made in part to protect the fish of the river, ironically, a concern originally analyzed in an ecological assessment carried out by the first author of this paper! (Hall & Day 1977). Thus it might be said that this one American (the first author) has caused a severe impact on the Cree.

TABLE 5

United States Ecosystem Alteration

Item	National 10^3/Year	Per Capita Annual	Per Capita Lifetime	Source
	(Hectares)			
Forest Loss	2,558	0.011	0.84	1
Cropland Expansion	169	0.001	0.06	1
Wetland Loss	162	0.001	0.05	2
Area Treated				
Fertilizer	85,419	0.4	26‡	3
Herbicide	69,319	0.3	21	3
Insecticide	27,852	0.1	9	3
Irrigation	18,992	0.1	6	1
	(Kilograms)			
Fertilizer	17,662,000	72	5,430	1
Pesticide	373,000	2	119	1
	(Cubic Meters)			
Water Withdrawal	517,321,000	2,126	162,150	1
Timber Consumption				
Industrial	467,563	1.9	144	3
Fuelwood	85,951	0.4	26	3

Sources:
1. The World Resources Institute (1990). *World Resources 1990-91*. New York: Oxford University Press.
2. Feierabend, J.S., and Zelazny, J.M. (1987). *Status Report of Our Nation's Wetlands*. Washington: The National Wildlife Federation; *The Christian Science Monitor* (21 November 1991), p. 1.
3. U.S. Bureau of the Census (1990). *Statistical Abstract of the United States: 1990*, 110th edition. Washington: GPO.
‡May be same area from one year to next.

DISCUSSION

Tables 1–5 give estimates of the environmental impacts in terms of an "average" resident of the United States. Our choice of this reporting unit has been guided in part by the data available, which are aggregated to the national level. We do not suggest that any particular American causes the exact amounts of each of the estimated impacts. It seems reasonable to attribute much less environmental degradation to a hungry, homeless person or to a person following a simple environmentally conscious lifestyle, than to an extremely wealthy or prodigal consumer. On the other hand, a wealthy American who dedicates his or herself to conservation and population stabilization may compensate for some of the impacts.

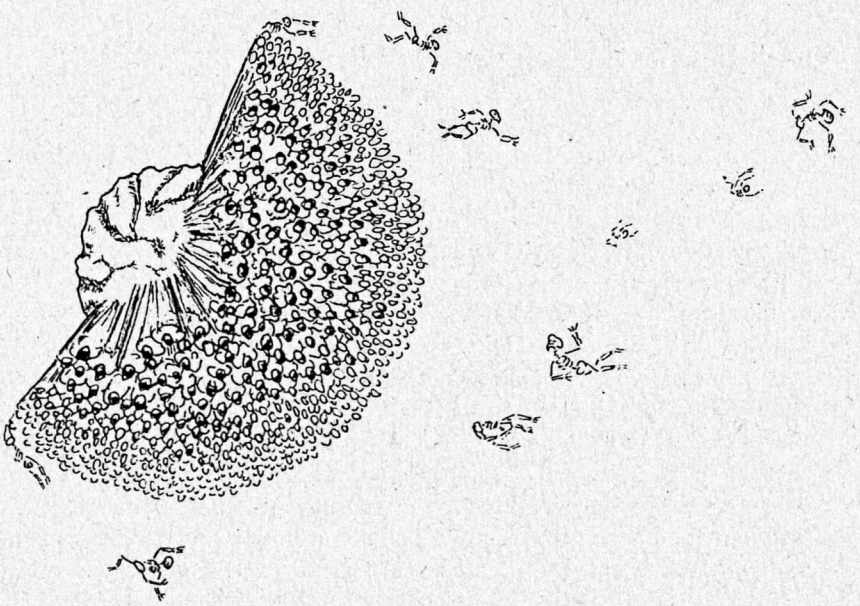
Nevertheless, aggregation to the national level makes sense because 1) most Americans follow middle class lifestyles, and 2) components of the US economy are interconnected, hence an

individual's environmental impacts are, to some extent, independent of personal lifestyle. For example, public expenditure is more than one-third of US GNP (US Census Bureau 1991), and public sector activities, such as road construction, law enforcement, public education, public administration, and military actions, exist on one's behalf regardless of individual lifestyle.

Even you, the reader, are creating resource demands as you "consume" this article. Begin with the text of this paper, which is a product of academic research. In order for researchers to work, one needs universities. The universities require resources to build and much energy to run. In addition, our university needs insurance to protect its buildings and equipment. In order for the insurance system to work, insurance company employees fly to meetings in airplanes. To feed the insurance company employees, the airlines serve (among other things) roast beef. To produce the beef, cattle eat corn. To grow the corn, farmers spray fields with fertilizers and pesticides. So, in a sense, you (and we) are in part accountable for the fish dying in the water, poisoned by the pesticides sprayed to protect the crops, to feed the cattle, to feed the insurance company employees, to insure the university, to support the researchers, to write this article. We have not even mentioned the computers, paper, or postal system, etc., used directly by us to produce this paper and by you to read this paper. As you can see, it is almost impossible to specify the resource demands of a specific individual's lifestyle or purchases, because the processes of the economy are so interwoven. Thus we have found it most appropriate to use broad national averages.

We have just argued that it makes sense to use a typical American as our reporting unit because the US economy is intricately interconnected. But the global economy is also interconnected, so why do we not report our results in terms of global per capita impact without regard to nationality? One reason is that the United States is substantially different from other countries when it comes to population growth and per capita consumption rate. The US impact is very high and relatively stable. This is not the case everywhere.

Within a decade, the world may have another billion people (US Census Bureau 1991). More than half of the next billion people will live in



South and East Asia, 42% and 19% respectively. Approximately one quarter will be Africans, and 10% will be Latin Americans. The United States, Canada, Russia, and all of Europe will account for only about 5% of the world's next billion people. Nevertheless, any US population increase will cause much environmental damage because the US per capita consumption rate is 10 to 100 times that of most of the world's countries.

Consider China, India, and the United States. During the next decade, India and China will each add to the planet about 10 times as many people as will the United States. Nevertheless, if per capita consumption levels stay constant, environmental degradation and natural resource depletion caused by the US population increase may exceed the environmental stresses caused by the increase in the populations of India and China combined. Compared to Indians, Americans (on a per capita basis) produce 27 times as much carbon dioxide (Boden et al. 1990), spend 101 times as much on the military, and consume 127 times as many telephones, 116 times as many televisions, and 35 times as much energy (US Census Bureau 1991). Furthermore, the American per capita consumption of resource-expensive meat is almost the same in mass as the Chinese per capita consumption of rice (US Census Bureau 1979-1988). Although the impacts on ecosystems (e.g., erosion and deforestation) are very large in China and India because of the large number of people, the per capita impact of a new person is greater in the United States. Thus, although we think that population control is critical in the developing world (because the developing world needs to balance its resource demand with its resource availability), population control in the United States is as important in determining the health of the planet.

Many factors influence one's attitudes and actions concerning the environment. Curiously, almost all of contemporary US culture is oriented toward increasing consumption of almost all resources. Some religious sects promote unrestrained procreation. The US media uses advertisements incessantly to encourage resource-consuming lifestyles and the identification of personal worth with consumption. The universities teach consumption insatiability as a basic axiom of introductory economics, which rarely examines the consequences of personal consumption on the environment. Although the present formal educational system is partly responsible for environmentally destructive American attitudes, we believe that education offers a channel for attitude change. We believe that education should be transformed from principally a discipline-oriented endeavor, which teaches economics separate from ecology and both separate from energy, into a multidisciplinary endeavor (Hall 1990). If Americans learn the effects of consumptive lifestyles, they may alter their behavior to reduce their impacts on the environment. We hope this article is a step on the road to a new environmental consciousness, one that links environmental activities to economic activities and reproductive choices.

CONCLUSION

From the perspective of the mother, father, family members, and friends, the arrival of a new baby is usually considered a wonderful event, as indeed it is; but from the perspectives of the world's natural ecosystems, another human being means additional strains on already severely strained resources. In the past, one additional human caused a relatively small impact on a large pool of the world's resources, but today each additional person has a much larger impact on a smaller pool of the world's remaining resources. We have predicted the magnitude of one hundred environmental impacts an American baby will cause during her or his lifetime. The total is an astonishingly large and complex set of impacts. This paper shows that the USA's growing population, combined with its high per capita consumption level, limits the well-being of this and future generations everywhere, including other species and cultures.

Many Americans are looking for ways they can help protect the environment. The success of such aspirations will be influenced by American economic processes, government regulations, cultural attitudes, educational orientations, and technological advances and limitations, which are outside the control of most individuals. But the decision to create a child is within the control of an individual. We would like all potential parents to be aware that, of all the decisions they will ever make, their decision on whether or not to create a child will have the largest impact on our global environment. The most effective way an individual can protect the global environment, and hence protect the well-being of all living people, is to abstain from creating another human. ▮

ACKNOWLEDGEMENTS

This paper began as a class project in the course Ecology for the Economic Process taught by C.A.S. Hall at SUNY/College of Environmental Science and Forestry. The authors would like to thank class members for their contributions: Glynnis Collins, Jim Creveling, Stephen Douglas, Dan Rooney, Leanne Rosa, and Christine Simones.

Please address correspondence to Dr. Hall, Department of Environmental Forest Biology, State University of New York/ College of Environmental Science and Forestry (SUNY/ESF), 302 Illick Hall, Syracuse, NY 13210. *A longer version of this article appeared in* Population and Environment: A Journal of Interdisciplinary Studies *(1994 Human Sciences Press, Inc.) and is reprinted with permission.*

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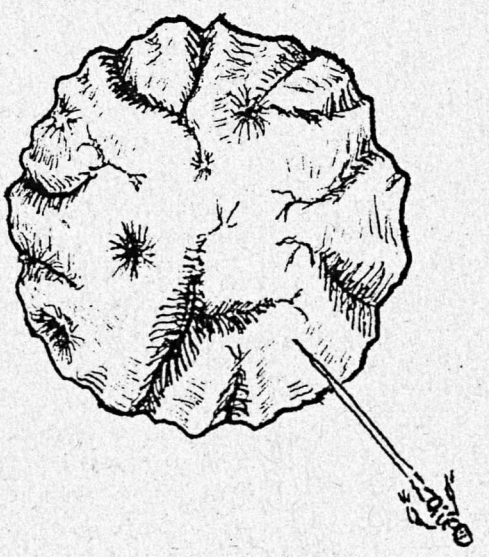

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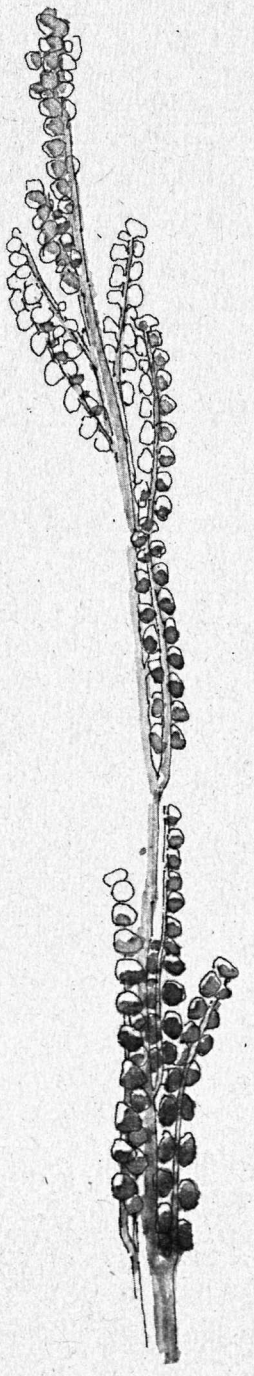
Book Reviews



Spirit and Nature: Why the Environment is a Religious Issue

edited by John Elder and Stephen Rockefeller; Beacon Press (25 Beacon St., Boston, MA 02108); 1992; $16; 226p.

The global environmental crisis, which threatens not only the future of human civilization but all life on earth, is fundamentally a moral and religious problem. It calls upon us to exercise our human freedom with a renewed sense of humility and responsibility (1).

In the fall of 1990 at the Middlebury College campus, an important event took place. Leaders representing an array of religious traditions participated in a four-day symposium designed to promote discussion and understanding of the environmental crisis and its connection to the crisis of spirituality and faith also evident in our society today. *Spirit and Nature: Why the Environment is a Religious Issue* is a volume of essays that reflects the interfaith dialogue that took place at Middlebury during those four special days. I was fortunate enough to be attending Middlebury at that time, so I can attest that this volume does indeed reflect the great wisdom and sensitivity the speakers shared with the participants as they tried to understand the problems at hand and initiate a search for solutions.

Stephen Rockefeller's essay "Faith and Community in an Ecological Age" discusses the basic premise of the volume irrespective of any particular faith; that is, the environmental crisis is also a spiritual crisis. To understand what brought human beings to their present state, we must look at the values and morals that guided people through the ages. The predominant Western traditions, namely Judeo-Christian ethics and Cartesian-Newtonian philosophies, have created a mechanistic society driven by economic progress and spiritually removed from natural surroundings. Our Western philosophies, impressive though the technological advances they've facilitated may be, have led human beings away from a holistic life, away from the species with whom we share the Earth, and away from a life filled with compassion, care, and restraint. The book's contributors see the need for "...a commitment, so wholehearted as to be justly termed religious in quality, to a new ecological worldview involving a dramatic transformation of the moral values and basic attitudes that govern life in the industrial-technological world. Only such a radical shift in values and attitudes will bring about and sustain the full range of required social changes" (141).

While the essays in the anthology vary as much as the faiths they represent, several ideas are consistently part of the discussion. Religion, the speakers agree, is about guidance, co-existence, and responsibility. Religion sets moral guidelines by which communities should live. Almost every leader in the anthology emphasized community and responsibility. The idea of community, both human and global, is central to overcoming both the spiritual and environmental crises. Responsibility, likewise: people must be accountable for their actions and the effects the actions have on the planet.

In an era when many theologians are finding deep flaws in traditional faiths and abandoning them, others are reevaluating their traditions to demonstrate that they actually provide insights valuable in confronting the global environmental crisis. Dr. Ismar Scorsch is one of those leaders. He defends the Jewish tradition against charges that Judaism is dualistic and anti-nature. According to Scorsch, Halakhah, the extensive legal tradition by which a Jew should guide his or her life, outlines a path very much in keeping with important environmental principles. Says Scorsch, Halakhah teaches compassion and kindness toward the animal kingdom, but most important, Halakhah teaches restraint. Jews do not need to turn away from their faith to show concern for the environment; they must simply turn more truly to the wisdom perhaps neglected by recent generations.

Unlike Scorsch, Sallie McFague does not reevaluate old symbols and ideas within

illustration by Susan Pedicord

her faith in an effort to prove that Christianity has always aligned itself with environmentally sound ideas. Rather, she looks for more liberating images that could be helpful for today's needs. The Christian worldview has been deeply anthropocentric and androcentric. A dominating and patriarchal male God has taught aggression and domination. Metaphors, McFague contends, are not permanent institutions but malleable ideas that shape and instruct people. They must be changed when they no longer prove useful to the community that created them. "No matter how ancient a metaphorical tradition may be, and regardless of its credentials in scripture, liturgy, and creedal statements, it must still be discarded if it threatens the continuation and fulfillment of life" (50). If our God is not male but all-inclusive, not dominating but nurturing, then it will help create a more nurturing, compassionate, inclusive world.

If Scorsch's lesson is restraint, elder Audrey Shenandoah's lesson is thanksgiving. The wisdom of indigenous cultures has been overlooked in Western history. Only in recent years have indigenous insights and philosophies been acknowledged as valuable. Indigenous peoples claim a great attachment and bond to the Earth and all her gifts. Human beings are seen as a small part of the creative process. If we acknowledge that we belong to the Earth, then we cannot but help to give thanks for it and protect it: "We [the Haudenosaunee] have been portrayed as people who worship the sun, who worship elements of the creation, and that is incorrect. We give thanks, we respect, and we acknowledge all the rest of creation" (21). People have forgotten, Audrey Shenendoah says, to give the proper thanks.

In sum, *Spirit and Nature* is a moving collection of essays written by some of today's most inspired voices. The anthology offers valuable suggestions on how we can find solutions to the environmental and spiritual crises and find more humble and respectful paths. ▮

Reviewed by Sarah Humphries, Wild Earth *intern*

An Unspoken Hunger

by Terry Tempest Williams; Pantheon; 1994; $20; 144p.

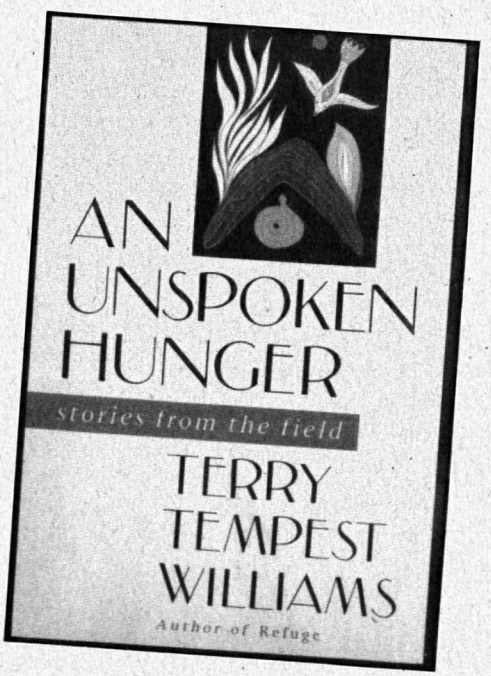
People who, like Terry Tempest Williams, live deeply in the land could each fill a book with reasons to regret being human. Who can stand across from a desert mesa, its red guts spilling out in mine tailings, or look at Coyote pelts flapping on a barbed wire fence without wondering whether we've traveled beyond hope? As a guide, Terry does not use despair as an escape route. She refuses to give up on people. In her new book of stories, *An Unspoken Hunger*, Terry explores connections and collisions between people and nature while keeping us firmly tied to each other and to our souls.

An Unspoken Hunger is an honest and elegant book. Remove the dust jacket and you will be holding a finely crafted field journal, the creamy, speckled brown of a wren's egg. Terry's stories from the field come from as far away as Africa, but center on her native land, the Great Salt Lake Basin of Utah. "In the Great Basin, I can read the landscape well. I know the subtleties of place. A horned lizard buried in sand cannot miss my eyes, because I anticipate his ... And when a great horned owl hoots above my head, I hoot too. Home is the range of one's instincts."

Terry's travels also take her to places as foreign to a naturalist as New York City's South Bronx or the lobby of the Mirage Hotel in Las Vegas. Whether floating in an enchanted pool under the watchful eye of Stone Creek Woman or staring at live white Siberian Tigers on display in a hotel lobby, Terry's connection to the wild endures. "We can try and kill all that is native, string it up by its hind legs for all to see, but the spirit howls and wildness endures."

Besides her talents as a naturalist, Terry is a gifted writer. Her style bridges prose and poetry, testimony and liturgy. She repeats a circular pattern in her tales from beginning to end. "Yellowstone: The Erotics of Place" begins and ends with the same incantation: "Steam rising. Water Boiling. Geysers surging. Mud pots gurgling...Lightning striking. Trees burning. Thunder Clapping. Smoke clearing. Eyes staring." When she adds the line, "Wolves howling into the Yellowstone," Terry reintroduces wolves into the Park. This is magic.

Located in the heart of the book, the short title piece is a poem not broken into line: "We look at each other and smile, eating avocados with sharp silver blades, risking the blood of our tongues repeatedly." Terry recognizes that formalities of style which shape a written work are abandoned in speech. Her stories are for telling, written for the ears and for the heart. Her willingness to dance so gracefully between different genres adds unspeakable beauty to her book.



Utne Reader (January 1995) chose Terry Tempest Williams among 100 visionaries "who could

change your life." The *Utne* 100 were selected by the editors for "liveliness, richness, conviction and clarity of their vision." The beauty of her language lets her voice soar, but it is her commitment to all nature, especially human nature, that gives her visionary power. Terry believes in people. Whether she profiles individuals we know such as Georgia O'Keeffe, Edward Abbey, and Mardy Murie, or personal heroes like her two uncles, her connection to each one comes through. She thinks of people in the context of community, the Coyote Clan: "individuals who are quietly subversive on behalf of the land."

In "A Eulogy for Edward Abbey," Terry writes about the Clan: "They are joyful and they are fierce. They can cry louder and laugh harder than anyone on the planet. And they have enormous range... Members of the Clan court risk and will dance on slickrock as flash floods erode the ground beneath their feet. It doesn't matter. They understand the earth recreates itself day after day..."

Do not wander into the wild canyons of *An Unspoken Hunger* expecting to find a way out. Terry's stories are richly braided, filled with paradox. She is not a guide given to following a single path. In "Undressing the Bear," she pauses to reflect on her writing and provides perhaps the deepest insight into her books: "I have felt the pain that arises from a recognition of beauty, pain we hold when we remember what we are connected to and the delicacy of our relations. It is this tenderness born out of a connection to place that fuels my writing. Writing becomes an act of compassion toward life, the life we so often refuse to see because if we look too closely or feel too deeply, there may be no end to our suffering. But words empower us, move us beyond our suffering, and set us free. This is the sorcery of literature. We are healed by our stories." ∎

Reviewed by Alicia Daniel, Associate Director of the Field Naturalist Program at the University of Vermont.

Other Recommended Titles

***Nature*, by Ralph Waldo Emerson; *Walking*, by Henry David Thoreau; Introduction by John Elder**; 1991; Beacon Press (25 Beacon St., Boston, MA 02108-2892); 122p.

In this attractive little volume, one of several in the Concord Literary series, John Elder reintroduces two classic 19th century essays and their authors to late 20th century readers of nature writing. Elder's introduction is compact and rich. He situates the writers in a tradition going back to Jonathan Edwards, Linnaeus, and Gilbert White, and continuing in divergent yet parallel lines through John Burroughs, Mary Austin, John Muir, E.O. Wilson, Peter Matthiessen, and Edward Abbey. He also clearly distinguishes these two complementary writers, Emerson the Transcendentalist who "gazed through nature's surface to its spiritual sub-stratum" and Thoreau the walker, the saunterer, who observed more closely the particulars of nature. Our journey through the 19th century prose of these two classics is much facilitated by Elder's direction. As some guidebooks say, this little book "merits a detour," i.e., if it is not on your path, leave your trail to get it—and read it! —*Robert Davis, Foreign Language Dept., Georgetown College, Georgetown, KY 40324*

Forest Primeval: The Natural History of an Ancient Forest, by Chris Maser;1994; Sierra Club Books (100 Bush St, 13th Floor, San Francisco, CA 94104); $12 paper; 304p.

Forest Primeval is sublime. This is one of those rare books that may actually save more trees than it destroys. All who love forests—and more important, those who don't yet love forests—should read this story of an old-growth landscape in western Oregon. When first published, in hardcover, *School Library Journal* named *Forest Primeval* "one of the Best Science and Technical Books of 1989." Sierra Club books has done us all a service by offering Maser's masterful work in paperback. May similar natural histories for original forests everywhere soon be available! —*John Davis*

Evolution Extended: Biological Debates on the Meaning of Life, edited by Connie Barlow; 1994; MIT Press (55 Hayward St, Cambridge, MA 02142); $27.50; 333p.

What have "biological debates on the meaning of life" to do with saving wildlife?, some *Wild Earth* readers will wonder. The facile response might be, conservation of biodiversity *means* extending evolution. More thorough responses are offered by numerous of the conversationalists (including E.O. Wilson, Julian Huxley, Charles Darwin, Gregory Bateson, Lynn Margulis, Karl Popper) in what Connie Barlow very successfully fashioned into a temporally transcendent salon, gracefully adorned with art and poetry. Barlow herself suggests, implicitly at least, perhaps the most compelling reason why wildlife advocates ought to follow and enter biological debates on the meaning of life: To live peaceably with the biosphere, modern society must create a new cosmology. Deep ecologists would do well to learn about and support the work of Brian Swimme, James Lovelock, Dorion Sagan, Mary Midgley, Diane Ackerman, Edward Wilson and other scientists and philosophers who are helping create a nascent cosmology based on what Wilson calls "the best myth we will ever have": the evolutionary epic. —*John Davis*

Announcements

Bringing the World Alive, The Orion Society's most recent publication for parents, teachers, and environmentally concerned citizens, recommends children's nature stories that introduce ecological information in ways that children can relate to and appreciate—optimistic visions for the future of people and the planet. *Bringing the World Alive* includes brief descriptions of 115 picture books and a full index of authors and illustrators. The publication is available for $6 per copy from The Orion Society, 136 East 64th St., New York, NY 10021.

Wild Mushrooms/Telluride, an educational conference on the study and cultivation of wild mushrooms, will be held 24-27 August 1995 in Telluride, Colorado. For information contact Fungophile, POB 480503, Denver, CO 80248-0503.

Citizen's Guide to Migratory Bird Conservation, a project of Partners in Flight, is a new booklet edited by Rick Bonney, Susan Carlson, and Martha Fischer and published by the Cornell Laboratory of Ornithology. The guide is full of useful information concerning techniques for bird conservation, concentrating on neotropical migrant birds. For a copy of the guide send $5 (or $2 each for five or more copies) to Bird Population Studies, 159 Sapsucker Woods Road, Ithaca, NY 14850. An article on Partners in Flight is scheduled for the fall 1995 issue of *Wild Earth.*

illustration by Sue Ring

TWP Update continued from p.7

The first newsletter was mailed in early April to all those who have participated in workshops. The newsletter will provide a forum for those involved in reserve design to update each other regularly and quickly. It is not meant to replace *Wild Earth* as a primary forum on the Wildlands process. It is meant to get information out to folks more quickly. If you are involved in reserve design work and haven't received one, let us know. If you have received one, tell us if you find it useful.

Workshop maps are continuing to be digitized and returned to workshop organizers.

Patagonia will feature The Wildlands Project in their fall catalog (several hundred thousand copies are distributed). Patagonia stores are planning education displays in their stores that will focus on the project and regional cooperating groups' work in areas where stores are located. Patagonia has also been providing marketing and other advice to the project. Patagonia gear is the best around, but now you have another reason to use it—they are supporting grassroots groups involved in Wildlands work. Contact the Oregon TWP office for more information.

Patagonia also recently organized a fundraising conference for grassroots groups. Materials prepared for the conference are available to groups, at no charge, from Thane Ryland, c/o Patagonia, Inc., 1609 West Babcock, Bozeman, MT 59715 USA.

We have expanded our fundraising efforts by contracting with Andy Robinson. We are still looking for a staff fundraiser who has a proven record with major donors. If you know a good candidate, please contact the Oregon office.

An expanded version of the project's conservation strategy authored by Reed Noss is being written by Steve Trombulak. It will emphasize the step-by-step process of designing core areas, corridors and buffer zones. Plans are to publish it as a special *WE* paper, or monograph. The next special issue of *Wild Earth* devoted to The Wildlands Project is scheduled for this winter. In response to requests from many of you, we are planning an organizationally-oriented pamphlet on the reserve design process.

Wildlands staff and board members will make several presentations at a symposium on the project at the 1995 Society for Conservation Biology meeting set for June in Fort Collins, Colorado. This is an important forum for developing ties with the scientific community.

The Project held a successful secondary education teacher training workshop in Tucson in January. For more information, see the article on p.29 and contact the Tucson office.

World Wildlife Fund Canada has just published two important documents: *A Protected Areas Gap Analysis Methodology: Planning for the Conservation of Biodiversity*, by Dr. Stan Rowe and others; and Dr. Reed Noss's *Maintaining Ecological Integrity in Representative Reserve Networks*. In Canada, order from WWF-Canada, 90 Eglington Avenue E., Suite 504, Toronto, ONT M4P 2Z7. The price is Can$5 each. In the US, Mexico and Central America order from Ned Ludd Books, POB 1399, Bernalillo, NM 87004, USA, 505-867-0878; US $5 each.

We thank the many of you who have contributed to The Wildlands Project's efforts in the past months with your money and your time. The Foundation for Deep Ecology, the Turner Foundation, Patagonia, the Underhill Foundation, World Wildlife Fund Canada and many hundreds of individuals have moved the vision a few more steps toward reality.

—David Johns, TWP Executive Director

ABOUT SUBMISSIONS

Artwork, **articles** and **letters** should be sent to the Art Director or Editor at our main address (POB 455, Richmond, VT 05477). *Wild Earth* welcomes submissions of original illustrations or high-resolution facsimiles thereof. Botanical/zoological/landscapes are eagerly sought, with depictions of enigmatic microflora especially prized. Representational drawings should include common and scientific names.

Articles and letters should be typed or neatly hand-written, double-spaced, and include a return address and word count on the title page. Those who use a computer **should include a copy on disk**. We use Macintosh (3.5" disk) but can usually convert from PCs. Writers should enclose self-addressed stamped envelopes. Deadlines are Jan.1, April 1, July 1, and Oct. 1 for spring, summer, fall, and winter issues, respectively. *Wild Earth* has a large and growing backlog of accepted articles. Thus, unfortunately, authors of lengthy articles must expect a delay of a year or more before their article sees print, even if it is accepted.

Poems should be sent directly to our Poetry Editors, Art Goodtimes (Box 1008, Telluride, CO 81435) and Gary Lawless (Gulf of Maine Books, 134 Maine St., Brunswick, ME 04011). Poets should realize that we receive scores more poems each quarter than we can publish.

Articles, if accepted, may be edited down for space or clarity. Articles with significant scientific content (e.g., most biodiversity reports and wilderness proposals) will be reviewed by our Science Editor for accuracy and clarity. Wilderness proposals will also be reviewed by our Executive Editor, and controversial or complicated pieces may be peer reviewed. Lengthy biologically-based articles generally should include literature citations.

Wild Earth occasionally reprints articles; but due to the surfeit of submissions we receive, reprints will usually be low priority. If an article is being submitted to other publications as well as *Wild Earth*, the writer should indicate so. We usually try to avoid duplication. We generally welcome other periodicals to reprint articles from *Wild Earth*, provided they seek permission in writing from the author and *WE*, and properly credit the articles.

In matters of style, we follow the *Chicago Manual of Style* loosely and Strunk & White's *Elements of Style* religiously. Also, we suggest that authors remember several basic rules when writing for *Wild Earth*, since we always have far more material than we can print and we expect our writers to be lucid, perspicacious, and ineffably winsome.

1. Eschew surplusage (Twain 1895).
2. Do not affect a breezy manner (Strunk & White 1959).
3. Watch your antecedents (Davis 1988).
4. Thou shalt not verbalize nouns (Abbey 1988).
5. Include a goldarn floppy (Butler 1992).
6. Mix drinks, not metaphors (Davis 1993).

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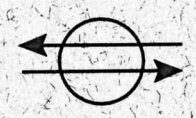

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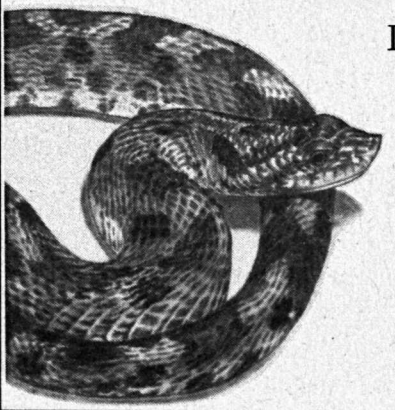

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Species Spotlight

Pterostichus vandykei

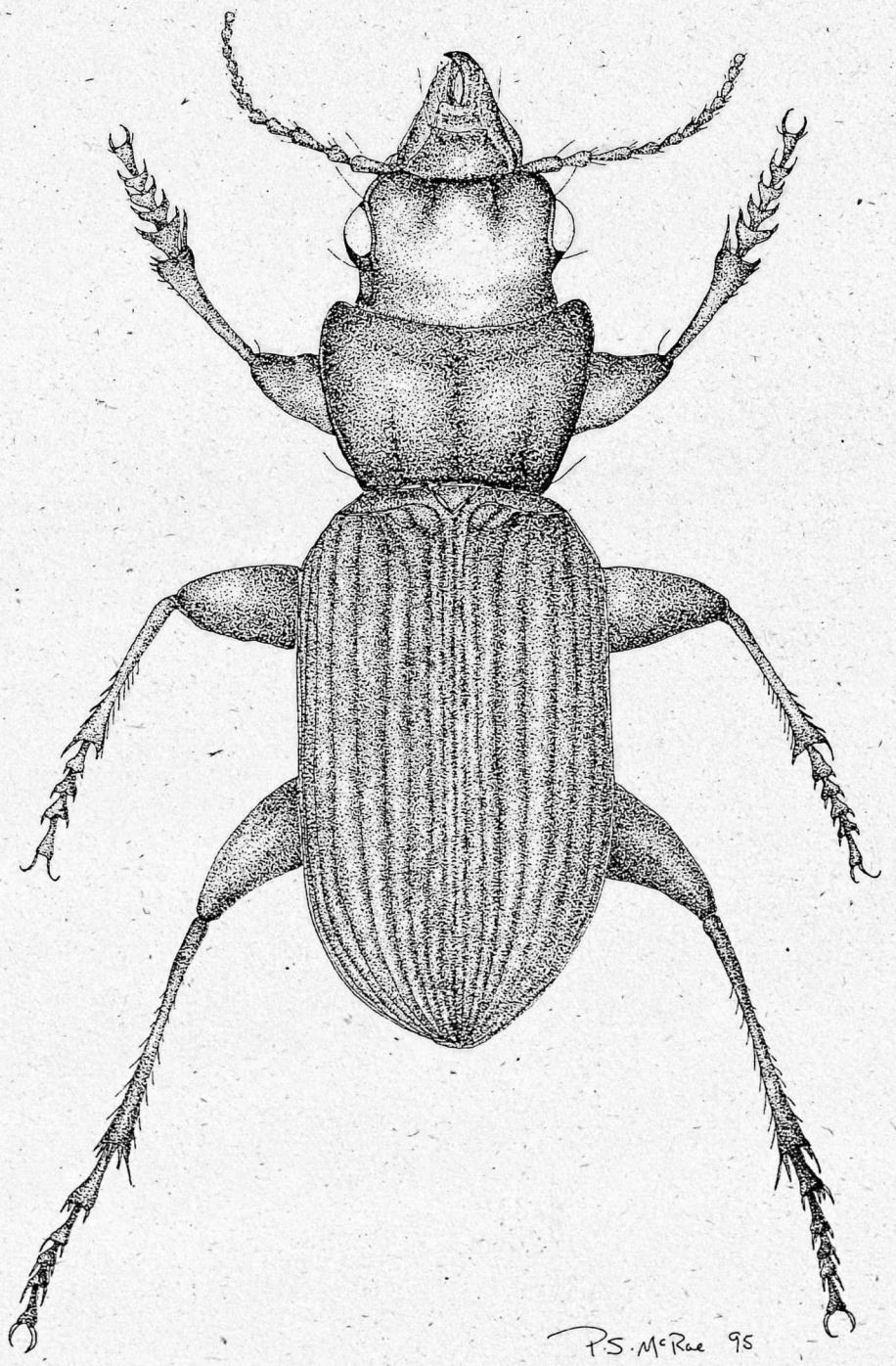
illustration by Peggy Sue McRae

Can it survive the 104th Congress?

Pterostichus vandykei (Shaeffer, 1910; sub-genus *Hypherpes*, family Carabidae, order Coleoptera, class Insecta, phylum Arthropoda, kingdom Animalia) is one of 2640 catalogued North American ground beetle species. Like many forest carabids, this beetle has fused fore-wings and merely vestigial flight wings, and thus is limited to walking as a means of dispersal. Such non-volant forest carabids tend to have restricted geographic ranges and may thus be especially vulnerable to habitat destruction.

According to insect ecologist and carabid expert James Bergdahl, *Pterostichus vandykei* is one of 697 carabid species documented in the Pacific Northwest (British Columbia, Washington, Idaho, and Oregon), and one of the 88 of these endemic to that region. *P. vandykei* was long considered endemic to Idaho (yet the state boasts more about its potatoes!), but is now known to range into eastern Washington, inhabiting small stands of forest on buttes and along rivers within the Palouse Prairie (which may suggest that this carabid is less vulnerable than some to habitat fragmentation).

Though a few carabids have gained nominal protection as threatened or endangered species, the vast majority are relatively unknown to scientists and completely neglected by resource extraction corporations and the Forest Service, which continue to destroy the beetles' habitat. Carabid conservation ought to be high on every politician's agenda, yet the 104th Congress is working overtime to gut the few federal laws (particularly the Endangered Species Act) and programs (particularly the National Biological Service) that might forestall extinctions. Ground beetles, then, are another reason to fight the Contract On America. —*JD*



Peggy Sue McRae (NW 1127 Ritchie St., Pullman, WA 99163) is a long-time wildlands activist and wildlife artist. Her work has appeared frequently in Wild Earth *since its inception; her stunning Northern Spotted Owl illustration graced our first cover.* —TB

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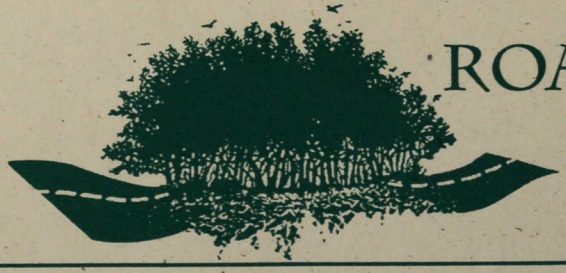

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