Special Issue The Wildlands Project

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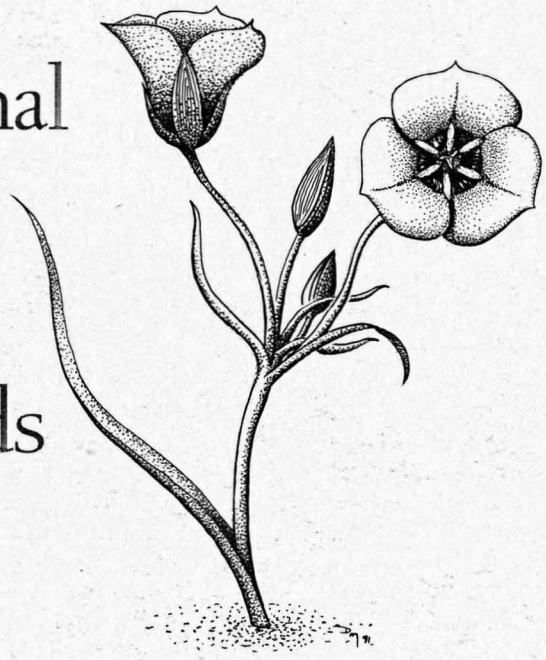
A Personal Brief for The Wildlands Project



by Edward O. Wilson

GREAT DREAMS, AS OPPOSED TO FANTASIES, are those that seem to lie at or just beyond the edge of possibility. When I first learned of The Wildlands Project, I thought it must be beyond that limit, an admirable whimsy of noble souls. But as quickly as I gave the idea serious thought, I was converted. With imagination and will, I firmly believe, it can be done.

The Wildlands Project is one of the great dreams, worthy of the millennium and of America. It can be considered as the final of the three stages of biodiversity conservation. The first stage is the creation of reserves, the marking off and protection here and there of some of the remaining shreds of the prehuman wild. Reserves are the essential core of biodiversity conservation, of course, but establishing them is only a rearguard action. As John Terborgh has chillingly documented in his 1999 book *Requiem for Nature* (Island Press), most "protected natural areas" are open to intrusion and shrinkage—especially so in the developing world. Even when well protected, they become isolates in a sea of intensified development, within which species still inevitably go extinct. The smaller the reserve, the higher the extinction rate. So the logical second stage is restoration, the enlargement of reserves already in place, by peripheral growth and the remediation of developed land to create new reserves.

The final stage is the restoration of wilderness by the establishment of large corridors, as envisioned by The Wildlands Project. Such a large step upward can be accomplished only through a combination of science and the political process. Its workable plan is the agenda of the conservation movement writ large, wherein geographical information on biodiversity is superimposed on maps of topography, hydrology, human settlement, agriculture, industry, and transportation routes, then used by appeal to regional self-interest to argue for wildland corridors.

Wildland projects are not a utopian vision. They have been viewed as practicable by ecologists from Alaska to Panama and already made government policy in Suriname. For these countries and for the rest of the world, now is the time to create systems of reserves, because the windows of opportunity are closing fast. Humanity has entered a shrinking bottleneck caused by overpopulation and the decline of per

continues on page 2

mariposa lily by Douglas Moore

About Wild Earth *and The Wildlands Project*

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

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

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

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

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cover art
"The Eyes Have It (wolf)," clay engraving with watercolor by Dennis Logsdon (©1999)

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A Personal Brief for The Wildlands Project *continued*

capita productive land. In the past 60 years the world population has grown from two billion to six billion, and it is projected to approach eight billion by 2020. Most experts agree that with the help of the industrialized countries eight billion people can theoretically be fed, housed, and clothed at a minimal standard of decency, but the strain on the environment will be intense.

The outlook is generally grim because the aftershock of economic development will be worse than the population explosion that preceded it. Most of the worst shortages will be in productive land and fresh water. The amount of productive land used by the average US citizen today—for food, water, fuel, habitation, clothing, transportation, and waste-management—is 12 acres. A large portion of this land is appropriated from other countries. This necessary dispersion is fundamentally the reason why the United States, wealthiest of nations, is so enmeshed in the economics and polity of the rest of the world. In contrast, the amount of productive land used by each person in the developing countries taken together is one acre. For the entire world population to enjoy US consumption with existing technology, the present-day human population would have to spread itself over two more planet Earths.

That is not going to happen, and the consequences of trying to find its equivalent on the planet we do have will be dire. The poor people of the world are striving strenuously to improve their lot. They cannot be blamed for following the lead of the richer nations. As a result they are wringing from Earth all of the material and energy they can reach. They are everywhere converting the last remnants of the natural environment in their final race to the limit of population growth and economic development.

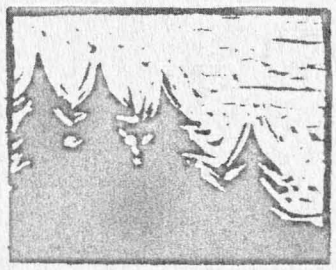
Such in essence is the crisis of biodiversity: without a vision of the sanctity of life, the fauna and flora of Earth are being sacrificed to meet the needs of its single most overextended species.

I think it obviously true that for humanity and the rest of life to travel safely through the bottleneck requires a revolution in moral reasoning, which in turn must entail a shift in the goals of science and technology. The vision offered by The Wildlands Project is an important part of that revolution. Humanity will be ill-served—forever!—by the careless and unnecessary destruction of the remaining bastions of biodiversity. It is possible to reverse the trend if wise choices in technological and economic development are made that include salvaging and in time restoring the natural world.

The return of Nature in swaths of wildland across the continents is morally compelling for what it provides future generations. It is ultimately the best way to protect native faunas and floras, and to add both physical and biological stability to the global environment. For the farsighted and courageous, its undertaking will be an epic adventure. For all the rest, its achievement will increase our security and restore some of the lost prehuman magic of the world so vital to the human spirit. ☾

Professor Edward O. Wilson is University Research Professor and Honorary Curator in Entomology at Harvard University's Museum of Comparative Zoology. His many books include The Ants *(with Bert Hölldobler),* The Diversity of Life, Naturalist, *and, most recently,* Consilience: The Unity of Knowledge *(Knopf, 1998).*

A Wilderness View



Means and Ends

The practices we now call conservation are, to a large extent, local alleviations of biotic pain. They are necessary, but they must not be confused with cures.

—Aldo Leopold (1941)

Some observers both within and without the American conservation movement have characterized it as largely negative or oppositional, good at saying *no* (don't dam that river, don't log that forest...) but less adept at saying *yes*. They suggest that conservationists have not been consistently careful to articulate a positive vision of sustainable natural and human communities to replace the rapacious, life-destroying culture we seek to overturn. It's a fair, if incomplete, assessment. When a thug is attacking your family, you don't take time to ponder the social, economic, and political reforms that might have deterred the attacker from a life of crime—you fight like hell to repel the assault.

While fighting ecological destruction is unlikely to be obviated any time soon (and indeed, some conservationists argue that we have been too little willing to confront directly the powerful forces that encourage land abuse), there is abundant evidence that the contemporary conservation movement is now capable of playing both defense and offense. Leading this trend beyond short-term thinking ("local alleviations of biotic pain"), toward a more comprehensive cure that would systematically protect wild Nature, is The Wildlands Project.

Twice before, *Wild Earth* has devoted theme issues to The Wildlands Project's vision and progress in drafting a blueprint for North American wilderness recovery. Here, we continue that ongoing coverage, with articles on the scientific, strategic, and spiritual substrate of our shared conservation agenda. We provide regional reports from Wildlands Project cooperators around the continent, and highlight the Sky Islands Wildlands Network of southeastern Arizona and southwestern New Mexico, and its complementary initiative in Mexico, the Sierra Madre Occidental Biological Corridor. Wildlands network proposals for the San Juan mountains of Colorado and for the central coast of British Columbia also appear herein; others will appear in upcoming issues of *Wild Earth*, including an overview of the proposed Maine Wildlands Reserve Network.

These documents should not be seen simply as scientific blueprints for preserving biodiversity in a given region, although that is their primary intent. I think they are better viewed as cultural landmarks, as interim cease-fire agreements on the way toward a comprehensive peace treaty between humans and Nature in the Americas. The work of wilderness recovery—of "networks of people defending networks of land," to borrow Michael Soulé's phrase—is the work of decades and centuries. The tactics conservationists employ to protect the land may change, but our goal remains constant: to save enough natural habitat (and the ecological processes that create natural diversity) to ensure that all life will flourish.

With the melding of reason and passion—of conservation science and love for wild Nature—conservation activists around the continent working to design and implement wildlands networks have developed a potent brew. Dave Foreman, co-founder of *Wild Earth* and The Wildlands Project, has characterized this effort to achieve wilderness recovery on a continental scale as "a path that leads to beauty, abundance, wholeness, and wildness."

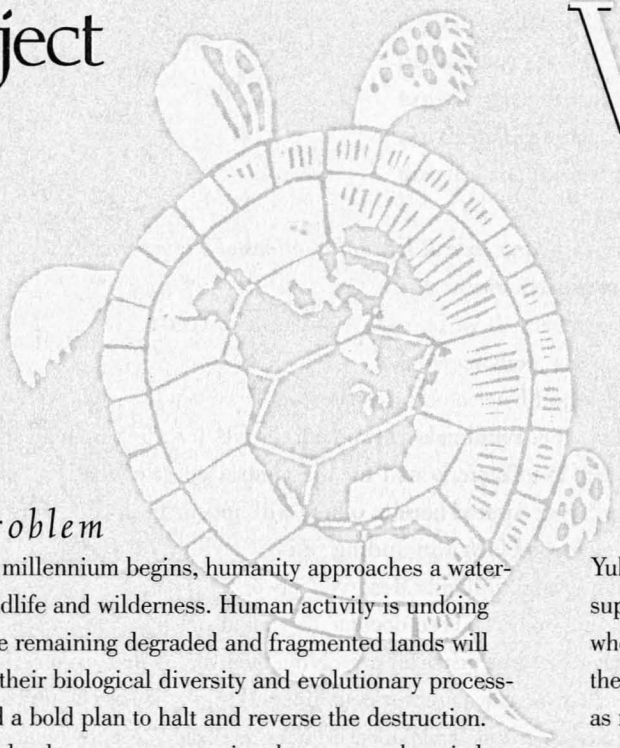
We invite you to walk that path with us.

—TOM BUTLER

We are grateful to our colleagues at The Wildlands Project, particularly Barbara Dugelby, David Johns, Harvey Locke, Michael Soulé, Kim Vacariu—and especially Dave Foreman—for their assistance in producing this issue.

The Wildlands Project

Mission, Vision, and Purpose



The Problem

As the new millennium begins, humanity approaches a watershed for wildlife and wilderness. Human activity is undoing creation; the remaining degraded and fragmented lands will not sustain their biological diversity and evolutionary processes. We need a bold plan to halt and reverse the destruction. Healing the land means reconnecting the parts so that vital flows can be renewed.

Our Mission

The mission of The Wildlands Project is to protect and restore the natural heritage of North America through the establishment of a connected system of wildlands. The idea is simple. To stem the disappearance of wildlife and wilderness we must allow the recovery of whole ecosystems and landscapes in every region of North America. Recovery on this scale will take time—100 years or more in some places. This vision for continental renewal rests on the spirit of social responsibility that has built so many great institutions in the past and acknowledges that the health of our society and its institutions depends on wildness. The land has given much to us; now it is time to give something back—to allow nature to thrive once more and to restore the links that will sustain both wilderness and the foundations of human communities.

Our Vision

We are ambitious: we live for the day when grizzlies in Chihuahua have an unbroken connection to grizzlies in Alaska; when wolf populations are restored from Mexico to the Yukon; when vast forests and flowing prairies again thrive and support their full assemblage of native plants and animals; when humans dwell with respect, harmony, and affection for the land; when we come to live no longer as conquerors but as respectful citizens in the land community.

Our Challenge

We are called to our task by the inability of existing parks, wilderness areas, and wildlife refuges to adequately protect life in North America in the face of increasing human numbers and technological change. While these areas preserve spectacular scenery and provide outstanding recreational opportunities, they are too small, too isolated, and represent too few types of ecosystems to perpetuate the continent's biological wealth. Despite the establishment of parks and reserves from Canada to Central America, true wilderness and native, wildland-dependent species are in precipitous decline.

- Grand predators including the grizzly bear, gray wolf, wolverine, jaguar, and American crocodile have been exterminated from large parts of their pre-Columbian range and are imperiled in much of their remaining habitat.
- The disappearance of these top predators and other keystone species hastens the unraveling of ecosystems and impoverishes the lives of human beings.
- Forests have been over-cut, cleared, and fragmented, leaving only scattered remnants of once vast ecosystems. Even extensive habitats, such as the boreal forest, face imminent destruction.

- Tall- and short-grass prairie, historically the most extensive community type in North America, and once home to an extraordinary concentration of large mammals, has been almost entirely destroyed or domesticated.
- Deserts, coastal areas, and mountains are imperiled by sprawling subdivisions and second-home development.
- Motorized vehicles penetrate the few remaining roadless areas on illegal roads and tracks.
- A rising tide of invasive exotic species—ecological opportunists of the global economy—threatens a new wave of extinction and the eventual homogenization of ecosystems everywhere.
- Climate change adds to the vulnerability of wildlands that remain.

These trends, acting globally, are among the notable causes of the current and sixth major extinction event to occur since the first large organisms appeared on Earth a half-billion years ago. The Wildlands Project, as a remedy, is working to create regional and continental networks of conservation areas that will protect wild habitat, biodiversity, ecological integrity, ecological services, and evolutionary processes.

The Meaning of Wilderness

We reject the notion that wilderness is merely a remote destination suitable only for backpacking. We see wilderness as a wild home for unfettered life. Wilderness means:

- Extensive roadless areas—vast, self-regulated landscapes—free of mechanized human use and the sounds and constructions of modern civilization;
- Viable, self-reproducing populations of all native species, including large predators;
- Natural patterns of diversity at the genetic, species, ecosystem, and landscape levels.

Such wilderness is absolutely essential. It is not the solution to every ecological problem, but without wilderness the planet will sink further into biological poverty, and humanity's communion with its roots will be lost forever.

Our Method

We seek partnerships with grassroots and national conservation organizations, government agencies, indigenous peoples, private landowners, and with naturalists, scientists, and conservationists across the continent to create networks of wildlands from Central America to Alaska and from Nova Scotia to California. We seek to heal nature's wounds by designing and creating wildlands networks and by restoring critical species and ecological processes to the land.

The wildlands networks will:

- Support the repatriation of top predators where they have been extirpated from present and future wilderness areas and national parks;
- Establish large areas of wild habitat where plants and animals are unrestrained, where native species thrive, and where nature, not technology, determines their evolutionary fate;
- Establish extensive linkages between large natural areas to ensure the continuation of migrations and other movements vital for the survival of healthy populations;
- Enable the recovery of natural processes such as fire.

We will implement these networks by:

- Supporting the designation of new conservation areas and improving the management of existing public lands;
- Campaigning both for the removal of public subsidies that maintain abusive land-use practices and for positive incentives that encourage responsible land management;
- Assisting land owners and land trusts in the voluntary protection of critical parcels of private land;
- Cooperating with transportation agencies to help remove or mitigate barriers to wildlife movement;
- Working with planners at all levels to create a balance between the needs of nature and human society;
- Promoting the restoration of disturbed lands and waters until that time when nature has recovered and can manage itself.
- Inspiring the people of North America to care for their home—for its own sake and for the sake of those yet to come.

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The Wildlands Project

A Balanced Approach to Sharing North America

by Harvey Locke

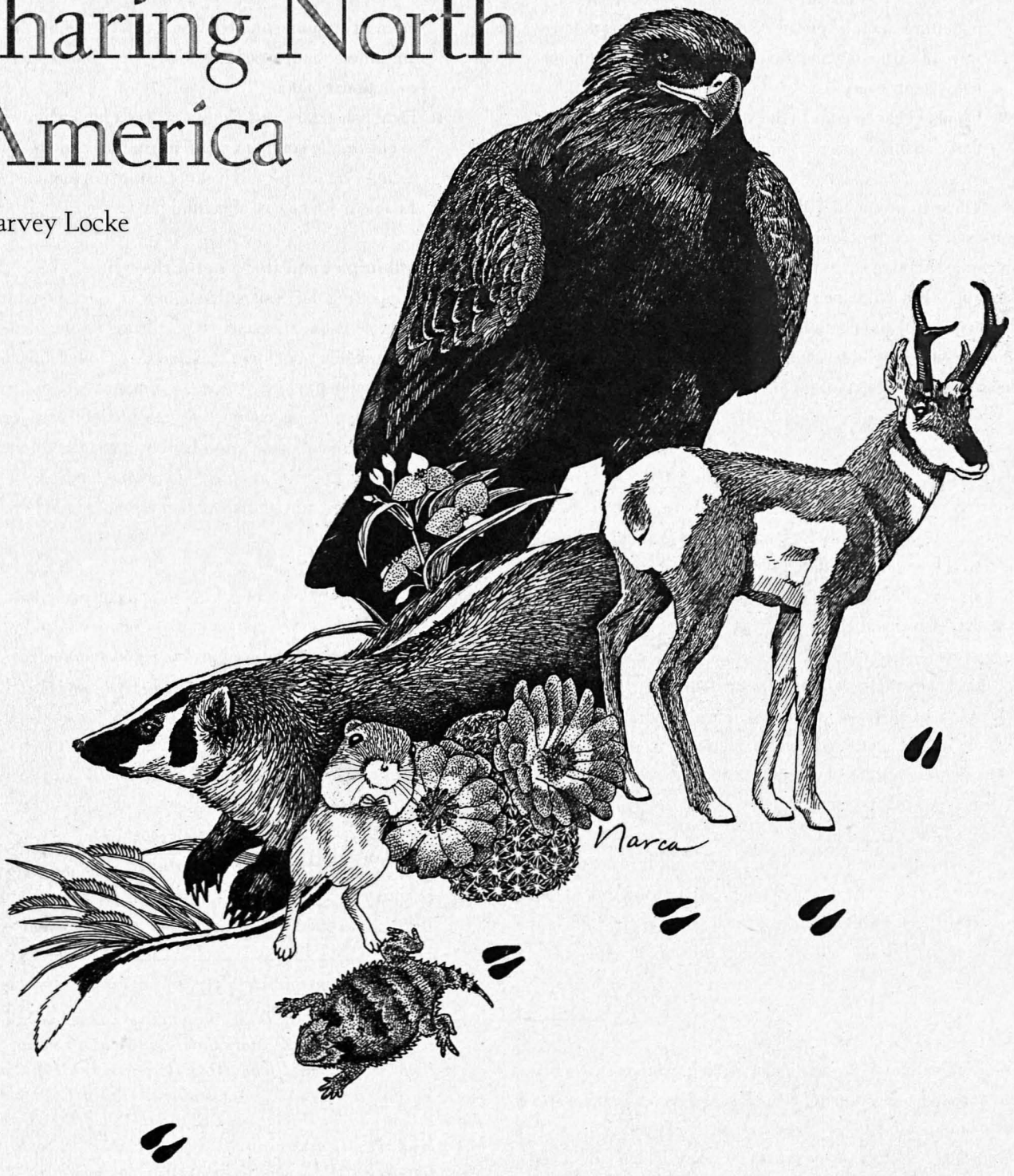


illustration by Narca Moore-Craig

NORTH AMERICA IS OUT OF BALANCE. Almost anywhere you go on this continent Nature is losing, even in those last, best places we like to believe are wild and secure. Conservation as usual simply isn't working.

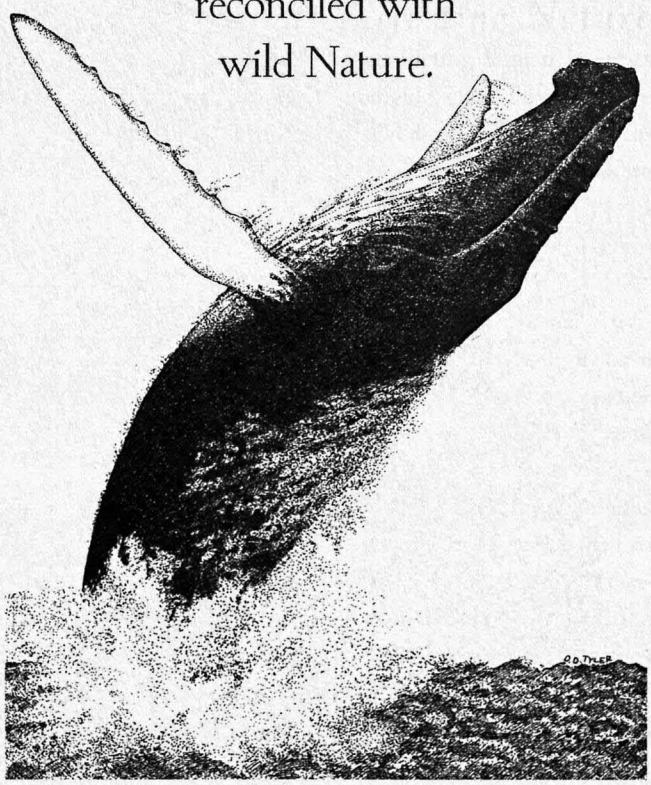
Yellowstone is a vast and unimaginably beautiful National Park. On its grassy northern plateau roam elk, pronghorn, bison, gray wolves, and grizzly bears. It is a place that inspired the National Park idea, a concept which has spread all over the Earth. Its remote valleys, untrammeled by civilization, still meet anyone's definition of wilderness. Yet we know that Yellowstone's future is not secure because it is an island cut off from the rest of the northern Rockies by habitat fragmentation. Even if the area around the park, the greater Yellowstone ecosystem, were not threatened by extractive activities and subdivision sprawl, it is not large enough to maintain viable populations of large carnivores unless it is reconnected to the rest of the Rockies running up to the Yukon.

Janos Prairie in the northern Mexico state of Chihuahua is home to the world's largest remaining black-tailed prairie dog colony. Thousands of these little animals perforate the plain, their burrows alone creating habitat for over twenty other species as they live out their lives in the prairie sun. Ferruginous hawks and golden eagles dive on this food source from the air while badgers and coyotes stalk them from the ground. In defense, to keep a clear view of their predators, the prairie dogs remove any shrubs, keeping the plains open, thereby also providing habitat for other species including the mountain plover. Yet the Janos Prairie dwindles as pesticides and cultivation close in on this last great remnant of the wildlife menagerie which once filled the Great Plains in the heart of North America.

The Queen Charlotte Islands on Canada's west coast is an enchanting archipelago. Some of its southern islands are protected by Gwaii Haanas National Park. Huge Sitka spruce and western red-cedar tower over streams filled with spawning salmon. The forest is suffused with the haunting presence of Haida totem poles and abandoned villages. Bald eagles scan for food from treetop perches while migrating whales feed in the myriad bays. A large subspecies of black bear feeds on the intertidal life. Sea stars, anemones, and nudibranchs live in tide pools caressed by the surging Pacific. But even here all is not well. Black-tailed deer, released on the islands in the last century, have no natural predators to keep their population under control so they wreak havoc by eating the forest understory, in places picking it clean down to the moss. Sea otters are gone due to being overhunted for the fur trade, causing a cascade of negative ecological effects through the marine ecosystem. Sea otters eat sea urchins and sea urchins eat kelp. Near the shore, the unusual kelp plant anchors itself to the ocean floor, creating underwater forests which in turn provide habitat for a variety of other species. With the sea otters gone, kelp beds are scarce and other species dwindle.

The great hardwood forests of eastern North America are home to a glorious array of songbirds whose color and music can move even the hardest heart. But these messengers of spring are declining due to habitat fragmentation and a surge in the numbers of small predators that thrive in fragmented landscapes. Brown-headed cowbirds and raccoons are diminishing the native birds of the great green canopy of eastern North America. Cowbirds, an open area species, invade songbird nests near forest edges where logging or development allow them to penetrate into what was previously deep forest. Larger predators, like the eastern cougar, which prey on raccoons and deer are no longer found within most of their traditional range. Raccoons are not kept under control, so they multiply and have an easy time killing songbirds. Similarly, domestic cats are killing countless songbirds as development encroaches on forest habitat, while overabundant deer mow down the undergrowth from rare plants to tree seedlings.

We dream of a continent where the land is healed, banished species return, and humanity is reconciled with wild Nature.



humpback whale by D.D. Tyler

Restoring Balance

North America is out of balance. As we stand on the threshold of the next millennium we must ask ourselves: Is this imbalance inevitable? Or can we right it? It *is* inevitable if we practice conservation as usual, fighting for the last tattered remnants of the once great fabric of life while thoughtless development tears the rest to shreds.

The Wildlands Project proposes to right the balance. We dream of a continent where the land is healed, banished species return, and humanity is reconciled with wild Nature. Our goal is to place before North Americans from Panama to Alaska a clear choice—the continued loss of the riches of the natural world or a clear and reasonable strategy to restore the treasures of Creation.

To achieve a harmonious relationship between humanity and the rest of Nature we must confront a formidable challenge. Simply put, we now are a deeply selfish species, appropriating or spoiling more and more of the Earth's living things, water, and atmosphere without thinking of the impact on other species. Much of this selfishness has been due to a lack of awareness of our impacts, rather than malice. But with the growing understanding we now have of the mechanisms of extinction, we can change our behavior to be more generous. We humans can now plan our activities in a way that ensures the rest of Creation flourishes along with us.

Conservation Planning

To do this we must practice conservation in a manner that will lead to long-term conservation instead of short-term stays of execution. Our goal should be to ensure that all living things that belong in North America have a home on this continent along with us. This means wild things must have enough habitat and be numerous enough to maintain healthy populations and to bounce back from natural events such as hurricanes, floods, predation, and fire that deplete their numbers. And we should not think the solution lies in trying to prevent those natural events, for they are life-renewing processes on which many species depend. We must also adjust our behavior to accommodate animals that have to move long distances to survive. Confining caribou, golden eagles, or grizzly bears to small isolated refuges won't ensure their survival because they need to move over large distances to meet their habitat and breeding needs. We can accommodate them by creating very large protected areas as well as smaller ones that are linked together in a wildlands network like jewels in a necklace. To do this we need to engage society in conservation planning.

Through conservation planning the natural connectedness of the web of life in North America can be restored, unneeded roads can be closed, unlogged forests protected, missing species reintroduced, and weedy species eliminated in a coordinated

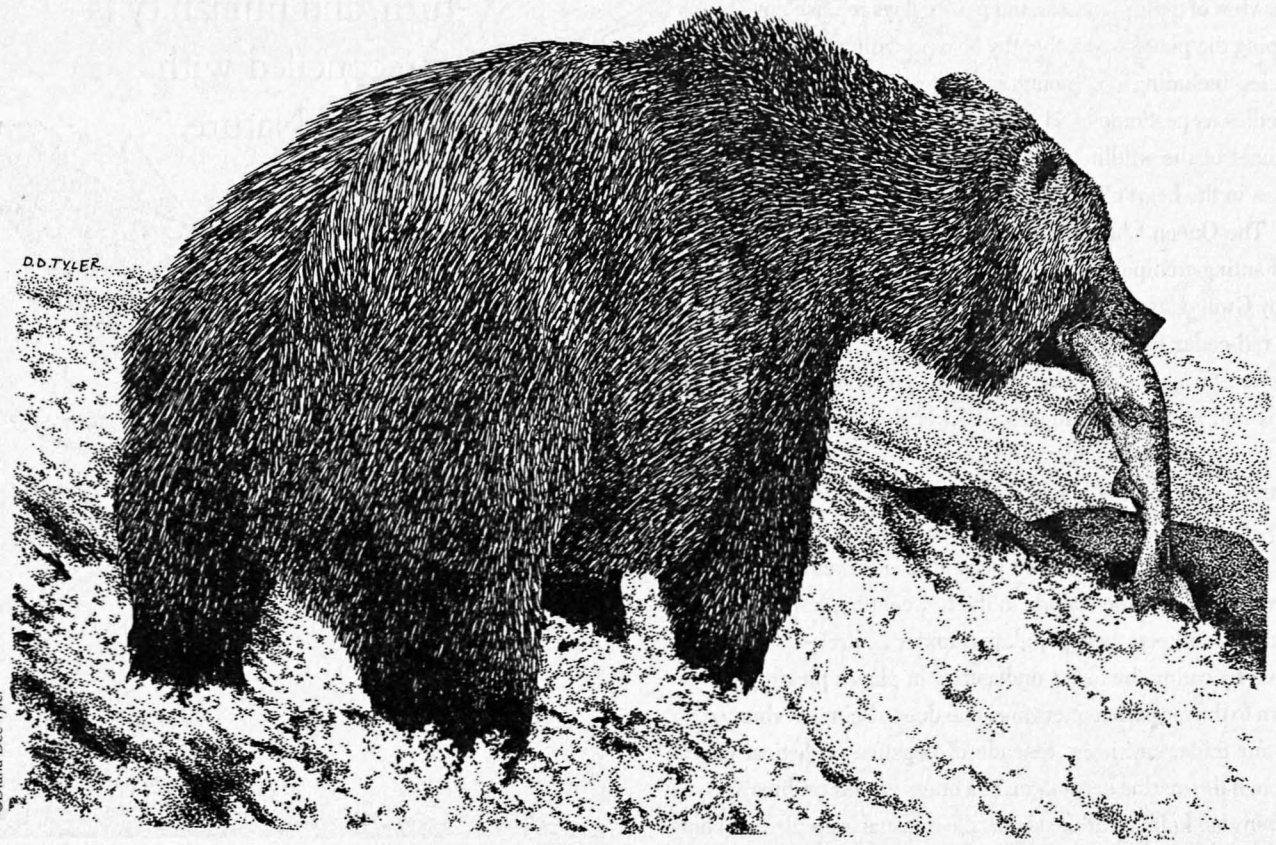


illustration by D.D. Tyler

way. Conservation planning includes identifying land for a wildlands network through "reserve design" or "conservation areas design." These interchangeable terms describe The Wildlands Project's way of identifying what lands are most critical to protect for wildlife, where connections should be maintained or restored between those protected areas, and how and where missing species can be recovered and damaged areas repaired.

We believe that helping large carnivores recolonize parts of their former range, both through reintroduction efforts and by restoring habitat linkages between existing populations, is not only the right thing to do but necessary for the survival of many other species. We call this "rewilding," which we think is fundamental to meaningful conservation plans because carnivores often play a key role in keeping smaller species alive. The aim of rewilding is to preserve or restore species at the top of the food chain, and allow natural ecological and evolutionary processes to reassert themselves across the landscape. Reintroducing sea otters to the Queen Charlotte Islands would restore flourishing kelp beds. Reintroducing cougars to the eastern hardwood forests would help songbirds and rare plants. If we want to maintain healthy ecosystems we need large carnivores. Since large carnivores require large cores linked by functional habitat corridors, a network of connected wildlands throughout the continent is necessary.

We at The Wildlands Project also love wilderness. We believe that Nature is a source of inspiration to people, as well as home to all living things. So we advocate that protected areas also provide wilderness where we can contemplate, celebrate, and enjoy Creation and the miracle of evolution free of industrial activities and noise. Wilderness is self-willed land—that part of the landscape where other species flourish. It is only fair that we share the Earth. We reject the well-meaning but dangerous efforts to discredit the wilderness concept advanced by some post-modern theorists. Wilderness exists in the public imagination and on the ground. It is a rich, robust concept that we will passionately defend and advocate as part of our conservation plans.

Conservation planning involves the human-built environment too. We humans, like other species, move vast distances around the continent, often by rail and highway. We need to ensure that our transportation systems do not chop the landscape into pieces. Interstate highways and rail lines can be elevated or buried in wild areas in order to allow animals to move freely across the landscape, just as they are in cities to allow traffic to flow freely. Our communities can be planned to allow open spaces of suitable habitat that provide secure corridors for animals to move across them. Maintaining connectivity between natural habitats is essential for wildlife and an achievable goal, even across lands where people live and produce commodities.

Private land will often be critical to our conservation plans. Voluntary mechanisms like conservation easements and wildlands philanthropy can benefit landowners and Nature. If saving a species requires restrictions on or public acquisition of private land, our society can provide compensation. North America is, after all, home to the richest civilization in history.

We believe that our dream of humans living in harmony with Nature is mainstream and sensible, not radical or unreasonable as some critics have called it. We think the only conservation efforts that are reasonable are ones that give other living things a chance. A reasonable conservation plan is one that the best available science shows will likely ensure that all life belonging in North America will survive and thrive along with us.

We believe the best way to that goal is by protecting large wilderness cores surrounded by zones of compatible uses and linked by habitat corridors in a network that represents all ecosystem types and successional stages, allows for natural processes to run unimpeded, and accommodates even the most sensitive and wide-ranging of native species. This includes reintroducing missing species such as large carnivores and bison. We must challenge those who call this unreasonable to show on good science how their plans, if different, would achieve the reasonable goal of protecting all of North American life.

Creating a New Context for Human Decisions Affecting Nature

What about the "real world" of conflicting human interests where people want to log, mine, subdivide, and cultivate Nature as well as protect it? Only a fool would deny this existing situation. In fact, all conservationists in some way are part of it as we consume Earth's resources too. And everyone knows that politics, the realm of reconciling competing interests, involves compromise. How do we at The Wildlands Project deal with that?

The answer is simple. Society wants both economic activity and protection of Nature. Advocates of economic activity have had the upper hand over advocates of Nature protection because they have grounded their arguments better and set the rules of the debate. They have created an atmosphere in which all activity is described as competing interests and where the solution is perceived to be an accommodation of conflicting human desires by giving everyone something. The problem with this is that conservationists have not advocated for land use based on all the needs of Nature. Instead we have argued for important values based on aesthetics, recreation, or saving "the best of the last," whereas the other side routinely resorts to its "bottom line" of market realities, economic activity, and lifestyle ambitions. We

have not entered the debate with an integrated vision of what *should* be done based on Nature's "bottom line" needs. So we lose all too often and Nature suffers for our failure.

From cosmic events to communicable disease, from the food we eat to the air we breathe, Nature is humanity's bottom line. We are defined by it and ultimately confined by it. The desire to ensure the survival of other living things along with us is a value widely held across society. It is a more absolute "bottom line" than the economic one, for extinction is irreversible. The only way we will be able to argue effectively for Nature's needs is through conservation planning that demonstrates what is necessary to ensure the survival of other species. If we remain trapped in the current debate of human interests and land uses, as though the issues were only about human aspirations, instead of the survival of Creation too, we will continue to fail in our desire and duty to protect Creation. But we at The Wildlands Project believe that when Nature's "bottom line" is well articulated and widely understood through conservation planning, human creativity will be able to find solutions that meet the intertwined needs of both humanity and Nature.

Our dream of linked wildlands in a landscape where humanity and Nature can flourish together is also practical. To a significant degree it is being advanced in Florida through the Florida Statewide Greenways Planning Project. The State of Florida has funded and adopted a plan to create an ecological network and a parallel recreational and cultural network which together are designed to preserve quality of life for people and wildlife, including imperiled species like the Florida panther and black bear. The good news from Florida can spread. And there is increasing evidence that protecting wildlands is good for the economy, partly because of ecotourism but principally because capital is mobile in the age of e-mail and airports. For quality of life reasons people with capital are increasingly bringing their wealth and the jobs they create to places that enjoy access to unspoiled Nature. Far from being antihuman, we embrace humanity and Nature living together in harmony.

Since The Wildlands Project's inception in 1991 we have been engaged in conservation planning with people from all over the continent—in places like Yellowstone to Yukon, in the Sky Islands and Mexico's Sierra Madre, in Nova Scotia, Klamath-Siskiyou, Central America, Colorado, and Maine to name a few. Several reserve design components of conservation plans are found in this special issue of *Wild Earth* and many more are underway. Recently we gathered many eminent scientists to collaborate in the publication of *Continental Conservation: Scientific Foundations of Regional Reserve Networks* (Island Press, 1999), which provides the scientific foundation for setting Nature's "bottom line."

The Wildlands Project seeks to engage not only the entire conservation movement but all of society in a great effort to share North America with the rest of Creation. We know restoring balance to North America will take time. But it is a grand and worthy challenge. A landscape of birdsong, butterflies, intact forests, grasslands full of buffalo, and forests full of caribou and wolves is the richest legacy we could leave to our children's children. It is also the right thing to do. ☾

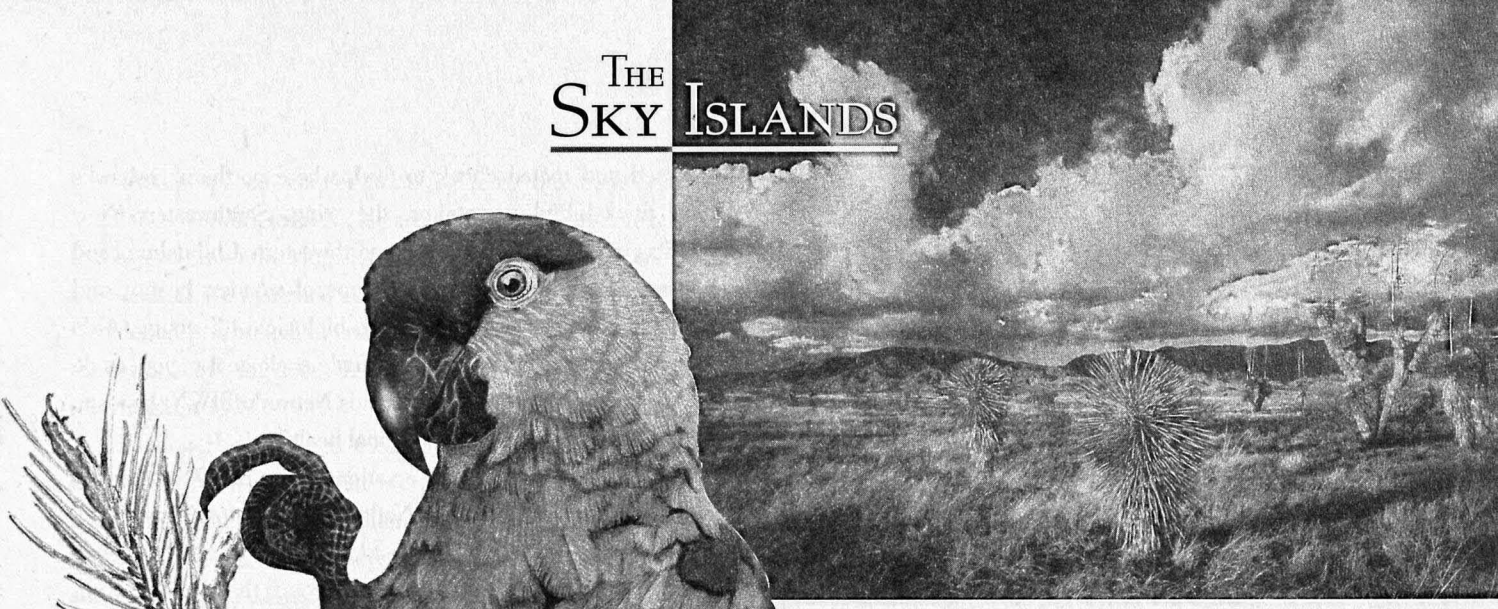
Harvey Locke, a native of Alberta, Canada, is president of The Wildlands Project board, vice president for conservation of the Canadian Parks and Wilderness Society, a board member of The Nature Conservancy of Montana, a founder of the Yellowstone to Yukon Conservation Initiative, and senior program officer for the environment at the Henry P. Kendall Foundation in Boston, Massachusetts.

POETRY

Earth Verse

Wide enough to keep you looking
Open enough to keep you moving
Dry enough to keep you honest
Prickly enough to make you tough
Green enough to go on living
Old enough to give you dreams

—Gary Snyder



The Sky Islands Wildlands Network

Diverse, Beautiful, Wild—and Globally Important

by Dave Foreman, Mike Seidman, Bob Howard, Jack Humphrey, Barbara Dugelby, and Andy Holdsworth

"TO MY MIND THESE LIVE OAK-DOTTED HILLS fat with side oats grama, these pine-clad mesas spangled with flowers, these lazy trout streams burbling along under great sycamores and cottonwoods, come near to being the cream of creation." So wrote Aldo Leopold (1937).

This landscape that so enthralled Leopold was where the Rocky Mountains and the Sierra Madre kiss, where the plants and animals of the Neotropics mingle with those of the Nearctic, where jaguar and grizzly hunted the same ridges, where elk and javelina

thick-billed parrot by Raziel Méndez Moreno ■ photo: Mt. Graham, Arizona by Jack Dykinga

Wildlands Network Overview

The Sky Islands Wildlands Network will meet its goals by protecting landscape connectivity for large carnivores between the Mogollon Highlands and the northern Sierra Madre Occidental through the Sky Island ranges, and by restoring stream systems in the Gila and Bavispe watersheds.

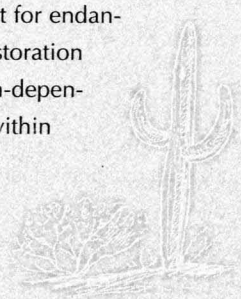
1) The Wilderness Areas of the Mogollon Highlands will be expanded. Connectivity between them will be protected or restored for the movement of large carnivores: Mexican wolf, mountain lion, jaguar, black bear, and grizzly bear.

2) The Mogollon Highlands will be linked to high quality habitat and new protected areas in the northern Sierra Madre Occidental (Mexico) by protecting Wilderness Areas (including as yet undesignated areas) and linkages in the Peloncillo and Chiricahua ranges.

3) Large blocks of wilderness habitat and landscape connectivity between them will be protected in the Galiuro/Aravaipa/Catalina/Rincon region.

4) The greater Galiuro region will be linked to high quality habitat and new protected areas in the northern Sierra Madre Occidental by protecting Wilderness Areas (including as yet undesignated areas) and landscape connectivity in the Santa Rita, Pajarito, and Huachuca Sky Island ranges in Arizona, and new protected areas and landscape connectivity in the Sky Island ranges of Sonora. Connectivity between Mexico and the United States for Mexican wolf and jaguar is a high priority.

5) The Gila River and its tributaries will be protected by National Wild and Scenic River designation and by designation of critical habitat for endangered species of fish. Stream restoration will improve habitat for riparian-dependent species and connectivity within rivers. Restoration will be done, where possible, on the Bavispe River and its tributaries.



browsed and rooted cheek to jowl, where northern goshawks took thick-billed parrots on the wing. Southwestern New Mexico, southeastern Arizona, northwestern Chihuahua, and northeastern Sonora are a landscape of wonder, beauty, and wildness—and of mind-boggling biological diversity. Aldo Leopold saw this landscape as a single ecological region, as do we today. The Sky Islands Wildlands Network (SIWN) hopes to protect it and restore it to ecological health.

Leopold began his conservation career in 1909 when he came to work for the Apache National Forest in Arizona. Here, where the White Mountains rise to 11,000 feet on the slopes of Mt. Baldy, where the Blue River cuts through the Mogollon Rim, Leopold shot the "green fire" wolf. The experience unsettled him and led him to ponder the interconnections among species and between species and the land. He began to think holistically, to see the big picture—to think like a mountain. Seeing the green fire die later led him to write the most powerful essays in *A Sand County Almanac* (Leopold 1949). His work for the US Forest Service in Arizona and New Mexico from 1909–1924 opened his mind to the importance of large carnivores in maintaining ecological integrity (Leopold 1944, 1949). Here he saw firsthand the damage cattle and sheep do to arid watersheds (Leopold 1924a, 1924b). Working on the Gila National Forest in New Mexico, he realized the necessity of formally protecting backcountry as Wilderness Areas. Set aside under Forest Service regulations, they would remain free of roads and "Ford dust." Pioneer skills and travel would linger, and quality hunting would not fade, although modernism swirled around on the outside (Leopold 1921, 1925). In 1936, Leopold bowhunted deer in the Rio Gavilan tributary of the Rio Bavispe in Chihuahua's Sierra Madre Occidental, and, for the first time, saw healthy land (Leopold 1937).[1]

The diversity, beauty, and wildness of the Mogollon Highlands, Sky Islands, and Sierra Madre molded the philosophy and aesthetic sensibility of Aldo Leopold—and gave us our greatest conservation thinker. Leopold's landscape was where the National Wilderness Preservation System—all 100 million acres of it today—was born.

The greater Sky Islands region is globally important for the lessons it taught Leopold, for its role in launching the wilderness preservation movement, and for its wild and enchanting landscape. We now understand, as he did many decades ago, that the region is also of international importance because of its outstanding biological diversity.

1. Brown and Carmony (1995) have reprinted Leopold's essays about this region in the wonderful book, *Aldo Leopold's Southwest.*

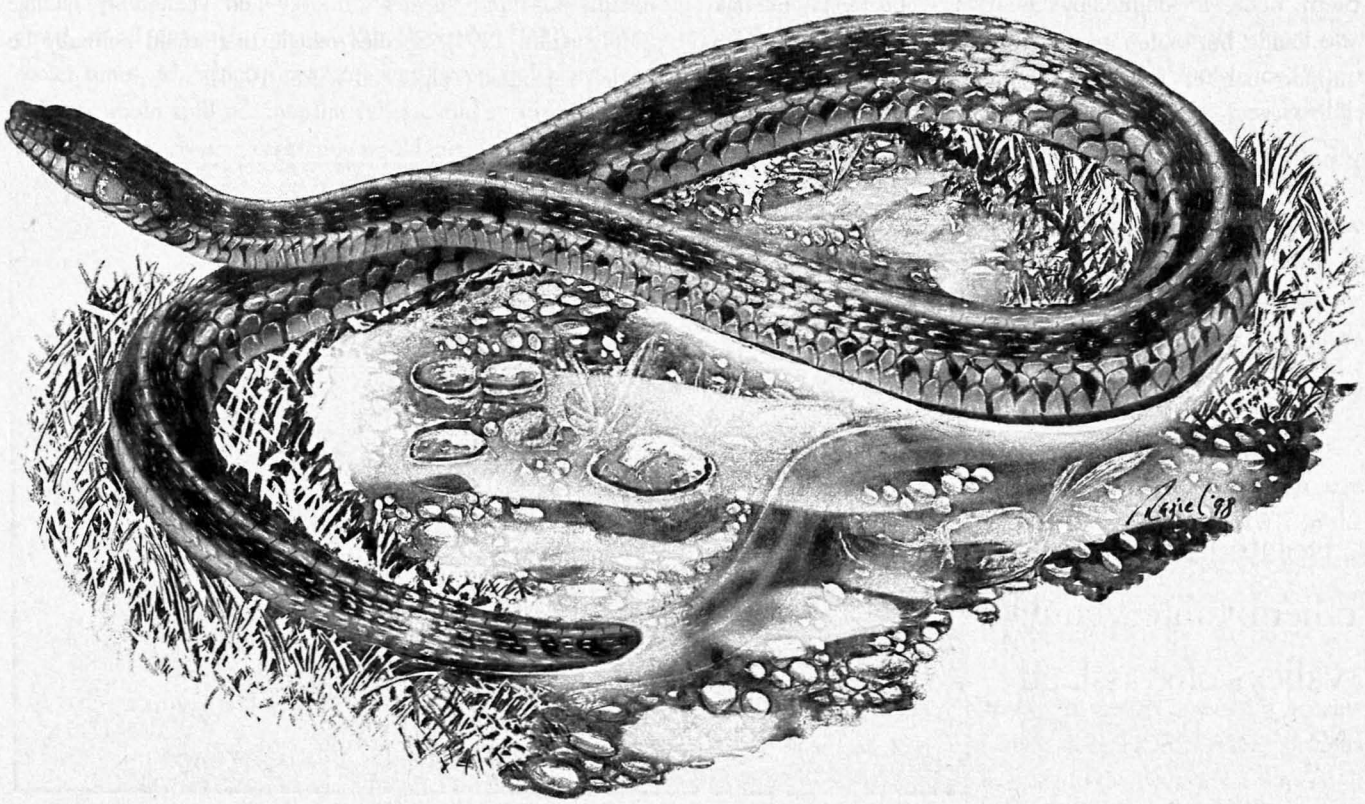
Our proposed conservation system, the Sky Islands Wildlands Network (SIWN), is part of a 17.3-million-acre region that extends from the Mogollon Rim in east-central Arizona and west-central New Mexico south to the northern Sierra Madre Occidental in Chihuahua and Sonora, Mexico. At the center of the region, covering about 9.9 million acres, are the Sky Islands (McLaughlin 1994).

Weldon Heald coined the term "sky islands" in 1967 to denote mountain ranges that are isolated from each other by intervening valleys of grassland or desert (Warshall 1994, McLaughlin 1994). The valleys of this basin and range country act as barriers to the movement of woodland and forest species somewhat like saltwater seas isolate plants and animals on oceanic islands. The 40 ranges of the Sky Island system may be thought of as an archipelago (Warshall 1994).

Although numerous local influences play a role, the great diversity of the Mogollon Highlands/Sky Islands/Northern Sierra Madre Occidental network stems from its location, elevation, and history. Oriented north and south between the Rocky Mountains and the Sierra Madre Occidental of Mexico, the Sky Islands rise at the meeting point of temperate North American species and warm subtropical species. They straddle two major floristic provinces (the Neotropic and Holarctic) and two faunal realms (the Neotropic and Nearctic) and are at the point of convergence of three climatic zones: tropical, subtropical, and temperate. The lowest gap in the continental cordillera between northern Canada and the Isthmus of Tehuantepec is in the Sky Islands, and this low pass encouraged the movement of eastern and western species, thus adding to the diversity. The highly diverse geology of the region also contributes to biological diversity (Warshall 1994).

The Sky Islands and Sierra Madre region is part "of the two richest floras of mega-Mexico—which ranks as one of the three top mega-diversity centers of the world" (Felger and Wilson 1994). The region covered by the Sky Islands Wildlands Network, extending south into Mexico approximately 200 miles, supports an estimated 2300–2800 species of flowering plants (McLaughlin 1994). Certain wildlife groups—ants, bees, lichens, snails, reptiles, birds, and mammals—are especially abundant. Indeed, the Sky Islands are the most diverse sector in the United States for ants, mammals, and reptiles (Warshall 1994). Some temperate species reach the southern limit of their ranges here while it is the northern limit for many tropical species (Felger and Wilson 1994).

At least 104 mammal species occur here; their diversity, as with plants, is the product of climatic and elevational factors and the proximity of two large biogeographic centers—the Sierra Madre, with its subtropical affinities, and the Mogollon



water snake *(Thamnophis sp.)* by Raziel Méndez Moreno

Highlands, with its strong affinity to the southern Rockies. Twenty-nine bat species are present in the region, with some subtropical species reaching their northern limits (Felger and Wilson 1994).

The Sky Islands are the northern limit of 14 plant families and four bird families, and the southern limit of seven bird families. The geographic limits of 30 bird, 35 reptile, and 15 mammal species occur here (Warshall 1994).

Over half the bird species in North America occur in the Chiricahua Mountains alone. Thirteen bird species are endemic to the northern Sierra Madre Occidental; four occur primarily in the region—the thick-billed parrot, purplish-backed jay, tufted jay, and Mexican chickadee. The Sierra Madre Occidental is considered the center of radiation for jays, woodpeckers, wrens, and ground sparrows (Felger and Wilson 1994).

The international border region has the richest bee fauna in the world, while the northernmost populations of leafcutter ants are found in southwestern Arizona on the edge of the Sky Islands. Many endemic fish species occur, or used to occur, in the Gila and Colorado river basins. The region contains 136 species of reptiles and amphibians, some—northern casque-headed frog, vine snake, green rat snake, and ridge-nosed rattlesnake—at the northern limit of their range (Felger and Wilson 1994).

The Sky Islands, as well as the Mogollon Highlands and Sierra Madre, are defined by the presence of oak and pine-oak woodlands, but some ranges, rising to 9000–10,000 feet, also support conifer forests (McLaughlin 1994). The White Mountains, Mogollon Mountains, and Black Range (all with elevations over 10,000 feet) in the northern part of region support spruce-fir forests and subalpine grasslands typical of the southern Rocky Mountains. Mixed conifer forests also flourish in the high country of the northern Sierra Madre Occidental. Precipitation increases with altitude, about four to five inches for every 1000-foot gain, while temperature decreases three or four degrees Fahrenheit over the same distance (Lowe 1985). This means that plants and animals with high moisture requirements must be able to survive low temperatures while animals requiring heat must have the ability to tolerate drought (Lowe 1985).

Species with broadly similar climatic preferences or tolerances sort themselves along the elevational gradient where the blend of temperature and aridity (and other factors) best supports them. This results in a stacking or layering of biotic communities on each range, from desert or grassland to subalpine forest, the number and kinds of communities varying with the latitude, size, and elevation of each range. Species of plants and animals originating in north temperate areas, including some from the Arctic Circle, tend to stack at the higher elevations, while species from the more tropical south, including some whose range extends into South America, occur nearer the base (Lowe 1985). The compression of biotic communities into relatively constricted vertical spaces with changes in elevation results in rapid species turnover and community change (McLaughlin 1994). Species mingle that would normally be widely separated (Felger and Wilson 1994).

Weldon Heald coined the term "sky islands" to denote mountain ranges that are isolated from each other by intervening valleys of grassland or desert.

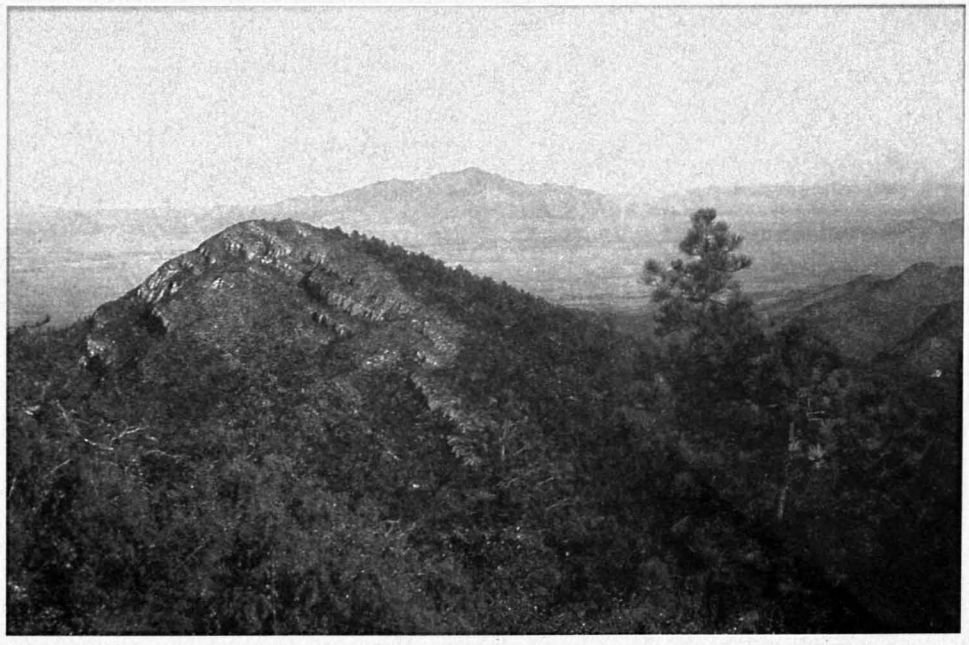
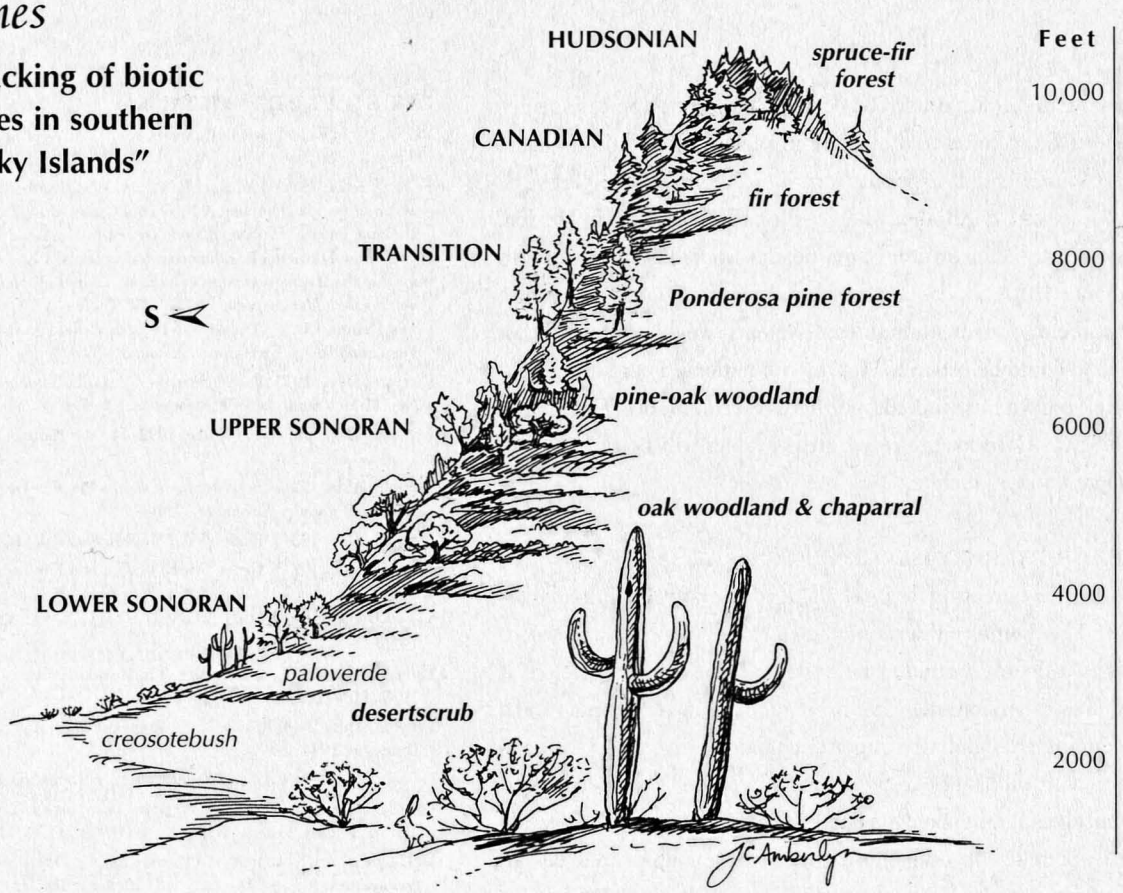


photo: Sierra de los Ajos, Mexico by Dale Turner

Life Zones

Vertical stacking of biotic communities in southern Arizona "Sky Islands"



Over the past two million years the location and mix of species along the altitudinal gradients has changed, as cycles of glaciation and warming have triggered species migrations up, down, or off mountain ranges (Van Devender 1990). During cooler times, which have predominated, woodland plants and animals would spill out into the valleys, and species formerly isolated by intervening vegetation would mix. Northern temperate species would immigrate into the region while many desert species would retreat south. During warmer interglacials, such as the present, subtropical desert vegetation would return. Woodland vegetation would migrate upslope and become stranded on individual ranges, as the valleys between Sky Islands became barriers they could not penetrate. The mountains thus become "islands" again (Van Devender 1990). Variation in the degree of mixing and isolation of species has made each Sky Island range and its biota novel.

THE SKY ISLANDS WILDLANDS NETWORK HAS GROWN OUT of previous campaigns to protect the region. Ever since Leopold recommended protecting the Gila Wilderness, conservationists and naturalists have defended this landscape against exploitation (Foreman 1972). Wilderness legislation in 1964, 1980, 1984, and 1990 protected important core areas (Foreman and Wolke 1992). In response to a 1992 Forest Service proposal to turn the Coronado National Forest in southeastern Arizona into a National Recreation Area, conservationists in Tucson formed the Sky Island Alliance (SIA) to defend the biological diversity of the region. In 1994, they presented a preliminary preserve design to a Forest Service conference on the Sky Islands (Turner et al. 1994). At that same conference, biologist Tony Povilitis (1994) offered another preliminary reserve system for the Sky Islands that would also include the Gila and Apache National Forests to the north. In December 1995, the Sky Island Alliance and The Wildlands Project hosted a three-day workshop to begin conservation area design for a "Mogollon Highlands/ Greater Gila/Sky Islands" region. Since then, many individuals from many groups in the United States and Mexico have worked to develop the Sky Islands Wildlands Network Conservation Plan, due for release by the summer of 2000. The SIWN Conservation Plan is more than a mapped conservation area design. In addition to the proposals initiated by SIWN in the conservation planning process, we embrace many independent conservation proposals that we did not initiate. Although we endorse many other conservation efforts, such efforts do not necessarily endorse SIWN.

Early in the conservation area design process, it became obvious that many distinctive elements of the Sky Islands ecosystem could not be protected in the United States alone. If

illustration by J.C. Amberlyn

jaguars, thick-billed parrots, ocelots, and other tropical species were to be restored to their rightful place in the United States, their source breeding populations in northern Mexico had to be protected as well. Roughly half of the SIWN region is in Mexico. Much of the conservation area design work has involved both nations. However, because of very different land ownership, resource management, and legal systems, we have decided that SIWN should be separated for the two nations. Therefore, a separate, but tightly linked, northern Sierra Madre Occidental Biological Corridor protected areas system will be proposed in Sonora and Chihuahua.

THE GREATER SKY ISLANDS REGION COMES NEAR TO BEING the cream of creation for its ecological diversity, haunting beauty, and beckoning wilderness. However, as Leopold understood, this is a deeply wounded landscape. To heal it and protect it requires a visionary, wide-ranging plan and campaign. In defending this globally important landscape, conservationists from both sides of the international border have dedicated themselves to Leopold's vision. The Sky Islands Wildlands Network refers to both the mapped conservation area design and the network of conservationists, scientists, and land users working together to protect it. Michael Soulé has described this approach as networks of people defending networks of lands (Soulé 1995, 2000).

In other articles that fill out this special Sky Islands section of *Wild Earth*, we discuss the different elements that we have used to produce the Sky Islands Wildlands Network Conservation Plan; we describe how our goals are based on healing the major ecological wounds the land has suffered; and we explain our strategy for implementing something as complex and audacious as the SIWN Conservation Plan. Conservationist and writer David Petersen takes us on a hike up one island in the sky, Baboquivari Peak, as he looks for the ghost of Ed Abbey. Our TWP colleagues Rurik List, Oscar Moctezuma, and Carlos Martínez del Rio discuss the work being done for the Northern Sierra Madre Occidental Biological Corridor. Finally, we look again at that glorious country through Aldo Leopold's eyes, and revisit an altered Mexican wilderness with both extraordinary potential for ecological recovery and important lessons to teach contemporary Mexican and American conservationists. ☾

Dave Foreman and Barbara Dugelby are on the reserve design team of The Wildlands Project. Jack Humphrey and Andy Holdsworth are staff for the Sky Island Alliance. Bob Howard is chair of the New Mexico Wilderness Alliance. Mike Seidman is on the board of the Sky Island Alliance.

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Introduction: The Greater Sky Islands Region

The greater Sky Islands region is globally important for its biological diversity, its biogeographical location, the "land ethic" lessons it provides, and as a birthplace of the National Wilderness Preservation System.

The proposed conservation system, the Sky Islands Wildlands Network (SIWN), is part of a 17.3-million-acre region, bounded by the Mogollon Rim on the north and the Sierra Madre Occidental range on the south. At the center of the region are the Sky Islands.

The term "sky islands" denotes mountain ranges that are isolated from each other by intervening valleys of grassland or desert. The Sky Islands/Sierra Madre region has been identified as a center of diversity for several groups of species; this great diversity flows from the region's location, elevation, and history. Oriented north and south between the Rocky Mountains and the Sierra Madre Occidental of Mexico, the Sky Islands rise at the meeting point of temperate North American species and warm subtropical species. They straddle two major floristic provinces (the Neotropic and Holarctic) and two faunal realms (the Neotropical and Nearctic).

The SIWN Conservation Plan

A *wildlands network* is a proposed complex of wilderness cores, landscape linkages, and compatible use zones in an ecologically defined area. SIWN has been designed using a *rewilding* approach. Rewilding is based on the argument that functional wildlands networks require their native keystone species, particularly large carnivores (which stabilize prey and smaller predator populations), to help maintain ecological diversity. Large, connected landscapes are essential for carnivore conservation. Rewilding also requires the reintroduction of extirpated species, ecological restoration, management guidelines, and compatible economic use standards. Together, these components form the Sky Islands Wildlands Network Conservation Plan.

Wounds to the Land

Aldo Leopold wrote, "One of the penalties of an ecological education is that one lives alone in a world of wounds. … " Beginning about 150 years ago and continuing to the present day, the ecological integrity of the Sky Island region has suffered six great wounds:

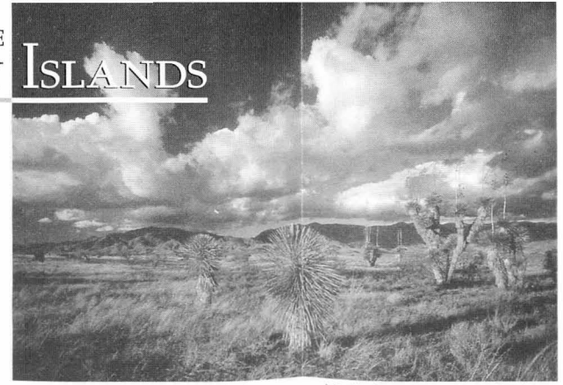
- Extermination of several species of native animals.
- Damage of watersheds, stream channels, and riparian forests.
- Fire suppression.
- Fragmentation by roads, dams, and other works of civilization.
- Aggressive and disruptive exotic species.
- Degradation of forests by logging.

Mission and Goals

The mission of the Sky Islands Wildlands Network is to heal the region's ecological wounds by first designing a map-based network of conservation areas, and then developing and implementing a conservation plan for the region. Six goals have been established, each tied to healing a major wound:

- Recovery of all large carnivores and ungulates, and other species native to the region.
- Restoration of watersheds, streams, and riparian forests.
- Restoration of a natural fire disturbance regime.
- Restoration and protection of habitat connectivity for wide-ranging native species.
- Elimination or control of exotic species.
- Protection of all remaining native forests and woodlands, and restoration of natural forest conditions.

The Sky Islands



Mt. Graham, Arizona by Jack Dykinga

Focal Species Planning

The rewilding approach to science-based conservation area design uses carefully selected *focal species* for planning. Focal species are organisms used in designing and managing reserves because their requirements for survival represent factors important to maintaining ecologically healthy conditions.

The SIWN Conservation Plan utilizes several types of focal species, including:

Umbrella: species that generally cover large and ecologically diverse areas in their daily or seasonal movements. Protecting enough habitat to assure a viable population of these organisms would provide habitat and resources to many other species that are more restricted in range.

Keystone: species that enrich ecosystem function in a unique and significant manner through their activities; the effect is disproportionate to their numerical abundance. The extirpation of keystone species often triggers other extirpations and significant changes or loss of habitats.

Flagship: charismatic animals, like wolves and eagles, which build popular support for a protected area.

Habitat Quality Indicators: species that require natural habitat of high ecological integrity, and that provide an early warning system because they are sensitive to ecological changes.

Wilderness Cores

The SIWN Conservation Plan is based on a core system of Wilderness Areas. The National Wilderness Preservation System on federal public land has proven to be the most effective means of protecting large areas of natural habitat in the United States.

Designated and proposed Wilderness Areas comprise a large part of the federal land in the SIWN region. Wilderness Areas are not human exclusion zones. A wide range of non-motorized recreational activities is permitted, including hunting and fishing. However, Wilderness Areas are not solely for recreation; they protect ecological values too.

After lands are designated Wilderness, there may be no permanent roads or use of mechanized equipment (except for certain administrative needs, usually only in cases of emergency).

Conservation on Private Lands

In the SIWN region, some of the ecologically most important areas are large private ranches currently managed by their owners as cores, linkages, or compatible use zones. Private lands, therefore, play a key role in the Sky Islands Wildlands Network.

Inclusion of private lands on the SIWN map does not mean that use of private land is being dictated. Rather, identifying such lands is recognition that exceptional management by the landowner protects these lands as vital habitats and linkage areas for wildlife. In many cases, private ownership better protects land for sensitive species than would public ownership.

SIWN's endorsement of outstanding private land management does not necessarily mean that such landowners have participated in regional conservation planning or endorse SIWN. Proposed designation and management guidelines for other units on the map apply only to public lands and not to private lands except where owners voluntarily enter into conservation easements.

Complementary Campaigns

In the Sky Islands Wildlands Network region, there are many independent conservation organizations and initiatives. Although embracing these many other conservation campaigns, SIWN does not propose to initiate or direct them, but rather to provide an integrated context, rationale, and coordination for them. Groups and individuals whose conservation work has the effect of contributing to realization of a regional wildlands network still may not endorse the SIWN plan. Nor does inclusion of such efforts imply their participation in planning SIWN.

SIWN Units

SIWN includes over 200 individual units of land, including federal, state, county, and private parcels that are proposed or recognized as cores, linkages, and compatible use areas. The conservation plan provides management guidelines for each land unit classification in the proposal. Following is a summary.

Core Areas. Designated or proposed Wilderness Areas on federal public lands, other public lands including National Parks & Monuments, Wildlife Refuges, and National Conservation Areas, or private lands managed for biodiversity protection.

Compatible Use Areas. Public lands with low road densities and limited to moderate use, or private lands voluntarily managed for natural values.

Landscape Linkages. Areas managed primarily for wildlife movement or dispersal.

Wild & Scenic Rivers. Rivers and streams proposed for Wild & Scenic River designation.

Study Areas. Public lands that need further study to determine Wilderness Area boundary recommendations.

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Diverse, Beautiful, and Wild

Sky Islands Wildlands Network

THE GREATER SKY ISLANDS REGION is globally important for its biological diversity, its biogeographical location, the "land ethic" lessons it provides, and as a birthplace of the National Wilderness Preservation System.

The Sky Islands Wildlands Network (SIWN) Conservation Plan provides a conceptual design for a very long-term effort to restore and maintain the region's native wildlife and ecological processes. The design is based on rewilding and focal species planning, and specifically seeks to heal six major wounds the region has suffered.

The plan envisions a complex of federal Wilderness cores linked and buffered by a variety of federal, state, and private lands managed to protect natural values (see description on reverse).

The SIWN Conservation Plan is perhaps best viewed as an "architect's sketch"—that provides perspective and context to the ongoing conservation efforts of many organizations and individuals, and presents a bold but achievable vision for protecting the extraordinary natural legacy of the Sky Islands region.

Thick-billed Parrot
Rhynchopsitta pachyrhyncha

Mexican Gray Wolf
Canis lupus baileyi

Jaguar
Panthera onca

Sky Island Alliance

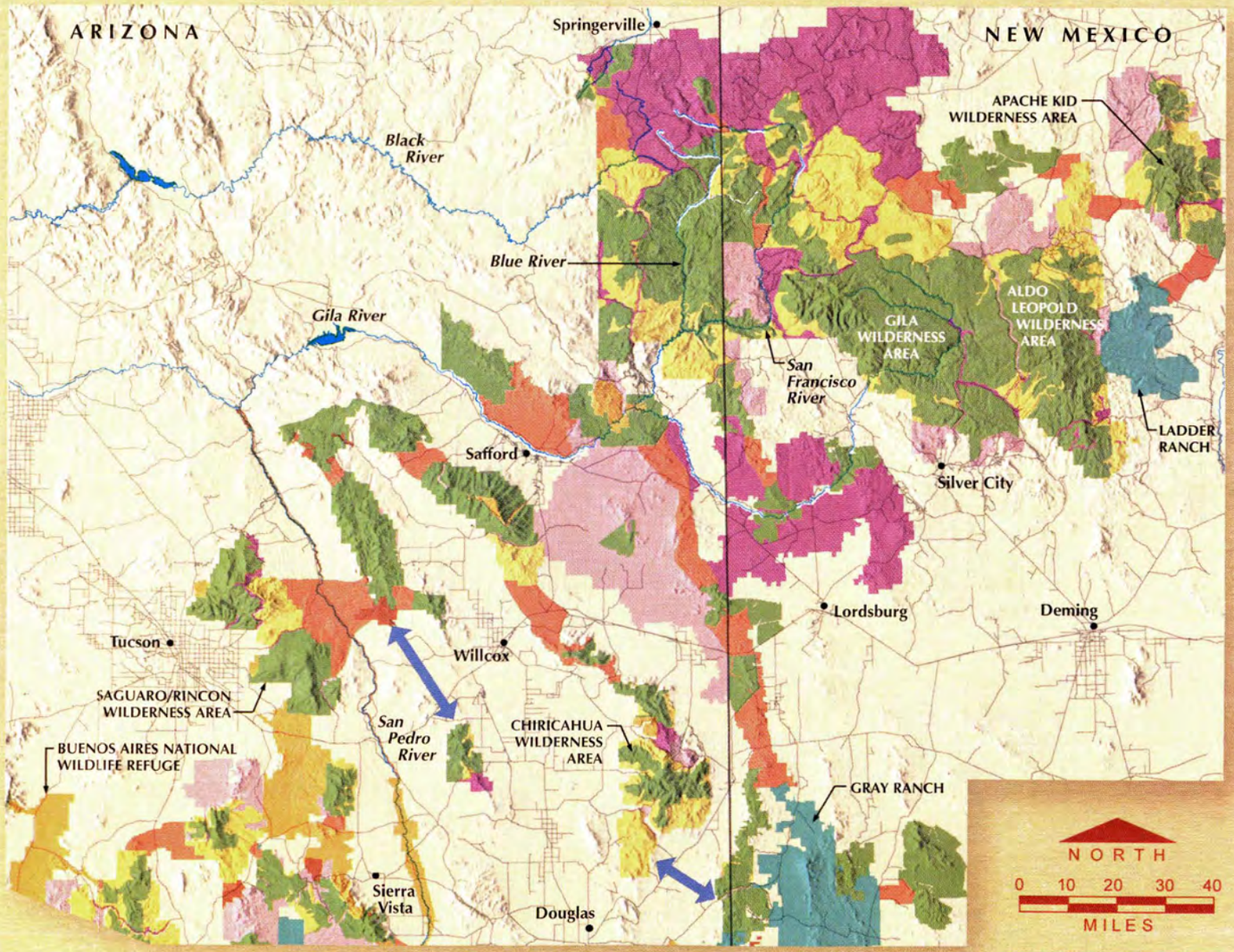
Naturalia — Comité para la Conservación de Especies Silvestres, A.C.

THE WILDLANDS PROJECT

NEW MEXICO WILDERNESS ALLIANCE

Graphic Design: Luis M. Ramirez, Multimedia Consultant ■ Digital Cartographic Design: Curtis Bradley

Protecting Nature in the Sky Islands: A Draft Proposal



Core Areas
- Wilderness Areas*
- National Parks & Monuments, Wildlife Refuges, National Conservation Areas, etc.*
- Private

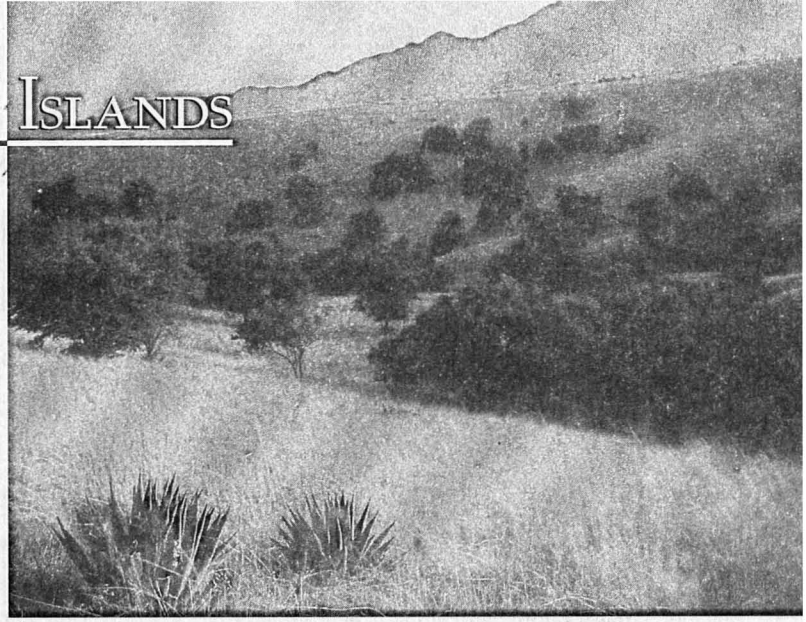
Compatible Use Areas
- Low Use (public land)
- Moderate Use (public land)
- Private

Landscape Linkages
- Wildlife Movement Linkage
- Dispersal Area

Other Areas
- Wild and Scenic Rivers (proposed)
- Study Areas

* existing and proposed

See SIWN Units on reverse for area descriptions.



The Elements of a Wildlands Network Conservation Plan

An Example from the Sky Islands

by Dave Foreman, Barbara Dugelby, Jack Humphrey, Bob Howard, and Andy Holdsworth

THE WILDLANDS PROJECT WAS ORGANIZED to coordinate conservation area design throughout North America, with a special focus on large carnivores and wilderness. During the last decade, we have learned a great deal about the scientific underpinnings of conservation area design and the on-the-ground steps necessary to carry out such a design and plan. Since its first issue, *Wild Earth* has been home to the practical discussion of how to design conservation areas so they are better able to protect species, ecosystems, and ecological processes.

Early on, we decided we needed direct experience with conservation area design in order to learn how to do it. Only then would we feel we could help others. The Sky Islands Wildlands Network Conservation Plan is the result of that work. We have learned much from the process as well as from the scientific workshop organized by Michael Soulé and John Terborgh in 1997. The book resulting from that workshop, *Continental Conservation: Scientific Foundations of Regional Reserve Networks* (Soulé and Terborgh 1999), is the single most important source for understanding the theoretical and applied science behind conservation area design. Here, we share the different pieces or elements that should be included in each conservation area design in the United States if it is to be comprehensive and contribute to real world conservation. Different regions of North America will emphasize certain of these elements over others, but most of these elements should be included in a thorough wildlands network proposal for any region.

photo: semi-desert grassland and Madrean oak woodland, Santa Rita Mountains, Arizona by Jack Dykinga

The Name of the Thing

As science-based reserve design and conservation area planning has evolved, many names have been used to describe the process and the product. Some words carry negative baggage in specific regions among certain groups with whom we would like to work. *Reserve* is such a word, with negative connotations for tribal groups and in Mexico. Because of this, we use *conservation area design* for the process (Jeo et al. 1999).

Since the mid-1980s, conservation area design to protect ecological values has been based on healing the fragmentation and degradation of the landscape with a complex of protected core areas, corridors, and buffer zones (Noss 1987). For this connected complex of protected areas, the product of the conservation planning process, we use *wildlands network.* The word wildlands has come to mean a range of natural and semi-natural landscapes. Network refers both to a network of conservation areas and to a network of people and communities who care about the land and are working together to protect (and use) it (Soulé 1995, 2000). A wildlands network is a proposed system of cores, linkages, and compatible use zones in an ecologically defined area, thus the Sky Islands Wildlands Network (SIWN, pronounced sigh-win).

Rewilding a landscape requires more than a mapped wildlands network, however. Reintroduction of extirpated species, ecological restoration, management guidelines, and compatible economic use standards are also necessary. When these management efforts are combined with a wildlands network, a *conservation plan* for the area is created. Therefore, conservation area design leads to a Wildlands Network Conservation Plan.

Rewilding

Recently The Wildlands Project formally resolved that "the long-term goal of reserve design [for The Wildlands Project] is rewilding." In the Sky Islands of Arizona and New Mexico, we have used rewilding as the ultimate goal of the SIWN Conservation Plan. Rewilding as a general term has been used by wilderness advocates for many years (Davis 1991–1992, Foreman 1992). In this sense it refers to "allowing or helping ecological and evolutionary processes reassert themselves across the landscape" (Butler pers. comm. 2000). This is not, however, a scientific or testable goal. In a narrower sense, rewilding is a scientific concept (Soulé pers. comm. 2000).

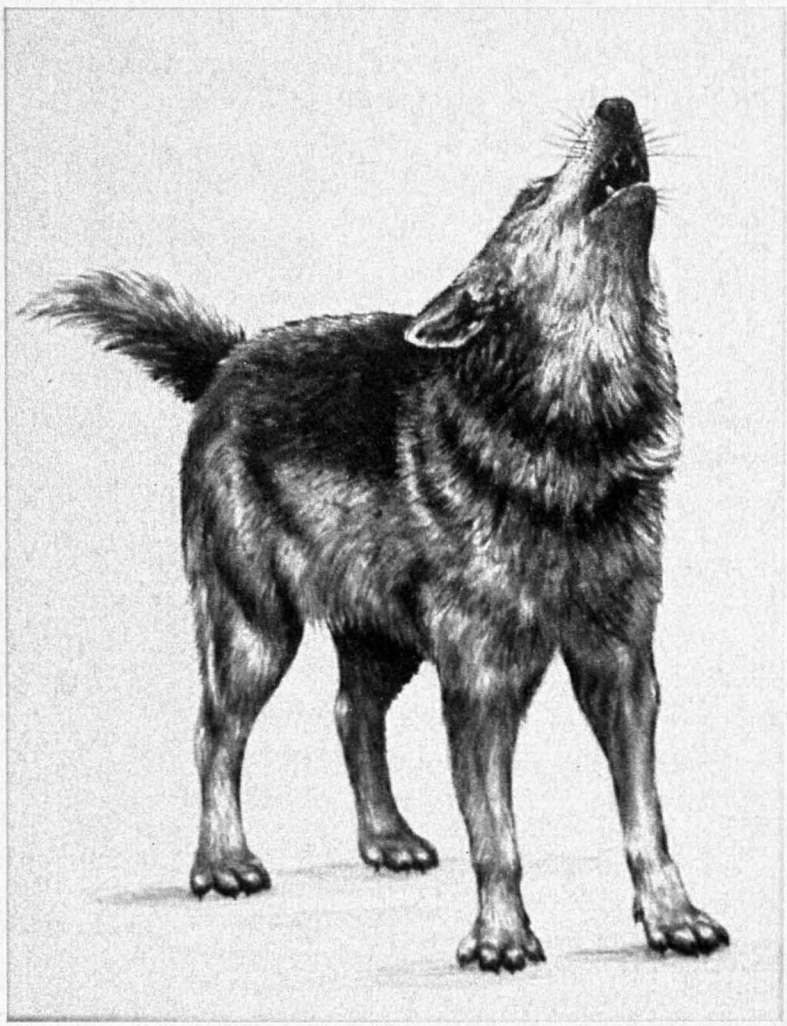


illustration by Todd Telander

Michael Soulé and Reed Noss set forth the idea and scientific justification for rewilding in the fall 1998 issue of *Wild Earth.* They "recognize three independent features that characterize contemporary rewilding:

- Large, strictly protected core reserves (the wild)
- Connectivity
- Keystone species."

In shorthand, these are "the three C's: Cores, Corridors, and Carnivores" (Soulé and Noss 1998).

This rewilding approach is built on recent scholarship showing that ecosystem integrity is often dependent on the functional presence of large carnivores. Soulé and his collaborators have shown that native songbirds survive longer in large suburban San Diego canyons where there are coyotes; they disappear faster when coyotes disappear. Coyotes eat foxes, opossums, and prowling house cats. Foxes and

cats eat quail, cactus wrens, thrashers, and their nestlings (Soulé et al. 1988, Crooks and Soulé 1999).

Songbirds are victims of the extirpation of wolves and cougars, according to David Wilcove, staff ecologist for the Environmental Defense Fund. The population decline of songbirds because of forest fragmentation is well documented, but Wilcove has suggested that songbird declines in eastern North America are partly due to the absence of large carnivores. Cougars and wolves do not eat warblers or their eggs, but raccoons, foxes, skunks, and opossums do; and cougars and wolves eat these midsize predators. When the big guys were hunted out, the populations of the middling guys exploded—with dire results for the birds (Wilcove et al. 1986). Soulé calls this phenomenon of mid-sized predators multiplying and behaving boldly in the absence of large predators *mesopredator release.*

Large carnivores are often major regulators of prey species numbers—the opposite of once-upon-a-time ecological orthodoxy. The removal or population decline of large carnivores can alter plant species composition, particularly the balance between large- and small-seeded plants, due to increased seed and seedling predation by superabundant herbivores that are normally regulated by large carnivores. John Terborgh of Duke University has made these findings in his studies of the ecological effects of eliminating jaguars, pumas, and harpy eagles from tropical forests (Terborgh et al. 1999). This is called *top-down regulation* (Soulé and Noss 1998). There is compelling evidence for such top-down regulation in terrestrial and marine ecosystems around the world.

Rewilding, therefore, is "the scientific argument for restoring big wilderness based on the regulatory roles of large predators," according to Soulé and Noss.

> *Three major scientific arguments constitute the rewilding argument and justify the emphasis on large predators. First, the structure, resilience, and diversity of ecosystems is often maintained by "top-down" ecological (trophic) interactions that are initiated by top predators (Terborgh 1988, Terborgh et al. 1999). Second, wide-ranging predators usually require large cores of protected landscape for foraging, seasonal movements, and other needs; they justify bigness. Third, connectivity is also required because core reserves are typically not large enough in most regions; they must be linked to insure long-term viability of wide-ranging species. ... In short, the rewilding argument posits that large predators are often*

Aplomado falcon by Todd Telander

instrumental in maintaining the integrity of ecosystems. In turn, the large predators require extensive space and connectivity. (Soulé and Noss 1998)

If native large carnivores have been extirpated from a region, their reintroduction and recovery is central to a conservation strategy. Wolves, grizzlies, cougars, lynx, wolverines, black bears, jaguars, and other top carnivores need to be restored throughout North America in their natural ranges.

Although Soulé and Noss state, "Our principal premise is that rewilding is a critical step in restoring self-regulating land communities," they also claim two non-scientific justifications for rewilding: "the ethical issue of human responsibility," and

the subjective, emotional essence of "the wild" or wilderness. Wilderness is hardly "wild" where top carnivores, such as cougars, jaguars, wolves, wolverines, grizzlies, or black bears, have been extirpated. Without these components, nature seems somehow incomplete, truncated, overly tame. Human opportunities to attain humility are reduced. (Soulé and Noss 1998)

With rewilding, Soulé and Noss have developed the *scientific basis* for the need for big Wilderness Area complexes. Here science buttresses the wants and values of wilderness recreationists. Big Wilderness Areas are necessary not only for inspiration and a true wilderness experience,[1] but also for the protection and restoration of ecological integrity, native species diversity, and evolution.

Healing-the-Wounds Goal-Setting

In his insightful essay "Round River," Aldo Leopold called for ecologists to heal the wounds of the land (Leopold 1972). Beginning about 150 years ago and continuing to the present day, the ecological integrity of the Sky Islands region has suffered six great wounds: extirpation of wildlife, damage to watersheds and streams, fire suppression, habitat fragmentation, exotic species, and forest degradation.

For the Sky Islands Wildlands Network, we have developed an approach for establishing our mission, goals, and objectives based on healing these wounds. The mission of the SIWN Conservation Plan is to be Leopold's doctor and heal these six wounds from a rewilding approach. This healing-the-wounds strategy is discussed in detail in the accompanying article.

Ecosystem Representation

Since 1926, representing samples of all native North American ecosystems in protected areas has been a stated goal of conservation (Shelford 1926). Ecosystem representation has been a factor in selecting new National Park units, Wilderness Area designation for National Forests in the eastern United States, the Bureau of Land Management wilderness study process, the Forest Service's second Roadless Areas Review and Evaluation (RARE II), and identifying candidate National Parks, Wildlife Refuges, and Wild and Scenic Rivers in Alaska (Foreman 1999b). Ecosystem representation has also been a goal for The Nature Conservancy in purchasing land for private nature reserves. In Canada, the Endangered Spaces campaign has sought to protect representative ecosystems across all provinces and territories (Hummel 1989, Hummel 1995). Nonetheless, both the United States (Noss et al. 1995) and Canada have done a poor job of ecosystem representation (as have all other countries).

Michael Soulé (pers. comm. 2000) explains:

Representation is a reasonable objective of conservation planning, but *ecologists point out that plant communities shift in space and change in membership over time. This means that communities or plant associations are not as concrete as species.*

Moreover, there is no way of knowing "how much is enough" of any given plant association (community)—how much is required to give us confidence about the stability or persistence of this association over time; in other words, the idea of a viable plant association is not meaningful.

Therefore, the only way of answering the how-much-is-enough question is to focus on species, particularly species whose viability and persistence indicate the "health" of a particular habitat or ecosystem. Large carnivores are often useful in this regard because their persistence often indicates the ecological integrity, diversity, and resilience of the system as a whole (the rewilding argument). In aquatic systems, indicators such as otter or beaver are often selected, as are fish or invertebrate species that are sensitive to water quality and food abundance.

There is a scientific way of talking about or estimating the viability of a trout or wolverine population; it is called population viability analysis. But there is, as yet, no scientific way of speaking of the viability of a patch of forest or a stream, without, that is, referring to the

1. Back in 1964, David Brower wrote that "*real* wilderness" was "big wilderness—country big enough to have a beyond to it and an inside" (Brower 1969).

species that depend on it. And it is easier and cheaper to monitor a few species than monitor everything that might suggest the health of a community.

So, while it is good to capture all the heterogeneity of vegetation, soil types, and topographies in a landscape or region, doing so will not provide for the space and connectivity on which diversity and resilience depend. Isolated patches are doomed to suffer extinction.

In the Sky Islands, we have approached ecosystem representation by careful selection of umbrella and habitat indicator focal species. Our hypothesis is that the protection of sufficient habitat for the identified focal species will ensure representation of the region's native habitats. We believe that using focal species to protect representative ecosystems is quicker, less expensive, and easier than other approaches. We offer this as a hypothesis to be tested.

Focal Species Planning

The rewilding approach to science-based conservation area design uses carefully selected *focal species* for planning. Brian Miller and his co-authors have refined the use of focal species (Miller et al. 1999).

Focal species are organisms used in planning and managing nature reserves because their requirements for survival represent factors important to maintaining ecologically healthy conditions. Ultimately, questions about ecological patterns and processes cannot be answered without reference to the species that live in a landscape (Lambeck 1997). Representation and special elements themes point to which areas should be included in reserves, but focal species analysis identifies additional high-value habitats and address the questions: "What is the quality of habitat?", "How much area is needed?", and "In what configuration should we design components of a reserve network?"

They also note that "any conservation plan failing to include the needs of native carnivores is incomplete."

The SIWN science committee identified several different kinds of focal species:

Umbrella—species that generally cover large and ecologically diverse areas in their daily or seasonal movements; protection of enough of their habitat to assure a viable population of these organisms would provide habitat and resources to many other species more restricted in range.

Keystone—species that enrich ecosystem function in a unique and significant manner through their activities, and the effect is disproportionate to their numerical abundance. The extirpation of keystone species often triggers other extirpations and significant changes or loss of habitats. Large carnivores are often keystone species. The beaver, through its modification of the landscape, is another keystone species (Mills et al. 1993).

Flagship—charismatic animals, like wolves and eagles, which build popular support for the protected area.

Habitat Quality Indicators—species that require natural habitat of high ecological integrity and that provide an early warning system because they are sensitive to ecological changes.

Wilderness Quality Indicators—species that are sensitive or vulnerable to human disturbance and thus require remote, wilderness habitat.

Prey—key prey species for focal predators in the above categories.

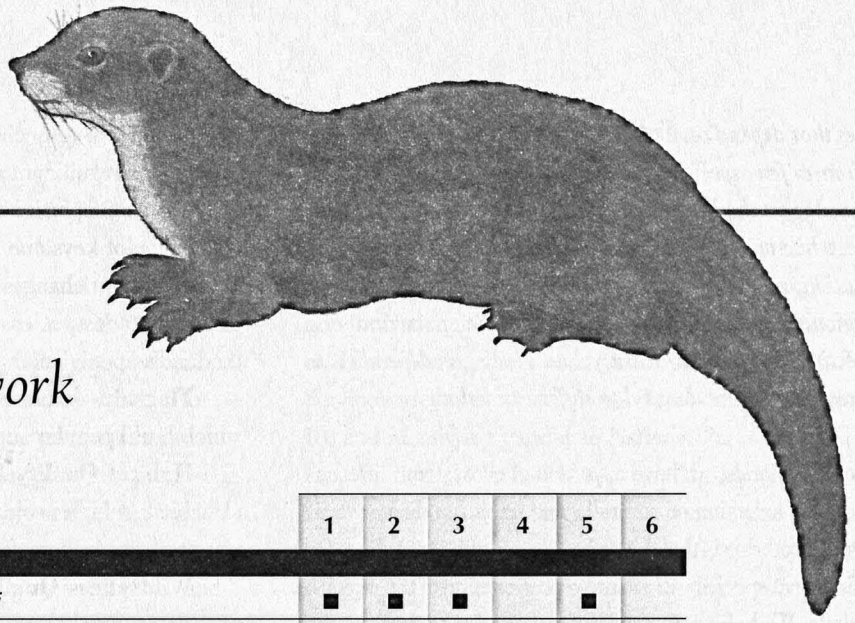
Umbrella species are especially important in designing a wildlands network. Miller and his co-authors write that:

Umbrella species should exhibit at least several of the following qualities: 1) large area requirements, 2) a defined habitat association, 3) a known life history, preferably through an ongoing study or monitoring effort, and 4) potential for regional viability or reintroduction. When calculating area requirements of umbrella species, we should think in terms of what is necessary for viable populations, whether viability is measured at local or regional scales (Berger 1997).

If terrestrial carnivores are used as umbrella species, we recommend considering females.

Miller and his co-authors further point out, "Female carnivores ... are the base of a wild population." This is because their home ranges reflect the area required to rear their young successfully.

By carefully selecting focal species in these categories, conservationists and scientists can design effective wildlands networks of cores, landscape linkages, and compatible use areas. Each of the focal species used in SIWN is either an umbrella or habitat indicator species. For example, we initially selected the southwestern willow flycatcher as the habitat indicator for the highly threatened cottonwood-willow riparian forest community. However, ornithologists told us that the flycatcher uses lower brushy areas and not the canopy of the gallery forest. The yellow-billed cuckoo was recommended as a habitat indicator for the canopy. Between the two birds, it is believed that the entire ripar-



Sky Islands Wildlands Network Focal Species

	1	2	3	4	5	6
CARNIVORES						
Mexican wolf *Canis lupus baileyi*	■	■	■		■	
Grizzly bear *Ursus arctos horribilis*	■		■	■	■	
Black bear *Ursus americanus*	■		■	■	■	
Jaguar *Panthera onca*	■		■	■	■	
Mountain lion *Felis concolor*	■	■	■		■	
Jaguarundi *Herpailurus yagouarundi*			■	■	■	
Ocelot *Leopardus pardalis*			■	■	■	
River otter *Lutra canadensis & Lutra annectens*	■	■		■		
Black-footed ferret *Mustela nigripes*	■		■			
UNGULATES						
Bighorn sheep *Ovis canadensis & Ovis canadensis mexicana*	■		■	■	■	
Pronghorn *Antilocapra americana*	■		■			■
Bison* *Bos bison*	■	■	■			■
Elk *Cervus elaphus*	■		■			■
Coues white-tailed deer *Odocoileus virginiana couesi*	■		■	■		■
RODENTS						
Beaver *Castor canadensis*		■	■	■		■
Prairie dog *Cynomys spp.*		■	■	■		■
RAPTORS						
Mexican spotted owl *Strix occidentalis lucida*			■	■	■	
Northern goshawk *Accipiter gentilis*			■	■	■	
Aplomado falcon *Falco femoralis*			■	■		
Golden eagle* *Aquila chrysaetos*	■		■			
FISH						
Gila trout *Oncorhynchus gilae*	■		■	■	■	
Apache trout *Oncorhynchus apache*	■		■	■	■	
Loach minnow *Tiaroga cobitis*				■		
Gila topminnow *Poeciliopsis occidentalis*				■		
OTHER						
Southwest willow flycatcher *Empidonax traillii extimus*	■		■	■		
Thick-billed parrot *Rhynchopsitta pachyrhyncha*	■		■	■	■	
Yellow-billed cuckoo *Coccyzus americanus*	■			■		
Chiricahua leopard frog *Rana chiricahuensis*	■		■	■		

1) Umbrella

2) Keystone

3) Flagship

4) Habitat Quality Indicator

5) Wilderness Quality Indicator

6) Prey

**especially relevant to SIWN's sister project in Mexico, the Sierra Madre Occidental Biological Corridor*

river otter by Douglas Moore

ian forest community will be represented. Specifically, if the flycatcher and cuckoo have healthy populations, then riparian forest will be properly represented in the Wildlands Network.

Focal species have a direct role in designing protected areas. Mexican wolves will preferentially use Madrean Evergreen Woodland at mid-elevations around Sky Island mountains (Brown et al. 1983, Johnson et al. 1992). Such areas are often laced with dirt roads and Jeep trails, which provide access to potential poachers. Therefore, SIWN proposes closing some dirt roads and enlarging Wilderness Areas, generally confined now to the higher elevations of the mountains, downslope into the gentler terrain covered by Madrean woodland. Similarly, experts tell us that jaguars will use canyon bottoms and streams supporting Arizona sycamores (Miller pers. comm. 1998, Terborgh pers. comm. 1998, Lopez pers. comm. 1999). Again, dirt roads and Jeep trails punch up into the mountains along watercourses. Therefore, SIWN proposes that some of the vehicle routes be closed and such areas be protected as Wilderness.

"Healing-the-wounds" goal-setting also directs the selection of focal species. We have tried to select focal species whose viability or recovery is tied to our six goals.

In selecting focal species that meet the requirements of umbrella, keystone, flagship, habitat quality indicators, wilderness quality indicators, and prey, we have attempted to pick species important both in the United States and Mexico. The Wildlands Network must allow for cross-border dispersal of species that we want to protect or restore. However, not all focal species are equally important in both countries, because the habitat or political and social conditions differ, or because the conservation status is not the same. Thus, some species may be good focal species in Mexico but lack importance in the United States or vice versa.

The Sky Island/northern Sierra Madre Occidental planning group, consisting of biologists and wilderness conservationists, refined the list of focal species over the course of several years and through many meetings (see chart). Following a natural history literature review of focal species (Frey 1998), experts for each species reviewed the report. Under the direction of Carlos Martinez del Rio, graduate students at the University of Arizona will integrate this new information and produce a revised report. This completed focal species report will be available on the web. The report will be used to summarize range, status, and habitat preferences for each focal species.

In the SIWN Conservation Plan document, each focal species is discussed with 1) information on status, range, and habitat preferences; 2) justification for selection as a focal species; and 3) management recommendations.

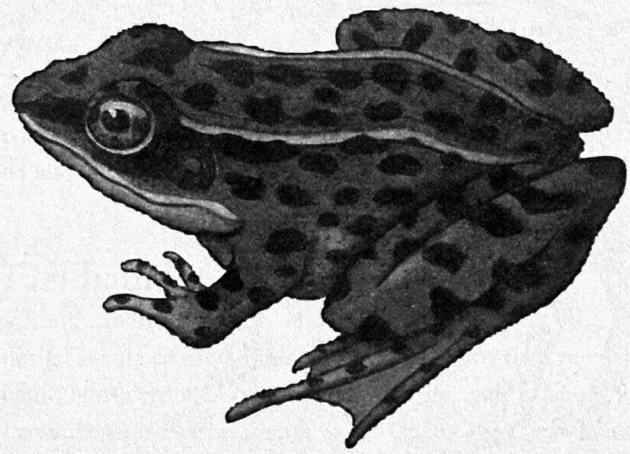
We believe that this diverse group of species has led to the design of a wildlands network in the Sky Islands region that not only will protect viable habitat for the focal species themselves, but also will represent all ecosystems and protect the habitat of many other species. We will continue to analyze the effectiveness of each focal species for guiding the conservation plan and may add or delete focal species if we find others that would better serve our purposes.

Wilderness Areas as Cores

A prestigious group of conservation biologists reports, "Experience on every continent has shown that only in strictly protected areas are the full fauna and flora of a region likely to persist for a long period of time" (Noss et al. 1999a). What are these strictly protected areas? "A distinguishing characteristic of core areas is limited human access—that is, low road density or, ideally, roadlessness" (Noss et al. 1999a).

SIWN is based on a core system of Wilderness Areas. In the United States, the National Wilderness Preservation System (and state wilderness systems, such as New York's) have proved to be the most effective means of protecting large areas, despite weaknesses in the 1964 Wilderness Act and unecological federal agency management (Foreman 1995–96). Designated and proposed Wilderness Areas make up a large part of the federal lands in the SIWN region.

Anticonservationists, resource managers, and postmodern deconstructionist scholars have confused the meaning of wilderness. Even many conservationists are unclear about the Wilderness Act and what it mandates. In using Wilderness Area designation as the cornerstone for a wildlands network, conservationists need to understand some basics about Wilderness Areas (Foreman 1999b).



Chiricahua leopard frog by Douglas Moore

First, Wilderness Areas are not human exclusion zones. A wide range of non-motorized recreational activities is permitted, including hunting and fishing. However, Wilderness Areas are not solely recreational areas. In the various definitions of Wilderness in the Wilderness Act, experiential and ecological values are both prominent and considered compatible.

The Wilderness Act has different criteria for candidate Wilderness Areas than for management of Wilderness Areas after designation. For example, there is no requirement that an area must be pristine or even roadless to be designated as Wilderness. "Pristine," which is an ultimate word like "unique," does not appear in the Wilderness Act. However, after designation, there may be no permanent roads or use of mechanized equipment (except for certain administrative needs, usually of the emergency kind) (Foreman 1998).

Designation of an area as Wilderness does not prevent future management to restore natural ecological conditions, such as reintroduction of wolves or beavers, restoration of natural fire, control of exotic species, or ecological restoration such as planting willow and cottonwood wands along degraded streams. Some Wilderness designation legislation has specifically called for restoration measures. In the 1999 Dugger Mountain (Alabama) Wilderness Act, for example, the Forest Service is directed to use equipment and an existing road to remove a fire tower. After removal, the road is to be permanently closed. In other cases, areas have been designated as Potential Wilderness Additions to allow ecological restoration and removal of nonconforming structures or uses. After restoration, the area automatically becomes Wilderness with roads closed and mechanized equipment banned.

Conservationists should not be shy about proposing less-than-pristine areas for Wilderness designation so long as they acknowledge the intrusions (Soulé 1991–92). These include areas with roads, past logging, and so on. Ecological and experiential (recreational and aesthetic) justifications need to be made for proposing such areas, however. In SIWN, areas in prime wolf or jaguar habitat with minor roads are proposed for Wilderness in order to protect these vulnerable species from road-borne harassment and poaching. The goal of Wilderness designation is not only to prevent destruction of untrammeled places, but also to help ecosystems become self-regulated again.

In a state-of-the-art scientific study and preliminary reserve design for the Klamath-Siskiyou region on the California-Oregon coast, Reed Noss writes, "Somewhat to our surprise, roadless areas on public lands turned out to function well as the basic 'building blocks' of our reserve design" (Noss 1999–2000). Elsewhere, Noss and his co-authors (1999b) write, "A surprisingly large number of conservation goals for the [Klamath-Siskiyou] region can be met through protecting and linking key roadless areas with high biological values. ... Important habitats and other natural features not represented in roadless areas can be protected through conservation actions on a relatively small area of additional public and private lands."

Wilderness Area designation is the tried and true way to protect roadless areas. A conservation area system without Wilderness Areas is incomplete. *Continental Conservation* puts it this way:

> *Conservation strategies that lack meaningful core areas are naive, arrogant, and dangerous. Such approaches assume a level of ecological knowledge and understanding—and a level of generosity and goodwill among those who use and manage public lands—that are simply unfounded.* (Noss et al. 1999a)

Conservation on Private Lands

Despite the large acreage of federal land in the SIWN region, some of the ecologically most important areas are in private ownership, whether as cores, linkage zones, or buffers. Private lands, therefore, play a key role in the Sky Islands Wildlands Network (Tompkins 1998, Davis 1998, Groom et al. 1999). Private lands used in the Wildlands Network include:

1) Nature Conservancy and Audubon Society preserves.

2) Large private ranches managed for conservation purposes, including large carnivore protection.

desert bighorn by Douglas Moore

3) Smaller private lands in important ecological locations, such as riparian areas, owned and managed by conservation-friendly people.

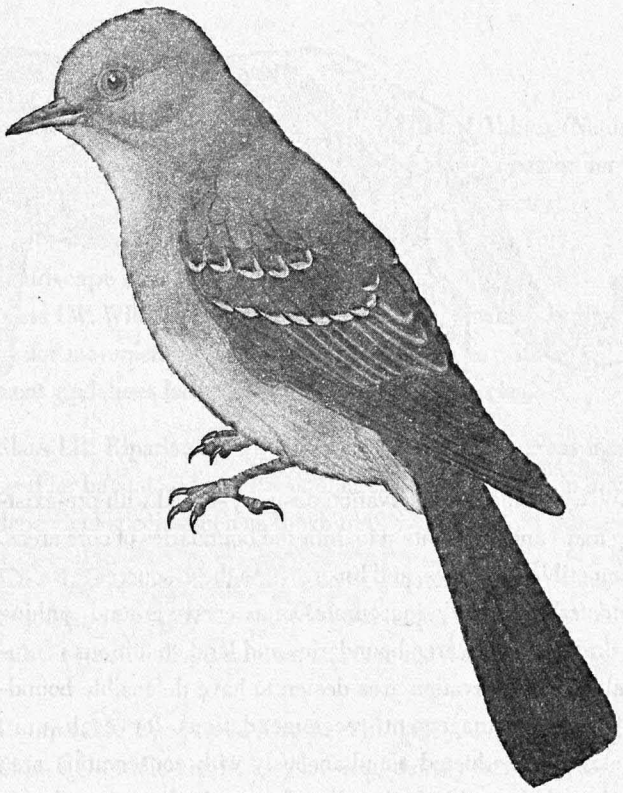
4) Key private inholdings and grazing allotments that need to be purchased by conservation groups or conservation-friendly individuals.

We stress that inclusion of private lands (2 and 3 above) on the SIWN map does not mean that we are telling landowners what to do with their property. Rather, identification of such lands is recognition that exceptional management by the landowners currently protects these lands as vital habitat and linkage areas for focal species. In many cases, private ownership better protects land for sensitive species than would public ownership. Such landowners are frequently undertaking innovative ecological restoration and species recovery efforts. SIWN's endorsement of outstanding private land management does not necessarily mean that such landowners have participated in planning SIWN or endorse SIWN.

For SIWN's sister wildlands network in the northern Sierra Madre Occidental of Mexico, The Wildlands Project, Naturalia, and Sky Island Alliance are strongly committed to facilitating the purchase of important core areas as habitat for jaguar, prairie dog, thick-billed parrot, and other focal species. In Mexico, as in the United States, conservation easements and long-term use agreements are useful tools to protect private lands for their natural values.

Compatible Use Areas

Our conservation area design methodology acknowledges the importance of buffer areas around core protected areas, although we use the term *compatible use area* instead of "buffer." By "compatible," we refer to activities that support, or, at a minimum, do not conflict with the goals and objectives of a Wildlands Network Conservation Plan. Compatible economic activities allow local landowners and resource users to continue their livelihoods while contributing to the long-term preservation of the natural heritage of a region. This element represents a critical strategy for building a local constituency for a conservation plan. A key part of any Wildlands Network Conservation Plan is a discussion of what economic activities or uses would be compatible with that plan. For SIWN, these include wolf-friendly ranching, ecotourism (e.g., bird watching), traditional wilderness and wildland recreation (including hunting and fishing), and restoration forestry. We are fortunate in the Sky Islands region that there are a number of large landowners and public and private lands ranchers who are exemplary land stewards and supporters of wolf and jaguar recovery. A variety of other stakeholders can be brought into the conservation plan in this way (Groom et al. 1999).



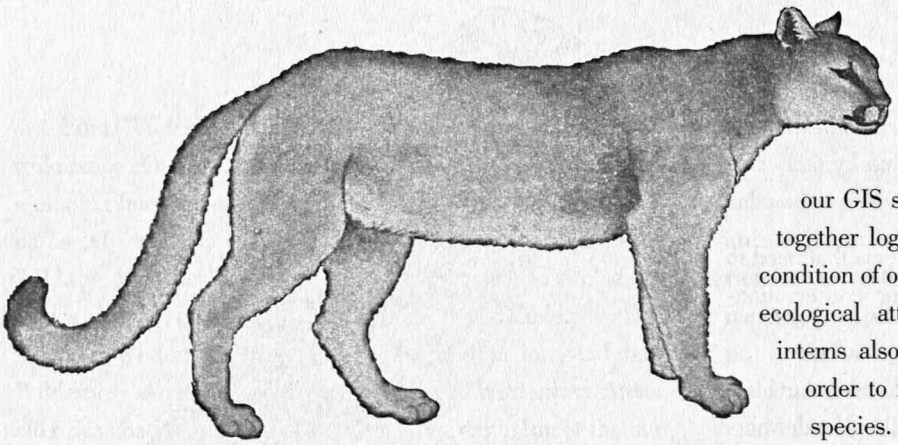
Southwest willow flycatcher by Douglas Moore

Economic Incentives

Wildlands Network Conservation Plans should include economic incentives that promote human interaction with the land that conserves, rather than destroys, wild Nature (McNeely 1988, Groom et al. 1999). Economic incentives are closely tied to compatible uses. In SIWN, such incentives include payments to ranchers who lose livestock to wolves, voluntary retirement options for grazing permittees (Kerr 1998a, 1998b), and loans for ecotourism (wolf viewing and bird-watching tours). SIWN-associated organizations contracted economist Karl Hess, Jr., to develop a proposal for replacing cattle grazing with trophy hunting of elk (Hess 1998). Unfortunately, the New Mexico Game and Fish Department currently opposes the idea. Hess also proposed a number of economic incentives to encourage local support for wolf recovery (Hess 1998). These have been incorporated into the SIWN Conservation Plan.

Fieldwork

Without fieldwork—lots of fieldwork—conservation area design is only an abstraction on a map. A strong field program contributes current data, greater credibility, and broader public support for conservation area design and implementation.



SIWN, like many conservation designs, started with pre-existing maps and information to draw the boundaries of core areas, compatible use zones, and linkages. As these sources are often outdated or partially inaccurate, an extensive ground-truthing of draft protected area boundaries and land conditions is crucial for a conservation area design to have defensible boundaries and management recommendations for each unit. Fieldwork conducted simultaneously with conservation area design also provides a baseline for monitoring areas during implementation, identifies management problems that need immediate attention (such as areas of illegal off-road vehicle use or severe overgrazing), and prioritizes areas needing more detailed studies. Finally, a volunteer field program offers an unparalleled opportunity to build a group of people who become committed advocates for the implementation of the wildlands network. There is rarely a more passionate advocate for our region than someone who has had the privilege to experience it on the ground.

The Sky Island Alliance has two major field efforts: track surveys and road and ecological condition surveys. For over four years, we have monitored an important linkage between core areas for the tracks of two focal species, mountain lion and black bear. This effort provides long-term data about these species' use of the area and an excellent opportunity to educate the public about the needs of wide-ranging carnivores. Over 150 volunteers have participated in this program so far and a cooperative venture with Keeping Track,[2] an organization that trains citizens to monitor wildlife habitat, is expanding our program into the Mexican Wolf Recovery Area.

Our road and ecological condition surveys have yielded excellent data and a dedicated group of field volunteers and advocates. We train volunteers using our Volunteer Field Guide, slide presentations, and experienced field leaders. Using standardized survey forms, observation logs, and mapped photos of observations, we ensure that consistent data is entered into a database and soon into our GIS system. Since June 1998, over 130 volunteers together logged 3500 hours surveying the existence and condition of over 500 miles of National Forest roads and the ecological attributes of the surrounding areas. Summer interns also surveyed the habitat quality of linkages in order to refine their boundaries for the needs of focal species. This work produces the field-justified boundaries for reserve design-based Wilderness proposals, forest plans, and other implementation steps. Just as important, volunteers have experienced energizing camaraderie as they learn first-hand why the SIWN proposal is the answer to long-term protection of these incredible lands.

Intensive fieldwork is needed to develop final Wilderness Area boundary proposals. Jim Catlin and others involved with the reinventory of Utah BLM roadless areas have fine-tuned the methodology for ground-truthing. The Sky Island Alliance and New Mexico Wilderness Alliance have adapted the Utah guidelines to reflect a more ecological approach. Both organizations have printed detailed field study guides and survey forms for their staff members and volunteers (SIA 1997, NMWA 1999); these are available to other TWP cooperating groups.[3] There are three aspects to wilderness field studies in SIWN: 1) general impression of the aesthetic, inspirational, and recreational wilderness values of the area; 2) technical study of human intrusions and impacts in and around the area, and development of a draft wilderness boundary; and 3) scientific study of the ecological values and wounds in and around the area.

Other fieldwork identifies barriers such as interstate highways and notes potential wildlife movement passages under them. Driving or hiking the length of linkage zones is another important type of field study.

Specific Units

SIWN includes over 200 individual units of land, including federal, state, county, and private parcels, proposed or recognized as cores, linkages, and compatible use areas. Each of these units has a name and standardized identification number. Each is mapped on 1:100,000 BLM maps (Wilderness Area proposals are also mapped on 1:24,000 topographic maps). A SIWN Unit Descriptions document gives information for each of these areas under these subheadings:

2. Keeping Track's innovative citizen-science programs help train volunteers in local communities to identify, monitor, and protect key wildlife habitats. For more information contact Keeping Track, PO Box 848, Richmond, VT 05477.
3. For more information, contact Kathy Daly, The Wildlands Project, 1955 W. Grant Rd., Suite 145, Tucson, AZ 85745; 520-884-0875; kathyd@twp.org

mountain lion by Douglas Moore

- General Description (including acreage and location).
- Ecological Values (including vegetative communities and focal species).
- Status (including ownership, management, protection, threats).
- Recommendations: Designation and management.
- Justification: Why the area is important as a linkage or core.
- Further Study: What other scientific research, fieldwork, or other study is needed.

Because the Unit Description document is several hundred pages long and is being regularly updated with fieldwork, it will be produced electronically on a web site.

Unit Classification and Management Guidelines

Building on Reed Noss's original classification system (Noss 1992), SIWN recommends management guidelines for the different sorts of land unit classifications in the proposal. Following is a summary.

Study Areas

These are public land areas that need additional fieldwork to determine final Wilderness Area boundary recommendations. An entire study area will not necessarily be proposed for Wilderness; much of it may be recommended as a linkage or compatible use area.

Core Areas (Noss et al. 1999a)

Class CW: Designated or Proposed Wilderness Area (Public Land). No logging, roads, motorized equipment or vehicles, mountain bikes, aircraft landings, or predator control. Phase out fire control and grazing in most areas.[4] Permit wilderness recreation, hunting, and fishing. Ecological restoration steps are clearly spelled out.

Class CA: Public Land (National Conservation Areas, National Parks, National Wildlife Refuges, State Parks, State Wildlife Areas, County Parks). No grazing, no logging, no motorized vehicles off designated roads, no large developed sites, low road density.

Class CP: Private Land Managed for Natural Values (Nature Conservancy and Audubon Preserves, roadless areas on large private ranches managed for their wilderness character).

Landscape Linkages (Dobson et al. 1999)

Class LW: Wildlife Movement Linkage. Areas managed primarily for movement by specific terrestrial species with management guidelines based on the needs of those species.

Class LR: Riparian Corridor. Streams and riparian areas managed for habitat and movement of aquatic species and riparian-dependent species such as songbirds.

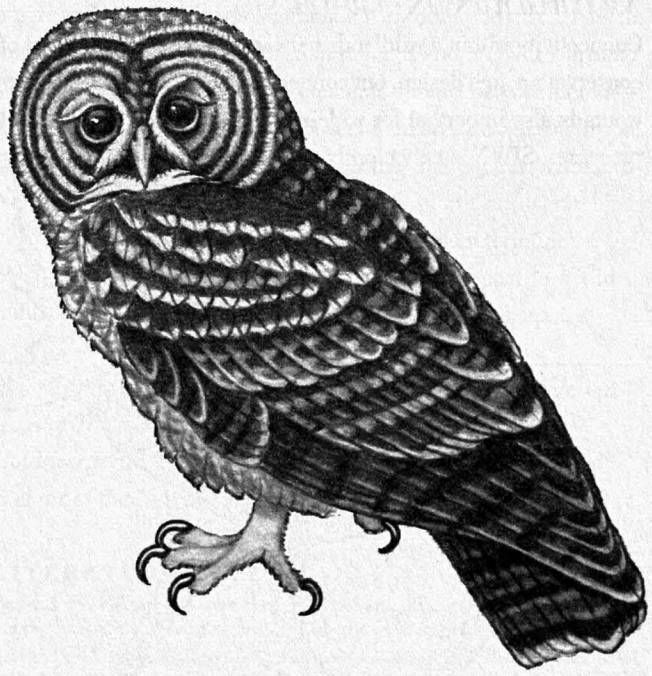
Class LD: Dispersal Area. Areas of federal, state, private, or mixed land that may not provide good habitat, but are generally safe for wildlife dispersal from one core habitat to another.

Compatible Use Areas (Groom et al. 1999)

Class UL: Public Lands, very low road density (less than .5 mile/square mile), limited extractive use.

Class UM: Public Lands, low road density (less than 1 mile/square mile), moderate extractive use.

Class UP: Private Land, especially large working ranches managed for biodiversity protection.



4. The SIWN Conservation Plan does not propose a phase-out of grazing in certain proposed Wilderness Areas where grazing permittees are doing an exemplary job and accept the presence of predators.

Mexican spotted owl by Douglas Moore

In general, all National Forest and Bureau of Land Management land outside of existing and proposed cores and linkages are proposed as Class UL or UM compatible use areas (except for major recreational developments). Meeting road density standards will require closure of some dirt roads and ways.

Details on management recommendations for all of these land management classes are in the SIWN Conservation Plan.

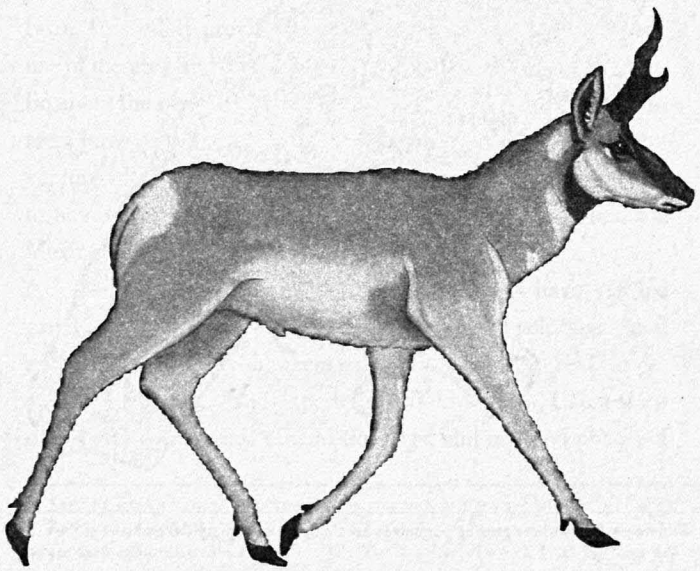
Focal Species Management Recommendations

Management recommendations for focal species are a key part of the SIWN Conservation Plan. These recommendations have been drafted through discussions with scientists and conservation groups. Recommendations for species may include: reintroduction or supplementation; hunting or fishing regulations; listing under the Endangered Species Act with critical habitat designation; habitat restoration, including exotic species control; modification of movement barriers, such as highways; conducting scientific research; habitat acquisition; and Wilderness Area designation to protect habitat. Management recommendations for each focal species are included in the focal species section of the conservation plan.

Linkage to Other Wildlands Networks

Connectivity within a wildlands network is a fundamental part of conservation area design, but connectivity to other wildlands networks is also important for wide-ranging species and ecological processes. SIWN is very closely tied to the wildlands network for the northern Sierra Madre Occidental in Chihuahua and Sonora, Mexico. This sister network has been cooperatively designed, using the same focal species. Species such as thick-billed parrot, jaguar, ocelot, jaguarundi, aplomado falcon, and Mexican wolf cannot really be protected in the United States alone; their habitat and dispersal routes in Mexico must be protected as well.

Similarly, SIWN will be tied to the Southern Rocky Mountains Wildlands Network through the New Mexico Link project and to the Grand Canyon Wildlands Network through the Arizona Link project. Linkages to wildlands networks for the Chihuahuan and Sonoran deserts are also part of SIWN (Scott et al. 1999).



Outreach and Promotion

Following conservation area design (including development of a conservation plan) and preceding implementation, comes a separate step of outreach and promotion. The Sky Islands Alliance and The Wildlands Project are developing a detailed plan for promoting SIWN. The plan will have different goals for different audiences.

Cataloging Compatible Conservation Initiatives

In any region where a conservation area design effort is underway, there are many other conservation efforts going on as well. With SIWN, we are continually cataloging other efforts that are generally compatible with our goals. These include federal government efforts (Mexican wolf recovery), county government plans (Pima County Sonoran Desert Conservation Plan), conservation group efforts (New Mexico Wilderness Alliance BLM roadless area reinventory), compatible use initiatives (wolf-friendly beef production), and so on. Although embracing these many conservation efforts, SIWN does not propose to initiate or direct them, but rather to provide an integrated context, rationale, and coordination for them. Groups and individuals whose conservation efforts have the effect of contributing to SIWN protection and realization still may not endorse the SIWN plan. Nor does inclusion of such efforts imply their participation in planning SIWN.

Implementation

A Wildlands Network Conservation Plan is an abstract exercise unless an implementation plan is conceptualized simultaneously. Conservation area design and planning for implementation must proceed on parallel tracks at the same time and with constant feedback. (See the separate article for details on implementation.)

pronghorn by Douglas Moore

Expert Review

Critical, ongoing review of Wildlands Network Conservation Plans is an important way of ensuring that the stated goals will be met. Since the plan's beginning, SIWN has received regular review from regional and national experts, including focal species specialists, botanists, ecologists, economic users of the land, recreationists, and other conservationists. This group of people has reviewed SIWN in workshops, interviews, documents, and in the field. Among the specific review periods were:

- **Design Workshops.** December 1995; April 1997; February 1998. About 30 conservationists and biologists from a variety of groups and institutions participated in each.
- **General Presentations.** TWP Grassroots Rendezvous, October 1998; Tucson Sierra Club, October 1998; TWP Implementation Workshop, February 1999; Southwest Wilderness Conference, May 1999.
- **Scientific Presentations.** University of Arizona Biology Department, December 1997; TWP Science Conference, November 1997; Natural Areas Association Conference, August 1997; Wilderness Science in a Time of Change Conference, May 1999.
- **Field Trips with Scientists.** February 1998 with jaguar biologist Brian Miller; December 1998 with John Terborgh and others.
- **Focal Species Review.** Draft report published January 1998; expert review of focal species report solicited July 1998; report revised based on expert reviews March 1999; final revision of report January 2000; final report finished Summer 2000.

This review process will be expanded as we launch a formal External Expert Scientific Review of SIWN in late spring. In this external review, we will solicit feedback from scientists, conservationists, and other experts who have not been directly involved with the project, and thus can offer an objective critique of the plan.

Methodology

SIWN has prepared a clear conservation area design methodology (Foreman, Dugelby, and Humphrey 2000). This methodology is based on strategies used for years by traditional conservation groups in developing Wilderness Area proposals, on the healing-the-wounds goal-setting process, and on the rewilding approach as developed by Soulé and Noss, with an overlay of focal species and landscape linkages. Our paper on methodology (available from The Wildlands Project) is in a chronological sequence, although SIWN did not do everything in this sequence. The SIWN methodology outlines each step of the conservation area design process, including data collected, analyses conducted, GIS work done, etc. The steps and sequence described reflect what we learned in developing SIWN and how we would conduct the process if we were to do it again.

Some conservation area designs have followed a chronological sequence of data collection, fieldwork, mapping, outreach, and implementation. Our recommendation is that work on all of these steps proceeds simultaneously with constant cross-referencing and revision. Rough reserve maps and the incomplete reserve design proposal document should be circulated within the planning group and among consulting experts in regular iterations as a work in progress. *You do not need all the data in hand, you do not need all field studies completed, you do not need final maps or justification, before you start putting lines on the map and writing a draft document!*

However, be clear about what data are solid, what are from assumptions, and what data are still being gathered. What is mapped and written as a wildlands network proposal in the early stages will be much revised as you proceed.

CONSERVATION AREA DESIGN IS ALWAYS A WORK IN progress. The Sky Islands Wildlands Network approach seems to work; we have learned much from doing it and are still learning. We believe each of the above elements should be considered—and usually included—in any conservation area design. Inclusion of all these elements will strengthen the influence a Wildlands Network Conservation Plan has in putting forth an overarching vision for a landscape. Although it may be counterintuitive, we believe this broad approach to planning will appeal to a wider public than would a stand-alone wildlands network map. ☾

Dave Foreman and Barbara Dugelby are on the reserve design team of The Wildlands Project. Jack Humphrey and Andy Holdsworth are staff for the Sky Island Alliance. Bob Howard is chair of the New Mexico Wilderness Alliance.

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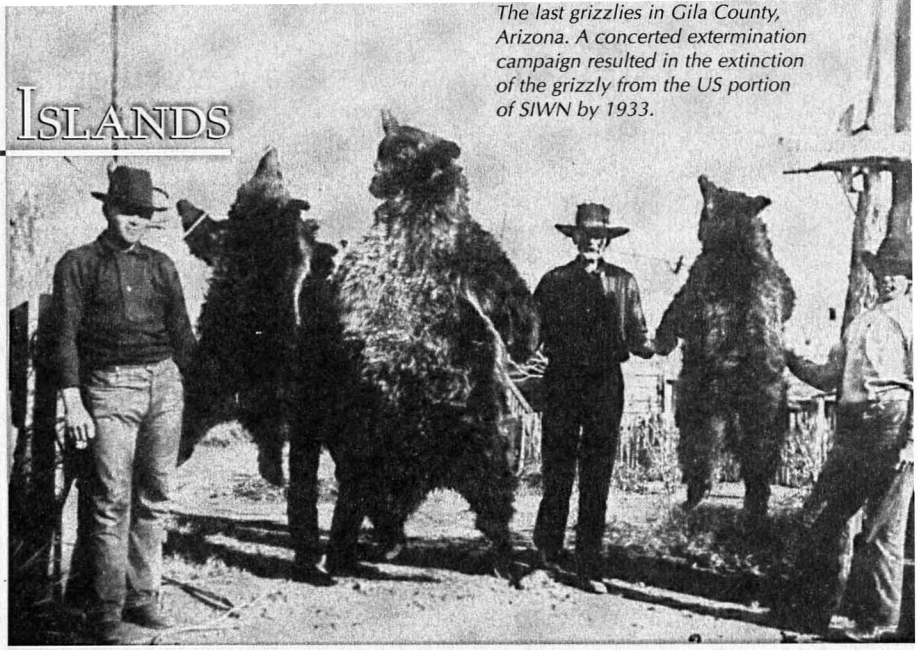
bison by Todd Telander



The last grizzlies in Gila County, Arizona. A concerted extermination campaign resulted in the extinction of the grizzly from the US portion of SIWN by 1933.

Healing the Wounds

An Example from the Sky Islands

One of the penalties of an ecological education is that one lives alone in a world of wounds. … An ecologist must either harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise.

—**Aldo Leopold, *Round River: From the Journals of Aldo Leopold*, 1972 (see also Ehrlich 1997)**

by Dave Foreman, Rurik List, Barbara Dugelby, Jack Humphrey, Bob Howard, and Andy Holdsworth

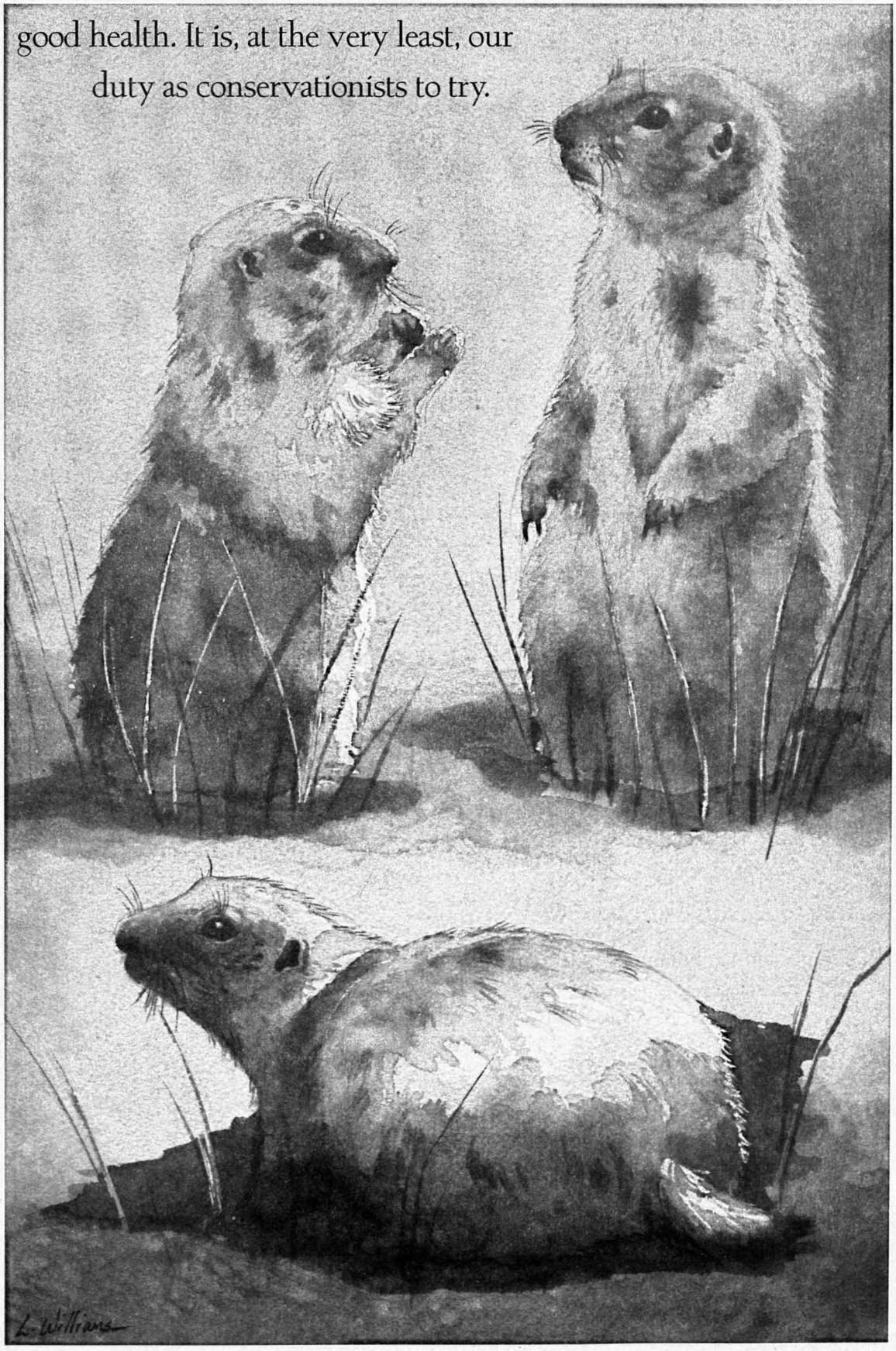
ALDO LEOPOLD CAME TO UNDERSTAND land health and ecological wounds from his experience in New Mexico and Arizona from 1909–1924 and trips to the Sierra Madre in Chihuahua in the mid-1930s. In 1937, he wrote:

> *For it is ironical that Chihuahua, with a history and a terrain so strikingly similar to southern New Mexico and Arizona, should present so lovely a picture of ecological health, whereas our own states, plastered as they are with National Forests, National Parks and all the other trappings of conservation, are so badly damaged that only tourists and others ecologically color-blind, can look upon them without a feeling of sadness and regret.* (Leopold 1937)

Far before his time in his ability to wisely read the story of the land, Leopold understood that free Apaches kept settlement out of the northern Sierra Madre Occidental well into the 20th century. Without livestock grazing and with healthy populations of mountain lions and wolves,

photo: Arizona Historical Society

Medicine for the land, or ecological restoration, has advanced much in the last sixty years. Perhaps we can raise this Lazarus of a landscape to robust good health. It is, at the very least, our duty as conservationists to try.



black-tailed prairie dogs by Lezle Williams

mountain ecosystems in Mexico were ecologically healthy, whereas similar mountain ecosystems in the United States were deeply wounded (Leopold 1937). Unfortunately, since Leopold's time, the mountain fastness of northern Mexico has been as carelessly exploited as the southwestern United States.

In recent years, ecological and historical researchers have greatly improved our understanding of the ecological wounds in the Sky Islands region. Even in the best-protected areas, such as National Parks and Wilderness Areas ungrazed by domestic livestock, pre-existing wounds may continue to suppurate (Sydoriak et al. 1999). For example, without wolves, natural fire, and recovered riparian forests (*bosques*), even the large Gila Wilderness Area is not a healthy landscape; in fact, without restoration its health may continue to decline.

Efforts to protect the land and create a sustainable human society in the Sky Islands region will come to naught without understanding these wounds and their underlying causes, and then attempting to heal them. More than sixty years ago, Leopold (1937) worried that "our own conservation program for the [Sky Islands] region has been in a sense a post-mortem cure." Medicine for the land, or ecological restoration, has advanced much in the last sixty years (or so we trust). Perhaps we can raise this Lazarus of a landscape to robust good health. It is, at the very least, our duty as conservationists to try.

The human history of the Sky Islands region is a litany of anthropogenic wounds to terrestrial and aquatic communities. Even the earliest humans in the region, the Clovis culture of big game hunters, around 13,000 years ago (calendar years or 11,000 uncalibrated radiocarbon years ago) wounded the land by causing the Pleistocene megafauna extinction, in which 33 out of 45 genera of large mammals in North America became extinct (Martin and Klein 1984). Martin and Burney (1999) identify 27 species of mammals larger than 100 lbs. that became extinct in the western United States and northern Mexico alone at that time. The overwhelming evidence points to human hunting as the major cause. Among the animals lost in the Sky Islands region were mammoths, mastodons, camels, horses, tapirs, shrub oxen, musk oxen, llamas, peccaries, bison, mountain goats, mountain deer, giant ground sloths, glyptodonts, dire wolves, saber-toothed cats (*Smilodon*), short-faced bears, American lions, American cheetahs, and giant condors (Martin and Klein 1984, Ward 1998). Some authorities, including Paul Martin of the University of Arizona, believe that the plant communities of the region are still in disequilibrium from this loss—an example of a long-festering ecological wound precipitated by the cessation of top-down regulation (Martin and Burney 1999).

With the arrival of Europeans in the Sky Islands region less than 200 years ago (300 years ago for the Santa Cruz Valley), the land again suffered deep and debilitating wounds. Of these ecological wounds, we have identified six as major. Each of these has more than one cause, and several of the causes contribute to more than one wound. The overall impact of these wounds is greater than their sum.

We will first discuss the major wounds, and then we will present the goals and objectives of the Sky Islands Wildlands Network Conservation Plan, which is designed to heal the wounds.

Wounds to the Land

The six major wounds in the Sky Islands/northern Sierra Madre Occidental landscape are:

- Many species of native animals—especially carnivores, large ungulates, and keystone rodents—have been extirpated or greatly reduced in numbers.
- Watersheds, stream channels, and riparian forests have been damaged almost beyond measure.
- Over a century of fire suppression has eliminated a natural disturbance regime vital to the integrity and function of forest, woodland, and grassland ecosystems.
- The region has been fragmented by roads, dams, and other works of civilization, potentially isolating wide-ranging species in nonviable habitat islands.
- Aggressive and disruptive exotic species, both plants and animals, have invaded or been purposefully introduced, threatening ecosystem integrity and the survival of individual species.
- Beginning in the 1870s with cutting for mine timbers, railroad ties, and firewood, and continuing to the present day with industrial logging operations, all forest types in the region have been degraded.

Other ecological wounds have occurred as well, but these six are the most pervasive and destructive.

Wound 1: Loss of Important Species

Causes: During the preceding 200 years or so, native animals—carnivores, large ungulates, keystone rodents, and other species—have been extirpated or greatly reduced in numbers

by 1) trapping; 2) market hunting; 3) competition from domestic livestock; 4) diseases introduced by settlers and domestic livestock; 5) livestock fencing; 6) predator and rodent control; 7) trophy and fur hunting; and 8) transformation of natural habitats for different human uses.

One species, the imperial woodpecker, and two (perhaps three) subspecies are extinct because of hunting, poisoning, trapping, and habitat destruction: Merriam's elk, the Mexican grizzly, and likely the Arizona river otter. In addition, desert bighorn sheep, Rocky Mountain bighorn sheep, pronghorn, and even javelina, mule deer, and Coues white-tailed deer were nearly extirpated around 1900. The bison was probably extirpated, although a handful of survivors may have persisted in northwestern Chihuahua. Except for twenty or so individuals reintroduced recently to the Apache National Forest of Arizona, the Mexican wolf has been extirpated in the wild, although a few individuals may remain in remote areas of the Sierra Madre. Breeding populations of jaguars, ocelots, and jaguarundis were reduced or eliminated in the United States. Mountain lions and black bears also declined sharply. Two keystone rodents—beavers and prairie dogs—suffered tremendous declines. Thick-billed parrots and aplomado falcons were extirpated from Arizona and New Mexico. The Tarahumara frog disappeared from the United States by the early 1980s (Sredl and Howland 1994).

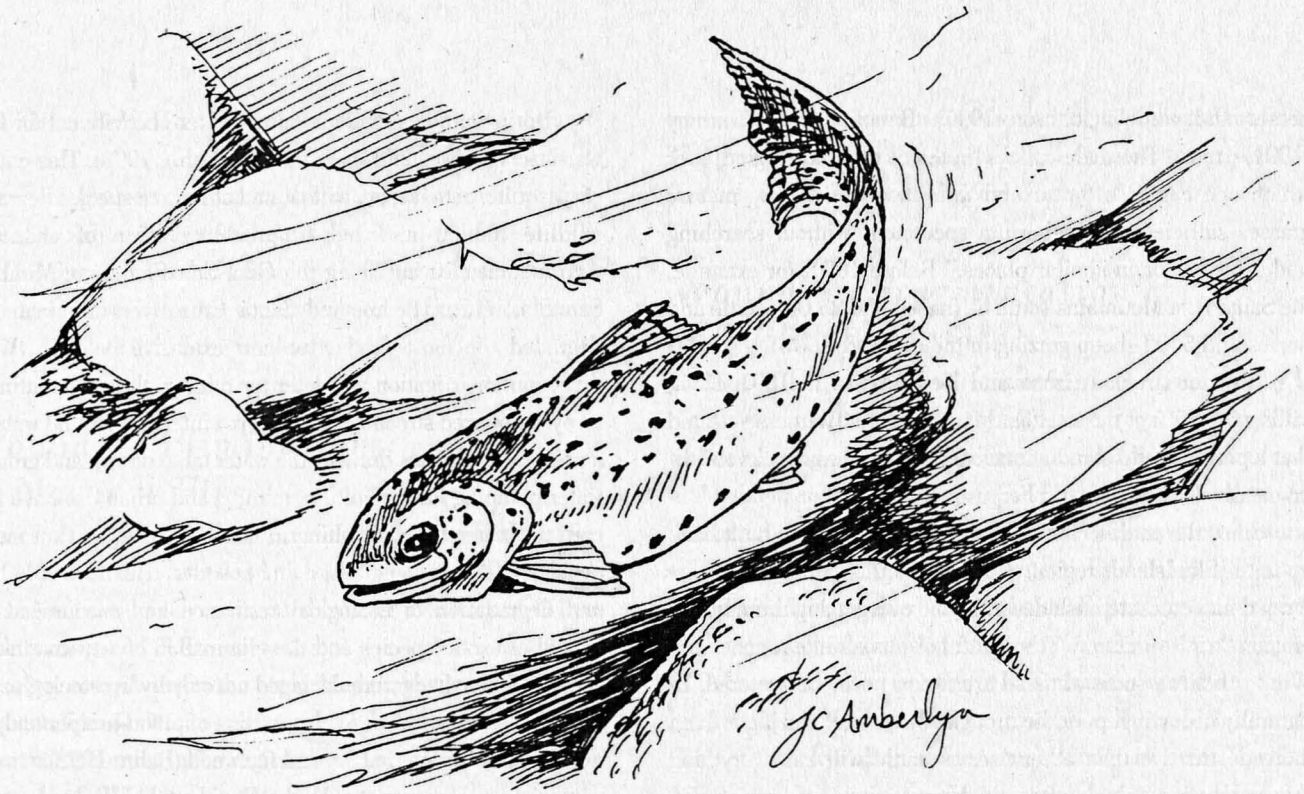
American trappers entered the Sky Islands region (then part of newly independent Mexico) in the 1820s (Hafen and Rister 1950). Beavers were abundant in the Gila, Rio Grande, and Little Colorado watersheds. By the 1840s, beavers were functionally extinct in the Sky Islands region, as they were throughout what is now the western United States (Beck 1962, Pollock and Suckling 1998). Market and hide hunters killed off the southern herd of bison in the 1870s (Matthiessen 1987). In the Sky Islands, mining camps sprang up in the 1870s, drawing market hunters who slaughtered pronghorn, deer, javelina, bighorn sheep, turkey, and even thick-billed parrots to feed the miners. Authorities on the thick-billed parrot believe that hunting may have been the main cause for its disappearance from the US (Snyder et al. 1994). The largest subspecies of elk, Merriam's, was abundant in the Mogollon Highlands (now the Gila and Apache National Forests). This subspecies may have ranged south through the Sky Islands ranges and valleys into Mexico, but reports are inconsistent (Bailey 1971). They were completely exterminated by hunters: the last few individuals were shot on Fly's Peak in the Chiricahuas in 1906 (Matthiessen 1987).

Cattle and sheep ranchers moved into the Sky Islands area in the 1880s and many encouraged the slaughter of wild ungulates, seeing them as competitors with cattle and sheep for forage. Domestic sheep transmitted diseases to both desert and Rocky Mountain bighorns, causing their near-extinction. Livestock fencing has disrupted the movement of pronghorn to seasonal water sources, leading to their rapid decline and agonizingly slow recovery. Botteri's and rufous-winged sparrows declined sharply because cattle grazing in southern Arizona severely damaged their grassland habitat (Rising 1996).

With their natural prey gone, Mexican wolves, Mexican grizzlies, mountain lions, and jaguars turned to cattle and sheep. In the United States, the Department of Agriculture's Predatory Animal and Rodent Control agency (PARC) used traps, guns, and poison to try to completely exterminate predators, including bobcats, ocelots, and coyotes (Dunlap 1988). By the mid-1930s, grizzlies were extirpated and wolves were functionally extirpated from New Mexico and Arizona (Brown et al. 1984, Brown 1985). Mountain lion populations were greatly reduced. Prairie dogs were functionally exterminated as a result of a taxpayer-sponsored, government poisoning program that continues today. Many ranchers disliked prairie dogs because of the mistaken belief that they damage the range. The black-footed ferret was lost from the region because of the massive decline of prairie dogs (Miller et al. 1996). Prairie dogs and predators also fell victim to so-called varmint hunters. Jaguars and ocelots in the US were shot on sight as valuable trophies or for their fur.

In Mexico, where cattle ranching moved into the mountains later, Mexican wolves, Mexican grizzlies, jaguars, and prairie dogs survived longer (Leopold 1937). The introduction of the 1080 compound (a powerful "predicide") in the 1950s was the major cause for the decline of wolf populations. The grizzly was a victim of the 1080 campaign against wolves (McBride 1980). With their numbers dramatically reduced, traps and guns took care of the surviving individuals. By 1980, the grizzly and wolf were functionally extinct even in Mexico. Large prairie dog towns remain in Chihuahua, although poisoning and conversion of their habitat to irrigated potato fields threaten them. Trophy and fur hunting of jaguars greatly reduced their populations in northern Mexico; they are still heavily hunted as livestock killers (Lopez 1999).

Subsistence hunting before the 1950s and logging of the forest in the Sierra Madre Occidental of Mexico thereafter was responsible for the extinction of the imperial woodpecker (Lammertink et al. 1997), as well as for the decline of the thick-billed parrot and military macaw.



Wound 2: Watershed, Stream, and Riparian Damage

Causes: Watersheds, stream channels, and riparian forests (bosques) have been severely damaged by 1) trapping-out of beavers; 2) livestock grazing; 3) water diversions; 4) groundwater pumping; 5) fuelwood cutting; 6) agricultural clearing; and 7) watershed damage from a variety of human activities.

In the arid Sky Islands region, water is generally the limiting resource. Some 80% of vertebrate species in the region are dependent on riparian areas for at least part of their life cycle; over half of these cannot survive without access to riparian areas (Noss and Peters 1995). In Arizona and New Mexico, more than a hundred federally and state listed species are associated with cottonwood-willow bosques (Noss and Peters 1995). Over half of the Threatened and Endangered species in the US portion of the Sky Islands region became so because of riparian losses (Suckling 1996b). Arizona and New Mexico have lost 90% of presettlement riparian ecosystems (Noss et al. 1995). The Nature Conservancy lists the Fremont cottonwood-Goodding willow riparian community as highly imperiled.

The near-extermination of beavers from the Sky Islands region by 1840 began the degradation of watersheds and riparian areas. Beaver dams had created extensive wetlands, controlled floods, stored water for slow release throughout the year, and provided high-quality habitat for many species. Some watercourses were staircases of beaver ponds for many miles. Without beaver dams, wetlands shrank and seasonal floods became unchecked (Pollock and Suckling 1998).

The grazing of domestic cattle and sheep has been the primary cause of watershed and stream destruction. Denzel and Nancy Ferguson (1983) describe the increase in livestock numbers after the Civil War:

> *In 1870, the total number of cattle in the Arizona Territory was only 5000 … by 1891 the population of cattle in the territory had grown to an estimated 1.5 million. … In 1870, the cattle population in 17 western states was estimated to be 4–5 million head; by 1890, that had grown to 26.5 million.*

During this period, great numbers of sheep also grazed the Sky Islands region and herds of goats were common in some Sky Island ranges (Bahre 1998). In this grossly overstocked range, thunderstorms carried away the topsoil in sheets, and gully washers turned placid streams into dry arroyos with 40-foot sheer banks. Arizona rancher H. C. Hooker described the San Pedro River valley in 1870 as "having an abundance of timber with large beds of sacaton and grama grasses. The river bed was shallow and grassy with its banks with luxuriant growth of vegetation." He gave a different description 30 years later, saying that "the river had cut 10 to 40 feet below its banks with its trees and underbrush gone, with the mesas grazed by thousands of

Apache trout by J.C. Amberlyn

horses and cattle" (Johnson 1997). Botanist J. W. Tourney (1891) wrote, "There are valleys [in the Sky Islands region] over which one can ride for several miles without finding mature grasses sufficient for herbarium specimens without searching under bushes or in similar places." Before 1891, for example, the Santa Rita Mountains south of Tucson had 25,000 cattle and horses and 5000 sheep grazing in them (Bahre 1998).

Drought struck Arizona and New Mexico in 1891–1893, killing 50–75% of the total cattle population. "Witnesses stated that a person could stand at one carcass and throw rocks to others nearby" (Ferguson and Ferguson 1983).

Since the cattle crash 100 years ago, herds have built back up in the Sky Islands region. Some desert grasslands were transformed into creosote bush desert by the overgrazing/drought/soil erosion "triple-whammy"; thoughtful observers like rancher Jim Winder believe some of these areas can never be restored. In naturally occurring, periodic droughts, livestock grazing is even more destructive than otherwise, as cattle will eat everything they can before dying—after which vegetative recovery is nearly impossible. In much of the Sky Islands region, in spite of the improvement from near desertified conditions at the turn of the century, millions of acres of grazing lands remain in only poor or fair condition. Riparian areas are considered by many authorities to be in their worst condition ever. Aldo Leopold (1937) wrote, "I sometimes wonder whether semi-arid mountains can be grazed at all without ultimate deterioration." His question remains unanswered.

During early settlement, bosques were heavily cut for fuelwood, fence posts, and mine timbers (Bahre 1998). This cutting of mesquite, cottonwood, willow, and other tree species degraded wildlife habitat and led to greater erosion of channels. Agricultural clearing along the Gila, San Francisco, Mimbres, San Simon, San Pedro, and Santa Cruz rivers eliminated or degraded the most productive and extensive bosques. Water diversion for irrigation and later for mining, the downcutting of arroyos (lowered streambeds in arroyos intercept ground water at a greater depth, thus drawing the water table down), and groundwater pumping for agriculture, mining, and urban use have lowered the water table, resulting in dried-up *cienegas* (wet meadows), dewatered rivers, and dying bosques. This loss of habitat and degradation of ecological resilience has encouraged the spread of exotic species and the elimination of sensitive native species. Watersheds were damaged not only by livestock grazing, but also by the widespread clearcutting of piñon-juniper and oak woodlands for mine timbers and fuelwood (Bahre 1998).

In the northern Sierra Madre Occidental of Chihuahua and Sonora, cattle freely graze riparian areas. Especially in the lowlands, where there is little tree cover outside the riparian areas, cattle have limited the growth of new trees, so when the old cottonwoods, sycamores, walnuts, and other riparian trees die, no young trees replace them. Cattle do similar damage in Arizona and New Mexico.

Another problem in the riparian areas in Mexico is that the river bottoms are often turned into access roads for timber

Riparian damage along the Gila River in the Gila Box National Riparian Conservation Area.

photo: George Wuerthner

exploitation. Related to this exploitation is the practice of throwing sawdust and other byproducts from the lumberyards into the rivers, which adversely changes the water quality, in turn affecting native fish and other freshwater species.

Too few have heeded Leopold's (1937) warning: "Somehow the watercourse is to dry country what the face is to human beauty. Mutilate it and the whole is gone."

Wound 3: Elimination of Natural Fire

Causes: A natural disturbance regime vital to the health of forest, woodland, and grassland ecosystems in the Sky Islands region has been largely eliminated by over a century of 1) livestock grazing; and 2) fire suppression.

Most ecosystems in the Sky Islands region coevolved with frequent fire. Only the most arid Chihuahuan and Sonoran desert communities in the region are not adapted to regular fire. Before about 1900, most montane forests burned in accordance with the two-to-seven-year wet-dry cycles associated with the El Niño-Southern Oscillation (Swetnam and Betancourt 1990, 1998, Swetnam and Baisan 1996). Primitive understandings of the ecological role of natural fire in these ecosystems led the Forest Service and other land managers to aggressively try to put out fires from about 1906 on. In addition to fighting fires, the Forest Service deliberately encouraged overgrazing by cattle and sheep to eliminate grass that carried the natural, cool, ground fires. Increasing numbers of scientists recognized fire's important role by the 1960s, but such ideas were heresy to many foresters and ranchers.

The reduction in fire frequency combined with overgrazing by cattle and sheep has allowed woody plants to out-compete grasses (competition from grasses was as significant as fire in keeping pine and juniper stands from becoming too dense and extensive). Consequently, snakeweed, creosote bush, prickly pear, cholla, acacia, mesquite, and piñon-juniper woodland have invaded and replaced grasslands. This has changed the balance of natural ungulates that graze and browse. Forested areas have been extensively degraded by the combination of fire control and overgrazing. By eliminating frequent, cool, ground fires in forests, land managers have allowed the fuel load to build up, thereby creating conditions for destructive conflagrations and crown fires (Humphrey 1958, Bahre 1998, Pollock and Suckling 1997, Suckling 1996a, Morgan and Suckling 1995, Fule and Covington 1994).

The control of natural fires has decreased their frequency, which has allowed enough time for seedlings to develop into trees large enough to withstand the occasional light surface fires. This has also led to the expansion of forests over grasslands (Leopold 1949, Fisher et al. 1987, Houston 1994).

Wound 4: Fragmentation of Wildlife Habitat

Causes: Wildlife habitat in the region has been fragmented by 1) highways, roads, and vehicle ways; 2) dams, irrigation diversions, and dewatering of streams; 3) destruction and conversion of natural habitat; and 4) other works of civilization, such as urban and ranchette development. Fragmentation has severed historic wildlife migration routes and has potentially isolated wide-ranging species in nonviable habitat islands. Expanding human populations and development continue to increase fragmentation.

At certain scales, isolation of habitats can contribute to native biodiversity. At the landscape or regional scale, the higher elevations of the Sky Island ranges are naturally isolated (Warshall 1994), permitting genetic divergence and speciation. However, native species using stream and riparian habitats and wide-ranging species such as carnivores, large ungulates, and migratory birds need natural connectivity in the landscape. This natural connectivity has been severed during the last century. Michael Soulé and John Terborgh (1999) remind us that "connectivity is not just another goal of conservation: it is the natural state of things."

Coolidge Dam on the Gila River, Presa de la Angostura on the Rio Bavispe, and Presa del Novillo on the Rio Yaqui; smaller dams on headwater streams of the Gila, San Francisco, Santa Cruz, Janos, and other rivers; irrigation diversion dams; and dewatered and degraded stretches of once-perennial streams have fragmented the habitat for native fish, amphibians, and aquatic invertebrates. Habitat loss and degradation of bosques have harmed riparian-dependent birds and other species. Habitat for wide-ranging species such as wolf, mountain lion, jaguar, pronghorn, and bighorn has been fragmented by roads, agriculture, and urban, suburban, and ranchette development.

Interstate Highways 10 and 19 are formidable barriers to many kinds of wildlife. Increased traffic on and the proposed widening of Mexico Highway 2 will make it a significant barrier, too. Even two-laned paved roads cause many deaths of animals trying to cross. Dirt roads fragment the landscape for wolves, jaguars, and other species vulnerable to opportunistic poaching. For example, at least five released Mexican wolves were shot alongside roads in the Apache National Forest in 1998. Even dirt tracks can fragment the landscape for slow-moving desert tortoises and snakes, especially when many off-road vehicle enthusiasts deliberately run over reptiles for thrills.

In Mexico, public access to private ranches is more open than in the US, and the access to *ejidos* (community lands) is practically uncontrolled. Under this situation, roads are a permanent source of poaching. Although the northern Sierra Madre Occidental does not have the industrial and agricultural infrastructure of the southwestern US, the landscape in Mexico is becoming increasingly fragmented because of growing economic pressure in the region and conversion of natural vegetation to agriculture, often for export products to the US market—all exacerbated by free trade agreements like NAFTA.

Wound 5: Invasion of Exotic Species

Causes: Aggressive and disruptive exotic species, both plants and animals, have 1) invaded; 2) escaped from cultivation; or 3) been deliberately introduced, threatening ecosystems and the survival of individual native species.

Conservation biologists now recognize exotic species as a leading cause of extinction, second only to habitat destruction (Wilcove et al. 1998). In the Sky Islands region, non-native plants and animals (primarily in aquatic, riparian, and mesic communities) are a major cause of endangerment of native species. Some of these destructive invaders were deliberate introductions; some escaped from cultivation; others hitchhiked in. Most do well in disturbed habitats.

Tamarisk (salt cedar), a native of the Middle East, was planted ornamentally in the late 1800s. It spread through cattle-damaged riparian areas and benefits from dams and flood-control levees, which prevent natural cycles of drying and flooding with which native species evolved. Tamarisk is now a major competitor of native cottonwoods, willows, and other riparian trees. It provides very little habitat or food for native species, although it does provide critical interim nesting habitat for the endangered southwestern willow flycatcher in a few areas where native vegetation has been lost. As a phreatophyte, tamarisk sucks up large amounts of water through its roots and transpires this moisture into the air, thereby drying up springs and streams upon which native species depend. Other destructive invader plants include Russian thistle (tumbleweed), sweet resin bush (Pierson and McAuliffe 1994), vinca, Bermuda grass, buffel grass, Johnson grass, and lovegrasses. Warshall (1994) reports that over 60 non-native plants have been naturalized in the region. Bowers and McLaughlin (1994) report 65 alien plants in the Huachuca Mountains alone.

Rainbow trout (not native to the Southwest) and European brown trout have been deliberately stocked in the high country streams of the Sky Islands region, where they threaten native Gila and Apache trout and, in the case of rainbows, breed with them, thereby diluting the gene pool. Bass, catfish, sunfish, other game fish, and bullfrogs have been deliberately planted in the Sky Islands region's warm-water streams and reservoirs where they are direct threats to native fish and frogs. Bait fish and crayfish also have spread and threaten aquatic natives. Bullfrogs are the primary threat to native frogs. Rosen and his co-authors state, "In the American Southwest, the native fish fauna is ... facing extinction due primarily to introduced predators and competitors" (Rosen et al. 1994, Rinne 1994). Fifteen non-native fish species are established (Warshall 1995). Among invertebrates, feral and domesticated honeybees aggressively compete for food with native bees, which may be vital to the pollination of native plants (Buchmann 1994).

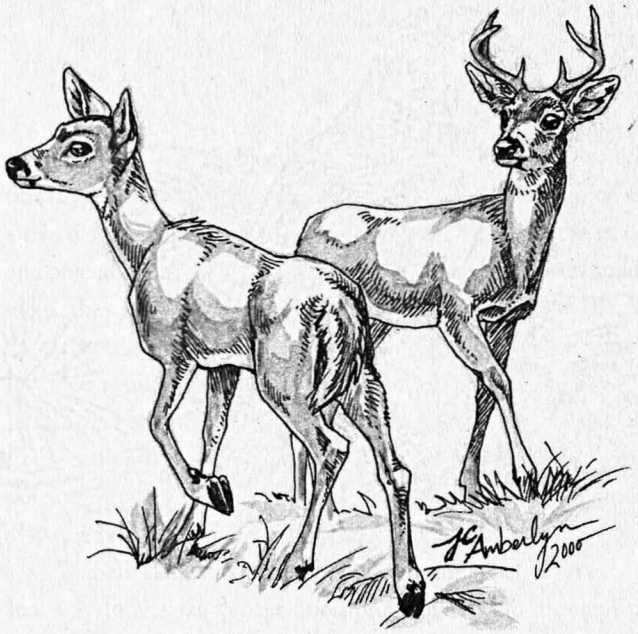
In parts of the Sierra Madre, the larger Texas white-tailed deer has been introduced in the range of the smaller Coues white-tailed, with potentially disastrous consequences for the native subspecies through interbreeding. The size difference between the subspecies is such that a female Coues can die while giving birth to a Texan hybrid (Weber and Galindo-Leal 1992). European wild boar have been introduced in the Sierra Madre Occidental, competing with the smaller white-collared peccary and damaging the fragile soil of the arid forests of the region (Galindo-Leal and Weber 1997).

Wound 6: Degradation of Forests and Woodlands

Causes: Degradation of forests is closely related to some of the wounds already discussed, especially Wound 3, elimination of natural fires. Beginning in the 1870s with 1) cutting for mine timbers, railroad ties, and firewood, and continuing to the present day with 2) industrial saw timber operations, all forest types in the region have been degraded.

Bahre (1998) reports that more than 30 mining centers operated in the Arizona portion of the Sky Islands in the late 1800s. Wood was the sole fuel for the mines and for all other uses. Madrean evergreen woodlands, mesquite bosques, and riparian woodlands were heavily exploited. Bahre also reports that significant saw timber logging occurred in the Graham, Chiricahua, Huachuca, Santa Rita, and Santa Catalina mountains during the late 1800s. A sawmill was located in the Santa Ritas as early as 1857. "Nearly 30 percent of the ponderosa pine and mixed-conifer forest in the Chiricahuas had been logged by eleven different sawmill operations before 1900" (Bahre 1998).

Bahre summarizes the early impact on forests:



None of the sky island evergreen woodlands and forests was pristine before they were set aside as forest reserves and national forests. By 1900, nearly all had been affected to some degree or another by mining, logging, fuelwood cutting, and grazing. At present, we have little idea what these woodlands and forests would be like had they not been logged or grazed, had the fire regimes not been manipulated, or had Forest Service management not occurred.

After World War II, commercial saw timber operations increased on the Gila and Apache National Forests, as they did throughout the National Forest System (Clary 1986). Current overstocking of forests was created purposely by the USFS and industry to maximize tree growth for fiber production. They wanted to eliminate old-growth forests and replace them with what they believed were "more efficient young forests."

Old-growth ponderosa pine forests are listed as one of the 21 most endangered ecosystems in the United States (Noss and Peters 1995). For all Arizona and New Mexico National Forests, the Southwest Forest Alliance reports, "About 90 percent of the old-growth has been liquidated, including 98 percent of the old-growth ponderosa pine." Wallace Covington, forestry professor at Northern Arizona University, says, "I've made it clear for 20 years there's been a population crash of old-growth trees—leave the damn things alone." He also writes, "The cumulative effect of old-growth logging, non-native species introductions, overgrazing, predator control, and fire exclusion has been ecosystem simplification so great that Southwestern forest ecosystems are at risk of catastrophic losses of biological diversity" (Suckling 1996b, Suckling 1996a, Pollock and Suckling 1997).

Seventy-three percent of the natural forest ecosystems of Chihuahua and Sonora have been severely altered (Flores-Villela 1989). From the original 23 million acres occupied by old-growth pine-oak forests in Mexico, only 0.6% (41,000 acres) remains (Lammertink et al. 1997). This in turn has led to the decline of species dependent on the old-growth forest, like the extinct imperial woodpecker and the endangered thick-billed parrot and Mexican spotted owl (Lammertink and Otto 1997). Nearly all the Sierra Madre Occidental has been logged at some point, and because of this, the present vegetation may be different than the original cover. For example, small oak forests surround large (over 100 feet high) conifer trees, reminders of the forest that once was.

Healing the Wounds

In 1992, Reed Noss wrote:

> *A conservation strategy is more likely to succeed if it has clearly defined and scientifically justifiable goals and objectives. Goal setting must be the first step in the conservation process, preceding biological, technical, and political questions of how best to design and manage such systems. Primary goals for ecosystem management should be comprehensive and idealistic so that conservation programs have a vision toward which to strive over the decades. A series of increasingly specific objectives and action plans should follow these goals and be reviewed regularly to assure consistency with primary goals and objectives.* (Noss 1992)

The goals of the Sky Islands Wildlands Network Conservation Plan are based on its mission of healing the ecological wounds of the region. Healing-the-wounds goal-setting also directs the selection of focal species. We have tried to select focal species whose viability or recovery is tied to our six goals. Each of our established six goals is tied to healing a major wound:

Goal 1. Recover all large carnivores and ungulates, and other species native to the region.

Goal 2. Restore watersheds, streams, and riparian forests.

Goal 3. Restore a natural fire disturbance regime.

Goal 4. Protect and restore landscape connectivity for wide-ranging species native to the region.

Goal 5. Eliminate or control exotic species.

Coues white-tailed deer by J.C. Amberlyn

Goal 6. Protect all remaining native forests and woodlands, and restore natural forest conditions.

Objectives are how goals are implemented. Given our goals and approach, we outline our objectives here.

Objectives for Goal 1: Recover Native Species

1) Maintain the viability of focal species; this requires large core reserves and landscape connectivity, as well as redundancy in the system, owing to probable but unpredictable natural and anthropogenic changes in the future.

2) Protect, recover, or reintroduce all missing or reduced-in-number large and mid-sized carnivores native to the region. These include Mexican wolf, jaguar, ocelot, jaguarundi, river otter, and black-footed ferret.

3) Protect, recover, or reintroduce missing or reduced-in-number ungulates, keystone rodents, and other native species. These include bison, bighorn, elk, beaver, prairie dog, aplomado falcon, thick-billed parrot, southwestern willow flycatcher, and Chiricahua leopard frog.

Objectives for Goal 2: Protect and Restore Riparian Areas

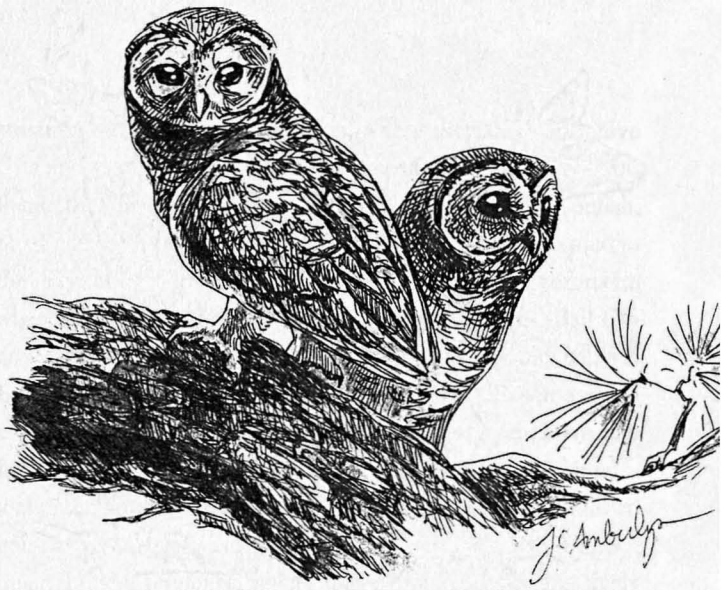
5) Identify and protect all riparian forest patches, no matter how small (Skagen et al. 1998).

6) Restore watersheds and watercourses so they can support focal species and maintain regional ecosystem integrity. This restoration program should include: removal (or much better management) of exotic species, including cattle, from riparian areas, planting of riparian trees and shrubs, restoration of natural populations of beavers (Pollock and Suckling 1998), erosion control structures, and so on (Simberloff et al. 1999).

7) Purchase private lands and bid on federal and state grazing allotments in riparian areas.

Objectives for Goal 3: Restore Natural Fire

8) Implement a comprehensive program to restore natural fire to the landscape, while respecting the special requirements of management in Wilderness Areas.



9) Modify or end domestic livestock grazing so that its role in disrupting natural fire cycles is eliminated or greatly reduced (Suckling 1996a).

Objectives for Goal 4: Restore and Protect Connectivity

10) Identify riparian linkages and areas important for wildlife movement.

11) Develop management standards and legal protection for such "corridor" areas.

Objectives for Goal 5: Control Exotic Species

12) Implement a comprehensive program to control and mitigate exotic species, including plants and animals such as tamarisk, bullfrogs, rainbow trout, and bass.

Objectives for Goal 6: Restore and Protect Native Forests

13) Protect all native forests (old-growth and other generally intact forests) and restore large areas of previously logged or degraded forests so that they recover old-growth characteristics (Suckling 1996b, Simberloff et al. 1999). Wilderness and Wilderness Recovery Area designation should be proposed for most of these areas.

14) Implement ecological grazing management that allows for restoration of natural forest conditions and processes (Morgan and Suckling 1995, Simberloff et al. 1999).

Mexican spotted owl by J.C. Amberlyn

These goals and objectives are "clearly defined and scientifically justified," and are based on "a vision toward which to strive over the decades" (Noss 1992). However, while the goals and objectives of a conservation plan should be bold, even audacious, they should also be achievable. Ideally, objectives should "specify *results* to be achieved, *specific criteria* to measure degree to which results are achieved, *time frame* for achieving results, [and] *target group*" (Arthur Carhart Center 1999). For the SIWN Conservation Plan, specific implementation steps address these points. Action plans will be developed for each implementation step. (See the accompanying article on implementation.)

We believe that a healing-the-wounds approach is an excellent way to analyze conservation problems and to accomplish visionary but achievable goals across a landscape. Healing the wounds is also a powerful metaphor that can move conservationists to action and can inspire the public. Healing ecological wounds can change people from conquerors to plain citizens of the land community (Leopold 1949). Unless we heal the wounds, we will have a continent "wiped clean of old-growth forests and large carnivores"; we will "live in a continent of weeds" (Terborgh and Soulé 1999). ☾

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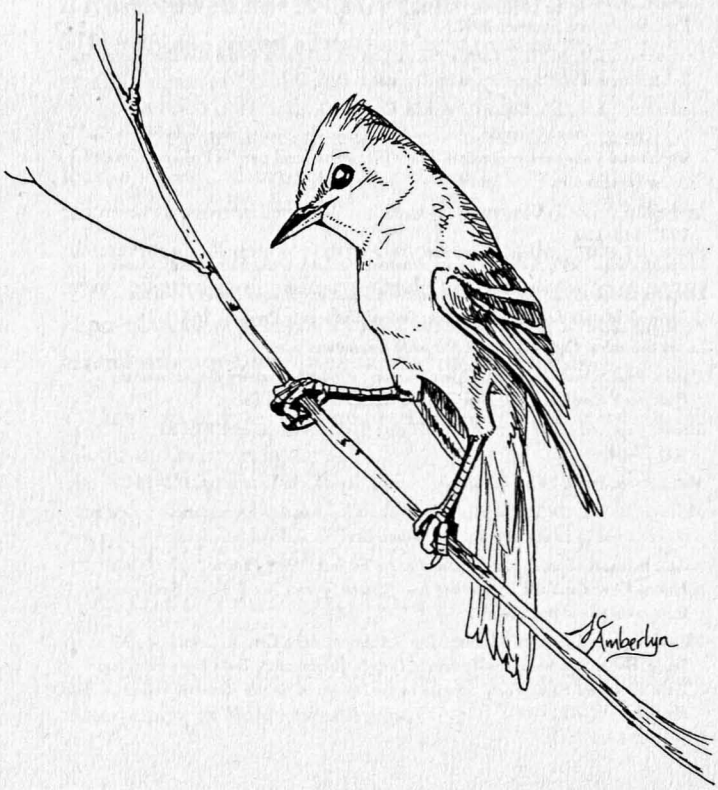
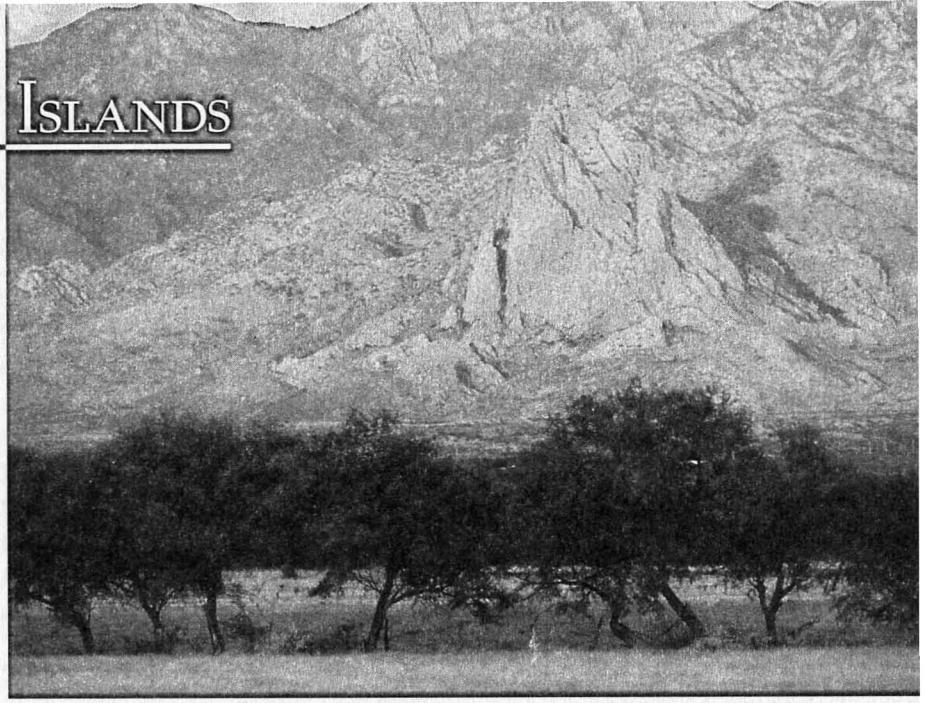


Southwest willow flycatcher by J.C. Amberlyn



Implementation of a Wildlands Network

An Example from the Sky Islands

by Dave Foreman, Barbara Dugelby, Jack Humphrey, Bob Howard, David Johns, and Rod Mondt

EDWARD ABBEY WARNED US that philosophy without action is the ruin of the soul. Similarly, a conservation area design without an implementation strategy—while not the ruin of the soul—is not of much practical value for rewilding a landscape or halting the extinction crisis. Conservation area design and development of an implementation plan are two sides of a single process. While some work on conservation area design precedes consideration of implementation, and while conservation area design should not be self-limited by implementation considerations, the two cannot be considered in isolation. To say that we push the envelope of what is possible does not mean we ignore the envelope. After all, an implementation plan contains the action steps to realize the goals and objectives of a Wildlands Network Conservation Plan.

The Sky Islands Wildlands Network (SIWN) approaches the rewilding of the landscape (Soulé and Noss 1998) by means of focal species planning (Miller et al. 1999) and healing-the-wounds goal-setting (Foreman et al. this issue), all of which are explained in other articles in this section. The proposal for the SIWN Conservation Plan is offered in two interrelated parts: the wildlands network proposal, a map-based conservation area design; and a conservation plan, which includes species recovery, ecological restoration, compatible economic and recreational use guidelines, and other management recommendations. These pieces are discussed in the elements article in this section. We hope to realize the wildlands network and the conservation plan through our *implementation plan*.

photo: Elephant Head, Santa Rita Mountains, Arizona by Jack Dykinga

Never before has a group, coalition, or agency implemented a landscape-level Wildlands Network Conservation Plan such as SIWN, although the state of Florida's implementation of a statewide network of conservation lands is a giant step in the right direction (Noss pers. comm. 2000). Cleaning the Augean stables seems easy in comparison. However, conservationists should not let the unprecedented nature and apparent complexity of implementing SIWN make us think it is impossible or overly complicated. We can simplify implementation by breaking the task down into reasonable pieces.

Metaphors are useful for picturing complex operations. A metaphor for implementing SIWN is a jigsaw puzzle. The completed conservation area design and conservation plan is the picture on the cover of the jigsaw puzzle box. Inside the box are all the different puzzle pieces (implementation steps) that, when fitted together, will make the complete picture (the Wildlands Network Conservation Plan). These steps are all the different campaigns and action items necessary to realize the conservation plan goals. We will not put the whole puzzle together in one fell swoop as conservationists did for, say, Alaskan wildlands with the Alaska National Interest Lands Conservation Act. Rather, different cooperating groups will place separate pieces down on the table from time to time.

How do we place the pieces on the table? Here a useful metaphor is the toolbox. Conservationists have a toolbox containing many tools (lobbying, litigation, organizing, public relations, working with government agencies, fundraising, new legislation, writing management plans, monitoring, applying science, doing scientific research, working with private landowners, land purchase, ecological restoration, etc.). Different conservationists have expertise in using different tools. Certain tools are appropriate to reach certain goals, others for other goals, and the choice depends on the circumstances. There may be some new tools in the box with which no one is yet expert.

An early step in developing an implementation plan is to catalog all the compatible conservation initiatives ongoing in the region. In many cases, an implementation step merely embraces another group's conservation initiative. In the SIWN region, other organizations, agencies, landowners, and scientists have ongoing programs that complement and help implement SIWN. These programs are not necessarily associated with SIWN and many predate it. These groups are pursuing their own goals under their own direction, but we recognize them as important efforts in realizing the overall SIWN goals. Implementation of SIWN does *not* require or suggest a single campaign. Indeed, such an approach could make implementation more difficult.

From this perspective, implementation is not something entirely new or difficult in concept. Most of the steps to implement SIWN are well known within the conservation community and there are many skilled practitioners. These include legislative designation of new Wilderness Areas and Wild Rivers; influencing National Forest and BLM management plans; encouraging conservation easements on private land; reintroducing extirpated species; and ecosystem restoration.

Of course, achieving these is not necessarily easy, and SIWN approaches them from a slightly different perspective than have other conservation plans before. Some implementation steps are relatively new, such as economic incentives, compatible uses, and working with state trust lands; however, capable people are developing these tools. Some projects can be implemented soon. Others will take longer. For example, we may have to wait for changes in the New Mexico and Arizona congressional delegations before designation of new Wilderness Areas can happen. It may take decades to complete SIWN. Bear in mind, however, that some participants in SIWN have already been working on a Blue Range Wilderness Area for 30 years.

At least four parts of SIWN are new and different:

■ Cataloging and embracing the various conservation and land-use programs in the region that tend to heal the wounds of the land and support the overall rewilding goal of SIWN. These proposals and efforts emanate from conservation groups, agencies, landowners, land users, scientists, and others; they are not originated by SIWN. SIWN is endorsing many efforts; such efforts are not necessarily endorsing SIWN.

■ Figuring out how to coordinate the use of these different tools by different entities to achieve an overarching conservation plan for a landscape-sized region (e.g., no one has ever before looked at federal, state, county, Nature Conservancy, and private land together; nor has anyone integrated land designation with species recovery, ecosystem restoration, and economic incentives);

■ Trying to accomplish some new things with familiar tools out of the conservation toolbox, particularly designating and managing lands for connectivity and compatible use (buffers);[1]

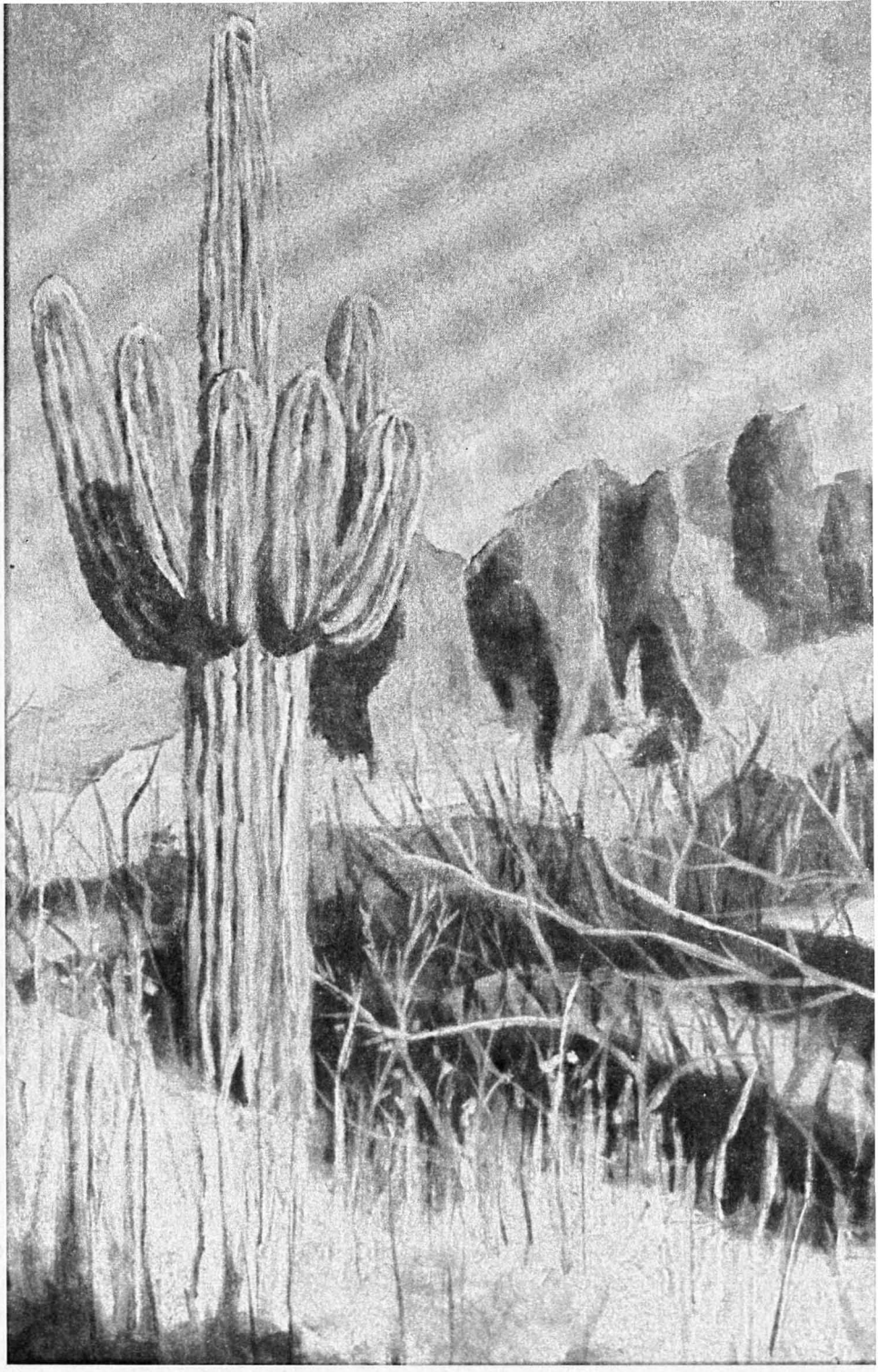
1. At least in the United States, applying management criteria systematically across the landscape to restore and maintain functional connectivity is new and notable, although the science undergirding such efforts is not. Indeed, connectivity and buffers were mentioned in Frankel and Soulé (1981), and considered much earlier by the pioneer ecologist Victor Shelford. For example, in 1931 Shelford stated that "national parks should be large enough to encompass the home ranges of as many animal species as possible and should be ringed by buffer zones," and he produced many maps illustrating this concept. These ideas were reiterated by George Wright a few years later (1935). In the early 1940s, Shelford proposed a connection of two parks in Illinois by a riparian corridor (Croker 1991).

■ Figuring out how to present such a complex and ambitious vision to the public and decision-makers.

Because of the very different land ownership patterns and political and social structure in Mexico, separate but compatible implementation strategies are being developed for SIWN in the United States and in its sister Wildlands Network Conservation Plan, the Northern Sierra Madre Occidental Biological Corridor in Mexico.

Our implementation strategy and the action steps within it were developed through widespread consultation with regional and international conservation groups, land users, academic experts, and government agencies. In February 1999, The Wildlands Project and Sky Island Alliance hosted a three-day workshop at Rex Ranch, south of Tucson, Arizona, at which the draft SIWN Implementation Plan was presented. Some thirty participants, including conservation campaigners, economists, media consultants, biologists, ranchers, outdoor recreationists, hunters and fishers, federal and state agency staff, and social scientists, discussed in detail how to implement a Wildlands Network Conservation Plan. The group gave thoughtful and very useful suggestions on how to improve the draft SIWN Implementation Plan, while offering strong general support for the Sky Islands Wildlands Network (Johns in press).

Healing a region's wounds is a seemingly overwhelming task. Creating a vision of a healthy landscape and the specific steps necessary to realize it is how we make it possible. ☾



Sonoran desert landscape by Lezle Williams

Dave Foreman and Barbara Dugelby are on the reserve design team of The Wildlands Project. Jack Humphrey and Andy Holdsworth are staff for the Sky Island Alliance. Bob Howard is chair of the New Mexico Wilderness Alliance. David Johns is on the board of The Wildlands Project. Rod Mondt is on the board of the Sky Island Alliance.

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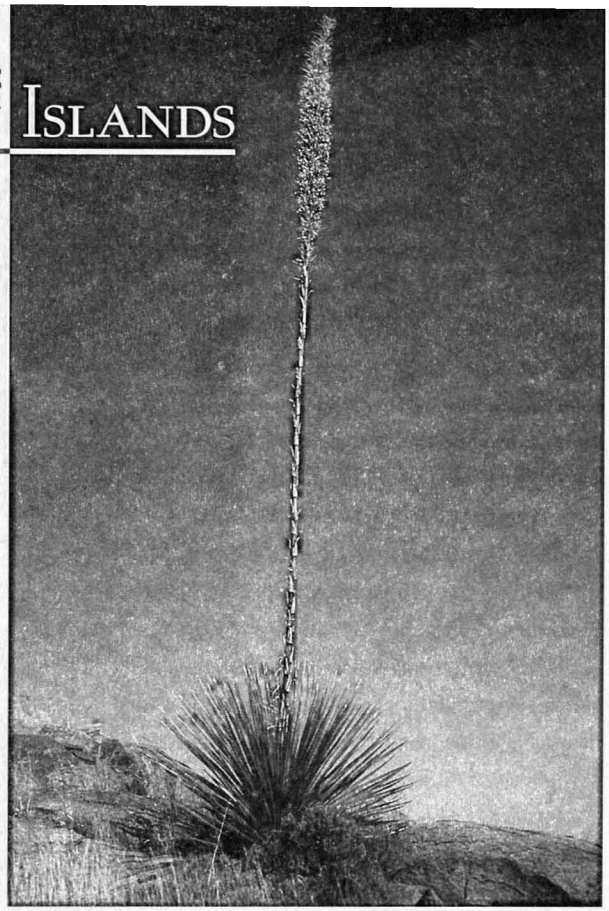
Baboquivari!



BABOQUIVARI! The very name is like a dream; a hard place to get to—jeeps might do it but will be unwelcome; best come on horseback or like Christ astride a donkey—way past the end of the pavement, beyond the farthest smallest sleepiest town, beyond the barbed wire (invented, some say, by a Carmelite nun), beyond the Papagoan hogans, beyond the last of the windmills, hoving always in the direction of the beautiful mountain.

—from the journals of Edward Abbey, November 1954

by David Petersen

ONCE UPON A TIME, I was granted the bittersweet honor of editing my friend Ed Abbey's twenty-one volumes of personal journals for publication.* Sadly, I had to leave out more than I could fit in. And one of those unpublished episodes has haunted me ever since. It's a detailed, exuberantly romantic fantasy of freedom, dignity, and place.

A desert place, naturally, anchored by a little island mountain range floating in the prickly midst of the Sonoran Desert southwest of Tucson. Its name is Baboquivari. Westward spreads the sparsely inhabited 2.3-million-acre Tohono O'odham (Papago) Indian Reservation. Immediately east sprawls the Altar Valley and the 120,000-acre Buenos Aires National Wildlife Refuge. To the south lies Sonora, Mexico—*la Sierra Madre Occidental* to the east, the azure Sea of Cortez to the west.

At the time of his Baboquivari journal scratchings, Abbey was a lonesome intellectual of twenty-four years, living in a dank loft in Edinburgh, Scotland, studying philosophy and literature as a Fulbright Fellow, writing his first novel … and building desert sand castles in the air:

> *Baboquivari—there, somewhere, in that vast desert wasteland, I shall build my festung, retreat, hideout … dark womb of the soul—a long low dark sprawling sunbaked storm-lashed hacienda of adobe … a fat library of esoteric books, an arsenal of music … all in one long open room crawling with centipedes, arachnids, vinegaroons.*

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* Abbey, Edward. 1994. *Confessions of a Barbarian. Selections from the Journals of Edward Abbey, 1951–1989.* David Petersen, editor. Boston: Back Bay Books, Little, Brown and Company.

This essay is adapted from a longer version originally published in The Nearby Faraway: A Personal Journey Through the Heart of the West *by David Petersen (Johnson Books, 1997).*

photo: Oscar Moctezuma

Years later, Ed would settle on (and for) the west edge of Tucson, almost within sight of Baboquivari Peak, which he visited often and climbed repeatedly. Babo's bulbous granite dome rises nearly 4500 feet to an elevation of 7730 feet above the desert basins that surround it.

Now Ed is gone, leaving me haunted by that hulking visage. Most years in March (when we can afford it), to honor the memory of a friend, Caroline and I flee our snowbound Colorado cabin and point ourselves southwest. This time, our destination is Baboquivari.

> *BABOQUIVARI! How this name strikes on the romantic heart.*

Quite so. Yet it's a name without a language, the final twisted link in a chain of awkward translations from Indian to Spanish to English. The source word, from the tongue of the indigenous Tohono O'odham—the aptly self-named "Desert People"—is *Waw* (say "vav") *Kiwulik*, or "rock drawn in at the middle."

To the O'odham, Baboquivari is holy ground. As detailed by Arizona ethnobiologist Gary Nabhan in his splendid Sonoran study *The Desert Smells Like Rain*, the Baboquivaris shelter a cave that "is *I'itoi Ki*, home to the Coyote-like character responsible for the Papago emergence into this world.... Because Baboquivari Peak towering over the cave can be seen from nearly every village on the reservation, this place is literally and figuratively at the heart of the Papago universe."

Today, but half of the north-south trending Baboquivaris lie within the O'odham preserve. The boundary traces the ridgeline, with the western slope belonging to the Indians and the eastern slope a checkerboard of private and public parcels. And any way you come at it, access to Baboquivari is a challenge. You can, if you must, purchase a permit to enter tribal lands and climb Baboquivari from the west, as Abbey did on his initial attempt a quarter of a century ago (as documented in *Cactus Country*). But the O'odham are a private people and less than eager to have swarms of outsiders buzzing over their land and sacred shrines, and I don't blame them.

Fortunately, there exists a little-known route to the flanks of Baboquivari from the east, which Caroline and I snooped out and even now are exploring.

> *Oh my beloved Baboquivari ... here the bullbat will resound at night, the greathorned owl hunch on its haunches in the dusk, the coyote yodel wanly on the hill, the mockingbird cry and the thrush hush all; and all about, the cactus.*

Cactus? Not so much, as it turns out. Westward, you bet. But here in the Altar Valley to the east of the Babos the elevation is just high enough to exclude the spectacular Sonoran cactus garden ecology in favor of an unlikely desert grassland—cow country, pardner. You'll see some cholla, plenty of prickly pear, an occasional barrel, a forlorn saguaro or two, little more.

Happily, the drive in from the blacktop is just as the young Cactus Ed imagined it:

> *... way past the end of the pavement ... over hard, dry, rocky hills on a dim trail ... under a harsh blue sky and a brilliant brassy sun ... beyond the last of the windmills, up an old dry arroyo bed paved with stone and quiet colors ... hoving always in the direction of the beautiful mountain.*

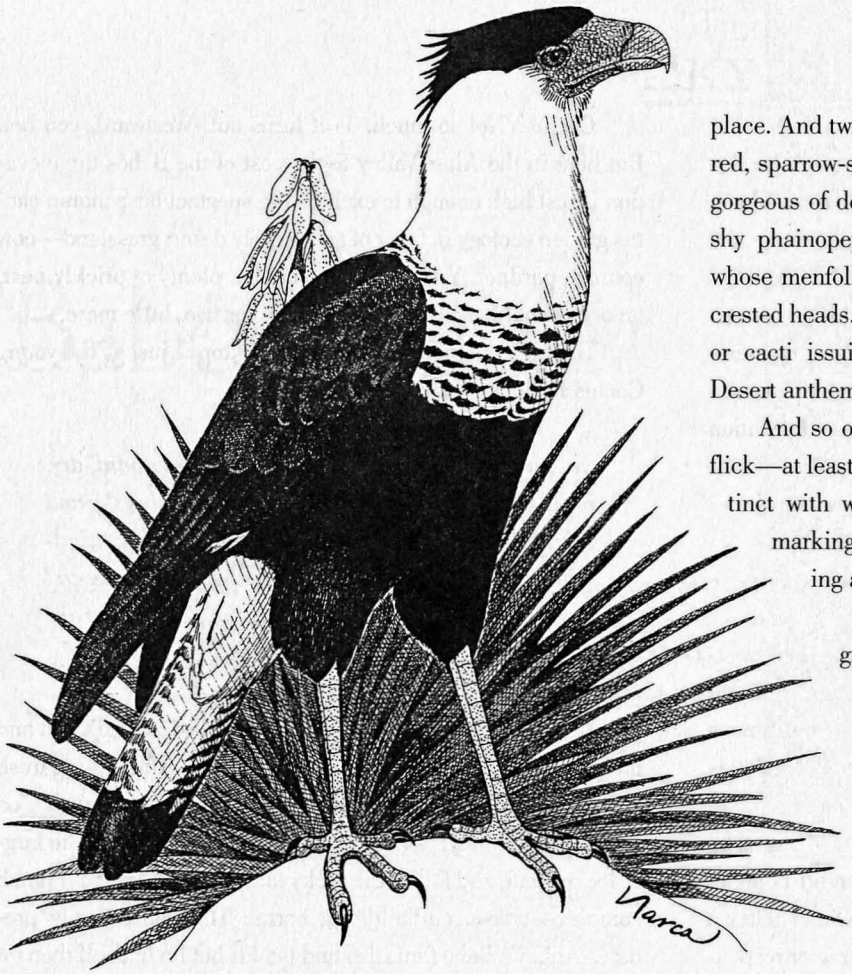
Dust-caked and butt-sore, we come at last to road's end and park the old beater in what passes for shade. After eating fresh Arizona oranges and tanking up on water, we hang packs on backs, stroll through an unlocked people portal beside the larger locked gate and follow the rocky lane to a well-kept old ranch complex—house, outbuildings, corral. The house easily predates Abbey's Babo fantasies and (as I'll bet he himself thought when first he saw it) fills his hide-out bill just so.

> *There it is—silent, dark, empty-seeming now, almost hidden under the trees in the lee of the red cliff, its dust-colored walls, black eyeless windows—quiet, aware, motionless, waiting.*

Two big beautiful horses eye us suspiciously as we stroll boldly through their domain. Nobody else at home.

Just past the ranch complex, a trail lines out along the dry gulch of Thomas Canyon, and we lean into its moderate uphill grade. Only nine o'clock on a mid-March morning but already a "brilliant brassy sun" sizzles like napalm on exposed skin. Soon enough, though, we come beneath big, shade-making trees—mostly evergreen oaks including Emory and the rare Mexican blue—with the odd walnut and spindly Mexican piñon pine tossed in for variety. *So* many trees that at the first crossing of the gulch we lose the faint trail beneath an ankle-deep litter of leaves. With semi-method we cast about, working up-canyon, relocate the way, move along.

In contrast to the cow-burnt *plana* of the valley below—where we camped last night and saw no wildlife of any kind, though one lonely coyote did "yodel wanly" from afar—the shaded riparian corridor of Thomas Canyon offers an abundance



of food, cover, even water (at least here in the lower canyon) in modest pools ringed with cattails and what I call "piss willows" in honor of their distinctly uric aroma. Wildlife abounds.

Already we've seen ground squirrels, rabbits, lizards, some big unfamiliar rodent, and we've noted evidence of others—javalina-sized bites out of prickly pear pads, coyote scats and tracks in the dust, the hard brown pellet droppings of deer. Although he mused in his journals that "at times perhaps we'll live on the dry desert air, eating sunlight and drinking the miraculous blue," Abbey and his little society of hermits would have had no trouble keeping themselves in wild meat hereabouts.

We cross the gulch a second time, alert lest we trod upon any of the Sonoran's plethora of poisonous residents. When Caroline spots a swarm of Apoidea buzzing angrily around a head-high hole in a big live oak alongside the trail ahead—having been forewarned that Sonoran bees are "Africanized"—we detour wide around. The bemused buzzers ignore us.

The higher we climb, the birdier it gets—a veritable "feathered landscape" (Terry Tempest Williams). When a nervous covey of Gambel's quail scurries past just ahead, we fall into a traveling game of Name that Bird. Most vocal and visible are the big, heavy-beaked Mexican jays, artful amalgams of raven and jay that thrive on the abundant mast in this nutty place. And twice we're blessed with flash-by glimpses of flame: red, sparrow-sized male vermilion flycatchers, among the most gorgeous of desert songsters. We hear more often than see the shy phainopeplas—big lean members of the flycatcher clan whose menfolk are glossy black with tuxedo tails and proudly crested heads. Look for phainos perched atop tall, isolated trees or cacti issuing their distinct single-note call: the Sonoran Desert anthem.

And so on—woodpeckers peck, thrashers thrash, flickers flick—at least until a pair of Harris hawks, resplendent and distinct with white-banded tails and chestnut wing and body markings, come shadowing low across the canyon, silencing and scattering the timid singers.

Far above the hawks, a swarm of swallows swirls gracefully on a right smart breeze eddying around Baboquivari massif. And hanging long and white from ledges and alcoves high on that stony visage, chalky stains like old men's beards mark the aeries of not just hawks, but eagles, ravens, even (we can suppose) that rare lovely falcon called *caracara*—the so-called "Mexican eagle" emblematic of that Nearby Faraway.

With the arrival of the hawks and the hushing of the songbirds, a liquid stillness floods the canyon. We stop and listen but hear only our own deep breathing. I look up—past trees and hawks and swallows and peak, into a flawless firmament. We've been roaming Baboland for days now, and are yet to hear or see a single stinkin' airplane.

One fat fly buzzes by, dissolving our pleasant trance. We hitch up our packs and carry on.

Our goal is a prominent notch in the ridge on the north shoulder of Baboquivari—the "drawn in at the middle" bit of O'odham fame, it would seem—where (we've been told) waits a cool, shaded, breezy campsite with a view. But no water. That must be humped all the long way up, providing this place with a built-in safeguard against overuse. Gazing up from the ranch, the saddle didn't appear so very far, but we've been slogging for more than two hours now without a serious (sit-down) break and our goal appears not one slog closer. I've encountered this curious visual phenomenon before in the Sonoran, and lay it to the mirage-making qualities of desert light and landscape.

The trail grows increasingly steep, rocky, and switchbacked as it ascends. Yet it's no worse than some "maintained" National Forest trails I've hiked in the Rockies and California Sierras, better than many and a lot less crowded (as in, nobody).

We pass spear-leafed yucca by the dozens—Arizona and soaptree varieties, I presume—their erect penile flower stalks

crested caracara by Narca Moore-Craig

probing like flagstaffs at a perfect Sonoran sky. Grasses and forbs abound, though this is a lame spring for wildflowers; the winter was dry even by parched local standards, and Caroline is disappointed to spot only the odd clump of sand verbena, a few droopy stalks of sad red penstemon, a rare yellow cluster of wilted bloomers atop fish-hook barrel cactus. The barrels, in conspiracy with mesquite, cholla, yucca, Engelmann and purple prickly pear, reach out to grab, stab, and slash at our legs, making us glad we eschewed shorts in favor of pants. Alligator junipers have begun popping up among the hardwoods and piñons, growing bigger and more plentiful as we climb.

Off to our right now looms a deeply eroded rhyolite dike—a crumbling volcanic castle wall—gray-yellow rock stained lime green with lichens. To our left, lichens likewise beard the stony face of Old Man Baboquivari, enlivening his otherwise stark facade.

Noon approaches and we begin to droop. Already we've chugged a quart of water each and are wondering if we've brought enough. Moods are sinking when a canyon wren flits by, gushing a joyful cascade of silvery notes that animate the arid atmosphere and revive our sagging spirits. How I love that little bird.

Directly above, a lone Chihuahuan raven fights headlong into an invisible wind, muttering irritably to himself. While I'm watching this spectacle in the sky, rather than the trail at my feet, a marble-sized stone shoots from beneath a clumsy boot and I go down hard, struggle to my feet (muttering irritably to myself), continue on.

And on.

Finally, after half a day of hiking, we mount Baboquivari's hirsute shoulder. I suppose an athletic young jock (or jockette), toting only the minimum of food and water and with a bee under his (or her) Bula cap, could make this hike—maybe four miles and three thousand vertical feet—in half the time. Good for him (or her). While it's no marathon, neither is it any cake walk and we've done well enough, Caroline and I. Perhaps too well. I mean—why rush it? Like life itself, rare is the destination that justifies a harried journey.

The saddle fulfills its promise—breezy and cool and deeply shaded. Plenty of room for two or even three small tents on fairly level packed earth. Long used (for millennia, no doubt), but little littered (a miracle these trashy days). A few minutes of local hunting and gathering should net plenty enough down-and-dead wood for a small evening conflagration. From here it's (mine to hope) an easy hike to the base of the mighty dome—should I decide, come morning, to attempt those last potentially killer thirteen-hundred-plus vertical feet.

This place is, in fact, the ideal approach camp for anyone planning to attack the peak from the east: a relaxed half-day up here, rest and enjoy … a full day to do the dome and return before dark … out the third day and (sigh) back to the "real" world.

Peering east from this vantage, it seems you can see a hundred miles, out across the beef-bashed Altar Valley to the Coronado National Forest (likewise overgrazed and, consequently, mesquite infested). Seven distinct island ranges ring the Altar (they say), straddling the US/Mexican border, though you'd be hard pressed to separate and name them, even from such a fine observatory as this.

Feeling light as angels without our packs, we float on up the trail above the campsite, looking for a window through the trees from which to spy out the O'odham world lying westward and below. No such luck (can't see the desert for the trees). What we can see, however, is wild and rewarding—except, perhaps, for Kitt Peak at the northern terminus of the range, upon whose bald pate are visible two of the squadron of observatory domes perched there, glowing white and round like the eggs of reptilian invaders from Mars.

Directly below us rises yet another jagged broken castle wall of lichen-greened rhyolite. Beyond that and far, far below, a few patches of Indian Country come winking through, bearded over with some three hundred species of cacti. Down there, somewhere, hides old *I'itoi*, the O'odham god—who must be sleeping, since down there also, his six thousand Desert People are in pain. They still have their homeland, much of it, but like so very many indigenous peoples worldwide, under cultural assault they've lost their spiritual roots and, consequently, their health, perhaps their very souls.

A tangerine twilight stirs intermittent breezes, and what few bugs there were today—flies, gnats, killer bees—disappear with the sun. Sitting here staring into the winking flames of our little fire, my cholesterol-clogged old heart skips a beat with the thought that a reliable sighting of an errant Mexican jaguar—a *jaguar* for chrissake, up from *la Sierra Madre*—was made in Brown Canyon, just south of here, just last week. Not even the romantic young Abbey envisioned such a miracle.

The flames flicker and fade to coals, the coals wink out and the night grows suddenly chill and dark, our only light a wan yellow rocker of quarter-moon.

> *The desert moon—there is magic for you … a bridge of ghostlight from here through space to the other world … a lonely moon above a lonely land.*

A lonely land, indeed. And hauntingly quiet. Even the owls, coyotes and poor-wills are mute this idyllic spring night.

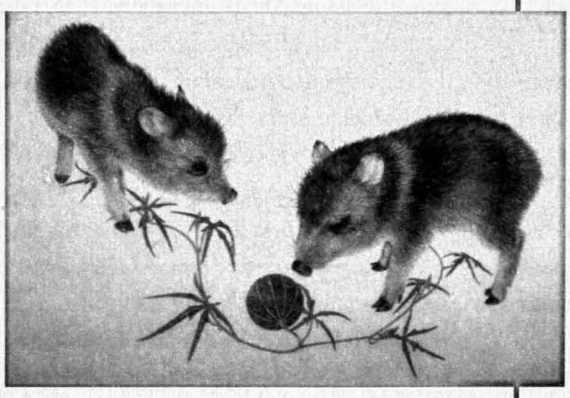
MORNING. BEFORE ABANDONING THIS LONG-SOUGHT place—which, like so many cherished others, I may never see again (how are we to know?)—I opt to explore farther up the trail as it approaches and spirals westward around the skyscraping vertical dome. Caroline, sensible as always, elects to stay in camp "to go for help if you don't come back." I've been cautioned against attempting the ascent alone, even the relatively "easy" class-four route. (The hard bit, as always, is getting back down.) But I'm carrying a fifty-foot length of stout nylon rope and I've got all day and a heartful of energy. We'll see.

And see we do, straight-away, when I hit serious snow, freezing me out, as it were, almost before I get started. On the hike up yesterday we spotted a few scattered patches of the anomalous white tucked back in the shade of alcoves and dikes, remnants of a freak spring storm that blew through here just over a week ago (with the adventurous jaguar). Now, up here in the abiding north-side shade, hard against the massif, the slippery damned stuff is everywhere. Soon the trail disappears entirely beneath deep, then deeper, ice-crusted drifts. The going gets increasingly treacherous and I give it up—even as Abbey was forced by snow to abandon his premier Baboquivari attempt.

So be it.

Having reached the end of the trail (for now), I make a little speech—to myself, I suppose, though I'd like to think otherwise—then use my trusty hiking staff to scratch two words into the snow: Abbey Lives! A message for a friend who (who knows?) might just pass this way. That done, my Baboquivari pilgrimage behind me, I return to camp, to the ever-sweet Caroline ... and to whatever awaits us down the trail. ☾

Writer, hunter, and conservationist David Petersen is the author or editor of thirteen books including A Hunter's Heart: Honest Essays on Blood Sport *and* Elkheart: A Personal Tribute to Wapiti and their World.



Javelina Soil

"Peccaries are known to lick and eat soil..."
The Encyclopedia of Mammals

Little upright flap of skin on nose
for pushing and rooting
cartilaginous glistening mucous holding
grains of mineral and decay

There is no bad soil
for a Javelina
no skull and crossbones, or
"Mercury Poisoning—Keep Out"

Long face dedicated to intimate contact
with the Earth
following tastes and touch,
squinty-eyed

Nostrils, tongue and teeth
never too close
ours are never
far enough away

We have an impediment:
we walk too high above the Earth
for soil to touch
our minds

The distance
between feet and mouth
that gives us wide vision is making space
between lettuce fields and thoughts

Many questions
arise in flooded desert
burying delicious morsels
once nosed from the clay

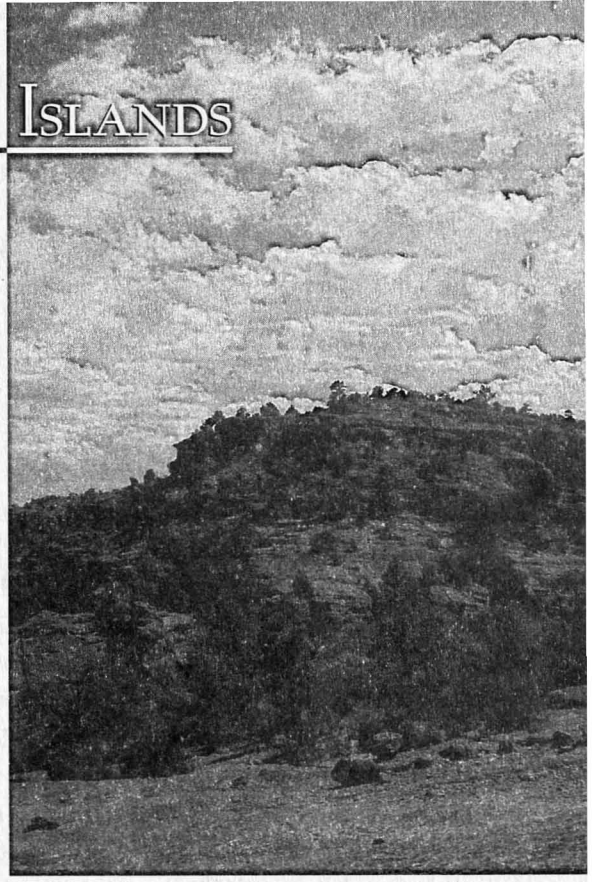
"Piggishness" is language for mindless eating
no synonym in Suidae or Tayassuidae
who know the roots
of their food

Javelina vision
could not include wasted ground
if it did there would be
no more sleeping with

Dried dirt on their lips

—Rob Baldwin

javelina young by Pamela Ensign



Cooperative Conservation

Wildlands Project Efforts in the Sierra Madre Occidental

by Rurik List, Oscar Moctezuma, and Carlos Martínez del Río

NORTHWESTERN MEXICO SHOULD HAVE special symbolic value for North American conservationists. When Aldo Leopold visited the region in 1936, he was startled by the abundance of wildlife and by the "aboriginal health" of the Sierra Madre Occidental. Leopold's visit to Mexico irreversibly changed his perspective about ecosystem health (Meine 1999). Sadly, very few places in the region remain as healthy as Leopold saw them only seventy years ago. Here we review the biological importance and conservation status of the northern Sierra Madre Occidental, describe the efforts of The Wildlands Project and our Mexican collaborators to develop a conservation strategy for this region, and assert that any wildlands conservation effort for the southwestern United States that does not consider northwestern Mexico is incomplete. While the political and social challenges on the Mexican and US sides of the border may differ, conservationists recognize the ecological interdependence and essential unity of the region. Clearly, effective trans-border cooperation will be needed to ensure the recovery and protection of ecosystem health.

The Land

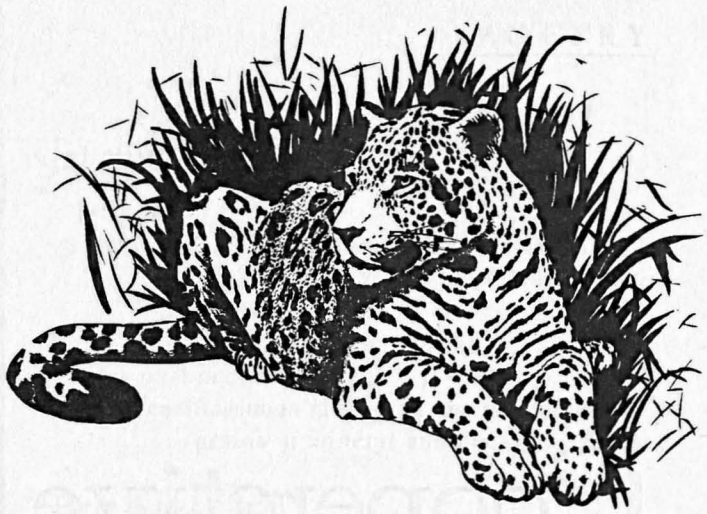
Northwestern Mexico is at the confluence of two floristic (neotropical/holarctic) and faunistic (neotropical/nearctic) regions (Walter 1979). The hybrid nature of this region makes it a hotspot of biological diversity and a priority for continental conservation. Because the region retains significant pristine forests and grasslands, it acts as a potential reservoir of animals and plants for other areas in Mexico and the US in which populations are declining or have disappeared (Ceballos et al. 1993). Although their populations are diminished, flocks of thick-billed parrots still inhabit the mountains, and jaguars are still common only a few hundred miles south of the US border in the *barrancas* (canyons) where the tropical deciduous forest extends farthest north.

photo: Casas Grandes, Chihuahua, Sierra Madre Occidental by Rurik List

Northwestern Mexico also provides key habitats for neotropical migrant birds that nest in the United States and Canada (Manzano-Fischer et al. 1999), and harbors a very high number of endemic species (Rzedowski 1993). Unfortunately, the rich ecosystems of northwestern Mexico are being rapidly lost to ecologically destructive human activity.

The Wounds

Cattle grazing, both in the mountains and on the lowlands, is facilitating the invasion of exotic plants and altering the original vegetation structure. The once extensive grasslands of Chihuahua are being transformed into savannas dominated by invasive mesquites (Gay and Dwyer 1980, List 1997, Weltzin et al. 1997). These grasslands were once inhabited by vast black-tailed prairie dog towns (*Cynomis ludovicianus*); with a few notable exceptions these towns have been largely eradicated (Ceballos et al. 1993). Overgrazing has also led to a significant impact on the potential food sources of formerly abundant wildlife (Leopold 1937, Galindo-Leal and Weber 1998). Rampant unregulated logging and forest clearing for drug plantations have resulted in habitat loss and fragmentation. Very little primary forest remains; of the 93,560 square kilometers of pine-oak forest in Mexico, only 0.6% is old growth (Lammertink et al. 1996). Such forest losses have led to biodiversity declines, soil erosion, and changes in the hydrology of deforested areas. Rivers, lakes, and streams suffer; freshwater fish are the most threatened vertebrate group in Mexico. Between 1901–1975, 41% of all native fish species have disappeared at several localities in Chihuahua (Contreras et al. 1976). Very few of the clear streams lined by sycamore, willow, and cottonwood described by Leopold (1937) persist untouched. Wolves and grizzlies, once common, have been exterminated. Some of their prey (elk, bison, and bighorn sheep) are also gone.



The First Steps Toward Regional Wildlands Recovery

Within northwestern Mexico, the northern Sierra Madre Occidental and the adjacent lowlands of Chihuahua and Sonora are of especial significance and concern. Sparsely settled by humans, these areas still retain relatively intact ecosystems. Many places contain a high diversity of endangered and endemic species. Furthermore, the wooded slopes of the Sierra Madre are the headwaters of several rivers that are key water sources for the more populated lowlands. Although the region is clearly one of immense biological richness it remains largely unstudied. Designing a proposal for a system of protected areas has been challenging.

In 1997 The Wildlands Project (TWP) and Naturalia Asociación Civil (a Mexican non-governmental organization with close ties to TWP) started the process of identifying conservation priorities in the region. We organized a workshop with local activists and scientists during which 32 priority conservation areas were identified (Fig. 1). These areas represent a minimal conservation core for the northern section of the Sierra Madre Occidental. They sample the diverse vegetation of northwestern Mexico and include several grassland types, oak, pine-oak, and coniferous forests, old-growth forests, gallery riparian areas, gallery forests, tropical deciduous forests, several types of desert scrub, and sand-dunes. Most contain species at risk (28 areas) and endemics (20 areas). About half of the areas hold one or several of the following elements: important nesting sites (e.g., for thick-billed parrots, 17 areas), unique habitats (15 areas), and/or noteworthy biological phenomena (e.g., the largest prairie dog towns on the continent, 16 areas). Many of the chosen areas are well preserved (13 areas), have ongoing conservation efforts (12 areas), have unusually high biodiversity (11 areas), and have low human population and road density (11 areas). In some places, alternative use of natural resources is taking place (e.g., ecotourism, 8 areas). Only three areas have cattle ranching, but these lands are also managed for wildlife (deer and turkey hunting primarily). Only one area (Sierra Los Ajos-Buenos Aires) is officially protected.

jaguar and Mexican wolf by Raziel Méndez Moreno

After the workshop, we held public meetings with local landowners to inform them about the project and to request permission to work on their lands. Our meetings were surprisingly successful. Most landowners expressed interest in the project and no one denied us access when we decided to "ground-truth" the areas that our workshop participants identified. The advantages and wisdom of maintaining good working relationships with landholders became evident when we began to implement a conservation initiative at Cebadillas Ejido.

The Second Phase

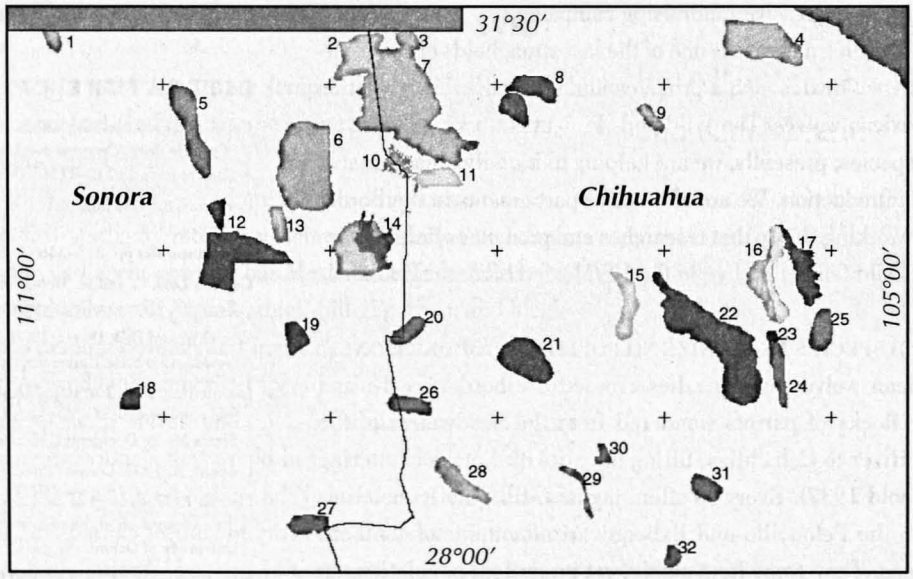
With help from the faculty and students of a local university (Universidad de Chihuahua), we began field work. We surveyed the areas identified at our meeting to assess their conservation status; the results were sobering. We soon realized that the most ecologically critical areas were suffering from degradation or were soon to be altered. Among the areas in imminent danger were the two most important breeding sites for thick-billed parrots (areas 10 and 28), the largest complex of prairie dog towns on the continent (area 7), and the mountainous region that was once the last stronghold of Mexican wolves and grizzlies (area 22). Because of the pressing nature of the threats, a short-term strategy was needed.

Because land tenure systems in Mexico are complex, leasing and buying land poses interesting challenges. With funding from the Foundation for Deep Ecology and the Embassy of Holland, we financed the production of a document that clarifies the options for purchasing or leasing property for permanent land protection. This comprehensive analysis, supplemented by further advice from lawyers and landowners, will guide our conservation strategy in northwestern Mexico and will help the conservation efforts of other organizations throughout the country. Protecting wildlands here requires understanding the complexities of land tenure in a rapidly changing political landscape. TWP and its Mexican counterparts are pioneering a landscape-scale conservation strategy in a country in which the conservation movement is still very young. Meaningful progress toward lasting biodiversity preservation in

Priority Conservation Areas

in the northern Sierra Madre Occidental and adjacent lowlands of Sonora and Chihuahua, Mexico

1) Sierra San Antonio
2) Sierra San Luis
3) El Berrendo
4) Samalayuca
5) Sierra Los Ajos-Buenos Aires
6) Sierra San Diego/El Tigre
7) Janos/ El Cuervo
8) El Capulín
9) Mirador El Caballo
10) Mesa de las Guacamayas
11) Tapiecitas
12) Bavispe-Sierra La Madera
13) Villa Hidalgo
14) Sierra Huachinera/Tabaco
15) Sierra Las Tunas
16) Pastizales en Valles Centrales
17) La Gregoria-El Sueco
18) Sierra Mazatán
19) Río Yaqui
20) El Poleo-Río Negro
21) Laguna Bavícora
22) Sierra El Nido
23) Laguna Encinillas
24) Pastizales Halófilos
25) Los Reyes
26) Mesa San Agustín
27) Mesa Campanero-Arroyo El Reparo
28) Cebadillas
29) Cuenca del Río Papigochic
30) Teseachic
31) Laguna Bustillos
32) Laguna Mexicanos



Mexico involves taking small steps, working with local communities, and adopting unorthodox approaches. One such approach is negotiating long-term conservation agreements with *ejidos*, rural land cooperatives. We have just completed a precedent-setting agreement with Cebadillas Ejido, which will give interim protection to the primary breeding grounds for the thick-billed parrot in the Sierra Madre Occidental (see accompanying article).

Northwestern Mexico and Continental Conservation

Our efforts to rewild the northern Sierra Madre Occidental of Mexico now involve many Mexican conservationists and scientists. We are preparing a proposal for a regional system of interconnected conservation areas, the Sierra Madre Occidental Biological Corridor. This proposed network will include core areas; corridors for wildlife movement, especially large carnivores; areas where functional keystone processes are still present (e.g., prairie dog colonies); and areas of great biodiversity importance.

With our Mexican collaborators (Pronatura Noreste, Sierra Madre Alliance, Instituto Tecnológico de Monterrey, Instituto de Ecología-UNAM), we are developing a strategy to purchase land and conservation easements in the core conservation areas identified in our proposal. Implementing these purchases will require an aggressive fundraising campaign.

The Sierra Madre is one of the last strongholds of large carnivores in Mexico, and a prime candidate for the reintroduction of Mexican wolves. The Wildlands Project is working to recover this species; presently, we are helping to identify areas suitable for reintroduction. We are also active participants in the Border Cats Working Group that researches and promotes efforts to conserve wild felids that live in the US/Mexico border region.

WILD SPECIES RECOGNIZE NO POLITICAL BORDERS. ONCE, Mexican wolves and grizzlies crossed the border freely, and huge flocks of parrots wandered from the headwaters of the Gila River to Cebadillas, filling the air with riotous chattering (Leopold 1937). Every so often, jaguars still quietly materialize in the Peloncillo and Baboquivari mountains of southern Arizona. They come from stable, yet imperiled, populations in Sonora, Mexico. The movements of these animals remind us of a time when the continent was intact and healthy. They should compel us to heal its wounds and restore the broken landscape connections. Conservation of the spectacular biodiversity of the Sky Islands of Arizona and New Mexico demands that we understand its organic links with Mexico, and requires collaboration between Mexican and American conservationists to develop and implement a wildlands network extending from the northern Sierra Madre Occidental to central Arizona and New Mexico. ☾

Carnivore ecologist and conservationist Rurik List has researched prairie dog ecosystems in the Sierra Madre Occidental since 1990. He was the Mexico program coordinator for The Wildlands Project (Apartado 98, Metepec 3, 52176 Estado de México, Mexico) from 1997–2000 and is now a post-doctoral researcher at the Institute of Ecology at the National University of Mexico (Instituto de Ecologiá, UNAM 3er Circuito Exterior Ciudad Universitaria, Anexo al Jardín Botánico Coyoacán, 04510 México, DF).

Oscar Moctezuma (Naturalia, AC, Petén #437, Col. Vertiz-Navarte, México 03600, DF, Mexico; info@naturalia.org.mx; www.naturalia.org.mx) has participated in numerous projects for conservation of species and ecosystems. He is vice-president of The Wildlands Project and general director of Naturalia, AC, an organization he founded in 1990.

Carlos Martínez del Rio (Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, AZ 85721-0088; cdelrio@u.arizona.edu) is a natural historian who studies animal-plant interactions. A member of The Wildlands Project's board, he dreams of a day when a chain of connected reserves will extend from Patagonia to the Yukon.

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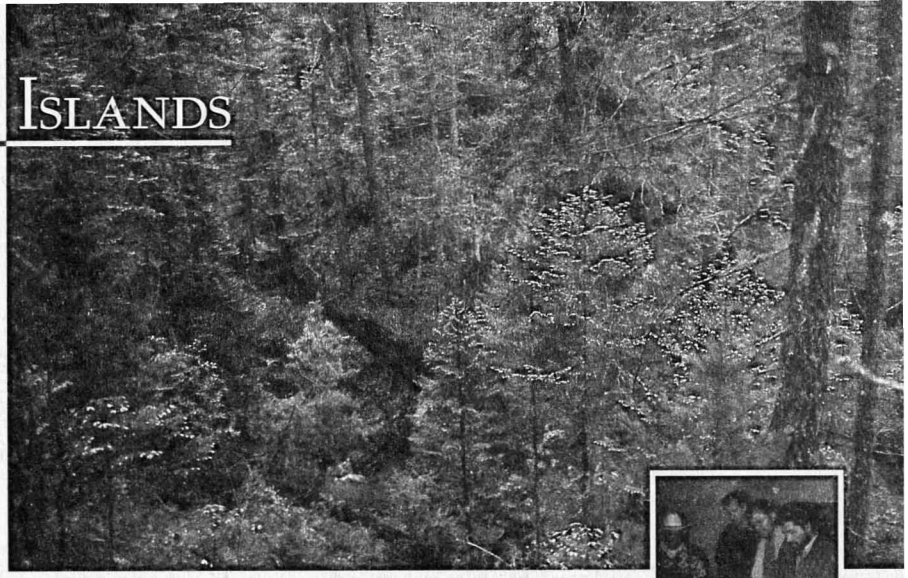


Ejido Cebadillas, Imperiled Parrots, and an Historic Conservation Partnership

by Allan McDonell and Kim Vacariu

EDWARD O. WILSON HAS WRITTEN that "every scrap of biological diversity is priceless, to be learned and cherished, and never to be surrendered without a struggle." The Wildlands Project (TWP) applies this dictum by working to safeguard biodiversity where it is intact and to restore the integrity of wild Nature where it has been compromised.

As a first step toward protecting the extraordinary biological richness of Mexico's northern Sierra Madre Occidental mountains and the adjacent prairies, our Mexican staff identified ecologically significant areas, including critical habitat for jaguars, thick-billed parrots, and black-tailed prairie dogs. TWP is committed to helping develop and implement a conservation areas network in this region that will protect these and other imperiled species. Recovered populations of wide-ranging species such as jaguars, Mexican wolves, and thick-billed parrots would likely become source populations for dispersing individuals that would begin to recolonize their former ranges in the American Southwest. We intend that Arizona and New Mexico will once again have jaguars in the arroyos and thick-billed parrots feeding on pinecones. But such intentions are only fantasies unless we first protect these animals' habitats in northwestern Mexico.

Because there is relatively little public land in Mexico, protecting the habitat identified by our Mexican staff requires some different tactics than conservationists employ in the United States and Canada, where government agencies may add lands to public ownership or amend land-use designations to effect biodiversity protection. Implementation of a wildlands network in northwestern Mexico will require imagination and flexibility on our part. Certainly, we will make land purchases and acquire conservation easements from private owners where practical

photos: mature forest at Ejido Cebadillas, Chihuahua; signing of agreement to protect parrot habitat (inset) by Rurik List

and necessary. But we also believe it is important to negotiate contractual conservation easements with Mexican *ejidos*—rural communities who hold land collectively.

There are many hundreds of *ejidos* in Mexico, and one tactic we are developing in association with established Mexican conservation groups is to enter into long-term contracts with *ejidos* for conservation purposes. Ultimately, we hope that perhaps 10–15% of all *ejido* lands, which are rarely available for sale, will be protected in this way. Until January 2000, however, no *ejido* land had ever been formally set aside for conservation.

Once we have established that a particular *ejido* has some ecologically significant habitat within its holdings, we must explore what we can offer the community in consideration of their giving us what we want—habitat protection. We do not intend to engage in community development in a social justice sense, however worthy that objective might be given these communities' numerous economic disadvantages. Rather, we proceed from the idea that we can negotiate effectively for land rights only if we know what the members of the *ejido* want.

THE THICK-BILLED PARROT OF THE SIERRA MADRE Occidental (*Rhynchopsitta pachyrhyncha*) is listed as an Endangered species under American and Mexican law; formerly ranging north into the mountains of Arizona and New Mexico, the stunning green-and-red bird's range is now limited to Mexico. The parrot's principal food is seed-bearing pinecones and it usually nests in cavities of old-growth trees. Thus, it seems reasonable to suggest that the thick-billed parrot may be an indicator species for the health of old-growth forest remnants in the northern Sierra Madre Occidental.

TWP Science Director Michael Soulé estimates that a single ten-thousand-acre tract of mature forest owned by Ejido Cebadillas may contain the nesting sites of up to half of all remaining western thick-billed parrots in the world. This forest is approximately fifty kilometers north of Basaseachic National Park, near the border of the states of Sonora and Chihuahua and roughly 150 miles south of the US border.

Ejido Cebadillas generates most of its annual revenue from logging activities on its 40,000 acres of land, managed through a fifteen-year forestry plan. Roughly 10,000 acres are mature high-elevation mixed conifer forest (predominantly ponderosa pine, Douglas fir, and juniper) that has seen light selective logging in the past but maintains old-growth characteristics.

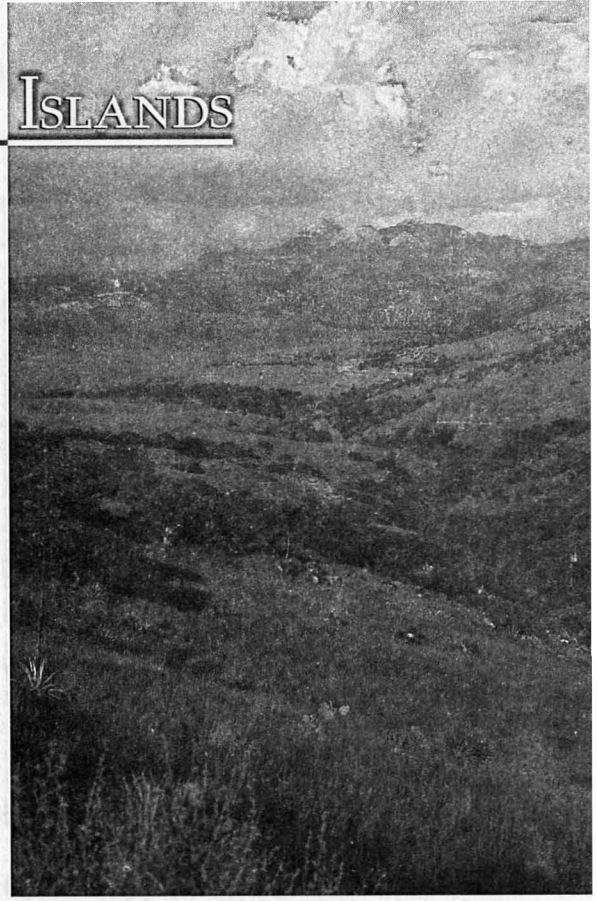
On January 22, the *ejido* signed an agreement with "Conservation Interests"—namely Pronatura Noreste, The Wildlands Project, Naturalia, Monterrey Tec, and the Sierra Madre Alliance—to defer logging in the forest for at least fifteen years. We will compensate *ejido* members for some of their lost logging revenue over that period and will help foster sustainable community development, providing both cash and expertise. For example, three cabins will be built on the edge of the forest, one for a watchman to guard against illegal logging, and two for ecotourists, such as birders who wish to observe the parrots in their nesting season, July through October.* In effect, we have fifteen years to demonstrate to the community that in the long run, the forest is worth more intact than if converted to lumber. Additionally, The Wildlands Project will fund a forestry plan for the *ejido*'s remaining holdings that will be submitted to the international Forest Stewardship Council for "green certification," which, if granted, will bring a higher price for timber than the *ejido* would have received using traditional logging practices.

One of the most exciting aspects of this historic agreement is that we and our Mexican conservation allies now have a model that we are eager to publicize to other *ejidos* whose lands contain ecologically significant habitat. With the protection of critical thick-billed parrot habitat in Ejido Cebadillas, the first privately owned "core area" needed to anchor a wildlands network in northern Mexico is in place. Eventually this network—the Sierra Madre Occidental Biological Corridor—will connect with its US companion project, the Sky Islands Wildlands Network. When fully implemented, the two initiatives will provide an unbroken system of wildland cores, landscape linkages, and compatible use buffer zones stretching from the Gila Wilderness in southeastern New Mexico to southern Chihuahua, protecting one of the world's most beautiful and biologically diverse regions. ☾

Allan McDonell, an attorney from British Columbia who helped negotiate the agreement with Ejido Cebadillas, serves on the board of directors of The Wildlands Project. Kim Vacariu is communications director of The Wildlands Project.

* Although the logistics are challenging, it is possible to view the parrots this season. For information, contact Diana Venegas Holguin and Javier Cruc Nieto—Chihuahua-based Monterrey Tec researchers who spent the past six field seasons identifying the thick-billed parrot habitat that has now been secured—at: Av. La Junta 1700, Chihuahua, Chih., Mexico; phone in Chihuahua (14) 133808; phone in Cuauhtémoc (158) 16235; dvenegas@buzon.online.com.mx.

thick-billed parrot by Kathy Daly



Conservationist in Mexico

by Aldo Leopold

THE PREDATORY APACHE OF OUR SOUTHWEST was early rounded up and confined in reservations, whereas across the line in Mexico he was, until his recent near-extinction, allowed to run at large. Therefore our southwestern mountains are now badly gutted by erosion, whereas the Sierra Madre range across the line still retains the virgin stability of its soils and all the natural beauty that goes with that enviable condition.

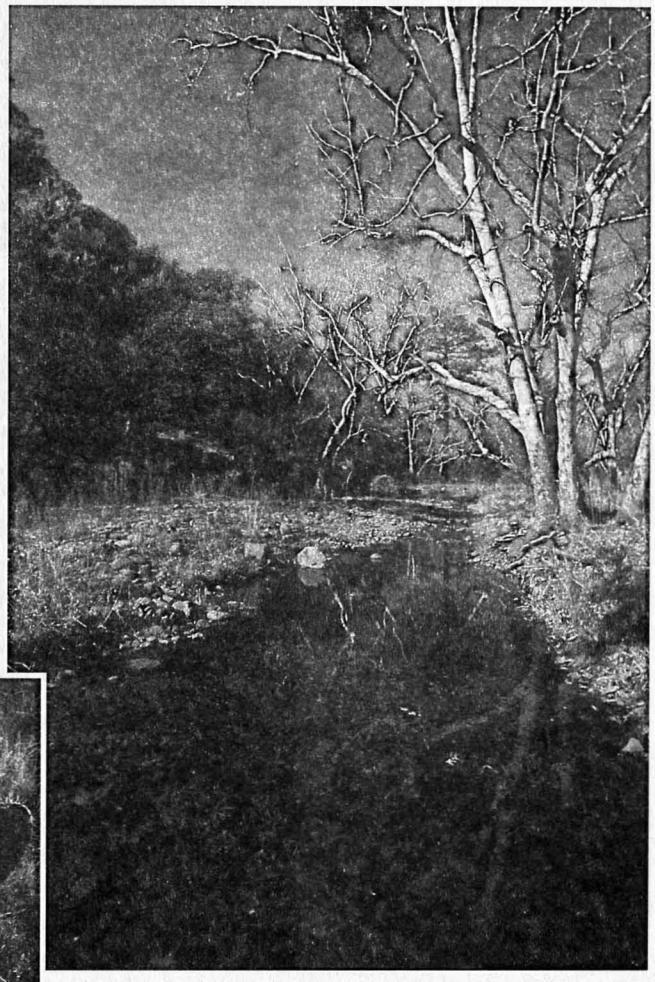
This seemingly disconnected reasoning will appear absurd only to those who still believe that the world is composed of a number of things, the inter-relationships of which are obvious or nearly so.

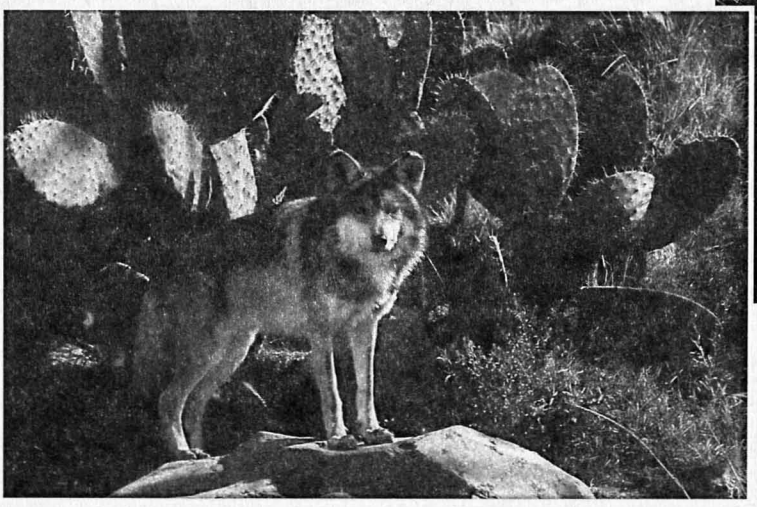
As a matter of fact, the statement is substantially accurate. This article aims to explain why and to philosophize on the irony of it. For it is ironical that Chihuahua, with a history and a terrain so strikingly similar to southern New Mexico and Arizona should present so lovely a picture of ecological health, whereas our own states, plastered as they are with National Forests, National Parks and all the other trappings of conservation, are so badly damaged that only tourists and others ecologically color-blind, can look upon them without a feeling of sadness and regret.

"Conservationist in Mexico" was first published in the March 1937 issue of American Forests. *It is reprinted here with permission of* American Forests Magazine *(www.americanforests.org).*

photo: Janos, Chihuahua by Rurik List

The Sierras present to us an example of an abundant game population thriving in the midst of its natural enemies. Let those who habitually ascribe all game scarcity to predators or who prescribe predator control as the first and inevitable step in all game management, take that to heart.





Let me hasten to add that this enviable contrast holds good only for the mountains. The low country on both sides of the line has been equally abused and spoiled. The Sierras escaped because of the mutual fear and hatred between Apaches and Mexicans. So great was the fear of Indians that the Sierras were never settled, hence never grazed, hence never eroded. This holds true up to Pancho Villa's revolution of 1916. During the revolution bandits performed the same ecological function as Indians. Since then, depression and unstable land policies have served to keep the mountains green.

It is this chain of historical accidents which enables the American conservationist to go to Chihuahua today and feast his eyes on what his own mountains were like before the Juggernaut. To my mind these live oak-dotted hills fat with side oats grama, these pine-clad mesas spangled with flowers, these lazy trout streams burbling along under great sycamores and cottonwoods, come near to being the cream of creation. But on our side of the line the grama is mostly gone, the mesas are spangled with snakeweed, the trout streams are now cobble-bars.

Somehow the watercourse is to dry country what the face is to human beauty. Mutilate it and the whole is gone. The rest of the organism may survive and even do useful work. The economist, the engineer, or the forester may feel there has been no great loss and adduce statistics of production to prove it. But there are those who know, nevertheless, that a great wrong has been committed—perhaps the greatest of all wrongs, and the sadder because both unintentional and irretrievable.

The Chihuahua Sierras burn over every few years. There are no ill effects, except that the pines are a bit farther apart than ours, reproduction is scarcer, there is less juniper, and there is much less brush, including mountain mahogany—the cream of the browse feed. But the watersheds are intact, whereas our own watersheds, sedulously protected from fire, but mercilessly grazed before the forests were created, and much too hard since, are a wreck. If there be those who do not yet know they are a wreck, let them read Will C. Barnes' history of the San Simon valley of Arizona in the October [1936] issue of *American Forests.*

The Chihuahua Sierras have been grazed only near the Mormon colonies. The Mormons were not afraid of Apaches and

photos: Mexican wolf; Mesa de las Guacamayas foothills, Chihuahua by Oscar Moctezuma

they sprinkled many a mountain valley with their brick ranch houses. Near the colony I visited—Colonia Pacheco—overgrazing and erosion have not progressed as far as they had in the White Mountains of Arizona in 1910. But the colonies are microscopic when compared with the bulk of the mountain area, which from my observation is for the most part ungrazed.

Very recently the Mexican "Resettlement Administration" has scattered landless voters over many a non-irrigable mountain valley, to dry-farm if the Lord sent rain and to get along somehow in any event. The only improvement over our own Act of June 11, 1906, is that the scattering is done only where there is enough land for a community and that the settlers have no guns.

These forest homesteaders are "deadening" the pines, scratching corn into the thin soil and day-herding their goats on the nearest hillside, a type of agriculture intermediate between an Appalachian hill-farm, a Philippine caigan, and a New Mexico "Small Holding Claim." I recognize the land pressure which forces the adoption of such a policy, but I also recognize the inevitable ruin which will follow. One can tell when nearing one of these settlements by the thinning sod, the thickening weeds, the browsed-off willows, and the oaks skinned for tanbark. Just so were our own dry canyons sent to their death.

But these resettlements are also as yet microscopic when compared with the bulk of the mountain area. They occur only near roads, and roads are as yet poor and far between. Engineers would call the mountains roadless.

In Arizona and New Mexico there are in general two kinds of deer range, the overstocked and nearly empty. Most of the herds are very thin, but every few years some new spot flares up with the sudden overpopulation of deer. The Kaibab was the first of these, but there has been a new one every year or two for a decade. Often, before the heavy wheels of legislative adjustment can turn, the range is severely injured. Most laymen have no comprehension of what a serious thing it is to overtax a browse range, especially in an arid climate. Recovery is a matter of decades, rather than of years. Some ranges wash away before they can recover.

Deer irruptions are by no means confined to the Southwest. They are breaking out from Georgia to Wisconsin, and from California to Pennsylvania. Why? Have deer always fluctuated from scarcity to overabundance? History would hardly so indicate.

In Chihuahua one can glean, by comparison, a hint of what may be the matter with our deer. Whitetail deer are abundant in the Sierras, but not excessive. So are wild turkeys. In nine days of hard hunting, two of us saw 187 deer, fifty of them bucks of two or more prongs. Deer irruptions are unknown. Mountain lions and wolves are still common. I doubt whether the lion-deer ratio is much different from that of Coronado's time. There are no coyotes in the mountains, whereas with us there is universal complaint from Alaska to New Mexico that the coyote has invaded the high country to wreak havoc on both game and livestock.

I submit for conservationists to ponder the question of whether the wolves have not kept the coyotes out? And whether the presence of a normal complement of predators is not, at least in part, accountable for the absence of irruption? If so, would not our rougher mountains be better off and might we not have more normalcy in our deer herds, if we let the wolves and lions come back in reasonable numbers?

At the very least, the Sierras present to us an example of an abundant game population thriving in the midst of its natural enemies. Let those who habitually ascribe all game scarcity to predators or who prescribe predator control as the first and inevitable step in all game management, take that to heart.

On the dry tops of the highest mesas, in the bottoms of the roughest and wildest canyons, anywhere in fact where a short watershed is intercepted by a ledge, dyke, or other favorable spot for impounding soil, the traveler in the Sierras finds loose-masonry dams constructed by the hand of man. There are hundreds of them.

How old are they? Who built them? What for? The first two questions find a ready answer. Not infrequently a 200-year-old pine is found growing behind the dam, its root-collar flush with the surface of the impounded soil. Obviously the dam is older than the tree. Unless Coronado and his captains had an unsuspected weakness for laying rock, and also more time and manpower than their journals indicate, these dams were built by prehistoric Indians.

In one case I saw the rocks of the dam clutched tightly in the roots of a great tree. Nobody stuck them there to fool tourists. Moreover there are dams in spots no white man has ever looked upon.

What were the dams for? This question is not so easy to answer. Some local residents say "erosion control." It might be conceivable that the Indians built dams to protect their more valuable soils—say in irrigated valleys—against erosion. But many of the dams I am describing are found around the edges of high mesas a thousand feet above the nearest permanent water. If such a spot ever showed erosion, the natural thing would be to seek a new spot, rather than to laboriously check a gully with rocks.

One is forced back to the theory that these dams were built to create little fields or food patches. The purpose was to impound soil where it would be irrigated by the runoff from slight rainfalls. The choice of locations strongly substantiates

this belief. Short watersheds composed mostly of bare rock were especially favored, provided there was a ledge or dyke or narrow place offering secure footing for the dam. In such spots the lightest rain produced runoff and irrigated the field, whereas the heaviest rain could not gather headway enough to tear out the dam.

What crops were raised in these little fields? This, to me, is a perplexing question. Their small size and the wide dispersion seems to preclude constant patrol against game, while the absence of metal tools seems to preclude game-proof fencing. Surely there were deer, turkey, and bears enough in those days to wreck any crop of plants palatable to them. The clue must lie in plants palatable to Indians but not to animals. Corn, it appears, is not molested by game until the ears form, but after that I fail to see how it could get by. Squash and melons would have the same weakness. Beans would seemingly be vulnerable at all times. Potatoes, peppers, and tobacco might possibly qualify as game-proof. I wonder if the archeologists have considered game-damage in reconstructing their picture of prehistoric Indian agriculture?

Everybody in Mexico has heard of the new motor road to Mexico City and is hoping for one like it to his village. The tourist-promotion policy of the present government is well known. It appears then that the funds alone will limit the rate at which the Sierra Madre is opened up. The policy of settling the landless in the mountain valleys will, if it persists, add further velocity to the road-building process and it will scatter livestock, as well as hunters and tourists, over the mountain country. The end result will be bad, unless Mexico does a better job than we have done in the regulation of grazing.

I sometimes wonder whether semi-arid mountains can be grazed at all without ultimate deterioration. I know of no arid region which has ever survived grazing through long periods of time, although I have seen individual ranches which seemed to hold out for shorter periods. The trouble is that where water is unevenly distributed and feed varies in quality, grazing usually means overgrazing.

With the extension of roads, recreation so-called will of course repeat the now familiar process of losing in quality as it gains in quantity of human service. Mexican citizens protest that they are going strong on National Parks and Forests. They are particularly proud of the International Park at Big Bend. They do not realize that these devices, laudable and necessary as they are, have not exempted us from the inexorable process of losing quality to gain quantity.

Mexico's experience with American hunters is an illuminating example of the limitations inherent in conservation formulae. It is no secret that until recently many visiting American hunters made pigs of themselves. Neither is it any secret that they were often aided and abetted in so doing by commercial guides. Mexico in self-defense has adopted the formula of clapping on a high license fee, and of limiting non-resident hunting to members of bonded "clubs." The theory is to call the bond for any misbehavior.

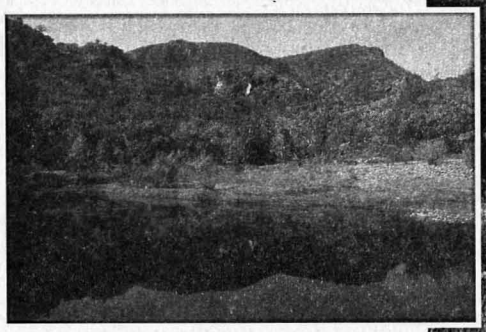
But how does the formula actually work? The bonded hunter is careful enough to stay within the law, but after such outlays he is, I think, equally careful to take all the law allows. In other words, he helps himself pretty generously and the drain on the game is probably not much less than it was in the lawless days.

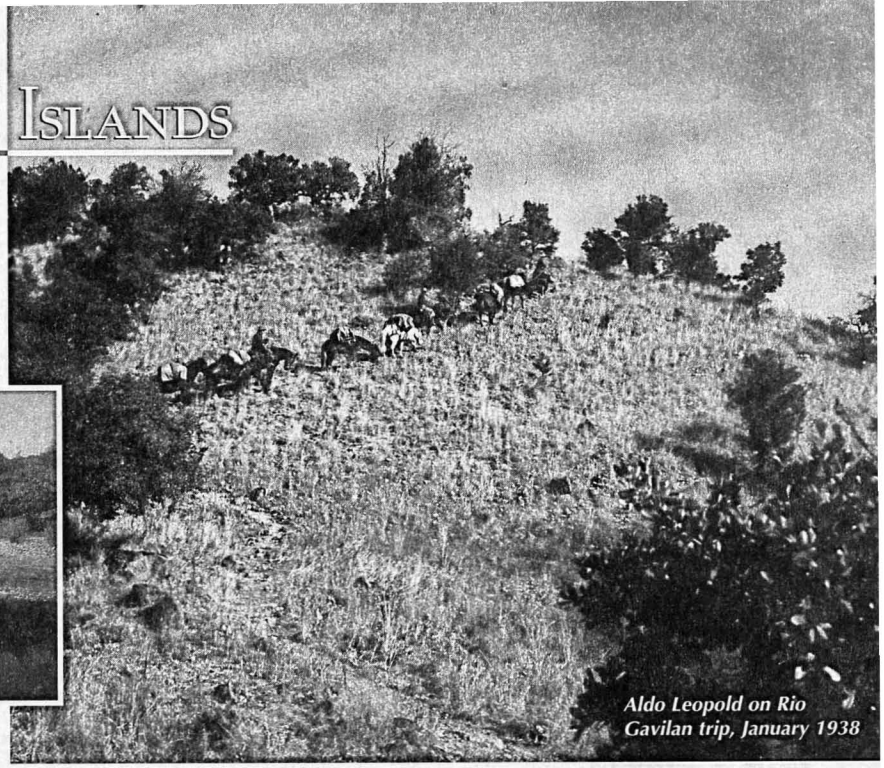
I point no moral except that we seem ultimately always thrown back on individual ethics as the basis of conservation policy. It is hard to make a man, by pressure of law or money, do a thing which does not spring naturally from his own personal sense of right and wrong.

Our own Southwest was pretty badly misused before the idea of conservation was born. As a result, our own conservation program for the region has been in a sense a post-mortem cure. There are, however, two magnificent semi-arid regions in which settlement came later than the conservation idea. One is South Africa and the other is the Mexican mountains. Hence both are of world-wide interest as laboratories in which conservation can be given a full and fair test. Can they arrest and control the wasteful and predatory nature of what we call "development?" The self-defeating nature of mass-use of outdoor resources? Or are these evils inherent in industrial civilization? The next few decades will probably bring us the answer.

Perhaps a clear answer to these complex questions of policy is too much to hope for, but in any event the Sierra Madre offers us the chance to describe, and define, in actual ecological measurements, the lineaments and physiology of an unspoiled mountain landscape. What is the mechanism of a natural forest? A natural watershed? A natural deer herd? A natural turkey range? On our side of the line we have few or no natural samples left to measure. I can see here the opportunity for a great international research enterprise which will explain our own history and enlighten the joint task of profiting by its mistakes. ☾

Aldo Leopold (1886–1948) was a forester, early wilderness proponent, avid sportsman, cofounder of The Wilderness Society, pioneering restoration ecologist, and the nation's first professor of game management. Above all, he was an insightful and prolific writer; his classic A Sand County Almanac *is perhaps the most influential conservation book in American history.*





Aldo Leopold on Rio Gavilan trip, January 1938

Leopold's Legacy in the Rio Gavilan

Revisiting an Altered Mexican Wilderness

by William Forbes and Thaddeus S. Haas

"IT IS THE PART OF WISDOM NEVER TO REVISIT A WILDERNESS." Aldo Leopold provides this advice in the essay "Green Lagoons," where he describes his 1922 canoe trip through Mexico's wild Colorado River Delta. Writing later, he realized that much of the delta had undergone conversion to agriculture and lamented the loss. Leopold concludes with the plea, "What avail are forty freedoms without a blank spot on a map?"[1]

Those of us "foolish" enough to revisit Leopold's other favored Mexican wilderness, portrayed in "Song of the Gavilan," will still find a blank spot where it should lie on most Mexican maps. The Rio Gavilan is located in the Sierra Madre Occidental, just west of the continental divide. It is approximately equidistant (200 miles) from Tucson, Arizona and El Paso, Texas and fifty miles west of Nuevo Casas Grandes, Chihuahua. The river starts at 8660 feet elevation, the high point in the watershed, then flows north and west through two respective gorges, entering the Rio Bavispe at approximately 4500 feet elevation.

photos: courtesy Aldo Leopold Foundation Archives; Bavispe River, Sonora by Rurik List (inset)

Aldo Leopold, Rio Gavilan

Despite logging and grazing since Leopold's 1936–1938 visits, the Rio Gavilan is still a very remote mountain locale. Most roads require high clearance, and only a handful of small settlements such as Mesa Tres Rios, Garcia, and Pacheco ring the 600-square-mile watershed. Descendants of Mormon colonists who guided Leopold still take visitors into Rio Gavilan country today.[2]

Perfect Health

On his first trip to the region, Leopold and his long-time hunting partner Ray Roark traveled by train from Madison to El Paso, then to Casas Grandes and the former lumber mill town of Pearson.[3] They rode horses up to local guide Clarence Lunt's home on September 4, 1936, then dropped over the continental divide the next day to spend a week in the upper gorge of the Gavilan.[4] Leopold returned to the same site again with his son Starker and brother Carl in December 1937 and January 1938.[5]

In contrast to the intensively managed (and biologically impoverished) German forests that Leopold had recently visited, and the American Southwest, where he'd seen how livestock grazing, fire suppression, and elimination of top carnivores led to erosion and deer irruptions, the Rio Gavilan revealed the power of natural controls in a "dynamic equilibrium." Here, naturally frequent wildfires burned through oak-pine woodlands with intact

photo courtesy Aldo Leopold Foundation Archives

predator-prey relationships (wolf-cougar-deer); in the rivers, native trout flourished. Leopold mentioned in later writings that, prior to visiting the Sierra Madre, he "had seen only sick land, whereas here was a biota still in perfect aboriginal health."[6]

Leopold referred to the Sierra Madre in numerous essays after his visits, the most notable of which are: "The Thick-Billed Parrot of Chihuahua,"[7] "Conservationist in Mexico,"[8] "Song of the Gavilan,"[9] and "Wilderness as a Land Laboratory."[10] Daily journal entries from his second trip were included by his son Luna in *Round River*.[11]

Wilderness as a Land Laboratory

Leopold's early advocacy for designated Wilderness Areas in the 1920s was based primarily on ensuring a resource for primitive recreation.[12] Later, he articulated biological arguments for wilderness preservation. He suggested in 1934 that Wilderness Society founders include ecological studies as a rationale for wildlands protection.[13] The Rio Gavilan met his criteria for "wilderness as a land laboratory," and he proposed multiple research projects for the area.

First, in a December 1938 letter to renowned Berkeley geographer Carl Sauer, Leopold summarized a plan to use the northern Sierra Madre as a control to compare with similar, yet altered, habitats of the US Southwest. Leopold was most interested in researching relationships of soil-water-streamflow, predators and prey, animals and vegetation, and the role of each in biotic "equilibrium." Leopold expressed to Sauer his curiosity about the lack of coyotes in the presence of wolves in the Gavilan. He thought eradicating wolves might be trading a "wolf problem for a coyote problem." A reply to Leopold has not been located in either the Leopold Papers or Sauer's Berkeley papers.[14]

Leopold also responded to a query from an Ecological Society of America committee seeking nominations for reserves with natural conditions.[15] On the one-page form, in the space for "Reservation needed," Leopold responded, "Yes, badly." Leopold suggested that the US finance a research station if Mexico acquired and protected the land. Committee chairman Charles Kendeigh replied with enthusiasm, working with Leopold to set up a subcommittee to investigate deer populations in natural areas.[16]

This led to Leopold's most advanced proposal, which called for including the northern Sierra Madre as a control in a geographically wide-ranging study of the mechanisms of deer irruptions. Leopold promoted the project to the USDA Forest Service in 1941, including his essay "Wilderness as a Land Laboratory" in mailings. The Forest Service turned down Leopold's proposal due to its decreasing budget.[17]

Despite setbacks, Leopold pursued his research goal until he passed away in April, 1948. Leopold supported Starker's plan to revisit the Rio Gavilan in the summer of 1948. Starker, then a young wildlife biologist, had been a student of Sauer.

Starker was disappointed upon arrival. Logging roads and sawmills penetrated to the edges of the watershed. Hundreds of livestock grazed the area. The most noticeable change involved the condition of the river's mainstem at the 1938 campsite: "The river bluffs were studded with crusty old junipers and oaks just as I had remembered them. But the river itself was not the same. What had been a narrow channel winding between grassy banks was now a wide, scoured trough of cobblestones left by summer floods."[18]

Logging at the headwaters, associated slash fires, and grazing of the watershed "sponge" had increased erosion and flooding. Starker made research collections from July 15–September 3, 1948, noting the wild conditions remaining in side canyons. He still encountered wolves and lions, but lamented impending changes in a 1949 *Pacific Discovery* article titled "Adios Gavilan."[19]

Conservationists in Mexico

Conservationists continue to visit the Rio Gavilan; they describe an altered but still remote watershed with great potential for wildlands recovery. J.T. Marshall conducted studies on fire ecology and birds during a 1950s drought, documenting erosion from grazing, and increased juniper stocking from fire suppression.[20]

Leopold and many subsequent visitors were fascinated by the area's numerous Paquime check dams or *trincheras*. Paquime culture (circa 900–1300 AD) inhabitants built the low stone dams across seasonal streams to slow runoff and retain soil, thereby creating small planting areas.[21] Robert McCabe, a former Leopold student who accompanied Starker in 1948, conducted a 1955 archaeological literature review. He surmised that seasonal Paquime villages kept deer from plundering their check dam crop fields.[22] The Gavilan contains the highest concentration of *trincheras* in the Sierra Madre.[23]

Wildlife researcher David E. Brown, who has categorized biotic communities of northwestern Mexico,[24] visited in 1988 and 1989 and stated that the area showed "less degradation than he (Leopold) feared. Ancient *trincheras* still hold back the soil, and the lack of roads has kept cows from overgrazing much of this country."[25] Robert Smith, retired US Fish and Wildlife Service biologist, visited the Gavilan with Starker Leopold in 1952 and

returned again in 1983 and 1990: "(The river) still flows even in the dry season. Its channel has widened and its bed degraded by flash floods, but there are a few trout, and if you hadn't seen it as Aldo Leopold saw it you might call it beautiful."[26]

Gary Paul Nabhan, writing about his visit to nearby foothills, parallels Leopold in suggesting that the Paquime were living in relative harmony with the land, perhaps even enhancing its health and diversity through erosion control.[27] Other studies suggest possible Paquime impacts to thick-billed parrots and foothill bison.[28] Arny Stonkus, a stream ecologist from King County, Washington, walked the lower half of the main Gavilan rivercourse in April 1998. Deep pools were dominated by chub, which have replaced most native trout on the mainstem.[29]

The US National Riparian Service Team, based in Prineville, Oregon, visited the Rio Gavilan in April 1999. Unlike Stonkus, they found several native trout in the mainstem. Despite bedload movement and bank cutting (one to four feet) from increased flooding, elements for recovery were present, including riverbank sycamores, native grama grass, alluvial soils, and a restricting bedrock base that lessens downcutting. The team had seen rivers in worse condition in the western US.[30]

Biotic Citizens

Most of Leopold's species of interest are now reduced in numbers. Leopold was especially enamored with thick-billed parrots (*Rhynchopsitta pachyrhyncha*). He described them as the "numenon" species of the Sierra Madre, signifying the essence of the range.[31] The parrots' critical limiting factor is the logging of older dead trees used for nesting at elevations above 2400 meters (7872 feet). Their historic nesting habitat is reduced by over ninety percent.[32]

Some parrot nesting sites are open to logging, some are protected by law, while others are so remote that logging roads are infeasible. One relatively unexplored conservation strategy is to actively create standing dead trees in selectively logged areas so thick-billed parrots can nest over a broader landscape.[33] Other limiting factors include capture for the pet trade and shooting, the likely cause of extirpation from the US, and still a problem in Mexico.[34]

The northern tributary of El Oro contains the only known nest site in the Gavilan watershed, yet several significant nesting sites surround the area. Leopold saw eighty-seven parrots in one week in 1937.[35] Eight were seen in a similar period in 1998. Parrots can still occasionally be seen bathing in Parrot Falls, or "Las Guacamajas," located about five miles west of Leopold's campsite.[36]

A female imperial woodpecker (*Campephilus imperialis*) was sighted in the Sierra Tabaco range, located to the northwest of the Rio Gavilan, in 1990 and 1993.[37] Sadly, the species is now thought to be extinct.

Humans (*Homo sapiens*) have had a notable presence in the Gavilan since at least the tenth century AD, through the Paquime, Opata, Apache, Mormon, and Mestizo cultures. Geronimo sought refuge about ten miles downriver from Leopold's campsite during the 1880s. The area is still revered by Apaches of Mescalero, New Mexico. Mormon colonists, escaping persecution in the western US, started several mountain and foothill communities in the late 1800s. The 1910 Mexican revolution brought land reform that was just beginning to be implemented when Leopold arrived.[38]

Ejidos are lands jointly owned by communities, set up after the 1910 Mexican Revolution. Some *ejidos* are undergoing privatization of parcels to enhance efficient land use. Approximately 70% of forest land in Chihuahua is under this communal ownership, 20% is under private ownership (including forest product companies), and only 4% is under government ownership.[39] The headwaters of the Gavilan are within the northern tip of Ejido El Largo-Madera, the largest landowner in the watershed. A recent study of Ejido El Largo-Madera indicated that landowners (*ejidatarios*) worry about dependence on forestry (70% depend on it); desire diversified employment opportunities; want improved infrastructure (i.e., roads); have limited investment ability; are 94% literate; and want to promote forest health.[40]

Lumbering and ranching constitute the dominant economic activities in the Gavilan. Pine trim and molding, milled in Casas Grandes and exported to the United States, is one of the main forest products. Since Leopold's visit, most of the logging has taken place on Ejido El Largo-Madera, since commercial species such as Chihuahua (*Pinus leiophylla var. chihuahuana*), Mexican white (*P. ayacahuite*), Apache (*P. engelmannii*), and Arizona (*P. ponderosa var. arizonica*) pine grow more easily on its high-elevation lands. Large (20–30 inches diameter) scattered pines have been replaced by dense young pines.[41] Some managed stands resemble the highly manipulated German forests that Leopold visited in 1935.[42]

The mid-watershed has seen scattered logging and intensive grazing on moderately sized private ranches (2500–10,000 acres/1000–4000 hectares each) set in the more open oak-pine woodlands. Drug trading has subsided from a dangerous high point in the 1980s. Most of the Rio Gavilan watershed lies within Municipio Casas Grandes, a county rated in the second lowest of five national socioeconomic categories combining income, education, services, and infrastructure.[43]

THIS SONG OF THE WATERS is audible to every ear, but there is other music in these hills, by no means audible to all. To hear even a few notes of it you must first live here for a long time, and you must know the speech of hills and rivers. Then on a still night, when the campfire is low and the Pleiades have climbed over rimrocks, sit quietly and listen for a wolf to howl, and think hard of everything you have seen and tried to understand. Then you may hear it—a vast pulsing harmony—its score inscribed on a thousand hills, its notes the lives and deaths of plants and animals, its rhythms spanning the seconds and the centuries. ~ **Aldo Leopold, from "Song of the Gavilan"**

Mexican gray wolves (*Canis lupus baileyi*) have been extirpated through trapping and shooting, although unconfirmed signs of "el lobo" (scat, tracks, howls) occurred in 1997–98 near the mouth of the Gavilan.[44] An experienced backcountry guide had a ten-minute sighting of a wolf near the headwaters in 1984.[45] Cougars (*Felis concolor*) are reported by ranchers in relative abundance. The last grizzly bear (*Ursus arctos horribilis*) in Mexico is believed to have been killed in the Sierra del Nido, east of the Sierra Madre Occidental, in 1962.[46] Ranchers still refer to a site in the heart of the Gavilan where a teenage cowboy was killed by a grizzly in the early 1900s.

As Leopold observed in the wolfless US Southwest, coyotes (*Canis latrans*) have become abundant. One elderly local rancher who has seen the changes first-hand echoes Leopold:

> *Before the wolf was killed off we never saw or even heard a coyote in the higher mountains ... coyotes killed one of the early calves last week. ... I have seen the turkeys stay in the trees for hours after daylight because coyotes were waiting for them to fly out ... people who live in the mountains are constantly losing their chickens ... they can't depend on their dogs because the coyotes will lure them away from the house and kill them. ... You very rarely see a wolf even when they have a good population ... we need to bring back the wolf.*[47]

Stream aggradation has pushed habitat for the native Yaqui trout (*Oncorhynchus sp.*) into gorges and several tributaries of the Gavilan. Research is needed to characterize native trout locations, habitat conditions, and life histories.[48] The only studies currently focused on these trout show significant genetic differences from northern trout species.[49] Non-native fish farms, a common regional economic diversification practice, pose the most serious current threat to remaining native trout populations through disease and hybridization. One such aquaculture operation has been installed at the headwaters of the Gavilan at El Colorado.[50] Here also resides the only known Rio Grande mountain-sucker population in the entire Yaqui River basin.[51]

Pulsing Harmony

One of Leopold's biggest conservation concerns was maintaining land-use practices that do not increase natural (healthy) rates of erosion.[52] The area's highest rates of erosion occurred after Leopold's visits as a network of logging roads, which now crisscross most of the watershed, was constructed. Some are merely widened horse tracks, abandoned without erosion control measures, or paralleled by deep gullies. Yarding of logs occurred up and down streamcourses in some cases. Grazing also still contributes to erosion, although stocking rates are not unusually high.[53] Forestry and road practices are improving, but funding for restoration and maintenance is limited.[54]

Leopold admired the region's frequent natural fire regime. Sierra Madre fire suppression efforts currently lack funding and formal organization. Although residents occasionally band together to fight wildfires, and grazing and roads can limit spread of lightning fires, the Sierra Madre Occidental offers potential for near-natural fire regimes.[55] This is another local survey need. A few areas in the Gavilan, such as near El Perdido and Mesa El Oso, have undergone conversion to thick oak brushfields as a result of pine logging and fire suppression.[56]

Marshall's 1957 reference to increased juniper growth from fire suppression is important.[57] Dense stocking of junipers, now observed in parts of the Gavilan, is problematic—dense

junipers have been known to use 11 inches of the 15 inches of annual rainfall in a similar environment in eastern Oregon.[58] Juniper removal can enhance rangeland productivity. Thus low-intensity wildland fires may be locally desired to simultaneously improve economic and land health.[59]

The National Riparian Service Team held a workshop in April 1999 in Casas Grandes. Not far from the site of Clarence Lunt's home where Leopold started his pack trips, one rancher is implementing their recommendations, removing juniper and fencing livestock from his creek during the first part of the growing season, thus allowing successional stages to build soil, retain water, and increase productivity.[60] This offers potential as a demonstration area for other ranchers.

Future Songs

Conservationists in Mexico can succeed in their efforts by working closely with local cultures[61] and agencies.[62] Still, there are formidable obstacles: large-scale resource development projects have potential to override small-scale conservation progress,[63] and issues such as prescribed fire and wolf reintroduction can be complex and sensitive.[64] Such imposing hurdles, however, should not prevent us from taking small first steps[65] and building on local social assets,[66] as exemplified by The Wildlands Project's recent success at Cebadillas (see McDonell and Vacariu this issue).

Leopold's "refined taste in natural objects"[67] suggests we come to grasp with and open ourselves up to an appreciation of the "natural, wild, and free."[68] The presence of wild things in wild places, such as thick-billed parrots and wolves in the Sierra Madre, adds something ineffable to the world and our involvement with it.

Yet there are further reasons to promote Leopold's components of land health. Singers in his "vast pulsing harmony"[69] can also provide economic benefit to local communities. Examples are regulation of coyotes by wolves and grazing productivity by fire. Potential economic benefits of thick-billed parrots have been relatively unexplored. One proposal for a northern Sierra Madre conservation zone recommends guiding visitors to view thick-billed parrots at a Rio Gavilan tributary waterfall.[70] Scale and sustainability are important in such economic initiatives.[71]

West of the Rio Gavilan lies a less-altered watershed, the smaller Rio Nutria, Spanish for "Otter River."[72] Leopold wrote, "the otter plays tag in its pools and riffles ... like the scientist, he has no doubts about his own design for living. He assumes that for him the Gavilan will sing forever."[73] Leopold's high note in "Song of Gavilan" was for us to sing in interdisciplinary harmony. Conservationists in Mexico, with Leopold's refined taste for things natural, wild, and free, can promote land health across preserved and used landscapes, so the northern Sierra Madre Occidental sings a vast pulsing harmony, forever. ☾

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74. The article is dedicated to the past, present, and future biotic citizens of Mexico. Special thanks go to Keith and Naoma Bowman, Nina L. Bradley, Barney Burns, Baird Callicott, Ruth Carapella, Oliver Dick, Ken Dickson, Rod Drewien, Mike Durkin, Wayne Elmore, Susan Flader, Dave Foreman, Peter Fule, Chuck Hagerdon, John and Sandra Hatch, Dean Hendrickson, Larry Herold, Buddy Huffaker, Martin Jaeckel, Phil Janik, Buddy Jensen, Floyd Johnson, Mark Kaib, Martjan Lammertink, Rurik List, Steve Leonard, Luna and Barbara Leopold, Mike Lunn, Paul Minnis, Curt Meine, David Molina, Tiberio Monterrubio, Oscar Estrada Murrieta, Gary Nabhan, Roger Otto, Greg Penniston, Carlos Prado, Mike and Gwen Romney, Bernie Schermetzler, Patrik Schumann, Robert Smith, Noel Snyder, Arny Stonkus, Efrain and Nelda Villa, Elvin and June Whetten, and Ron Wiley.

A Conservation Area Design

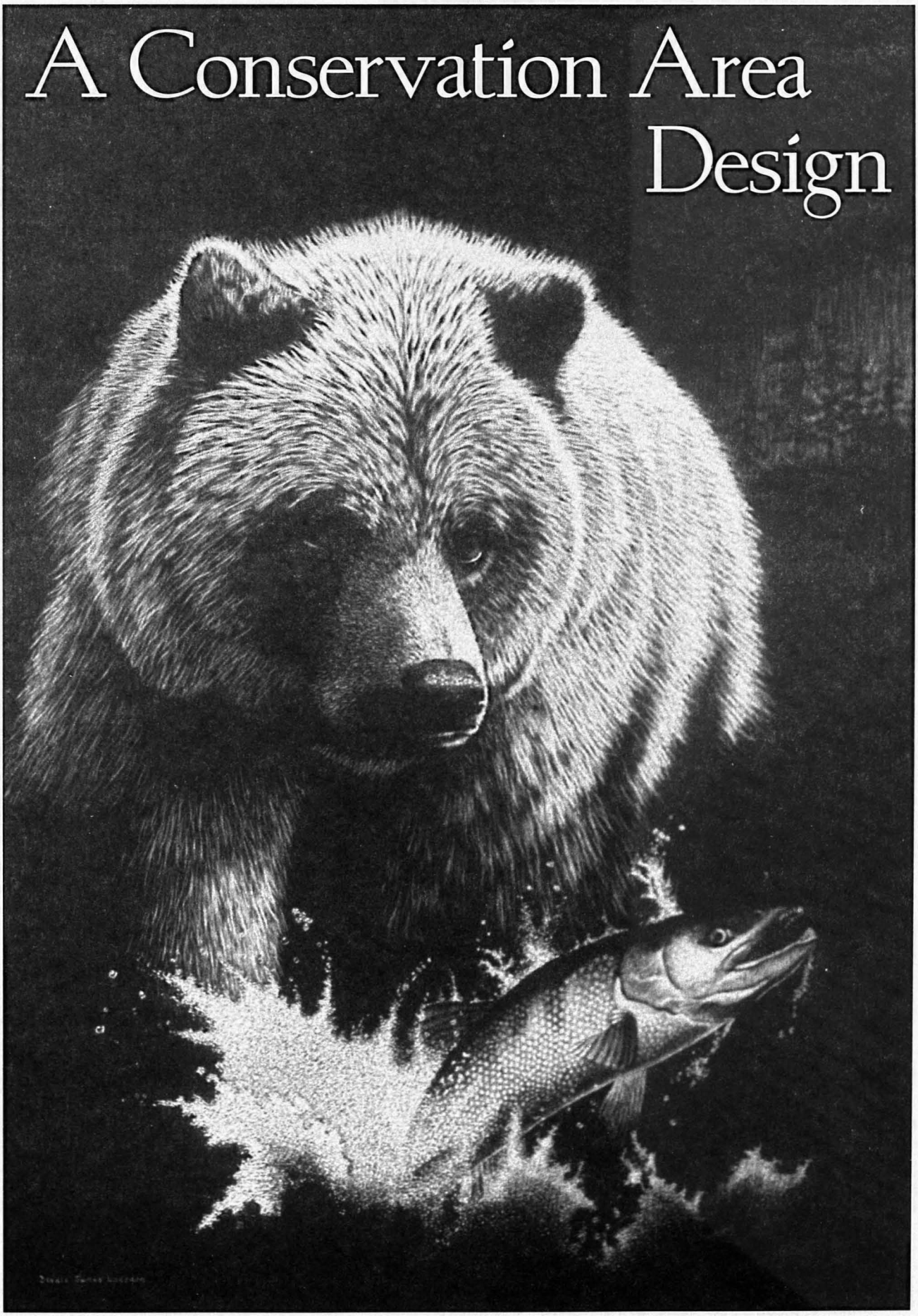


illustration by Dennis Logsdon

for the Central Coast of British Columbia

by M.A. Sanjayan, Richard Jeo, and Dennis Sizemore

It is a place so beautiful that when it is gone, if it is gone, people will not be able to believe, if they happen across a stray photo or a yellowing book or magazine, that it ever existed—not on this earth, and certainly not in this century.

— Rick Bass, from Quskas Lake on the central coast of British Columbia, 1997

NOW GLOBALLY RARE, covering less than 1% of the Earth's land surface, temperate rainforests once stretched in a narrow band from northern California to southeast Alaska (Schoonmaker et al. 1997). Residents of these ancient forests included races of Pacific salmon, the coastal grizzly bear, and, for over 10,000 years, the hunting-and-gathering cultures of the Northwest's First Nation people. Today, no intact rainforest watershed remains in the US lower 48. Similarly, the grizzly bear has been eliminated, the magnificent runs of salmon are incidental at best, and the native people have been disbanded, impoverished, and largely exterminated. To the north, however, the central coast of British Columbia (BC) still contains expansive unimpaired rainforest wilderness systems containing lowland Sitka spruce/western hemlock forests, vast runs of Pacific salmon, grizzly bear, and native peoples still grasping to their forest and water traditions.

Here we describe a proposed system of conservation areas designed to protect and restore ecological values of coastal BC in the face of the many pressing threats and existing wounds to the region. While we engage a scientific process for determining the necessary extent of protected areas in this region, we acknowledge that such a system cannot operate totally independent from value judgments. What is the value of wild areas—valleys with centuries-old stands of cedar and spruce, enormous runs of Pacific salmon, and top predators like grizzly bears, wolverines, and wolves? Such values are difficult to quantify, although some have attempted to do so in socioeconomic terms (Randall 1990). As such, a key assumption we make in developing this design is that the conservation of biodiversity[1] has intrinsic value and is generally good.

1. Biodiversity conservation is defined here as maintaining and restoring all native species and communities in their natural range of abundance and distribution. The preservation of ecotypes and ecosystem functions is implied.

Further, while we acknowledge that biodiversity may have considerable economic and social values that should be accounted for in management decisions (Hanemann 1990), for the sake of clarity, we do not attempt to include these anthropocentric values here. Instead, our work focuses on defining conservation goals based solely on ecological values, and defining and delineating areas of high priority for protection based on meeting these conservation goals. Taken together, these values, goals, analyses, and maps make up a Conservation Area Design (CAD) for the central coast of British Columbia (see map).

While numerous studies have explored and defined general goals and principles for the design of reserves or protected areas (Diamond and May 1976, Soulé and Simberloff 1986, Newmark 1995, Trombulak 1996), relatively few have attempted to describe actual reserve design case studies. Here we identify and prioritize areas for maintaining and restoring large carnivore populations, salmon stocks, and old-growth forests. These two taxa and one community type best define and represent the coastal temperate rainforest of British Columbia. We assume that maintaining these attributes will help conserve natural levels of biodiversity.

General Approach

Our approach involved integration of principles from reserve design methods described in the scientific literature. We used a combination of techniques, including a coarse-filter approach focusing on endangered ecosystems, a multiple focal species approach, and regional landscape connectivity planning, thereby overcoming the limitations of each individual technique and meeting the goals set by Noss (1993, 1996).[2] Our CAD focused on identifying and delineating conservation areas to meet four primary goals:

1) Maintain and/or restore viable populations of large carnivores.

2) Maintain and/or restore viable populations of all salmon stocks.

3) Maintain and/or restore representation of all ecosystems, including successional stages.

4) Maintain and/or restore natural landscape connectivity.

We considered a number of factors in order to identify areas necessary and sufficient to meet these goals, including:

- Current and historical human impacts to species, processes, or ecosystems as forwarded by Ehrlich (1997) and the Sky Island Alliance (1998).
- Current biotic values, including the ecological importance of species, communities, processes, and ecosystems. We applied methods forwarded by Given and Norton (1993) and Allendorf et al. (1997) who suggest the inclusion, but separate treatment, of both current biotic value *and* future threats.
- Current threats to species, communities, processes, or ecosystems as well as probable future threats and risks, based on biological trends, human development plans, long-term management decisions, and expert predictions. Threats and risk include both anthropogenic factors (e.g., logging plans) as well as sensitivity or vulnerability (e.g., species susceptible to extinction or near extinction).
- Ecological status and needs of focal species or taxa.

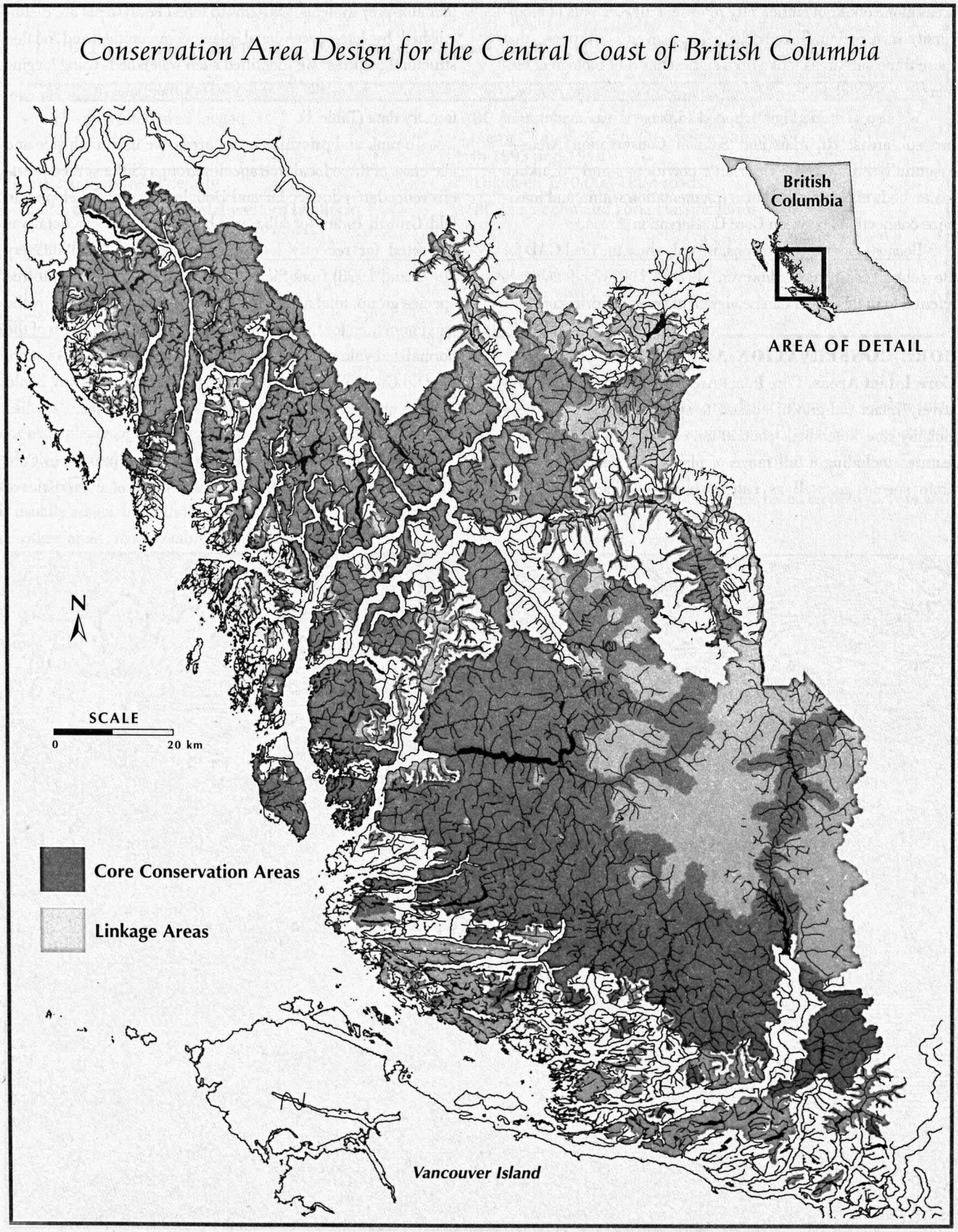
We were limited by the availability of information about relevant species and communities. For example, the first goal of our design was to maintain and/or restore viable populations of large carnivores, yet sufficient data were available only for the grizzly bear. Until further information is generated, we hope that the requirements of the grizzly may capture some of the needs of other carnivores including black bears, wolves, and wolverines. Similarly, information was incomplete for all ecosystems present on the central coast, so we have simply utilized what was available with the expectation that we have captured and represented much of what is present.

Nevertheless, this Conservation Area Design represents a synthesis of the most current data sets for the identified species, communities, and biophysical attributes of the central coast. As it becomes available, new information should be incorporated into this organic document. Thus, a methodology is established that is continually refined and tested as a hypothesis against new data.

Justification and Methods

At the scale of watersheds, we identified and mapped Core Conservation Areas composed of three types of sub-areas or core units: Core Intact Areas, Core Grizzly Bear/Salmon Habitat Areas, and Core Restoration Areas. Using each of these types of

2. These goals are:
1) Represent, in a system of protected areas, all native ecosystem types and seral stages across their natural range of variation.
2) Maintain viable populations of all native species in natural patterns of abundance and distribution.
3) Maintain ecological and evolutionary processes, such as disturbance regimes, hydrological processes, nutrient cycles, and biotic interactions.
4) Design and manage the system to be resilient to short-term and long-term environmental change and to maintain the evolutionary potential of lineages.


Conservation Area Design for the Central Coast of British Columbia
British Columbia
AREA OF DETAIL
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20 km
Core Conservation Areas
Linkage Areas
Vancouver Island

areas alone does not sufficiently represent all elements of biodiversity in a region. Taken together, however, we propose that these three sub-areas make up a sufficient set of biological elements for comprehensive conservation planning in the region.

We also identified and mapped Linkage Areas made up of two sub-areas: Riparian and Salmon Conservation Areas—essentially buffered riparian corridors—and Linkage Watersheds chosen to minimize fragmentation within and maximize connections between Core Conservation Areas.

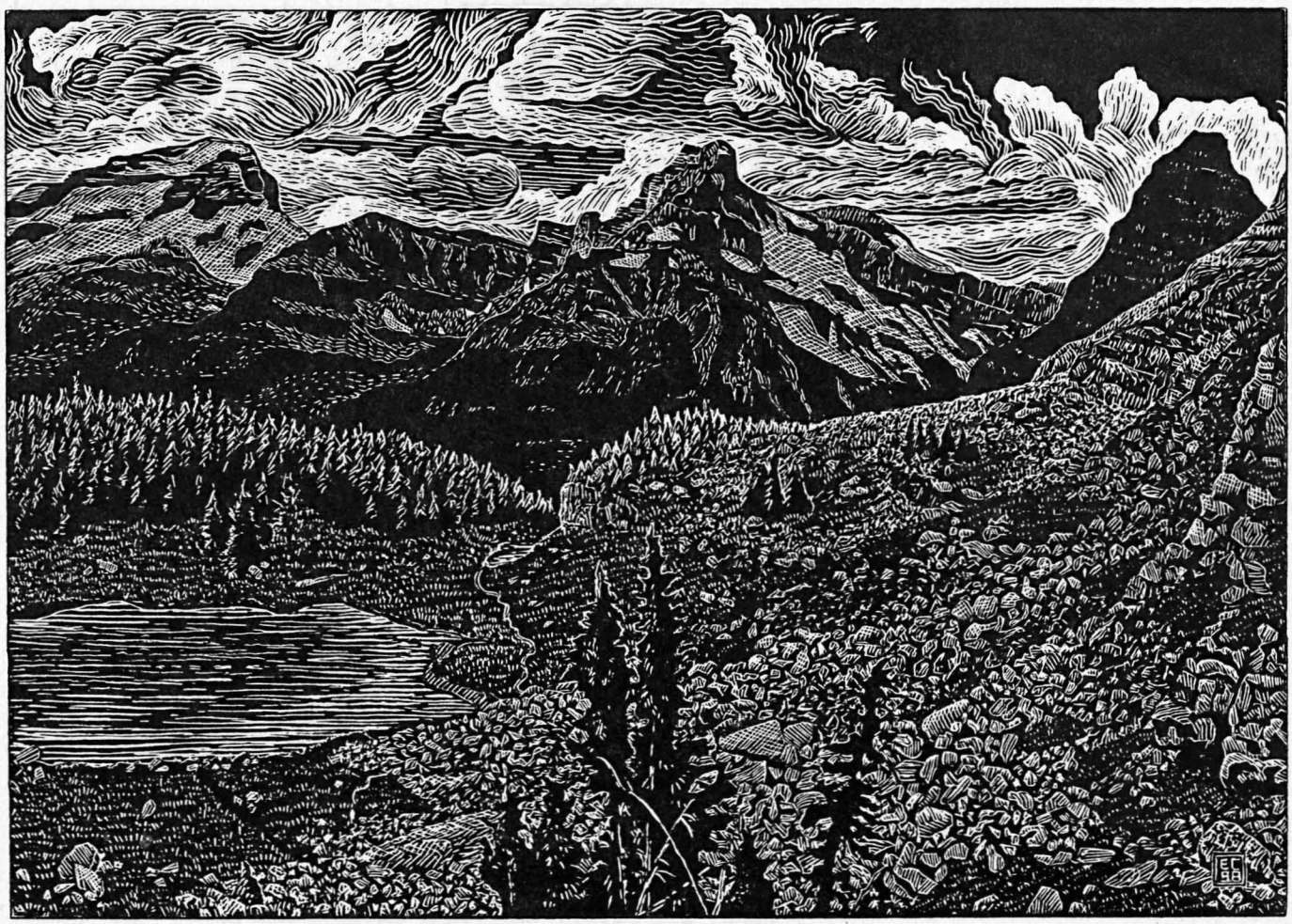
Because of space limitations, we only show the final CAD for the central coast here. However, all map layers and analyses referred to in this paper can be viewed at www.roundriver.org.

CORE CONSERVATION AREAS

Core Intact Areas. Core Intact Areas are watersheds with relatively intact old-growth coastal temperate rainforests. These globally rare watersheds contain the ecosystem's characteristic features including a full range of plant, wildlife, and invertebrate species as well as natural processes including intact predator-prey systems. Old-growth forest ecosystems are distinguished by late-successional plant communities and related structural features. We identified such watersheds using logging data, road data, BC biogeoclimatic zone classification, and forestry data (Table 1).

To rank and prioritize intact areas, we used both size and age class of three focal tree species groups (Sitka spruce, western redcedar/yellow-cedar and Douglas fir) and developed an Old Growth Index for all watersheds. Forest cover data was corrected for recently logged areas using satellite imagery (1993 and 1998) from Sierra Club of BC. For each focal tree species group, total area was calculated and normalized by the maximum area for that species in the database. The sum of the normalized values was computed for each watershed. As such, the Old Growth Index accounts for both the total amount of old growth, and amount of old growth of the three focal species listed above.

This analysis attempted to capture and represent in Core Intact Areas the structural, functional, and age characteristics of



Lake Hungabee, Yoho National Park, BC by Evan Cantor

Table 1. Criteria for Core Intact Areas. Watersheds designated as such must have all of the following attributes.

WATERSHED ATTRIBUTE	SOURCE INFORMATION
< 10% of forested area logged	BC Ministry of Forestry database with logging data from Sierra Club of BC satellite imagery analysis conducted in 1993 and 1998
< 0.2 km/km² road density	Digitized 1:20,000 TRIM roads
< 1:2, alpine tundra:coastal western hemlock area ratio (to eliminate watersheds that are primarily rock and ice)	BC biogeoclimatic zone classifications
Old-growth structure – generally large (height class > 37.5 m tall), old (age class > 250 years) trees	BC Ministry of Forestry database

old-growth forests that differ according to species composition. For example, Douglas fir is associated with drier areas on east-side slopes in sub-maritime areas while Sitka spruce tends to be associated with floodplain and riparian areas. Western redcedar is usually associated with low-elevation wet hyper-maritime and maritime areas, most notably on steeper slopes with infrequent disturbances (e.g., windthrow) and it is replaced by yellow-cedar at higher elevations (Meidinger 1991).

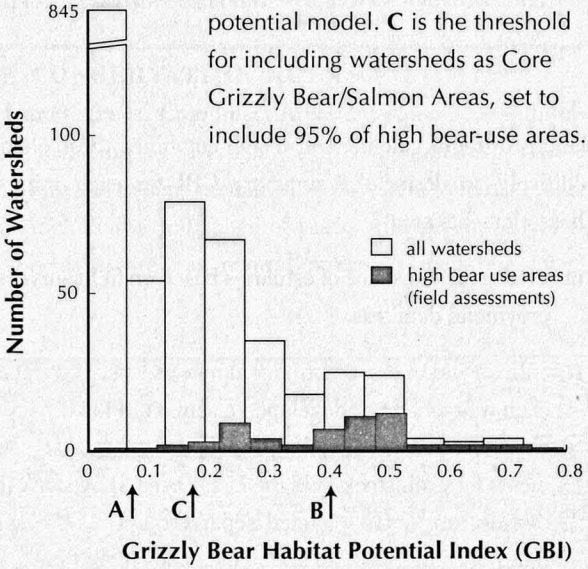
Core Grizzly Bear/Salmon Habitat Areas and Core Restoration Areas. Individual watersheds with a high density of roads were screened out from consideration as Core Grizzly Bear/Salmon Habitat Areas and Core Restoration Areas. Human activity, signified by roads, frequent use of inlets and rivers by boats, logging, recreational facilities, hunting, and settlements, is avoided by grizzly bears. Signified by the presence of roads, numerous studies have documented the extreme under-use by grizzlies and other carnivores of habitats modified or utilized by humans (Archibald et al. 1987, Mattson et al. 1987, McLellan and Shackleton 1988, McLellan 1990, Kasworm and Manley 1990, Mattson et al. 1992, 1996, Clevenger and Waltho 2000). These studies suggest that road densities for grizzly bear habitat should not exceed 0.6 km/km² and target levels of road density for long-term persistence should be no more than about 0.35 km/km². Therefore, we eliminated watersheds with high road densities (> 0.35 km/km²) from consideration as core areas.

For the remaining areas we developed a simple grizzly bear habitat potential model that allowed ranking of watersheds based on a Grizzly Bear Index (GBI). Because grizzly bears and salmon are intimately associated with each other in the coastal temperate rainforest of BC, our habitat potential model included salmon values. Grizzly bears have well known habitat associations or requirements. Our model combined these elements, additively, to derive the summary GBI for each watershed. These elements are:

- Presence or absence of estuaries based on field surveys and provincial data sets.
- Salmon index derived from salmon escapement data. For each watershed, we developed a salmon index which is the normalized mean abundance (calculated by mean escapements for each stock over the last 40 years) by stock (identifiable run that is counted separately). Thus the salmon index accounts for both abundance and stocks (five species and separate runs).
- Riparian index based on the riparian area within each watershed (sum of the area within 100 meters of any stream detectable using the 1:50,000 BC watershed atlas) normalized by the maximum riparian area for all watersheds in the study area.
- Old-growth area as defined in the section on Core Intact Areas.

Once all watersheds were ranked by excluding heavily roaded areas and applying the Grizzly Bear Index, we determined areas to be included in the Core Grizzly Bear/Salmon Habitat Areas by setting a threshold derived from field data collected in 1997 and 1998 by the Raincoast Conservation Society and Round River Conservation Studies. A number of watersheds were assessed as high grizzly bear activity areas (based on tracks, day beds, bear trails, scat, sign, and sightings) from field data. Although we did not randomly sample the entire study area for grizzly bear activity, our field data was used to test and calibrate

Figure 1. Grizzly bear habitat potential model compared with fieldwork results. White bars show the distribution of Grizzly Bear Habitat Potential Index (GBI) scores by watershed. Most watersheds have a low GBI value. The gray bars show the distribution of scores for watersheds that were assessed in the field as high grizzly bear use areas (see text for details). **B** is the mean GBI score for field assessed high bear-use areas. High bear use areas have significantly higher ($p < 0.01$) GBI scores than expected through random selection of watersheds (**A**) using Monte Carlo statistical methods. We used the scores from high bear-use areas to calibrate our habitat potential model. **C** is the threshold for including watersheds as Core Grizzly Bear/Salmon Areas, set to include 95% of high bear-use areas.



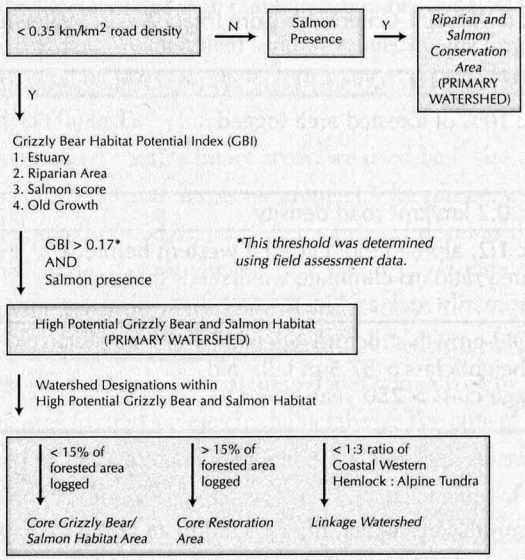
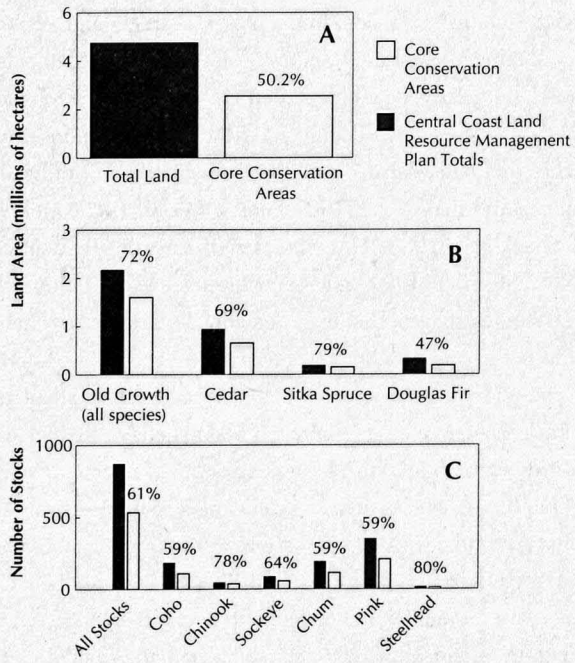


Figure 2. Decision tree for determining Core Grizzly Bear/Salmon Habitat Areas, Core Restoration Areas, Riparian and Salmon Conservation Areas, and Linkage Watersheds using road density, grizzly bear habitat potential, and salmon presence.

Figure 3. Representation analysis for Core Conservation Areas. **A)** Amount of land proposed in Core Conservation Areas is 2.39 million hectares or about 50% of the land in the study area. **B)** Representation of remaining forests with old-growth structure in proposed Core Conservation Areas includes 157,000 hectares (out of 217,200 hectares). **C)** Representation analysis of salmon stocks. 61% (530/ 871) of total stocks are represented in Core Conservation Areas. Species representation includes 108 of 184 coho stocks, 36 of 46 chinook stocks, 55 of 86 sockeye stocks, 112 of 191 chum stocks, 207 of 349 pink stocks, and 12 of 15 steelhead stocks.



our habitat potential model, which identified known high grizzly bear areas. Indeed, there was good correspondence between the model and field assessments (Figure 1). High bear-use areas (point B, assessed using field data) had significantly higher GBI scores ($p < 0.01$) than randomly chosen watersheds (point A). Since we wanted to be certain that the thresholds for determining core areas captured known areas of high grizzly bear activity, we set our threshold for assigning core watersheds at a level that captured 95% of high bear-use areas (GBI = 0.17, point C).

Comprehensive conservation of salmon requires the protection of the entire primary watershed—the encompassing watershed that is serviced by a river or inlet that flows directly into the ocean—not just the smaller, secondary, or tertiary watersheds upon which the analysis was carried out. Additionally, large carnivores require large areas of contiguous habitat. Thus, watersheds with GBI > 0.17 that also contain salmon runs (anywhere in the primary watershed) were expanded to the boundary of the entire primary watershed.

Finally, we applied a 15% logging threshold to separate out Core Restoration Areas from Core Grizzly Bear/Salmon Habitat Areas (Figure 2). Thus, areas with greater than 15% logging impacts (on the productive forests) but which still scored above the threshold using the GBI were designated as Core Restoration Areas where ecoforestry and restoration could possibly maintain and/or bring back grizzly bears and salmon.

LINKAGE AREAS

Regional conservation area designs should account for long-term connectivity between core protected areas as well as connectivity in both north-south and east-west directions. We define two types of areas designated specifically to maintain natural levels of connectivity—Riparian and Salmon Conservation Areas, and Linkage Watersheds.

Riparian and Salmon Conservation Areas. These are salmon-bearing watersheds outside of the Core Conservation Areas. The spatial extent of the Riparian and Salmon Conservation Areas is defined as the area necessary to maintain salmon spawning, rearing, and migration habitat, and the area necessary to maintain connectivity for large carnivores. FEMAT (1993) compatible buffers around riparian areas are used as the starting point for this linkage area, but some sensitive locations (e.g., habitat surrounding spawning beds) require more extensive protection.

Linkage Watersheds. These are watersheds with a greater than 2:1 ratio of alpine tundra to coastal western hemlock bio-geoclimatic zone area. Thus, Linkage Watersheds are composed primarily of high elevation "rock and ice." They nevertheless serve to connect the thin strips of productive low-elevation old-growth forests that they often adjoin. Linkage Watersheds play a potentially important role in maintaining natural levels of connectivity between Core Conservation Areas.

Results

CORE CONSERVATION AREAS

Core Conservation Areas are made up of three types of Core Areas: 1) Core Intact Areas; 2) Core Grizzly Bear/Salmon Habitat Areas; and 3) Core Restoration Areas. In all, Core Conservation Areas comprise 53.6% (2.55 million hectares) of the land in the study area. Seventy-two percent of the remaining forest with old-growth structure and 61% of all salmon stocks are represented in Core Conservation Areas (Figure 3). Mean road density in Core Conservation Areas is about 0.07km/km^2, suggesting that wilderness values remain high.

Core Conservation Areas are clustered in three general locations within the study area. A large cluster of core watersheds located around the Rivers/Smith Inlet area includes some intact watersheds. A second cluster is found north of Knight Inlet and includes the Klinaklini River, the Stafford and Apple Rivers, and the Ahutniti watershed complex. This area also has been identified as a study area in the BC government's Protected Areas Strategy. Additionally, the Klinaklini River provides a north-south connectivity route to the southern extent of Tweedsmuir Park. The third large cluster of Core Conservation Areas is located in the northern extent of the study area, including a large portion of Princess Royal Island, the Khutze River, and surrounding watersheds that are adjacent to Fjordlands Provincial Park. This area also includes much of the proposed Spirit Bear Park area.

While the scope of the Core Conservation Areas is quite large, we suggest that the extent of these areas is not unreasonable and fits within the range of other biologically based protected area strategies (Soulé and Sanjayan 1998).

LINKAGE AREAS

Riparian and Salmon Conservation Areas are designed to protect salmon habitat and maintain landscape connectivity for large carnivores. This layer essentially delineates salmon-bearing rivers along with buffers set by FEMAT (1993) standards.

If particular areas are not designated as linkage zones, many important large water features, such as the Bella Coola River and the Kimsquit River, would be disqualified from inclu-

sion in this Conservation Area Design based on high road densities. However, the enormous salmon potential of these rivers signifies that they must be included both for salmon conservation and east-west connection.

Watersheds that are rock and ice but belong to primary watershed groups with high potential grizzly bear and salmon habitat have been designated as Linkage Watersheds. These areas are found in the eastern portion of the study area (e.g., above the Klinaklini River). Although these areas are not currently threatened by development, they should be managed to maintain landscape-level connectivity.

Discussion

Many previous reserve designs, including those proposed for British Columbia by some environmental groups, have focused almost exclusively on identifying and conserving intact areas. Our analysis shows that protecting Core Intact Areas alone would not afford sufficient protection for salmon stocks (only 41%, or 360 out of 871, of all stocks would be protected, and just 35% of chinook and 13% of steelhead stocks would be protected). In addition, it is unlikely that by only protecting intact areas, sufficient contiguous habitat would be set aside for large, wide-ranging carnivores. Thus, while intact areas should form the cornerstone for conservation area networks, other high habitat potential areas and restoration areas should also be included.

Within Core Intact Areas and Core Grizzly Bear/Salmon Areas, only very limited human activities should be permitted and all efforts should be made to maintain species at their natural levels of distribution and abundance. Commercial logging, hunting of carnivores, road construction, and establishment of new permanent human settlements should be prohibited in the core areas. Motorized access to freshwater systems also should be restricted. Subsistence-level use and recreational use may be permitted with adequate safeguards.

Within Core Restoration Areas, current commercial logging activities should be phased out. Possible mechanisms for phase out include immediate application of variable retention forestry and a move towards ecoforesty. Active restoration should also be carried out through deactivation of roads and thinning of plantations.

Linkage Watersheds do not require as high a level of protection because threats are fairly minimal. However, while human activities such as recreational use and sustainable development may be allowed, activities that restrict the passage of large animals—especially carnivores—should be minimized. Thus mining, road construction, and unsustainable hunting, particularly hunting of grizzly bears, should be prohibited. Human activities in Riparian Linkage and Salmon Conservation Areas should not threaten salmon spawning, rearing, and migration habitat and should not disrupt long-term connectivity for large carnivores. Within these areas the principles of ecoforestry should be followed. In particular, adequate streamside riparian habitat should be safeguarded from human activity (roads, logging, etc.). Trapping and subsistence-level use may be permitted, as would recreational use, provided that these activities do not adversely affect riparian zones or salmon runs.

The determination and delineation of Core Conservation Areas and Linkage Areas, as well as the sub-categories contained therein, represents a major synthesis of biophysical and ecological data that is only now becoming available for the central coast region of BC. Without this type of analysis it will be difficult to comprehensively address the needs of both human *and* non-human denizens of the region. We fully recognize that this is only a first step—but a necessary first step. Our conservation proposal is based on incomplete information and current scientific understanding. We expect our maps and analyses to evolve as others develop new information. We welcome such change and urge researchers to seize the initiative we have provided and fill in the "gaps."

Even the best plan or design will come to naught unless implemented. If the extinction crisis, now underway globally, is to be tackled locally, the Conservation Area Design for the central coast of British Columbia must be integrated into all regional conservation and development policies. The fate of this key step is in the hands of local people, conservation organizations, concerned First Nations, and government representatives. If it fails, this unique synthesis of data and the map it provides will become not a map for hope but another post-mortem for Nature. ☾

The full copy of the BC Central Coast Conservation Area Design report, including all maps, is available at: www.roundriver.org/CAD.html

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Advice for Late Bloomers

Find an island and wait
for a storm, the usual destruction
of trees. Plow them under.

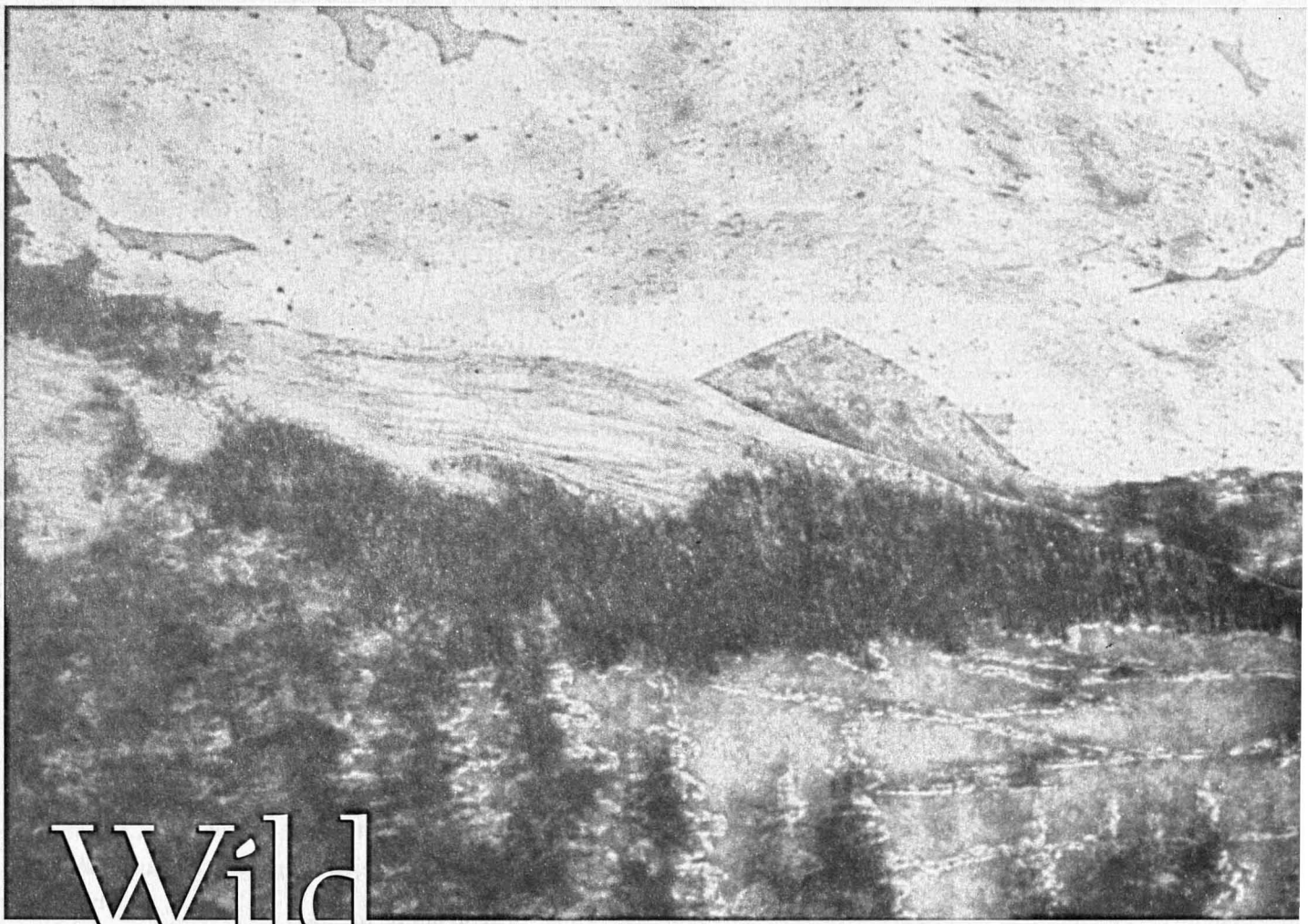
Grass will rise,
call up flowers.
You're awaking
a prairie.

Find a dead volcano and read the signs:
Don't Step on the Silverswords.
Each clump of leaves like silver daggers
guards the growth that might take fifty years
to launch its blossom rocket
as high as you if you stretched
your arms to the sky.

Break a greenhouse window and allow
a protected plant to taste its first natural air.
Hundreds of gold buds will open
as its new green spire grows, twelve feet proud.

This three-foot cactus
no one noticed for a century
takes your wild and patient bow.

—Shelby Allen



Wild San Juans

by Mark Pearson

Measured against a Glacier or a Yellowstone or a Bob Marshall Wilderness, the too-tame "wilderness experience" available in most of today's overgrazed, mine-poisoned, logging-road-slashed, trail-tortured, ski-slope-scarred, condo-littered Colorado mountains is a big fat yawn. Colorado's silver San Juans are far too sublime to languish among that harness-broke majority. They are … another Yellowstone waiting for permission to happen. The [grizzly] bear habitat here is in fact superior to that in Yellowstone.

—David Petersen, *Ghost Grizzlies* (1995)

"Weminuche Valley" by Amy Grogan

SOUTHWEST COLORADO'S San Juan Mountains harbor the last best chance to forgo Petersen's apocalyptic description of the southern Rockies, which stretch from southern Wyoming's Medicine Bow Range to northern New Mexico's Sangre de Cristos. The Wild San Juans wildlands network aims to build on the range's still abundant wild habitat to bring back not only the grizzly, but the other top carnivores already extirpated or driven near the brink. The San Juans, and the entire southern Rockies by extension, anchor a continental mountain chain that extends north into Canada.

Colorado conservationists are crafting a Southern Rockies Ecoregion reserve plan, and have recently completed a state of the ecosystem report. The southern Rockies' largest region of wild habitat resides in southwest Colorado's San Juan Mountains. The wildlands recovery plan for the larger ecoregion will build on the state of the ecosystem report and specific wildlands proposals, such as the Wild San Juans effort described here.

Proponents of rewilding the southern Rockies do not accept the idea that Nature, once degraded, must remain that way. The southern Rockies is an obvious place to begin rewilding, for only recently have humans extirpated large carnivores in Colorado's San Juan Mountains. Colorado's last, "last" grizzly was a 25-year-old sow killed in an altercation with a hunting outfitter in 1979, deep in the heart of the South San Juan Wilderness. Previously, a "last" Colorado grizzly was peremptorily proclaimed by the Colorado Division of Wildlife in 1952, also killed in a portion of the wild San Juans that would become the Weminuche Wilderness. In the intervening decades, unofficial reconnaissance (not of the government variety) has revealed numerous grizzly spoor, though thankfully not a grizzly carcass, giving some hope that the San Juans may still harbor a few survivors (Petersen 1995).

What makes the San Juans a prospective host for the southernmost grizzly population in North America are two million acres of high quality wildlands. The San Juans possess a million acres of formally protected Wilderness, including the southern Rockies' largest Wilderness Area, the 500,000-acre Weminuche. Another million acres of wilderness-qualifying roadless areas are concentrated in a dozen National Forest parcels containing significant lower-elevation ecosystems, most spectacular of which are the old-growth ponderosa pine forests of the 150,000-acre Hermosa Roadless Area.

Weave all this country together, and one starts to build a respectable inventory of remote, pristine ecosystems where Nature reigns supreme with her fires, floods, avalanches, insect outbreaks, and windthrow. This is the ultimate goal of our citizens plan—protecting these ecosystems via a wildlands network in Colorado's San Juan Mountains that will consist of a functional system of large, wildland reserves able to support the needs of far-ranging native carnivores.

The big carnivores that belong in the San Juans are the inspiring totems of wilderness lore: grizzly bear, lynx, wolverine, and wolf. As noted, the San Juans were and perhaps still are the last stronghold of grizzly bear in the southern Rockies. The last confirmed evidence of native lynx occurred ten years ago, also near the South San Juan Wilderness, but in early 1999 Colorado's Division of Wildlife released into the San Juans 43 lynx transplanted from Canada and Alaska. Colorado's reactionary legislature willing, wolverine will be similarly reintroduced and/or supplemented beginning in 2001 or soon thereafter. A recent US Fish and Wildlife Service biological survey determined the range could easily support over a hundred wolves (Bennett 1994). It's time we got on with the job of rebuilding populations of these magnificent carnivores, rewild-

ing the San Juans in the process. The Wild San Juans wildlands network proposes four interlocking goals:

- Protect and expand large, wild, core habitats
- Return the native predators
- Secure critical landscape corridors
- Live, work, and play in harmony with native species and wild habitats.

Designing the Wildlands Network

Inspired by the vision of The Wildlands Project, scientists and local activists brought their skills and intimate knowledge to bear in a reserve design process. We employed a scientific methodology that uses focal species to guide the work. Focal species are useful because they help us determine what Nature needs; when various species with different habitat needs are chosen and considered together, they can give a picture of what it takes for Nature to function. Our focal species include the flammulated owl and Abert's squirrel, both of which favor mature and old-growth ponderosa pine forests; pine marten and northern goshawk, which help identify key mature mixed-conifer and aspen forests; lynx, which need large tracts of mature spruce and fir; and grizzly bear, which require large tracts of roadless lands free from human activity. Landscape connectivity between large core areas is indicated in part by elk migration corridors. Aquatic focal species include river otter and Colorado River cutthroat trout, both of which require high-quality streams. Together, this grand menagerie represents particular habitats and landscape requirements such as large areas and connectivity.

The foundation of the proposed Wild San Juans network is the region's existing wild country, both designated and de facto wilderness. The Weminuche, its adjacent Piedra unit, and South San Juan Wilderness Areas contain over 120 miles of the Continental Divide's spine and vast, verdant forests of spruce and fir. These legislatively protected areas combined with the contiguous roadless areas create a total core area of 875,000 acres. This core is likely of sufficient size and suitable habitat to sustain a viable lynx population, which might require 500,000 to 1.2 million acres of undeveloped habitat (Hoover and Wills 1987).

Beyond these core areas, the Wild San Juans network is enhanced by incorporating two additional large habitat areas for focal species that would simultaneously provide landscape bridges to the western San Juans. The wildlands network envisions Wilderness designation for Hermosa (150,000 acres) and San Miguel (60,000 acres) roadless areas. Hermosa creates a roadless connection between the Animas and Dolores river watersheds, and San Miguel provides a protected landscape linkage between the Weminuche Wilderness and the 40,000-acre Lizard Head Wilderness in the San Juans' western reaches.

As is typical elsewhere in the Rockies, most protected habitat in the San Juans occurs at higher elevations. This high country contains important communities of mixed-conifer forest (white fir/Douglas-fir), Engelmann spruce-subalpine fir forest, and alpine tundra. A key goal of the Wild San Juans network is expanding the protected area system to include unrepresented ecosystem types, thereby protecting more of the poorly represented ecosystems, primarily ponderosa pine and aspen.

For example, the 150,000-acre Hermosa roadless area contains the San Juans' premier remaining stands of old-growth ponderosa pine along its lower drainages, as well as expansive stands of aspen and mixed-conifer at higher elevations. Hermosa's designation as Wilderness, therefore, would serve multiple purposes: it would increase the suitable habitat for wide-ranging focal species, expand ecological diversity of the wildlands network by adding lower-elevation habitats, and protect a critical landscape corridor.

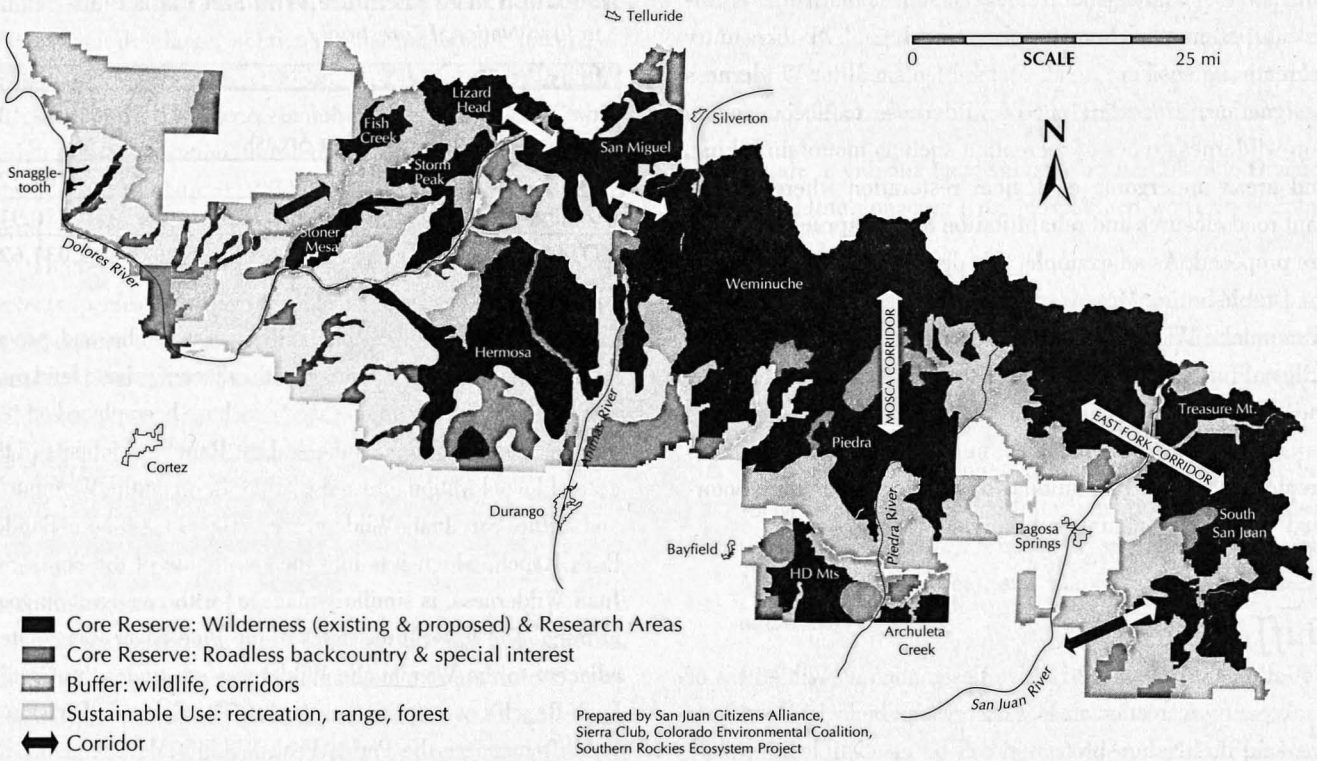
Two additional proposed Wilderness Areas similarly extend ecological representation: the 30,000-acre HD Mountains tract protects extensive ponderosa pine and piñon-juniper stands; and Stoner Mesa, a gently sloping 20,000-acre plateau, consists almost entirely of pure, climax aspen stands.

Connecting the Landscape

Habitat connections between wild, core areas make the core-connectivity-carnivores concept work (Soulé and Noss 1998). The most significant landscape connection needed is between the San Juans' two largest Wilderness Areas, the Weminuche and the South San Juan. Two distinct routes connect these areas: a high-elevation corridor along the Continental Divide, and a low-elevation corridor across the San Juan River. Neither is protected now, but in the Wild San Juans Plan, both are protected through Wilderness designation, the high-elevation corridor as a free-standing Wilderness unit and the low-elevation corridor by addition of contiguous roadless lands to the two Wildernesses.

The Wild San Juans wildlands network identifies other key dispersal and migration corridors outside existing and prospective Wilderness using elk migration data as well as riparian corridors, ridgelines, and blocks of contiguous forest cover. Elk were assumed to be a good surrogate for large predators like wolves because top carnivores would follow this elk prey base. Riparian corridors and

Proposed Wild San Juans Network



FOCAL SPECIES	REPRESENTED HABITAT
Lewis' woodpecker	ponderosa pine; primary cavity nester
flammulated owl	old-growth ponderosa pine; secondary cavity nester
Abert's squirrel	late-successional ponderosa pine
marten	mature mixed-conifer and spruce-fir
northern goshawk	mature pine, mixed-conifer, aspen
lynx	mature spruce-fir
elk	movement corridors
river otter	high-quality aquatic habitat
Colorado River cutthroat trout	high-quality aquatic habitat without non-native species
beaver	high-quality riparian forests

FOCAL SPECIES	LANDSCAPE ELEMENT
flammulated owl, marten, Abert's squirrel	interior and old-growth forest
lynx, marten, goshawk	large undisturbed tracts
elk, grizzly bear, lynx	wide-ranging dispersal

ridgelines were selected both to avoid significant road density and to accommodate various species that prefer streams or ridges. Areas of contiguous forest cover were chosen to accommodate movement of interior sensitive species such as pine marten that prefer not to stray far (more than 100 meters) from forests. While not precluding human use, the Wild San Juans Plan anticipates that corridors will have road densities of 0.5 mile/square mile or less to reduce human poaching and other disturbances.

The Wild San Juans wildlands network supplements the system of wilderness core areas and landscape connections

flammulated owl by Douglas Moore

with another management category subset that reflects different patterns of human recreational use. "Backcountry recreation areas" are areas deemed too small for Wilderness designation, areas left out of wilderness to accommodate non-wilderness types of recreation such as mountain biking, and areas undergoing ecological restoration where significant road closures and rehabilitation of past spruce clearcuts are proposed. As an example, this designation would be used to establish the Mosca corridor between Piedra and the Weminuche Wilderness. Here, the plan calls for closing 20 miles of road to restore a non-motorized connection between the alpine summer range of the Weminuche and the Piedra's dense forests along a major elk migration corridor. This also creates enhanced recreational opportunities for non-motorized visitors like mountain bikers.

Buffer Zones

Not all of the San Juans receive designation as Wilderness or backcountry recreation areas. Conservation biologist Reed Noss has said that Nature protection can be compatible with more intense economic use outside core areas and connecting landscape corridors (Noss and Cooperrider 1994). We propose that much of the remaining National Forest matrix be allocated to general wildlife habitat as a buffer zone, including an area for recovering Columbian sharp-tailed grouse where livestock grazing will need to be modified or eliminated. Under the Wild San Juans Plan, these lands are excluded from the "suitable timber base" (that is, protected from logging). These lands, along with the ecological restoration areas mentioned above, comprise the buffer zones described in the Noss model.

Sustainable Use Zones

Still other lands, with existing roads and past timber harvest, are allocated to general timber and range management. Such stewardship zones create the sustainable use areas of the Noss model. It is anticipated that any timber harvest in these areas will be focused on ecological restoration, such as returning ponderosa pine stands to pre-European-settlement conditions prior to reintroducting natural fire regimes, and offered as small sales appropriate for purchase by local loggers and sawmills.

ALL OF THE AREAS DESCRIBED THUS FAR CONSIST OF public lands managed as the San Juan National Forest. The allocation of these two million acres under the Wild San Juans Plan breaks down as follows:

Allocation of Areas in the Wild San Juans Plan
San Juan National Forest only

AREA CATEGORY	ACRES
Core Areas (including Wilderness Areas and Backcountry Recreation Areas)	1,211,481
Buffer Zones	461,226
Sustainable Use Areas	358,918
TOTAL	**2,031,625**

Nature does not distinguish between public and private land ownership, so coordination with adjacent private land owners is critical. Conservation easements have been placed on several area ranches, such as the At Last Ranch, which sits in the critical low-elevation forested corridor between the Weminuche and South San Juan Wildernesses. The 35,000-acre Banded Peak Ranch, which juts into the south side of the South San Juan Wilderness, is similarly managed with conservation goals in mind. The lower three miles of the Pine River immediately adjacent to the Weminuche Wilderness are under the Granite Peak Ranch's conservation easement. The Colorado Division of Wildlife manages the Perins Peak Wildlife Management Area for critical winter range (particularly for elk) and non-motorized recreation at the lower end of the Junction Creek Roadless Area. Recognition of these interrelated landscapes ensures that the Wild San Juans reserve design is not compromised once outside public lands. The Wild San Juans network holds hope for recreating a self-sustaining locus of native carnivores and natural ecosystems, complementing—and ultimately connecting to—the centers of ecological activity represented by the greater Yellowstone and Glacier ecosystems, and other wildlands farther north in the Rocky Mountains.

Evaluating the Wild San Juans Wildlands Network

Once we completed the mapping and planning for our wildlands network design, we sought objective expert reviewers to apply a critical eye to it. Expert reviewers in this case included a local professor of forest ecology considered the premier authority on fire ecology in the San Juans, several plant ecologists intimately familiar with the ecosystem, and long-time citizen conservation activists. Reviewers suggested minor modifications, but all expressed support for the conservation approach envisioned.

Their comments indicated that the Wild San Juans wildlands network should readily meet the habitat needs of spruce-fir dwelling species and those needing extensive blocks of

habitat, such as lynx, wolverine, and grizzly bear. The reserve system includes large, contiguous habitat blocks located at higher elevations across the breadth of the entire San Juans, with key connecting spruce-fir habitat corridors identified. A middle-to-low-elevation forested corridor also connects the San Juans' two largest Wildernesses, the Weminuche and South San Juan.

The review suggested our Wild San Juans Plan reasonably protects species requiring large blocks of mature and old-growth mixed conifer and aspen, such as northern goshawk and pine marten. Numerous lower-elevation additions to existing Wilderness, expansion of Piedra, and protection of the Hermosa roadless area create an interlocking system accommodating goshawk in the central San Juans. The heavily-fragmented western end of the San Juans is less accommodating, although numerous roadless canyons create natural fingers of habitat laced throughout this region.

Species which require old-growth ponderosa pine habitats, such as Abert's squirrel and flammulated owl, are decently protected by the reserve design in the central San Juans, among the cluster of Piedra/HD Mountains/Hermosa roadless areas, but are less protected in the heavily fragmented blocks of second-growth ponderosa pine in the San Juans' western end. To improve this situation, the Wild San Juans Plan proposes two special interest areas surrounding remnant stands of old-growth ponderosa in the western San Juans to create a base of ponderosa reserves on which to build future recovery efforts. Restoration of pre-European-settlement ponderosa pine would increase habitat for species needing old growth.

Evaluation also determined that riparian species are well-represented in the Wild San Juans wildlands network. Reintroduced river otters have expanded their range from the Piedra River to the nearby Los Pinos River within the Weminuche Wilderness, and many cutthroat trout streams are included within Research Natural Areas and Wilderness Areas.

As a result of comments, we adjusted the Wild San Juans Plan to include two additional focal species: beaver, because of their role as keystone species in maintaining water flow, raising water tables, and providing habitat for other species; and the Lewis' woodpecker as a primary cavity nester.

Implementation

Thoughtful reserve designs mean little unless implemented by those who oversee our wild ecosystems. We are committed to implementing the Wild San Juans Plan and have already taken strides in this direction:

- The San Juan National Forest has committed to incorporating the Wild San Juans wildlands network among its alternatives analyzed for the forthcoming management plan revision for the two-million-acre National Forest.
- We are mobilizing local support for the Colorado Division of Wildlife's ongoing lynx and planned wolverine reintroductions.
- We are pursuing road closures in key corridors (Mosca) and advocating for domestic sheep grazing reductions in potentially occupied grizzly bear habitat (South San Juan Wilderness).
- We are defending critical components of the Wild San Juans wildlands network from a proposed luxury resort (East Fork corridor), expanded snowmobile use (San Miguel Roadless Area), and timber cutting (Weminuche additions).

In the 1960s and 70s, a frenzy of destructive "new forestry" timber sales scarred thousands of acres of subalpine forest ecosystems. However, in the last two decades the San Juans have seen slow but perceptible progress toward our larger goals. Half a million acres of new Wilderness were designated in 1980 and 1993 in and around the San Juans, reintroduced river otters and lynx roam landscapes from which they were once driven, and two gigantic ski resorts proposed for the San Juans' heart were defeated. The future is as bright or as dim as we make it. With blueprints like the Wild San Juans conservation plan, we have set course toward a brighter future, restoring all of Nature's beauty in a rewilded southern Rockies. ☾

Mark Pearson has worked on Colorado wilderness issues for 20 years. He recently coordinated volunteer input to the Wild San Juans Plan under the auspices of the San Juan Citizens Alliance (PO Box 2461, Durango, CO 81302; 970-259-6181; www.sanjuancitizens.org), a grassroots group committed to environmental protection in the San Juan Basin of southwest Colorado and northwest New Mexico.

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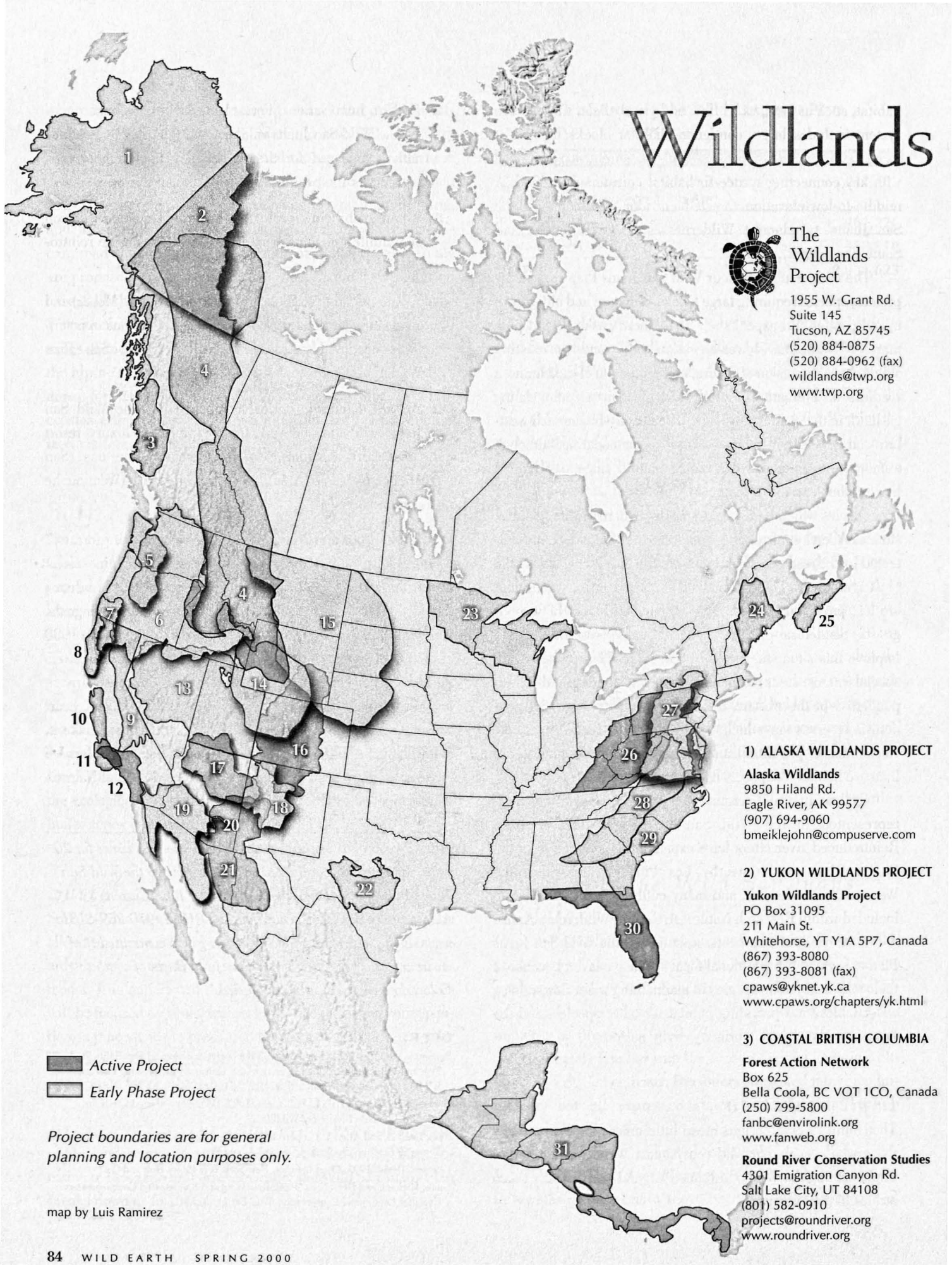
Petersen, David. 1995. *Ghost Grizzlies*. New York, NY: Henry Holt and Co.

Soulé, Michael, and Reed Noss. 1998. Rewilding and Biodiversity: Complementary Goals for Continental Conservation. *Wild Earth* 8(3):18–28.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Project boundaries are for general planning and location purposes only.
map by Luis Ramirez

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13) UTAH WILDLANDS PROJECT

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Round River Conservation Studies
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The Wildlands Project (see )

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28) PIEDMONT WILDLANDS PROJECT

29) COASTAL PLAIN WILDLANDS PROJECT

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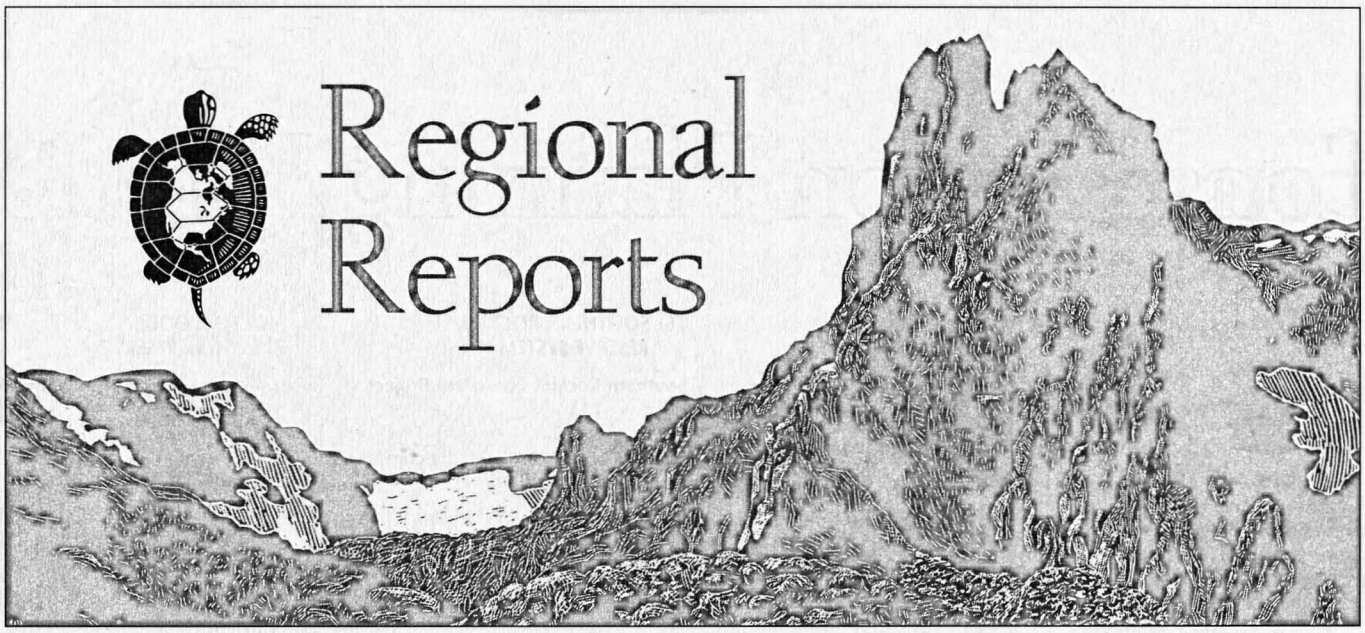


The number before each project refers to the map and contact list on the previous page.

2) YUKON WILDLANDS PROJECT

The Yukon Wildlands Project is working to protect Nature in the northern part of the Yellowstone to Yukon Conservation Initiative. A major success has been the Yukon government's approval of an ambitious Protected Areas Strategy (PAS) in December, 1998. The first new territorial protected areas in seven years were announced in late 1999. The PAS is based on many of the principles of conservation biology, including ecoregion representation, critical habitat, and wildlife movement corridors, along with wilderness and cultural heritage sites. Land claims agreements with First Nations will likely yield eight more protected areas in the next few years.

During 1999 we focused on the highest priority candidate areas in the Protected Areas Strategy. The Fishing Branch watershed in northern Yukon is now protected, with a core area of 540,000 hectares flanked by a habitat protection area of 100,000 hectares. In the central Yukon we helped ensure that the final boundaries for the Tombstone Mountain Park included all nine local ecosystem types, protecting 216,000 hectares. Species of concern include woodland and barren ground caribou, Dall's sheep, and a variety of rare plants.

In south-central Yukon we supported efforts to initiate a feasibility study for a new National Park by completing four biological surveys in the Wolf Lake watershed, an area of some 10,000 square kilometers. This work was done in cooperation with the Teslin Tlingit council and included scientists, First Nations elders, and local Renewable Resource Council members. Focal species in this multi-year research and mapping project include an intact woodland caribou herd along with associated predators, and chinook salmon.

Southeast Yukon has the territory's richest pristine boreal forest, which is now vulnerable to logging, oil and gas development, mining, and a "roads to resources" proposal. Our project to fend off these threats was initiated in 1996 and resulted in two pending core protected areas, now in final negotiations through the First Nations land claim. Planning workshops focused on both scientific and traditional ecological knowledge. Suitable focal species include woodland caribou, grizzly bear, bull trout, pine marten, goshawk, and a variety of neo-tropical migrant songbirds. A preliminary protected area proposal for the southeast will be released in the spring of 2000.

Our background conservation research report, proposal, and conservation strategy for the 50,000-square-kilometer planning region in the Wind, Snake, and Bonnet Plume watersheds will be released in 2000. Focal species will include the grizzly bear, woodland caribou, and arctic grayling. ~ *Contact: Juri Peepre, Yukon Chapter, Canadian Parks and Wilderness Society*

4) YELLOWSTONE TO YUKON CONSERVATION INITIATIVE

The Yellowstone to Yukon (Y2Y) region is approximately 460,000 square miles (1.2 million sq km). Y2Y stretches 2000 miles (3200 km) and 15 degrees of latitude, from west-central Wyoming to the Peel River in the Yukon Territory. The region ranges from 125 to 500 miles (200–800 km) wide, corresponding with ecological boundaries along the eastern montane-foothills and the western inland-coastal watersheds. The boundaries of the study area are both fuzzy and permeable, changing with the species or process under consideration.

Y2Y's overarching conservation goal is to maintain the region's native biodiversity and natural resilience. The conservation plan, when finished, will braid together conservation area design, socio-political research, and implementation. A matrix that adequately protects focal species (e.g., grizzly bear, lynx, bull trout, aspen) and focal processes (e.g., fire, flood, nutrient cycling) relative to stressors (e.g., deforestation, roads and railways, sedimentation, global warming) lies at the heart of the Y2Y conservation area design.

illustration by Evan Cantor

Ecosystem representation has yet to be fully defined for the region. Preliminary work based on a hybrid of US and Canadian vegetation and ecosystem classifications has identified 19 broad vegetation units. Presently, elevational, latitudinal, and longitudinal gradients are well-represented along the Y2Y axis for terrestrial species. Aquatic and avian considerations, soon to be incorporated in our planning, will influence how we account for representation.

The region's ecological wounds have not been formally inventoried, but habitat fragmentation due to deforestation, road-building, suburban and urban sprawl, oil and gas exploration, large-scale mining, and the expansion of major east-west transportation corridors will top the list. An emerging concern is burgeoning backcountry recreation, with a proliferation of resorts and motorized use. The presence of non-native fish is a major aquatic insult, and the loss of outlying foothill and prairie habitat is emerging as significant problem for mountain bird populations.

Achievements include: publishing the Yellowstone to Yukon Atlas; a Science Advisory Forum; an Aquatics Strategy Workshop; and carnivore habitat effectiveness modeling. We will soon host a Data Standards & Information Management Workshop.

This year Y2Y will unveil its grizzly bear habitat effectiveness model for the region; compare US and Canadian procedures for assessing watershed integrity; integrate aquatic-terrestrial conservation considerations into a comprehensive reserve network; launch vegetation and avian working groups; assemble an avian conservation layer; and develop a Geographic Information System (GIS) with data-sharing capabilities for the entire region. The Yellowstone to Yukon Conservation Initiative will complete a preliminary Y2Y-wide reserve design in 2001.

Our major challenge is synchronizing the ambitious aspirations of a network committed to a bi-national, multi-scale, scientifically defensible conservation area design with the financial implications of such a vision. ~ *Contact: Marcy Mahr, Y2Y Science Coordinator*

5) CENTRAL CASCADES ALLIANCE
Wildlands Restoration and Protection Project

The goal of the Central Cascades Alliance Wildlands Restoration and Protection Project (WRAPP) is to develop a wildlands reserve system that will preserve native biodiversity.

Our study area encompasses the Central Cascades mountain range, bounded by Snoqualmie Pass just north of Mt. Rainier National Park in Washington and Willamette Pass south of the Three Sisters Wilderness in Oregon. It also includes highly productive lowlands found on each side of the Cascade crest, including the Willamette Valley on the west side and transitional zones into east-side, scrub-steppe ecosystems.

The Central Cascades region is an important "node" or landscape connector, providing a north-south corridor for animal dispersal and potentially connecting protected areas in the Klamath-Siskiyou, Coast Range, and North Cascades regions. Through the new Rainforest to Rockies Conservation Initiative (R2R), wildlands projects in the Pacific Northwest will eventually link with the Rocky Mountains via the Yellowstone to Yukon network.

Central Cascades Alliance is in the initial phase of wildlands reserve design planning. A recipient of the Conservation Technology Support Program GIS grant in 1999, CCA has begun to build an in-house GIS system. In the next year we will produce a State of the Ecosystem Report to provide a "snapshot" of the current condition of the bioregion. This report will rely primarily on existing databases available from federal and state agencies and on independent scientific reports. Its goal is to describe the ecological health of the area. To gain support for conservation planning among rural residents, we will highlight ecosystem services, particularly those that affect the sustainability of human communities, such as local sources of water supply.

Although our State of the Ecosystem Report will be written for a general audience, the data used in its production will provide the basis for wildlands planning. CCA is building community support for wildlands planning through participation in regional conservation efforts including the Adopt-A-Wilderness campaign. This program trains volunteers to survey roadless areas, skills that can be applied to future wildlands ground-truthing efforts.

Though lynx and other large carnivores still persist in our region, wildlife habitat is heavily fragmented by years of commercial logging on public and private land, limiting the amount of suitable land for wildlife reserves. Other challenges include gaining cultural and political acceptance of the need for wildlands protection. ~ *Contact: Carrie Ward*

6) THE RAINFOREST TO ROCKIES CONSERVATION INITIATIVE

The Rainforest to Rockies Conservation Initiative (R2R) is a network of conservation groups in the Pacific Northwest committed to developing a regional conservation plan to protect and restore native biodiversity. The network includes:

American Lands Alliance
Central Cascades Alliance
Coast Range Association
Friends of the Gorge
Gifford Pinchot Task Force
Grant County Conservationists
Hells Canyon Preservation Council
Kettle Range Conservation Group
Northwest Ecosystem Alliance
Oregon Natural Desert Association
Oregon Natural Resources Council
Siskiyou Regional Education Project
Washington Trails Association
The Wildlands Project

The R2R study area includes all of Oregon and Washington and contiguous portions of California, Nevada, Idaho, and British Columbia. We share a border to the east with the Yellowstone to Yukon Conservation Initiative.

Our mission is to protect and restore wildlands in the Pacific Northwest through the design and implementation of a system of connected reserves. The R2R network will be designed for resiliency, will support healthy populations of all native species—including wide-ranging species

and large predators—and will include all ecosystem types. We believe that the economic and social sustainability of human communities in the Northwest depends on intact, functioning, whole ecosystems.

In March 2001, we will produce a Draft Conservation Plan based on rewilding of habitat for a select group of carnivores, including grizzly bear, wolf, fisher, and wolverine. This draft plan will include recommendations for core habitat areas, protective buffers, wildlife corridors, and land management. Refinement of the plan will follow, including application of representation analysis, special elements analysis, and an aquatic/terrestrial integration model for a more accurate assessment of watershed conditions.

The R2R Conservation Initiative hired a full-time coordinator in July 1999. We have developed a 2000–2003 workplan and budget to guide our outreach, conservation planning, communications, and fundraising activities. Studies of regional economic trends have been collected and summarized in an annotated bibliography. Existing reports and conservation plans that could contribute to regional wildlands planning efforts, including plans for the Coast Range, Klamath-Siskiyous, North Cascades, and Columbia Mountains, have been collected. Communications between member groups is enhanced through our e-mail listserve. In the next six months we will begin to collect data for our carnivore focal species analysis.

Our greatest challenge lies in gaining public acceptance of regional wildlands habitat protection and restoration as an essential element of life in the Pacific Northwest. ~ *Contact: Kevin Kilduff, Coordinator*

9–12) CALIFORNIA WILDERNESS COALITION

The California Wilderness Coalition is developing a wildlands vision for California's greater Sierra Nevada region. The Sierra Nevada Wildlands Project planning boundaries include three ecoregions: John Muir's "Range of Light" (the Sierra Nevada), the Modoc Plateau, and the Cascade Ranges. Together, this larger bioregion encompasses 106,657 square kilometers.

Approximately 60% of this region is publicly owned. In the past, conservation planning efforts in this part of the state have avoided addressing major ecological wounds across all land ownership types. Increasing road density and urban and semi-urban sprawl are the main ecological threats to private lands in our planning area. Because the trends and patterns of human land use in this region are not evenly distributed, we are assessing the rewilding needs for each ecoregion or subregion. In the Sierra Nevada ecoregion, for example, the northern and west-side foothill subregions are of particular concern because road and ranchette development have seriously fragmented and degraded native grasslands, riparian habitats, woodlands, and forest communities. Additional major ecological wounds—evenly distributed throughout the region and typical of both private and public lands—are cattle grazing and resource extraction (e.g., mines and clearcuts).

In order to address specific ecological wounds, our project is developing conservation strategies for focal species using GIS technology. In addressing regional connectivity issues, we are emphasizing the needs of our remaining large and middle-sized carnivores including the mountain lion, black bear, wolverine, marten, and Pacific fisher. Several species of birds, native grazers, and anadromous fish have also been identified as focal species.

To improve and refine our project's objectives and methods, the California Wilderness Coalition recently hosted a science mapping workshop that brought together research scientists, land managers, planners, and conservationists to review our focal species maps and contribute their knowledge to the design process. Based on the workshop, we are now revising and elaborating needed analyses for our first wildlands report, scheduled for review in April 2000. We consider this to be the first milestone in the long process of refining and implementing a vision for ecological recovery in the greater Sierra Nevada region. ~ *Contact: Chris Erichsen*

10) THE VENTANA WILDLANDS PROJECT

The Ventana Wildlands Project encompasses the northern central coast region of California, from the San Francisco Bay Area southward to northern Santa Barbara County. Sharing the goal of protecting and restoring ecological integrity to the greater central California coast region, the project is a collaboration between Coast Ranges Ecosystem Alliance (CREA), California Wilderness Coalition, and the GIS Lab & Environmental Studies program at the University of California-Santa Barbara (UCSB), in association with the Conception Coast Project (CCP). The team quickly produced a map of regional ecosystem integrity to visually represent and communicate landscape-scale conservation and rewilding needs. The vision map is a coarse-scale conceptual picture of conservation needs that begins to address three of five great ecological wounds suffered in the region: 1) loss and fragmentation of terrestrial habitats, 2) loss and/or severe population reductions of wide-ranging carnivores and ungulates, and 3) loss and degradation of riparian, aquatic, and coastal habitats. We used the spatial requirements of a few wildlife species as surrogates for the needs of their associated ecosystems.

Focal species analyses were based primarily on existing digital data and include mountain lion, kit fox, tule elk (reintroduction), and salmonids (emphasizing steelhead). Mountain lion and kit fox analyses were based on habitat suitability index models developed by the California Department of Fish and Game (CDFG). CCP provided an analysis of representation of vegetation types, which we integrated with the focal species analyses and other information to develop the vision map. In turn, CREA extended its coverage of steelhead southward to include all of coastal southern California. The steelhead analysis required a new digital database, derived from historical field data provided by CDFG. Our greatest challenges to date have been limitations on availability of pertinent or robust digital data, and funding.

Near-future plans for the project include seeking feedback on the vision map from scientific reviewers, resource agencies, conservation organizations, and land trusts. This vision and subsequent iterations will provide graphic tools for communicating landscape-scale conservation issues to the general public, and for the development and implementation of proposed solutions. Coast Ranges Ecosystem Alliance is being established as a nonprofit organization. ~ *Contact: Verna Jigour, Conservation Design Coordinator*

11) THE CONCEPTION COAST PROJECT

The Conception Coast Region encompasses portions of four counties on the south-central coast of California. The region is a biodiversity hotspot, supporting over 1500 native species and over 140 endemic species.

Due to increasing population pressures in Southern California and associated development threats, we feel it is critical to collaborate with others in the creation and implementation of a reserve design. Our bioregional approach can be summed up in the following four goals: to enhance the use of sound science in land-use planning and management by providing ecological information; to increase awareness of the interconnectedness of ecological integrity and quality of life; to improve communication and cooperation among stakeholders; and to facilitate the use of these ideas in the implementation of an ecologically viable reserve design.

We have developed an internal vision map to drive our decisions, and will be hosting a workshop in May to enlist the broader community in the creation of a public vision map. On the agenda will be a list of focal species for discussion, including the mountain lion, steelhead trout, southwestern willow flycatcher, and the red-legged frog; another topic will be identifying major ecological wounds. The resultant map will be combined with the Ventana Wildlands Project and California Wilderness Coalition Reserve Design maps to provide our community with a context and long-term vision.

The CCP has created a GIS database of coarse-scale ecological data, and is continually adding fine-scale, expert information. The database has helped to create maps and presentations to aid local conservation efforts and work towards reserve design at a sub-regional scale. Our maps helped secure funding from Congress for the National Park Service (NPS) to conduct a feasibility study of national seashore status for the Gaviota Coast. This is a critical area because it provides connectivity between undeveloped coastline and the inland mountains, including the Sierra Nevadas. The CCP has been asked by NPS and Gaviota Coast Conservancy to create the maps and presentations for the study.

A number of challenges have presented themselves during our first four years, including maintaining consistent funding and resolving data sharing issues. With the addition of a part-time staff person, however, we are beginning to overcome these obstacles. ~ *Contact: Michael Summers*

13, 14) THE WILD UTAH PROJECT

The Wild Utah Project (WUP) has had an exciting year of transition as we completed mapping roadless and potential wilderness areas and initiated a reserve design for our ecoregion.

Since our beginnings in 1996, we have worked with the local conservation community to map and analyze potential wilderness areas, primarily on Bureau of Land Management (BLM) lands. In this effort, we coordinated hundreds of volunteers who surveyed thousands of acres of BLM lands and took thousands of photographs of human impacts on the landscape. We then used a Geographic Information System (GIS) to create maps for the Citizens' Wilderness Inventory. These maps are now used by the BLM in their planning processes. The completion of the Citizens' Inventory coincided with the BLM's recent "Section 202" planning process in which up to 2.6 million acres of Utah BLM land might be designated as Wilderness Study Areas (WSAs).

In collaboration with the Southern Utah Wilderness Alliance, WUP submitted to the BLM a two-part analysis that included the most detailed comments ever provided to the agency regarding the accuracy of their surveys for roadless areas. The second part of the document was a "conservation biology analysis" in which we used the distribution of rare and imperiled species within the tracts under consideration to argue for appropriate WSA designation (see and download this final product at www.suwa.org/bio202).

This analysis followed a similar project—a conservation biology analysis of the draft management plan for Grand Staircase Escalante National Monument (see www.roundriver.org/escalante.html)—produced in collaboration with Round River Conservation Studies. Both of these studies demonstrate an effort among several dozen scientists to use both science and a planning and comment period process to affect land decisions of management agencies.

These mapping projects and biological analyses of federal land management proposals have set the stage for a comprehensive reserve design in our region. Last summer the Wild Utah Project hired a conservation biologist to assist with this task. In 2000 we will begin a wildlands design for the "Wyoming Great Divide" in collaboration with The Wildlands Project, Round River Conservation Studies, Predator Education Fund, the Wyoming Outdoor Council, Biodiversity Associates, and others. We plan to cooperate with many other regional stakeholders and to establish an implementation council. ~ *Contact: Jim Catlin and Allison Jones*

16) THE SOUTHERN ROCKIES ECOSYSTEM PROJECT

The goal of the Southern Rockies Ecosystem Project (SREP) is to identify, protect, and restore areas critical to the maintenance of biological diversity and ecological integrity in the southern Rocky Mountains of southern Wyoming, Colorado, and northern New Mexico. The southern Rockies have been degraded by over a century of mining, grazing, logging, water projects (e.g., dam-building), and predator control. These activities have resulted in the loss and fragmentation of native habitat, led to the extirpation of species such as the gray wolf, grizzly bear, and black-footed ferret, and placed numerous other native species at risk. The southern Rockies are currently threatened by urban, residential, resort, and recreational development.

SREP is designing a reserve system to address these ecological problems. The network will incorporate three main components: 1) special biological and landscape elements (e.g., biodiversity hotspots, roadless areas, healthy riparian communities, and wildlife corridors); 2) representation of native ecosystem types; and 3) focal species' habitat needs. We have already made much progress mapping and analyzing unprotected roadless areas in the southern Rockies, and have discovered significant areas of lower- and middle-elevation ecosystem types that are underrepresented in the region's current system of parks and designated Wilderness Areas. Several large roadless-area complexes may also be

capable of supporting at-risk and extirpated wide-ranging native predator species, such as the wolverine and gray wolf. To further the goal of restoring native predator species, we have also created preliminary maps that delineate prey density and movement patterns. SREP will continue to create and refine map layers and will combine these layers into a draft comprehensive reserve system proposal by fall 2000.

One of our biggest challenges has been to analyze and summarize our geographic information in SREP's recently released "State of the Southern Rockies Ecoregion" report, which outlines the ecological history and status of the region, as well as opportunities for future conservation. Our reserve design work is proving no less challenging, but we are excited about the many conservation opportunities in the southern Rockies. ~ *Contact: Doug Shinneman*

24, 25) THE GREATER LAURENTIAN WILDLANDS PROJECT

The Greater Laurentian Wildlands Project (GLWP) is working in New England, New York, and southeastern Canada to design and implement an interconnected ecological reserve network. Although fragmented by forestry, agriculture, highways, and urban development, this region nonetheless has great untapped potential for large-scale wildlands recovery. Through its reserve designs and associated efforts, GLWP seeks to build upon existing protected areas, create new wilderness, and foster landscape connectivity such that native biodiversity and ecological function are restored for the long term.

GLWP is in the final stages of completing a draft reserve design for Maine. Sparsely populated in most of its territory, and with more than 22 million acres of forested land, Maine presents a unique opportunity for wilderness recovery in the Northeast. The Maine Wildlands Reserve Network (MWRN) uses special elements, representation, and focal species in its design of a reserve system intended to begin rewilding the Northern Forest. The MWRN proposal is scheduled for release later this year.

In 1999, we completed the design of a potential restoration effort between the Adirondacks in New York and Algonquin Provincial Park in Ontario (A2A); the wolf is a focal species. In another bi-national effort, we hosted a wildlands mapping meeting in Nova Scotia, the results of which have helped catalyze on-the-ground conservation projects. We also co-hosted a Vermont biodiversity conference, as well as a roundtable discussion for Vermont conservation leaders. We continue to play a leadership role in the Coalition to Restore the Eastern Wolf (CREW) and other regional coalitions, and outreach to land trusts remains a priority.

Our priorities in the near future include the Maine Wildlands Reserve Network, support for A2A, and incorporating information from the cooperative Vermont Biodiversity Project into a reserve design for the state. In the longer term, we envision integrating this and other regional reserve designs into a comprehensive conservation plan for the eastern North Woods.

GLWP and its collaborators face formidable challenges in a region that too often places short-sighted value on the "working landscape" at the expense of ecological health. Public opinion indicates overwhelming support for wild forests and wildlife, which have shown amazing capacity for recovery over the past century. With equal tenacity, we will continue to emphasize that "wild forests *are* working forests." ~ *Contact: Robert Long*

26) APPALACHIAN RESTORATION CAMPAIGN
Central Appalachian Assessment

ARC is a project of Heartwood, the largest forest protection network in the East. The core of ARC's work is designing a reserve system for the central Appalachian region, an ecosystem considered one of the most endangered on Earth. Our three-part Central Appalachian Assessment (CAA) is a detailed approach to conservation planning at the regional level (view all of our work at www.heartwood.org/arc).

Building on work of Dr. E. Lucy Braun, wilderness advocate Ernie Dickerman, and Dr. R.F. Mueller, this project will specifically address some of the region's most serious ecological wounds, such as mountaintop removal mining, strip mining, acid mine drainage, sprawl, and forest fragmentation. We are working toward recovery of a landscape that is highly fragmented and privately controlled—a stark contrast to lands west of the 100th meridian.

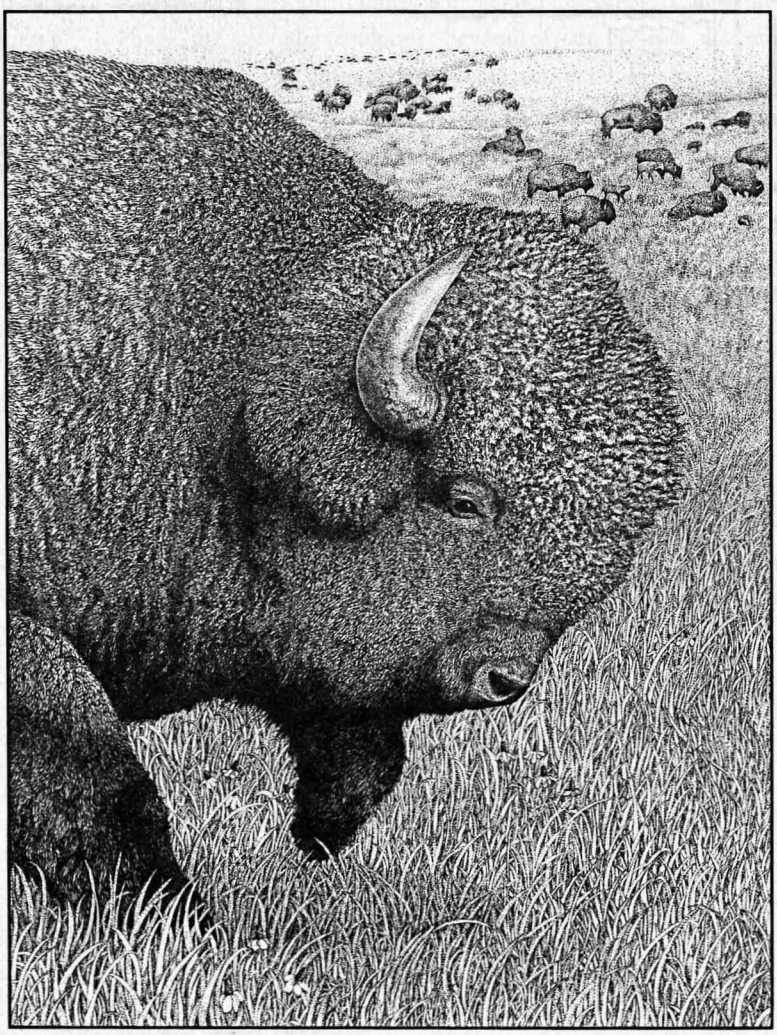
Specific accomplishments include:

- Completing the Eastern Cougar Habitat Suitability Analysis highlighting specific areas where cougar habitat clearly exists. The intent of the study is to encourage conservation of this important top carnivore and umbrella species.
- The mapping of publicly owned lands in Appalachia, defining and mapping protected lands in Appalachia, and proposing new potential core reserves such as Blackwater Canyon National Park. Many of these maps were presented in 1998 to the Lucy Braun Society's annual meeting and to the EPA's Mid Atlantic Integrated Assessment Conference in Baltimore, MD.
- Hosting the second Central Appalachian Ecological Integrity Conference in Elkins, WV in 1998.
- Completing "Central Appalachia: History and Hope for Renewal," ARC's slideshow.
- Producing maps and tables depicting the rapid growth of chip mills in the Southeast. Global demand for pulp is predicted to double in the next 30 years.
- Mapping the first draft of the proposed 38,000-acre Blackwater Canyon National Park in northeast West Virginia. Heartwood and the West Virginia Highlands Conservancy are also suing to stop logging and development on behalf of four listed species in the Canyon.
- Assisting in a wildlands-based alternative for the Jefferson National Forest Plan Revision process.

ARC hopes to protect this region while providing for the economic needs of this and future generations. We think it is important to include state agencies and other interested parties in the design process. ~ *Contact: Jason Halbert, Coordinator; Don Giecek, GIS Coordinator*

Conserving Biodiversity on and Beyond the Turner Lands

by Mike Phillips



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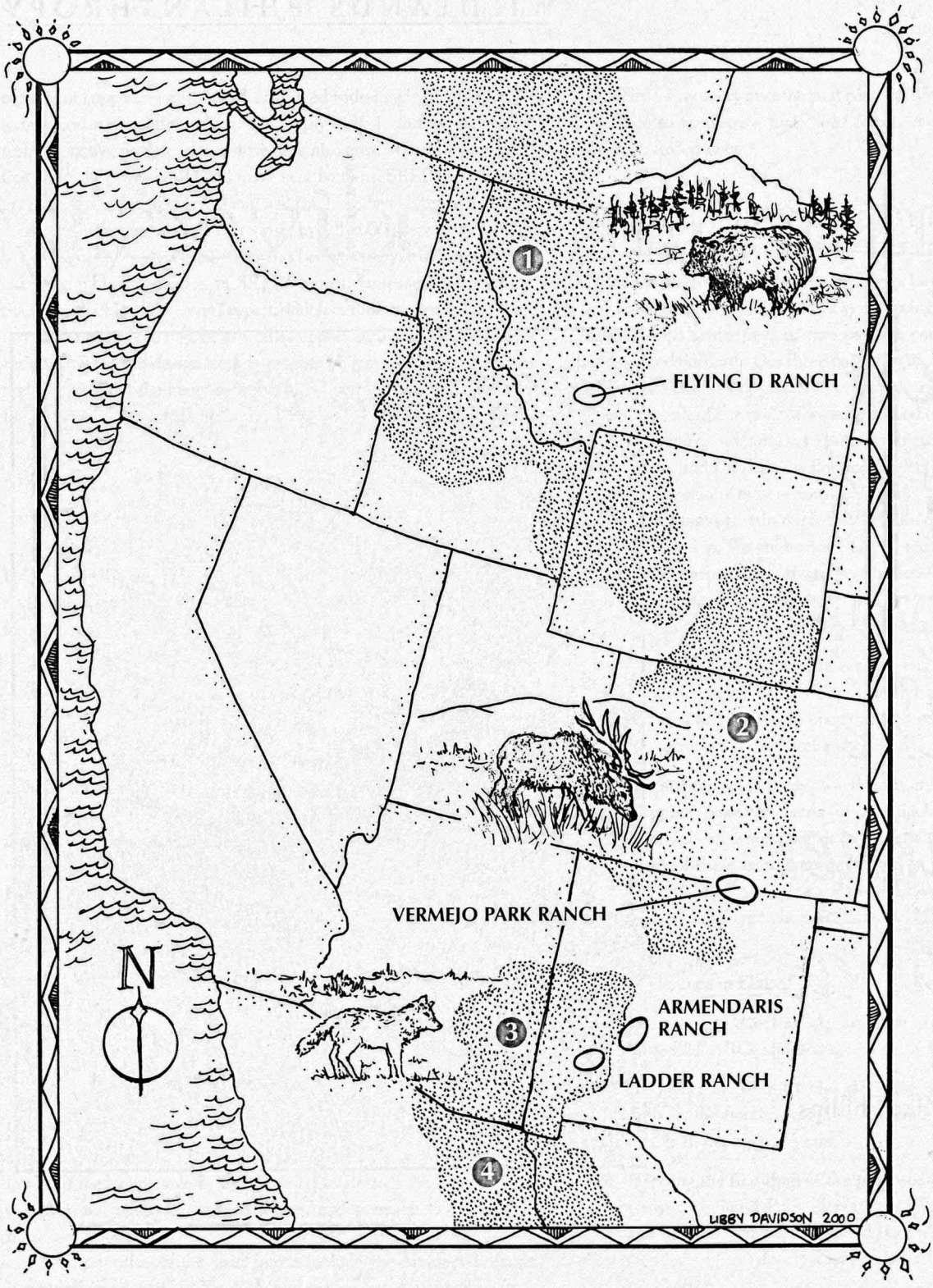
I FIRST MET TED TURNER IN 1995 when he visited Yellowstone National Park where I was directing the wolf reintroduction effort for the National Park Service. I vividly remember the park superintendent's call the night before Ted's arrival arrived to relay his schedule and express an expectation that I would provide him an opportunity to observe wolves and grizzly bears. I hung up the phone, unconcerned about our odds of seeing wolves: we had nine animals in captivity that needed to be fed. And during Ted's visit, providence provided us a good look at two grizzlies while we were hauling elk quarters to the Rose Creek pen.

bison by D.D. Tyler



Turner Ranch Lands within Proposed Wildlands Networks

(approximate locations)

1
Yellowstone to Yukon Conservation Initiative

2
Southern Rockies Reserve System

3
Sky Islands Wildlands Network

4
Sierra Madre Occidental Biological Corridor

map by Libby Davidson

During the day we discussed the world's woes. It became apparent that Ted believed that the accelerating loss of biological diversity ranked near the top of the list of global problems. He expressed concern that the destruction of Nature would eventually have profound and negative consequences for all of humankind. He realized that every year thousands of native species and attendant ecological interactions, fine-tuned by time and place, disappear due to human action—losses so severe that the redundancy and certainty of Nature is being stripped away, wearing thin the lives of millions. He expressed frustration over this trend, which, as the Yellowstone wolf project illustrated, is reversible. He understood that restoration is an alternative to extinction.

We discussed the factors that drive the extinction crisis. He agreed that the most important single cause was habitat loss, mostly on private land, that occurs as owners seek to maximize economic gain. This troubled Ted because he understood that arresting the extinction crisis will require the keen involvement of private landowners.

Later, and after conferring with his son Beau and other family members who are equally concerned about biodiversity loss, Ted realized that his active involvement in the conservation of imperiled species could improve the recovery prospects for many plants and animals. As owner of more than 1.5 million acres, he could set an example to other landowners that coexistence with endangered species was possible, and by doing so illustrate the utility of the Endangered Species Act. These possibilities prompted the family to form, in June 1997, the Turner Endangered Species Fund (TESF) and Turner Biodiversity Divisions (TBD), and to bring me on board to oversee the activities of both.

The Fund and the Divisions are dedicated to conserving biological diversity by working to ensure the persistence of imperiled species and their habitats, with an emphasis on private land. We concentrate on carnivores, grasslands, plant-pollinator complexes, species with historic ranges that include Turner properties, and dissemination of credible scientific and policy information about biodiversity conservation. Our projects, which are based on the principles of conservation biology, involve state and federal agencies, universities, non-governmental organizations, and private citizens. We operate on the belief that wrapping many minds around a problem is a certain route to success. In our endeavors, whether we seek to manage extant populations or restore extirpated species, the ultimate goal is population persistence with minimal management. We believe that self-sustaining populations of native species indicate a healthy or at least a recovering landscape.

The TESF is recognized by the Internal Revenue Service as a nonprofit charity. Such recognition provides a tax-exemption as long as TESF funds are used solely for projects involving species considered Threatened or Endangered by a state or the federal government. In contrast to the Turner Foundation, which is a grant-making charity, the TESF is an operational charity that helps conceive, design, and implement field projects. The Biodiversity Divisions were formed to focus on imperiled species (and their habitats) that are not listed as Threatened or Endangered. According to Ted, the Divisions are part and parcel of responsible ownership.

Currently the TESF and the TBD are involved in roughly two dozen projects including reintroduction efforts for plants, birds, fishes, and mammals. The flagship effort at present addresses conservation of migratory pollinators and their plant partners along a 1500-mile migration corridor that stretches from the southwestern US to southern Mexico. This campaign is being orchestrated by the Pollinator Conservation Consortium based at the Arizona-Sonora Desert Museum.

Although our fieldwork emphasizes Turner properties, we are diligent to launch projects that generate benefits transcending Turner land boundaries. Several of our projects dovetail nicely with well-known, large-scale conservation area design initiatives. These include:

Yellowstone to Yukon Reserve Design and the Flying D Ranch. The Flying D Ranch encompasses 113,000 acres and is the largest tract of private land in the greater Yellowstone ecosystem. The "D" is one of the best-known ranches in the West; upon its purchase Mr. Turner donated a conservation easement to The Nature Conservancy. The ranch is dominated by montane rangeland and spruce forests and shares a border with the Lee Metcalf Wilderness of the Gallatin National Forest. Maintaining the health of the resident elk herd is an important management objective for the ranch. In collaboration with Montana Fish, Wildlife, and Parks, the ranch provides keen recreational opportunities to elk hunters who use adjacent public land throughout the season and to hunters who participate in the D's late-season cow elk hunt.

Grizzly bears and wolverine have been sighted on the ranch, and during the winter of 1998–99 TESF biologists observed one wolf and detected wolf tracks on three other occasions. Wolf tracks were also detected in February of this year. In sharp contrast to the situation on most private land, large carnivores are welcome on the D. Recently the TESF submitted a proposal to the US Fish and Wildlife Service (USFWS) to assist with: 1) monitoring gray wolves that settle in the public/private land interface in the northwest corner of the greater Yellowstone ecosystem (with an emphasis on the Flying D Ranch), and 2) developing aversive conditioning techniques to reduce livestock depredations.

Integrating the D into the mix of lands available to large carnivores and utilizing the field skills of the Turner Endangered Species Fund greatly advances carnivore conservation, a central feature of the Yellowstone to Yukon initiative.

Southern Rockies Ecosystem Project and the Vermejo Park Ranch. Vermejo Park Ranch (VPR) encompasses 580,000 acres along the southeastern border of the Southern Rockies Ecosystem Project's conservation area design bound-

ary. Elevations at the ranch range from 6000 to 12,000 feet. Because of this elevational heterogeneity, myriad ecotypes can be found on the property including short-grass prairie, piñon-juniper woodlands, ponderosa pine forests, mixed conifer stands, spruce-fir forests, and alpine habitats. The large size and great diversity of the ranch has long been recognized; in the past, the Department of Interior considered Vermejo as a possible addition to the National Park System.

Like all Turner properties Vermejo is managed to ensure the persistence of native species. Here we have several important imperiled species projects in place (e.g., restoration of black-tailed prairie dogs and black-footed ferrets). Moreover, the ranch provides a grand opportunity to advance wolf recovery, a central feature in the southern Rockies reserve design. Without doubt, Vermejo can support a self-sustaining population of wolves that would produce dispersers which would settle other suitable sites throughout the southern Rockies. To fully appreciate Vermejo's potential it is useful to note that:

- the ranch is five times larger than Isle Royale, which has supported a wolf population since the late 1940s when a few wolves crossed Lake Superior via an ice bridge and settled the island,
- the density of Vermejo's elk herd compares favorably with the density of Yellowstone's northern range herd, which supports the densest and arguably the healthiest wolf population ever studied (health being measured by body weights and reproductive performance),
- poaching and accidental human-induced mortalities (e.g., collisions with vehicles) would be virtually non-existent because access to the ranch is strictly controlled, and
- the ranch is well within dispersal range of public land where wolves should receive priority consideration (e.g., the San Juan National Forest).

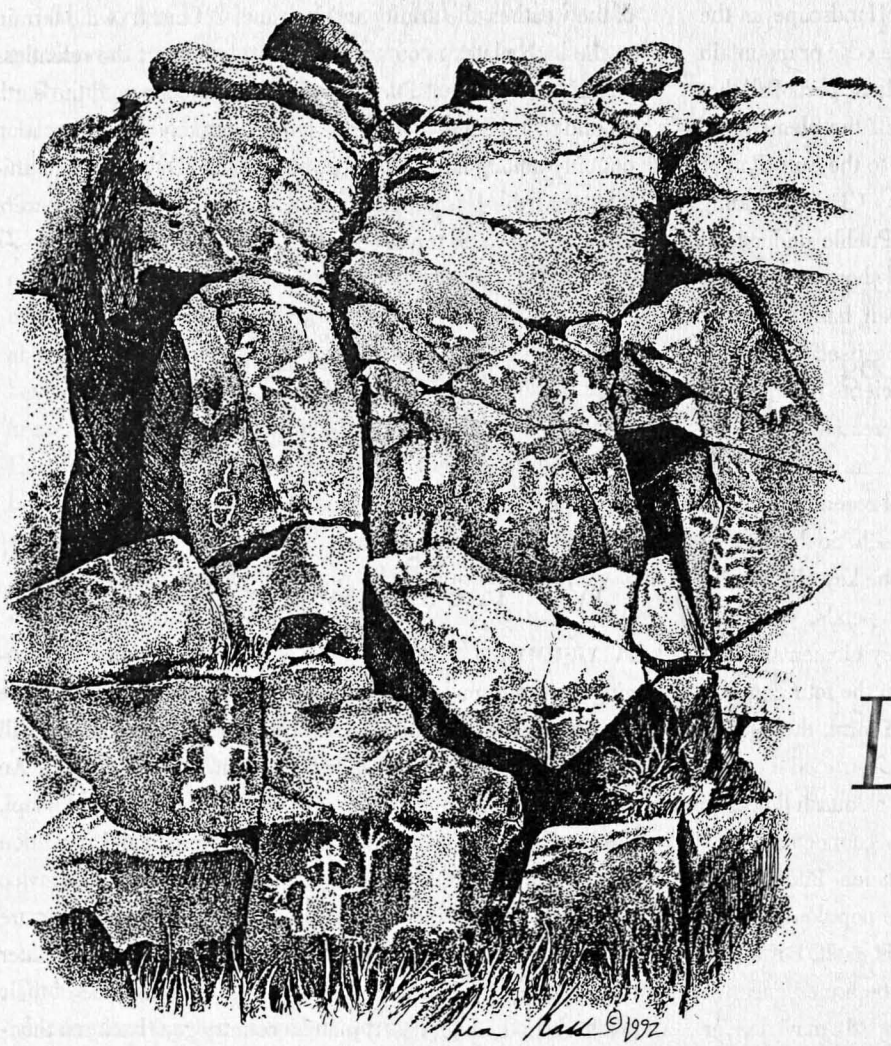
The Turner Endangered Species Fund is certain that the Vermejo Park Ranch can serve as a nidus for wolves settling vast stretches of wildlands in the southern Rocky Mountains and beyond. Indeed, reintroducing wolves at Vermejo should greatly facilitate the restoration of a wolf population that is continuous from Canada to Mexico!

Sky Island Wildlands Network and the Armendaris and Ladder Ranches. The Armendaris Ranch (335,000 acres of Chihuahuan Desert grasslands and desert scrub, riparian habitats along the Rio Grande River, and the Fra Cristobal Mountains) and the Ladder Ranch (250,000 acres of mixed desert grassland, riparian areas, piñon-juniper stands, and mixed-pine forests) are situated along the northeastern edge of the Sky Island Wildlands Network (SIWN). The diverse habitats, elevational heterogeneity, large size, and proximity to public land of these ranches—as well as our emphasis here on native species conservation—ensure that they will always figure prominently in landscape-scale conservation efforts in the region.

Predictably, SIWN emphasizes the restoration of carnivores, and efforts at the Ladder Ranch contribute mightily to this end. For example, at the Ladder we maintain a captive breeding facility for Mexican wolves for release to the wild by the US Fish and Wildlife Service. Additionally, the TESF fully supports the reintroduction of Mexican wolves into the Gila National Forest, hopefully on the Ladder's allotments, and has offered the services of a biological technician to assist with radio-tracking. Finally, the Ladder's management team greatly improved the suitability of the region for large carnivores by developing an agreement with the US Forest Service for removing livestock from the ranch's two allotments, which cover 70,000 acres in the Gila's Aldo Leopold Wilderness.

THE TURNER ORGANIZATION HAS MADE GOOD PROGRESS conserving native species during the last few years. However, we realize that much work remains if we are to establish our efforts as persistent forces and properly integrate Turner properties into large-scale conservation reserve design planning. We recognize that these tasks will be challenging because emphasizing private stewardship of biodiversity is new, the problems are complex, and effective solutions require broad-based socio-political, geographic, and fiscal considerations. The difficulty of the tasks, however, does not diminish our substantial resolve, which is based on the belief that any real solution to the extinction crisis will rely on the genius and determination of humankind. Accordingly, we are determined to contribute by establishing a new measure for conserving the wondrous diversity of life on Earth. ☾

Mike Phillips has been the executive director of the Turner Endangered Species Fund and coordinator of the Turner Biodiversity Divisions since their inception in 1997. He has worked on wolf recovery and research since 1980, including the Yellowstone wolf restoration project and the red wolf recovery program. He lives in Bozeman, Montana.



Landscape, History, and the Pueblo Imagination

AN EXCERPT

by Leslie Marmon Silko

From the Emergence Place

PUEBLO POTTERS, the creators of petroglyphs and oral narratives, never conceived of removing themselves from the earth and sky. So long as the human consciousness remains *within* the hills, canyons, cliffs, and the plants, clouds, and sky, the term *landscape,* as it has entered the English language, is misleading. "A portion of territory the eye can comprehend in a single view" does not correctly describe the relationship between the human being and his or her surroundings. This assumes the viewer is somehow *outside* or *separate from* the territory he or she

This essay, originally published as "Landscape, History, and the Pueblo Imagination," appears in Leslie Marmon Silko's Yellow Woman and a Beauty of the Spirit *(©1996 by Leslie Marmon Silko) under the title "Interior and Exterior Landscapes: The Pueblo Migration Stories." This excerpt is used with permission of Touchstone/Simon & Schuster, Inc.*

illustration by Lia Kass

surveys. Viewers are as much a part of the landscape as the boulders they stand on. There is no high mesa edge or mountain peak where one can stand and not immediately be part of all that surrounds. Human identity is linked with all the elements of Creation through the clan: you might belong to the Sun Clan or the Lizard Clan or the Corn Clan or the Clay Clan.* Standing deep within the natural world, the ancient Pueblo understood the thing as it was—the squash blossom, grasshopper, or rabbit itself could never be created by the human hand. Ancient Pueblos took the modest view that the thing itself (the landscape) could not be improved upon. The ancients did not presume to tamper with what had already been created. Thus *realism,* as we now recognize it in painting and sculpture, did not catch the imaginations of Pueblo people until recently.

The squash blossom itself is *one thing:* itself. So the ancient Pueblo potter abstracted what she saw to be the key elements of the squash blossom—the four symmetrical petals, with four symmetrical stamens in the center. These key elements, while suggesting the squash flower, also link it with the four cardinal directions. By representing only its intrinsic form, the squash flower is released from a limited meaning or restricted identity. Even in the most sophisticated abstract form, a squash flower or a cloud or a lightning bolt became intricately connected with a complex system of relationships which the ancient Pueblo people maintained with each other, and with the populous natural world they lived within. A bolt of lightning is itself, but at the same time it may mean much more. It may be a messenger of good fortune when summer rains are needed. It may deliver death, perhaps the result of manipulations by the Gunnadeyahs, destructive necromancers. Lightning may strike down an evildoer. Or lightning may strike a person of good will. If the person survives, lightning endows him or her with heightened power.

Pictographs and petroglyphs of constellations or elk or antelope draw their magic in part from the process wherein the focus of all prayer and concentration is upon the thing itself, which, in its turn, guides the hunter's hand. Connection with the spirit dimensions requires a figure or form which is all-inclusive. A "life-like" rendering of an elk is too restrictive. Only the elk *is* itself. A *realistic* rendering of an elk would be only one particular elk anyway. The purpose of the hunt rituals and magic is to make contact with *all* the spirits of the Elk.

The land, the sky, and all that is within them—the landscape—includes human beings. Interrelationships in the Pueblo landscape are complex and fragile. The unpredictability of the weather, the aridity and harshness of much of the terrain in the high plateau country explain in large part the relentless attention the ancient Pueblo people gave the sky and the earth around them. Survival depended upon harmony and cooperation not only among human beings, but among all things—the animate and the less animate, since rocks and mountains were known to move, to travel occasionally.

Through the Stories We Hear Who We Are

ALL SUMMER THE PEOPLE WATCH the west horizon, scanning the sky from south to north for rain clouds. Corn must have moisture at the time the tassels form. Otherwise pollination will be incomplete, and the ears will be stunted and shriveled. An inadequate harvest may bring disaster. Stories told at Hopi, Zuñi, and at Acoma and Laguna describe drought and starvation as recently as 1900. Precipitation in west-central New Mexico averages fourteen inches annually. The western pueblos are located at altitudes over 5600 feet above sea level, where winter temperatures at night fall below freezing. Yet evidence of their presence in the high desert plateau country goes back ten thousand years. The ancient Pueblo people not only survived in this environment, but many years they thrived. In AD 1100 the people at Chaco Canyon had built cities with apartment buildings of stone five stories high. Their sophistication as sky-watchers was surpassed only by Mayan and Inca astronomers. Yet this vast complex of knowledge and belief, amassed for thousands of years, was never recorded in writing.

Instead, the ancient Pueblo people depended upon collective memory through successive generations to maintain and transmit an entire culture, a worldview complete with proven strategies for survival. The oral narrative, or "story," became the medium in which the complex of Pueblo knowledge and belief was maintained. Whatever the event or the subject, the ancient people perceived the world and themselves within that world as part of an ancient continuous story composed of innumerable bundles of other stories.

* Clan: A social unit composed of families sharing common ancestors who trace their lineage back to the Emergence where their ancestors allied themselves with certain plants or animals or elements.

The ancient Pueblo vision of the world was inclusive. The impulse was to leave nothing out. Pueblo oral tradition necessarily embraced all levels of human experience. Otherwise, the collective knowledge and beliefs comprising ancient Pueblo culture would have been incomplete. Thus stories about the Creation and Emergence of human beings and animals into this World continue to be retold each year for four days and four nights during the winter solstice. The *humma-hah* stories related events from the time long ago when human beings were still able to communicate with animals and other living things. But, beyond these two preceding categories, the Pueblo oral tradition knew no boundaries. Accounts of the appearance of the first Europeans in Pueblo country or of the tragic encounters between Pueblo people and Apache raiders were no more and no less important than stories about the biggest mule deer ever taken or adulterous couples surprised in cornfields and chicken coops. Whatever happened, the ancient people instinctively sorted events and details into a loose narrative structure. Everything became a story.

TRADITIONALLY EVERYONE, FROM THE YOUNGEST CHILD to the oldest person, was expected to listen and to be able to recall or tell a portion, if only a small detail, from a narrative account or story. Thus the remembering and retelling were a communal process. Even if a key figure, an elder who knew much more than others, were to die unexpectedly, the system would remain intact. Through the efforts of a great many people, the community was able to piece together valuable accounts and crucial information that might otherwise have died with an individual.

Communal storytelling was a self-correcting process in which listeners were encouraged to speak up if they noted an important fact or detail omitted. The people were happy to listen to two or three different versions of the same event or the same *humma-hah* story. Even conflicting versions of an incident were welcomed for the entertainment they provided. Defenders of each version might joke and tease one another, but seldom were there any direct confrontations. Implicit in the Pueblo oral tradition was the awareness that loyalties, grudges, and kinship must always influence the narrator's choices as she emphasizes to listeners this is the way *she* has always heard the story told. The ancient Pueblo people sought a communal truth, not an absolute. For them this truth lived somewhere within the web of differing versions, disputes over minor points, outright contradictions tangling with old feuds and village rivalries.

A dinner-table conversation, recalling a deer hunt forty years ago when the largest mule deer ever was taken, inevitably stimulates similar memories in listeners. But hunting stories

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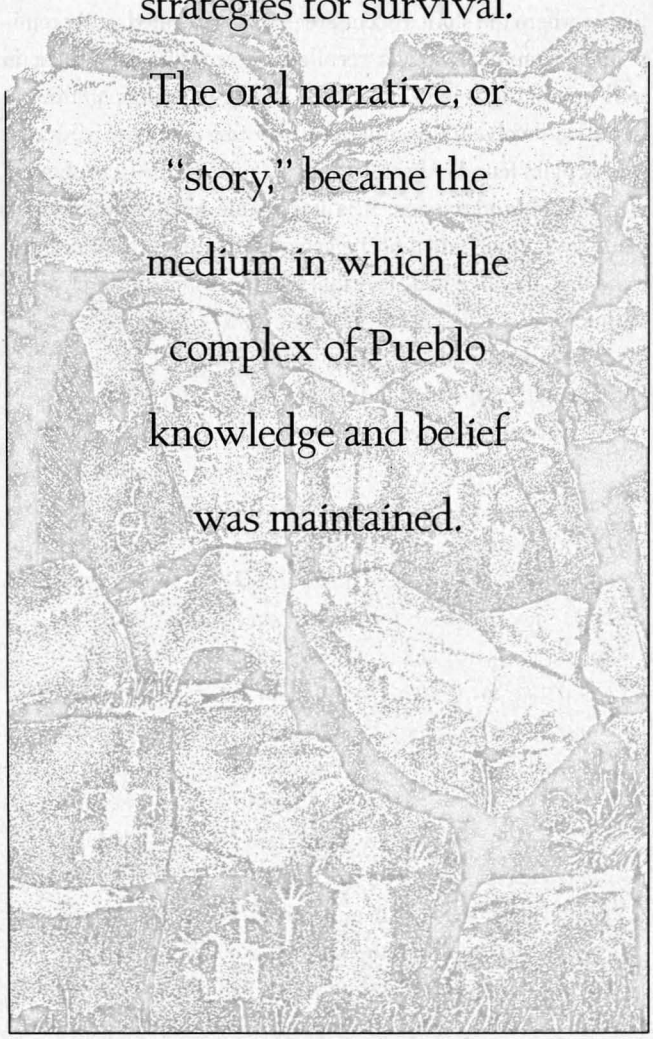


were not merely after-dinner entertainment. These accounts contained information of critical importance about behavior and migration patterns of mule deer. Hunting stories carefully described key landmarks and locations of fresh water. Thus a deer-hunt story might also serve as a "map." Lost travelers, and lost piñon-nut gatherers, have been saved by sighting a rock formation they recognize only because they once heard a hunting story describing this rock formation.

The importance of cliff formations and water holes does not end with hunting stories. As offspring of the Mother Earth, the ancient Pueblo people could not conceive of themselves except within a specific landscape. Location, or "place," nearly always plays a central role in the Pueblo oral narratives. Indeed, stories are most frequently recalled as people are passing by a specific geographical feature or the exact place where a story takes place. The precise date of the incident often is less important than the place or location of the happening. "Long, long ago," "a long time ago," "not too long ago," and "recently" are usually how stories are classified in terms of time. But the places where the stories occur are precisely located, and prominent geographical details recalled, even if the landscape is well-known to listeners. Often because the turning point in the narrative involved a peculiarity or special quality of a rock or tree or plant found only at that place. Thus, in the case of many of the Pueblo narratives, it is impossible to determine which came first: the incident or the geographical feature which begs to be brought alive in a story that features some unusual aspect of this location.

There is a giant sandstone boulder about a mile north of Old Laguna, on the road to Paguate. It is ten feet tall and twenty feet in circumference. When I was a child, and we would pass this boulder driving to Paguate village, someone usually made reference to the story about Kochininako, Yellow Woman, and the Estrucuyo, a monstrous giant who nearly ate her. The Twin Hero Brothers saved Kochininako, who had been out hunting rabbits to take home to feed her mother and sisters. The Hero Brothers had heard her cries just in time. The Estrucuyo had cornered her in a cave too small to fit its monstrous head. Kochininako had already thrown to the Estrucuyo all her rabbits, as well as her moccasins and most of her clothing. Still the creature had not been satisfied. After killing the Estrucuyo with their bows and arrows, the Twin Hero Brothers slit open the Estrucuyo and cut out its heart. They threw the heart as far as they could. The monster's heart landed there, beside the old trail to Paguate village, where the sandstone boulder rests now.

It may be argued that the existence of the boulder precipitated the creation of a story to explain it. But sandstone boulders and sandstone formations of strange shapes abound in the Laguna Pueblo area. Yet most of them do not have stories. Often the crucial element in a narrative is the terrain—some specific detail of the setting.

A high dark mesa rises dramatically from a grassy plain fifteen miles southeast of Laguna, in an area known as Swanee. On the grassy plain one hundred and forty years ago, my great-grandmother's uncle and his brother-in-law were grazing their herd of sheep. Because visibility on the plain extends for over twenty miles, it wasn't until the two sheepherders came near the high dark mesa that the Apaches were able to stalk them. Using the mesa to obscure their approach, the raiders swept around from both ends of the mesa. My great-grandmother's relatives were killed, and the herd lost. The high dark mesa played a critical role: the mesa had compromised the safety which the openness of the plains had seemed to assure. Pueblo and Apache alike relied upon the terrain, the very earth herself, to give them protection and aid. Human activities or needs were maneuvered to fit the existing surroundings and conditions. I imagine the last afternoon of my distant ancestors as warm and sunny for late September. They might have been traveling slowly, bringing the sheep closer to Laguna in preparation for the approach of colder weather. The grass was tall and only beginning to change from green to a yellow which matched the late-afternoon sun shining off it. There might have been comfort in the warmth and the sight of the sheep fattening on good pasture which lulled my ancestors into their fatal inattention. They might have had a rifle whereas the Apaches had only bows and arrows. But there would have been four or five Apache raiders, and the surprise attack would have canceled any advantage the rifles gave them.

Survival in any landscape comes down to making the best use of all available resources. On that particular September afternoon, the raiders made better use of the Swanee terrain than my poor ancestors did. Thus the high dark mesa and the story of the two lost Laguna herders became inextricably linked. The memory of them and their story resides in part with the high black mesa. For as long as the mesa stands, people within the family and clan will be reminded of the story of that afternoon long ago. Thus the continuity and accuracy of the oral narratives are reinforced by the landscape—and the Pueblo interpretation of that landscape is *maintained.* ☾

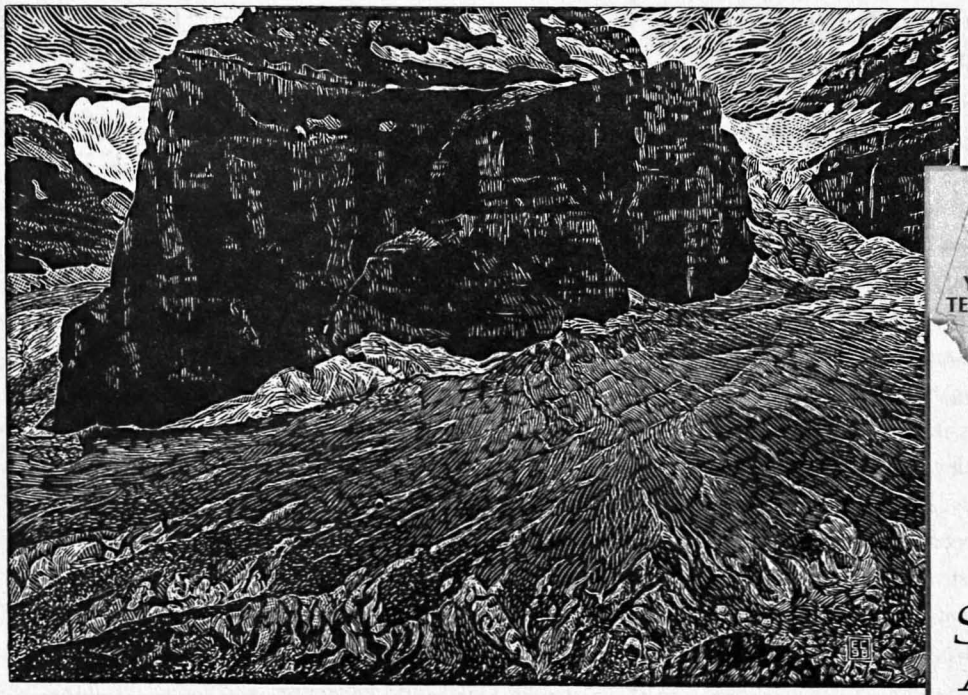
One of our foremost writers on Native American issues, Leslie Marmon Silko draws on her mixed Laguna and white heritage in her novels, essays, poetry, and short stories. Her books include Yellow Woman and a Beauty of the Spirit, Ceremony, *and* Almanac of the Dead. *She lives in Tucson.*

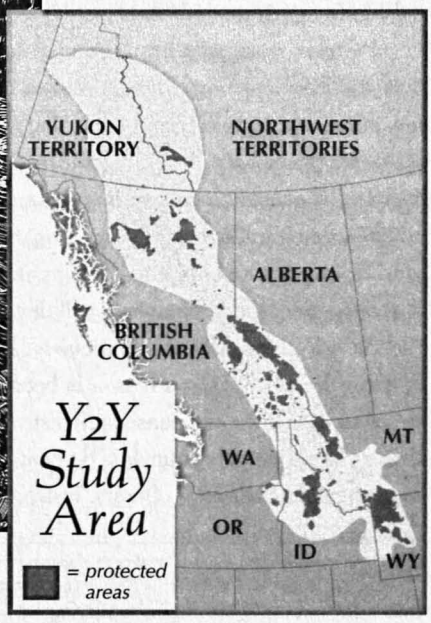
The Changing Economy of Yellowstone to Yukon: Good News for Wild Lands?

by Ray Rasker and Ben Alexander

IN 1997, WE AUTHORED A REPORT for The Wilderness Society entitled *The New Challenge: People, Commerce and the Environment in the Yellowstone to Yukon Region.* Our intent was to underscore changes occurring in the region known as Yellowstone to Yukon (Y2Y), to highlight the positive and the negative attributes of the "new economy," and to challenge the conservation community to expand its toolbox to involve communities and address private land issues. The purpose of this article is to highlight some of the findings and summarize the pros and cons of using economics as a tool for conservation.[1]

In brief, the findings of *The New Challenge* indicate that the economy of the Y2Y region has changed drastically in the last 25 years. Resource industries such as mining, timber, oil, and gas are no longer the only game in town. Neither is agriculture. They are now joined by an influx of relatively new sources of growth, including retirees, telecommuters, new technology and information-based industries, and a host of people seeking to live a simpler rural life.





1. Copies of *The New Challenge* can be obtained from the Northern Rockies office of The Wilderness Society at 406-586-1600, or you can download a PDF file via http://www.wilderness.org/ccc/northrockies/y2y.htm.

Victoria Glacier, Banff National Park, Alberta by Evan Cantor

What does this changing economy mean for the land? Unfortunately, the predominant reply from the conservation community goes something like: "Oh, this is great news. The bad industries are going away and our side is winning!" Not only is such a comment oversimplified, it is wrong. Some of you may recall *Newsweek*'s interpretation of Y2Y as an attempt to create "a wildlife superhighway." In economics, as in conservation biology, there is a great danger of distilling complex arguments into an erroneous conclusion.

Economics—Why Bother?

A professor of agricultural marketing once said, "Canned spinach. Why bother?" Certain ideas are simply bad ones; this can also apply to the use of economics as a conservation tool, particularly if taken out of a larger context. Conservation is a social decision, and economics is only a subset of society. Commerce should have nothing to do with whether we want to make room in our lives for beauty and wildness, and whether we want to share our world with wild creatures like grizzly bears and wolves. These are value choices that lie outside the calculus of profit and loss statements.

Other well-founded objections to the use of economics as a prominent conservation tool come from those who have heard from economists before, particularly the "free market" variety. Those enamored with neoclassical economic theory have a cult-like belief that the "free market," allowed to run free from government intervention, will magically provide for the good of all. For example, some economists argue that National Parks and National Forests ought to be privatized. Yet evidence of good stewardship from private timber companies is less than compelling.

Perhaps most annoying is the belief of some economists that resource depletion is not a problem because we can always rely on human ingenuity and technology to develop substitutes. In theory, this seems plausible for a resource like oil. When oil does become scarce, one can imagine substituting it with technologies that harness solar energy, or cars that run on hydrogen fuel. However, it would be naive to assume that if grizzly bears become extinct the marketplace will develop a substitute.

So why should conservationists listen to economists? Perhaps the most obvious reason is because people matter. All too often ecologists and conservationists have portrayed ecosystems as being devoid of humans, yet people have played a role in ecosystems for thousands of years. Instead of economics, perhaps the appropriate discipline should be called human ecology—the study of the role of humans in the ecosystem. In this approach, people matter because we impact the ecosystem. People also matter because we all have legitimate needs and aspirations. Economics is one of the tools we can use to understand these needs and aspirations as well as the consequences of our actions.

Another reason for using economics as a conservation tool is that if the analysis is done right, the discussion centers around the health of the human household, which includes the role nature plays in contributing to people's quality of life. This is a much more robust view than the limited insights afforded by equating economics with commerce and those things that we can measure in dollars.

Finally, perhaps the most important reason for using economics is to correct much of the misinformation that exists. People in small, rural communities throughout the US and Canadian Rockies are constantly told by industry proponents (and even some university economists who ought to know better) that their economic future needs to be like the past, that their only hope for financial security is more of the same—more logging, more energy development, and more mining. Public land managers on both sides of the border have continually pushed for high levels of resource extraction under the guise of job creation. These biases are confused even further by the misuse of economic base theory, where only industries that extract and export resources are defined as part of the "base," or export generating sectors. Such confusion shows up in the form of bumper stickers that say "If it can't be grown, it must be mined." In this view, service industries such as health care, real estate, finance, and engineering depend on the health of extractive industries, as if resource extraction were "the horse pulling the cart." In reality, however, every sector of the economy has the ability to add new wealth to a local economy by bringing in outside dollars. This includes graphic designers, engineers, publishers, artists, retirees, tourists, and architects—just about anyone who sells a service or product to clients outside the local area. The difference is that the product can travel via FedEx, UPS, or modem, and is therefore less visible than the trains filled with coal or trucks with livestock.

An additional source of confusion for many is that when a lumber mill or mine closes, the tendency is to assume that the only option is to embrace tourism.[2] In today's vernacular the term *services* has become synonymous with tourism—the proverbial "hamburger flipper" jobs. This awkward term, a remnant of an antiquated Standard Industrial Classification (SIC) system, lumps

2. For a review of the social and cultural costs of tourism see Jobes, P.C. 1991. "The Greater Yellowstone Social System." *Conservation Biology* 5(3):387–394. See also Johnson, J.D., D.J. Snepenger, and S. Akis. 1993. "Host Resident Sentiment Toward Tourism in a Transitional Rural Economy." *Annals of Tourism Research* 21(3); and Martin, B.S. and M. Uysal. 1990. "An Examination of the Relationship Between the Carrying Capacity and the Tourism Lifecycle: Management and Policy Implications." *Journal of Environmental Management* 31:327–333.

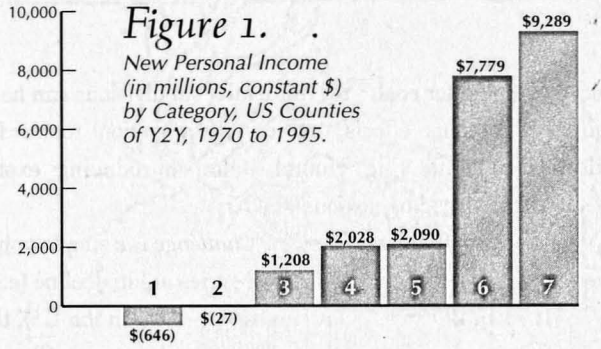


Figure 1.

New Personal Income (in millions, constant $) by Category, US Counties of Y2Y, 1970 to 1995.

1) Farm and Agricultural services; **2)** Resource extraction; **3)** Construction; **4)** Other manufacturing (non-extraction); **5)** Government; **6)** Services & professional; **7)** Non-labor

Source: Bureau of Economic Analysis. 1997. Regional Economic Information System (REIS CD-ROM), US Department of Commerce, Washington, DC. All figures in 1995 constant $.

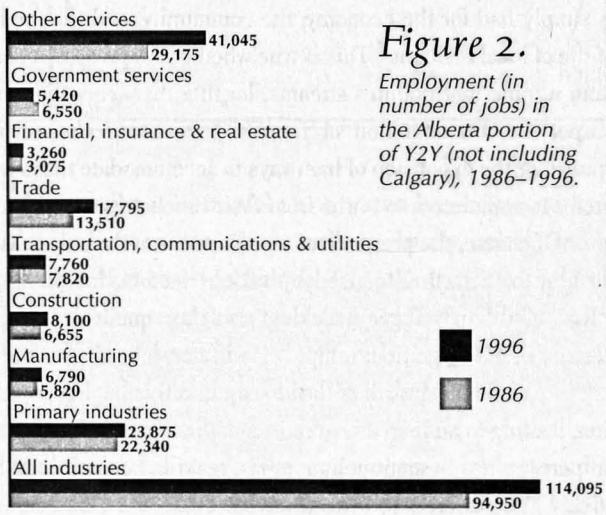


Figure 2.

Employment (in number of jobs) in the Alberta portion of Y2Y (not including Calgary), 1986–1996.

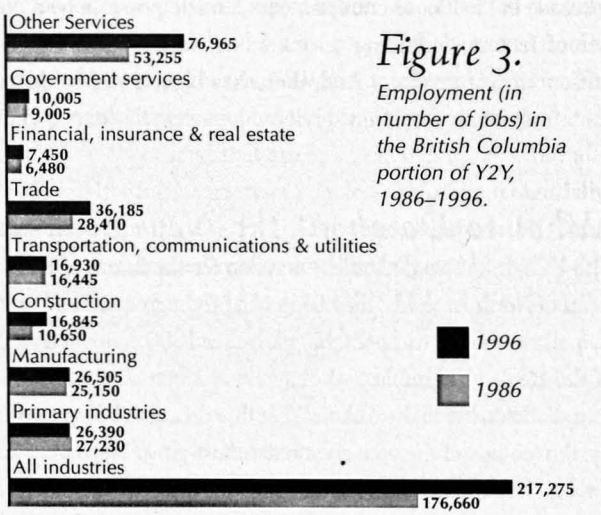


Figure 3.

Employment (in number of jobs) in the British Columbia portion of Y2Y, 1986–1996.

Source: Statistics Canada. 1986 and 1996 Census. Industry Canada, Ottawa, Ontario.

high-paying and information-intensive occupations such as engineering and architecture into the same category as hotel maids and social service workers. No wonder people are confused.

For those who would like to see the full details, examples, and discussion of the changing economy of the Y2Y area, and for a review of the literature related to issues such as economic base and the term *services*, we refer you to *The New Challenge*. Below is a brief synopsis of our major findings.

The Y2Y Economy in Brief

A few figures illustrate the dramatic change that has occurred in the region in the last few decades. For example, in the US portion of Y2Y over 97% of the growth in personal income in the last 25 years has been in industries other than mining, oil and gas development, and logging. The fastest growing sources of income are non-labor sources, such as retirement and investment income, and a mix of service and professional industries. To put this growth in perspective, in 1995 non-labor sources alone represented more than twenty times the personal income earned in farming and ranching, and more than eleven times the income earned in mining, oil and gas, lumber and wood products industries combined (Figure 1).

In the Canadian portion of Y2Y, the economy has also diversified away from a dependence on resource sectors. From 1986 to 1996, over 40,600 new jobs were created in the Alberta portion of Y2Y, while employment in the resource sectors declined by 840 jobs. If Calgary is taken out of the statistics, it is clear that the bulk of the growth (over 70%) is in industries other than resource extraction: from 1986 to 1996 the non-metropolitan portion of Alberta in the Y2Y region generated 19,145 new jobs, while the resource sectors added 1535.

Similarly, from 1986 to 1996 in the British Columbia portion of Y2Y the so-called primary industries (mining, oil and gas, and timber) lost 840 jobs, while the rest of the economy added 40,615 new jobs. At the same time unemployment rates dropped and average incomes rose (Figures 2 and 3).

These figures do not mean that resource extraction is unimportant. The current boom in oil and gas development once again reminds residents of northern Alberta and British Columbia of the prominence of resource development. Instead, the figures illustrate a simple yet compelling point: even when resource industries are in absolute decline, the rest of the economy continues to grow. No longer are resource industries the economy's only driving force.

A Good News/Bad News Story

The recent growth illustrates that there are options for rural development beyond agriculture, resource extraction, or even tourism. Communities that are attractive places to live can capitalize on the growth in services, "footloose" businesses, and

retirees. By protecting their picturesque setting they can attract migrants who open sophisticated businesses with high wages, the so-called knowledge-based industries such as pharmaceutical research, desktop publishing, engineering, architecture, management consulting, and software development. However, these figures indicating the emergence of an entirely different economy should not be interpreted as a battle between the "bad" industries (resource extraction) and the "good" industries (services, and growth attributed to retirement and investment income). In many ways, the new growth poses as difficult a challenge to functioning ecosystems in Y2Y as the traditional sectors.

In a recent article in *Conservation Biology,* Richard Knight summed up the challenge of this new growth succinctly: "While we have been preoccupied with struggles to protect public lands from never-ending assaults, an alarming trend has occurred, largely unnoticed, on the 'back forty': we are losing private lands to commercial and residential development at rates seldom equaled in history." As an example, he points out that in the US, from 1982 to 1992, over one million hectares of pasture land and nearly 400,000 hectares of wetlands were lost to development.[3]

Geographers and some economists have referred to the phenomenon of growth in mountain towns such as Jackson, Wyoming; Bozeman, Montana; Fernie, British Columbia; and Canmore, Alberta as "amenity-based" growth, where the amenities of an area—the streams, mountains, wildlife, and recreation opportunities—attract people who in turn create economic activity. This new form of development, where people migrate first and then find a job, is good in many ways because it helps diversify the local economy. It also helps the economy grow, and from this growth stems a vast array of new challenges, including urban sprawl, brought on not just by newcomers, but also by long-term residents who ride the wave of prosperity as a way to "upscale" to a dream home in the mountains.

In *The New Challenge,* we describe economic development as an additive process, where a new economy is piled on top of the traditional resource sectors, adding both opportunities and problems. It is a view that puts the role of resource industries such as mining, oil and gas development, and forestry in perspective. The nature of resource extraction means that sometimes large amounts of land must be disturbed to locate and extract the resource. In southeastern British Columbia, for example, mining companies displace between five and ten tons of earth to successfully extract one ton of coal. They level whole mountains, create huge rock dumps, divert stream courses, and pollute the atmosphere with coal dust in the quest to meet the world's demand for coal.[4] Yet residential subdivisions can have equally disastrous effects, cutting off migration routes for wildlife, contaminating ground water, introducing exotic species, and spreading noxious weeds.

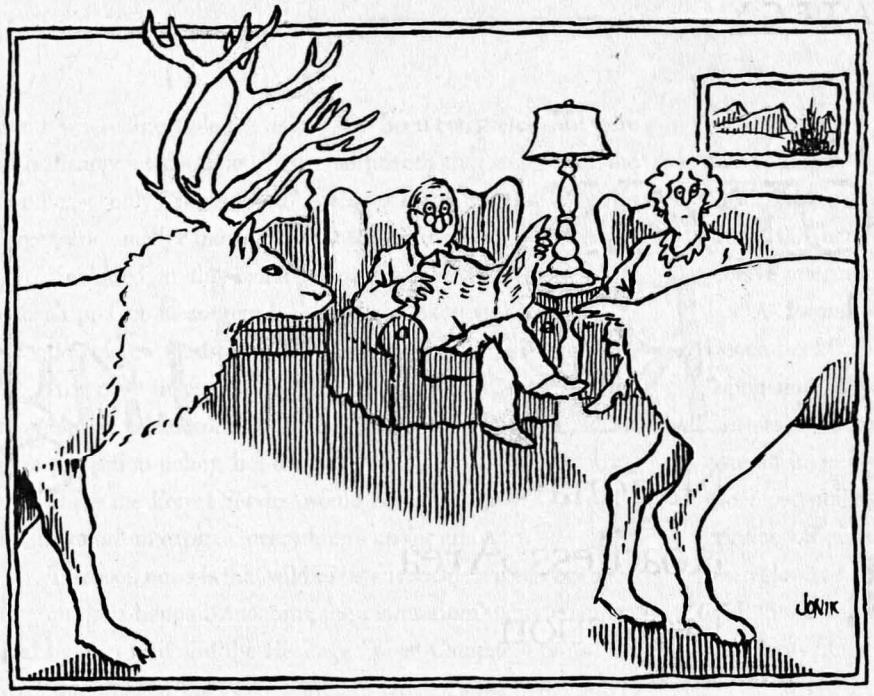
The central finding in *The New Challenge* is a simple point: even during times when resource industries are in decline (e.g., 1986–1991 in BC and Alberta and 1970–1995 in the US), the rest of the economy continues to grow at a robust pace. Clearly, the economic base has broadened. And, if some of the recent growth is stimulated by people's desire to live and do business in a picturesque mountain environment, then resource development at a scale and pace that destroys environmental amenities is simply bad for the economy, the community, and the quality of life of local residents. This is true whether the pressure comes from a mine that pollutes streams, logging that scars the landscape, the fragmentation of ranches to accommodate urban sprawl, or the expansion of highways to accommodate those who prefer to commute into towns from their ranchettes.

Of course, the presence of amenities is not the only reason for growth. Growth is caused by various factors, including an influx of urban refugees seeking a higher quality of life; a decline in out-migration; a rapid rise in non-labor income (driven in part by the growth of the stock market); an aging population, leading to an increase in retirement income; and increased property values in metropolitan areas, making housing comparatively more affordable in rural areas. There has also been an increase in "footloose entrepreneurs," made possible by a number of factors, including telecommunications technology and outsourcing of services. And, there has been a rise in demand for tourism and recreation services.

What to Do about the New Economy

The Y2Y initiative embodies "a vision for the future of the wild heart of North America, the vision of a bright green thread, uncut by political boundaries, stitching together 1800 contiguous miles of the Rocky, Columbia and Mackenzie Mountains, all the way from Yellowstone to the Yukon." For this dream to become a reality, the toolbox of the conservationist must grow. We should continue to use the old tools: to be vigilant and argue forcefully for the public's right to influence how public lands are managed. What is relatively new to the conservation community is the need to develop ways to integrate conservation efforts across the full complex of private and public lands, and to engage residents of the region in a way that builds ownership in the Y2Y vision.

3. Knight, R.L. 1999. Private Lands: The Neglected Geography. *Conservation Biology* 13(2):223–224.
4. Richard Callicut, Managing Editor, *The Elk Valley Miner*, interview by author, July 22, 1997.



Residential subdivisions can have disastrous effects, cutting off migration routes for wildlife, contaminating ground water, introducing exotic species, and spreading noxious weeds.

Perhaps the most fruitful place to start is to help communities control urban sprawl. A toolbox already exists, and it includes market-based techniques (e.g., the purchase of development rights), regulatory tools (e.g., zoning) and tax relief options (e.g., conservation easements or lower tax rates for those who keep land undeveloped). It also includes finding ways to help developers discover that they can earn higher profits by selling lots in subdivisions where natural areas are protected.

A number of communities within Y2Y are already having some success with these approaches. In Jefferson County, Montana, agricultural landowners proposed their own zoning district, which stipulates a 640-acre minimum lot size. The county commissioners adopted the zoning ordinance which now protects parcels of land that are large enough to farm and also provide habitat for a variety of species, including (potentially) grizzly bears. In the Big Hole watershed, southwest of Butte, Montana, ranchers and outfitters voluntarily established a dry-year water management plan on the Big Hole River to protect the Arctic grayling and they have drilled wells to water cattle away from river banks to allow recovery of riparian vegetation. This group is currently exploring a land-use plan that would prevent development along the river.

In the Crowsnest Pass area in Alberta, the Rocky Mountain Elk Foundation has purchased key parcels of elk winter range to protect them from development, and The Nature Conservancy of Canada is currently buying development rights on select parcels to maintain viable grizzly corridors. In British Columbia, the Agricultural Reserve Act protects significant private lands in the Rocky Mountain Trench from being developed for non-agricultural purposes, and the Trench Natural Resources Society, a diverse partnership of ranchers, wildlife groups, and management agencies, is reintroducing fire to the ecosystem to reverse forest encroachment and re-create grassland for cattle and wild ungulates.

These examples point to the emergence of collaborative solutions that are protecting natural resources. The irony, of course, is that the more we succeed in protecting habitat for wildlife, and scenic views and recreational opportunities for humans, the more attractive the region becomes to even more people. Which raises the question: how many people is too many? Even with the best planned growth, we can overwhelm an ecosystem. There are no easy answers, but one partial solution is to focus on reducing per capita consumption and regionalizing economies and governance structures so that the real costs—social and ecological—of growth must be reckoned with at the local level.

The fate of our wildlands and communities should not come down to a choice between resource extraction and amenity-driven growth. Our choice—our new challenge—will be about choosing the right pace and scale of all types of development. There is a role for mining … if done properly. There is a role for forestry and agriculture … if practiced with good stewardship. And there is room for more people … if we are willing to live in town, reduce our levels of consumption, and recognize the needs of other species. Finding this balance is a much bigger challenge, and in the end more gratifying than simply pitting one set of economic players against another. ☾

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illustration by John Jonik

Toward *Rewilding*

National Forest Roadless Area Protection

by Jim Jontz

AT THE OCTOBER 1998 WILDLANDS PROJECT Grassroots Rendezvous, my chance to toss a pitch to the heavy hitters came Sunday morning when conservation biologists Michael Soulé and Reed Noss spoke together on a panel about rewilding strategies. "What three current policy issues are most important to the rewilding of North America?" I asked the two. The answer from Reed, with Michael's concurrence: Roads, Roads, and Roads.

To be sure, there were other issues on their list: controlling invasive species and restoring natural fire regimes, Noss noted; economic globalization and recovery of large carnivores, Soulé added. But given the priority these two prominent scientists place on roads,* it is auspicious that some initiatives in the political pipeline right now could significantly improve National Forest roads and roadless areas policy by year's end—if we, as wildlands advocates, do our job to rally public support.

In February 1999, an 18-month moratorium on road construction in 33 million acres of National Forest roadless areas took effect, the result of a directive by US Forest Service Chief Michael Dombeck. The moratorium provides at least some level of protection for enormous chunks of National Forest wildlands, including nine million acres in Idaho and six million acres in Montana alone. (That these two states have such large acreages of federal public land that qualify for Wilderness designation yet remain unprotected reflects the anti-wilderness sentiment of their Congressional delegations during the last round of Wilderness designations.)

Although the moratorium was a large step forward in recognizing and respecting the value of wildlands, advocates were dismayed that the directive covered only slightly more than half of existing roadless areas, notably leaving out Alaska's Tongass National Forest, all of the Forests under the Northwest Forest Plan, and a number of other Forests primarily in the Rockies and the

* The negative ecological effects of roads are well established in the scientific literature. The Wildlands Center for Preventing Roads (PO Box 7516, Missoula, MT 59807; 406-543-9551; www.wildrockies.org/WildCPR) maintains a comprehensive bibliographic database of scientific papers on erosion, fragmentation, sedimentation, effects on wildlife, aquatic and hydrological effects, and other impacts of roads.

illustration by Gus diZerega

South where forest plan revisions had been completed. We were also disappointed (although not surprised) that except for the Southeast, only "inventoried" roadless areas of 5000 acres or larger, and smaller tracts adjacent to existing Wilderness Areas were included in the moratorium. Moreover, the moratorium doesn't protect areas from logging undertaken without the construction of new roads or abuse from off-road vehicles (ORVs).

And most discouraging: Chief Dombeck proposed that the moratorium would end upon the promulgation not of a roadless area protection policy, but a new *roads policy*—outlining when and where the Forest Service would build more roads. The day the moratorium expires, everything's up for grabs.

The good news is that wildlands advocates haven't been sitting on their hands bemoaning the moratorium's shortcomings. Led by Ken Rait and the Heritage Forest Campaign (an initiative supported by the Pew Charitable Trusts), a massive effort to extend longer-term protection to all roadless areas 1000 acres or greater by administrative rulemaking has been underway since even before the road-building hiatus was announced. Using a range of tactics including e-mail messages to Al Gore, endorsements from scientists and religious leaders, editorials in dozens of newspapers, town hall meetings in New Hampshire and other key locations, and a letter signed by 168 Members of the US House of Representatives, the campaign and its partners are ginning up strong public support for wildlands protection.

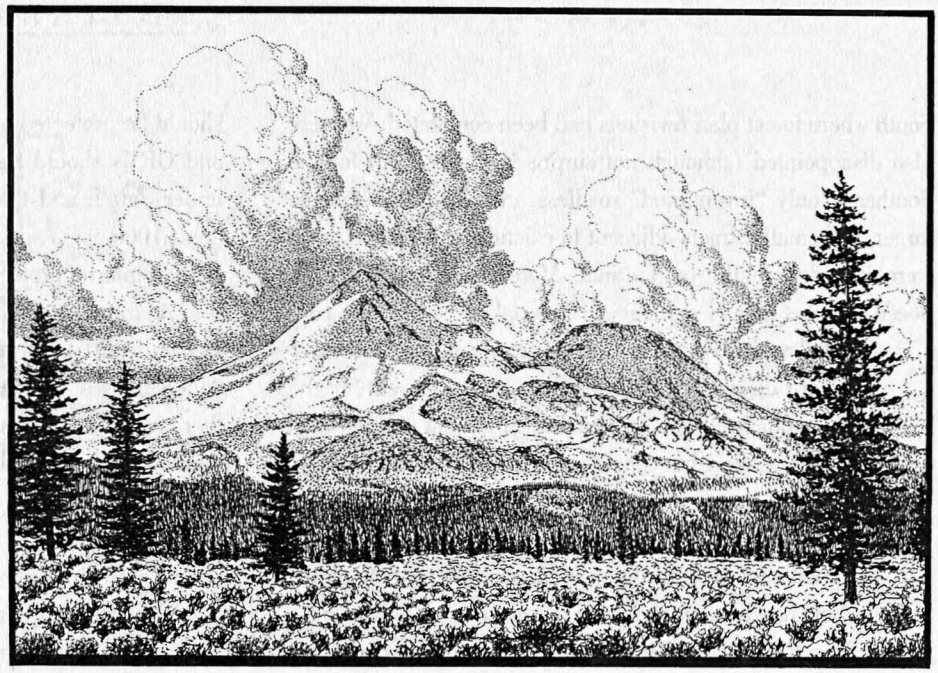
INDEED, THE EFFORT HAS (SO FAR) PRODUCED RESULTS. On October 13, 1999, President Clinton took a field trip to the George Washington National Forest in Virginia to announce that rulemaking would proceed on an initiative considering a range of options for protecting National Forest roadless areas. The weakest option would protect 40 million acres of inventoried roadless areas 5000 acres or larger from road-building, but would exclude the Tongass; the strongest would protect 60 million acres from logging and road-building, including the Tongass, and provide management direction to limit other destructive activities including grazing and ORV use.

This fight is far from over. Resolving a number of critical concerns has been left to a two-part public rulemaking process. If adopted, Part I of the new rule would immediately restrict certain activities in inventoried roadless areas including road construction and, perhaps, commercial logging conducted without road-building. Part II would establish national direction for managing inventoried roadless areas, and determine to what extent (if any) similar protections should be extended to uninventoried roadless areas. The position of the Heritage Forest Campaign is that all National Forests, including the Tongass, should be protected under Part I; that logging, grazing, mining, and ORVs should be prohibited in addition to road-building under Part I; and that all uninventoried and smaller roadless areas 1000 acres and larger or of ecological significance should receive interim protection until Part II is completed.

A formal comment period on the rulemaking ended December 20, following a series of regional public hearings and "open houses" conducted by the Forest Service. Of course, there is significant opposition from logging, mining, and development interests, and their friends in the Congress. But by far the most noise has come from angry ORV users. If Forest Service officials are surprised, it is only because they have been slow to notice escalating ORV use on the National Forests and the resulting damage that has increasingly concerned grassroots forest defenders.

Activists in Colorado have considered recreation to be the biggest threat to public lands in that state for several years. The situation is almost as bad in Montana and an increasing number of other states. ORVs are "wilderness killers" when user-created vehicle trails are recognized by the Forest Service as legitimate travelways, and potential Wilderness Areas become disqualified as a result. As their turnout at the roadless area policy public meetings demonstrates, ORV users will be vocal in opposing Wilderness designation for any public lands they are allowed to use.

Led by the Wildlands Center for Preventing Roads (Wildlands CPR) and The Wilderness Society, a coalition of over ninety organizations is seeking action from the Forest Service on ORVs through a formal petition for rulemaking filed December 9, 1999. This petition and the roadless area proposal provide excellent opportunities to educate Administration officials, Members of Congress, the media, and the public that the valuable National Forest roadless areas that we've struggled to defend from logging roads are also under assault from poorly regulated ORV use. In fact, there are two Executive Orders, largely unenforced, that already direct federal agencies to deter inappropriate ORV activity on public lands. The federal Council on Environmental Quality (CEQ)—usually the most sympathetic office to wildlands in the federal complex—has virtually abandoned its responsibility to oversee these Executive Orders and insure their proper implementation. Courageous local Forest Service managers occasionally take a stand, such as the White River National Forest plan revision proposing a "closed except when posted open" ORV policy. But it isn't clear what support there will be from higher ranking Administration and agency officials to address the threat of ORVs across the landscape.



WHAT ARE THE REASONS FOR THE crescendo of attention to National Forest roadless areas? I would argue that the current climate is the result of both a better understanding of the pertinent science and the success of citizen advocates in building new political support for wildlands protection.

The science comes from several diverse sources, including the 1993 Eastside Scientific Society Report recommending protection of roadless areas 1000 acres in size; the scientific work done for the Interior Columbia Basin Ecosystem Management Project (ICBEMP); and a letter signed by 169 scientists in 1997 recognizing that protecting roadless areas is critical "because they represent the least human-disturbed habitats in an almost universally disturbed landscape." Even President Clinton joined the chorus, with his comment (on the occasion of his disappointing decision to sign the FY 1998 Interior Appropriations bill) that "science, not politics" should govern roadless area management.

In fact, it is politics and science together that have produced this new respect for roadless areas. The "green scissors" coalition of environmental and taxpayer groups working to end destructive and costly subsidies lobbied Congress to cut timber road subsidies from 1996–1999. Efforts by former Reps. Joe Kennedy (D-MA) and Elizabeth Furse (D-OR), retiring Rep. John Porter (R-IL), and Sen. Richard Bryan (D-NV) resulted in several close votes on amendments to the Forest Service budget to cut logging road funds. Particularly alarming to the Forest Service and their friends in the Administration was an unanticipated 50-50 vote in the Senate in 1997 on Senator Bryan's amendment to cut money for building logging roads. "Food stamps for timber companies," Bryan called it. The initial commitment from the leadership of the Agriculture Department to bring about interim protection for roadless areas was offered during the heat of the Bryan amendment debate.

The defeat in 1998 of the "forest health" bill introduced by former Rep. Bob Smith (R-OR) and approval by the House of a competing proposal from Rep. Sherwood Boehlert (R-NY) to protect roadless areas demonstrated beyond question the strong, bipartisan support for roadless areas in the US Congress. This is no small accomplishment. Five years ago, hardly anyone in Congress knew what a roadless area was. Initially, the issue was articulated only in terms of the road-building subsidy, but over time Members of Congress, the media, and the public became aware of the value of the roadless areas themselves.

The job of administrative protection of roadless areas isn't yet done, but it's not too early to be talking about the next step: *Wilderness designation for all of the 60 million acres of unprotected National Forest wildlands*. The fact that 33 million acres of roadless areas are receiving interim protection right now is precisely the springboard that should be used in articulating the need to double or triple the size of the National Wilderness Preservation System over the next few years. Wildlands leaders in Congress, including members of the new Wilderness Caucus in the Senate established by Sen. Russ Feingold (D-WI), need to step to the plate and get some big Wilderness bills filed as vehicles to further educate their colleagues, the media, and the public about the need for permanent, legislative wildlands protection.

OF COURSE IN THE CURRENT CONGRESS, DON YOUNG (R-AK) isn't going to whip these bills through committee and rush them to the floor for early passage. But what better time than now, with the fate of millions of acres of roadless lands to be decided in a matter of months, to "set the marker" for the most complete, effective, and long-term protection of all roadless areas—Wilderness.

How is this argument best stated? Conservationists have made substantial progress in inserting roadless areas protection into the current political lexicon based almost entirely on the characteristics of individual roadless wildlands (lack of fragmentation, protection for watersheds, places of solitude). The current interest in roadless areas, however, should be translated into a broader understanding of the urgency of protecting large blocks of the landscape across North America with roadless areas at their core.

Mt. Shasta, California by Gus diZerega

Perhaps elected officials are not ready for this discussion of "rewilding" in its broadest sense. But, the issue can be cast in favorable terms by creating awareness that recovery for most of the great carnivores and other charismatic species that stir the public's imagination will require all roadless areas to be protected, and then some. The grizzly bear, wolf, lynx, jaguar, bull trout, and the salmonids will need a system of protected roadless areas no smaller, and probably much larger, than the 49% of the National Forests that are currently wild, either protected (18%) or unprotected (31%). (Yes, some of these imperiled species can survive outside of wilderness if humans do not persecute them, but they *are* persecuted and thus need big wilderness to avoid contact with humans.) Now is the time for conservation groups (national and grassroots) and their scientific allies to bring out the maps and explain what it will take for the griz and the bull trout to make a go of it in the new millennium. "You know those roadless areas we've been talking about?" our rap might begin. "Well, the reason we need to be protecting all of them, and more, is because the survival of these magnificent creatures requires it."

In addition to the roadless area rulemaking and the ORV petition mentioned above, there are several other important public policy opportunities in the works that give us the means to leverage the current visibility of roadless areas into a discussion about why protecting large blocks of wild habitat is necessary:

1) The "roads policy" that was originally intended to replace the roadless area moratorium will still move forward, determining how strong the direction is for removing portions of the 383,000 miles of "official" roads on the National Forest system. Recognizing that even the preservation of all current National Forest roadless areas would not fully protect native biodiversity, we must, through restoration, "create" new roadless areas.

2) The Forest Plan revision process, affecting 70% of the National Forests in the next three years, is required to include study of and recommendations for Wilderness protection. New rules being promulgated under the National Forest Management Act (NFMA) will determine guidelines for how Wilderness recommendations are made, and other important wildlands management provisions including species viability requirements.

3) Finally, there is that omnipresent threat and opportunity—the budget process—where we must head off any anti-roadless area riders, and convince the Congress that the roadless area moratorium is the perfect time to remove the subsidies for logging and road-building that drive a great deal of the destruction of roadless areas to begin with, and, instead, shift Forest Service spending to landscape restoration needs.

THERE IS A GREAT DEAL TO BE SAID FOR "PLACE-BASED" conservation advocacy. The fight over roadless areas will be won, in part, by pointing to Lamb Brook and Boulder Mountain and Deadman and other storytale places and saying, "Hey, here's what we are talking about." Still, the marketing of roadless area protection is fundamentally about selling an idea based on the insights of conservation biology. By definition, there is a lot that is special about a roadless area.

This would seem to be an unwise moment to slip back into old habits of deciding which roadless areas we ought to advocate for Wilderness protection, and which ones we should not. Such a discussion (we think this area will be harder to protect than that one, or someone will oppose it, and so forth) is driven by politics, not science. But now that we've framed the debate over roadless areas as one step toward protecting the wildlands networks that conservation biology suggests are necessary to maintain biodiversity, we ought to keep it there. "It's not just the value of this or that roadless area by itself," we must argue. "It's the *network* of roadless areas, and the broader landscape of *wildness,* that will make it possible for the lynx to survive."

Big Wilderness is a powerful vehicle to educate the public, media, and Members of Congress about why previous approaches to conservation aren't enough today. We understand so much more about the ecological and evolutionary value of Wilderness Areas than we did 35 years ago when the Wilderness Act became law. We have a much better knowledge of the type and extent of biological conservation that is required if we are to share this continent with the creatures that excite our imaginations.

That's not to say that we can't, or shouldn't, argue for Wilderness by talking about specific places and the solitude, beauty, and inspiration they offer to our bodies and souls. But we must also articulate our new understanding—equally inspiring—about what we must do to ensure that tomorrow's landscape will be shared with wolves and bears and bull trout and all things, great and small, that constitute life on this great, green planet. ☾

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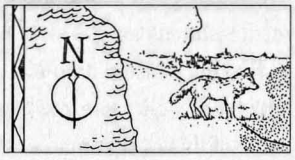

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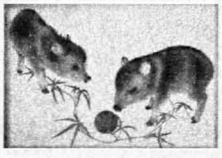

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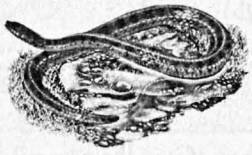

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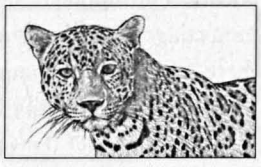

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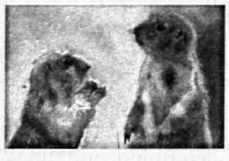

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Science, Religion, and the Natural World Conference Yale School of Forestry, The Wilderness Society, Yale Divinity School, The National Religious Partnership for the Environment, and Forum on Religion and Ecology will sponsor "The Good in Nature and Humanity: Connecting Science, Religion, and the Natural World," May 11–14 at Yale University, New Haven, CT. This gathering will examine the interplay of faith, reason, and the challenge of ethical resource use. Keynote by Wendell Berry. For information, contact www.yale.edu/natureandhumanity or call 203-432-5114; fax 203-432-3817.

Eastern Old Growth Conference This year's Eastern Old Growth Conference, entitled "Managing to Create the Ancient Forest," will be held May 18–20 at Sweet Briar College, Sweetbriar, VA. Contact Ted Harris, The 500 Year Forest Foundation, 804-384-2324.

Heartwood Meeting The Heartwood Forest Council, Dogwood Alliance, Appalachian Voices, and Wildlaw will co-host a gathering for forest activists from May 26–29 at Camp Blanton in southeastern Kentucky. For information call Heartwood at 812-337-8898; or Dogwood at 828-883-5889; lorax@citcom.net.

SCB Meeting The Annual Meeting of the Society for Conservation Biology will be held June 9–12, 2000 at the University of Montana, Missoula. Contact Fred Allendorf (darwin@selway.umt.edu) or Dan Pletscher (pletsch@forestry.umt.edu) or visit www.unt.edu/sch2000/ for information.

ESA Annual Meeting The Ecological Society of America's 2000 Annual Meeting will be held in Snowbird, Utah on August 6–10, 2000. The theme is "Advancing and Communicating Ecology"; over 3000 scientists are expected to attend. The program will include symposia, several scientific field trips and workshops, and a large exhibit hall featuring scientific texts and new publications, with a special focus on ecological technology. More detailed information about the agenda is available at: esa.sdsc.edu/snowbird2000.htm.

National Wilderness 2000 Conference "Wilderness 2000: The National Conference" will be held September 8–10, 2000 at the Hyatt Regency Hotel in Denver, Colorado. The conference seeks to give activists tools to set a wilderness agenda, invite non-traditional allies to participate in wilderness advocacy, and inject wilderness issues into public debate. Co-sponsored by the Sierra Club, The Wilderness Society, California Wilderness Coalition, Colorado Wilderness Network, and the Colorado Environmental Coalition. For more information, contact Sara Scott at wild2000@tws.org.

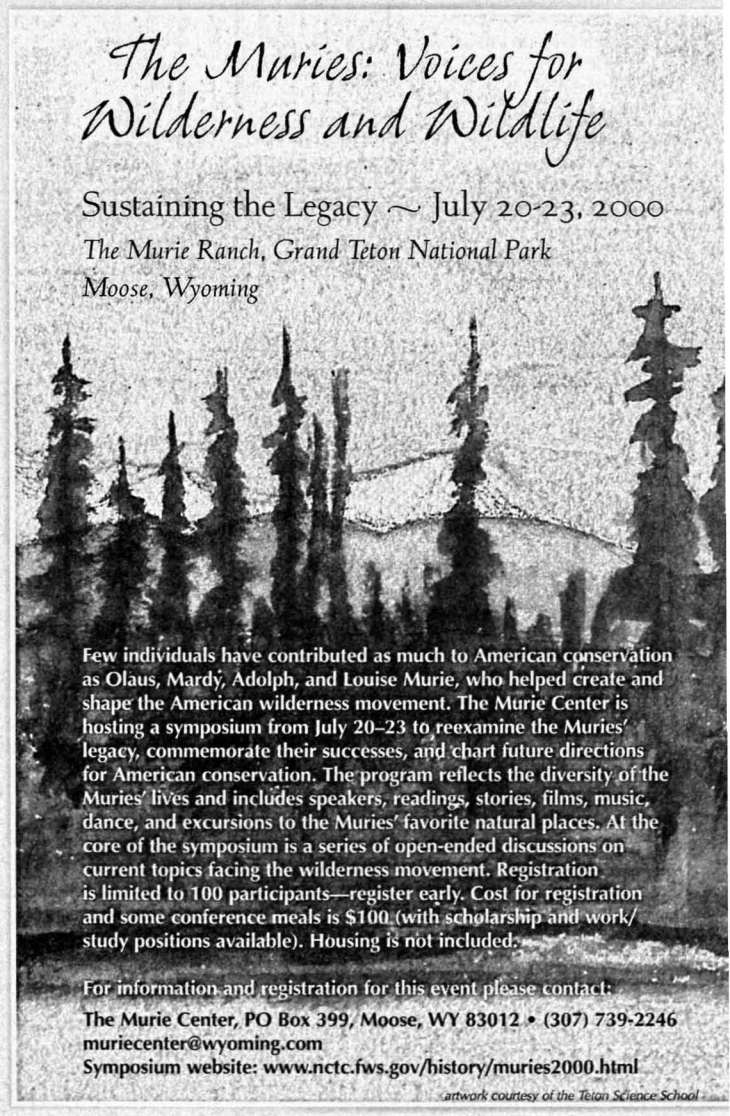
National Wolf Recovery Strategy Copies of a new 36-page report entitled "Places for Wolves: A Blueprint for Restoration and Long-Term Recovery in the Lower 48 States" are available from Defenders of Wildlife. The report outlines a national wolf strategy and also aims to influence an upcoming proposed rule on wolf classification under the Endangered Species Act expected this year. Mail a $6 check payable to Defenders of Wildlife to: Jessica Resnik, Defenders of Wildlife, 1101 14th St. NW, Suite 1400, Washington, DC 20005.

Ecological Effects of Roads A Special Section of the February 2000 issue of *Conservation Biology* includes eight articles focused on the ecological effects of roads. In addition to the information presented in this special section, Wildlands Center for Preventing Roads (PO Box 7516, Missoula, MT 59807; 406-543-9551; WildlandsCPR@wildrockies.org) maintains a 6000-citation bibliography on the ecological effects of roads that may be helpful to individuals working in this field. Copies of this issue of *Conservation Biology* can be obtained through: Blackwell Science, Inc., Commerce Place, 350 Main St., Malden, MA 02148-5018; 888-661-5800.

More on Roads A new report has been released by the Natural Resources Defense Council detailing the scientific basis for roadless area conservation. "End of the Road: The Adverse Ecological Impacts of Roads and Logging" is a compilation of much of the best available, independently peer-reviewed science. The report is available online at www.nrdc.org/nrdcpro/fppubl.html.

National Forest Logging Report The logging program on National Forests cannot be justified on economic grounds. This conclusion is documented in a report, "The Economic Case Against National Forest Logging," prepared by Forest Guardians and Forest Conservation Council. Copies are available from The National Forest Protection Alliance at 505-986-1163.

Executive Director Search Sky Island Alliance seeks an individual to shepherd the implementation of a bold wildlands reserve network in southern Arizona and New Mexico. The executive director will help craft multi-faceted conservation initiatives and represent the Alliance to other organizations, the public, and media. Fundraising and membership development will be major responsibilities. Send cover letter, resume, references, and two writing samples by May 1 to: David Hodges, Sky Island Alliance, PO Box 1891, Tucson, AZ 85702. For more information, contact David at (520) 326-4874 or hodges@goodnet.com.



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

BACK ISSUES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

23/Fall 1996 Religion and Biodiversity, Eastern Old Growth: Big Tree Update, Gary Nabhan on Pollinators and Predators, South African Biodiversity, Dave

Foreman praises Paul Shepard, NPS Prescribed Fires in the Post-Yellowstone Era, Alaska: the Wildlands Model, Mad Cows and Montanans, Humans as Cancer, Wildlands Recovery in Pennsylvania

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

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

26/Summer 1997 • (✖) Doug Peacock on the Yellowstone Bison Slaughter, Reed Noss on Endangered Major Ecosystems of the United States, Dave Foreman challenges abiologists, Hugh Iltis challenges abiologists, Virginia Abernethy explains How Population Growth Discourages Environmentally Sound Behavior. Gaian Ecology and Environmentalism, The Bottom Line on Option Nine, Eastern Old Growth Report, How Government Tax Subsidies Destroy Habitat, Geology in Reserve Design, part 2 of NPS Prescribed Fires in the Post-Yellowstone Era

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

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

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

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

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

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Jaguar

In 1922, as Aldo Leopold and his brother explored the meandering estuary at the mouth of the Colorado River in Sonora, Mexico, they examined tracks at every shallow ford, looking for signs of *el tigre:*

> *We saw neither hide nor hair of him, but his personality pervaded the wilderness; no living beast forgot his potential presence, for the price of unwariness was death. No deer rounded a bush, or stopped to nibble pods under a mesquite tree, without a premonitory sniff for* el tigre. *No campfire died without talk of him. No dog curled up for the night, save at his master's feet; he needed no telling that the king of cats still ruled the night; that those massive paws could fell an ox, those jaws shear off bones like a guillotine.*

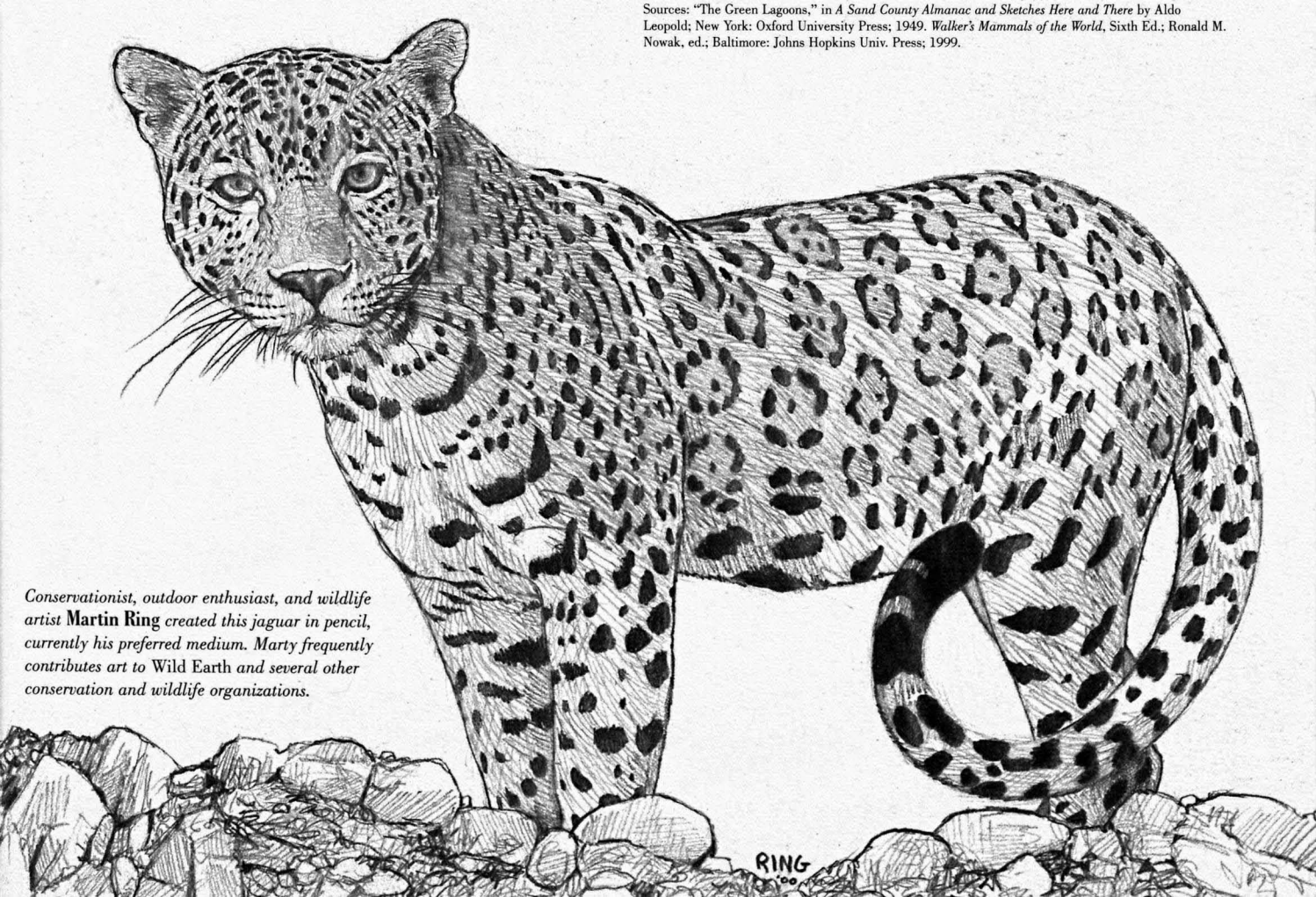
Once common in forests, woodlands, and savannahs across a broad swath of the Americas (and even into desert country at the northern extremity of its range), the jaguar is now greatly diminished in numbers and range due to habitat loss and fragmentation, and direct persecution by humans. The commercial fur trade and conflicts with livestock producers drove the killing.

The great cat has been eliminated from large parts of South and Central America. Perhaps only 500 individuals survive in all of Mexico and no breeding population is thought to have occurred in the US for at least half a century. The occasional jaguar sightings in New Mexico and Arizona are probably individual males dispersing from populations in Chihuahua and Sonora, Mexico.

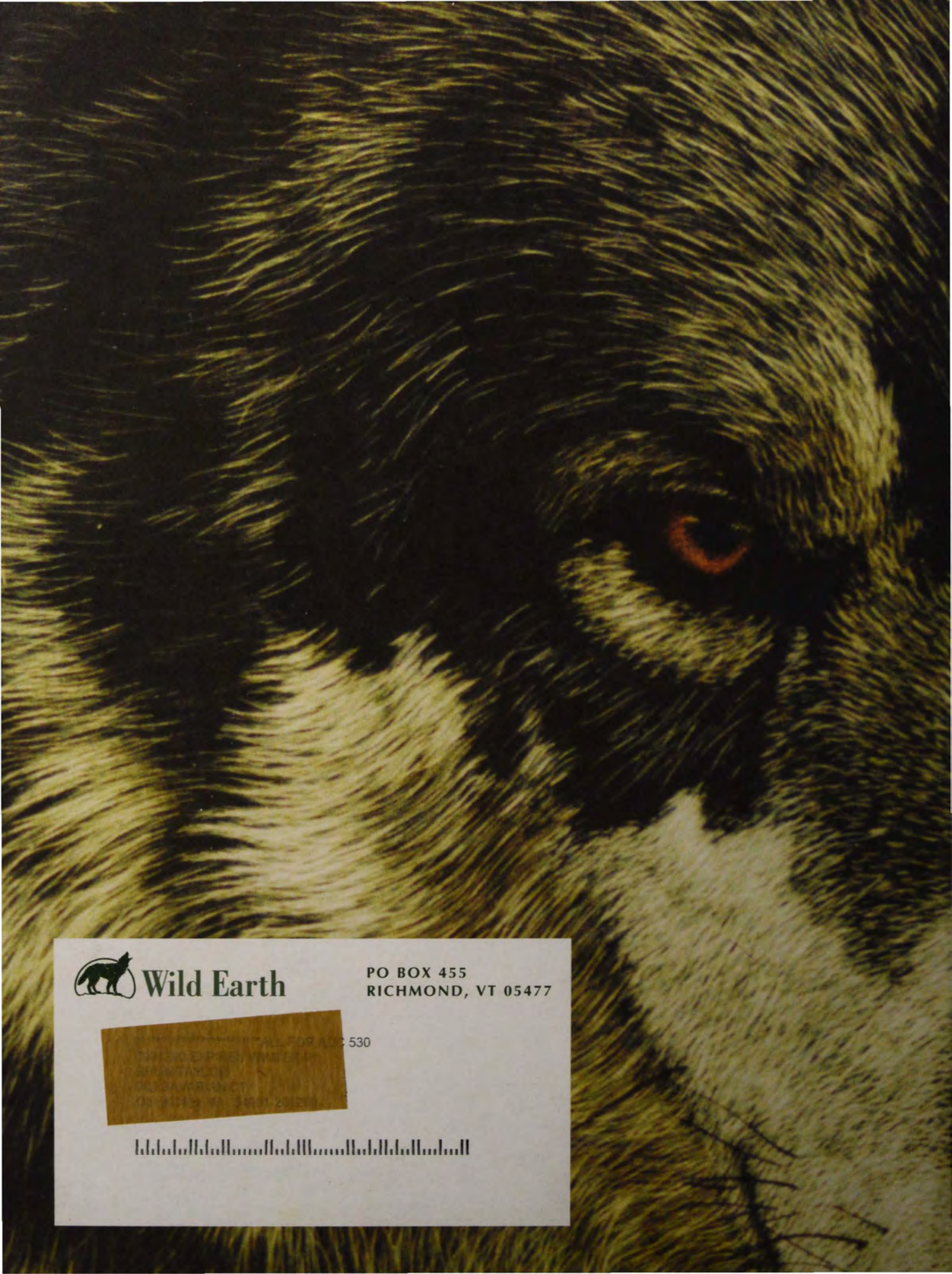
Ending wanton killing of jaguars—and protecting systems of conservation lands that provide secure habitat and maintain connectivity between populations—will be necessary for the king of cats to recolonize much of its former kingdom and resume its key role in maintaining ecosystem health. ☾

length, head and body: 44"–73"; *tail:* 18"–30" ■ *weight:* 79–348 lbs. (198–265 lbs. typical for males, 132–198 lbs. typical for females in Venezuela) ■ *appearance:* spotted; base color varies from pale to reddish yellow, to reddish brown, to nearly black for melanistic individuals (which are common) ■ *historic range:* Argentina to Arizona (in prehistoric times, until the end of the Pleistocene, jaguars ranged across much of what is now the southern United States)

Sources: "The Green Lagoons," in *A Sand County Almanac and Sketches Here and There* by Aldo Leopold; New York: Oxford University Press; 1949. *Walker's Mammals of the World*, Sixth Ed.; Ronald M. Nowak, ed.; Baltimore: Johns Hopkins Univ. Press; 1999.



Conservationist, outdoor enthusiast, and wildlife artist **Martin Ring** *created this jaguar in pencil, currently his preferred medium. Marty frequently contributes art to* Wild Earth *and several other conservation and wildlife organizations.*



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