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The Wildlands Project and the Rewilding of North America

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THE WILDLANDS PROJECT AND THE REWILDING OF NORTH AMERICA

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INTRODUCTION

Ecological concerns, including the preservation of habitat for rare and imperiled species and the protection of representative examples of all ecosystems, have always been at least minor goals in wilderness area and national park advocacy in the United States. At the Sierra Club Biennial Wilderness Conferences from 1949 to 1973, scientists and others presented ecological arguments for wilderness preservation and discussed the scientific values of wilderness areas and national parks. In the 1920s and 1930s, the Ecological Society of America and the American Society of Mammalogists developed proposals for ecological reserves on the public lands. The eminent ecologist Victor Shelford was an early proponent of protected wildlands big enough to sustain populations of large carnivores.[1]

Some of this country's greatest conservationists have been scientists, too. One of the many hats John Muir wore was that of a scientist. Aldo Leopold was a pioneer in ecology and wildlife management and argued for wilderness areas as ecological baselines.[2] Bob Marshall had a Ph.D. in plant physiology and explored the unmapped Brooks Range in Alaska not just for adventure, but also to study tree growth in that extreme climate. Olaus Murie, long-time President of The Wilderness Society, was an early wildlife ecologist and one of the first to defend the wolf.

Aesthetic, recreational, and utilitarian (e.g., watershed protection) arguments have traditionally dominated advocacy for national parks and wilderness areas and these values have had more influence on what areas were protected than have ecological arguments. In the last decade, however, ecological arguments have risen to the top of the conservation

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* Chairman of the Wildlands Project, publisher of *Wild Earth*, and a director of the New Mexico Wilderness Alliance. Portions of this article have appeared in a different form in *Wilderness: From Scenery to Nature*, WILD EARTH, Winter 1995–96, at 8; *Missing Links*, SIERRA, Sept./Oct. 1995, at 52. A different version of this article will appear in *The War on Nature*, a book in progress by Dave Foreman. Thanks to Michael Soulé and Steve Gatewood for their suggestions.

1. Michael Soulé & Reed Noss, *Rewilding and Biodiversity As Complementary Goals for Continental Conservation*, WILD EARTH, Fall 1998, at 19, 20–21.

2. The section entitled "Wilderness" in Leopold's *A Sand County Almanac* is stunning for the extent to which it anticipated much of modern conservation biology. ALDO LEOPOLD, A SAND COUNTY ALMANAC AND SKETCHES HERE AND THERE 188–201 (1949).

movement. Scientists, particularly from the new discipline of conservation biology, have become more prominent in conservation groups. This is most true in the Nature Conservancy, Wildlife Conservation Society, and World Wildlife Fund, but other groups, like the Sierra Club and The Wilderness Society, in their current campaigns to protect endangered species, wetlands, and ancient forests, have emphasized ecological values. Hard-hitting groups like the Biodiversity Legal Protection Fund, Southwest Center for Biodiversity, and Forest Guardians have filed science- based lawsuits and appeals to protect species and ecosystems alike.

I. THE RISE OF CONSERVATION BIOLOGY

Since 1991, the Wildlands Project has brought together citizen conservationists and conservation biologists to formulate a new idea of conservation and to apply science to the design and management of protected areas. This ecological renaissance in conservation has come about because of new research and theory in several branches of biology. Looking back over our shoulders, we see that five interrelated lines of scientific inquiry have led to the sort of wilderness networks now being proposed by the Wildlands Project and other conservation groups. These are extinction dynamics, island biogeography, metapopulation theory, large carnivore ecology, and natural disturbance ecology.

Ecological values began to come to the fore when we became aware of the shrill fury of the extinction crisis. The most important—and gloomy—scientific discovery of the twentieth century was made only twenty years ago. During the 1960s and 1970s, field biologists had grown more and more disturbed by population declines in a myriad of species and by loss of ecosystems of all kinds around the world. Tropical rainforests were falling to saw and torch. Coral reefs were dying from God knows what. Ocean fish stocks were crashing. Elephants, rhinos, gorillas, tigers, and other charismatic megafauna were being slaughtered. Frogs were vanishing. These staggering losses were in oceans and on the highest peaks, in deserts and in rivers, and in tropical rainforests and Arctic tundra alike.

A few scientists, including geneticist Michael Soulé (later founder of the Society for Conservation Biology) and Harvard's famed E.O. Wilson, put these worrisome anecdotes and bits of data together. They knew, through paleontological research by others, that in the 570 million years or so of the evolution of modern animal phyla there had been five great extinction events—the hard punctuations in the equilibrium.[3] Wilson and company calculated that the current rate of extinction was one thousand to ten thousand times the background rate of extinction in the fossil rec-

3. The last event happened 65 million years ago, at the end of the Cretaceous period when dinosaurs became extinct.

ord.[4] That discovery hit with all the subtlety of an asteroid striking Earth: RIGHT NOW, TODAY, LIFE FACES THE SIXTH GREAT EXTINCTION EVENT IN EARTH HISTORY. The cause is just as unsettling: eating, manufacturing, traveling, warring, and breeding by six billion human beings.

The crisis we face is biological meltdown.[5] Soulé has said that the only large mammals that will be left after the turn of the century will be those we consciously choose to protect.[6] He wrote, "The end of speciation for most large animals rivals the extinction crisis in significance for the future of living nature. As [Bruce Wilcox and I] said in 1980, 'Death is one thing, an end to birth is something else.'"[7]

Knowledge that we were living in, *and causing*, the greatest mass extinction since the end of the dinosaurs scared the daylights out of both biologists and conservationists. Biology could no longer be removed from activism if scientists wished their research subjects to survive. Conservation could no longer be about protecting outdoor museums and art galleries, and setting aside backpacking parks and open-air zoos. Biologists and conservationists all began to understand that species could not be brought back from the brink of extinction one by one. Nature reserves had to protect entire ecosystems to guard the flow and dance of evolution.

A new branch of applied biology was launched. "Conservation biology," Soulé declared in 1985, "differs from most other biological sciences in one important way: it is often a crisis discipline. Its relation to biology, particularly ecology, is analogous to that of surgery to physiology and war to political science."[8]

Conservation biologists immediately turned their attention to nature reserves, "the most valuable weapon in our conservation arsenal," according to Soulé and Bruce Wilcox in 1980.[9] A key question was: Why had national parks, wilderness areas, and other reserves not prevented the extinction crisis? And, flowing from that question was the issue of how

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4. *See* EDWARD O. WILSON, THE DIVERSITY OF LIFE 280 (1992).

5. Wilson warns that the number of species driven to extinction "might easily reach 20 percent by 2022 and rise as high as 50 percent or more thereafter." *Id.* at 278. Some nonscientists, particularly those who stand to make a buck off of exploitation of the land, and neoclassical resource economists pooh-pooh this extinction crisis. University of Tennessee ecologist Stuart Pimm has taken the lead in quantifying the magnitude of the extinction crisis. *See* Stuart L. Pimm et al., *The Future of Biodiversity*, 269 SCIENCE 347, 348–49 (1995).

6. "This century will see the end of significant evolution of large plants and terrestrial vertebrates in the tropics." Michael E. Soulé, *Thresholds for Survival: Criteria for Maintenance of Fitness and Evolutionary Potential*, *in* CONSERVATION BIOLOGY: AN EVOLUTIONARY-ECOLOGICAL PERSPECTIVE 151, 168 (Michael E. Soulé & Bruce A. Wilcox eds., 1980).

7. Michael E. Soulé & Bruce A. Wilcox, *Conservation Biology: Its Scope and Its Challenge*, *in* CONSERVATION BIOLOGY: AN EVOLUTIONARY-ECOLOGICAL PERSPECTIVE, *supra* note 6, at 1, 8.

8. Michael Soulé, *What Is Conservation Biology? A New Synthetic Discipline Addresses the Dynamics and Problems of Perturbed Species, Communities, and Ecosystems*, 35 BIOSCIENCE 727, 727 (1985).

9. Soulé & Wilcox, *supra* note 7, at 4.

reserves could be better designed and managed in the future to protect biological diversity.

Conservation biologists first drew on a young, vigorous field of population biology called *island biogeography* for insights. In the 1960s, E.O. Wilson and Robert MacArthur studied colonization and extinction rates in oceanic islands like the Hawaiian chain. They hoped to devise a mathematical formula for the number of species that an island can hold, based on factors such as the island's size and its distance from the mainland.[10]

Soon after MacArthur and Wilson developed their theory of island biogeography, Jared Diamond, John Terborgh, and Michael Soulé applied island biogeography to *land-bridge* islands.[11] Oceanic islands are different from land-bridge islands in that they have never been connected to the continents. Hawaii, for example, is a group of volcanic peaks rising from the sea floor to above the waves. Any plants or animals had to get there from somewhere else—by flying, blowing, or floating across several thousand miles of open ocean.

But land-bridge (or continental) islands, like Taiwan, Vancouver, or Ireland, were once parts of nearby continents. When the glaciers melted 18,000 to 10,000 years ago and the sea level rose some four hundred feet, these high spots were cut off from the rest of the continents and became islands. Over the years, land-bridge islands invariably lose species of plants and animals that remain on their parent continents, a process called *relaxation.* Island biogeographers developed mathematical formulas for the rate of species loss and for future colonization, and to determine whether equilibrium would someday be reached.

Certain generalities jumped out at the researchers. The first species to vanish from land-bridge islands were the big guys: tigers, rhinos, bears, and moose. The larger the island, the slower the rate at which species disappear. The farther an island is from the mainland, the more species it loses; the closer, the fewer. An isolated island loses more species than one in an archipelago.

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10. *See* ROBERT MACARTHUR & EDWARD WILSON, THE THEORY OF ISLAND BIOGEOGRAPHY 5–7 (1967). David Quammen's outstanding book, *The Song of the Dodo*, looks at island biogeography and extinction in exhaustive, but fascinating, detail. *See* DAVID QUAMMEN, THE SONG OF THE DODO: ISLAND BIOGEOGRAPHY IN AN AGE OF EXTINCTIONS (1996).

11. *See* John Terborgh, *Preservation of Natural Diversity: The Problem of Extinction Prone Species*, 24 BIOSCIENCE 715, 715 (1974); *see also* Jared Diamond, *The Island Dilemma: Lessons of Modern Biogeographic Studies for the Design of Natural Reserves*, 7 BIOLOGICAL CONSERVATION 129, 144 (1975). *See generally* Michael Soulé & Allan J. Sloan, *Biogeography and Distribution of the Reptiles and Amphibians on Islands in the Gulf of California, Mexico, in* TRANSACTIONS OF SAN DIEGO SOC'Y OF NAT. HIST. 139, 154 (1966) (discussing and illustrating "the relationship of the number of terrestrial vertebrates to the size of the island, and to the distance from the probable source of immigrants").

Closely tied to island biogeography is the *species-area relationship.*[12] The species-area relationship has been shown with birds, mammals, reptiles, and other kinds of animals on the Greater Sunda Islands (the Indonesian archipelago), Caribbean islands, and elsewhere. In 1979, Michael Soulé and his students Bruce Wilcox and Claire Holtby used the species-area relationship to predict the loss of large mammals in East African reserves.[13] An ecological rule of thumb is that if the area of a habitat is reduced by ninety percent, it will lose fifty percent of its species.[14]

Usable habitat also can be reduced by fragmentation of forest ecosystems. Ornithologists have become increasingly alarmed by the role of forest fragmentation in the decline of songbirds. For years, it has been known that warblers, flycatchers, vireos, thrushes, and other songbirds have been declining in the more fragmented parts of the central and eastern United States and Canada. These *neotropical migrants* winter in Central America and Mexico, but fly north in the spring to take advantage of the long days and abundant insects to breed and raise young (yes, mosquitoes and no-see-ums are good for something—actually for many things). The decline of neotropical migrants was first blamed on destruction of their winter habitat in the tropics. Careful research later showed that a larger piece of the puzzle was fragmentation of their forest habitat in North America. Many of the neotropical migrants need interior forests for habitat. This interior forest is especially important for nesting because it protects against nest parasitism.

The brown-headed cowbird is one of those animals that is hard to love. Formerly a denizen of the plains and prairies where it followed herds of bison and elk to scoop up insects in their wake, it spread east with the clearing of the Great Eastern Forest and with the growing number of cattle in settlements. The cowbird is a nest parasite—it lays its eggs in the nests of other birds and leaves them to be hatched and raised by the unknowing builders of the nest. Cowbird chicks generally hatch sooner than do warblers, vireos, and other songbirds. The young cowbird often pushes the

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12. "One of the principles of modern ecology is that the number of species that an area can support is directly proportional to its size. A corollary is that if area is reduced, the number of species shrinks." Michael E. Soulé, *An Unflinching Vision: Networks of People Defending Networks of Land*, *in* NATURE CONSERVATION 4: THE ROLE OF NETWORKS 1, 2 (Denis A. Saunders et al. eds., 1995).

13. *See* Michael Soulé et al., *Benign Neglect: A Model of Faunal Collapse in the Game Reserves of East Africa*, 15 BIOLOGICAL CONSERVATION 259, 261 (1979). The predictions of Soulé, Wilcox, and Holtby have recently been confirmed by William Newmark. *See* William Newmark, *Insularization of Tanzanian Parks and the Local Extinction of Large Mammals*, 10 CONSERVATION BIOLOGY 1549, 1552 (1996).

14. A thorough discussion of island biogeography and species-area relationship as it applies to conservation was done by Bruce Wilcox in 1980. *See* Bruce A. Wilcox, *Insular Ecology and Conservation*, *in* CONSERVATION BIOLOGY: AN EVOLUTIONARY-ECOLOGICAL PERSPECTIVE, *supra* note 6, at 95, 96–99, 113.

other eggs out of the nest and the poor little warbler parents work themselves to a frazzle feeding the big, ugly, demanding cowbird chick.

Songbirds need interior forest habitat for nesting because brown-headed cowbirds will usually penetrate only a few hundred yards into a forest.[15] But, when road corridors, power line rights of way, clearcuts, housing developments, and the like break up a forest, the interior forest habitat is greatly reduced or disappears, allowing songbirds no refuge from cowbird brood parasitism.[16]

In 1985, as Soulé, William Conway, Peter Brussard, Katherine Ralls, David Ehrenfeld, Jared Diamond, and other top biologists were forming the Society for Conservation Biology, University of Michigan ecologist William Newmark looked at a map of the western United States and realized that our national parks were islands.[17] As the sea of settlement and logging had swept over North America, national parks had become islands of ecological integrity surrounded by human-dominated lands. Newmark set out to answer the question of whether island biogeography applied to these areas.

Newmark found that the smaller the national park and the more isolated it was from other wildlands, the more species it had lost. The first species to go had been the large, wide-ranging critters, such as lynx and wolverine. Relaxation had occurred, *and was still occurring.* Newmark predicted that all national parks would continue to lose species, as Soulé had previously predicted for East African reserves.[18] Even Yellowstone National Park is not big enough to maintain viable populations of all the large wide-ranging mammals. Only the total area of the connected complex of national parks in the Canadian Rockies is substantial enough to ensure their survival.

While Newmark was applying island biogeography to national parks, Reed Noss and Larry Harris at the University of Florida were using the *metapopulation*[19] concept to design reserves for the Florida pan-

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15. *See* David Wilcove et al., *Habitat Fragmentation in the Temperate Zone, in* CONSERVATION BIOLOGY: AN EVOLUTIONARY-ECOLOGICAL PERSPECTIVE, *supra* note 6, at 237, 249–50.

16. *See id.*

17. *See* William D. Newmark, *Legal and Biotic Boundaries of Western North American National Parks: A Problem of Congruence*, 33 BIOLOGICAL CONSERVATION 197 (1985); *see also* William Newmark, *A Land-Bridge Island Perspective on Mammalian Extinctions in Western North American Parks*, 325 NATURE 430 (1987) [hereinafter Newmark, *A Land Bridge Island Perspective*].

18. "Without active intervention by park managers, it is quite likely that a loss of mammalian species will continue as western North American national parks become increasingly insularized." Newmark, *A Land Bridge Island Perspective*, *supra* note 17, at 432.

19. Metapopulations are analogous to a region of semi-isolated human villages.

ther, an endangered subspecies, and the Florida black bear, a threatened subspecies.[20]

A small isolated population of bears or panthers faces all sorts of genetic weirdness—inbreeding depression causes a chronic loss of fitness, genetic drift causes progressive loss of genetic variation, and, as a result of these two effects, natural selection becomes less effective.[21] Also, a small population is more vulnerable than a large one to local extinction (*winking out* in ecological jargon). If the animals are isolated, their habitat cannot be recolonized by members of the species from another population. But if habitats are connected so that animals can move between them—even as little as one horny adolescent male every ten years—then, inbreeding is usually avoided, and a habitat whose population winks out can be recolonized by dispersers from a nearby population.

Bruce Wilcox and Dennis Murphy wrote in 1985 that "habitat fragmentation is the most serious threat to biological diversity and is the primary cause of the present extinction crisis."[22] Noss acted on their warning by designing a conceptual nature reserve system for Florida consisting of core reserves surrounded by buffer zones and linked by habitat corridors. In a paper presented to the 1986 Natural Areas Conference, Noss said, "The problems of habitat isolation that arise from fragmentation can be mitigated by connecting natural areas by corridors or zones of suitable habitat."[23] In other words, the problem of island-like nature reserves can be mitigated by protecting and restoring connective habitat in a fragmented landscape.[24]

Florida is the fastest growing state in the nation. When the Noss proposal, calling for sixty percent of Florida to be protected in such a nature reserve network, was first published in 1985, it was considered, well, impractical. But, over the last decade this visionary application of conservation biology has been refined by the State of Florida. Now, state agencies and the Nature Conservancy are using the refinement to set priorities for land acquisition and protection of key areas.

In 1994, the Florida Game and Fresh Water Fish Commission published a 239 page document, *Closing the Gaps in Florida's Wildlife Habitat Conservation System*.[25] Using GIS computer mapping technol-

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20. *See* Reed F. Noss, Landscape Considerations in Reintroducing and Maintaining the Florida Panther: Design of Appropriate Preserve Networks (1985) (unpublished report submitted to the Florida Panther Technical Advisory Council).

21. *See* Soulé, *supra* note 8, at 727, 730.

22. Bruce Wilcox & Dennis Murphy, *Conservation Strategy: The Effects of Fragmentation on Extinction*, 125 AMERICAN NATURALIST 879, 884 (1985).

23. Reed Noss, *Protecting Natural Areas in Fragmented Landscapes*, 7 NAT. AREAS J. 1, 5 (1987).

24. I give a slide show on island biogeography and reserve design a couple of dozen times a year. The most common response I get is, "Why did it take so long to figure out something that obvious?"

25. JAMES COX ET AL., FLORIDA GAME AND FRESH WATER FISH COMM'N, CLOSING THE

ogy, *Closing the Gaps* identified biodiversity hot spots for Florida.[26] The study looked in detail at range occurrences and habitat needs for thirty sensitive species ranging from the Florida panther to the pine barrens treefrog, and at twenty-five thousand known locations of rare plants, animals, and natural communities.[27] Existing conservation lands in Florida cover 6.95 million acres.[28] The hot spots, called strategic habitat conservation areas, encompass another 4.82 million acres.[29] Florida is working with private landowners to protect identified areas and has appropriated $3.2 billion to purchase strategic habitat conservation areas and other conservation lands by the year 2000. Once a new Ph.D.'s pie in the sky, a conservation biology-based reserve system is now the master plan for land protection in Florida.[30]

While metapopulation dynamics and island biogeography theory were being applied to nature reserve design, biologists were beginning to recognize the value of large carnivores to their ecosystems. Previously, scientists tended to see wolves and jaguars as relatively unimportant species perched on top of the food chain (though Aldo Leopold, prescient as ever, recognized their keystone role in the 1940s[31]). These large carnivores really did not have that much influence on the overall functioning of the natural system, biologists thought. Until the 1930s, in fact, the National Park Service used guns, traps, and poison to exterminate gray wolves and mountain lions from Yellowstone and other parks (they succeeded with the wolf).

Today, biologists know that lions, bears, and wolves are ecologically essential, in addition to being important for a spicy taste of wildness in the landscape. For example, the eastern United States is overrun with white-tailed deer. Their predation on trees is preventing forest regeneration and altering species composition according to University of Wisconsin botanists Don Waller, Steve Solheim, and William Alverson.[32] If allowed to return, wolves and mountain lions would scatter deer from their concentrated wintering yards and reduce their numbers, thereby allowing the forest to return to more natural patterns of succession and species composition.

GAPS IN FLORIDA'S WILDLIFE HABITAT CONSERVATION SYSTEM: RECOMMENDATIONS TO MEET MINIMUM CONSERVATION GOALS FOR DECLINING WILDLIFE SPECIES AND RARE PLANT AND ANIMAL COMMUNITIES 1 (1994).

26. *See id.*

27. *See id.*

28. *See id.*

29. *Id.*

30. The Nature Conservancy's lead person on this was Steve Gatewood, now the executive director of the Wildlands Project.

31. *See* LEOPOLD, *supra* note 2, at 132.

32. *See* WILLIAM S. ALVERSON ET AL., WILD FORESTS: CONSERVATION BIOLOGY AND PUBLIC POLICY 30 (1994).

With the extermination of wolves and the near extermination of mountain lions sixty years ago in Yellowstone, elk populations increased. Freed of their predators, elk grew lazy and lackadaisical, loafing in large herds in river meadows. Their behavior had changed so much, it was hard to call them elk. Not only have they overgrazed the grasslands, their browsing of willow shoots has hampered beavers from becoming reestablished in Yellowstone. But, with the recent reintroduction of wolves to Yellowstone, elk have become elk again. They're awake! They're moving. They're looking over their shoulders. They aren't loafing in large groups in open river valleys. Wolves have changed their behavior for the better and are bringing integrity back to the ecosystem.

Michael Soulé and his colleagues have shown that native songbirds survive in large suburban San Diego canyons where there are coyotes; they disappear faster when coyotes disappear. Coyotes eat foxes and prowling house cats. Foxes and cats eat quail, cactus wrens, thrashers, and their nestlings.[33]

In the eastern United States, David Wilcove, staff ecologist for the Environmental Defense Fund, has found that songbirds are victims of the extirpation of wolves and cougars. As we have seen, the population decline of songbirds as a result of forest fragmentation is well documented, but Wilcove has shown that songbird declines are partly due to the absence of large carnivores in the East. Cougars and gray wolves do not eat warblers or their eggs, but raccoons, foxes, skunks, and possums do, and the 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.[34] Soulé calls this phenomenon "*mesopredator release.*"[35]

In addition to being critical players in various eat-or-be-eaten schemes, large carnivores are valuable as *umbrella species.* Simply put, if enough habitat is protected to maintain viable populations of top predators, like wolves or harpy eagles, then most of the other species in the region will also be protected. Those which are not, such as rare plants with very restricted habitats, can usually be protected with vest-pocket preserves of the old Nature Conservancy variety.

A final piece in conservation biology's big-picture puzzle is the importance of natural disturbances. Caribbean forests are adapted to periodic hurricanes. Many plant communities in North America evolved with wildfire. Floods are crucial to new trees sprouting in riparian for-

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33. *See* Michael E. Soulé et al., *Reconstructed Dynamics of Rapid Extinctions of Chaparral-Requiring Birds in Urban Habitat Islands*, 2 CONSERVATION BIOLOGY 75, 75–92 (reporting the results of a statistical analysis conducted to determine the distribution of native, chaparral-requiring birds in urban San Diego County and concluding that coyotes control the populations of smaller predators there).

34. *See* Wilcove et al., *supra* note 15, at 237.

35. Soulé et al., *supra* note 33, at 83–84.

ests. Such disturbances help maintain the natural mosaic of landscapes and natural vegetation types. If a wildland is too small, a disturbance can effect or perturb all of it, thus eliminating a habitat type for a long time. To be viable, habitats must be large enough to absorb major natural disturbances (types of *stochastic events* in ecologist lingo). As early as 1978, ecologists Pickett and Thompson argued that nature reserves needed to be big enough for natural disturbance regimes. They termed this a "*minimum dynamic area.*"[36] When Yellowstone burned in 1988, there was a great hue and cry over the imagined destruction, but ecologists tell us that the fire was natural and beneficial. Because Yellowstone National Park covers two million acres and is surrounded by several million acres more of national forest wilderness areas, the extensive fires affected only a portion of the total reserve area.

Things did not turn out so well when the Nature Conservancy's Cathedral Pines Preserve in Connecticut was hammered by tornadoes in 1989. In this tiny patch of remnant old-growth white pine forest (some trees were 150 feet tall), seventy percent of the trees were knocked flat, devastating the entire forest patch. Had the tornadoes ripped through an old-growth forest of hundreds of thousands of acres, they instead would have played a positive role by opening up small sections to new forest growth.

What we learn from all this science is: Nature reserves must be big and connected.

II. THE WILDLANDS PROJECT AND REWILDING

These five areas of recent ecological research—extinction dynamics, island biogeography, metapopulation theory, large carnivore ecology, and natural disturbance dynamics—are the foundation for the Wildlands Project and for all science-based nature reserve design. For a conservation strategy to succeed, it must have clearly defined goals. These goals should be scientifically justifiable. Reed Noss suggested four basic goals for an honest conservation strategy in 1992:

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, including predation.

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36. S.T.A. Pickett & John N. Thompson, *Patch Dynamics and the Design of Nature Reserves*, 13 BIOLOGICAL CONSERVATION 27, 27 (1978).

4) Design and manage the system to be responsive to short-term and long-term environmental change and to maintain the evolutionary potential of lineages.[37]

From the perspective of these goals, we can look closely at existing wilderness areas and national parks and ask, "Why has the world's greatest nature reserve system failed to prevent biological meltdown in the United States?"

As we have seen, wilderness areas and national parks are generally islands of wild habitat in a sea of human-altered landscapes. By fragmenting wildlife habitat, we imperil species from grizzlies to ovenbirds who need large, intact ecosystems. Because they have been chosen largely for their scenic and recreational values, and to minimize resource conflicts with extractive industries, wilderness areas and national parks are often "rock and ice"—high elevation, arid, or rough areas which are beautiful and are popular for backpacking, but which also are *relatively* unproductive habitats. For the most part, the richer deep forests, rolling grasslands, and fertile river valleys on which a disproportionate number of rare and endangered species depend have passed into private ownership or, if public, have been "released" for development and resource exploitation. In a detailed review, Reed Noss and colleagues found that, of the various natural ecosystem types in the United States, fifty-eight have declined by eighty-five percent or more and thirty-eight by seventy to eighty-four percent.[38] To make matters worse, the elimination of large carnivores, excessive control of natural fire, and livestock grazing have degraded even the largest and most remote wilderness areas and national parks in the lower forty-eight states.

To protect biological diversity, we must build on current national park, wildlife refuge, and wilderness area systems. The ecological model for nature reserves of large wilderness cores, buffer zones, and biological linkages is widely accepted by scientists and is the basis for proposals by the Wildlands Project. Core wilderness areas would be strictly managed to protect and, where necessary, to restore native biological diversity and natural processes. Traditional wilderness recreation is entirely compatible with preservation, so long as ecological considerations come first.[39] Biological linkages (corridors) would provide secure routes between core reserves for the dispersal of wide-ranging species, for genetic exchange between populations, for the flow of ecological processes, and for mi-

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37. Reed F. Noss, *The Wildlands Project: Land Conservation Strategy*, WILD EARTH, Special Issue 1992, at 10, 11. As an example of how widely accepted the conservation biology approach has become, the Department of Defense in 1998 listed Noss's goals as the management direction for military lands.

38. REED F. NOSS ET AL., U.S. DEP'T OF INTERIOR, ENDANGERED ECOSYSTEMS OF THE UNITED STATES: A PRELIMINARY ASSESSMENT OF LOSS AND DEGRADATION 1 (1995).

39. For example, cliffs in Arizona's Granite Mountain Wilderness Area are closed to climbing when peregrine falcons are nesting, and a stretch of Utah's wild San Juan River is closed to camping when bighorn are lambing.

gration of plants and animals in response to climate change. Surrounding the core reserves, stewardship zones (buffers) would allow increasing levels of compatible human activity away from the cores. Active intervention or protective management, depending on the area, would aid in the restoration of extirpated species and natural conditions.[40]

Since the formation of the Wildlands Project in 1991, conservation biologists and traditional citizen conservationists have worked together to develop the theory and methodology of how nature reserve networks should be designed and managed. Considerable new field research has strengthened our understanding of how ecosystems work and what provides *integrity* in ecosystems. The Wildlands Project also recognizes that traditional conservation values of beauty, inspiration, and recreation are vital and work together with ecological values for a compelling argument for nature protection. Together, these approaches help us heal the ecological wounds suffered by North America.

The Wildlands Project calls this "*rewilding*."[41] The rewilding approach to science-based reserve design uses planning for carefully selected *focal species*. Brian Miller, a conservation biologist with the Denver Zoo, has studied black-footed ferrets in Wyoming and jaguars and mountain lions in Mexico. As chair of the science committee for the Wildlands Project, he has refined the use of focal species. "Focal species are organisms used in planning and managing reserves because their requirements for survival represent factors important to maintaining ecologically healthy conditions."[42]

Miller and his colleagues have identified several different kinds of focal species.

1. *Keystone species* "enrich ecosystem function in a unique and significant manner through their activities, and the effect is disproportionate to their numerical abundance."[43] As we have seen above, large carnivores are often keystone species. The beaver, through its modification of the landscape, is another keystone species.

2. *Umbrella species* "generally cover large areas in their daily or seasonal movements."[44] By protecting enough habitat for them, habitat for many other species is also protected. Wolverines and jaguars are good examples.

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40. *See* Reed Noss, *A Recipe for Reserve System Design and Management*, WILD EARTH, Special Issue 1992, at 24, 24–25 (stating that a regional reserve system requires active management to protect and maintain native environment and native species).

41. Soulé & Noss, *supra* note 1, at 19.

42. Brian Miller et al., *Using Focal Species in the Design of Reserve Networks*, WILD EARTH, Winter 1998–99, at 81, 81.

43. *Id.*

44. *Id.*

3. *Flagship species* are charismatic animals, like wolves and eagles, who build "popular support for the protected area."[45]

4. *Indicator species* "provide an early warning system" because they "are sensitive to ecological changes."[46] The northern spotted owl is the best known example here.

By carefully selecting focal species in all these categories, conservationists and scientists can design effective nature reserve networks of cores, corridors, and buffers.

This rewilding approach is built on recent scholarship showing that ecosystem integrity is often dependent on the functional presence of large carnivores. John Terborgh of Duke University (in my mind the dean of tropical ecology) is currently studying the ecological effects of eliminating large carnivores from tropical forests. He has determined that large carnivores are major regulators of prey species numbers—a conclusion which is the opposite of a once-upon-a-time ecological orthodoxy. He has also found that the removal or population decline of large carnivores can alter plant species composition, particularly the balance between large-seeded and small-seeded plants, due to increased seed and seedling predation by superabundant herbivores that are normally regulated by large carnivores. This is called "*top-down regulation.*"[47] There is compelling evidence for such top-down regulation in forests outside the tropics as well.

Rewilding is "the scientific argument for restoring big wilderness based on the regulatory roles of large predators," according to Soulé and Noss.[48] They have explained that:

> 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 .... Second, wide-ranging predators usually require large cores of protected landscape for secure foraging, seasonal movement, 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 instrumental in maintaining the integrity of ecosystems; in turn, the large predators require extensive space and connectivity.[49]

If native large carnivores have been extirpated from a region, their reintroduction and recovery is central to a conservation strategy. Wolves,

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45. *Id.*
46. *Id.*
47. Soulé & Noss, *supra* note 1, at 22.
48. *Id.*
49. *Id.* (citations omitted).

grizzlies, cougars, lynx, wolverines, black bears, jaguars, and other top carnivores need to be restored throughout North America in their natural ranges.

Soulé and Noss recognized "three independent features that characterize contemporary rewilding:

- Large, strictly protected core reserves (the wild)
- Connectivity
- Keystone species"[50]

In shorthand, these are "the three C's: Cores, Corridors, and Carnivores."[51]

Although Soulé and Noss stated that "[o]ur principal premise is that rewilding is a critical step in restoring self-regulating land communities,"[52] they also claimed two nonscientific justifications: "the ethical issue of human responsibility"[53] and "the subjective, emotional essence of 'the wild' or wilderness."[54] With respect to the second nonscientific justification, Soulé and Noss observed that "[w]ilderness 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."[55]

What Soulé and Noss have done with the concept of rewilding is of landmark importance for the wilderness conservation movement as well as for those primarily concerned with protecting biological diversity. They 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 not only necessary for inspiration and a true wilderness experience,[56] but are absolutely necessary for the protection and restoration of ecological integrity and native species diversity.

While conservation has traditionally focused on public lands, we now realize that private lands must play a major role in nature reserve networks if connectivity is to be built back into the landscape and if all ecosystems and biological hot spots are represented. Since the 1950s, the

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50. *Id.*
51. *Id.*
52. *Id.* at 23.
53. *Id.* at 24.
54. *Id.*
55. *Id.*
56. Back in 1964, David Brower wrote that "*real* wilderness" was "big wilderness—country big enough to have a beyond to it and an inside." David Brower, *Wilderness—Conflict and Conscience*, *in* VOICES FOR THE WILDERNESS 3, 3 (William Schwarz ed., 1969).

Nature Conservancy has worked to acquire private lands of high ecological value. Now, the Foundation for Deep Ecology (FDE), the Wildlands Project, and other groups are encouraging *wildlands philanthropy*—the acquisition of large areas by conservation-minded people who will manage such lands for their ecological value.[57] Doug Tompkins, president of FDE, has used his private wealth to acquire eight hundred thousand acres of old-growth temperate rainforest in Chile.[58] He is developing trails, campgrounds, and other facilities so that the people of Chile can use the area, but his main purpose is to protect a rare and threatened wild landscape of international importance. Ted Turner is managing his large ranches for their natural values and has hired conservation biologist Mike Phillips to supervise the recovery of endangered species on the Turner ranches.[59] Wildland philanthropists will use the Wildlands Project and conservation biologists to identify ecologically important lands for private acquisition.

Michael Soulé and Reed Noss have argued that there have been three currents in the conservation stream. The first is the traditional wilderness movement (beauty, recreation, inspiration).[60] The second is the protection of representative ecosystems, hot spots of biodiversity, and habitats of rare or endangered species.[61] The third is the application of island biogeography with the recognition of the need for connectivity between protected areas.[62] Rewilding is a fourth current.[63] Note that these are *currents* in a *stream.* They most emphatically do not replace one another in a chronological order as values justifying land protection. They reinforce one another. They are complementary, not contradictory.

It is important to note that the Wildlands Project is not just about science, but about conservation—the blending of traditional wilderness values of beauty, inspiration, and recreation with ecological values. As Soulé and Noss clearly stated, "Rewilding with extirpated carnivores and other keystone species is a means as well as an end. The 'end' is the moral obligation to protect wilderness and to sustain the remnants of the Pleistocene—animals and plants—not only for our human enjoyment, but because of their intrinsic value."[64]

Nonetheless, because of the impression of criticism by conservation biologists of traditional national park and wilderness area conservation, some conservationists, like the Sierra Club's Mike McCloskey, have

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57. *See* John Davis, *Wildlands Philanthropy: Private Wealth Protecting Public Values*, WILD EARTH, Summer 1998, at 19, 19–22.

58. *See id.* at 21.

59. *See* Nancy Plevin, *Turner's Plans Rile His Ranching Neighbors—Wolves to Be Released in New Mexico*, SEATTLE TIMES, Dec. 7, 1997, at A8.

60. *See* Soulé & Noss, *supra* note 1, at 20–22.

61. *See id.* at 21.

62. *See id.*

63. *See id.* at 22.

64. *Id.* at 26.

questioned the turn to a conservation biology approach. McCloskey presented a paper, *Conservation Biologists Challenge Traditional Nature Protection Organizations*,[65] at a 1995 meeting of the International Union for the Conservation of Nature (IUCN) Commission on national parks and protected areas. His criticisms of conservation biologists included the following observations:

1. Conservation biologists treat reasons for wilderness other than biodiversity protection as "secondary, if not trivial and old-fashioned;"[66]
2. Conservation biologists criticize existing protected areas, not in terms of why they were protected when they were protected, but in terms of "their new biodiversity goals;"[67]
3. "Their disdain for what has been achieved so far is evident;"[68]
4. "[O]verblown credit [has been] given to the 'worthless lands' theory propounded by Alfred Runte;"[69] and
5. Conservation biologists "want to change some of the ways protected areas are managed"[70] and advocate "hands-on management,"[71] "more intrusiveness than is now authorized in Wilderness Areas and [a] de-emphasis on recreation,"[72] and "vesting more authority in managers."[73]

Though I think McCloskey misunderstands the position of conservation biologists and the Wildlands Project, he throws out an important caution to us. When conservation biologists have tried to analyze the weaknesses of the national park and wilderness area systems from a standpoint of protecting the whole diversity of life, they have sometimes failed to make clear the tremendous successes of traditional American conservation and how an ecological approach is entirely compatible with a traditional conservation approach.

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65. Michael McCloskey, *Conservation Biologists Challenge Traditional Nature Protection Organizations*, WILD EARTH, Winter 1996–97, at 67 [hereinafter McCloskey, *Conservation Biologists*]. McCloskey continues his critique of the conservation biology approach in this symposium. *See* Michael McCloskey, *Changing Views of What the Wilderness System Is All About*, 76 DENV. U. L. REV. 369, 373–74 (1999).

66. McCloskey, *Conservation Biologists*, *supra* note 65, at 67.

67. *Id.*

68. *Id.*

69. *Id.* at 68.

70. *Id.* at 69.

71. *Id.*

72. *Id.* at 70.

73. *Id.*

Criticism by the Wildlands Project and most conservation biologists is not (nor should be) directed at wilderness areas and national parks, but at the political process that has shaped them over the last century. It is true that our wilderness/park system has not protected representatives of all ecosystems, all native wildlife, and ecological processes. *However, the fault is with American land use history and the political process of nature reserve designation, not with the idea of wilderness areas and national parks as means of protection.* The extinction crisis is not caused by a reliance on wilderness areas and national parks. If these areas have not fully protected biodiversity, it is because of the political forces working at every step of the way to weaken and pare away at such proposed reserves. The biodiversity crisis is worsening partly because *not enough land has been protected as wilderness areas and national parks.*[74] Reed Noss said, "Wilderness recovery, I firmly believe, is the most important task of our generation."[75]

Existing wilderness areas and national parks and roadless or lightly-roaded areas on the public lands are the building blocks for an expanded ecological nature reserve network. Far from tossing aside existing protected areas and the National Wilderness Preservation System and National Park System, conservation biologists and the Wildlands Project want to expand such areas and connect them.

While it is historically true that arguments for protecting areas emphasized scenic, utilitarian, and recreational values, other arguments were made from ecological standpoints. Not all national parks were protected primarily for their scenery. Mt. McKinley National Park was set aside in 1917 not for its stunning mountain but as a wildlife reserve. Everglades National Park, finally established in 1947, was specifically protected as a wilderness ecosystem. Even the Forest Service used ecosystem representation to recommend areas for wilderness in the Second Roadless Area Review and Evaluation (RARE II)[76] in 1977–79.

Wilderness areas and national parks do protect areas of great value for biological diversity. McCloskey rightly pointed out that the 1930s battle for Kings Canyon National Park won an area wanted as a dam site by Central Valley irrigators and that $1.3 billion of timber went into Redwood National Park.[77] He further noted that "[w]hile commercial interests often succeeded in getting some areas they coveted dropped

74. Postmodern deconstructionist critics of the wilderness idea seem unable to understand this important point. *See, e.g.*, J. Baird Callicott & Michael P. Nelson, *Introduction* to THE GREAT NEW WILDERNESS DEBATE 1, 12–13 (J. Baird Callicott & Michael P. Nelson eds., 1998).

75. Noss, *supra* note 37, at 10.

76. *See* FOREST SERV., U.S. DEP'T OF AGRIC., RARE II FINAL ENVIRONMENTAL IMPACT STATEMENT: ROADLESS AREA REVIEW AND EVALUATION (1979).

77. *See* McCloskey, *Conservation Biologists*, *supra* note 65, at 68.

from park proposals, this does not mean that conservationists got nothing, or that parks got only worthless lands."[78]

Low elevation valleys in a number of wilderness areas in the Northwestern United States, along with the Hoh and Quinalt Valleys in Olympic National Park, are the finest remnants of old growth forest left in the United States. Conservationists fought hard for these places for ecological reasons and won over the strident opposition of the timber industry. The finest and most natural old growth ponderosa pine forest in the world is protected in New Mexico's Gila Wilderness. State and federal wilderness areas and parks in the East hold most of the old growth forest there and much of the best recovering forest—the Five Ponds Wilderness in New York's Adirondack State Park has fifty thousand acres of old growth forest. Some of the best remaining wetlands and even a few sizable grasslands are preserved in wilderness areas and national parks. Also, wilderness areas and national parks protect prime habitat (though not enough of it) for imperiled and sensitive species like wolverine, fisher, grizzly bear, gray wolf, mountain lion, and bighorn sheep. If it were not for these areas protected through the blood, sweat, and tears of *recreational* wilderness conservationists, these species would be in much more danger today than they are—if they existed in the lower forty-eight states at all. Wilderness areas and national parks are prime areas for reintroduction of extirpated species—the gray, red, and Mexican wolf, bighorn sheep, mountain lion, woodland caribou, and California condor.

Let me be clear: Explanations for why national parks and wilderness areas have not fully protected nature in the United States and elsewhere are meant to help conservationists add areas to protected status, not to denigrate the considerable achievements of conservationists in the past. Ecological values for nature reserves are not meant to replace those values based on beauty, recreation, inspiration, or existence value, but to add to them.

CONCLUSION

Over fifty years ago, Aldo Leopold wrote,

> One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted on land is quite invisible to laymen. 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.[79]

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78. *Id.*

79. Aldo Leopold, Journal Entry, *in* ROUND RIVER: FROM THE JOURNALS OF ALDO LEOPOLD 165 (Luna B. Leopold ed., 1953).

Except perhaps in the far north, all of North America has suffered grievous ecological wounds. The Wildlands Project and other conservationists and scientists must become Leopold's doctor.

Identifying the major ecological wounds to a region allows conservationists to develop clear goals and objectives for a conservation plan. For example, some of the major wounds in the southwestern United States include:

1. Extirpation or decline of large carnivores and other keystone species through market hunting, poisoning, trapping, and habitat destruction;
2. Destruction and degradation of riparian areas through overgrazing and water diversion;
3. Fragmentation of habitat by roads, dams, towns, and agriculture;
4. Invasion or deliberate introduction of exotic species that replace native species;
5. Elimination or diminution of "keystone" natural processes such as lightning-caused fire and periodic river and stream flooding; and
6. Damage to forest ecosystems through logging, fuelwood collection, and grazing.[80]

Regional conservation strategies supported by the Wildlands Project in the southwestern United States have as their goals healing these ecological wounds. The approach we are using blends traditional wilderness area advocacy, focal species planning, and rewilding.

Perhaps more than anything else, conservation is a quest for humility. Going into the wilderness on foot or by canoe—on the wilderness's terms—is a pilgrimage of humility. Embracing the need for large carnivores in the wilderness landscape is an even deeper step toward humility. We must ask ourselves, "What kind of people do we wish to be?" Can we find the generosity of spirit, the greatness of heart to allow self-willed land, to share our world with wolves and jaguars? Are we wise enough to understand that wilderness is the arena of evolution?

Reed Noss writes, "We have an opportunity unique to our generation: to halt a mass extinction."[81] There is no greater opportunity—nor responsibility.

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80. *See* Sky Islands Alliance, A Proposal for the Creation and Stewardship of the Sky Islands/Greater Gila Nature Reserve Network (1998) (unpublished manuscript, on file with the author).

81. Noss, *supra* note 37, at 10.