

1 The Policy and Science of Regional Conservation

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This book addresses conservation at the continental scale by providing conservationists and biologists with the latest scientific principles for protecting living nature in whole regions and continents. But why is there suddenly a need for a new synthesis of conservation biology applicable at these large scales?

Thinking Bigger

Nature conservation has largely been an ad hoc process. Tracts of land have been protected from development for their scenic value, or because they contain impressive concentrations of wildlife, or less often because they harbor rare species or notable biological diversity. This ad hoc approach to biological conservation has left Canada, the United States, Mexico, and most other countries with highly fragmented systems of parks and reserves in which some elements of the native biota are over-represented and others are not represented at all. Not only are most of the protected areas too small, but they are also isolated from other protected areas by agricultural lands, freeways, industrial zones, or other unnatural environments that are inimical to the large majority of native species. The resulting fragmentation of the natural environment severely threatens biological diversity. Modern conservation biology provides abundant evidence that small preserves, over the years, lose species. Even the largest national parks in western North America are too small to maintain all their larger mammals (Newmark 1995).

Many species cannot long survive in small habitat remnants because the ecological processes that stabilize their populations have been dis-

torted or disrupted. Small areas are incapable of supporting the full spectrum of processes that sustain diversity—most notably the population stabilization of prey provided by top carnivores. Where crucial processes such as predation are distorted or absent, ecological systems often collapse with the loss of large numbers of species. The lesson learned from experience with small preserves is this: To be effective, biological conservation must be planned and implemented on large spatial scales. Conservation biologists have learned that nature and wildness cannot be saved by protecting a piece here and a piece there.

This book expounds the scientific basis for applying conservation principles at spatial scales encompassing whole regions and continents. A new conservation paradigm is needed because the protection of wilderness and biodiversity, including viable populations of large carnivores, is now recognized as a more formidable challenge than had been anticipated only a decade or so ago. Not only was scientific theory for protecting biodiversity insufficiently developed, but many of the social theories that guided the policies of conservation organizations have proved to be flawed. (See Kramer et al. 1997; Terborgh 1999.)

We do not want to give the impression, however, that the approaches and prescriptions recommended in this volume are meant to replace current conservation practices. First, not every conservation goal can be—or should be—addressed at the regional or continental scale. The challenges at the local level are profound and important; they must not be neglected. It would be disastrous if everyone abandoned the conservation needs of their communities to work exclusively at the level emphasized in this book. And second, depending on the social or biological context, some regional approaches can be inappropriate. Where large predators never existed (islands), or where they are long extinct (Australia), or where the density and intensity of human occupation is so great that the reintroduction of large animals is precluded (much of Europe, parts of Asia), there may be less biological justification for regional and interregional connectivity. Moreover, the kinds and scale—temporal and spatial—of conservation projects envisioned in the following chapters require a certain level of political stability (Soulé 1991), a certain level of national wealth, a certain level of organization, and most certainly a degree of human dignity, human rights, and social justice (Ehrlich et al. 1995). Nonetheless, we believe that most of the principles elaborated in this book, *mutatis mutandis*, apply worldwide.

While granting that there is still a major role for conservation of smaller, more isolated wildlands at the local scale, it has been apparent

for a quarter-century that connectivity and bigness of protected areas are ecological necessities (Frankel and Soulé 1981). Until recently, however, the scientific theory for the protection of biodiversity was insufficiently developed and synthesized to guide conservationists at this bigger scale of enterprise. This book aims to conceptualize the scientific basis for this campaign—networks of protected areas that extend through entire regions and weave together wildlands on entire continents. This chapter sets the stage by introducing the major themes and background of policy and science that motivate these prescriptions.

A sense of urgency exists among conservationists everywhere. Not only is the present situation grim, but the rates of habitat loss and fragmentation are certain to increase (Soulé and Sanjayan 1998), particularly in the tropics. The challenge is daunting. Yet the present contains many possibilities. Many wildlands can still be protected, especially in the less populated and wealthier nations. Nearly everywhere there are opportunities to restore degraded and derelict lands to conditions that support biological diversity and provide ecological services.

Success in this endeavor depends on two conditions: good science and the popularization of a compelling, practical, and inspiring vision. The book outlines the current body of science—the description, theory, and prescription for large-scale conservation projects as presented, for example, in Noss and Cooperrider (1994)—and describes one such motivating vision (*Wild Earth*, Special Issue 1, 1992; Foreman et al. 1992) in the Preface. Here let us simply observe that conservationists who are courageous enough to confront the inexorability of current trends have only one constructive recourse: to pause, put aside at times their defensive tactics, their pleading, appealing, dealing, and suing, and help fashion a radically honest, scientifically rigorous, alternative land-use agenda. A major barrier at present is the dominance of policies, worldwide, that dismiss the utility of protected areas and promote the notion of sustainable development.

A large body of research in conservation biology has shown that maintaining ecological structure, diversity, and resilience demands strict, large-scale protection of entire ecosystems (see Noss and Cooperrider 1994). There is evidence that roughly 50 percent of the land in a region needs to be protected in systems of linked core areas if the goal of preventing further anthropogenic extinctions is to be achieved (Soulé and Sanjayan 1998). But most attempts to enlarge nature's estate by increasing the amount of effectively protected lands have failed, both in the rich and the poor countries. The percentage of land protected from exploita-

tion worldwide has increased only marginally—from 4 percent to just over 5 percent—during the last two decades. One reason for this has been a lack of consensus on the need for more and larger protected areas associated with a policy shift away from protection and toward development.

The zenith of land protection occurred during the 1960s and 1970s. A major landmark in the United States was the passage of the Wilderness Act in 1964. It succeeded in protecting some federal Forest Service lands in the West from intensive exploitation or development. But lobbying by natural resource industries and developers trimmed the amount of land protected from the 24 million hectares proposed originally to about 3.6 million—an area about half the size of Maine. And recently the anticonservationist U.S. Congress has stifled spending for land protection under the Land and Water Conservation Act.

Meanwhile in Africa and Asia, many colonies were achieving independence. In those headier days it was fashionable for national leaders to create protected areas, even if only on paper. These declarations met with little resistance because human populations were half of what they are today and the opponents of protected areas were less influential and less organized. Today with renewable resources being harvested at unsustainable rates almost everywhere, the opportunity cost of creating additional preserves is viewed by many politicians as being too high. Peru, for example, has declared a moratorium on creating any new protected areas in the Amazon until the entire region has been explored for fossil hydrocarbons.

On the social side, it was fashionable in the 1960s and 1970s to support international conservation by hiring, training, and outfitting park guards. But beginning in the early 1980s, the policy pendulum in international assistance began to swing away from park protection and enforcement toward local economic development. The new bandwagon became Sustainable Development. Promotion of sustainable development was a well-intentioned but naive strategy to link economic growth to nature protection. Today it is evident that the effort to protect life on earth is failing—despite all the outpouring of feel-good news releases about sustainable development, integrated conservation and development, community-based conservation, ecosystem management, and sustainable forest management. These harmony-based notions are inspiring indeed. Their benefits for nature, however, are more likely to bear fruit during the twenty-second century—after the waves of population and market globalization have passed—but too late to save most of wild nature.

The Region in Conservation

What are the conditions necessary to save living nature and wildness, particularly in North and Central America? Are the current intensity and scale of conservation sufficient to forestall the prophecies of an anthropogenic mass extinction? Is the conservation movement sufficiently organized and funded? What are the ecological and genetic principles of sound conservation at realistic geographic scales? These questions constitute much of the contemporary conservation challenge. Several organizations are attempting to address these issues, including the integration of scientific principles into the practice of conservation. Here are the principal elements in a strategic analysis:

- The contemporary mass extinction is being caused by anthropogenic forces: habitat loss and fragmentation, overexploitation of large or economically valuable animals (terrestrial predators, primates, parrots, marine fishes) and sensitive ecosystems (aquatic ecosystems, old-growth forests, coral reefs), introduction of invasive alien species, pollution, and climate change. The pressures on wildlands caused by these forces are still increasing.
- The design of functional protected area networks requires knowledge of how ecosystems are regulated—particularly the role of large carnivores.
- The spatial distribution of nature reserves and wilderness should be based on the principles of biogeography, wildlife biology, ecosystem ecology, and macroecology, with attention given to the anthropogenic forces listed above.
- Measures must be put in place immediately to maintain critical species, ecosystems, and landscape connectivity. Otherwise, human population growth and conversion of landscapes to agriculture and other economic uses will render these solutions politically impossible.
- Saving biodiversity and wilderness will require conceptualization and implementation of projects on larger spatial and temporal scales than heretofore envisioned.
- Other solutions to the impending biodiversity crisis—those favored by the international organizations, including the agencies of the United Nations and lending institutions—are exacerbating the problem by continuing to propagate the myths of harmony with nature, sustainability, and the notion that economic development is a necessary precursor of conservation (Soulé 1995).

In response to this analysis, conservationists are called upon to reexamine the scientific principles and management guidelines that have been in vogue during the last two decades and begin to reshape them for use at larger spatial and temporal scales. The goal of this chapter is to set the stage by addressing a number of critical issues. While the focus is on North America, the chapters refer to other continents; many of the principles are universal.

A Fresh Approach

In its mission statement The Wildlands Project (TWP) diagnosed the current conservation challenge in spatial and temporal terms and emphasized the need to think and plan on grander geographic scales—regional networks of conservation lands—and to implement these networks over long periods of time if necessary (Foreman et al. 1992). While noting that today's parks, wilderness areas, and wildlife refuges preserve scenery and provide recreational opportunities, the mission statement recognizes that "they are too small, too isolated, and represent too few types of ecosystems to perpetuate the biodiversity of the continent." Underlining the implied dimensions of this diagnosis, the statement calls for "vast landscapes without roads, dams, motorized vehicles, . . . where evolutionary and ecological processes . . . can continue."

The infrastructure of this conservation strategy would comprise systems of core reserves, insulated in places by buffers, and linked within and between regions by ecological corridors that allow natural movements—including dispersal of wide-ranging species for genetic exchange between populations and for the migration of animals in response to climate change. A forerunner of this model is the biosphere reserve of UNESCO's Man and Biosphere Program; see Noss (1992) for references. How important is this typology of cores, corridors, and buffer zones? Perhaps the most sublime moments in intellectual life are when old frameworks dissolve and new ones take form. This appears to be happening to this trilogy. Though it is still convenient to use these land-use constructs (and we retain them as chapter headings), they are becoming obsolete in many contexts.

Why is this? Above all, the definitions are becoming blurred. The reader will discover that core areas, particularly large ones, provide connectivity for many species and processes. Moreover, regional and interregional corridors provide core habitat for many species, even for top carnivores. And buffers, assuming they are well designed, can be restored or managed so that they function as corridors and core habitat for some

species. Finally, buffers may become core-like, and parts of cores may even have to become buffer-like, if only for reasons of economic and political expediency.

Regardless of one's view of categorical rigidity, however, a premise of this overall conservation strategy is that land-use planning must happen at the regional level, must be participatory, and must occur on spatial and temporal scales never attempted before (Soulé 1992). In fact, the vision is explicitly continental: the goal is to join regional networks together to recreate the potential of movements and flows that were severed decades to centuries ago by land uses and policies favoring helter-skelter development and shortsighted exploitation of natural resources.

The Need for a Regional Strategy

Several organizations, including The Nature Conservancy and the World Wildlife Fund in the United States and Canada, now support the planning of nature reserves on a scale encompassing entire regions. What do we mean by "region," and why has it become a major focus in conservation planning and implementation? According to the Oxford English Dictionary, a region is a realm (region derives from "regere" in the sense of "to rule") or country distinguished by certain natural features, by its climate, and by its flora and fauna. Classical examples of regions encompass a range of spatial dimension—from hilly places to entire continents. Indeed, Scater noted in 1858 that "South America is the most peculiar of all the primary regions of the globe as to its ornithology."

Today the term "region" refers to some intermediate scale between locality and continent and is often defined by obvious topographic or biogeographic features such as vegetation. Thus we refer to the boreal forest region of Canada or to the Sonoran Desert region encompassing much of northwestern Mexico and part of the southwestern United States. A region is large: bigger than a landscape, bigger than any single national park, bigger than a mountain or lake (hence the Southern Rocky Mountains or the Great Lakes Region), and, therefore, bigger than the jurisdiction of most land management units, including many county, state, provincial, or even national governments. Planning for regions, then, requires the protection of biodiversity and wilderness on a scale that is broader than the dimensions of these traditional administrative elements (Clark and Minta 1994). The region as a geographic unit for conservation represents a ratcheting up of conservation planning.

Therefore a regional, let alone a continental, approach requires forms

of design, implementation, and management that are qualitatively different from local conservation (such as single nature reserves or even national parks). A regional scope presents new possibilities. Projects that are impractical locally (such as the reintroduction of large carnivores) become feasible at a regional scale. Stand-replacing fires that may be catastrophic at the local or small-wildlands scale can be left to burn themselves out in a region. Problems of transboundary conservation—the brown (grizzly) bear in Canada and the United States, for example, and the jaguar and Mexican wolf in Mexico and the United States—appear formidable from the perspective of states but become tractable within a regional context. Conversely, projects that are feasible at the local scale (such as the complete elimination of exotic species by volunteer workers—say from a wetland or sand dune) are difficult if not impossible at a regional scale and alternatives must be considered. In summary, then, a regional approach must deal with the complexities of scale (Chapter 2) as they apply to process, species (Chapter 3), and restoration (Chapter 4).

Continental Conservation

Do analogous problems exist at the continental scale in the context of nature conservation? Several conservation issues must be addressed at a bigger scale than the region. North America's peregrine falcons (*Falco peregrinus*), for example, were nearly extirpated by the egregious use of pesticides. Conservation biologists and falcon aficionados responded by mounting a successful continental effort to save them. The notion of continental scale is also meaningful in a biogeographical context. Entire families and genera of plants and animals are often restricted to individual continents, and conservation coordination may have to be continent-wide: the people concerned with such taxonomic groups must address continent-specific ecological and cultural factors. The macaws, for instance, a group of large, New World parrots, are found only from Mexico to South America and are seriously threatened because of the pet trade and habitat destruction. In this case the remedies—conservation and political—must be administered on a continental scale.

The continent is also the geographic unit of relevance for many large-bodied, wide-ranging species. Moreover, a genetically and demographically viable population of these animals may number in the thousands of individuals—thus requiring areas comprising many regions to provide sufficient habitat. For such species, the continent (or a large part of one) is the appropriate conservation scale. Thinly spread species of large carnivores like the brown bear, the puma (*Felis concolor*), the jaguar (*Felis*

onca), and the wolverine (*Gulo gulo*) are often not viable, genetically or demographically, within single regions, even those as large as the Sierra Madres, the Adirondacks, or the northern Cascades. Viable populations of such animals require vast areas spanning many regions. And because such creatures are often keystone players (Mills et al. 1992; Power et al. 1996; Chapter 3) in ecosystems, their conservation is a supraregional or continental issue.

The Scale of Things

So far we have made the assumption that you—the reader—are comfortable “zooming” from, say, your backyard to your entire continent, and that you have some understanding of the different problems faced by individual creatures and entire species that are relevant at these different geographic scales. Indeed, issues of scale are ubiquitous in conservation, particularly as we consider regional networks and continental conservation (Chapter 2). A major emphasis in this book is the need to think and plan on scales that transcend traditional political boundaries (counties, states, provinces, nations) and familiar spans of time (lifetimes).

Most planners and politicians are hemmed in by narrow jurisdictional, bureaucratic, and political horizons, including terms of office. Such strictures are too limiting for conservation. The conservationist must cultivate the capacity to shift smoothly from, say, the needs of individual plants and animals—on seasonal and annual scales—to the temporal and spatial criteria for long-term population viability (centuries and millennia) and the long-distance interchange of material and energy between marine and terrestrial ecosystems (Chapter 6). Managers, too, must develop a facility with scale. At the local scale the exotics problem might be manageable, for example, depending on the vigilance and commitment of local authorities and the interested public (Chapter 4). At the national level, however, the management of an alien species may involve complex trade negotiations with importers, issues of sovereignty, legislation, and public education.

Issues of scale can also create conflicts. The managers of a local nature reserve—say one established to protect a particular marsh, wetland, or patch of prairie—may not feel compelled to plan for the viability of wide-ranging or migratory species such as cranes, caribou, cougars, or coyotes. “This,” they will say, “is somebody else’s problem.” Though such a cavalier dismissal of certain species should never be condoned, it is understandable. The problem is most evident where large carnivores are the issue. Fear of being mauled and eaten by these animals (the “Jaws” syndrome) is nearly universal—notwithstanding all the statis-

tical evidence about the frequency of such attacks compared, say, to injury and death in the home, in the automobile, from lightning, or even from encounters with bees or deer.

In many cases conservation activists shun the issue of predators because they worry about opposition from ranchers and worried parents. Compliance with such negative anthropocentric attitudes, however, requires the rejection of the scientific arguments for the roles of top carnivores (Chapter 3), not to mention the dismissal of the prime conservation goal: the return of viable, healthy populations of all native species (Noss 1992). And "all" means all—even those animals that may not be convenient or beautiful. It is the responsibility of conservationists to educate themselves and their human communities about the ecological importance of predators, not duck the issue. Moreover, local and regional conservationists cannot ignore their responsibility to the whole system: each planning and implementation group must bear its share of the regional responsibility for all species and ecological processes.

Top-Down Regulation

A central issue in this volume—a theme that emerges in every chapter—is the important role played by keystone species, particularly wide-ranging carnivores, in ensuring the viability of protected areas. In fact, research is showing that the rules guiding the architecture of regional conservation networks are, to a considerable degree, determined by the habitat requirements of keystone species (Chapters 3 and 5).

The scale and dimensions of a conservation network are often dictated by the needs of wide-ranging species, particularly top predators. Although a key role for top predators had been dismissed as recently as 1996 (Polis and Strong 1996), there is increasing evidence that the absence of large carnivores can initiate cascading perturbations through the trophic web—disturbances that often manifest as superabundant populations of herbivores and medium-sized predators. These perturbations, in turn, may cause reproductive failure and local extinction of plant species and prey, including birds, reptiles, amphibians, and rodents. A complementary hypothesis holds that productivity-limited ecosystems—those regulated by the growth and biomass of plants—are not common in the presence of the complete set of native carnivores, except, perhaps, in arid regions.

Because the viability of ecosystems may often depend on the viability of species whose interactions regulate the systems, it follows that the

size of a system and its actual, on-the-ground, configuration of boundaries and corridors must accommodate the needs of a critical handful of highly interactive species. Because these species often include the large carnivores—which are both admired and feared by human beings but embody the essence of wilderness—the goal of maintaining viable populations of keystone species, particularly large carnivores, has been referred to as “rewilding” (Soulé and Noss 1998).

Rewilding is the latest element in the history of scientific conservation. It does not, however, stand alone. Rather, it complements other approaches for designing regional networks of nature protection by contributing an independent justification for bigness and connectivity. And like certain other methodologies, it facilitates design and management of protected areas because it obviates the need to consider every species in detail (Chapter 5). Thus rewilding is both an end (because of our duty to repair past mistakes in management) and a means by which the viability of conservation units is achieved. This unusual conjunction of means and ends is, perhaps, the most intellectually compelling feature of rewilding.

Prominent among the complementary methodologies for the design of reserve networks are the “coarse-filter” approach and the consideration of disturbance dynamics (Chapter 5). When the conservation mission includes the protection of all elements of biodiversity, for example, including native species, it is virtually imperative to incorporate representatives of each type of biotic community that occurs in the region. Still, the representation of all biotic elements is no guarantee that these elements will persist. In most cases, the determination of minimum viable areas for vegetation or habitat types must be based on the needs of particular species, usually the wide-ranging predators, and on the temporal/spatial scale of major classes of disturbance. Thus there is an important distinction to be made between protection (inclusion in a protected area) and preservation (long-term persistence of protected species). At present there is no scientific formula for determining minimum viable areas for the preservation of vegetation or habitat types, except by reference to the needs of particular species.

Rewilding and Connectivity

Nature is now in pieces, and rewilding is a justification for restoring connectivity on a regional or landscape level. This is because the remaining remnants of habitat are nearly always too small and too isolated to provide sufficient habitat for the top carnivores. Therefore, except in un-

denatured “frontier” regions such as much of Canada north of the 50th parallel (54th parallel in British Columbia) and Alaska, it is necessary to plan and implement systems that will restore connectivity. Connectivity also maintains or restores ecological processes that have been severed or severely constricted by human activities (Chapter 6).

As inhabitants of a world in pieces, we need to remind ourselves that connectivity is not just another goal of conservation: it is the natural state of things. Connectivity, therefore, is a *sine qua non* for conservation. Originally nature was connected on the scale of continents, though this certainly does not justify the willy-nilly creation of artificial corridors. Rarely will haphazard reassembly of habitat patches restore an ecologically viable landscape. Connectivity, *per se*, is not the goal we advocate (Chapter 6). The goal is to reverse the terrible consequences of fragmentation at the habitat and landscape scale—to restore the effective exchange of individuals and materials among sites for genetic maintenance, for demographic stability, for migration, and for the sake of other ecological processes. But, as critics have pointed out, connectivity is not analogous to an elastic bandage: one size does not fit all. Nor does one kind of connectivity solve all problems. The kind and scale of connectivity must fit the context and address the goals of the project at hand.

The term “habitat fragmentation” evokes a static, two-dimensional notion—a kind of poorly constructed checkerboard of habitat islands on a background of denatured land converted to economic uses. The metaphor of fragmentation, therefore, fails to convey the quivering isolation of animals, energy, and nutrients in a degraded landscape. Wild nature is full of movement and interchange, often on a scale of hundreds and thousands of kilometers. It is this dynamic element of nature that the notion of fragmentation fails to capture. In effect, each isolated remnant of nature is caught in a tightening tourniquet of civilization. Initially the tourniquet is made of roads or small subsistence farms. Gradually the constraining band broadens outward as more habitat is converted to farms, clearcuts, and villages. Eventually highways, dams, intensive agriculture, and cities become impervious barriers in the landscape, permeable only to aerial flyers and drifters. Some of these flyers, like the long-nosed bats described in Chapter 6, perform critical services by moving between isolated ecosystems and knitting together island habitats.

Not all so-called corridors benefit nature. Some—such as utility corridors, equestrian and bicycle paths, and greenways—facilitate the travel of invasive exotics, human beings, and their pets, seriously hampering the viability and movements of native plants, animals, and the vital flows of materials and energy that constitute the circulation of wildlands

(Moran 1994). Nevertheless, restoration of ecological connectivity must be a ubiquitous conservation activity in the temperate and tropical regions.

Rewilding and Restoration

Ecological restoration on a regional scale is a new endeavor (Chapter 4). Until recently, restoration ecology has emphasized the repair of local wounds such as those caused by mining, agriculture, grazing, and invasive, exotic species. Now we face a larger challenge—including the need to reverse decades of fire suppression in forests, nearly a century of predator extirpation, overgrazing, and other abuses to wildlands.

The field of ecological restoration has not normally been concerned with biodiversity or conservation per se. In fact, native species have been a secondary objective in most restoration projects. The focus in restoration has been the recovery of ecological *process*, particularly soil stabilization and productivity of polluted or derelict lands. But ecological processes are largely an epiphenomenon—they depend on the persistence of certain species (Shrader-Frechette and McCoy 1993). The restoration of native species diversity, including large carnivores, will require theory and experimentation on a larger scale. Coordination of projects is essential, so that the cumulative impacts of restoration projects promote the overall conservation goals of the regional network.

All this requires a significant shift in ecological perspective: a new paradigm in restoration ecology. Most restorationists, for example, do not think in terms of top-down regulation of ecosystems; rather, the dominant paradigm is bottom-up, driven by succession in plant communities. At the regional scale, however, the emphasis often may be on the recovery of large carnivores and their trophic base of ungulates.

Maps: The Land-Use Agenda

Biological conservation, rewilding, and restoration are complementary tools for nature protection. Their implementation, however, is virtual rather than real until positive changes occur on the ground. Such change is almost always guided by maps.

Maps stimulate desires—for territory, for natural resources, for real estate development, even for conservation. Therefore, the ideology of those who produce land-use maps is important. If developers are the only people mapping the land's future use, then they control the land-use agenda. Indeed, the dominant ideology of land use is development. But

the impact of development on nature is not “development” (less entropy or more order)—it is more entropy. For biodiversity, development is really de-development or denaturation (Soulé 1991).

One of the reasons why economic development usually trumps nature protection is that promoters of growth have a corner on the production of maps used by jurisdictions and agencies that make land-use decisions—decisions that define the future of the land. Development maps promise to deliver social or economic benefits. In the world of planning, land-use maps are promissory notes for economic growth—increased profits and more local employment. Conservationists and others who oppose unending growth and development are often accused of opposing progress and forced on the political defensive. This is not acceptable.

If maps are the agenda, then conservationists must enter the mapping arena. They must begin producing attractive alternatives—maps that also promise a social good: the benefits of wilderness and nature protection. Such maps must be honest, scientifically rigorous, and inspiring so that the hegemony of the growth myth can be offset by the notion that the long-term interests of society are well served by a sufficient system of protected areas. Science and maps, when allied, constitute a powerful partnership.

Good conservation maps require scientific knowledge as well as technologies like geographic information systems. This troubles some conservationists who believe that science and technology contaminate the aesthetic and spiritual arguments for nature and wilderness conservation (McCloskey 1996–1997). Other critics simply dislike science per se or are revolted by invasive research and management interventions—such as the use of radio collars (Turner 1996). Not all scientists (nor all conservationists) are saints, of course, but science and advocacy must become allies in the defense of nature. The essential role played by conservation science today is made explicit in the following chapters.

A Vision and a Challenge

The new field of regional and continental conservation offers many opportunities for research, synthesis, and application. Time, however, is running out for nature as the world enters an era of rapid, chaotic, dissipative change—nature’s end game. In the short run, the most noteworthy of these trends include the globalization of commerce and the statutory and technological facilitation of trade and resource

extraction. Except in a few cold places, ecosystems will be overwhelmed as the human population and economy continue to grow and expand.

What attitudes and behavioral changes will be required? Every field biologist knows the world is in crisis. And crises call forth new roles, including that of the scientist/activist—the articulate, committed expert. Deftness will be required of those who have chosen conservation of nature as their mission. The most skillful will learn to abandon favorite theories, comfortable opinions, cherished classifications, and the fear of controversial policies—such as the reintroduction of large carnivores. And, of course, an inspiring vision is essential. In the frenetic, noisy years ahead, only such visions will attract attention and kindle hope. Finally, conservation on the ground must replace the repetitive cycle of conferences, reports, recommendations to governments, and ineffective treaties.

Continental conservation is already intellectually challenging. But new, more comprehensive methodologies and theoretical constructs will be demanded. There will, however, be less tolerance of models that fail to reflect both biological and social realities. The litmus test of ideas is no longer just elegance; it is pragmatism. For good or bad, the question must be: does it work, and for how long? Social scientists can help to answer these questions by informing conservationists about cultural differences and opportunities, and by providing guidance for implementation, including how to address conflicts in values and such problems as cross-border (international) cooperation.

But biologists themselves are not necessarily inept when it comes to implementing conservation on the ground. Organizations such as the Wildlife Conservation Society and Conservation International, as well as the careers of many dedicated tropical biologists, have repeatedly demonstrated that the long-term presence of a scientist/activist can make a profound difference in a region. A perennial, personal commitment to a place appears to accomplish more than the infusion of large dollops of dollars.

The next three chapters explore the conceptual landscape of regional and continental conservation. Chapter 2 surveys the complexities of scale. Chapter 3 considers the significance of species interactions and ecological processes. Chapter 4 addresses the role of restoration at the regional scale. The scientific details of designing and implementing regional conservation in core areas (Chapter 5), in corridors (Chapter 6), and in buffer zones (Chapter 7) constitute the balance of this volume.

Chapter 8 urges the reader, whether scientist or advocate, to commit more time to the challenge of saving nature. Because it will soon be too late (Ehrlich 1997: 49, 91), no other generation will ever face this challenge with such urgency.

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