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After Earth Day:

Continuing the Conservation Effort

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Conservation Biology and Sustainable Societies: A Historical Perspective

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ON THE FIRST EARTH DAY, so the story goes, a group of concerned citizens in the San Francisco Bay area decided to make a statement about the pervasive environmental effects of the automobile in our society. They buried one. In so doing, they symbolically interred all the pollution-burdened skies, soiled seacoasts, lost wildernesses, bulldozed neighborhoods, gridlocked cities, *ad infinitum* urban sprawl, ostentatious wealth, unscrupulous mechanics, and drive-in churches that the automobile represented to them. Earth Day 1970 was nothing if not fresh.

Afterwards, it is said, on the other side of town, the leaders of a money-strapped community assistance organization vehemently objected to the display. They protested, quite naturally, that they could have used the car to transport the elderly and deliver food to the needy.

It was so much easier to be environmentally aware in 1970. One sensed danger keenly, as would a wild creature. The causes were clear, the solutions self-evident. One felt the righteousness of the crusade in one's bones, and knew that the simple answer was simplicity itself. In nature, one could find order, peace of mind, and the foundations for a philosophy that would save one's soul. Greed was the root of the evil, and all corruptions would wither once an awareness of ecology and a change in values pervaded society. The problems of human society? Return to nature, and all would be well.

And it was so much easier *not* to be environmentally aware in 1970. The threats to decent and durable human societies were

strictly political and economic in nature, and once the impediments to political and economic freedom were removed, all would be well. Insufficient and inequitably apportioned wealth was the root of evil, and all corruptions would diminish once the economic pie was made larger and/or (depending upon one's political philosophy) more fairly distributed. The environmentalists were not simply unrealistic; they were irrelevant at best, dangerous at worst—a strange collection of irrational utopians, discontented Luddites, social misfits, misguided misanthropes, and probably atheistic anarchists, supplemented by the odd scientist or two. Ecology? What was that? Nature? No need to deal with bothersome complications. The *real* problems of the *real* world would be solved through economic expansion and restructuring.

Ah, for the days of stereotype and dogma, simple answers and narrow definitions. They demanded so little of us. They lent themselves so much more easily to rough rhetoric, bloody politics, and the massed media. They were so much less of a drain on our psychic energies than lifelong devotion to what Edward Abbey called "Reason with a capital R—Sweet Reason, the newest and rarest thing in human life, the most delicate child of human history, . . . intelligence informed by sympathy, knowledge in the arms of love."¹

The polarity that marked American environmental attitudes in 1970 has not disappeared, but the sheer weight of environmental pressures, if nothing else, has deepened the discussion. In certain circumstances—the efforts to protect North America's remaining old growth forests and the fate of the Arctic National Wildlife Refuge in Alaska, to cite two obvious examples—the polarity remains potent, and for good reason. On these far borders, we act out the final scenes of a very old drama. Here our culture's unresolved tensions, conflicting values, and divided way of life play out on the largest remaining intact corners of the original American stage.

More broadly, the conflicting points of view can now be heard on a global scale. Developed nations grow increasingly aware of the full costs—environmental and socioeconomic—of the trail they have blazed over the last few tumultuous centuries. Developing nations naturally protest that environmental concern is a luxury of the already prosperous, and that more immediate concerns preclude such investments of time, money, and human

ability. The wealthy nations, having driven the sleek automobile, are beginning to warn of its dangers. The poor nations seek the life that the car has come to represent.

But Sweet Reason, rare, demanding, and delicate though it is, is also a caustic agent. Eventually it erodes even the most granitic stereotypes and stone-faced dogmas. An appreciation of history, complexity, diversity, and humanity must inevitably seep into the cracks in the solid edifice of ideas. It penetrates hard attitudes in due time—though, it seems, only after those attitudes have resulted in eroded ecosystems, degraded landscapes, and desperate societies.

Of course, the stereotypes and dogmas were never so simple to begin with; there were just too few souls intrepid enough to explore the underlying premises and conditions. One of the few, George Perkins Marsh, warned in 1864 that "the earth is fast becoming an unfit home for its noblest inhabitant, and another era of equal human crime and human improvidence . . . of like duration . . . would reduce it to such a condition of impoverished productiveness, of shattered surface, of climatic excess, as to threaten the depravation, barbarism, and perhaps even extinction of the species."² The inhumane assessment of a misanthrope? The wail of a ranting Luddite? Having devoted himself to careful study and documentation of the processes by which "man had changed millions of square miles, in the fairest and most fertile regions of the Old World, into the barrenest deserts," Marsh was among the first to concern himself with what we now awkwardly call "sustainability." More poetically, Marsh challenged his contemporaries "to renovate a nature drained by [human] improvidence of [the] fountains which a wise economy would have made plenteous and perennial sources of beauty, health, and wealth."³

Few in Marsh's time accepted the challenge. Another "era of human improvidence" did indeed ensue, one ultimate result of which, a century later, was an Earth Day spectacle of buried automobiles and polarized attitudes. The larger questions, questions as pervasive and encircling and ignored as air itself, went largely unanswered in 1970, and we are still working on them. Put bluntly: how did we manage to work ourselves into so damn stupid a bind? Put personally: who are the bums who put us in this position? Put more soberly: has the very idea of freedom,

the noblest dream of earth's "noblest inhabitant," been reduced to the mere opportunity to choose between two sides of the same corrupt coin—progressive environmental degradation and a progressively "improvident" human society?

One of those who would later accept Marsh's challenge—Aldo Leopold—once wrote that "conservation, without a keen realization of its vital conflicts, fails to rate as authentic human drama; it falls to the level of a mere Utopian dream."⁴ Leopold was writing specifically in reference to conservation education, and its need to confront dilemmas directly and realistically, not merely lapse into depressing statistics and rehashed propaganda. But more generally, Leopold's point was directed toward all who strove so mightily toward simplistic personal utopias, but who neglected to respect or replenish the "fountains" to which Marsh alluded: the firmament, the cyclic waters, the common ground, the protective forests, the wetlands, grasslands, rangelands, and deserts, the incalculable floral and faunal heritage—the material world of which all dreams are really made, and on which all dreams will always depend.

LEOPOLD POSSESSED as keen a realization of conservation's "vital conflicts" as any person of his day. His whole life may be read as an effort, not to achieve ultimate resolution of those conflicts—he was too pragmatic a person to believe that final resolution was possible—but to communicate the urgency of conservation, to broaden its meaning, to contribute to its scientific foundations, to extend and strengthen its rationale, and, not least, to accentuate the positive impact of conservation not only on the natural world, but on human individuals and human communities. By such means was Leopold himself able to come to grips with conservation's conflicts, and help us to understand the wide gap in human consciousness that precipitates them.

This concern with ultimate sources of conservation disputes reverberated in Leopold's writing throughout his career. He gave especially poignant expression to it in one obscure, fragmentary manuscript: a three-paragraph introduction to an essay, scrawled on the back of a piece of hotel stationery. The hotel was in Berlin, where Leopold was staying during an extended

tour of Germany and neighboring lands. The year was 1935, and Leopold had undertaken the tour to examine the history and status of forestry and wildlife conservation in central Europe. I have always imagined the scene to be cold, confining, uneasy: Aldo Leopold, his conservation philosophy forged in the free-wheeling and spacious American context, sitting quietly at a desk in a dim hotel room in Nazi-era Berlin, fully cognizant of the political forces then upheaving Germany, trying to come to terms with the seeming irrelevance of conservation under such circumstances. He reached back in time in an attempt to expand the context:

The two great cultural advances of the past century were the Darwinian theory [of evolution] and the development of geology. The one explained how, and the other where, we live. Compared with such ideas, the whole gamut of mechanical and chemical invention pales into a mere matter of current ways and means.

Then he focused on the present and his own most absorbing interest:

Just as important as the origin of plants, animals, and soil is the question of how they operate as a community. Darwin lacked time to unravel any more than the beginnings of an answer. That task has fallen to the new science of ecology, which is daily uncovering a web of interdependencies so intricate as to amaze—we're here—even Darwin himself, who, of all men, [would] have the least cause to tremble before the veil.

And then Leopold cast his thoughts toward the future:

One of the anomalies of modern ecology [by which Leopold probably meant, more precisely, *applied ecology or conservation*] is that it is the creation of two groups, each of which seems barely aware of the existence of the other. The

one studies the human community almost as if it were a separate entity, and calls its findings sociology, economics, and history. The other studies the plant and animal community, [and] comfortably relegates the hodge-podge of politics to "the liberal arts." *The inevitable fusion of these two lines of thought will, perhaps, constitute the outstanding advance of the present century.*⁵ [Emphasis added]

Leopold left the fragment unrefined and the essay incomplete. The statement, as it stood, was uncharacteristic. Such sweeping predictions were not generally Leopold's style. It does, however, reflect his typical unwillingness to treat the human community and the natural community—and, analogously, the liberal arts and sciences—as "separate entities." It reflects, too, his dawning sense that this split was destined to be of short duration, not necessarily (to paraphrase one of his own later statements) because it was bad for the plant and animal community, but because it would finally be bad for people.⁶

Has Leopold's prediction come true? Have the "two lines of thought" moved toward a fusion point? The evidence on Earth Day 1970 was certainly mixed. That season, one could hear Richard Nixon declare a clean environment "the birthright of every American," while the *New Republic* disparaged the environmental movement as "the biggest assortment of ill-matched allies since the Crusades."⁷ Two decades—each proclaimed "the decade of the environment" at one point or another—have since passed, and yet another "decade of the environment" has begun. As if all previous decades had nothing to do with "the environment." As if in the future, once we have succeeded or failed in our efforts, we will enter a decade *not* "of the environment."

The question can be approached from another angle: instead of looking for direct evidence of fusion, we can search for circumstantial evidence of attitudes that are less polarized, of a stronger foundation of shared assumptions, maybe even of that rare "intelligence informed by sympathy, knowledge in the arms of love." Here there is cause for hope. Far away from both the hard edges and the alleged centers of power, quiet voices speak of changes that are no less (and arguably more) revolutionary for being local, personal, and incremental.

A ridge-tilling Illinois farmer: "I wake up in the morning and I have choices. What do I want to do today? I want to grow crops and turn them into money. But I don't want to handle pesticides if I can help it. If I gotta do pesticides, then farming ain't fun."⁸

A suburban recycling coordinator: "Companies used to dismiss environmentalists and environmental groups as the radical fringe. Today they are hiring those same people."⁹

From a grassroots environmental group in Poland: "We find Poland being hard hit by numerous crises at the same time. To think that there are different crises isolated one from another is not the best way to understand them. People have no chance to meet their basic needs. They are lacking healthy and cheap food, medicines, flats, water, air, joy, freedom, and vision. . . . It is getting grey and sad around here."¹⁰

A Brazilian journalist: "We should wage the environmental battle for ourselves, not for anybody else. It all boils down to responsibilities. Developed and developing countries each have different responsibilities to their people and to the world. . . . Only if North and South start learning from each other's problems and accepting their respective responsibilities to humanity will the environmental issue be properly addressed."¹¹

What is happening here? For those who have been working in the environmental arena over the years, such declarations are signs of the most encouraging kind—of fellow citizens whose practical needs, concerns, and desires have led them to investigate the basic premises, confront the conflicts, and question the assumptions and the authorities. They suggest that the stereotypical attitudes of Earth Day 1970 have matured into something more substantial; that ideas about what constitutes "environmental concern" have grown beyond (without outgrowing) considerations of clean air, clean water, and wildlife; that ideas about social justice and economic well-being no longer exist in an absolute environmental vacuum; that ideas about the communities we live in, and about the very concept of community itself, are broadening.

From the standpoint of both history and contemporary environmental concerns, the apparent relaxation of the old polarity raises many questions. How deep do the convictions go? Are these signs that we are truly reaching Leopold's "fusion point"?

Are we moving toward that point quickly enough? And if our attitudes are becoming less polarized, have we merely succumbed to ineffective, but feel-good, compromise? Finally, and most importantly, will the consensus be strong enough, ingrained enough, to endure harder times, and the onslaught of cynicism that hard times might bring? In our understanding of the relationship between human and environmental well-being, have we forged links between causes and effects strong enough to withstand unanticipated social and economic pressures?

These questions lead us back to the "two lines of thought" that Leopold saw coming together: the study of the human community, and the study of plant and animal communities, or ecosystems. Since Earth Day 1970 both of these areas of knowledge have evolved in response to heightened, more widespread, and more immediate environmental concerns. Participants in the 1970 Earth Day observance would recognize most of the principles that underlie the new emphases, but might not understand today's language. As we have redefined the issues, and as the issues have redefined us, new terms have emerged to frame our discussion. This is nothing new. Throughout the history of science, conservation, and the environmental movement, new ideas have required new words, and inflexible words have been shed like snakeskins. The more usable and adaptable remain, and some are among those most familiar to us: "wildlife," "conservation," "ecology," and even "environment" itself.

Two of the more recent coinages—or at least new uses for older words—are worth examining. The scientific basis of conservation, the "study of the plant and animal community" of which Leopold wrote, is being reformulated in part by a movement toward "conservation biology." Whereas in 1970 the established disciplines were assumed to provide the sufficient scientific basis for conservation, the emergence of conservation biology in the 1980s signified the belief of many that it was necessary to refocus scientific energies, particularly with regard to a most basic attribute of natural systems: "biological diversity" or, for short, "biodiversity." And whereas in 1970 the basic durability of human communities, in all their permutations and diversity, was simply assumed, many speak now of the need for "sustainable" societies. "Sustainability" has muscled its way into the highest government circles as both a policy objective and an

environmental goal. Its use implies that many believe it necessary to redefine what the human community is about.

The speed with which these terms have been adopted—they have gained in use, definition, and circulation only in the last decade or so—is indicative of the flux in our individual and collective thinking. They incorporate senses, ideas, nuances, and shades of meaning that have been present much longer, but they are by no means firmly defined or accepted. Something in recent times, however, has allowed them to flourish. Words, like plant and animal species, inhabit particular niches and evolve with time. Their linguistic ranges shrink and grow, their meanings change, their forms are shaped and tempered by circumstance and opportunity. The question for us is: what do these words tell us about our cultural environment and the shifting relationship between the "two lines of thought" in the epoch following Earth Day 1970? Do they offer insights into the changing physics of our planetary dilemma—the degree of fusion or polarity on matters environmental?

In 1986 concerned conservation professionals banded together to form a new organization, the Society for Conservation Biology. The founding of the new organization was one expression of growing concern over the accelerated loss of genetic, species, and ecosystem diversity around the world. "The society," noted its first president, Dr. Michael Soulé, "is a response by professionals, mainly biological and social scientists, managers and administrators, to the biological diversity crisis that will reach a crescendo in the first half of the twenty-first century. We assume implicitly that we are in time, and that by joining together with each other and with other well-intentioned persons and groups, the worst biological disaster in 65 million years can be averted."¹²

These concerns, of course, predated, but were restimulated by, the rise in popular understanding of ecology and human environmental impacts that Earth Day 1970 represented. There was, in 1970, no one interdisciplinary organization of biologists devoted to the broad range of conservation questions. The biological foundations of conservation had been built over the previous seventy years or so in a wide variety of relevant

disciplines: geography, forestry, wildlife ecology, ornithology, zoology, botany, entomology, genetics, soil science, agronomy, limnology, marine biology, and so on through the catalogue of specialties. The application of biological research to conservation work, in short, already had a long and rich history. Each of these had made important contributions to the general cause of conservation, and each in turn had benefited from advances made in other fields.

None of these fields alone, however, had provided the information, techniques, or perspective sufficient to counter the quickening trend of environmental degradation and attendant biological impoverishment. In the 1970s the expanded environmental movement attempted to confront the trend through a series of crucial conferences and legislative initiatives. The United Nations Conference on the Human Environment in Stockholm in 1972 brought the full range of environmental issues, for the first time, before the international community. The 1972 conference built on an earlier 1968 Conference on the Use and Conservation of the Biosphere, sponsored by the United Nations Educational, Scientific, and Cultural Organization (UNESCO). One result of this earlier conference was a coordinated Man and the Biosphere (MAB) Program that included the establishment of an international system of biosphere reserves, an important step in defining the issues that conservation biology would soon focus on. Another important milestone came in 1973, with the institution of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which provided scientific and administrative procedures for the protection of endangered species worldwide.

Meanwhile, in the United States, the National Environmental Policy Act (1969), and in particular its provision requiring federal agencies to prepare environmental impact assessments prior to undertaking proposed actions, would with time give professional biologists an enhanced (though rarely a central) role as environmental analysts and advisors. The necessity of interdisciplinary research on environmental impacts and policy under NEPA hastened what was already a growing realization that disciplinary expertise had to be combined with interdisciplinary coordination if conservation efforts were to succeed. In 1973 the Endangered Species Act formalized the growing public concern over the loss of native plants and animals, providing

unprecedented legal mechanisms for the protection and restoration of threatened and endangered flora and fauna on federal lands. Importantly, the act also directed that the habitats of these organisms be protected, although in practice this protection has been weak. Nevertheless, these and other statutes passed in the same period gave conservationists hope that endangered plants and animals and threatened habitats would gain full consideration in the face of human economic pressures.

Translating this hope into effective management procedures would not be so simple. Through the 1970s and into the early 1980s, the old truth, confirmed throughout conservation history, had to be proven once again: that, absolutely necessary as legal measures were, they alone could not achieve conservation. Basic biology supersedes society's laws. Ultimately, attaining conservation goals depended on understanding and changing entrenched patterns of resource use and abuse that threatened plant and animal populations and habitats and disrupted the functioning of ecosystems.

Something seemed to be lacking, too, in the ability of the various conservation-related sciences, acting in isolation, to respond to these challenges, and especially to the speed and scale at which they were occurring. Whole systems seemed to be increasingly at risk. In the temperate zones, intensified land use accelerated long-term trends in the fragmentation, isolation, degradation, disruption, and outright destruction of forests, farmland, woodlots, range, grasslands, and wetlands. Aquatic systems and the fisheries they supported were increasingly taxed by declining water quality, heavy harvesting, species introductions, and short-sighted fishery management strategies. Desertification threatened already sensitive arid lands around the world, but especially in sub-Saharan Africa. And in the humid tropics, the conflagration of massive deforestation was beginning to build, drawing greater scientific attention to the prime attribute of the rainforests: the sheer diversity of the life forms they contained.

Prior to the 1980s, biological diversity was a relatively neglected concept in conservation, not so much because its importance was doubted, but because it was taken for granted. Theoretical ecologists had long debated the question of diversity and its relation to ecosystem stability—coming to no definitive

conclusion other than that the relationship was intricate—while field conservationists were more concerned with practical efforts to save, protect, and manage particular species, wild places, and populations. Biological diversity, in short, was the medium in which conservation took place—so pervasive, so definitive, and so self-evident that even conservationists seemed unable to think of it with the objectivity it demanded. It was assumed. It was as obvious as life itself.

And extinction, diversity's partner in the evolutionary process, was likewise a relatively neglected area of study from a conservation standpoint. Paleontologists, of course, studied ancient extinctions, and in doing so provided the foundation of knowledge on which an appreciation of contemporary diversity could be built. The basic biology, however, of recent anthropogenic extinctions generally went unscrutinized. Perhaps this could be attributed to the difficulty that conservationists had in examining objectively a process they were sworn to forestall. "For one species to mourn another," Leopold wrote with the passenger pigeon in mind, "is a new thing under the sun."¹³ Those in mourning do not immediately turn to the clinical questions of cause and effect. The possibility, however, of frequent, imminent, and prominent extinctions and extirpations—in America, the California condor and the grizzly, the snail darter and the Desert Hole pupfish, the Furbish lousewort and the blue whale—forced biologists to focus on the phenomenon of extinction *as a process*, and to do so *on a global scale*. This, in turn, led many back to the smaller, quieter, less gaudy members of the biotic community, the vast majority of which, it was pointed out, science had yet even to dignify with proper Linnaean nomenclature. Even the extent of that great unnamed majority was a matter of pure speculation—unknown, as Harvard biologist E. O. Wilson would note, "even to the nearest order of magnitude."¹⁴

Even as conservationists began to pay more attention to these less conspicuous members of the biotic community, they stepped up their efforts to preserve habitat at larger landscape, ecosystem, and regional scales. In the United States, this was evident through the 1970s both in the continuing efforts to preserve wilderness in accordance with the Wilderness Act of 1964 and in the steadily growing concern over the loss of diversity resulting from management decisions on national forests,

rangelands, and parklands. But the preeminent example of ecosystem-level conservation efforts came in the tropical rainforests, where it became evident that the loss of diversity had already reached crisis dimensions. Although another decade would pass before the situation became highly publicized and politicized, the seeds were being sown throughout the 1970s by field biologists, ecologists, and taxonomists alarmed by the rapidly intensifying conversion of the species-rich rainforests. Perceptive conservationists and scientists had been expressing concern about tropical forests for years and even decades, but these voices had gone largely unheeded. By the late 1970s and early 1980s, the first concerted wave of articles, books, and reports appeared, raising the issue of rainforest destruction in such a manner that it could no longer be ignored.¹⁵

As the erosion of biological diversity became more visible and immediate, policy makers and members of the scientific community not traditionally focused on conservation came alive to the issue. In 1981, the United States Department of State sponsored an International Strategy Conference on Biological Diversity. In 1980 and 1981, the United Nations Food and Agriculture Organization and the U.N. Environmental Program hosted four conferences in Rome on the conservation of genetic resources of fish, other animals, forests, and crops. This concern over the loss of domestic animal and crop germplasm highlighted a growing trend. The loss of diversity at the genetic level, a relatively neglected area of research in conservation, became a critical focus during these years. In 1982, several conservation organizations, U.S. agencies, and UNESCO sponsored a conference in Washington devoted to the "Application of Genetics to the Conservation of Plants and Animals."¹⁶ As a result of these efforts, the conservation of germplasm and analysis of the genetic basis of "viable" populations gained a more prominent place on the conservation research agenda. Many of those who now began to identify themselves as "conservation biologists," in fact, had their scientific roots in biology at the genetic rather than the population or ecosystem level.

The term "conservation biology" itself was not new. It had been used previously, although in an inchoate sense.¹⁷ After 1978, the year that the first International Conference on Conservation Biology was held at the University of California-San Diego, it

began to denote a more direct infusion of conservation efforts with recent findings in genetics, evolutionary biology, theoretical ecology, and biogeography.¹⁸ At the same time, new insights in the earth and environmental sciences were enriching the intellectual atmosphere surrounding conservation issues. Since at least the mid-1970s, geophysicists had been drawing attention to the important role of rainforest vegetation in regional and global climatic patterns and the associated water and carbon cycles. Meanwhile, the revolutionary synthesis of plate tectonics in geology and the provocative elucidation of the Gaia hypothesis served to draw the life sciences and geophysical sciences closer together in both theory and method. A further contribution came in the early 1980s, when Luis and Walter Alvarez stimulated scientific discussion of mass extinction with their novel theory that the extinction event at the Cretaceous-Tertiary boundary was due to a devastating asteroid impact. The theory (and, importantly, related debates surrounding the "nuclear winter" scenario in 1984-1985) not only put biological diversity into a revised evolutionary and ecological context, but gave it enhanced visibility at both the professional and popular level.¹⁹

In 1986 a second international conference on conservation biology was held at Ann Arbor. By this time professional interest was focused enough to support establishment of the Society for Conservation Biology and its new journal, *Conservation Biology*. Growing numbers of scientists and conservation officials, and in particular young professionals trained with post-Earth Day environmental sensibilities, found in the approach of conservation biology a refreshing perspective on the problems confronting their varied fields and professions. More specifically, it represented an intensified effort to address conservation issues as they must inevitably be addressed: through the integration of conservation theory and practice, philosophy and policy, underpinned by solid interdisciplinary scientific research and application, involving all levels of biological organization.

These varied forces reached critical mass in September 1986, when the U.S. National Academy of Sciences and the Smithsonian Institution sponsored a four-day "National Forum on BioDiversity." The forum, which included thousands of participants linked by satellite to Washington, brought together not only prominent biologists, but anthropologists, economists,

philosophers, policy makers, a poet, a filmmaker, a theologian. In 1988, the National Academy published the proceedings of the forum in the book *Biodiversity* (the abbreviated term "biodiversity" was suggested by Walt Rosen, a member of the NAS staff who assisted in planning the forum).²⁰ The volume has since become a standard reference. Its editor, E. O. Wilson, summarized the basic intent of the forum in his opening paragraph: "Biological diversity must be treated more seriously as a global resource, to be indexed, used, and above all, preserved. . . . We must hurry to acquire the knowledge on which a wise policy of conservation and development can be based for centuries to come."²¹

This, to a large degree, would become the mission of those who adopted the label "conservation biologist." The new terminology has not been without its critics, particularly in "traditional" conservation fields such as forestry and wildlife management, and this criticism has not been without some merit.²² New terms always run the threat of becoming buzzwords—substitutes for, rather than indicators of, progress. But terms come into (and fade from) circulation for good reasons, and these reasons are usually more important than the terms themselves. In this case "conservation biology" and "biodiversity" capture new emphases in the science, its epistemological context, and its application: the crisis orientation; the neglected importance of diversity in previous conservation research; the need to move beyond conservation efforts that focused only on a few large, beautiful, edible, popular, watchable, huntable, and/or economically important species; the need to adopt a longer-term view of the evolutionary and ecological background of conservation practices; the recognition of the importance of geographical scale and biological hierarchies; the impact of unprecedented global environmental phenomena (e.g. population growth and the greenhouse effect) on floral and faunal composition; accordingly, the need to bring a more balanced international perspective to conservation, and to anticipate problems in exporting the traditional temperate zone/American model; and the need to counter the "hardening of the categories" that afflicts scientific (as well as humanistic) inquiry and exploration in the modern age.

Conservation, in short, is evolving, reforming itself, as it has always done in the past, as it must to meet the demands that

will be made on it in the future. The emergence of conservation biology and the rise of biodiversity as a unifying concept indicate that the scientific foundations of conservation are expanding, overlapping, and shifting, out of necessity and through new understanding. In this, it is not so much a new science as it is a more comprehensive, better integrated response to problems that are themselves, tragically, more extensive, more immediate, and more intricate than most had realized in 1970. In doing so, it builds on and extends a tradition of applied ecological knowledge in conservation that has always been present, but that has long been stifled by narrower approaches. Universities, agencies, professional groups, and conservation organizations have begun to adapt, in varying degree, to the reorientation. The process continues. "These changes," as E. O. Wilson writes, "can be expected to reshape the international conservation movement for decades to come."²³

WILSON NOTES THAT, during these same years, awareness was growing "of the close link between the conservation of biodiversity and economic development. In the United States and other industrial countries, the two are often seen in opposition, with environmentalists and developers struggling for compromise in a zero-sum game. But in the developing nations the opposite is true. Destruction of the natural environment is usually accompanied by short-term profits and then rapid local economic decline."²⁴ This awareness grew quickly in the 1980s as the bright bloom of the Green Revolution began to fade in many areas, and as large-scale international development policies and projects, many of them profoundly threatening to biological and cultural diversity, failed to fulfill their promise. Meanwhile, the industrialized nations began to face the accumulated costs of environmental neglect—in their soils and waters, on their remaining wildlands, on their farms and in their suburbs, in their industrial sectors and urban cores. Even the wealthy nations had to begin to assess the need for what George Perkins Marsh called so perfectly, so long ago, "a wise economy."

In 1970, the blueprints for building such an economy, and a society around it, were only vaguely visible. Part of the problem

was that conservationists had long had their hands full trying to save all the pieces that the older structure had marginalized; keeping abreast of losses precluded any systematic devotion to alternatives. But another part of the problem was that most social scientists and development experts had received training in sociology, economics, history, and political science that treated human society "almost as if it were a separate entity." The social sciences were not alone in this regard, of course, but merely reflected dominant social attitudes and the ever-greater specialization of the professions and disciplines following World War II. Even professional conservationists, by and large, still treated human society and the biotic community as "separate entities," simply concentrating on the latter.

The prospects, then, circa 1970, were not altogether encouraging. The biologists and conservationists who knew most about the ecological foundations of human society were generally unprepared, by training and often by temperament, to tackle the tough questions of socioeconomic reform and readjustment. Social scientists, economists, historians, politicians, and the media were unschooled in the intricacies of the natural and environmental sciences, and often uninterested. That these two broad human "taxa" could learn fundamental lessons from one another seemed a faint hope. That they would nonetheless *have to* learn from one another would, as we entered the 1990s, be beyond question, at least for a growing number of concerned citizens, scientists, and policy makers.

Conservation biologists have, as noted above, played an important role in changing the terms and the atmosphere of the debate. In doing so, they have had to broaden their traditional focus on biological reserves, habitat preservation, and single species management and come to see biological diversity in its full social, historical, and geographical context. Ray Dasmann summarized this realization in 1987, when he wrote that "we cannot extend our concern for wild nature unless we are also concerned for the welfare of people, because the two cannot be separated. . . . If efforts to conserve biological diversity are to succeed, nature conservation must become part of a total land use pattern. Sustainable use and management must have a role." Dasmann himself noted that "a decade or two ago these words would not have been received with much enthusiasm."²⁵ In those

intervening years, however, the increasingly evident relationship between social and economic pressures and environmental decline, particularly in the developing world, had left little room, and less time, for piecemeal approaches.

During these years, the term "sustainable" emerged to describe the new orientation. As with any new catchphrase (including "conservation biology"), it faced serious obstacles to acceptance: the red pencil of editors, the blank stares of the unaware, the coolness of entrenched academics, the caution of reluctant bureaucrats, the ardor of its own adherents. Many authors ran with it, not pausing to look back. Others lamented its lack of definition, as if this were some fatal disease, and not the sign of new ideas being conceived. Still others were understandably insulted. Among development theorists, analysts, and experts, "sustainability" was always a given. Just as conservationists had taken biological diversity for granted, so had their colleagues in the social sciences rarely stopped to ponder the ecological preconditions of social cohesion and continuity; it, in a sense, was the medium in which *their* work took place. Now, however, those basic factors had to be given greater weight.

These considerations were hardly being weighed for the first time. Thomas Robert Malthus in many ways began the discussion in 1798 with his *Essay on the Principle of Population*, applying to human society a primitive version of the principle that ecologists would later call "carrying capacity." Malthus' scenario was not optimistic. Extrapolating the trends as he saw them, he discerned an inevitable tendency toward overpopulation and resource scarcity. Marsh, looking in 1864 at the influence of prevailing patterns of resource use on "the social life and social progress of man," was a bit more sanguine; while he held only a "faint hope that we shall yet make a full atonement for our spendthrift waste of the bounties of nature," he did look forward to "an epoch when our descendants shall have marched as far beyond us in physical conquest as we have marched beyond the trophies erected by our grandfathers."²⁶

With the subsequent rise of the conservation movement in the United States in the early 1900s, the notion of sustainability appears in the guise of "sustained yield" of timber, water supplies, range forage, fisheries, and, somewhat later, wild game populations. Compared to the lack of restraint that had characterized the use

of these resources over the centuries, the idea that they could and should be managed rationally for perpetual economic benefits was revolutionary. But the underlying reductionist, utilitarian assumptions—that they were discrete "resources," and that they existed solely for the perpetual economic benefit of human beings—would come to be challenged in turn by a yet broader view of conservation that combined science, ethics, aesthetics, and long-term economics in its rationale.

An important turning point came in the 1930s, when a vanguard of American scientists and conservationists began to explore the social and economic as well as biological ramifications of the emerging science of ecology. The influences were many: the intensification of agriculture, particularly in the American midwest, in the 1920s; subsequent accelerated rates of soil erosion and habitat loss; the devastation of the Dust Bowl; the simultaneous disruption of the human economy and social system; the progressive disappearance of wilderness; unprecedented irruptions of wildlife populations; increasing rates of local extinctions and extirpations.²⁷ These and other factors combined to produce a realization that what we now term "sustainability" was in fact predicated not merely on the fine latticework of ideas concerning the human community, but also on basic ecological facts of life.

Aldo Leopold embodied this transition. A product of the early conservation movement, his lifelong efforts to reconcile the preservationist and utilitarian viewpoints within the movement, and to bring a stronger scientific viewpoint to environmental dilemmas, led him to question the very premises on which conservation had been built. Ultimately, he would argue for an approach that stressed the need for both preservation and "wise use" within a broader context, based on a critical understanding of environmental change and ecological functions, an informed aesthetic appreciation of natural processes and objects, and an ethical regard and respect for the "land community" as a whole.²⁸ The transition did not come quickly for Leopold, and it did not come easily. The aspect of his shift in perspective most pertinent to the current discussions of sustainability occurred in the latter half of the 1930s. In 1935, Leopold noted that "philosophers have long since claimed that society is an organism, but with few exceptions they have failed to understand that the organism

includes the land which is its medium."²⁹ By the end of the decade that essential relationship would be recast in his thought and in his prose: ecology, the "new fusion point for the sciences," taught Leopold to see land as the whole that included human society, and the study of its lifeways could help reveal how human beings might live decently within it. He charged his scientific brethren with the task: "We might get better advice from economists and philosophers if we gave them a truer picture of the biotic mechanism."³⁰

That task, however, would be put on hold by World War II. The struggle for dominance and survival in the human community drained attention away from the broader considerations of the relationship between the human and biotic communities. The promising syntheses within conservation in the late 1930s faded in the fog. As Leopold himself noted, "Against a background of war, [conservation] looks like a milk-and-water affair."³¹ But in ways not immediately apparent, the war also served to focus attention on conservation issues. The internationalization of a generation, the heightened role and responsibility of science, the accelerated pace of resource exploitation, the advent of new production processes, and the employment of atomic weaponry—the most concentrated threat to "sustainability" yet devised—would redefine the context of environmental debate.

In the years immediately following the war, a series of ecologically informed, international-scale assessments of the global condition appeared that were, in Robert Paehlke's words, "precursors of a coming change in public consciousness."³² Two of these, Fairfield Osborn's *Our Plundered Planet* and William Vogt's *Road to Survival* (both published in 1948), were especially important in conveying the message to the conservation community. Osborn, bringing a more modern perspective to Marsh's essential points, wrote that "man must recognize the necessity of cooperating with nature. He must temper his demands and use and conserve the natural living resources of this earth in a manner that alone can provide for the continuation of civilization. The final answer is to be found only through comprehension of the enduring processes of nature."³³ "Above all," Vogt wrote, "we must learn to know—to feel to the core of our beings—our dependence upon the earth and the riches with which it sustains us"³⁴ [emphases added]. The same intellectual climate led to

Leopold's concurrent expression of the land ethic: "A land ethic changes the role of *Homo sapiens* from conqueror of the land community to plain member and citizen of it. It implies respect for his fellow members, and also respect for the community as such."³⁵ Such expressions, ignored for the most part by the intellectual leaders of the era, and little heeded in the post-war rush to normalcy and prosperity, nonetheless would have a tenacious hold on readers who, by one route or another, came to them. Those readers, in turn, would lead the country to Earth Day.

The process by which the various strands of "sustainability" came to be woven together in the ten years before and after Earth Day is a complex one, and we are only now gaining perspective on the patterns. The emergence of concern about biological diversity, summarized above, was a highly significant part of that process. Others bear at least brief mention. With *Silent Spring*, Rachel Carson brought the basic concepts of ecology to an audience of unprecedented size. Paul Ehrlich's best-selling book *The Population Bomb* (1968) picked up the Malthusian theme and reignited that aspect of the discussion. Garrett Hardin's essay "The Tragedy of the Commons," first published in 1968, showed the power of carrying capacity as a conceptual tool in comprehending the environmental impact of human population pressure. Barry Commoner's work in the 1960s and 1970s emphasized the role of technological choices and socioeconomic systems in determining the actual impact that population growth would have on environmental systems. The energy crises of the 1970s brought home the fundamental role of energy production, transport, and consumption in determining not only the environmental impact, but the very character, of modern society. Amory Lovins' *Soft Energy Paths* (1977) led the way to alternative analyses of this critical factor. Kenneth Boulding, E. F. Schumacher, and Herman Daly, among other non-traditional economists, helped to move that field toward not simply a more rational approach to ecological conditions, but toward an economics that drew on and applied basic ecological principles to human economic systems.³⁶

This partial list of the best known publications can only serve, at best, as an index of the general surge of environmental thought and activism. One might examine any specific area of environmental reform to trace the impact of this surge, but the

one that would prove most significant in the evolution of the "sustainability" idea would be the most fundamental: agriculture. As these assorted factors in the formula—population growth, technological change, pollution control, energy use, economic analysis—jostled for accommodation in the 1970s and the connections between them became better defined, American agriculture in particular presented an important area for their integration.

Agriculture, in a post-World War II pattern that characterized, to a greater or lesser extent, all areas of resource use in the developed world—forestry, fisheries and water resource management, range management, wildlife management, recreation—became more specialized, intensive, and commodity-driven even as many aspects of the resource base deteriorated. In each of these areas, alternative, more integrated approaches went into deep eclipse for a generation. On the agricultural front, many traditional techniques of soil conservation and management were widely abandoned, but they had secured a niche in modern agricultural policy and science beginning in the 1920s and held on to that niche through the post-war decades. In addition, the strong tradition of more holistic approaches to farming, though overshadowed, never disappeared entirely. With the rise of ecology these approaches began to gain the attention and imprimatur of science.³⁷

The manifold impacts of industrial-style agriculture—groundwater contamination, accelerated soil erosion, soil compaction, nutrient depletion, salinization, pesticide resistance, diminished soil floral and faunal activity, decreasing wildlife populations, loss of crop germplasm diversity, farmer health problems, declining rural communities, economic insecurity—became increasingly evident in the late 1970s and 1980s, reinforcing one another in a cycle that fragmentary approaches could not effectively address. Agricultural science, education, and policy, locked into strong traditions of their own, responded slowly to the situation.

The result was a grassroots "sustainable agriculture" movement (although it had and has many other names) that brought the term into wide usage among a constituency that—importantly—could apply it on the ground and give it greater definition. This trend was reinforced when the economic crises and droughts of the mid- to late 1980s drove many farmers off the land, and

forced an even greater number to take a hard look at the economics, in particular the high cost of purchased inputs, of their farming practices. As a consequence more and more farmers have begun to adopt alternative practices for economic reasons, but have realized other benefits. Sustainable agriculture has by no stretch of the imagination won the day, and the formula for achieving it will never be finally determined (and indeed must vary by site and circumstance). But the very process of research, demonstration, and application, usually led by the farmers themselves, has given strength to the movement. Along the way the term "sustainability" and its variants have come to signify a broadened approach that simultaneously tries to deal with the social, economic, agronomic, environmental, and intergenerational costs of conventional agriculture.

Meanwhile, a parallel shift has taken place—to what degree it is hard to measure—at the international level. International development programs, which by the nature of their mission entail a large component of *agricultural* development, have for decades been dominated by efforts to export the American model of high-input production agriculture. The technologies that collectively comprised the Green Revolution succeeded in raising raw yields in many regions of the world, but not without significant social and environmental costs. As the gains in yield show signs of plateauing, additional arable lands have grown scarce, and the quality of the soil and water resource base has suffered the effects of widespread neglect and abuse. The environmental and associated cultural impacts of the large scale, energy-dependent methods have called into question many basic assumptions of the development model.³⁸

At the same time, the complicity of international development agencies (in particular the large international lending institutions) in funding environmentally insensitive development projects, backing economically perverse policies, and leading developed countries into deeper and deeper ruts of debt, reinforced the sense that alternative approaches were needed. The most dramatic and well publicized consequence of the old approach—the intensified conversion of the rainforests of the Amazon basin—represented the final absurdity of a way of thinking about human communities and their development that by the late 1980s had run its course. In this environmental crucible, concerns over biodiversity loss,

poverty, the decline of indigenous cultures, and inappropriate approaches to development melded together in sadly spectacular fashion.

Importantly, this took place just as additional global scale environmental concerns—the depletion of the Earth's ozone layer, the specter of the greenhouse effect, the Law of the Sea negotiations—came to the fore. A culminating point in this period was the release in 1987 of the widely publicized report of the World Commission on Environment and Development, *Our Common Future* ("the Brundtland Report," as it came to be called), which called for a redirection of international development policies to foster sustainable economic development and resource management.

The Brundtland Report, however, was only the latest, most prominent (and by no means least controversial) summary statement concerning international development and environmental policy. The advocates of sustainability had been busy for over ten years in an intensive effort to define and refine their alternative analyses. Building in particular on the insights (and faults) of the landmark Club of Rome report *The Limits to Growth* (1972), this work was reflected in an outpouring of new publications that brought the idea before policy experts and the general public. A far from complete list of these publications would include: *Alternatives to Growth: A Search for Sustainable Futures* (1977), *The Dispossessed of the Earth: Land Reform and Sustainable Development* (1979), *Assessing Tropical Forest Lands: Their Suitability for Sustainable Uses* (1981), *Building a Sustainable Society* (1981), *Sustainable Food Systems* (1983), *Agricultural Sustainability in a Changing World Order* (1984), *Sustainable Resource Development in the Third World* (1987), *Sustainable Development: Exploring the Contradictions* (1988), *Sustainable Development in Agriculture* (1988), *Sustainable Environmental Management: Principles and Practice* (1988), and *Fragile Lands of Latin America: Strategies for Sustainable Development* (1989).³⁹ There were many others, and the library is still expanding. Inevitably, this outpouring has been criticized as a mere bandwagon phenomenon. Others hold that the bandwagon has been too long in the coming. Still others point out that the mere invocation of "sustainability" does not portend any significant concern for the broader ecosystem except as it

concerns human welfare, thus perpetuating the very root cause of non-sustainability.⁴⁰

Whatever else the use of the term "sustainability" signifies, it represents a phenomenal shift in rhetoric and *potentially* in practice. Taken in sum, studies such as those provide a detailed blueprint for social change and development that was lacking on Earth Day 1970. Sustainability, like conservation biology, represents an attempt to implement a more integrated approach to the problems at hand. It has forced those who work on these issues to go back to basics, to ask fundamental questions about their methods and goals, and to take into account—quite literally—the ecological basis of secure human societies. And for some, at least, it has opened the way to a wider ethical perspective that allows ecosystems to be "sustained" not only for their human benefit, but for their own inscrutable purposes. As with conservation biology, this reorientation has forced universities, agencies, professional groups, and conservation organizations to adapt. There are signs that these adaptations will result in real changes, although the speed and depth of change have yet to be determined. That is where we come in.

THERE WILL ALWAYS be those who insist on framing any and all environmental issues in terms of "people versus trees," "jobs versus the environment," "progress versus stagnation." But people are becoming increasingly aware of the fallacies, simplistic assumptions, and myopic historical perspectives that underlie such sentiments, and are searching for viable, workable alternatives that do not involve choosing the short-term evil of individual hardship or the long-term evil of environmental decline. We all face this challenge, each in our own spheres of influence. If the prospects sometimes seem daunting, we might take some comfort in the reminder that the great naturalist Olaus Murie once offered: "Evolution is our employer."⁴¹

Over the last twenty years, conservation biology has emerged as an integrative area of scientific endeavor that tries to help us fathom the full diversity of life, understand the impact of human activities on that diversity, and devise means to maintain and restore it within functionally healthy ecosystems. To do so, it

has had to pay increased attention to the human side of our dilemma: the historical patterns, social conditions, policy decisions, and development goals that so largely determine the fate of biological diversity around the world—and in our backyards. Conservation biology, in this sense, is an important indication that we may be overcoming the dichotomy that Leopold described in 1935.

Over the last twenty years, too, sustainability has become an umbrella term to guide social development in a manner that recognizes the fundamental importance of ecosystem health and the diversity of life—the ultimate source and basis of healthy human societies. Although still defined largely in human economic terms, sustainability does imply that constant attention must be given to long-term environmental quality, and shows promise that it may come to recognize the inherent value of the biotic community in which human society has coevolved and with which human society must coexist. Sustainability, in this sense, is also an indication that we have advanced toward the day when Leopold's dichotomy will be of interest only to historians.

The advent of conservation biology and the widely stated goal of sustainable societies indicate that the times have indeed changed. Both concepts attempt to encompass vast realms of knowledge and activity. We find now that these spheres, the biotic and the human, can no longer be considered separately. If on Earth Day 1970 those concerned with the health of the environment and those concerned with the health of human society generally spoke past one another, this can no longer be the case. Their words were stones, cast into a large pool of frustration. Now the concentric circles emanating from those stones have rippled widely on the water, growing more comprehensive with time, meeting and overlapping, and finally converging into a common circle of concern.

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NOTES

1. Edward Abbey, *Abbey's Road* (New York: E.P. Dutton, 1979), 127.
2. George Perkins Marsh, *Man and Nature, Or, Physical Geography as Modified by Human Action*, edited by David Lowenthal (Cambridge: Harvard University Press, 1965), 43. Originally published in 1864.
3. *Ibid.*, 29.
4. Aldo Leopold, Review of A. E. Parkins and J. R. Whitaker, *Our Natural Resources and Their Conservation, Bird-Lore* 39, 1 (1937), 75.
5. Quoted in Curt Meine, *Aldo Leopold: His Life and Work* (Madison: University of Wisconsin Press, 1988), 359–60.
6. See "The Outlook for Farm Wildlife" in Susan Flader and J. Baird Callicott, eds., *The River of the Mother of God and Other Essays by Aldo Leopold* (Madison: University of Wisconsin Press, 1991), 326.
7. See Roderick Nash, *The Rights of Nature: A History of Environmental Ethics* (Madison: University of Wisconsin Press, 1989), 125; and Stephen Fox, *John Muir and His Legacy: The American Conservation Movement* (Boston: Little, Brown and Company, 1981), 326.
8. "Herbicide Rates: The Quest for Less," *Prairie Farmer* 163, 4 (February 19, 1991), 14.
9. "Environment Again Seen as a Topic for Study," *Chicago Sun-Times*, November 13, 1990, 22.
10. "A Brief Version of Our Ideas," *Green Brigades-Ecologists' Paper*, 2 (Summer 1990), 15. This passage is drawn from a statement of the Congress of the Green Federation, Kosciuszki, Poland, June 30–July 2, 1989.
11. Ricardo Bayón, "The Blame? Who Cares?," in *Independent Sectors Network '92* 3 (December 1990), 2–3. Published by The Centre for Our Common Future, Geneva, Switzerland.
12. Michael Soulé, "History of the Society for Conservation Biology: How and Why We Got Here," *Conservation Biology* 1(1), 4.
13. Aldo Leopold, *A Sand County Almanac and Sketches Here and There* (New York: Oxford University Press, 1949), 110.
14. Edward O. Wilson, "The Current State of Biological Diversity," in *Biodiversity*, E. O. Wilson and F. M. Peter, eds. (Washington, D.C.: National Academy Press, 1988), 5.
15. Prominent examples from this crucial period include Norman Myers' *The Sinking Ark* (Oxford: Pergamon Press, 1979), Anne and Paul Ehrlich's *Extinction* (New York: Random House, 1981), and the National Academy of Sciences reports *Conservation of Tropical Moist Forests and Research Priorities in Tropical Biology* (1980).
16. I am grateful to Sherri Boykin for providing a chronology of these events in her "Brief History of the Rise of Conservation Biology," prepared for the Conservation Biology Seminar at the University of Wisconsin-Madison, February 1987.
17. Susan Jacobson notes, for example, that Paul Errington and Frederick Hamerstrom, in the first article of the first issue of the *Journal of Wildlife Management*, referred to "the new and growing field of conservation biology."

In the same issue, a statement of policy for the new Wildlife Society stated that "wildlife management along sound biological lines is also part of the greater movement for conservation of our entire native flora and fauna." See Susan Jacobson, "Graduate Education in Conservation Biology," *Conservation Biology* 4(4), 431-40.

18. Out of this initial conference emerged the volume *Conservation Biology: An Evolutionary-Ecological Perspective*, edited by M. E. Soulé and B. A. Wilcox (Sunderland, Mass.: Sinauer Associates, Inc., 1980).

19. Allen Mazur and Jinling Lee, "Sounding the Global Alarm: Environmental Issues in the National News," unpublished manuscript. I would like to thank Dr. Mazur for emphasizing these points in personal correspondence.

20. Edward O. Wilson, "Editors Foreword," in *Biodiversity*, vi.

21. Wilson, "The Current State of Biodiversity," 3.

22. See the articles, for example, in the "In My Opinion . . ." section of the *Wildlife Society Bulletin* 17(3), 335-60.

23. Wilson, "Editor's Foreword," vi.

24. *Ibid.*, v-vi.

25. Ray Dasmann, "The Land Ethic and the World Scene," in Thomas Tanner, ed., *Aldo Leopold: The Man and His Legacy* (Ankeny, Iowa: Soil Conservation Society of America, 1987), 114.

26. Marsh, *Man and Nature*, 13, 44.

27. For overview discussions of this transition, see especially Donald Worster, *Nature's Economy: A History of Ecological Ideas* (Cambridge: Cambridge University Press, 1985; first published by Sierra Club Books in 1977), 205-290; and Nash, *The Rights of Nature*, 55-86.

28. For more detailed examinations of the development of Leopold's conservation philosophy, see Susan Flader, *Thinking Like a Mountain: Aldo Leopold and the Evolution of an Ecological Attitude Toward Deer, Wolves, and Forests* (Columbia: University of Missouri Press, 1974); J. Baird Callicott, *In Defense of the Land Ethic: Essays in Environmental Philosophy* (Albany: State University of New York Press, 1989); Roderick Nash, *The Rights of Nature: A History of Environmental Ethics* (Madison: University of Wisconsin Press, 1989); Eugene Hargrove, *Foundations of Environmental Ethics* (Englewood Cliffs, N. J.: Prentice Hall, 1989); Max Oelschlaeger, *The Idea of Wilderness: From Prehistory to the Age of Ecology* (New Haven: Yale University Press, 1991); and Curt Meine, "The Utility of Preservation and the Preservation of Utility: Leopold's Fine Line," in *The Wilderness Condition: Essays in Environment and Civilization*, in Max Oelschlaeger, ed., (San Francisco: Sierra Club Books, 1992).

29. "Land Pathology," in Flader and Callicott, *The River of the Mother of God*, 212.

30. "A Biotic View of Land," in Flader and Callicott, *The River of the Mother of God*, 267.

31. "Land Use and Democracy," in Flader and Callicott, *The River of the Mother of God*, 295.

32. Robert Paehlke, *Environmentalism and the Future of Progressive Politics* (New Haven: Yale University Press, 1989), x.

33. Fairfield Osborn, *Our Plundered Planet* (Boston: Little, Brown and Company, 1948), 201.

34. William Vogt, *Road to Survival* (New York: William Sloane Associates, 1948), 286.

35. Leopold, *A Sand County Almanac*, 204. For additional discussion of the historical and intellectual context of Leopold's land ethic, see especially S. Flader, "Aldo Leopold and the Evolution of a Land Ethic," in Tanner, *Aldo Leopold: The Man and His Legacy*; J. B. Callicott, "The Conceptual Foundations of the Land Ethic," in *In Defense of the Land Ethic*; R. Nash, "Aldo Leopold's Intellectual Heritage," in J. B. Callicott, ed., *Companion to A Sand County Almanac: Interpretive and Critical Essays* (Madison: University of Wisconsin Press, 1987); and C. Meine, "Building 'The Land Ethic,'" in Callicott, *Companion*.

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37. See especially Richard Harwood, "A History of Sustainable Agriculture," in C. A. Edwards, R. Lal, P. Madden, R. H. Miller, G. House, eds., *Sustainable Agricultural Systems* (Ankeny, Iowa: Soil and Water Conservation Society, 1990), 3-19.

38. For a detailed discussion, see V. W. Ruitan, ed., *Biological and Technical Constraints on Crop and Animal Productivity: Report on a Dialogue* (St. Paul: University of Minnesota Institute for Agriculture, Forestry, and Home Economics, 1989). See also Charles Benbrook, "Protecting Iowa's Common Wealth: Challenges for the Leopold Center for Sustainable Agriculture," *Journal of Soil and Water Conservation* 46(2), 89-95. See also Richard B. Norgaard, "The Development of Tropical Forest Economics," and Stephen Gliessman and Robert Grantham, "Agroecology," both in Suzanne Head and Robert Heinzman, eds., *Lessons of the Rainforest* (San Francisco, Sierra Club Books, 1990).

39. See Meridith and Greenberg, "Global Sustainability: A Selected, Annotated Bibliography."

40. For example, see N. C. Brady, "Making Agriculture a Sustainable Industry," in C. Edwards et al., eds., *Sustainable Agricultural Systems*, 20-32; Kenneth Dahlberg, "Sustainable Agriculture—Fad or Harbinger?" *BioScience* 41(5), 337-39; Hal Salwasser, "Sustainability as a Conservation Paradigm," *Conservation Biology* 4(3), 213-16; Reed Noss, "Sustainability and Wilderness," *Conservation Biology* 5(1), 120-22.

41. Olaus Murie, "Ethics in Wildlife Management," *Journal of Wildlife Management* 18(3), 290.