

A New Century for Natural Resources Management

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Chapter 1

The Oldest Task in Human History

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The whole world is coming.

A nation is coming, a nation is coming.

The Eagle has brought the message to the tribe.

The father says so, the father says so.

Over the whole earth they are coming.

The buffalo are coming, the buffalo are coming.

The Crow has brought the message to the tribe.

The father says so, the father says so.

Sioux Ghost Dance Song (1890)(1)

We end, I think, at what might be called the standard paradox of the twentieth century: our tools are better than we are, and grow better faster than we do. They suffice to crack the atom, to command the tides. But they do not suffice for the oldest task in human history: to live on a piece of land without spoiling it.

Aldo Leopold (1938)(2)

One way to understand the roots of conservation in the United States is to examine the documentary evidence from official meetings, policy decisions, and legislative actions that took place a century ago. Another way is to examine the evidence outdoors, *in situ*, in the landscapes we inhabit, in the places we are.

Most of the tangible links to conservation's origins have disappeared. The bones of the myriad bison were long ago hauled off the plains to meet their ends in glue pots and gardens. The plumes of the egrets have gone the way of all fashion. The remains of the last passenger pigeons roost beneath bell jars, growing fustier with every passing decade. The topsoils of the midwestern prairies rest in downstream mucks; the plants that made them—and that they made—have lost their claim on the horizon, and do well to hold on in their graveyard and railway refugia.

Some objects, however, remain to bear witness. Walk among the aspen, balsam fir, paper birch, and bracken fern forests in the upper Great Lakes and you will find them: the old stumps of the fallen white pines. Some

hunker down in the shade of sugar maples (to become, with a minor leap of imagination, bears). Others stand out, weathered gray, in grassy openings. Their insides have rotted away, moss, lichen, and insects doing the work of the ages. Only the outer annual rings of punky wood remain, disintegrating easily in the human hand. Many of the stumps are charred about their sides—reminders upon reminders, signs of the fire last time.

The epoch of white pine logging reached its climax in northern Wisconsin and adjacent Michigan in the late 1880s and early 1890s. The seeds from which those trees sprouted had sifted to earth two, three, even four centuries before that. Who knows how deep their roots went. White pine sometimes followed white pine on the same site, the roots reinhabiting tried-and-true pathways carved through glacial soil, boulder fields, and bedrock by their patient ancestors.

An early forester, writing in 1898, described the effects of one brief generation of lumbering on northern Wisconsin. "Nearly the entire territory has been logged over. The pine has disappeared from most of the mixed forests and the greater portion of pineries proper has been cut. . . . Nearly half of this territory has been burned over at least once, about three million acres are without any forest cover whatever, and several million more are but partly covered by the dead and dying remnants of the former forest. . . . Here are large tracts of bare wastes, 'stump prairies,' where the ground is sparsely covered with weeds and grass, sweet fern, and a few scattering, runty bushes of scrub oak, aspen, and white birch" (3). By the time those words were written, the smart lumbermen of the white pine states had already shifted their attention and capital to the pinelands of the south and the astonishing conifer forests of the Pacific Northwest.

From the standpoint of the culture whose three centuries of expansion brought them down, the extensive stands of *Pinus strobus*, from Maine to Minnesota, were in exactly the right place at exactly the right time, providing the raw material it desired most ardently and insatiably. From the white pine's perspective—if we may grant a perspective to another species—its distribution placed it in the worst possible place at the worst possible time, directly in the path of a gathering force that had little inclination to pause, even to consider the circumstances conducive to its self-perpetuation. As the "inexhaustible" pineries were, in due course, exhausted, pause came of necessity, at least for some people and some forests (4).

The old stumps will not last much longer. In a few more years, they will have melted back to the soil, reabsorbed by the medium, returned fully to the flow of time and nutrients. For a little while more, they will record the extreme to which a concept of social and economic development was taken,

and the moment when a new commitment to "the oldest task in human history" germinated.

The delirious climax of white pine logging coincided with other indicators of changing times, landscapes, and social conditions. In 1889, weary remnants of the Indian nations across the west undertook the Ghost Dance in a desperate effort to revive their lost world. The dance and the dream came to an end on December 29, 1890, at the Battle of Wounded Knee (5). The report of the 1890 census, noting that the "unsettled" area of the United States had become broken into isolated fragments, declared that the "frontier of settlement" had closed. Three years later, at the Columbian Exposition in Chicago, historian Frederick Jackson Turner would build on this finding in his seminal discussion of "the significance of the frontier in American history" (6). In the fall of 1890, Congress acted to protect the lands now included within Yosemite and Sequoia National Parks (7). And on March 3, 1891, Congress passed the Forest Reserve Act; later that month President Harrison signed into existence the Yellowstone Park Timber Land Reserve, the nation's first forest reserve and the germ of the national forest system (8).

A century ago, some of these "current events" were widely reported; others were hardly noticed. A century later, they appear as transition points in a pattern of cultural change. The pattern is still emerging. There is no definitive agreement on its development in the past or its implications for the future, and it contains much room for debate, varied emphasis, and alternative visions. But the changes that began in the 1890s would be fundamental; the basic and tacit assumptions of the preceding era would no longer go unchallenged. Few contemporary citizens, for example, saw the lumber barons' "large tracts of bare wastes" as anything but evidence of the latest welcome advance of civilization. And while deforestation has continued to be visited upon other lands, and the attitudes behind deforestation persist, stumpfields at least are no longer what they were a century ago—a universal emblem of human progress.

The changes of the 1890s did not arrive unanticipated. Although belief in the creed that the stump symbolized had long dominated American society, undercurrents of reaction against it had welled up intermittently, emerging through various cultural channels. Early and mid-18th century poets, writers, and thinkers—most notably Ralph Waldo Emerson and Henry David Thoreau—articulated an alternative view of the natural world, as a source not simply of material goods, but also of aesthetic satisfaction, philosophical insight, and spiritual solace. Landscape artists of the period,

including Thomas Cole, Asher Durand, Frederick Edwin Church, Albert Bierstadt, and Thomas Moran, conveyed a similar view in their light-suffused canvasses. Other adventuring artists—Karl Bodmer and George Catlin prominent among them—gave real faces and lives to the generic “savages” that existed beyond the ken of “civilization.” At the same time, a diverse group of proto-conservationists, including George Perkins Marsh, Frederick Law Olmsted, John Wesley Powell, George Bird Grinnell, and Carl Schurz, insisted that the attitudes and policies that had until then guided European settlement and development of the North American landscape required adjustment.

For most of the century, these remained the expressions of a responsive few. As of 1890, there was no coherent body of philosophy, science, history, literature, economics, policy, and law through which the American people could understand and govern their long-term relationship with the natural world, and little evidence that such was regarded as an important social goal. Although there were important antecedents to a coming transformation—among them, the establishment of Yellowstone National Park (1872) and the Adirondack Forest Preserve (1885); the organization of the American Forestry Association (1875); and the founding of the original Audubon Society and Boone and Crockett Club (in 1886 and 1887, respectively)—these were sporadic developments. In 1890, there was no U. S. Forest Service; there was, for that matter, no actual profession of forestry in the United States. Nor were there professions devoted to wildlife or range management, or government agencies overseeing these concerns. There was little public discussion of the responsibility of private citizens and private industry toward the natural objects, processes, and conditions on which their livelihoods, and the well-being of the society, depended. By 1890, however, the doctrine of conquest and the undercurrents of opposition to it had begun to precipitate out the social and political movement that would come to be called *conservation* (9).

No one person can be said to have ushered in the new movement. Two figures, however, stand out as exemplars of the impulses that drove it and the tensions that divided it: John Muir and Gifford Pinchot.

In 1889 and 1890, John Muir was primarily occupied with the effort to gain federal protection for the lands surrounding his beloved Yosemite Valley. His success in this endeavor led to the formation of the Sierra Club in 1892, and to Muir's ascendance as the country's leading voice for the protection and preservation of wild nature—a role he would maintain until his death in 1914. Building on philosophical foundations laid by Emerson and Thoreau, but bringing to his arguments a lifetime of experience in wild

country, Muir made the public case for preservation on several grounds. Like many who were agitating on behalf of forests, Muir could cite the benefits of forest cover in protecting soils and regulating water flows. However, the protection of forests, and wilderness in general, involved a broader spectrum of values. Muir strongly emphasized the restorative powers of “a little pure wilderness”: exposure to original nature provided aesthetic, psychological, and spiritual benefits that could not be gained in urban or even pastoral landscapes. There was in Muir's outlook, too, an abiding sense of the intrinsic beauty and value of all things within “the one great unit of creation.” The plunder and waste that went by the name of progress thus constituted nothing less than acts of desecration, attributable ultimately to the hubris of “Lord Man.”

As the embodiment of the “romantic-transcendental preservation ethic” (as J. Baird Callicott has characterized it), Muir defined one wing of the nascent conservation movement (10). What guidance did this ethic offer in the effort to “live on a piece of land without spoiling it”? It said, in effect, that for those remnants of yet unspoiled land, one succeeds in the task by not living on them at all, but rather by setting them aside as places where, in the words of the later Wilderness Act, “man . . . is a visitor who does not remain.”

At the end of 1890, Gifford Pinchot was returning to the United States, having spent the previous year studying forest management in France, Switzerland, and Germany. Although interest in forestry had been growing in the United States (primarily among scientists) through the 1870s and 1880s, Pinchot was the first American to receive formal training in the field. He returned determined to bring professional forestry to a country where, as he put it, “the most rapid and extensive forest destruction ever known was in full swing” (11). Within 15 years, Pinchot, riding the wave of the Progressive movement with his friend and political patron Theodore Roosevelt, would succeed. With the creation of the Forest Service in 1905, Pinchot established forestry as the locus of conservation within the government and within the public mind.

And what was forestry? “Forestry,” he maintained until the end of his life, “is Tree Farming.” Its purpose: “. . . to make the forest produce the largest possible amount of whatever crop or service will be most useful, and keep on producing it for generation after generation of men and trees.” “The forest,” he added, “rightly handled—given the chance—is, next to the earth itself, the most useful servant of man” (12). This utilitarian emphasis lay at the heart of the “resource conservation ethic” that defined the other wing of the conservation movement, and that Pinchot more than any other individual promulgated and operationalized. Where Muir saw “one great unit of

creation," Pinchot found "just two things on this material earth—people and natural resources" (13). "The first great fact of conservation," it followed, "is that it stands for development" (14).

The guiding principle of utilitarian conservation was to manage resources so as to produce commodities and services "for the greatest good of the greatest number for the longest time." To this end, wild nature was not to be preserved, but actively manipulated by scientifically informed experts to improve and sustain yields. Those yields were to be harvested and processed efficiently, and the economic gains allocated equitably. How, then, to live on a piece of land without spoiling it? By strengthening the oversight role of government, enacting science-based regulations and resource management practices, developing the resources with a minimum of waste, and distributing the benefits of development fairly among all users.

During the 1890s and 1900s, Muir and Pinchot and their respective followers jostled for primacy, with the overarching figure of the day—Teddy Roosevelt—maintaining a precarious position between them. Although the sheer amount of energy and action invested in conservation during Roosevelt's presidential years served to divert attention from the movement's internal tensions, the two approaches to conservation could not and would not coexist for long. The tensions finally surfaced in the much-discussed battle over the damming of the Tuolumne River in Yosemite's Hetch Hetchy valley (15). The battle, waged over a 20-year period, reaching its denouement in 1913, drew the lines uncompromisingly: Hetch Hetchy could not be both preserved as natural parkland and used to store water. And so the controversy begged the ultimate question: what was it to *conserve* this place—or any place? Was there a conservation movement, or were there in fact two movements, born of related concerns but moving toward radically different ends?

The dam at Hetch Hetchy was built, but the underlying issue remained unresolved. Muir fought against the destruction of wild nature and the attitude that had allowed legitimate use to be perverted into rampant abuse. Pinchot fought against the inefficient use of natural resources, the political corruption that such use often entailed, and the inequitable distribution of wealth and power that had both allowed and followed rapid resource depletion. The preservationists and the utilitarians both opposed the destructive forces of the day, and their goals often overlapped. But their visions could not be accommodated (much less reconciled) until conservation itself was redefined, its scientific underpinnings reformulated, and its social implications reconsidered.

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That process would not begin until the 1930s. In the meantime, activism metamorphosed into administration. The political movement for conserva-

tion reform was transformed into the more mundane execution of conservation policy. And as that transformation occurred, Pinchot's vision held sway. By the late 1930s, the principles of utilitarian resource conservation had been applied not only to forests, but to other "useful" components of the landscape: river systems, agricultural soils, rangelands, sport and commercial fisheries, game animals, scenic areas. As new laws, policies, and bureaucracies were created to promote sustained yields of and from these components, resource management became fully institutionalized and professionalized.

The late 1930s stand out as an especially dynamic period in conservation history, as new resource problems arose, new scientific concepts and information emerged, and new thoughts on the social and economic context of conservation took form. In retrospect, World War II and its aftermath altered profoundly the roles of and relationships among the different resource management professions. For these reasons it is worth reviewing the origins and development of the various professions, and their status on the eve of the war.

Forestry

Forestry continued to serve as the lead conservation profession in the three decades following Pinchot's early campaign. Its role expanded as the Weeks Law (1911) and Clarke-McNary Act (1924) extended the national forest system to the eastern states, strengthened forestry research, and supported increased forestry activity at the state level. Training opportunities also expanded. Led by the Pinchot-endowed Yale Forest School, colleges and universities throughout the country established forestry departments to stock the Forest Service and state agencies, as well as the timber industry. As the most solidly established and, in many ways, broadest of the resource management professions, forestry also tended to attract those whose primary interest lay in related fields (such as wildlife conservation, recreation, soil conservation, and range management) that as yet lacked formal training and employment opportunities.

One result of this breadth was that the Forest Service—still a young agency with diverse responsibilities (and, significantly, a relatively flexible structure of administrative authority)—became a proving ground for new ideas in conservation. Through the 1910s and 1920s, many of the founding principles in range and wildlife management, soil conservation, wildland recreation, and wilderness protection derived from work on the national forests. Similarly, many of the rising leaders in conservation—including Aldo Leopold and Robert Marshall—came from the ranks of the Forest Service.

Forestry's flexibility in these early years is best appreciated against the background of the nation's changing timber supply and demand. The goals of the Forest Service in managing the national forests (as rather modestly stated in the 1905 *Use Book*, the governing manual of the Forest Service) were to "[preserve] a perpetual supply of timber for home industries, [prevent] destruction of the forest cover which regulates the flow of streams, and [protect] local residents from unfair competition in the use of forest and range" (16). While the focus within the Forest Service gradually shifted over the next two decades toward timber harvesting and silviculture, there remained much room to consider alternative uses and diverse approaches to forest management. As Robert Nelson points out in this volume, timber interests actually pressured the Forest Service to limit production from the national forests as a means of propping up prices for timber taken off of private holdings. As a result, recreation remained a (if not *the*) leading use of the forests until World War II (17).

There was, however, a further consequence to this trend that would have long-term consequences for the forestry profession. As the cut of timber on privately held lands continued apace, the specter of their depletion began to loom. By the early 1930s, many foresters, foreseeing the inevitable pressures this would bring to bear on public forests, began to argue for much stronger federal control of private forestlands. (Pinchot himself would inveigh against the "forest butchery" on private lands, calling on the government to exercise its "right to prevent forest destruction by private owners") (18). The warnings, for a variety of reasons, went largely unheeded. The upshot was that, when the supply of private timber inevitably tightened, the Forest Service and the profession of forestry as a whole would have less room politically and philosophically in which to maneuver. Even as forestry would come to define itself ever more narrowly by its emphasis on timber production, the conditions under which the profession operated were constricting.

Agriculture

The depletion and erosion of agricultural soils had been a concern among conscientious landholders since the earliest days of the republic. Thomas Jefferson, to cite one notable example, conducted early experiments in crop rotation and contour plowing. However, as long as new farmland remained cheap and readily available, farmers had little incentive to follow Jefferson's lead. No concerted national movement to protect soil and other farm re-

sources would emerge until expansion into new arable lands was economically prohibitive or geographically infeasible.

In the first three decades of the 20th century, however, agriculture confronted several overarching trends that would, by the late 1930s, place unprecedented emphasis on the conservation of soil, water, and wildlife on the farm. At the turn of the century, industrialization was rapidly altering the farm landscape through the mechanization and intensification of agricultural production. These transformations affected soils and wildlife habitat directly, not only by encouraging agricultural expansion (especially in the midwest and plains states), but by changing the nature of farm inputs, outputs, and cropping practices. At the same time, the draining of wetlands and the appropriation of surface waters for irrigation altered hydrological processes and aquatic systems over large portions of the midwest, high plains, intermountain west, and far west.

Agricultural expansion continued into the 1920s, as World War I gave increased impetus to preexisting pressures. New technologies and the complex agricultural economy of the 1920s allowed the number of farms to increase to a high of 6.8 million in the early 1930s, even as rural people moved into cities and towns and farm labor became more scarce (19). By the late 1920s, the changes in agriculture had begun to take their toll in the form of more widespread soil erosion (and associated problems with siltation and flooding), accelerated losses of wildlife habitat, and increasing economic instability and dislocation. These forces were felt to varying degrees in different regions of the country, but culminated in the mid-1930s with the disaster of the Dust Bowl in the southern high plains.

The U.S. Department of Agriculture issued its first advisory bulletin on soil erosion in 1928. Its coauthor, Hugh H. Bennett, would in the years that followed become the leading public advocate on the issue, proselytizing among farmers and politicians, pressing the federal government into a more active role. In 1935, with the problem literally looming in the air of Washington, Congress established the Soil Conservation Service. Significantly, the new SCS began to promote watershed-wide conservation measures that integrated soil conservation with other resource management practices.

As these broad changes overtook agriculture, science played a growing but dichotomous role. Operating through the land-grant colleges and their associated extension services, agricultural scientists increasingly found themselves drawn into two camps. On one side were those who, adopting industrial systems as their model, focused on increasing production through the development of new farm equipment, crop varieties, fertilizers, and other purchased inputs. On the other side were those who, adopting natural

systems as their model, focused on maintaining fertility and productivity through traditional methods and materials, while selectively integrating new technologies into their operations. At the end of the 1930s, the schism between these two approaches was not yet wide; the disaster on the plains had given all involved a sober lesson in the pitfalls and promises of modern agriculture.

Range Management

Like forestry, range management in the United States arose in response to the depletion of a resource once regarded as inexhaustible. By the end of the 1890s, overstocking with cattle and sheep had degraded forage resources throughout the expansive arid and semi-arid grasslands of the trans-Mississippi west. The number of livestock on the western ranges had risen precipitously in the 30 years following the Civil War as the bison herds were exterminated and the plains Indians subdued, and as distant livestock markets became accessible via new railroad lines. But in the late 1880s, a combination of overproduction, hard winters, low rainfall, and financial jitters among distant speculators brought an end to the livestock boom—though not before damaging grasslands throughout the west.

Ranchers themselves were the first to draw attention to the situation. By the turn of the century, their observations of deteriorating range conditions had been confirmed in a series of official surveys and reports. Soon thereafter, the first range experiment programs were developed with the aim of improving grazing practices and increasing the forage resources available to domestic livestock. By 1910, the Forest Service and eight states had established agricultural experiment stations devoted to range research, while state universities throughout the west began to offer coursework in range management (20). More conservative use of range resources, however, was slow in coming. In many parts of the west (especially the southwest), ranges were once again overstocked (mainly with cattle) in anticipation of higher demands during World War I—demands that failed to materialize before the war ended. The result in many areas was further deterioration of the range and accelerated rates of soil erosion (21).

Federal land policies had for decades abetted the decline of rangeland both through ill-conceived programs for parcelling out the public domain and through poor administration of grazing on those lands that remained publicly owned. Beginning in the 1890s, the government initiated a series of land policy changes to improve conditions for settlers while exercising stronger control over public lands. These policy changes included, promi-

nently, the establishment of grazing regulations on the newly created national forests. The Forest Service thus came to assume a key role in the development of range management.

Meanwhile, there remained the vast unreserved rangelands outside of the national parks and forests—lands that, after their appropriation from the native Indian inhabitants, had been used freely by both small ranchers and large livestock interests, and that had continually been the object of intense turf battles and heated political dispute. The battle for control of the public rangelands culminated in 1934 with the passage of the Taylor Grazing Act, which withdrew these lands from further disposition, established the Grazing Service to administer them (the Grazing Service was later combined with the General Land Office to form the Bureau of Land Management), and provided for a system of land leasing through organized grazing districts. Much as the creation of the Forest Service had stimulated the development of forestry as a profession, the establishment of the BLM would prompt the rise of range management as a discrete field.

Wildlife Management

Although concerns about the decline of wild plant and animal populations had long fueled the conservation movement, wildlife management did not emerge as a separate profession until the 1930s.

Through the 1800s, market hunting and habitat loss had resulted in the depletion, and in some cases extirpation, of many important wild game species—most visibly the bison and passenger pigeon, but also the black bear, white-tailed deer, elk, beaver, turkey, prairie chicken, and many waterfowl and wading birds. Efforts to reverse this trend were often initiated at the state level, since states retained jurisdiction over what was then termed “wild life.” At the same time, sportsmen’s organizations and other citizen groups had formed around the issue and pressed for reforms. By the end of the century, most states had established fish and game agencies, outlawed market hunting, and enacted strong fishing and hunting regulations. The new agencies, however, were often ineffective, and enforcement of regulations was uneven at best. Thus, in most regions, the movement for wildlife conservation focused initially on the protection of game species through stronger law enforcement, tighter restrictions on hunting, and the designation of refuges—as well as the persecution of large predators (which were by common consent regarded as “vermin” rather than legitimate “wild life”).

While states often took the lead in protecting game, many of the most

important reforms occurred at the federal level. The U.S. Bureau of Biological Survey was established in 1896 (having originated as the Division of Economic Ornithology and Mammalogy in the Department of Agriculture). Though lacking law enforcement powers, the Bureau provided a focus for the growing interest in wildlife protection. The Lacey Act (1900) strengthened the states' hands by prohibiting the interstate transportation of game killed in violation of state laws. Through the national forests and parks, the federal government assumed a larger role in protecting some of the most important and visible wildlife populations and habitats. (And in suppressing others: in 1914 Congress allocated the first funds for predator control on the nation's public lands.) Theodore Roosevelt had also created, by presidential proclamation, the earliest federal refuges and sanctuaries—the forerunners of the later system of national wildlife refuges. And in 1916, the United States and Canada signed the landmark Migratory Bird Treaty, granting both governments new authority to protect waterfowl and other migratory birds.

By the mid-1920s, game *protection* had begun to evolve into game *management*. The need was evident. The decline of many game species—including even species of small game whose populations had initially benefited from the expansion of agriculture—accelerated as a result of intensified habitat loss and hunting pressures following World War I. Responses to the situation within the conservation community varied. Some argued for outright bans on hunting. Others argued for the rebuilding of game populations through predator control, artificial propagation programs (especially for waterfowl and upland game birds), and the introduction of exotic species. A new school of thought, however, focused on the protection and restoration of habitat as a way of allowing populations of native species to reestablish and perpetuate themselves. Aldo Leopold, the leading proponent of this approach, summarized his views in *Game Management* (1933), the first text in the field. By applying concepts from the emerging science of ecology to the conservation of animal populations and their habitats, Leopold's work would revolutionize the field—with repercussions that extended far beyond the management of game.

The field evolved rapidly in the 1930s. Under the energetic leadership of Jay N. "Ding" Darling, the Bureau of Biological Survey broadened its mission and its budget. New funds for research, habitat protection, and other management activities became available with the passage of the Migratory Bird Hunting Stamp ("Duck Stamp") Act (1934) and the Pittman-Robertson Federal Aid in Wildlife Restoration Act (1937). Research and training programs opened up in universities throughout the country. During these years, too, the conceptual foundations of the field broadened.

Ingrained antipredator attitudes began to shift as the ecological functions of predators came to be more widely appreciated (and, in particular, as resurgent deer herds burgeoned beyond the carrying capacity of their habitats). The idea of management itself began to extend beyond game animals to include "nongame" animals and plants. Rare and endangered species began to receive increased attention. The clearest indication of these trends was the rapid adoption, beginning in 1936, of the one-word term "wildlife," which for at least some wildlife managers included all forms of wild plants and animals. By 1940, wildlife management was established as a distinct field with its own professional society and journal, and a strengthened federal agency—the Fish and Wildlife Service (22).

Fisheries Management

The early development of fisheries management in the United States paralleled that of wildlife management. By the late 19th century, populations of many economically important freshwater, anadromous, and marine fish were depleted as a result of overharvesting, habitat loss, dam construction and water diversion, and water pollution from industrial, urban, and agricultural sources. In response, states initiated efforts to place the exploitation of fisheries on a sustained yield basis. Most states enacted strict regulations or prohibitions on commercial fishing in inland waters. Fish hatcheries began to supplement natural reproduction as early as the 1870s; along with law enforcement, the development of hatcheries soon became the primary activity of state fishery departments. The rise of fish culturing led to the formation of the American Fish Culture Association (later renamed the American Fisheries Society) in 1870. A year later Congress established the American Fisheries Commission, and directed it to promote the artificial propagation, distribution, and introduction of game and food fishes.

Fish culture came to dominate the field so completely that, by the early decades of the 20th century, "fishery management" was already essentially synonymous with "hatchery management." The well-established fisheries profession found a ready home in the new utility-minded and efficiency-driven conservation movement. Advances in the study of fish biology, behavior, and ecology were applied quickly in the operation of hatcheries to improve production. But while money and hopes were increasingly invested in hatcheries as the key to sustained fish yields, there was scant evidence of their effectiveness in actually increasing or maintaining catches. Meanwhile, relatively little attention was given to other aspects of fishery conservation: the size, methods, and timing of harvesting; the genetic and

behavioral impacts of artificially propagated fish (especially nonnative species and strains) on native wild populations; the status of nongame fish and other organisms within the aquatic community; the effects of surrounding land uses on water and habitat quality; or the hydrological and biological impacts of large-scale irrigation systems, dams, and other engineering projects (especially on the large midwestern and western river systems).

From the beginning, a persistent minority of fisheries biologists had questioned the prevailing management approaches, especially the heavy emphasis on artificial fish stocking. This was attributable in part to the concurrent development of the science of limnology, which had an impact on fisheries management analogous to that of animal ecology on wildlife management (23). In addition, biologically informed anglers—of whom there were increasing numbers—began to question the authority of the fishery managers. By the 1930s, an alternative school had arisen that placed greater emphasis on the management of habitat (for both coldwater and warmwater species) (24). According to fisheries biologist J. T. Bowen, “During the 1930s . . . fish culture assumed a less important role in the [American Fisheries] Society, and by 1936 the membership reflected a completely new outlook” (25). Although fish culture would remain dominant, the “new outlook” would begin to address previously neglected aspects of fishery management, including systematic research on fish populations and their aquatic environment, the protection and restoration of habitat, and the development of effective fishing regulations.

Recreation

Camping, hiking, hunting, fishing, and other forms of outdoor recreation were important but nonetheless secondary conservation concerns during the Progressive era. And when recreational values were wedded to the preservation ethic, as in the case of Hetch Hetchy, they could be considered a positive impediment to development by commodity-oriented resource managers. The status of recreation began to change with the establishment of the National Park Service in 1916, and with the early manifestations of the automobile culture in the 1920s. The Park Service was created to bring some order to the management of the nation's 13 existing national parks (and, in part, to bind political wounds following the Hetch Hetchy dispute). Many of the parks, including Yellowstone, Yosemite, Grand Canyon, and Glacier, were conceived and developed with the support, if not the outright lobbying, of the railroad lines that served them. As the private automobile

and new highways provided even greater mobility to the public, areas of important aesthetic and recreational value (at both the state and federal level) became subject to increasing use. Accordingly, conservation agencies and organizations began to devote greater attention to them.

The prosperity of the 1920s, the advent of two enthusiastic fishermen-presidents (Coolidge and Hoover), and the rise (beginning in 1922) of the Izaak Walton League as an important force in national conservation politics all fed the trend. Coolidge convened two National Conferences on Outdoor Recreation (in 1924 and 1926), firmly establishing recreation as a basic conservation concern. This momentum carried over into the New Deal years, especially as the Civilian Conservation Corps provided increased manpower for development of park facilities. At the same time, in part as a result of the heightened visibility of recreational values, regard for wilderness protection rose within the Forest Service, and the level of competition between the Forest Service and Park Service over potential park and recreation lands increased.

An important aspect of national park management in the early 1930s was the increasing interest in scientific research and management of wildlife in the parks. In 1931, a Wild Life Division was created within the Park Service and placed under the directorship of George Wright, a young biologist familiar with the contemporary advances in ecology and wildlife management. Over the next five years, Wright led a team of like-minded scientists who endeavored “to supplement protection with more constructive wildlife management” (26). Their efforts to promote an ecologically sound and scientifically informed approach to the management of parklands suffered a crucial setback, however, when Wright was killed in a car accident in 1936.

Wilderness

Wallace Stegner wrote that, “if the national park idea is, as Lord Bryce suggested, the best idea America ever had, wilderness preservation is the highest refinement of that idea” (27). The preservationist impulse had not dissipated after Hetch Hetchy. To a degree, its energies had been diverted into the work of the National Park Service, but a small minority of dedicated wilderness enthusiasts continued to struggle against the tide of development from within the federal agencies, while other nonprofessional activists pushed from outside the agencies.

After Hetch Hetchy, the first concrete moves to protect wilderness on public lands came from within the Forest Service. In 1919 and the early 1920s, landscape architect Arthur Carhart persuaded his Forest Service

supervisors to limit resort development at Trappers Lake in Colorado and in the boundary waters of Superior National Forest in northern Minnesota. In 1924, Aldo Leopold and several of his colleagues in the Forest Service succeeded in reserving a large portion of New Mexico's Gila National Forest as the Gila Wilderness Area—the first such area to be so designated. Through the mid-1920s, Leopold led a faction of foresters who supported the “preservation of a system of wilderness remnants” in the national forests (28). In response, the Forest Service gave increasing support to wilderness protection, culminating in the issuance of the “L-20” regulations in 1929, which formally established wilderness protection as a Forest Service responsibility (29).

During the 1930s wilderness advocates, led by forester Robert Marshall, continued to press for the inventory and protection of roadless areas on public lands. Opposition to the wilderness idea had hardly subsided. Pressures to intensively manage and exploit the public lands mounted both within and beyond the federal agencies, often abetted by New Deal conservation programs that stressed intrusive development as a means of providing employment. These continuing threats led Marshall and other wilderness activists to form The Wilderness Society in 1935. Its goal, in part, was to secure stronger statutory support for the administratively vulnerable wilderness areas. Progress toward this goal would prove to be slow, but the wilderness idea continued to gain support in the federal agencies in the late 1930s. In 1939, for example, the Forest Service issued updated “U” regulations that gave greater protection to some 14 million acres of roadless land within the national forests.

Where, then, was conservation *as a movement* in the late 1930s? It was broader and deeper than it had been three decades before. It was more urgent, more fully appreciated by the general public, and more thoroughly woven into the public discourse and public institutions. It had gained greater professional definition—and bureaucratic bulk—but it was also more actively promoted by dedicated nonprofessionals and citizen organizations.

Yet for all the strides taken, the recurring challenge of conservation that Aldo Leopold noted in 1938 had not been satisfactorily addressed. In the dust of the times, neither the utilitarian nor the preservationist philosophy seemed adequate for the “oldest task.” For a small but growing cohort of conservationists, a new way of approaching the challenge was required. In formulating that approach, they would focus their attention on key elements of both. They embraced the preservationist critique of human arro-

gance and greed, while carrying forward the high regard for and aesthetic appreciation of wild nature. At the same time, they accepted and relied upon the authority of science—a legacy of their training as resource managers in the utilitarian mode. But it was a new and different kind of science upon which they drew.

At the conclusion of *Breaking New Ground*, his autobiographical account of the rise of forestry and conservation, Gifford Pinchot laid out his vision of a future in which injustice, inordinate profit, and concentrated wealth would cease to determine the social order of mankind. “When it comes,” he wrote, “I hope and believe the new order will be based on cooperation instead of monopoly, on sharing instead of grasping, and that mutual helpfulness will replace the *law of the jungle*” [emphasis added] (30). Notwithstanding the legitimacy of the ideal that Pinchot hoped to communicate, his choice of metaphors (which he repeated several lines later) revealed much about the world view upon which he—and much of the conservation establishment—had built their policies and their professions. The implication? Nature unmanaged was ruled by unbridled red-in-tooth-and-claw competition. It was a world, in the end, of constant struggle for existence, a wild world that should and would be civilized through the application of human managerial skill.

Pinchot was writing in the mid-1940s, near the end of his life. The irony is that, by that time, the world view on which his metaphor was based was already outmoded—at least in the minds of a growing number of scientists and conservationists. Moreover, the new view was being formulated and promulgated in part by conservation scientists from the official ranks. In a critical passage from a 1939 address to a joint meeting of American foresters and ecologists, Aldo Leopold made the point:

Ecology is a new fusion point for the sciences. . . . The emergence of ecology has placed the economic biologist [read “forester,” “wildlife manager,” “range manager,” etc.] in a peculiar dilemma: with one hand he points out the accumulated findings of his search for utility, or lack of utility, in this or that species; with the other he lifts the veil from a biota so complex, so conditioned by interwoven cooperations and competitions, that no man can say where utility begins or ends. No species can be “rated” without the tongue in the cheek. The old categories of “useful” and “harmful” have validity only as conditioned by time, place, and circumstance. The only sure conclusion is that the biota as a whole

is useful, and biota includes not only plants and animals, but soils and waters as well (31).

By the late 1930s, ecology had begun to revolutionize the scientific view of "the jungle" and the environmental context within which human society operates. As Baird Callicott writes, ecology was beginning to reveal the natural world as "more than a collection of . . . useful, useless, and noxious species arrayed upon an elemental landscape of soils and waters. Rather, it is a vast, intricately organized and tightly integrated *system* of complex *processes*" [emphases in original] (32). The progress of human civilization, it followed, could not be understood apart from its evolutionary backdrop and its ecological foundations. Writing in 1933, Leopold suggested that "civilization is not, as [the historians of its progress] often assume, the enslavement of a stable and constant earth. It is a state of *mutual and interdependent cooperation* between human animals, other animals, plants, and soils, which may be disrupted at any moment by the failure of any of them" [emphasis in original] (33).

Conservation, its scientific and historical context thus recast, could no longer be defined in either pure utilitarian or preservationist terms. Utility was a far more complicated matter than even the most ardent utilitarians realized. "Usefulness" was a property not simply of discrete commodities, but derived *from* the entire biotic community. Moreover, a broad range of ecological factors determined the quality and quantity of any given service, resource, or commodity that the community might provide. "Yields" could be sustained only if economic pressures and resource management practices did not undermine what Leopold termed "land health"—the evolutionary coadaptations and ecological interactions that allowed the community to function properly. Wilderness, by the same token, had more than just aesthetic or recreational value. It stood at one end of a land use *continuum*. It served as a "land laboratory"—a place against which to compare landscapes altered by intensive human use. And the preservation of wildlands afforded protection (at least to a degree) to their diverse parts and their ecological processes, which had much to offer in the effort to understand "how healthy land maintains itself" (34).

Seeking a more comprehensive ethic to guide conservation, Leopold and a minority of like-minded individuals stressed the need to combine conservative use and preservation, based on an appreciation of ecological health and the diversity, integrity, stability, and beauty of the biotic community. Conservation could then strive for more than just the sustained yield of resources and commodities, or even the preservation of the nation's dwindling and increasingly isolated remnants of wilderness. "The real end [of conservation]," Leopold held, "is a *universal symbiosis with land*, economic

and esthetic, public and private" [emphasis in original] (34). Or, as he stated more succinctly, conservation is "a state of harmony" between people and land.

How then to live on a piece of land without spoiling it? The answers provided by the "evolutionary-ecological land ethic" (for which Leopold was only one, albeit particularly eloquent, spokesperson) turned out to be much more delicate and complex than either the utilitarian or preservationist schools of thought had suggested. Begin with a basic appreciation of the biotic community as a whole, its composition, its structure and processes, and the historical changes that have taken place within it. Protect at least samples of each different kind of community. Use the resources of the land and waters conservatively, with high regard for native diversity, and with the fullest possible awareness of the ecological functions that maintain the system's health. Develop and revise management strategies based on the best information that the *integrated* natural sciences can provide. Actively restore, wherever feasible, that which has been lost, degraded, or unwisely altered. Identify and work to change the social and economic forces that constrain such actions. Be active, since time is short; but be patient, since success is by definition incremental and long-term.

And something more. In "The Land Ethic," Leopold's final expression (drafted in 1947) of his long-evolving philosophy, he calmly nudged conservation forward with these words:

The land ethic . . . enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land. . . . A land ethic of course cannot prevent the alteration, management, and use of these "resources," but it does affirm their right to continued existence, and, at least in spots, their continued existence in a natural state. In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land community to plain member and citizen of it (36).

Of the many messages embedded within this passage, the most important may be the most subtle: Leopold's deliberate placing of the term "resources" within quotation marks—perhaps the only time he ever did so. With that slightest of rhetorical gestures, Leopold simultaneously acknowledged the reality of human resource use and the limits of utilitarian conservation philosophy, even as he confirmed the inherent worth and dignity of "things natural, wild, and free." Conservation would not, and *could not* succeed as long as people regarded—and hence managed—nature merely as a disaggregated assortment of "natural resources." Success in the oldest task in human history could not be gained simply by developing more powerful and sophisticated tools to extract goods and services from the natural world.

Success required more comprehensive ways of perceiving, understanding, and appreciating the relationship between people and nature. Success, in other words, required that we not simply change the land, but that we change ourselves.

This redefinition of conservation had profound implications for the various resource management professions. For one thing, it raised fundamental questions about the validity and viability of separate professions, disciplines, and departments. Within his own area of expertise—wildlife management—Leopold tried to push those who “[saw] utility and beauty only in pheasants and trout” to see more fully the “utility and beauty of the biota as a whole.” By the early 1940s, all the conservation fields had “dissenters” (to use Leopold’s term) who had arrived at the same conclusions: in trying to understand natural systems and human activity within them, the assumptions and approaches of reductionist science (valid knowledge is gained by dividing reality up into ever-smaller parts), utilitarian philosophy (this knowledge achieves its highest end when used to meet strictly human needs), and conventional economics (human needs are always served through increases in raw productivity) were inadequate. In the view of the “dissenters,” attention had to be given to the connections and relationships in nature over various scales of space and time. In other words, one could not simply manage trees, or soils, or game animals, or scenic vistas, or any other resource, as isolated entities; one had to consider the diverse components within the landscape as a whole and their ecological interactions over time. Professional labels notwithstanding, conservation implied—demanded—integration (37).

World War II changed everything. The promising synthesis that had begun to emerge within conservation was overwhelmed by the war, and undated by social changes in the war’s aftermath. Even before Leopold put the finishing touches on “The Land Ethic,” the natural resource management professions had begun to move in other directions—indeed, each in its own direction. Instead of growing more flexible, the boundaries between scientific disciplines, departments, and agencies became more rigid. Instead of converging on a shared vision of ecological health and integrity, the conservation professions became increasingly specialized and focused on increasing the output of their particular commodities. Instead of narrowing, the gaps in understanding only widened—gaps separating the various natural sciences, the basic and applied sciences, the sciences and other areas of human knowledge, the academic departments and the conservation agencies, the different conservation professions, the professionals and the public.

Writing in 1945, Paul Sears traced much of the problem “back to college classrooms, where a type of fragmental teaching has been going on that breaks the world of human experience up into air-tight compartments.” He insisted that “this sort of piecemeal teaching simply has to be stopped. It is getting to be too costly to our modern society” (38). For most, however, those costs (if they were admitted at all) were too far removed to be of much concern. The new generation of postwar resource managers slipped easily (and for the most part unknowingly) into a disciplinary framework to which there were few alternatives. The ramifications were, and remain, far-reaching. As Reed Noss and Allen Cooperider have observed:

Disciplinarianism . . . resulted in a pattern of natural resource management that is fragmented and inefficient. Individuals trained in one discipline work on problems in isolation from other specialists, even within the same agency. Agency land use plans are often written as if there are separate landscapes to provide for timber, wildlife, livestock forage, clean water, and recreation (39).

The forces of technological innovation, population growth, and economic expansion reinforced the trend. The demand for all natural resources increased dramatically during the postwar boom years. As the pressure to increase production—of crops, timber, livestock forage, fish stocks, game animals, visitor days—grew, so did the faith that all conservation problems could be solved through technical solutions. At a point in history when conservation problems were becoming more complex, clear communication more valuable, and unity of purpose more necessary, the counterforces seemed inexorable.

The development of forest management in the postwar years serves as a useful case study. While “dissenting” foresters had argued for a broader view of the composition, function, and management of forest ecosystems, the profession as a whole drifted in the other direction. Historian Samuel Hays notes:

As early as the 1920s the dendrology textbooks and courses in forestry schools that described forest species and their distribution became restricted to commercial types. The texts explained that foresters need not know all forest species—foresters were not botanists—but only those that were useful for wood production. This narrowed their conception of a forest considerably (40).

As the profession’s conception of the “resource” further narrowed in the postwar years, the demand for forest products rose rapidly, especially in response to the housing and construction boom. The effects were most

apparent in, though not confined to, the national forests. The means to the all-but-universally accepted end of sustained timber yields began to shift. The selective cutting methods that prevailed in forestry through the 1930s began to give way after the war to even-aged management of larger-scale forest units. Productivity gains were sought through increased inputs in the form of fertilizers and genetically "improved" tree stocks. Pest management was sought through increased applications of synthetic pesticides and intensified control of competing vegetation. Clearcutting became the preferred method of harvest, replanting with trees of the same age and species the preferred method of reforestation. According to Hays, "by the 1960s the elements of this technical system had been worked out in great detail" (41).

Economies of scale and economic incentives reinforced the shifts in forest practices. At the same time, the *subculture* of the forestry profession had changed. Timber interests played an ever-growing role in setting the education, research, and policy agenda. The postwar cohort of foresters grew farther away from the vision of unified conservation that was in many ways their own professional inheritance. Even when, for example, the Multiple Use-Sustained Yield Act of 1960 directed the Forest Service to balance timber production with other uses, the underlying idea—wiser coordination of forest management's means and ends—remained essentially dormant. Timber production remained the primary use, within the subculture if not in the law. There was simply too little integration of thought or action among the managers—much less among the users—much less within society—to give "multiple use" meaningful expression, or meaningful criticism.

Variations on the same pattern played out in the other fields of resource management. Hence: to improve agricultural productivity, expand and intensify farm operations using artificial fertilizers and pesticides, a limited number of "modern" seed varieties, and an ever-growing array of "labor-saving" technologies; to improve range forage production, remove woody vegetation, apply herbicides, and seed with more "desirable" forage species; to build up stocks of fish and game, introduce exotic species and expand artificial propagation programs; to prevent floods and manage water resources, dam the headwaters, straighten the channels, channelize the streambeds, and raise the levees. The same generic forces could be perceived in agriculture, range management, wildlife management, fisheries management, recreational planning: increasingly sophisticated management techniques, with an emphasis on large-scale, input-intensive practices and systems; primary, often exclusive, focus on a few commercially valuable components of the ecosystem; increasing economies of scale; standardization in planning and production methods; simplification of natural systems

and processes; the development of an insular professional priesthood; increasingly close ties between resource management agencies and politically (and financially) influential user groups and industries. The various fields also shared derelictions: a lack of attention to the particulars of place, to the complexity and diversity of ecosystems, to the inevitable harmful effects of fragmented thought on both the natural and human communities.

There was, however, a counter-force. World War II had had other, more positive impacts on conservation. It tempered the near-religious faith in science as the font of all progress and technological innovation as the solution to all human problems. It gave a generation international experience and increased the availability of information, transforming conservation into a global concern. It spawned technologies that would revolutionize human understanding of natural systems and their evolution. It galvanized those who saw, not specialization, but synthesis of knowledge as the essential requirement in the modern age.

These factors coalesced around particular issues—including the loss of wilderness, the nuclear arms race, and pollution problems—with increasing regularity in the 1950s, then surfaced dramatically in 1962, when Rachel Carson published *Silent Spring*, giving rise to the modern environmental movement. The new environmentalists and the older resource managers were far from sympathetic in their motivations, their experience, or their approaches. There was, however, common ground. Starting from it, many within both the natural resource management professions and the environmental movement began a gradual return, still far from complete, toward the integrated understanding that Leopold and others had first tried to articulate 30 years before.

If the years 1945–1965 were characterized by increasing specialization, the remainder of the 1960s and 1970s saw the increasing acceptance of environmental values and goals within the conservation professions and within society at large. Translating these values into effective conservation action, however, would prove to be a slow and fitful process. The political and economic obstacles to reform (both within and beyond the professions) remained formidable. Specialization continued to exercise its drag; even in seeking to attain broader environmental goals, conservationists of all sorts still tended to focus on single species, single resources, single parts of the landscape—single aspects of any conservation dilemma. But as younger resource managers, agency officials, and scientists, trained in the post-Earth Day era, began to enter and rise through the ranks, they carried with them a stronger sense that, in order to conserve anything, the professions had to be brought together in the human mind and in the landscape.

By the mid-1980s, the consequences of *disintegrated* conservation could

no longer be avoided or misinterpreted. The effects could be seen across the landscape, from the innermost city to the outermost wildland: in the decline and waste of urban neighborhoods; in the desperate spread of suburbia and the frenetic rise of "edge cities"; in the stresses placed on agricultural soils and waters, and on farm families, economies, and communities; in the clearing and fragmentation of forests under intensified logging pressures; in the continued loss and degradation of wetlands, deserts, and other wildlands; in the inability to insulate national parks and other protected areas from air- and waterborne pollutants and other transboundary threats; in the decline of important fisheries as a result of overharvesting and the disruption of the aquatic systems that support them; in the endangerment of life's genetic, species, and ecosystem variety to such a degree that a new term, "biodiversity," had to be coined to comprehend the situation; in the incurring of long-term social and environmental costs under so many different ecological circumstances that another new term, "sustainability," had to be coined to communicate the dilemma.

The systemic nature of these by-now familiar problems has become steadily more apparent, as have the limits of the traditional conservation professions acting separately to address them. Especially in the latter half of the 1980s, the need for interdisciplinary approaches became more formally recognized within the established professions. The problems themselves defined new foci for scientific research and application, including conservation biology, restoration ecology, landscape ecology, and sustainable agriculture. Concepts that had hovered on the periphery of resource management—sustainability, ecological health, ecosystem management—moved toward the center of the discussion. The social sciences and humanities reentered the discussion as ecological economics, environmental history, and environmental philosophy became established subjects of study.

By the 1990s, a century after conservation first began to take form, it was again reinventing itself, evolving in response to both internal tensions and external challenges. Behind these recent adaptations is the tenacious idea that conservation is more than a simple matter of long-term human economic self-interest; that it entails moral choices and responsibilities involving the community of life in which we evolved and to which we belong. Like conservation itself, the evolutionary-ecological land ethic has emerged fitfully over the last century, and is only now growing into the role it must play in human affairs in the future. Muted by a generation of cornucopian dreams and Cold War fears, ignored by those "[for] whom education and culture have become almost synonymous with landlessness," dismissed by many as an impractical and ill-defined ideal—and often advanced by those disinclined to confront the dilemmas it suggests—the land ethic now rings

with increasing definition and resonance as conservation enters its second century (42). But it remains, in Wallace Stegner's words, "not a fact, but a task" (43).

Conservation is, and has always been, a radical endeavor, "radical" in the first and literal sense of the word: pertaining to, and proceeding from, *roots*. Conservation pertains to and proceeds from the roots of experience; of knowledge, value, and wealth; of dreams and the divine. We who are about to confront the sobering realities of this brave new century can sense only with difficulty the historical roots of conservation. For now, we can still find them hidden deep in the shade of the recovering northwoods, where the stumps of fallen white pines mark the reckless and restless past. We can still hear them in the words of a Ghost Dance song chanted, in dire need, on the high plains a century ago. In the world that the Ghost Dancers tried to dance back into existence, wildness had free reign. That wild world cannot be fully regained, but its loss may be at least partially redeemed. Perhaps, after all, a nation is coming—a world is coming—to recognize that wildness, properly known, is not the antithesis of civilization, but its complement and its context, essential to its vitality, inherent in its definition. The revival of the white pine and the northwoods forest, the restoration of the bison and the prairie, the building of healthy human communities able to coexist with and within nature—these may yet signify the return of wildness, not as an enemy but as a guide, as another generation prepares to take on the newest, oldest task in human history.

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Notes

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