Profile ■ by Gerald F. Vaughn and Curt D. Meine

Acting on Principle

Aldo Leopold and Biodiversity Conservation

Aldo Leopold (1887–1948) defined conservation as "a state of health in the land," by which he meant the capacity of all components of the biotic community (including humans, too) to restore, renew, and perpetuate themselves. Leopold's land ethic derives from an ecological conscience that told him, "We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."

The reasoning behind Leopold's land ethic, and the experiences that contributed to its formulation, are powerfully described in his classic *Sand County Almanac* (1949) and the collected essays in *The River of the Mother of God and Other Essays by Aldo Leopold* (1991). These writings trace Leopold's lifelong effort to achieve a workable reconciliation of preservationist and utilitarian views of the natural world and the place of people within it. In his writings we find early expressions of many basic tenets of modern biodiversity conservation.

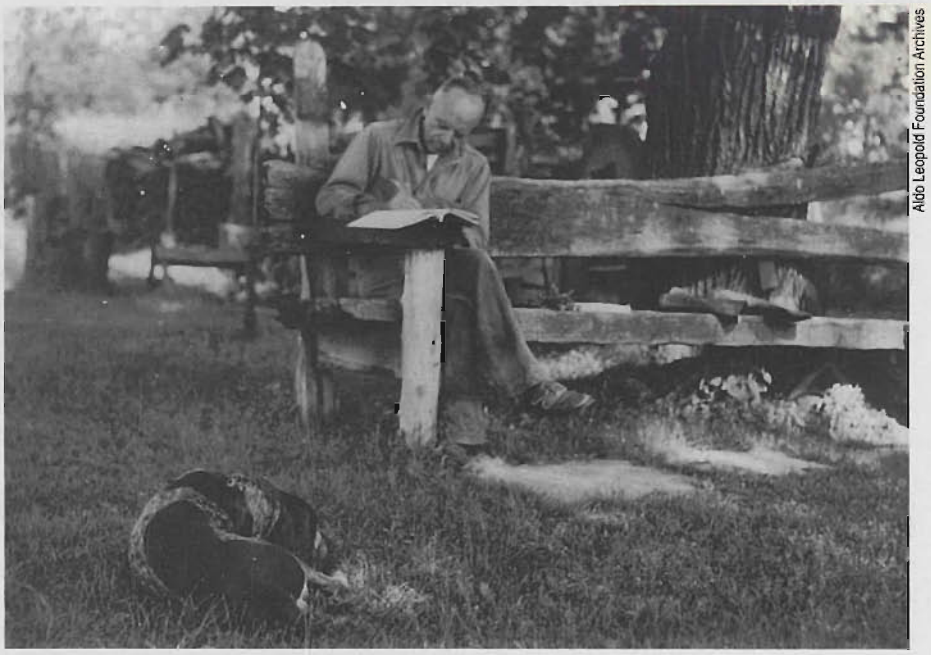
The need and obligation to conserve biodiversity, an aspect of the Leopold land ethic that has gained greater attention in recent years, poses an escalating public policy challenge. Intense and protracted debate over renewal of America's Endangered Species Act indicates this challenge has yet to be met.

Leopold and biodiversity conservation

The term "biodiversity" had not yet been coined when Leopold taught and wrote. However, his definitions of conservation, land health, and ecological approaches to land use reflected a steadily increasing appreciation of the value of biotic diversity. Leopold was representative of the few visionary ecologists in the 1930s and 1940s who had the foresight to anticipate our contemporary biodiversity crisis. His contributions to conservation science, literature, and philosophy are far-reaching and widely acknowledged.

Less recognized are Leopold's efforts to influence conservation policy to reflect his (and the conservation movement's) expanding knowledge base and ethical imperative. In part through Leopold's lasting influence, conservation increasingly has come to mean the appropriate "mix" of preservation, maintenance, restoration, and sustainable use within larger ecosystem or landscape contexts.

A forester by training, Leopold's interests and understanding broadened to encompass game management, soil and water conservation, wilderness preservation, wildlife conservation, and ultimately what he called "land ecology." He defined land ecology as "putting the sciences and arts together for the purpose of understanding our environment." He perceived and taught that the interrelationships among ecology, economics, and ethics are central to responsible land management and conservation. While widely and deservedly known as a leading advocate of wilderness protection, he was also acutely concerned about sustainable management of ecosystems intensively modified by humans. Perhaps most significantly, he recognized the interrelatedness of various conservation interests to one another, and the need to coordinate them for the long-term and common good.



Aldo Leopold Foundation Archives

Leopold writing in his journal at "the shack."

In January 1934, Leopold, then professor of game management at the University of Wisconsin, was named (along with Thomas H. Beck of Connecticut and Jay N. "Ding" Darling of Iowa) to President Franklin D. Roosevelt's Committee on Wild Life Restoration. This three-man committee was asked to pre-

pare a report for the new president outlining steps that America should and could take to promote wildlife restoration after many decades of not-so-benign neglect. The committee's recommendations included acquisition of four million acres for restoration of migratory waterfowl and shore birds; five million acres for upland game; at least one million acres for song, insectivorous, ornamental, and other threatened nongame birds; and two million acres for big game, fur bearers, and other valuable mammals. Much of this land was planned to, and did, come from the Roosevelt administration's purchase of submarginal farmlands as part of national land use readjustments and economic recovery.

In March 1934 President Roosevelt named Darling as chief of the U.S. Bureau of Biological Survey. The impact of Darling's appointment was soon felt. At the American Game Conference in January 1935, Leopold could report: "We began in 1934 to apply the refuge and restoration policy recommended in 1930 [referring to the American Game Policy], but needed long before that. Jay Darling and his crew have made a valiant start, and that is something."

During the brief twenty months that Darling held the office, the administration of wildlife conservation policy was transformed. The Bureau of Biological Survey was reorganized and revitalized. The Congress passed, and Roosevelt signed, the Duck Stamp Act and the Fish and Wildlife Coordination Act. The waterfowl refuge system gained millions of acres. Nationwide censuses of wintering waterfowl began. The Cooperative Wildlife Research Unit program was established at land grant colleges and universities. Plans and preparations were made for President Roosevelt's 1936 North American Wildlife Conference, which focused the nation's attention on wildlife problems and policies. As a direct result, the National Wildlife Federation and Wildlife Management Institute were established. Darling's tenure as head of the Bureau of Biological Survey would be short and tumultuous, but would redefine the basic structure of wildlife conservation programs in the United States.

Aldo Leopold Foundation Archives

These were major steps forward in conserving some components of what we now think of as biodiversity. However, by this time (the mid 1930s), Leopold was moving toward the realization that conserving the spectrum of biodiversity is broader even than conserving "wildlife."

Moreover, the rapidly emerging science of ecology had begun to shift the foundations upon which the resource management professions were being built. As science revealed the complexity of natural systems, it brought the caution that as resource managers we are only tinkerers.

Keeping all the cogs and wheels

The first precaution of intelligent tinkering, Leopold therefore advised, is to keep all the cogs and wheels. In an essay titled "The Round River," he asks: "Have we learned this first principle of conservation: to preserve all the parts of the land mechanism? No, because even the scientist does not yet recognize all of them." In contemporary terms, he adopted the stance that biodiversity must be respected and retained, since neither society nor science understands enough about the functioning of natural systems to be sure which components of nature's diversity (genes, species, and communities) may be useful or expendable. For Leopold, it was a short leap from this

realization to an ethical regard for the land and its constituent members.

Especially important in this regard were those members that had declined due to human activities. In a 1936 article titled "Threatened Species" (his first devoted solely to the topic), Leopold urged that an inventory of near-extinct lifeforms be undertaken. He wrote: "There are of course many ends which cannot and many others which need not be precisely defined at this time. But it admits of no doubt that the immediate needs of threatened members of our fauna and flora must be defined now or not at all." His concept of conserving biotic diversity was rapidly expanding and taking shape.

Biological diversity, or biodiversity for short, refers to the variety of plant, animal, and microorganism species; the genetic diversity they contain; and the ecosystems (habitats, biotic communities, and landscapes) and ecological processes in which they are embedded. To Leopold's mind the true measure of land health is the capacity of the ecosystem to maintain and renew itself. He dismissed the notion that conservation involves merely the relative availability of discrete resources: "This 'famine concept' is inadequate, for a deficit in the supply in any given resource does not necessarily denote lack of [land] health, while a failure of function always does, no matter how ample the supply."

Leopold emphasized that the conservation of biotic diversity is a precautionary strategy, and that the criteria of success in conservation involve transeconomic values and considerations. Biodiversity is of course vital to humanity in that it constitutes the life-support system upon which we depend for air, food, clothing, shelter, medicines, and other essentials. Clean air, rainfall, temperature moderation, watershed function, natural seeding and pollination, healthy forests and wildlife populations, soil productivity, germplasm, species of undiscovered medicinal value, landscape amenities, outdoor recreation, tourism—all reflect the life-support and life-enhancing services that biodiversity provides. In addition, many conservationists (Leopold foremost among them) argue that biotic diversity has value not only for the human goods and services it provides, but by the very fact of its existence.

Biodiversity conservation aims to maintain the inherent variety of the world's biota and the potential for that biota to continue to exist and evolve. This subsumes more traditional notions of utilitarian conservation. In a 1939 article "A Biotic View of Land," Leopold writes:

> 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.

In a 1944 paper "Conservation: In Whole or in Part," Leopold carefully redefines conservation to reflect an expanding mandate: "Such collective functioning of interdependent parts for the maintenance of the whole is characteristic of an organism. In this sense land is an organism, and conservation deals with its functional integrity, or health."

Achieving land health, Leopold held, calls for recognition of the reciprocal relationship between public and private interests in the land. Reflecting the influence of his close associate, economist George S. Wehrwein, Leopold accepted that this combining of interests involves trade-offs. Leopold wrote: "Conservation is paved with good intentions which prove to be futile, or even dangerous, because they are devoid of critical understanding either of the land, or of economic land-use." Building such critical understanding became his highest priority as a teacher and writer. Only then, he believed, could we as individuals and as a society balance the rights and responsibilities inherent in the use of land. Leopold knew well that acting on principle is seldom easy, and he lamented: "How much to compromise is a question on which there is no such thing as advice, or consolation." Yet, to get things done, as Paul W. Barkley and David W. Seckler indicate, "An analytic scheme that includes trade-offs is superior to one that does not, and cost/effective-

Aldo Leopold Foundation Archives

Planting pines at his farm, 1938.

ness appears to be an operational first approximation of such a scheme."

In the late 1940s Leopold entreated his colleagues, "...we might get better advice from economists and philosophers if we gave them a truer picture of the biotic mechanism." Since then, research and education have begun to meet this need. Much work has been undertaken to identify areas of highest concentration of biodiversity, to protect areas at immediate risk of disappearance or disturbance, and to devise sustainable management regimes for nonprotected areas. Though taxonomic inventories and biogeographic mapping of the world's species remain incomplete, new techniques are being used to assess more quickly and accurately the diversity within ecosystems. This enables allocation of conservation funds to be increasingly proportional to the significance of specific ecosystems and the extent to which each is threatened.

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Collaboration needed

Aldo Leopold observed that social and natural scientists tend to collaborate at a distance, if at all, in resolving conservation dilemmas:

> One of the anomalies of modern ecology 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."

In the mid 1930s he saw this lack of symbiosis as symptomatic of our disciplinary training and reward structure, and he anticipated: "The inevitable fusion of these two lines of thought will, perhaps, constitute the outstanding advance of the present century." It is a fusion, and an advance, toward which we are still groping and must more earnestly seek.

Leopold's hoped-for symbiosis of the social and natural sciences is vitally needed to improve public policy making. Closer collaboration among economists, ecologists, and conservation biologists could aid decision makers in setting priorities for optimal allocation of conservation funds and fairer distribution of the benefits and costs of conserving biodiversity. Without better teamwork by economists, ecologists, and conservation biologists, political motives alone will set priorities for conserving biodiversity. ◙

■ For more information

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