small-scale economies of production and consumption, community spirit, lifestyles that respect cultural and natural diversity, ecological embeddedness, and care of nonhuman species both for the ways they enhance human life and for their intrinsic value.

The legacy of Social Ecology for the environmental movement and the future directions of social-ecological thought are not known. It is unclear whether Social Ecology will thrive as an ecophilosophy in its own right, whether its insights will be absorbed into new syntheses in environmental thought and activism, or whether the term *Social Ecology* will end up being applied only to analyses narrowly focused on social-justice concerns in environmental and ecological contexts. Murray Bookchin died in 2006. In the years before his death his polemics alienated him from many of his contemporaries. However, the key insights of Social Ecology continue to command attention: Social and ecological problems are inseparable, and social domination has long been implicated in the destruction of the biosphere.

SEE ALSO *Animal Ethics; Biocentrism; Bookchin, Murray; Darwin, Charles; Deep Ecology; Ecological Feminism; Ecology: II. Community Ecology; Environmental Justice; Environmental Philosophy: V. Contemporary Philosophy; Land Ethic; Leopold, Aldo; Naess, Arne.*

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SOCIETY FOR CONSERVATION BIOLOGY

The Society for Conservation Biology (SCB), established in 1986, seeks to promote the scientific study of issues pertaining to the loss, maintenance, and restoration of biodiversity. The SCB and its flagship journal, *Conservation Biology,* bring together scientists, scholars, policy makers, and members of nongovernmental organizations who share the goal of protecting and perpetuating the earth's biological diversity. Since its inception the SCB has recognized an essential role for environmental ethics in informing, shaping, and applying the science of conservation biology. Conversely, ideas and insights from conservation biology have contributed to the development of environmental philosophy and ethics.

ORIGINS AND DEVELOPMENT OF CONSERVATION BIOLOGY

The SCB was founded in 1986 in response to the increasingly urgent concern over global threats to biological diversity in the late twentieth century. More broadly, however, the emergence of conservation biology as a new interdisciplinary field reflected long-term trends in conservation science and practice. A concern with biological diversity has deep roots in the worldviews of native cultures around the world; in the scientific tradition of Europe and North America (in the fundamental contributions, for example, of Linnaeus, Charles Darwin, and Alfred Russel Wallace); and in the work of naturalists and protoconservationists of the 1800s (the writings, for example, of Alexander von Humboldt, Henry David Thoreau, and George Perkins Marsh). With the rise of the Progressive-Era conservation movement in the United States in the early 1900s, science became more intimately tied to conservation policy and practice. It

was, however, fragmented into varied disciplines, preecological in content and narrowly utilitarian in application. This scientific content both reflected and reinforced the philosophical split in the early conservation movement between the utilitarian resource-conservation ethic (often associated with forester Gifford Pinchot) and the nature-preservation ethic (often associated with naturalist John Muir).

By the 1930s ecological and evolutionary science had begun to influence various resource-management fields (including agriculture, forestry, wildlife management, range management, and fisheries management), easing this long-standing tension within the conservation movement. Early biogeographers and ecologists such as Henry C. Cowles, Frederic Clements, Henry Gleason, Victor Shelford, Charles Elton, and Ernst Mayr developed basic concepts of community ecology, ecological change, population dynamics, and plant and animal distribution, giving greater emphasis to the role of biological diversity in the structure, composition, and function of biotic communities. Aldo Leopold, applying these concepts to land management and stewardship in the 1930s and 1940s, redefined conservation as "a state of health in the land," which he further described as "the capacity for self-renewal in the soils, waters, plants, and animals that collectively comprise the land" (1991, p. 318). In thus recasting conservation's goals—most explicitly in his influential essay "The Land Ethic," published posthumously in the environmental classic *A Sand County Almanac* (1949)—Leopold wedded conservation science and conservation ethics. Leopold's land ethic implied that conservation was no longer just the purview of professional resource managers charged with the efficient production of goods from the earth, but also of individuals and institutions assuming responsibility for the health of the land. A generation later this coupling of science and ethics in the service of an ecologically robust approach to conservation provided an important cornerstone for the field of conservation biology.

In the decades following World War II, the resource-management professions faced mounting environmental and philosophical challenges in the United States and around the world. An expanding and increasingly globalized economy increased the burdens on natural communities through overexploitation; pollution; the spread of invasive species; the early indications of climate change; and widespread habitat loss, alteration, and fragmentation. These environmental changes engendered ever-lengthening lists of threatened and endangered species (later legally defined and protected) and alarm over the loss of biological diversity at various geographical scales. The world's species-rich tropical forests, for example, became a focal point of global environmental concern by the late 1970s. The traditional resource-management fields, with their inherited disciplinary boundary lines, reductionist tendencies, and commodity-dominated priorities, were ill-equipped to address these systemic challenges.

Conservation biology emerged in response to these trends. It was a part of the same process of intellectual cross-pollination that spawned such fields as environmental ethics, environmental history, ecological economics, landscape ecology, agroecology, and restoration ecology in the late 1970s and 1980s. Conservation biology was the product of a fusion of several overlapping spheres of scientific inquiry: coevolution and population biology (as developed in the 1960s by Peter Raven and Paul Ehrlich, among others); island biogeography (grounded in the landmark research of E. O. Wilson and Robert MacArthur); conservation genetics (especially as synthesized by Otto Frankel and Michael Soulé); and inquiry into the social dimensions of conservation policy and international development (through key contributors such as Thomas Lovejoy, Bruce Wilcox, and Norman Myers).

THE FOUNDING OF THE SCB

Conditions were ripe for the creation of the new field and its namesake professional society. A series of scientific workshops and conferences held between 1978 and 1985 gave the field increasing definition. In 1986 a major forum on the conservation of biodiversity—a neologism adopted in the course of planning the forum—was convened in Washington, D.C., under the auspices of the Smithsonian Institution and the U.S. National Academy of Sciences. Many of the forum's scientific leaders helped to establish the new group. In 1987 the SCB, under its first president Michael Soulé, organized its first annual meeting and published the first issue of *Conservation Biology*.

A close and continuing relationship between environmental ethics and conservation biology was forged in these early years of the SCB. The 1986 forum on biodiversity included not only a wide range of scientists but also environmental ethicists and scholars from other fields. Soulé, the central figure in defining conservation biology and organizing the SCB, credited the influential Norwegian environmental ethicist Arne Naess with shaping his priorities for the field; it was to be a "mission-driven" and "value-laden" field that accepted the moral responsibility of humans to safeguard and sustain the community of life. The bylaws required that one seat on the society's board of directors be reserved for a scholar in the humanities and environmental ethics. The first editor of *Conservation Biology*, David Ehrenfeld, had published his own contribution to environmental philosophy, *The Arrogance of Humanism*, in 1981. Beginning with Ehrenfeld's editorship, the journal regularly

featured articles on environmental ethics alongside its more customary scientific studies.

Even as conservation biology has sought to unify the disparate domains of natural-resource management, it has also significantly influenced the discourse of environmental ethics. It has raised vital issues such as the human role in shaping "natural" ecosystems; the role of biological diversity in conservation strategy; the movement toward more community-based, participatory approaches to conservation decision making; the philosophical rationales and ecological foundations of sustainability; and the role of the conservation biologist as scientist in an explicitly values-driven undertaking.

SEE ALSO *Biodiversity; Conservation; Conservation Biology; Globalization; Land Ethic; Leopold, Aldo; Naess, Arne; Resource Management.*

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SOCIOBIOLOGY

SEE *Evolutionary Psychology.*

SOILS

Soil is the portion of the earth's surface that consists of a mixture of disintegrated rock and humus, or dead organic matter. Soil science, a branch of agronomy, has categorized thousands of soil types according to their physical and biochemical characteristics. In addition to its mineral substrate and humus tilth, a soil may contain 30,000 species of organisms, with a thimbleful containing billions of bacteria, fungi, algae, protozoa, and nematodes, plus virus particles. The soil microbiologist Selman Waksman received the Nobel Prize for discovering soil actinobacteria that produce lifesaving antibiotics. Soil may be critical in preventing the spread of antibiotic resistance to preserve the medical value of these soil-borne antibiotics.

VALUE AND DEGRADATION

Soil has both intrinsic and instrumental value, but modern agriculture has allowed soil degradation through erosion and contamination of soils and waters with chemicals. Though considered by some medical authorities to be a pathology, eating soil (geophagy or pica) can improve human or animal health by dissolving micronutrients. The clay mineral surfaces adsorb harmful bacteria, viruses, and toxic organic compounds and are eliminated from the body. Soil also performs a variety of ecosystem services. Soil microbes enzymatically digest the complex organic compounds of dead plants, animals, and other microbes, producing simple inorganic ions by mineralization (rotting or composting). Roots absorb those ions, and the carbon dioxide gas released enables photosynthesis. This action constitutes nutrient cycling in all terrestrial ecosystems, the study of which is a major branch of ecosystem ecology. A wide variety of toxic and hazardous organic compounds are bioremediated into harmless or beneficial inorganic substances by soil microbes. The soil biota provides biological resilience to chemical insults if it is not overwhelmed.

The "spirit of the soil" includes several extrascientific concepts. The idea of native soil has inspired patriotism for centuries, which results from the concept of soil as a symbol for the place of a person's birth and, before world trade and transport, the source of a person's nutrition. Centuries ago the apparently spontaneous appearance of mushrooms caused humans to develop the idea of vitalism, by which the soil was said to transmit a vital force from animals, through their manure, to the soil and then into the newly developing plants, once more providing sustenance for animals. The development of soilless hydroponic horticulture—plants are grown in water and supplied by dissolved inorganic fertilizers (nutrients)—developed by Justus von Leibig disproved the idea of vitalism. However, Wendell Berry and others have suggested that soil nevertheless retains a memory of its past management.

Aldo Leopold proposed a land ethic that would promote biological diversity, ranging from the humble earthworm to all other life-forms, with each one having a right to maintain a habitat within the soil. Leopold's early papers, written while he was a U.S. Forest Service