

CENTENNIAL NOTE

Ecology: The First One Hundred Years

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If "ecology," from its Greek etymology, is intended to be the "scientific study of the house," the history of its first hundred years indicates that ecology itself has a complex architecture. Like an ancient Chinese house, ecology is placed on many foundation stones, sprawling in several directions, housing an extended family of intriguing diversity in a loosely connected and intricate network. As with many extended families, fundamental disagreements abound; ecologists disagree on which achievements in the past were most significant, which hierarchical levels of biological organization can be studied ecologically, and in which direction the future of ecology may be found. Ecology today is a loosely defined discipline with fuzzy edges separating it from a number of well-recognized disciplines, including natural history, evolutionary biology, physiology, and population genetics.

In a sense, 1991 marks the end of the first hundred years of ecology, a time during which it passed from its infancy of recognition to having an "identity crisis" of adolescence, not yet recognized as a mature science. Although the term "oekology" was first coined by Haeckel in 1866, he continued to explain what he meant by it in 1891, as the term gained the recognition of scientists; "ecology" first appeared in a newspaper in 1893 (McIntosh 1985). Haeckel saw ecology as the study of the physiological basis of the Darwinian "struggle for existence." Elton saw ecology in 1927 in broader terms as "scientific natural history," extending natural history beyond the limitations of casual observation, toward a theoretical understanding. Andrewartha and Birch (1954) saw ecology only as the study of populations and factors that linked the distribution and abundance of organisms with their environment. In contrast, Odum (1964) and Margalef extended ecology to higher levels of organization, stating that "ecology . . . is the biology of ecosystems" (Margalef 1968).

If ecologists have been unable to agree on the fundamental functional unit of study, they are even less inclined to agree on a theoretical basis of ecology, differing widely on the philosophical roots out of which ecological theories should grow. Because physiology and population biology grew out of deterministic reductionism, many ecologists are inclined to view community events as resulting from the sum of the activities of the component populations. Early community and ecosystem ecologists, notably Clements and Odum, viewed these large units as having their own properties that could not be explained in any direct way from investigation of the component populations or organisms. Their thoughts, based in 19th Century holism, asserted that communities and ecosystems could be studied only as intact entities because "emergent properties" were lost when the unit was dismantled. Contemporary systems ecology, growing from dialectic materialism, aims to "resolve" this debate by philosophically viewing all ecological objects as cybernetic systems (Blauberger

et al. 1977). This diversity of philosophies led to a great body of literature in the past decade discussing the paradigms of ecology (*sensu* Kuhn 1962) that resulted in an agreement among many ecologists not to discuss any article that used the word "paradigm," but agreement on little else.

A tautological summary, that "ecology is what ecologists do," further illustrates the diversity within this field. If there are "two biologies" as Mayr (1982) identified, one essentially time-invariant and concerned with function (e.g., physiology) and the other concerned primarily with time-dependent events (e.g., evolutionary biology), ecologists are drawn from both camps. Also, ecologists are found among both "experimental biologists" and "natural historians," the fundamental distinction noted by Cravens (1978). Contemporary ecologists usually identify themselves primarily either by habitat (e.g., aquatic ecologist) or by hierarchical level (e.g., community ecologist) and secondarily by organism studied.

Perhaps because of this diversity and the interfacing of "ecology" with more readily identifiable scientific fields, ecology today remains largely an invisible science. Academic ecologists and ecology courses are usually found in departments of biology, zoology, or botany rather than in a department of ecology. Professional scientific societies often ignore "ecology." The American Association for the Advancement of Science recognizes a variety of disciplines as "primary fields of interest" in which ecologists can be found: genetics, biology, plant science, zoology, microbiology, physiology, toxicology, but not "ecology." The Ecology Section was designated as a unique section of The Ohio Academy of Science in 1977. The 419 papers presented in that section at the annual OAS meeting illustrate that ecology in Ohio parallels the diversity seen elsewhere: evenly distributed between terrestrial (44%) and aquatic (49%) habitats, the objects of study were organisms (11%), populations (30%), communities (35%), or ecosystems (20%), with mathematical models and general treatments making up the remainder.

Recent trends in ecology include human activities as part of the community or ecosystem to be studied, instead of exclusive emphasis on "natural communities" that exclude humans, an approach pioneered by the eminent ecologist and native Ohioan, Paul Sears (1954). Application of ecological insights to human activities was the topic of 22% of the papers at the OAS in the past decade, while the toxic impact of human activities on populations, communities, and ecosystems was the topic of 15% of the papers presented. Much ecology today tends to examine geographically larger landscapes. In Ohio much current research is conducted on the productivity of agroecosystems and the impact of large agricultural watersheds on eutrophication and toxification of Lake Erie. Also, much current activity in Ohio is directed toward understanding and preserving inland and coastal wetland communities.

Despite the significance of these topics for both scientific and practical purposes, ecology as a recognizable science in its own right remains in its adolescence. Sears' earlier thoughts (1954) may become the basis of our future as a science: "when we as a profession learn to diagnose the total landscape not only as the basis of our culture, but as an expression of it, and to share our especial knowledge as widely as we can, we need not fear that our work will be ignored or that our efforts will be unappreciated."

LITERATURE CITED

Andrewartha, H. G. and L. C. Birch 1954 The Distribution and Abundance of Animals. The University of Chicago Press.

Blauberger, I. V., V. N. Sadovsky, and E. G. Yudin 1977 Systems Theory, Philosophical and Methodological Problems. Progress Publ., Moscow.

Cravens, H. 1978 The Triumph of Evolution. University of Pennsylvania Press.

Elton, C. 1927 Animal Ecology. Sidgewick and Jackson, London.

Haeckel, E. 1891 Plankton studien. Jena Zeitschrift fur Naturwissenschaft. 25: 232-236.

Kuhn, T. S. 1962 The Structure of Scientific Revolutions. The University of Chicago Press.

Margalef, R. 1968 Perspectives in Ecological Theory. The University of Chicago Press.

Mayr, E. 1982 The Growth of Biological Thought. Belknap Press.

McIntosh, R. P. 1985 The Background of Ecology. Cambridge University Press.

Odum, E. P. 1964 The new ecology. BioScience. 14: 14-16.

Sears, P. B. 1954 Human ecology: A problem in synthesis. Science. 120: 959-963.

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Members of the Senior Academy Council should be motivated self-starters who can complete a task independently and be willing to serve for several years. Most business of the Council will be handled by phone or mail; however, the Council will meet at the Annual Meeting each spring and once in the fall. Please volunteer yourself or nominate others who you believe would serve well on the Senior Academy Council.

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