

PREFACE

I was motivated to write this book for a variety of reasons. First, I intended to write a critical review of the ecosystem concept. All phases of science need critical review and ecology is no exception. Review is a bit like checking one's bearings when on a hike in the mountains. It is important to know where you are. The ecosystem has been a key concept in the development of modern ecology, yet today it is widely misunderstood and misused. Many of my students in the 1980s came to graduate school thinking the ecosystem concept was old-fashioned and that it had been rejected by ecologists. It was clear that ecologists did not share a common understanding of the concept, nor were they agreed on how ecology should be taught to the beginning student. Part of the reason for this situation is the information explosion in ecology. As I collected data for the review of the ecosystem concept, I became overwhelmed by the quantity of information. In seeking to organize it, gradually I became convinced that a chronological organization would be more useful than the traditional division into structure and function.

Therefore, the project evolved from a scientific review into a history of the ecosystem concept. Ecology as a subject is little more than one hundred years old, and recently it has experienced a period of rapid growth in public awareness. I have found few students, and few people, who have a clear understanding of the development of scientific ecology. In fact, the time frame for analysis of a topic or a concept in a graduate ecology course seems to have a depth of only five to ten years. Although this limited perspective reflects the amount of

information students can assimilate in any subdiscipline of ecology, it also reflects the fact that there are few historical studies of ecology: it is taught as if it had no history. Thus the historical approach is distinctly useful beyond the focus on an important concept.

It is obvious that the review of a scientific concept and its history represent two very different perspectives. The study of history is a discipline that has its own methods, canons of scholarship, and standards. Contrary to what many scientists might imagine, a history is not merely a chronological listing of past events. Rather, the events must be examined, questioned, and placed in an appropriate context. Studying the history of ecology is like peeling an onion. Once one layer is removed, a new layer appears, so causation and motivation are linked, layer upon layer, in time. Further, the interaction of the historian with these interpretations changes as the story becomes more and more complex. There is no general history of ecology, no set of facts that represents ecological change in time. Instead, each event is as unique as each individual organism is to the field ecologist; each historical interpretation is as limited as each ecological hypothesis; and each historian is as limited by his or her experience and capacity to understand as each ecologist is in beginning a new research project in a new habitat.

I can cite an example of this phenomenon, associated with this particular story. In September 1992, Joel Hagen published his history of the ecosystem concept in *An Entangled Bank*. Hagen and I use approximately the same material, but we each tell two very different stories about ecosystem ecology. His approach is to embed the ecosystem concept in a history of American and English ecology. My approach has been to focus on the concept and the individuals contributing to concept development and then to consider causal factors that led to the pattern we observe. Joel Hagen is a historian and comes to the story from outside, as it were; I was a participant in the story and approach it from within. The result is two different books.

All disciplines have standards by which the usefulness of their creations are judged. I would apply two criteria. The first is generality. Does the study open the window to larger vistas? Does it provide links to other events occurring at the same time? Does it link our present concerns with those of ecologists in other times and places? The second is uniqueness. Does it possess a singular voice so that the individual behind the interpretation becomes visible? The voice of Fernand Braudel, the late master of French history, is distinct and clear even in translation. I can make the same comment about contemporary environmental historians such as Bill Cronin, Al Crosby, and Donald Worster. I hope that in this book I have satisfied these criteria.

As I proceeded in writing this book, I realized more and more that my own

role in the development of the ecosystem concept and in the many activities that created the concept as we know and use it today influenced my perspectives and interpretations. My view has been that of a participant, not merely of an observer. I have tried to check the tendency to rely on memory and express personal convictions, yet inevitably at times the personal voice intrudes. For this reason, I provide more biographical comment than is usual in a preface.

My particular approach to this enterprise comes partly from my family background and partly from my graduate training. My maternal grandfather, Lewis C. Baird, was a historian, army officer, and engineer. He wrote several personal histories, as well as the *History of Clark County Indiana*, published in 1909, which was one of many county histories of that era. I was raised with my grandfather's histories as models of family and public life. As a graduate student at Washington State University when I began a master's program in zoology and wildlife management, Herbert Eastlick was chair of the department of zoology and Helmut Buechner was my major professor. These men taught that a scholar should know his or her subject critically and that the library was as important to the ecologist as the laboratory or field. I was required to make a bibliography of the literature pertaining to my research topic, to read all of the papers and books in this literature, and to incorporate them into my thesis. Each evening I carried a shoe box that contained my bibliography on three-by-five cards to the library. Thus I became attracted to the bibliographic review and thorough analysis of a topic from the beginning of my scientific career.

My graduate training continued at Michigan State University, where I was fortunate to be guided into a study of the energetics of a food chain by Don W. Hayne. This study was one of the first of its kind, and through it I met Eugene P. Odum and became associated with him at the University of Georgia, where I have remained throughout my career, working on ecosystem studies, among other projects, and have been involved in many of the major ecosystem efforts nationally and internationally. These efforts included the International Biological Program, the ecosystem studies of the U.S. Atomic Energy Commission, the UNESCO Man and Biosphere projects, and most recently work with the organization of the Association of Ecosystem Research Centers. I served as division director of the National Science Foundation Division of Environmental Biology (1979–81), which provides financial support to ecosystem studies.

One can, of course, justify an interest in reviewing a concept on other than personal grounds. In 1964, the biologist Bentley Glass wrote in defense of reviewing in the *Quarterly Review of Biology*. Glass quoted Robert Graves: "The scholar is a quarryman, not a builder, and all that is required of him is that he should quarry cleanly. He is the poet's insurance against factual error." Glass goes on to argue with Graves:

But I would say that the real scientist, if not the scholar in general, is no quarryman, but is precisely and exactly a builder—a builder of facts and observations into conceptual schemes and intellectual models that attempt to represent the realities of nature.

This insight, this vision of the whole of nature—or at least some larger part of it—exists in all degrees among the individuals we call scientists. The man who adds his bits of fact to the total of knowledge has a useful and necessary function. But who would deny that a role by far the greater is played by the original thinker and critic who discerns the broader outlines of the plan, who synthesizes from existing knowledge through detection of the false and illumination of the true relationships of things a theory, a conceptual model, or a hypothesis capable of test?

The creativity of scientific writing lies precisely here. The task of the writer of a critical review and synthesis that fulfills these objectives and meets these criteria is not only indispensable to scientific advance, it surely constitutes the essence of the scientific endeavor to be no mere quarryman but in some measure a creator of truth and understanding. The aesthetic element that makes scientist akin to poet and artist is expressed primarily in this broader activity.

In this examination of the development of ecosystem studies, I also have been guided by a model from Arthur Lovejoy, who wrote *The Great Chain of Being*. Lovejoy subtitled this book "The History of an Idea," and his phraseology captured my imagination. The ecosystem is an idea, a powerful idea, and a popular idea. I have tried to keep this always in mind. Later, I learned that the study of the history of ideas is a subdiscipline of history. I do not pretend to have gone that far. Rather, I use the phrase metaphorically to describe my intent and goal.

Finally, I apologize for not being encyclopedic. There is an advantage to such an aim, and my first intention was to include everything pertinent to the story within this volume. But scientific literature is not a linear stream of papers and books, each building on the other. Rather, it is a complex of forward motions, turnings, repeating, and contradictions. Individuals enter for a time, are active, and then turn to other pursuits. Therefore, instead of an encyclopedia, I have adopted the metaphor of the drama, with a stage, principal characters, and a cast of hundreds. Unfortunately, because of space and time restrictions, I have had to exclude many of those standing immediately offstage. The script moves through time in a straightforward fashion, but each act has a separate identity.

What do we now have? We have elements of a review, a history, a drama, and certainly, a story. Bill Cronin, at a Duke University gathering of environmental historians, said that history is storytelling. He emphasized that since we have a story, we should be aware of a teller of the tale, a store of past events from which the teller selects, an audience, and an environment that encloses the storyteller and his audience. I hope that each of these specific elements is clear in what lies ahead.

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