BOOK REVIEWS

A Tale of Two Brothers

An Entangled Bank. The Origins of Ecosystem Ecology. JOEL B. HAGEN. Rutgers University Press, New Brunswick, NJ, 1992. xii, 245 pp. + plates. $38; paper, $16.

In 1971, I thought I had found a perfect topic for a doctoral dissertation in the sociology of science: I had discovered ecosystem ecology at a small island laboratory in the Baltic Sea. The American professor Howard Odum had been to Sweden the year before and, like a missionary proselytizing for a new religion, had converted the young chemists, hydrologists, and biologists working at Askö, just south of Stockholm, to the power of systemic thinking. When I visited them, the Askö scientists had begun to plan an ecosystem study of the Baltic Sea, and they had also begun to transform ecological research in Sweden into the "big science" that would characterize other ecosystem projects around the world.

I never wrote that dissertation, but I couldn't help thinking about it as I read Joel Hagen's informative new history of ecosystem ecology. What had attracted me at the time was the "culture" of the ecosystem ecologists, their curious mixture of scientific ambition and politico-religious fervor that combined into the conviction that if all relevant variables about the Baltic ecosystem could be quantified and put into a computer model the sea would almost automatically get cleaner. It was certainly not an outlandish idea at the time, when many of us were calling for an ecological revolution, and for me the Askö culture was almost inspirational; but the ambition did turn out to be somewhat misconceived.

Hagen provides an extremely readable survey of the history of ecosystem ecology, but he doesn't really explain either the inspiration or the misconception. He deliberately rejects the broad canvas of Donald Worster, who, in his already classic *Nature's Economy* (1977), traced the roots of ecology back to Francis Bacon and his ideas of human dominion over nature. For Worster, the new ecosystem ecology that emerged after the Second World War was based on a modern-day version of the Baconian mentality, transforming nature into a system of production units to be managed efficiently. Worster counterposed the "imperialist" attitude of ecosystem ecology to an "arcadian" attitude to nature that he found at work in evolutionary, or natural history, approaches to ecology.

Hagen adopts a more straightforward method in recounting the history of ecosystem ecology. He starts with Darwin and Spencer in the 19th century, emphasizing the "ambiguous" picture of nature that both men left to ecology. Darwin's metaphor of the "entangled bank" is used by Hagen to stress the complexity but also the interpretative flexibility of Darwinian concepts. Ecologists for Hagen are not Kuhnian normal scientists, upholding a dogmatic faith in one overriding paradigm or attitude to nature; they are rather pragmatic and flexible professionals. And ecology itself, rather than being formed by a dialectical conflict between imperialists and arcadians, as Worster suggested, is for Hagen more a matter of emphasis: should one focus on "entanglements" or the "survival of the fittest" in explaining natural processes, and, even more important, should one emphasize systemic regularities or local and population peculiarities?

As Hagen tells the story, ecosystem ecology is largely the creation of two brothers, Eugene and Howard Odum. Hagen recounts the different emphases of the older, more physiologically minded Eugene and the electronically oriented Howard, explaining the differences partly on the basis of personality, partly on the basis of education. Eugene was educated in the Midwest, where laboratory studies and organismic thinking were prominent features of ecological research, whereas Howard was a student of G. Evelyn Hutchinson at Yale, a proponent of cybernetics and energetic-chemical modeling. Though the brothers differed both personally and professionally, they shared a belief in what might be called progressive holism, the idea that an understanding of systemic process in nature could help improve the way in which human societies interacted with their natural environments. It would have been interesting if Hagen had written more about the "regionalism" of the brothers' father, the sociologist Howard W. Odum, which seems to have been an important influence for both Eugene and Howard.

Hagen's tale of two brothers is colorfully told. There are numerous references to the intellectual and broader social contexts in which ecology developed, even though the book is primarily focused on the key scientific ideas and conceptual developments. There is a fine discussion of the career of Frederic Clements, which brings out both the role of personality—Clements had a strong one—in the development of science and the significance of funding agencies in the setting of research agendas. Clements, whose ideas were crucial for ecosystem ecology, worked in the 1920s at the Carnegie Institution of Washington, and Hagen describes the ways in which his ideas about ecological succession were given an institu-

"Eugene and Howard Odum receiving the 1987 Crafoord Prize. *Left to right:* Mrs. Elizabeth (H. T.) Odum, Mrs. Martha (E. P.) Odum, Howard T. Odum, Mrs. Anna-Greta Crafoord, Eugene P. Odum, King Carl XVI Gustaf." [From *An Entangled Bank*; Royal Swedish Academy of Sciences]

Vignettes: Nomenclature

The Dolomites were named to honor the French geologist, Déodat de Grater de Dolomieu, Knight of Malta, captious adventurer, aristocratic adherent of the Revolution, august geologist. Dolomieu studied the Dolomites at the end of the 18th century. He studied Italian volcanoes, and knew that the heat could not come from combustion, but did not reach an alternative explanation. The common calcium-magnesium-carbonate mineral dolomite, whose reaction to dilute hydrochloric acid is to form slow-breaking bubbles, also honors Dolomieu as does the rock dolomite, a stone with 50% or more of the mineral dolomite. It is imprecise to give mineral, rock, and mountain range the same name. But geologists, who are little honored anywhere and sometimes ignored among more mathematical and experimental scientists, can rejoice in honoring the dead Dolomieu.

—M. *Dane Picard*, in *Mountains and Minerals/Rivers and Rocks: A Geologist's Notes from the Field* (Chapman and Hall)

The naming of the digits . . . can be traced back at least as far as Aethelbert, the first Christian Anglo-Danish king of Kent, who in A.D. 616 laid down a set of laws of compensation for the loss of fingers or thumb. King Alfred and King Canute, both thoughtful—if preoccupied (Alfred) or optimistic (Canute)—sovereigns, revised these laws and in so doing identified each digit by name. . . . The terms used by anatomists . . . are fairly obvious. *Auricularis* (little finger) denotes the digit most commonly employed to extract wax from the depths of the outer ear. The implication of *demonstratorius* (index finger) is self-explanatory, but why *impudicus* for the middle finger? . . . Professor Wood Jones, a great authority on the hand, preferred the term *obscenus* . . . to describe the digit that is used to express scorn and derision. The ring finger, the *annularis*, is again self-explanatory, although its synonym, the once widely used *medicus*, is not. . . . One suggestion that has been made is that this digit was used by medieval physicians to stir their cordials and nostrums.

—*John Napier*, in *Hands* (revised edition; Princeton University Press)

tional foothold there, but also how his domineering personality made it difficult to establish a school of followers. What Clements left to American ecology was thus an "ambiguous legacy"—a holistic attitude to nature, a physiological emphasis, and a set of ideas about biological succession, all of which affected ecosystem ecology, more as points of critical departure than as paradigmatic assumptions. As opposed to other historians of ecology, who have stressed the "dogmatic" influence of Clements's ideas, Hagen is at pains to show that science does not develop through dramatic revolutionary shifts of paradigm but rather through intricate patterns of change in which social, institutional, and personal factors interact with the theory and practice of research.

The rich social history that Hagen gives us of the early history of ecosystem ecology is extremely useful. But as he moves closer to the present day, he tends to limit his focus, and the book becomes a more traditional intellectual history. Hagen makes use of Chunglin Kwa's doctoral dissertation (in the Department of Science Dynamics at the University of Amsterdam), as well as Peter Taylor's research on Howard Odum, to show how ecosystem ecology was developed by the Odum brothers into a distinct scientific specialty in the 1940s and '50s. But he tells us relatively little about the other approaches to ecology emerging at the same time, or the important environmental debates and controversies that provided so much of the basis for the popularity and significance that ecosystem ecology would garner in the 1960s. By keeping his focus on the Odum brothers—and their colleagues within the "big ecology" projects of the International Biological Program—he misses some of the important social factors at work.

In the late 1960s, ecosystem ecology formed a significant strand of the broader environmental consciousness that was starting to emerge. The popular writings of the Odum brothers, as well as much of the voluminous literature in social and human ecology, were all affected by the ideas of ecosystem ecology. By going public, ecosystem ecology extended the range of its influence—in the social sciences, in environmental management, in engineering, and even in philosophy. But at the same time, as Hagen notes, ecosystem ecology tended to lose its authoritative status as an ecological specialty. Without a more detailed exploration of the interactions between ecosystem ecology and the broader environmental discourse, it is difficult to understand the changing fortunes of the specialty. Hagen has, however, given us a valuable survey of some of the field's most important intellectual sources.

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Getting Funded

A Guide to NIH Grant Programs. SAMUEL M. SCHWARTZ and MISCHA E. FRIEDMAN. Oxford University Press, New York, 1992. xii, 296 pp., illus. $39.95 or £32.

Science is done by scientists, not funding agencies, but not much can be done without financial support. The biomedical sciences and biology generally owe much of their explosive growth during the past 40 years to investigator-initiated projects supported by the external grants programs of the U.S. National Institutes of Health (NIH). Directly or indirectly, research not only in the United States but throughout the world has profited from those programs, which provide a success story unparalleled in the history of governmental support of both basic and clinical research. However, an investigator seeking support is not interested in history but in prospects, and no reader of *Science* needs to be told that the present situation and the view forward are by no means as rosy as those to the rear. An applicant needs all the help he or she can get.

This volume is in part a reference, containing tabulations of numerical information about NIH and descriptions of some of the labyrinthine procedures by which applications and grants are processed and administered, and in part a how-to guide for applicants. The authors are as familiar with the inside workings of the system as anyone could be; between them, they have held at least 11 responsible positions (listed on the dust jacket) in the vast NIH organization. The presentation is rather flat in style but lucid and straightforward.

Because the volume is a guide and reference to be consulted rather than a book to be read, it seems appropriate to list the chapters. After an introduction, chapters 2 and 3 list the 14 institutes and four centers, with their recent budgets, and chapter 4 lists types of extramural support mecha-