

theories', *Archives Internationales d'Histoire des Sciences* XXIV, 1974, 73–111, 243–318 in particular pp. 91–92). He has even argued that Copernicus's playing around with the eccentricity of Mars reflects his wish to move the center of the planetary system from the mean to the true sun (Hunting the immobile centre of Copernicus' planetary system', *Studia Copernicana XIV = Colloquia Copernicana IV*, 1975, 93–100). Whatever interdisciplinary picture of Copernicus's scientific achievement should depend on this core of analysis just as linked by a principle of correspondence.

*Kristian Peder Moesgaard*

Sharon E. Kingsland, *The Evolution of American Ecology 1890–2000* (Baltimore: Johns Hopkins University Press, 2005). 313 pp. hc. \$50. ISBN 0-8018-8171-4.

This fine book provides an excellent opportunity to reflect back on the ecological sciences and their entanglement with environmental concerns in the USA. Kingsland offers a novel view of the rich history of ecology that is well worth reading.

The standard history of ecology taught in most colleges and universities in the USA is usually based on Donald Worster's *Nature's Economy: A History of Ecological Ideas*, which has appeared in several editions since it was first published in 1977. Key figures in this book include Henry David Thoreau, John Muir, and Aldo Leopold, whose philosophical and ethical views serve as the origin of ecological reasoning. None of them are even mentioned in Kingsland's account, which focuses instead on the importance of scientific institutions in the history of ecology. This is surely a refreshing and novel approach that breaks new grounds in our understanding of how ecology became a dominating scientific approach to the environment. Who has ever heard of Nathaniel Britton, Henry Rusby, or Arthur Hollick? Yet, these natural historians, Kingsland argues, through the establishment of the New York Botanical Garden in 1891, provided the institutional ground from which ecology as a science could emerge in the USA.

The entrepreneurs at the New York Botanical Garden were searching for ways to standardize and professionalize the practice of natural history. They engaged a series of scientists in what evolved into a 'Big Science' project with the largest museum in the world organizing the nation's plants according to Britton's own American Code. Kingsland argues that the ecological approach to natural history was attractive to scholars at the Garden because it 'fitted into a larger quest for control over the evolutionary process, which in turn was related to the broader development of the country's resources as the population expanded' (p. 94). She shows that ecology was a science of the Progressive Era emerging as a response to the rapid transformation of the land. Ecology offered a way to control life and apply rational scientific methods to problems generated by peoples' desire to migrate into and adapt to new landscapes.

One such changing landscape was the desert environment in Arizona, and Kingsland discusses at length the early history of the Desert Botanical Laboratory near Tucson. These chapters represent, perhaps, the highlight of the book. The Carnegie Institution was the owner of the Laboratory, though in reality, it came to function as a satellite of the New York Botanical Garden, with scholars commuting between the institutions. This connection enables Kingsland to show how the 'gospel of efficiency', to use the title of the historian Samuel Hays' renowned book about the history of environmentalism during the Progressive Era, also came to dominate ecological research in Arizona. As people tried to settle in the region, ecologists were there to help them use the new environment. This social role of ecologists serves as evidence in Kingsland's pointed criticisms of the historian of biology, Robert E. Kohler. He argues in his latest book, *Landscapes and Labscapes* (2002), that what differentiated ecology from natural history was its use of laboratory methodology and practice in the field. This, according to Kohler, made ecology into a 'schizoid' science that 'lurched' on the border between two different scientific cultures (Kohler, pp. 75, 137). Kingsland disagrees: "The scientists at the Desert Laboratory did not so much 'lurch' between laboratory and field as move easily between different

scientific enterprises, different places, and different communities. They felt no conflict between any disparate or antithetical cultures of laboratory and field" (p. 97). According to this criticism, Kohler focuses unduly on the importance of laboratories to ecologists, instead of the real source of ecological methodology, namely socially situated questions of how people should adapt into and transform new landscapes.

This is not to say that Kingsland uses social studies of science methodology in her book. In a similar vein as Kohler, Kingsland avoids lines of arguments that could inflame the expiring Science War of the late 1990s. Although she uses the social context of the Progressive Era to explain the emergence of ecology, her methodology is taken from the object of her book. It is the concepts of niche and adaptability in ecology that Kingsland uses to analyse how ecologists struggled for a place in the American society. This methodological approach gives the reader a sense of being entrapped in a self-referential vicious cycle, where the history of ecology uses ecology to describe itself.

What the book does provide the reader is information about the life and work of a series of ecologists, including Frederic Clements, Henry Cowles, Ellsworth Huntington, Eugene, and Howard Odum, and a host of less known scholars. Kingsland deserves credit for having brought to light ecologists who have been left in the dark by other historians of ecology. This inclusive approach, however, becomes less focused as Kingsland's history of ecology evolves into the Cold War. The symposium 'Man's Role in Changing the Face of the Earth' at Princeton University in 1955, serves as a key to this period. It was largely the work of Carl Ortwin Sauer, a human geographer Kingsland discusses at length. She reads this famous symposium as a continuation of earlier discussions in ecology about human social and environmental adaptability through scientific advice and management. This is an original and convincing interpretation, as the symposium is often seen as a turning point—and not continuation—in the history of ecology. Kingsland ends her book with a short overview of the events that came to dominate the history of ecology in the 1960s and beyond.

The book focuses exclusively on 'American Ecology', or more accurately, on the history of ecology in the USA (and not Canada, Mexico, or Latin America). Though every book must have certain boundaries, there are reasons to question whether the national boundary is an adequate one for an international science like ecology. It is true that many of the ecologists Kingsland discusses were caught up in the nation's Progressive Era politics of the early 20th century. Yet, it is equally true that the same scientists found inspiration for their scientific work beyond the USA. The rich and engaging new material of this book may illustrate that the time is overdue for a new comprehensive international history of the ecological sciences.

Peder Anker

Graeme J.N. Gooday. *The Morals of Measurement: Accuracy, Irony, and Trust in Late Victorian Electrical Practice* (Cambridge: Cambridge University Press, 2004). xxv, 285 pp. hc. £55. ISBN 0-521-43098.

What do you find when you look inside a technological 'black box'? Graeme Gooday provides a provocative and incisive answer to this question in his extensive examination of the early history of electrical measurement. By unpacking the various meanings that 19th-century electrical engineers, scientists, and members of the public attached to electrical measuring devices, Gooday demonstrates the often-problematic nature of devices like the voltmeter that are taken for granted today.

Gooday lays out his central premise in his preface (p. xx): electrical measurement was 'industrialized' in the 1880s and 1890s. During this period, machines automated measurements that had previously been done by hand by skilled practitioners. Over the course of this transition, practitioners struggled to define what constituted accuracy and reliability when it came to the new automated measuring devices. As Gooday makes clear, particularly in his first two chapters, is that measuring devices had multiple meanings for practitioners. Depending on what is being measured in what context, various instruments could be judged adequate or inadequate.