

saved much wildlife and harvesting of wild plants and animals. Here, the concepts of conservation and sustainable economic production get intermingled. Food supply will have to be increased dramatically for an ever increasing human population. For economic, ecological, and social reasons this has to be extended beyond national boundaries. Finding soft solutions for quantitative and qualitative increases of food, reducing costs, and environmental risks might be even more difficult than just maximizing yields per land unit. The combined rice and fish production is a good example of how biocoenotic systems can lead to increased production on the same land area, while at the same time keeping pests and diseases below levels that affect yields and reduce external input costs without the application of biocides. Cocultivation of fish in rice fields and other aquatic habitats created by the rice growing enterprise could provide much needed protein to people all over the world. The technology of fish culture has improved vastly and if suitable fish species and the necessary investments are all brought together it could lead to a major economic and social breakthrough for humanity. The more we know about the interactions of plants and animals relevant for agriculture, the more we have a chance to develop interdependent generation-responsible systems to produce food and food choices for a world population reaching 10 billion before the middle of the 21st century. The cultivation of rice has often led to great increases of vectors (such as mosquitoes, copepods, and snails) that are transmitting diseases to humans, domesticated animals, and wildlife. The impact of biocides on the rice field ecosystem has been a major factor in the demise of fish stocks that were harvested in these fields. Integrated pest management has meant that there is a much improved situation for fish farming in irrigation systems and for harvesting edible proteins particularly in rural areas.

The possibilities of integrated fish culture and harvesting, the use of integrated pest control, and the conservationist approach to agriculture can all benefit from a broad based set of papers that cover as wide a range of subjects as possible such as those presented in this volume. The current book is unique in that it draws upon the experience of two generations of scientists that worked on all continents where rice is grown (except Africa). This volume will be invaluable to researchers around the world who wish to find comprehensive data on the aquatic ecology of rice fields. Biologists will find an updated survey of fauna and flora, and ecologists will discover descriptions of the intimate relationships among different components of rice ecosystems and aquatic cycles. Data are provided that will be useful for a comparison of aquatic systems

around the world. Agronomists will find this book helpful because the culture of rice as well as the fish and other organisms in rice fields are considered directly or indirectly for human food. It will also be useful for applied agronomists and fishery biologists, as well as for vector ecologists, pest control researchers, technicians, and rice plant and fish farmers. An integrated and multidisciplinary approach has been followed in most chapters. Many of the chapters base their results on long-term studies and a thorough review of the literature.

This monograph provides a compendium on global ecological studies of rice fields. Some flaws due to insufficiently clear reproduction of graphs are made up by the wide range of information. This volume will provide students with a good starting point in their research. It will be a useful tool and authoritative guide for all of these purposes.

HANS-U DAHMS, *Biology and Coastal Marine Laboratory, Hong Kong University of Science & Technology, Kowloon, Hong Kong*



## ENVIRONMENTAL SCIENCES

FROZEN EARTH: THE ONCE AND FUTURE STORY OF ICE AGES.

*By Doug Macdougall. Berkeley (California): University of California Press. \$24.95. xi + 256 p; ill.; index. ISBN: 0-520-23922-9. 2004.*

*Frozen Earth* is an informative and entertaining book suitable for general readers. It summarizes what is known about the causes and effects of ice ages by tracing the origin and evolution of the ideas that formed the basis of current theory on the subject. Complex factors that influence the planet's climate are explained simply and are placed in a historical context that includes biographical accounts of researchers such as Louis Agassiz, James Croll, and Milutin Milankovitch. The combination of science and history succeeds in placing readers inside the struggle to understand this important aspect of our planet's past.

The book begins with an introduction to ice ages, the associated terminology, and the challenges early researchers faced. The volume describes efforts to prove that glaciers covered much larger portions of the Earth in the past, and the influence of astronomical factors on the cycling of glacial advances and retreats during the Pleistocene. Other chapters include discussions of the power of glaciers to directly or indirectly mold landscapes; a survey of ice ages that occurred be-

fore the Pleistocene; a detailed introduction to coring as a method to decipher the history of ice ages; an overview of the influence of ice ages on evolution (especially human evolution); and an account of climate change in the last millennium, including its effects on human society. The book concludes with a discussion of greenhouse gases, climate change, and warnings about the potential consequences of human alteration of greenhouse gas concentrations given the catastrophic consequences of natural alterations documented in the past.

My quibbles are few. An easily accessible diagram—perhaps on the inside cover—that summarizes the chronology of ice age occurrences and their hypothesized effects (discussions of which are scattered throughout the book) would have been useful. After reading the chapters related to the astronomical theory of ice ages, readers may be disappointed later to discover that astronomical factors are not the whole story and that the ultimate causes are still not fully understood. Nonetheless, *Frozen Earth* is an ambitious book that treats a wide range of topics while providing a delightful read. I recommend it.

WINDSOR E AGUIRRE, *Ecology & Evolution*, Stony Brook University, Stony Brook, New York

#### CLIMATE CHANGE IN PREHISTORY: THE END OF THE REIGN OF CHAOS.

By William James Burroughs. Cambridge and New York: Cambridge University Press. \$30.00. xii + 356 p; ill.; index. ISBN: 0-521-82409-5. 2005.

This engaging book brings together the latest thinking on how climate history may have affected human history since the last interglacial (approximately the last 120,000 years). Both disciplines have made great advances in the past two decades. Global climatic histories have been developed using fine-grained ice core and ocean core records, as well as suitable terrestrial proxies. These methods provide increasingly precise and reliable measures of climate change during both the “chaotic” ice ages, when climates fluctuated wildly on a decadal scale, and the milder interglacial periods such as the Holocene in which we now live, and during which climates are by far more stable and sanguine. Since the last interglacial, anatomically modern humans began to spread out from Africa and eventually colonized the world, leaving a record of artifacts, genes, languages, and evidence of interactions with their environment, ranging from megafaunal mass extinctions to domesticated dogs to the distribution of head lice to the hegemony of agrarian landscapes. The author’s purpose is to link these two histories; in doing so, he covers an

amazing range of relevant topics and does not shirk from controversy.

Given the breadth of coverage, lapses both large and small are bound to creep in. The largest lapse, worth mentioning here, is that the human mitochondrial haplogroup X is given as occurring only among European and Native American peoples, which suggests a likely colonization across the Atlantic. However, the presence of haplogroup X in east-central Asian populations now makes that colonization once again as untenable as it sounds. Readers may also note a somewhat declining level of typographic accuracy in later chapters. Nevertheless, the story the author weaves is up to date and utterly fascinating, and it captures the excitement and promise in combining studies of climatic and human history.

DAVID RHODE, *Earth & Ecosystem Sciences*, Desert Research Institute, Reno, Nevada

#### THE EVOLUTION OF AMERICAN ECOLOGY, 1890–2000.

By Sharon E Kingsland. Baltimore (Maryland): Johns Hopkins University Press. \$50.00. xi + 313 p; ill.; index. ISBN: 0-8018-8171-4. 2005.

The breadth of ecology as a scientific discipline, with roots in so many other fields, makes it a messy and challenging historical subject. Kingsland has ambitiously followed the growth of American ecology from the end of the 19th throughout the 20th century, looking at social, economic, and scientific influences. Her primary thesis is that the westward movement of the American nation, which involved the development of new natural resources and the challenge of living in new climates, created the need for a science that would not only understand the relationship between organisms and their environments, but ultimately facilitate the control of that relationship.

The tension between understanding and controlling nature, or between pure and applied science runs throughout the book and throughout the history of ecology. Of particular interest are ideas that may seem academic today, but had practical or political implications at their inception, such as the Clementsian notion of succession as a predictable sequence of community change reaching a stable climax. If different stages of succession support floras of differing economic value, then land managers would want to understand both the ontogeny of succession and how to manipulate it. Other ideas that are similarly examined include the “balance of nature,” Lamarckian evolution, and the ecosystem concept.

The generality of Kingsland’s insight narrows somewhat as the narrative moves closer to the pres-