worry the details of canopy photosynthesis.

Fourth, a much wider range of scale-dependent ecological phenomena than those mentioned in the text should be considered. For example, what is the feedback between plant cover and precipitation in desert regions? What is the feedback between the area covered by deciduous trees and temperature in snowy boreal latitudes? How might the area of hilly, easily eroded upland terrain in boreal regions affect the extent of minerotrophic wetlands dominated by deciduous larches? How does the extent of contiguous flammable habitat (or "fireshed") affect the local frequency of wildfire? (See T. J. Givnish, *Evolution* **35**, 101 [1981].) How does the extent of dusty regions in the Sahara lead to the fertilization of Amazonian forests?

Fifth, even though their biomass is relatively low, the pivotal role that certain animals can play in determining ecosystem function must be considered. Ungulates and termites mightily shape the structure and productivity of tropical savannas, and beavers set the tempo of disturbance and succession in many boreal wetlands. Multi-level effects that cascade through trophic webs may have equally important consequences. For example, baleen whales may play a critical role in regulating the productivity of the Antarctic Ocean by heavily grazing krill, which in turn consume planktonic algae, the primary producers. Similarly, marine fisheries that have crashed stocks of large food fish may be enhancing algal production and slowing the increase in global CO_2 levels by raising the population levels of small fish that eat zooplankton. These possibilities deserve exploration.

Finally, it is essential to incorporate the effects of the most important agent driving global change—human population growth and economic activity—directly in any analysis of the atmosphere-biosphere system. What are the effects on carbon exchange, transpiration, albedo, and rainfall of converting vast areas of rainforest to slash-and-burn fields? How do prairies and cornfields differ in their local and large-scale impacts on the biosphere? How do human activities affect the landscape pattern of natural and agricultural communities? (See D. J. Stanley and A. G. Warne, *Science* **260**, 628 [1993].) What are the synergisms among the atmospheric changes wrought by human activities (for example, between increases in ozone and carbon dioxide concentrations)? And what are the implications for ecosystem function and biospheric processes of the mass extinctions of plant and animal species projected for the coming decades? The most important determinant of ecological scaling laws—perhaps now, and certainly in the future—may be as much the human birthrate as the photosynthetic rate.

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The Binary Zoo

The Realm of Interacting Binary Stars. J. SAHADE, G. E. McCLUSKEY, JR., and Y. KONDO, Eds. Kluwer, Norwell, MA, 1993. vi, 451 pp., illus. $140, £77, or Dfl. 225. Astrophysics and Space Science Library.

One of the great scientific accomplishments of this century has been the development of a reasonably comprehensive theory of the evolution of single stars. Since the late 18th century, however, we have known that some stars are in gravitationally bound systems of two or more stars. More recent observations have revealed that in fact most stars are members of such binary or multiple systems. These range from systems in which the stars are in actual contact to those in which the stars are about a million stellar radii apart.

From the 1940s to the 1960s, as the theory of single stars was becoming firmly established, compelling ground-based evidence accumulated indicating that many close binaries of diverse types are "interacting," primarily through transfer of mass or radiant energy. The interactions can be strong enough that they profoundly affect the evolution of the component stars. The advent of space astronomy, especially in the x-ray and ultraviolet, while elucidating some previously known systems, also revealed the existence of x-ray binaries, in which various end-state objects of stellar evolution, such as compact degenerate stars or even black holes, produce copious x-rays by accreting matter from a close companion star. We are now presented with, as the editors of this volume put it, a veritable "zoo" of interacting binaries.

Although the individual contributions to *The Realm of Interacting Binary Stars* vary in their accessibility to the nonexpert, most of the authors have made an effort to develop their topics from first principles. I think the paper by Trimble and the one by Meyer-Hofmeister and Ritter are particularly effective in this regard. I found myself wishing for a chapter of similar clarity that would bring all the disparate systems together in a coherent evolutionary picture. Unfortunately, such a picture simply does not exist at present.

I am impressed, as an informed outsider, both by the advances in knowledge that have been made and by the mysteries that remain. On the one hand, we know much more than we once did about cataclysmic variables, nova outbursts, type I supernovas, massive x-ray binaries, and stellar activity. On the other hand, we still do not understand the nature, origin, or fate of classically known systems like the relatively common W Ursae Majoris contact systems or of oddballs like ϵ Aurigae. Among more recently discovered systems, we have considerable difficulty with the whole class of low-mass x-ray binaries and millisecond pulsars, and we do not even know the nature of the mass accreting object in exotic systems like SS433. Encouraging progress is being made in the areas of mass flow in Algols and the origins of binary stars, and new, more effective observation techniques are being developed.

Certainly there remains much work to be done, by observers and theorists alike, to achieve the same fundamental clarity about binary star evolution that we now possess for single stars. I think this book will be useful to those who strive to develop that understanding.

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NMR for Beginners

Fundamentals of Nuclear Magnetic Resonance. JACEK W. HENNEL and JACEK KLINOWSKI. Longman Scientific and Technical, Harlow, Essex, U.K., and Wiley, New York, 1993. xii, 288 pp., illus. $49.95 or £22.50.

Since its discovery in 1945 by Purcell, Torrey, and Pound at Harvard University and by Bloch, Hansen, and Packard at Stanford University, nuclear magnetic resonance (NMR) has become a powerful research tool in many different fields that touch our everyday lives. It has been used in the determination of the chemical structure of complex molecules of biological significance, the study of the basic properties of technologically important new materials such as high-T_c (high transition-temperature) superconducting ceramics, and mineral exploration. Magnetic resonance imaging is now an important instrument in medical diagnostics. These widespread applications have made a basic understanding of NMR essential for students in many scientific disciplines outside of physics. There has long been a need for an