

Book Reviews

Details versus Models

The Ecosystem Concept in Natural Resource Management. Based on a symposium, Albuquerque, N.M., Feb. 1968. GEORGE M. VAN DYNE, Ed. Academic Press, New York, 1969. xiv + 386 pp., illus. \$16.50.

Despite the large number of recent books which have somehow combined the notions of "ecology" and "system" in the title, the text, or both, this book is unusual to a startling extent. The subject matter orientation is different from that of preceding offerings: nine of the chapters are by authors whose primary interest is in range, or forests. Only one of the ten chapters deals with fish and game management. The philosophical orientation is different from that of many other books. This book insists that to understand the natural world we must have a great deal of detailed information about many different aspects of that world—minerals, soil, water, weather, plants, animals, and the interactions among these—or we simply won't understand how the system functions. By implication, this book makes a strong argument for the case that ecosystems cannot be understood in terms of a small number of simple principles. Rather, it argues, a great deal of information must be collected over a considerable period of time; any other approach is likely to be misleading. Only by understanding how all the components of the system interact can we understand the system. Thus, for example, the key to the arctic lemming cycle may be found in the interacting system of nutrients, soil, vegetation, and herbivores.

A clear implication of this argument is that big teams and big budgets are required for ecosystem analysis, and part of the book provides insight into the organizational problems of such big

teams and how to surmount them. However, on the subject of methodology, the book is somewhat baffling. In the last chapter, on training natural resource scientists to deal with ecosystems, Van Dyne indicates that Ph.D. programs in experimental systems ecology should be 12 percent mathematics, statistics, and logic and Ph.D. programs in theoretical systems ecology should be 39 percent these subjects. Yet this is one of the most totally nonmathematical books on modern science this reviewer has ever seen. A number of interpretations can be placed on this observation, and one of these is most thought-provoking. Perhaps many of us are oversold on the importance of mathematics, statistics, and computers. Perhaps tremendous knowledge of an actual system, as demonstrated in this book by several authors, is an adequate means of dealing with complexity. At any rate, not enough experience in dealing with extreme complexity has accumulated yet in ecosystem analysis for us to know for certain which methodology is best. Another extremely interesting point is made in the chapter by Charles Cooper. He notes that preliminary computer experiments have shown that hypothetical simple systems are far more sensitive to changes in the relations between components than to changes in the values of the components themselves. Since this same finding is coming from different groups of people working on models of cities, it may be a fundamental statement about the properties of systems in the biological and behavioral sciences.

Ecosystem analysis is just beginning; this book is an essential tool for scientists who wish to be informed about that beginning.

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More Man-Made Problems

Noise and Man. WILLIAM BURNS. Lippincott, Philadelphia, 1969. x + 338 pp., illus. \$11.

This book, first published in Great Britain in 1968, reflects—quite accurately—in information, concern, and mood the views that interested life scientists, physicians, and engineers came to hold throughout the '50's and the '60's regarding the effects of noise. With the exception of the rather brief introductory historical summary, it is only in the final paragraph of the book that we read that noise "is yet another by-product of technical advance which has not been adequately controlled" and that the elimination of noise "should be viewed as a part of the practice of preventive and industrial medicine, such as the provision of clean water supplies, and the continued attention to such problems as atmospheric pollution, the chemical contamination of foods, traffic and industrial accidents, and the ill effects of cigarette smoking."

So ends a book written to make it easier for "audiologists, engineers, medical officers in industry, medical practitioners, otologists, physicists and health physicists, safety officers in industry, psychologists, public health officers . . . and administrators in local government" to become acquainted with what the author labels a rather wide and confusing field. The common denominator of this professional conglomerate is to him the "enquiring non-specialist reader" who would like a short factual account of the many problems that arise from noise: annoyance, interference with conversation, leisure, sleep, and efficiency; in particular, potentially harmful effects on hearing.

Burns deals as follows with these topics: There are three chapters on sound and its measurement, three chapters on hearing—the peripheral mechanism thereof, measurement of hearing and deafness—and then a short chapter on various disturbing effects of noise including those alleged to affect man's physical and mental health. After a chapter on how to assess and reduce certain interference effects, there follow three chapters on temporary and permanent noise-induced hearing losses and on hearing conservation. The next two chapters touch such topics as aircraft noise and the sonic boom. Finally there are 4 pages of conclusions and about 50 pages given over to a dozen

appendices (mainly taken from materials published by the British Standards Institution or the International Standards Organization) whose contents range from acoustical terms and decibel conversion charts to precautions in audiometry and various types of loudness calculations.

No author could have been expected to cover thoroughly, in 300-odd pages, a "field" held together by a term—noise—or at best by a relation—that of *noise to man*. Most of the numerous references listed contain data of some sort taken under more or less well controlled conditions. But the nonspecialist reader is not so much in need of more data as of a critical evaluation of the assumptions or even prejudices of those who report them. He needs a framework into which he can fit all these facts. Only in the area of hearing loss—where the effects of noise exposure can be ascertained with a great deal more certainty than most other effects that are ascribed to noise and where anatomical, physiological, and behavioral data in animals can be correlated with audiometric findings in man—does there seem to emerge a useful conceptual approach. It consists of a stimulus-response type of model in which noise exposure represents the stimulus whose various parameters can be quite well quantified, as can the demographic characteristics of the exposed population.

Such a model helps both in bringing a certain order into the plethora of data and in specifying maximum permissible exposures that will reduce the risk of hearing loss to an acceptable level. But when it comes to other effects of noise (with the possible exception of interference with speech communication), the problems of establishing acoustic standards to protect what we have come to call the quality of life are far more difficult. Stimulus-response relations no longer suffice. We must be willing to face such issues as social and economic benefits and costs (is the quiet environment really a free good?), technological risks, and privacy. A much deeper understanding of the factors that enter into noise pollution becomes required: What part do economic considerations and population density play? To what extent do people become sensitized to noise when they see themselves the victims rather than the beneficiaries of a noise-producing activity? What human values underlie the trade-offs that legislation and administrative regulations have to take

into account? Nobody should criticize Burns for not having included such considerations in his book. They have surfaced only much more recently. There is, for instance, the report entitled "A Study of Technology Assessment" which the Committee on Public Engineering Policy of the National Academy of Engineering submitted to the House Committee on Science and Astronautics in July 1969, which reflects a much more comprehensive approach to dealing with the physiological, psychological, and social consequences of technology. *Noise and Man* reminds us that in an increasingly man-made world our ignorance regarding the effects of man-made noise exemplifies the risk of letting technological progress outpace our understanding of man.

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The Workings of the NSF

The National Science Foundation. DOROTHY SCHAFFTER. Praeger, New York, 1969. xii + 278 pp. \$7.95. Praeger Library of U.S. Government Departments and Agencies.

This is a reference book for scientists, public administrators, high school and college students, and others who may need information about the organization, structure, and main functions of the National Science Foundation. It makes no pretense of being a definitive agency study. It briefly sketches the historical background of the NSF and traces some of the changes that have occurred in the agency since its establishment in 1950. The major programs of the NSF are clearly described and defined, including international projects, science education, institutional programs, and science information activities. The agency's role in supporting basic research in the United States is emphasized.

The author writes from the point of view of a specialist in political science. Her main interest is in the legislative and administrative processes that have contributed to the agency's growth and staying power. The best chapters in the book deal with the Foundation's relations with Congress, with other executive agencies, and with its "special publics." A careful reading of these chapters can provide insight into the operational limitations on the NSF and its reluctance to take the lead in formu-

lating national science policy. The author demonstrates a solid understanding of administrative politics and the complexities of bureaucracy. The book's strongest point is its accurate portrayal of the administrative style and self-image of the Foundation.

Schaffter's work may be criticized on two counts. First, the historical background of the NSF is relatively neglected. The pluralist convictions of the leading scientists of the 1940's were programmed into the NSF and are still shaping it to a marked degree. The precedents set by the Office of Scientific Research and Development during World War II were of great significance. The rise of the Atomic Energy Commission and the emergence of the National Institutes of Health limited the scope of the NSF even before it was established. In the 1950's, Sputnik had a large impact on the institutions of American science, including the NSF. None of these historical themes is adequately developed. The second weakness of the book is its overcautious approach. The author hints at the organizational and operational problems of the Foundation but is never bold enough to evaluate its performance. She quotes instead from congressional documents, particularly the critical reports of the Daddario subcommittee, and from independent scholars such as Don K. Price.

The book is the first of its kind about the National Science Foundation. It is informative and well organized. It will be widely used. One wishes only that the author had been less bland and more historical in her approach to this important federal agency.

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Reactions and Mechanisms

Catalysis in Chemistry and Enzymology. WILLIAM P. JENCKS. McGraw-Hill, New York, 1969. xvi + 656 pp., illus. \$14.50. McGraw-Hill Series in Advanced Chemistry.

During the last decade certain related pathways of research in biochemistry and organic chemistry have converged to become the interdisciplinary avenue of organobiochemistry. Now William P. Jencks has turned his hand to compiling, collating, and critically reviewing the published material relevant to this interdisciplinary. The title of