BOOK REVIEWS, continued

Nitrogen Fixation by Free-living Microorganisms
Edited by W. D. P. Stewart, Department of Biological Sciences, University of Dundee, United Kingdom, Cambridge University Press Syndics, 32 East 57th Street, New York, NY 10022. 1976. 472 p. $37.50.

Nitrogen fixation was one of the main themes of the International Biological Program (IBP) established in 1964 by the International Council of Scientific Unions. Much of the work on nonsymbiotic N-fixation which has resulted directly or indirectly from the efforts of the IBP is summarized in the various sections of this book. Some of the papers were presented at a symposium on N fixation held at Edinburgh in September 1973 while others were submitted by individuals who participated in the IBP.

The volume is divided into four parts. The first entitled “Nitrogen Fixation by Free-Living Bacteria” begins with a good review paper on the physiology and ecology of free-living, nitrogen-fixing bacteria. Seven additional papers, many of them ecological in nature, deal with anaerobic N-fixing bacteria in soils of Russia, N-fixation in the rhizosphere of tropical grasses and of rice plants, in soils of cultivated fields and natural plant communities, in the phyllosphere and in association with vascular aquatic plants, and with the influence of associated microorganisms on nonsymbiotic N-fixation. The latter paper reports specific studies with two strains of N-fixing bacteria.

The second part is entitled “Nitrogen Fixation by Free-Living Blue-Green Algae.” Two articles are concerned with certain aspects of the physiology of N-fixation by specific blue-green algae. The primary, of an ecological nature, are concerned with N-fixation by blue-green algae in polar and subpolar regions, temperate soils, tropical soils, and in various habitats in Morocco. For the studies reported the acetylene reduction technique was extensively used. Two papers summarize work on nitrogen fixation by algae in subtropical areas. These include summaries of inoculation tests with algae for rice culture. Yield increases due to inoculation are reported to vary from nothing up to about 30%. In view of the wide variation noted in some of this type, it would have been helpful if the authors had discussed evidence of statistical evaluation of results.

A short section, “The Acetylene Reduction Technique,” reports the historical development of the test, provides an excellent review of recent studies using the technique, and includes two specific studies in which the technique is utilized.

The last section, Part IV, is entitled “The Biochemistry of N-Fixation.” The first paper, The Biochemistry of Nitrogen Fixation - An Introduction, devotes one page to the subject matter involved in the title. The bulk of the paper is concerned with the serology and polysaccharides of Rhizobia. The second paper covers certain aspects of the biosynthesis of leghaemoglobin in the cells of Rhizobia in legume root nodules. Considering the title of the volume both these papers would appear to be inappropriate.

These two articles, however, are followed by six excellent papers on the enzyme, nitrogenase. Subject matter covers preparation and properties of the nitrogenase proteins, the nitrogenase reaction, kinetics and mechanism of the nitrogenase system, reductants and inhibitors, and the relationship between nitrogenase and ATP. The last paper discusses aline reduction by nitrogenase.

In general this volume represents a concise summary of present knowledge of nitrogen fixation by free-living microorganisms. The authors total 59 and come from all five continents. Some of the work was summarized, but due to language difficulties and restricted circulation of journals, would not otherwise be available to everyone. — James P. Martin, University of California, Riverside, CA 92502.

Management of Southwestern Desert Soils
By Wallace H. Fuller. Published by the University of Arizona Press, Box 5398, Tucson, AZ 85702. 195p. 1975. $7.50.

This softcover book is written in a semitechnical style acceptable to a nonscientific audience. The author, a practical soil microbiologist, however, has not provided bibliographic information for the more interested readers. References such as soil survey reports, extension publications, and other popular publications could help the nontechnical reader to appreciate and write in short concise paragraphs containing the traditional generalizations on the subject matter. Additional explanatory information would improve the general appeal of the book. Subsections usually consist of one or two short paragraphs. The book is divided into ten chapters. Chapters are not easily correlated with corresponding soil sections. The chapters are: (i) Why soil management, (ii) How plants grow in a desert, (iii) Soils have profiles, (iv) Why organic matter, (v) What nutrients are needed, (vi) How fertilizers are used, (vii) Some soils need conditioning, (viii) How arid lands are managed, (ix) Testing soils, waters, and plants, and (x) How soils act for waste disposal.

Each chapter is well illustrated with a total of 62 illustrations and 28 tables. The technical researcher will not use this book as a reference source, but it will be useful as a recommended source of information on management of desert soils to the nonprofessional gardener or hobby farmer.

One small problem for the nontechnical reader of this book may be the use of scientific terminology. All terminology is explained at least once, but this will still present a problem in reading the book. Dr. W. H. Fuller, everything considered, has filled a previous existing void on management of southwestern desert soils. We all have reason to thank the author for this very useful contribution to the nontechnical literature. — Lloyd B. Penn, Texas Agricultural Research Station, Texas A&M University, El Paso, TX 79927.

Foundations on Expansive Soils

The purpose of this book, as the author states, is to provide the practicing engineer with a summary of the state-of-the-art with respect to foundations on expansive soils plus practical solutions based on the author’s experience. Mr. Chen, professor of civil engineering at the University of Denver, Colorado, and has more than 40 years of experience in soil mechanics and foundation engineering. During the past 15 years, the author has investigated many thousands of building sites in areas of expansive soils in the Rocky Mountain region, and performed detailed engineering studies of more than 1000 buildings with cracked foundations and walls because they were not designed to withstand the pressures and movements of the expansive soils on which they were built.

In addition to being of value to engineers, there are two aspects of this book that make it of unique value as a reference to soil scientists. First, it deals largely with light structures such as dwellings, for which on-site engineering investigations are usually not performed. The bulk of the references in engineering literature deal with structural performance and failure involving large, heavy structures. Second, the book includes discussions of numerous methods of design and construction of foundations for light structures that will overcome problems caused by expansive soils. These special methods are discussed in detail and could well serve as a basis for identifying practices to use in building on expansive soils identified by soil surveys.

Data are cited indicating that the average annual loss due to structural failures on expansive soils in the United States exceeds $2.2 million, more than the combined damage from floods, hurricanes, earthquakes, and tornadoes. The author and his readers are impressed with the importance of identifying the expansive soils before construction. On-site investigation and testing is the approach suggested by the author although in current practice, testing is performed for a very small percentage of dwelling sites. Lack of references to the utility of soil surveys in identifying areas of expansive soils is a serious omission. Also, certain relationships presented as general applicable to subject to. For example, it is stated that “soils with dry density of more than 110 pounds per cubic foot generally exhibit high swelling potential;” or, if the excavator says that “the soil is hard as a rock, it will inevitably exhibit expansion problems.”

The first part of the book deals with the nature of expansive soils and the mechanics of soil swelling. Although the important phenomena that operate in swelling soils are discussed, several of the discussions are incomplete or current theory is omitted. An example is the statement that X-ray diffraction is not a very reliable method of identifying the clay mineral content. However, the dewater absorption method is more reliable. As there are a number of good textbooks already available that cover the material in the first part of this book, it is not recommended as a student’s text on the nature of expansive soils and the mechanics of soil swelling.

The sections of the book that deal with actual case studies and with practices for preventing damage to structures are of unique value, both in the teaching and in the practice of soil mechanics. All readers, however, should recognize the limitations imposed by the area of the author’s experience. In spite of widespread success with slab-on-ground construction for dwellings in Texas and elsewhere on expansive soils, the author suggests that such construction should be limited to soils with low to moderate swelling characteristics.

More than 150 figures are used as illustrations. A number of these are difficult to comprehend. In general the text would have profited from more thorough editing both in format of printing and in the editing of the ideas expressed. However, I consider it to be the best available reference for building light structures on expansive soils. — Donald E. McCormack, Soil Scientist, Soil Conservation Service, Washington, D.C.