decision aids. The various chapter authors present the current thinking on how different types of models are seen to contribute to weed management, some favoring empirical models, some mechanistic models, and some conceptual models of whole farm systems. The editors made a good decision in allowing these different points of view to be expressed to describe the current state of understanding of the challenges of modeling such a complex system as that involving weed and soil management.

In the introduction, the editors indicate that they encouraged authors to be bold in their concepts to present as many perspectives as possible. So in spite of an effort to provide a basis for integrating soil and weed information, the book contains inevitable diverse and sometimes conflicting views of goals and directions for research and management. But the boldness of the authors is somewhat muted and the perspective is fairly conventional with respect to weed and soil management in the midwestern U.S. corn (*Zea mays* L.) and soybean (*Glycine max* (L.) Merr.) belt. For example, there is little discussion of integrating soil and nonchemical weed management, even though soil science has much to offer for progress to be made in this area. Instead, the rationale for understanding soil processes is mostly for the sake of optimizing herbicide use. However, this does not diminish the value of this book, given the continued importance of herbicides to growers and to public concerns about agriculture.

My personal impression after reading this book is that it provides an excellent basis for the next step in advancing weed management: integration of social science with weed science. I say this because the chapter on grower attitudes about weed management did not cite a single scientific study or survey of those attitudes. Elsewhere, chapters demonstrate how the direction of research is clearly toward the development of decision models, yet authors offer no data on how growers make weed management decisions and even question the motivating incentive for the use of such models. These comments are not a criticism of the book; rather, they indicate how clearly this book characterizes the current understanding and level of integration of weed science with other relevant disciplines.

I recommend this book as a resource and possibly a textbook for courses in weed ecology. I suspect it will take an important place on the bookshelf of weed scientists as a good source of information on soil-weed interactions. In the spirit of integration with which this book was prepared, my hope is that it will also find a place on the bookshelf of soil scientists.—JOHN CARDINA, Department of Horticulture and Crop Science, Ohio State University, Wooster, OH 44691 (cardina.2@osu.edu).

Gaseous Nitrogen Emissions from Grasslands


Grasslands occupy about 20% of the world land area and are important economically to many countries. Intensive utilization of grasslands for production of meat, milk, and other animal products has, however, impacted local and regional water and atmospheric quality. Nitrogen input into intensively used grasslands from fertilization and animal waste deposition can lead to the export of regionally and globally significant amounts of ammonia and nitrous oxide to the atmosphere. Considerable research has been conducted over the past decade to understand the processes involved in emission of environmentally active nitrogen compounds into aquatic systems and to the atmosphere, to quantify the amounts of nitrogen emitted, and in developing mechanisms of mitigating these emissions.

This hardcover book contains the proceedings of a conference held at the Institute of Grassland and Environmental Research, North Wyke Research Station, Okehampton, Devon, UK, during May 1996. The aim of the conference was to bring together current research being conducted within grassland soils and systems related to animal production and the soil nitrogen cycle, and to discuss the relationships of these systems to national and global nitrogen issues. The book contains six sections: (i) Controls and Interactions of Emissions from Grassland Soils; (ii) Ammonia Fluxes within Grassland Systems; (iii) Nitrous Oxide Emissions from Grassland Soils; (iv) Effects of Organic Manures on Emissions; (v) Nitrogen Emissions from Grassland Systems: Models and Budgets; and (vi) Research Needs. Each of the first five sections contains an overview paper and several complete research papers along with extended abstracts of papers presented as posters at the conference. In total, the volume contains 36 full papers and 22 extended abstracts that collectively provide an up-to-date account of research on volatile nitrogen compounds in temperate, intensively managed grasslands. Conspicuously absent is information about the large areas of semiarid temperate grasslands in northern China and Mongolia and North America and from tropical grassland systems. Only one full paper and one extended abstract discuss gaseous emissions from African savanna systems. In spite of the limited global extent of the information presented, the general concepts discussed are applicable to all grasslands and the interaction of these systems with livestock production. The book, as suggested in the preface, is recommended reading for "agricultural and atmospheric scientists, the agricultural community and policy and decision makers."—A.R. MOSIER, USDA-ARS, P.O. Box E, 301 S. Howes Street, Ft. Collins, CO 80522 (amosier@lamar.colostate.edu).

**Temperate Agroforestry Systems**


Agroforestry systems should, arguably, be more diverse than the simple sum of agricultural, livestock, and forestry systems on the same landscape. As a deliberate attempt to incorporate woody perennials into crop-livestock systems, agroforestry is:

... a dynamic, ecologically based, natural resource management system that, through the integration of trees in farm and rangeland, diversifies and sustains smallholder production for increased social, economic and environments benefits. (R. Leakey. 1996. Agroforestry Today 8(1):5–7).

The editors of *Temperate Agroforestry Systems* have brought together an impressive list of authors to demonstrate that agroforestry outside of the tropics is indeed ecologically complex with economic and environmental benefits being derived from such complexity.

In the introductory chapter, the authors outline the historical development of agroforestry as a discipline in the temperate zones based on concepts borrowed from tropical regions. They point out that environmental aspects of agroforestry...