soil water behavior and of the abundance/distribution of soil nitrate. The influence of tillage on the soil water regime is discussed as well as influence of N transformations and the impact of soil water management.

Chapter 10. Cropping systems: Ecology and management. This chapter discusses management systems and some of the potential impacts of various systems and/or components on nitrate leaching. Management systems reviewed include monoculture, cover crops, interannual rotations, mixed cropping, and multiple cropping.

Chapter 11. Management of water balance components. The water balance components include precipitation and irrigation, water stored in the soil profile, evaporation, transpiration, runoff, and percolation. This chapter discussed the components where the greatest management can be exercised, i.e., water application (including chemical application in irrigation water), runoff, and percolation.

Chapter 12. Linkages with groundwater. This chapter briefly discusses water percolating through the unsaturated soil zone to groundwater in terms of Darcy's theory and to actual movement via preferential flow paths. Nitrate concentrations in the deep percolation water and water treatment are also addressed.

Chapter 13. Transformations and movement of nitrate in aquifer systems. Aquifer systems, processes affecting nitrate concentrations in aquifer systems, and process interactions are discussed. Nitrate dynamics case studies of local and regional aquifers are presented as well as potential for restoration of nitrate contaminated aquifers.

The relationship between nitrogen management and groundwater quality is a very broad and complex subject. This book does a good job of addressing many aspects of this topic. Although space considerations do not allow each aspect to be discussed in great detail, the literature is well reviewed and presented. There are numerous references that allow readers to pursue topics further, if desired. This book is a good reference for scientists, engineers, and hydrologists who work in the subject area as well as being an excellent source book for agricultural policy makers.—LOYD B. OWENS, USDA-ARS, P.O. Box 478, Coshocton, OH 43812.

detailed discussion of lichen biology, with the exception of the chapter on lichen biology, the topics are discussed in a conversational format and appropriate level of detail. A section of the scientific literature is provided at the end of the book, with a short list of suggested readings for each chapter. I recommend this book for those with a general interest in the effects of air pollution on plants and as an introductory text for undergraduate level air pollution courses.—J.W. JOHNSTON, Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831. (Oak Ridge National Laboratory is operated by Martin Marietta Energy Systems Inc., for the U.S. Department of Energy under contract DE-AM54-84OR21400.

Ground Water Models: Scientific and Applications


This book is the outcome of a study by the Committee on Ground Water Modeling Assessment, supported by the U.S. National Research Council and co-sponsored by the U.S. Nuclear Regulatory Commission, the U.S. Environmental Protection Agency, the U.S. Army, and the National Science Foundation. The committee set out to evaluate the accuracy of computer models of ground-water flow and transport and to assess the utility of models for use in assigning liability for contamination and for making regulatory decisions.