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Grassland Dynamics: Long-Term Ecological Research in Tallgrass Prairie. Edited by Alan K. Knapp, John M. Briggs, David C. Hartnett, and Scott L. Collins. New York: Oxford University Press, 1998. xvi+364 pp. Figures, tables, plates, references, index. \$65.00 cloth (ISBN 0-19-511486-8).

This book summarizes the wealth of new information on tallgrass prairie ecology gleaned from over fifteen years of intensive study of the Konza Prairie Research Natural Area in the Flint Hills of northeastern Kansas. Because the Flint Hills' steep topography and shallow soils made the region unsuitable for plowing, the area contains the largest tracts of native tallgrass prairie anywhere. The 3,427 hectare Konza site has been the focus of research since 1972 and funded since 1981 by the National Science Foundation's Long-Term Ecological Research (LTER) program. LTER also funds research at twenty other sites representing all major North American and Antarctic biomes, ranging from deserts to coastal ecosystems. The general goal of LTER is to understand the controls over such key ecological processes as productivity, species dynamics, and nutrient cycling, the long-term dynamics of which cannot be deciphered from the typical one to three year studies undertaken by ecologists. One of only two tallgrass prairie sites in the LTER network, Konza is the only one in which the major goal of researchers is to understand the effects of climate, fire, and grazing on tallgrass prairie ecology. What makes Konza unique is that research treatments are implemented on large, watershed-level areas, permitting the study of whole ecosystem and landscape responses to grazing and fire. An impressive amount of effort has gone into scrutinizing this benchmark tallgrass prairie site; *Grassland Dynamics* offers a synthesis of studies representing the state of knowledge about prairie ecology.

The book is divided into sections on physical environment, terrestrial populations and communities, hydrology and aquatic ecology, and ecosystem and landscape-level analysis. The chapters thereby provide a comprehensive look at the tallgrass prairie environment, organisms, and ecosystem processes, although a reader who wants more information on the ecology of certain species may need to look elsewhere. Moreover, this is not a book

about the entire tallgrass prairie region; most of its chapters, however, do a good job of placing the Konza information into a broader context.

A dominant theme emphasized in nearly every chapter is that tallgrass prairie, unlike other ecosystems, especially drier grasslands, is characterized by multiple limiting resources—water, light, and nutrients—all of which vary in time and space and all of which are affected by climate, grazing, and fire regimes. Consequently, the conceptual framework for most of the research is one in which resources and disturbance regimes interact to produce a response and in which the ecosystem is usually in a transitional “non-equilibrium” state as it responds to one or more changes in resources or disturbances. The recurring themes of non-equilibrium states, interactions, lag times, and transient dynamics in the response of prairie to climate, fire, and grazing may sound like a lot of jargon to the uninitiated, and indeed it is a bit frustrating to find a lack of general rules about what makes a tallgrass prairie tick. However, this reflects the state of ecology more than the state of Konza research: ecology is a young science whose very goal of explaining interactions among organisms and the many factors in their environment makes it difficult to be highly predictive. To the extent that ecology has a general theory, its relevant pieces are used by the authors of most of the chapters. Those on populations and communities, for example, use the core-satellite hypothesis of species distributions to explain patterns in the plant, bird, small mammal, and insect data.

The difficulties of studying a complex system aside, some clear trends have emerged from the Konza studies, particularly those related to the effects of annual spring burning. Spring fires increase the productivity of dominant grasses in years of adequate rainfall, decrease forb diversity, increase the grazing activity of bison, decrease the populations of some birds, small mammals, and insects that depend on surface litter and woody plants, and increase the populations of some birds, small mammals, and insects that depend on more open habitats or the availability of grass seed. All of these trends are well-documented in this volume, with tables and figures summarizing years of data. Interestingly, some simple trends researchers anticipated as a consequence of earlier work by John Weaver, Paul Risser, and others, or of simulation model predictions, have not occurred. For example, soil organic matter was expected to decline with burning of biomass; this response, however, has not been measured, even in watersheds subjected to ten years of annual spring burning. The authors point out a number of potential reasons: small declines in the large pool of soil organic matter, for example, may not be detectable in the short term; or declines

could be offset by burning's stimulatory effect on production. Whatever the cause, this sort of misfit between expectations and data is a compelling reason for further long-term study of the tallgrass prairie. In addition, the authors lay out a number of interesting, yet-to-be answered questions involving seasonality of fire, grazing, prairie restoration, and climate change — topics being addressed in the current round of Konza studies.

Who should read this volume? Upper-level undergraduate and graduate students, teachers, and managers of tallgrass prairie should all find it a valuable resource. The absence of words like "conservation" and "management" from the index signifies the book is intended for an academic audience. Nonetheless, the naturalist and prairie enthusiast wanting more than a superficial treatment of prairie ecology ought to find much here to satisfy their interests. Many studies present the ecology of a particular biome in bits and pieces. *Grassland Dynamics: Long-Term Ecological Research in Tallgrass Prairie* is an exception — a carefully integrated synthesis of our current understanding of the tallgrass prairie ecosystem. **Mary Ann Vinton**, *Department of Biology, Creighton University*.