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# Review of *Population Biology of Grasses* Edited by G. P. Cheplick

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**Population Biology of Grasses.** Edited by G. P. Cheplick. New York: Cambridge University Press, 1998. xii+399 pp. Figures, tables, notes, references, index. $85.00 cloth (ISBN 0-521-57205-3).

*Population Biology of Grasses* provides a wealth of knowledge beyond population biology that ecologists and ecosystem biologists will find relevant to their concerns, particularly those with an interest in grasslands.

Though not limited to the Great Plains region, the book would make an excellent addition to the reference shelf of anyone interested in grasses and grassland-related ecosystems, including readers with an interest in land management and preservation. While the papers are written for different levels of readers, all provide information accessible to non-specialists.

Starting at the gene-level and proceeding to communities and ecosystems, the book's sections provide excellent summaries of present knowledge in a broad spectrum of grass-related subjects. "Allozyme diversity in the grasses" (M. J. W. Godt and J. L. Hamrick) provides a clear, concise inventory of the factors accounting for gametic diversity among and within grass species and populations while also raising stimulating points—particularly for community ecologists—about diversity. This study provides less information than most of the others on ecological implications, focusing more on a consideration of genetic differences.

"Ecology of seed dormancy and germination in grasses" (C. C. Baskin and J. M. Baskin) and "Seed dispersal and seeding establishment in grass populations" (G. P. Cheplick) offer excellent reviews of information on individual species, including substantial discussions on seed dormancy, dormancy-breaking and germination requirements, soil seed banks, mechanisms of dispersal (grasses being generally characterized by only modest dispersal), and processes of seed dispersal and establishment within populations. Both sections include considerations of factors affecting community and ecosystem-level processes.

"Clonal biology of caespitose grasses" (D. D. Briske and J. D. Derner) evaluates the mechanisms potentially capable of regulating ramet demography and the mechanisms conferring ecological success on caespitose grasses once they are established. The discussion includes plant architecture and demography (clone breakup and age—less than fifty years among North American species) as well as ramet recruitment through apical dominance, resource competition, physiological integration, red:far-red ratio of solar radiation, and equitable resource acquisition by ramet hierarchies within clones. Extensive sections on ecological implications and management considerations (such as long-term effects of herbivory) are included.

"Ecological aspects of sex expression in grasses" (J. A. Quinn) briefly introduces the reader to the diversity of breeding systems in grasses (from hermaphroditism to dioecism), then focuses on the one-hormone model of sex determination and its relation to environmental effects and to effects of minor genetic changes on sex expression and the breeding system. This is followed by a discussion of potential factors influencing the breeding

system — and phenotypic plasticity — of populations of wide-ranging species (the role of factors such as r- and K-selection and density-dependent/ -independent regulation of sex, for example). The ecological relevance of these factors is a principal component of the study.

Ecosystem-level discussions are included in "Interspecific variation in plasticity of grasses in response to nitrogen supply" (E. Garnier), which synthesizes information relevant to nutrient supply as it relates to plasticity of growth rate, biomass allocation, and plant nitrogen within the grass family, using nitrogen as a model element. Written more (but not exclusively) for the specialist, this section discusses how nutrients affect grass populations, asking such ecologically-important questions as "What sets the limit for this upper nitrogen concentration a given species can reach?" Preliminary studies on grasses show this may well be linked to anatomical features, particularly leaves.

Grass populations and their distribution and interactions are thoughtfully reviewed in "Population biology of intraspecific polyploidy in grasses" (K. H. Keeler) and "Plant-plant interactions in grasses and grasslands" (W. K. Lauenroth and M. O. Aguilera). The first summarizes what is presently known about the importance of polyploidy, in its many variations, in affecting grass populations and distributions, although, as Keeler states in the summary, "The implications of the presence of multiple cytotypes for local adaptation have scarcely begun to be investigated." The second moves beyond the cytotype to focus on spatial patterns of individuals, competitive abilities (for light, soil nutrients, and soil water, for instance), and plant responses to this competition. The authors' offer a particularly useful discussion of the significance of these factors to community and ecosystem processes, including considerations of resource distribution and capture, seedling recruitment, and adult-seedling competition and roots and litter effects. Their summary statement is important to those involved in field research: "While other processes such as disturbances, weather variability, and landscape-scale variability in soil development and parent materials have large effects on community and ecosystem dynamics, understanding plant-plant interactions is fundamental to being able to predict how grasses will respond to these other processes."

"Competition between grasses and woody plants" (S. D. Wilson) considers other factors affecting grasslands, particularly tree invasion, and includes a good review of factors affecting grass-tree competition, although it does not fully cover specific effects of tree invasion on grasslands. Wilson focuses on the replacement of grasses by trees (and shrubs) along gradients

of increasing evapotranspiration or productivity (mostly in North American locations), although, as the author states, more is yet to be known about these dynamics, since "future advances in grass competition are likely to be greatest in studies which rely more on manipulating and measuring belowground processes."

Sections on "Fungal endophyte infection and the population dynamics of grasses" (K. Clay) and "Arbuscular mycorrhizas and the population biology of grasses" (K. K. Newsham and A. R. Watkinson) provide excellent reviews of associations between grasses and systemic fungae. Discussions include growth, reproduction, taxonomy, infection dynamics, nutrient requirements, and distribution as well as effects on grass reproduction, seed germination, grass vigor, stress-tolerance, and competitive capabilities. Grassland ecologists with limited knowledge of these biotic interactions will find both discussions particularly beneficial.

The concluding sections, "Population dynamics in the regeneration process of monocarpic dwarf bamboos, *Sasa* species" (A. Makita), "Population dynamics of perennial grasses in African savanna and grassland" (T. G. O'Connor and T. M. Everson), and "A life cycle approach to the population ecology of two tropical grasses in Queensland, Australia" (D. M. Orr) provide detailed examinations of specific ecosystems.

*Population Biology of Grasses* is an excellent, well-written book that should prove a useful reference to a broad group of grassland enthusiasts, whether their focus be basic ecological processes or management of grassland ecosystems. **Thomas B. Bragg**, *Department of Biology, University of Nebraska at Omaha.*