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Review of *The Evolving Science of Grassland Improvement* by L. R. Humphreys

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The Evolving Science of Grassland Improvement. L. R. Humphreys. New York: Cambridge University Press, 1997. xvii+261 pp. Tables, figures, notes, references. \$80.00 cloth (ISBN 0-521-49567-9).

The Great Plains consisted of several million square kilometers of native perennial grasslands in the middle of the nineteenth century. Most is still grassland, but on more than half the area native perennials have been replaced by single species annuals harvested for grain. For many of us who live and work in the region, the term grassland is reserved for native perennial grasslands, one of the elements of the current mosaic of land cover types that comprise the contemporary Great Plains. This is a narrow definition of grassland and only a small part of what L. R. Humphreys is referring to when he uses the term in *The Evolving Science of Grassland Improvement*.

The grasslands to which Humphreys refers range from “unimproved” native grasslands (such as those in the Great Plains) to “improved” grasslands — intensively managed agricultural systems consisting of high-yielding varieties of forage grasses that receive nitrogen and perhaps other fertilizer and intensive grazing management. Since these improved grasslands are the book’s major focus, most of the material is not directly applicable to the Great Plains.

The book consists of seven chapters supplemented by an appendix summarizing the International Grassland Congresses between 1937 and 1993. Chapter 1, "Grassland Improvement and Environmental Protection," provides an introduction to the subject as well as an overview of global change and the role grassland improvement could play in mitigating its adverse effects. The characteristics of high quality forage plants, conservation of germ plasm and plant introductions (with an interesting twist on biodiversity issues), plant breeders, and variety protection are the subjects of the second chapter. Chapter 3, which addresses the role of nitrogen in improved grasslands, including legumes, contains a quote from the 1937 International Grassland Congress that captures much of the book's tone: "No grassland is worthy of the name, and indeed is hardly worth bothering with, unless a legume is at work. Find or breed the right legume for every corner of the world and you will have tolerably good grassland in every corner of the world." "Growth and Defoliation," the fourth chapter, provides an excellent overview of the topic, including non-structural carbohydrates, frequency and height of cuttings, leaf area index and growth analysis, defoliation, carbon balance of swards, leaf area and meristematic activity, and biological N fixation. Grassland managers will find much to interest them here regardless of the degree of "improvement" of their systems.

Chapter 5 on grassland ecology will also interest Great Plains grassland managers because of its focus on understanding changes and relating them to management decisions. On the topic of rangeland condition, Humphreys repeats the best-known limitations to the Clementsian-based models and promotes the state and transition approach as an alternative. He indicates clearly that we are still a long way from a widely applicable model; moreover, he mercifully avoids the rangeland health trap. The sixth chapter deals with grazing management, the objective of which, as Humphreys concisely puts it, is "to synchronize the supply of available forage with the demand of animals . . . to maintain the vigour of acceptable pasture." Many of its ideas will be engaging to grassland managers on the Plains.

The final chapter discusses the role of simulation models, decision support systems, and soft systems in grassland management, concluding with an intriguing conceptual model which Humphreys proposes to link what he calls holistic integration (soft systems) with basic (reductionist) science. Approximately three hundred of the nine hundred items in the forty-seven-page reference section are from the 1990s.

Although *The Evolving Science of Grassland Improvement* is not a "must read" for Great Plains grassland scientists and managers, I thoroughly

enjoyed my time with it. The book is well produced and attractively laid out. Furthermore, Humphreys provides the perspective and occasional highly opinionated remark we should expect from an emeritus professor. On page 8, for instance, we are told that "In the absence of animals the UK countryside would be impenetrable and unattractive rather than idyllic. . . ." On page 61, we are treated to the following comment with respect to the introduction of forage plants: "A more fundamental dichotomy exists between pasture agronomists and the adherents of the primitive who seek to protect indigenous grassland communities from the invasion of foreign herbage plants, at whatever costs to the potentially enhanced stability of the ecosystems." While we may not agree with Humphreys, we can be sure his opinions are well considered and well intentioned. **William K. Lauenroth**, *Department of Rangeland and Ecosystem Science, Colorado State University*.