Wildlife and Livestock as Elements of Grassland Ecosystems

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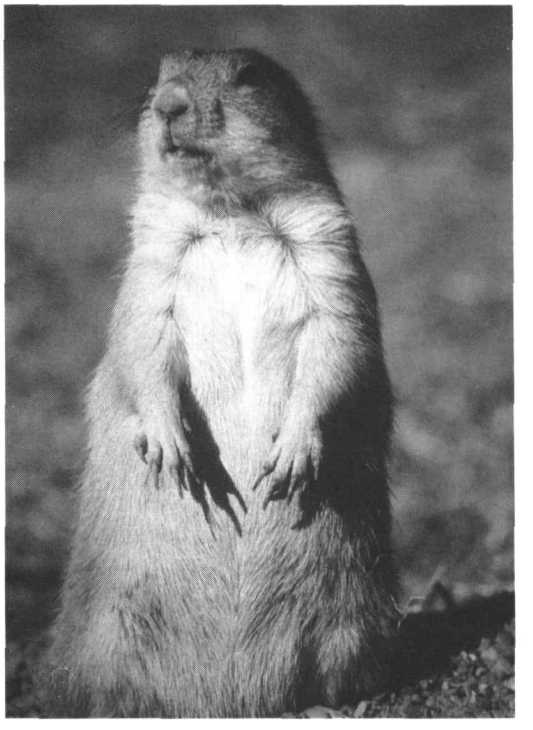
When Carpenter (1940) described the North American grassland biome, he developed detailed associations of plants, animals, climate and soils. Moreover he observed that grasslands evolved through the interaction of these elements. Carpenter's past insights serve to remind us of the role that plants and animals have in the maintenance of healthy grasslands.



Areas heavily grazed by bison provide vegetative structure conducive to prairie dogs. (Craig Knowles Photo).

Plant and Animal Interactions

Early in the twentieth century, naturalists and ecologists first described the classification, distribution and productivity of North American grasslands. Indigenous animal life was included in the list of biotic and abiotic (soils, topography, climate and fire regimes) elements that interact to produce natural systems. These pioneering scientists recognized the functional role of large ungulates, small mammals and birds in the maintenance of grassland systems.

More than 50 years ago, Carpenter (1940) described the North American grassland biome as an association of the "Andropogon-Bouteloua-Bison-Canus" genera. He further divided this biome into: Tall Grass Prairie, Andropogon-Bison-Canis Association; Mixed Grass Prairie, Andropogon-Bouteloua-Bison-Antilocapra Association; and the Short Grass Prairie, Bouteloua-Bulbilis-Bison-Antilocapra Association. Within each division he discussed a process driven system. He specifically pointed out the ecological and evolutionary interactions among native grazing animals with plants.

Large grazing animals are essential elements of grassland ecosystems.

Because the natural sciences diverged into specific professional disciplines, each more narrow in scope, it's our belief that land management never fully developed practices that allowed for the maintenance of biological processes. This has partly contributed to the popular belief that wild and domestic ungulates are simply grassland consumers. And, that wildlife are competitors with domestic livestock for resources. Concern for the conservation of biological diversity "re-emerged" during the mid to late 1980's. Land managers are now expected to implement activities that address the maintenence of ecological systems, their function and structure.

The formation and maintenance of grassland biomes is dependent on the presence of wildlife species that occur or once occurred there. In some parts of the world domestic animals have filled this role for centuries. This is particularly

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The ecology of burrowing owls is closely tied to prairie dog colonies. (Craig Knowles Photo).

true of the livestock breeds developed by nomadic Mongolian herdsmen. Their culture is based on a several thousand year association with grasslands. Grassland communities are maintained by interaction with herbivorous animals. Herbivory is integral to the maintenance and function of grassland systems. The North American Bison, prior to European settlement, is a dramatic example of a large grazing animal's role in grassland ecosystems. Grazing and hoof action by large concentrations of bison altered areas making them suitable for other types of native species. These large, gregarious, and migratory ungulates proved to be incompatible with modern civilization and agriculture in most of North America. Other than in a few areas, bison were removed from North American grasslands by the middle part of the nineteenth century. However, as indicated by West (1993) and others, under well-planned management, cattle may be used to re-introduce historical processes.

On the North American Plains, herbivory by bison and other native wild ungulates was one biotic process that shaped the structure, composition and function of grassland systems. Historically, the vast land base provided ample space for large herds to migrate long distances in search of forage. The migratory nature of bison (herds of many thousand) allowed for ecologically significant rest in what might be considered an "overused" area today.

Areas heavily grazed by bison provided a diversity of vegetative structure and composition favorable to the development of black-tailed prairie dog colonies. These prairie dog colonies (a large network of underground burrows among short to mid grasses) provided ecological "services" for other species by having readily accessible food and sites for nesting and denning. Currently, 40% (100 species) of the vertebrate fauna found west of the Missouri River in Montana are serviced by these colonies. Some of the more well-known species include Burrowing Owls, Ferruginus Hawks, black-footed ferrets, and the Mountain Plover, a species which has it's own unique relationship to bison.

The Mountain Plover is currently being considered for protection under the United States Federal Endangered Species Act of 1973. Plovers require heavily grazed areas for nesting. Over the past century, the reduction of domestic livestock grazing and the conversion of these lands to cultivation have severely reduced nesting habitat for mountain plovers. This species is currently using prairie dog towns more than reported historically. In turn prairie dog towns are less abundant in the grasslands because of cultivation, poisoning, and reduced grazing (Knowles and Knowles 1991).

Grazing also affects the nutritional quality and palatability of available grasses as demonstrated by the "preference" of some native grazing animals for certain pastures grazed by livestock. Research in Montana, by the senior author and others, has shown that Rocky Mountain elk during spring "green-up" select forage in pastures that were grazed the previous summer or fall by cattle. Ongoing research shows that in some instances, vegetative regrowth after livestock grazing can be more nutritious than the current year's growth ungrazed. These examples demonstrate the need to promote and maintain the plant and animal interactions critical for maintenance of grassland systems.

Management Implications

Grassland management strategies should move away from attempts to resolve immediate species specific (cattle vs. wildlife) land use conflicts and begin to develop long-term approaches designed to sustain grassland systems. This may require re-introducing "natural" processes needed for ecosystem function and maintenance. Management strategies should focus on sustaining healthy vegetation

Humans and their livestock are natural elements of many Asian grasslands.

and ensuring the presence of wildlife species or communities that play a role in ecosystem dynamics. And, long term management practices should produce only base or "natural" levels of soil erosion and good water quality. We believe this differs from current approaches that meet the needs of one or two charismatic species and a particular class of livestock. In portions of Asia, livestock and the nomadic human culture continue to induce processes natural to their grassland systems. In some parts of the North American grasslands, livestock grazing can be considered a process that will help to meet our human needs while maintaining sustainable ecosystems.

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