Single-Factor Concepts About Rangeland

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Several articles have suggested that grassland phenomena can be explained by a single factor rather than the multiple factors used in range management. Single factor concepts about range to be discussed are: *vegetation and soil were not stressed by wild grazing animals, bare soil areas are more reliable indicators of management than changes in the plant species,* and *the distribution of grass species is not determined by climate.*

Vegetation and soil were not stressed by wild grazing animals

Evans (1998, p.252) stated, "In the rangeland of North America, Indians followed the herds of buffalo and it was not until domesticated cattle and sheep were introduced ...that the vegetation and soils of the plains and mountains were put under stress." This assumption is not supported by England and DeVos (1969) who summarized the literature documenting the damage and over-grazing done by bison and other herbivores. Hueg (1969) summarized literature that reported buffalo polluted waters and that some streams were yellow from excreta in the summer. Wild animals gathered around water in dry periods and over-utilized the near-by forage. In South Dakota west of the Missouri River near the North Dakota boundary, an early settler reported the range had northwest-southeast oriented light- and dark-colored bands. The light bands had short grasses and the dark bands had western wheatgrass. Migrating bison, according to him, had trampled and killed the short grasses but the western wheatgrass had subsoil roots that were below those of the short grasses. Rhizomes can become dormant when conditions are unfavorable and resume growth when they become favorable. Western wheatgrass rhizomes can be dormant for at least seven years (Albertson and Weaver, 1944), and big bluestem rhizomes can be dormant from four to eight years (Archer and Bunch, 1953, p. 197).

Bare soil is a reliable indicator of management

Evans (1998, p.263) also believed, "The creation, or not of bare soil, is probably a better indicator of sustainability than trying to assess changes in vegetation productivity." Bare areas can be created when drought or prairie fires destroy plants and the management should consider the remaining plants, as well as the past climatic conditions and the soil at the site. On some soils, bare areas are a natural phenomenon. Although an exclosure at the Cottonwood Range Field Station in southwest central South Dakota had not been grazed for twenty years, the soil surface at four sampling locations within the exclosure had from 20 to 55 percent bare areas (White, 1991). The vegetation canopy ranged from 0 to 60 percent little bluestem and from 0 to 35 percent western wheatgrass. The soils were weakly developed where little bluestem grew and moderately well developed where western wheatgrass grew. Species composition changes as a soil develops (White 1971). Bare areas, regardless of how they formed, may be colonized rapidly if stoloniferous plants such as blue grama (Stubbendieck et al. 1973; White 1993) and buffalograss or rhizomatous plants such as big bluestem, western wheatgrass, prairie cordgrass and sideoats grama are contiguous to the bare area. Depending on the species that died and the replacement species present, the productivity of a given site may or may not be increased. Frequently, annual forbs are the first plants to grow on bare areas following prairie fires or drought. They protect the soil and allow more productive plants to become established.

The distribution of grass species is not determined by climate.

Brown (1993, Abstract) stated, "Since the Little Ice Age, the westward movement of tall warm-season grasses...suggests the climate does not determine grass patterns...." Arnell (1996) reported that the temperature had increased after the Little Ice Age, which may account for the increase in tall warm-season grasses. Bray (1971) discussed the vegetational distribution in relation to recent climate changes. Droughts have been recorded in tree-ring widths in Nebraska (Weakly 1943), South Dakota (DeGaetano and Miller, 1990), North Dakota (Will 1946), and the Great Plains (Bark 1978). Albertson and Weaver (1944) studied vegetation across the short-grass and tall-grass areas before, during, and after the 1930s drought. Short and mid-grasses increased as the tall grasses decreased in abundance during the drought. Western wheatgrass and buffalograss increased in abundance to the detriment of other grasses. If spring soil moisture was sufficient, western wheatgrass grew and used the moisture so that warm-season grasses had insufficient moisture for vigorous growth.

I observed in 1955–1956 in Hand County, South Dakota that soil moisture was insufficient for cool-season grasses in the spring but, after precipitation in July, blue grama grew profusely. By late summer, the blue grama seed heads gave the range a bluish color. At the Cottonwood Range Field Station, blue grama increased and western wheatgrass decreased in abundance where the stocking rate was low in a pasture. Therefore, it appears that the pattern of grasses can change rapidly in response to either long- or short-term climatic changes.

Brown believed that tall grasses have moved westward during the last part of the post-glacial period. However, during years with ample warm-season precipitation, many steep slopes in central South Dakota have a conspicuous canopy of big bluestem flower stalks but in drier seasons, individual plants are very difficult to find. A two- or three-inch-high big bluestem inflorescence appeared one year in a pasture with a high stocking rate at the Cottonwood Station although no plants had been observed there previously. Tall grasses apparently can survive inconspicuously for years and then increase rapidly in favorable years. The apparent change in species is likely from the growth of plants that have been in the area and not by the migration of the species from other areas as proposed by Brown and Gersmehl (1985) in their "...migrating-wave hypothesis of grass species dominance...."

Conclusions

Single factor concepts about range are of limited value. In contrast, the multiple-factor concept utilizes the past and present climate, soil properties, plant species, and grazing intensity in range management decisions.

Supporting Literature

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