

Management as Related to Range Site in the Central Plains of Eastern Colorado

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Many of the major problems of the Great Plains can be traced to a misinterpretation of their natural potential. First identified by early explorers as the Great American Desert, the Great Plains were subsequently extolled as a modern-day Garden of Eden by some land promoters and speculators. Regardless of their classification, there still persists an optimistic tendency to expect production levels from

farm and ranch lands characteristic of more humid and less erratic climates. Today, for example, we are faced with diverse opinions and expectations of what should grow on Great Plains rangelands and what they can be expected to produce.

A knowledge of the potential and manageable plant cover inherent to the various kinds of rangeland found in the Great Plains is essential to properly

guide and evaluate management of a range resource. An examination of several kinds of rangeland found in a portion of the Central Great Plains illustrates some of the diverse plant cover and managerial problems entailed.

Rangelands in the Plains of Eastern Colorado

The specific area considered is restricted to the rolling plains of eastern Colorado, excluding foothills, mesas, and recent mountain outwash fringing the eastern front of the Rocky Mountains. This natural grassland, located in the highest and driest portion of the Central Plains, has an annual average precipitation varying from 12 to 16 inches. Approximately 70 to 75 percent of the total precipitation falls in the period extending from April 1 to September 30. The area acts as a melting pot for plant cover in-

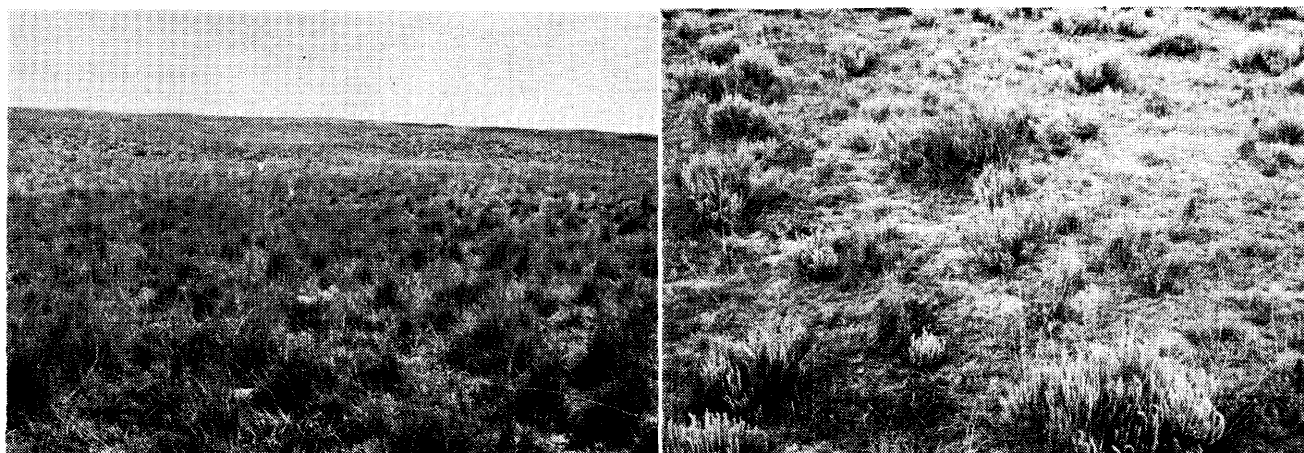


FIGURE 1. *Left:* Sandhill site in excellent range condition. The dominant tall grasses include sand bluestem, little bluestem, and prairie sandreed. *Right:* Sandhill site in poor range condition. The tall grasses have disappeared. Principal species include sand dropseed, hairy grama, and sand sagebrush.

fluences migrating from colder northern climates and those originating in warmer climates southward. It further acts as a buffer against the westward expansion of the classical kind of mixed prairie found in areas of higher precipitation to the east, northeast, and southeast. This buffer, however, has its weak points, and is frequently infiltrated by grasslands characteristic of more humid climates on certain favorable sites.

This portion of the Central Great Plains serves as a focal point for the long-standing controversy concerning the relative place of shortgrasses and midgrasses. A comparison with other Great Plains rangelands reveals many points of similarity but also some distinct differences. The abundance of cool-season midgrasses and sedges characteristic of certain range sites in latitudes further north is not to be expected in the Central Great Plains. The kind of mixed prairie vegetation found on medium-textured upland soils in the higher precipitation zones to the eastward, in which little bluestem (*Andropogon scoparius*) is an important midgrass constituent, occurs only on a few favorable sites. There is no direct contact with the desert plains grassland located far to the south.

Rangelands here described closely resemble those found in extreme western Kansas and portions of northeastern New Mexico.

Currently the Soil Conservation Service recognizes approximately 12 different range sites in this segment of the Great Plains. A range site is a physiographic land unit having sufficient homogeneity of climate, soil, and topography to produce essentially the same kind or amount of plant cover when in climax condition. All of the range sites in eastern Colorado contain some midgrasses and seven of them contain some tallgrasses when in climax condition. However, the relative proportion of shortgrasses, midgrasses, and tallgrasses varies materially between sites. Grassland authors, ranchers, and range technicians working in the area, have long recognized at least some of these distinctions in kinds of potential plant cover. Practically all of them, for example, distinguished plant communities found on sandy soils, hardlands, and floodplains. Weaver and Albertson, in addition to their own studies and conclusions, have recently summarized the findings of other workers in this locality (6). However, the generalized and all too common opinion still persists

that this portion of the Central Plains is simply one kind of rangeland and the basic question is whether manageable plant cover should consist of shortgrasses or mixtures of shortgrasses and appreciable amounts of midgrasses.

No intelligent answer to this question is possible without a critical evaluation of the potential plant cover in relation to the widely divergent environments resulting from soil, topographic, and climatic variants within the area. Considerable progress in such evaluations, first highlighted by the early work of Shantz (3), has been and is being made. As a result, comprehensive answers concerning the nature of the potential plant cover are becoming more apparent. Further, the problem of evaluating range improvement or decline is given specific guidance and direction.

A comparison of climax plant communities on deep sand, sandy loam, and silt loam uplands in the 12 to 16-inch precipitation zone of eastern Colorado illustrates the inherent differences in potential plant cover, and indicates specific variations in key management species that must be recognized if reasonable forage and livestock production levels, consistent with the po-

tential of the land, are to be attained.

Sandhill Rangelands

Deep sands of the Tivoli and Valentine soil series characterize the sandhill range site in eastern Colorado. Favorable soil moisture relationships resulting from high water intake rates and low wilting coefficients, as compared to finer textured soils, largely offset the disadvantages of relatively low water-holding capacities of these soils in a semi-arid climate. This site, when in excellent range condition, supports a tallgrass and midgrass plant community in which any appreciable amounts of shortgrasses are definitely out of place. Even with a decline in range condition, shortgrasses rarely assume dominance. Deep-rooted, rhizomatous grasses that are capable of withstanding soil deposition or removal, are native to the site. Chief among these are sand bluestem (*Andropogon hallii*) and prairie sandreed (*Calamovilfa longifolia*). Associated midgrasses of major importance are little bluestem (*Andropogon scoparius*) and needle-and-thread (*Stipa comata*). These species, together with other tallgrasses and midgrasses of secondary importance, make up over 50 percent of the plant composition in excellent range condition. Shortgrasses, principally hairy grama (*Bouteloua hirsuta*) and blue grama (*Bouteloua gracilis*) comprise 15 percent or less of the composition, not only in relict areas but also in pastures having a history of proper grazing use.

Medium-Textured Upland Rangelands

Moderately deep to deep silt loam soils of the Weld, Baca, and similar soil series characterize the loamy upland range site in eastern Colorado. These are the hardlands and wheatlands of cropland agriculturists. The merits of relatively high water-holding capacities are, in large measure, offset by insufficient precipitation to capitalize on this ad-

vantage. As compared to deep sands, water intake rates are lower, wilting coefficients higher, and susceptibility to drought greater in a semi-arid climate. Moisture relationships are not favorable to deep rooted tallgrasses. This site is a natural home for shortgrasses. Blue grama is the overwhelming climax dominant. Buffalo grass (*Buchloe dactyloides*) is a significant secondary species in extreme eastern Colorado but is of minor importance or lacking entirely at higher and drier elevations westward. Midgrasses are definitely secondary components of the climax, generally comprising less than 15 percent of the composition on this site. Recent studies by Albertson and Tomanek (6) on similar rangeland in northeastern Colorado support this contention. The principal midgrass species include western wheatgrass (*Agropyron smithii*), side-oats grama (*Bouteloua curtipendula*), and needle-and-thread. Perennial three awn (*Aristida* spp.) and sand dropseed (*Sporobolus cryptandrus*), while assuming midgrass stature, are minor components of the climax. On this site and in this area they increase with grazing use. They are relatively abundant on disturbed areas and on abandoned cropland. They are not valid indicators of the relative place of midgrasses as compared to shortgrasses under climax conditions.

Sandy Plains Rangelands

Sandy loam soils typified by the Ascalon and Dalhart series are included in the sandy plains range site in eastern Colorado. These soils are characteristically underlain by somewhat finer textured subsoils. These are the row crop lands of agriculturalists. In a semi-arid climate their moisture relationship for native plants is more favorable than that of silt loam uplands and somewhat less favorable than deep sands. The plant cover consists of an intimate mixture of

midgrasses, shortgrasses, and some tallgrasses. Major species include little bluestem, side-oats grama, blue grama, prairie sandreed, needle-and-thread, hairy grama, and sand bluestem. Midgrasses and tallgrasses combined comprise from 25 to 40 percent of the climax composition. Sand dropseed is of secondary importance, but, together with perennial three awns, may dominate as a result of declining range condition. Plant cover on this site can and frequently does assume a dominance by shortgrasses as a result of a decline in range condition.

Herbage yield studies made in connection with field observations of the Soil Conservation Service (5) indicate significant variations in forage production between these kinds of rangeland. Using the yield of the loamy upland range site as an index of 1.0, the approximate index of the sandy plains site is 1.3, and of the sandhills site, 1.6. The herbage yield of the sandhills and sandy plains sites are drastically reduced by the decrease or disappearance of tallgrasses and midgrasses.

An evaluation of additional range sites in eastern Colorado indicates considerable variation in potential plant covers, in the relative proportion of midgrasses, shortgrasses, and tallgrasses, and in herbage yield. Thus, an evaluation of range sites aids materially in clarifying the shortgrass versus midgrass controversy, and in giving guidance and direction to management. Generalized assertions as to the kind of potential plant cover that do not recognize significant variations in environment are of necessity ambiguous. The same degree of ambiguity would apply to an evaluation of the effects of management if variations in potential plant cover were ignored.

Relation to Management

Research studies made in this portion of the Central Great Plains include an evaluation of

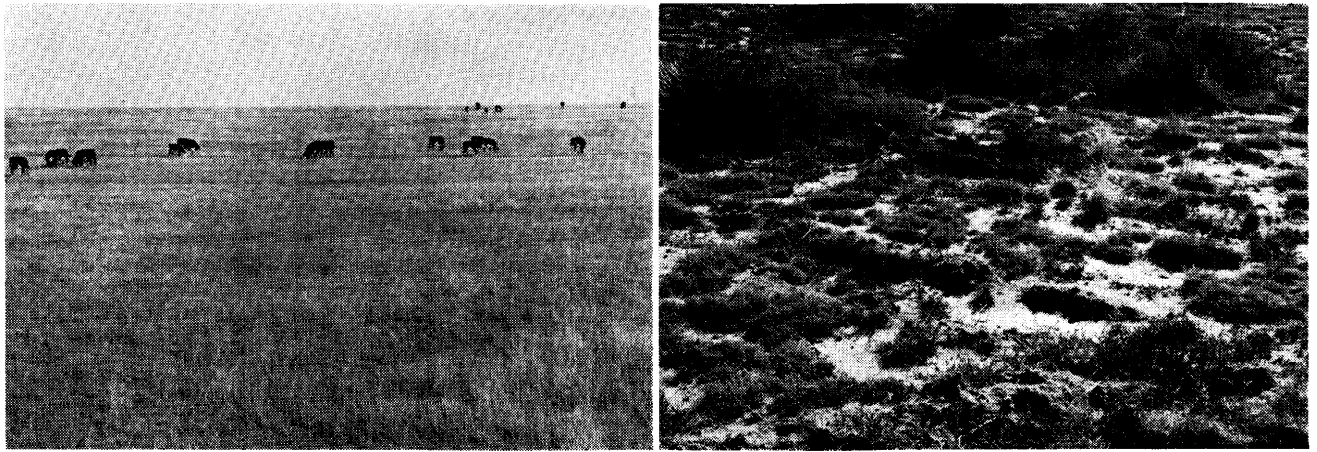


FIGURE 2. *Left*: Loamy upland site in excellent range condition. Blue grama is the dominant species, with a scattered overstory of western wheatgrass. *Right*: Sandy plains site in poor range condition. The midgrasses and tall grasses have largely disappeared. The principal remaining species are blue grama, three awn, and yucca.

grazing intensity on shortgrass ranges near Nunn, Colorado. A ten-year summary of this study by the Rocky Mountain Forest and Range Experiment Station (4) concluded that shortgrass vegetation can be expected to maintain itself and may improve in condition under continuous moderate grazing use. When condition is below maximum for the site, improvement in condition can be expected under continuous light grazing use. Net income was shown to be highest from moderate use as compared to heavy and light use.

Recently the Colorado Agricultural Experiment Station has initiated range improvement and management studies on sandy lands in east-central Colorado and on hardlands in southeastern Colorado. Results of these studies, and the continuation of pasture studies by the Agricultural Research Service near Nunn, Colorado, will provide further information on the use and management of these kinds of rangeland.

A recent field evaluation made by the Soil Conservation Service in the plains of eastern Colorado and New Mexico illustrates the benefits of good range condition in terms of beef production (1, 2). The evaluation, based upon yearlong commercial breeding herd operations, included a de-

termination of range site, range condition, and beef production in terms of pounds per acre and pounds per cow unit grazed. Beef production was 14.8 pounds per acre and 374 pounds per cow unit on ranches averaging good range condition, 10.9 pounds per acre and 348 pounds per cow unit on fair, and 8.0 pounds per acre and 277 pounds per cow unit on ranches averaging poor range condition.

Trained observers, combining the experience and opinions of ranchers and co-workers with repeated observations of the same area of rangeland over a period of years, reach some conclusions as to the nature and behavior of plant cover under different kinds of use and management. The observations which follow are in this category.

Management of medium-textured loamy upland rangelands in the 12 to 16-inch precipitation zone of the Central Great Plains should be based on the establishment or maintenance of a vigorous plant cover dominated by blue grama. Buffalo grass is, or should be, a secondary species. A comparatively small but significant amount of midgrasses, principally western wheatgrass, side-oats grama, and needle-and-thread is to be expected on this kind of rangeland. These species contribute significantly to yield,

and in the case of western wheatgrass and needle-and-thread, provide early-season green forage at a critical period. Their maintenance in a plant cover dominated by shortgrasses is difficult under continuous grazing use. Periodic rest, geared specifically to the growth habits of these midgrasses, aids materially in assuring their continued production. Dense sodlike stands of blue grama and buffalo grass are not the most productive cover on this kind of rangeland. Under these conditions the individual plants are generally low in vigor and shallowly rooted.

Sandhill rangelands in eastern Colorado can be profitably used and managed in a manner that will maintain productive stands of tallgrasses and midgrasses. Key management species include sand bluestem, prairie sandreed, and little bluestem. Management based on such species as blue or hairy grama and sand dropseed soon leads to a marked decline in productivity. This kind of rangeland rarely is dominated by shortgrasses following a decline in range condition. It is subject to severe wind erosion damage following deterioration. Therefore prudent use and management is essential, not only to assure high production levels, but also to maintain a reasonable degree of soil stability.

Management of sandy plains rangeland should be based on key midgrasses and tallgrasses if the potential productivity of the site is to be realized. This kind of rangeland frequently is dominated by shortgrasses following a decline in range condition. When dominated by shortgrasses, such rangeland can be used and managed in a manner that will provide adequate protection against wind erosion, but fails to provide either the amount or variety of forage produced by the potential plant cover.

Primary consideration has been given to the nature and management of plant cover in the Central Plains of eastern Colorado. A knowledge of potential plant cover and the interpretation of changes in terms of range improvement or decline are deemed essential to the establishment and attainment of management objectives. Certainly all of the basic principles of sound range and livestock management common to all rangelands are equally applicable to the Central Plains. Inasmuch as this area is historically and dramatically subject to periodic drought, the problem of adjusting the degree of grazing use to available forage supplies is especially significant. Measures commonly advocated for the solution of this problem include maintenance of adequate forage reserves and flexibility in herd composition and management. Unfortunately the advocacy of

these measures is substantially easier than their continued timely application. However, the adoption of these practices by an increasing number of ranchers testifies to a progressive realization of their need and feasibility. Despite the severity and impact of the current drought on plant cover and ranch income, there still are ranches on which the present condition of the range would hearten range operators and technicians. Such profitable and long-term use of native rangelands is one of the basic elements in the stable and productive use of land in the Great Plains.

Summary

1. A knowledge of potential plant cover for each kind of rangeland is essential to properly guide and evaluate grazing use and management.

2. An examination of several range sites in the Central Plains of eastern Colorado reveals significant variations in the kind and amount of plant cover characteristic of the climax. These variations are due to divergent environments resulting from different combinations of soil, topography, and climate.

3. Range site evaluations aid materially in determining the relative place of shortgrasses, midgrasses, and tallgrasses for the various kinds of rangeland in this area.

4. Deep sands support a plant cover dominated by tallgrasses

and midgrasses. A plant cover dominated by shortgrasses in which midgrasses are definitely secondary species, characterizes medium textured upland soils. Sandy loam soils support an intimate mixture of midgrasses, shortgrasses, and tallgrasses.

5. To realize optimum forage and livestock production levels, management of native rangelands in this area should be based upon the re-establishment or maintenance of the kind of plant cover characteristic of the potential for the various range sites involved.

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