

TALL GRASS PRAIRIE IN COLORADO AND ITS AESTHETIC VALUE

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ABSTRACT

Tall grass prairies were once commonplace in Colorado, along the Front Range foothills and adjoining the Black Forest. Today only vestiges of the original prairies remain, and they too are rapidly succumbing to the onslaught of the developers' bulldozers.

Five relict prairies near Boulder contributed to ecological description of Colorado prairies on deep, clayey soils. The prairies are floristically diverse, containing over 180 plant species, and are rich in western elements of the vascular flora. With cattle and horse grazing, these prairies can change to mixed-grass and shortgrass prairie types. Intense grazing has caused the loss of vast prairie areas in Colorado.

Prairie areas in the Boulder-Denver-Colorado Springs metropolitan complex are in critical danger of extinction. However, the residents of this area have invariably expressed interest in seeing such natural vegetation. Many have said that they were amazed to learn of tall grass prairies still existing in the United States, much less in their own back yard! The cultural, educational, and aesthetic worth of prairies can be of enormous benefit to the over 2 million residents of the greater Denver area.

Tall grass prairie? In Colorado? "Come on, you're kidding!"

So exclaim many of the residents of the greater Denver area when I tell them about their exciting prairies. "I thought the tall grasses were plowed up decades ago and converted to corn in the Midwest." At present few Coloradoans are aware that tall grass prairies still exist in the U.S., much less in their own backyard!

Tall grass prairie, true prairie, or simply prairie was once commonplace in eastern Colorado. Early botanists described Colorado prairies resembling those of Illinois, Iowa, or Missouri along the fringes of the Black Forest between Colorado Springs and Denver (Shantz 1906, Livingston 1952) and in the mountain front foothills near Boulder (Vestal 1914, Dodds et al 1908, James 1930, Branson et al 1965). Doubtless Zebulon Pike unknowingly beheld Colorado prairie long before he perceived the famous peak he said would never be climbed. Except in a few technical publications, no one has ever bothered to document the existence and beauty of this wonderful vegetation that nearly fringes the entire "Great American Desert." And today the tall grass prairies of Colorado are nearly extinct and almost forgotten.

Yes, prairies can still be found in Colorado, but you've got to hunt for them. Why, you ask, this excitement about tall grass prairie? Perhaps, as Jim Wilson, a prairie addict from Nebraska says, "This complex, brawling, tension-ridden world alarms us and we find comfort in the timeless, reassuring presence of the Prairie." There is little doubt that the prairie is indeed something very exceptional. Consider, for example, the Colorado prairie. The original prairies were resplendent with 5- or 6-foot waving stems of big bluestem, switchgrass, yellow indiagrass, porcupine grass, and hosts of other grasses of shorter stature. Well over a hundred different kinds of bright flowers emblazoned these waving fields from April through October. People are hunting for prairies because they are phenomenally rich and diverse biological communities, and Colorado prairies are no exception.

Yet, our Colorado Prairies are something uniquely western, as shown by floristic studies from 5 relict prairie areas near Boulder (Table 1). The flowering year begins in profusion as early as April. Sand lilies, pasque flowers, and yellow violets contribute to early spring color. In May the mariposas, arnicas, lupines, and puccoons may explode with glorious hues, either singly, each species dominating for the moment with its own color, or in combination of multicolor spectacle. June is the time for gaillardias, paintbrush, golden banner, cinquefoil, blue flax, and

many others. In late July and August there is a brief hiatus in prairie color, for now the grasses have achieved considerable height, and their waving stems are a sea of motion. Among the grasses, however, both white and purple petalostemons, Navaho tea, golden aster, and other bright flowers occur. By September the grasses have mostly completed their year's cycle. The soils are becoming dry, and the clear, cool days of Colorado's Indian summer have arrived. This is time to find asters, goldenrods, blazingstars and even the rare western prairie gentian in full flower. The big bluestem, yellow indiagrass, and switchgrass are turning gold and red. Skunkbush is brilliant orange. The prairie autumn in luxuriant chromas provides a fitting completion to the colorful procession of the prairie year.

Our Colorado prairies are a wealth of plant and animal life. One botanist (Livingston 1952) listed over 140 flowering plant species on prairies of the Arkansas-Platte Divide. This is doubtless an underestimate of plant richness, for I have tallied over 180 vascular plant species in prairie remnants near Boulder. Some prairie dwellers are quite rare. The great blue lobelia reaches us from prairies of Illinois and Iowa and is an exceptional "discovery" in prairie areas south of Denver. In foothill prairies near Boulder are the rare indigo and Jersey tea. This latter shrub was much sought for by New Englanders after the Boston Tea Party episode, for its leaves and flowers make an excellent sweet beverage. The bird watcher can have his day in the Colorado prairies, too. Many birds are also found in the more widespread mixed and shortgrass prairies, but the secretive grasshopper sparrow is a species that I associate with the tall grasses. Its insect-like "buzz-buzz-buzz-zz-zz" reveals its nesting territory somewhere in that dense foliage.

The prairie is normally a vegetation of the sub-humid forest borders of eastern North America. It occurred there in a region of 20-50 inches of yearly average precipitation that is now, as we know, mostly cornland. In Colorado, too, the prairie is mostly a forest border vegetation; in this case ponderosa pine is the main forest type. Prairies exist here on sites where soil characteristics or topography compensate for the low rainfall. Near Boulder the prairie remnants are found on deep, clayey soils (Table 2). Such soil can store enormous quantities of water and is an effective reservoir for the year's precipitation. Although Boulder's mean annual precipitation averages only 18.5 inches, virtually all of this can be stored for spring and summer prairie growth in the deep clayey profiles. Along the Black Forest margins, on the other hand, are areas of deep, sandy soil (Livingston 1952). Such soils effectively trap light rains as well as torrential cloudbursts of summer. Rapid percolation of water into sandy soil enables water to be effectively used by the deep rooted prairie plants (Williams and Holch 1946, Branson et al 1965).

Much of the original Colorado Prairie disappeared as the result of livestock grazing. Much of the prairie flora is ice cream to cattle and horses. Livestock long confined to luscious, tasty pastures of bluestem and other very palatable grasses and forbs have succeeded in reducing the tall grass prairies to the mixed and shortgrass ranges so widespread in eastern Colorado (Table 3). Prairie remnants are only found today where intensive grazing is no longer practiced.

The second principal cause for the prairie's disappearance has been, and continues to be, Colorado's rapid urbanization. These wonderfully diverse and colorful communities were - unfortunately - most widespread in the Denver metropolitan area. Finding a prairie remnant in this area is like discovering something out of Colorado's pioneering past. Prairie plants "converse only with the dead", Aldo Leopold wrote on his desolate bus ride through the modern Illinois countryside. Has the Colorado prairie a similar destiny - to be forgotten in our willy-nilly haste to prepare the land for more commercial establishments and real estate developments? I found one prairie remnant in a bustling business district in the Boulder city suburbs. The prairie community in full splendor existed on a tract of less than one acre, trisected by a busy, noisy highway on one side, an irrigation ditch which effectively excluded grazing cattle on the second side, and commercial properties replete with filling stations, restaurants, and billboards on the third. This "lot" had indeed been bypassed in the onrush of urban sprawl, and a mini-prairie refuge established by default. Few, however, see behind the billboards into the community of plants and animals beyond. Another prairie in Boulder was not so fortunate. Great yellow monsters belching clouds of smoke and pall and filling the air with angry roar had, in a matter of mere hours, forever relegated a 20-acre prairie to the realm of the dead (Table 4). No one was there to mourn its loss, but the grasshopper sparrow shall never return.

In Colorado we have suddenly arrived at a point in time where laws of diminishing returns and increasing suburban monotony demand drastic reappraisal of prairie worth. This appraisal cannot be entirely based upon economics. Prairies are suddenly very valuable as "people pasture," to again borrow the appropriate phrase from Jim Wilson. In people pasture we harvest not goods and services, but incommensurables. The roads out of Denver carry each weekend, in the words of Lewis Mumford, "a load of desperate people looking for a spot of green or a patch of blue or a pool of quiet -- the mirage of the great metropolitan desert." It's hard to believe that the open spaces of the great Colorado outdoors are filling up so rapidly and with such helter-skelter ugliness. The prairie, however, is restful and beautiful - a metropolitan oasis. And the remaining remnants are well worth searching for and identifying, preserving and including in regional landscape planning, in advance of the bulldozer's hungry maw.

In Colorado we have treated prairies with callous disregard, perhaps out of ignorance. It is not too late, however, to recognize the worth of prairies in the Denver area. They are beautiful and restful natural communities. They contain rare and unusual plants and animals. They provide educational and cultural pursuits. They contribute to landscape diversity and the stimulation that this, in turn, gives to our mental perceptions. And prairies and prairie tracts are a glorious kind of, simply, open space. With their unique mountain backdrop, the prairies of Colorado are probably unrivalled in their aesthetic value.

Table 1. Geographic elements of the Colorado prairie flora, Boulder and Jefferson Counties. Data based upon 5 relict prairie communities and 2 prairie vegetation associations (Andropogon gerardi/Poa pratensis and Andropogon gerardi/Bouteloua gracilis).

ELEMENT	TYPICAL SPECIES	PERCENT OF PRAIRIE FLORA
Cosmopolitan (Widespread in N.A. or Eurasia)	<i>Prunus virginiana</i> <i>Tragopogon dubius</i> <i>Dactylis glomerata</i>	20
Western	<i>Mahonia repens</i> <i>Linum lewisii</i> <i>Poa secunda</i>	20
Great Plains	<i>Yucca glauca</i> <i>Sphaeralcea coccinea</i> <i>Bouteloua gracilis</i>	32
Cordilleran (Rocky Mt. Montane)	<i>Rubus deliciosus</i> <i>Thermopsis divaricarpa</i> <i>Muhlenbergia montana</i>	15
Eastern U.S.	<i>Ceanothus herbaceus</i> <i>Solidago rigida</i> <i>Andropogon gerardi</i>	7
Southwestern	<i>Ceanothus fendleri</i> <i>Monarda pectinata</i> <i>Lycoris phleoides</i>	6

Table 2. Prairie soil at Mountain Shadows Prairie, Boulder County, Colorado. Parent materials of the upper profile are granitic and sandstone alluvia; lower in the profile, Cretaceous siltstones. Vegetation at the profile site consists of Andropogon gerardi and Poa pratensis with scattered forbs.

<u>HORIZON</u>	<u>DEPTH</u>	<u>DESCRIPTION (FIELD OBSERVATIONS ON JULY 11, 1967)</u>
A1	0-1.5 (dm.)	Very dark gray brown (10YR 3/2 moist <u>or</u> dry) cobbly gravelly sandy loam; very friable; weak fine granular; fibrous roots plentiful; clay 3%; pH 6.4; boundary clear smooth.
A3	1.5-3.5	Dark reddish brown (5YR 3/2 to 3/3 moist) or dark brown (7.5YR 3/2 dry) cobbly gravelly sandy loam; friable; weak fine prismatic; roots plentiful, fibrous roots especially dense around cobble cavities; scattered pockets of reddist brown (5YR 4/4 moist) sand are probably highly weathered sandstone cobble remnants; clay 9%; pH 6.2; boundary clear and smooth.
B1	3.5-5	Yellowish red (5YR 4/6 moist) or dark reddish brown (5YR 3/4 dry) gravelly sandy loam with scattered round cobbles; moderate medium prisms with humus coatings of dark reddish brown (5YR 3/3 moist) on the ped faces; friable when moist, friable-firm when somewhat drier; roots common, usually on ped and stone surfaces; clay 18%; pH 6.5; horizon 0-1.5 dm thick, boundary wavy, abrupt or clear.
B21	5-9	Yellowish red (5YR 4/6 moist) or dark brown (7.5YR 4/4 dry) sandy clay loam; gravels infrequent; strong coarse to very coarse prisms with humus coatings giving a dark reddish brown cast (5YR 3/4 moist) to the ped faces; firm moist and extremely hard when dry; roots common but confined to ped surfaces; clay 30%; pH 6.5; boundary slightly wavy to smooth; abrupt.
IIB221r	9-11	Yellowish brown (10YR 4/4 moist on ped faces; 2.5Y 5/4 moist in ped interior) or yellowish brown (10YR 5/4 dry) silty clay loam, no gravels or stones; strong coarse to very coarse prisms with humus coatings; friable; roots sparse; clay 36%; pH 6.2; boundary slightly wavy or smooth; gradual.
IIB3	11-14	Olive brown (2.5Y 4/4 moist) or olive yellow (2.5Y 6/6 dry) silt loam; moderate coarse to very coarse prisms with faint humus coatings, the prisms readily breaking into strong medium angular blocks; abundant fine blackish (10YR 3/2) flecks on the angular blocky ped faces; firm; roots sparse; clay 26% at 13-14 dm; pH 6.6; boundary diffuse.
IIC	14-17	Light gray (2.5Y 7/2 dry) silt loam; firm moist and very hard when somewhat drier; strong medium angular blocky breaking into strong fine angular blocky; very local whitish carbonate spots effervescing mildly with HCL; no roots; clay 24%; pH 6.8

Variations

The cobbly layer ranges from 2 to 10 dm in thickness; it may be abrupt to the II material or abrupt to the sandy clay loam of the I layer. The I-II boundary is wavy and independent of the depth within the profile and thickness of the strong prismatic B2. At one profile site the IIB221r horizon occurred at the 2-5 dm depth. This is probably as shallow within the profile as this horizon occurs in this area. The 1r designation implies that the faint reddish coatings on the ped surfaces of the II material occurs from the illuviation of clay iron derived by the weathering of the I minerals.

Table 3. Influence of grazing on Colorado tall grass prairie. Abundance classes are based upon quadrat studies in the Mountain Shadows Prairie during 1966 and 1967. The abundance classes are as follows: 0, absent or very rare; 1, infrequent and of minor importance; 2, common; 3, very common and subdominant or dominant; 4, extremely abundant and dominant. The comparisons of grazed and ungrazed pastures are based upon fence effect.

SPECIES	ABUNDANCE CLASS	
	Ungrazed	Grazed
Tall grasses		
<i>Andropogon gerardi</i>	3	1
<i>Sorghastrum nutans</i>	2-1	0
<i>Panicum virgatum</i>	2-1	0
Midgrasses		
<i>Stipa comata</i>	1	1
<i>Bouteloua curtipendula</i>	2	2
<i>Poa pratensis</i>	3-4	1
<i>Poa compressa</i>	2	1
Short grasses		
<i>Bouteloua gracilis</i>	2	3
<i>Buchloe dactyloides</i>	2	2
<i>Bouteloua hirsuta</i>	1	1
<i>Aristida longiseta</i>	1	2
Tall forbs		
<i>Tragopogon dubius</i>	2	1
<i>Psoralea tenuiflora</i>	1	2
<i>Solidago rigida</i>	1	0
Intermediate and low forbs		
<i>Artemisia frigida</i>	2	4
<i>Artemisia canadensis</i>	1-2	1
<i>Artemisia ludoviciana</i>	1-2	1-2
<i>Evolvulus nuttallianus</i>	0	1
Low shrubs		
<i>Rosa sp.</i>	1	0-1
<i>Gutierrezia sarothrae</i>	1	1

Table 4. Vegetation of a vanished prairie. During Spring, 1970, the Mountain Shadows Prairie in Boulder County, Colorado (SE1/4 S8 R70W T1S) was wiped out by bulldozers. Vegetation of this approximately 20 acre prairie had been sampled by the canopy coverage method on May 8, June 9, and August 2, 1967.

SPECIES	COV/FREQ/CONST*	SPECIES	COV/FREQ/CONST
<i>Andropogon gerardi</i>	33/64/3	<i>Potentilla fissa</i>	0/3/2
<i>Panicum virgatum</i>	2/5/2	<i>Potentilla hippiana</i>	0/2/
<i>Sorghastrum nutans</i>	4/16/3	<i>Eriogonum alatum</i>	0/2/1
<i>Stipa viridula</i>	9/27/2	<i>Aster porteri</i>	0/4/3
<i>Phleum pratense</i>	0/1/1	<i>Grindelia squarrosa</i>	0/3/2
<i>Andropogon scoparius</i>	5/15/3	<i>Ratibida columnifera</i>	0/1/1
<i>Sporobolus cryptandrus</i>	1/7/2	<i>Taraxacum officinale</i>	0/4/
<i>Agropyron smithii</i>	1/4/1	<i>Senecio spartoides</i>	0/2/1
<i>Sitanion longifolium</i>	0/5/2	<i>Lactuca scariola</i>	0/1/1
<i>Stipa comata</i>	0/6/3	<i>Erigeron flagellaris</i>	0/1/1
<i>Koeleria gracilis</i>	1/17/2	<i>Oxybaphus linearis</i>	0/1/1
<i>Aristida longiseta</i>	0/4/2	<i>Phacelia heterophylla</i>	0/1/1
<i>Lycurus phleoides</i>	0/1/1	<i>Calochortus gunnisonii</i>	0/1/1
<i>Bouteloua curtipendula</i>	1/15/3	<i>Leucocrinum montanum</i>	0/2/
<i>Poa pratensis</i>	52/98/3	<i>Apocynum androsaemifolium</i>	0/1/1
<i>Poa compressa</i>	11/40/3	<i>Heterotheca villosa</i>	0/1/1
<i>Eleocharis sp.</i>	2/22/1	<i>Gaillardia aristata</i>	0/1/1
<i>Sporobolus heterolepis</i>	p	<i>Dalea purpurea</i>	0/1/1
<i>Stipa spartea</i>	p?	<i>Liatris punctata</i>	0/1/1
<i>Panicum oligosanthes</i>	0/1/1	<i>Paronychia jamesii</i>	0/1/1
<i>Juncus sp.</i>	1/12/2	<i>Chenopodium sp.</i>	0/4/
<i>Boutelous gracilis</i>	3/35/3	<i>Artemisia dracunculus</i>	p
<i>Bouteloua hirsuta</i>	3/20/2	<i>Iris missouriensis</i>	p
<i>Carex heliophila</i>	5/28/3	<i>Mertensia lanceolata</i>	p
<i>Buchloe dactyloides</i>	7/23/2	<i>Lesquerella montana</i>	p
<i>Vulpia octoflora</i>	p	<i>Calylophus serrulata</i>	p
<i>Bromus japonicus</i>	0/ /6	<i>Thelesperma megapotamicum</i>	p
<i>Hordeum pusatillum</i>	0/ /2	<i>Delphinium virens</i>	p
<i>Artemisia ludoviciana</i>	7/46/3	<i>Monarda pectinata</i>	p
<i>Aster falcatus</i>	7/33/3	<i>Asclepias stenophylla</i>	p
<i>Tragopogon dubius</i>	6/58/	<i>Asclepias viridiflorus?</i>	p
<i>Ambrosia artemisiifolia</i>	1/24/3	<i>Carduus leiophyllus</i>	p
<i>Artemisia frigida</i>	1/12/3	<i>Solidago missouriensis</i>	p
<i>Artemisia canadensis</i>	1/12/2	<i>Solidago rigida</i>	p
<i>Camelina microcarpa</i>	3/26/	<i>Gutierrezia sarothrae</i>	0/2/2
<i>Psoralea tenuiflora</i>	3/9/2	<i>Rosa sp.</i>	0/4/1
<i>Scorzonera laciniata</i>	1/8/	<i>Yucca glauca</i>	p
<i>Cirsium undulatum</i>	1/4/1	<i>Ceanothus herbaceus</i>	p
<i>Penstemon virens</i>	0/6/	<i>Echinocereus viridiflorus</i>	0/2/2
<i>Penstemon secundiflorus</i>	0/2/	<i>Opuntia polyacantha</i>	p
<i>Penstemon virgatus</i>	p		

* Cover and frequency are rounded to the nearest percent; occurrence in 1,2, or all 3 sample areas is indicated under constance. Data are based upon systematic samples of 50 (May and June) or 90 (August) quadrats each 2 x 5 dm and spaced at 1 meter intervals. Presence outside sample quadrats is shown by the p. Plant names follow Weber, W.A., 1967. Rocky Mountain Flora.

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