

**A PHYTOSOCIOLOGICAL ANALYSIS OF A TALLGRASS
PRAIRIE IN BOULDER COUNTY, COLORADO**

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Abstract. The vegetation of a tallgrass prairie remnant in Boulder, Colorado was sampled and analyzed with the Braun-Blanquet phytosociological system. Thirteen syntaxa were identified; 4 groups and 9 community-types. Vegetation was further analyzed using detrended correspondence analysis ordination. DCA and Spearman's rank correlations indicate that vegetation is controlled primarily by soil moisture and edaphically related factors. Floristic comparison between this site and the Canadian Prairie Provinces revealed 38 species in common. Both studies identified three broad moisture regimes.

INTRODUCTION

Tall-grass prairies represent a relatively small portion of the grasslands that occur on all of the non-polar continents (Reichman, 1987). Prairies tend to occur in the interior of large continental land masses and are characterized by a predominance of grasses and the absence of trees, except in riparian areas. Prairies generally exist on flat or rolling terrain and in semiarid climates. In spite of the limitations imposed by climate, prairies possess great floristic diversity.

Several tall-grass prairie remnants are managed and protected by the City of Boulder, Colorado Open Space Program, for the maintenance and enhancement of the vegetation (City of Boulder Open Space, 1986). A phytosociological study was conducted in September 1988 on one of these remnants, known as "Parcel 7". The primary objectives of this paper are to: 1) determine the gradient or complex of gradients affecting the floristic distribution on Parcel 7, and 2) to compare the floristic composition of this site with the floristic composition

of the Canadian grasslands as described by Looman (1980, 1981). We hypothesize that moisture and soil texture are critical factors influencing species distributions on Parcel 7. At the Konza prairie in Kansas, plant communities are differentiated primarily on the basis of soil type, because of nutrient and moisture differences among major soil units (Reichman, 1987). Grassland studies performed by Brotherson (1983), Dix et al. (1967), and Abrams et al. (1987) all indicate a strong correlation between species distribution and soil moisture regime. Noy-Meir (1973) proposed an "inverse texture hypothesis" which illustrates that soil texture and soil water-holding capacity differentially affects vegetation. Sala et al. (1988) supported this hypothesis for grasslands specifically.

The grasslands of the Canadian Prairie Provinces occupy an area of approximately 235,000 km², mostly occurring in small parcels from 100 m² up to 50 ha in extent (Looman, 1980). Looman classified Canadian grasslands into a six-level syntaxonomical hierarchy using the Braun-Blanquet classification method. He categorized the Canadian prairie habitat type into dry grasslands, mesic grasslands, and meadows. Each habitat type was associated with differing substrates and soils. Because both the phytosociological studies conducted on the grasslands of the Canadian Prairie Provinces and on the tall-grass prairie of Boulder County were based on similar methods, floristic comparisons ^{between these studies} ~~were made~~. ^{it was possible to make}

SITE DESCRIPTION

Parcel 7 of City of Boulder Open Space Lands comprises approximately 108 ha, located south of the city's limits, ^{and} west of Colorado Highway 93. It consists of a broad Pleistocene alluvial terrace situated 2-3 m above the active floodplain of a small tributary to South Boulder Creek. ⁹¹ The climate ^{is comparable to that of} in Boulder ^{which} is semiarid, with mean annual precipitation of approximately 470 mm. Mean January temperature is 0.4° C and mean July temperature 23.1° C (Soil Conservation Service 1975).

Soils at the study site are classified into two series, Nederland very-cobbly sandy loam and Niwot soils (Soil Conservation Service 1975). Nederland soils occur on the drier sites on top of the alluvial terrace (Figure 1). In similar areas throughout west-central Boulder County, they have a very-cobbly sandy loam mollic epipedon, less than 50 cm thick, overlying an argillic horizon that also is very-cobbly sandy loam (Soil Conservation Service 1975). Niwot soils are found on the more-poorly drained floodplain sites below the terrace. Accordingly, these soils, although gravelly, are more fine-textured than the Nederland soils. Niwot soils have shallow mollic epipedons overlying sands and gravels, and are often mottled. The Nederland soils are classified as Aridic Argiustolls, and Niwot soils as Typic Haplaquoll, indicating significant drainage differences between these soils.

This site is presumed to be a remnant of a narrow belt of tall-grass prairie that once stretched all along the eastern front of the Rocky Mountains. Branson et al (1965) suggested that such tallgrass remnants developed owing to favorable soil moisture conditions. Despite the semiarid climate, the areas ^{subsoils} adjacent to the mountain front ^{or} ~~would be~~ moister from accumulated downslope movement of subsurface soil moisture. This would contribute ^s greater moisture to these coarse-textured outwash fans and alluvial terraces. However, settlement in this area has resulted in fragmentation of this vegetation into isolated remnants (Dix et al. 1967).

METHODS

Field Sampling

Thirteen potential community-types were recognized during a site reconnaissance as "entities" (sensu Mueller-Dombois and Ellenberg, 1974; Table 1). The patterns of distribution among these entities were observed to be related to broad moisture regimes within the site. For example, the Bouteloua gracilis -Artemisia frigida entity was best expressed on rocky, xeric floodplain sites while the Spartina pectinata entity appeared to be restricted to more hydric sites.

areas and comparisons between different studies.

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