# Blue Grama and Buffalograss Patterns in and Near a Prairie Dog Town

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**Highlight: Blue grama and buffalograss patterns differed in response to prairie dog mound building activities. While both species exhibited smaller pattern sizes within prairie dog towns compared to outside, but adjacent areas, the size of clumps and patches differed for the two species. Prairie dog activities caused a two-fold decrease in pattern size of blue grama by reducing size of clumps and patches. On the other hand, buffalograss patches were fragmented into small clumps which were not observed outside the town.**

The black-tailed prairie dog (*Cynomys ludovicianus*) is a native of the Great Plains region of North America and has been studied extensively as to its role in grassland ecosystems. In particular, Osborn and Allen (1949), Koford (1958), and Bonham and Lerwick (1976) reported that definite vegetation patterns consisting of concentric rings occur within prairie dog towns. Several authors have also observed that vegetative composition within towns were related to prairie dog clipping of taller plants and feeding habits, as well as mound building activities (King 1955; Koford 1958; Lerwick 1974). While these kinds of specific differences have been noted, no attempt has been made to describe vegetation patterns within prairie dog towns on a quantitative basis.

Greig-Smith (1964) noted that spatial distribution of individual plants may be random, contagious, or regular. He further observed that plants are seldom randomly distributed. Then, pattern can best be defined as a departure from randomness (Kershaw 1958; Greig-Smith 1964) and can be subdivided into two categories: (1) contagious, which is characterized by clumping or aggregation of individual plants, and (2) regular, which is characterized by even or uniform spacing of individual plants as in an orchard. Contagious patterns in natural vegetation are much more common than are regular patterns.

One of the more obvious and most often encountered patterns in any vegetation type involves the morphology of the individual plant. Therefore, Anderson (1961) emphasized that the normal morphological pattern for a species should be determined and used as a basis to compare the performance of a given species under varying ecological conditions.

The present study was to measure pattern size for blue grama (*Bouteloua gracilis*) and buffalograss (*Buchloe dactyloides*) in and near a dog town and to relate any specific pattern sizes found to prairie dog mound building. Normal patterns, as defined by Anderson (1961), for both species were considered as those occurring outside, but adjacent to, the town. Effects of prairie dog activities on normal patterns for these species were then determined by comparing the clump and patch sizes found outside the town to those inside the town.

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## Site Description

The prairie dog town was located in the western part of the Central Plains Experimental Range, 50 km northeast of Fort Collins, Colo. Blue grama and buffalograss were the dominant species, and midgrasses such as western wheatgrass (*Agropyron smithii*) and needleandthread (*Stipa comata*) were major associates. Perennial forbs were abundant and included scarlet globemallow (*Sphaeralcea coccinea*), plains Bahia (*Bahia oppositifolia*), locoweed (*Astragalus* spp.), and Brittons skullcap (*Scuttellaria brittonii*). Annuals included sixweeks fescue (*Volpia octoflora*), woolly plantain (*Plantago purshii*), tansyleaf aster (*Aster tanacetifolius*), and stickweed (*Lappula redowskii*). Cattle had moderately grazed the area during the spring for several years, before and during the study.

The soils of the site are from the Shingle series, which have textures varying from sandy loam to sandy clay loam in the top 6 inches, while subsoils are predominately a sandy clay loam. There were no significant diferences among chemical or physical characteristics of soils inside compared with those outside the prairie dog town (Lerwick 1974).

## Methods

A method for pattern measurements suggested by Kershaw (1957) was used to obtain cover data for blue grama and buffalograss at 1-cm intervals along ten 12.8-m line transects. Each transect was divided into 256 basic units of 5 cm each and the total number of occurrences for blue grama and buffalograss in each of the units was recorded. Six of these transects were located within the prairie dog town while four transects were used to obtain data outside the town. In the latter area, transects were placed parallel and 15 m apart, while transects inside the town originated at the center of randomly selected burrows.

Percentage ground cover for each species was obtained by dividing the number of transect points at which the species was encountered by the total number of observation points on the transect and multiplied by 100. Data from each transect were grouped into basic data blocks, consisting of five consecutive points, for analysis. These blocks were then grouped into successively larger blocks for each separate analysis such that each block was twice as large as that in the preceding analysis and half as numerous. That is, the smallest block consisted of five basic data points and each successive set of blocks was formed by combining two adjacent basic units (Fig. 1).

Analysis of variance procedures were used to obtain estimates of mean squares for each block size (Greig-Smith 1952, 1964; Kershaw 1957). A trend in magnitude of mean squares as block size increases indicates that a decrease or increase is occurring in the variation of the data. This trend can be easily seen, if it exists, by plotting block size

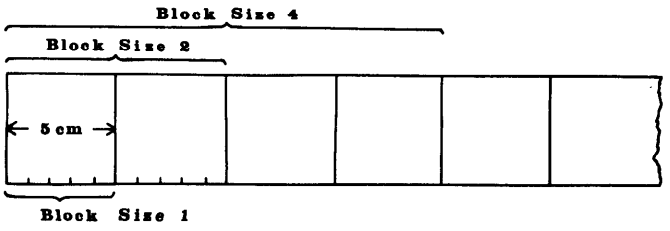


**Fig. 1.** *Method for combining blocks for mean square analyses.*

against mean square values for increasing block sizes. A peak occurs on the graph when a maximum of variation occurs between two adjacent blocks. This peak provides an estimate of the size of the clump or patch of the species as indicated by block size.

## Results and Discussion

### Sizes of Normal Patterns

The mean square procedure using block sizes has at least two limitations for the study of species patterns. One is the assumption of linearity of the pattern as block size increases, while the second occurs when blocks of data are formed. The latter procedure allows the measured scale to be, for example, either 1.6 m or 3.2 m in size. Yet, in reality, the size may be anywhere between the two. However, the procedure was useful to compare patterns inside versus outside the town.

The normal pattern for blue grama based on data outside the prairie dog town showed that peaks occurred at two different block positions (Fig. 2). This pattern that was independent of prairie dog activities was then used for comparison of pattern inside the town. The mean size of the smaller pattern for blue grama outside the town was indicated by a peak at block size 8 (0.4 m). This pattern size was related to the aggregation of blue grama clumps with a mean linear size of 0.4 m, while the peak at block size 64 corresponded to the blue grama patch mean size of 3.2 m.

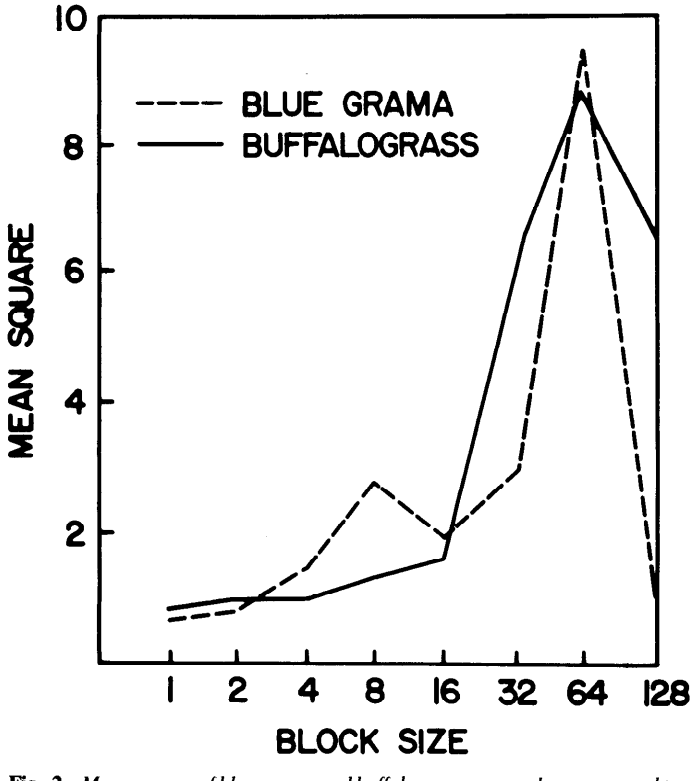


**Fig. 2.** *Mean square of blue grama and buffalograss cover values compared to sample block size outside the prairie dog town.*

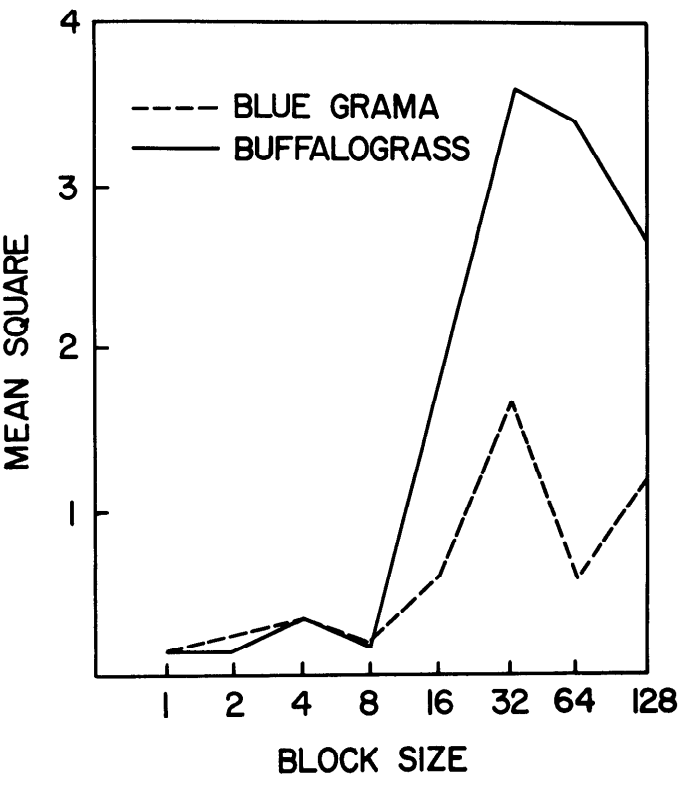


**Fig. 3.** *Mean square of blue grama and buffalograss cover values compared to sample block size in a prairie dog town.*

Pattern sizes for buffalograss outside the prairie dog town were indicated by one prominent peak (Fig. 2), which coincided with that of blue grama (3.2 m). Aggregated clumps of buffalograss also occurred naturally within larger patches of buffalograss.

### Sizes of Patterns inside the Town

Blue grama cover inside the town gave two peaks on the mean squares versus block size graph, which corresponded to two morphological units, clumps and patches (Fig. 3). The smaller pattern size was indicated by a peak occurring at block size 4 (4 blocks of 5 cm each), which corresponded to the mean size of 0.2 m for blue grama clumps found near prairie dog burrows. These clumps were observed to occur within larger patches of blue grama indicated by a peak at block size 32 (1.6 m) (Fig. 3). This smaller pattern is attributed to the morphologically controlled way in which blue grama tillers.

Pattern measurements for buffalograss inside the town also gave peaks at two different block sizes and indicated pattern sizes for buffalograss were the same as those for blue grama (Fig. 3). That is, the pattern size indicated by a peak at block size 4 (0.2 m) is the mean clump size of buffalograss occurring in prairie dog towns while the larger pattern size at block 32 (1.6 m) is a measure of mean patch size.

Both blue grama and buffalograss cover inside the town generally increased as distance from the burrow increased. Furthermore, the occurrence of small clumps of blue grama and buffalograss near crater mounds were remnants of a once larger patch of blue grama or buffalograss sod. The prairie dog's habit of scratching topsoil from the area around burrows probably broke up larger patches of blue grama and buffalograss into smaller clumps.

### Comparison of Pattern Sizes and Prairie Dog Activities

A comparison of pattern sizes for blue grama inside and

outside the dog town revealed that two basic differences occurred (Figs. 2 and 3). The same small scale (0.2 m) pattern that was associated with clumps of blue grama near prairie dog burrows did not appear outside the town. Instead, the pattern size for clumps from the outside area was larger (0.4 m) and was considered to be the normal pattern for an area free of prairie dog mound building. Furthermore, there was a significant decrease ($P = .01$) in size of blue grama patches within the town (1.6 m) compared to outside the town (3.2 m). Therefore, prairie dog activities seemingly contributed to two-fold decrease in the size of both blue grama clumps and patches within the town through construction of crater mounds.

Buffalograss within the town aggregated into clumps within patches as was the case with blue grama. However, this aggregation was on a smaller level than that in the outside area which indicated that prairie dog mound construction also resulted in fragmentation of buffalograss patches into smaller units as was the case for blue grama (Figs. 2 and 3). However, the pattern size for buffalograss outside the town did not include a significant small scale pattern.

In conclusion, blue grama and buffalograss were affected in a morphologically similar way by prairie dog mound building activities. Both species displayed smaller pattern sizes inside the town compared to those pattern sizes in adjacent areas unaffected by prairie dogs. As pointed out previously, peaks occurring at given block sizes do not suggest an exact measurement of scale size, but rather are an estimate of that size. Therefore, the occurrence of peaks at the same block size for both species does not suggest a common, identical scale for clumps or patch size for the two species.

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