# Grazing Patterns of Deer and Goats in Shrublands

M.K. OWENS, AND D.E. SPALINGER

Texas A&M Agricultural Research & Extension Center at Uvalde

## BOTTOM LINE

The grazing patterns of deer and goats were affected by different vegetative parameters although they were grazing in the same pasture.

**Summary**

- Although Spanish goats and white-tailed deer were grazing in the same 2.5 acre area, their perceptions of the environment was very different.

- The length of the grazing path and its tortuosity were dependent on different plant characteristics for the two herbivores. Within the goat grazing paths, shrub distribution accounted for most of the variation whereas plant shape explained the most variation in the deer grazing paths.

- Deer grazing patterns were determined mostly by the shape of shrubby bluesage and secondarily by shrub abundance.

**Introduction**

A better understanding of how large herbivores respond to their physical environment can help managers allocate available resources with greater efficiency. The use of fractal geometry can provide objective, quanitative information about complex spatial patterns of animal movement and plant distribution that are scale independent. Grazing paths can be expressed as fractals that indicate the tortuosity of an animals' movement. Plant shape and distribution can also be expressed as fractals. The perimeter:area fractal dimension indicates the complexity of the shape of individual shrubs, while the distribution of shrubs can be reflected by the box count fractal dimension.

In this study, goat and deer feeding paths were characterized as fractals and compared to the fractal dimensions of the surrounding shrub community to assess the relationship between feeding patterns and the environment.

**Experimental Approach**

A 2.5 acre area was enclosed with a 10 ft tall fence to conduct white-tailed deer and goat feeding trials. The study site was dominated by blackbrush (Acacia rigidula), guajillo (A. berlandieri), ceniza (Leucophyllum frutescens) and shrubby bluesage (Salvia ballotiflora).

During individual feeding bouts, animal locations were recorded to the nearest meter using a grid system. A total of 44 feeding bouts were recorded from July 30, 1993 to September 6, 1993. Path length and fractal dimension of the grazing path were calculated for each individual feeding bout.

Shrub location and shape were recorded using large scale (1:107) aerial photography. Individual shrub species were identified in the field, delineated on the aerial photographs and digitized into a geographic information system (GIS). Viewsheds for each bout were identified using a GIS and included all shrubs that could be seen from each feeding point along the grazing path.

Perimeter-area fractal dimensions were estimated for the shrubs within each feeding bout. Additionally, a measure of the dispersion of the shrubs contained in each grazing bout was determined using the box count method.

A multivariate regression was used to detect relationships between animal movement patterns and the shrub community within the viewshed. Separate regression models were developed for goats and deer using the animal path fractal dimension and path length as dependent variables. In both cases, the independent variables were perimeter to area and box count fractal dimensions calculated for each of the four dominant shrub species separately and all other shrub species combined.

## Results

*Vegetative Characteristics*

The complexity of plant shape (perimeter:area fractal) was generally low in the pasture, ranging from 1.16 to 1.26. Goats and deer selected grazing paths with slightly greater perimeter:area fractals of guajillo and shrubby bluesage than were found in the pasture as a whole (Figure 1A). Grazing paths of both deer and goats demonstrated a lower grid fractal dimension than the pasture as a whole for each of the dominant species and for all shrubs combined (Figure1B). Deer grazing paths were dominated by guajillo and blackbrush, with guajillo being more abundant along the path than in the pasture as a whole (Figure 1C). Goat grazing paths were dominated by guajillo and minor shrub species. The guajillo occurred at approximately the same composition as in the pasture while the minor species were more represented in the grazing path than in the pasture (Figure 1C).

*Path Lengths*

Mean distance between feeding stations was significantly greater for deer (20 ft) than for goats (13 ft) and path length was greater (826 vs 597 ft, respectively). Path length of white-tailed deer was negatively related to the perimeter:area fractal of shrubby bluesage and positively related to the grid fractal of all shrubs combined. Over 54% of the variation in path length of goats was attributed to the significant negative effects of the perimeter:area fractal of shrubby bluesage and the positive effects of the grid fractals of shrubby bluesage and all remaining shrubs.

*Path Fractals*

Deer grazing paths tended to be straighter than goat grazing paths (D=1.27 vs 1.53, respectively). Deer foraging paths became straighter as the shape complexity of shrubby bluesage plants increased, but as other shrubs became more complex in shape, the grazing path became more tortuous. As shrubs became more plane-filling, the grazing path became more tortuous. Goat grazing paths were negatively related to the amount of blackbrush and positively related to the shape of shrubby bluesage. As blackbrush became more plane-filling and the shape of shrubby bluesage became more complex, the grazing path of goats became straighter.

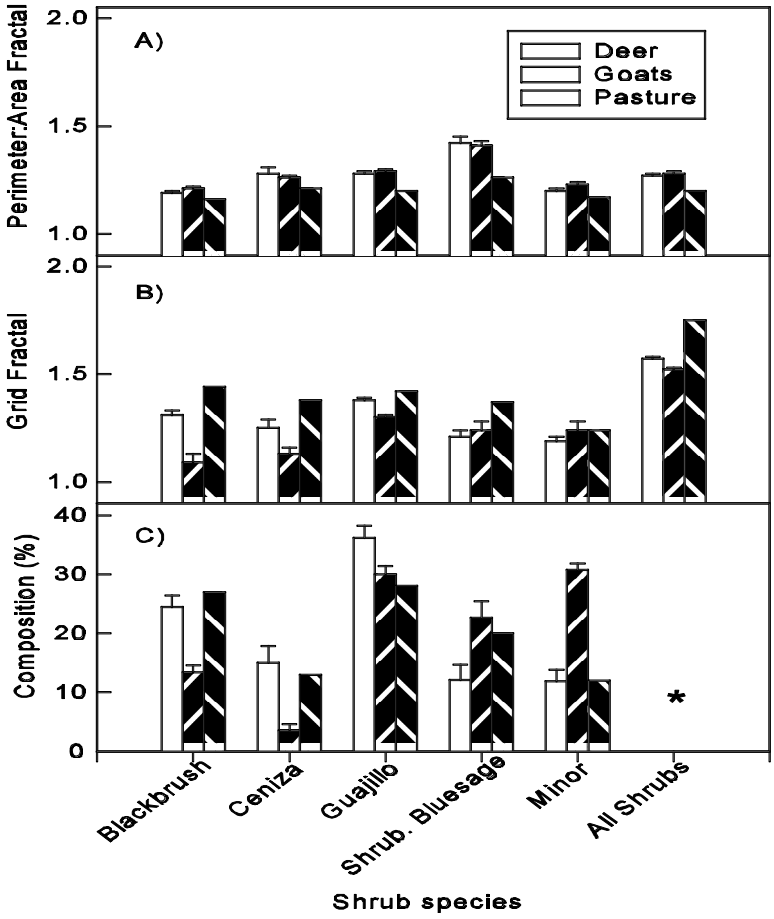


Figure 1. Plant and grazing path fractal dimensions in a mixed shrubland