Cattle Temporal and Spatial Distribution in Midwestern Pastures using Global Positioning (A Progress Report)

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Introduction

Previous research has shown that grazing cattle tend to congregate in riparian zones of pastures to obtain water and shade for thermoregulation. However, problems associated with thermoregulation may be increased because of the presence of endophyte-infected tall fescue in pastures. Defining relationships between cattle distribution, such pasture characteristics as size, shape, shade distribution, botanical composition, and climatic factors related to heat stress, will provide the basis for development and implementation of management practices that minimize non-point source pollution possibly associated with grazing cattle.

Therefore, the objectives were to evaluate the effects of pasture characteristics and botanical composition and climate on temporal and spatial distribution of grazing cattle

Materials and Methods

Pastures ranging from 33 to 309 acres on five cooperating beef cow-calf farms were used. During spring, summer, and fall of 2007 and 2008, 2 to 3 cows per farm were fitted with Global Positioning System (GPS) collars to record position at 10-minute intervals for periods of 5 to 14 days. Seventy-four data sets, all farms combined over two years, were obtained throughout the grazing seasons to determine cattle locations.

Streams and/or ponds and fence lines were referenced in all pastures using a handheld GPS receiver. Upon referencing, points were used to establish zones in the pastures. Zones were in the stream or pond (water source), and 50, 100, 200, or greater than 200 ft (uplands) from the water. Riparian zone was expressed as the area of the water source plus the 50 and 100 ft zones.

Microclimate data including ambient temperature, black globe temperature, dew point, wind speed and direction, relative humidity, and rainfall were collected at 10-minute intervals. For each unit increment of each microclimate variable, the number of observations that a cow was in or within 100 ft of the water source was divided by the total number of observations at that temperature to determine the probability of a cow being in either of these zones at that microclimatic variable increment.

Results and Discussion

Water source. Across farms, cattle spent a greater proportion of time in a water source in summer than spring or fall in both years (Table 1). In spite of seasonal differences in the percentage of time cows were located in the water source, cows across all farms spent less than 2 percent of observations in the water source. This presence is lower than percentages reported by others in the literature, but pastures used in the previous studies were smaller than the pastures in the current study.

Riparian Zone. The proportion of observations of cows located in the riparian zone of pastures (Table 1) did not differ between seasons, but did differ between farms. Because of the differences in the percentage of time that cattle were in the riparian zone between farms, the influence of pasture characteristics and microclimate on cattle temporal/spatial distribution were evaluated. Microclimatic changes and abnormal rainfall

amounts that caused flooding in summer 2008, may have contributed to differences of cattle distribution within the riparian area between years.

Botanical composition. Cattle locations were regressed against botanical composition of the pastures, but no relationship existed.

Microclimate variables. Cattle locations and microclimatic factors were paired to evaluate the temporal/spatial distributions within the riparian area of a pasture. Of the climatic variables, ambient temperature most accurately predicted the probability of cow presence in the riparian area.

Shade distribution. Using Geographical Information Systems (GIS) software, image analysis of aerial photos showed that pasture shade across all farms ranged from 27.2 to 72.8 percent of the pasture area. Riparian shade ranged from 55.5 to 79.1 percent of the riparian area and accounted for 2.8 to 58.4 percent of the total pasture shade. In spite of this variation in pasture shade, proportion of cow distribution was only weakly related to the proportion of total pasture shade in the riparian zone, particularly in the summer and fall when the effects of shade should have been the greatest.

In contrast to the riparian shade effects, the proportion of cattle observations in riparian area was related to proportion of riparian area in total pasture. Proportion of riparian zones in the pastures accounted for 76, 63, and 92 percent of the variation in the proportion of observations of cows within the riparian zones of the pastures during the spring, summer, and fall grazing seasons.

Preliminary results imply that the presence of cattle in riparian zones of pastures increased with increasing ambient temperature and the proportion of pasture as riparian area. The proportion of time that cattle were in the riparian area of the pastures was only weakly related to the proportion of the total pasture shade in the riparian zones. However, these pastures contained considerable shade outside of the riparian area. Surprisingly, the presence of cattle in riparian zones was not related to the proportion of tall fescue in pastures.

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Table 1. Mean percentage of observations of cattle within the water source and riparian zones of pastures in spring, summer, and fall seasons on five farms in 2007 and 2008.

	2007 and 2008 grazing seasons, percent of observations					
Name	Water source			Riparian zone		
	Spring	Summer	Fall	Spring	Summer	Fall
Farm A	1.3[a]	0.7[b]	0.9	17.5[b]	10.5[bc]	13.2[b]
Farm B	0.2[b]	1.7[ab]	1.1	2.5[c]	5.8[c]	5.4[b]
Farm C	1.4[ab]	2.2[a]	1.0	17.3[ab]	10.4[bc]	9.5[b]
Farm D	1.9[a]	1.2[ab]	1.0	26.8[a]	19.6[a]	22.4[a]
Farm E	1.2[ab]	2.8[a]	1.4	17.6[ab]	27.3[a]	27.7[a]

[a,b,c]Means with different superscripts differ by (P=0.05) between farms within seasons (columns).