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Effects of Stocking Rate, Botanical Composition, and Stream Bank Erosion on the Physical Characteristics of the Streamside Zones of Pastures (Three-year Progress Report)

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Abstract

Grazing management practices that allow cattle to congregate near pasture streams may result in the loss of vegetative cover and promote accumulation of manure near the streams, increasing the risk of nonpoint source pollution of the stream

Keywords

RFR A9081, Animal Science, Natural Resource Ecology and Management

Disciplines

Agricultural Science | Agriculture | Animal Sciences | Ecology and Evolutionary Biology

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Introduction

Grazing management practices that allow cattle to congregate near pasture streams may result in the loss of vegetative cover and promote accumulation of manure near the streams, increasing the risk of nonpoint source pollution of the stream.

The objective of this project was to evaluate the effects of stocking rate of pastures and the botanical composition of the pastures' streamside zone on the forage sward height, the proportions of bare and manure-covered ground, and erosion along the banks of pasture streams.

Materials and Methods

Thirteen pastures with streams, ranging from 7 to 265 acres, on 12 cooperating farms in the Rathbun Lake watershed were used. Producers of these operations recorded the number of cows, heifers, and bulls stocked in these pastures as they entered and left the pasture from November, 2006 to November, 2009.

Bi-monthly, from May through November, proportions of bare and manure-covered ground and the forage sward height and

species were measured on both sides of the stream at up to 30 locations at 100-ft intervals along the stream in each pasture. Proportions of bare and manure-covered ground were measured perpendicular to the stream by a 50-ft line, beginning at the edge of the stream. Sward height was measured with a falling plate meter (8.8 lb/yd²) and vegetation species was identified at the mid-point of the line.

Erosion measurements were taken during the spring, summer, and fall grazing seasons of 2007 to 2009.

Differences in the proportions of bare and manure-covered ground, forage sward height, and the proportion of each vegetative species between farms were analyzed. Regression and stepwise multiple regression equations were calculated.

Results and Discussion

Stocking rate. The period stocking rate per stream length was related to the forage sward height measured approximately 25 ft from the stream. In stepwise multiple regressions, sward heights in the streamside zone decreased as the proportions of tall fescue, legumes, bluegrass, and annual stocking rate of cow-days/stream ft increased ($r^2=0.56$).

Bare soil. Bare soil proportions along the stream banks did not differ between sampling intervals, but did differ by farms. Proportion of bare soil along the banks was only weakly related to the period stocking rate per stream length. In stepwise multiple regressions, bare soil decreased as reed canarygrass increased and legumes decreased. These variables accounted for 35% of the variation in the proportion of bare soil. Because annual

stocking rate was not accounted for in the variation, natural factors like stream flow and rainfall may have larger effects on bare soil adjacent to streams than cattle traffic.

Manure-covered soil. The proportion of manure-covered soil within 50 ft of the stream increased as the annual stocking rate per stream ft increased. In multiple stepwise regressions, the proportion of manure-covered ground increased as the annual stocking rate of cow-days per stream ft and tall fescue and bluegrass increased and as broadleaf weeds and sedge decreased. These variables accounted for 47% of the variation in manure-covered soil and may represent effects of stocking rate of areas with the most commonly grazed species.

Vegetation species. Mean sward height across sampling intervals decreased from July to November implying that stream banks may be more susceptible to erosion from precipitation runoff over the winter season. Farms with the least proportion of tall fescue and highest proportion of reed canarygrass also had the least amount of bare soil in the riparian areas. These factors may provide a critical understanding of vegetative species that may help decrease the percentage of bare soil in riparian areas of pastures. Variations in species prevalence may imply that cattle are selecting more palatable vegetative species early in the growing season and decreasing the sward height late in the grazing season, which allows more aggressive vegetative species to take over the riparian areas of pastures.

Erosion rates. The greatest amount of erosion occurred during the spring grazing season, which may be due to above normal rainfall, prior to entering or exiting winter, resulting in stream banks losing their tensile strength, causing erosion to occur. Because annual stocking density per stream ft was not correlated to annual stream bank erosion, natural factors like stream flow and rainfall have larger effects on stream bank erosion than cattle traffic. Management strategies may be implemented during periods of excessive rainfall to decrease the timing and frequency of cattle being located in the streamside zones.

Results imply that increasing stocking rate will result in decreases in sward height and increases in manure-covered soil in streamside zones. However, the effects of stocking rate on the proportion of bare soil adjacent to streams are small.

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Table 1. Average sward height, bare ground, and manure-cover in the streamside zones of pastures across sampling months.

Sampling months	Sward height (in.)	Bare soil (%)	Manure-covered soil (%)
May	4.67 ^{ab}	16.44	0.52 ^{ab}
July	5.54 ^a	14.74	0.48 ^{ab}
September	3.43 ^{ab}	15.99	0.34 ^b
November	1.55 ^c	15.54	0.56 ^a
Average	3.80	15.68	0.48

^{a,b,c}Within a column, least squares means without a common subscript differ ($P < 0.05$).