

Impact of Grazing Management on Cattle Distribution and Physical Characteristics of the Riparian Zones of Pastures

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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 accumulation of manure near pasture streams. These conditions may cause loading of the streams with sediment, phosphorus, and pathogens carried in surface runoff. The loss of vegetation and increased compaction associated with concentrated cattle traffic may promote stream bank erosion causing further impairment of stream water quality. The objectives of the current study were 1) to evaluate cattle distribution patterns, in relation to a pasture stream/pond and 2) to evaluate the effects of stocking rate and the botanical composition of the pastures' riparian zone on the forage sward height and the proportions of bare and manure-covered ground along the banks of pasture streams.

Materials and Methods

Five pastures on five cooperating farms (objective 1), including the McNay Research Farm, and 13 pastures on 12 cooperating farms (objective 2), including the McNay Research Farm in the Rathbun Lake watershed, were identified as appropriate for the project in the fall of 2006. Pastures ranged in size from 7 to 265 acres and had stream reaches of 948 to 5,511 ft that drained watersheds of 624 to 13,986 acres. Owners of these operations recorded the number of cows, heifers, and bulls stocked in these pastures as they entered or left the pasture from November 2006 to November 2007.

Cattle distribution. Two to three cows per pasture were fitted with GPS collars for a two week period in the spring, summer, and fall of 2007. Cattle position was recorded every 10 minutes during sampling periods. Proportions of time that the cattle were in a pasture stream/pond or within 50 ft of a pasture stream/pond were determined.

Pasture physical characteristics. Bi-monthly, from May through November 2007, proportions of bare and manure-covered ground and the forage sward height and vegetation species were measured on both sides of the stream at 100-ft intervals along the stream in each pasture. Proportions of bare and manure-covered ground were measured perpendicular to the stream. Sward height was measured with a falling plane meter (8.8 lb/yd²) and vegetation species was identified at 28 ft from the stream. Botanical composition was calculated as a proportion of the major vegetative species located at each vegetated site.

Cow-days for each pasture were calculated. Stocking rates were calculated on area and distance basis by dividing by the pasture acres and stream reach length for the total year.

Results and Discussion

Cattle distribution. Mean proportions of observations when cattle were in the streams/ponds in summer (1.9%) did not differ from fall (1.3%), but were greater ($P < .10$) than spring (0.9%). Cattle distribution among other pasture areas did not differ between seasons. Mean proportions of time cattle spent in any of the designated zones differed ($P < .05$) among farms. The proportion of time that the cattle were in and within 50 ft of a stream/pond increased with increasing ambient temperature ($r^2 = 0.37$).

Pasture physical characteristics. Annual stocking rate at the 13 sites, means (ranges), were 123 (0–290) cow-days/acre and 3.66 (0–10.2) cow-days/ft of stream. Mean sward height (10.7 cm), bare soil (13.8%), and manure-covered soil (0.61%) differed ($P < .05$) between the 13 pastures. Variability between farms was particularly great for the sward height and proportion of bare soil. Mean proportions of tall fescue (46.3%), reed canarygrass (20.8%), legume (0.75%), broadleaf weeds (15.4%), and brush (2.8%) differed ($P < .05$) between farms. The proportions of smooth brome grass, orchardgrass, timothy, sedge, and weed grasses in the riparian areas of all farms were low and did not differ between farms.

Mean sward height across the 13 pastures was greater ($P < .05$) in July (6.3 in.) than in September (3.8 in.) and November (1.5 in.). Mean sward height of the pastures in May (4.2 in.) was also greater than in November. The low sward height of pastures in November implies that the stream banks might be susceptible to erosion and sediment and nutrient losses in runoff over winter. Mean proportions of ground that was bare or manure-covered over the 13 pastures did not differ between months. In May, the mean proportions of Kentucky bluegrass, smooth brome grass, and orchardgrass were greater ($P < .05$) and the mean proportion of tall fescue was lower ($P < .05$) in the 13 pastures than in the other months. The proportions of vegetated sites with broadleaf weeds were greater ($P < .05$) in July and September than in May and November. The proportion of vegetated sites with brush was greater ($P < .05$) in November than in May and July.

Annual stocking rate per acre was most highly related to the forage sward height ($y = 22.96 - 0.191x + 0.0005x^2$; $r^2 = .35$). This equation implies that to maintain 4 in. of forage on stream banks, annual stocking rate could not exceed 88 cow-days/acre in the area adjacent to

a stream. The proportion of bare soil along the stream banks was only mildly related to the annual stocking rate per acre ($r^2 = .20$). The proportion of bare soil along stream banks also increased as the proportion of tall fescue in the pastures increased ($r^2 = .27$) and decreased as the proportion of reed canarygrass increased ($r^2 = .41$). Because the proportion of the bead line used for measurement of bare soil that went down the bank relative to that on top of the bank varied between pastures depending on the depth of the channel and a high proportion of the sites without ground cover were down the banks, the small relationship of stocking rate to the proportion of bare soil may imply that natural factors like stream flow might have larger effects on bare soil than cattle traffic.

The proportion of manure-covered ground increased as the annual stocking rate per acre increased ($r^2 = .47$). The proportion of manure-covered ground also increased as the proportion of tall fescue in the pastures increased ($r^2 = .24$).

Results imply that increasing stocking rate will result in significant decreases in sward height and increases in manure cover in riparian zones. While increasing the stocking rate will also tend to increase the proportion of bare soil, this effect was relatively small.

Acknowledgements

The authors thank the cooperating producers and the personnel in the Rathbun Land and Water Alliance for their assistance with this project. The material in this report is based on work supported by the Cooperative State Research, Education, and Extension Service, U.S. Department of Agriculture, under Award No. 2006-51130-03700. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect the view of the U.S. Department of Agriculture.