Impacts of Grazing Management on Cattle Distribution and Non-Point Source Pollution from Pastures in the Central United States

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Introduction There are concerns that cattle tend to congregate in riparian areas which are highly susceptible to environmental damage , resulting in impaired water quality from stream bank erosion and manure deposition (CAST , 2002) . Few studies have evaluated the effects of grazing management on water quality in the humid Midwestern region of the USA . Climate , topography , forage species , and management practices may influence animal behavior , as it relates to use of riparian areas and the subsequent impacts of grazing on stream bank erosion and water quality . The objective of the current study was to evaluate the effects of grazing management , the availability of off-stream water sources , and micro-climate on the temporal/spatial distribution of cattle in pastures with streams .

Materials and methods Six 12 .1-ha cool-season grass pastures , each bisected by a 196 meter stream segment , were grouped into 2 blocks and assigned one of three grazing management treatments . Treatments included : continuous stocking with unrestricted stream access , continuous stocking with stream access restricted to a 4 .9-meter wide crushed rock crossing , and 5-paddock rotational stocking with one paddock in the riparian zone . Each pasture was stocked with 15 fall-calving Angus cows from mid-May through mid-October in 2005 , 2006 , and 2007 .

Cattle distribution patterns were monitored by visual observation and with GPS collars (AgTraX^{tm}-BlueSky Telemetry , Aberfeldy , Scotland) . During visual observations , cattle distribution patterns and activity were monitored from 0600 to 1800 hours on two consecutive days from May through September of 2005 through 2007 . One cow per pasture was fitted with a GPS collar for 2 weeks per month from May through September in 2006 and 2007 . Collars recorded cattle position every 10 minutes 24 hours per day . The effects of off-stream water on cattle distribution was evaluated by providing access to off-stream water to cows during the second week in which cows were fitter with GPS collars in May , July , and September . Off-stream waters were located a minimum distance of 220 meters from the stream on both sides of the stream . Cattle location was defined as within stream , 0 to 34 meters from the stream , 34 to 68 meters from the stream , and greater than 68 meters from the stream .

Results and discussion Based on both visual observation and GPS collar data , cattle managed by continuous stocking with unrestricted stream access spent a greater ($P<0.05$) proportion of time in and within 34 meters of the stream than did cattle managed by continuous stocking with restricted stream access or rotational stocking . Cattle in unrestricted stream access pastures spent an average of 6 .1% of the time within the stream and an additional 15 .7% of the time within 34 meters of the stream over the 3 grazing seasons , based on visual observation data . Cattle managed by rotational stocking spent 0 .3 and 3 .5% of the time in and within 34 meters of the stream , respectively , while cattle managed by continuous stocking with restricted stream access spent 1 .2 and 0 .8% of the time in or within 34 meters of the stream , respectively , based on visual observation . The proportions of time cattle spent in or within 34 meters of the stream estimated by GPS collars were 1 .2 and 10 .6% in pastures managed by unrestricted stream access . The difference between visual observation and GPS collar data is likely caused by the visual observations being conducted during daylight hours only , while GPS collar data is collected 24 hours per day . With warmer temperatures during daylight hours , cattle are more likely to congregate near the stream in an attempt to regulate body temperature .

In 2006 , the presence of an off-stream water source decreased ($P<0.05$) the proportion of time cattle spent within the stream by approximately half when cattle had unrestricted stream access . A similar effect was not observed in 2007 , possibly because of differences in the presence of natural off-stream water sources associated with precipitation between the two years .

At higher ambient temperatures , cattle distribution patterns within pastures were altered as cattle attempted to regulate body temperatures . At ambient temperatures above 27℃ , the proportion of time cattle spent within 34 meters of the stream increased ($R^2=0.85$) when cattle were managed by continuous stocking with unrestricted stream access .

Conclusions The amount of time cattle spend in or near pasture streams may be reduced with improved grazing management that alter cattle behavior ; this alteration in cattle distribution may result in positive water quality impacts .

Reference

Council for Agricultural Science and Technology (CAST) . 2002 . Environmental impacts of livestock on U .S .grazing lands . Issue Paper 22 .Ames , IA .