319 Non-point Source Pollution Program

Eastern South Dakota Riparian Demonstration Project

South Dakota State University

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Vegetation use of riparian pastures

Seven riparian pastures along tributaries of the Big Sioux River in eastern South Dakota were monitored for the impact of livestock grazing on litter cover, vegetative cover, plant height, and visual obstruction measurements. Transects running parallel to streams at a distance of 5, 25, 50, 75, and 100 m away from the streams were established at 3 to 4 sites per pasture. All sites were monitored in spring (June) and late summer (August) of 2008. Three of the sites were rotationally grazed and 4 sites were continuously grazed. Table 1 and 2 describes the effect of livestock distribution across the pasture as a function of transect distance from the stream in the spring and summer. Plant height and visual obstruction were significantly different at distances from the stream. These data show that cattle did not overgraze the areas adjacent to the stream (5 m away), but tended to graze more between 25 and 50 m away from the stream. There were no differences in percent litter or vegetative cover at different distances away from the stream. The cover of litter and vegetation was higher as the season progressed (Tables 1 and 2). There was no difference in any of the measurements between rotational grazing and season long continuous grazing systems. This was likely due to the fact that pasture size at these locations were generally less than 100 acres and distances to water or other parts of the pasture was never greater than 0.5 miles.

Runoff and sediment yield

Sprinkle infiltrometer measurements were made during the summer of 2007 and 2008 at two western and five eastern sites in South Dakota. Runoff and sediment yield were estimated using a Cornell sprinkle infiltrometer (Fig. 1). Infiltration runs were made on dry field conditions. Rate of application was approximately 0.5 cm/min for 45 minute runs. This was equivalent to applying at a rate of 11.8 inches/hr. Additional vegetation measurements of plant height, vegetative cover, litter cover, and vegetative weight were made for the modeling purposes. Soil moisture, bulk density, and slope also were made. Average runoff ranged from 0.08 cm/min at Summit to 0.36 cm/min at Sturgis (Table 3). Average sediment yield was greater for the two western South Dakota sites compared to the five eastern sites. This was supported by the fact that vegetative and litter cover tended to be less at sites from the mixed-grass prairie in western South Dakota compared to tallgrass prairie sites in eastern South Dakota. In addition, western South Dakota sites were comprised of clayey or dense clay ecological sites compared to silty and thin upland ecological sites in the east which would have coarser soil textures.

These infiltration runs would mimic intense, short-lived rainfall events. The fact that very little sediment yield was produced from the eastern South Dakota sites suggests that erosion from these grasslands is actually quite low. Sedimentation of streams feeding into the Big Sioux River would more likely be due to the process of natural stream bank erosion or sediment entering the stream from hoof action of livestock activity and not from overland flow. In western South Dakota, sedimentation of streams could come from soil erosion from uplands as indicated by our sediment yield estimates. Another mechanism of sediment loadings that our measurements technique does not explain is the process of overland flow resulting in gully formation. During intense rainfall events, overland flow could create cutting and gulley erosion. At the high experimental application rates, 66 and 72% of the water applied ran off at Cottonwood and Sturgis, respectively. At the eastern South Dakota locations, runoff rate accounted for 16 to 64% of the application rate.

Conclusion

These data suggest that livestock grazing of riparian pastures in eastern South Dakota, does not impact sediment loading from the surrounding uplands. Use of vegetation was fairly even across the pasture as indicated from the vegetation measurements at different distances from the stream. Since riparian pasture size was relatively small at the eastern South Dakota locations, livestock distribution was even. Cattle tend to not overgraze near the stream. One reason might be the fact that vegetation is not as palatable and/or hummocky terrain deters livestock from over using these areas. To minimize stream bank erosion and reduce direct access to streams by livestock, alternative water sources, rock crossings, and fencing could be effective strategies. Fencing out wide buffers alongside the stream may not be necessary.

Table 1. Litter cover, vegetative cover, plant height, and visual obstruction measured at seven sites in eastern South Dakota, June 2008.

	Distance from stream (m)				
	5	25	50	75	100
Litter, %	27.9	28.2	29.0	30.3	30.8
Vegetative cover, %	45.2	43.1	40.1	42.7	48
Plant height, cm	13.5 a	11.4 b	12.0 ab	13.1 ab	14.5 a
Visual obstruction, cm	10.3 a	8.7 b	9.1 b	10.1 a	10.7 a

[a,b]Means followed by a similar letter are not significantly different (P>0.05).

Table 2. Litter cover, vegetative cover, plant height, and visual obstruction measured at seven sites in eastern South Dakota, August 2008.

	Distance from stream (m)				
	5	25	50	75	100
Litter, %	72.6	73.6	77.1	75.9	78.4
Vegetative cover, %	59.6	55.9	57.9	59.8	63.4
Plant height, cm	13.8	11.1	13.2	14.6	15.0
Visual obstruction, cm	11.9 ab	10.6 b	11.2 b	13.1 a	13.8 a

[a,b]Means followed by a similar letter are not significantly different ($P>0.05$).

Table 3. Summary statistics of runoff, sediment yield, vegetation and soil parameters adjusted to a constant sprinkler application rate of 0.5 cm/min.

Site	Parameter	Mean	Stdev	Min	Max
Brookings	runoff (cm/min)	0.11	0.07	0.02	0.24
n=24	sediment (kg/ha)	13.01	18.73	0.14	65.88
	Plant height (cm)	27.96	17.13	7.00	50.00
	Veg cover (%)	62.71	19.89	25.00	95.00
	Litter cover (%)	78.33	16.53	15.00	95.00
	Veg weight (g/0.25m^2)	57.00	28.47	19.50	115.60
	Bulk density	1.32	0.09	1.22	1.62
Cottonwood	runoff (cm/min)	0.33	0.08	0.11	0.43
n=34	sediment (kg/ha)	333.22	615.34	0.43	2882.98
	Plant height (cm)	16.65	8.40	3.00	30.00
	Veg cover (%)	31.26	13.44	15.00	60.00
	Litter cover (%)	53.88	26.59	12.00	95.00
	Veg weight (g/0.25m^2)	23.76	8.99	6.65	38.61
	Bulk density	1.31	0.13	1.07	1.60
Clear Lake	runoff (cm/min)	0.32	0.09	0.08	0.47
n=32	sediment (kg/ha)	40.81	46.92	4.07	200.97
	Plant height (cm)	15.53	7.04	6.00	33.00
	Veg cover (%)	27.59	10.32	15.00	65.00
	Litter cover (%)	81.44	25.29	10.00	98.00
	Veg weight (g/0.25m^2)	33.29	20.22	9.06	86.31
	Bulk density	1.13	0.20	0.10	1.25
Colman	runoff (cm/min)	0.27	0.14	0.00	0.48

n=46	sediment (kg/ha)	62.64	76.04	0.00	268.36
	Plant height (cm)	8.79	5.59	3.00	25.00
	Veg cover (%)	51.52	19.60	20.00	85.00
	Litter cover (%)	63.91	32.53	15.00	100.00
	Veg weight (g/0.25m^2)	32.21	23.75	3.60	86.87
	Bulk density	1.18	0.08	1.01	1.34
Aurora	runoff (cm/min)	0.25	0.14	0.01	0.47
n=41	sediment (kg/ha)	77.51	91.80	0.00	467.10
	Plant height (cm)	12.35	7.50	3.00	28.00
	Veg cover (%)	39.66	16.36	15.00	85.00
	Litter cover (%)	74.10	21.61	15.00	100.00
	Veg weight (g/0.25m^2)	33.22	22.51	4.22	80.37
	Bulk density	1.39	0.13	0.89	1.62
Sturgis	runoff (cm/min)	0.36	0.09	0.10	0.46
n=24	sediment (kg/ha)	706.83	1070.03	2.13	4939.88
	Plant height (cm)	23.00	6.52	13.00	35.00
	Veg cover (%)	39.92	15.26	15.00	70.00
	Litter cover (%)	27.00	34.81	1.00	90.00
	Veg weight (g/0.25m^2)	47.83	23.63	20.50	104.55
	Bulk density	1.50	0.12	1.28	1.70
Summit	runoff (cm/min)	0.08	0.09	0.00	0.34
n=28	sediment (kg/ha)	25.58	30.71	0.00	135.18
	Plant height (cm)	18.07	6.43	4.00	27.00
	Veg cover (%)	38.96	18.72	15.00	85.00
	Litter cover (%)	84.04	17.24	40.00	98.00
	Veg weight (g/0.25m^2)	40.30	23.74	12.75	94.00
	Bulk density	1.08	0.09	0.88	1.32

Figure 1. Cornell sprinkler infiltrometer.