BEAVER *(CASTOR CANADENSIS)* HABITAT USE IN EASTERN SOUTH DAKOTA, 2000-2001

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ABSTRACT

The quality of riparian habitat and related habitat use by beavers *(Castor canadensis)* was examined during 2000 and 2001 in grazed and ungrazed areas along the Big Sioux River in eastern South Dakota. Actual density of trees was significantly higher in ungrazed areas than in grazed areas ($P < 0.01$). Beaver activity was evident on 85 of 527 (16.1%) trees sampled. Beavers did not select tree species for cutting according to availability. Beavers selected for green ash and peachleaf willow. Over half (53%) the trees damaged by beaver either stayed alive or resprouted. Trees cut by beaver were significantly smaller in diameter ($P < 0.05$) than uncut trees. The amount of grazed habitat along the Big Sioux River increased from 45% to 80% since 1987.

Keywords

Beaver, Big Sioux River, *Castor canadensis,* Riparian Habitat

INTRODUCTION

It has been widely accepted that riparian habitat aids in reducing soil erosion, stabilizing riverbanks and providing habitat for prairie wildlife. Beavers *(Castor canadensis)* rely on riparian habitat for food and shelter and are capable of enhancing riparian habitat for fish and wildlife by damming rivers and streams (Hanson and Campbell 1963, Rutherford 1964). However, some foresters, as well as many landowners, view these beaver activities as detrimental to riparian habitat (Miller 1985), the only naturally occurring forest in much of the Northern Great Plains. Riparian habitat in eastern South Dakota has been degraded due to cultivation of agricultural crops and livestock grazing (Smith and Flake 1983). Dieter and McCabe (1989) found grazing and farming altered 45% of the habitat adjacent to the Big Sioux River. There has been concern that beavers may be adding to the loss of riparian habitat by removing additional trees.

The objectives of this study were: 1) to compare habitat use by beavers in ungrazed areas with grazed areas along the Big Sioux River, 2) to determine if

beaver activity is accelerating the destruction of riparian habitat along the Big Sioux River, 3) to determine the changes in riparian habitat along the Big Sioux River over the past 15 years by comparing data collected in this study with that collected by Dieter (1987).

STUDY AREA

The study area was located in the Big Sioux River Basin in eastern South Dakota. The Big Sioux River originates in southwestern Roberts County, South Dakota, and flows in a southerly direction to its confluence with the Missouri River at Sioux City, Iowa. The basin contains about 117,160 square km of contributing area of which 68,880 square km are in South Dakota. The river occupies a broad, shallow valley from its source to approximately Sioux Falls, South Dakota. The South Dakota portion of the river contains many small, intermittent streams. Width of the river channel within the study area varies from 15 to 40 m and water depth ranges from 0.3 to 1.7 m. The Big Sioux Basin contains level to gently sloping silty and loamy soils as well as undulating to sloping silty soils. The land along the Big Sioux River is primarily used for livestock grazing and farming. Grazed areas are characterized by widely scattered large trees with no regeneration and/or little to no understory. In contrast, ungrazed areas have a thick understory and are heavily forested by small trees interspersed by a few larger trees (Smith and Flake 1983).

METHODS

During summer of 2000 and 2001, we surveyed the riparian zone on the main river channel of the Big Sioux River from near Watertown, South Dakota to near Trent, South Dakota in an effort to quantify the existing riparian habitat and to estimate beaver use of trees. Sample plots were defined as strip transects three meters wide with lengths being the distance in meters from the shoreline to the outer edge of the wooded habitat. Sample plots were randomly selected by traveling a timed distance (10 to 99 seconds) downstream from the northern boundary of the study area at a moderate speed (5 mph) in a motorized boat. At each sample plot, we walked a strip transect carrying a rod (3m) from the water's edge toward a fixed point on the upland. Each woody plant that touched the rod was counted in the strip transect, and species and diameter at breast height (DBH) were recorded. We measured the distance from the water to each tree and the total length of each strip transect. All trees that were alive and/or damaged by beaver were included in the sample, but those that had died due to flooding or disease were omitted.

Riparian habitat along each sample plot was categorized according to land use as grazed or ungrazed. A sample plot was considered grazed if livestock, or direct evidence of livestock, were present in the immediate area. A sample plot was considered ungrazed if no sign of grazing activity was visible in the immediate area. Actual density (AD = Number of trees of species A/ha), and relative

density (RD = Number of trees of species A/total number of trees x 100) were calculated for all trees sampled. All trees sampled were examined for signs of beaver damage and classified as having fresh cuts, old cuts, or no damage. Those with fresh or old beaver damage were further classified according to the extent and type of cutting: 1) fresh cuts, 2) old cuts, 3) alive and standing but damaged, and 4) cut with resprouting. We defined fresh cuts as those occurring in the post-winter period of the current year. Old cuts were those occurring in a previous year and causing death of the tree. The third category included trees that had suffered obvious beaver damage, but were not killed by this activity. The fourth category included all trees that were cut by beavers and exhibited regrowth. The number of trees cut by beavers, and relative cuts (Cr = Number of trees of species A cut/total trees cut x 100), were calculated for all tree species. Statistical data analysis was done with SAS (SAS 1999) using a combination of chi-square analysis and t-tests.

RESULTS

We sampled 412 strip transects, with a combined distance of 2.22 km and an area of 0.66 ha, along the main channel of the Big Sioux River. Of the 412 strip transects, grazed habitat accounted for 330 (80.1%), and ungrazed habitat accounted for 82 (19.9%) transects. Ten tree species were encountered in the strip transects. Green ash *(Fraxinus pennsylvanica)*, boxelder *(Acer negundo)*, and northern hawthorn *(Crataegus rotundifolia)* were found predominantly in grazed habitats (Table 1). Silver maple *(Acer saccharinum)*, peachleaf willow *(Salix amygdaloides)*, common buckthorn *(Rhamnus cathartica)*, and cottonwood *(Populus deltoides)* were found predominantly in ungrazed habitats (Table 1). American elm *(Ulmus americana)* was found equally in both habitats. Green ash, peachleaf willow, and boxelder were found throughout the river system, but silver maple was found only in the southern reaches of the Big Sioux River.

AD was significantly higher ($p \geq 0.01$) in ungrazed habitat (1067 trees/ha) than in grazed habitat (529 trees/ha). Green ash, boxelder, northern hawthorn, and bur oak *(Quercus macrocarpa)* had higher AD in grazed habitats. All other species had higher AD in ungrazed habitats. Green ash, boxelder, American elm, northern hawthorn and burr oak had higher RD in grazed habitats (Table 2).

Beaver Usage

Beaver activity was evident on 125 of 527 (24.0%) of the trees sampled (Table 3). There was no difference in the percentage of trees cut between grazed and ungrazed habitats. Peachleaf willow (33%) and green ash (32%) were the two most heavily utilized tree species (Figure 1). The relative proportion of both species cut was greater than their RD. American elm was the only other species sampled that had a greater proportion cut than its RD. No beaver activity was seen on common buckthorn, northern hawthorn, bur oak and wild plum. Beavers did not select trees according to their availability (Figure 1). Chi-square

Table 1. Species, number, and percentage of trees sampled in grazed and ungrazed habitats along the Big Sioux River in eastern South Dakota, 2000-2001.

Species	Ungrazed N (%)	Grazed N (%)	Total	Overall Percent
Green ash *Fraxinus pennsylvanica*	37 (30)	87 (70)	124	23.5
Silver maple *Acer saccharinum*	99 (98)	2 (2)	101	19.2
Peachleaf Willow *Salix amygdaloides*	71 (76)	23 (24)	94	17.8
Boxelder *Acer negundo*	23 (33)	46 (67)	69	13.1
Common Buckthorn *Rhamnus cathartica*	51 (98)	1 (2)	52	9.9
Cottonwood *Populus deltoides*	34 (100)	0 (0)	34	6.5
American elm *Ulmus americana*	13 (52)	12 (48)	25	4.7
Northern Hawthorn *Crataegus rotundifolia*	0 (0)	10 (100)	10	1.9
Bur Oak *Quercus macrocarpa*	1 (20)	4 (80)	5	0.9
Wild plum *Prunus americana*	2 (100)	0 (0)	2	0.4
Unknown*	1	10	11	2.1
Totals	**332**	**195**	**527**	**100.0**

* No identifiable features on any part of the dead tree

analysis indicated that green ash, peachleaf willow, and American elm were selected (P=0.05) for over other species.

There were significant differences in the mean DBH between cut and uncut trees. Green ash had a significantly smaller ($P \leq 0.05$) mean DBH for cut (42.3 cm) than uncut trees (73.7 cm). Cottonwood had a significantly larger ($P \leq 0.05$) mean DBH for cut (20.6 cm) than uncut trees (8.5 cm). The mean DBH of all cut trees (30.8 cm) was significantly ($P \leq 0.05$) less than for uncut trees (42.2 cm) (Table 4). Beavers selected to cut small trees in both habitat types. A high percentage (80%) of trees cut by beaver were less than 30 cm DBH (Figure 2).

DISCUSSION

In order to assess the impact of beavers on riparian habitat, a basic concept of what the habitat consists of is necessary. Dieter and McCabe (1989) found

Table 2. Actual density (AD=trees/ha), and relative density (RD =density of trees of species A/total density of trees x 100) of 10 tree species sampled along the Big Sioux River in eastern South Dakota, 2000-2001.

	Ungrazed		Grazed	
Trees	**AD**	**RD**	**AD**	**RD**
Green Ash	119	11.2	249	47.0
Silver Maple	319	29.9	6	1.1
Peachleaf Willow	229	21.4	66	12.4
Boxelder	74	7.0	131	24.9
Common Buckthorn	165	15.4	3	0.5
Cottonwood	110	10.3	0	0
American Elm	42	3.9	34	6.5
Northern Hawthorn	0	0	29	5.4
Bur Oak	3	0.3	11	2.2
Wild Plum	6	0.6	0	0
Total	***1067**	**100**	***529**	**100**

* Actual densities significantly different at the 0.01 level with chi-square = 13541.5, 18df

Table 3. Density of trees damaged by beaver by habitat classification along the Big Sioux River in eastern South Dakota, 2000-2001.

Land Use	**Number of Trees Sampled**	**Number of Trees cut (%)**	**Number of Trees damaged but alive* (%)**	**Density (Trees cut/ha)**
Grazed	195	34 (17.4)	18 (9)	97.1
Ungrazed	332	51 (15.4)	22 (7)	164.5
Totals (Avg.)	**527**	**85 (16.1)**	**40 (8)**	**(128.8)**

* May have exhibited resprouting from a cut or just have been partially cut

that grazing or farming altered 45% of the sampled riparian habitat around the Big Sioux River. We found that over a 15-year period, the amount of habitat along the Big Sioux River altered by grazing or farming had increased to 80%. The effects of livestock grazing, which has caused a dichotomy of habitat conditions along the Big Sioux River, can influence beaver activity (Munther 1981). Dense thickets of willows were found along areas of ungrazed habitat. Ungrazed areas have an abundance of small trees of common species available for use by beavers, (Novakowski 1967, Northcott 1971, Jenkins 1975 and 1979, Pinkowski 1983, Dieter 1987), while grazed areas have few large trees and almost no small trees available for beaver use (Dieter 1987). Livestock activity eliminates small diameter trees and stems, causing beavers living in grazed areas to select larger trees to cut. Green ash, silver maple, and peachleaf willow were the three most abundant tree species sampled, accounting for over 60% of the total. Green ash and boxelder persist in grazed areas, but there is little regeneration. Also, grazed

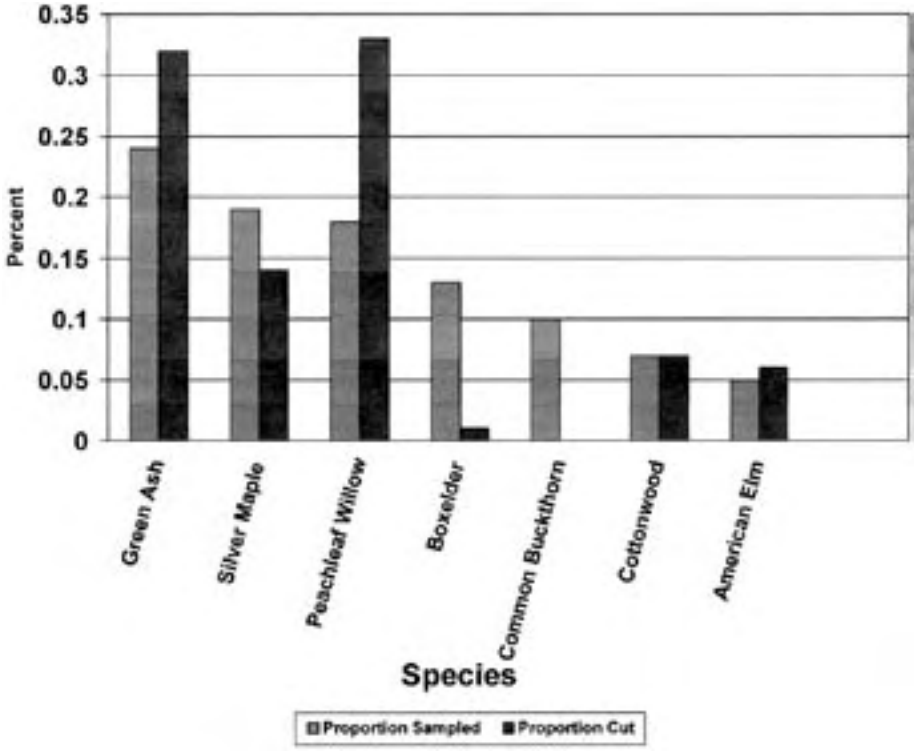

Figure 1. Percent of species of trees sampled and those cut by beaver along the Big Sioux River in eastern South Dakota, 2000-2001.

Table 4. Diameter at breast height (DBH) of the most abundant tree species cut by beaver along the Big Sioux River in eastern South Dakota, 2000-2001.

	Mean DBH (cm)	
Species	**Uncut**	**Cut**
Green ash *Fraxinus pennsylvanica*	73.7	42.3*
Silver maple *Acer saccharinum*	30.1	30.4
Peachleaf Willow *Salix amygdaloides*	68.1	45.8
Cottonwood *Populus deltoides*	8.5	20.6*
American Elm *Ulmus americana*	49.0	49.8
Means	**42.2**	**30.8***

*Statistically significant at the 0.05 level

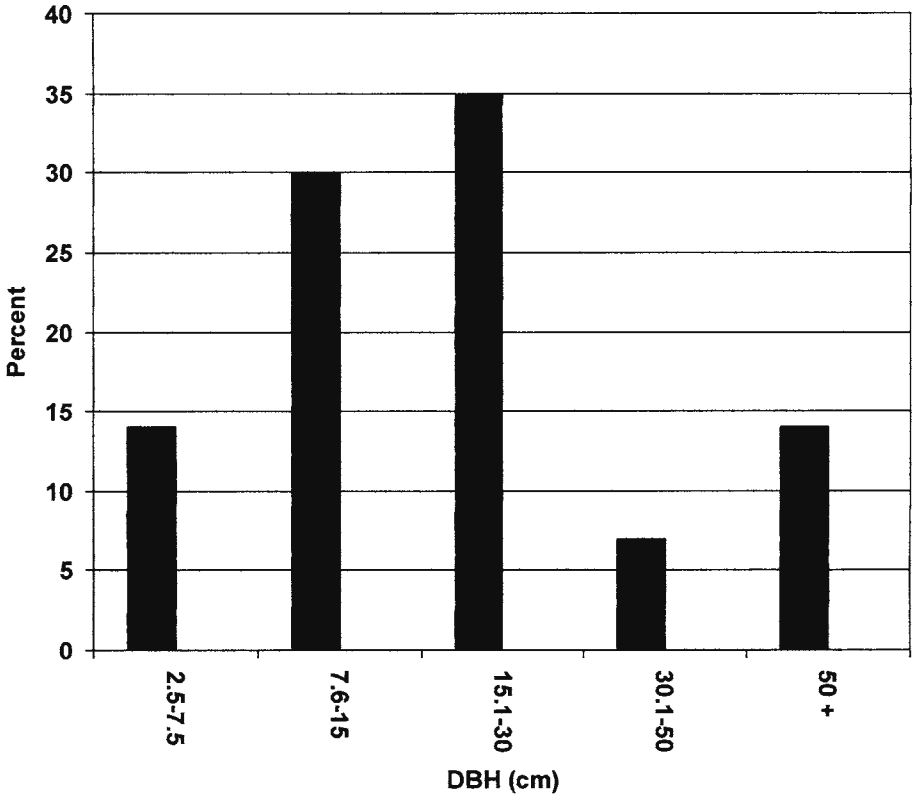

Figure 2. Proportion of trees cut by beaver based on diameter at breast height (DBH) along the Big Sioux River in eastern South Dakota, 2000-2001.

areas had a low density of large trees, while ungrazed areas had high density of trees of various sizes. Beavers prefer small diameter trees near waterways due to the ease of cutting and transporting to lodge and cache sites (Dieter 1987).

Aspen *(Populus tremuloides)*, where present, is a preferred tree species of beaver (Hall 1960, Brenner 1962, Northcott 1971), but beaver often use other tree species as well (Chabreck 1958, Nixon and Ely 1969). Green ash was the dominant tree species along the Big Sioux River and was the second most utilized species by beaver. Peachleaf willows comprised the majority of the large DBH trees cut by beaver. Beaver seldom utilized boxelder or common buckthorn. Dieter (1987) concluded that the avoidance of these species was possibly due to taste and/or texture. Beaver activity killed less than half the trees that were cut. Some damaged trees stayed alive, while some felled trees and stems resprouted, creating dense habitat. Several studies have found that felled trees often resprout, creating dense, brushy habitat (Hall 1960, Kindschy 1985, Krinard and Johnson 1981).

We found beaver activity was similar in both grazed and ungrazed habitat. However, in ungrazed habitat, there was a greater availability of small DBH trees of most species. Therefore, beaver activity probably does more damage to grazed

habitat along the Big Sioux River. The cutting of large DBH trees by beavers will likely continue in grazed habitat, because there is no new tree growth and large old trees that are felled do not exhibit regrowth.

CONCLUSION

Beavers use grazed habitats along the Big Sioux River, but ungrazed habitats provide better habitat and a more diverse and abundant food source. Ungrazed areas are capable of sustaining a higher beaver population than grazed areas, and beavers may actually enhance these areas rather than damage them. Of greatest concern along the Big Sioux River is the continued loss and degradation of riparian habitat due to livestock grazing. The primary factor associated with the reduction, deterioration, and loss of riparian habitat along the Big Sioux River is livestock grazing and crop cultivation. Beavers may be aiding in destruction of riparian habitat in grazed areas because they are taking the limited new growth that occurs as well as killing the few large trees available.

A return of suitable ungrazed habitat could help distribute the existing beaver population over a greater area. Even with increased conservation incentives provided by federal agencies, the habitat is still being damaged and reduced. Restrictions on livestock grazing within a predetermined distance from habitat along the river channel would allow for regeneration of forest in currently grazed areas. Along with increasing beaver populations, many species of birds, mammals, fish, and flora would benefit from the improved riparian habitat.

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