Can Shade Structures Help Riparian Areas?

A look at using constructed shades to pull cattle off riparian areas in northeastern Nevada.

By J. C. Davison and J. D. Neufeld

Management Techniques and Riparian Grazing

The damage caused by unmanaged cattle grazing on riparian habitats is well documented.[1] At the same time, ample evidence exists that well-managed cattle grazing is compatible with maintaining, and even improving, riparian habitats.[2] The key to creating stream-friendly grazing systems is to reduce the amount of time cattle spend in these sensitive riparian habitats.[3] We faced this challenge when we began our study on Antelope Creek during the spring of 1996. Antelope Creek is located on private land approximately 40 miles north and east of Battle Mountain, Nevada. The active stream channel had dropped to approximately 10–15 feet below the surrounding valley bottom, and bank erosion still occurs during high spring runoff events. Although many positive improvements had already been begun, we were interested in methods to foster continued improvements along this stream. Antelope Creek has already formed a small floodplain, and herbaceous, riparian plant communities are reestablishing along most of the banks. Intermittent willow clumps are also growing along the length of the stream. Established methods to exclude cattle from riparian areas along sensitive stream banks include fencing and the development of off-site water and mineral sources. Some researchers have even tried genetic selection of cattle herds and negative conditioning with electrical shock.[4,5]

In the spring of 1996, we began a project to determine whether constructed shade structures could reduce the amount of time cattle spend in the Antelope Creek riparian areas and, in turn, the impacts on riparian plant communities from grazing. The shades were intended to provide a more desirable location for cattle to loaf and ruminate than the adjacent riparian habitats that had little or no shade. Previous research that showed benefits in cattle production were primarily confined to feedlots and dairies,[6,7] and studies that concerned themselves with shade in range and pastures systems had conflicting results.[8–11] Our main goals were to determine whether 1) artificially constructed, shaded areas would be used preferentially by significant numbers of cattle in place of adjacent riparian bottoms; and 2) riparian-vegetation use classes, as estimated by stubble height and current-year shrub use, were lower adjacent to the shade structures when compared with the nonshaded areas, and if so, how far out from the structures.

Our project was conducted for 3 years, and changes in water quality (chemical analysis), riparian vegetation, and the size and shape of the stream bank were also investigated. We will not report these results here. We are focusing on the effects of constructed shade areas on Antelope Creek because of the recent interest and recommendations for use of shade to control cattle movements.

Shade-Structure or Loafing-Area Location and Construction

The project began with the clearing of 8 separate shade or loafing areas spread out over approximately 3.5 miles of

Antelope Creek (Fig. 1). At each location, we removed all sagebrush and other shrubs from an area that was approximately 25 feet wide and 75 feet long to provide a desirable location for the cattle to loiter and ruminate.

After the sites were cleared, we built a shade structure over each loafing site. The shade structures were constructed of 2 parallel rows of six, 6-inch × 6-inch, pressure-treated posts, set 3.5 feet into the soil. The rows were 16.5 feet apart.

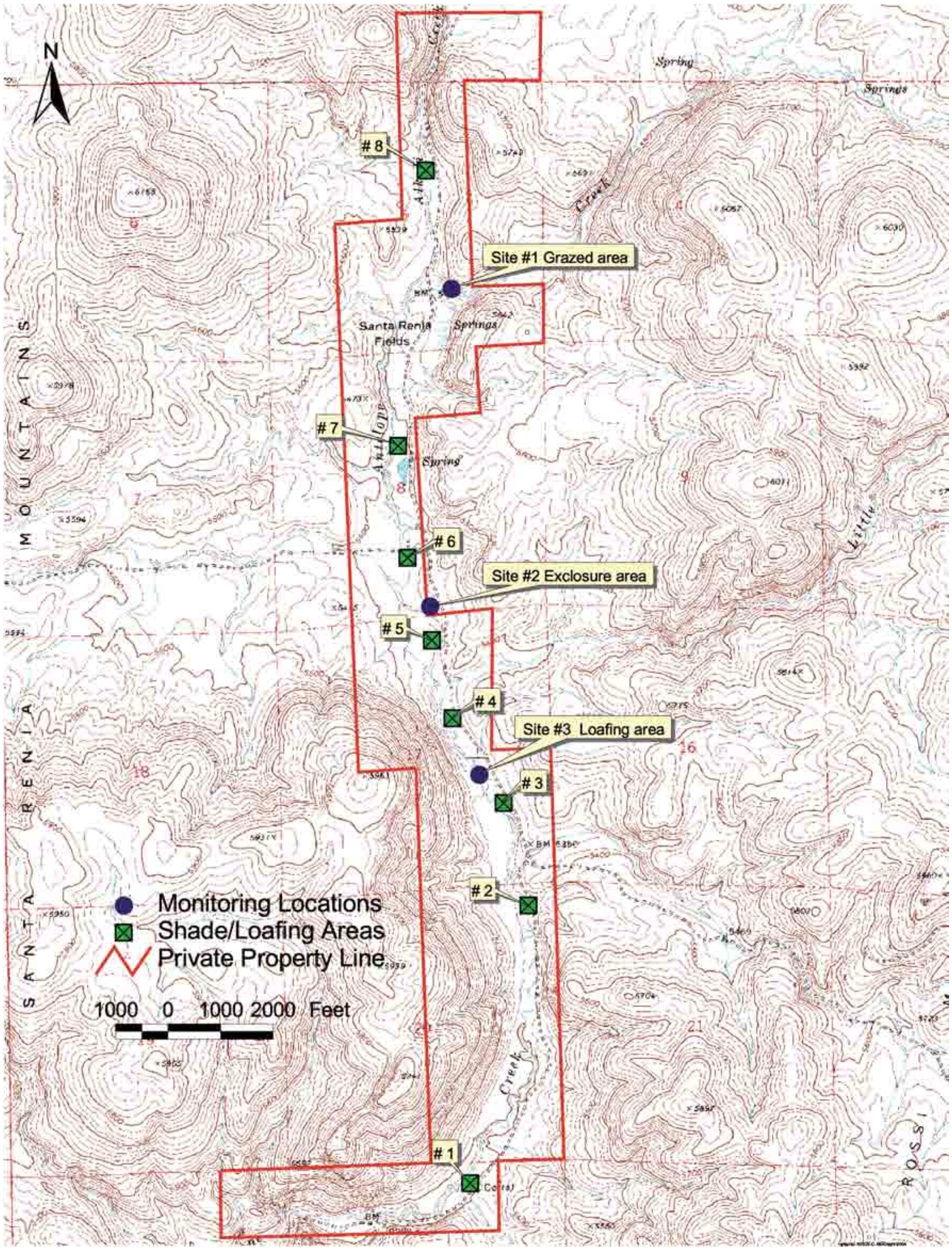

Figure 1. Map of project showing shade/loafing areas and permanent monitoring sites.

Figure 2. Cattle using shade structure adjacent to Antelope Creek.

Each post within the rows extended approximately 12.5 feet above the soil surface and was positioned every 10 feet. They were oriented in a north–south direction. A black, horticultural-grade shade cloth was fabricated and suspended between the posts with one-eighth inch wire rope and cable clamps. The shade cloth was rated as 95% shade and was porous to allow for drainage of water and to reduce wind resistance. The shade cloths were placed on the posts each spring and removed after the cattle left in the fall. Each shade structure cost approximately $1,150 to build (Fig. 2).

The ranch manager and authors selected the shade and loafing sites based on certain criteria. We selected sites that 1) provided easy access for the livestock to and from Antelope Creek, and 2) were a reasonable distance to the creek. We also selected sites on both sides of the creek. We spaced sites No. 2–7 about 1,500 feet apart to form a core loafing area. We sited locations No. 1 and 8 approximately 1 mile above and below the core area. The core area was established to determine if 6 closely grouped shade structures would result in lower overall livestock use levels within the core area when compared with creek areas without constructed shade and loafing areas. The purpose of shade/loafing areas No. 1 and 8 was to determine, if successful, the different use levels radiating from a shade structure and thus approximate the spacing necessary to protect a riparian area.

Monitoring and Cattle Use

We built an exclosure on the creek in the middle of the core loafing area to act as a nongrazed control. The exclosure was approximately 700 feet long and encompassed the entire width of the creek bottom. It consisted of a 2-wire electric fence that was set up each spring and removed each fall. It was generally effective in excluding cattle for all 3 years of the project.

We established permanent monitoring sites within the exclosure and at 2 other locations on the creek. A permanent monitoring site was established within the core shade/loafing area (downstream from the exclosure) and another was established between the core shade/loafing area and site No. 8. We labeled the monitoring sites as the exclosure, loafing, and grazed site, respectively (Fig. 1).

We established permanent photo points at each monitoring site and along the creek adjacent to each shade and loafing area. Pictures and use levels were obtained each fall at the 3 permanent monitoring points and at the photo points located near each shade/loafing area.

The results we discuss in this article include only the use and monthly counts of livestock within the project area during the midafternoon. We counted and classified cattle as 1) under, or immediately adjacent to, the shaded area, 2) in the riparian area, or 3) in the upland area within the project. We tallied the total sightings and expressed the location of the sightings as a percentage of the total count each year of the study.

Our definition of use was "The proportion of the current year's forage production that was consumed or destroyed by grazing animals." Use levels were estimated by comparing ungrazed forage with that remaining after the plant growth had ceased in the fall and cattle had been removed from the allotment (November). Use levels were estimated using the key forage-plant use method. Use levels were classified as none (0% use), slight (1%–20% use), light (21%–40% use), moderate (41%–60% use), heavy (61%–80% use), or severe (81%–100% use). We estimated use for the herbaceous (grass) communities as a whole because species were intermingled with no easily discernible borders. Wiregrass (*Juncus balticus*) communities were sampled because they are not normally consumed until other forage sources are exhausted. The proportion of current year's growth that had been removed from the woody species present was also estimated at the same time. Use estimates were obtained on the floodplain adjacent to the creek at each shade/loafing site and within the 3 permanent sampling locations (loafing, grazed, and exclosure). We also measured the stubble heights of herbaceous plants when we obtained the use estimates. Stubble heights were obtained separately for wiregrass communities and the more desirable grass communities at each permanent monitoring location and adjacent to the shade sites.

What We Found

1996

During the 1996 season, cattle did not enter the allotment until the 3rd week of September. They left the allotment in November when they were returned to the ranch. Precipitation amounts were normal to dry during the 1996 season. The creek began to dry up in midsummer with water flows very low after July. Pools were present at most locations except during late summer, when no water was available near shade/loafing area No. 1. The most used areas were those closest to water that had large trails down the entrenched sides of Antelope Creek. Another factor that was preferred by the cattle was the presence of large flat areas on the floodplain adjacent to the creek. The most used shade/loafing area had both factors present. Shade/loafing area No. 5 was the furthest from water, had relatively poor access to the creek, and the trail ended in a relatively narrow reach of the stream. It was the least used loafing area during all 3 years of the project. Shade/loafing area No. 2 was close to the creek, had several trails to the creek, and had a large, flat area. It was used the most frequently.

Riparian areas were the most preferred location for cattle to be found, when counts were made, regardless of the location of the shade and loafing area. During 1996, 70% of the cattle sightings were in riparian areas. We classified cattle as using the loafing areas 27% of the time, and only 3% of the cattle we counted were on the uplands in the project area.

Table 1. Use levels and stubble height measurements following the 1996 grazing season

Location	Herbaceous use rating	Grass stubble heights (inch)	Wiregrass stubble heights (inch)	Woody plant use rating
Shade 1	Severe	<1	1–2	Heavy
Shade 2	Severe	<1	2–3	Moderate–heavy
Shade 3	Heavy	1–2	4–6	Light
Shade 4	Severe	<1	3–4	Moderate–heavy
Shade 5	Heavy	1–2	5–6	Light–moderate
Shade 6	Heavy	1–2	6–8	Moderate–heavy
Shade 7	Moderate	2–3	6–8	Moderate–heavy
Shade 8	Light	3–5	No use	Slight
Loafing area	Heavy	1–2	3–4	Heavy
Grazed area	None	No use	No use	Moderate*
Enclosure	None	No use	No use	No use

*Used by deer as indicated by tracks and droppings.

Table 2. Use levels and stubble height measurements following the 1997 grazing season

Location	Herbaceous use rating	Grass stubble heights (inch)	Wiregrass stubble heights (inch)	Woody plant use rating
Shade 1	Severe	<1	<1	Heavy
Shade 2	Heavy	<1	3–5	Moderate–heavy
Shade 3	Light	2–4	6–8	Light
Shade 4	Severe	1	3–6	Moderate–heavy
Shade 5	Heavy	1–2	5–6	Light–moderate
Shade 6	Heavy	1–2	5–6	Moderate–heavy
Shade 7	Moderate	2–3	6–8	Moderate–heavy
Shade 8	Light	3–4	6–8	Slight
Loafing area	Moderate	2–3	6–8	Heavy
Grazed area	Light–moderate	2–4	5–7	Slight
Enclosure	None	No use	No use	No use

1997

The 1997 season was very different because the weather was much cooler and wetter during the spring and early summer. Spring runoff flows were very high, and cutting of some vertical banks was obvious. Soil deposits were evident at several locations following the spring high water. Rains were frequent throughout the season. The creek held water longer than during the 1996 season, and some water was always available near each shade/loafing area. The cattle entered the project area in mid-May and made very little use of any riparian areas or the shade/loafing areas until midsummer. The cattle were removed in November.

Cattle use patterns were different during 1997 than the previous grazing season. We found that riparian areas were still the most preferred by cattle, with 50% of the total number of sightings occurring in them. Upland use increased to 32% of the sightings because of the cool, wet spring, whereas use of the shade/loafing structure accounted for 18% of the sightings.

1998

The 1998 season was again cooler and wetter than normal. High spring flows occurred, resulting in obvious cutting and deposition of soil throughout the project area. Grass production was exceptional at all locations within the project, and adequate water was available at all locations throughout the season.

When cattle entered the allotment in mid-June they initially used the upland areas in preference to the riparian or loafing areas. We found that cattle use began to shift to the riparian areas in July and it was the preferred location until late fall, when it again shifted to the uplands.

During the 1998 season, we classified cattle use of riparian areas at 61%. Use of the loafing areas was 21%, whereas upland use was 18% of the cattle counted. We believe upland use fell from that classified during the previous season because the late arrival of cattle on the allotment.

Observations on Shade Structure Use by Cattle

High temperatures were common during all the summer months that cattle were in the allotment. We commonly measured temperatures in the shade as high as 105°F during late July and early August. Temperatures in the direct sunlight exceeded 120°F. In spite of that, we often observed cattle laying in full sunlight immediately adjacent to an unoccupied shade structure during the hottest part of the day. We also recorded them lying next to the creek in full sunlight although the nearby shade structure was unoccupied. At other times, cattle were crowded under the shade structure, whereas other cattle were lying near the creek or adjacent to the shade. The use of the shade structures by cattle appeared, to us, to be random. The majority of cattle on the allotment were black or black baldies. The remainder were Hereford or Hereford-cross cattle that were predominately red in color. An occasional light-colored animal was observed. Our cattle counts and observations did not determine that shade use was dependent on the color of the animals present. The age of the animals present did not appear to be a factor in use of the loafing areas because use of the loafing areas was not different between cows and calves.

In all 3 years of our study, cattle preferred the riparian areas to upland areas or the constructed-shade loafing areas. Cattle used the riparian areas in approximately 60% of the counts. Uplands were used the most during the cool, wet springtime months. The 3-year average use was about 18%. Once the forage began to dry the cattle began using the riparian and shade/loafing areas. Cattle used the shade/loafing areas moderately with the average, 3-year use count being 22%.

Plant Use by Cattle

The use monitoring we completed during the project supported the visual observations of cattle use. One objective of the study was to determine if use levels of riparian vegetation were measurably lower adjacent to the shade/loafing areas when compared with "open areas" without shade/loafing areas. If so, how far from the loafing area were use levels lowered? We selected use levels because they provide a rapid indication of cattle use levels and patterns. The results of the streamside use monitoring are displayed in Tables 1–3.

We found that average use levels varied only slightly during the 3 years that data was collected. The variations were thought to be related to the climatic conditions each year, the time cattle entered the grazing allotment, and accessibility of the riparian area adjacent to the shade structures. Normal livestock distribution patterns also played a role in use levels. The northern portion of the study area generally received less use during the project than the middle-to-southern portion regardless of climate or the factors we previously mentioned. The "grazed" transect area received less use than anticipated because of the presence of a large meadow area and spring near the site. Cattle used the meadow area extensively while generally avoiding the "grazed area" monitoring site.

Figure 3. Typical use levels in loafing area the following grazing season during the study.

Our most important finding during the course of the project was that there was no practical difference in use levels or stubble heights because of the presence of the loafing area and shade structures (Fig. 3). The estimates of average use levels that we observed when walking the length of the project reinforced the conclusion that the shade structures did not result in any less use of riparian plants than that

Table 3. Use levels and stubble height measurements following the 1998 grazing season

Location	Herbaceous use rating	Grass stubble heights (inch)	Wiregrass stubble heights (inch)	Woody plant use rating
Shade 1	Severe	<1	1	Heavy
Shade 2	Severe	<1	2–3	Heavy
Shade 3	Moderate	2–3	4–6	Heavy
Shade 4	Heavy	<1	3–4	Heavy
Shade 5	Heavy	1–2	5–6	Heavy
Shade 6	Heavy	1–2	6–8	Heavy
Shade 7	Heavy	2–3	6–8	Heavy
Shade 8	*	*	*	*
Loafing area	Heavy	1–2	3–4	Heavy
Grazed area	Moderate	2–3	4–5	Heavy
Enclosure	None	No use	No use	No use

*No Information gathered as structure was inaccessible during spring, and shade was not erected.

found on areas away from the structures. In fact, we observed that use levels on woody species may have been slightly higher adjacent to the shade/loafing structures. Because the number of willow colonies were limited, use levels were almost uniformly high throughout the project area every year. We concluded that the loafing areas did not meet our objective of reducing use levels on the adjacent riparian areas.

Recommendations

Our evaluation of the results of this project indicated that little or no positive changes occurred on the riparian areas on Antelope Creek as a result of increased cattle use of the shade/loafing areas. That finding is expected as the cattle use of the shade/loafing areas was random and sporadic throughout the life of the project.

Use levels on herbaceous plants were not reduced by the presence of the loafing areas. Use levels were normally heavy at most locations, and we found no measurable difference in use or stubble heights remaining at the end of the growing season. Use levels of woody species were no lower, and may have been slightly higher, adjacent to the loafing areas. Although we did not quantify the differences, our visual observations were that willow plants adjacent to the most used shade/loafing areas sustained more use overall than those located away from the areas.

We concluded that although cattle will use shade/loafing areas, the use is not consistent enough to result in significantly lower use of the adjacent riparian vegetation. Our results mirror those experienced in riparian grazing programs that fail to remove all cattle when a move becomes necessary. Even if small numbers of cattle remain in the riparian pasture, damage to the riparian community can occur.

Existing literature indicates that cattle will sometimes use shade structures enough to change pasture use levels. Our work did not support that finding. Although cattle did use the structures, the use was not high enough to reduce riparian vegetation use levels.

We assume that the Antelope Creek area does not get hot enough for a long enough time period to force cattle into using the shades for long periods. The majority of cattle used the shades during the hottest portion of the afternoon, which lasted only 2–3 hours. They were also observed lying in the direct sunlight adjacent to the shade structures, while the structures sat empty.

Considering the cost of construction ($1,158.27/structure), the maintenance required, and the lack of direct benefit, we cannot recommend the use of shade/loafing structures at this time for the northern portions of Nevada. Further studies may be useful in the southern portion of the West to determine their effectiveness in warmer climates.

Authors are Area Specialist, University of Nevada, Cooperative Extension, 111 Sheckler Road, Fallon, NV 89406 (Davison); and Extension Educator–Crops, Canyon County Cooperative Extension, University of Idaho, 501 Main St., Caldwell, ID 83605 (Neufeld). *This project was funded by a 319-H water quality grant administered by the Nevada Department of Environmental Protection.*

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