Forestry Note:

LOW-COST GULLY CONTROL USING FIBER MAT AND TREES

Introduction

Gully erosion can be a serious problem and expensive to treat. Some shallow headcuts or overfalls, and shallow upper gullies with small drainage areas, can be treated at relatively low cost by shaping and applying a fiber mat product in combination with tree planting as described here. Treatment feasibility and design are dependent on tree growth potential, slope and other site conditions.

Forestry Services selected two upper gully sites with shallow overfalls in Tillman County, Oklahoma, for testing these practices. This Forestry Note describes the treatments and documents the effectiveness of these low-cost erosion control practices.

These small gullies developed on sloping, deep, sandy subsoil on an eroded area shaped during the construction of the dam and pipe drop-structure on a large gully system near Grandfield. Figure 1 is a photo of the gully area before treatment, taken from the top of the drop-structure dam. The first gully treated is in the right center of Figure 1. The second gully is near the center of the photograph.

Figure 1. Small gullies in Tillman County before treatment, seen from the top of the dam

Treatment 1: Full-Length Fiber Mat

This gully is about 70 feet long and empties onto a flat area (Figure 2). The slope is steep. The site is very sandy and dry, with low tree-growth potential. The watershed area is less than one acre.

Figure 2. The first gully before treatment

The treatment consisted of shaping the gully with hand labor, laying out and anchoring the fiber mat and planting black locust seedlings through the fiber mat and on the surrounding area (Figure 3). The fiber mat was anchored with heavy wire pins supplied by the manufacturer.

Fiber mat products made of a variety of materials, including straw, excelsior and coconut fibers, are available for erosion control use. The fiber material is stitched between sheets of synthetic netting. For this project, coconut fiber mat was selected because of its durability. The fiber itself lasts from four to six years, and the netting somewhat longer, which helps stabilize the site while vegetation becomes established.

Figure 3. Planting seedlings after gully shaping and placement of fiber mat

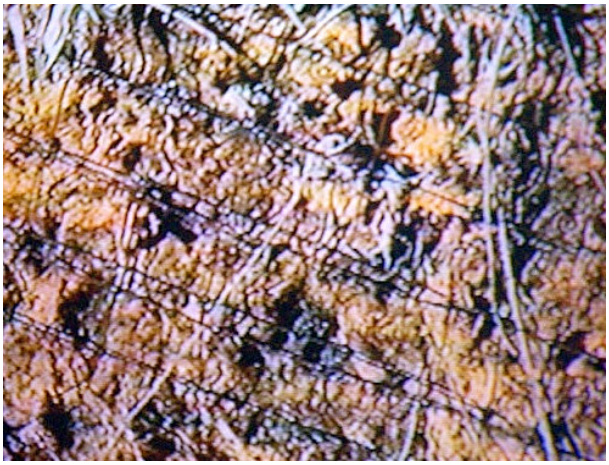

Figure 4. A close-up view of the fiber mat netting in its sixth year of service

Figure 5. Vegetated condition of the gully in the winter following the fourth growing season

Treatment 2: Headcut and Channel Erosion Control on a Continuous Gully

Figure 6 shows the second gully prior to treatment. Although the soil is also deep and sandy, the site is more favorable to vegetative growth because it is flatter and receives runoff from the slopes. The drainage area is about one acre.

Figure 6. Pretreatment conditions of the second gully

The shallow headcut was shaped manually with shovels. Trenches about one foot deep were dug for burying the edges of the fiber mat (Figure 7a). Shaping and fiber mat application

Figure 7a. Placing fiber mat in the second gully

were limited to the headcut area (Figures 7b and 7c). Black locust seedlings were planted through the fiber mat on a 3-foot by 3-foot spacing.

Figure 7b and 7c. Views of the completed fiber mat application looking upslope (Figure 7b above) and down slope (Figure 7c below)

To stabilize the main part of this gully, we installed a structure consisting of an 8-foot section of cattle panel, supported by steel posts (Figure 8). The entire area was planted with black locust seedlings on a 5-foot by 5-foot spacing.

Post-treatment growth of the black locust seedlings and grass on this site was moderate. Figures 9a and 9b are views of the headcut site in the second and fourth growing seasons following treatment. Figure 9c is a view of vegetative growth at the cattle panel location on the gully in the winter following the fourth growing season.

Figure 8. Cattle panel structure with trash accumulation and vegetation in the second growing season after treatment

Figure 9a and 9b. Views of vegetative growth on the treated headcut site in the second growing season (Figure 9a above) and fourth growing season (Figure 9b below) following treatment

Figure 9c. Vegetative growth at the cattle panel location-winter following the 4th growing season

Estimated Costs

Treatment costs are presented below:

Cost Item	No. of Units	Cost ($) Per Unit	Total
Fiber mat (Square Yards)	110	$0.90	$99
Cattle Panel (4 feet by 16 feet)	½	12	6
T-posts	3	3	9
Labor (Hours)	20	8	160
		Total Cost	$274

The principal single cost item was labor. Most of the labor in this experimental treatment was provided by pre-parolees in the Oklahoma Department of Corrections. The listed labor hours and rate are estimates for hired or contract labor at the time the project was installed.

Effectiveness and Maintenance

Figures 10a and 10b are views of the gully area in the second and sixth growing seasons, respectively. Views are from the top of the dam, the same viewpoint as in Figure 1.

The first and second gully sites are in the right center and center, respectively, of each of the photos below.

Figure 10a. Gully site and trees at age two

Figure 10b. Same view as in Figure 1 and 10a, in the sixth growing season

The results indicate the fiber mat and tree planting practices are effective where drainage areas are small (generally less than 5 acres) and conditions permit tree growth. The fiber mat provides initial erosion control and acts as a mulch to conserve moisture during the seedling establishment period.

The black locust trees improve the microclimate for growth of grasses and other surface vegetation. Black locust, a legume, also benefits other plants by fixing nitrogen in the soil. Its root system, having numerous strong branching roots growing laterally and downward, is very effective in stabilizing banks

and limiting erosion (Figure 11). Typically, root lengths are several times the height of the tree. A stand of trees forms a network of branching roots.

Figure 11. View of black locust root system. The trees are 5 years of age, and 3 to 4 inches in diameter at the root collar.

Ongoing vegetation management is necessary for continued effectiveness. While relatively close spacing in planting is good practice for early erosion control and to insure a good stand, later thinning may be needed. The erosion in this case occurred in a planting on a shaped steep slope on another part of the large gully system. Factors contributing to this erosion are the lack of ground cover, due to shading by the closely-spaced trees, and concentration of runoff on part of the slope. Additional follow-up practices that are needed include water diversion, shaping to control runoff, possibly the use of fiber mat and thinning to promote ground-cover vegetation.

It is important to note that black locust is often short-lived because of attack by borers and *Phellinus* heart rot. When the stands deteriorate, often at about age 20 to 30, cutting the trees will promote sprouting and new root development.

While other tree species for aesthetic and riparian area management objectives may be included in erosion control plantings, black locust should be the primary species of choice because of its exceptional characteristics for this purpose. Where other species are planted with black locust, wider spacing is needed around the seedlings, and in later thinning and cutting of the black locust stand.

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Other Information Sources

Additional information on these gully control treatments and other gully erosion control using trees in combination with other practices can be obtained from the local offices of Forestry Services and the Conservation Districts or by calling Forestry Services at 405-522-6158. *Low-Cost Gully Control Using Fiber Mat and Trees* is one of a series of Forestry Notes produced by the Oklahoma Department of Agriculture, Food, & Forestry - Forestry Services Division on low-cost practices to control soil erosion. Additional Forestry Notes in this series include:

- Side-Gully Control Using Trees, Hand Labor, Rock and Other Materials
- Stabilizing Gully Walls and Bottoms With Deflectors and Trees

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