USE OF FLOODWATER TO DISPERSE GRASS AND SHRUB SEEDS ON NATIVE ARID LANDS

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ABSTRACT

Dry stream channels of arid rangelands are typically more fertile and mesic than adjacent slopes. The productivity of these channels is evident by their relatively abundant plant biomass. Substantial down-channel establishment of seeded and native species from root-plowed and seeded strips was observed on the Jornada Experimental Range. There appears to be good potential for using flood water as a low-input method of seed dispersal for subsequent revegetation of natural waterways.

INTRODUCTION

The shrub-grasslands of the arid Southwest have shifted dramatically to shrub-dominated communities in the last 125 years (Buffington and Herbel 1965). This shift has resulted in reduced forage for livestock, reduced ground cover, and accelerated soil loss by wind and water erosion. In addition, desirable habitats for wildlife have been adversely affected (McKell and Garcia-Moya 1989).

Efforts to reverse, or slow, this trend by using specialized grazing systems, mechanical and chemical control of shrubs, or reseeding of desirable plant types have been only moderately successful at best. The costs of improvements of arid lands generally do not justify the required investment given the biological uncertainty of the response to the treatments. For example, plant establishment efforts often fail because of either infrequent and unpredictable rainfall events, soil crusting, poor soils, high incidence of rodents, high ambient temperatures, or one of many other adverse events. Low-input methods that would utilize on-site resources and maintain or increase the productivity, stability, and use of these lands would be very desirable.

GENERAL OBSERVATIONS

As shrubs have increased and grasses decreased, flooding has removed soil and organic materials and redistributed them along the dry channels. The increased fertility and moisture have increased within-channel potential for plant productivity. This is evident by the abundant plant biomass production along the channels as compared to the slopes. Therefore, these channels should be the focus for revegetation efforts. In addition, these desert waterways provide favorable conditions for continued plant dispersal and establishment.

Rainfall patterns in the arid Southwest are such that approximately 50 percent of the annual precipitation occurs as intense, localized thundershowers from mid- to late summer. Resulting flood water carries seed, silt, and organic material, and deposits them along the stream in areas where the flow is slowed by bends, vegetation, or decreasing slope. The deposited seed may remain moist for several days to a week, meeting favorable conditions for seedling emergence and establishment. Stream transport of the seed may also accomplish scarification and presoaking requirements for germination. Once seedlings emerge along these waterways, they have the greatest opportunity for establishment.

JORNADA OBSERVATIONS

The potential for natural seeding by flood water along dry streambeds was demonstrated by two unrelated activities on the Jornada Experimental Range (JER), located northeast of Las Cruces, NM. Approximately 25 years ago, strips were root plowed perpendicular to the direction of water flow (Herbel and others 1973), where creosote bush (*Larrea tridentata* DC) had invaded a black grama (*Bouteloua eriopoda* [Torr.] Torr.) community on the south boundary of the JER. This is a gentle sloping area fanned with many small gullies.

These plowed strips were seeded with Lehmann lovegrass (*Eragrostis lehmanniana* Nees), Boer lovegrass (*Eragrostis chloromelas* Steud.), black grama, sideoats grama (*Bouteloua curtipendula* [Michx.] Torr.), blue grama (*Bouteloua gracilis* [H.B.K.]), and fourwing saltbush (*Atriplex canescens* [Pursh] Nutt.).

Independent of these events, a natural gas pipeline was constructed across the area, ranging from 50 to 500 meters downstream from the root-plowed areas. This left a small dike less than 12 inches high extending across the area.

RESULTS

Currently, stand establishment of the seeded species ranges from poor to good in five different root-plowed strips upstream from the pipeline. The best original establishment of the seeded species occurred along the gullies within the strips. Downstream establishment of both seeded and native species was observed. We ascertained that the dike from the pipeline caused flood water to slow, allowing the deposition of silt, organic material, and seed. The establishment of these plants enhanced further seed and silt deposition.

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Grass and fourwing saltbush communities have expanded laterally and upstream from the dike. This area is composed of good stands of both love grasses, sideoats grama, and fourwing saltbush, as well as plains bristlegrass, (*Setaria leucopila* [Scribn. & Merr.] K. Schum.), a native species. The area above the dike has excellent forage production, vegetative cover, and wildlife habitat. In contrast, creosote bush is the predominant plant below the dike, with bare surface between the plants (see figs. 1 and 2).

It appears that seeds from the root-plowed areas were deposited near the dike. As new plants became established they produced seed and also slowed water coming from upstream for additional silt and seed deposition along the gully. Consequently, gullies were filled with soil and organic material, adding to the fertility and promoting additional establishment of grasses both laterally and along the gully. As this community developed, creosote and tarbush plants have died, likely because of increased competition from the grasses and possibly because of modifications in the subsoil environment (soil moisture, microflora). These changes have slowed water flow and have increased water infiltration, silt, and organic matter deposition, further increasing the fertility and mesic conditions

Figure 1—Plant establishment downstream from root-plowed strips and above dike.

Figure 2—Creosote bush and bare surface just below dike.

along the gullies. It also appears that fourwing saltbush is more competitive with the grass invasion than either creosote or tarbush.

POSSIBILITIES FOR MANAGEMENT

To utilize flood water for dispersing and establishing seedlings, a simple gully seeder was developed. One seeder consisted of a post, placed in the gully, with a vane that would be moved by the water (see fig. 3). This in turn would move a slide covering the mouth of an inverted seed bottle attached to the post. The seed would be dropped into the stream and carried downstream where it could be deposited with silt and organic matter for potential germination and establishment. A second seeder was also tested; it consisted of a steel post with the inverted seed bottle attached with a stopper in the mouth of the bottle. A flexible wire was attached to the stopper and threaded through the eye of a bolt at the base of the post and to an approximately 1-foot section of railroad tie, which would only be moved when sufficient flow provided proper conditions for dispersal and establishment.

These seeders were positioned in small gullies, and approximately 750 gallons of water were pumped into the gully, simulating flood conditions. The bottle was filled with alkali sacaton (*Sporobolus airoides* [Torr.] Torr.), blue panic (*Panicum antidotale* Retz.), and fourwing saltbush seed. The gully was dammed approximately 50 meters downstream to allow for the settling of the silt and water. Brush and debris were added to the surface just above the dike to provide shade and protection to the seed and silt.

Very good germination of the grasses and fourwing saltbush was observed just upstream from the dikes where seed was covered with silt and where the surface was protected by shading. Graveled areas were also good seed beds for germination. However, it is essential for these plants to receive adequate additional moisture for establishment and their development to maturity. These conditions were not met, and all the seedlings died. However, the experiment demonstrated the potential for flood water to disperse and germinate seeds. An additional advantage of the gully seeder is that if they are not activated by flooding the seed can be used another year.

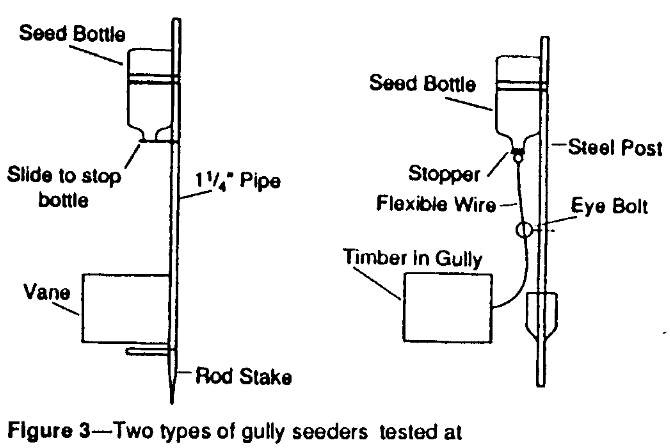

Figure 3—Two types of gully seeders tested at Jornada Experimental Range.

DISCUSSION

From these observations, seed of grass and shrub species are readily carried downstream by flood water. Flooding often provides favorable conditions for seed germination and establishment along waterways. In small gullies where the water flow is slowed and the seedlings become established, several things occur. The plants become a seed source for subsequent downstream seeding and further slowing and catching seed from upstream. These small gullies become filled with sediment, and the grass and shrub populations establish themselves along the gully, often restructuring these channels. As water flow slows, infiltration would improve. The increased water infiltration and fertility along the channels as compared to the slopes provides a special environment and would allow native species to reoccupy these areas.

Possible low-input management methods might include the establishment of grass and shrub communities in the upper slopes of selected gullies or streambeds. This could be enhanced by root plowing, damming, use of portable and temporary irrigation systems, or gully seeders where investment may be justified because of the potential productivity of sites. Once these communities have been established, they would become sources for downstream seeding. Downstream establishment could also be enhanced by downstream damming, and chemical or mechanical brush control along the potentially productive channels. With minimal input these methods could be initiated annually as resources are available, yet they would have long-term effects on downstream seeding and establishment of desirable plant communities.

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