Enhancing Precipitation Effectiveness on South Texas Rangeland

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Damaged water cycles are a major ecosystem dysfunction on semi-arid south Texas rangelands. Heavy grazing for several hundred years, combined with cessation of fire and frequent droughts has disrupted the ecological processes of nutrient cycling, energy capture, community succession, and, in particular, hydrologic processes. Lack of fertility, erosion, and compaction all contribute to decreased water infiltration and increased runoff, resulting in lowered vegetation diversity, surface coverage, increases in brush, lowered productivity, etc. Unchecked, the downward spiral of resource deterioration will continue.

Increasing the stability and water infiltration rate in the soil surface will initiate the repair and maintenance of damaged processes that enhances plant production and protects the soil surface with plant litter or living vegetation. Traditional seedbed preparation and seeding is a high risk practice. Like other risk reduction strategies, water harvesting increases the probability of success, but it does not eliminate failure. This proposed project uses native and coastal bermuda hay as a seedbed mulch as well as soil ripping/subsoiling as economical process-oriented approach to improving water effectiveness and enhancing rangeland restoration.

Procedures

Treatments were seeded to grasses through the use of hay mulches (spreading seed-containing hay along the seedbed). This mulch keeps water from running off the site, slows the flow, and allows it to infiltrate into the soil. Seeds are protected, have adequate moisture and protection, thus enhancing germination probability and lowering the risk of stand failure.

Feeding hay. In November, 1999 and January, 2000 hay that had been conserved from a local native grass pasture (Tanglehead, *Heteropogon contortus*) was fed to livestock. In late 2001, a series of strips were disked on parallel senderos spaced .25 mile apart. During December, 2001, and January-March, 2002, depending upon which pasture the cattle were in, native grass seed was hand seeded on 200 ft. of a disced strip. A round bale of coastal bermudagrass hay was unrolled over the seeded area and the cattle allowed to feed on the hay. This resulted in the seed being covered with organic matter, a seed bed being prepared by hoof action, dung and urine being added to the mix, and residual hay slowing water runoff over the area allowing greater infiltration. Native grasses included a little bluestem prairie mix (obtained from Kenedy county and San Patricio county); 2-flower and 4-flower Trichloris (Kika de la Garza Plant Materials Center) and Plains Bristlegrass and yellow indiangrass (Pogue Seed Co.); and Tanglehead (JimWells county).

Ripping. Soil compaction often limits the amount of moisture infiltrating into rangeland soils. Severely deteriorated rangelands, especially in arid and semiarid regions, often recover slowly or

not at all after initiation of proper grazing management or the total removal of livestock because of lack of vegetation cover, poor soil aggregation, low infiltration rates, and the resultant harsh environment for plant establishment and growth. Mechanical treatments such as ripping can expedite natural recovery of these desertified rangelands. Ripping (also referred to as subsoiling or deep chiseling) involves pulling a heavy shank equipped with a broad lifting tip, 12 to 20 inches deep through the soil on the contour. Space between rips is usually 10 to 30 feet. Ripping increases soil porosity and rate of infiltration, causes uplifting of the soil (which resists surface runoff), leaves a furrow in the center of the uplift which helps retain water, and provides a seedbed for new plant establishment.

Four rangeland plots were treated in March 5, 2002. The plots were on Gray Sandy Loam and Sandy Clay Loam Soils. Each plot was ripped using a 60 hp rubber tired tractor and a 243 lb single shank ripping blade. The blade included a broad (2 inch) lifting tip. Rips were made on the contour with 24-30' spaces between rips at a depth of 18-20 inches. Soil moisture ranged from low to moderate. Rips were installed in 3rd gear at 1800 rpm. The tractor took 5 minutes to rip a distance of ca. 300 yards.

Ripping/Seeding. In 2002 a one-row seeder was purchased and mounted to fit above the single-shank ripper. A supply of native grass seed was also purchased. In October a series of ripping/seeding treatments was installed; Plains bristlegrass, tanglehead, green sprangletop, Lometa Indiangrass, a native plant mix, and blue panic grass. Ca. 3 inches of precipitation were received on the plots over the succeeding 4 days. These plots will be monitored over the next several months.

The project is being conducted on La Copita Demonstration Ranch near Alice in Jim Wells county, Texas.

Results and Discussion

Precipitation. The Rio Grande Plains of Texas is characterized by erratic precipitation. Droughts are frequent and are generally severe. Rainfall received during the study period thus far reflects this erraticness (Table 1). In 2001, rainfall received was 61% of the mean. In 2001 it was 111%. However, 18 inches of the 31 inches received in 2001 came in 2 rainfall episodes. Runoff obviously increased under such intense rainfall events. When rainfall patterns and trends are combined with compacted, droughty soils on rolling hills, effective precipitation is reduced even more.

Table 1. La Copita Demonstration Ranch Monthly Precipitation, 2000 - 2002 (to date).

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
2000	.81	.93	1.4	.23	3.03	1.00	0	.76	.42	2.15	5.53	.48	16.78
2001	1.05	1.08	2.07	.34	1.30	1.84	1.58	11.01	.54	.42	7.22	2.21	30.65

2002	.06	.35	.05	.29	1.74	2.92	12.02	1.43	3.04				

Seeding Trials. To date 27 plots have been established, utilizing 11 different native grass species, on disturbed and non-disturbed soils. Site selection was based on the ability of the site to intercept rainfall as it flows with the slope of the terrain. Results have been mixed and can be explained by several individual, or combinations, of variables (Table 2).

All grasses should of course, be adapted to the range site on which they were planted. In these tests quality of seed was not a factor. Also mechanical seedbed preparation did not appear to be a major factor either. Species adaptations appeared to be a major factor in that only two species - tanglehead and plains bristlegrass - readily established under all the scenarios tested (Figure 1). A major limiting factor obviously is rainfall amount and timing. In 2001, stand establishment ranged from good to failures, with most plots failing to establish. Conversely, in 2002, with good rainfall to date, establishment has been fair to excellent. The only exception has been Little Bluestem - however, there's some indication that this species requires more time to germinate and establish. Consequently, a later evaluation will determine whether this is the case or not.

This project will continue through 2005. Efforts to match funding was successful through a grant from the Grazinglands Conservation Initiative.

Figure 1. Tanglehead (*Heteropogon contortus*) stand resulting from feeding native hay to livestock.

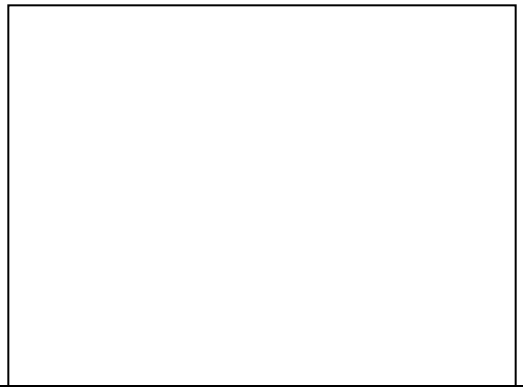

Table 2. Response of Grasses To Seeding Through Feeding of Hay To Livestock.

Year	Species	No. of Tests	Seedbed	Method	Response
1999	Tanglehead	2	None	1	Excellent Stand

2001	Bristlegrass	1	None	2	Good Bristlegrass Stand
	Indiangrass Mix	2	None	2	Good Bristlegrass Stand
	Indiangrass	1	None	2	Failure
	Buffelgrass	1	None	2	Fair Stand
	Introduced Mix	1	None	2	Same Kleingrass
	Little Bluestem	2	None	2	None
	Buffelgrass/ Bristlegrass	2	None	2	Fair (Both Species)
	Native Mix	1	None	2	None
2002	Bristlegrass	4	Disc	3	Good Stand
	Tanglehead	5	Disc	2	Excellent Stand
	Little Bluestem	4	Disc	2	Failure
	Trichloris	2	Disc	2	Failure

1 = Native Grass Hay
2 = Spread Seed, then unrolled Round Bale, and allowed cattle to feed.