

Natural Methods of Establishing Native Plants on Arid Rangelands

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Abstract—Desertification of native rangelands is a global problem. Mechanical and chemical approaches to remediate these lands are not universally suitable or appropriate, and often times induce disturbances that escalate rather than resolve the trend. Therefore, we are proposing to utilize natural systems such as wind, water, or animals to disperse seeds of desirable native plant species. These methods would have minimal disturbance on native landscapes. Concepts of water and animal seed dispersal on arid rangelands are discussed.

In the last 120 years there has been a significant conversion of grasslands to shrublands in the northern Chihuahuan Desert. This change is thought to be driven by a combination of natural and anthropomorphic disturbances (Buffington and Herbel 1965). Principle causes have been attributed to overgrazing and drought; however, other important factors influence the dynamics of native plant communities. This transition is described as desertification and may have negative implications for global climate (Schlesinger and others 1990). Vegetation conversions to shrub dominated states are generally regarded as pernicious from several view points such as wildlife habitat, watershed hydrology, aesthetic conditions, livestock grazing land, or recreational aspects. In many cases, removing the causes of disturbance will not reverse this transition, and current shrubland states may be permanent without considerable intervention (Friedel 1991). Gibbens and others (1992) reported that recent rates of honey mesquite, *Prosopis glandulosa* Torr., establishment in the northern Chihuahuan Desert are sufficient to further change many remaining grassland areas to mesquite dominated rangelands. Unfortunately, natural resource managers are not presently equipped to repair desertified lands. Current intervention technologies such as chemical and mechanical brush control and re-seeding with both native and introduced plant species require substantial inputs of capital, labor and fossil fuels, and could not be regarded as universally suitable or appropriate (Barbier 1989). A general consensus is that it is extremely difficult to restore grasslands to their original condition.

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Israeli scientists are developing an approach to repair desertified lands called "savannization" (Gillis 1992). Their philosophy focuses on selecting specific regions within the desert landscape that are most suitable for renovation. They consider less than 5% of the desert to be suitable for these revegetation efforts. This is an extension of the resource island concept proposed by others, more recently by Schlesinger and others (1990).

Our parallel concept of savannization is based on the premise that resources, primarily water and soil nutrients are distributed heterogeneously across a landscape resulting in some sites being more favorable for reestablishment of native species. These relatively favorable micro-environments would be logical sites for remediation of desertified conditions.

Successful native plant species have evolved mechanisms and strategies that utilize natural systems such as wind, water and animals to disperse their seed (Barrow and Havstad 1992). We propose that these systems should be exploited in remediation efforts. For example, the successful invasion of mesquite in the southwestern United States can be attributed largely to the dispersal of its seeds by animals and humans.

The rationale for this research approach resulted from recent observations on root plowed plots previously established on gently sloping creosote sites on the Jornada Experimental Range by Herbel and others (1973). Vegetation patterns on the original seeded plots remains very similar to the descriptions given at the time of establishment. However, increase of the grasses and fourwing saltbush, *Atriplex canescens* (Pursh) Nutt., resulting from natural downstream seeding from these plots is many times greater than the original seeded plots. Our objective is to develop low input, minimal disturbance revegetation technologies that rely on endemic abiotic and biotic forces to promote autogenic succession within these favorable sites.

Materials and Methods

Water Dispersal of Seed

Target areas were selected at strategically located upstream sites along gently sloping arroyos now occupied principally with creosotebush, *Larrea tridentata* (DC.) Coville, and tarbush, *Flourensia cernua* DC. These sites receive regular inputs of water, nutrients and organic matter. Our intent was to establish permanent seeding blocks of native perennial grasses and shrubs selected for their competitive ability and productivity, which by their

downstream establishment would improve productivity, habitat and hydrology both longitudinally and laterally along the arroyo.

Four seeding blocks were established by scraping the surface of undesirable shrubs from an area 10 meters wide and 30 meters long. Each block crossed a shallow gully, and blocks were established just prior to the anticipated summer rainy season. Four dikes approximately 30 cm high were constructed every 6 to 7 meters along the gully within each seeding block to slow and trap water during flooding. We seeded black grama, *Bouteloua eripoda* Torr., fourwing saltbush, and sideoats grama, *Bouteloua curtipendula* (Michx.) Torr., above the dikes where water was trapped. A portable fence to exclude livestock and rabbits was placed around the site. A portable sprinkler irrigation system was installed and a water tank truck was used to apply approximately one inch of water in each application as needed to supplant inadequate precipitation.

Gully Seeders

Gully seeders as described by Barrow (1992) were installed along gently sloping gullies during three successive summer rainy seasons.

Animal Dispersal

Barrow and Havstad (1992) inserted encapsulated seeds of several grass and shrub species directly into the digestive tract of cattle to determine animal-related effects upon viability and germination. Seed collected from the feces and undigested seed was analyzed and compared for germinability. Seed bearing fecal pats were also placed on rangeland sites to observe germination responses.

Results and Discussion

These studies were established to determine long term effects of the tested practices; therefore, we are only reporting the initial phase. Precipitation was below normal from July through September of 1992. Supplemental irrigation was applied every two to three weeks during this period and good stands of young plants of black grama, sideoats grama and fourwing saltbush were obtained. Protection from small rodents for emerging saltbush seedlings was provided by .5 cm mesh x 30 cm high and 30 cm in diameter wire circles. Fourwing saltbush also emerging in the spring of 1993 after favorable winter precipitation and also after favorable summer precipitation in 1993 were not disturbed by rodents because of either their absence or the abundance of other vegetation. In the fall of 1993 the grass plants produced seed and fourwing saltbush plants ranged from 25 to 75 cm in height.

No flooding occurred during 1991 and 1992 to activate gully seeders, but they were tripped five times during July 1993, each time dispersing seed into the flood waters. Seeds of alkali sacaton, *Sporobolus airoides* Torr., blue panicgrass, *Panicum antidotale*, and fourwing saltbush passed through cattle with minimal loss of germination and also germinated well in fecal pats. Sideoats grama seeds were digested and did not survive passage. Some seeds of blue panic germinated after three years in fecal

pats when precipitation was favorable. Under arid conditions, for animal dispersal to be effective, seed must be selected for ability to survive the digestive tract and in the pat until favorable conditions for germination are met. Hot dry conditions occurring immediately after the pat dropped cause severe crusting and prevention of seedling emergence. Animal dispersal of seed could be an effective means of seeding some remote or inaccessible locations if proper selection of seed, timing and animal management practices were followed.

The increase of productive shrubs and grasses along arroyos would be expected to increase fertility and water infiltration and would subsequently improve numerous habitat values. Such remediation technologies used on a regular basis provide low input efforts at strategic locations and would have long term benefits with minimal biological disturbance. It is unlikely that any single approach would assure complete success. Therefore, removal of pernicious shrub species by chemical or mechanical means may aid these natural processes if applied strategically or in a timely manner within a total management system.

Long-term responses will be further quantified by measurements of vegetation responses to applied technologies. The goal is to remediate deteriorated conditions rather than to restore prior vegetation. The latter may be neither feasible nor desirable.

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