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Prescribed Burns of Savannas Require Different Strategies and Precautions (Missouri)

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Because savannas include trees and shrubs, restorationists must use methods of prescribed burning that are different from those used on prairies. Woody savanna plants not only cause fires to smolder longer than prairie forbs and grasses, they produce more sparks, and pose a greater threat to the safety of field workers. In this note, I offer a few recommendations for conducting fires safely in savannas.

Firebreaks should be mowed as they are in prairies and then cleared of leaf litter and grass by using leaf blowers or rakes. If the work is done weeks or months before the burn, fire bosses should check the firebreaks to make sure they are still clear and will not carry a fire. Firebreaks in drainageways or those created during the winter must be checked for flammable material once they dry or thaw out. If possible, managers should avoid 90 degree corners when designing a firebreak to go around obstacles. Small headfires and fire whirls can develop at these sharp bends, producing updrafts that can send smoldering, dry leaves into the air where they can start spot fires outside the firebreak.

Living or dead trees located near a fire line can also create problems if they catch fire. They may "chimney," causing airborne embers to shoot out the top of the trunk—embers that could ignite dead or dry vegetation outside the firebreak. The fire may also weaken trees and cause them to fall across the line. To avoid these problems, I suggest cutting down any potentially troublesome dead snags or live, hollow trees prior to burning. If this is not an option, then managers should remove all dry leaves, fallen bark and branches, and thick grass for a distance of 1 to 1.5 m (3 to 5 ft) around the base of the tree, especially any problem tree on the downwind side of the burn unit. This labor-intensive procedure will reduce *but not eliminate* the likelihood of these trees catching on fire.

Cutting down a burning tree—a very dangerous activity—should be considered only as a last resort because it is impossible to predict where such a tree will fall. Creating a secondary firebreak is usually a better option.

Trees or branches that are already lying in or across the fire line should be removed or cut so that full width of the firebreak is maintained. Fire bosses should design firebreaks to avoid these downed materials if they cannot be removed or cut. Crews should check them closely after a burn because the logs may smolder for days. This creates a potential for spot fires on subsequent days when weather conditions may allow the fire to flare up and spread. In addition, logs on steep slopes can roll downslope across firebreaks as they continue to burn.

Woody material also causes safety problems that are not typically associated with prairie burns. For one thing, woody debris falling from standing or burnt-out trees poses a danger to crews. Crews should avoid these areas for several days after a burn and wear safety helmets if they must re-enter the burn unit. Second, there is a greater potential for smoke-related problems to occur even hours after the burn. This is especially the case when a nighttime temperature inversion does not allow the smoke to escape. Third, dead snags and hollow, live trees may cause problems if they fall into nearby roads or powerlines.

In addition to woody material, savannas also have a mixture of fuel loads ranging from slowing-burning leaf litter to fast-burning grasses. Managers should consider these differences when establishing firebreaks and managing the fire as it passes through different types of vegetation. They must also be aware that fires can be different due to the amount of fuel available at the time. For example, a spot fire in an unburned area will burn with more intensity and be more difficult to control than a fire on a recently burned area.

Leaf litter and dead branches in or along firebreaks will smolder longer than standing dead grass. This makes flappers less effective on savanna burns than on prairie burns. Moreover, the smoldering nature of woody materials means more staff time is necessary to mop-up and monitor a savanna burn. Whether or not staff will be available late in the day or on subsequent days should be considered when planning prescribed fires on savannas.

Finally, oaks and other trees often hold their dead leaves through the winter, which can create the potential for spot fires if the trees are located near fire lines. Red cedars (*Juniperus virginiana*) are highly flammable and thickets of them are capable of carrying a crown fire. I recommend keeping fire lines away from cedar thickets, if possible. Otherwise, cedars can be cut and removed, although it is a very labor-intensive process. Cut cedars should be moved outside the burn unit or, under damp or humid conditions, piled and burned within the unit prior to the prescribed burn.

These recommendations reflect the cumulative experience of the Missouri Department of Natural Resources, which for more than 13 years has used prescribed burns to manage savannas within Missouri's state parks.

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Low-Cost Seeding Practices for Restoring Desert Environments (New Mexico)

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Over the past 120 years, the grasslands of the northern Chihuahuan Desert have been converted to shrublands dominated by species such as mesquite (*Prosopis* spp.). Unfortunately, attempts

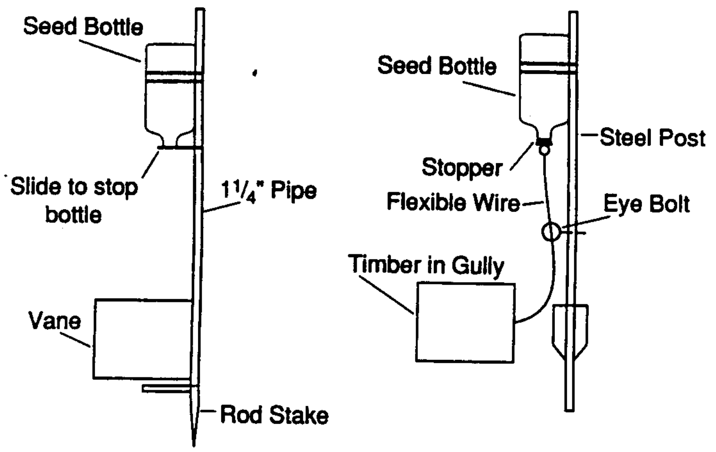

Figure 1. Ingenious in their design, these gully seeders work with natural forces to revegetate erosion-prone gulches. *Drawing courtesy of authors*

to restore these grasslands have often been unsuccessful despite substantial expenditures of money, labor, and fossil fuels. At the Jornada Experimental Range, we have recently begun to test low-input restoration technologies in an attempt to remedy this situation. One aspect of this program focuses on the use of both water and animals to deposit viable seeds into favorable microsites.

Every summer, intense thunderstorms with heavy rains sweep across the Chihuahuan Desert causing gully erosion on unvegetated slopes. We have found that these gullies, with their concentrated moisture and organic matter, make excellent sites for reestablishing native species. To take advantage of this situation, we have developed low-cost (less than $5) gully seeders that disperse seeds during peak rainfall events (see Figure 1). The seeders have a movable element—either a vane or a piece of wood—that is placed in the water channel. When sufficient water flows through the channel, the vane or piece of wood moves, releasing the stopper from the upturned bottle of seed. The seed then falls out of the bottle and moves downstream to areas where it is deposited along with a mixture silt and organic matter (Barrow, 1992). We have observed that a large portion of the seeds deposited in this manner not only produce full-grown plants, but that the progeny of these plants disperse readily into the surrounding area. In the future, we plan to improve seeding success by placing dikes and micro-catchments within gullies and by adding organic amendments such as animal waste.

Domestic and native animals can also be used to disperse seed. In one study (Barrow and Havstad, 1992), researchers fed steers gelatin capsules containing fourwing saltbush (*Atriplex canescens*), side-oats grama, (*Bouteloua curtipendula*), stiff panicum (*Panicum hirsutum*), and alkali sacaton (*Sporobolus airoides*). Most seeds were deposited in the cattles' dung within 48 hours, although the percentage of seed found in the dung after 96 hours ranged from zero percent for side-oats grama to over 62 percent for stiff panicum. Other studies using both cattle and sheep have yielded similar results (Simao Neto *et al.*, 1990). We believe that it may be possible to modify the passage rate and/or the biochemical environment in the digestive tract in order to regulate the level of seed survival.

We plan to evaluate the fate of seeds (both desirable natives and undesirable exotics) after dispersal. Other researchers have noted that seedlings do emerge from the feces of cattle, sheep, deer, and rabbits in temperate pastures (Welch, 1985). Jeff Herrick has found field seedling emergence rates ranging from two percent to 65 percent in a tropical pasture system, with as many as two-thirds of these seedlings surviving through the end of the season (Herrick, unpublished data). We expect that field emergence and establishment rates will be significantly lower in the harsher, desert environment.

Native wildlife might also serve as seed-dispersal agents. For example, we are working with kangaroo rats to see if they will disseminate and "plant" fourwing saltbush—a species that will compete with mesquite. We feed the kangaroo rats the seed of fourwing saltbush along with seed that they prefer. Recent laboratory trials have shown that, as we hypothesized, the rats consume the preferred seed while either scattering or hoarding the fourwing saltbush seed. We believe that hoarded fourwing saltbush seed will germinate and establish themselves. In fact, germination rates could be quite high because the seed is exposed to a fungal inoculum while being carried in the cheek pouches of the kangaroo rats.

Research directed toward understanding ecological processes and their applications is ongoing. In time, we hope to develop an array of technologies that will be widely available and easily accessible to managers of arid- and semi-arid environments.

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Drip Irrigation Aids Revegetation of South Texas Blackbrush Community

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