Post-fire Seeding for Hydrologic Recovery

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A healthy stand of seeded grasses from the Cerro Grande Fire. Photo by Sam Loftin, LANL.

Seeding has long been an important treatment for post-fire watershed rehabilitation. It has also become arguably the most controversial tool in the toolbox. Few topics generate as much heated discussion as choosing an appropriate seed mix or critiquing the seed mix chosen.

High severity fires often consume standing vegetation as well as the soil organic layers and associated seed bank. Consequently, soils are left unprotected and little seed reserve may be left to stabilize soils in the future. This increases the potential for substantial runoff, soil erosion, downslope flooding, and degradation of water quality. Seeding attempts to restore some stability to burned soils and watersheds. The decision to seed or not requires an evaluation of the risk to resources of either course of action. Frequently, it appears that fires are seeded as a standard course of action. Given the controversial nature of the issue, it is probably best to justify the need to seed rather than the converse.

How and Where to Seed

Considerations when designing a seeding project include seed application techniques, treatment location, choice of appropriate seed, seeding rates, availability, and cost. Application techniques can range from aerial seeding for large areas (by plane or helicopter) to hand application with or without mulching or other seedbed enhancement techniques. Although aerial seeding allows the treatment of large areas at relatively low unit cost, its outcome can be unpredictable, and often results in fat mice rather than stable soils. A more successful and cost-effective approach is to target or avoid specific landscape features. Areas with high burn severity are targeted, whereas areas with low and moderate burn severity often retain sufficient seed in the seed bank to promote regrowth, and needle fall following the fire can provide adequate mulch. Areas that are avoided include south- and west-facing exposures, because they are often too hot and dry for seed germination without mulch cover. Note that surface applications of seed without mulch cover often do not germinate the first season, so benefits may not be realized for nine to 12 months.

Choosing the Seed Mix

Choosing an "appropriate" seed mix is another tricky task. What are the environmental constraints? Will it grow? How long will it persist? Should natives or non-natives be used? A seed mix that works at the 10,000-foot elevation in the Sangre de Christo Mountains may not work at 6,000 feet on the Caja del Rio, even though they are both in the same Forest District. Local experts and seed distributors can match species with environmental conditions. Another concern is species persistence: How long will the seeded species survive in the burned area? Annual species such as annual ryegrass (*Lolium multiflorum*) or cereal grains are often used to provide quick cover to protect soils, then die

out in a year or two, thereby limiting competition and suppression of native plant species. Perennial species such as slender wheatgrass (*Elymus trachycaulus*) and mountain brome (*Bromus marginatus*) have been used successfully in northern New Mexico to provide cover for two to seven years before they die out. Some areas at Los Alamos National Laboratory (at approximately 7,000 feet elevation) that burned in the Cerro Grande Fire of 2000 were seeded with annual ryegrass, barley (*Hordeum vulgare*), slender wheatgrass, and mountain brome, and then straw-mulched. The seeded annual species came in strong by the 2001 growing season, seeded perennials were abundant by 2002, and by 2003 endemic native species dominated the site, with seeded species found only in protected areas. In contrast, the 1964 Wildcat Fire on the Apache-Sitgreaves Forest in Arizona was seeded with a mix that contained an African exotic, weeping lovegrass (*Eragrostis curvula*), and 35 years later the area was still dominated by lovegrass. The site is stable, but native plant and animal abundance and diversity is less in many areas than in native grassland. In general, the use of persistent non-native species is not recommended.

Although native species sound like the obvious answer, the issue is not that simple. Availability and cost are always of concern when dealing with native seed, particularly during the fire season when supply goes down and demand and cost go up. Non-native species are attractive because they often have higher germination and growth rates. But the real issue in the native versus non-native debate revolves around the introduction of new genotypes. Most people would consider blue grama (*Bouteloua gracilis*) a native species, but if the seed is collected in Oregon and cultivated in South Dakota, is it appropriate to use in Colorado? How are we affecting native populations by introducing genotypes adapted to other regions? Is it preferable to use non-native species that will die out in a few years rather than to introduce nonlocal genotypes of a species that can interbreed with the locals? Answers to these questions are being debated. Fortunately, many growers offer certified or "source-identified" seed. Certified seed verifies the specific seed variety, while source-identified seed has information on where the seed was collected, to allow a better match with local conditions.

Keeping Noxious Weeds Out

Another seeding concern is the inadvertent introduction of noxious weeds. This is a problem associated with all aspects of wildfire, from suppression to rehabilitation. Most noxious weeds have evolved to take advantage of disturbances such as fire. Treatments like seeding and mulching provide a pathway for introduction. Certified weed-free seed should be used for all applications and all major growers offer this service. Weed-free certification simply means that the samples taken from a particular seed lot contained no weed seeds listed as prohibited by the state where the seed is to be applied, and the amount of state-restricted weed seeds is less than some defined limit. Lists of prohibited and restricted species for each state can be obtained through the State Noxious Weed Seed Requirements link provided below. It is recommended that seed be tested for purity by an independent seed lab. Such labs often are associated with state agricultural universities and the analysis is usually fast and inexpensive. Be aware that certification and testing do not guarantee purity; some weed seed almost always remains, and with it the possibility of noxious weed introduction.

Burned area rehabilitation and natural resource management in general are all about managing risk. Risks associated with seeding or not seeding or the use of natives versus non-natives should be identified and documented before decisions are finalized. One way to reduce the controversy and gain consensus for treatment options is to engage local agencies and interested parties and develop strategies to be implemented in emergency situations before a crisis occurs.

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Additional Information . . . . . .

State Noxious Weed Seed Requirements: www.ams.usda.gov/lsg/seed/seed_pub.htm.