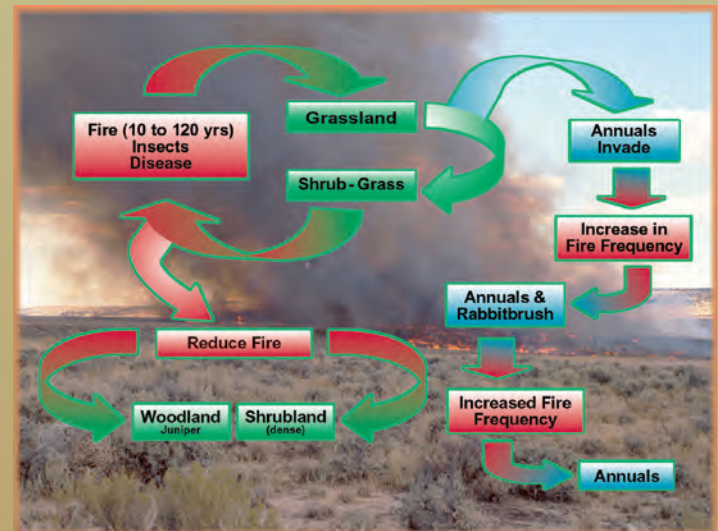


Born of Fire—Restoring Sagebrush Steppe

Background

Fire is a natural feature of sagebrush grasslands in the Great Basin. The invasion of exotic annual grasses, such as *Bromus tectorum* (cheatgrass), has changed the environment in these ecosystems. Invasive annual grasses provide a dense and continuous source of fuel that extends the season for fires and increases the frequency of fires in the region. Frequent fires eventually eliminate the native sagebrush. These annual grasses also change soil nutrients, especially carbon and nitrogen, such that invasive annual grasses are favored over the native plants. The Forest and Rangeland Ecosystem Science Center of the U.S. Geological Survey (USGS) is studying how to reduce the problems caused by these invasive annual grasses and restore native sagebrush grasslands. The areas of research include understanding disturbance regimes, especially fire, discerning the role of nutrients in restoring native plants, determining the potential to restore forbs important for wildlife, and ascertaining the past and present use of native and nonnative plants in revegetation projects.

change in the natural fire regime. Sagebrush steppe ecosystems of the Great Basin in the western United States are examples of fire-prone ecosystems. Many wildlife species depend on sagebrush steppe ecosystems for survival. Unfortunately, a change in the natural fire regime is decreasing the extent of sagebrush ecosystems, and the populations of wildlife species that depend on sagebrush are undergoing steep declines because of habitat loss. The invasion of cheatgrass is fueling larger and more frequent fires that are out-competing sagebrush as well as the associated forb and grass species that are native components of that ecosystem.



Wildlife and land managers wish to restore sagebrush steppe ecosystems in a way that is self-sustaining. However, one challenge is to figure out what to restore when an area is currently a monoculture of cheatgrass. For example, these areas were dominated naturally by either sagebrush or grasslands, or were a combination of both prior to European settlement. This is a difficult question to answer when faced with cheatgrass dominating millions of acres of lands.



Scientists at the USGS Forest and Rangeland Ecosystem Science Center are trying to answer questions about the historic fire-return intervals in these ecosystems and which plants to restore after fires. Most of the work is being conducted on lands managed by the Bureau of Land Management (BLM). A study examining fire records between 1988 and 1999 indicated that there was a doubling of fires in the last 12 years, mostly between 1996 and 1999. All BLM field offices have noted an increase in the proportion of land that has burned over this time period.

Invasive Species Influenced by Fire

Many ecosystems are fire dependent in that the plant species growing there depend on periodic wildfires to regenerate and establish. Fire is a natural component in these ecosystems; however, in the last century many factors have contributed to a

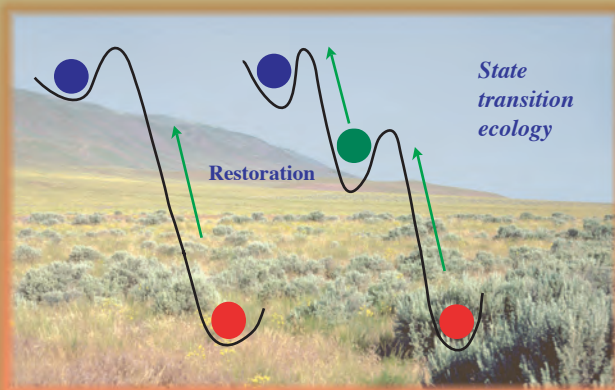
Fire and Nutrients

Prescribed fires tend to raise levels of nitrogen for two to three months following a fire. Studies have shown that cheatgrass is favored in high nitrogen conditions over native plants, which can tolerate lower levels of nitrogen. Prescribed fires are typically conducted in fall, and these tend to increase the seed production of annual grasses such as cheatgrass. Wildfires may have had a similar effect, although wildfires typically occurred in late summer or early fall. Therefore, it may be necessary to reintroduce fire in the springtime before the cheatgrass produces seeds.

Testing Solutions

USGS scientists are testing several potential solutions:

1. Stop the fire cycle that is occurring because it is perpetuating the regeneration and survival of the annual grass cheatgrass
2. Plant native plants that may be able to compete with cheatgrass
3. Use a transition stage to restore an ecosystem from a monoculture of cheatgrass to an entirely native shrubland-grassland community — intermediate stage may be necessary to help compete against cheatgrass



4. Decrease availability of nitrogen to help facilitate the growth of native plants

Native Forb Species and Fire Management

Since European settlement of the Intermountain West, sage grouse abundance and productivity has declined and their range has decreased. The decline of sage grouse populations is primarily due to permanent loss and degradation of sagebrush-grassland habitat. Recently, several studies have shown that sage grouse productivity may be limited by the availability of certain preferred, highly nutritious forb species that have also declined within sagebrush ecosystems of the Intermountain West. During the spring and summer, forbs are extremely important in maintaining the nutritional status and productivity of pre-laying hens and growth and survival of rapidly growing chicks. Scientists at the Forest and Rangeland Ecosystem Science Center have conducted research to determine the suitability of three species of forbs for revegetation projects where improving sage grouse habitat is a goal. Species suitability was determined by evaluating the emergence, survival and reproduction of *Crepis modocensis*, *Crepis occidentalis*, and *Astragalus purshii* in response to methods of establishment (seeding or transplanting),

— Forbs for Sage Grouse —



Astragalus purshii
(woolypod milkvetch)



©Terry Steele
Crepis occidentalis
(largeflower hawksbeard)



pre-establishment treatment (burned or unburned), and microsite (mound or interspace). It was determined that the revegetation of sage grouse habitat with *Crepis* species is a viable option because it exhibits high germinability and survival, favorable responses to fire, and wide distribution.

Restoration or Rehabilitation?

The goal of restoration entails difficult questions: what is the restored state for a given area and how is that goal achieved? It may be necessary to first proceed through rehabilitation states to control erosion and halt the spread of invasive plants by using other competitive plants that may not be native to sagebrush steppe ecosystems; however, executive order 1312, enacted in 1999 by President Clinton, directs that natives will be used wherever possible. One challenge with restoring native plants is finding available seed sources. USGS scientists are conducting studies to provide this information to land management agencies such as the BLM. It is important to find appropriate species, but also to develop rehabilitation treatments that will work to re-establish native plants.

Future Research:

- Understand the decomposition of sagebrush ecosystems and microbes that are present in these ecosystems
- Defoliation to decrease cheatgrass seed bank
- Use of herbicides to impede cheatgrass but that will not harm natives
- Combining burning and seeding strategies to re-establish natives
- Finding ways to decrease risk of fire in urban areas where lives and structures are in danger

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