Joint Fire Science Program
Fire Science Brief
RESEARCH SUPPORTING SOUND DECISIONS

A photo of prescribed burning on the site. This photo represents a typical ungrazed site. Credit: Gabrielle Diamond.

Do Fence Me In: Cattle Enlisted in the Great Basin to Reverse the Cheatgrass/Wildfire Cycle

Summary

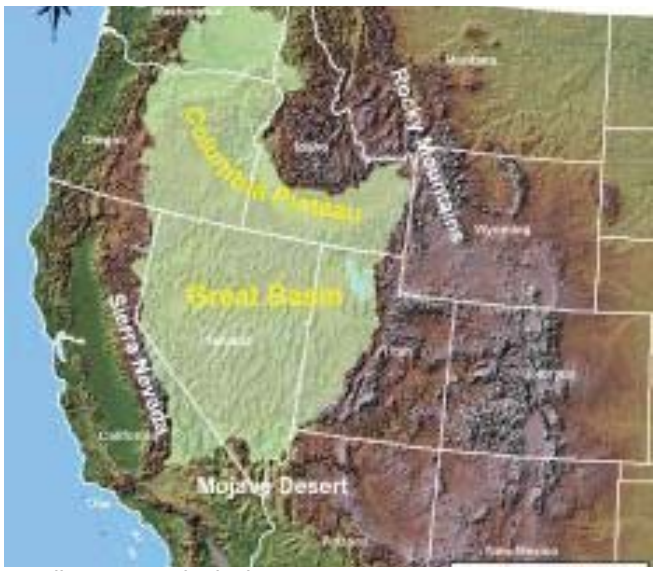
Cheatgrass and cattle have co-existed in the Great Basin since the late 19th century, when both were introduced by settlers of the western territories. Unchecked grazing of the sagebrush-steppe community decimated the native perennial grasses in some areas and gave cheatgrass, a nonnative annual, permanent inroads into the ecosystem. Cheatgrass is generally palatable and nutritious for cattle in spring, but dries quickly in the hot, dry summers typical of the Great Basin, becoming a flashy fuel that carries fire quickly. The invasion has drastically shortened the fire return interval and led to increasingly intense and fast spreading wildfires, which have caused perhaps irrevocable changes on the landscape. Recent research has demonstrated that short periods of intensive, or targeted, grazing by cattle followed by prescribed burning can, in as few as two years, break the cheatgrass/wildfire cycle. After two years of spring grazing followed by fall burning, fire was virtually stopped in its tracks in small experimental enclosures in the Bureau of Land Management's Winnemucca District in northwestern Nevada. This method of reducing fire hazard, while not suitable for controlling cheatgrass on the landscape scale, may be used strategically as fire breaks to slow the spread of wildfire or buffer strips to protect areas that still retain native vegetation. The project, a result of cooperation among private landowners and lessors of public lands, and state and federal agencies, could also usher in a new era of public/private cooperation in land management and fire control.

Key Findings

- Cheatgrass has invaded much of the western United States, including the sagebrush-steppe community of the Great Basin, replacing native vegetation and dramatically increasing fire frequency and intensity.
- Intensive grazing for short periods before cheatgrass goes to seed, followed by prescribed fire, is more effective than burning or grazing alone at reducing cheatgrass cover and the seed bank.
- Grazing and burning are effective at reducing fire hazard on severely degraded land, but they are labor intensive and more suitable for establishing fire breaks and buffer zones than for landscape-scale control or restoration of native vegetation.
- An economic analysis reveals that a common herbicide used to treat cheatgrass is less costly initially than grazing and burning in reducing cheatgrass biomass and fire hazard, but in the long term, the investment, primarily in fencing, pays off in weight gains from calves going to market.
- The Great Basin cannot heal itself. Each year, the intensity and severity of fire increases. More than technical treatments, cooperation is needed to save what's left of the historic native vegetative communities and stem the tide of cheatgrass invasion.

Introduction

The Great Basin—the area west of the Rockies and east of the Sierra Nevada, north of the Mojave Desert and south of the Columbia Plateau—is a region of extremes. Harsh winters during which temperatures rarely rise above freezing are followed by hot summers with temperatures hovering near 100° Fahrenheit (37° Celsius). Precipitation is low, averaging only 10–12 inches (24–30 centimeters) a year, mostly in the form of winter snows. The basin and range topography of the region is typified by valleys around 4,000 feet (1,200 meters) in elevation surrounded by mountain ranges up to 12,000 feet (3,600 meters).



Credit: U.S. Geological Survey.

Unlike much of the west, after the extinction of the megafauna such as mastodon, woolly mammoths, camels, and horses at the end of the Pleistocene Era, the area evolved with little grazing pressure from large herbivores such as bison, deer, and antelope, which were relatively rare in the area. In fact, until the introduction of domesticated livestock, the jackrabbit was the dominant herbivore in the Great Basin.

Enter the earliest settlers, who brought with them cattle, then sheep. Of the three vegetative communities in the region—sagebrush, salt desert shrub, and pinyon-juniper woodlands—the sagebrush-steppe community was best suited to support moderate grazing, but soon the land was subjected to unchecked grazing and severe erosion problems. "The native vegetation included perennial grasses, perennial forbs, and an overstory of shrubs, primarily big sagebrush," says Chris Call, an associate professor in the Department of Wildland Resources at Utah State University.

By the 1880s, native perennial vegetation at lower elevations had succumbed to overgrazing. In 1934, in response to the severe degradation of western rangeland, the Department of Interior, through the newly created Grazing Service, enacted the Taylor Grazing Act, which called for control of grazing on public lands through a permitting system and exclusion of livestock from land deemed unsuitable for agricultural purposes. The Grazing Service merged with the General Land Office in 1946 to create the Bureau of Land Management (BLM), which today oversees 264 million acres of public lands, including 75 million acres in the Great Basin.

Through the years, the agency has succeeded in reducing grazing pressure in the Great Basin and other western rangelands, but neither BLM, other state and federal agencies, nor private landowners have yet managed to break the cheatgrass/fire cycle. A decade ago, in response to one of the worst fire seasons on record, BLM created the Great Basin Restoration Initiative (GBRI). The aim of the GBRI is to "restore some areas of high values, reduce the effects of annual grasses and noxious weeds in others, and reverse the destructive cycle of wildland fires." The agency also recognizes that such a daunting task cannot be accomplished without reliance on local partnerships with private landowners.

Image of cheatgrass surrounding sagebrush, demonstrating the density and ability of cheatgrass to dominate a system. Credit: Gabrielle Diamond.

Flash point

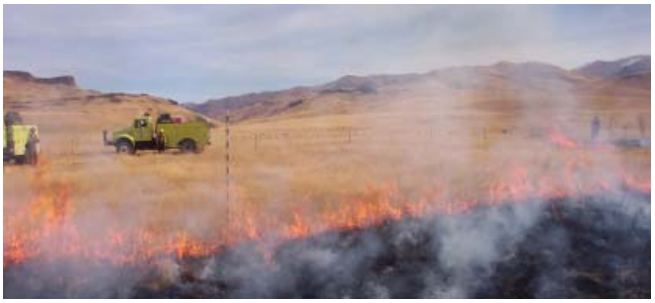
In 1999, one of the worst wildfires in the history of the Great Basin was ignited by a series of dry lightning strikes on northern Nevada rangelands. When the fires died down, 1.7 million acres (0.688 million hectares) had burned. Afterwards, a group of private land owners and concerned citizens who live in and near the BLM's Winnemucca District in northwestern Nevada approached BLM with a plan to help in early detection and fire suppression. "Local ranchers got together to form the Wildfire Support Group (WSG), working with BLM, the Forest Service, and other agencies to help each other out in suppressing fire," says Call. BLM offered fire suppression training and certification to landowners, and soon the group became interested in pre-suppression of fire and finding ways to knock back the cheatgrass/wildfire cycle.

With support from the Joint Fire Science Program (JFSP), Call and colleague Nicole McCoy at Utah State, and Nora Devoe, science coordinator of BLM's Western Region, embarked on a study to investigate the use of intensive grazing followed by fire to reduce biomass and fine litter and seed bank densities in an area heavily infested with cheatgrass. John Falen, a local rancher with WSG, offered to contribute his cattle to the project, and other members of the group volunteered their time and labor to implement the plan, which involved herding the cattle into experimental plots that measured 200 by 200 feet (60 by 60 meters), about an acre and a half (two thirds of a hectare).

The entire experiment had four treatments: grazing followed by prescribed burning, grazing alone, burning alone, and a control. In 2005 and again in 2006, on the graze/burn plots, the enclosures were stocked at a very high level, 33 cow/calf units per acre (83 per hectare) in early- and mid-May, and cattle were allowed to graze for one to two days before being removed. "For targeted grazing to be effective, you have to catch the cheatgrass at the boot stage, as the flowers are beginning to develop and emerge and before the plant goes to seed," Call says. This is also the stage at which cheatgrass is very palatable. Later, it develops a stiff bristle, or awn, which can cause trouble with the cow's mouth.

The graze/burn treatment areas were burned in October 2005 and 2006. "In the first year, grazing reduced the fuel load and the subsequent fire consumed most of the litter," Call says. The second year, the treatments were repeated. "By the second fall, there was not as much continuity of live fuel load and litter. The second fire burned only about five meters into the plot before it burned out."

A photo of the cattle on the actual site. This does not show all the cows in the paddock at once. Credit: Gabrielle Diamond.



Grazed, first year of treatment. Site has been grazed to 80–90 percent utilization. Credit: Gabrielle Diamond.

Another aim of the study was to determine the effect of grazing/burning on the seed bank. By targeting grazing at the boot stage, the research team found the grazing/burning treatment resulted in the lowest seed density of the three treatments and control, followed by grazing alone. This information could be useful to ranchers and land managers trying to establish the most effective timing for grazing.

Restoration and rehabilitation

"There will never be resources to treat every single acre," says Nora Devoe, who is also a science coordinator for the Great Basin Cooperative Ecosystems Study Unit. "We have to first protect remaining habitat, then concentrate on areas with the best potential for restoration." Areas that are dominated by cheatgrass would require tremendous inputs, and most agree that native vegetation can probably never compete with cheatgrass in these severely degraded systems. In these cases, the goal is not restoration but rehabilitation.

After the experimental treatments in the Winnemucca District, she notes that while the grazing and burning treatment reduced the cheatgrass, there was a shift to undesirable nonnative species—such as clapsping pepperweed and tansy mustard that filled the vacuum—and one native perennial grass, Sandberg bluegrass. Restoration to native conditions of such areas is probably not feasible. The intensive grazing also damages the soil crusts.

Sandberg bluegrass. The graze/burn treatment at the end of the project, 2007. The green in the background are individual *Poa secunda* plants. Credit: Gabrielle Diamond.

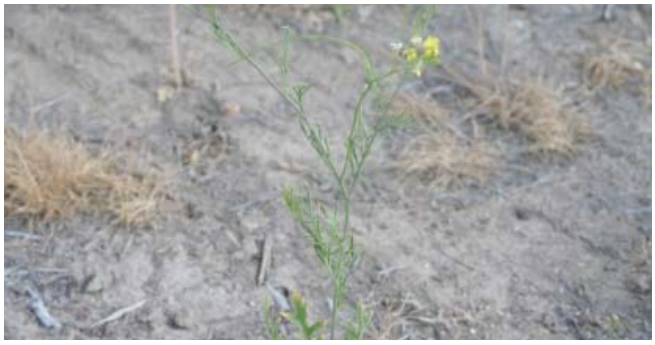


Image of mustard which is a co-dominant to the site. Credit: Gabrielle Diamond.

There are, however, areas where there is a decent understory of native perennial grasses. "If precipitation levels are good and the areas are managed correctly, it is possible to increase the native grasses and maintain some diversity," says Devoe.

Cost considerations

A third aim of the JFSP-funded project was to compare the cost of the graze/burn treatment with that of Plateau®, a commonly used, pre-emergence herbicide that kills emerging seedlings. "It limits carbon allocation, and the plants starve to death," says Joel Diamond. As part of his dissertation, Diamond, a doctoral candidate at Utah State, extrapolating from the results of the experimental treatment, finds that after three years the grazing/burning treatment could be more cost effective than the herbicide.

The experimental site is located near the boundary of Humboldt-Toiyabe National Forest, where preventing cheatgrass expansion is a high priority. Diamond proposes that grazing could be applied effectively as a fire break or buffer zone by installing contiguous fenced strips several miles long on severely degraded sage/cheatgrass communities that abut healthier ecosystems.

Diamond's economic analysis shows that while herbicide costs are initially much lower, over time, grazing would be more cost effective. The big upfront cost in targeted grazing is the electric fencing used to concentrate the cattle. By grazing when nutritional value is at its peak, with high or moderate levels of biomass, animal weight gain would be sufficient to offset the cost over time. "This treatment would basically pay for itself within three years," he says.

Fighting aliens with aliens

Another strategy in the war against cheatgrass is to reseed cheatgrass infested areas to other forage species such as crested wheatgrass. "It's trading one monoculture with another," Diamond says, "but crested wheatgrass doesn't carry fire as well." In addition, like many native perennial grasses of the Great Basin, it's a bunchgrass, which does not have the fuel continuity of cheatgrass. The nutritional value of crested wheatgrass is also higher than cheatgrass later in the summer, and it supports wildlife such as pronghorn or mule deer better than cheatgrass. "Some data support the theory that crested wheatgrass supports an increase in sage grouse and native rodents like Kangaroo rats, which are granivores."

Timing of grazing is also a way to manipulate the plant community depending on the goal, whether to reduce fire hazard, maintain a cheatgrass community for further grazing, or to eliminate cheatgrass with the aim of reseeding with another forage or a native plant. "We can reduce the seedbank of cheatgrass to about 600 seeds per square meter in a plant community that otherwise can have as many as 20,000 seeds per square meter."

Common cause

In 1999, Jan Schade watched from his new home near the town of Orovada north of Winnemucca, Nevada, as tens of thousands of acres burned. Though he is not a rancher, his land is surrounded by cattle ranches. "Every time we have a fire, cheatgrass expands, impacting wildlife and eliminating the sagebrush community," he says.

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Schade is the coordinator of the WSG. The group provides BLM land managers in the Winnemucca region with support by communicating information on the occurrence and nature of fire and mounting assistance with initial fire suppression in areas that are far from agency firefighting resources. Its members have knowledge of the local conditions and access to heavy equipment to help suppress fires. One of the ranchers, John Falen, loaned cattle for the JFSP graze/burn experiment.

Though replanting with native vegetation may work in plant communities that are not heavily invaded by cheatgrass, Schade says that in more degraded systems "native plants will not compete, cheatgrass will win every time." In areas intended for grazing, other forage grasses that are easier to establish than some of the natives may be good choices for reseeding after treatments to reduce cheatgrass, whether mechanical, chemical, grazing, burning, or some combination of these. "Crested wheatgrass, forage kochia, and some rye grasses can compete and stabilize the system, and these species are also somewhat fire resistant."

Schade supports the efforts of private land owners to help in the common cause of achieving a balanced

ecosystem that supports wildlife as well as livestock. "As stewards of the land, instead of battling each other, we need to tie in with others, including sportsmen coalitions," he says. "The [WSG] is helping bring down the barriers that exist between public agencies and private land owners." The group works with ranchers, wildlife advocates, sportsmen, and state and federal agencies to focus on exactly what is needed for both the public and ranchers. "If something isn't turned around soon we won't recognize the Great Basin as it has been for thousands of years."

Image of the thick density of vegetation. The broadleafed plant within the cheatgrass is the pepperweed. Credit: Gabrielle Diamond.

The pioneer spirit

The spirit of cooperation that led to the small-scale JFSP-funded project in BLM's Winnemucca District has proven contagious. Call is now embarking on a large-scale project based on the data he and his colleagues collected in the graze/burn experiments. This effort covers the five states of the Great Basin—Utah, Nevada, Oregon, Idaho, and California. "This is a region-wide effort for managing invasive annual grasses like cheatgrass using state of the art technology in the appropriate sequence to put cheatgrass and other annual grasses at a disadvantage," he says. The treatments include grazing in May follow by burning in October. "After burning we apply the herbicide Plateau. If the litter has been removed, the herbicide can penetrate into the soil and kill the seedlings that emerge."

After herbicide application, the treatment plots will be seeded with a mixture of perennial grasses and forbs. The Ecologically Based Invasive Plant Management (EBIPM) program is based in Burns, Oregon, and consists of a team of 20 to 25 scientists, land managers, universities, and BLM, and is led by the USDA Agricultural Research Service. But EBIPM is about more than science. "We are involving private landowners who offer their land for the research and are encouraging them to adopt these practices," Call says.

Management Implications

- Repeated targeted grazing followed by prescribed burning is indicated as a control of cheatgrass on severely degraded rangelands where little to no desirable vegetation remains.
- Targeted cattle grazing/burning strips may be strategically deployed to slow or prevent the spread of wildfire or create fire breaks or buffer zones, but it may be logistically impractical to implement at the landscape scale.
- The Wildfire Support Group provides local assistance in fire suppression and pre-suppression to federal and state agencies. It can serve as a model for future cooperative arrangements between private landowners and state and federal agencies.

Further Information: Publications and Web Resources

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Scientist Profiles

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