Bromus tectorum

Cheatgrass, Downy Brome

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Public Lands History Center at Colorado State University, September 2014

History

The chronicle of cheatgrass begins with the early domestication of cattle, sheep and goats in southwestern Asia and has followed the migration of humans and their livestock. Records suggest cheatgrass reached the United States as a grain contaminant by 1889 in three noncoastal wheat-growing districts. The first recorded locations of cheatgrass presence are: Spence's Bridge, British Columbia in 1890; north of Ritzville, WA along the Great Northern Railroad in 1893; and in Provo, UT in 1894. Cheatgrass has conventionally followed the path of human cultural expansion. In some instances it was deliberately introduced as a species resistant to overgrazing. Records show an experimental farm at a college in Pullman, WA planted cheatgrass seeds that it received from the US Department of Agriculture in 1897. Another point of deliberate introduction and dispersal of cheatgrass may have occurred in Oregon in the mid-1910s where it was sold as a "100-day grass."[1]

Figure 1. Cheatgrass. Source: Jim Pisarowicz, Wind Cave National Park, Available from: Wind Cave National Park, http://www.nps.gov/wica/naturescience/grasses-cheatgrass.htm (accessed July 2014).

Over the last hundred years, cheatgrass has expanded its occupation to more than 40,000,000 hectares of land across the United States and has raised concerns about disruptions to the soil nitrogen cycle of inhabited ecosystems. Cheatgrass is widespread across Colorado and has propagated in high elevations throughout the western United States in the last 10 to 15 years. The first record of cheatgrass in Rocky Mountain National Park (ROMO) is in 1996, although it likely had been present for a number of years prior. At this time it was observed by Chris R. Rutledge and Dr. Terry McLendon of Colorado State University that "populations are widespread and dense and are likely inhibiting natural secondary succession." Treatment for cheatgrass at Rocky Mountain National Park began in 2003 focusing around the Beaver Meadows Visitor Center. By 2010 there were an estimated 325 acres of infested land in the park. Cheatgrass is a List C noxious weed in Colorado.[2]

Biological Concerns

Cheatgrass comes with a host of biological concerns. Its effect on the soil nitrogen cycle is detrimental to the establishment and development of other plant species. R. L. Rimer reports that cheatgrass is able to outcompete native grass species due to its higher primary productivity and different root phenology, affecting nitrogen cycling and organic matter formation in soil. Mark W. Paschke's observations suggest cheatgrass could bolster its competitive advantage through negative interactions with the soil microbial community that reduce the speed at which other plants are able to recover.[3]

Aside from the abilities of cheatgrass to alter soil chemistry, the physical characteristics of this winter annual grass predispose it to high competition against native perennial plants. Cheatgrass reproduces by seed. Typically germinating in fall, the seedlings overwinter, and it is able to grow quickly in the spring before many other species get a chance to establish. The seeds are viable for two to five years and each plant can produce anywhere from 25 to 400 seeds, depending on the cover density. Seeds are capable of passing through the digestive tract of wildlife and remaining viable, allowing wildlife to act as a method of dispersal. These patterns of growth increase fire risk in the late season in large stands of cheatgrass that ignite and spread quickly. Cheatgrass increases fine dry fuels, resulting in higher fire risk, after which it can repopulate the area quickly, creating a self-sustaining cycle that is difficult to overcome.[4] Exploring the possible explanations of cheatgrass's encroachment into high elevations of ROMO, Cynthia Brown suggests that the extraordinary rate of climate change in the west is a possible driver in high elevation systems. Higher temperatures and greater rainfall are creating warmer and wetter spring conditions that expedite the expansion of a species already disposed to early-season growth.[5]

Management Strategies

Hand-pulling, mowing, grazing, burning, herbicides, and cumulative stress are all methods that have been used to attempt to control cheatgrass. Hand-pulling is effective in small areas but not a realistic option for large swaths of coverage and mowing requires access that is not always available. Experiments with burning in low-elevation ponderosa pine forests in Kings Canyon National Park show cheatgrass's increased ability to grow in post-fire conditions.[6]

The 2010 Year-End Exotics Report for Rocky Mountain National Park states that herbicide treatments with Imazapic (Plateau) from 2009 were extremely effective in treatment plots against cheatgrass but treatments also resulted in "more collateral damage to surrounding native vegetation than managers would like to have seen." Studies of cheatgrass control in ROMO by Christopher Davis and Cynthia Brown have found a five-fold decrease in cheatgrass cover following application of Imazapic. Due to funding restrictions and the 2013 government shutdown, Imazapic treatments have been temporarily halted. Meanwhile, land managers at Zion National Park have engaged in aerial applications of Imazapic (and Glyphosate, if cheatgrass has begun to grow) during the fall months, trying to control cheatgrass and other invasive annual grasses on thousands of acres of pinyon-juniper that were consumed by wildfires in 2006 and 2007. As a follow up procedure to this aerial application, managers at Zion plan to revegetate the affected area with native grass and shrub species.[6]

Under the 2003 Invasive Exotic Plant Management Plan, permitted treatments include herbicide and sugar application. Sugar treatments are effective but are prohibitively expensive for large-scale applications and chemical treatments hinge upon the efficacy of the intended herbicide.[6]

Recommendations

Past methods for cheatgrass treatment have been effective in controlling the species but can also open ecological voids for repeated invasion. As research continues, new information should be incorporated into any management decision that is made. The author also recommends funding additional research toward a new type of sucrose treatment to find a solution that is both ecologically successful and economically feasible. A potential option may be masticated plant material that can be spray applied with a mixture of native seeds. This treatment would provide enough sugar to realign the soil chemistry in favor of native perennials and reseed the area in one step. Studies (to identify the best type of plant material, how to masticate it, and when to apply the mixture) need to be conducted to develop a thorough understanding of the method's effectiveness.

An alternative recommendation would be to utilize the cumulative stress method of treatment by combining the pressures of herbicide treatments with Imazapic and vegetative competition. Prescribed fire is not recommended given the results of studies in Kings Canyon National Park post-fire, and that cheatgrass naturally tends to be one of the first species to establish post-fire.

Endnotes

[1]James A. Young, "Cheatgrass," Rangelands 9 (1987): 266; Richard N. Mack, "Invasion of Bromus Tectorum L. into Western North America: An Ecological Chronicle," Agro-Ecosystems 7 (1981): 152-153.
[2] R. L. Rimer et. al., "Invasion of Downy Brome (Bromus tectorum L.) Causes Rapid Changes in the Nitrogen Cycle," American Midland Naturalist 156 (2006): 252; Cynthia S Brown, "The Unwelcome Arrival of Bromus Tectorum To High Elevations," 2003: 1; National Park Service Colorado, "Rocky Mountain National Park: Year-end Exotics Report," 2010; Chris R. Rutledge and Terry McLendon, "An Assessment of Exotic Plant Species of Rocky Mountain National Park," Colorado State University Department of Rangeland Ecosystem Science (1996); Julie Knudson, Matt Ounsworth, Michael Prowatzke, Jamie Dahlkemper, Jim Bromberg, and Brian Kolokowsky, "Rocky Mountain National Park Exotics Year-End Reports," Rocky Mountain National Park: Division of Resource Stewardship, 2000-2013.
[3]Rimer, "Invasion of Downy Brome," (2006): 253; Mark W. Paschke et. al, "Nitrogen Availability and Old-Field Succession in a Shortgrass Steppe" Ecosystems 3 (2000): 156.
[4]Michele A. James, "Controlling Cheatgrass in Ponderosa Pine and Pinyon-Juniper Restoration Areas," (2007): 2; Brown, "The Unwelcome Arrival," (2003): 1; Hilary L. Getz et. al., "Initial Invasion of Cheatgrass (Bromus tectorum) into Burned Piñon-Juniper Woodlands in Western Colorado," American Midland Naturalist 159 (2008): 489.
[5]Brown, "The Unwelcome Arrival,"(2003): 3.
[6]James, "Controlling Cheatgrass" (2007): 2-5.