USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Salmon-Challis National Forest, Idaho Dept of Fish & Game, Bureau of Land Management Salmon Field Office

in cooperation with

Rocky Mountain Elk Foundation, Mule Deer Foundation, and Private Landowners

Aerial Herbicide Application to Control Invasive Annual Grasses & Invasive Forbs

Purpose

Reduce fine fuels accumulation to decrease fuel loading and fire severity, control non-native invasive species, promote functional native plant communities, and provide high quality wildlife habitat for big game species, including bighorn sheep, elk and mule deer.

Background

The history of human uses across the Salmon-Challis National Forest (SCNF) and Salmon Field Office BLM (SFO BLM) inadvertently resulted in the establishment and spread of multiple non-native invasive species. The most ecologically detrimental of these include invasive annual grasses, such as cheatgrass (*Bromus tectorum*), spotted knapweed (*Centaurea biebersteinii*), and rush skeletonweed (*Chondrilla juncea*). Many sites have experienced repeated wildfire, which has promoted the spread of invasive annual grasses. Cheatgrass has become pervasive and, in turn, contributes to more frequent wildfire in an area that naturally receives high thunderstorm activity. Partners recognize the relationship between invasive annual grasses, more frequent fire return intervals, and increasing fire severity. SCNF and SFO BLM are now able to use aerial application for weed control and restoration actions. In Fall 2018, the SCNF Fuels and Invasive Species resources partnered with the Idaho Department of Fish and Game to implement a pilot project to determine if aerial treatment of cheatgrass, spotted knapweed and other invasive species could reduce weed density and distribution, reduce fine fuels in the form of invasive annual grasses, contribute to a more natural pattern of fire across degraded landscapes, and promote recovery of a more resilient native plant community. If so, aerial application could be used to reverse more than a century of ecological degradation created by invasive annual grasses and other noxious weeds. Herbicides are designed to be effective in killing plants.

While not all herbicides exhibit the same mode of action or control all species in all plant families, herbicide use can have undesirable effects on some non-target plants. This was a major factor in making decisions about herbicides and rates for the pilot project. Of those herbicides available for use, a combination of Aminopyralid and Imazapic was selected for the pilot project since emerging research shows that this can be very effective on cheatgrass while being less impactive on desirable native plants.

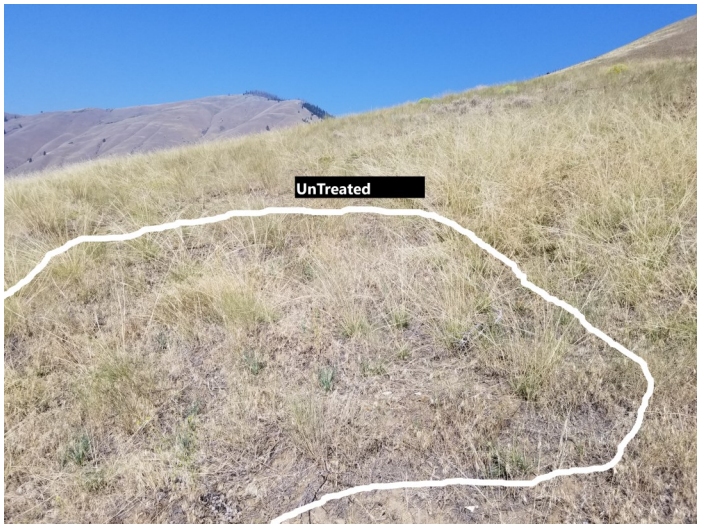
Pilot Year Activities: Approximately 960 acres were treated aerially using helicopters with Aminopyralid at 5 oz/ac and Imazapic at 6 oz/ac as well as a drift control agent and surfactant. Herbicides were applied in late October 2018.

Ongoing Treatments: Since the pilot project in 2018, SCNF and partners have successfully treated approximately 14,725 acres aerially from 2019 through 2021.

Results

Invasive Species - Aerial herbicide coverage on cheatgrass is likewise excellent with control consistently at or above 90 percent. We estimate that approximately 80 percent of emerging cheatgrass dies in the fall or early in the spring. Another 10 percent develops seed heads, but most of the seeds do not fully develop and are not viable (see photo to right). Herbicide application control of spotted knapweed is well above 90% using Aminopyralid at 5 oz/ac. Control of both species is evident the spring following a fall treatment and persists for around two years.

Imazapic is a commonly used herbicide for the control of invasive annual grasses, however, control efficacy can be inconsistent. Aminopyralid is a relatively new herbicide molecule and there is still a great deal of active research ongoing. Aminopyralid at 5 – 7 oz/ac is very effective in providing synergistic control of invasive annual grasses in combination with Imazapic. The most recent research shows that Aminopyralid is responsible for the sub-lethal effects to cheatgrass. We continue to monitor to gain a more complete understanding of cheatgrass control using Aminopyralid and Imazapic.



The two pictures above show treated and untreated conditions in areas where cheatgrass invasion has caused fine fuel loading and depauperate plant communities. The photo to the left shows the interstitial spaces fully occupied by cheatgrass. The continuous cover of cheatgrass causes wildfires to start more easily and move more quickly. This changes the fire regime, leading to more frequent and larger, more severe fires on a site that historically burned patchily and at less frequent intervals. The photo on the right shows the area post-treatment with cheatgrass removed by the first aerial application. In this situation, continuous fuels are removed and fire must jump more slowly from bunchgrass to bunchgrass. Without competition from cheatgrass and other invasive plants, the plant community can begin to recover structure and function with a complete assemblage of native plants and pollinators.

For example, where sufficient levels of native grass plants remain to provide a seed source post-treatment and the plants are close enough to provide seed to fill in the gaps, then natural native grass regeneration occurs. [*Picture of seed rain from native bunchgrass plants onto bare ground post-treatment.*] ⇨

Similar recruitment is observed with native forbs such as arrowleaf balsamroot.

In addition to removing fine fuels, treatments improve wildlife habitat by giving a boost to native wildflowers and bunchgrasses that many species rely on for forage. The areas most likely to be invaded by cheatgrass, and therefore the areas being targeted for treatment, are also important big game winter range. After years of watching winter range degrade, we finally have effective tools to improve the habitat. This is a big reason why the program has so many eager partners!

Native Species - Most desirable native plant species show little to no effect or only short-term impacts from the Aminopyralid/Imazapic treatment. An Aminopyralid/Imazapic mix would not be expected to injure native bunchgrasses (e.g. *Pseudoroegneria spicata* or *Hesperostipa comata*). Observed outcomes appear to indicate positive responses in native grass cover, seed production, and recruitment. Conifers and most evergreen shrub species (e.g. ponderosa pine (*Pinus ponderosa*) or sagebrush (*Artemisia* spp.)) have been very little affected; some larger plants appeared to have shorter growth internodes and some very young plants exhibited evident herbicidal injury (Note that pine tip moths have been commonly observed in ponderosa pine in recent years and tip damage is not to be confused with herbicide injury). The herbicide effects have been temporary. Green leaves, buds and stems of the year on some deciduous shrubs also exhibit temporary herbicide injury. These effects are mostly ameliorated by the following year.

The one exception to shrubs displaying only minor herbicide injury is mountain mahogany (*Cercocarpus ledifolious*), a long-lived evergreen shrub that grows in rock outcrops and other rocky areas. Some mountain mahogany has been injured in various degrees in some places. Where mountain mahogany occurs in discrete stands, these areas are excluded from treatment. In other places, it occurs dispersed across the landscape on rocky sites and exclusion is not possible. Monitoring indicates that decadent or dying plants that were already in decline may succumb to the herbicide application while other plants that are healthy appear to make a full recovery from herbicide injury. Results are not always consistent. We are adjusting the types of surfactants used and will continue to monitor.

[Mountain mahogany with minor and major herbicide injury, plant to lower right may die.]

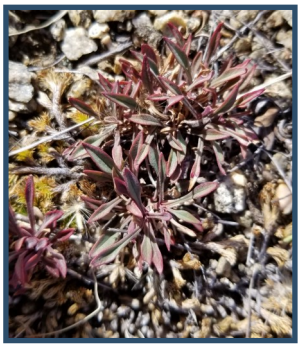
Many forb species showed minor to moderate effects on well-established plants, for example, growth habitat, flower abundance and seed production is affected, but plants otherwise complete a normal reproductive cycle and set viable seed (e.g. *Nemophila kirtleyi*, an annual native forb or *Balsamorhiza sagitta*, a perennial native forb). Arrowleaf balsamroot (*Balsamorhiza sagitta*) is the native forb most impacted by the herbicide application, which is to be expected since members of the Aster (or Sunflower) plant family are more susceptible to Aminopyralid than others. However, arrowleaf balsamroot is a long-lived perennial forb with a very large and deep tap root. It is generally resilient to herbicide injury and usually recovers within one—two years after treatment.

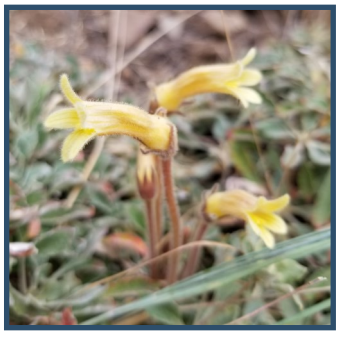
[Moderate herbicide injury on arrowleaf balsamroot seven months post-treatment. Note epinasty (leaf curling), chlorosis (yellowed foliage), and reduced flowering. Viable seed production is also reduced in Year One after Treatment.]

Other forb species appeared to be completely unaffected by the herbicide combination (e.g. early spring flowering corm and bulb species or members of the Borage, Carrot, and Lily plant families). Among those plants that displayed no effect is Lemhi penstemon, an endemic plant species that occurs only in Lemhi County and adjacent Montana.

Lemhi penstemon is recognized by the Forest Service as a Sensitive plant species and by the Idaho Department of Fish and Game as a Species of Conservation Concern. Management actions are to contribute to long-term conservation of the species and maintenance of populations across its range.

[Lemhi penstemon in flower seven months post-treatment with no apparent herbicide effects]





[Native forbs' response to treatment. This includes annuals, biennials, and perennials in a variety of plant families. Each of these pictures were taken in units that were treated the previous fall. Observed herbicide impacts are minimal to none.]