

Colorado Parks and Wildlife

WILDLIFE RESEARCH PROJECT SUMMARY

NutraFix Rate Trials

Period Covered: January 1, 2020 – December 31, 2020

Principal Investigators: Danielle B. Johnston (Habitat Researcher, CPW)

Project Collaborators: Kevin Gunnell, Great Basin Research Center Coordinator, Utah Division of Wildlife Resources; Tom Monaco, Research Ecologist, Agricultural Research Service, Logan, Utah; Trent Verquer, Habitat Coordinator; Todd Schmidt, Area 3 Wildlife Manager; Levi Kokes, Property Technician, Tamarack State Wildlife Area; Kirk Oldham, Area 7 Wildlife Manager; Ivan Archer, Area 7 Assistant Wildlife Manager; Buddy McNeel, Property Technician, Garfield Creek State Wildlife Area; Brian Gray, District Wildlife Manager; Mike Swaro, Area 6 Assistant Wildlife Manager; Colton Murray, Property Technician, Bitterbrush State Wildlife Area

All information in this report is preliminary and subject to further evaluation. Information MAY NOT BE PUBLISHED OR QUOTED without permission of the author. Manipulation of these data beyond that contained in this report is discouraged.

EXECUTIVE SUMMARY

NutraFix is a uniquely formulated fertilizer which has proven effective for cheatgrass control in preliminary trials in Montana, Utah, and Colorado. It contains a high proportion of boron, a micronutrient which is toxic at sufficiently high application rates. Initial trials with the product indicate that application rates of 110 - 390 kg/ha (100 - 350 lbs/ac) can control cheatgrass while promoting desirable, perennial vegetation. More specifically, optimal rates will likely depend on site conditions, and that relationship may be complex. We sought to better understand how to use this product while minimizing cost and potential toxic effects. We established replicated trials (n = 4) of 84, 168, and 336 kg/ha (75, 150, and 300 lbs/ac) application rates at Tamarack SWA (2 sites), Bitterbrush SWA, Garfield Creek SWA, and West Rifle Creek SWA. The sites vary in soil texture, precipitation, and plant community. We coordinated with the Utah Division of Wildlife resources so that the same rates could be tested at 5 sites in Utah, which will extend the range of site conditions studied. Soil sampling and testing will be conducted to determine the product's impact on soil microbes and macronutrient cycling. Vegetation response and soils will be monitored through 2023.

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BACKGROUND

NutraFix is a recently developed fertilizer formula which has been shown in preliminary trials to control cheatgrass while promoting the growth of perennial plants. The product is high in boron, a micronutrient which is toxic at higher concentrations. Although the mechanism is not well understood at this time, it seems that there may be a sweet spot of NutraFix concentration which is toxic to cheatgrass but beneficial for other plants.

At most sites, very good control of cheatgrass occurs at rates of about 340 kg/ha (300 lbs/ac), without injury to perennial plants. At some sites, cheatgrass control can be achieved with rates as low as 110 kg/ha (100 lbs/ac; *Stuart Jennings, Edaphix LLC, pers. comm.*). However, a complete understanding of how to formulate rate recommendations is lacking (*Stuart Jennings, Edaphix LLC, pers. comm.*). As the cost of the product is \$2.50/lb, understanding the minimum required rate will be necessary if the product is to be helpful for land management.

Minimizing application rate may also prevent unintended consequences. A product application rate of 340 kg/ha (300 lbs/ac) produces a boron concentration of 68 mg/kg (assuming a soil bulk density of 1.33 g/cm³ and incorporation to 5 cm, given the product is 13.56% boron). This concentration has been shown to have moderately toxic effects on soil organisms (Amorim et al. 2012). Impacts to soil organisms could affect cycling of macronutrients such as nitrogen, with far-reaching consequences. Through a partnership with the Agricultural Research Service, we plan to assess soil microbial activity, nitrogen cycling, and basic soil properties in response to application rate.

Plant and soil responses may vary by site, because soil properties such as organic matter influence the bioavailability of micronutrients. The study plan includes five sites with variable soil properties. Our Utah partners are also testing the product at five sites, which will help us begin to understand the factors influencing optimal rates. The rates tested are: control, low (84 kg/ha or 75 lbs/ac), medium (168 kg/ha or 150 lbs/ac) and high (340 kg/ha or 300 lbs/ac). Each rate was tested in each of four replicate 60 m X 42

m blocks at each site, with plots measuring 15 m X 42 m. Vegetation cover will be measured by point-intercept in May or June 2021-2023. Soil sampling will occur in spring and fall 2021-2023. For more details, please see the study plan.

ACTIVITIES IN 2020

We selected 5 study sites and implemented NutraFix treatments in 2020. Our criteria for study sites included:

- At least 15% cheatgrass cover
- At least 4 acres of relatively homogenous vegetation available
- Slopes less than 8%
- Low or no risk of flooding
- A variety of soil types represented across sites

The five sites are listed below in Table 1 and are shown in Figure 1.

Table 1. Site names and descriptions. Soil types and ecological sites are National Resource Conservation Service designations. Precipitation values are 30-year normals provided by the PRISM climate group (Oregon State University).

Site name	NRCS soil type and Ecological Site	Dominant vegetation	Annual precipitation mm (in) †
Tamarack SWA Sand	Valent Loamy Sand/Deep Sand Rolling Sands	Sand sage, sand bluestem, prairie sandreed, cheatgrass	440 (17.3)
Tamarack SWA Loam	Dailey Loamy Sand/Deep Sand	Sand bluestem, prairie sandreed, sand sage, cheatgrass	440 (17.3)
Bitterbrush SWA	Maybell Sand/Sandhills	Hairy golden aster, silver sage, cheatgrass, sand dropseed, needle and thread grass, Indian ricegrass	360 (14.3)
West Rifle Creek SWA	Heidt clay loam/Clayey Foothills	western wheatgrass, bottlebrush squirreltail, green needlegrass, cheatgrass	490 (19.1)
Garfield Creek SWA	Potts Loam and Vale Silt Loam/Rolling Loam	western wheatgrass, big sagebrush, cheatgrass, musk thistle	410 (16.3)

At each site, we delineated blocks so that vegetation cover, slope, and aspect within blocks was as homogenous as possible. Within a site, all blocks were within the same NRCS soil map unit except for Garfield Creek, where we had two blocks on Potts Loam and two blocks on Vale Silt Loam. At Tamarack Sand, three blocks were on north to northeastern slopes of dunes, while the fourth block was in a flat area on top of dunes. At West Rifle Creek, we noted musk thistle (*Carduus nutans*) at the site, and laid out the blocks so that two blocks contained thistle and two blocks were thistle-free. Although we are interested in learning if NutraFix causes thistle expansion, we also wanted to represent normal management activities. Since the thistle is undesirable, the normal management activity would be to

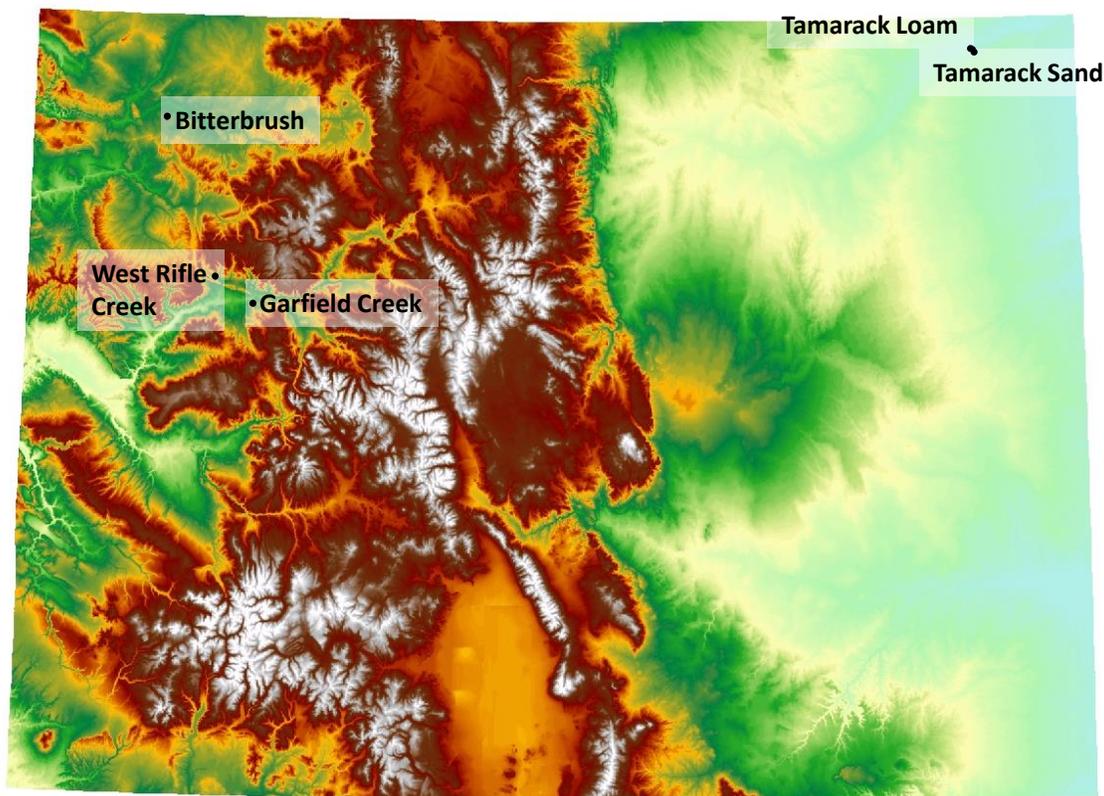


Figure 1. Locations for the five rate trial sites set up in 2020.

suppress it as much as possible before applying a product which might cause it to increase. We spot-sprayed rosettes of thistle with a mixture of 23 g ai/li aminopyralid (2 oz/gal Milestone) with surfactant on 8/12/20. Ideal timing for thistle control is either in the spring, before flowering, or in late fall, once new rosettes have germinated. Thus our application is likely to be only partially effective for thistle control. Effects of NutraFix on thistle will be monitored and reported.

NutraFix was applied between 8/21/20 and 9/4/20. Ideal timing for product application is August, to allow the product to be incorporated by fall rains, prior to cheatgrass germination (*Stuart Jennings*, pers. comm.). We feel confident that the timing of application was appropriate. The soils at all sites were extremely dry and no cheatgrass germination had occurred. Indeed, cheatgrass germination was not evident at any of the field sites we visited in 2020 until late October.

NutraFix was applied with a hand-crank chest spreader (EarthWay 3100 Professional Hand Crank Broadcast Spreader; Figure 2). We calibrated the spreader by counting the number of cranks required when walking the length of the plot, and then adjusting the aperture to dispense the desired amount of product in that number of cranks. By dividing the plot into 7 strips we were able to apply the product evenly at the lightest rate (84 kg/ha). Higher rates were achieved by walking the strips twice (medium rate) or 4 times (high rate).

FUTURE WORK

We plan to monitor percent cover with line point intercept late May- late June 2021. We will use a 40 m transect set up diagonally in each plot, with 2 m buffers from the plot corners. We will collect hits every 20 cm for 200 hits per plot. We plan to collect soil samples concurrently with vegetation data as well as in October, concurrent with germination of cheatgrass. Monitoring will continue through 2023.



Figure 2. Spreading the NutraFix product with the chest spreader.