Analyzing the Expansion of *Ustilago* Fungi Species Within *Bromus tectorum L.* in the Bighorn Basin

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Abstract

The purpose of this project is to determine the extent of the Ustilago fungi species that has infected *Bromus tectorum L.*(Cheatgrass) in the Bighorn Basin of Wyoming. This project aimed to determine infection rates across the basin. The student researcher collected Cheatgrass samples to identify the fungus. Once identified, the researcher collected data on infection rates. She did this by taking a handful of Cheatgrass, pulling up the roots, and counting each plant individually. She then counted the total number of infected plants. Once this was done, she divided the infected amount by the total number of plants. This was repeated three times at each site. Infection rates were then averaged. The results were that the Old Highway site had an infection percentage of 45%, Blue Bank Demo with 27%, Big Cottonwood had 15%, Renner 2%, Alkali Flats 33%, Webber with 14%, Dino Tracks at 55%, Shell Creek had 33%, 5 Mile Road had 48%, Oregon Basin Road had 11%, Little Buffalo Basin site was 21%, and 14 Mile road had 30%.

Introduction

Many are familiar with the invasive, detrimental grass *Bromus tectorum L.*, commonly known as Cheatgrass or Downy Brome. It truly is a cheater, cheating native plants of nutrients, moisture, and habitat. A *Ustilago* species was identified, initiating the project. Cheatgrass, being invasive, spreads through multiple means. It is expensive to plan and conduct treatment operations, and the longevity of the results is uncertain. Chemicals, grazing, and burning have all been used, but historically, fungi have been applied to suppress grass. Finding it in its natural state is quite incredible. The work has been done to determine the extent to which Ustilago species have affected Cheatgrass.

Literature Review

It's an invader, a cheater. A rancher, range or wildlife conservationist, a farmer, and even a pet owner will say it's a nightmare. *Bromus tectorum L.*, known as Cheatgrass or Downy Brome, has created a chain of effects across the Western United States. Cheatgrass originated in Eurasia and was introduced via livestock feed, seed contaminants, and by attaching to clothing and to livestock fur and hide, according to Stephen Novak (Boise State University News & Novak, 2025). Dr. Novak teaches General Ecology, Organic Evolution, Conservation Biology, and Phylogeography at Boise State University in Boise, Idaho (Boise State University, 2025). His research interests are in plant population ecology and evolutionary biology. He has investigated factors that influence the level and structure of genetic variation, as well as polyploid speciation and the ecological consequences of polyploidy (Boise State University, 2025).

The spread of cheatgrass in the late 1800s was accidental, but it is very much detrimental today. Cheatgrass invades pastures and natural habitats, creating fuel for large wildfires and taking out native plants. Cheatgrass can become contaminated during seed storage or through natural dispersal. Once cheatgrass reaches a pasture or farm land, the yield grade declines. According to the Wyoming Weed & Pest Council, a study found that among Wyoming's 10 invasive species, they have caused a loss of $83.5 Million (Wyoming Weed & Pest Council, 2025).

It takes expensive herbicides to keep production levels in check. Some herbicides include Journey, Plateau, and Rejuvra. Depending on the acres, type of chemical, and rate of use, the cost increases. For example, applying Rejuvra at a rate of 5 oz per acre could cost $42 per acre (Lawrence & Stephenson, 2020). These chemicals can be applied at multiple stages of germination and growth, resulting in improved outcomes (Lawrence & Stephenson, 2020). Even with chemical use, it can become expensive, and longevity may vary over time.

Biocontrol was being evaluated as a solution for treating Cheatgrass. Using a naturally occurring fungus was the goal. Using a fungus removes chemicals from the equation; animal and human safety is higher, and it uses a fungus that already exists and works. *Ustillago bullata*, known as head smut, already affects Cheatgrass. It naturally occurs in healthy ecosystems. The fungus, *Ustilago bullata,* can reach epidemic proportions. A study conducted in May 2013 found that B. rubens and B. tectorum had an infection rate of 90% with the fungus Ustilago bullata (Hilbig et al., n.d.). In April of 2024, the two *Bromus* grass species had a percentage cover of less than 1% (Hilbig et al., n.d.). Cheatgrass production can be reduced by *Ustilago bullata*. The conditions must be favorable for the fungus to thrive. The *species Ustilago bullata performs best under cool, moist conditions, as with many fungi* (Boguena, 2003). The higher the temperature,



the lower the infection rate. According to Boguena(2003), Ustilago bullata performs best when it infects seedlings in the fall.

Materials and Methods

Purpose and Objective: This research project aimed to determine infection percentages and the expansion of *Ustilago* fungi species on *Bromus tectorum L.* in the Bighorn Basin.

Hypothesis:

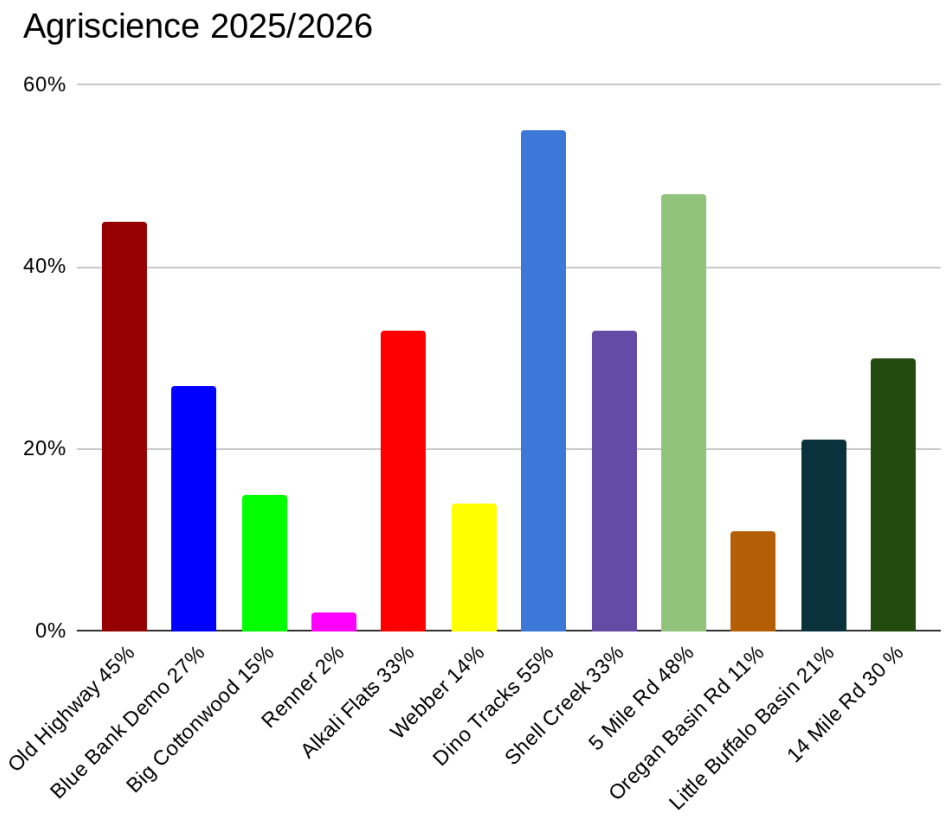
Materials:

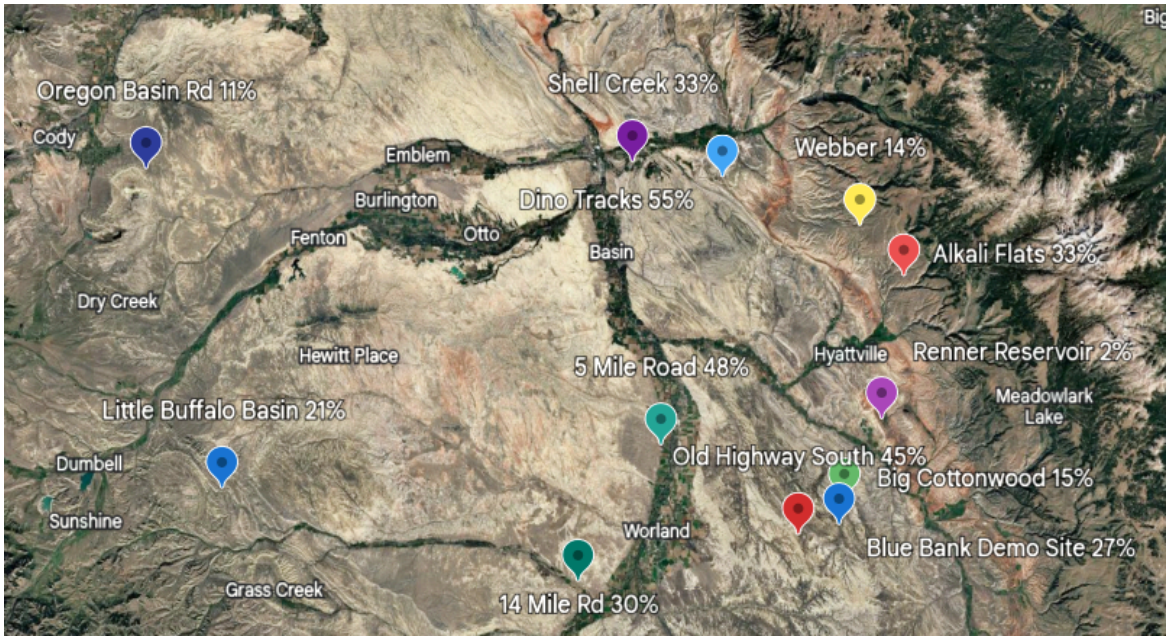
- Brown Paper Bags
- White Paper
- Writing Utensil
- Clipboard
- Device for Collecting Elevation & Coordinate Data
- Dissecting Microscope
- Compound Microscope
- Microscope Glass Slides
- Forceps
- Vehicle/Truck
- Mapping System (Google Earth)
- Calculator

Overview of Experiment Process: The student collects *Bromus tectorum L. (Cheatgrass)* samples and places them in brown paper bags. At the site, they should record the elevation and coordinates. The purpose of collecting samples is to determine the fungus species. Once the fungus species is identified, it is time to collect percentage data. It is up to the researcher to

determine sites. Once at the site, they walked out to a stand of Cheatgrass, picked a handful, and counted the total number of plants. Afterwards, they count the number of infected plants. The student should repeat this process twice more, for a total of three times at each site. The student researcher also needs to collect elevation and coordinate data for each site and assign a name to each site. All data needs to be recorded on a data sheet. Once all the data is collected, the student calculates the infection rate as a percentage. They should do this by dividing the number of infected plants by the total number of plants. Once all three percentages are determined for a site, the site's average percentage should be calculated.

Results





Discussion and Conclusions

This project provided valuable data and insights. The Old Highway site had an infection percentage of 45%, Blue Bank Demo with 27%, Big Cottonwood had 15%, Renner 2%, Alkali Flats 33%, Webber with 14%, Dino Tracks at 55%, Shell Creek had 33%, 5 Mile Road had 48%, Oregon Basin Road had 11%, Little Buffalo Basin site was 21%, and 14 Mile road had 30%. It is notable that Renner had such a low infection rate despite a very healthy Cheatgrass population. It was very dense with Cheatgrass. The Dino Track Site had the highest infection rate. The ecosystem's health was good. There was a solid three inches of germination growth under the Cheatgrass. The differences between the locations of the fungus and the percentages are quite interesting to observe. Not every place was almost a monoculture of Cheatgrass. Some areas had significant Cheatgrass coverage above 50% of the plant population, while others had much lower coverage. Observing the Webber site with the fungal species was particularly interesting, given

that it was at a higher altitude on the mountain. It was a successful project and created long-lasting memories and connections.

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