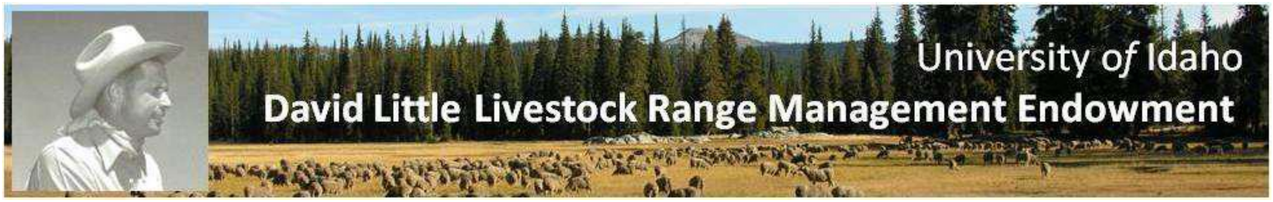

<u>2023 Progress Report</u>:

Non-Target Effects of Herbicide Application: Restoration Potential for Greater Sage-Grouse Habitat

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<u>Background</u>:

The sagebrush steppe is a unique environment that hosts diverse and specialized wildlife and plants, while also satisfying human needs for livestock grazing and recreation. As invasive annual grasses have become more pervasive throughout western landscapes, there is an increased need for management techniques that will control their spread and restore sagebrush steppe communities. In the past, both wildlife and cattle have depended on this intact ecosystem and its periodic fire; however, the addition of cheatgrass (*Bromus tectorum*) and other annual grasses has shortened fire cycles, causing the range to burn more often and promoting the continued establishment of invasive annual grasses (Davies et al., 2011). Moreover, annual grasses such as cheatgrass suppress the growth of the native forbs that wildlife and cattle alike depend on (Flory and Clay, 2010).

The greater sage-grouse (*Centrocercus urophasianus)* is a wildlife species that heavily depends on intact sagebrush steppe through its various life history stages, and as such, serves as an umbrella species for sagebrush wildlife management and conservation (Crawford et al., 2004). Invasion of cheatgrass results in multiple consequences for sage-grouse and other highly adapted wildlife species: large yearly variations in herbaceous cover, lack of shrub cover due to fire, shorter green-ups, and reduced presence of preferred dietary forbs (Crawford et al., 2004). Because they depend heavily on this subset of native perennial forbs and sagebrush itself, sage-grouse populations are at increased risk of habitat loss when invasive annuals are present. Herbicide application is often used as a tool to control invasive plants in both natural and agricultural systems (Zavaleta et al., 2001). They also have potential to be used as tools within the framework of restoration ecology, aiding managers in returning ecosystems to their intact state, particularly when used in tandem with other restoration tools (Zavaleta et al., 2001). Still, little is known regarding the non-target effects of indaziflam and similar pre-emergent herbicides on wildlife. Determining how these herbicides affect native plant communities and thus the wildlife that depends on them will be key to better managing our rangelands.

<u>Hypotheses/Objectives</u>:

We aimed to answer research questions related to the relationship between greater sage-grouse habitat use and changes in the plant community after indaziflam application. Habitat use in this context is defined as the locations and associated characteristics used by sage-grouse to meet their life history needs. Habitats are defined as the collection of physical and biological environmental variables that sage-grouse use to survive and reproduce (Krausman and Morrison, 2016).

H1: Greater sage-grouse habitat use will vary between treatment areas where indaziflam was applied and control areas, where herbicide application did not take place. We predict that herbicide application will change the plant species composition of the treated areas by increasing availability of preferred forbs, thus facilitating use of treated areas by sage-grouse.

Objective: Evaluate whether the use of a pre-emergent herbicide increases the abundance of preferred forbs available to sage-grouse, resulting in increased habitat use. Determine which locations are utilized by greater sage-grouse, and which vegetation characteristics coincide with the higher levels of use.

Procedures:

To address the above objectives, we relied on three forms of data collection: sage-grouse pellet surveys, preferred forb surveys, and camera trapping using trail cameras. The study was conducted at Rinker Rock Creek Ranch, a working research ranch in south-central Idaho. The treated sites (n = 4 sites) underwent indaziflam application in either 2019 or 2020 and have thus undergone the 3-year period for complete weed control. The control sites (n = 5 sites) were selected based on similarity in aspect and slope of, as well as proximity to, the treated areas. We collected data from May through August of 2023.

We randomly stratified our 50 m pellet transects by ecological site type, including soil type and slope, within each site. We determined the number of transects per site based on site size (ha) as well as plant species accumulation curves. We placed approximately 2 transects per 1.5 hectares, 50-m apart, at a minimum of 3 transects per site type. We then created species accumulation curves for plants at the start of our sampling effort, with effort (i.e., number of transects) considered appropriate where the curve plateaus.

We traversed all 48 (n = 48) established transects every other week and collected sage-grouse scat as visually encountered. We recorded spatial information and descriptions for each cluster of pellets found within 2 meters of the transect. We also conducted preferred forb surveys along the 50-meter transects in treated and untreated areas. We utilized the quadrat method, which entailed the placement of a 2 x 1 m quadrat every 5 m along the transect (n = 10 quadrats). Within that frame, we collected cover data for each plant within the frame, identified to species when possible.

Finally, we placed trail cameras within each site considering maximum allowable disturbance, distance from forb transects, and inter-camera distances. We collected basic plant data, including shrub height, within 3m of each camera location. Additionally, we matched each camera with the closest 50-m transect, which will be used to determine potential correlation between nearby vegetation data and the presence of grouse.

We will compare pellet locations, treated as a positive sage-grouse detection, with detections from cameras and the availability of preferred forbs in both treated and untreated areas to determine any correlation among detections and resources. Results will be used to inform wildlife and land managers about the potential wildlife benefits brought about by utilizing indaziflam as a habitat restoration tool for greater sage-grouse.

Accomplishments/Preliminary Results:

We traversed each transect a total of four times throughout the field season, locating a total of 123 pellet piles. Nearly half (22/48) of the transects were positive for grouse detection via pellets. About 44% of the pellet piles were on control transects, whereas ~56% were on transects treated with indaziflam.

We collected a total of approximately 3.5 million photos via remote camera deployment over a period of 2.5 months. Greater sage-grouse were detected in at least 650 photos. We are currently in the process of analyzing photos using Microsoft's MegaDetector AI model, which will provide us with more detailed information on individual instances of positive sage-grouse detections, including those which are not preliminarily known (Microsoft, 2022).

We observed ~145 plant species along preferred forb transects. Approximately 70 of those observed species are designated as preferred forbs for greater sage-grouse. The average Bromus coverage across control transects was 19.89%, while the average Bromus coverage across treated transects was 5.01%.

With further analysis, we expect to establish correlations between Bromus coverage and preferred forbs, preferred forbs and greater sage-grouse habitat use, and Bromus coverage and sage-grouse habitat use. We will explore the estimation of habitat use and detection probability with mark-recapture occupancy analysis.

Outputs:

We completed the first year of field-based data collection in August 2023. In 2024 we will present preliminary results at annual meetings of the Idaho Chapter of the Wildlife Society (ICTWS) meeting and Society of Range Management. We will then attend both the 2025 Society of Range Management (SRM) meeting and 2025 ICTWS meeting to present posters. We also aim to publish our greater sage-grouse camera trapping methodology analysis by 2025.

Literature Cited:

Crawford, J. A., Olson, R. A., & West, N. E. (2004). Ecology and management of sage-grouse and sage-grouse habitat. Journal of Range Management, 57(1), 2–19.

Davies, K. W., Boyd, C. S., Beck, J. L., Bates, J. D., Svejcar, T. J., & Gregg, M. A. (2011). Saving the sagebrush sea: An ecosystem conservation plan for big sagebrush plant communities. Biological Conservation, 144(11), 2573–2584.

Flory, S. L., & Clay, K. (2009). Non-native grass invasion alters native plant composition in experimental communities. Biological Invasions, 12(5), 1285–1294.

Krausman, P. R., & Morrison, M. L. (2016). Another plea for standard terminology. The Journal of Wildlife Management, 80(7), 1143–1144.

Microsoft, 2022. AI for Earth camera trap image processing API. (5.0) [Computer software]. Microsoft. https://github.com/microsoft/CameraTraps/blob/master/megadetector.md.

Zavaleta, E. S., Hobbs, R. J., & Mooney, H. A. (2001b). Viewing invasive species removal in a whole-ecosystem context. Trends in Ecology &Amp; Evolution, 16(8), 454–459.