2024 Project Completion Report: Non-Target Effects of Herbicide Application: Restoration Potential for Greater Sage-Grouse Habitat

By: Kirby Lau

PRELIMINARY RESULTS for 2024:

PROJECT NO.: Current Budget Number 639958

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

PERSONNEL:

Dr. Tracey Johnson, Associate Professor (College of Natural Resources) & Director of Research at Rinker Rock Creek Ranch

Dr. Timothy Prather, Professor (College of Agriculture and Life Sciences) & Senior Associate Director of the U of I Rangeland Center

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BACKGROUND:

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 annual grasses 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 to balance the needs of wildlife and food production. This proposed study therefore aligns with the wildlife habitat enhancement and undesirable plant control aspects of the Little Endowment, as

domination of the plant community by invasive annual grasses results in the loss of intact native forb communities, and forage quality for livestock and habitat for wildlife is greatly decreased as a result.

HYPOTHESIS & OBJECTIVES:

We aim 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 habitat characteristics coincide with the higher levels of use.

PROCEDURES:

With the aid of 2024 David Little funding (CY2024), we collected data from May-August 2023 using the following methods: sage-grouse pellet surveys, preferred forb surveys, and camera trapping using trail cameras. We collected all data at Rinker Rock Creek Ranch, a working research ranch in central Idaho. The treated sites (n =5) underwent indaziflam application in either 2019 or 2020 and have thus undergone the 3-year period for complete weed control. The control sites (n = 4) were selected based on similarity in aspect and slope of, as well as proximity to, the treated areas. Sampling transects are 50m long and are randomly stratified by ecological site type (EST) characteristics, including soil type and plant composition, within each site. We placed at least 3 transects per EST within each treatment or control site, with additional transects added based on accumulation curves of plant species (n = 48 transects). We traversed each transect 4 times per season and collected sage-grouse scat as visually encountered, with spatial information recorded for each pellet or pellet pile found within ~2m of the transect. We also conducted surveys for preferred forbs along the 50-mtransects in treated and control sites, per the BLM Sage-Grouse Habitat Assessment Framework. To do this, we assessed forb, shrub, grass, and bare ground cover utilizing a 1m x 2m quadrat placed every 10m along each transect. We identified plants to species when possible. Finally, we established trail cameras (n = 45) within all 9 sites based on distance to the nearest transect and site size (ha). For consistency, we placed cameras at the same location each year. We maintained cameras from June through mid-August and processed photos using Megadetector AI and Timelapse. Data from camera surveys are currently being utilized in a methods paper (in preparation) examining grouse detection via pellets vs. cameras.

We will compare pellet pile counts, used as an indicator of habitat use by grouse, with the cover and diversity of preferred forbs alongside other relevant covariates in both treated and control sites to determine any relationship between habitat use and treatment effects on the plant community. Results will be used to inform wildlife and land managers about the potential wildlife benefits brought about by utilizing indaziflam as a sagebrush restoration tool.

PRELIMINARY RESULTS:

We completed vegetation cover surveys along each transect in 2023 and 2024. We averaged cover results across each transect, giving an average cover value for each species at the transect level. The 3 most common preferred forbs (PFs) on treated transects in 2023 were *Phlox longifolia*, *Collomia linearis*, and *Agoseris glauca,* while *Phlox longifolia*, *Collinsia parviflora*, and *Agoseris glauca* were most common on control transects. In 2024, the most common PFs on treated transects were *Phlox longifolia*, *Agoseris glauca*, and *Eriogonum heracloides*, while *Phlox longifolia*, *Collinsia parviflora*, and *Agoseris glauca* were again the most common on control transects. Plant community analysis for sage-grouse using mixed effects models with a random effect of transect nested within pasture suggested that treatment affected the following variables: annual preferred forb cover (-), bare ground (+), *Bromus* cover (-), annual preferred forb Shannon diversity (-), preferred forb richness (-), and annual preferred forb richness (-). Overall, treatment negatively impacted annual preferred forbs while perennial preferred forbs experienced no significant impacts during our study period. *Bromus* cover, representing the two invasive annual grass species present, was also significantly negatively impacted (β=-1.18, SE=0.18, p= 4.59e-09). When converting to the original scale, we found that treated transects had 0.31 times less *Bromus* cover than control transects (95% CI: 0.22–0.44).

We completed 8 surveys along each pellet transect across 2023 and 2024, locating 123 pellet piles in 2023 and 122 piles in 2024. Forty-six percent of all transects had detections in 2023, and 56% had detections in 2024. In both years, we observed more piles on treated transects (62% in 2024, 56% in 2023) compared to control transects. Formal analysis using mixed effects models with a random effect of transect nested within pasture found that there was a significant effect of treatment on grouse habitat use as represented by pellet pile counts. When accounting for other environmental covariates, including the distance to the largest known lek on the property, distance to vehicular roads, and the distance to riparian areas, the effect of treatment was masked; however, as treatment effect was significant in a univariate model, there is reason to believe that treatment led to increased use of treated sites by sage-grouse (β=0.68, SE=0.30, p=0.021). When converting to the original scale, we found that treated transects had 1.98 times more grouse pellet piles than control transects (95% CI: 1.11–3.53).

PUBLICATIONS/OUTPUTS:

- Lau, K.S., Prather, T., & Johnson, T.J. (2024). Beyond the pellet: trail cameras and pellet surveys yield similar detection estimates of greater sage-grouse (*Centrocercus urophasianus*). [Manuscript in preparation].
- Lau, K.S., Prather, T., & Johnson, T.J. (January 2024). Beyond the Pellet: A Trial of Trail Cameras for Quantifying Habitat Use by Greater Sage-Grouse (*Centrocercus urophasianus*). [Poster presentation]. Society for Range Management Conference. Reno, NV.
- Lau, K.S., Prather, T., & Johnson, T.J. (March 2024 Beyond the Pellet: A Trial of Trail Cameras for Quantifying Habitat Use by Greater Sage-Grouse (*Centrocercus urophasianus*). [Poster presentation]. Idaho Chapter of the Wildlife Society. Coeur D'Alene, ID.

Conclusions drawn from our final analyses, once complete, will be available for use by land managers, wildlife agencies, livestock operators, private herbicide companies, and other special interest groups. It will be disseminated via scientific publications and presentations to both stakeholders and rangeland- or wildlife-focused conference audiences (e.g., at the annual Idaho Chapter of the Wildlife Society Meeting). Additionally, the results will be available through popular publications and social media for the University of Idaho and through the university's library system. These efforts will spread awareness about potential solutions to cheatgrass invasion in the state of Idaho, while also developing our understanding of wildlife-herbicide interactions so that we may serve as informed stewards of the sagebrush steppe.

SOURCES CITED:

1. 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.
2. 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.
3. Flory, S. L., & Clay, K. (2009). Non-native grass invasion alters native plant composition in experimental communities. *Biological Invasions*, *12*(5), 1285–1294.
4. Krausman, P. R., & Morrison, M. L. (2016). Another plea for standard terminology. *The Journal of Wildlife Management*, *80*(7), 1143–1144.
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