PERSONAL INFORMATION

Applicant ID: 1000403050
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Date of Birth

Date of Birth: 08/23/2004
State: CO
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High School Location

City: Fort Collins
State: CO
Country: United States

Demographic Information

Gender: Female
Veteran Status: No
Ethnicity: Not Hispanic or Latino
Race: White
Disability: Yes

EDUCATION AND WORK EXPERIENCE

List of academic institutions attended:

Academic Institution	Location	Start Date	End Date	Degree Granting Program	Degree	Degree Cmpl.	Grad. Date	Field of Study	Cum. GPA	GPA Basis
COLORADO STATE UNIVERSITY	FORT COLLINS, CO, United States	08/2023	12/2025	Yes	BS	I am currently enrolled in the program.		Life Sciences - Other (specify) - Ecosystem Science and Sustainability	4.0	4.0

Joint-Degree Institutions

Academic Institution	Joint-Degree Program	Transcript Includes Both Degrees	PDF Registrar Letter Uploaded
COLORADO STATE UNIVERSITY	No		

Teaching and work experience:

Title	Institution/Organization	Start Date	Other Experience Ongoing	End Date
Forestry Field Worker I	City of Fort Collins	05/2025	Yes	
Undergraduate Research Assistant	Colorado State University	06/2024	No	05/2025
Undergraduate Teaching Assistant	Colorado State University	01/2024	No	05/2024

Significant academic honors, fellowships, scholarships, publications and presentations:

Phi Theta Kappa Scholarship Recipient 2023-2025

Presented at the Colorado State University Celebrate Research and Undergraduate Creativity (CURC) 2025 event. I presented a poster titled: Effects of Indaziflam on Native Species Seed Emergence. I received the CURC College Honors: Warner College of Natural Resources award for my presentation.

Undergraduate Institution: COLORADO STATE UNIVERSITY
Current Institution: COLORADO STATE UNIVERSITY

PROPOSED FIELD OF STUDY

Major Field of Study: Life Sciences - Ecology

Proposed graduate study interdisciplinary? No

PROPOSED GRADUATE STUDY

Proposed Academic Institution: University of Colorado at Boulder
Proposed Graduate Program: M.A. Ecology and Evolutionary Biology
City: Boulder
State: CO
Country: United States

REFERENCES

Last Name	First Name	MI	E-mail Address	Ref. Rank	Status
Myers	Lauren		Lauren.Myers2@colostate.edu	1	Submitted to NSF
Hall	Ed		Ed.Hall@colostate.edu	2	Submitted to NSF
Henriksen	James		jamesrh@rams.colostate.edu	3	Submitted to NSF

PERSONAL, RELEVANT BACKGROUND AND FUTURE GOALS STATEMENT

Document Uploaded: Yes

GRADUATE RESEARCH PLAN STATEMENT

Document Uploaded: Yes

Proposed Research Title

Proposed Research Title: Non-target effects of indaziflam on soil microbial communities in semi-arid shrublands

Key Words

Key Words: indaziflam, semi-arid shrubland, soil microbes

NSF GRFP PROGRAM INFORMATION

Completed Study

Level 1: Current undergraduates in the final year of Bachelor's degree program or individual who previously completed a Bachelor's degree with NO prior enrollment in a graduate degree program.

Advisor

First Name	MI	Last Name	E-mail Address

Do you wish your name to be published on the Honorable Mention List, posted on the NSF GRFP site? Yes

Personal, Background, and Future Goals Statement

Personal Background

Being raised in Colorado, I was fortunate to grow up with the great outdoors right in my backyard. I spent my summers as a kid camping in national forests, building terrariums, and learning about the environment through direct exposure. These experiences were the beginning of an exciting curiosity - to understand the inner workings of the environment and its constituents - that has followed me throughout my life.

Yet, as I have grown older and more observant of the world around me, I have been forced to confront difficult truths about the great outdoors that have raised me, and that have become synonymous with home, familiarity, and comfort. During the pandemic, feeling as if the world was ending and being disgruntled by the fact that I had to spend my entire summer isolated from friends, I spent lots of time in nature. I remember one early evening in late summer I drove up to Horsetooth Reservoir in the foothills of Fort Collins. I parked in a lot that I visited often and hiked down to a familiar pair of trees that I often set up my hammock in. As I laid in my hammock overlooking the water that reflected the setting sun, my peaceful outdoor abode quickly shifted to what would become a real-life nightmare. Just beyond Horsetooth Rock, I saw plumes of smoke stretching into the sky. Those plumes of smoke were coming from the Cameron Peak Fire, the largest fire in our state's history[1]. In the following months, the sky rained ash, wildlife flooded the city seeking refuge from the flames, and our local river turned black from burnt debris. To this day, scars from the fire remain etched in our lands.

This event was pivotal. Beforehand, climate change and environmental degradation were threats that I knew of and that I thought were important, but they seemed distant and intangible. After experiencing the Cameron Peak Fire, I realized just how present and urgent these issues were. I realized that the outdoors that had become my home were in grave danger.

My childhood experiences that fostered a gentle curiosity for the environment combined with the harsh realizations elicited by the Cameron Peak Fire are largely what led me to study Ecosystem Science and Sustainability at Colorado State University.

Intellectual Merit

My path into the world of academia has been a bit non-traditional. I finished high school early, graduating when I was 16, with hopes that fast-tracking my education would allow me to escape a difficult home life. Yet, being so young and burnt-out from rushing through high school, I realized that because I had been so laser-focused on finishing school, I hadn't thought much about what I wanted to do with my life, and I didn't feel ready to jump into college. Because of this, I chose to spend time working and saving money while thinking about my next steps.

After a semester off from school, I decided to enroll at my local community college. My first semester, I only took one class while continuing to work outside of school. That one class was an introductory programming class, which I really enjoyed. I ended up spending three semesters in community college, taking several general requirement classes as well as a handful of computer science courses. I intended on transferring to Colorado State University to pursue a degree in computer science, because I really enjoyed data science and programming. However, during the summer before transferring to CSU, I noticed that the thought of pursuing a career in computer science made me feel anxious and uneasy. I realized that while I enjoyed computer science, I didn't have a passion for it.

I spent many weeks thinking about what I truly wanted to do. I had to land on something that I enjoyed doing, that I felt passionate about, and that would allow me to do something good in this world. Still having that persistent curiosity and love for the environment and recognizing that a real need existed for environmental protection, I decided to pursue my Bachelor's in Ecosystem Science and Sustainability at CSU.

During my time at CSU, I have taken several courses that have helped me explore this passion and prepare me for future academic endeavors. Of note, the classes that I found most fulfilling were those that focused on environmental sciences. In these courses, I gained fundamental understanding of several key topics, including nutrient cycling, dynamic systems, soil taxonomy, atmospheric composition, plant ecology, and ecosystem production.

Outside of the classroom, I had the opportunity to apply my knowledge in a lab setting, working as an undergraduate research assistant in Dr. Cynthia Brown's lab at Colorado State University. As a research assistant, I worked alongside graduate student Lauren Myers, whose research evaluated non-target impacts to the plant community of indaziflam, a pre-emergence herbicide used to manage Bromus tectorum (cheatgrass), an invasive annual grass widespread in the western United States. Indaziflam inhibits cellulose production, preventing radicle formation and seedling emergence. While indaziflam effectively reduces cheatgrass cover, land managers were unsure of the herbicide's impact on the native seedbank. This helped to inform the research question of our study: Does indaziflam inhibit seed emergence for native species in Colorado? For this study, we used several species of different functional groups, including invasive and native grasses and native forbs. We conducted a greenhouse dose-rate response study to investigate our research question. After helping with data collection and analysis for the original project, I took on my own sub-project and used our data to investigate the relationship between functional group & rate and seed weight & rate as predictors for emergence. I used R to create generalized linear models and to create plots that demonstrated trends across groups.

I had the opportunity to present my project at Colorado State University's Celebrate Undergraduate Research & Creativity event in 2025. My experiences as an undergraduate research assistant allowed me to see the research process go from theory to practice; I participated in several stages, from planning to data collection to analysis. Creating my own sub-project allowed me to navigate these stages a bit more independently, and to practice using tools like R to analyze data and interpret summary statistics. Presenting my project helped me practice communicating to the broader public and conveying the significance of the research we had done.

Another project that I got to help with was the Two Frontiers Project, a research initiative that aims to discover and investigate extremophilic microbial species. I participated in this project as part of my capstone course and learned much about microbes and their importance to the environment. During my time on this project, I produced forum content for the CitSci project page which helped generate interest among citizen scientists, I produced GIS products that mapped hot springs across Colorado, I created an ArcGIS story map to be used for outreach, and I practiced DIC microscopy to obtain pictures of cyanobacteria and other microbes found in samples from field sites.

I believe all these experiences have allowed me to practice and develop the skills necessary to spearhead my own research.

Broader Impacts

Participating in undergraduate research sparked a passion for me, and while I learned many skills from the opportunity, I also recognize that there is lots left for me to learn. Graduate school will give me the opportunity to practice the research process further and continue to develop skills that I began to practice during my time in Dr. Cynthia Brown's lab. While I've learned so much as an undergraduate student, it can be difficult to take theoretical knowledge and translate that to a research project and applicable information for informing policy, management decisions, and other broader implications. Graduate school will allow me to practice this skill, learn new skills, and become more confident as a scientist. I hope that the skills that I gain will allow me to produce work that can be used by local, state, and national agencies for land management, restoration, combatting the effects of climate change, and progressing our collective understanding of biogeochemistry.

I also hope that my experiences will allow me to participate in scientific education as my career progresses. During my time as an undergraduate student, I had the opportunity to work as a lab teaching assistant for an introductory biology course. Helping my peers learn foundational scientific knowledge and practice new skills in a lab setting was so exciting for me, because I got to see the beginning of future scientific careers, and use my knowledge to help people that may one day be my colleagues. Just as important as producing novel research is the passing of the torch to future generations of scientists who will lead the way in combatting the same issues that I hope to address throughout my career.

Although I've always had an interest in science, I never thought that research was something that someone like me could pursue. I thought that I didn't come from the right background, and because no one in my family has gone to graduate school, I always thought I wouldn't either. My perspective

changed because of the people that I've worked with as an undergraduate student, and the teachers that have inspired me and showed me that science is for everyone. I hope that one day I can be that person for someone too.

The last way that I hope to reach others through research is by contributing information that will help local ranchers and land managers make well-informed decisions. I believe that in our fight against the most pressing environmental issues, scientists must not forget about the people that are suffering from the consequences of the issues we study.

Future Goals

After graduate school, I hope that I can continue to work in research. My hope is that I can produce novel studies that provide information that can be used both by local stakeholders as well as policymakers.

References

1 Department of Public Safety, Colorado Division of Fire Prevention and Control

Non-target effects of indaziflam on soil microbial communities in semi-arid shrublands

Background

Cheatgrass is an invasive annual grass that has increased in both abundance and extent across the Intermountain West in recent decades[1]. One concern associated with cheatgrass is wildfire. Cheatgrass generates fine fuel that increases fire frequency and severity, and risk of fire mortality for native plants[2]. The Intermountain West is a region dominated by semi-arid shrublands, which provide rangeland resources among other ecosystem services[3]. The effects of cheatgrass on semi-arid shrubland fire regimes can disrupt the system, resulting in a shift to an invasive annual grass alternative state[3] and creating a feedback loop that makes shrubland recovery difficult[4].

Indaziflam, a pre-emergence herbicide that prevents cellulose biosynthesis, has been used to effectively reduce cheatgrass cover and fine fuel, positively impacting native species richness[5]. Yet, indaziflam may also cause non-target effects that could negatively impact native species. While some studies have investigated the non-target effects of indaziflam on native plant species in semi-arid shrublands[6], research on the non-target effects on soil microbial species is extremely limited.

The one study that has been conducted to investigate the effects of indaziflam on soil microbial species in semi-arid shrublands found significant differences between indaziflam treated and non-treated plots. In their study, Bradbury et al. collected soil samples from field sites in Boulder County and measured physical soil characteristics including concentration of soil organic matter, concentration of soil nitrate, and pH of soil samples. Bradbury found significant differences across these soil characteristics between treated and non-treated plots. Additionally, Bradbury et al. collected soil samples for microbial analysis, extracting DNA and using PCR and gene amplicon sequencing. They found that microbial community composition significantly differed between treated and non-treated plots, for bacteria, archaea, and fungi. For bacteria and archaea, they found that differences in soil characteristics were correlated with community composition. Fungi composition differences were only correlated with soil organic matter changes[7].

While the findings of this study suggest that indaziflam could impact microbial community composition, samples were only collected at one time point for each site rather than at multiple time points. Thus, temporal analysis of the effects of indaziflam on soil microbial communities is lacking, and it is unclear whether the changes that Bradbury documented were due to indaziflam itself or due to reduced cheatgrass cover.

Understanding the effects of indaziflam on soil microbial communities is imperative, as altering soil microbial communities can impact restoration efficiency. Consequences of herbicide application can be vast, from microbial diversity changes, altered microbial functions, and even introduction of evolutionary pressure on microbial communities[8].

Question

How does indaziflam affect soil microbial communities in semi-arid shrubland ecosystems over time?

Objectives

To better understand how microbial communities change over time after indaziflam treatment and to differentiate the effects of indaziflam itself on microbial composition changes versus the effects of changing plant communities because of reduced cheatgrass cover.

Methods

For this study, I will collaborate with Boulder County Parks and Open Spaces (BCPOS) to conduct a field study on land managed by BCPOS. I will include paired treated and non-treated 5m x 5m sites in Boulder County, and either 1) treat sites at the beginning of the study so that changes can be documented from initial treatment or 2) identify sites treated most recently, depending on BCPOS objectives.

I will take initial soil samples from both treated and non-treated sites as a control, as I expect to see non-treated site samples remain comparable to initial samples, and treated samples to change over time. I will take soil samples at the beginning of the growing season (April), in the middle (July), and at the end (October) to compare seasonal variations. I will also take plant cover data, using quadrats to

measure plant cover of a randomly selected 1m x 1m section of each plot. I will take samples and measurements for two growing seasons.

For soil samples, I will measure soil organic matter, pH, soil nitrate, and microbial community species composition. In addition, I will measure indaziflam residue and metabolites of soil samples using LC-MS, to better understand the relationship between indaziflam residuals and soil characteristics.

Intellectual Merit

While indaziflam is effective at controlling cheatgrass, its non-target effects, especially regarding soil microbial communities, remain nebulous. There is no question that cheatgrass must be controlled to preserve the health and stability of semi-arid shrublands, but restoration may be ineffective if negative impacts to soil exist. By including a temporal aspect, this research will provide novel information on the direct impacts of indaziflam on soil microbes and characteristics over time. Additionally, indaziflam residual measurements can be coupled with soil measurements to investigate whether concentration of herbicide and soil characteristics are related.

Broader Impacts

Semi-arid rangelands characterize much of the continental U.S., extending across more than a third of the land[9]. Semi-arid shrublands provide rangeland and thus are an integral resource for ranching and agricultural practices. This research will provide information that addresses current knowledge gaps regarding the non-target effects of indaziflam on soil microbial communities and soil health. Non-target effects identified by this research will provide land managers and ranchers with information that will better equip well-informed decision-making when applying indaziflam. Data generated by this study will also help land managers develop prevention strategies to mitigate negative non-target effects if needed, reducing harm to soil health while accessing benefits such as reduced wildfire risk and increased native plant species richness.

I plan to publish my research in relevant journals such as *Restoration Ecology*. Additionally, I hope to collaborate with Boulder County Parks and Open Spaces and/or other local agencies to create resources (infographics, guides) for local ranchers and other land managers to ensure that the information generated by my study goes to those most impacted by the results. I will present my findings at relevant conferences, including the Society for Range Management annual conferences in 2027 and 2028.

I plan to work with undergraduate students for my study and will include the students at every step of the research process, from planning to data collection to analysis. I wouldn't be filling out this application or pursuing research if it weren't for the graduate student that I got to work with as an undergraduate, so nothing would make me happier than to help someone else develop the skills and passion for research that may lead them to pursue their own research one day.

References

1 Bradley et al. *Biological Invasions*, 20, 1493-1506 (2018). **2** Davies et al. *International Journal of Wildland Fire*, 22, 353–358 (2013). **3** Barker et al. Ecosphere, 10(11):e02929 (2019). **4** Rodhouse et al. *Global Ecology and Conservation*, 28:e01689 (2021). **5** Sebastion et al. *Pest Management Science*, 73(10), 2149-2162 (2017). **6** Sebastion et al. *Restoration Ecology*, 33(8): e70163 (2025). **7** Bradbury et al. *Frontiers in Microbiology*, 15:1450633 (2024). **8** Michael et al. *Asian Soil Research Journal,* 8, 34-41 (2024). **9** DeLoss, *Colorado State University Source* (2025).