Monitoring the Distribution and Diversity of Grasshoppers in the Cascade-Siskiyou National Monument: *Final Report of Research Findings*

By Joe Baures & Jacob Florey

To perform our research project within the Cascade-Siskiyou National Monument, we sampled for grasshopper abundance and diversity across five elevationally differing sites on a weekly basis, from the dates of July 3rd to October 3rd. In order to capture a complete profile of both grasshopper diversity, and abundance, we performed a total of 200 net sweeps, with an additional 30 person minutes of diversity sampling at each of the five sites during every visit. After performing collections each week, we catalogued the collection date, site, life stage, species, and number of individuals to gather species abundance/richness data. With the utilization of computer programs such as Microsoft Excel and R statistical software, we were able to record, sort, and analyze the data that we collected in the field. From this, we found and compared the species richness, abundance, and Shannon diversity among sites. The collection of this data gave insight into how grasshopper diversity, behavior, species richness, habitat preference, and development varied around the different elevations and areas of the Monument. From our fieldwork, we documented 24 different species of grasshopper (Orthoptera: Acrididae) across 15 genera in the Cascade-Siskiyou National Monument, expanding the known species number from 17 found the previous year. We were also able to extend the known eastern range limit of the endemic grasshopper species *Chloealtis aspasma* into Klamath County, and sighted the earliest known record of this species (July 3rd). Our research also documented the first known record of *Melanoplus oregonis* outside of Crater Lake National Park. By finding the species richness, abundance, and Shannon diversity for all sites, we were able to compare the sites, and found that Hobart Bluff Trailhead had the highest species richness and abundance out

of all the sites sampled. We also found that total abundance of grasshoppers was highest during late July for all sites, while species richness varied, but had no clear trend in common with all sites. From our data, we determined which species were most and least abundant at each site, with *Melanoplus ascensus* being the most abundant throughout the Monument overall.

Besides our sampling of the grasshoppers themselves, we gathered extensive data on the temperatures found at each site. We did this by deploying a total of 25 temperature loggers (5 at each site), with temperature loggers placed in a variety of microclimates. We also measured ground and air temperature during our weekly visits at each site to further strengthen our data. By capturing temperature data at each site, and in a variety of microclimates, we were able to track how temperature changed throughout each day, and over the entirety of the season. This data enabled us to not only get a baseline record of site temperatures for future comparisons, but also allowed us to look for trends in how grasshopper variation may differ with temperature both among sites, and between microclimates. Although further investigation is needed to fully understand these relationships, we did find that our lowest elevation site was hottest on average, and this was the same site that had some of the lowest species richness, as well as some of the lowest total abundance. The cooler, mid to high elevation sites appeared to have a greater number of species and individuals when compared to our low elevation sites. These trends will be better understood with continued monitoring in future years, where data then can be compared to the data we have currently collected.

Our research has, and will continue to strengthen our understanding of the Cascade-Siskiyou National Monument, as it expanded and further built upon the grasshopper studies that were performed during the summer of 2023. Our fieldwork this year extended to one more site than previously sampled, and resulted in the documentation of seven more species than

before. This research has allowed us to create a more complete profile of grasshopper diversity and abundance throughout the Monument, and will be useful for future grasshopper research in comparing how the Monument has changed over time. By studying how grasshopper populations change over time, this data can contribute to more than just our understanding of grasshoppers, as it may be used to predict how other changes may occur in the Monument as well. Grasshoppers are primary consumers, making them vital to food webs, which gives them great potential to be indicator species in studying how the Monument is changing. With the temperature data we have also collected, temperature fluctuations with elevation and time can be better understood within the Monument, and we can see how populations of grasshoppers and perhaps other organisms may change with it. Our research of grasshoppers with continued long-term monitoring will aid in the detection and mitigation of environmental change within the Monument, which is of increasing concern, especially in places where biodiversity is immense.

Our research project has not only helped in furthering the understanding and protection of the Cascade-Siskiyou National Monument, but has helped to promote further appreciation of the Monument as well. With our research, we have been able to find and highlight many unique and special grasshopper species of the Monument such as *C. aspasma*. Many grasshopper species found within the Monument are relatively understudied, so our research provides information that hasn't been previously known. Our documentation of species such as *C. aspasma* and *M. oregonis* outside of their known range are examples of this. Bringing light to organisms that are not often studied can help to further public appreciation of what biodiversity the Cascade-Siskiyou National Monument has to offer. The presentations we have given at Southern Oregon University, both for STEMREX, and for the Monument Research Symposium have provided us opportunities to further the public's knowledge regarding grasshoppers of the

Monument. By learning more about these grasshoppers, members of the public have been encouraged to go out and explore the Monument in search of these fascinating organisms. With grasshoppers being so widespread, there is opportunity for them to be found all throughout the Monument, and not just in one area. Our identification guide that we disseminated has also helped to further this appreciation, providing information on how members of the public can further explore grasshoppers in the Monument, even without prior knowledge.

We would like to express our immense gratitude for the funding that was generously provided by Friends of Cascade-Siskiyou National Monument. This funding enabled us to perform quality research with equipment that was proper for the job. This equipment included sweep nets for catching of grasshoppers, replacement nets (necessary due to wear and tear in the field), insect rearing cages for specimen collection, and notebooks for recording field observations. The mileage reimbursement, as well as per diem that was provided greatly aided us in the extensive costs that come with food and travel to the various locations we sampled throughout the Monument. The stipend that was kindly provided by Friends of Cascade-Siskiyou National Monument also significantly helped us, as it allowed us to take time away from work in order to execute our research goals for the summer. The funding provided to us was essential to our mission and we deeply thank the Friends of Cascade-Siskiyou National Monument for giving us such an excellent opportunity to perform research.

Below is a detailed account of the funds that were spent on the project:

Materials Funding

The funds provided were spent on the following materials, essential for the research of monitoring grasshopper diversity and distribution across the Cascade-Siskiyou National Monument.

Item	Quantity	Cost Per Unit	Total Cost
Gemplers Sweep Nets	2	$124.99/unit	$249.98
Bugdorm Insect Rearing Cages (4-pack)	1	$147.20/unit	$147.20
Rite in the Rain Notebooks (3-pack)	1	$24.08/unit	$24.08
Replacement Nets	5	$32.99/unit	$164.95
Total Materials Funding Spent:	$586.21		

Stipend Funding

The funds provided were spent to cover the stipends of Joe Baures and Jacob Florey, allowing them as student researchers to spend time away from work to perform research on grasshoppers in the Cascade-Siskiyou National Monument.

Date Range & Recipient	Cost Per Recipient
Joe Baures (July 3rd - October 3rd)	$500.00
Jacob Florey (July 3rd - October 3rd)	$500.00
Total Stipend Spent:	$1000.00

Per Diem Funding

The funds provided were spent on meals during the weekly field trips that Joe Baures and Jacob Florey took to perform field research in the Cascade-Siskiyou National Monument.

Travel Description	Number of Individuals	Number of Days	Cost Per Individual	Total Cost
To: Cascade Siskiyou National Monument From: Southern Oregon University	2	12	$30.00	$720.00
Total Per Diem Spent:	$720.00			

Mileage Funds

The funds provided were spent to cover the costs of mileage while traveling to the various field sites throughout the Cascade-Siskiyou National Monument during each week of sampling. Mileage funds were spent on gas and vehicle maintenance for the personal vehicles used while traveling between the Cascade-Siskiyou National Monument and Southern Oregon University.

Travel Description	Number of Miles	Number of Trips	Cost Per Mile	Total Cost
To: Cascade-Siskiyou National Monument From: Southern Oregon University	25	12	$0.67	$201.00
To: Southern Oregon University From: Cascade-Siskiyou National Monument	25	12	$0.67	$201.00
Total Mileage Funds Spent:	$402.00			

Summary of Total Project Funds Spent

The total amount of funding provided was spent on the following overall costs, contributing to the completion of research by Joe Baures and Jacob Florey in monitoring the diversity and distribution of grasshoppers in the Cascade-Siskiyou National Monument.

Description of Fund Spending	Amount Spent
Total Materials Cost	$586.21
Total Stipend Cost	$1000.00
Total Per Diem Cost	$720.00
Total Mileage Cost	$402.00
Overall Project Funds Spent:	$2,708.21