

The Friends of Nachusa Grasslands
2023 Scientific Research Project Grant Report
Due June 30, 2024

Please answer the following questions with clearly written summaries to give Nachusa Friends' science committee members, officers, and board members a good idea of what you accomplished using your grant money. Unless you object to the Friends doing so, your report will be uploaded into the science section of the Friends' website: nachusagrasslands.org.

1. Please save this form to your desktop with a unique file name that includes "Friends 2023 Science Grant Report" and your last name.
2. Complete the form using the headings in bold as your guide.
3. Save the file as a Word document or a PDF.
4. Attach the file to an e-mail, and send it to: nachusafriendsscience@gmail.com no later than June 30, 2024.
5. The subject of the e-mail should be "2023 Scientific Research Grant Report" and your last name.
6. If you have not completed your work, please submit this form anyway by the June 30 deadline and plan to contact Friends after your project is complete so that we may learn from and publicize the outcomes as appropriate.

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2023 grant amount: \$4,400

Research Project Topic: Grazing legacy effects on soil microbes influence *Monarda fistulosa* L. insect and stress related phytochemistry, but not responses to insect herbivory

Research Project Purpose: We tested how 1) grazing effects on soil microbes alter plant growth and volatile organic compound (VOC) production, and 2) how grazing and microbial effects on VOC production influence plant responses to insect herbivory.

Research Project Outcomes to date: Soil microbes collected from sites grazed by bison produces produced differences in *M. fistulosa* phytochemistry (VOCs) relative to plants grown with microbes from grazing exclusion sites. While grazing associated changes in VOCs did not influence plant responses to insect herbivory, phytochemical changes were linked to VOCs associated with insect signaling and plant stress responses.

Describe how the grant funds you have received from the Friends of Nachusa Grasslands have been used in regard to the above topic, purpose, and/or outcomes:

- Funds were used to cover travel to and from Nachusa Grasslands in May 2023.
- Funds were used to purchase *M. fistulosa* seeds
- Funds were used to purchase *Spodoptera frugiperda* eggs (Fall Army Worms)
- Funds were used to offset costs associated with Illumina MiSeq runs for soil and leaf bacteria and fungi

Describe how your project has benefited the work and goals of Nachusa Grasslands: This work demonstrates how land management such as grazing by bison influences interactions between soil microbes and their associated plant hosts. Since grazing effects on microbes alter plant phytochemistry associated with signaling insects and plant stress responses, this suggests that grazing may alter interactions between plants and their pollinators.

Describe how your findings can be applied to challenges in management practices for restoration effectiveness and species of concern: Our findings imply that grazing effects on soil microbes alter plant phytochemistry associated with signaling insects and stress responses. Since grazing is a key component of managing tallgrass prairie ecosystems, our findings suggest that grazing exclosures serve to alter interactions between soil microbes, plant hosts, and associated insects. More work is required to test if grazing effects on *M. fistulosa* phytochemistry alter interactions with pollinators and other herbivores.

Please list presentations/posters you have given on your research:

- Grazing legacy effects on soil microbiota alter *Monarda fistulosa* (L.) vegetative volatile phytochemistry. 10th annual Nachusa Grasslands Science Symposium.

Have you submitted manuscripts to scientific journals? If so, which ones? If not, do you anticipate doing so? (Please send digital copies of published articles to the Friends so that we can learn from your work.)

- We currently have a draft manuscript created and plan to submit the manuscript at *New Phytologist*.

What follow-up research work related to this project do you anticipate (if any)?

- Follow up research will focus on how other management methods alter plant phytochemistry, and how changes in VOCs influence insect pollinator behavior.

Optional: Suggestions for improving the application and award process for future Friends of Nachusa Grasslands Scientific Research Grants: