

**The Friends of Nachusa Grasslands
2022 Scientific Research Project Grant Report
Due June 30, 2023**

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. Donors and prospective researchers often read these reports after they are posted.

1. Please save this form to your desktop with a unique file name that includes "Friends 2022 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, 2023.
5. The subject of the e-mail should be "2022 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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2022 grant amount: \$8,500.00

Research Project Topic:

Community dynamics, flower preferences, and parasite loads of native bees and domesticated honey bees at Nachusa Grasslands.

Research Project Purpose:

The purpose of this project is to: 1.) Determine bee community composition (especially bumble bees) in relation to various distances from known honey bee hives. 2.) Determine floral preferences of bees at various distances from known honey bee hives, 3.) Determine parasite loads of bumble bees and honey bees at various distances from known honey bee hives, and 4.) Determine management implications and education components about honey bees, native bees, and their interactions at Nachusa Grasslands.

Research Project Outcomes to date:

The current study yielded a total of 783 bee specimens (5 families, 27 genera, and 79 species) vouchered or observed visiting native and/or non-native floral resources at various distances (0.5

km, 1 km, and 2 km) from known hives (apiary on Stone Barn Road) and in supplementary collections throughout Nachusa (Figure 1). These data will be used to supplement previous collections to prepare a list of bee species occurring at Nachusa in addition to providing the basis for the current study.

Honey Bee and Bumble Bee Composition:

Honey bees were observed and collected in all areas of Nachusa and at all three distances from the Apiary. Of all honey bees collected for the main study, 29.5 percent were foraging at 0.5 km and 29.5 percent at 2.0 km from the apiary, whereas, 41 percent were foraging at the intermediate 1.0 km distance from the Apiary. Although the highest number of honey bees were observed at 1.0 km this was mainly driven by two of the four samples and only 3 of the four samples contained honey bees whereas, at 0.5 km and 2.0 km all samples contained honey bees.

Bumble bees were found across all samples at all distances from the apiary but species composition and abundance varied with distances. RPBB occurred at 0.5 km and 2.0 km from the apiary but in very low numbers (n=4). Interestingly the proportion of honey bees and bumble bees were very similar across the three distances with the largest difference occurring at 1.0 km with 41 percent of honey bees collected and 36 percent of bumble bees collected. Community level comparisons are ongoing and will be supplemented with 2023 field work.

Flower Use and Composition:

Honey bees utilized 14 flower species across the three distances from the apiary on Stone Barn Road. These included several resources used by many bumble bee species such as *Eryngium yuccifolium*, *Eutrochium maculatum*, *Silphium perfoliatum*, and *Veronicastrum virginicum*. Honey bees utilized all three flower species on which RPBB were observed suggesting direct competition for resources as well as the potential for direct interactions which could promote parasite transfer. Analyses on flower use by various bumble bee species and changes in flower species use across the three distances from the apiary are ongoing and will be supplemented with 2023 field work.

Parasite analyses:

Unfortunately, parasite load analyses on bumble bees and honey bees failed in 2022 as samples were destroyed during a power failure event causing a freezer and its contents to defrost. Issues related to parasite sampling have now been rectified by creating an in field sampling technique for placing individual bee specimen directly into alcohol to avoid the potential for cross contamination of individuals and to avoid the need for long term freezer storage.

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:

The funds obtained from the grant have been used to defray the costs of travel and labor to perform approximately 8 days of fieldwork, 4 days of processing specimens, and report writing. Funds have also been used to purchase expendable supplies needed for parasite analyses. These funds

have been a significant help to pursue and analyze this research. In addition, ESI has provided additional labor and supplies in kind to support this research.

Describe how your project has benefited the work and goals of Nachusa Grasslands:

Research on plant-pollinator communities is instrumental to determine appropriate conservation measures for bees, butterflies, flowering plants, and prairie habitat. These keystone groups affect and contribute to the entire ecosystem health at Nachusa Grasslands. Pollination and pollination success are a major concern for seed production at Nachusa Grasslands. To insure long term survival of these ecological processes, native pollinators need consideration, investigation, and conservation. Having the appropriate suite of pollinators and having data to support these efforts is vital to understanding RPBB and other native bee conservation. This research directly contributes to the knowledge of rare, threatened, and endangered bee species inhabiting Nachusa Grasslands, understanding the impacts of honey bees on native bee communities, and documenting the pollinator species present for comparative pollinator community analyses at Nachusa Grasslands.

RPBB is federally endangered and parasite transfer and competition with honey bees are among the leading concerns for RPBB conservation (see species status assessment or species recovery plan). Having data that would support or reject any negative influences of honey bees is important for understanding the conservation strategies needed to protect this species. With Nachusa Grasslands having one of the largest populations of RPBB in Illinois (and possibly throughout its range) these data are critical for its continued existence and management. The goal is to determine what (if anything) is happening between native bees and honey bees and provide information to educate the local community and pollinator enthusiasts on ways to support the declining bee and pollinator communities. This project would provide the Friends of Nachusa Grasslands with a comprehensive understanding of the pollinator community, the pollinators' relationship to the flowering community, the interactions between native and non-native bees, and provide necessary information for current and future prairie habitat management and objectives. This project will also make a great continuation of the ongoing efforts to study pollinators and other organisms within Nachusa Grasslands.

Describe how your findings can be applied to challenges in management practices for restoration effectiveness and species of concern:

During previous studies at Nachusa, ESI observed five variables that need further investigation but are highly linked ecologically. These variables include 1.) an incredible floral display and availability of flowers at Nachusa Grasslands, 2.) an impressive, native bee community with high species richness, 3.) many rusty patched bumble bees (RPBB; *Bombus affinis*), a federally endangered bee species, 4.) many honey bees (not native to Nachusa Grasslands) using flowers on Nachusa although TNC has no colonies, and 5.) a large apiary with many honey bee hives along Stone Barn Road. Since RPBB is listed as a federally endangered species and parasite transfer and competition with honey bees are among the leading concerns for RPBB conservation (see species status assessment or species recovery plan), interactions between bumble bees and honey bees need to be assessed. Thus, ESI proposed collecting data to help determine the effects of local honey bees on bee community composition, bee floral preferences, and (if possible) pathogen

loads. ESI's study design addressed these questions by sampling bees at various distances (0.5 km, 1 km, and 2 km) from known hives (apiary on Stone Barn Road).

If this study finds implications from honey bees then this may lead to mitigation for these species which may involve several complications from dealing with private land owners to who has the rights to resources produced by wildflowers. ESI has experience in these tricky situations and can help develop a plan of action to mitigate and/or avoid any negative consequence to native pollinators, especially rusty patched bumble bee.

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

I presented my research at the Science Symposium at Nachusa Grasslands on 22 April 2022.

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.)

Wolf, A. T., J. C. Watson, T. J. Hyde, S. G. Carpenter, and, R. P. Jean. 2022. Floral Resources Used by the Endangered Rusty Patched Bumble Bee (*Bombus affinis*) in the Midwestern United States. *Natural Areas Journal* 42 (4): 301-312.

Additionally, a separate paper on RPBB genetics will be submitted within the next month. I am co-authoring with several other researchers including John Mola.

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

The proposed research was funded again in 2023 and thus additional data on bumble bee communities and flower use will be obtained in 2023 and parasite field collection has been re-evaluated and new procedures have been developed which should help answer questions on parasite loads this year.

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