

## The Friends of Nachusa Grasslands 2016 Scientific Research Project Grant Report

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**2015 grant amount:** \$500

Please answer the following questions with 1- to 2- sentence summaries:

**Research Project Topic:** Recolonization of dung beetles following prairie restoration and re-introduction of bison.

**Research Project Purpose:** This project represents the first systematic survey of dung beetles at Nachusa, and one of the few studies in the Midwest U.S. The objectives were to (1) document the species present, (2) determine if dung beetle communities change with the age of a restored prairie, and (3) determine if abundance or diversity are altered by the presence of bison.

**Research Project Outcomes to date:** We trapped 707 dung beetles in 16 site (2 remnant prairies, 13 restored prairies, and an agricultural field). At least five species were present in these samples, including members of the genus *Aphodius*, which may include multiple species but are very difficult to identify beyond the genus or subgenus level. The Franklin Creek Natural Area site south of Naylor Rd. had the highest abundance of beetles, perhaps related to the adjacent pastures. In the absence of this outlier site, densities of dung beetles were significantly higher in bison sites compared to non-bison sites (Fig. 1). This pattern was driven by the two most abundant species, *Onthophagus hecate* (58% of beetles) and *O. knausi* (37%). The Franklin Creek site had a very high abundance of *O. knausi*, a poorly-known species that may be responding positively to the presence of large herbivorous mammals (including both bison and domestic livestock). Analyses also indicated that dung beetle densities increased significantly as prairies aged and that burning increased dung beetle densities.

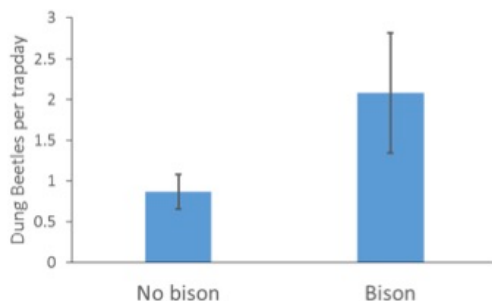


Fig. 1. Dung beetle densities are significantly higher in sites with bison present ( $t_{13} = 2.64$ ,  $P = 0.021$ ).

This project was paired with an undergraduate research project by Peyton Whiston, a biological sciences major at NIU supervised by Dr. Holly Jones and supported by the McKearn Fellows program. Peyton examined dung decomposition rates in a subset of restored prairies with and without bison to determine if the ecosystem service provided by dung-associated arthropods is affected by the presence of these large native grazers.

Peyton demonstrated that dung decomposition rates were greater in bison sites, likely as a result of increased dung beetle densities. This represents an exciting demonstration of an ecosystem process effect of re-introduced bison.

**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 provided by the Friends of Nachusa Grassland were used to reimburse travel costs between NIU and Nachusa. Support from the Friends of Nachusa in 2015 allowed me to develop these trapping techniques and purchase the supplies needed to trap, pin, and identify dung beetles.

**Describe how your project has benefited the work and goals of Nachusa Grasslands:** Nachusa Grassland provides an opportunity to investigate fundamental questions in ecology, including the processes that drive community assembly and ecosystem functions. Working in a managed site allows ecologists to identify how human management decisions influence community and ecosystem patterns beyond just the re-establishment of a diverse plant community. These preliminary results provide a new dimension of support for the positive effects that managed grazing and prescribed fire at Nachusa have on the entire biological community.

**Describe how your findings can be applied to challenges in management practices for restoration effectiveness and species of concern:** One of the important impacts of bison reintroduction at Nachusa will be their effects on nutrient cycling. Although people have talked about the bison “adding” nutrients to the soil through their dung and urine deposition, the bison are much more likely to be removing nutrients from the overall system. This is normal and expected for grazing animals, as much of the nitrogen present in waste evaporates before it is returned to the soil. However, nutrients in bison waste that are returned to the soil may help contribute to heterogeneity in soil conditions and the spatial diversity in plant communities that this is expected to support. Dung beetles will play an important role in establishing their spatial heterogeneity as they directly return nutrient-containing dung to the soil where it will be accessible by soil microbes and, eventually, plant roots. If prescribed fires promote dung beetle densities, then this management practice may be benefiting plant diversity in a new way, in addition to the immediate effect of reducing fire-intolerant plant competitors. Ongoing research as part of the ReFuGE project should help clarify the generality of these patterns.

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

Whiston, P., H. P. Jones and N. A. Barber. 2017. Quantifying the ecosystem services of dung beetles in a restored prairie. Midwest Ecology and Evolution Conference, Urbana, IL. (poster)

Whiston, P., H. P. Jones and N. A. Barber. 2017. Quantifying the ecosystem services of dung beetles in a restored prairie. NIU Undergraduate Research & Artistry Day, DeKalb, IL. (poster)

Barber, N. A., P. Whiston and H. P. Jones. 2017. Structure and function of dung beetle communities in response to grazing and prescribed fire in restored tallgrass prairie. Ecological Society of America, Portland, OR. (poster accepted, Aug. 2017)

**Have you submitted manuscripts to scientific journals? If so, which ones? If not, do you anticipate doing so? (Please keep us informed on publications.)**

This research has not been submitted for publication, but one manuscript focusing on another beetle group is under revision following positive reviews:

Barber, N. A., K. A. Lamagdeleine, J. E. Willand, H. P. Jones and K. W. McCravy. In revision. Species and functional trait re-assembly of ground beetle communities in restored grasslands.

**Optional: Offer suggestions for improving the application and award process for future Friends of Nachusa Grasslands Scientific Research Grants:** It is really encouraging to see the Friends' commitment to supporting research, especially student research. The research grants program is playing a significant role in developing early-career scientists in Illinois, and we will see the benefits and payoff for many years to come as these students move into careers as scientists and conservation practitioners.