

Potential Research Topics at Nachusa Grasslands

The following is an evolving compilation of research questions pondered by stewards and staff at Nachusa Grasslands. The Friends of Nachusa Grasslands would like to support scientific research that provides insight into the answers to these questions, but will not restrict its science grant awards to research endeavors that address only these specific questions. This list is meant to encourage researchers who are thinking of doing work at Nachusa to consider these and related research topics in their planning.

Impacts and management of exotic invasive species (both plant and non-plant). For example,

1. How do non-native invasive species (plant, insect, etc.) compete with native species? Both within and between trophic groups?
2. How can *Trifolium pretense* (red clover), *Lotus corniculatus* (bird's foot trefoil), *Phalaris ardinacea* (reed canary grass), and *Melilotus* sp. (sweet clover) and other non-native invasive plants be eradicated or greatly reduced most effectively? Original and creative hypotheses welcome.
3. Does over-seeding lead to increased plant diversity and effectively push out unwanted species (invasive, non-native, and/or weedy natives)? Can species mixes be designed for highly resistant communities? Can fire and/or grazing regimes be modified to reduce non-native competition?
4. In a changing climate, which invasive species are expected to become more competitive with natives? Are there non-native invasive plants that could move into the region or that may already be here that could become invasive? Which species should we be on-guard for? How can the introduction of these species to the preserve be prevented?
5. What non-native animal species exist on the preserve? What impact do they have on native species populations? Can and should they be eradicated?

Resistance and resilience of the restored tallgrass prairie community to disturbance management (e.g. fire and/or grazing): For example,

1. How does fire frequency and grazing affect insect populations? Do unburned sites leave sufficient refuge for these insect species? We have inventories of a few groups of insects at Nachusa (dragonflies, bees, moths, butterflies, specialized orthopterans, mosquitoes, ground and dung beetles, ticks), but we need to know more about all of the insect populations present. What species are present, and how does management affect their populations? Regal fritillary butterflies, for example, are abundant at Nachusa. How do prescribed burns impact this species? Are the eggs and/or larva surviving fires, or are larva only surviving in unburned units? How can we better manage, restore, and reconstruct prairie to promote diverse insect populations and a large abundance of these species?
2. How and why does the beaver population shift on the preserve, and what is their impact on Nachusa ecosystems over time?
3. How do the substrates of our wetlands and streams change over time as a function of beaver impact, flooding, and management decisions (tree and drain tile removal, fire, grazing)? What impact do these substrate changes have on aquatic flora and fauna populations?
4. What effect is repeated fire and/or grazing having on the shrub and tree layers of Nachusa's savannas and woodlands?
5. How do biological, physical, and chemical soil characteristics change over time as a result of various management regimens in different habitats? Can these changes inform future management decisions?
6. Should bison wallows be over-seeded? Is there enough of a seed bank in wallows to recover? If not, what is the appropriate seed composition and weight for over-seeding? Or are wallows generally used over multiple years and should not be expected to re-vegetate during that time?

Restoring habitat for rare and declining prairie species (including plants, animals, fungi, etc. For example,

1. What is the role of meso-predators on our turtle populations? Can we learn from DNA analysis of predator scat what their prey are? Are there other techniques that can be used to study predator diet? Is predator control of any kind warranted and/or productive?
2. Improving germination of *Comandra umbellata* is a goal of unit stewards. A recent study at Nachusa examined correlations between genetic diversity, stand characteristics, mycorrhizal communities, and soil characteristics. It found that genetic diversity across the preserve was isolated, and diversity within stands varied by phosphorus availability. Possible questions for research include: How does phosphorus availability impact flower and seed production? Could facilitated pollen transfer between identified genetic groups of *C. umbellata* produce greater numbers of seed and/or more consistently viable seed? Does seed recruitment depend on soil characteristics and/or density of *C. umbellata* stems?
3. We have ongoing random block studies looking at how and whether over-seeding a low diverse prairie can increase its diversity. Would someone like to adopt this ongoing study?
4. What's the best way to turn an old pasture full of brome grass and weeds into a biologically diverse native prairie? We have several pastures we are thinking about seeding. What's the best way to proceed? Round them up first? Use grass herbicide first? Seed directly into the brome?
5. We know some populations of native bees are using restorations. Are other remnant-dependent or endangered insect species using the restorations? How can we encourage persistence of these species in restorations?
6. Sandhill cranes nested at Nachusa this year. What management strategies would attract and maintain a breeding population of bobolinks or prairie chickens? Or other less common faunal species? What needs to be done to increase the abundance of these species?
7. Flies can transmit disease in bison. What fly species do we have and are they vectors for these common diseases? How could we manage to break disease cycles with minimal impact on other native species?

Previously completed inventory studies on turtles have provided useful information valuable in making management decisions, e.g. timing prescribed fire in turtle habitat before turtles come out of their hibernaria. Further studies to "find out what we have" at Nachusa may provide additional management insight. A lichen survey by habitat? Mosses, ferns, snails, and slugs are all knowledge gaps at Nachusa. Other flora and fauna surveys suggested by researchers?