2022 Research Symposium Abstracts

ORAL PRESENTATIONS

Impact of non-native *Amynthas* spp. on soil structure, fungal biomass and fungal diversity in forest soils

Dana Johnson, Department of Soil Science

Mycorrhizal fungi form symbiotic relationships with plants, exchanging nutrients and water for simple carbon substrates derived from plant photosynthesis. The invasion of jumping worms (*Amynthas* spp.) to forest ecosystems may affect this relationship via impacts on soil structure and fungal communities. Jumping worms are native to southeast Asia and, since their introduction to the United States in the early- to mid-1900s, have spread rapidly. In 2013, jumping worms were discovered in the UW–Madison Arboretum. In forest ecosystems, jumping worms have been shown to alter mycorrhizal fungal community composition and modify soil structure in the top centimeters of the soil. Soil structure impacts numerous soil properties including water-holding capacity, infiltration rates, and gas exchange. One important component of soil structure is soil aggregation – i.e., the clumping together of small soil particles into larger units. Increase in soil aggregation improves water infiltration and storage, gas exchange, and root penetration. Soil structure also has interactive effects with soil microbes. For example, organic matter held within aggregates can be physically protected from microbes, thereby protecting it from degradation, while certain fungi have been shown increase soil aggregation.

Recent work at the Arboretum documented a change in soil bacterial and fungal communities over the course of a jumping worm invasion, but further work is needed to untangle the relationships between jumping worms, soil aggregation, and fungal communities. In this study, we used *in situ* soil mesocosms to determine if the introduction of jumping worms to soil: (1) impacts soil structure via changes in soil aggregation and (2) affects soil fungal communities by decreasing fungal diversity and biomass. Four months after introducing jumping worms, we observed shifts in soil pH and moisture as well as changes in fungal community composition compared to control soil.

Coauthors: Bradley Herrick and Thea Whitman

Butterfly conservation and the effects of grassland grazing management

Skye Harnsberger, Department of Entomology

Although 80% of grassland in Wisconsin is grazed land, most insect conservation practices are tailored to land management on protected grassland. Understanding the potential for conserving pollinators on grazed land can have a wide impact. We asked: Is grazed land viable habitat for butterflies? How does it compare to protected grassland? We assessed vegetation and butterfly communities on four (ungrazed) UW–Madison Arboretum properties and compared them to grazed grasslands. We also compared two methods of grazing cattle (rotational and continuous grazing) to explore the question: does grazing management methodology affect floral and butterfly diversity and abundance? These results can inform farmers interested in aligning their grazing methodologies with their native butterfly community, as well as conservationists interested in grazing their protected grasslands as a means of controlled disturbance and an alternative to prescribed burning.

Coauthors: Claudio Gratton, Karen Oberhauser, and Violeta Calderon

Community dynamics of Curtis Prairie

Mary-Claire Glasenhardt, Nelson Institute for Environmental Studies

All ecosystems change over time. For conservation ecology, the goal is the preservation of the earth's native ecosystems and the biodiversity that they contain. To accomplish these goals, long-term monitoring is essential as it is the only way to determine trends. As one of the first scientifically guided restoration projects, Curtis Prairie is the focus of this research. Assessing the change occurring in this plant community could provide valuable insights into the development of prairie restorations in general, as well as provide management targets for the UW–Madison Arboretum. Adding to history of plant community surveys dating to 1946, in the summer of 2021 Isaac Bailey – a fellow master's student – and I collaboratively resurveyed Curtis Prairie. With the help of volunteers, we surveyed 1,011 m^2 plots collecting data on species presence, species abundance, along with fruit or flower presence. For a subset of 101 plots in which topsoil moisture was also recorded, I will present our initial findings.

Coauthors: Isaac Bailey and Paul Zedler

Dynamics of lead pollution in Curtis Prairie

Nick Hoffman, Nelson Institute for Environmental Studies

How has stormwater runoff affected plant community composition of the Curtis Prairie restoration? To begin to investigate this question, we measured lead concentrations in the sediments of the prairie's two stormwater ponds, Curtis and Coyote. Our measurements show that lead concentrations in the sediments of Coyote Pond peaked around 1980, when airborne lead concentrations were near their peak. The lead concentrations in the sediments of Curtis Pond peaked a few years after those in Coyote. This difference in lead pollution chronology is explicable in terms of the differing sewershed characteristics of the two ponds. The data imply that as a sewershed's impervious surface area increases, the lag time between peak airborne lead concentrations and peak waterborne lead concentrations increases, and the ultimate magnitude of peak waterborne lead concentrations increases. This lesson may be generalizable to emerging contaminants that circulate via the atmosphere.

Coauthor: Sean Scott

Spatial and temporal patterns of seed deposition in encroached tallgrass prairies

Eliza Soczka, Department of Integrative Biology

Woody encroachment, or the spread of woody vegetation into previously grass- and forb-dominated ecosystems, threatens the diversity, productivity, and persistence of tallgrass prairies. The threat of encroachment is particularly great in this ecosystem because, once a prairie is invaded by a critical threshold of woody vegetation, its establishment is difficult to reverse. By researching the processes driving woody encroachment, we can better understand how woody species come to persist in tallgrass prairies. Here, we quantify patterns of woody and herbaceous seed deposition in a tallgrass prairie to investigate positive feedbacks generated by existing woody vegetation that enable further encroachment. We deployed seed traps on the ground in areas of high woody vegetation cover and neighboring areas of low woody vegetation cover and collected seeds monthly throughout the growing season. We found a significant statistical difference in the number of seeds deposited in high versus low woody vegetation mid-summer. Percent cover of woody vegetation positively correlates to more seed deposition of woody species. Results have important implications for the conservation and management of tallgrass prairies. Practitioners should target woody vegetation removal before seed set to minimize further establishment.

Coauthors: Katherine Charton and Ellen Damschen

Management matters: Differential impacts of woody management on prairie microhabitats and communities

Katherine Charton, Department of Integrative Biology

Woody encroachment, or the spread of woody vegetation into previously grass- and forb-dominated and open-canopied ecosystems, is a global phenomenon resulting in ecosystem decay. Intervening before communities irreversibly transition requires an understanding of multiple interacting variables, including active management such as mowing or herbicide application that is meant to mitigate further woody spread. Here, we examine how management impacts woody vegetation, microhabitats, and plant communities in tallgrass prairie. In 2020, we established plots at seven remnant sites spanning a dry to mesic gradient across southern Wisconsin, targeting patches of gray dogwood (*Cornus racemosa*). In 2021, we applied treatments mirroring common management practices, including a cut-stem, cut-stem herbicide, and foliar herbicide treatment, as well as an unmanaged control. To quantify treatment effects, we measured resprouting woody ramets and soil temperature and moisture throughout the growing season and community cover and composition at the end of the growing season. We found a significant increase in ramet height in only the unmanaged control and a significant decrease in the number of ramets in both the cut-stem herbicide and foliar herbicide treatments. We also observed an increase in soil temperature and a decrease in soil moisture in all three management treatments, though trends were highly site-specific. Finally, plant community composition was most dramatically altered in the cut-stem herbicide treatment, though changes among functional groups were again highly site-specific. Our results highlight the inconsistencies in management outcomes and the need to better understand how concurrent environmental variables interact with management. Future research will use site covariates and climate manipulations to further elucidate mechanisms of plant community change. The impact of management on tallgrass prairie is highly relevant to the conservation of this imperiled ecosystem and can help further our understanding of disturbance and community stability.

Coauthor: Ellen Damschen