2020 Research Symposium Abstracts

ORAL PRESENTATIONS

How will our native conifers respond to winter warming?

Rachel Jordan, Department of Botany

Climate change poses a threat to forests in all seasons, including winter. Warming may result in more frequent and/or extended midwinter periods of above-freezing temperatures, presenting an opportunity for photosynthesis in trees that retain their leaves year-round, such as conifers. While some conifer species may benefit from thaws, others may be injured or killed by repeated freeze-thaw cycles. Vulnerability to this damage depends on specific overwintering strategy, but the winter behavior of many important eastern conifers is not well-understood, preventing the development of accurate projections of future survival and even forest composition in response to climate change. This talk describes the ways in which research at the Arboretum seeks to understand different overwintering strategies utilized by Wisconsin's native conifers and their implications for physiological, ecological, and industrial processes in a changing climate.

Coauthor: Kate McCulloh

Opinion leadership and urban water issues in Arboretum neighborhoods

Theresa Vander Woude, Department of Life Sciences Communication and Nelson Institute for Environmental Science

The Arboretum is connected to surrounding residential neighborhoods, and the people who live there, by water. While addressing our society's urban water issues will require technical approaches, many approaches to these challenges will also require shifts in human behavior. Theresa will review how people living around the Arboretum help create social change around managing urban water, including the role of opinion leadership and what social science says about the role of interpersonal communication and how innovations spread. She will discuss preliminary work from her 2019 Arboretum Research Fellowship, informed by interviews with neighborhood-scale leaders near the Arboretum and a broader community survey. The project's topical approach to water issues focused on the community goals identified in the Wingra Watershed Plan, tying community engagement with a focus on salt reduction, storm water infiltration, and phosphorus mitigation via leaf management. Participants generally expressed care for water and a willingness to engage, and wanted be able to stand behind trusted leadership around a common, identified need and goal before acting.

Coauthor: Bret Shaw

Experimental effects of invasive jumping worms on American toads in the UW–Madison Arboretum

Erin Crone, Department of Forest and Wildlife Ecology

Invasive species can affect native populations by changing habitat quality and food resources. Asian jumping worms (*Amynthas spp*.) are invasive in parts of North America, including the UW–Madison Arboretum, because of their rapid spread and disruption of topsoil and leaf litter microhabitats. *Amynthas* spp. may also alter prey resources for native predators, including amphibians. In this study, we compared impacts of *Amynthas* spp. and *Lumbricus* spp., an established non-native earthworm, on metamorphic American toads (*Anaxyrus americanus*) in outdoor mesocosms at the Arboretum. Then we evaluated whether toads consume *Amynthas* spp. in laboratory feeding trials. Both *Amynthas* spp. and *Lumbricus* spp. reduced leaf litter in the mesocosm experiment but did not strongly affect soil moisture, pH, or temperature. Toad survival and growth varied across mesocosms but were not strongly affected by earthworm presence. In the laboratory, toads preyed on both *Amynthas* spp. and *Lumbricus* spp. but were far less successful at capturing *Amynthas* spp. Capture frequency was lower for *Amynthas* spp. than for *Lumbricus* spp., likely due to behavioral responses of *Amynthas* spp. Future studies should evaluate how invasive Asian earthworms affect prey availability and the diets of amphibians and reptiles under natural field conditions.

Coauthors: Erin Sauer, David Drake, Bradley Herrick, and Daniel Preston

Six decades of forest change in Noe Woods

Jared Beck, Department of Botany

Over the past 250 years, woodlands and forests of southern Wisconsin have experienced dramatic changes in physical structure and plant species composition. We often lack historical baselines to quantify such changes but, when available, long-term studies can offer valuable insights into the patterns, pace, and drivers of ecological change. Employing a long-term study of trees in the UW–Madison Arboretum, I characterized 63-year changes (1956–2019) in the forest structure and composition in Noe Woods. Beginning in 1956, researchers mapped, measured, and identified all trees greater than 10 cm diameter at breast height (DBH) within a 4.65 acre (1.88 hectare) plot. In 2019, I resurveyed trees in Noe Woods and used these and historical data to characterize 63-year changes in forest structure and tree composition. The physical structure of Noe Woods has changed dramatically from semi-open woodland to a closed canopy forest. The conspicuous changes in forest structure have been accompanied by shifts in the abundance and composition of tree species. White Oak (*Quercus alba*) and Black Oak (*Q. velutina*) remain the dominant canopy tree species, but their numbers have declined since 1956 as mature trees (especially *Q. velutina*) die. Meanwhile, there has been no appreciable regeneration of any oak species. Instead, there has been a marked increase in shade-tolerant, fire-intolerant species such as Black Cherry (*Prunus serotina*), American Elm (*Ulmus americana*), Boxelder (*Acer negundo*), and Red Maple (*Acer rubrum*). These species first established under large Black Oaks killed by oak wilt

(*Ceratocystis fagacearum*), suggesting that a combination of disease and the loss of fire are driving succession in Noe Woods. Changes in the physical structure and tree composition of Noe Woods reflect transitions observed in oak savannas and woodlands across the upper Midwest. The data from Noe Woods provide insights into those changes, including both the pace of change and the drivers responsible for shifts in forest structure and tree composition. However, the long-term study in Noe Woods also presents an excellent baseline and a unique opportunity to study woodland restoration.

POSTERS

Prairie restoration, management, and landscape effects on bumble bee (*Bombus* spp.) communities in southern Wisconsin

Jade Kochanski, Department of Entomology

Bumble bees (*Bombus* spp.) have been declining worldwide over the last several decades and habitat loss is thought to be one of the main drivers. Conservation practices (e.g. prairie restorations) that restore bee habitat are a means of mitigating these declines. However, we do not know how bumble bee communities respond to restoration and management activities in southern Wisconsin. We hypothesized that sites restored with native prairie seedings would be more similar to remnant prairie communities and have greater bumble bee abundance, diversity, and richness when compared to sites that had never been seeded. Sites with seedings plus prescribed fire would be the most similar to remnant prairies and have greater bumble bee abundance, diversity, and richness when compared to sites that had been seeded but not managed or sites that had never been seeded or managed. In 2018 and 2019, we investigated bumble bee communities and floral resources at 39 sites managed by the Natural Resources Conservation Service's (NRCS) Wetland Reserve Easement (WRE) program and 6 remnant prairies managed by various agencies including the UW–Madison Arboretum. Bumble bee abundance, diversity, and richness were measured across two types of prairie restorations (1. Native prairie seeding, 2. Seeding with periodic prescribed burns) and compared to two reference groups (3. Not seeded, not burned, 4. Remnant prairie, prescribed burns). Our results show that bumble bees in southern Wisconsin respond to native prairie restorations. Sites with seeding had increased abundance and richness, but decreased diversity of bumble bees when compared to sites that were not seeded. Seeded sites were more similar to remnant prairies than to sites that were not seeded. We did not observe prescribed burns to have additional positive or negative effects on bumble bees. These findings suggest that grassland restoration can have positive effects on bumble bee communities.

Coauthors: Stephanie McFarlane, Ellen Damschen, and Claudio Gratton

Investigating the presence of co-facilitation between invasive Asian and European earthworms (*Amynthas tokioensis* and *Lumbricus rubellus*) and invasive honeysuckle (*Lonicera* spp.) in a mesocosm experiment

Emily Snelson, Department of Botany

Non-native earthworms have the potential to significantly alter the soils, nutrient cycling, and biota of northern temperate forests. European earthworms have been present in the upper Midwest for centuries, but increasing reports of Asian "jumping worms" (e.g. *Amynthas* spp.) have demonstrated the need for studies on the ecological impacts of Asian earthworms specifically and how their effects may differ from those of their European counterparts. Of particular importance is understanding the interactions of *Amynthas* spp. with invasive plants such as honeysuckle (*Lonicera* spp.) due to previous evidence pointing to co-facilitation between honeysuckle and European earthworms, leading to an "invasional meltdown." To test for possible co-facilitation between jumping worms, European worms, and honeysuckle, a mesocosm experiment was conducted to determine (1) if earthworm success in honeysuckle-invaded environments differs between jumping (*Amynthas tokioensis*) and European (*Lumbricus rubellus*) earthworms, and (2) if success for each earthworm species is affected when both groups are present in the same location. While data analysis for this project is still underway and full results have yet to be determined, this study will provide insight on potential co-facilitation existing between these prolific invasive species and may indicate suggestions for future land management practices. In addition, this information will add to our knowledge base on how jumping worms interact with European earthworms, influencing the short and long-term implications of jumping worm invasions on native ecosystems.

Coauthor: Brad Herrick

An evaluation of disturbed populations at Faville Prairie

Mercedez Kennedy, Nelson Institute for Environmental Studies

Faville Prairie is a remnant prairie adjacent to the Crawfish River in Jefferson County, Wisconsin. This prairie has been surveyed several times, notably in 1978 and 2010. These two surveys were done before and then after a significant flooding event that occurred at Faville Prairie in 2008. The comparison of the previous surveys showed a severe decline in the populations of several plant species, including the target species *Silphium terebinthinaceum* (prairie dock) and *Silphium laciniatum* (compass plant). The present study resurveyed Faville Prairie in 2019 to evaluate the rate at which *Silphium terebinthinaceum* and *Silphium laciniatum* have recovered from the population crash. Target species were also located outside of the survey plots to determine seed output and reproduction success. Abundance in the 2019 surveys was not significantly different than abundance in the 2010 survey for both *Silphium terebinthinaceum* and *Silphium laciniatum*. From these results, we conclude that the populations have not yet recovered from their drastic declines in abundance, and the prairie ecosystem may have experienced a shift in its stable state due to environmental drivers. Given predicted increases in extreme weather events due to climate change,

plant population declines may be occurring more often, as habitats change. This will have implications on biodiversity and ecosystem functions of grassland ecosystems.

Co-author: Paul Zedler

Monitoring monarch butterfly populations (*Danaus plexippus*)

Kennedy Laessig, Department of Forest and Wildlife Ecology

As Monarch Butterfly populations continue to decrease, it is important for scientists to monitor their numbers through field research. Conducting data on monarch egg, larvae, and adult populations assists in comparison among other locations throughout the migratory season. As for my research, I collected population data at three different prairie sites around Madison, Wisconsin. I will use the collected data to compare the populations and blooming plants species at specific sites within Wisconsin.