2019 Research Symposium Abstracts

ORAL PRESENTATIONS

Rodent usage of commercially available treated nesting materials

Sydney Ring, Department of Entomology

Lyme disease prevention is a valuable approach for avoiding potentially serious complications, and one method that has been employed for reducing local tick burden is the use of tick tubes. The current study, conducted in the University of Wisconsin–Madison Arboretum, was established as a method to compare small mammal usage of tick tubes with two different materials: cotton balls and cotton batting. Efforts have been focused on better understanding the small mammal relationships and interactions with each material. The resulting data of tubes weights and camera traps have been assessed to quantify both changes in material weights after deployment, and small rodent behavior using camera traps. Researchers have concluded that, in this head to head comparison, neither of the materials was sufficiently "preferred" by mice and in fact, both materials are actively collected and have their own individual benefits. Further investigation is merited to better understand how the material is utilized within the entire population of mice to determine which type of cotton is best suited for this integrated tick management study.

Cypripedium candidum in the southeast glacial plains of Wisconsin: Distribution, ecology, and threats

Andrea Weissgerber, Department of Planning and Landscape Architecture

The purpose of this study was to explore how select biotic and abiotic factors influence the presence and disappearance of the white lady's-slipper orchid (*Cypripedium candidum*) in the southeast glacial plains of Wisconsin. *C. candidum* was once a prevalent species in southern Wisconsin calcareous fens and wet prairies. However, populations have experienced rapid decline and it is now a state threatened species. With a coefficient of conservatism of ten, requirements for *C. candidum* are closely linked to system functioning. This orchid is believed threatened due to habitat loss contributed by land use change, alteration of hydrologic regimes, and woody and invasive species encroachment. Increased herbivory has also been considered a potential factor in its decline. However, the current distribution of *C. candidum* is anecdotal; last known comprehensive surveys in Wisconsin occurred over thirty years ago and its population response to both community and ecosystem level changes are unknown. We surveyed thirty sites in the southeast glacial plains of Wisconsin where *C. candidum* had been previously documented in order to determine changes in population distribution. Orchids were found at only half of these sites. Present populations were often localized or clustered within a site. The spatial distribution of *C. candidum* was analyzed for three of the survey sites where orchids were found. Orchid presence and absence within each site was studied for potential relationships

with hydrology, water chemistry, light availability, herbivory, and associated species. Results of this study indicate that orchid presence is positively correlated with minerotrophic hydrologic regimes. Additionally, shrub encroachment may have both direct and indirect effects on *C. candidum* populations. These effects include changes to *C. candidum* life history characteristics and surrounding groundwater functioning. While opportunistic browsing is possible, herbivory does not seem to be a major factor in *C. candidum* decline. In order to conserve populations, land managers and restorationists must actively manage against shrub encroachment and protect historic ground water levels and chemistry. Conservation and management for this orchid inherently leads to the conservation of the entire community and has far reaching benefits for a wide range of species.

Survey of the mosquito fauna of the UW–Madison Arboretum, 2019 update

Vinicios Ferreira-de-Freitas, Department of Entomology

The mosquitoes (Diptera: Culicidae) are a group of insects mainly known to the public for the blood-feeding behavior of the females. They are abundant both in the flying adult stage and in aquatic habitats as larvae and pupae and play an important role in the ecosystems where they live, many potentially serving as bioindicators of environmental quality. In consonance with recent efforts to map biodiversity in the U.S., and in the world in general, from 2016 to 2018, we performed a brief survey of the mosquitoes of the UW–Madison Arboretum. In 2016, we utilized two units of the CDC Miniature Incandescent Light Trap and one of the Miniature Downdraft Blacklight (UV) Trap to sample three different areas for a total of six weeks between 2:30 p.m. and 9 a.m. In 2017, we surveyed four different water bodies by dipping, during the months of April, May, and June. In 2018, we performed sporadic collection utilizing CDC traps and manual collection. Collected adult mosquitoes were dry mounted and larvae were reared to adults, and larval and pupal exuviae were slide mounted; all the material is deposited in the Wisconsin Insect Research Collection. The UW–Madison Arboretum provides habitat for at least 21 species of mosquitoes. This taxonomic survey served as an invaluable insight into the biodiversity, bionomics, and ecology of the mosquito fauna of the Arboretum and helped elucidate aspects of mosquito diversity that will serve as a basis for a review of the mosquito fauna of the state.

Coauthors: Nicholas Thrun, Jacob Wolf, and Lyric Bartholomay

The ubiquitous unseen: Past and present exposition of the Arboretum's mycoflora

Alden C. Dirks, Department of Agronomy

The Arboretum is home to a diversity of fungi, which underlies all aspects of ecosystem functioning across its varied landscapes. Best known for hand planting the Greene Prairie, Henry Greene was also a mycologist who spent years documenting and describing plant pathogenic fungi at the Arboretum in the 1960s. Today, his inventories can serve as a tool to monitor plant disease and detect emerging pathogens. Over 50

years later, we are expanding upon Greene's fungal surveys using DNA sequencing and morphological studies of macrofungi in collaboration with the Madison Mycological Society and North American Mycoflora Project. Initial collection efforts have yielded over 100 specimens, some of which showcase the ecological impacts of a changing climate and the transcontinental movement of plants and fungi. This summer, citizen scientists will have the opportunity to engage with the Arboretum's mycoflora through guided bioblitzes, expanding the public's appreciation for a ubiquitous but often overlooked group of organisms.

Keynote: Macro-consequences of micro-organisms: fungal influences on forest responses to changing climates

Richard Lankau, Department of Plant Pathology

Temperate forests are under increasing stress from rising temperatures and increasingly variable precipitation. Traditionally, it has been assumed that tree species have two options to respond to climate change – range shifts through space to track historical climates, or adaptation in place to tolerate novel climates. Our research group is investigating a possible third option – can trees gain tolerance to novel climates by changing their associations with microbial partners in their roots? Plants rely on microbial partnerships for a suite of essential processes, including nutrient acquisition, drought tolerance, and suppression of soil disease, raising the possibility that introduction of new microbial species may change a tree population's tolerance of abiotic conditions. In a series of linked field and greenhouse experiments, we found that inoculating tree seedlings with microbial communities sourced from drier locations can promote seedling tolerance of drought. We are currently expanding this work across multiple tree species, field sites, and climatic conditions to ask, 1) can simulated movement of microbial communities promote tree recruitment in drought conditions, and, 2) what consequences might microbially mediated shifts in tree species performance have for the future composition and function of forests.

POSTERS

Monarch butterfly landscape ecology

Skye Harnsberger, Department of Entomology

The eastern population of monarch butterflies has plunged due to habitat loss along their migratory route. Recent estimates of the extent of habitat restoration needed to return monarchs to a sustainable population require the planting of 1.8 billion stems of milkweed. To ensure that habitat restoration efforts are targeted toward areas that are accessible and optimal for monarch use, it is necessary to understand the effects of ecosystem spatial heterogeneity on monarch presence. Landscape ecology provides the unique framework for understanding these patterns. Sixty survey sites in Wisconsin were analyzed for milkweed patch size, percentage of grassland within 1 km, and monarch density. Preliminary results from one season of surveys showed that sites with large isolated patches of milkweed had the highest densities of monarchs. This research

can be used to inform conservation practices regarding configurations and locations of new milkweed plantings within a landscape and give insight into the ways in which monarchs find and use patches of milkweed.

Are trees contagious? Exploring patterns of spatial aggregation in temperate forest trees

Brooke Bowser, Department of Botany

Wisconsin's forests cover 46 percent of the state and support a rich assemblage of biological diversity and associated ecosystem services. Climate change, altered disturbance regimes, and other anthropogenic factors, however, are driving long-term changes in forest structure and species composition. This makes it important to improve our understanding of the ecological processes affecting species dynamics. To better understand the ecological processes shaping forest dynamics, we surveyed tree communities at three forest sites in southern Wisconsin: Abrahams Woods State Natural Area, Natural Bridge State Park, and a parcel of forest owned by the University of Wisconsin Botany Department adjacent to Pine Hollow State Natural Area. At each site, we measured and mapped all trees >1 cm diameter at breast height (DBH) within a 100 x 100 m plot, recorded counts and species identities of seedlings in 360 evenly spaced 1 m^2 quadrats, and took hemispherical photographs to quantify understory light availability. These data allowed us to explore how spatial patterns in the distribution of tree seedlings (<1 cm DBH) and saplings (1–10 cm DBH) within and among species varied in response to light availability and proximity to adult trees. The observed spatial distribution of trees varied both among species and among life stages reflecting differences in the ecological factors influencing local population dynamics. For example, Black Cherry (*Prunus serotina*) seedlings are abundant near large cherry trees but saplings are scarce. Thus, *P. serotina* exhibits a pattern of spatial repulsion consistent with the "Janzen-Connell effect" predicted to result when host-specific pathogens increase the mortality of juveniles near adults. Our findings confirm that both abiotic conditions and biotic interactions influence local spatial patterns, recruitment success, and tree community dynamics in temperate forests. Understanding these forces is important for predicting how these forests will respond to future ecological changes.

Coauthor: Jared Beck

Dragonfly monitoring at the Arboretum

Jessica Ross, Arboretum

In Wisconsin, there are over 160 documented species of dragonflies, more than 60 of which can be found in Dane County. However, dragonfly habitats far outnumber research professionals who have the time and skills to monitor them. To fill this gap, a new citizen science initiative to monitor dragonflies began at the UW–Arboretum in the summer of 2018. The goal was to document the presence and absence of adult dragonflies at natural and artificial stormwater ponds. In this pilot year, nine active volunteers monitored 11 sites within the Arboretum. Over the course of the summer,

citizen science volunteers observed 13 unique species, laying the groundwork for further inventory of Arboretum dragonflies and their habitat use. The dragonfly monitoring program will continue to expand next season and welcomes anyone interested in participating.

Coauthor: Brad Herrick

Influence of earthworm invasion on root growth and mycorrhizal colonization of sugar maple (*Acer saccharum*)

Kevin Hobbins, Department of Botany

Non-native European earthworm species (family Lumbricidae) have been well studied and shown to significantly alter ecosystem structure and function in communities previously uninhabited by earthworms. Fewer studies have investigated the ecological impacts of European earthworm replacement by other groups of invasive earthworms. Since 2013 central Wisconsin has begun this transition; European earthworms are declining in response to growing populations of east-central Asian earthworms (genus *Amynthas*, family Megascolecidae). In contrast to European species, *Amynthas* are capable of living at much higher densities and persist primarily in the uppermost soil layers. Due to these differences, we assessed the effects of *Amynthas* and European earthworms on specific root length (SRL) and arbuscular mycorrhizal (AM) fungal colonization of sugar maple (*Acer saccharum*) fine roots. SRL was measured as the ratio of root length to dry mass and represents an index of benefit to cost of fine roots. A higher SRL indicates a plant invests more into resource acquisition at the expense of less robust and shorter-lived roots. AM colonization was measured as percent hyphal coverage and presence of fungal vesicles and arbuscules. We hypothesized that sugar maples of *Amynthas*-invaded plots will contain a lower percent colonization of AM fungi with a subsequent increase in SRL, as trees must invest more in resource acquisition due to the disruption of their fungal symbioses. However, preliminary results suggest there are no differences in SRL between trees growing with and without *Amynthas*. Preliminary observations of AM fungi also suggest that sugar maples contain few fungal structures, regardless of the type of earthworm present. Overall, *Amythas* have not likely altered the morphological and ecological root characteristics of sugar maples in an ecosystem already transformed by European earthworms.

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