2015 Science Day Abstracts

ORAL PRESENTATIONS

Effects of Common Buckthorn (*Rhamnus cathartica*) on Small Mammal Post-dispersal Seed Predation

Kristina Bartowitz
Nelson Institute for Environmental Studies, UW–Madison

Invasive plant species can drastically affect ecosystem functions as well as plant and animal communities. Many structural changes in ecosystems can arise from direct impacts of invaders on native species. Although not often investigated, these changes in habitat structure might generate novel indirect effects in ecological communities because the activities of foraging animals are often affected by habitat structure. For example, exotic shrubs might alter rates of seed predation by providing a structural refuge for small mammal seed consumers, or by altering the structure litter layer. If so, these changes in seed predation could alter the composition of native plant communities and possibly facilitate greater invasion. We examined whether common buckthorn (*Rhamnus cathartica*) alters habitat characteristics, such as a decreased leaf litter layer and increased cover, to influence native plant seed survival via choices in seed predation by small mammals. We completed three seed removal studies in the UW Arboretum in a *R. cathartica* invaded forest, where half of our plots had *R. cathartica* completely removed (n=16, 8 plots with *R. cathartica* intact and 8 plots with *R. cathartica* removed). Along with *R. cathartica* seeds, the native seeds used were: *Acer rubrum*, *Acer saccharum*, *Prunus serotina*, and *Quercus rubra*. The experiments ran for three weeks in July, September, and November.

We found that there were seed removal differences by habitat between the removal and intact plots, as well as seed removal differences by species. Total seed removal was significantly higher in the *R. cathartica* intact plots than removal plots. Leaf litter depth was significantly higher in the removal plots, while canopy cover did not differ between the two habitats. Removal rates differed between intact and removal plots, suggesting that *R. cathartica* produces a change in seed removal rates. These differences could influence the survival of native seeds, and in turn the way that plant communities are established. Understanding these changes can assist with restoration efforts through management and seed additions.

Small Mammal Community Response to Prairie Restoration

Sarah Betzler
Nelson Institute for Environmental Studies, UW–Madison

Habitat restoration is an essential tool for the preservation of biodiversity, ecosystem services, and landscape connectivity. In practice, restoration is usually limited to re-creating the physical conditions of the site and replacing native vegetation: mobile or cryptic taxa are often neglected due to lack of resources, lack of understanding, or an assumption that they will return on their own. For my Master's thesis, I am studying the responses of grassland rodent and shrew communities to prairie restoration activities, in order to begin to address this gap. During the summer of 2014, I trapped small mammals on four grassland sites with mixed restoration histories: two sites were owned and managed by the UW–Madison Arboretum, one by the WDNR, and one by private landowners. In the next few weeks, I will compare the communities of adjacent restored and unrestored or relic grasslands; I will also analyze data from museum specimens collected in Wisconsin over the past hundred and fifty years, in order to supplement the data I gathered and look for broader trends.

Intervention Strategies for Deer Ticks and Tick-borne Pathogens in Wisconsin and the Arboretum

Jordan Mandli
School of Medicine and Public Health, UW–Madison

Spurred by the discovery of a single larval deer tick in 2010, UW researchers have worked diligently with the Arboretum staff in assessing the growing threat of a newly established deer tick population. Since 2010, surveys have not only indicated an increasing number of ticks throughout the Arboretum property, but has also shown growing incidence of tick-borne pathogens such as Lyme disease that threaten community health. To quell these growing trends, members of the UW Medical Entomology Laboratory have begun exploring host-targeted interventions designed to reduce the tick population and reduce the infection rate of reservoir hosts that perpetuate the pathogen's life cycle. This presentation will describe the current status of tick infestation in the Arboretum and will discuss current research and useful tools to protect neighbors and outdoor enthusiasts alike.

Consequences of a Newly Arrived Non-native Earthworm (*Amynthas agrestis*) for Wisconsin Forest and Prairie Soils

Jiangxaio Qiu
Department of Zoology, UW–Madison

Invasion of exotic earthworms is a global phenomenon that has profound impacts on ecosystem structure and function. Prior research has well documented effects of invasive earthworms of European origin (family Lumbricidae) in northern temperature forests, but the ecological consequences of earthworms from other regions or families remain poorly understood. *Amynthas* (family Megascolecidae), a genus of Asian earthworm, has been increasing in North America and rapidly spreading northward. The discovery of *Amynthas agrestis* at the UW–Madison Arboretum in fall 2013 marked its first recorded appearance in Wisconsin, and made Midwestern states the leading front of northward expansion. We conducted a mesocosm experiment and complementary field study from June to November 2014 and asked: (1) what are the consequences of *Amynthas agrestis* invasion on soil and litter properties, and (2) how do effects differ across forest and prairie ecosystems? Preliminary results of the mesocosm experiment showed that, in both forest and prairie soils, litter depth and foliage mass declined substantially if *Amynthas agrestis* was present, as compared to controls (all $P<0.001$). We found greater litter declines in forest than in prairie soils, perhaps because of differences in litter digestibility. Similarly, field observations showed that *Amynthas agrestis* accelerated loss of foliage mass through time and substantially reduced litter depth, with the strongest effect late in the growing season when the *Amynthas* population peaks. Our study provided initial evidence that the effects of this new invader can be significant, and further suggested the possibility for cascading effects through soils by transforming and incorporating leaf materials into the soils.

Keynote Address: Research for Adaptive Restoration at the Arboretum

Dr. Joy Zedler
Aldo Leopold Chair of Restoration Ecology
Department of Botany, UW–Madison

Adaptive restoration is a key to improving restoration methods and outcomes; it involves large field experiments and iterative decision-making by an integrated team of researchers and managers. Among the Arboretum's greatest restoration challenges are invasive wetland plants that displace native species. Researchers have clarified the causes of species invasions, explored potential control methods, and tested

methods to re-establish wetland vegetation. The Arboretum's 430 acres of unrestored land provide many opportunities to restore wetlands adaptively. The Arboretum could regain national prominence in restoration ecology by demonstrating and promoting adaptive restoration as part of its "brand."

POSTERS

The effects of *Amynthas agrestis* on Surface Litter Mass and Depth in Wisconsin's Forests and Prairie Ecosystems

Joe Bevington
Department of Zoology, UW–Madison

The invasion of exotic earthworms is a global phenomenon that profoundly influences essential ecosystem processes and functions. Current understanding of invasive earthworms in North America is primarily based on studies of European earthworms (e.g., *Lumbricidae* spp.). The ecological consequences of exotic earthworms of Asian origin (e.g., *Amynthas* spp.) are poorly understood. The purpose of this study was to examine effects of the newly discovered invasive *Amynthas agrestis* (commonly known as the Asian crazy worm) on both prairie and forest ecosystems within the Yahara watershed of southern Wisconsin, USA. Using a combined mesocosm experiment and a complementary field observation study, we sought to address how *A. agrestis* affects surface litter mass and depth, and whether these effects differ across forest and prairie ecosystems. Results from both mesocosm and field observation studies showed that *A. agrestis* significantly reduced the litter mass and depth in both forest and prairie ecosystems ($p<0.001$). The effects were greater in forest (64.8% and 64.5% reduction in litter mass and depth, respectively) than in prairie (23.4 % and 41.0% reduction in litter mass and depth, respectively). Temporally, the effects also varied with time, with the strongest impacts in late July and September ($p<0.001$). The litter layer is an essential part of soil ecosystems, and the depletion or substantial reduction of litter due to invasive *A. agrestis* could have subsequent effects on plant germination, survival and other soil fauna.

A Graminicide (Clethodim) Harmed Reed Canary Grass More than the Native Awl Fruit Sedge

Nick Galleguillos
Department of Botany, UW–Madison

Attempts to control reed canary grass (*Phalaris arundinacea,* Pa) might be effective using a graminicide other than sethoxydim. We hypothesized that a July application of the graminicide clethodim could control Pa without harming *Carex stipata* (Cs) in a mixed stand, but would be less effective than the broad-spectrum, systemic herbicide glyphosate in a monotype of Pa. In the mixed stand, clethodim did little harm to Cs. Maximum leaf lengths of Cs were similar with and without the graminicide (47 ± 5.0 and 49 ± 5.0 cm, resp.). Clethodim killed Pa shoots within 5 weeks, while glysophate took only 3 weeks. Also, Pa treated with clethodim regrew after 3–9 weeks in 4 of 8 treatment plots. In contrast, shoots sprayed with glysophate turned brown and did not regrow. The effectiveness of clethodim on Pa was site dependent; Pa resprouted in 4 of 16 monoculture plots but in all 8 mixed plots. The two sites differed in soil moisture, time between mowing and herbiciding, and Pa height when herbicided. As hypothesized,

clethodim reduced growth of Pa, with little harm to Cs. Further research is needed to assess the need for a second, late-season application of clethodim.

Is this Native Cattail Marsh a Potential Reference Site for Restoration?

Chris Hirsch
Department of Botany, UW–Madison

Reference sites are important for planning ecological restoration projects because they provide critical information about target community structure and function, which is necessary to set appropriate restoration objectives. During restoration, practitioners assess progress by comparing the site's characteristics to those of one or more reference sites. Remarkably, a recent review of the literature found that only 132 of 301 studies (44%) utilized a historical reference site (Wortley et al. 2013).

Intact native cattail (*Typha latifolia*) marshes are uncommon in Wisconsin and rare in the Arboretum. Thus, I characterized the community structure of this remnant native cattail marsh so the data could assist conservation and restoration efforts. In September and October of 2014, I sampled the vegetation of an approximately 975-m² remnant cattail marsh in the unplowed portion of Curtis Prairie. The site was dominated by three species: Canada Blue Joint Grass (*Calamagrostis canadensis*), Broad Leaf Cattail (*Typha latifolia*), and Tussock Sedge (*Carex stricta*). At the time of the survey, 20 plant species were present, and the average species richness was 4.6 species per m². The site contained one non-native species *(Polygonum persicaria*) and one native invasive species (*Solidago canadensis*). Combined, these two species were present in 12 of the 45 quadrats (26%) with an average cover of >25%. The species sequence curve indicated that the site was not dominated by any single species. The Floristic Quality Index for the site was 11.22, and the Mean Conservatism Coefficient was 3. These results compare well with the Wisconsin Department of Natural Resources (Haber 2014) and the Chicago District Army Corps of Engineers (USACE 2008) restoration criteria for vegetative performance. Therefore, I conclude that this native cattail patch could serve as a useful restoration reference site.

The Cattail Conundrum: Invasion of Wingra Fen by Typha x glauca

Anna Knezic
Department of Botany, UW–Madison

Fens are among the rarest and most diverse wetlands in Wisconsin. The Arboretum's Wingra Fen, however, has lost diversity due to invasive hybrid cattails (*Typha x glauca*). A possible cause is the loss of near-surface groundwater during summer night-time irrigation, i.e., lower groundwater could have allowed the peat mound to decompose, lowering the elevation and creating a depression that would facilitate ponding. The hybrid cattail has aggressively invaded Wingra Fen and other Arboretum wetlands and stormwater facilities. I asked: is this clone is stable or expanding?

Using GPS technology, I searched intervals along the perimeter of the cattail stand and found green ramets that were farthest from the rest of the cattail clone in each segment. Then I measured the radial distance to the nearest ramet with dead biomass from last year. The measurement was an estimate of annual expansion. The annual expansion rate of cattails in Wingra Fen averaged about 30 cm, and the leaf

length of ramets averaged about 160 cm. Expansion rates of cattails in Gardner Marsh were measured by Steve Hall several years ago; his rates averaged 80 cm/yr.

Hybrid cattails are expanding and thriving in Wingra Fen and need management (control). Future censuses should note total leaf length per ramet, which might help explain differences in expansion around the clone.

The effects of Alum on Bacterial Communities

Alex Linz and Sam Schmitz
Department of Civil and Environmental Engineering, UW–Madison

In an attempt to control excess phosphorus, which results in algal blooms, the City of Madison added alum into a storm water pond in the UW–Madison Arboretum. To better understand how the addition of alum affects the bacterial populations of the ecosystem, we conducted our own study alongside the City of Madison. The results received from the study are unable to determine any correlation between changes in bacterial biodiversity and the addition of alum. Variability and evenness of bacteria in the lake system also appear unaffected by the alum in the ecosystem. However, it would be ideal to have a full year's worth of data before concluding whether the alum has a significant impact on a lake's bacterial communities.

Curtis Prairie: More than a Prairie

Mark Wegener and Dr. Joy Zedler
Arboretum and Department of Botany, UW–Madison

In the years since Curtis Prairie's establishment, changes within the iconic prairie's watershed have introduced new challenges to ongoing restoration efforts. Using Global Positioning System (GPS) and Geographic Information System (GIS) technology, a number of students and volunteers have contributed to a new map of the prairie that reveals more than 22% of Curtis Prairie is now wetland, with implications for management, monitoring, and ecosystem functions.

The Effects of Residual Permethrin on Bumblebees

Nathan Wong
Department of Entomology, UW–Madison

The purpose of this study is to assess whether a treatment that is used against ticks is harmful to bumblebees. The practice of having white-footed mice use permethrin-treated cotton balls in their nest bedding is effective in reducing tick numbers and reducing the incidence of Lyme disease, which is spread when ticks feed on humans. However, permethrin-treated cotton balls left over in rodent burrows could pose a lethal threat to bumblebee colonies moving into those abandoned nests. Bumblebees are very important pollinators in their habitat, thus introduction of permethrin into the wild could be detrimental to the ecosystem. In order to get a better understanding of how permethrin influences the growth of colonizing bees, common eastern bumblebees (*Bombus impatiens)* were tested against varied concentrations of permethrin. A test was conducted to determine whether permethrin-treated cotton balls degraded in soil over a certain period of time. Permethrin-treated cotton balls were also introduced to

bumblebee colonies to see if they had any significant effect on the colonies. Higher concentrations or longer exposure time to permethrin resulted in quicker deaths of bumblebees. Results are decreases in bumblebee mass in colonies that were introduced to permethrin-treated cotton balls, showing worse bumblebee health. By gathering information on lethality of permethrin to individual bees and complete hives, we can determine whether the tick treatment method poses any significant threat to incoming bumblebee populations.