2021 Research Symposium Abstracts

ORAL PRESENTATIONS

Factors affecting Chinese mystery snail invasions in urban ponds

Gabrielle Shay, Department of Forest and Wildlife Ecology

Invasive species can alter freshwater ecosystems through their effects on native populations and food webs. However, unlike many invasive species, the ecological roles of the Chinese mystery snail, *Cipangopaludina chinensis,* are not well known. Its invasive populations established in North America, including Wisconsin, are continuing to climb, presenting concerns over their effect on freshwater ecosystem function and health. With little research on the community-level effects of these snails, establishing effective management plans to control their effects on native freshwater species is challenging. In this study we hope to determine the effects of different nutrient levels (high/low), and predatory fish (absence/presence) on Chinese mystery snail populations, native snails, primary production, native amphibians, and zooplankton.

Coauthor: Daniel Preston

Toward a better understanding of climate change impacts on management outcomes: Do changing patterns of precipitation impact woody encroachment in tallgrass prairie?

Katherine Charton, Department of Integrative Biology

In an era of rapidly changing climatic conditions, anticipating the rate and extent of ecosystem change will help inform conservation priorities and adaptation efforts. Woody encroachment is one such globally occurring change, and managing it requires an understanding of multiple interacting environmental variables. This project examines the effects of existing woody management practices and changing patterns of precipitation on woody invaders and native plant communities in tallgrass prairies. This past summer, we established plots and collected pre-treatment data at seven remnant (i.e., unplowed) sites spanning a dry to mesic moisture gradient at the Arboretum, Arboretum outlying properties, and non-Arboretum properties across southern Wisconsin. Patches of grey dogwood (*Cornus racemosa*), a prevalent and aggressive native woody invader, were targeted for plot establishment. In collaboration with land managers, we finalized a study design that could be implemented consistently across all sites. This upcoming summer, plots will be managed using a cut stem, basal bark herbicide, or cut stem herbicide treatment, or else remain unmanaged as a control, and will receive either reduced or ambient precipitation using rainout shelters. Detailed plant community data will be collected annually during the growing season in subsequent years. Results are expected to elucidate how the interaction between management and precipitation impacts prairie communities and will be highly relevant to our understanding of disturbance and community stability.

Coauthor: Ellen Damschen

Invasive shrubs generate biotic resistance to invasive earthworms

Carson Keller, Department of Zoology

Ecosystems often experience the contemporaneous invasion of multiple species; however, there is little understanding of the interactive effects that concurrent invasions have on trophic interactions (i.e., predator-prey and plant-herbivore). Modified plant-herbivore interactions can have direct consequences on native plant species survival, distribution, and population dynamics. Identifying variation in small mammal trophic interactions is critical to determining if native species actively resist (i.e., biotic resistance) or facilitate invasional success; biotic resistance can occur when native species alter their biotic interactions and behaviors in ways that prevent or resist invasions. Invasive shrubs and earthworms can rapidly modify the habitat structure and community dynamics of an ecosystem and also have the potential to facilitate one another's success. Increases in the habitat structure provided by invasive shrubs may exacerbate small mammal consumer pressure on native seeds, invasive earthworm cocoons, or both.

We used site-level experimental manipulation of invasive buckthorn (*Rhamnus cathartica*) to determine: (1) if changes in small mammal trophic interactions promote invasional meltdown (i.e., cofacilitation) or biotic resistance and (2) if invasive species mediate the consumer pressure experienced by native plant species. We quantified seed and cocoon removal by arthropods and small mammals for invasive jumping worm cocoons (*Amynthas* spp.) and three native herbaceous seeds species (*A. canadensis, G. maculatum, C. thalictroides*) of restoration interest. We found that both cocoon and seed predation increased by over 20% when buckthorn was present relative to when buckthorn had been removed; however, the effect of buckthorn on seed predation varied by seed species. Small mammal cocoon and seed predation was greater than arthropod predation alone and significantly declined when buckthorn was removed. This pattern of consumer pressure was potentially driven by the substantially higher levels of white-footed mouse (*Peromyscus leucopus*) activity within buckthorn invaded plots. Our results indicate that the habitat structure provided by invasive shrubs modifies small mammal trophic interactions generating biotic resistance to invasive earthworms. Failing to account for native species interactions may constrain our ability to predict the mechanisms leading to invasional success or failure and the ability of ecosystems to resist to multiple invasions.

Coauthor: John L. Orrock

Landscape- and local- level variables driving monarch butterflies to breeding habitat in Midwest grasslands

Skye Harnsberger, Department of Entomology

It is estimated that over one billion milkweed stems need to be restored to sustain the eastern North American migratory population of monarch butterflies. To ensure that habitat restoration efforts are targeted towards areas that maximize monarch population growth, it is important to understand the effects of landscape heterogeneity on monarch occurrence in habitat patches (i.e. grasslands with milkweeds) across the

landscape. Over two summers (2018–19), we surveyed monarch adults, larvae, and eggs at sixty grassland sites in Wisconsin that varied in patch size and landscape context (proportion grassland, forest edge density, and road density). We also estimated milkweed density and blooming plant species richness to characterize local patch quality. Adult monarch abundance was highest at patches with the lowest proportion of surrounding grassland and lowest road density, and was heavily influenced by patch quality variables. Egg and larva density in a patch increased with milkweed density and blooming plant species richness within a patch. Patch size was unrelated to monarch abundance. These results suggest that optimal sites for monarch habitat restoration are within landscapes with less surrounding habitat and that high milkweed density and blooming plant species richness should be conservation goals.

Coauthors: Wayne E. Thogmartin, Chris Trosen, Karen Oberhauser, and Claudio Gratton

Experimental effects of invasive goldfish (*Carassius auratus*) and Chinese mystery snails (*Cipangopaludina chinensis*) on native pond communities in Madison, WI

Erin Crone, Department of Forest and Wildlife Ecology

Invasive species impact native species through a combination of factors including competition, predation, and habitat alteration. Untangling these effects in a dynamic ecosystem presents a challenge, especially when multiple invaders are present. The presence of multiple invaders in an ecosystem may lead to invasional meltdown in which multiple invaders facilitate one another and amplify effects on native communities. Urban habitats like stormwater ponds are particularly prone to species invasions due to habitat alterations and increased likelihood of anthropogenic introductions. We used a mesocosm experiment at the UW–Madison Arboretum to study how pond communities are impacted by two freshwater invasive species that co-occur in Dane County, Wisconsin: goldfish (*Carassius auratus*) and Chinese mystery snails (*Cipangopaludina chinensis*). Specifically, we investigated how resource use, predation, and habitat alteration by these invaders impacted the native community and whether facilitation occurred between the two invaders. We found that Chinese mystery snails displayed some competitive effects on native snails and tadpoles. Goldfish altered primary production, and they reduced grey treefrog (*Hyla versicolor*) and juvenile native snail survival through predation. We found increased reproductive success of Chinese mystery snails when goldfish were present, suggesting that facilitation may be occurring between the two species.

Coauthors: Erin Sauer and Daniel Preston