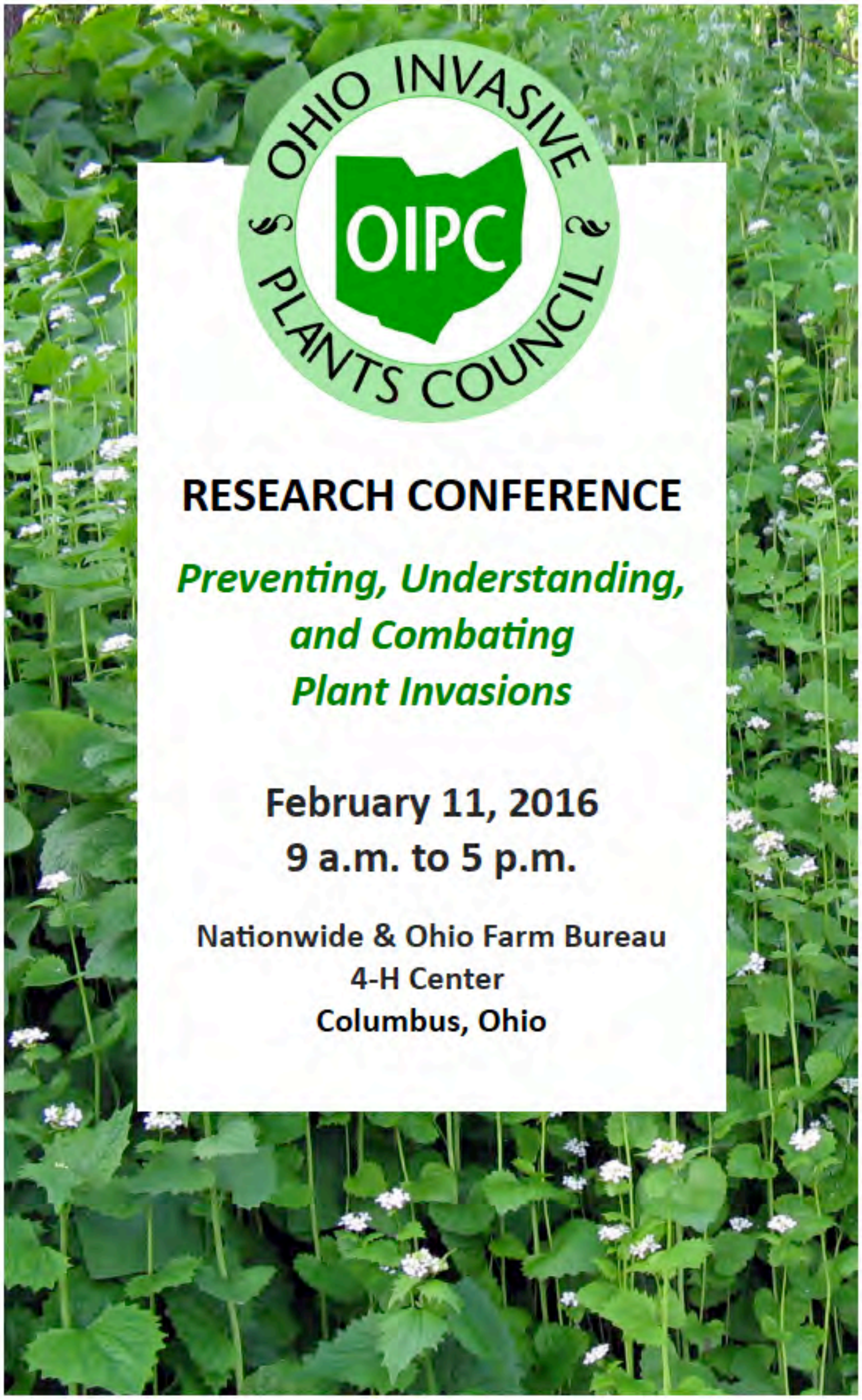
PROCEEDINGS AND ABSTRACTS



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RESEARCH CONFERENCE SPEAKERS

Keynote Speaker: Dr. Sarah Reichard is a Professor at the University of Washington and is Associate Director of its Botanic Garden. Her research is focused on understanding the biology of invasive plants and using that understanding to develop risk assessment methods to prevent their introduction and spread. Dr. Reichard co-authored a National Academy of Science report "Predicting Invasions of Nonindigenous Plants and Plant Pests." She was co-editor of "Invasive Species in the Pacific Northwest," (University of Washington Press) and author of numerous research papers, she also served six years on the federal Invasive Species Advisory Committee and is on the Invasive Species Specialist Group of the International Union for the Conservation of Nature.
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Jonathan Bauer, Ph.D., Postdoctoral Scholar, Indiana University
Jonathan Bauer researches the restoration of invaded and degraded plant communities. This research tests the ecology of plant species coexistence, invasion, and succession and applies this knowledge to improving strategies for managing invasive species and re-establishing rare plant communities. jonathantbauer@gmail.com

Theresa Culley, Ph.D., Professor, University of Cincinnati
Theresa Culley's lab studies the evolution of plant breeding systems and the interplay between the reproductive biology of a species (its pollination biology, seed production, susceptibility to herbivory, etc.) and population genetics. Theresa is also the Chair of the Ohio Invasive Plant Assessment Team. theresa.culley@uc.edu

Justin Kermack, Graduate Student, Cleveland State University
Justin Kermack was awarded the 2014 OIPC student research grant for "The Effect of Site Characteristics on the Reproductive Output of Lesser Celandine (*Ranunculus ficaria*)". justin j.kermack@vikes.csuohio.edu

David Gorchov, Ph.D., Professor, Miami University
Dave Gorchov's lab studies plant ecology, including the dynamics of plant invasions in forests, and effects of deer and invasive plants on native plants. GorchoDL@miamioh.edu

Emily Rauschert, Ph.D., Assistant Professor, Cleveland State University
Emily Rauschert's lab focuses on plant invasions, including the spread and spatial dynamics of invasive species, which is often driven by human activities. e.rauschert@csuohio.edu

Kathy Smith, Program Director, Forestry, Ohio State University Extension
Kathy Smith is the Program Director for the Ohio Woodland Stewards Program at the Ohio State University. She is responsible for coordinating, promoting and teaching programs targeted towards Ohio's many woodland owners and natural resource professionals. smith.81@osu.edu

Conference Chair: Jean H. Burns, Ph.D., Assistant Professor, Case Western Reserve University
The Chair of the Ohio Invasive Plants Council Research Working Group. Jean Burns studies what makes invasive plants invasive and the effects of invasive species on native species. *jbm122@case.edu*

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ABSTRACTS
KEYNOTE ADDRESS

Partners in prevention: how industry, academia, and government can work together on invasive plant species.

Sarah Reichard
University of Washington Botanic Gardens

For hundreds of years humans have introduced plants from other regions for food, medicine, landscape improvements, and for many other uses. Those who did so were celebrated and rewarded. But as understanding of the impacts of invasive non-native plants has grown, the situation has changed and many “plant explorers” and nursery owners have been feeling pressure from people concerned about the environment. In many cases this has led to conflicts.

It is more productive to try to understand how plants are introduced and distributed and work with those in the industry to prevent new invasions. One way to do that is to determine best management practices or “codes of conduct.” Codes of conduct are voluntary practices that derive from shared values and principles. At a workshop in 2001, a group of about 100 people gathered in St. Louis to articulate those values and develop principles for codes describing practices for nurseries, botanic gardens, and other horticultural disciplines. That collaboration allowed conversations to begin among horticulturists and ecologists.

From that effort, a non-profit named “Sustainable Conservation” began an effort 10 years ago to implement some of the Codes in California. They developed a program called “PlantRight” with a steering committee made up of people representing a number of stakeholders, from nurseries to academics. Their first task was to create a website showing invasive plants in the many climate zones of that state and recommend alternatives. Six years ago they started surveying nurseries around the state, using trained Master Gardeners, to see if they were selling those plants listed on the website as invasive in their region. Although many are still selling at least one invasive species, the number of invasive plants found in the approximately 250 stores surveyed has declined.

The PlantRight program also undertook a project to develop a Plants Risk Evaluation (PRE), a tool that could be used to evaluate plants being introduced for horticultural use. The model developed uses 19 questions about the biogeography, climate zones, vegetative growth, reproduction, and whether it is known to have ecological or health risks. The model was tested on 56 known invaders and 36 species introduced for horticulture but not known to escape cultivation. The model was highly effective and is continuing to be refined by PlantRight staff in conjunction with horticulturists.

The horticulture industry is now trying to identify sterile cultivated varieties (or “cultivars”) of known invasive species. Unfortunately, most of the cultivars are “male sterile” meaning they produce no or reduced pollen. However, most of the plants can produce fertile seeds if another cultivar, or the wild type, are nearby and fertile pollen is able to reach the stigma of the sterile cultivar plants. Other types of sterility, like female sterile plants, are rarely possible. Triploids, with just three sets of chromosomes are generally sterile because the chromosomes lack the ability to pair, but they can if other triploids are available. A further problem is that the PRE does not consider cultivars and cannot be used to evaluate their risk. Because the issue of invasive plants includes both natural and social science components, and because the answers to the questions they raise are complex, partnerships to solve the problems are essential. Academics, land managers, and industry all have their own unique perspectives that are critical to making progress.

PRESENTATIONS

Invasive species as back-seat drivers of environmental change: complex interactions in the restoration of forest understories

Jonathan T. Bauer
Indiana University

It is often difficult to determine whether invasive species dominate a community because they have displaced native species or because invasive species benefit from the human impacts that are the underlying cause of native species declines. To differentiate these possibilities, MacDougall and Turkington (2005) proposed that invasive species might be considered drivers or passengers of native species declines. I have hypothesized that many of our problematic invasive species are best categorized as "back-seat drivers", both benefiting from human impacts to natural areas and also contributing to further declines in native species. I have applied this idea to the management of Garlic Mustard (*Alliaria petiolata*) and Purple Wintercreeper (*Euonymus fortunei*). In the case of Garlic Mustard, we observed increases of native plants and soil fungi after five years of Garlic Mustard removal, suggesting that Garlic Mustard can act as a driver of native species declines. In contrast, other researchers have found that reducing deer density can simultaneously reduce Garlic Mustard abundance and lead to increases in native species; also experimenting with transplanting native species into dense patches of Garlic Mustard indicate that native species may be able to successfully outcompete Garlic Mustard. Together, these results indicate that Garlic Mustard may be a good fit for the back-seat driver model of invasion, as it appears to benefit from human caused disturbance to natural areas and can also cause further declines in native species. I have also found support for the back-seat driver model of invasion with experimental management of Wintercreeper. Removal alone does not lead to native species recovery, but the presence of Wintercreeper can limit restoration efforts by preventing recruitment of native species from seed. In contrast, transplanted seedlings of native species are unaffected by the presence of Wintercreeper, but these transplanted seedlings were limited by herbivory and drought. Overall, Wintercreeper may prevent restoration success, but invasive control alone is not sufficient to allow full restoration of the forest understory. This is consistent with the "back-seat driver" model of invasion, and indicates that successful restoration of invaded areas will take into account management of invasive species along with the other factors that have caused the declines of native plants.

Opportunity and movement: forest roads facilitate plant invasion

Emily Rauschert
Cleveland State University

Roads facilitate the success of invasive plants in two major ways. Road creation and roadsides are strongly associated with disturbance, which greatly increases invasion risk. Roadsides are often prime habitat for invasive plants due to a lack of competitors, increased light availability and altered soil characteristics. Roads also serve as movement corridors, and the associated movement of animals, people, vehicles and heavy equipment moves invasive plant propagules from the forest edge into the interior. Both paved and unpaved roads have been associated with higher prevalence of invasives and dispersal of new invasive plants. Unpaved roads may offer excellent opportunities for the establishment and subsequent spread of invasive plants; new rural roads are still being created in the US. The maintenance of existing roads had been hypothesized to disperse invasive plants such as *Microstegium vimineum* (Japanese stiltgrass) into new areas. A series of experiments were conducted to quantify the role of road grading in moving seeds along roads. Road maintenance does move seeds several orders of magnitude further than natural dispersal, and several cases of long-distance dispersal were observed. A landscape model was used to investigate the potential of altering road management to slow invasion or to protect ecologically sensitive areas. No management techniques investigated significantly reduced spread rates; however, grading less often or taking shorter grading passes did help protect sensitive areas. Road creation and maintenance are necessary parts of our current society that will continue; these results highlight the need for careful consideration of the increase in plant invasion associated with roads.

The cultivar dilemma: how to assess invasiveness in horticultural cultivars in Ohio

Theresa M. Culley
University of Cincinnati

Invasive plants that are non-native can be problematic in many areas of the United States, but the role of horticultural introductions has been relatively understudied. Although the vast majority of nursery introductions do not become invasive, those that do (usually woody species) can negatively and sometimes dramatically impact natural communities on a local to regional scale. However, the role of horticultural cultivars has rarely been examined within the context of plant invasions. Cultivars, varieties of plant species intentionally selected for some desirable trait and maintained for commercial distribution, are exceedingly common in horticulture today.

Cultivars could contribute to plant invasions in different ways. First, some cultivars may spread into natural areas on a local scale through vegetative spread. But rarely do cultivars spread broadly within the landscape; rather it is the offspring of cultivars that usually become problematic. More often, presumably "sterile" cultivars may hybridize with one another to produce viable seeds, which can then be dispersed into natural areas. For example, Callery pear (*Pyrus calleryana*) and purple loosestrife (*Lythrum virgatum)* have been documented to spread in this way. In addition, it is important to monitor cultivars over several years to examine whether they are truly sterile; some, such as some Japanese barberry (*Berberis thunbergii*) cultivars that may become sexually prolific after several years.

To prevent future plant invasions of species with past or current ornamental origins, it is important to overcome challenges in invasive species assessments. Namely, researchers and land managers must first identify what is actually spreading into natural areas. In addition, cultivars are especially problematic to assess when protocols depend on evidence from the scientific, peer-reviewed literature because information on specific cultivars is usually scarce or lacking. Ultimately, each state must decide on its own philosophy of assessing cultivars – are cultivars "innocent" until found otherwise or are cultivars assumed to be invasive until shown not to be? Ultimately, each state will need to define what is an acceptable risk while developing assessments and/or regulations regarding cultivars (e.g., complete sterility, highly reduced fertility, or some other requirement). Fortunately, several states are now working together to solve these challenges by incorporating input from all stakeholders, including land managers and the nursery industry. In conclusion, researchers, plant breeders, nursery professionals, and land managers must work together proactively to identify cultivars that have the potential to escape and to concurrently find suitable alternatives that are commercially desirable.

The effect of site characteristics on the reproductive output of Lesser Celandine (*Ranuculus ficaria*)

Justin P. Kermack, Emily S. Rauschert
Cleveland State University

Lesser celandine (*Ranunculus ficaria*), an ephemeral perennial invasive plant brought over from Europe, is becoming widespread throughout the northeastern United States. This herbaceous buttercup is able to create extensive dense mats that limit native species growth during a spring window critical for native species growth. It takes advantage of an early growing season and rapid reproduction rates, which enable this species to create dense monocultures, threatening native communities and ecosystems. There is cause for concern as its high production of bulbils and tubers, linked with its ephemeral growth pattern, allow lesser celandine to outcompete, disperse and establish more rapidly than its local competitors. Elimination of native spring ephemerals results in decreased biodiversity.

We examined lesser celandine abundance and reproductive output (seed, bulbil and tuber production rates) in plants collected from plots spanning a disturbance gradient away from a river. We hypothesize that reproductive output and lesser celandine abundance will be highest in moist floodplain at intermediate distances from rivers.

There was high variability observed between sample sites, with average bulbil production ranging from 0.2 to as high as 6.1 per stem and tuber production ranging from 1.1 to as high as 8.5 tubers per plant. Densities of lesser celandine were found to be as high as 3100 plants/m^2 in some areas. No seed production was observed. Some sites were consistent with our hypothesis, where maximal reproductive output and lesser celandine abundance were greatest at intermediate distances from the river; however reproductive output and lesser celandine abundance were not significantly greater at intermediate distances from rivers, thus we cannot support our hypothesis. PAR had a significant linear relationship with plant biomass ($p<0.05$). Light availability may play an important role in driving lesser celandine spread. This study was able to expand on the current limited understanding of lesser celandine, which can prove helpful in more effectively reducing population size and spread.

Interactions of invasive shrubs, over-abundant deer, and native plants in Ohio forests

David L. Gorchov
Miami University

White-tailed deer densities are greater than pre-settlement estimates in many areas of Ohio and elsewhere in North America. High deer densities negatively impact native forest plants, as do invasive plants such as bush honeysuckles, *Lonicera* spp. Relatively few studies have investigated the interactive effects of deer and invasive shrubs on native plants. We investigated these interactions with a split-plot experiment in the Miami University Natural Areas, Oxford, Ohio. We established five 20 x 20 m deer exclosure plots in 2010, each paired with a deer access plot; in half of each plot we removed all Amur honeysuckle, *L. maackii*, the dominant shrub in these forest stands. Responses of forest floor plants (< 1 m) were recorded spring and summer over four years (2011-2014).

We found that plant species composition was impacted by deer (only in spring), but not by *L. maackii*, whereas plant species richness in both spring and summer was reduced by *L. maackii*. The interaction between *L. maackii* and deer treatments was significant only for tree cover, which was highest in plots without *L. maackii* or deer and similarly low in areas of the other treatment combinations. This sub-additive (antagonistic) interaction could be due to *L. maackii* mitigating the negative effects of deer, or deer mitigating the negative effects of *L. maackii.* Evidence for the former comes from experimental plantings of sugar maple seedlings that had higher survival rates under *L. maackii* shrubs in areas accessible to deer, but lower survival under these shrubs where deer were excluded, suggesting *L. maackii* protects seedlings from browse. Evidence for the latter comes from reduced cover and basal area growth of *L. maackii* in deer access plots, presumably due to deer browse. In subsequent studies we found evidence of deer browse on *L. maackii* in these plots, and year-round in three habitats in the Natural Areas. Based on the estimated mass of browsed twigs and estimates of food needs of the deer population, *L. maackii* appears to comprise > 40% of deer diets in these Areas. Maintenance of high deer populations by *L. maackii* implies this shrub impacts native plants via ‘apparent competition.’

Our findings suggest that in areas of high deer density, control of *L. maackii* will not benefit tree seedling survival or growth. Both deer and invasive shrub control are recommended in order to improve tree seedling recruitment, and will likely also allow recovery of forest herbs preferred by deer.

Tracking invasive species: the app and the maps

Kathy Smith
Ohio State University Extension

As landowners across the Great Lakes continue to deal with invasive species issues (plants, insects and mammals) several Ohio State Extension specialists set out to create an app that citizens can use to report what they are seeing across the state. While working with individuals at the University of Georgia, and several other partners in the region, the Great Lakes Early Detection Network (GLEDN) smart phone app launched in late summer of 2012. The app covers plants, insects, diseases, mammals and includes aquatic specific issues, such as fish and mussels. In this talk we will cover how to use the app as an identification resource and how to report sightings using either points or polygons. We will also cover how to access the data for custom maps.

POSTERS

Lethal and sub-lethal effects of the invasive shrub Amur honeysuckle (*Lonicera maackii*) on an aquatic organism, a field-to-lab experimental approach

Eric B. Borth, Kevin W. Custer, Sean Mahoney, Sarah Frankenberg, Ryan W. McEwan
Department of Biology

The invasive plant *Lonicera maackii* (Amur honeysuckle) has caused many negative effects for native vegetation as it spreads through the eastern United States including the loss of biodiversity and alterations in ecosystem function in forests. Many studies focus on effects of Amur honeysuckle invasion on terrestrial habitats, while effects on aquatic habitats have received much less attention. In this set of experiments we aim to improve our understanding of how terrestrial invasion of Amur honeysuckle affects aquatic organisms. This will be investigated using *Hyalella azteca*, a standard "model" aquatic organism used to assess toxicity in flowing waters (streams and rivers), to reveal effects that Amur honeysuckle may have on aquatic macroinvertebrates. We hypothesized that exposure to *L. maackii* foliage would alter the growth, survivorship and feeding rates of the generalist shredder *H. azteca*. In the lab, *H. azteca* were exposed to riparian honeysuckle leaf leachate (made by soaking 10 g leaves in 100 mL dechlorinated water for 24 h) and leaf leachate of typically co-occurring riparian native tree species (*Asimina triloba, Acer saccharum,* and *Acer negundo*) in 48 h acute static toxicity tests. When exposed to an Amur honeysuckle leachate dilution series (6.25%, 12.5%, 25%, 50%, 100%) survival was significantly affected in all dilutions (p-value < 0.001). When exposed to native leaf leachate dilutions *H. azteca* survival was only significantly affected in the 100% leachate treatment of the *Asimina triloba,* (p-value < 0.001) and *Acer negundo* (p-value = 0.009), and there were no significant effects in *Acer saccharum* treatments (p-value =0.446). In future field experiments, *H. azteca* will be placed in microcosms within a stream while being exposed to Amur honeysuckle and native leaves. These microcosms will allow us to assess leaves as a habitat resource *in situ*, which is an important function of riparian leaf inputs. To our knowledge, this is the first field-to-lab microcosm experiment designed to test the aquatic impacts of this terrestrial invasion. These results could have wide-ranging repercussions for management of this species in headwater stream riparian zones which are particularly vulnerable to perturbations and are increasingly a focus of conservation.

Restoration of an invaded riparian zone influences stream macroinvertebrate biomass

Caitlin M. Buchheim, Rachel E. McNeish, M. Eric Benbow, Ryan W. McEwan
University of Dayton

Riparian zones are an interface between terrestrial and aquatic habitats influencing in-stream temperature, availability of terrestrial subsidies, and reducing bank erosion rates. Alterations of the riparian plant community can impact their associated aquatic systems. Amur honeysuckle (Lonicera maackii: hereafter honeysuckle) outcompetes native plants and influences terrestrial arthropod communities. In the Midwestern USA, many riparian plant communities are heavily invaded by honeysuckle, creating a dense canopy over headwater streams. Management practices aim to remove riparian honeysuckle; however, it is not well understood how these practices influence stream ecosystems. In this experiment, honeysuckle was removed from a headwater stream reach with a dense honeysuckle riparian forest. We investigated how this "restoration" activity influenced in-stream macroinvertebrate biomass dynamics compared to a "control" reach where the honeysuckle invasion remained intact. We predicted removal of honeysuckle would (H1) increase overall macroinvertebrate biomass, (H2) increase in detritivore and herbivore function feeding group (FFG) biomass with (H3) seasonal effects on total macroinvertebrate biomass. In August-September 2010, honeysuckle was removed along Black Oak Park stream in Centerville-Washington Park

District, OH, creating a 150-meter honeysuckle removal reach and an upstream honeysuckle (control) reach. Aquatic macroinvertebrates were collected with a Surber sampler monthly from August 2010 to December 2014 within both reaches (n = 5/reach) and identified to genus when possible. Macroinvertebrate body metrics were measured with a micrometer using Image J software. Macroinvertebrate biomass (i.e. standing stock biomass) was estimated for each taxon and FFG using length-mass allometric equations. Preliminary analyses indicated honeysuckle removal did not significantly influence macroinvertebrate biomass; although, interesting patterns were observed. There was 30% more biomass in the removal reach compared to the honeysuckle reach. Amphipoda, Trichoptera, and Zygoptera taxonomic orders had the greatest biomass in the removal reach and the honeysuckle reach with the exception of Zygoptera. Detritivore and predator FFG contributed the most biomass within both stream reaches. Total biomass peaked during fall and spring respectively for both reaches, indicating there were seasonal patterns. These preliminary results suggest removal of Amur honeysuckle impacts aquatic macroinvertebrate biomass taxonomically, functionally, and seasonally, potentially influencing the flow of energy within the stream food web.

Deer and invasive plant removal can change soil fungal communities and soil chemistry: evidence from a long-term field experiment

David J. Burke, Sarah R. Carrino-Kyker, Susan Kalisz
The Holden Arboretum
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The University of Pittsburgh

The invasive plant species garlic mustard (*Alliaria petiolata*) has the potential to affect plant community composition and ecosystem processes in temperate hardwood forests primarily through the excretion of allelopathic chemicals into the soil that can disrupt important groups of soil fungi. These same forests are often affected by high levels of white tailed deer (*Odocoileus virginianus*) herbivory, which can have large effects on forest plant community composition and regeneration. However, whether invasive plants and deer herbivory interact to affect soil fungi and nutrient availability, and whether these effects can be reversed through managed removal of same are still poorly understood.

We examined the recovery of soil microbial communities and soil physiochemical conditions 8 years after initiation of a deer exclusion study that included removing garlic mustard from half of the experimental plots. Six paired plots were established in 2002 to exclude deer from a temperate hardwood forest and beginning in 2006 the experiment initiated removal (weeding) of garlic mustard (GM) from half of each plot resulting in a fully crossed design with four treatments (-GM/-DEER, GM/-DEER, -GM/DEER, GM/DEER). In June 2014, we collected 5 soil samples from weeded and unweeded portions of each plot for a total of 120 soil cores. Cores were collected to a depth of 5-cm and used to examine communities of soil fungi including arbuscular mycorrhizal (AM) fungi, which form beneficial relationships with plant roots using DNA-based techniques. We also examined nutrient availability and soil physicochemical properties of the soil.

We found that fungal communities changed across the plots and that both general fungal communities and AM fungal communities were significantly correlated with readily available nitrogen and phosphorous. Although general fungal communities were not affected by deer exclusion or garlic mustard removal, AM fungal communities changed in response to deer exclusion but were unaffected by garlic mustard removal. However, garlic mustard removal did significantly increase soil organic matter content as evidenced by higher carbon-nitrogen ratios. Our study suggests that long-term removal of deer and garlic mustard can alter important groups of soil fungi and change organic matter content within temperature hardwood forests.

Invasive plant assessment of *Eleutherococcus sieboldianus, Hemerocallis fulva, Ipomoea purpurea, Liriope muscari, Lythrum virgatum*, and *Rubus phoenicolasius* in Ohio

Theresa M. Culley, Ilana Vinnik, Yulia Vinnik
University of Cincinnati

Invasive, introduced plants can lead to significant damages to the environment, economy, and ecology in natural areas throughout Ohio. Early detection and prevention of such plants is critical. One approach is to monitor current invasion status, known ecosystem effects, and traits that have been identified in the scientific literature as being linked with invasiveness. Invasive status was assessed for six non-indigenous species, *Eleutherococcus sieboldianus*, *Hemerocallis fulva*, *Ipomoea purpurea*, *Liriope muscari*, *Lythrum virgatum*, and *Rubus phoenicolasius* using the Ohio Invasive Plants Council (OIPC) assessment protocol. This assessment protocol consists of 18 questions, which concentrate on Current Invasion, Biological Characters, and Ecological Impacts. Responses were given based on an in-depth review of the scientific literature, existing lists from other states, and information from OIPC members. We selected the best single response for each question, and then summed up the points associated with each response. The cumulative total point value was then used to determine whether a plant was "Invasive", "Pending Further Review" or "Not Known to be Invasive." Based on this assessment, we determined that *R. phoenicolasius* is "Invasive", *I. purpurea* and *H. fulva* were placed in the category of "Pending Further Review", and *L. virgatum*, *E. sieboldianus*, and *L. muscari* were identified as "Not Known to be Invasive". Careful management of these species can minimize environmental and economic problems. Using these results, landowners and land managers can decide which species to target for their management and control efforts. It is worth mentioning that Pending Further Review and Not Known to be Invasive species will be reassessed in the future, as it is possible that their total point values can increase as more information becomes available in the peer-reviewed literature.

Management Dilemmas: native bee community diversity increases along forest patch edges in response to a density gradient of the alien invasive *Lonicera maackii*

Michael Cunningham-Minnick, Thomas O. Crist
Miami University

Apoidea, or bees, are a diverse group of primary pollinators in decline due to decreases in habitat and associated resources, including floral availability. Throughout Ohio, *Lonicera maackii*, a well-known invasive woody shrub, grows in dense populations within gaps, unmanaged open spaces, and edges, reducing fecundity and diversity of understory and herbaceous plants through shading effects. Bee diversity is intimately correlated with plant diversity, but the response of bee communities to *L. maackii* invasions may be complicated by the high density floral pulse provided by *L. maackii* in sunlit areas. Here we determine how *L. maackii* and its floral resources affect bee diversity along edges of 12 secondary-growth forest fragments. Each forest patch was between 5 and 20 hectares and surrounded by intensive agriculture, collectively representing a gradient of *L. maackii* densities 0 to 0.002311 m2 BA/m2 in southern Ohio and Indiana. We sampled the bee community and recorded floral availability along a 100 meter transect of each forest edge during the *L. maackii* blooming period of May 11 to June 1 in 2015. We found a strong positive response of bee community abundance, richness, and evenness with increasing *L. maackii* density, regardless of adjacent crop identity and patch size. Although many species of native bee found in disturbed habitats exhibit generalist foraging behaviors, we were surprised to find nearly all 24 detected genera were responding positively to increasing densities of *L. maackii*. The apparent heavy use of this aggressive invasive as a resource by Ohio's native bee communities warrants careful consideration by those planning and conducting *L. maackii* removals at a patch-level scale. Removals may need to include native flowering plantings that share a blooming period with *L. maackii* in order to avoid unintentional declines in bee populations. On the other hand, perhaps this is an opportunity to find ecological thresholds involving the inclusion of invasive species that are cost-effective and realistically manageable as we continue towards novel ecosystem assemblages in the Anthropocene.

Amur honeysuckle berry effects on benthic macroinvertebrates: laboratory and field microcosm sediment exposures

Kevin W. Custer, Eric B. Borth, Sean D. Mahoney, Lucas W. Gaynor, Ryan W. McEwan
University of Dayton

Amur honeysuckle (*Lonicera maackii*) is an invasive shrub species that is becoming abundant in headwater stream riparian areas. This species has been shown to negatively affect plant-to-plant and plant-to-insect interactions, but has largely been overlooked in stream ecology. In headwater streams, *L. maackii* can form dense canopies, which can alter subsidies from native hardwood trees (filter effect) entering the stream, and contribute large amounts of *L. maackii* subsidies (leaves and berries) into the stream. During late fall, *L. maackii* berry production peaks, and berries accumulate on stream sediments. We hypothesized that *L. maackii* berry subsidies on stream sediments will affect survival and growth on selected benthic macroinvertebrates during lab and field exposures. Two organisms were selected to test berry effects: lab cultured *Hyalella azteca* (Amphipoda) and field collected *Anthopotamus verticis* (Ephemeroptera). Invertebrates were exposed in field microcosms at Wiles Creek (Aullwood Audubon Center), and in a standard laboratory sediment test design. A gradient of *L. maackii* berries (1.25g, 2.5g, 5.0g, 10.0g wet wt.) were added to sediment treatments, which included a reference (no berries). In the lab, *H. azteca* and *A. verticis* survival and growth was significantly (p-value < 0.001) affected by the presence of berries during 96 hour and 48 hour exposures, respectively. However, the field microcosm exposures (96 h) showed varied results; with *H. azteca* having comparable survival and growth as observed during the lab study (p-value < 0.001), but *A. verticis* exhibiting no survival or growth effects ($p > 0.05$). Importantly, during the lab exposures, dissolved oxygen (DO) and pH levels fell below 2 mg/L and 5.5, respectively. However, DO and pH levels during the microcosm experiments were comparable to normal stream conditions. We observed *A. verticis* avoiding (climbing and swimming) sediments with berries in the microcosms, and this may help explain the varied field results. These results suggest the presence of *L. maackii* berries can have an effect on benthic organism survival and growth under realistic sediment exposures. Future research will explore additional organism responses, and estimating berry densities in headwater streams for comparison to lab and microcosm densities.

***Lonicera maackii* alters terrestrial-aquatic nutrient fluxes by modifying throughfall Chemistry**

Shante N. Eisele, Rachel E. McNeish, Ryan W. McEwan
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Many watersheds throughout the Midwestern USA have been invaded by the shrub Amur honeysuckle (*Lonicera maackii*), resulting in riparian near-monocultures that can create an overarching canopy above streams. Riparian zones are crucial in mediating non-pointsource pollution (e.g. runoff) entering streams.Alterations in riparian zone plant composition can alter riparian function. Due to the unique chemistry of honeysuckle leaves there is potential for this invasive to alter nutrient contributions from the terrestrial environment into aquatic systems. To determine how honeysuckle forests influence terrestrial-aquatic nutrient fluxes that enter aquatic systems, we measured chemistry of rainwater passing through the plant canopy (throughfall) in invaded and non-invaded forests. We predicted honeysuckle shrubs would (H1) increase nutrient content in throughfall and (H2) intercept more water compared to native canopy. We also predicted (H3) there would be seasonal patterns in throughfall nutrients. To test our hypotheses, we installed throughfall collection rigs in a prairie and forest (n = 10/site) at Taylorsville

MetroPark in Vandalia, OH during the 2015 growing season. Rigs in the prairie site (control) had a 1-L collection bottle attached at 10ft to ensure they collected water above all plant material. Forest site rigs had two throughfall collection points: above honeysuckle from the native canopy and below honeysuckle (honeysuckle + upper canopy). Before rain events (n = 4), funnels were secured to direct water into collection bottles. Throughfall samples were collected soon after rain events and processed in the lab for nitrogen, phosphorous, and carbon content. Honeysuckle throughfall had more ammonia (N-NH3), carbon, and phosphorous (PO43-) compared to upper canopy and control treatments. There was less throughfall below honeysuckle compared to other treatments, indicating honeysuckle shrubs intercepted a substantial amount of water.

Throughout the study, phosphorous spiked in July while nitrate levels peaked in August and November. These results indicated honeysuckle forests alter the chemistry of rainwater entering aquatic systems, potentially impacting the biogeochemistry of these systems indirectly through groundwater recharge and runoff and directly as throughfall entering the system. These findings highlight the importance of riparian plant composition regarding nutrient loading into adjacent aquatic ecosystems.

Invasive garlic mustard (*Alliaria petiolata*) suppresses native Mayapple (*Podophyllum peltatum*) growth more in the presence of invasive earthworms (*Lumbricus terrestris*)

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Invasive species are species whose populations spread rapidly in an area in which they do not naturally occur, potentially having negative effects on native communities due to the possession of attributes that allow them to outcompete native species. One mechanism that may explain the detrimental effects of some invasive plants is allelopathy, a phenomenon in which plants produce chemicals that suppress the growth, survival or reproduction of another plant. The invasive plant *Alliaria petiolata* produces allelochemicals that leach out of its leaf litter and kill the mycorrhizal mutualists of native plants. Because invasive *Lumbricus terrestris* earthworms feed by moving leaf litter down into the soil, we hypothesized that the presence of these earthworms might increase the negative effect of *Alliaria petiolata* allelochemicals on native plant performance. We tested this hypothesis using the native plant *Podophyllum peltatum*, which is common in our local forests and depends on mycorrhizal mutualists, making it potentially vulnerable to the allelochemicals produced by *Alliaria petiolata*. We used a 2 × 2 × 2 factorial design with each treatment containing the presence or absence of *Alliaria petiolata, Lumbricus terrestris,* and activated carbon. Activated carbon is highly absorbent, and could absorb allelochemicals and soil nutrients, allowing us to ask whether the soil environment influences the potential interaction between these invaders. We found that *Alliaria petiolata* suppressed *Podophyllum peltatum* growth in the presence of *Lumbricus terrestris,* but only when activated carbon was present, indicating that activated carbon was acting as a stressor in this experiment. Thus we find that this invasive earthworm can increase the negative effects of *Alliaria petiolata* on native plant performance, and this result depends on the soil environment. Although invasive earthworms cannot be controlled by any known management strategy, their negative effects can be mitigated by controlling invasive garlic mustard (*Alliaria petiolata*).

Dormant season foliar spraying slows spread of winter creeper in wooded natural areas

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Winter creeper, *Euonymus fortunei*, is an evergreen vine. The infertile, trailing vines form dense mats of ground cover that decrease native plant diversity and native ground cover. When the vines climb trees they are transformed into fertile vines that flower and produce seed that can be distributed by birds or water. Winter creeper growing in trees is common in residential areas and can spread and degrade natural woodlands. The objective is to rid natural areas of the dense evergreen winter creeper ground cover without killing or damaging the native ground cover. The results should preserve the native plants and promote the early restoration of the displaced native species. Foliar treatment of the winter creeper vines with herbicide is done on warm days in late winter. By that time the shoots of native plants are dormant or absent from above ground. The delay also allows selection of application temperatures to favor the absorption of the herbicide. The goal is to apply a fine spray to all of the leaves. Susceptibility of winter creeper to late winter foliar application of herbicide was verified by the failure of the plants to sprout normally with the return of warm weather. Growth was slow and distorted. Clearly the herbicides were taken up and distributed and lethal process occurred after warming activated plant metabolic processes. A survey of some 20 species of native plants were surveyed and showed no visible effects. The program offers a practical means for preventing the near-total loss of spring wildflowers and serious deterioration of woodland natural areas by winter creeper. Initial results show susceptibility of English ivy and periwinkle to the application protocol as well. The program offers hope for saving native wildflowers from these serious and demoralizing threats. We are using the preservation of native wildflowers as a lever to encourage landowners to eliminate winter creeper from trees.

The relative importance of EAB-caused tree mortality and abundance of Amur honeysuckle on tree seedling communities

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Emerald ash borer (EAB), *Agrilus planipennis,*caused ash mortality and the presence of the invasive shrub Amur honeysuckle, *Lonicera maackii*, may cause extensive changes to forest seedling communities and thus have major consequences for future forest composition. We hypothesize that ash mortality will increase, and *L. maackii* will decrease resource availability and thus influence seedling communities.

We sampled three 400 m^2 circular plots annually 2012-2014 at each of 16 sites established by the USFS to represent a time range since EAB infestation throughout Ohio. Nested within each plot were a sub-plot (200 m^2) and four (4 m^2) micro-plots. Within plots we assessed ash health (1(healthy) to 5(dead)), measured all trees ≥10 cm diameter at breast height (DBH), and calculated percentage of ash basal area (BA) for those rated ≥3 and 5. Within each sub-plot we measured *L. maackii* cover and measured the two largest *L. maackii* shrubs in each quadrant to calculate *L. maackii* BA. Response variables were calculated from seedlings (20-100cm) censused in the micro-plots. We investigated effects of percentage ash BA rated ≥3, those rated 5, *L. maackii* BA, and *L. maackii* percent cover on tree seedling communities. Seedling response variables included species richness, abundance, proportion of *L. maackii*, proportion of invasives (excluding *L. maackii*), proportion of trees, and recruits.

Collectively, more poor quality ash and higher percentages of *L. maackii* cover were the best predictors for species richness; more species occurred in plots with poorer quality ash and less *L. maackii* cover. Independently, *L. maackii* cover was the best predictor for seedling abundance, proportion of tree seedlings, number of seedling recruits, and proportion of *L. maackii* seedlings. For each variable there were fewer seedlings present in plots with more *L. maackii* cover; except for *L. maackii* seedlings, which increased in plots with more *L. maackii* cover. Separately, plots with more poor quality ash had a greater proportion of invasive seedlings when *L. maackii* seedlings were excluded. Based on the models we evaluated, *L. maackii* is more important for driving tree seedling community dynamics than EAB and should be the focus of restoration efforts.

Response of litter-dwelling ants to experimental removals of white-tailed deer and Amur honeysuckle in eastern deciduous forest

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The overabundance of white-tailed deer (*Odocoileus virginianus*) and the presence of an invasive shrub, Amur Honeysuckle (*Lonicera maackii*) have strong effects on ecosystem processes in the eastern deciduous forest of North America. Both deer and Amur honeysuckle decrease abundance and richness of seedlings, saplings, and herbaceous plants in the forest understory, but few studies have examined how they alter litter-dwelling arthropods. Ants (Formicidae), in particular, play key functional roles in forest ecosystems, acting as ecosystem engineers, predators, and seed dispersers. Potential changes to ant abundance and community structure can have cascading effects on various ecosystem processes. We examined the response of the ant community to long-term deer exclosure and Amur honeysuckle removal in a mid-successional deciduous forest of southwestern Ohio. Ant species richness, abundance, and community composition as well as standing leaf litter biomass were sampled and analyzed from five sites from 2011 to 2015. The sites consisted of a 20x20-m^2 deer exclosure paired with a control plot, each with a split-plot removal of Amur honeysuckle. There were no direct effects of Amur honeysuckle or deer treatments on ant richness, abundance, or community composition. However, ant richness and abundance were positively related to standing leaf litter biomass. Standing leaf litter biomass was negatively affected by deer presence and there was a weak positive effect of Amur honeysuckle presence. Our results provide evidence that deer overabundance has local negative impacts on the biodiversity of ant communities by altering the standing leaf litter biomass, which may have cascading effects on forest ecosystem functioning. These results show limited effect of Amur honeysuckle on the leaf litter ant community, which indicate the removal of Amur honeysuckle will have little negative effect on leaf litter ants.

Population density and richness of stream salamanders in headwater streams across a gradient of *Lonicera maackii* invasion intensity

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Lonicera maackii is an invasive shrub in riparian zones along headwater streams in much of the Midwestern USA that has been linked to alterations in terrestrial and aquatic ecosystems. The foliage of *L. maackii* release water-soluble phytochemicals into the ecosystem that have adverse effects on terrestrial insects, herbivores, and native plant growth. Previous research demonstrated that *L. maackii* increases tadpole mortality in several amphibian species; however, little is known about the impact of *L. maackii* on stream salamanders, which serve as the top predators in headwater streams. Although qualitative assessment of salamander communities in streams is a common practice, quantitative methods for the estimation of salamander population density are currently under-developed. Our research goals are to (1) create a prototype device for quantification of salamander abundance in streams, (2) validate this prototype through field trials across seasons and habitat types, and (3) implement the developed technology to understand salamander population fluctuations along an invasion gradient of *L. maackii*. We predict that stream salamander abundance and richness will decrease along an increasing gradient of *L. maackii* invasion due to the shift in food and leaf litter habitat availability. Currently, prototypes are being developed and tested in 1st and 2nd order streams near Dayton, Ohio. These prototypes were placed in various riffle and riparian habitats along a stream in Englewood Metropark in Vandalia, OH, targeting *Eurycea cirrigera* (Southern Two Lined salamander). Two Lined salamanders are extremely sensitive to pollutants in streams due to their long aquatic larval stage (12-24 months), making them an ideal candidate for stream health monitoring. The prototypes were surveyed for salamanders every other day for a two-week period. Preliminary results indicated that the prototypes infrequently attracted adult and

larval Two Lined salamanders. Modifications of the prototypes continue and future surveys will include qualitative and quantitative assessment of salamander abundance across a range of invasion intensity.

Importance of an invasive shrub, Amur honeysuckle, in the diet of white-tailed deer

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A mechanism that could be occurring between invasive and native plants is apparent competition, defined as a negative indirect interaction that one species has on another species. In this case, the invasive is increasing the abundance of an herbivore, which is impacting native plants. Apparent competition dynamics could be altered by the role of seasonality on the interaction between species. Some invasive plants, such as Amur honeysuckle, *Lonicera maackii*, exhibit extended leaf phenology (ELP) compared to native plants, where the leaves expand earlier in the spring and last longer in the fall. Thus white-tailed deer in invaded habitats have access in early spring to twigs with leaves, which are more nutritious than twigs without leaves. The four main objectives in this study are to estimate, for the Miami University Natural Areas, (1) the species composition of available woody browse, (2) the seasonal pattern of deer browse on *L. maackii*, (3) the contribution of *L. maackii* to deer diet, and (4) the nutritional quality of *L. maackii*. I set up 50 meter transects with 0.25 m2 quadrats at 5 m intervals in *Juniperus* dominant, forest edge, and forest interior habitats throughout the Natural Areas. In these quadrats, I recorded the species composition of available woody plants in the deer browse height range, 0.3 to 2.1 m, as well as a monthly census of deer browse on *L. maackii* over the course of a year. I am estimating the monthly consumption of *L. maackii* by deer in the Natural Areas and dividing this by my estimate of the total mass of food consumed by deer. To test the nutritional quality of twigs, I plan to determine percent nitrogen for *L. maackii* twigs both with and without leaves. There is more availability of *L. maackii* in the deer browse height range compared to other available woody plants. Deer are browsing on *L. maackii* twigs in each habitat every month. *L. maackii* is a major part of deer diet in the Natural Areas. The results of this study will help in understanding if invasive plants indirectly affect native plants through herbivore-mediated apparent competition.

Terrestrial-aquatic connections: the riparian invasive shrub *Lonicera maackii* alters ecosystem subsidies and drives shifts in aquatic biota and ecosystem processes

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Lonicera maackii, an invasive shrub in riparian zones, has adverse effects on terrestrial insect and plant survivorship, growth, and reproduction. *Lonicera maackii* grows along riparian corridors, creating an overarching canopy, which deposits substantial volumes of leaf litter into stream systems each autumn. The influence of these leaf litter inputs on aquatic communities and organic matter processing is currently unknown. We investigated linkages between this terrestrial invader and aquatic biota and ecosystem processes via a riparian restoration experiment. Woody invasive flora were removed in August 2010 from a 1600 m2 riparian buffer. Autumnal, in-stream leaf litter was assessed over 75d, while above stream canopy cover, aquatic macroinvertebrate community patterns, and nutrient availability were measured monthly for three years. Removing the *L. maackii* canopy increased light availability to the stream. In-stream nitrogen was reduced as a result of honeysuckle removal and the timing and abundance of leaf material entering the stream was significantly altered. For example, *Platanus* spp. contributed the most leaf organic matter within the removal reach (35-40%) but was mainly absent in the control reach. *Lonicera maackii* leaf litter consistently contributed ~25% of in-stream leaf litter in the honeysuckle reach, but was mostly absent in the removal reach. *Lonicera maackii* riparian forest was associated with decreased aquatic macroinvertebrate density and species richness and resulted in a different macroinvertebrate community that was taxonomically and functionallyunique compared to the removal reach. These findings suggest removal of a dominant invasive shrub substantially impacts terrestrial organic matter and nutrient subsidies entering headwater streams, influencing the timing and abundance of leaf litter habitat and food resources for aquatic macroinvertebrate communities.

Density-dependent intraspecific interactions do not drive drought tolerance of the highly invasive shrub, *Rosa multiflora* (Thunb.)

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It is well known that biotic species interactions significantly alter plant population and community dynamics in natural ecosystems. Multiple studies have reported that density dependent positive interactions can modify the effect of extreme stressors on plant performance (stress gradient hypothesis, SGH). However, the application of this hypothesis to the performance of invasive species in terrestrial ecosystems is not well understood. In the present study, we tested the predictions of the SGH in the highly invasive shrub, *Rosa multiflora* under extreme drought conditions. The main objective of this study was to test whether density-dependent mechanisms at the intraspecific level are important drivers in determining the role and intensity of positive plant interactions between *R. multiflora* seedlings under extreme drought conditions. Using a manipulative greenhouse study, we tested plant performance of *R. multiflora* seedlings to a 4- level density treatment (1, 2, 3, or 4 plants), and a 4-level soil moisture gradient (high = 0.47 – 0.53 m^3m^{-3}; medium = 0.26 – 0.39 m^3m^{-3}; low = 0.11 – 0.25 m^3m^{-3}; extreme = 0 – 0.10 m^3m^{-3}). Overall, our results provide preliminary evidence that biotic interactions under stressful conditions between seedlings of *R. multiflora* do not conform to the classic predictions argued by the stress gradient hypothesis (SGH). More specifically, the plant performance (relative growth rate (RGR) and total biomass production) of individuals grown under high density and extreme drought did not improve or experience a group advantage as predicted by the SGH. Such a finding is relatively unexpected, given the application of the SGH across a multitude of environments and plant functional groups. Instead, our study indicates that seedling performance was driven by the expression of specific drought-tolerant traits. Such a finding may explain the ability of *R. multiflora* to rapidly and successfully invade the high light, edge-like habitats where it is commonly found. Furthermore, our study also indicates that when grown alone, *R. multiflora* produces twice as much biomass than when grown at higher densities. Thus, it may be more beneficial and cost effective for management efforts to focus on smaller populations of *R. multiflora*, compared to larger and denser populations.

Legacy effects of invasive flowering rush on Lake Erie wetland restoration

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Following removal of dense monocultures of invasive plants, restoration of native ecosystems can be influenced by long-term chemical and biological changes, known as legacy effects. This research investigated the potential for such legacy effects following the removal of Flowering Rush (*Butomus umbellatus*), an understudied emergent of Great Lakes wetlands. We investigated the effects of soil invasion history, presence of remnant stands of *B. umbellatus* vegetative propagules, or litter on the success of native reestablishment. A seed mix of 25 native species was sown into flats with soil collected from native-dominated soils, areas with formerly moderate invasions, or areas with persistent monocultures. These sown plant communities were then subjected to single and combined treatments of living *B. umbellatus* vegetative propagules and litter alongside unsown flats that examined the composition of seed bank communities. We measured aboveground biomass production and community composition after three months, and also collected supporting data on field soil and tissue nutrient levels and litter decomposition in complementary studies.

We found significant negative effects of vegetative propagules on native seedling growth and diversity, and of soils from heavily infested sites on native diversity and evenness, while litter increased biomass and diversity. Other data suggesting possible changes to microbial communities and ecosystem nutrient cycles after monocultures are removed warrant further investigation. This research provides insights into how Flowering Rush impacts Lake Erie marshes; highlighting the need to target removal or suppression of vegetative propagules for controlling its spread and restoring affected wetlands following removal of existing stands.

Testing the effectiveness of a native fungus to control *Ailanthus* in Ohio forests

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The highly-invasive tree *Ailanthus altissima* is widely distributed in the eastern U.S. forests. Given its prolific sprouting potential, traditional methods of control often fail. In 2003, the native soil-borne fungus, *Verticillium nonalfalfae,* was identified as the causal agent of large areas of dead and dying *Ailanthus* in Pennsylvania. Recently it was isolated from dying *Ailanthus* in Virginia and Ohio. Pennsylvania researchers demonstrated that it selectively kills *Ailanthus* while not harming a wide range of native woody species.

In 2013, we expanded the testing of this fungus in Ohio implementing greenhouse and field experiments to evaluate the susceptibility of Ohio seed sources of non-*Ailanthus* species to the fungus. In 2014, plots were established at five forested areas to characterize the response of stem-injected *Ailanthus* trees to the fungus, estimate its rate of spread, monitor for effects on non-target species,and assess the response of impacts on regenerating native and non-native vegetation. Within the test plots, *Ailanthus* (>6 cm d.b.h.) represented 34% of the total basal area. *Acer* spp. (*A. saccharum* and *A. rubrum*) were the second most common group. The shrub layer was most often *Lindera benzoin* (60% of plots), followed by *Rosa* spp. (23%) and *Elaegnus angustifolia* (15%). Native tree regeneration was sparse, with tree seedlings representing only 9% cover within regeneration subplots. This suggests that native tree regeneration of any kind may be poor due to the existing shrub layer. In 2015, 200 *Ailanthus* trees ranging from 15 to 40 cm diameter at breast height were inoculated with fungal spores. Within two weeks, treated trees began to wilt and senesce. After 16 weeks 74% of the inoculated trees were either dead or displayed >90% defoliation with epicormic sprouting but no other species displayed symptoms. These preliminary findings corroborate our companion greenhouse inoculations of seedlings of oak, hickory, elm, ash and beech species in Ohio, as well as the >70 plant species tested in Pennsylvania. This native fungus shows great promise as a biocontrol agent of *Ailanthus* but non-target testing is ongoing to determine its safety.

Effects of winged burning bush (*Euonymus alatus*), management strategy, and white-tailed deer (*Odocoileus virginisanus*) on spider assemblages

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Invasive shrubs can have major impacts on forest ecosystems through the alteration of biotic structure and abiotic parameters. Spiders are sensitive to changes in the forest environment (habitat structure, temperature, humidity, light, soil moisture). Burning bush (*Euonymus alatus*) is a growing invasive concern in Ohio. Because it shares many traits with established invasive shrubs, burning bush has the potential to alter forest and spider communities. Similar to invasive plant species, deer alter forest communities through alterations in vegetation. This reengineering of forest plant communities alters microclimates and spider assemblages. Management of invasive plant species and deer are key to many restoration strategies, but different management strategies may have different effects on associated spider assemblages. In this study we sought to identify how burning bush is affecting associated spiders, identify which management strategy maximizes spider diversity, and determine if the presence of deer alters these interactions. We constructed deer exclosures with adjacent controls in burning bush- and native dominated areas. Within each exclosure, we applied three management treatments to the existing woody plants (none, complete removal, and a basal herbicide treatment that left aboveground dead biomass standing). Ground-dwelling spiders were sampled using pitfall-traps, and shrub-dwelling spiders were sampled using a pesticide application. Total spider abundance was approximately 1.5 times higher in native non-treated plots (4.9 ± 1.3) than the corresponding burning bush plots (3.3 ± 0.8). Burning bush is not yet affecting spider diversity of composition. In plots where burning bush was present, the basal spray method supported the highest overall spider abundance (4.4 ± 1.1) and diversity of the management strategies. Deer exclusion only had significant effects on the spider abundance in native plots, and therefore would not be a beneficial restoration strategy in burning bush affected areas.

Although this study has only been for a short time, the effects of burning bush on the total spider assemblages are immediately apparent. Overall, native plots support a greater abundance of total spiders; and in areas where burning bush is already established, a basal spray management regime would appear to most benefit spider abundance and diversity.

Amur honeysuckle invasion as a driver of ecosystem processes: nutrient dynamics in riparian forests and headwater streams

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The exotic shrub *Lonicera maackii* (Amur honeysuckle) has proliferated throughout Ohio forests, negatively impacting biodiversity and altering ecosystem function. Small streams meander through many invaded forests and the biology of these streams is impacted by the terrestrial invasion. When riparian zones are heavily invaded by *L. maackii*, the branches of the shrub create dense canopies above the stream, trapping native leaf litter and depositing its own leaf material. *Lonicera maackii* leaves are higher in nitrogen and lower in lignin than most native species, with a rapid decomposition rate; therefore, terrestrial invasion has strong potential for changing the nutrient availability in both the riparian zone and stream. We hypothesize that across a gradient of *L. maackii* invasion there will be a measurable gradient in stream chemistry and nutrient concentration. We specifically predict that areas of high *L. maackii* invasion will be associated with significantly increased concentrations of nitrogen and phosphorus. To assess the nutrient availability within invaded streams compared to noninvaded streams, five different headwater stream sites have been established in Southwest Ohio, USA, which span a gradient of *L. maackii* invasion from no honeysuckle, to moderate invasion, to heavy honeysuckle invasion. Six riparian zone plots and five square plots in the each stream have been established at each field site. At each sampling event, riparian soil pore water and stream water will be collected on a monthly basis through summer and winter and a weekly basis in spring and fall, so that the influence of *L. maackii*'s unique phenology may be detected. Samples will be analyzed for standard parameters including nitrogen and phosphorus concentration. Understanding the connection between invasion and nutrient fluxes between riparian stream systems has great potential for influencing land management. The State of Ohio currently has regulations regarding Best Management Practices in relation to riparian corridors; however, none of these rules consider the species composition of the riparian zone, as all species are assumed to be equal in nutrient output. We hypothesize that the traits of specific species matter tremendously and that the “trait monoculture” created by *L. maackii* invasion can substantively alter riparian function.

How specialist and feneralist herbivores are responding to non-native plant threats

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Non-native plants are quickly spreading into our native habitats with unknown consequences to our native fauna. The purpose of this study was to investigate the interactions of native insect herbivores with non-native, invasive plants. We investigated interactions of the specialist honeysuckle sawfly (*Zaraea inflata*) and the specialist snowberry sawfly (*Zaschizonyx montana*) with native (*Lonicera reticulata* and *Symphoricarpos albus*) and non-native (*Lonicera maackii* and *Lonicera japonica*) honeysuckle species. We also examined the interactions of the generalist fall webworm (*Hyphantria cunea*) with native (*L. reticulata* and *Prunus serotina*) and non-native (*L. maackii*, *L. japonica*, *Pyrus calleryana, Euonymus alatus,* and *Elaeagnus umbellata*) plant species. No-choice bioassays were conducted with *Z. inflata* larvae, *Z. montana* larvae, and *H. cunea* caterpillars to determine how well they survive, grow, and develop on various native and non-native plant species. Choice bioassays were also conducted to determine host preference of *Z. inflata* larvae and *H. cunea* caterpillars.

The *Z. inflata* larvae had similar survival and performance on *L. reticulata*, *S. albus*, and *L. maackii*. The larvae performed the worst on *L. japonica.* When the larvae were given a choice between native and non-native plant leaves, the larvae strongly preferred the native species. The *Z. montana* larvae performed equally well on its host *S. albus* and the invasive *L. maackii*. The larvae performed poorly on native *L. reticulata* and died quickly when fed non-native *L. japonica. Hyphantria cunea* caterpillars displayed some variation in performance on native and non-native plants. They performed well on some non-native plants like *L. maackii* and *P. calleryana,* but performed poorly on others (*L. japonica, E. alatus, and E. umbellata*). When given a choice between native and invasive plants, however, they preferred native plants. Overall, *Z. inflata*, *Z. montana*, and the *H. cunea* generally prefer native plants over novel invasive plants even, in some instances, when they can perform equally well on the invasive plants. Understanding factors that influence host choices of adults and larvae could benefit efforts at using native insects as biocontrol agents for *L. maackii* and other non-native, invasive plants, which would be both ecologically and economically beneficial.