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I, Allison Mastalerz , hereby submit this original work as part of the requirements for the degree of Master of Science in Biological Sciences.

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The role of ornamental gardening in forest plant invasions across an urban-rural gradient in Southwestern Ohio

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The role of ornamental gardening in forest plant invasions across an urban-rural gradient in Southwestern Ohio

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Abstract

Invasive plant species can lead to reduced biodiversity and are expensive to control. Ornamental gardening has played a key role in introducing nonnative species into new areas where they may become invasive. This study investigated the role of ornamental gardening along an urban-rural gradient as a pathway for introducing nonnative plant species to forests in Southwestern Ohio. Vegetation surveys were conducted in 15 forests, and patterns of nonnative species richness were analyzed. To better understand which nonnative plant species should be considered invasive, two invasive plant risk assessments were used. Results indicated that the ornamental gardening pathway has been important in introducing invasive species along the entire urban-rural gradient, but the prominence of the ornamental pathway in introducing nonnative species was stronger in rural areas compared to urban areas. The two risk assessments used, the Australian Weed Risk Assessment and the Ohio Invasive Plant Assessment, indicated that 18 of the 39 nonnative plant species documented during the forest vegetation surveys should be considered invasion risks, 14 of which species had ornamental origins. This project suggests that engaging gardeners and professional horticulturalists in sustainable gardening practices could be one of the most efficient ways to reduce the number of nonnative plant species from entering natural areas. More research concerning the social and behavioral aspects involved in introducing invasive plants with ornamental origins could provide important information that would enable meaningful education and outreach.

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Chapter 1: Patterns of Pathway Prominence in the Introduction of Nonnative Species Along an Urban-Rural Gradient

Introduction

Many plant species have been introduced into the United States, and most are considered benign to our agricultural ambitions and the conservation of our natural habitats. A small subset of these nonnative, introduced plants have expanded their initial introduction range and numbers to the detriment of native communities and the natural areas in which they reside. This subset, termed invasive plants, is considered to be a significant threat to biodiversity worldwide (Reichard and White, 2001; Lodge *et al.* 2006; Parker *et al*. 2007; Moser *et al.* 2009; Miller *et al.* 2010). In order to reduce the ever increasing numbers of invasive plant species in this time of scarce resources, focused and efficient policies as well as actions are needed.

A promising approach to reduce the increasing number of invasive species in areas of conservational interest is to focus on understanding the different ways they are transported to a new place (Reichard and White, 2001; Lockwood *et al.* 2007; Pyšek *et al.* 2011; Bradley *et al.* 2012). Humans are the chief transporters, moving species into new environments for a plethora of reasons (Pimentel *et al.* 2005; Lockwood *et al.* 2007; Pyšek *et al.* 2011; Fan *et al.* 2013). Some plants have been accidentally introduced as a seed contaminant in crop seeds, as packaging material, or historically as seed contaminants in ballast soil (Reichard and White, 2001; Lockwood *et al.* 2007). Other species are brought to new areas for cultivation purposes because they are useful for erosion control, or have ornamental, medical, or culinary value (Reichard and White, 2001; Sullivan *et al.* 2005; Bradley *et al.* 2012). Identifying patterns associated with introduction pathways can provide insight into how to diminish the role a particular pathway

plays in introducing new invasive species (Reichard and White, 2001; Dehnen-Schmutz *et al.* 2007; Lockwood *et al.* 2007; Drew *et al.* 2010).

The most prominent pathway for many invasive plant introductions is the ornamental horticulture pathway (Reichard and White, 2001; Mack and Erneberg, 2002; Sullivan *et al.* 2005; Peters *et al.* 2006; Dehnen-Schmutz *et al.* 2007; Drew *et al.* 2010; Bradley *et al.* 2012). In the United States, at least 50% of all invasive plant species and 82% of all woody invasive plant species are thought to have been intentionally introduced for ornamental gardening purposes (Reichard and White, 2001; Ööpik *et al*. 2008; Bradley *et al.* 2012), with other countries such as Czech Republic, New Zealand, Australia, South Africa, and Great Britain following similar, if not more extreme patterns (Pyšek *et al.* 2002; Sullivan *et al.* 2005; Protopopova *et al*. 2006; Dehnen-Schmutz *et al.* 2007; Foxcroft *et al.* 2008; Heywood, 2010). In 2010, nursery plant imports to the United States were estimated to be worth more than $250 million, and the market is growing (Drew *et al.* 2010; Bradley *et al.* 2012). It remains unclear what proportion of the ornamental species introduced will become invasive, but as the horticultural industry continues to expand, more invasive species will likely be introduced in the future.

Unfortunately, many qualities that can enable a plant to successfully invade an area are the same traits that attract gardeners. These traits include increased flowering and seed production, absence of serious disease and pest issues, hardiness, the ability to spread quickly, and diverse cultivar selection (Ööpik *et al*. 2008; Peters *et al*. 2006; Culley and Hardiman, 2007; Dehnen-Schmutz *et al.* 2007; Lockwood *et al.* 2007; Bradley *et al.* 2012). Gardening can also facilitate ornamental plant invasions because repeated introductions will increase the potential a plant has to establish and spread (Reichard and White, 2001; Peters *et al.* 2006; Culley and Hardiman, 2007; Lockwood *et al*. 2007; Ööpik *et al*. 2008; Pyšek *et al.* 2011). This is especially

important when considering forest invasions, as germination rates and seedling survival are low for the majority of plant species in such habitats (Kuhman *et al.* 2010). Increased propagule pressure, or how many and how often individuals are introduced and escape into natural areas (Andersen *et al.* 2004; Lockwood *et al.* 2007), is often necessary to establish self-sustaining populations in forests (Kuhman *et al.* 2010; Pyšek *et al.* 2011).

While the prominence of the ornamental pathway is widely acknowledged, it remains unclear if the importance of the pathway contributes new species consistently along different gradients and within different regions. Urban natural areas tend to have greater nonnative plant species richness than their rural counterparts, with several studies indicating that local human population size is the best predictor of nonnative species richness (Guntenspergen and Levenson, 1997; Pyšek *et al.* 2002; McKinney, 2004; Sullivan *et al*. 2005; Duguay *et al*. 2007; Zipperer and Guntenspergen, 2009; Kuhman *et al*. 2010). Additionally, a forests' surrounding landscape type (forested, agricultural, or urban) has been found to influence which species contribute to the nonnative species richness found in the forest (Duguay *et al.* 2007). It is possible that the proportion of invasive plant species with ornamental origins could be greater in forests located within urban settings when compared to rural settings. Increased presence of such species in urban areas is often attributed to an increased concentration of ornamental landscaping, as well as access to more ornamental plant distributers in more populated areas (Pyšek *et al*. 2003; Sullivan *et al.* 2005; Wania *et al*. 2006; Zipperer and Guntenspergen, 2009; Gavier-Pizarro *et al.* 2010a; Gavier-Pizarro *et al*. 2010b; Kuhman *et al.* 2010). As urbanization and species introductions are occurring with increasing frequency, it has become important to understand how the ornamental gardening pathway impacts species introductions along the urban-rural gradient because pathway management provides an essential key to reducing the number of

invasive plant species introductions (Reichard and White, 2001; Dehnen-Schmutz *et al.* 2007; Drew *et al.* 2010; Pyšek *et al.* 2011; Bradley *et al.* 2012; Fan *et al.* 2013).

This project aims to identify patterns in the ornamental gardening pathway in introducing nonnative plant species in temperate deciduous forests of Southwest Ohio. It is hypothesized that nonnative plant species richness for species with ornamental origins will be greater in forests located within urban areas than in rural areas because there is more disturbance and propagule pressure associated with urban land-use. Further, the proportion of species with ornamental origins that contribute to nonnative species richness is expected to decrease as one moves from forests in urban areas to rural areas, thus impacting conservation strategies depending on location (Pyšek *et al.* 1998; Huebner and Tobin, 2006; Gassó *et al.* 2009; Huebner *et al.* 2009; Vicente *et al.* 2010). It is possible that since the majority of Ohio's invasive plant species are already of ornamental origin (Ohio Division of Natural Areas and Preserves, 2000), the proportion of nonnative plant species with ornamental origins present in natural areas will not significantly differ between the urban and rural areas.

Methods

Forest Surveys

To quantify the proportion of non-native species of ornamental origin, 15 different forests along an urban-rural gradient in Southwestern Ohio were sampled between 6th of July and the 9th of August, 2012. Forests were identified using Google Earth and permission for on-site surveys was obtained from the various land managers. The sites were at least two kilometers apart from each other (Figure 1), and ranged in size from 9.3 to 1765 hectares. Ideally, the size of the forests would be approximately equal, but the existing forests varied greatly in size throughout

the region. Instead of attempting to document the presence of all plant species in each forest, a circular vegetation sampling zone, 120 m^2 in diameter, was randomly created between 100 and 200 meters inside the forest edge as delineated by Google Earth. This field design was employed to ensure the same sampling effort for each of the forests, regardless of how large the forests themselves were. Consistently placing the circular sampling zone within 100 to 200 meters of the edge created snapshots of forest vegetation along an urban-rural gradients for direct comparison.

Forests were systematically sampled for vegetation, employing three 60 meter transects radiating out from the center of the sampling zone, with the transects dividing the circle into three equal portions. Along each transect, two 1 m^2 quadrats were randomly tossed to the forest floor every 10m, with one quadrat toss to the right of the transect tape, and the second toss to the left. Herbaceous species and sapling less than one meter tall were identified, and their percent cover was recorded. There were 12 quadrats per transect, with a total of 36m^2 area sampled for the understory community at each site. Woody species were also identified and counted every 20 meters along the transect, within a rectangular area 7m by 15m. These rectangular areas were consistently placed along only one side of the transect tape. A 45 minute timed-meander was conducted at the end of the survey. The meander consisted of thoroughly walking the circular sampling zone for 45 minutes, and documenting any plant species, woody or herbaceous, which had not been noted in the transect survey. This method has been shown to increase the ability to document rare species occurrences (Huebner, 2007).

Species lists were compiled for each forest site, in which native and nonnative plant species were differentiated (Appendix 1). Furthermore, the nonnative species were designated as those with or without ornamental origins (Table 1)(Appendix 2). Instead of designating a

species as invasive or not, the term 'nonnative species' is used throughout because it was not possible to determine if the species observed were dependent of an outside propagule source, or were part of self-sustaining populations (Sullivan *et al*. 2005). The invasion risks posed by the observed nonnative species is the topic of the next chapter.

There were three sites (Ft. Ancient State Memorial Forest, Richardson Forest Preserve, and Sharon Woods) that contained unidentified plant species. There was one unidentified plant at Richardson Forest Preserve and Sharon Woods, and four unidentified plants at Ft. Ancient State Memorial Forest. These plants were not included in the data analysis.

To ensure that the forests sampled were accurately portrayed as rural or urban, a circle with a radius of one kilometer was created around the central point of the forest sampling zones. These large circular areas did not overlap because the sites (particularly, the central points within the sites) were at least two kilometers apart from each other, ensuring forest site independence. Human population densities within the larger, one kilometer radii areas were calculated using the 2010 population density maps created by the U.S. Census Bureau.

Percent impervious surface was also calculated for the large circular areas, using maps of Southwestern Ohio downloaded from the Multi-resolution Land Characteristics Consortium (MRLC) (http://www.mrlc.gov/) and analyzed with ArcGIS. The MRLC maps contained four categories to quantify impervious surface with a pixel resolution of approximately 25mx25m square: high, medium, low, and zero impervious surfaces. Low impervious surfaces were identified as pixels containing up to 50% impervious surfaces; with the medium category representing a pixilated area containing 51-75% impervious surfaces and 76-100% for the high category. Each pixel containing an impervious measure was summed together, and weighted

according to the highest impervious surface value within each of the categories. For example, the Buttercup Nature Preserve had 2556 high impervious surface pixels, 52,564 medium impervious surface pixels, and 118,578 low impervious surface pixels, which accounted for 0.44%, 8.99%, and 20.28% of the circular area surrounding the site, respectively. The percentages were summed to estimate the total impervious surface of the circle, weighting each value with the highest impervious surface percentage for the categories. For example, the total percent impervious surface of Buttercup Nature Preserve was calculated by: [0.44*1 (highest category)] + [8.99*0.75 (medium category)] + [20.28*0.50 (low category)] resulting in a 17.323% impervious surface estimate for the 2km diameter circular area.

Statistical Methods

When population density was used as an explanatory variable for patterns of nonnative species richness along an urban-rural gradient, generalized linear models (GLMs) were used. Because these data consist of count data, a Poisson distribution was employed to handle the proper error structure. Furthermore, when analyzing the proportion of species that make up certain categories (i.e. total species richness, nonnative species richness), a binomial distribution was used. The data for both species richness and proportions were under- and over-dispersed, respectively, assuming Poisson and binomial distributions. To account for dispersion, GLMs were fit using quasipoisson and quasibinomial distributions (McCullagh and Nelder, 1989). The population densities calculated were log-transformed to increase linearity.

There were three sites that appeared to place disproportionately high leverage on the models using population density as the independent variable. However, the species richness values documented at these sites (Tranquility Wildlife Area, Farbach-Werner Nature Preserve,

and Newberry Wildlife Sanctuary) are biologically valid. Additionally, these outliers do not place too much leverage on the models to make them invalid, and therefore remained in the analysis.

Percent impervious surface data were highly non-normal, and transformations were ineffective at bringing the variance to fit the assumptions of the generalized linear modeling process. Consequently, Spearman Rank-Order Correlation Analysis was used investigate patterns of nonnative species richness in relation to percent impervious data. Because there were tied values within variables (e.g. five forests had 46 native species observed), the Tie-corrected Spearman Rank-Order Correlation was applied (Sheskin, 2007). The systematic sampling design produced an oversampling of the central portion of the sampling zone, therefore abundance measures can only be used in a descriptive capacity, and were not analyzed for patterns along an urban-rural gradient. The oversampling issue is not a problem for the species richness data because the timed meander method measured species presence within the entire sampling area. The statistical software used for analysis was R version 2.15.1.

Results

Thirty-nine different nonnative species were observed in the course of forest sampling: Amur Maple (*Acer ginnala*), Hedge Maple (*Acer campestre*), Norway Maple (*Acer platanoides*), Tree of Heaven (*Ailanthus altissima*), Garlic Mustard (*Alliaria petiolata*), Porcelainberry (*Ampelopsis brevipedunculata*), Lesser Burdock (*Arctium minus*), Bittercress (*Barbarea vulgaris*), Japanese Barberry (*Berberis thunbergii*), Catalpa (*Caltapa speciosa*), Oriental Bittersweet (*Celastrus orbiculatus*), Autumn Olive (*Elaeagnus umbellate*), Winged Euonymus (*Euonymus alatus*), Wintercreeper (*Euonymus fortunei*), Glossy Buckthorn (*Frangula alnus*),

English Ivy (*Hedera helix*), Tall morningglory (*Ipomoea purpurea*), Japanese Privet (*Ligustrum japonicam*), Border Privet (*Ligustrum obtusifolium*), California Privet (*Ligustrum ovalifolium*), Chinese Privet (*Ligustrum sinense*), European Privet (*Ligustrum vulgare*), Lilyturf (*Liriope muscari*), Japanese Honeysuckle (*Lonicera japonica*), Amur Honeysuckle (*Lonicera maackii*), Osage Orange (*Maclura pomifera*), Japanese Stiltgrass (*Microstegium vimineum*), White Mulberry (*Morus alba*), Wild Parsnip (*Pastinaca sativa*), Princess Tree (*Paulownia tomentosa*), Mile-a-minute Weed (*Persicaria perfoliata*), Broadleaf Plantain (*Plantago major*), Oriental Ladysthumb (*Polygonum cespitosum*), Callery Pear (*Pyrus calleryana*), Common Buckthorn (*Rhamnus cathartica*), Multiflora Rose (*Rosa multiflora*), Dandelion (*Taraxacum officinale*), Siberian Elm (*Ulmus pumila*), and Common Gypsyweed (*Veronica officinalis*). Of the 39 species observed, 28 were known to have ornamental origins (Table 1).

The average number of plant species recorded in the 15 forests was 54.67 species, ranging from 39 to 72 species (Table 2). Forests held an average of 45.6 native and 8.67 nonnative species. Native plant species richness ranged from 33 to 61 species, while nonnative plant species ranged from 2 to 16. The average forest was composed of 83.5% native species and 16.5% nonnative species, with the proportion of native species ranging from 72.9% to 95.9% of total species observed (Table 3). The average number of nonnative species observed with ornamental origins was 6.4, ranging from 2 to 11 (Table 2). The average species richness of nonnative plants with non-ornamental origins was 2.27, and ranged from 0 to 7 species across sites. Species with ornamental origins, on average, contributed to 79.2% of the nonnative species richness, ranging from 56.3% to 100% (Table 3).

Amur Honeysuckle occurred most frequently in forests, as it was observed in 13 out of the 15 forests (Table 4). The second most common nonnative species were Wintercreeper and

Multiflora Rose, each observed in 12 forests. Garlic Mustard was the third most frequently observed species. Seventeen nonnative species were observed occurring in only a single forest.

The local human population densities surrounding the 15 different forest sampling sites ranged from 9.71 people/kilometer^2 (Brush Creek State Forest) to 835.792 people/kilometer^2 (Buttercup Nature Preserve) (Table 2). The other explanatory variable examined, percent impervious surface, ranged from 0% (Brush Creek State Forest) to 37.96% (Farbach-Werner Nature Preserve) (Table 2).

Species Richness Patterns

Local human population density was not a good predictor of total species richness in the 15 forests sites. The null deviance in the GLM using a quasipoisson distribution with the log-transformation of population density was 18.781 with 14 degrees of freedom and the residual deviance was 18.629 with 13 degrees of freedom, meaning that only 0.81% of the variation was explained in the data ($F_{1,13} = 0.1042$, $p = 0.752$)(Figure 2).

There was a significant relationship between local human population density and nonnative species richness ($t = 3.608$, Std. Error = 0.06537, $p = 0.00318$). The model explained approximately 54.16% of the variation in the data ($F_{1,13} = 15.193$, $p = 0.001834$) (Figure 3). Additionally, as human density increases, nonnative species richness contributed more to a forest's total species richness ($t = 5.068$, Std. Error = 0.05674, $p = 0.000215$)(Figure 4). The model illustrating this relationship explained 70.07% of the variation in the data ($F_{1,13} = 29.938$, $p = 0.000107$).

The number of ornamentally introduced species occurring in forests also increased as population density increased (t = 2.705, Std. Error = 0.05572, p = 0.01801)(Figure 5). The model explains 39.03% of the variance in the data ($F_{1,3}$ = 7.9951, p = 0.01426). As population density increased, the percentage of nonnative species with ornamental origins decreased (t = -4.002, Std. Error = 0.1518, p = 0.00151)(Figure 6). Approximately 62.17% of the variance in the data was explained by the model ($F_{1,13}$ = 24.136, p=0.000284).

The percent impervious surface surrounding forests sites was not associated with total species richness observed in forests (r_s = 0.3792, p > 0.05), but was moderately associated with the number of nonnative plant species observed in forests (r_s = 0.6526, p < 0.01) (Table 5). There was also a moderately strong, positive association between percent impervious surface and the proportion of total species richness made up of nonnative species (r_s = 0.6279, p < 0.05). There was no significant association between the percentage of impervious surfaces surrounding a forest and the number of ornamentally introduced, nonnative species found in the forest (r_s = 0.4964, p > 0.05), but a moderately strong, negative association was observed when looking at the percentage of impervious surfaces and the proportion of nonnative species richness with ornamental origins (r_s = -0.6697, p < 0.01).

Discussion

This project supports the assumption that urban forests have greater nonnative plant species richness than their rural counterparts. Also, the findings support the hypothesis that local human population size is a good predictor of nonnative species richness (McKinney, 2004; Sullivan *et al*. 2005; Duguay *et al*. 2007; Zipperer and Guntenspergen, 2009; Kuhman *et al*.

2010). Furthermore, our results also support the hypothesis that ornamentally introduced species occur in greater numbers within urban forests.

What is intriguing in this study is that when we look at the strength of the introduction pathways along the urban-rural gradient, we can see that the prominence of the ornamental pathway in introducing nonnative species becomes stronger in rural areas compared to urban areas. That is not to say that the ornamental pathway is any less important in introducing nonnatives into urban areas, but that the pathway dynamics are different. In urbanized areas, there are many routes a nonnative plant can take to become introduced to a forest, which explains why the forests in more urban areas contain more nonnative species. The routes leading to forests in rural areas, on the other hand, are limited, and reduce the number of opportunities a nonnative species has to reach the forest. The results of this study suggests that the ornamental gardening route is the path nonnative species use to get to rural forests almost exclusively. In fact, of four most rural forest sites, only one of 12 nonnative species identified (Common Gypsyweed) lacked ornamental origins. An alternative explanation is that the introduction pathway pressures are equal, but that only ornamentally originating species survive in rural forests, however, supporting data for this theory does not exist.

It is important to emphasize that the inferences that can be drawn from this study are constrained by several issues. The regional nature of the study makes it important recognize that the patterns detected in nonnative species richness should only be applied to Southwest Ohio. The floristic surveys were conducted in the height of summer, and so the patterns found on the species richness data can only be applied to that temporal segment of Southwestern Ohio's flora. Furthermore, the flora surveyed were all within 100-200 meters of each forest's edge, a sampling scheme adopted to overcome the fact that the 15 forests ranged in size. By constricting the

surveyed area to the edge, it is thought that the same part of the forest (the edge) was being measured. Due to only edge portions being surveyed, conclusions about interior forest areas should not be inferred from this study.

Despite these constraints, this project illustrates that to reduce the number of nonnative species entering forests, the ornamental pathway needs to be addressed across the entire urban-rural area. The findings of this study also suggest that by focusing on reducing the prominence of the ornamental pathway in less populated areas, meaningful headway can be made into reducing the number of invasive species entering rural forests. For example, if an organization wanted to conduct an educational program for community members to help reduce the number of introduced species escaping into the wild, selecting a more rural location for the event may result in a higher return on the organization's investment. We may never be certain if a nonnative species that escapes cultivation will become invasive, but by reducing the number of escapees, we are certainly reducing the pool from which the next invasive plant species could come from. Education efforts directed at gardeners could produce increased pressure on supply chain or policy makers when they become aware of the impacts their individual decisions have associated the natural areas (Reichard and White, 2001; Dehnen-Schmutz *et al.* 2007; Bradley *et al.* 2012).

The efforts of this project bring attention to the strength of the ornamental gardening introduction pathway, which can help forest managers who are in the position of managing both urban and rural forests, but it also provides documentation of nonnative species occurrences in the regional forests. Future studies are needed to increase our knowledge about invasive species in the region and their pathways. A sampling method that allows for analysis of nonnative species abundances should be used, which would allow for conclusions regarding the extent at which species are occurring in forests along the urban rural gradient. Of particular concern are

the eight species that accounted for a large proportions of total cover measured in at least one site: Oriental Bittersweet, Winged Euonymus, Wintercreeper, English Ivy, Japanese Honeysuckle, Amur Honeysuckle, Oriental Ladysthumb, and Multiflora Rose (Table 3). While some of these species are considered already invasive, Winged Euonymus, English Ivy, and Wintercreeper are still regularly sold at gardening supply stores. More information and insights into patterns of pathway prominence along an urban-rural gradient can help guide pathway management to knowledge-based solutions regarding forest invasions.

Literature Cited

Andersen, M.C., Adams, H., Hope, B. and Powell, M. (2004) Risk Assessment for Invasive Species. *Risk Analysis* 24(4): 787-793.

Bradley, B.A., Blumenthal, D.M., Early, R., Grosholz, E.D., Lawler, J.J., Miller, L.P., Sorte, C.J.B., D'Antonio, C.M., Diez, J.M., Dukes, J.S., Ibanez, I. and Olden, J.D. (2012) Global change, global trade, and the next wave of plant invasions. *Frontiers in Ecology and the Environment* 10(1): 20-28.

Culley, T.M. and Hardiman, N.A. (2009) The role of intraspecific hybridization in the evolution of invasiveness: a case study of the ornamental pear tree *Pyrus calleryana*. *Biological Invasions* 11: 1107-1119.

Dehnen-Schmutz, K., Touza, J. Perrings, C. and Williamson, M. (2007) A century of the ornamental plant trade and its impact on invasion success. *Diversity and Distributions* 13: 527-534.

Drew, J. Anderson, N. and Andow, D. (2010) Conundrums of a complex vector for invasive species control: a detailed examination of the horticultural industry. *Biological Invasions* 12: 2837-2851.

Duguay, S., Eigenbrod, F. and Fahrig, L. (2007) Effects of surrounding urbanization on nonnative flora in small forest patches. *Landscape Ecology* 22: 589-599.

Fan, Z., Moser, W.K., Hansen, M.H. and Nelson, M.D. (2013) Regional Patterns of Major Nonnative Invasive Plants and Associated Factors in Upper Midwest Forests. *Forest Science* 59: 38-49.

Foxcroft, L.C., Richardson, D.M. and Wilson, J.R.U. (2008) Ornamental Plants as Invasive Aliens: Problems and Solutions in Kruger National Park, South Africa. *Environmental Management.* 41: 32-51.

Gassó, N., Sol, D., Pino, J., Dana, E.D., Lloret, F., Sanz-Elorza, M., Sobrino, E. and Vilá, M. (2009) Exploring species attributes and site characteristics to assess plant invasions in Spain. *Diversity and Distributions* 15: 50-58.

Gavier-Pizarro, G. I., Radeloff, V.C., Stewart, S.I., Huebner, C.D. and Keuler, N.S. (2010a) Rural housing is related to plant invasions in forests of southern Wisconsin, USA. *Landscape Ecology* 25: 1505–1518.

Gavier-Pizarro, G. I., Radeloff, V.C., Stewart, S.I., Huebner, C.D. and Keuler, N.S. (2010b) Housing is positively associated with invasive exotic plant species richness in New England, USA. *Ecological Applications* 20: 1913–1925.

Guntenspergen, G.R. and Levenson, J.B. (1997) Understory plant species composition in remnant stands along an urban-to-rural land-use gradient. *Urban Ecosystems* 1: 155-169.

Heywood, V.H. (2010) The role of botanic gardens as resource and introduction centres in the face of global change. *Biodiversity and Conservation* 20: 221-239.

Huebner, C.D. and Tobin, P.C. (2006) Invasibility of mature and 15-year-old deciduous forests by exotic plants. *Plant Ecology* 186: 57-68.

Huebner, C.D. (2007) Detection and Monitoring of Invasive Exotic Plants: A Comparison of Four Sampling Methods. *Northeastern Naturalist* 14(2): 183-206.

Huebner, C.D., Morin, R.S., Zurbriggen, A., White, R.L., Moore, A. and Twardus, D. (2009) Patterns of exotic plant invasions in Pennsylvania's Allegheny National Forest using intensive Forest Inventory and Analysis plots. *Forest Ecology and Management* 257: 258-270.

Kuhman, T.R., Pearson, S.M. and Turner, M.G. (2010) Effects of land-use history and the contemporary landscape on non-native plant invasion at local and regional scales in the forest-dominated southern Appalachians. *Landscape Ecology* 25: 1433–1445.

Lockwood, J.L., Hoopes, M.F. and Marchetti, M.P. (2007) *Invasion Ecology.* Malden, MA: Blackwell Publishing Ltd.

Lodge, D.M., Williams, S., MacIsaac, H.J., Hayes, K.R., Leung, B., Reichard, S., Mack, R.N., Moyle, P.B., Smith, M., Andow, D.A., Carlton, J.T., and McMichael, A. (2006)

Biological Invasions: Recommendations for US Policy and Management. *Ecological Applications* 16: 2035-2054.

Mack, R.N. and Erneberg, M. (2002) The United States Naturalized Flora: Largely the Product of Deliberate Introductions. *Annals of the Missouri Botanical Garden* 89: 176-189.

McCullagh, P. and Nelder, J.A. (1989) *Generalized Linear Models* (2nd ed.) Boca Raton, FL: Chapman & Hall/CRC.

McKinney, M.L. (2004) Citizens as Propagules for Exotic Plants: Measurement and Management Implications. *Weed Technology* 18: 1480-1483.

Miller, T.K., Allen, C.R., Landis, W.G. and Merchant, J.W. (2010) Risk assessment: Simultaneously prioritizing the control of invasive species and the conservation of rare plant species. *Biological Conservation* 143: 2070-2079.

Moser, W.K., Barnard, E.L., Billings, R.F., Crocker, S.J. Dix, M.E., Gray, A.N., Ice, G.G., Kim, M, Reid, R. Rodman, S.U. and McWilliams, W.H. (2009) Impacts of Nonnative Invasive Species on US Forests and Recommendations for Policy and Management. *Journal of Forestry* 107: 320-327.

Ohio Division of Natural Areas and Preserves (2000) Ohio's Invasive Plant Species. https://ohiodnr.com/Portals/3/invasive/pdf/OHIO%20INVASIVE%20PLANTS.pdf Accessed 5-12-13.

Ööpik, M., Kukk, T., Kull, K. and Kull, T. (2008) The importance of human mediation in species establishment: analysis of the alien flora of Estonia *Boreal Environmental Research* 13: 53-67.

Parker, C., Caton, B.P. and Fowler, L. (2007) Ranking Nonindigenous Weed Species by Their Potential to Invade the United States. *Weed Science* 55: 386-397.

Peters, W.L., Meyer, M.H. and Anderson, N.O. (2006) Minnesota horticulture industry survey on invasive plants. *Euphytica* 248: 75-86.

Pimentel, D., Zuniga, R. and Morrison, D. (2005) Update on the environmental and ecolomic costs associated with alien-invasive species in the United States. *Ecological Economics* 52: 273-288.

Protopopova, V.V., Shevera, M.V. and Mosyakin, S.V. (2006) Deliberate and unintentional introduction of invasive weeds: a case study of the alien flora of Ukraine. *Euphytica* 148: 17-33.

Pyšek, P., Prach, K. and Mandák, B. Invasions of alien plants into habitats of central European landscape: a historical pattern. In U. Starfinger, K. Edwards, I. Kowarik and M. Williamson (Eds.) *Plant Invasions: Ecological Mechanisms and Human Responses* (23-32). Leiden: Backhuys Publishers.

Pyšek, P., Sádlo, J., Mandák, B. and Jarosík, V. (2002) Czech alien flora and the historical pattern of its formation: what came first to Central Europe. *Oecologia* 135: 122-130.

Pyšek, P., Jarošík, B. and Pergl, J. (2011) Alien Plants Introduced by Different Pathways Differ in Invasion Success: Unintentional Introductions as a Threat to Natural Areas. *PLoS ONE* 6(9): e24890

Reichard, S.H. and White, P. (2001) Horticulture as a pathway of invasive plant introductions in the United States. *BioScience* 51**:** 103-113.

Sheskin, D. (2007) *Handbook of parametric and nonparametric statistical procedures* (4th ed.) Boca Raton, FL: Chapman & Hall/CRC.

Sullivan, J.J., Timmins, S.M. and Williams, P.A. (2005) Movement of exotic plants into coastal native forests from gardens in northern New Zealand. *New Zealand Journal of Ecology* 29: 1-10.

Vicente, J., Alves, P., Randin, C., Guisan, A. and Honrado, J. (2010) What drives invasibility? A multi-model inference test and spatial modeling of alien plant species richness patterns in northern Portugal. *Ecography* 33: 1081-1092.

Wania, A., Kühn, I. and Klotz, S. (2006) Plant richness patterns in agricultural and urban landscapes in Central Germany—spatial gradients of species richness. *Landscape and Urban Planning* 75: 97-110.

Zipperer, W.C. and Guntenspergen, G.R. (2009) Vegetation composition and structure of forest patches along urban-rural gradients. In McDonnell, M.J., Hahs, A.K. and Breuste, J. H. (Eds.), *Ecology of Cities and Towns: A Comparative Approach.* Cambridge: Cambridge University Press.

Tables and Figures

Table 1. A List of 39 Nonnative Plant Species Observed in Forests Surveys Conducted in Southwestern Ohio, 2012. Plant associations with the ornamental introduction pathway are included. Please see Appendix 2 for references.

Nonnative Species Name	**Nonnative Common Name**	**Ornamental Origin?**
Acer campestre	Hedge Maple	Y
Acer glinala	Amur Maple	Y
Acer platanoides	Norway Maple	Y
Ailanthus altissima	Tree of Heaven	Y
Allaria petiolata	Garlic Mustard	N
Ampelopsis brevipedunculata	Porcelainberry	Y
Arctium minus	Common Burdock	N
Barbarea vulgaris	Bittercress	N
Berberis thunbergii	Japanese Barberry	Y
Catalpa speciosa	Catalpa	Y
Celastrus orbiculatus	Oriental Bittersweet	Y
Elaeagnus umbellata	Autumn Olive	Y
Euonymus alatus	Winged Euonymus	Y
Euonymus fortunei	Wintercreeper	Y
Frangula alnus	Glossy Buckthorn	Y
Hedera helix	English Ivy	Y
Ipomoea purpurea	Tall Morningglory	Y
Ligustrum japonicum	Japanese Privet	Y
Ligustrum obtusifolium	Border Privet	Y
Ligustrum ovalifolium	California Privet	Y

Ligustrum sinense	Chinese Privet	Y
Ligustrum vulgare	Common Privet	Y
Liriope muscari	Lilyturf	Y
Lonicera japonica	Japanese Honeysuckle	Y
Lonicera maackii	Amur Honeysuckle	Y
Maclura pomifera	Osage Orange	N
Microstegium vimineum	Japanese Stiltgrass	N
Morus alba	White Mulberry	Y
Pastinaca sativa	Wild Parsnip	N
Paulownia tomentosa	Princess Tree	Y
Persicaria perfoliata	Mile-a-minute Weed	N
Plantago major	Broadleaf Plantain	N
Polygonum cespitosum	Oriental Ladysthumb	N
Pyrus calleryana	Callery Pear	Y
Rhamnus cathartica	Common Buckthorn	Y
Rosa multiflora	Multiflora Rose	Y
Taraxacum officianale	Dandelion	N
Ulmus pumila	Siberian Elm	Y
Veronica officinalis	Common Gypsyweed	N

Table 2. Summary of Forest Data. The human population density (people/Km^2) for the sites were calculated by creating a 1 km radius circle around the center forest point at each site and using the 2010 U.S. Census data. The total number of plant species observed at each site is also included in the table. The totals are then further broken down into native or nonnative categories. Nonnative species have been subcategorized as either species with ornamental origin or without ornamental origin.

Site	Population density (people/ Km^2)	Percent impervious surface (% impervious surface/ Km^2)	Total species	Native species	Nonnative species	Nonnative species with ornamental introduction pathways	Nonnative species with non-ornamental introduction pathways
Brush Creek State Forest	9.71	0.000%	48	46	2	2	0
Buttercup Nature Preserve	835.792	17.323%	59	45	14	11	3
California Woods Nature Preserve	819.318	4.628%	53	42	11	7	4
Embshoff Woods	835.792	15.194%	59	43	16	9	7
Farbach-Werner Nature Preserve	506.313	37.960%	72	61	11	7	4
Ft. Ancient State Memorial	31.969	0.121%	51	46	5	5	0
Ft. Hill State Memorial	11.969	0.211%	57	54	3	3	0
Miami Whitewater Forest	153.552	13.514%	54	46	8	6	2

Mitchell Memorial Forest	153.552	2.596%	49	39	10	7	3
Mt. Airy Forest	835.792	2.985%	51	40	11	7	4
Newberry Wildlife Area	506.313	12.130%	39	33	6	5	1
Richardson Forest Preserve	506.313	2.897%	45	39	6	5	1
Sharon Woods	506.313	10.887%	51	43	8	6	2
Tranquility Wildlife Area	21.178	0.110%	70	61	9	8	1
Withrow Nature Preserve	405.05	4.552%	56	46	10	8	2

Table 3. The proportional distribution of species in relation to their native status and to their pathway of introduction if nonnative in 15 forest sites in Southwestern Ohio.

Site	Proportion of total species richness that is native	Proportion of total species richness that is nonnative	Proportion of nonnative species richness that has ornamental origins	Proportion of nonnative species richness that does not have ornamental origins
Brush Creek State Forest	0.958	0.042	1.000	0.000
Buttercup Nature Preserve	0.763	0.237	0.846	0.154
California Woods Nature Preserve	0.792	0.208	0.636	0.364
Embshoff Woods	0.729	0.271	0.563	0.437
Farbach-Werner Nature Preserve	0.847	0.153	0.636	0.364
Ft. Ancient State Memorial	0.836	0.164	1.000	0.000
Ft. Hill State Memorial	0.947	0.053	1.000	0.000
Miami Whitewater Forest	0.852	0.148	0.750	0.250
Mitchell Memorial Forest	0.796	0.204	0.700	0.300
Mt. Airy Forest	0.784	0.216	0.636	0.364

Newberry Wildlife Area	0.846	0.154	0.833	0.167
Richardson Forest Preserve	0.848	0.152	0.833	0.167
Sharon Woods	0.827	0.173	0.750	0.250
Tranquility Wildlife Area	0.871	0.129	0.889	0.111
Withrow Nature Preserve	0.821	0.179	0.800	0.200

Table 4. Collated list of nonnative species and how many forests they were observed in, along with measures of occurrence, during the sampling of 15 different forests in Southwestern Ohio.

	Number of forests species found	Number of forests species found in herbaceous sampling	Number of forests species was observed in meander	Number of forests species was observed in tree sampling	Avgerage percent cover, $36m^2$	Min percent cover, $36m^2$	Max percent cover, $36m^2$
Acer campestre	1	0	1	0	-	-	-
Acer ginnala	1	1	0	0	0.03	-	-
Acer platanoides	1	1	0	0	0.03	-	-
Ailanthus altissima	4	2	2	1	0.07	0.03	0.11
Alliaria petiolata	11	11	0	0	0.22	0.01	0.64
Ampelopsis brevipedunculata	2	0	2	0	-	-	-
Arctium minus	3	0	3	0	-	-	-
Barbarea vulgaris	2	1	0	0	0.08	-	-
Berberis thungbergii	5	1	2	2	0.11	-	-
Catalpa speciosa	1	0	1	0	-	-	-
Celastrus orbiculatus	3	3	0	0	2.55	0.03	6.08
Elaeagnus umbellata	5	3	2	2	0.78	0.03	0.94
Euonymus alatus	7	4	2	3	0.40	0.03	1.31
Euonymus fortunei	12	8	4	0	1.95	0.11	9.36
Frangula alnus	1	0	1	0	-	-	-
Hedera helix	2	1	1	0	15.44	-	-
Ipomoea purpurea	1	1	0	0	0.28	-	-
Ligustrum japonicum	3	2	1	1	0.04	0.03	0.06
Ligustrum obtusifolium	1	0	0	1	-	-	-
Ligustrum ovalifolium	1	1	0	0	0.06	-	-
Ligustrum sinense	1	1	0	1	0.11	-	-
Ligustrum vulgare	2	1	1	0	0.03	-	-
Liriope muscari	1	0	1	0	-	-	-
Lonicera japonica	10	9	1	0	0.95	0.06	3.42
Lonicera maackii	13	12	0	11	6.47	0.19	17.81
Maclura pomifera	1	0	0	1	-	-	-
Microstegium vimineum	2	0	2	0	-	-	-
Morus alba	1	0	1	0	-	-	-
Pastinaca sativa	1	0	1	0	-	-	-
Paulownia tomentosa	1	0	1	0	-	-	-
Persicaria perfoliata	2	0	2	0	-	-	-
Plantago major	3	1	2	0	0.03	-	-
Polygonum cespitosum	9	9	0	0	0.29	0.03	1.06
Pyrus calleryana	4	3	1	0	0.06	0.06	0.06
Rhamnus cathartica	1	0	0	1	-	-	-
Rosa multiflora	11	7	4	2	0.48	0.03	1.69
Taraxacum officinale	1	1	0	0	0.11	-	-
Ulmus pumila	1	1	0	0	0.78	-	-
Veronica officinalis	1	0	1	0	-	-	-

Table 5. The Tie-corrected Spearman Rank-Order Correlation results testing the strength of the association between local percent impervious surface surrounding the forest sampling sites and different species richness values.

Association between site impervious surface and…	**r_s**
Total specie richness	0.3791
Nonnative species richness	0.6526**
Proportion of total species richness that is nonnative	0.6279*
Nonnative species richness with ornamental origins	0.4964
Proportion of nonnative species richness that has ornamental origins	-0.6697**

* indicates $p < 0.05$, ** indicates $p < 0.01$

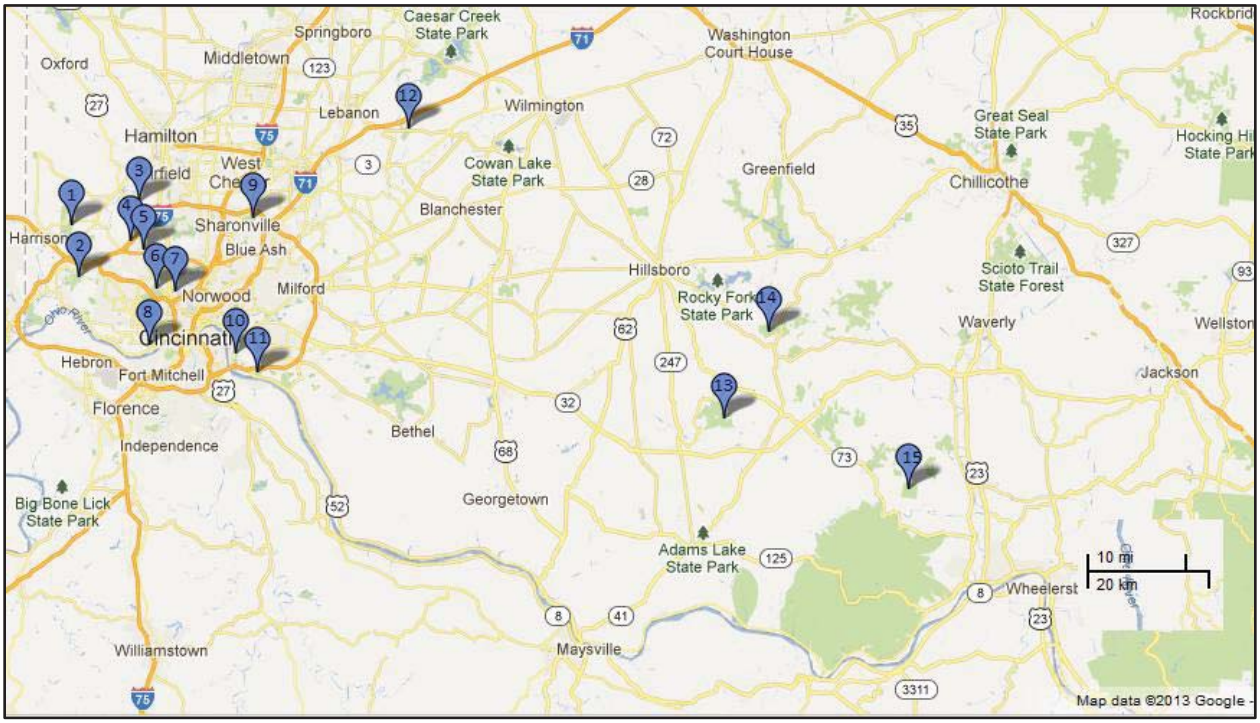

Figure 1. Map of forest sites located in Southwestern Ohio. (1) Miami Whitewater Forest (2)Mitchell Memorial Forest (3) Richardson Forest Preserve (4) Newberry Wildlife Sanctuary (5) Farbach-Werner Nature Preserve (6) Mt. Airy Forest (7) Buttercup Nature Preserve (8) Embshoff Woods (9) Sharon Woods (10) California Woods (11) Withrow Nature Preserve (12) Ft. Ancient State Memorial Forest (13) Tranquility Wildlife Area (14) Ft. Hill State Memorial Forest (15) Brush Creek State Forest. Image was obtained from Google Earth.

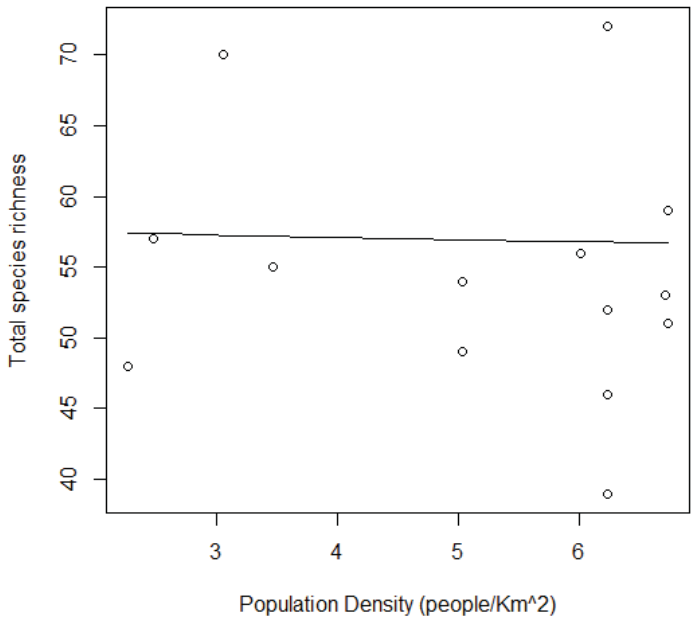

Figure 2. A generalized linear model (using the Quasipoisson distribution) illustrating the relationship between the total species richness observed at forest sites and the log of local population density (log[people/km^2]). There is no significant relationship between a forest site's total plant species richness and the log of the local human population density (t = -0.32, Std. Error = 0.02655, p = 0.752).

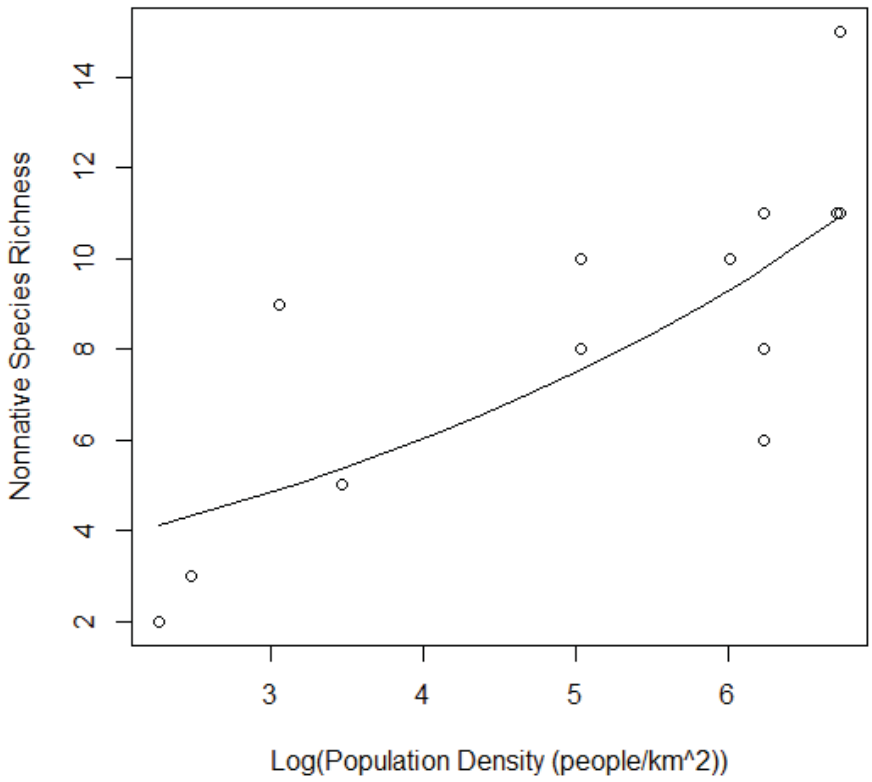

Figure 3. Modeling the relationship between the log of local human population density and nonnative plant species richness. There is a significant relationship between local human population density and local forest nonnative species (t = 3.608, Std. Error = 0.06537, p = 0.00318). The model explained approximately 54.16% of the variation in the data ($F_{1,13}$ = 15.193, p = 0.001834).

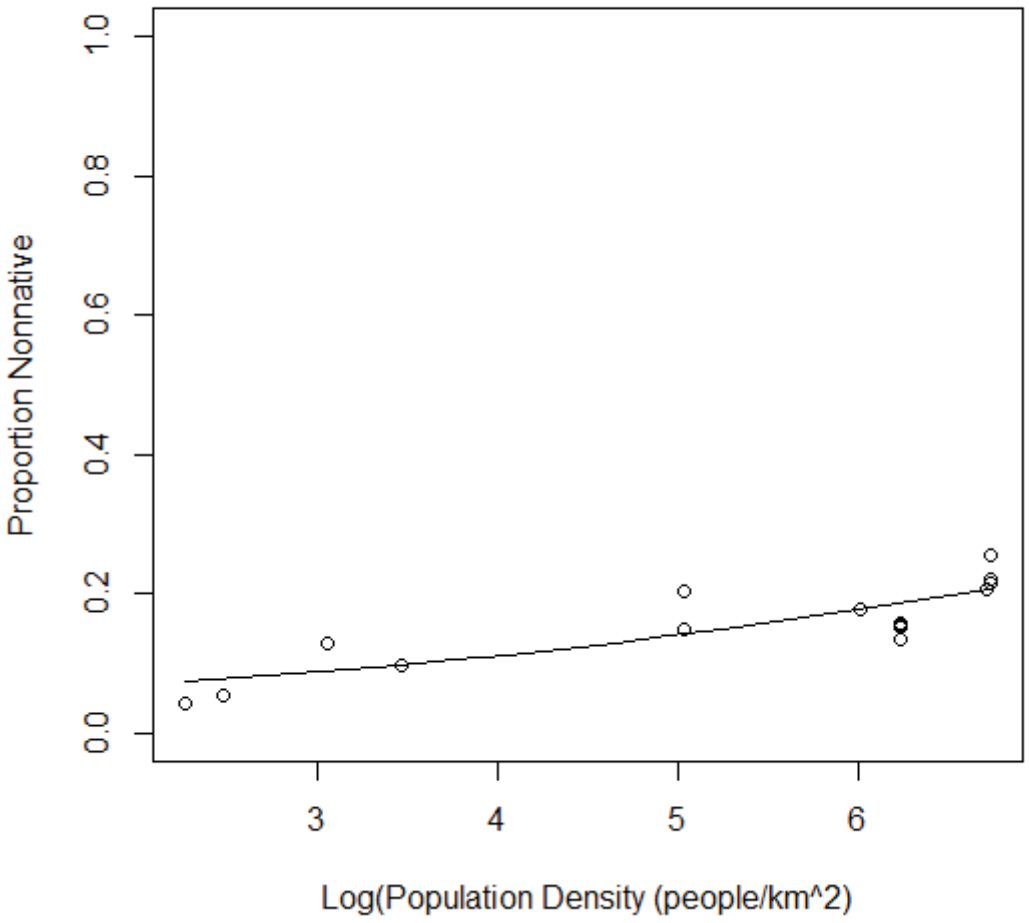

Figure 4. The modeled relationship between forest sites local population densities and the proportion of total species richness made up of nonnative species. As human density increases, nonnative species richness makes up more of a forest's total species richness (t = 5.068, Std. Error = 0.05674, p = 0.000215). The model explains 70.072% of the variance in the data ($F_{1,13}$ = 29.938, p = 0.000107).

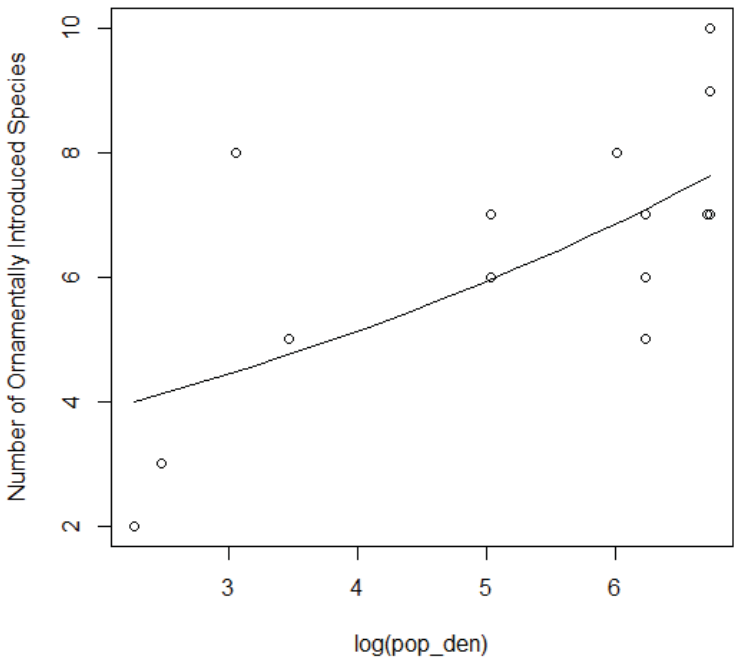

Figure 5. The relationship between the log of human population density and the number of nonnative species with ornamental origins. As the population density increases, the number of nonnative species with ornamental origins increases (t = 2.705, Std. Error = 0.05572, p = 0.01801). The model explains 39.03% of the variance in the data ($F_{1,13}$ = 7.9951, p = 0.01426).

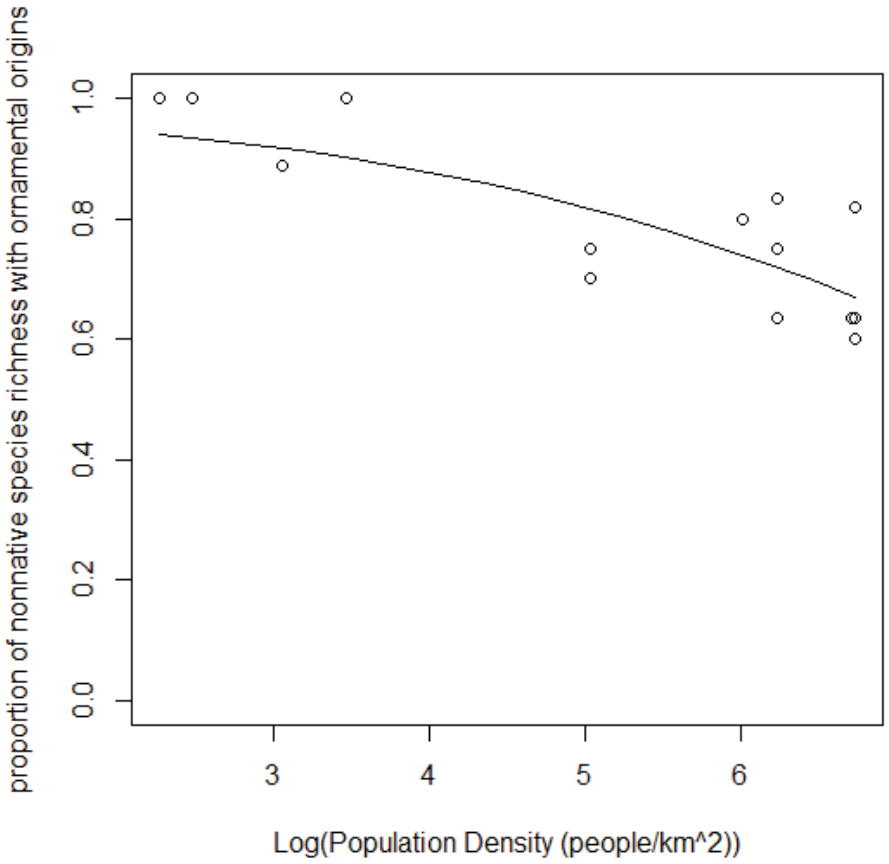

Figure 6. The modeled relationship between local population densities and the proportion of total nonnative species richness made up of species with ornamental introduction pathways using the Quasibinomial distribution. As human density increases, ornamental species contribute proportionally less to nonnative species richness ($t = -4.002$, Std. Error = 0.1518, $p = 0.00151$). The model explained 62.17% of the variance in the data ($F_{1,13} = 17.424$, $p = 0.0002835$).

Chapter 2: Understanding Invasion Risks Through the Use of Two Risk Assessments: the Australian Weed Risk Assessment and the Ohio Invasive Plant Assessment

Introduction

A common problem in invasive plant species management is deciding whether a nonnative plant merits the allocation of scarce resources (Andersen *et al.* 2004; Kapler *et al.* 2012). Invasive ecologists have come to recognize that most nonnative species observed in the wild should not automatically be considered invasive (Williamson & Fitter, 1996; Andersen *et al.* 2004; Křivánek and Pyšek, 2006; Keller *et al.* 2007; Adams *et al.* 2011; Catford *et al.* 2012; Hulme, 2012; Kapler *et al.* 2012; Fan *et al.* 2013) but should only be labeled as such after extensive review. Land managers and conservationists face significant challenges in allocating resources for control of invasive plant species, and the ability to make an early discernment between nonnative species that would or would not endanger their conservation efforts, would allow for greater efficiency (NISC and ANS, 2005; Renz *et al.* 2009; Pyšek *et al.* 2011; Kapler *et al.* 2012; Fan *et al.* 2013).

The distinction between invasive and not invasive is best understood by examining how a species first comes to be recognized as invasive. While 'invasive' is a term that might seem static, a species becomes invasive through a dynamic, complex process commonly separated into four stages: introduction, establishment, spread, and invasion (Andersen *et al.* 2004; Lockwood *et al.* 2007; Dehnen-Schmutz, 2011; Keller *et al.* 2011; Pyšek *et al.* 2011). The introduction stage is when a species is physically brought to a novel location outside of its native range (Anderson *et al.* 2004; Lockwood *et al.* 2007; Pyšek *et al.* 2011; Bradley *et al.* 2012). The establishment phase begins when an introduced species escapes into a natural area and forms a self-sustaining population (Lockwood *et al.* 2007; Pyšek *et al.* 2011). Successful advancement through the establishment phase is often related to a species'

propagule pressure (Andersen *et al.* 2004; Lockwood *et al.* 2007; Pyšek *et al.* 2011), as well as a variety of tactics based on their life history traits and the ecology of the novel habitat (Catford *et al.* 2011; Pyšek *et al.* 2011). As populations start to increase in abundance and extend themselves into additional areas, the species enters into the spread phase. With time, a species can grow in abundance to the point that the ecosystem is negatively impacted (Andersen *et al.* 2004; Bradley *et al.* 2012; Kapler *et al.* 2012; Fan *et al.* 2013). These impacts to ecosystems can be direct or indirect, but ultimately, can bring about unwanted shifts in ecosystem composition and services, and are costly to control (Kolar & Lodge, 2001; Hughes & Madden, 2003; Adams *et al.* 2011; Kapler *et al.* 2012; Fan *et al.* 2013). When the impacts to the environment become easily apparent, the species is considered by many to be invasive (Lockwood *et al.* 2007). The United States Federal Government defines an invasive plant as a nonnative species that is, at the very least, anticipated to "cause economic or environmental harm or harm to human health" (Executive Order 13112, 1999). It is important to note the use of 'harm' in this definition. Harm is a concept that means different things to different people, so the human element of interpretation is an essential part to recognizing an invasive species (Andersen *et al.* 2004; Lockwood *et al.* 2007).

Accurately predicting whether a nonnative species will become invasive has been a central goal of invasion scientists for decades (Kolar and Lodge, 2001; Křivánek and Pyšek, 2006; Keller *et al*, 2011; Bradley *et al*. 2012). Invasive plant risk assessments take advantage of the fact a major area of research in invasion ecology has been to identify how and why some nonnative plant species can bring about harm to a novel area while other species do not (Andersen *et al.* 2004; Křivánek and Pyšek, 2006; Fan *et al.* 2013). An important consideration in this process is that each stage of the invasion process can be seen as containing a variety of obstacles a species must overcome to advance to the next stage (Williamson and Fitter, 1996; Andersen *et al.* 2004; Lockwood *et al.* 2007; Keller *et al.* 2011; Fan *et al.* 2013). An introduced species can die during cultivation or never make it into natural areas, it could fail to independently persist or spread, or its presence in the novel ecosystem might end up benign (Williamson and Fitter, 1996; Andersen *et al.* 2004; Keller *et al.* 2007; Lockwood *et al.* 2007; Adams *et al*. 2011;

Keller *et al.* 2011; Catford *et al*. 2012; Hulme, 2012). In fact, it is estimated that only 10% of species that make it to a particular stage in the invasion process will overcome the hurdles present and progress to the next stage (Williamson & Fitter, 1996). Risk assessments are designed to provide a logical framework for decision makers to effectively characterize factors of plant invasions to determine if a particular plant introduction will result in negative ecological consequences (Andersen *et al.* 2004; Niemiera and Von Holle, 2009; Miller *et al.* 2010; Keller *et al.* 2011; Kapler *et al.* 2012).

Determining which of the nonnative plant species should be considered invasive exemplifies challenges many forest managers face when constructing management plans. Early detection and eradication is one of the most promising ways to control for invasive species, but the reality is many forests that are actively managed contain numerous nonnative species and attempting to control and eradicate each one is impractical, if not impossible. The question then, is how should a forest manager decide which of the nonnatives to focus their control efforts on? To help develop an efficient way to answer this question, a case study was conducted using field observations. First, vegetation surveys were carried out in 15 Southwestern Ohio forests during the summer of 2012, and which identified 39 nonnative species (Chapter 1). Two invasive plant risk assessments were then used to establish which, if any, of the nonnative plants detected in field observations posed invasive risks. There is evidence that some forest managers support the use of risk assessments to guide management decisions, but many are skeptical of the effectiveness and accuracy of such models (Renz *et al.* 2009; Kapler *et al.* 2012). We expect this project to provide insights that will help clarify how risk assessments can be used by forest managers in an efficient and informative way for prioritizing conservation efforts. Furthermore, the results of this study can directly inform the forest managers of the forest sites surveyed which nonnative plant species are present in their natural areas and which species should be prioritized for control efforts.

Although there are a variety of weed risk assessments now available, we chose to focus on the following two invasive plant risk assessments for this case study: the Australian Weed Risk Assessment and the Ohio Invasive Plants Assessment. The Australian Weed Risk Assessment (AWRA) was designed

to screen nonnative plant imports before arrival into the country as a preemptive effort to reduce the number of invasive species admitted into Australia (Pheloung *et al.* 1999). It is one of the oldest and most successful assessments that has been created (Gordon *et al.* 2008b; Robert *et al.* 2011) and has often been used as a model for other assessments (McClay *et al.* 2010; Koop *et al.* 2012). The success of the AWRA at distinguishing the invasive species present in a pool of nonnative species is consistently above 90% for regions tested worldwide, once modifications to four of its questions are made to reflect the biogeographical context of the region in question (Pheloung *et al.* 1999; Daehler *et al.* 2004; Křivánek and Pyšek, 2006; Gordon *et al.* 2008a; Gordon *et al*. 2008b; Andrea & Vilà, 2010; Roberts *et al.* 2011; Koop *et al.* 2012).

The Ohio Invasive Plant Assessment (OIPA) was created to evaluate invasion capabilities of plant species specifically for the state of Ohio, where the field work for this case study was conducted (Chapter 1). The creation of the OIPA was a collaborative effort by the Ohio Invasive Plants Council (2012), including contributors from academic, governmental and horticultural fields. The inclusion of different stakeholders in the risk assessment process helps increase the credibility of the process because questions and concerns raised by various groups can be discussed and handled in a transparent way (Renz *et al.* 2009; Kapler *et al.* 2012). In contrast to the AWRA, this assessment was designed to test the invasive risks posed by species that have already been observed in the region, as well as those that might be introduced at a later time. In addition, the assessment has only recently been finalized, and processing some species identified in the field would be valuable for a preliminary first run.

A benefit in using two different assessments is the increased level of confidence in assigning the 'invasive risk' determination to a species, especially if both assessment tools arrive at the same conclusion. Most land managers operating under situations of scarce resources would likely only use one risk assessment because of time constraints. It is hypothesized that the two risk assessments will deliver similar results, where the species that pose the highest risk of invasion will receive the highest scores from both assessments, and species that do not pose a risk of invasion will receive the lowest scores. If

true, then the land manager can simply select one of the assessments. It is important to note that this project is not designed to rigorously evaluate and compare the two assessments, but rather serves as an example of how to determine which nonnative species observed in natural areas pose an invasive risk.

Methods

To assist forest managers in determining if risk assessments can be used to help effectively identify invasive plant species and prioritize conservation efforts, 39 nonnative species observed while sampling 15 Southwestern Ohio forests in 2012 (see Chapter 1) were processed through two different risk assessment schemes described earlier. Scores generated by both assessments indicate the level of risk the plant poses: Invasive, Not invasive, Evaluate further/Pending further review, and Insufficient data.

When at all possible, the information used to answer the questions within each assessment was obtained from peer-reviewed scientific literature. For some species, such as Lilyturf (*Liriope muscari*) and Amur Maple (*Acer ginnala*), there was a paucity of information in the scientific literature. When this occurred, information was obtained from various government, academic, horticultural, and invasive organizations. When no evidence was found to accurately answer a given question or there were conflicts in the literature, the answer to the question was marked as unknown. Templates for each of the risk assessments were created in Excel to provide streamlined documentation for each species assessed where questions could be answered, references cited, notes regarding answers could be included, and scores could be calculated (Appendix 2).

Australian Weed Risk Assessment

The Australian Weed Risk Assessment protocol (AWRA) was developed in 1999 to aid in biosecurity efforts to control the entry of plant species into the country that had weedy, or invasive, potential (Pheloung *et al*. 1999). To make the AWRA suitable for assessing risk in Ohio climates and soils, four modifications were made following guidelines detailed in Gordon *et al*. (2010). First, question 2.01 asks if a species is suited to Australian climates and this was changed to reflect Ohio's climate,

asking instead if a species is suitable for the USDA Plant Hardiness Zones 5b, 6a, and 6b. Second, question 2.04 addresses climate information, specifically about precipitation. The National Atlas mapmaking interface was used to assess the average annual precipitation for Southwestern Ohio (National Atlas, 2013). Between 2005 and 2009, the annual average precipitation in Ohio ranged from 35 to 50 inches of rain per year (National Atlas, 2013). Consequently, question 2.04 was modified to ask if the species could live in areas that experienced 35-55 inches of rain annually. Third, question 4.10 was modified to ask if the species in question could grow on any soil order representing more than 5% cover in Ohio. Finally, question 8.05 asks if there are any effective enemies to the species in question for the area of interest. The question was changed to inquire if the plant being assessed had any effective predators or diseases present Ohio.

Guidance on how to answer each question in the AWRA was provided by the 2007 International WRA Workshop (Gordon *et al.* 2010). Explanations of the how to answer each of the 49 different questions in the AWRA are based on the intention and context of each question. These explanations were used extensively while assessing the 39 nonnative species (described above) to ensure accurate and consistent answers.

Ohio Invasive Plant Assessment

The Ohio Invasive Plant Assessment (OIPA) was developed to identify invasive plants that currently threaten Ohio's natural ecosystems in an objective and scientifically accurate way (Ohio Invasive Plants Council, 2012). The assessment was also written to address ornamental introductions or plants with a horticultural background; as such, cultivated varieties (cultivars) of species can also be assessed for invasive potential. The OIPA is made up of two sets of questions (Step I and Step II). Step I is a set of four questions designed to simplify the assessment process. The questions ask about a plant's (1) federal and state level noxious weed status, (2) known distribution across the state, (3) current impact on natural areas in the state and (4) invasive status in surrounding states or states east of the Mississippi

River in the same climatic zones. If the answers to questions 1 and/or 2 are 'yes', the species is considered invasive, and no other questions need to be answered. If the answers to questions 1 and 2 are 'no', but the answers to questions 3 and 4 are both 'yes', then the species is labeled invasive, and no other questions need be answered. If a species is not deemed invasive after answering the Step I questions, there is a second set of 18 more in-depth questions (Step II) to be answered that seek to identify a species distribution in the state, its biological characters, and its ecological impacts. In practice, any species could also be run through Step II, even if the Step I questions indicate that it is invasive.

As the OIPA has only been recently compiled, there was no official guidelines for answering questions when the answer was open to interpretation. Default responses were created for certain questions in Step II of the assessment to improve consistency in answers (Table 1). Discussions with Dr. Theresa Culley, one of the assessment authors and chair of the committee that created the document, provided insights and guidance on the formation of the default responses to comply with the intent of the questions.

Statistical Analysis

To test the hypothesis that the AWRA and OIPA protocols would yield similar results for the set of 39 nonnative plant species, a Tie-corrected Spearman's Rank Order Correlation was conducted (Sheskin, 2007). A Normal Q-Q plot revealed there were outliers within the set of scores, therefore Pearson's Correlation could not be used (Crawley, 2007). Spearman's Rank Order Correlation measures bivariate association with rank-order data. Specifically, it determines the presence and strength of a monotonic relationship between the results of the two assessments (Sheskin, 2007). It is also used in situations where one would like to know the degree of agreement between rankings provided by two judges (Sheskin, 2007). For each assessment, the 39 species were organized by rank based on the scores they received, with the highest score receiving a rank of one.

There were numerous ties within each assessment, defined as when two or more species received the same score for one assessment. Of the 39 species assessed, 27 were involved in ties for the AWRA and 28 species were involved in ties for the OIPA. When this occurred, the average rank was used, following Sheskin (2007). For example, in the AWRA, three species, Amur Honeysuckle (*Lonicera japonica*), Japanese Stiltgrass (*Microstegium vimineum*), and Common Buckthorn (*Rhamnus cathartica*) tied for the first rank (each then had a rank of 2, following averaged of 1-3 ranks). Because of the excessive numbers of ties in the data, the Tie-corrected Spearman's Rank-Order Correlation Coefficient is appropriate because without the correction, the traditional Spearman's Rank-Order Correlation Coefficient can overestimate the absolute value of the statistic (Sheskin, 2007).

To help determine which species should be given management priority, a comparison of how species scored in relation to the other species was conducted. For this comparison, Step II questions in the OIPA were answered regardless of whether the species was determined invasive in Step I (Table 2). This allowed for all species to have a score that could be included in the analysis.

In the OIPA, four species were determined to have 'Insufficient data' because they had four or more 'unknown' answers (Table 3). Their scores were considered incomplete and were therefore excluded from the Tie-Corrected Spearman's Rank-Order Correlation Coefficient analysis described above. The AWRA did not determine any of the species to have 'insufficient data'. Thirty-five species were included in the correlation analysis. Data analysis was completed using R software, 2.15.1.

Results

The AWRA determined that all 39 nonnative species should be considered invasion risks, while the Ohio Invasive Plant Assessment identified 18 of the 39 species as invasive risks (Table 3). The species designated as invasion risks by both assessments were: Norway Maple (*Acer platanoides*), Tree of Heaven (*Ailanthus altissima*), Garlic Mustard (*Alliaria petiolata*), Japanese Barberry (*Berberis thunbergii*), Oriental Bittersweet (*Celastrus orbiculatus*), Autumn Olive *(Elaeagnus umbellate*), Winged

Euonymus (*Euonymus alatus*), Wintercreeper (*Euonymus fortunei*), Glossy Buckthorn (*Frangula alnus*), English Ivy (*Hedera helix*), Border Privet (*Ligustrum obtusifolium*), Japanese Honeysuckle (*Lonicera japonica*), Amur Honeysuckle (*Lonicera maackii*), Japanese Stiltgrass (*Microstegium vimineum*), Wild Parsnip (*Pastinaca sativa*), Mile-a-minute Weed (*Persicaria perfoliata*), Callery Pear (*Pyrus calleryana*), and Multiflora Rose (*Rosa multiflora*).

Unlike the AWRA, which scored all 39 nonnative species in the 'Invasive' category, the OIPA scored species in each of the four possible categories. The following nine species were designated 'Pending further review': Porcelainberry (*Ampelopsis brevipedunculata*), Common Burdock (*Arctium minus*), Tall Morningglory (*Ipomoea purpurea*), Chinese Privet (*Ligustrum sinense*), European Privet (*Ligustrum vulgare*), White Mulberry (*Morus alba*), Broadleaf Plantain (*Plantago major*), Oriental Ladysthumb (*Polygonum cespitosum*), and Common Buckthorn (*Rhamnus cathartica*); the following eight species were determined 'Not an invasion risk': Northern Catalpa (*Catalpa speciosa*), Osage Orange (*Maclura pomifera*), Common Gypsyweed (*Veronica officinalis*), Siberian Elm (*Ulmus pumila*), Dandelion (*Taraxacum officinale*), Princess Tree (*Paulowina tomentosa*), Japanese Privet (*Ligustrum japonicum*), and Bittercress (*Barbarea vulgaris*); and four species were designated as having 'Insufficient data': Amur Maple (*Acer ginnala*), Hedge Maple (*Acer campestre*), California Privet (*Ligustrum ovalifolium*), and Lilyturf (*Liriope muscari*).

The AWRA scores ranged from 13 (Japanese Privet and Northern Catalpa) to 32 (Japanese Honeysuckle, Japanese Stiltgrass, and Common Buckthorn) (Table 4). Of the 27 species involved in ties, there were six two-way ties, four three-way ties, and one five-way tie. When determinations were computed based solely on the scores created from Step II of the OIPA, 10 of 39 species were considered an invasive risk (Table 2). Sixteen species fell into the 'Pending further review' determination, nine species were not considered an invasion risk, and four species had insufficient amounts of data available to receive a score. Scores ranged from 25 (Bittercress) to 55 (Amur Honeysuckle), and there were eight two-way ties and four three-way ties (Table 4).

The Tie-Corrected Spearman's Rank-Order Correlation Analysis indicated that the OIPA and AWRA scores exhibited a monotonic increasing relationship, but the strength of the relationship was weak ($r_s = 0.4364$, n = 35, $p < 0.02$) (Sheskin, 2007). While some species ranked similarly in the two methods, there were several exceptions. For example, Oriental bittersweet ranked fourth out of 35 species in the OIPA and ranked 4.5 in the AWRA (recall rankings can have decimals from averaging tied ranks) (Table 4). Japanese Privet was also ranked similarly by both assessments, receiving the 29.5 rank in the OIPA and a rank of 34.5 in the AWRA. In contrast, there were some species which exhibited inconsistent ranking placement within the two assessments. For example, Amur Honeysuckle ranked the highest in the OIPA (rank 1), but only received the 16th rank from the AWRA. Common Buckthorn came in 12th in the OIPA and 2nd in the AWRA.

Discussion

When a group of nonnative species are observed in a managed forest, it becomes important to identify which of the species might become invasive in order to efficiently prioritize management action. In this case study, two invasive plant risk assessments, the Australian Weed Risk Assessment (AWRA) and the Ohio Invasive Plant Assessment (OIPA), were used to determine which of the 39 nonnative plant species observed during forest vegetation surveys in Southwestern Ohio in the summer of 2012 posed a substantial invasion risk. There were 18 species designated as having an invasion risk by both assessments (Table 3), and they consisted of trees, shrubs, perennials, and annuals.

It was hypothesized that the AWRA and OIPA assessments would have similar rankings, with both assessments scoring species in a similar fashion. Interestingly, approximately half of the 39 species assessed were identified as an invasion risks by both assessments and only a weak monotonic association between the ranked scores was observed ($r_s = 0.4364$, n = 35, $p < 0.02$) (Table 4). Therefore, the idea that a forest manager could simply select one of these two invasive plant risk assessment models and prioritize nonnative species control efforts based on the risk determinations is not as straightforward as

one might like, but there are many important lessons to be garnered from this case study. Differences in the assessment results were interesting for several reasons, as discussed below, and have implications for management decisions involved with invasive species control.

Assessment Comparisons

The assessments resulted in rankings with only a weak monotonic association because while there were some species with similar ranks, other species were ranked very differently. For example, both Oriental Bittersweet and Japanese Barberry scored 50 points in the OIPA assessment, ranking them 4.5 out of the 39 species (ranks were averaged when tie scores were involved) (Table 4). The AWRA results also placed Oriental Bittersweet in the 4th ranking position (indicating a strong monotonic association), but Japanese Barberry only ranked 12.5 out of 39 based on its AWRA score. In addition, Tree of Heaven also received the 12.5 rank according to the AWRA model, but was ranked as 2.5 out of 39 in the OIPA model.

One important explanation for the divergences in rankings between the two assessments involves formatting differences, such as the greater number of questions posed by the AWRA. The OIPA has a total of 18 questions that are used to produce a score in Step II while the AWRA has 49 questions (Pheloung *et al.* 1999; Ohio Invasive Plants Council, 2012). In addition, inconsistent rankings were also influenced by the way in which questions are posed in the two assessments. Questions in the OIPA are more broad in scope, whereas the AWRA contains a greater number of more specific questions. For example, the OIPA has one question asking about a species' dispersal ability, with possible responses for low (0 points), medium (3 points) and high (5 points) potential for long-distance dispersal. In contrast, AWRA has eight questions concerning dispersal mechanisms, asking about various modes of intentional and unintentional plant dispersal (e.g. are propagules bird dispersed, are propagules buoyant, are propagules intentionally dispersed by humans). The responses are in yes/no format and 'yes' responses receive one point, and 'no' responses receive negative one point. This formatting distinction contributed

to the discrepancy observed in Amur Honeysuckle, Japanese Barberry, and Garlic Mustard rankings. These species all received five points from the OIPA model for dispersal, but received zero (Amur Honeysuckle and Japanese Barberry) or negative two (Garlic Mustard) based on the answers to the eight questions in the dispersal cohort of questions in the AWRA. Questions framed in a broad sense in the OIPA that correspond with an number of more specific questions in the AWRA include inquiries about a plants' ability to establish, impacts on ecosystem processes, and impacts on successional trajectories.

In addition to questions that are formatted differently, there are certain questions that are explicitly considered in both assessments, but response options and subsequent scorings are dissimilar. For example, each assessment inquires about vegetative reproduction. In the AWRA, the response options are yes or no; if the species is involved in any type of natural vegetative reproduction, it receives one point, and if it does not, it receives a score of negative one. In the OIPA, the evaluator is presented with responses detailing different ways a plant can reproduce vegetatively: 'no vegetative reproduction' receives a score of zero; 'reproduces within the original site' receives one point; 'having runners or spreading rhizomes that root easily' receives three points; 'fragments easily and fragments can be easily dispersed' receives 4 points; and 5 points is assigned if the 3 point and 4 point responses are both answered affirmatively. Ten species, including Tree of Heaven, Porcelainberry, and Wintercreeper, received three points for their vegetative reproduction abilities by the OIPA, and only one point from the AWRA. Other specific questions that have different responses and point values ask about hybridization capabilities, generation time, and prolific seeding.

Another important difference in point allocations is that the questions in Step I of the OIPA are not associated with point values. There are eight species (Multiflora Rose, Winged Euonymus, Mile-a-minute Weed, Norway Maple, Wintercreeper, English Ivy, Border Privet, and Wild Parsnip) that are considered invasive risks by the OIPA due solely to the answers provided in Step I, and receive lesser risk determinations based on their score tallied by answers in Step II (Table 2). The lack of points associated with these questions also leads to ranking divergences.

The differences in how certain questions are asked and scored in these two assessments illustrate limitations commonly associated with invasive plant risk assessments. There is no single group of characters and factors that a species must have to become an invasive species, but rather inavasiveness may be due to a complex array of traits and processes inherent to an individual taxon. Consequently, variation in the relative importance of individual characters and factors that contribute to the success of an invasive species complicates the creation of accurate scoring models (Hughes and Madden, 2003; Andrea and Vilà, 2010; Benke *et al.*2010; Miller *et al.* 2010; Hulme, 2012). Additionally, species can adapt and change in their new environments, and these new environments may change as well, adding spatial and temporal complexity to the assessment modeling process (Hulme, 2012). Quantifying the level of uncertainty that should be associated with a particular questions' score (based on how much weight it is given) is also a difficult task (Benke *et al.* 2010; Miller et al. 2010; Roberts *et al.* 2011; Hulme, 2012). Some risk assessment schemes have turned to using complex computer modeling to explore how to properly weight the score for the different invasive factors (Benke *et al.* 2010; Miller *et al.* 2010). Without such complex modeling, it has been largely impossible to accurately determine the statistical significance of the results of invasive plant risk assessments, particularly with species that have already been introduced (Benke *et al.* 2010). Assessments designed to determine pre-introduction risks have had some success with Receiver-Operator Curve (ROC) Analysis, but its applicability does not transfer to schemes designed for post-introduction assessments (Hughes & Miller, 2003; Benke *et al.* 2010).

Along with formatting issues, threshold level placement appears to contribute significantly to the ranking discrepancies observed in the results. The two assessments indicate that there are species within the group of 39 nonnative plants that should be considered invasion risks. The majority of these species (Amur Honeysuckle, Japanese Stiltgrass, Multiflora Rose) have been considered invasive for some time (Hartman and McCarthy, 2008; Adams and Engelhardt, 2009; Banasiak and Meiners, 2009), but a few (English Ivy, Winged Euonymus) are still being debated. Whether or not a species is determined invasive by an assessment depends in large part on where threshold levels have been set for labeling a species as

invasive. The AWRA's threshold level is at a score of six out of 32 points, much lower than the threshold of the OIPA (currently 45 of 75). The AWRA assessment has been optimized to identify those species that are truly an invasion risk, but at the cost of determining a species invasive may not be truly invasive (i.e. false positives) (Kolar & Lodge, 2001; Hughes & Madden, 2003; Andersen *et al.* 2004; Daehler *et al.* 2004; Křivánek and Pyšek, 2006; Gordon *et al.* 2008a; Niemiera and Von Holle, 2009; Andrea and Vilà, 2010; Onderdonk *et al.* 2010; Roberts *et al.* 2011; Hulme, 2012; Koop *et al.* 2012). This threshold level of six has been considered too low by several researchers, who have suggested that the threshold be increased to reduce the number of species that are falsely identified as invasion risks (McClay *et al.* 2010; Koop *et al.* 2012). Others have speculated that the cost of the false positives is the price society must pay to keep natural areas from being harmed by invasive species (Hughes and Madden, 2003; Niemiera and Von Holle, 2009; Dehnen-Schmutz, 2011). Assigning accurate threshold values is difficult because there is usually an intermediate zone in an assessment's scoring where both invasive and noninvasive species fall (Hughes and Madden, 2003; Gordon *et al.* 2008b; Koop *et al.* 2012). The OIPA can be considered as having a higher threshold, designating a species as an invasive risk when it has scored at least 45 out of 75 points. The higher threshold allows for less false positives, but there is a tradeoff in that it has the potential to misidentify a truly invasive species as noninvasive (Hughes and Madden, 2003; Gordon *et* al. 2008b; Hulme, 2012). The larger 'Pending further review' category of the OIPA (35-44 points compared to 1-6 points for the AWRA) essentially tags species that, with more time and research, could be determined an 'Invasive risk' in the future. Species progress through the stages of invasions at various rates, with many taking over 100 years before they are seen as invaders (Lockwood *et al.* 2007). Species categorized as 'Pending further review' remain in the pool of plants to be annually processed until they are definitively determined to be an invasion risk or not. Even then, a species that has been determined 'Not an invasive risk' can be processed again if new information about its distribution, biology or ecology is brought to light (Ohio Invasive Plants Council, 2012).

Implications

For a forest manager trying to assess which of the nonnative species should be given management priority given a limited budget, the differences in the results of the two risk assessments can be instructional. The assessments results illustrate the complexity at the heart of invasion plant ecology (Niemiera and Von Holle, 2009; Benke *et al.* 2010). The variability in the role of plant characteristics, compounded by the spatial and temporal elements involved, make assessing invasion risk problematic – so problematic that some believe the effort is a waste of time (e.g. Hulme, 2012). Others, however, believe that risk assessments represent a responsible middle ground, whereby scoring plants based on certain traits and factors that are acknowledged to give a species a greater likelihood of invasion success, can work as a sound management tool that provides a logical way to prioritize action (Hughes and Madden, 2003; Andersen *et al.* 2004; Renz *et al.* 2009; Kapler *et al.* 2012).

The problem addressed in this case study is that the question 'Which of the nonnative species observed should be considered invasive?' is not satisfactorily answered because of inconsistencies in how the two assessments' score invasion risk. There are 18 species that were scored in both assessments as invasion risks, but different risk determinations were obtained for 21 other species. It might seem that at the end of processing all the species, there are many questions left unanswered, but managers have to make decisions when there are gaps in the knowledge. In processing these species through the two risk assessments, one can discern two major lessons this case study brings to light. First, while invasive plant risk assessments may vary, there is general consensus on which characters and factors are important in identifying whether a species is invasive or will become invasive. Processing species through a risk assessment provides an evaluator with an efficient framework to explore the important elements that may allow a species to become invasive. A forest manager can glean important information regarding the invasiveness of nonnative species he or she has observed in their forests in an efficient, structured way, but can decide independently on how to interpret the scores provided. There are two main functions of invasive plant risk assessments: to provide information to help decide whether to restrict a plant from a

certain region, or, as in this case study, to help decide which nonnative species merit a portion of scarce resources to improve conservation efforts (Andersen *et al*. 2004). While assessment and management roles often overlap, it is in management positions where the authority and responsibility to make the decisions is found (Andersen *et al.* 2004). By acknowledging the distinction between assessment and management, flexibility surrounding threshold placements is created. Managers could deal with threshold values by processing several nonnative species in their own area that are not considered invasive to determine where the appropriate threshold values should be positioned within the scoring range for their given location. Another approach could be to use how the points are distributed within a certain species' assessment to highlight what might make it become invasive. For example, if a species received a majority of its points from the reproduction and dispersal questions, it becomes important to implement that information into an action plan for its control.

A second lesson this case study brings to light is the importance of striking a balance between uncertainty and prudence. As discussed above, the level of uncertainty associated with certain traits and factors varies among species as well as in time and space (Bradley *et al.* 2012; Hulme, 2012). High scoring species should undoubtedly receive resources for control measures, but resource expenditure should also be devoted to eradicating newly observed species. Early detection and eradication measures are considered one the most cost effective ways to control invasive species (Keller *et al.*2006; Andrea and Vilà, 2010; Hulme, 2012; Bradley *et al.* 2013). A species considered not invasive at this time does not mean that it will not become invasive at a later date (Miller *et al.* 2010; Roberts *et al.* 2011; Catford *et al.* 2012). This means that while risk assessments are good at identifying some species, future invaders might be flying under their radar. This indicates that balancing high scoring nonnative species prioritization with early detection and eradication of observed nonnatives could strike a more cost effective balance in the long term.

Conclusions

Land managers often need to identify which of the nonnative species they have observed in their natural areas should be considered an invasion risk, given the limited funding they have at their disposal for eradication and control efforts. This case study aimed to identify species that are invasion risks from a pool of 39 nonnative species that had been observed in Southwestern Ohio forests in the summer of 2012. Eighteen of the species were determined invasion risks by the AWRA and OIPA assessments, but our results also highlighted the variability and uncertainty involved in risk assessments because 21 additional species were assigned different determinations.

The AWRA is a tool that has been used with success in various regions throughout the world (e.g. Daehler *et al.* 2004; Křivánek and Pyšek, 2006; Gordon *et al.* 2008a; Gordon *et al*. 2008b; Andrea & Vilà, 2010), but it was ultimately designed to be used as a pre-screening tool, which makes it good at identifying invaders at low thresholds, but not at prioritizing action for those species a forest manager knows is already on their property. In contrast, the OIPA is a tool designed for post-introduction assessment, which results in weighting certain factors in a more amenable fashion for prioritizing management (Křivánek and Pyšek, 2006); however, the OIPA and its threshold values are largely untested due to its recent development in 2012.

Two significant, key lessons were identified by analyzing the complexity presented in this case study. First, by processing nonnative species through risk assessments, one can learn valuable information about the important elements involved in the invasion process in a structured and efficient way that provides a rational, knowledge-based framework for invasive species management prioritization. Second, efficient allocation of funds needs to be balanced among species known to have high invasion risk and early detection and eradication efforts.

Literature Cited

Adams, D.C., Bwenge, A.N., Lee, D.J., Larkin, S.L. and Alavalapati, J.R.R. (2011) Public preference for controlling upland invasive plants in state parks: Application of a choice model. *Forest Policy and Economics* 13: 465-472.

Adams, S.N. and Engelhardt, K.A.M. (2009) Diversity declines in microstegium vimineum patches. Biological Conservation142: 1003-1010.

Andersen, M.C., Adams, H., Hope, B. and Powell, M. (2004) Risk Assessment for Invasive Species. *Risk Analysis* 24(4): 787-793.

Andrea, J. and Vilà, M. (2010) Risk analysis of potential invasive plants in Spain. *Journal for Nature Conservation* 18: 34-44.

Anonymous (September 2007) Floriculture and Nursery Crops Yearbook. Market and Trade Economics Division, Economic Research Service, U.S. Department of Agriculture, FLO-2007. http://webarchives.cdlib.org/sw1s17tt5t/http://ers.usda.gov/Publications/flo/2007/09Sep/FLO2007.pdf Accessed 4-8-13.

Banasiak, S.E. and Meiners, S.J. (2009) Long term dynamics of Rosa multiflorain a successional system. Biological Invasions 11: 215-224

Bradley, B.A., Blumenthal, D.M., Early, R., Grosholz, E.D., Lawler, J.J., Miller, L.P., Sorte, C.J.B., D'Antonio, C.M., Diez, J.M., Dukes, J.S., Ibanez, I. and Olden, J.D. (2012) Global change, global trade, and the next wave of plant invasions. *Frontiers in Ecology and the Environment* 10(1): 20-28.

Catford, J.A., Vesk, P.A., Richardson, D.M. and Pyšek, P. (2012) Quantifying levels of biological invasion: towards the objective classification of invaded and invasible ecosystem. *Global Change Biology* 18: 44-62.

Crowley, M.J. (2007) The R Book John Wiley & Sons, Ltd., West Sussex, England

Daehler, C.C., Denslow, J.S., Ansari, S. and Kuo, H. (2004) A Risk-Assessment System for Screening Out Invasive Pest Plants from Hawaii and Other Pacific Islands. *Conservation Biology* 18(2): 360-368.

Dawson, W., Burslem, D.F.R.P. and Hulme, P.E. (2009) The suitability of weed risk assessment as a conservation tool to identify invasive plant threats in East African rainforests. *Biological Conservation* 142: 1018-1024.

Dehnen-Schmutz, K. (2011) Determining non-invasiveness in ornamental plants to build green lists. *Journal of Applied Ecology* 48: 1374-1380.

Executive Order 13112, 1999. Federal Register 64 (25), 6183–6186.

Fan, Z., Moser, W.K., Hansen, M.H. and Nelson, M.D. (2013) Regional Patterns of Major Nonnative Invasive Plants and Associated Factors in Upper Midwest Forests. *Forest Science* 59(1): 38-49.

Gordon, Doria R. and Crysta A. Gantz. (2008a) Screening new plant introductions for potential invasiveness: a test of imparts for the United States. *Conservation Letters* 1: 227-235.

Gordon, D.R., Onderdonk, D.A., Fox, A.M., Stocker, R.K. and Gantz, C. (2008b) Predicting Invasive Plants in Florida Using the Australian Weed Risk Assessment. *Invasive Plant Science and Management* 1(2): 178-195.

Gordon, D.R., Mitterdorfer, B., Pheloung, P.C., Ansari, S., Buddenhagen, C., Chimera, C., Daehler, C.C., Dawson, W., Denslow, J.S., LaRosa, A., Nishida, T., Onderdonk, D.A., Panetta, F.D., Pysek, P., Randall, R.P., Richardson, D.M., Tshidada, N.J., Virtue, J.G. & Williams, P.A. 2010. Guidance for addressing the Australian Weed Risk Assessment questions. *Plant Protection Quarterly* 25: 56-74.

Hartman, K.M. and McCarthy, B.C. (2008) Changes in forest structure and species compostition following invasion by a non-indigenous shrub, Amur Honeysuckle (Lonicera maackii) *Journal of the Torrey Botanical Society* 135(2): 245-259.

Hughes, G. and Madden, L.V. (2003) Evaluating predictive models with application in regulatory policy for invasive weeds. *Agricultural Systems* 76: 755-774.

Hulme, P.E. (2012) Weed risk assessment: a way forward or a waste of time? *Journal of Applied Ecology* 49: 10-19.

Kapler, E.J., Thompson, J.R. and Widrlechner, M.P. (2012) Assessing Stakeholder Perspecitives on Invasive Plants to Inform Risk Analysis. *Invasive Plant Science and Management* 5: 194-208.

Keller, R.P., Lodge, D.M. and Finnoff, D.C. (2007) Risk assessment for invasive species produces net bioeconomic benefits. *PNAS* 104(1): 203-207.

Keller, R.P. Kocev, D. and Džeroski, S. (2011) Trait-based risk assessment for invasive species: high performance across diverse taxonomic groups, geographic ranges and machine learning/statistical tools. *Diversity and Distribution* 17: 451-461.

Kolar, C.S. and Lodge, D.M. (2001) Progress in invasion biology: predicting invaders. *TRENDS in Ecology & Evolution* 16(4): 199-204.

Koop, A.L., Fowler, L., Newton, L.P. and Caton, B.P. (2012) Development and validation of a weed screening tool for the United States. *Biological Invasions* 14: 273-294.

Křivánek, M. and Pyšek, P. (2006) Predicting invasions by woody species in a temperate zone: a test of three risk assessment schemes in the Czech Republic (Central Europe). *Diversity and Distributions* 12: 319-327.

Lockwood, J.L., Hoopes, M.F. and Marchetti, M.P. (2007) *Invasion Ecology* Malden, MA : Blackwell Publishing Ltd.

Mack, R.N. and Lonsdale, W.M. (2001) Humans as Global Plant Dispersers: Getting More Than We Bargained For. *Bioscience* 51(2): 95-102.

Mack, R. N. and Erneberg, M. (2002) The United States Naturalized Flora: Largely the Product of Deliberate Introductions. *Annals of the Missouri Botanical Garden* 89(2): 176-189.

McClay, A., Sissons, A., Wilson, C. and Davis, S. (2010) Evaluation of the Australian weed risk assessment system for the prediction of plant invasiveness in Canada. *Biological Invasions* 12: 4085-4098.

McDonald, J.H. (2009) Chi-square test of independence (pages 57-63) *Handbook of Biological Statistics* (2nd ed.) Baltimore, MD: Sparky House Publishing.

USGA. National Atlas. http://www.nationalatlas.gov/mapmaker Accessed 2-7-13.

National Invasive Spcecies Council (NISC) and Aquatic Nuisance Species (ANS) Task Force (2005) Focus Group Conference Report and Pathways Ranking Guide. U.S. Department of Agriculture, Animal Plant Health Inspection Service, Plant Protection and Quarantine 301-734-8412

http://invasivespecies.gov/global/prevention/prevention_documents/Pathways%20Guide_--final.pdf Accessed 4-22-13.

National Research Council (2002) *Predicting Invasions of Nonindigenous plants and plant pests* Washington D.C : National Academy Press.

Niemiera, A.X. and Von Holle, B. (2009) Invasive Plant Species and the Ornamental Horticulture Industry. In Inderjit (Ed.), *Management of Invasive Weeds* (167-187). Netherlands: Springer.

Nishida, T., Yamashita, N., Asai, M., Kurokawa, S., Enomoto, T. Pheloung, P.C. and Groves, R.H. (2009) Developing a pre-entry weed risk assessment system for use in Japan. *Biological Invasions* 11: 1319-1333.

Ohio Invasive Plants Council (2012) Ohio Invasive Plants Assessment Protocol

Onderdonk, D.A., Gordon, D.R., Fox, A. M. and Stocker, R.K. (2010) Lessons learned from testing the Australian weed risk assessment system: the devil is in the details. *Plant Protection Quarterly* 25(2): 79-86.

Pheloung, P.C., Williams, P.A. and Halloy, S.R. (1999) A weed risk assessment model for use as a biosecurity tool evaluation plant introductions. *Journal of Environmental Management* 57: 239-251

Pimentel, D., Lach, L., Zuniga, R. and Morrison, D. (2000) Environmental and economic costs of Nonindigenous Species in the United States. *BioScience* 50(1): 53-65.

Pyšek, P., Jarošík, B. and Pergl, J. (2011) Alien Plants Introduced by Different Pathways Differ in Invasion Success: Unintentional Introductions as a Threat to Natural Areas. *PLoS ONE* 6(9): e24890

Reichard, S.H. and White, P. (2001) Horticulture as a pathway of invasive plant introductions in the United States. *BioScience* 51**:** 103-113.

Renz, M., Gibson, K.D., Hillmer, J., Howe, K.M., Waller, D.M. and Cardina, J. (2009) Land Manager and Researcher Perspectives on Invasive Plant Research Needs in the Midwestern United States. *Invasive Plant Science and Management* 2: 83-91.

Roberts, W., Harrod, O. Mitterdorfer, B. and Pheloung, P. (2011) Regulating invasive plants and use of weed risk assessments. *Current Opinion in Environmental Sustainability* 3: 60-65.

Sheskin, D. (2007) *Handbook of parametric and nonparametric statistical procedures* (4th ed.) Boca Raton, FL: Chapman & Hall/CRC.

USDA Plant Hardiness Zone Map, 2012. Agricultural Research Service, U.S. Department of Agriculture. Accessed from http://planthardiness.ars.usda.gov. Accessed 2-7-13

Williamson, M. and Fitter, A. (1996) The varying success of invaders. *Ecology* 77: 1661-1666.

Tables and Figures

Table 1. Default responses and clarifications to some questions in the Ohio Invasive Plant Assessment (OIPA) protocol. Default scoring instructions often signify gaps in research. Responses are considered to a compromise between the need to not overreach what conclusions can be made from the lack of specific evidence, and common sense.

OIPA Question	Clarification/Default response
5. Sexual Reproduction	If evidence indicates that the species reproduces annually, but there is no evidence detailing if there is variability in seed production, the default is the 3 points answer.
6. Number of Viable Seeds or Propagules per Plant	If sources state seed set is "prolific" but no numeric evidence was found, the question should receive the 3 point score answer.
8. Dispersal Ability	If sources do not state approximate distance seeds disperse, but indicate they are dispersed by birds and/or wildlife, the question should receive the 5 point answer. If seeds are dispersed by wind or water, they should receive the 3 point answer.
11. Impact on Ecosystem Processes	This question refers to processes, therefore only biogeochemical cycle impacts should be considered. Community Structure and Composition changes are not included in this question.
12. Impact on Rare Organisms	Organism must be present in Ohio
16. Population Density	Absolute cover estimates are not needed for the 4 or 5 point answers. If the species is described as dominant or if it has been documented to form dense thickets, it should receive a 4 point answer.
17. Role in Succession in Natural Areas	If source indicates the species can change community structure and/or composition, the 1 point answer should be used. With time and data, changes in community composition and structure can lead to changes in successional trajectories, but information on this subject is often lacking.

Table 2. The determinations assigned to 39 nonnative species based on Step I and Step II questions for the Ohio Invasive Plant Assessment. Completion of Step I questions results in either an 'Invasive' determination or instructs you to answer Step II questions. Step II provides more information to determine if a species should be categorized as 'Invasive' or not. The threshold level for an 'Invasive' determination is 45 points or more. Scores that range from 35 to 44 are determined 'Pending further review', and scores that range from 0 to 34 are determined 'Not invasive'. If there are more than four 'unknown' answers, a species will receive an 'Insufficient data' determination.

Nonnative species name	Nonnative common name	Invasive based on Step I	Step I 'Yes' answers	Step II determination	Step II scores
Lonicera maackii	Amur Honeysuckle	Invasive	3,4	Invasive	56
Ailanthus altissima	Tree of Heaven	Invasive	2	Invasive	52
Elaeagnus umbellata	Autumn Olive	Invasive	2,3,4	Invasive	52
Celastrus orbiculatus	Oriental Bittersweet	Invasive	3,4	Invasive	50
Berberis thungbergii	Japanese Barberry	Invasive	3,4	Invasive	50
Frangula alnus	Glossy Buckthorn	Invasive	3,4	Invasive	49
Lonicera japonica	Japanese Honeysuckle	Invasive	3,4	Invasive	48
Microstegium vimineum	Japanese Stiltgrass	Invasive	3,4	Invasive	48
Alliaria petiolata	Garlic Mustard	Invasive	2,3,4	Invasive	48
Pyrus calleryana	Callery Pear	Invasive	3,4	Invasive	45
Rosa multiflora	Multiflora Rose	Invasive	2,3,4	Pending Review	44
Rhamnus cathartica	Common Buckthorn	Go to Step II		Pending Review	43
Euonymus alatus	Winged Euonymus	Invasive	3,4	Pending Review	41
Arctium minus	Common Burdock	Go to Step II		Pending Review	41
Persicaria perfoliata	Mile-a-minute Weed	Invasive	1,3,4	Pending Review	40
Ampelopsis brevipedunculata	Porcelainberry	Go to Step II		Pending Review	40
Acer platanoides	Norway Maple	Invasive	3,4	Pending Review	40
Ligustrum vulgare	European Privet	Go to Step II		Pending Review	39
Euonymus fortunei	Wintercreeper	Invasive	3,4	Pending Review	39
Polygonum cespitosum	Oriental Ladysthumb	Go to Step II		Pending Review	39
Plantago major	Broadleaf Plantain	Go to Step II		Pending Review	37
Ipomoea purpurea	Tall Morningglory	Go to Step II		Pending Review	36
Hedera helix	English Ivy	Invasive	2,3,4	Pending Review	36

Morus alba	White Mulberry	Go to Step II		Pending Review	36
Ligustrum obtusifolium	Border Privet	Invasive	3,4	Pending Review	35
Ligustrum sinense	Chinese Privet	Go to Step II		Pending Review	35
Pastinaca sativa	Wild Parsnip	Invasive	1	Not Invasive	34
Veronica officinalis	Common Gypsyweed	Go to Step II		Not Invasive	34
Paulownia tomentosa	Princess Tree	Go to Step II		Not Invasive	31
Ligustrum japonicum	Japanese Privet	Go to Step II		Not Invasive	31
Taraxacum officinale	Dandelion	Go to Step II		Not Invasive	28
Ulmus pumila	Siberian Elm	Go to Step II		Not Invasive	28
Catalpa speciosa	Northern Catalpa	Go to Step II		Not Invasive	26
Maclura pomifera	Osage Oragne	Go to Step II		Not Invasive	26
Barbarea vulgaris	Bittercress	Go to Step II		Not Invasive	25
Acer campestre	Hedge Maple	Go to Step II		Insuficient Data	21 (4U)
Acer ginnala	Amur Maple	Go to Step II		Insuficient Data	19 (4U)
Ligustrum ovalifolium	California Privet	Go to Step II		Insuficient Data	15 (4U)
Liriope muscari	Lilyturf	Go to Step II		Insuficient Data	5 (8U)

Table 3. The determinations 39 nonnative species received from the Ohio Invasive Plant Assessment (OIPA) and the Australian Weed Risk Assessment (AWRA). The determinations for the OIPA were taken from the results that included both Steps I and II.

Species	OIPA Determination	AWRA Determination
Acer campestre	Insufficient Data	Invasive
Acer ginnala	Insufficient Data	Invasive
Acer platanoides	Invasive	Invasive
Ailanthus altissima	Invasive	Invasive
Alliaria petiolata	Invasive	Invasive
Ampelopsis brevipedunculata	Pending Further Review	Invasive
Arctium minus	Pending Further Review	Invasive
Barbarea vulgaris	Not Invasive	Invasive
Berberis thungbergii	Invasive	Invasive
Catalpa speciosa	Not Invasive	Invasive
Celastrus orbiculatus	Invasive	Invasive
Elaeagnus umbellate	Invasive	Invasive
Euonymus alatus	Invasive	Invasive
Euonymus fortunei	Invasive	Invasive
Frangula alnus	Invasive	Invasive
Hedera helix	Invasive	Invasive
Ipomoea purpurea	Pending Further Review	Invasive
Ligustrum japonicum	Not Invasive	Invasive
Ligustrum obtusifolium	Invasive	Invasive
Ligustrum ovalifolium	Insufficient Data	Invasive
Ligustrum sinense	Pending Further Review	Invasive
Ligustrum vulgare	Pending Further Review	Invasive
Liriope muscari	Insufficient Data	Invasive
Lonicera japonica	Invasive	Invasive
Lonicera maackii	Invasive	Invasive
Maclura pomifera	Not Invasive	Invasive
Microstegium vimineum	Invasive	Invasive
Morus alba	Pending Further Review	Invasive
Pastinaca sativa	Invasive	Invasive

Paulownia tomentosa	Not Invasive	Invasive
Perisicaria perfoliata	Invasive	Invasive
Plantago major	Pending Further Review	Invasive
Polygonum cespitosum	Pending Further Review	Invasive
Pyrus calleryana	Invasive	Invasive
Rhamnus cathartica	Pending Further Review	Invasive
Rosa multiflora	Invasive	Invasive
Taraxacum officinale	Not Invasive	Invasive
Ulmus pumila	Not Invasive	Invasive
Veronica officinalis	Not Invasive	Invasive

Table 4. The scores and ranks for 35 nonnative species using the Ohio Invasive Plant Assessment (OIPA) and the Australian Weed Risk Assessment (AWRA). The OIPA only provides point allocation for Step II questions.

Species Latin Name	OIPA score	OIPA rank	AWRA score	AWRA rank
Lonicera maackii	56	1	24	16
Ailanthus altissima	52	2.5	25	12
Elaeagnus umbellata	52	2.5	23	20
Celastrus orbiculatus	50	4.5	31	4
Berberis thungbergii	50	4.5	25	12
Frangula alnus	49	6	28	6.5
Lonicera japonica	48	8	32	2
Microstegium vimineum	48	8	32	2
Alliaria petiolata	48	8	23	20
Pyrus calleryana	45	10	16	33
Rosa multiflora	44	11	28	6.5
Rhamnus cathartica	43	12	32	2
Euonymus alatus	41	13.5	22	22.5
Arctium minus	41	13.5	19	28.5
Perisicaria perfoliata	40	16	29	5
Ampelopsis brevipedunculata	40	16	21	25
Acer platanoides	40	16	17	32
Ligustrum vulgare	39	19	24	16
Euonymus fortunei	39	19	22	22.5
Polygonum cespitosum	39	19	20	27
Plantago major	37	21	25	12
Ipomoea purpurea	36	23	27	8.5
Hedera helix	36	23	24	16
Morus alba	36	23	19	28.5
Ligustrum obtusifolium	35	25.5	24	16
Ligustrum sinense	35	25.5	24	16
Pastinaca sativa	34	27.5	26	10
Veronica officinalis	34	27.5	18	30.5
Paulownia tomentosa	31	29.5	21	25
Ligustrum japonicum	31	29.5	13	34.5
Taraxacum officinale	28	31.5	23	20
Ulmus pumila	28	31.5	21	25
Catalpa speciosa	26	33.5	13	34.5
Maclura pomifera	26	33.5		30.5
Barbarea vulgaris	25	35	27	8.5

Chapter 3: Synthesis

The aim of my thesis research was to learn more about the role ornamental gardening plays in introducing invasive plants to Southwestern Ohio forests along an urban-rural gradient. Forests were sampled to identify which nonnative species were currently present, and risk assessments were conducted to differentiate between the invasive and noninvasive species. Eighteen of the 39 nonnative species documented in the forests were identified as being invasion risks by both assessments. Invasion patterns along the urban-rural gradient were analyzed, and the number of invasive, ornamentally introduced species was found to increase as urbanization intensified ($t = 5.37$, Std. Error = 0.04929, $p = 5.45e\text{-}05$) but the proportion of invasive species with ornamental origins declined as population density ($t = -4.251$, Std. Error = 0.1785, $p = 0.000946$) and impervious surface ($r_s = -0.557827$, $p = 0.03071$) increased.

This study shows that when deciding on how to allocate management resources between different control measures for invasive plants, it behooves forest managers to engage constructively with their communities to help educate gardeners on how their choices can impact their surrounding environment. Fourteen of the 18 invasive species had ornamental origins, but in terms of all of the nonnative species observed, the proportion of nonnative species that were determined invasive was not strongly associated with the ornamental gardening pathway when analyzed with a Fisher's Exact test ($p = 0.714$, $CI_{95\%} = 0.30 – 9.56$). In essence, when one looks at the pool of nonnative species observed with ornamental origins in this case study, the proportion that were determined invasive is approximately 50% (14 out of 27 species). This implies that having ornamental origins does not necessarily make a species more likely to be invasive, but that the ornamental pathway is creating a larger pool of species that enter the introduction phase of the invasion process, at least in the region examined in our investigation. In other words, this study supports the idea that plant invasion success can be due in part to ornamental gardening because of its association with providing a disproportionately large number of species to the introduction phase of the invasion process when compared to other pathways (Mack and Lonsdale, 2001; Mack and Erneberg, 2002; Dehnen-Schmutz, 2011; Pyšek *et al.* 2011). Following the Williamson's tens rule (Williamson and

Fitter, 1996), the more species that enter the introduction phase, the more species will become invasive. By spending time engaging the local community and discussing the merits of different ornamental plants based on their invasion risk, land managers can potentially reduce the number of nonnative species they have to control and also increase people's willingness to pay for control efforts (Adams *et al.* 2011). If nonnative plants popularized for ornamental gardening are selected based on their inability to overcome hurdles present at each stage of the invasion process, the proportion of introduced nonnatives that have the potential to become invasive will also be reduced (Simberloff, 2006; Dehnen-Schmutz, 2011). In addition, researchers working on engineering popular invasive plants to eliminate their ability to spread, as through the creation of sterile cultivars, could help reduce the number of invasive species entering forests, although more efforts are needed to ensure plant sterility (Knight *et al.* 2011).

In addition to the local community, engagement with the nursery owners and plant growers is essential. Those in the horticultural community have been connecting natural science and human interest in plant cultivation for centuries, and have a depth of knowledge concerning successful ornamental species. There is evidence that many residential gardeners and professional horticulturalists are interested in taking steps to transform the ornamental gardening pathway to lessen its importance as a means for invasive species introductions, but research involving social elements in invasive species management and control is lacking (Reichard and White, 2001; Renz *et al.* 2009; Drew *et al.* 2010; Kapler *et al.* 2012). For example, a survey conducted in Iowa found that 87% of 200 master gardener respondents would rather buy plants from a retailer who has used an invasive plant risk assessment, and more than a majority would be willing to pay more if they knew a retailer had processed their plants through a risk assessment (Kapler *et al.* 2012). A survey of Minnesotan horticultural professionals indicated that a majority of nurserymen and plant retailers consider invasive plant species a very important issue, and there was a willingness to label potentially invasive plants and educate customers (Peters *et al.* 2006). More research into identifying people's perceptions about invasive species, and how different social and political factors impact public selection of ornamental plants could contribute to building more effective educational

programing and awareness campaigns. Management success can be rely greatly on stakeholder attitudes and opinions concerning what management actions are acceptable (Peters *et al.* 2006; Kapler *et al.* 2012).

This study also indicates that a concerted effort to engage rural communities in sustainable gardening practices could be one of the most efficient ways to reduce the number of nonnative plant species from entering those areas. The four forests surrounded by lowest population densities in this study contained a total of six species both risk assessments determined invasion risks, and they were all of ornamental origins. A focused effort on creating a dialogue with these communities could be an important factor in keeping the number of invasive species in these areas' forests low. One possible way to engage and educate gardeners is through the use of invasive plant risk assessments. When the Ohio Invasive Plant Council publishes the results of their risk assessments to the public, an outreach program using the Ohio Invasive Plant Assessment as a platform could provide a constructive framework to communicate important information about how and why ornamental species can become invasive. Because the Ohio Invasive Plant Assessment is a collaboration between academic, governmental, and horticultural fields, the public may view it as a more credible and transparent process (Kapler *et al.* 2012). Efforts in engaging urban gardeners will also be essential in reducing the number of invasive species reaching urban forests, but this study indicates that focusing on other routes of introductions needs to be addressed in a more concerted way. As urbanization increases, it will be important to identify the key routes of introduction in these areas. More research into developing pathway management to reduce the introduction on nonnative species through unintentional means will become essential, if native plant species are to remain an important part of the urban flora (Pyšek *et al.* 2011). While it is unlikely that every invasive plant species can be kept from a region's natural areas, diminishing their numbers by modifying the ornamental pathway with input from all stakeholders could bring a meaningful reduction on the impact on our natural areas' biodiversity, and provide more time to develop the tools needs for control.

Literature Cited

Adams, D.C., Bwenge, A.N., Lee, D.J., Larkin, S.L. and Alavalapati, J.R.R. (2011) Public preference for controlling upland invasive plants in state parks: Application of a choice model. *Forest Policy and Economics* 13: 465-472.

Dehnen-Schmutz, K. (2011) Determining non-invasiveness in ornamental plants to build green lists. *Journal of Applied Ecology* 48: 1374-1380.

Drew, J., Anderson, N. and Andow, D. (2010) Conundrums of a complex vector for invasive species control: a detailed examination of the horticultural industry. *Biological Invasions* 12: 2837-2851.

Kapler, E.J., Thompson, J.R. and Widrlechner, M.P. (2012) Assessing Stakeholder Perspecitives on Invasive Plants to Inform Risk Analysis. *Invasive Plant Science and Management* 5: 194-208.

Knight, T.M., Havens, K. and Vitt, P. (2011) Will the Use of Less Fecund Cultivars Reduce the Invasiveness of Perennial Plants? *BioScience* 61: 816-822.

Mack, R. N. and Erneberg, M. (2002) The United States Naturalized Flora: Largely the Product of Deliberate Introductions. *Annals of the Missouri Botanical Garden* 89(2): 176-189.

Mack, R.N. and Lonsdale, W.M. (2001) Humans as Global Plant Dispersers: Getting More Than We Bargained For. *Bioscience* 51(2): 95-102.

Peters, W.L., Meyer, M.H. and Anderson, N.O. (2006) Minnesota horticulture industry survey on invasive plants. *Euphytica* 248: 75-86.

Pyšek, P., Jarošík, B. and Pergl, J. (2011) Alien Plants Introduced by Different Pathways Differ in Invasion Success: Unintentional Introductions as a Threat to Natural Areas. *PLoS ONE* 6(9): e24890

Reichard, S.H. and White, P. (2001) Horticulture as a pathway of invasive plant introductions in the United States. *BioScience* 51**:** 103-113.

Renz, M., Gibson, K.D., Hillmer, J., Howe, K.M., Waller, D.M. and Cardina, J. (2009) Land Manager and Researcher Perspectives on Invasive Plant Research Needs in the Midwestern United States. *Invasive Plant Science and Management* 2: 83-91

Simberloff, D. (2006) Risk Assessments, Blacklists, and White Lists for Introduced Species: Are Predictions Good Enough to Be Useful? *Agricultural and Resource Economics Review* 35: 1-10.

Williamson, M. and Fitter, A. (1996) The varying success of invaders. *Ecology* 77: 1661-1666.

Appendix I: Species lists for 15 different forests in Southwestern Ohio. The lists are the result of forest sampling conducted in 2012. Sampling dates follow the forest names.

Brush Creek State Forest, 8-8-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
4-leaf Cleavers	*Galium circaezans*	Japanese Honeysuckle	*Lonicera japonica*
6-leaf cleavers	*Galium aparine*	Multiflora Rose	*Rosa multiflora*
Ash	*Fraxinus americana*		
Aster	*Aster spp.*		
Avens	*Geum spp.*		
Beech	*Fagus grandifolia*	**BRU Species Richness Totals**	
Black Cherry	*Prunus serotina*	Total	48
Black Snakeroot	*Sanicula odorata*		
Blackjack Oak	*Quercus marilandica*	Natives	46
Bosc's Panicgrass	*Dichanthelium boscii*	Nonnatives	2
Bracken Fern	*Pteridium aquilinum*		
Bramble	*Rubus spp.*	Ornamental	2
Cherry Birch	*Betchula lenta*	Nonornatmental	0
Common Cinquafoil	*Potentilla simplex*		
Dittany	*Cunila origanoides*		
False Solomon's Seal	*Smilacina racemosa*		
Flowering Dogwood	*Cornus florida*		
Goldenrod	*Solidago spp.*		
Grape	*Vitus spp.*		
Grass	*Poaceae*		
Green Briar	*Smilax hispida*		
Hog Peanut	*Amphicarpaea bracteata*		
Largeflower Bellwort	*Uvularia grandiflora*		
Low Blueberry	*Vaccinium vacillans*		
Nutsedge	*Cyperus esculentus*		
Ohio Buckeye	*Aesculus glabra*		
Paw Paw	*Asimina triloba*		
Poison Ivy	*Toxicodendron radicans*		
Pokeweed	*Phytolacca americana*		
Red Maple	*Acer rubrum*		
Red Oak	*Quercus rubra*		
Redbud	*Cercis canadensis*		
Sassafras	*Sassafras albidum*		
Shagbark Hickory	*Carya ovata*		
Spicebush	*Lindera benzoin*		
Sugar Maple	*Acer saccharum*		
Swamp White Oak	*Quercus bicolor*		
Sweet Gum	*Liquidambar styraciflua*		
Tulip Poplar	*Liriodendron tulipifera*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
White Oak	*Quercus alba*		
White Snakeroot	*Ageratina altissima*		
Whorled Loosestrife	*Lysimachia quadrifolia*		
Yellow Wood Sorrel	*Oxalis stricta*		

Buttercup Nature Preserve, 7-9-12			
Native Common Name	***Native Latin Name***	**Nonnative Common Name**	***Nonnative Latin Name***
6-leaf Cleavers	*Galium aparine*	Amur Honeysuckle	*Lonicera maackii*
American Bell Flower	*Campanulastrum americanum*	Big Blue Lilyturf	*Liriope muscari*
Arrowwood Viburnum	*Viburnum dentatum*	Chinese Privet	*Ligustrum sinense*
Ash	*Fraxinus americana*	English Ivy	*Hedera helix*
Aster	*Aster spp.*	Garlic Mustard	*Allaria petiolata*
Avens	*Geum spp.*	Great Burdock	*Arctium lappa*
Beech	*Fagus grandifolia*	Japanese Barberry	*Berberis thunbergii*
Black Cherry	*Prunus serotina*	Catalpa	*Catalpa speciosa*
Black Snakeroot	*Sanicula odorata*	Multiflora Rose	*Rosa multiflora*
Black Walnut	*Juglans nigra*	Porcelainberry	*Ampelopsis brevipedunculata*
Boxelder	*Acer negundo*	Oriental Ladysthumb	*Polygonum cespitosum*
Bramble	*Rubus spp.*	Tree of Heaven	*Ailanthus altissima*
Chinkapin Oak	*Quercus muehlenbergii*	Winged Euonymus	*Euonymus alatus*
Clearweed	*Pilea pumila*	Wintercreeper	*Euonymus fortunei*
Devil's Walking Stick	*Aralia spinosa*		
Grape	*Vitus spp.*	**BUT Species Richness Totals**	
Grass	*Poaceae*	Total	59
Green Briar	*Smilax hispida*		
Hackberry	*Celtis occidentalis*	Natives	45
Hairy Wood Mint	*Blephilia hirsuta*	Nonnatives	14
Hoary Mockorange	*Philadelphus pubescens*		
Honewort	*Cryptotaenia canadensis*	Ornamental	11
Honeylocust	*Gleditsia triacanthos*	Nonornatmental	3
Ironwood	*Ostrya virginiana*		
Jewelweed	*Impatiens capensis*		
Ohio Buckeye	*Aesculus glabra*		
Paw Paw	*Asimina triloba*		
Philidelphia fleabane	*Erigeron philadelphicus*		
Pignut Hickory	*Carya glabra*		
Poison Ivy	*Toxicodendron radicans*		
Pokeweed	*Phytolacca americana*		
Redbud	*Cercis canadensis*		
Sassafrass	*Sassafras albidum*		
Shagbark Hickory	*Carya ovata*		
Silver Maple	*Acer saccharinum*		
Stickseed	*Hackelia virginiana*		
Sugar Maple	*Acer saccharum*		
Tulip Tree	*Liriodendron tulipifera*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
Washington Hawthorn	*Crataegus phaenopyrum*		
White Snakeroot	*Ageratina altissima*		
Wild Crabapple	*Pyrus coronaria*		
Wild Strawberry	*Fragaria virginiana*		

California Woods Nature Preserve, 7-11-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
American Bellflower	*Campanulastrum americanum*	Amur Honeysuckle	*Lonicera maackii*
Ash	*Fraxinus americana*	Garlic Mustard	*Allaria petiolata*
Aster	*Aster spp.*	Japanese Honeysuckle	*Lonicera japonica*
Beech	*Fagus grandifolia*	Japanese Stiltgrass	*Microstegium vimineum*
Beggar's ticks	*Bidens discoidea*	Mile-a-minute Weed	*Polygonum perfoliatum*
Black Cherry	*Prunus serotina*	Norway Maple	*Acer platanoides*
Black Locust	*Robinia pseudoacacia*	Oriental Bittersweet	*Celastrus orbiculatus*
Black Snakeroot	*Sanicula odorata*	Oriental Ladysthumb	*Polygonum cespitosum*
Boxelder	*Acer negundo*	Tree of Heaven	*Ailanthus altissima*
Celandine poppy	*Stylophorum diphyllum*	Winged Euonymus	*Euonymus alatus*
Clearweed	*Pilea pumila*	Wintercreeper	*Euonymus fortunei*
Downy Juneberry	*Amelanchier arborea*		
Dwarf Larkspur	*Delphinium tricorne*		
Grape	*Vitus spp.*	**CAL Species Richness Totals**	
Grass	*Poaceae*	Total	53
Green Briar	*Smilax hispida*		
Hackberry	*Celtis occidentalis*	Natives	42
Lowland Bladderfern	*Cystopteris protrusa*	Nonnatives	11
Nimblewill	*Muhlenbergia schreberi*		
Northern Red Oak	*Quercus rubra*	Ornamental	7
Ohio Buckeye	*Aesculus glabra*	Nonornatmental	4
Ohio Spiderwort	*Tradescantia ohiensis*		
Paw Paw	*Asimina triloba*		
Pignut Hickory	*Carya glabra*		
Poison Ivy	*Toxicodendron radicans*		
Pokeweed	*Phytolacca americana*		
Slippery Elm	*Ulmus rubra*		
Solomon Seal	*Polygonatum biflorum*		
Spicebush	*Lindera benzoin*		
Stickseed	*Hackelia virginiana*		
Stinging Nettle	*Urtica dioica*		
Sugar Maple	*Acer saccharum*		
Sycamore	*Platanus occidentalis*		
Trillium	*Trillium spp.*		
Tulip Poplar	*Liriodendron tulipifera*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
Walnut	*Juglans nigra*		
White Snakeroot	*Ageratina altissima*		
Wild Strawberry	*Fragaria virginiana*		
Winged Monkeyflower	*Mimulus alatus*		

Embshoff Woods, 7-13-12			
Natives; Common Name	***Natives; Latin Name***	**Nonnatives: Common Name**	***Nonnatives: Latin Name***
6-leaf Cleavers	*Galium aparine*	Amur Honeysuckle	*Lonicera maackii*
Ash	*Fraxinus americana*	Autumn Olive	*Elaeagnus umbellata*
Big-leaf Avens	*Geum macrophyllum*	Broadleaf Plantain	*Plantago major*
Beggar's Ticks	*Bidens discoidea*	Common Burdock	*Arctium munus*
Black Cherry	*Prunus serotina*	Garlic Mustard	*Allaria petiolata*
Black Rapsberry	*Rubus occidentalis*	Japanese honeysuckle	*Lonicera japonica*
Black Snakeroot	*Sanicula odorata*	Osage Orange	*Maclura pomifera*
Boxelder	*Acer negundo*	Mile-a-minute weed	*Persicaria perfoliata*
Choke cherry	*Prunus virginiana*	Multiflora rose	*Rosa multiflora*
Common Wingstem	*Verbesina alternifolia*	Oriental Bittersweet	*Celastrus orbiculatus*
Enchanter's Nightshade	*Circaea lutetiana*	Oriental Lady's thumb	*Polygonum cespitosum*
Giant ragweed	*Ambrosia trifida*	Porcelainberry	*Ampelopsis brevipedunculata*
Goldenrod	*Solidago spp.*	Common Privet	*Ligustrum vulgare*
Grape	*Vitus spp.*	Tree of Heaven	*Ailanthus altissima*
Grass	*Poaceae*	Wild Parsnip	*Pastinaca sativa*
Hackberry	*Celtis occidentalis*	Wintercreeper	*Euonymus fortunei*
Hawthorn	*Crataegus spp.*		
Honewort	*Cryptotaenia canadensis*		
Honeylocust	*Gleditsia triancanthos*		
Red Mulberry	*Morus rubra*	**Species Richness Totals**	
Nimblewill	*Muhlenbergia schreberi*	Total	59
Ohio Buckeye	*Aesculus glabra*		
Paw Paw	*Asimina triloba*	Natives	43
Poison Ivy	*Toxicodendron radicans*	Nonnatives	16
Pokeweed	*Phytolacca americana*		
Red Cedar	*Juniperus virginiana*	Ornamental	9
Red maple	*Acer rubrum*	Nonornatmental	7
Self-heal	*Prunella vulgaris*		
Shagbark Hickory	*Carya ovata*		
Slippery Elm	*Ulmus rubra*		
Redroot Pigweed	*Amaranthus retroflexus*		
Stickseed	*Hackelia virginiana*		
Sugar Maple	*Acer saccharum*		
Sweetgum	*Liquidambar styraciflua*		
Sycamore	*Platanus occidentalis*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
Walnut	*Juglans nigra*		
White Snakeroot	*Ageratina altissima*		
White Wood Aster	*Eurybia divaricata*		
Wild Strawberry	*Fragaria virginiana*		
Yellow Wood Sorrel	*Oxalis stricta*		

Farbach-Werner Nature Preserve, 7-17-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
6-leaf Cleavers	*Galium aparine*	Amur Honeysuckle	*Lonicera maackii*
Agrimony	*Agrimonia parviflora*	Broadleaf Plantain	*Plantago major*
Am. Cranberry Bush	*Viburnum trilobum*	Callery Pear	*Pyrus calleryana*
American Elm	*Ulmus americana*	Common Burdock	*Arctium munus*
Arrowwood Viburnum	*Viburnum dentatum*	Garlic Mustard	*Allaria petiolata*
Ash	*Fraxinus americana*	Japanese Barberry	*Berberis thunbergii*
Aster	*Aster spp.*	Japanese Honeysuckle	*Lonicera japonica*
Beech	*Fagus grandifolia*	Multiflora Rose	*Rosa multiflora*
Beggar's ticks	*Bidens discoidea*	Oriental Ladysthumb	*Polygonum cespitosum*
Big-leaf Avens	*Geum macrophyllum*	Winged Euonymus	*Euonymus alatus*
Black Cherry	*Prunus serotina*	Wintercreeper	*Euonymus fortunei*
Black Locust	*Robinia pseudoacacia*		
Black Raspberry	*Rubus occidentalis*	**Species Richness Totals**	
Black Snakeroot	*Sanicula odorata*	Total	72
Blackjack Oak	*Quercus marilandica*		
Bladdernut	*Staphylea trifolia*	Natives	61
Boxelder	*Acer negundo*	Nonnatives	11
Brambles	*Rubus spp.*		
Chinkapin Oak	*Quercus muehlenbergii*	Ornamental	7
Clearweed	*Pilea pumila*	Nonornatmental	4
Common Milkweed	*Asclepias syriaca*		
Eastern Wahoo	*Euonymus atropurpureus* Jacq. var. *atropurpureus*		
Enchanter's Nightshade	*Circaea lutetiana*		
Flowering Dogwood	*Cornus florida*		
Goldenrod	*Solidago spp.*		
Grape	*Vitus spp.*		
Grass	*Poaceae*		
Hackberry	*Celtis occidentalis*		
Ironweed	*Vernonia gigantea*		
Monkeyflower	*Mimulus ringens*		
Nimblewill	*Muhlenbergia schreberi*		
Nutsedge	*Cyperus esculentus*		
Paw Paw	*Asimina triloba*		
Pignut Hickory	*Carya glabra*		
Pin Oak	*Quercus palustris*		
Poison Ivy	*Toxicodendron radicans*		
Pokeweed	*Phytolacca americana*		
Ragweed	*Ambrosia artemisiifolia*		
Red Cedar	*Juniperus virginiana*		
Red Maple	*Acer rubrum*		
Red Mulberry	*Morus rubra*		
Red Oak	*Quercus rubra*		
Redbud	*Cercis canadensis*		
Sassafrass	*Sassafras albidum*		
Self-heal	*Prunella vulgaris*		
Slippery Elm	*Ulmus rubra*		
Solomon Seal	*Polygonatum biflorum*		
Spicebush	*Lindera benzoin*		
Stickseed	*Hackelia virginiana*		
Sugar Maple	*Acer saccharum*		
Sycamore	*Platanus occidentalis*		
Tulip Poplar	*Liriodendron tulipifera*		
Violets	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
Walnut	*Juglans nigra*		
White Snakeroot	*Ageratina altissima*		
Wild Ginger	*Asarum canadense*		
Wild Strawberry	*Fragaria virginiana*		
Woodland Stonecrop	*Sedum ternatum*		
Yellow Wood Sorrel	*Oxalis stricta*		

Ft. Ancient State Memorial Forest, 7-23-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
4-leaf Cleavers	*Galium circaezans*	Amur Honeysuckle	*Lonicera maackii*
6-leaf Cleavers	*Galium aparine*	Autumn Olive	*Elaeagnus umbellata*
Ash	*Fraxinus americana*	Japanese Honeysuckle	*Lonicera japonica*
Aster	*Aster spp.*	Japanese Privet	*Ligustrum japonicum*
Avens	*Geum spp.*	Mulitflora Rose	*Rosa multiflora*
Beech	*Fraxinus americana*		
Beggar's ticks	*Bidens disoidea*		
Black Cherry	*Prunus serotina*	**Unknowns**	
Black Snakeroot	*Sanicula odorata*	Chinese Yam	
Blackberry	*Rubus allegheniensia*	Hairy Unknown Herb (HUH)	
Bracken Fern	*Pteridium aquilinum*	Unknown Herb 1 (UH1)	
Bosc's Panicgrass	*Dichanthelium boscii*	Unknown Herb 4 (UH4)	
Common Cinquefoil	*Potentilla simplex*		
Downy Juneberry	*Amelanchier arborea*	**FTA Species Richness Totals**	
Field Thistle	*Cirsium discolor*	Total	55
Flowering Dogwood	*Cornus florida*		
Goldenrod	*Solidago spp.*	Natives	46
Grape	*Vitus spp.*	Nonnatives	5
Grass	*Poaceaea*		
Hog Peanut	*Amphicarpaea bracteata*	Ornamental	5
Mockernut Hickory	*Carya alba*	Nonornatmental	0
Paw Paw	*Asimina triloba*	Unknowns	4
Poison Ivy	*Toxicodendron radicans*		
Red Cedar	*Juniperus virginiana*		
Red Maple	*Acer rubrum*		
Red Oak	*Quercus rubra*		
Redbud	*Cercis canadensis*		
Sassafras	*Sassafras albidum*		
Self-heal	*Prunella vulgaris*		
Slippery Elm	*Ulmus rubra*		
Solomons Seal	*Polygonatum biflorum*		
Stickseed	*Hackelia virginiana*		
Sugar Maple	*Acer saccharum*		
Swamp White Oak	*Quercus bicolor*		
Tulip Poplar	*Liriodendron tulipifera*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
Virginia Mountain Mint	*Pycnanthemum virginianum*		
White Oak	*Quercus alba*		
White Snakeroot	*Ageratina altissima*		
White Wood Aster	*Eurybia divaricata*		
Wild Strawberry	*Fragaria virginiana*		
Woman's Tobacco	*Antennaria plantaginifolia*		
Yellow Wood Sorrel	*Oxalis stricta*		
Zigzag Goldenrod	*Solidago flexicaulis*		

Ft. Hill State Memorial Forest, 8-7-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
4-leaf Cleavers	*Galium circaezans*	Japanese Privet	*Ligustrum japonicum*
6-leaf Cleavers	*Galium aparine*	Siberian Elm	*Ulmus pumila*
American Bellflower	*Campanulastrum americanum*	Wintercreeper	*Euonymus fortunei*
American Hornbeam	*Carpinus caroliniana*		
Ash	*Fraxinus americana*		
Aster	*Aster spp.*		
Avens	*Geum spp.*	**FTH Species Richness Totals**	
Beech	*Fagus grandifolia*	Total	57
Black Cherry	*Prunus serotina*		
Black Cohosh	*Cimicifuga racemosa*	Natives	54
Black Snakeroot	*Sanicula odorata*	Nonnatives	3
Boxelder	*Acer negundo*		
Bracken Fern	*Pteridium aquilinum*	Ornamental	3
Bramble	*Rubus spp.*	Nonornatmental	0
Cherry Birch	*Betchula lenta*		
Clearweed	*Pilea pumila*		
Common Cinquefoil	*Potentilla simplex*		
Downey Juneberry	*Amelanchier arborea*		
Flowering Dogwood	*Cornus florida*		
Grape	*Vitus spp.*		
Grass	*Poaceae*		
Greenbriar	*Smilax hispida*		
Hogpeanut	*Amphicarpaea bracteata*		
Indian Cucumber Root	*Medeola virginiana*		
Jewelweed	*Impatiens capensis*		
Largeflower Bellwort	*Uvularia grandiflora*		
Maidenhair Fern	*Adiantum capillus-veneris*		
Mapleleaf Viburnum	*Viburnum acerifolium*		
Nimblewill	*Muhlenbergia schreberi*		
Nutsedge	*Cyperus esculentus*		
Ohio Buckeye	*Aesculus glabra*		
Partridge Berry	*Mitchella repens*		
Paw Paw	*Asimina triloba*		
Pennsylvania Smartweed	*Polygonum pensylvanicum*		
Pignut Hickory	*Carya glabra*		
Poison Ivy	*Toxicodendron radicans*		
Red Maple	*Acer rubrum*		
Red Oak	*Quercus rubra*		
Sassafras	*Sassifras albidum*		
Shagbark Hickory	*Carya ovata*		
Solidago	*Solidago spp.*		
Solomon Seal	*Polygonatum biflorum*		
Spicebush	*Lindera benzoin*		
Sugar Maple	*Acer saccharum*		
Swamp White Oak	*Quercus bicolor*		
Tall Rattlesnake-Root	*Prenanthes altissima*		
Tulip Poplar	*Liriodendron tulipifera*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
White Oak	*Quercus alba*		
White Snakeroot	*Ageratina altissima*		
White Wood Aster	*Eurybia divaricata*		
Wild Ginger	*Asarum canadense*		
Yellow Wood Sorrel	*Oxalis stricta*		

Miami Whitewater Forest, 7-25-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
4-leaf Cleavers	*Galium circaezans*	Amur Honeysuckle	*Lonicera maackii*
6-leaf Cleavers	*Galium aparine*	Autumn Olive	*Elaeagnus umbellata*
Ash	*Fraxinus americana*	Callery Pear	*Pyrus calleryana*
Aster	*Aster spp.*	Common Privet	*Ligustrum vulgare*
Beggar's ticks	*Bidens discoidea*	Garlic Mustard	*Allaria petiolata*
Big-leaf Avens	*Geum macrophyllum*	Muliflora Rose	*Rosa multiflora*
Black Cherry	*Prunus serotina*	Oriental Ladysthumb	*Polygonum cespitosum*
Black Snakeroot	*Sanicula odorata*	Wintercreeper	*Euonymus fortunei*
Boxelder	*Acer negundo*		
Bramble	*Rubus spp.*		
Bristly Greenbriar	*Smilax hispida*	**Species Richness Totals**	
Butternut	*Juglans cinerea*	Total	54
Clearweed	*Pilea pumila*		
Downey Juneberry	*Amelanchier arborea*	Natives	46
Flowering Dogwood	*Cornus florida*	Nonnatives	8
Gooseberry	*Ribes cynosbati*		
Grape	*Vitus spp.*	Ornamental	6
Grass	*Poaceae*	Nonornatmental	2
Hackberry	*Celtis occidentalis*		
Heartleaf Skullcap	*Scutellaria ovata*		
Honewort	*Cryptotaenia canadensis*		
Jacob's Ladder	*Polemonium reptans*		
Mockernut Hickory	*Carya alba*		
Paw Paw	*Asimina triloba*		
Poison Ivy	*Toxicodendron radicans*		
Red Oak	*Quercus rubra*		
Redbud	*Cercis canadensis*		
Round-leaf Ragwort	*Packera obovata*		
Sassafras	*Sassafras albidum*		
Self Heal	*Prunella vulgaris*		
Shagbark Hickory	*Carya ovata*		
Slippery Elm	*Ulmus rubra*		
Solomon Seal	*Polygonatum biflorum*		
Spicebush	*Lindera benzoin*		
Stickseed	*Hackelia virginiana*		
Sugar Maple	*Acer saccharum*		
Tall Rattlesnakeroot	*Prenanthes altissima*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
White Oak	*Quercus alba*		
White Snakeroot	*Ageratina altissima*		
Wild Ginger	*Asarum canadense*		
Wild Strawberry	*Fragaria virginiana*		
Woodland Stonecrop	*Setum ternatum*		
Yellow Wood Sorrel	*Oxalis stricta*		

Mitchell Memorial Forest, 8-3-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
6-leaf Cleavers	*Galium aparine*	Amur Honeysuckle	*Lonicera maackii*
American Bellflower	*Campanulastrum americanum*	Autumn Olive	*Elaeagnus umbellata*
American Hornbeam	*Carpinus caroliniana*	Garlic Mustard	*Alliaria petiolata*
Ash	*Fraxinus americana*	Japanese Barberry	*Berberis thunbergii*
Aster	*Aster spp.*	Japanese Honeysuckle	*Lonicera japonica*
Avens	*Geum spp.*	Multiflora Rose	*Rosa multiflora*
Black Cherry	*Prunus serotina*	Oriental Ladysthumb	*Polygonum cespitosum*
Black Snakeroot	*Sanicula odorata*	Japanese Privet	*Ligustrum japonicum*
Boxelder	*Acer negundo*	Wintercreeper	*Euonymus fortunei*
Bracken Fern	*Pteridium aquilinum*	Bittercress	*Barbarea vulgaris*
Brambles	*Rubus spp.*		
Chinkapin Oak	*Quercus muehlenbergii*		
Clearweed	*Pilea pumila*	**Species Richness Totals**	
Downey Juneberry	*Amelanchier arborea*	Total	49
Grape	*Vitus spp.*		
Grass	*Poaceae*	Natives	39
Greenbriar	*Smilax hispida*	Nonnatives	10
Hackberry	*Celtis occidentalis*		
Honeylocust	*Gleditisia triacanthos*	Ornamental	7
Nutsedge	*Cyperus esculentus*	Nonornatmental	3
Paw Paw	*Asimina triloba*		
Poison Ivy	*Toxicodendron radicans*		
Red Cedar	*Juniperus virginiana*		
Red Oak	*Quercus rubra*		
Sassifras	*Sassifras albidum*		
Self-heal	*Prunella vulgaris*		
Shagbark Hickory	*Carya ovata*		
Slippery Elm	*Ulmus rubra*		
Spicebush	*Lindera benzoin*		
Stickseed	*Hackelia virginiana*		
Sugar Maple	*Acer saccharum*		
Swamp White Oak	*Quercus bicolor*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
Walnut	*Juglans nigra*		
White Pine	*Pinus strobus*		
White Snakeroot	*Ageratina altissima*		
Wild Strawberry	*Fragaria virginiana*		
Yellow Wood Sorrel	*Oxalis stricta*		

Mt. Airy Forest, 7-6-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
4-leaf Cleavers	*Galium circaezans*	Amur Honeysuckle	*Lonicera maackii*
6-leaf Cleavers	*Galium aparine*	Broadleaf Plantain	*Plantago major*
American Bell Flower	*Campanulastrum americanum*	Dandelion	*Taraxacum officianale*
Ash	*Fraxinus americana*	Garlic Mustard	*Alliaria petiolata*
Avens	*Geum spp.*	Hedge Maple	*Acer campestre*
Black Cherry	*Prunus serotina*	Japanese Barberry	*Berberis thunbergii*
Black Locust	*Robinia pseudoacacia*	Japanese Honeysucke	*Lonicera japonica*
Black Snakeroot	*Sanicula odorata*	Multiflora Rose	*Rosa multiflora*
Boxelder	*Acer negundo*	Oriental Ladysthumb	*Polygonum cespitosum*
Brambles	*Rubus spp.*	Winged Euonymus	*Euonymus alatus*
Chinkapin Oak	*Quercus marilandica*	Wintercreeper	*Euonymus fortunei*
Clearweed	*Pilea pumila*		
Cottonwood	*Populus deltoides*		
Grape	*Vitus spp.*	**MTA Species Richness Totals**	
Grass	*Poaceae*	Total	51
Green Briar	*Smilax hispida*		
Hackberry	*Celtis occidentalis*	Natives	40
Honewort	*Cryptotaenia canadensis*	Nonnatives	11
Honeylocust	*Gleditisia triacanthos*		
Nimblewill	*Muhlenbergia schreberi*	Ornamental	7
Nutsedge	*Cyperus esculentus*	Nonornatmental	4
Pignut Hickory	*Carya glabra*		
Poison Ivy	*Toxicodendron radicans*		
Red Mulberry	*Morus rubra*		
Red Oak	*Quercus rubra*		
Shagbark Hickory	*Carya ovata*		
Slippery Elm	*Ulmus rubra*		
Solidago	*Solidago spp.*		
Solomons Seal	*Polygonatum biflorum*		
Spanish Needles	*Bidens bipinnata*		
Spicebush	*Lindera benzoin*		
Stickseed	*Hackelia virginiana*		
Sugar Maple	*Acer saccharum*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
White Snakeroot	*Ageratina altissima*		
Wild Ginger	*Asarum canadense*		
Wild Strawberry	*Fragaria virginiana*		
Woodland Stonecrop	*Sedum ternatum*		

Newberry Wildlife Preserve, 8-1-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
Ash	*Fraxinus americana*	Amur Honeysuckle	*Lonicera maackii*
Avens	*Geum spp.*	Autumn Olive	*Elaeagnus umbellata*
Basswood	*Tilia americana*	Callery Pear	*Pyrus calleriana*
Beggar's ticks	*Bidens discoidea*	English Ivy	*Hedera helix*
Black Cherry	*Prunus serotina*	Garlic Mustard	*Alliaria petiolata*
Black Locust	*Robinia pseudoacacia*	Wintercreeper	*Euonymus fortunei*
Boxelder	*Acer negundo*		
Clearweed	*Pilea pumila*		
Downy Juneberry	*Amelanchier arborea*	**Species Richness Totals**	
Flowering Dogwood	*Cornus florida*	Total	39
Grape	*Vitus spp.*		
Grass	*Poaceae*	Natives	33
Hackberry	*Celtis occidentalis*	Nonnatives	6
Nutsedge	*Cyperus esculentus*		
Ohio Buckeye	*Aesculus glabra*	Ornamental	5
Paw Paw	*Asimina triloba*	Nonornatmental	1
Pennsylvania Smartweed	*Polygonum pensylvanium*		
Pignut Hickory	*Carya glabra*		
Red Maple	*Acer rubrum*		
Redbud	*Cercis canadensis*		
Self-heal	*Prunella vulgaris*		
Shagbark Hickory	*Carya ovata*		
Slippery Elm	*Ulmus rubra*		
Spicebush	*Lindera benzoin*		
Stickseed	*Hackelia virginiana*		
Sugar Maple	*Acer saccharum*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
Walnut	*Juglans nigra*		
White Snakeroot	*Ageratina altissima*		
Wild Strawberry	*Fragaria virginiana*		
Woodland Stonecrop	*Sedum ternatum*		
Yellow Wood Sorrel	*Oxalis stricta*		

Richardson Forest Preserve, 8-2-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
6-leaf Cleavers	*Galium aparine*	Amur Honeysuckle	*Lonicera maackii*
American Bellflower	*Campanulastrum americanum*	Callery Pear	*Pyrus calleriana*
Ash	*Fraxinus americana*	Garlic Mustard	*Alliaria petiolata*
Aster	*Aster spp.*	Multiflora Rose	*Rosa multiflora*
Avens	*Geum spp.*	Winged Euonymus	*Euonymus alatus*
Black Cherry	*Prunus serotina*	Wintercreeper	*Euonymus fortunei*
Black Locust	*Robinia pseudoacacia*		
Black Snakeroot	*Sanicula odorata*		
Black Walnut	*Juglans nigra*		
Boxelder	*Acer negundo*	**Unknowns**	
Brambles	*Rubus spp.*	Unknown Herb 1	
Bristly Greenbriar	*Smilax hispida*		
Clearweed	*Pilea pumila*		
Downy Yellow Violet	*Viola pubescens*	**Species Richness Totals**	
Grass	*Poaceae*	Total	46
Hackberry	*Celtis occidentalis*		
Hepatica	*Hepatica nobilis*	Natives	39
Hog Peanut	*Amphicarpaea bracteata*	Nonnatives	6
Honewort	*Cryptotaenia canadensis*		
Honeylocust	*Gleditisia triacanthos*	Ornamental	5
Ohio Buckeye	*Aesculus glabra*	Nonornatmental	1
Paw Paw	*Asimina triloba*	Unknowns	1
Pignut Hickory	*Carya glabra*		
Poison Ivy	*Toxicodendron radicans*		
Red Maple	*Acer rubrum*		
Self-heal	*Prunessa vulgaris*		
Shagbark Hickory	*Carya ovata*		
Slippery Elm	*Ulmus rubra*		
Solomon Seal	*Polygonatum biflorum*		
Spicebush	*Lindera benzoin*		
Sugar Maple	*Acer saccharum*		
Swamp White Oak	*Quercus bicolor*		
Sycamore	*Platanus occidentalis*		
Trumpet Creeper	*Campsis radicans*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
White Snakeroot	*Ageratina altissiam*		
Wild Ginger	*Asarum canadense*		

Sharon Woods, 7-27-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
4-leaf Cleavers	*Galium circaezans*	Amur Honeysuckle	*Lonicera maackii*
6-leaf Cleavers	*Galium aparine*	Amur Maple	*Acer glinala*
American Hornbeam	*Carpinus caroliniana*	Garlic Mustard	*Allaria petiolata*
Aster	*Aster spp.*	Japanese Honeysuckle	*Lonicera japonica*
Big-leaf Avens	*Geum macrophyllum*	Multiflora Rose	*Rosa multiflora*
Black Cherry	*Prunus serotina*	Oriental Ladysthumb	*Polygonum cespitosum*
Black Cohosh	*Cimicifuga racemosa*	Winged Euonymus	*Euonymus alatus*
Black Snakeroot	*Sanicula odorata*	Wintercreeper	*Euonymus fortunei*
Boxelder	*Acer negundo*		
Bramble	*Rubus spp.*		
Chinkapin Oak	*Quercus muehlenbergii*	**Unknowns**	
Clearweed	*Pilea pumila*	Unknown Herb 1 (UH1)(see pic)	
Downy Juneberry	*Amelanchier arborea*		
Enchanter's Nightshade	*Circaea lutetiana*	**Species Richness Totals**	
Flowering Dogwood	*Cornus florida*	Total	52
Grape	*Vitus spp.*		
Green Briar	*Smilax rotundifolia*	Natives	43
Hackberry	*Celtis occidentalis*	Nonnatives	8
Honewort	*Cryptotaenia canadensis*		
Jewelweed	*Impatiens capensis*	Ornamental	6
Largeflower Bellwort	*Uvularia grandiflora*	Nonornatmental	2
Nutsedge	*Cyperus esculentus*	Unknowns	1
Ohio Buckeye	*Aesculus glabra*		
Paw Paw	*Asimina triloba*		
Pignut Hickory	*Carya glabra*		
Poison Ivy	*Toxicodendron radicans*		
Red Mulberry	*Morus rubra*		
Northern Red Oak	*Quercus rubra*		
Redbud	*Cercis canadensis*		
Shagbark Hickory	*Carya ovata*		
Slippery Elm	*Ulmus rubra*		
Solomon Seal	*Polygonatum biflorum*		
Spicebush	*Lindera benzoin*		
Stickseed	*Hackelia virginiana*		
Sugar Maple	*Acer saccharum*		
Swamp White Oak	*Quercus bicolor*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
Walnut	*Juglans nigra*		
White Ash	*Fraxinus americana*		
White Snakeroot	*Ageratina altissima*		
Yellow Wood Sorrel	*Oxalis stricta*		

Tranquility Wildlife Area, 8-9-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
4-leaf Cleavers	*Galium circaezans*	Amur Honeysuckle	*Lonicera maackii*
6-leaf Cleavers	*Galium aparine*	Autumn Olive	*Elaeagnus ubellata*
Ash	*Fraxinus americana*	California Privet	*Ligustrum ovalifolium*
Aster	*Aster spp.*	Common Buckthorn	*Rhamnus cathartica*
Avens	*Geum spp.*	Common Gypsyweed	*Veronica officinalis*
Beech	*Fagus grandifolia*	Tall Morningglory	*Ipomoea purpurea*
Black Cherry	*Prunus serotina*	Japanese Barberry	*Berberis thunbergii*
Black Locust	*Robinium pseudoacacia*	Japanese Honeysuckle	*Lonicera japonica*
Black Snakeroot	*Sanicula odorata*	Multiflora Rose	*Rosa multiflora*
Blackjack Oak	*Quercus marilandica*		
Bosc's Panicgrass	*Dichanthelium boscii*		
Brambles	*Rubus spp.*	**TRA Species Richness Totals**	
Carolina Buckthorn	*Frangula caroliniana*	Total	70
Cherry Birch	*Betchula lenta*		
Cut-leaved Grape Fern	*Botrychium dissectum*	Natives	61
Eastern Wahoo	*Euonymus atropurpureus*	Nonnatives	9
Flowering Dogwood	*Cornus florida*		
Gladefern	*Athyrium pycnocarpon*	Ornamental	8
Golden ragwort	*Packera aurea*	Nonornatmental	1
Grape	*Vitus spp.*		
Grass	*Poaceae*		
Green Briar	*Smilax hispida*		
Hogpeanut	*Amphicarpaea bracteata*		
Honewort	*Cryptotaenia canadensis*		
Largeflower Bellwort	*Uvularia grandiflora*		
Leatherwood	*Dirca palustris*		
Mockernut Hickory	*Carya alba*		
Nimblewill	*Muhlenbergia schreberi*		
Nutsedge	*Cyperus esculentus*		
Partridge Berry	*Mitchella ripens*		
Paw Paw	*Asimina triloba*		
Philidelphia Fleabane	*Erigeron philadelphicus*		
Poison Ivy	*Toxicodendron radicans*		
Rattlesnake-Plantain	*Goodyera pubescens*		
Red Cedar	*Juniperus virginiana*		
Red Oak	*Quercus rubra*		
Redbud	*Cercis canadensis*		
Rosepink	*Sabatia angularis*		
Rusty Blackhaw	*Viburnum rufidulum*		
Sassafras	*Sassafras albidum*		
Self-heal	*Prunella vulgaris*		
Slippery Elm	*Ulmus rubra*		
Solomon's Seal	*Polygonatum biflorum*		
Spicebush	*Lindera benzoin*		
Striped Pipsissiwa	*Chimaphila maculata*		
Sugar Maple	*Acer saccharum*		
Swamp White Oak	*Quercus bicolor*		
Trumpet Creeper	*Campsis radicans*		
Tulip Poplar	*Liriodendron tulipifera*		
Umbrella Magnolia	*Magnolia tripetala*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
White Oak	*Quercus alba*		
White Snakeroot	*Ageratina altissima*		
White Wood Aster	*Eurybia divaricata*		
Whorled Loosestrife	*Lysimachia quadrifolia*		
Wild Ginger	*Asarum canadense*		
Wild Strawberry	*Frageria virginiana*		
Woman's Tobacco	*Antennaria plantaginifolia*		
Yellow Wood Sorrel	*Oxalis stricta*		

Withrow Nature Preserve, 7-18-12			
Native Common Names	***Native Species Name***	**Nonnative Common Name**	***Nonnative Species Name***
4-leaf Cleavers	*Galium circaezans*	Amur Honeysuckle	*Lonicera maackii*
6-leave Cleavers	*Galium aparine*	Common Privet	*Ligustrum vulgare*
American Bellflower	*Campanulastrum americanum*	Garlic Mustard	*Allaria petiolata*
Ash	*Fraxinus americana*	Japanese Honeysuckle	*Lonicera japonica*
Beech	*Fagus grandifolia*	Multiflora Rose	*Rosa multiflora*
Big-leaf Avens	*Geum macrophyllum*	Oriental Bittersweet	*Celastrus orbiculatus*
Black Cherry	*Prunus serotina*	Oriental Ladysthumb	*Polygonum cespitosum*
Black Raspberry	*Rubus occidentalis*	Tree of Heaven	*Ailanthus altissima*
Black Snakeroot	*Sanicula odorata*	Winged Euonymus	*Euonymus alatus*
Boxelder	*Acer negundo*	Wintercreeper	*Euonymus fortunei*
Bramble	*Rubus spp.*		
Bristly Greenbriar	*Smilax hispida*		
Clearweed	*Pilea pumila*	**Species Richness Totals**	
Flowering Dogwood	*Cornus florida*	Total	56
Grape	*Vitus spp.*		
Grass	*Poaceae*	Natives	46
Hackberry	*Celtis occidentalis*	Nonnatives	10
Ironweed	*Vernonia altissima*		
Jewelweed	*Impatiens capensis*	Ornamental	8
Leaf-cup	*Polymnia canadensis*	Nonornatmental	2
Nutsedge	*Cyperus esculentus*		
Ohio Buckeye	*Aesculus glabra*		
Paw Paw	*Asimina triloba*		
Pignut Hickory	*Carya glabra*		
Poison Ivy	*Toxicodendron radicans*		
Pokeweed	*Phytolacca americana*		
Ragweed	*Ambrosia artemisiifolia*		
Red Mulberry	*Morus rubra*		
Red Oak	*Quercus rubra*		
Redroot Pigweed	*Amaranthus retroflexus*		
Slippery Elm	*Ulmus rubra*		
Solidago	*Solidago spp.*		
Solomon Seal	*Polygonatum biflorum*		
Spicebush	*Lindera benzoin*		
Stickseed	*Hackelia virginiana*		
Sugar Maple	*Acer saccharum*		
Swamp White Oak	*Quercus bicolor*		
Tulip Poplar	*Liriodendron tulipifera*		
Violet	*Viola spp.*		
Virginia Creeper	*Parthenocissus quinquefolia*		
Virginia Knotweed	*Polygonum virginianum*		
White Baneberry	*Acyaea pachypoda*		
White Snakeroot	*Ageratina altissima*		
Wild Ginger	*Asarum canadense*		
Wild Strawberry	*Fragaria virginiana*		
Yellow Wood Sorrel	*Oxalis stricta*		

Appendix II: Identifying whether 39 nonnative species have ornamental origins.

Nonnative Common Name	***Nonnative Latin Name***	**Ornamental Origin?**	**Reference**
Hedge Maple	*Acer campestre*	Y	1
Amur Maple	*Acer glinala*	Y	2
Norway Maple	*Acer platanoides*	Y	3
Tree of Heaven	*Ailanthus altissima*	Y	4
Garlic Mustard	*Allaria petiolata*	N	5
Porcelainberry	*Ampelopsis brevipedunculata*	Y	6
Common Burdock	*Arctium minus*	N	7
Yellow Rocket	*Barbarea vulgaris*	N	8
Japanese Barberry	*Berberis thunbergii*	Y	9
Catalpa	*Catalpa speciosa*	Y	31
Oriental Bittersweet	*Celastrus orbiculatus*	Y	10
Autumn Olive	*Elaeagnus umbellata*	Y	11
Winged Euonymus	*Euonymus alatus*	Y	12
Wintercreeper	*Euonymus fortunei*	Y	12
Glossy buckthorn	*Frangula alnus*	Y	13
English Ivy	*Hedera helix*	Y	14
Tall Morning Glory	*Ipomoea purpurea*	Y	15
Japanese Privet	*Ligustrum japonicum*	Y	16
Border Privet	*Ligustrum obtusifolium*	Y	16
California Privet	*Ligustrum ovalifolium*	Y	16
Chinese Privet	*Ligustrum sinense*	Y	16
Common Privet	*Ligustrum vulgare*	Y	16
Big Blue Lilyturf	*Liriope muscari*	Y	17
Japanese Honeysuckle	*Lonicera japonica*	Y	18
Amur Honeysuckle	*Lonicera maackii*	Y	19
Osage Orange	*Maclura pomifera*	N	32
Japanese Stiltgrass	*Microstegium vimineum*	N	20
White Mulberry	*Morus alba*	Y	21
Wild Parsnip	*Pastinaca sativa*	N	22
Princess tree	*Paulownia tomentosa*	Y	23
Mile-a-minute weed	*Persicaria perfoliata*	N	24
Broad leaf Plantain	*Plantago major*	N	25
Oriental Ladysthumb	*Polygonum cespitosum*	N	26
Callery Pear	*Pyrus calleryana*	Y	27
Common Buckthorn	*Rhamnus cathartica*	Y	28
Multiflora Rose	*Rosa multiflora*	Y	12
Dandelion	*Taraxacum officianale*	N	29
Siberian Elm	*Ulmus pumila*	Y	12
Common Gypsyweed	*Veronica officinalis*	N	30

Reference Number	Reference Details
1	Ornamental qualities outlined by many gardening websites. Here is one example: http://woodyplants.mannlib.cornell.edu/details.php?id=7. Accessed 10-3-12.
2	North Dakota Tree Information Center - ND Tree Handbook. Amur Maple (*Acer ginnala*). http://www.ag.ndsu.edu/trees/handbook/th-3-85.pdf. Accessed 10-3-12
3	Munger, Gregory T. 2003. Acer platanoides. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, March 19].
4	Feret, P.F., R.L. Bryant and J.A. Ramsey (1974) Genetic variation among american seed sources of Ailanthus altissima. *Scientia Horticulture* 2: 405-411.
5	Rodgers, V.L., K.A. Stinson and A.C. Finzi (2008)Ready or not, Garlic Mustard is Moving In: *Alliaria petiolata* as a Member of Eastern North American Forests. *BioScience* 58(5): 426-436.
6	Waggy, Melissa A. 2009. Ampelopsis brevipedunculata. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, October 4].
7	Gross, R.S., P.A. Werner and W. R. Hawthorn (1980) The biology of canadian weeds. 38. Actium minus and Arctium lappa. *Canadian Journal of Plant Science* 60: 621-634.
8	MacDonald, M. A. and Cavers, P. B. 1991. The biology of Canadian weeds. 97. Barbarea vulgaris. *Canadian Journal of Plant Science* 79: 149-166
9	Lubell, J.D. and M.H. Brand (2011) Germination, growth and survival of *Berberis thunbergii* and *Berberis thunbergii* var. *atropurpurea* in five natural environments. *Biological Invasions* 13:135-141.
10	Lett, C.N., L.E. DeWald, and J. Horton (2011) Mycorrhizae and soil phosphorus affect growth of *Celastrus orbiculatu. Biological Invasions* 13: 2339-2350.
11	Catling, P.M., M.J. Oldham, D.A. Sutherland, V.R. Brownell, and B.M.H. Larson (1997) The recent spread of Aurumn-olive, *Elaeagnus umbellata*, into southern Ontario and its current status. *Canadian Field-Naturalist* 111(3): 376-380.

12	Dirr, M.A. (1998) *Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses.* (5th ed.) Champaign, IL: Stipes Pbulishing L.L.C.
13	Gucker, Corey L. 2008. Frangula alnus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, March 19].
14	Dlugosch, K.M. (2005) Understory Community Changes Associated with English Ivy Invasions in Seattle's Urban Parks. *Northwest Science* 79(1): 53-60.
15	Halvorson, W.L. and Guertin, P. (2003) USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. Factsheet for: *Ipomoea purpurea*. http://sdrsnet.srnr.arizona.edu/data/sdrs/ww/docs/ipom_spp.pdf. Accessed 10-3-12.
16	Maddox, V., Byrd, J.Jr. and Serviss, B. (2010) Identification and Control of Invasive Privets (*Ligustrum* spp.) in the Middle Southern United States. *Invasive Plant Science and Management* 3(4): 482-488.
17	USDA Germplasm Resources Information Network (GRIN), http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?410578, accessed 11-14-12.
18	Schierenbeck, K.A. (2004) Japanese Honeysuckle (*Lonicera japonica*) as an Invasive Species; History, Ecology and Context. *Critical Reviews in Plant Sciences* 23(5): 391-400.
19	Luken, J.O. and J.W. Thieret (1996) Amur Honeysuckle, Its Fall from Grace. *BioScience* 46(1): 18-24.
20	Huebner, C.D. (2011) Seed Mass, Viability, and Germination of Japanese Stiltgrass (*Microstegium vimineum*) under Variable Light and Moisture Conditions. *Invasive Plant Science and Management.* 4: 274-283.
21	Stone, Katharine R. 2009. Morus alba. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, March 19].

22	N. Cain, S Darbyshire, A. Francis, R Nurse, M Simard . The Biology of Canadian weeds. 144. Pastinaca sativa L.. *Canadian Journal of Plant Science*, Volume 90, Number 2 (January 2010), pp. 217-240, <http://ejournals.ebsco.com/direct.asp?ArticleID=499BB87A370158F9BB14>
23	Innes, Robin J. 2009. Paulownia tomentosa. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, March 19].
24	Stone, Katharine R. 2010. Polygonum perfoliatum. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, October 3].
25	Hawthorn, W.R. (1974) The biology of Canadian weeds. 4. Plantago major and P. rugelii *Canadian Journal of Plant Science* 54:383-396.
26	Matesanz S, Horgan-Kobelski T, Sultan SE (2012) Phenotypic Plasticity and Population Differentiation in an Ongoing Species Invasion. PLoS ONE 7(9): e44955. doi:10.1371/journal.pone.0044955
27	Culley, T.M. and N.A. Hardiman (2007) The Beginning of a New Invasive Plant: A History of the Ornamental Callery Pear in the United States. *BioScience* 57(11): 956-964.
28	Knight, K.S., J.S. Kurylo, A.G. Endress, J.R. Stewart, and P.B. Reich (2007) Ecology and ecosystem impacts of common buckthorn (*Rhamnus cathartica*):a review. *Biological Invasions* 9(8): 925-937.
29	Invasive Species Project, Columbia University. Project Editor and Page Author: James Danoff-Burg http://www.columbia.edu/itc/cerc/danoff-burg/invasion_bio/inv_spp_summ/Taraxum_officinale.htm. Accessed 10-3-12.
30	Jordan, M.J., G. Moore and T.W. Weldy. 2008. Invasiveness ranking system for non-native plants of New York. Unpublished. The Nature Conservancy, Cold Spring Harbor, NY; Brooklyn Botanic Garden, Brooklyn, NY; The Nature Conservancy, Albany, NY. http://www.nyis.info/user_uploads/3ffa5_Veronica.officinalis.NYS.pdf. Accessed 10-3-12

31	Ohio Division of Natural Resources, http://ohiodnr.com/forestry/trees/catalpa_nthrn/tabid/5349/Default.aspx. Accessed 6-19-13
32	Smith, J.L. and Perino, J.V. (1981) Osage Orange (*Maclura pomifera*): History and Economic Uses. *Economic Botany*35(1): 24-41.

Appendix III: Templates for the Australian Weed Risk Assessment (AWAR) and the Ohio Invasive Plants Assessment.

Modified A-WAR Form B

Botanical Name:		Outcome:	
Common Name:		Score:	
Family Name:		Your name: Allison Mastalerz	

History/Biogeography				
A	1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	
C		1.02	Has the species become naturalised where grown	
C		1.03	Does the species have weedy races	
	2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zones in the 5b, 6a & 6b?[a]	
		2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	
C		2.03	Broad climate suitability (environmental versatility)[b]	
C		2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	
		2.05	Does the species have history of repeated introductions outside its natural range	
C	3 *Weed elsewhere*	3.01	Naturalised beyond native range	
E		3.02	Garden/amenity/disturbance weed	
A		3.03	Weed of agriculture/horticulture/forestry	
E		3.04	Environmental weed	
		3.05	Congeneric weed	
Biology/Ecology				
A	4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	
C		4.02	Allelopathic	
C		4.03	Parasitic	
A		4.04	Unpalatable to grazing animals	
C		4.05	Toxic to animals	
C		4.06	Host for recognised pests and pathogens	
C		4.07	Causes allergies or is otherwise toxic to humans	
E		4.08	Creates a fire hazard in natural ecosystems	
E		4.09	Is a shade tolerant plant at some stage of its life cycle	
E		4.10	Grows on any soil order representing >5% cover in Ohio.[d]	
E		4.11	Climbing or smothering growth habitat	
E		4.12	Forms dense thickets	
E	5 *Plant type*	5.01	Aquatic	
C		5.02	Grass	
E		5.03	Nitrogen fixing woody plant	
E		5.04	Geophyte	
C	6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	
C		6.02	Produces viable seed	
C		6.03	Hybridizes naturally	
C		6.04	Self-fertilization	
C		6.05	Requires specialist pollinators	
C		6.06	Reproduction by vegetative propagation	
C		6.07	Minimum generative time (years)	
A	7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	
C		7.02	Propagules dispersed intentionally by people	
A		7.03	Propagules likely to disperse as a produce contaminant	
C		7.04	Propagules adapted to wind dispersal	
E		7.05	Propagules buoyant	
E		7.06	Propagules bird dispered	
C		7.07	Propagules dispersed by other animals (externally)	
C		7.08	Propagules dispersed by other animals (internally)	
C	8 *Persistence attributes*	8.01	Prolific seed production	
A		8.02	Evidence that a persistent propagule bank is formed (>1 yr)	
A		8.03	Well controlled by herbicides	
C		8.04	Tolerates or benefits from mutilation, cultivation, or fire	
E		8.05	Effective natural enemies present in Ohio	

	Total Score:
A=agricultural	Outcome:
E=environmental	Agricultural Score:
C=combined	Environmental Score:
	Minimum ?s per section
	A 1.01-3.05 (2?s)
	B 4.01-4.12 (2 ?s)
	C 5.01-8.05 (6?s)

a =Data from USDA Hardiness zones map (http://planthardiness.ars.usda.gov/PHZMWeb/) compared to distribution map on USDA PLANT database (http://plants.usda.gov/java/)

b = distribution occurs in at least climactic regions in the Koppen-Geiger climate classification scheme (http://webmap.ornl.gov/wcsdown/wcsdown.jsp?dg_id=10012_1), using the distribution map on USDA PLANT database (http://plants.usda.gov/java/)

c= compare national atlas map (http://www.nationalatlas.gov/mapmaker) with USDA PLANT database (http://plants.usda.gov/java/)

d =compare University of Idaho's "Dominant Soils Map" (http://soils.cals.uidaho.edu/soilorders/i/USsoilorders.jpg) with USDA PLANT database (http://plants.usda.gov)

Ohio Invasive Plant Assessment Protocol

Botanical Name:			
Common Name:			
Family Name:			

1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?	☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.
	☐ No. Continue on to question 2.
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]	☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.
	☐ No. Continue on to question 3.
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?	☐ Yes.
	☐ No.
	☐ Unknown.
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]	☐ Yes.
	☐ No.
	☐ Unknown.

If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II

Step II: Invasion Status

1. Current Invasion in Ohio
□ plant is not found in natural areas (0 pts.)
□ plant is found in natural areas but only because it persists from previous planting in that location (e.g. old home sites) (0 pts.)
□ plant is only expanding from sites of previous planting (1 pts.)
□ plant occurs in natural areas away from sit of planting (3 pts.)
□ Information unknown (U)
2. State Distribution[a]
□ plant is not naturalized in any region of Ohio (0 pts.)
□ plant is naturalized in only one region in Ohio (1 pts.)

□ plant is naturalized in two regions in Ohio (2 pts.)
□ plant is naturalized in three regions in Ohio (3 pts.)
□ plant is naturalized in four regions in Ohio (4 pts.)
□ plant is naturalized in five regions in Ohio (5 pts.)
□ Information unknown (U)
3. Regional/US Distribution
□ plant is not considered to be a problem in any other state (0 pts.)
□ plant has been reported as a widespread problem in another non-neighboring state within the USDA Plant Hardiness Zones 5-6 (1 pts.) (1 pts.)
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)
□ plant has been reported to be a widespread problem in similar habitat outside the US (1 pts.)
□ Information unknown (U)
Step II: Biological Characters
4. Vegetative Reproduction
□ no vegetative reproduction (0 pts.)
□ reproduces readily within the original site (1 pts.)
□ has runners or spreading rhizomes that root easily (3 pts.)
□ fragments easily and fragments can be easily dispersed (4 pts.)
□ has runners or spreading rhizomes that root easily AND fragments easily and fragments can be easily dispersed (5 pts.)
□ Information unknown (U)
5. Sexual Reproduction
□ no sexual reproduction (0 pts.)
□ infrequent sexual reproduction (1 pts.)
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)
□ frequent sexual reproduction (one or more events per year) (5 pts.)
□ Information unknown (U)
6. Number of Viable Seeds or Propagules per Plant
□ few (0-10) (1 pts.)
□ moderate (11-1,000) (3 pts.)
□ prolific (>1,000) (5 pts.)
□ Information unknown (U)
7. Flowering Period
□ one month or less per year (0 pts.)
□ two months(1 pts.)
□ three to five months (2 pts.)
□ longer than five months (3 pts.)
□ Information unknown (U)
8. Dispersal Ability
□ low potential for long-distance seed/propagule dispersal (>1km) (0 pts.)
□ medium potential for long-distance seed/propagule dispersal (3 pts.)

□ high potential for long-distance seed/propagule dispersal (5 pts.)
□ Information unknown (U)
9. Generation Time
□ long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (0 pts.)
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)
□ Information unknown (U)
10. Establishment
□ unable to invade natural areas (0 pts.)
□ can only colonize certain habitat stages (e.g. early successional habitats) (1 pts.)
□ aggressively colonizes and establishes in edge habitats (3 pts.)
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)
□ Information unknown (U)
Step II: Ecological Importance
11. Impact on Ecosystem Processes
□ no known effect on ecosystem-level processes (0 pts.)
□ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)
□ causes long-term, substantial alterations in the ecosystem (e.g., changing fire regime of an area, changing hydrology of wetlands) (5 pts.)
12. Impact on Rare Organisms
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)
□ negatively impacts listed species, such as through displacement or interbreeding (3 pts.)
13. Impact on Native Animals
□ no known negative impact on animals (0 pts.)
□ documented direct or indirect negative effects on animal taxa (3 pts.)
14. Impact on Native Plants
□ no known negative effects on native plants (0 pts.)
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)
□ impacts native plants to such an extent that community structure is greatly altered (5 pts.)
15. Hybridiztaion
□ no known instances of hybridization with other plant species (0 pts.)
□ can hybridize with native Ohio plants or commercially-available species, but seeds are inviable (1 pts.)
□ can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.)
16. Population Density
□ occurs only as small, sporadic populations or individuals (1 pts.)
□ typically forms small, monospecific patches (3 pts.)
□ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)
□ forms an extensive, monospecific stand (absolute cover >50%) (5 pts.)
17. Role in Succession in Natural Areas
□ successional information is unknown (0 pts.)
□ is an early successional species that temporarily invades a disturbed site but does not persist as the site matures (0 pts.)

□ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)
□ readily invades disturbed sites, persists and interferes with succession of native plants (3 pts.)
18. Number of Habitats Invaded
Forestlands: Floodplain forest, hemlock-hardwood forest, mixed mesophytic forest, beech-maple forest, oak-maple forest, oak-hickory forest. ***Grasslands:*** Alvar*, beach-dune community*, bur oak savanna*, slough-grass-bluejoint prairie*, sand barren*, big bluestem prairie, little bluestem prairie (xeric limestone prairie*+), post oak opening*+ ***Wetlands:*** Bog*, fen*, twigrush-wiregrass wet prairie*, marsh, buttonbush swamp, mixed shrub swamp, hemlock-hardwood swamp*, maple-ash-oak swamp, white pine-red maple swamp* * Considered a rare plant community in Ohio by ODW's Biodiversity Database Program. + = xeric limestone prairies or cedar glades and post oak openings are unique to the Interior Low Plateau Region of Adams, Highland and Pike counties, and are not included in Schneider and Cochrane (1997).
□ not found in any natural habitats in Ohio (0 pts.)
□ only found in 1 broad category (1 pts.)
□ found in 2 broad categories or 2 rare habitat types (3 pts.)
□ found in 3 broad categories or 3 rare habitat types (4 pts.)
□ found in 4 or more rare habitat types (5 pts.)
Total Score

Appendix IV: Completed Individual Ohio Invasive Plant Assessments

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Acer campestre*	Outcome:	Insufficient data (4 unknowns)	**References**	
Common Name:	Hedge Maple	Score:	21		
Family Name:	Aceraceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		□ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		□ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		8	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				U	

□ Information unknown (U)		
2. State Distribution[a]	2	2
□ plant is naturalized in two regions in Ohio (2 pts.)		
3. Regional/US Distribution	0	
□ plant is not considered to be a problem in any other state (0 pts.)		
Step II: Biological Characters	0	No evidence
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	9
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	3	9
□ moderate (11-1,000) (3 pts.)		
7. Flowering Period	0	9
□ one month or less per year (0 pts.)		
8. Dispersal Ability	3	9,10
□ medium potential for long-distance seed/propagule dispersal (3 pts.)		
9. Generation Time	U	10
□ Information unknown (U)		
10. Establishment	U	No evidence
□ Information unknown (U)		
Step II: Ecological Importance	3	8
11. Impact on Ecosystem Processes		
□ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	8
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.)	3	8
16. Population Density □ Information unknown (U)	U	No evidence
17. Role in Succession in Natural Areas □ successional information is unknown (0 pts.)	0	No evidence
18. Number of Habitats Invaded □ only found in 1 broad category (1 pts.)	1	8
Total Score	4 unknown	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/profile?symbol=ACCA5 Accessed 12-7-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.eddmaps.org/distribution/usstate.cfm?sub=12452 Accessed 12-7-12

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 12-7-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 12-7-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm. Accessed on 1-3-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 12-7-12.

7. Germplasm Resources Information Network (GRIN); http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. van Gelderen, D.M., de Jong, P.C. and Oterdoom Maples of the World Ed. Theodore R. Dudley. Portland: Timber Press, 1994.

9. Brand, Mark H. "UCONN Plant Database of trees, shrubs, and vines" http://www.hort.uconn.edu/plants/a/acecam/acecam1.html Accessed 1-10-13

Question # for Step I	Notes for *Acer campestre*
2	Present in low numbers in 2 counties (in 2 different regions of Ohio)
3	Is considered to have allelopathic properties.
4	Not in IN, KY, MI, or PA
Question # for Step II	**Notes for *Acer campestre***
1	Species has been observed in natural areas, but it is unclear how it got there. The plant I observed was in Mt. Airy Forest. It is possible that persists from a previous planting. More information is needed.
4	Plant can be propaged vegetatively, but it is doubtful it reproduces this way in the wild.
5	One event per year. Default answer is 3 points because no information regarding variation among seed production found.
6	Species produces viable seeds. The 3 point answer is selected b.c it is unlikely that the tree produces less than 11 viable seeds per year, but no numeric values were found.
7	May
8	Fruit is a samara and is wind dispersed (default 3 points). Species is actively cultivated, so answer could be modified to reflect its ability to be dispersed by humans into their gardens, where they have been documented to have escaped..
9	Ref. 10 states species is slow growing, but specific generation times were not uncovered.
11	Is considered to have allelopathic properties (ref. 8).
14	Is considered to have allelopathic properties (8).
15	Can hybridize with some other maples.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Acer platanoides*	Outcome:	Pending Further Review	**References**	
Common Name:	Norway Maple	Score:	40		
Family Name:	Aceraceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,8,9	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6,7,9	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				U	1,2,

□ Information unknown (U)		personal observation
2. State Distribution[a]	4	1,2
□ plant is naturalized in four regions in Ohio (4 pts.)		
3. Regional/US Distribution	5	3,5,6
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	0	No evidence
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	9
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	3	9
□ moderate (11-1,000) (3 pts.)		
7. Flowering Period	0	10
□ one month or less per year (0 pts.)		
8. Dispersal Ability	3	9
□ medium potential for long-distance seed/propagule dispersal (3 pts.)		
9. Generation Time	U	
□ Information unknown (U)		
10. Establishment	5	9
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)		
Step II: Ecological Importance	3	8
11. Impact on Ecosystem Processes		
□ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	8
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.)	3	8
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	9
17. Role in Succession in Natural Areas □ readily invades disturbed sites, persists and interferes with succession of native plants (3 pts.)	3	9
18. Number of Habitats Invaded □ only found in 1 broad category (1 pts.)	1	9
Total Score	40	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=ACPL Accessed 1-8-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=3002 Accessed 1-8-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-8-13

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-8-13.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm. Accessed on 1-8-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-8-13.

7. Germplasm Resources Information Network (GRIN); http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. van Gelderen, D.M., de Jong, P.C. and Oterdoom Maples of the World Ed. Theodore R. Dudley. Portland: Timber Press, 1994.

9. Munger, Gregory T. 2003. Acer platanoides. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, January 10].

10. Brand, Mark H. Uconn Plant Database, *Acer platanoides:*http://www.hort.uconn.edu/plants/a/acepla/acepla1.html Accessed 1-10-13

Question # for Step I	Notes for *Acer platanoides*
3	Naturalized in 4 regions of Ohio (1), 5 regions (2). Considered allelopathic (8). It is considered a species with "competitive superiority,…reducing abundance and diversity of native species and alteration of forest community structure (9)"
4	IN, MI, PA, CT
Question # for Step II	**Notes for *Acer platanoides***
1	Species has been observed in natural areas, but it is unclear how it got there. The plant I observed was in California Woods. It is possible that persists from a previous planting. More information is needed.
2	Ref. 2 shows the species in all 5 regions. 4 points was selected to be conservative.
3	IN, MI, PA
4	Plant can be propaged vegetatively, but it is doubtful it reproduces this way in the wild.
5	One event per year. Default answer is 3 points.
6	Species produces viable seeds. The 3 point answer is selected b.c it is unlikely that the tree produces less than 11 viable seeds per year. Species is known for producing abundant seedlings each year. More detailed information could increase the points this question received.
7	April
8	Fruit is a samara and is wind dispersed (Default answer 3 points). Species is actively cultivated, so answer could be modified to reflect its ability to be dispersed by humans into their gardens.
9	Ref. 10 states species is slow growing, but specific generation times were not uncovered.
10	This species is a very good competitor in closed-canopy and forest gap environments. It can suppress regeneration of other species. It has been noted to become a dominant species in some New England forests and has been noted to "be gradually replacing previously dominant oaks."
11	Considered allelopathic (8).
14	Considered allelopathic (8).
15	Can hybridize with other maples.
16	"In a New Jersey Piedmont mixed hardwood forest, Norway maple seedlings reached densities of 40,500 stems/acre (100,000 stems/ha) or 0.9 stems/ft2 (10 stems/m2). Norway maple seedlings and saplings appear to be strong understory competitors beneath native species such as sugar maple."
17	Species is able to become a dominant species in Northeastern forests, displacing native vegetation.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Ailanthus altissima* (Mill.)Swingle	Outcome:	Invasive	References	
Common Name:	Tree-of-Heaven	Score:	52		
Family Name:	Simaroubaceae	Your name: Allison Mastalerz			
Step I: Initial Assessment					
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		13	
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1, 14 & 15	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,3,14,15	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		2,4,13	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**References**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	1,3,6

□ plant occurs in natural areas away from site of planting (3 pts.)		
2. State Distribution[a]	5	3,15
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	4, 5, 6,7,8,9
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters		
4. Vegetative Reproduction	3	9,10,12,13
□ has runners or spreading rhizomes that root easily (3 pts.)		
5. Sexual Reproduction	5	9,10,13
□ frequent sexual reproduction (one or more events per year) (5 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	3,6,7,8,9,10,13
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	1	10,11,13
□ two months(1 pts.)		
8. Dispersal Ability	3	12, 13
□ medium potential for long-distance seed/propagule dispersal (3 pts.)		
9. Generation Time	3	13
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)		
10. Establishment	3	6, 13
□ aggressively colonizes and establishes in edge habitats (3 pts.)		
Step II: Ecological Importance		6, 13,16
11. Impact on Ecosystem Processes	3	
□ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)		
12. Impact on Rare Organisms	0	no evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	no evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	6,7,9,11,12,13,16
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	no evidence
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	9,10, 13
17. Role in Succession in Natural Areas □ readily invades disturbed sites, persists and interferes with succession of native plants (3 pts.)	3	13
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	13
Total Score	52	

References

1. National Invasive Species Information Center, Northern Distribution Map: http://nrs.fs.fed.us/fia/maps/Invasive-maps/tree/webmap_aial.pdf

2. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl

3. The Ohio State University OARDC Extension Ohio Perennial and Biannual Weed Guide: http://www.oardc.ohio-state.edu/weedguide/singlerecord.asp?id=410

4. The Midwest Invasive Plant Network: http://www.mipn.org/Final%20Invasive%20Species.07%20high%20res.pdf

5. Invasive Plant Atlas of the United States: http://www.invasiveplantatlas.org/whereinvasive.html?sub=3003

6. Forest Health - University of Kentucky: www.ca.uky.edu/forestryextension/KWM/Tree%20of%20Heaven.pdf

7. Tree-of-Heaven - Purdue Extension Entomology - Purdue University extension.entm.purdue.edu/caps/pestInfo/treeHeaven.htm

8. Michigan Invasive Plant Species Accounts mnfi.anr.msu.edu/education/factsheets.cfm

9. PCA Alien Plant Working Group - Tree-of-Heaven (Ailanthus altissima) www.nps.gov/plants/alien/fact/aial1.htm

10. USDA Forest Services Silvics Manual vol. 1&2 Agricultural Handbook 654 http://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_2/ailanthus/altissima.htm

11. Tree-of-Heaven Control, Maryland Department of Resources: http://www.naturalresources.umd.edu/Publications/PDFs/Other/TreeOfHeaven.pdf

12. Kowarik, I. (2008). "Water dispersal as an additional pathway to invasions by the primarily wind-dispersed tree Ailanthus altissima". Plant ecology (1385-0237), 198 (2), p. 241.

13. Fryer, Janet L. 2010. Ailanthus altissima. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/
14. USDA Plants Database: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=AIAL
15. Early Detection & Distribution Mapping System, for Tree of Heaven: http://www.invasiveplantatlas.org/subject.html?sub=3003#maps
16. Gómez-Aparicio, L. and Canham, C.D. (2008) Neighbourhood analyses of the allelopathic effects of the invasive tree *Ailanthus altissima* in temperate forests. *Journal of Ecology* 96(3): 447-458.

Question # for Step I	**Notes for *Ailanthus altissima***
1	Tree-of-heaven is classified as a noxious or invasive plant on National Forest System lands
2	1=>Widespread in forests in 3 regions; 14&15=> this species is found naturalized in every county in the state, but number of individuals is not included.
3	This plant forms self-replicated populations outside of cultivation.
4	CT, MA, NH, VT, IN (1 national park), PN (3 national parks), WV (2 national parks)
Question # for Step II	**Notes for *Ailanthus altissima***
3	Indiana, Michigan, Kentucky, Pennsylvania, West Virginia
4	According to 12, it is possible that species can have veg. regrowth after fragments have floated in water (river). According to 13, creates large clonal colonies from roots sending up new stems
5	1 event per year- most seeds are viable.
6	400,000 - 2 million seeds/plant/year
7	2 months in some places (13)
8	Evidence shows that species seeds disperse through wind, water and indirectly by human transportation.

9	1-2 years. Flowering 6 week-old seedlings have been documented.
10	Lack of evidence makes determining if this species will invade intact forests. Some believe it does, others believe it won't.
11	This species is allelopathic. Additionally, species can form dense monocultures leading to crowding-out events that could be considered substantial, but more research needs to be conducted to verify this.
12	Numerous examples of tree-of-heaven displacing plant species, but not specifically threatened or endangered ones.
14	Species is allelopathic. It can form dense monocultures which displace native vegetation. "It may affect natural successional trajectories, in part from competition for light and nutrients in early-successional environments, and possibly from allelopathy. (13)" I believe that the 3 point answer is justified because, while we have evidence of crowding out, there is no clear evidence that the specie *greatly alters* community structure. With more information, it is possible that the answer will increase in points.
15	Lack of positive evidence, therefore the answer is unknown.
16	"Forms dense thickets"
17	See notes for question 13

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Alliaria petiolata*(M. Bieb.) Cavara & Grande	Outcome:	Invasive	**References**	
Common Name:	Garlic Mustard	Score:	48		
Family Name:	Brassicaceae	Your name: Allison Mastalerz			
Step I: Initial Assessment					
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,3,4	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,3,4,10	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		5,6,7,8	
		☐ No.			
		☐ Unknown.			

If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II	Score	References
Step II: Invasion Status		
1. Current Invasion in Ohio	3	1,3,4
□ plant occurs in natural areas away from site of planting (3 pts.)		
2. State Distribution[a]	5	1,3,4
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	5,6,7,8
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters		
4. Vegetative Reproduction	0	9
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	1	9
□ infrequent sexual reproduction (1 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	9,10,11
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	1	9
□ two months(1 pts.)		
8. Dispersal Ability	5	9,10
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	3	9,10,11
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)		
10. Establishment	5	9,10,11
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)		
Step II: Ecological Importance		2,9,10,11
11. Impact on Ecosystem Processes	0	
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	

□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals □ documented direct or indirect negative effects on animal taxa (3 pts.)	3	2,9
14. Impact on Native Plants □ impacts native plants to such an extent that community structure is greatly altered (5 pts.)	5	2, 9,10,11
15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	9
17. Role in Succession in Natural Areas □ successional information is unknown (0 pts.)	0	9
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	9,11
Total Score	48	

References

1. National Invasive Species Information Service: Northern Distribution Map (by Forestry dept.): http://nrs.fs.fed.us/fia/maps/Invasive-maps/herb/webmap_alpe4.pdf Accessed 7-10-12

2. Plant Conservation Alliance: http://www.nps.gov/plants/alien/fact/pdf/alpe1.pdf Accessed 7-10-12

3. USDA Plants Database, distribution in Ohio counties: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=ALPE4 Accessed 7-10-12

4. Early Detection and Distribution Mapping System: http://www.invasiveplantatlas.org/subject.html?sub=3005#maps Accessed 7-10-12

5. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/CAPS/pestInfo/garlicMustard.htm Accessed 7-10-12

6. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed7-10-12

7. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 7-10-12

8. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_010314.pdf. Accessed 7-10-12.

9. Munger, Gregory T. 2001. Alliaria petiolata. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, July 10].

10. Alaska Natural Heritage Program: Nonnative Plant Species Biographies: http://aknhp.uaa.alaska.edu/botany/akepic/non-native-plant-species-biographies/ Accessed 7-10-12.

11. Meekins, J.F. & McCarthy, B.C (1999) Competitive ability of Alliaria petiolata (Garlic Mustard, Brassicasceae), an Invasive Nonindigenous Forest Herb. *International Journal of Plant Sciences* 160(4) pp. 743-752

Question # for Step I	**Notes for *Alliaria petiolata***
2	1,3&4=>widespread distribution in all 5 regions, but population sizes not given.
3	10=>species outcompetes native plants, "alters habitat suitability for native birds, mammals, and amphibians and might affect the populations of these animals.
4	IN, KY, MI,PA
Question # for Step II	**Notes for *Alliaria petiolata***
3	IN, MI, KY, PA
5	This answer seems most appropriate, given that the species is a biennial. There is also variance in the number of seeds observed in individual silique.
6	165-8,000 seeds/plant, estimated seed production (seeds/m^2) for Ohio: 19,060 - 38,025.
7	Early April - Early June
8	Is transported by rodents, birds, deer, and humans.
9	2 years
11	Species is potentially allelopathic, so this answer could increase with more data.
12	No evidence
13	The rare *Pieries virginiensis* (the West Virginia white butterfly) lays eggs on this species. Garlic mustard often "fatally inhibits" larval growth.
14	This species is thought to be a severe threat to many spring ephemerals and the animals that depend on them.
15	No evidence
16	9=>has potential to dominate the herb layer
17	It may alter succession, but more evidence is needed for a positive answer. Can invade mature forests with minimal disturbance.
18	9=>Bluestem prairies, Oak savanna N. floodplain forest , Oak-hickory forests, Ash-Elm forest, Beech-Maple, ; 11=>open fields, inundated mesic communities, forests, dry and sandy forests

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Ampelopsis brevipedunculata*	Outcome:	Pending Further Review	**References**	
Common Name:	Porcelain berry, Amur peppervine	Score:	40		
Family Name:	Vitaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		U	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6,7,8	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**References**
Step II: Invasion Status					

1. Current Invasion in Ohio □ Information unknown (U)	U	1,2
2. State Distribution[a] □ plant is naturalized in three regions in Ohio (3 pts.)	3	1,2
3. Regional/US Distribution □ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)	3	3,7
Step II: Biological Characters 4. Vegetative Reproduction □ has runners or spreading rhizomes that root easily (3 pts.)	3	9,11
5. Sexual Reproduction □ frequent sexual reproduction, but high variation among years in seed production (3 pts.)	3	8,1
6. Number of Viable Seeds or Propagules per Plant □ Information unknown (U)	U	
7. Flowering Period □ three to five months (2 pts.)	2	8,9,10,11
8. Dispersal Ability □ high potential for long-distance seed/propagule dispersal (5 pts.)	5	8
9. Generation Time □ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)	3	10,11
10. Establishment □ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)	5	8
Step II: Ecological Importance 11. Impact on Ecosystem Processes □ no known effect on ecosystem-level processes (0 pts.)	0	No evidence
12. Impact on Rare Organisms □ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)	0	No evidence
13. Impact on Native Animals □ no known negative impact on animals (0 pts.)	0	No evidence
14. Impact on Native Plants	3	8,11

□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		
15. Hybridization	0	No evidence
□ no known instances of hybridization with other plant species (0 pts.)		
16. Population Density	4	8
□ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)		
17. Role in Succession in Natural Areas	3	8
□ readily invades disturbed sites, persists and interferes with succession of native plants (3 pts.)		
18. Number of Habitats Invaded		
□ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	89
Total Score	45	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=AMBR7 Accessed 1-8-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=3007 Accessed 1-8-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-8-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-8-13.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 8-14-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-8-13.

7. Germplasm Resources Information Network: http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?2964 Accessed 1-8-13

8. Waggy, Melissa A. 2009. Ampelopsis brevipedunculata. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, January

9. Del Tredici, P. Wild Urban Plants of the Northeast: A field guide Ithaca, Cornell University Press, 2010

10. Dirr, Michael A. 1998. Manual of woody landscape plants: Their identification, ornamental characteristics, culture, propagation and uses. 5th ed. Champaign, IL: Stipes Publishing. 1187 p. [74836]

11. Woodward, S.L. and Quinn, J.A. Encyclopedia of Invasive Species: From Africanized Honeybees to Zebra Mussels Santa Barbara, Calif. : Greenwood, 2011
12. Ashton, Isabel W.; Hyatt, Laura A.; Howe, Katherine M.; Gurevitch, Jessica; Lerdau, Manuel T. 2005. Invasive species accelerate decomposition and litter nitrogen loss in a mixed deciduous forest. Ecological Applications. 15(4): 1263-1272. [54520]
13. U.S. Department of Agriculture, Forest Service, Eastern Region. 2004. Eastern Region invasive plants ranked by degree of invasiveness, [Online]. In: Noxious weeds and non-native invasive plants. Section 3: Invasive plants. Milwaukee, WI: Eastern Region (Producer). Available: http://www.fs.fed.us/r9/wildlife/range/weed/Sec3B.htm [2004, February 16]. [46748]

Question # for Step I	Notes for *Ampelopsis brevipedunculata*
2	Occurring in 3 regions of Ohio, but not enough information to conclude population sizes. Species tendency to create dense monocultures will likely change this answer to a yes, if it is officially documented.
3	More information is needed to know how it will impact ecological processes and functions in Ohio.
4	PA, MA, TN, CT
Question # for Step II	**Notes for *Ampelopsis brevipedunculata***
1	Species is present in natural areas, but information regarding how it arrived there is not documented.
3	1 adjoining state (PA), as well as MA
5	Produces flowers and seeds throughout summer. Default answer is 3 points because no information regarding variation among seed production found.
7	Species flowers throughout the summer season (June-Sept.)
8	Seeds are dispersed by birds, small animals, and white-tailed deer. Additionally, seeds float and might disperse through waterways.
9	Within 2 years.
14	Shades out other plants and when growing vertically on another plant, the host plant is susceptible to wind-throw and ice damage
16	This species has become a dominant plant species in some natural areas in New England. "[It] can dominate the vegetation by forming a "blanket" over shrubs, trees, and the ground, especially on forest edges. (8)"
17	Species occurs in natural areas in all phases of succession influences succession by killing supportive vegetation and preventing seedling emergence.(8)"

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Arctium minus*	*Outcome:*	*Pending Further Review*	***References***	
Common Name:	Common burdock, lesser burdock	Score:	41		
Family Name:	Asteraceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6,7	
		☐ No.			
		☐ Unknown.			

If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II	Score	Refer-ences
Step II: Invasion Status		
1. Current Invasion in Ohio	3	8
□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	3	4
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)		
Step II: Biological Characters	0	8
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	1	8
□ infrequent sexual reproduction (1 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	8
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	1	8
□ two months(1 pts.)		
8. Dispersal Ability	5	8
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	3	8
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)		
10. Establishment	U	No evidence
□ Information unknown (U)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		

13. Impact on Native Animals □ documented direct or indirect negative effects on animal taxa (3 pts.)	3	8
14. Impact on Native Plants □ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)	3	8
15. Hybridization □ can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.)	3	8
16. Population Density □ typically forms small, monospecific patches (3 pts.)	3	8
17. Role in Succession in Natural Areas □ successional information is unknown (0 pts.)	0	No evidence
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	8
Total Score	41	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=ARMI2 Accessed 1-8-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=5140 Accessed 1-8-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-8-13

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-8-13

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-8-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-8-13

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13.

8. Gross, R.S., P.A. Werner and W. R. Hawthorn (1980) The biology of Canadian weeds. 38. Actium minus and Arctium lappa. Canadian Journal of Plant Science 60: 621-634

Question # for Step I	Notes for *Arctium minus*
2	Species is widespread in all 5 regions, but population size measurements were not found.
3	Species forms self-replicating populations, but impacts to ecological processes and functions are unclear.
4	KY
Question # for Step II	**Notes for *Arctium minus***
1	Species not widely cultivated, so it is assumed it's widespread distribution is due to factors other than cultivation.
2	KY
5	Species is a biennial
6	*A. minus* averaged 11,700 seeds per plant in a study in Waterloo, Ontario. A study in Michigan got similar results.
8	Species is distributed by sticking to animals and hitchhiking, default score of 5 points given to species dispersed by birds or wildlife.
9	Species is a biennial
13	Cattle will eat the species and the milk produced will be bitter if eaten in large enough quantities.
14	Species is able to outcompete native vegetation and create small monocultures by shading-out other plants (see question 16)
15	Can occasionally hybridize with other *Arctium* species, creating intermediate progeny that can impact Ohio plants.
16	"Clearings are formed beneath patches of adult plants and the large numbers of seeds deposited beneath the adults results in high seedling densities within the clearings."

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Barbarea vulgaris*	Outcome:	Not invasive at this time	**References**	
Common Name:	garden yellowrocket, bittercress, wintercress, yellow rocket	Score:	25		
Family Name:	Brassicaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6,7	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-**

Step II: Invasion Status		ences
1. Current Invasion in Ohio	3	8
□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	3	7,8
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)		
Step II: Biological Characters	1	8
4. Vegetative Reproduction		
□ reproduces readily within the original site (1 pts.)		
5. Sexual Reproduction	1	8,9
□ infrequent sexual reproduction (1 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	8
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	0	8
□ one month or less per year (0 pts.)		
8. Dispersal Ability	0	8
□ low potential for long-distance seed/propagule dispersal (>1km) (0 pts.)		
9. Generation Time	3	8
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)		
10. Establishment	1	8
□ can only colonize certain habitat stages (e.g. early successional habitats) (1 pts.)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		

14. Impact on Native Plants □ no known negative effects on native plants (0 pts.)	0	No evidence
15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	8
16. Population Density □ occurs only as small, sporadic populations or individuals (1 pts.)	1	8
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	8
18. Number of Habitats Invaded □ only found in 1 broad category (1 pts.)	1	8
Total Score	25	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=BAVU Accessed 1-8-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=5175 Accessed 1-8-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-8-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-8-13.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-8-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-8-13.

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. MacDonald, M. A. and Cavers, P. B. 1991. The biology of Canadian weeds. 97. Barbarea vulgaris. Canadian Journal of Plant Science 79: 149-166

9. Virginia Tech Weed Identification Guide. http://www.ppws.vt.edu/scott/weed_id/barvu.htm Accessed 1-17-13

Question # for Step I	Notes for *Barbarea vulgaris*
2	Species is widespread in all 5 regions, but population size measurements were not found for Ohio.
3	Species forms self-replicating populations, but impacts to ecological processes and functions are unclear.
4	CT, IN, MI, NH, WI, considered a "lesser threat" in KY
Question # for Step II	**Notes for *Barbarea vulgaris***
1	Species is not cultivated.
3	IN, MI. "*Barbarea* spp. Is listed as a primary noxious weed under the Canada Seeds Act" and several other provinces in Canada list the species on their noxious weeds lists.
4	"New rosettes can develop from vegetative buds on the root system. Rosettes arise similarly from root fragments exposed to sunlight."
5	Species is a biennial. It is sometimes observed as a winter annual.
6	Seed production varies based on environmental conditions, but individuals in moderate conditions can average 40,000 seeds.
8	Seeds are ejected through dehiscences of the silique valves and disperse on average approx. 1 meter from the parent plant. Species seeds, when moistened, form a sticky surface that either allows the seed to attach to an animal, or attaches to soil particles.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Berberis thunbergii*	Outcome:	Invasive	**References**	
Common Name:	Japanese Barberry	Score:	50		
Family Name:	Berberidaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		3,12	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		2,3,4,10,12	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		2,3,4,6,7,9,10	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	3,4,10,12

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	5	12
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	4,7,8,9,10
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	3	3,4,10,11
4. Vegetative Reproduction		
□ has runners or spreading rhizomes that root easily (3 pts.)		
5. Sexual Reproduction	3	2,4,10
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	3	4,10
□ moderate (11-1,000) (3 pts.)		
7. Flowering Period	1	2,4,10
□ two months(1 pts.)		
8. Dispersal Ability	5	4,10
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	U	No evidence
□ Information unknown (U)		
10. Establishment	5	2,8,10
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)		
Step II: Ecological Importance	3	2,4,10
11. Impact on Ecosystem Processes		
□ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	2,10
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	2,4,10
17. Role in Succession in Natural Areas □ readily invades disturbed sites, persists and interferes with succession of native plants (3 pts.)	3	10
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	10
Total Score	50	

Reference

1. Knight, T.M., Havens, K., Vitt, P. " Will the use of less fecund cultivars reduce the invasiveness of perennial plants?" BioScience

2. Plant Conservation Alliance: http://www.nps.gov/plants/alien/fact/pdf/alpe1.pdf

3. USDA PLANTS database: http://plants.usda.gov/java/nameSearch

4. DCNR (Pennsylvania) Invasive Exotic Plant Tutorial for Natural Land Managers: http://www.dcnr.state.pa.us/forestry/invasivetutorial/japanese_euro_barberry.htm

5. Ohio Forests, 2006, Resource Bulletin, NRS-36, 2009: http://www.nrs.fs.fed.us/pubs/rb/rb_nrs36.pdf

6. Produced by the USDA Forest Service, Forest Health Staff, Newtown Square, PA.: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/japanese-barberry.pdf

7. KY Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm

8. Assessment of Japanese barberry (Berberis thunbergii) in Indiana's Natural Areas May 25, 2007 assessment meeting – Don Miller, Kate Howe, Hilary Cox, Ellen Jacquart: http://www.in.gov/dnr/files/Official_Japanese_Barberry_Assessment.pdf

9. Michigan Natural Features Inventory, Michigan Invasive Plant Species Accounts: http://mnfi.anr.msu.edu/education/factsheets.cfm

10. USDA Forest Service Fire Effects Information: http://www.fs.fed.us/database/feis/plants/shrub/berthu/all.html

11. Del Tredici, P. Wild Urban Plants of the Northeast: A field guide Ithaca, Cornell University Press, 2010

12. EDDMapS Distribution for Japanese Barberry: http://www.invasive.org/browse/subinfo.cfm?sub=3010,

Question # for Step I	Notes for *Berberis thunbergii*
2	Species is shown to be in at least 3 regions (ref. 1). Reference 12, considered more complete and up-to-date, shows species to be naturalized in all regions of Ohio. Population sizes are not given.
3	Species has self-replicating populations outside of cultivation and displaces native shrubs, changes soil chemistry and biota.
4	Massachusetts (banned), Connecticut (invasive, but not banned), IN, KY, PN, WV, MI
Question # for Step II	**Notes for *Berberis thunbergii***
2	Reference 3 shows species naturalized in 3 regions, but reference 12, considered more up-to-date, shows species in all 5 regions, therefore the answer gets 5 points.
5	Species produces viable seed, but seed production is dependent on which cultivar it is, light availability and stem density.
6	Seed output varies with cultivar identity. Some can produce more than 1000 seeds/plant/years while others can't. The 3 point answer seemed to be the most fair answer.
8	Dispersed by birds and small mammals
10	Species has been documented as establishing in healthy, natural forests.
11	Species changes soil chemistry and biota by increasing nitrogen in the soil.
14	Species creates dense thickets, crowding out native vegetation. It also changes soil chemistry and biota.
16	Species can form dense thickets in some places, with adequate time and conditions.

Ohio Invasive Plant Assessment Protocol				
Botanical Name:	*Catalpa speciosa* (Warder ex Barney) Warder ex Engelm.	Outcome:	Not invasive	**References**
Common Name:	Catalpa	Score:	26	
Family Name:	Bignoniaceae	Protocol conducted by Allison Mastalerz		
Step I Questions				
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		
		☐ No. Continue on to question 2.		
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		
		☐ No. Continue on to question 3.		
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1
		☐ No.		
		☐ Unknown.		
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		2,3,4,5
		☐ No.		
		☐ Unknown.		
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score** / **Refer-ences**
Step II: Invasion Status				

1. Current Invasion in Ohio □ plant occurs in natural areas away from site of planting (3 pts.)	3	6
2. State Distribution[a] □ plant is naturalized in five regions in Ohio (5 pts.)	5	1
3. Regional/US Distribution □ plant is not considered to be a problem in any other state (0 pts.)	0	no evidence
Step II: Biological Characters		
4. Vegetative Reproduction □ reproduces readily within the original site (1 pts.)	1	6
5. Sexual Reproduction □ frequent sexual reproduction, but high variation among years in seed production (3 pts.)	3	6,9
6. Number of Viable Seeds or Propagules per Plant □ prolific (>1,000) (5 pts.)	5	6
7. Flowering Period □ one month or less per year (0 pts.)	0	6,9
8. Dispersal Ability □ medium potential for long-distance seed/propagule dispersal (3 pts.)	3	6
9. Generation Time □ long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (0 pts.)	0	8
10. Establishment □ can only colonize certain habitat stages (e.g. early successional habitats) (1 pts.)	1	6
Step II: Ecological Importance		
11. Impact on Ecosystem Processes □ no known effect on ecosystem-level processes (0 pts.)	0	no evidence
12. Impact on Rare Organisms □ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)	0	no evidence
13. Impact on Native Animals □ no known negative impact on animals (0 pts.)	0	no evidence
14. Impact on Native Plants	3	7,8

□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		
15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	
16. Population Density □ occurs only as small, sporadic populations or individuals (1 pts.)	1	
17. Role in Succession in Natural Areas □ successional information is unknown (0 pts.)	0	no evidence
18. Number of Habitats Invaded □ only found in 1 broad category (1 pts.)	1	6
Total Score	26	

References: All websites accessed on 7-10-13

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=CASP8

2. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html.

3. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm.

4. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm.

5. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf.

6. Del Tredici, P. *Wild Urban Plants of the Northeast: a field guide.* Ithaca & London: Comstock Publishing Associates, 2010. Print.

7. Ohio Department of Natural Resources, Division of Forestry Tree Fact Sheet: http://ohiodnr.com/forestry/trees/catalpa_nthrn/tabid/5349/Default.aspx

8. Amoroso, M. (2005) The Showy Northern Catalpa. *American Forests* 111(2): 44-46.

9. Stephenson, A.G. (1982) When does outcrossing occur in a mass-flowering plant? *Evolution* 36(4): 762-767.

Question # for Step I	Notes for *Catalpa speciosa*
3	Naturalized in all regions, but not known to impact communities
Question # for Step II	**Notes for *Catalpa speciosa***
5	Produces viable seed annually, but no information on consistency of viability per annum.
8	Wind dispersed
9	7 years
14	Grows very large and can shade out other species.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Celastrus orbiculatus*	Outcome:	Invasive	**References**	
Common Name:	Oriental Bittersweet	Score:	50		
Family Name:	Celastraceae	Your name: Allison Mastalerz			
Step I: Initial Assessment					
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,12,13	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,4,8,9,10,12,13,	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		2,3, 4,5	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	12,13

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a] □ plant is naturalized in three regions in Ohio (3 pts.)	3	12,13
3. Regional/US Distribution □ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)	5	2,3,4,5,6,7
Step II: Biological Characters	3	1,4,5,6,9
4. Vegetative Reproduction □ has runners or spreading rhizomes that root easily (3 pts.)		
5. Sexual Reproduction □ frequent sexual reproduction (one or more events per year) (5 pts.)	5	4,5,7,9
6. Number of Viable Seeds or Propagules per Plant □ moderate (11-1,000) (3 pts.)	3	4,5,6
7. Flowering Period □ one month or less per year (0 pts.)	0	4,8,9,11
8. Dispersal Ability □ high potential for long-distance seed/propagule dispersal (5 pts.)	5	5, 9,10,11
9. Generation Time □ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)	3	8
10. Establishment □ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)	5	2,6,9,10
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes □ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms □ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)	0	7
13. Impact on Native Animals □ no known negative impact on animals (0 pts.)	0	
14. Impact on Native Plants □ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)	3	2,4,6,7,9

15. Hybridization □ can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.)	3	2,4,8,9
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	2,6,7,8,9,10
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	2,4,8,9,10
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	2,4,5,9
Total Score	50	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/profile?symbol=CEOR7. Accessed 5-29-12

2. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 5-29-12.

3. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 5-29-12.

4. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 5-29-12

5. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 5-29-12.

6. Greenberg, C.H., Smith, L.M. and Levey, D.J. (2001) Fruit fate, seed germination and growth of an invasive vine - an experimental test of 'sit and wait' strategy. *Biological Invasions* 3:363-372.

7. McNab, W.H. and Loftis, D.L. (2002) Probability of occurrence and habitat features for oriental bittersweet in an oak forest in the southern Appalachian mountains, USA. *Forest Ecology and Management* 155:45-54.

8. Pooler, M.R., Dix, R.L. and Feely, J. (2002) Interspecific hybridizations between the native bittersweet, *Celastrus scandens,* and the introduced invasive species, *C. orbiculatus. Southeastern Naturalist 1:69-76.*

9. Southeast Exotic Pest Plant Council Invasive Plant Manual (SE-EPPC): http://www.se-eppc.org/manual/bittersweet.html. Accessed 6-11-12.

10. Patterson, D.T., 1974. The ecology of oriental bittersweet, Celastrus orbiculatus, a weedy introduced ornamental vine.

11. Miller, James H. 2003. Nonnative invasive plants of southern forests: a field guide for identification and control. Gen. Tech. Rep. SRS–62. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 93 p.: http://www.invasive.org/eastern/srs/OAB.html Accessed 6-11-12.
12. Distribution of Oriental Bittersweet Map, USDA Forest Service, Northern Research Station. http://nrs.fs.fed.us/fia/maps/Invasive-maps/vine/webmap_ceor7_done.pdf Accessed 6-11-12
13. EDDMapS:http://www.invasive.org/browse/subinfo.cfm?sub=3012

Question # for Step I	**Notes for *Celastrus orbiculatus***
2	Species identified in 2 regions according to USDA Plants database. Ref.12 shows species naturalized in 3 regions and ref. 13 shows species in all 5 regions
3	Species occurs in at least 3 regions of Ohio and is considered to alter natural areas.
4	Indiana, Kentucky, Michigan, Pennsylvania
Question # for Step II	**Notes for *Celastrus orbiculatus***
2	It is unclear which reference (12 or 13) is more accurate or up to date, therefore the answer gets 3 points. Further data will likely increase the points for this answer.
3	2=IN, 4=MI, 3=KY,5=Penn
4	1="rapid veg. spread"; ,64=reproduction by "spreading underground roots that form new stems.(4)"; 5="expands vegetatively by stolons (above-ground stems), and rhizomes (underground stems), and through root suckering, the ability to send shoots up from the roots."; 9="develops and expands by layering stolons and root-suckers."
5	4,5,7=states sp. Has prolific seed production, but doesn't state # of events per year. But indv. plants set *prolific* amounts of seeds annually; 9="Seedling germination is generally high (up to 95%) and begins in mid to late spring. The highest rate of seed germination is in lower light intensities."
6	4,5="prolific" but no # given.6=seed germination rates are high for this sp., in both shade and lightened settings, but no numbers given. Due to the lack of actual numbers, the response is 'moderate' to err on the conservative side….This answer will most likely change to 'prolific' when a scientific count is conducted.
7	4=May & June; 8,9 & 11=May
8	5= has long range dispersal b/c many birds eat fruit; 9="long range dispersal"; 6=seeds are dispersed by birds and mammals (and humans) and that avian consumption aids seed dispersal.; 10="fruits are eaten by birds which provide more widespread dispersal."

9	8=species matures in 2 years
10	2,10="forms nearly pure stands in forests.(2)", 6=sp. Will germinate in low light (forest interior) areas and persists "indefinitely" until environmental conditions change (canopy gap) and then it grows aggressively; 9=can establish in a multitude of areas (see question 18), and with prolific seed set, and seed viability lasting several years, a robust seed bank can be created.
12	native bittersweet *Celastrus scandens*is considered relatively rare, but it is not listed
14	6= overtops plants, shading them out. Also trees more susceptible to wind throw by increasing the canopy weight, which in turn, increases the disturbance rates of the forest. 7=highly competitive with native veg. 2,4,9=might hybridize with native bittersweet ("threatens genetic integrity")
15	8= a female *C. scandens* was pollenated by *C. orbiculatus* in a controlled experiment. Viable seed was produced from the cross. 2,4,9=might hybridize with native bittersweet ("threatens genetic integrity"), native bitersweet considered "relatively rare (9)"
16	the sp. Can form nearly pure stands in forests, but does not say specifically absolute percent per whole area
17	10= creates monocultures by shading out others, not thru changes created in soil. 2,4="It can strangle shrubs and small trees, and weaken mature trees by girdling the trunk and weighting the crown. There is some evidence that it can hybridize with American bittersweet, thus threatening the genetic integrity of the native species. (2)" 9= "Oriental bittersweet is a serious threat to plant communities due to its high reproductive rate, long range dispersal, ability to root sucker, and rapid growth rate. Climbing Oriental bittersweet vines severely damage native vegetation by constricting and girdling stems. Vines can shade, suppress, and ultimately kill native vegetation." I believe that through all the reasons I have listed here, the species should be considered to receive the 1 point score here. More information may increase the score for this question.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Elaeagnus umbellata*	Outcome:	Invasive	**References**	
Common Name:	Autumn Olive	Score:	52		
Family Name:	Elaeagnaceae	Your name: Allison Mastalerz			
Step I: Initial Assessment					
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2,3	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,3,4	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		6,7,8,9	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**References**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	1,2,3,4

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	5	1,2,3
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	6,7,8,9
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	0	4
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	4
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	4,10
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	1	4
□ two months(1 pts.)		
8. Dispersal Ability	5	4,5,10
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	3	4
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)		
10. Establishment	5	4, 10
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)		
Step II: Ecological Importance	3	4,10,11
11. Impact on Ecosystem Processes		
□ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	5	4,10,11
□ impacts native plants to such an extent that community structure is greatly altered (5 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	4,10
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	4,11
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	4,10,11
Total Score	52	

References

1. USDA Plants database, plant profiles, distribution map at Ohio County Level: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=ELUM. Accessed 6-19-12

2. USDA National Invasive Species Information Center, *Elaeagnus umbellata*Distribution Map: http://nrs.fs.fed.us/fia/maps/Invasive-maps/shrub/webmap_elum.pdf Accessed on 6-19-12.

3. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at http://www.eddmaps.org/; last accessed June 19, 2012.

4. Munger, Gregory T. 2003. Elaeagnus umbellata. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, February 14].

5. Kohri, M. (2011). "Spatial-temporal distribution of ornithochorous seeds from an Elaeagnus umbellata community dominating a riparian habitat". Plant species biology (0913-557X), 26 (2), p. 174.

6. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program:http://extension.entm.purdue.edu/CAPS/pestInfo/autumnOlive.htm. Accessed 7-20-12

7. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed7-20-12

8. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 7-20-12

9. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_010314.pdf. Accessed 7-20-12.

10. Brym, Z.T., Lake, J.K., Allen, D. and Ostling, A. (2011) Plant functional traits suggest novel ecological strategy for an invasive shrub in an understory woody plant community. *Journal of Applied Ecology* 48:1098-1106

11. Catling, P.M., Oldham, M.J., Sutherland, D.A., Brownell, V.R. & Larson, B.M.H. (1997) The recent spread of Autumn-olive, Elaeagnus umbellata, into Southern Ontario and its current status. *Canadian Field-naturalist* 111: 376–380.

Question # for Step I	**Notes for *Elaeagnus umbellata***
2	1= species has naturalized in all 5 regions. 2=species has been observed as naturalized in counties in all five regions. 3=Only 19 of 88 counties do not have species occurring in natural (non-landscaped) areas.
3	1,2,3,4=>self-replicating populations; 4=>populations can become dense thickets, displacing native plants, also, could potentially change soil nitrogen levels, impacting habitats that are infertile soil dependent.
4	IN, KY, MI,PA
Question # for Step II	**Notes for *Elaeagnus umbellata***
3	IN, KY, MI, PA
4	sp. Can send up root suckers and will vigorously resprout when above ground mass is harmed or removed, but sp. Does not have rhizomes or runners.
5	Fruit production is reduced by shading
6	4=>66,000 seeds/plant
7	most places is 2 mo., but 3 mo. In FL
8	dispersed by birds and small mammals
9	4=>3-5 years in favorable conditions
10	10=>sp. Is found persisting in edge and interior of forests
11	10=>species is considered allelopathic, it fixes nitrogen, and can form large monocultures, displacing native plant species.; 11=> forms dense stands at the expense of native vegetation
14	10=>sp. Is allelopathic and changes soil nitrogen, and can create monotypic stands that displace native plants.; 11=> forms dense stands at the expense of native vegetation
16	4&10=>states that sp. Forms large monotypic stands
17	More information may increase the score for this species.

Ohio Invasive Plant Assessment Protocol				
Botanical Name:	*Euonymus alatus*	Outcome:	Pending Further Review	**References**
Common Name:	Burning Bush	Score:	41	
Family Name:	Celastraceae	Your name: Allison Mastalerz		
Step I: Initial Assessment				
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		
		☐ No. Continue on to question 2.		
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2
		☐ No. Continue on to question 3.		
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,3,7,8
		☐ No.		
		☐ Unknown.		
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,6
		☐ No.		
		☐ Unknown.		

If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II	Score	Refer-ences
Step II: Invasion Status		
1. Current Invasion in Ohio	3	1,3,6,7,8
□ plant occurs in natural areas away from site of planting (3 pts.)		
2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	3,4,6
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	1	10
4. Vegetative Reproduction		
□ reproduces readily within the original site (1 pts.)		
5. Sexual Reproduction	1	4,8,11
□ infrequent sexual reproduction (1 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	9
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	1	7
□ two months(1 pts.)		
8. Dispersal Ability	5	7,8,10
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	U	No evidence
□ Information unknown (U)		
10. Establishment	5	7,8,10
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		

13. Impact on Native Animals □ no known negative impact on animals (0 pts.)	0	No evidence
14. Impact on Native Plants □ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)	3	8,9,10
15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ typically forms small, monospecific patches (3 pts.)	3	7,8,10
17. Role in Succession in Natural Areas □ successional information is unknown (0 pts.)	0	No evidence
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	7
Total Score	41	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/profile?symbol=EUAL13. Accessed 6-27-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at http://www.eddmaps.org/; last accessed June 27, 2012.

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/CAPS/pestInfo/wingedBurningBush.htm accessed 7-3-12

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed7-3-12

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 7-3-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_010314.pdf. Accessed 7-3-12.

7. Fryer, Janet L. 2009. Euonymus alatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, June 27].

8. Pennsylvania Invasive Plants Fact Sheet: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_010293.pdf accessed 7-3-12

9. Knight, T.M., Havens, K. and Vitt, P. (2011) Will the use of less fecund cultivars reduce the invasiveness of perennial plants? *BioScience* 46(8):1141-1147.
10. Swearingen, J., B. Slattery, K. Reshetiloff, and S. Zwicker. 2010.Plant Invaders of Mid-Atlantic Natural Areas, 4th ed. National Park Service and U.S. Fish and Wildlife Service. Washington, DC. 168pp.
11. Ohio Division of Forestry Burning Bush Fact Sheet: http://ohiodnr.com/forestry/trees/burning_bush/tabid/5346/Default.aspx Accessed 7-20-12

Question # for Step I	**Notes for *Euonymus alatus***
2	This species is naturalized in all 5 regions of Ohio, but information on #s of individuals is lacking.
3	Species does naturalize outside of cultivation. There is concern that due to its unpalatability for deer, it could out-compete native spp. The species also forms dense thickets which crowds out native spp., impacting both terrestrial and aquatic areas. Spec
4	IN, KY,PA
Question # for Step II	**Notes for *Euonymus alatus***
1	Species is dispersed by birds, allowing for long-distance dispersal.
3	KY, IN, PA
4	10=>"spreads locally through vegetative reproduction."
5	There is no evidence as to how the species reproduces in the wild, however, it is known that the species produces viable seeds in the wild (4), therefore should at least receive a score of 1 for this question. More information is likely to increase the score for this question.
6	avg. 1238 seeds/plant
8	dispersed by birds
9	7=>it can est. in intact natural areas…in IL, it was observed as aggressive 10=>"forms dense thickets and displaces native plant species in forest understories of the US"
14	10=>"forms dense thickets and displaces native plant species in forest understories of the US"

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Euonymus fortunei*	Outcome:	Plant of Concern	**References**	
Common Name:	Wintercreeper	Score:	44		
Family Name:	Celastraceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,3,4,5	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		6,7	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	1,2

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	3	1,2
□ plant is naturalized in three regions in Ohio (3 pts.)		
3. Regional/US Distribution	3	6,7
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)		
Step II: Biological Characters	3	4,5
4. Vegetative Reproduction		
□ has runners or spreading rhizomes that root easily (3 pts.)		
5. Sexual Reproduction	5	5
□ frequent sexual reproduction (one or more events per year) (5 pts.)		
6. Number of Viable Seeds or Propagules per Plant	U	No evidence
□ Information unknown (U)		
7. Flowering Period	1	5
□ two months(1 pts.)		
8. Dispersal Ability	5	5
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	U	No evidence
□ Information unknown (U)		
10. Establishment	5	3,4,5
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)		
Step II: Ecological Importance	3	3,4,5
11. Impact on Ecosystem Processes		
□ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	3,4,5
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	5
17. Role in Succession in Natural Areas □ readily invades disturbed sites, persists and interferes with succession of native plants (3 pts.)	3	5
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	5
Total Score	44	

References

1. USDA Plants database, plant profiles:http://plants.usda.gov/java/profile?symbol=EUFO5. Accessed 7-3-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at http://www.invasiveplantatlas.org/subject.html?sub=3024#maps accessed 7-3-12

3. Smith, Lauren M. and Reynolds, Heather L. (2012) Positive plant-soil feedback loop may drive dominance of a woodland invader, *Euonymus fortunei*. *Plant Ecology* DOI 10.1007/s11258-012-0047-z

4. Swearingen J, Slattery B, Reshetiloff K, Zuicker S (2010) Plant Invaders of Mid-Atlantic Natural Areas 4th ed, 4th edn. National Park Service and U.S, Fish and Wildlife Service, Washington, DC

5. Zouhar, Kris. 2009. Euonymus fortunei. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, March 30].

6. Kentucky Exotic Plants Council Invasive Species List: http://www.se-eppc.org/ky/list.htm Accessed 7-20-12

7. Pennsylvania invasive species list: http://www.dcnr.state.pa.us/ucmprd1/groups/public/documents/document/dcnr_010314.pdf Accessed 7-20-12

Question # for Step I	Notes for *Euonymus fortunei*
2	In regions 3,4 and 5, but population sizes are not given
3	3="reduces native diversity" & 4=displaces herbs & seedlings, and growing on trees. 5=outcompetes existing vegetation, spreads rapidly, replaces spring ephemerals, becomes a monoculture, replacing native groundcover species.
4	KY, on the "watch" list in PA
Question # for Step II	**Notes for *Euonymus fortunei***
1	Along with 1 & 2, I have personally observed species in natural areas away from planting.
2	In regions 3,4 and 5
3	KY and PA
8	sp. Is dispersed by birds and by water
9	No data was found to make an accurate answer…the species apparently must be growing upwards (vines along ground rarely, if ever, produce seed) and reach a stem diameter of 1cm. I found no documentation of how long it takes to accomplish this.
11	3="reduces native diversity" & 4=displaces herbs & seedlings, and growing on trees. 5=outcompetes existing vegetation, spreads rapidly, replaces spring ephemerals, becomes a monoculture, replacing native groundcover species.
14	See notes for question 11
16	Along with 5, I have personally observed naturalized populations occurring at 50-100% abundances, but have observed it most often accounting for 15-50% cover.
17	5="Observations by Hutchison in Illinois suggest that invasive populations of wintercreeper may alter successional trajectories because it spreads rapidly and replaces spring ephemerals. In mesic and dry-mesic woods at Fern Rocks Nature Preserve, wintercreeper covered the ground and eliminated native groundcover species in many places . Observations by managers in Kentucky indicate that invasive, groundcover populations of wintercreeper can establish monocultures in which native species are excluded."

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Frangula alnus*	Outcome:	Invasive	References	
Common Name:	Glossy Buckthorn	Score:	49		
Family Name:	Rhmnaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,3,4,8	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		5,6,7	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	4

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	5,6,7
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	0	3
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	9
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	3	3,4,7,8,9
□ moderate (11-1,000) (3 pts.)		
7. Flowering Period	2	4,7,9
□ three to five months (2 pts.)		
8. Dispersal Ability	5	3,4,9
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	3	9
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)		
10. Establishment	5	3,4,7,8,9
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)		
Step II: Ecological Importance	3	3,4,7,8
11. Impact on Ecosystem Processes		
□ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	3
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	3,4,7,8
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	3,4,7,8,9
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	3,4,7,8
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	3,4,7
Total Score	49	

References

1. USDA Plants database, plant profiles:http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=FRAL4 accessed on 7-3-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online athttp://www.invasiveplantatlas.org/subject.html?sub=5649#maps accessed 7-3-12

3. Nagel, L.M., Corace III, R.G., Storer, A.J. (2008) "An experimental approach to testing the efficacy of management treatments for glossy buckthorn at Seney National Wildlife Refuge, upper Michigan". Ecological restoration (1543-4060), 26 (2), p. 136.

4. Ohio Invasive Plants Council Plant Fact Sheet: http://www.dnr.state.oh.us/dnap/invasive/2buckthorn/tabid/1997/Default.aspx Accessed 7-22-12

5. Indiana's Most Unwanted Invasive Plant Pests: Indiana Cooperative Agricultural Pest Survey Program: http://extension.entm.purdue.edu/CAPS/pestInfo/buckthorn.htm Accessed 7-20-12.

6. Pennsylvania's Invasive Plant list: http://www.dcnr.state.pa.us/ucmprd1/groups/public/documents/document/dcnr_010314.pdf Accessed 7-20-12

7. Michigan Natural Features Inventory Invasive Plant Species Accounts: http://www.misin.msu.edu/facts/detail.php?id=13 Accessed 7-22-12

8. Cunard, C. & Lee, T.D. (2009) Is patience a virtue? Succession, light, and the death of glossy buckthorn. *Biological Invasions* 11:577-586.

9. Gucker, Corey L. 2008. Frangula alnus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, July 22].

Question # for Step I	Notes for *Frangula alnus*
2	Regions 1,2,3 and 4, but details as to the size of the populations are lacking.
3	Species observed outside of cultivation. Species is a fast growing plant that forms dense stands which crowd out native species, inhibits tree regeneration, and can alter ecosystem processes.
4	IN, PA, MI
Question # for Step II	**Notes for *Frangula alnus***
2	1&2=>regions 1 through 4, and I have personally observed sp. Naturalized in region 5
3	IN, PA, MI
4	3=>stump resprouts, but no vegetative reproduction
5	See below (question 6)
6	sources all state that seed set for this plant is "prolific" but only 9 gives est. of 430-1560 offspring/yr. 9 also states that it seed production is variable due to climate conditions - dry summers reduce vigor.
7	4 months
8	dispersed by birds
11	3=>"Where glossy buckthorn becomes established, it can form a dense homogenous monoculture, outcompete native shrubs, and alter other ecosystem processes"
13	3=>proposes that by reducing the diversity of shrubs in the area, migrating birds will be adversely effected because different shrubs provide food at different times throughout the summer. It's important to note that birds do eat this sp fruit.
14	sp. Can outcompete and crown out native plant species, inhibit tree regeneration
17	outcompetes and crowds out native vegetation, forms dense monotypic stands, but there is evidence (8) that suggests that sp. Will be unable to compete in late successional forests - so as forests move to low-light and low-nutrient habitats, buckthorn will eventually lose out.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Hedera helix*	Outcome:	Pending Further Review	**References**	
Common Name:	English Ivy	Score:	36		
Family Name:	Araliaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2,8,9,10	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,8,9,10	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		4,5	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				1	1,2

□ plant is only expanding from sites of previous planting (1 pts.)		
2. State Distribution[a]	4	1,2
□ plant is naturalized in four regions in Ohio (4 pts.)		
3. Regional/US Distribution	3	4,5
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)		
Step II: Biological Characters	3	1,7,11,12
4. Vegetative Reproduction		
□ has runners or spreading rhizomes that root easily (3 pts.)		
5. Sexual Reproduction	1	7,8,11
□ infrequent sexual reproduction (1 pts.)		
6. Number of Viable Seeds or Propagules per Plant	1	11
□ few (0-10) (1 pts.)		
7. Flowering Period	1	11
□ two months(1 pts.)		
8. Dispersal Ability	5	7,8,9,10,11
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	0	11
□ long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (0 pts.)		
10. Establishment	5	7,8,9,10,11
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	Lack of evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
	0	Lack of evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	8,9,10,11
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	Lack of evidence
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	7,8,9,10,11
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	11
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	7,8,9,11
Total Score	36	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/profile?symbol=HEHE Accessed 7-26-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at http://www.invasiveplantatlas.org/subject.html?sub=3027; accessed 7-26-2012.

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 5-29-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 5-29-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 5-29-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 5-29-12.

7. Dlugosch, K.(2005) Understory community changes associated with English ivy invasions in Seattle's urban parks. *Northwest Science*79, pp. 53-60

8. Thomas, L. K. 1980. The Impact of Three Exotic Species on a Potomac Island. National Park Service Monograph Series: Number 13. United States Department of the Interior.: http://www.cr.nps.gov/history/online_books/science/13/contents.htm Accessed 7-26-12.

9. PAC: http://www.nps.gov/plants/alien/fact/hehe1.htm

10. Randall, J. M., and Marinelli, J. 1996. Invasive Plants: Weeds of the Global Garden. Brooklyn Botanic Garden, Handbook #149. p. 93

11. Waggy, Melissa A. 2010. Hedera helix. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ Accessed 7-26-12.

Question # for Step I	Notes for *Hedera helix*
2	1&2=>regions 1,3,4,5; 8,9,10=>species forms dense monotypic mats, excluding native herbaceous spp. Further, can create stress (and death in some cases) of trees the vine grows on. 8=>sp. Is a host for bacterial leaf scorch (*Xylella fastidiosa*) which harms elms, oaks, maples, and others
3	see notes for question 2
4	KY, PA(listed on Watch list)
Question # for Step II	**Notes for *Hedera helix***
1	This answer is conservative because references 1,2 give no evidence that would allow for the 3 point answer instead of the 1 point answer. As I've personally seen the species in areas where it is VERY unlikely that it was expanding from previous planting, I would hazard that with more evidence, this answer could account for 3 points, but more evidence is needed.
4	Species can also reproduce easily from fragments, but it is unknown if plant fragments easily
6	Numerical values for seed production were not found, but 11=>seed production is not prolific - but it is important to note that species does produce viable seed, therefore the answer receives 1 point).
7	flowering period depends on where you are. In IL, flowering period is from June-Sept., but for New England, it is just September. The 1 point answer seemed most appropriate.
8	Seeds dispersed by birds.
9	Juvenile period can last indefinitely, but usually at least ~10 years
14	crowds out native species
16	Many references state species forms dense monotypic mats on forest floors, so 4 point answer seems reasonable.
17	Evidence is lacking but please note: 11=>"On sites where English ivy becomes dominant, it may influence succession. English ivy may inhibit regeneration of the understory, resulting in an English ivy- dominated community with few if any woody plants getting tall enough to form a shrub layer. Because English ivy facilitates tree fall and accelerates forest gaps, it may influence succession by creating canopy gaps."

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Ipomoea purpurea*	Outcome:	Pending Further Review	**References**	
Common Name:	common morning-glory, tall morning-glory	Score:	36		
Family Name:	Convolvulaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		2,3,4,5,6,7	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				U	1,2

□ Information unknown (U)		
2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	3	2,4,7
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)		
Step II: Biological Characters	0	11
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	8,9
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	8,9
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	2	10
□ three to five months (2 pts.)		
8. Dispersal Ability	3	9
□ medium potential for long-distance seed/propagule dispersal (3 pts.)		
9. Generation Time	3	8,9
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)		
10. Establishment	3	11
□ aggressively colonizes and establishes in edge habitats (3 pts.)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	9,10
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ typically forms small, monospecific patches (3 pts.)	3	11
17. Role in Succession in Natural Areas □ successional information is unknown (0 pts.)	0	No evidence
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	9
Total Score	36	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=IPPU2 Accessed 1-9-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=10092 Accessed 1-9-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-9-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-9-13.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-9-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-9-13.

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. Defelice, M.S. (2001) Tall Morningglory, *Ipomoea purpurea*(L.) Roth - Flower or Foe? *Weed Technology* 15(3):601-606.

9. Guertin, Patty (2003) USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. Factsheet for: *Ipomoea purpurea* (L.) Roth http://sdrsnet.srnr.arizona.edu/data/sdrs/ww/docs/ipom_spp.pdf Accessed 1-14-13.

10. Chaney, L. and Baucom, R.S. (2012) The evolutionary potential of Baker's weediness traits in the common morning glory, *Ipomoea purpurea* (Convolvulaceae). *American Journal of Botany* 99(9):1-7.

11. Regina Baucom Ph.D., Professor, Michigan University, Biology department. personal correspondence. 1-22-13

Question # for Step I	Notes for *Ipomoea purpurea*
2	Species occurs in all 5 regions, but quantitative information about the population sizes in these areas is lacking. More information would likely change this to a 'yes' answer.
3	Species is widespread, but evidence about impacts of the species on ecological processes and functions is lacking.
4	WV(In seed), KY, TN,
Question # for Step II	**Notes for *Ipomoea purpurea***
1	Species exisists in natural areas, but evidence of how they arrived there (b.c. of past planting, b.c of bird dispersal) is lacking.
3	KY, WV
5	Species is an annual, but no information on whether seed production varied (default score = 3 pts).
6	~26,000 seeds/plant/year
8	Seeds dispersed by wind and rain action (default score 3). It is often cultivated, so if humans are included in this questions it would receive the 5 point answer.
9	Species is an annual.
10	"Morning glory can invade anywhere there is disturbance -- usually roadsides and agricultural fields."
14	Species grows quickly and can smother other vegetation. When growing on another plant, it can also shade-out the host plant. Host plants may also have increased stem breakage due to the additional weigh of *I.purpurea.* Also, morning glory can have a "choking growth", where the plant strangles the plants it climbs on.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Ligustrum japonicum*	Outcome:	Not invasive	**References**	
Common Name:	Japanese Privet	Score:	31		
Family Name:	Oleaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.			
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				U	1,2,

□ Information unknown (U)		personal observation
2. State Distribution[a]	U	1,2
□ Information unknown (U)		
3. Regional/US Distribution	3	6
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)		
Step II: Biological Characters	0	8
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	5	8
□ frequent sexual reproduction (one or more events per year) (5 pts.)		
6. Number of Viable Seeds or Propagules per Plant	3	8
□ moderate (11-1,000) (3 pts.)		
7. Flowering Period	1	8
□ two months(1 pts.)		
8. Dispersal Ability	5	8
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	U	
□ Information unknown (U)		
10. Establishment	3	8
□ aggressively colonizes and establishes in edge habitats (3 pts.)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	8,9
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	8,9
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	8,9
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	8
Total Score	31	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch Accessed 1-9-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3034 Accessed 1-9-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-9-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-9-13.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-9-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-9-13.

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. Munger, Gregory T. 2003. Ligustrum spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, January 22].

9. Maddox, V. Byrd, J. Jr. and Serviss, B. (2010) Identification and Control of Invasive Privets (*Ligustrum* spp.) in the Middle Southern United States. *Invasive Plant Science and Management* 3(4): 482-488.

Question # for Step I	Notes for *Ligustrum japonicum*
2	According to Ref. 1 & 2, species is not naturalized in Ohio. I observed it off trail in Ft. Ancient, Ft. Hill and Mitchell Memorial Forest.
4	PA
Question # for Step II	**Notes for *Ligustrum japonicum***
1	Species is not documented to be naturalized in Ohio, but I have observed it in natural areas away from trails (Ft. Ancient, Ft. Hill and Mitchell Memorial Forest).
2	See notes from question 1.
3	PA
5	Seed output can vary due to shading, but output is still considered "substantial".
6	hundreds of seeds per plant per year.
8	Species is dispersed by wildlife - particularly birds.
11	Changes community composition - but that is not a process….
14	Displaces vegetation
16	Species has been observed forming dense, impenetrable thickets that displace numerous native plant species.
17	Outcompetes with native plants - alters community composition (default answer 1). More information is needed to state successional trajectories have been altered.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Ligustrum obtusifolium*	Outcome:	Pending Further Review	**References**	
Common Name:	Border Privet	Score:	35		
Family Name:	Oleaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,3,8	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		4,5,6,7	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	4,5,6,7
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	0	No evidence available
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	3,8,9
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	U	No evidence available
□ Information unknown (U)		
7. Flowering Period	0	8,9=>June
□ one month or less per year (0 pts.)		
8. Dispersal Ability	5	3,8,9
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	U	
□ Information unknown (U)		
10. Establishment	5	8,9
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)		
Step II: Ecological Importance	0	3,8,9
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	8,9
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	8,9
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	8,9
18. Number of Habitats Invaded □ only found in 1 broad category (1 pts.)	1	8,9
Total Score	35	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/profile?symbol=LIOB. Accessed 7-31-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at http://www.invasiveplantatlas.org/subject.html?sub=10087#maps. Accessed July 31, 2012.

3. Maddox, V., Byrd, J. and Serviss, B. (2010) Identification and Control of Invasive Privets (*Ligustrum* spp.) in the Middle Southern United States. *Invasive Plant Science and Management* 3(4): 482-488.

4. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program:http://extension.entm.purdue.edu/CAPS/pestInfo/privet.htm Accessed 8-6-12.

5. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 8-6-12.

6. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm. Accessed on 8-6-12

7. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd1/groups/public/documents/document/dcnr_010314.pdf Accessed 8-6-12.

8. DCNP Invasive Exotic Plant Tutorial for Natural Lands Managers: Border Privet: http://www.dcnr.state.pa.us/forestry/invasivetutorial/border_privat.htm Accessed 8-6-12

9. Forestry Service Weed of the Week Fact Sheet: Border Privet: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/border_privet.pdf Accessed 8-6-12

Question # for Step I	Notes for *Ligustrum obtusifolium*
2	Species has been detected in natural areas in all 5 regions, but the numbers of individuals in the populations is not stated.
3	3=>"can be highly aggressive, often forming nuisance thickets." 8=>forms thickets that outcompete native understory plants, including wildflowers.
4	IN,KY,MI,PA
Question # for Step II	**Notes for *Ligustrum obtusifolium***
5	One event/year. No information was found on variance in seed production, so default answer is 3 points.
8	dispersed by birds, small mammals.
11	can change community composition (by decreasing native species richness) => but this is not a process.
13	Border privet's close relative Chinese privet has shown to reduce bee species richnesses and abundances in southeastern U.S
14	can change community composition (by decreasing native species richness)
16	Creates dense thickets
17	Species is able to invade area disturbed areas (and habitats further along in succession), but its ability to alter successional trajectories is unclear.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Ligustrum ovalifolium*	Outcome:	Insufficient Data	**References**	
Common Name:	California privet, garden privet	Score:	15 with 4 Unknowns		
Family Name:	Oleaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				U	1,2

□ Information unknown (U)		
2. State Distribution[a]	1	1,2
□ plant is naturalized in only one region in Ohio (1 pts.)		
3. Regional/US Distribution	3	6
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)		
Step II: Biological Characters	0	No evidence
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	8,10
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	U	
□ Information unknown (U)		
7. Flowering Period	1	8,9
□ two months(1 pts.)		
8. Dispersal Ability	5	10
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	U	
□ Information unknown (U)		
10. Establishment	1	8
□ can only colonize certain habitat stages (e.g. early successional habitats) (1 pts.)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	0	No evidence
□ no known negative effects on native plants (0 pts.)		

15. Hybridization	0	No evidence
□ no known instances of hybridization with other plant species (0 pts.)		
16. Population Density	U	No evidence
□ Information unknown (U)		
17. Role in Succession in Natural Areas	0	No evidence
□ successional information is unknown (0 pts.)		
18. Number of Habitats Invaded	1	personal observation
□ only found in 1 broad category (1 pts.)		
Total Score	15	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=LIOV Accessed 1-9-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=11561 Accessed 1-9-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-9-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-9-13.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-9-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-9-13

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. Missouri Botanical Garden Plant Finder, Plant details pages: *Ligustrum obalifolium*http://www.missouribotanicalgarden.org/gardens-gardening/your-garden/plant-finder/plant-details/kc/c323/ligustrum-ovalifolium.aspx Accessed 1-23-13

9. Dirr, M.A. 1998 Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses. (5th ed.) Stipes Publishing L.L.C., Champaign, Illinois

10. Invasive Plant Atlas of New England Plant Factsheet http://www.eddmaps.org/ipane/ipanespecies/shrubs/Ligustrum_ovalifolium.htm. Accessed 1-23-13

Question # for Step I	Notes for *Ligustrum ovalifolium*
2	Species has been documented in ref. 1 & 2 to be in 1 county in region 3. I personally observed species in Tranquility Wilderness Area in Adams county.
4	PA
Question # for Step II	**Notes for *Ligustrum ovalifolium***
1	Species has been documented in ref. 1 & 2 to be in 1 county in region 3. I personally observed species in Tranquility Wilderness Area in Adams county.
2	See note for question 1.
3	PA
5	Produces viable seed maturity, but no data was found as to the viability of the seed set in various years.
7	June-July
8	Dispersed by birds
10	Tolerates a variety of soil and solar conditions, including urban conditions.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Ligustrum sinense*	Outcome:	Pending Further Review	**References**	
Common Name:	Chinese privet, small-leaf privet	Score:	35		
Family Name:	Oleaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2, personal observation	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.			
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		2,3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				U	1,2

□ Information unknown (U)		
2. State Distribution[a]	U	1,2
□ Information unknown (U)		
3. Regional/US Distribution	3	2,4,6
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)		
Step II: Biological Characters		
4. Vegetative Reproduction	1	10
□ reproduces readily within the original site (1 pts.)		
5. Sexual Reproduction	5	8
□ frequent sexual reproduction (one or more events per year) (5 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	9
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	1	8
□ two months(1 pts.)		
8. Dispersal Ability	5	8,9
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	U	
□ Information unknown (U)		
10. Establishment	3	8
□ aggressively colonizes and establishes in edge habitats (3 pts.)		
Step II: Ecological Importance		
11. Impact on Ecosystem Processes	0	No evidence
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	8,9
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	8,9
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	8,9
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	8
Total Score	35	

Reference

1. USDA Plants database, plant profiles:http://plants.usda.gov/java/nameSearch Accessed 1-9-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3035 Accessed 1-9-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-9-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-9-13

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-9-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-9-13

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. Munger, Gregory T. 2003. Ligustrum spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, January 22].

9. Wang, H. and Grant, W.E. (2012) Determinants of Chinese and European Privet Invasion in Southern U.S. Forestlands. Invasive Plant Science and Management. 5:454-463

10. USDA & NRCS Plant factsheet: Chinese Privet *Ligustrum sinense* http://plants.usda.gov/plantguide/pdf/pg_lisi.pdf Accessed 1-22-13

Question # for Step I	Notes for *Ligustrum sinense*
4	KY, PA, TN
Question # for Step II	**Notes for *Ligustrum sinense***
1	Ref 1 & 2 do not show species naturalized in the state, but I have personally observed the species in Buttercup Nature Preserve. It is unclear how the individual arrived there.
3	KY, PA, TN
4	Produces via root suckers.
5	Shading reduces output, but not substantially.
6	"A mature plant can produce hundreds of fruits containing millions of seeds (~2.7million) annually."(9)
8	Dispersed by wildlife, particularly birds.
10	Can establish with low light conditions, but will not persist without canopy gaps. In forests where canopy gaps occur, "Chinese privet can invade relatively undisturbed habitats". In this situation, I believe it is appropriate to consider the edge of the canopy gap to be an "edge" habitat
14	Crowds out native plants by creating dense thickets.
16	Species is capable of forming dominant monospecific stands.
17	Alters community compositions and structure (Default score 1)

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Ligustrum vulgare*	Outcome:	Pending Further Review	**References**	
Common Name:	Common privet, European privet	Score:	39		
Family Name:	Oleaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.			
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		2,3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				U	1,2

□ Information unknown (U)		
2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	2,3,4,5,6
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	0	8
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	5	8
□ frequent sexual reproduction (one or more events per year) (5 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	9
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	1	8
□ two months(1 pts.)		
8. Dispersal Ability	5	8,9
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	U	
□ Information unknown (U)		
10. Establishment	1	8
□ can only colonize certain habitat stages (e.g. early successional habitats) (1 pts.)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	8
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	8
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	8
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	8
Total Score	39	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=LIVU Accessed 1-9-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3036 Accessed 1-9-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-9-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-9-13

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-9-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-9-13

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. Munger, Gregory T. 2003. Ligustrum spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, January 22].

9. Wang, H. and Grant, W.E. (2012) Determinants of Chinese and European Privet Invasion in Southern U.S. Forestlands. *Invasive Plant Science and Management.* 5:454-463

Question # for Step I	Notes for *Ligustrum vulgare*
2	Species is naturalized in all 5 regions of Ohio, but detailed information regarding population sizes is lacking.
4	TN, CT, IN, KY, MI, PA
Question # for Step II	**Notes for *Ligustrum vulgare***
1	Species is naturalized in all 5 regions of Ohio, but detailed information regarding how individuals arrived in the area is lacking.
3	TN, CT, IN, KY, MI, PA
5	Seed output may be reduced by shading, but output is still considered "substantial".
6	"A mature plant can produce hundreds of fruits containing millions of seeds (~2.7 million) annually)"(9)
8	Dispersed by wildlife - particularly birds.
10	Species is able to establish in disturbed habitats and can persist "for a substantial period of time"(8). In Ohio, canopy cover seems to limit species distribution.
14	Crowds out native vegetation
16	Species is capable of creating dominant monospecific stands.
17	Species occurs and persists in Southwestern Ohio forests, but it is not clear if it alters community composition at this time.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Liriope muscari*	Outcome:	Insufficent Data	**References**	
Common Name:	Big blue lilyturf	Score:	5 + 8 unknowns		
Family Name:	Asparagaceae **also placed in Convallariaceae, Liliaceae, and Ruscaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.			
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-**

Step II: Invasion Status		ences
1. Current Invasion in Ohio	U	1,2
□ Information unknown (U)		
2. State Distribution[a]	U	
□ Information unknown (U)		
3. Regional/US Distribution	0	
□ plant is not considered to be a problem in any other state (0 pts.)		
Step II: Biological Characters	3	8,9
4. Vegetative Reproduction		
□ has runners or spreading rhizomes that root easily (3 pts.)		
5. Sexual Reproduction	U	9
□ Information unknown (U)		
6. Number of Viable Seeds or Propagules per Plant	U	No evidence
□ Information unknown (U)		
	1	8
□ two months(1 pts.)		
8. Dispersal Ability	U	No evidence
□ Information unknown (U)		
9. Generation Time	U	No evidence
□ Information unknown (U)		
10. Establishment	U	No evidence
□ Information unknown (U)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		

14. Impact on Native Plants	0	No evidence
□ no known negative effects on native plants (0 pts.)		
15. Hybridization	0	No evidence
□ no known instances of hybridization with other plant species (0 pts.)		
16. Population Density	U	No evidence
□ Information unknown (U)		
17. Role in Succession in Natural Areas	0	No evidence
□ successional information is unknown (0 pts.)		
18. Number of Habitats Invaded	1	Personal observation
□ only found in 1 broad category (1 pts.)		
Total Score	5	

Reference

1. USDA Plants database, plant profiles:http://plants.usda.gov/java/profile?symbol=LIMU6 Accessed 1-9-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=11612 Accessed 1-9-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed1-9-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed1-9-13

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-9-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-9-13

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. Missouri Botanical Garden Plant Details Page, *Liriope muscari*: http://www.missouribotanicalgarden.org/gardens-gardening/your-garden/plant-finder/plant-details/kc/l100/liriope-muscari.aspx Accessed 1-28-13

9. FLORIDATA webpage: http://www.floridata.com/ref/l/liri_mus.cfm Accessed 1-28-13

Question # for Step I	Notes for *Liriope muscari*
2	Species is not naturalized in Ohio according to ref.s 1 & 2. I have personally observed the species in Buttercup Nature Preserve, off-trail.
Question # for Step II	**Notes for *Liriope muscari***
1	Species is not naturalized in Ohio according to ref.s 1 & 2. I have personally observed the species in Buttercup Nature Preserve, off-trail, but it is unclear how the individual arrived at its location.
4	"Clumps slowly expand by short stolons, but do not spread aggressively like *Liriope spicata*."(8); 9->"spreads quite fast in reasonable soil"
5	Seeds will germinate, but FLORIDATA states that propagation is easier by dividing clumps. This makes it clear that the species should at least get 1 point for this answer, but more information is needed.
7	August - Sept.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Lonicera japonica*	Outcome:	Invasive	**References**	
Common Name:	Japanese honeysuckle	Score:	48		
Family Name:	Caprifoliaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,6,8,9	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,12	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	1,2,13
□ plant occurs in natural areas away from sit of planting (3 pts.)					

2. State Distribution[a] □ plant is naturalized in five regions in Ohio (5 pts.)	5	1,2
3. Regional/US Distribution □ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)	5	3,4,5,12
Step II: Biological Characters 4. Vegetative Reproduction □ has runners or spreading rhizomes that root easily (3 pts.)	3	7,8,9,11
5. Sexual Reproduction □ frequent sexual reproduction, but high variation among years in seed production (3 pts.)	3	7,9,11
6. Number of Viable Seeds or Propagules per Plant □ moderate (11-1,000) (3 pts.)	3	7,9
7. Flowering Period □ three to five months (2 pts.)	2	7,8,9
8. Dispersal Ability □ high potential for long-distance seed/propagule dispersal (5 pts.)	5	6,8,9
9. Generation Time □ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)	3	8
10. Establishment □ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)	5	6,8,9,10,11,13
Step II: Ecological Importance 11. Impact on Ecosystem Processes □ no known effect on ecosystem-level processes (0 pts.)	0	No evidence
12. Impact on Rare Organisms □ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)	0	No evidence
13. Impact on Native Animals □ no known negative impact on animals (0 pts.)	0	No evidence
14. Impact on Native Plants □ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)	3	6,8,9,11,13
15. Hybridization	0	No evidence

□ no known instances of hybridization with other plant species (0 pts.)		
16. Population Density	4	6,8,9,11,13
□ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)		
17. Role in Succession in Natural Areas	1	6,8,9
□ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)		
18. Number of Habitats Invaded	3	8,9
□ found in 2 broad categories or 2 rare habitat types (3 pts.)		
Total Score	48	

References

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch?keywordquery=lonicera+japonica&mode=sciname&submit.x=0&submit.y=0 Accessed 8-13-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at http://www.invasiveplantatlas.org/subject.html?sub=3039#maps; accessed 8-13-2012.

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 8-13-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 8-13-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on8-13-1212

6. Lemke, D. (2011). "Distribution modeling of Japanese honeysuckle (Lonicera japonica) invasion in the Cumberland Plateau and Mountain Region, USA". Forest ecology and management (0378-1127), 262 (2), p. 139.

7. Larson, K.C., Fowler, S.P. and Walker, J.C. (2002) "Lack of Pollinators Limits Fruit set in the Exotic Lonicera Japonica." *American Midland Naturalist,* 148 (1), pp. 54-60.

8. Schierenbeck, K.A. (2004). "Japanese honeysuckle (Lonicera japonica) as an invasive species; history, ecology, and context". Critical reviews in plant sciences (0735-2689), 23 (5), p. 391.

9. Munger, Gregory T. 2002. Lonicera japonica. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, March 6].

10. Skulman, B.W. (2004). "Evidence for allelopathic interference of Japanese honeysuckle (Lonicera japonica) to loblolly and shortleaf pine regeneration". Weed science (0043-1745), 52 (3), p. 433

11. Larson, B.M.H. (2007). "The biology of Canadian weeds. 135. Lonicera japonica Thunb.". Canadian journal of plant science (0008-4220), 87 (2), p. 423.

12. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd1/groups/public/documents/document/dcnr_010314.pdf Accessed 8-13-12.

13. Ohio Dept. of Natural Resources Japanese honeysuckle fact sheet: http://www.ohiodnr.com/dnap/invasive/9japhoneysuck/tabid/2004/Default.aspx Accessed 8-13-12

Question # for Step I	**Notes for *Lonicera japonicum***
2	Species has been detected in natural areas in all 5 regions, but the numbers of individuals in the populations is not stated.
3	Species has been detected in natural areas in all 5 regions. It has been shown to alter plant community compositions by reducing species diversity, especially in the understory community.
4	IN, KY,MI, PA
Question # for Step II	**Notes for *Lonicera japonicum***
5	Fertility is reduced b/c self-incompatible, and needs pollinators to disperse pollen, but its flowering period is very long.
6	Seed set is highly variable depending on light conditions, age, and size (to name a few). It is unclear how many seeds can be produced, but we know in some areas, the species is a prolific seed producers (many, many more than 11 seeds/plant/year), and in others, it is limited by self-incompatibility. Further research could increase answer's score.
7	7=>at least 3 months; 8=>ideal conditions allow for 8 months of flowering. 9=>3-7 months, depending on location. The answer for this question was chosen to be a conservative balance between 7, 8 and 9.
8	bird, deer, small mammals, humans,
9	1-2 years
14	Reduces species diversity throughout competing understory plants - this includes seedlings of important timber trees.
16	Species forms large monotypic stands.
17	There is not enough data available to determine if the species interferes with succession. It is known that the species can invade a range of successional forests (early to late) and that it can reduce species diversity. With more research, this answer will probably be switched to the 3 point answer.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Lonicera maackii*	Outcome:	Invasive	**References**	
Common Name:	Amur Honeysuckle	Score:	56		
Family Name:	Caprifoliaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2,7,8	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,7,8,	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	1,2,7,8
□ plant occurs in natural areas away from sit of planting (3 pts.)					

2. State Distribution[a] □ plant is naturalized in five regions in Ohio (5 pts.)	5	1,2,7,8
3. Regional/US Distribution □ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)	5	3,4,5,6
Step II: Biological Characters 4. Vegetative Reproduction □ no vegetative reproduction (0 pts.)	0	
5. Sexual Reproduction □ frequent sexual reproduction (one or more events per year) (5 pts.)	5	9
6. Number of Viable Seeds or Propagules per Plant □ prolific (>1,000) (5 pts.)	5	10
7. Flowering Period □ two months(1 pts.)	1	10
8. Dispersal Ability □ high potential for long-distance seed/propagule dispersal (5 pts.)	5	7,8,9,10
9. Generation Time □ long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (0 pts.)	0	10
10. Establishment □ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)	5	7,8
Step II: Ecological Importance 11. Impact on Ecosystem Processes □ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)	3	7,8,10
12. Impact on Rare Organisms □ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)	0	No evidence
13. Impact on Native Animals □ documented direct or indirect negative effects on animal taxa (3 pts.)	3	11
14. Impact on Native Plants □ impacts native plants to such an extent that community structure is greatly altered (5 pts.)	5	8,10
15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence

16. Population Density □ forms an extensive, monospecific stand (absolute cover >50%) (5 pts.)	5	7,8,10
17. Role in Succession in Natural Areas □ readily invades disturbed sites, persists and interferes with succession of native plants (3 pts.)	3	8,10
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	10
Total Score	56	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/profile?symbol=LOMA6 Accessed 8-13-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online athttp://www.invasiveplantatlas.org/subject.html?sub=3040;Accessed 8-13-12.

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 8-13-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 8-13-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 8-13-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 8-13-12.

7. Gorchov, D.L. and Trisel, D.E. (2003) Competitive effects of the invasive shrub, *Lonicera maackii*, on the growth and survival of native tree seedlings. *Plant Ecology* 166: 13-24.

8. Hartman, K.M. and McCarthy, B.C. (2008) Changes in forest structure and species composition following invasion by a non-indigenous shrub, Amur Honeysuckle (*Lonicera maackii*) *Journal of the Torrey Botanical Society* 135(2):245-259.

9. Luken, J.O. and Thieret, J.W. (1996) Amur Honeysuckle, Its fall from Grace. *BioScience* 46(1): 18-24.

10. Munger, Gregory T. 2005. Lonicera spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, August 13].

11. Watling, J.I. (2011). "Extracts of the invasive shrub Lonicera maackii increase mortality and alter behavior of amphibian larvae". Oecologia (0029-8549), 165 (1), p. 153.

Question # for Step I	Notes for *Lonicera maackii*
2	Species has been observed as naturalized in all 5 regions. Is documented as widespread in region 5.
4	IN,KY,MI,PA
Question # for Step II	**Notes for *Lonicera maackii***
3	IN,KY,MI,PA
5	9=>abundant annual fruit set;
6	up to 1.2 million seeds per plant
8	It is dispersed by birds and humans.
9	3rd or 4th year
10	While the species may not be able to invade late successional forests, it can aggressively invade the interiors of early and mid-successional forests
11	Species is allelopathic
13	*Anaxyrus americanus* tadpoles had increased mortality when reared in amur honeysuckle extracts.
14	8=>"We, however, found sites which were long-invaded by *Lonicera maackii* and consisting only of overstory trees and *L. maackii* shrubs. In sites that were long-invaded by *L. maackii*, we and others found that forests are virtually two-tiered systems consisting only of overstory trees and *L. maackii* shrubs with few plants in the understory and midstory recruitment strata."

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Maclura pomifera* (Raf.) C.K. Schneid.	Outcome:	Not invasive	**References**	
Common Name:	Osage Orange, Hedge apple	Score:	26		
Family Name:	Moraceae	Protocol conducted by Allison Mastalerz			
Step I Questions					
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.			
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		2,3,4,5	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**

Step II: Invasion Status		
1. Current Invasion in Ohio □ plant is only expanding from sites of previous planting (1 pts.)	1	6
2. State Distribution[a] □ plant is naturalized in five regions in Ohio (5 pts.)	5	5
3. Regional/US Distribution □ plant is not considered to be a problem in any other state (0 pts.)	0	2,3,4,5
Step II: Biological Characters		
4. Vegetative Reproduction □ reproduces readily within the original site (1 pts.)	1	6,8
5. Sexual Reproduction □ frequent sexual reproduction, but high variation among years in seed production (3 pts.)	3	6,7,8
6. Number of Viable Seeds or Propagules per Plant □ prolific (>1,000) (5 pts.)	5	6,7,8
7. Flowering Period □ two months(1 pts.)	1	6,7,8
8. Dispersal Ability □ high potential for long-distance seed/propagule dispersal (5 pts.)	5	7,8
9. Generation Time □ long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (0 pts.)	0	6,7,8
10. Establishment □ can only colonize certain habitat stages (e.g. early successional habitats) (1 pts.)	1	6,7,8
Step II: Ecological Importance		
11. Impact on Ecosystem Processes □ no known effect on ecosystem-level processes (0 pts.)	0	6
12. Impact on Rare Organisms □ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)	0	
13. Impact on Native Animals □ no known negative impact on animals (0 pts.)	0	

14. Impact on Native Plants	0	
□ no known negative effects on native plants (0 pts.)		
15. Hybridization	U	6
□ Unknown (U)		
16. Population Density	3	7,8
□ typically forms small, monospecific patches (3 pts.)		
17. Role in Succession in Natural Areas	0	
□ is an early successional species that temporarily invades a disturbed site but does not persist as the site matures (0 pts.)		
18. Number of Habitats Invaded	1	6,7,8
□ only found in 1 broad category (1 pts.)		
Total Score	26	

References

1. UDSA PLANTS Profile Page for Maclura pomifera: http://plants.usda.gov/java/profile?symbol=MAPO Accessed 7-9-13

2. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 7-9-13.

3. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 7-9-13.

4. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 7-9-13

5. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 7-9-13.

6. Smith, J.L. and Perino, J.V. (1981) Osage Orange (*Maclura pomifera*): History and Economic Uses. *Economic Botany* 35(1): 24-41.

7. Burns, Russell M., and Barbara H. Honkala, tech. coords. 1990. Silvics of North America: 1. Conifers; 2. Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. vol.2, 877 p.

8. Carey, Jennifer H. 1994. Maclura pomifera. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, July 9].

Question # for Step I	Notes for *Maclura pomifera*
3	The species is naturalized in Ohio, but it's impact on natural communities is unclear.
Question # for Step II	**Notes for *Maclura pomifera***
1	Species was used as a hedge in pioneer days and its successful naturalization is attributed to those individuals. More information could increase the score for this question
7	(6) indicates 1.5 months, (7) indicates 3 months therefore, 2 months was used. (8) suggests it depends on location.
8	dispersed by birds, livestock, and wild mammals and water
15	One hybrid of Osage orange is recognized, i.e., *Cudrania tricuspidata x Maclura pomifera var. inermis = Macludrania hybrida* Andr6 (Burton, 1973; Rehder 1940), and this hybrid is sometimes planted in the United States. *Cudrania* is native to China, Korea, and Japan.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Microstegium vimineum*	Outcome:	Invasive	**References**	
Common Name:	Japanese Stiltgrass	Score:	48		
Family Name:	Poaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,7,8,9	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	1,2

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a] □ plant is naturalized in five regions in Ohio (5 pts.)	5	2
3. Regional/US Distribution □ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)	5	3,4,5,6
Step II: Biological Characters	3	10
4. Vegetative Reproduction □ has runners or spreading rhizomes that root easily (3 pts.)		
5. Sexual Reproduction □ frequent sexual reproduction, but high variation among years in seed production (3 pts.)	3	9,10
6. Number of Viable Seeds or Propagules per Plant □ moderate (11-1,000) (3 pts.)	3	8,10
7. Flowering Period □ two months(1 pts.)	1	10
8. Dispersal Ability □ Information unknown (U)	U	7,8,9,10
9. Generation Time □ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)	3	7,8,9,10
10. Establishment □ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)	5	8,9,10
Step II: Ecological Importance	3	7,8,9,10
11. Impact on Ecosystem Processes □ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)		
12. Impact on Rare Organisms □ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)	0	No evidence
13. Impact on Native Animals □ documented direct or indirect negative effects on animal taxa (3 pts.)	3	8
14. Impact on Native Plants □ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)	3	8,9,10

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ typically forms small, monospecific patches (3 pts.)	3	7,8,9,10
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	7,8,9,10
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	9,10
Total Score	48	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch. Accessed 8-13-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at http://www.eddmaps.org/; last accessed June 27, 2012.

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed8-13-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 8-13-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on8-13-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 8-13-12.

7. Adams, S.N. and Engelhardt, K.A.M. (2009) Diversity declines in microstegium vimineum patches. *Biological Conservation*142:1003-1010.

8. Huebner, C.D. (2011). "Seed mass, viability, and germination of Japanese stiltgrass (Microstegium vimineum) under variable light and moisture conditions". Invasive plant science and management (1939-7291), 4 (3), p. 274.

9. Ward, J.S. and Mervosh, T.L. (2012). "Nonchemical and herbicide treatments for management of Japanese stiltgrass (Microstegium vimineum)". Invasive plant science and management (1939-7291), 5 (1), p. 9.

10. Fryer, Janet L. 2011. Microstegium vimineum. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, August 13].

Question # for Step I	Notes for *Microstegium vimineum*
2	1=>shows species in just region 5; 2=>shows species in all 5 regions. Population densities are not included in maps.
4	IN,KY,MI,PA
Question # for Step II	**Notes for *Microstegium vimineum***
2	While ref. 1 documents that the species is only in 1 region, ref. 2 is considered more up-to-date, therefore the answer is as it is.
3	IN,KY,MI,PA
4	Produces stolons and tillers.
6	5-50 seeds per plant
8	7,8,10=>state that species is able to disperse long distances b/c its ability to disperse by deer, flooding, and humans BUT ref. 9 & 10 caution that dispersal distances have yet to be determined through proper experimentation, and is based on anecdotal accounts, therefore the answer to this question is unknown.
9	species is an annual
11	Stiltgrass is associated with changes soil biota and chemistry. It contributes to declines in plant and wildlife diversity, and degrades forest production. Evidence is lacking for long-term effects, but as the length of the invasion increases, this answer will most likely become 5 points.
13	species associated with decreased soil microarthropod and arthropod diversity
14	Species reduces native plant diversity and can decrease important timber stock productivity
16	The species forms monocultures, but the size of the patches are not given.
17	The species does invade and persist in disturbed sites (and sites all across the successional gradient), but its ability to interfere with successional trajectories is unclear. All references state that the species has the potential to change succession, but more research is needed.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Morus alba*	Outcome:	Pending Further Review	**References**	
Common Name:	White Mulberry	Score:	36		
Family Name:	Moraceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2,7	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,7,8	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	1,2,7

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	3,4,6
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	0	8
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	7,8,9
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	3	8,9
□ moderate (11-1,000) (3 pts.)		
7. Flowering Period	1	7,8
□ two months(1 pts.)		
8. Dispersal Ability	5	7,8
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	U	7,8,9
□ Information unknown (U)		
10. Establishment	1	8
□ can only colonize certain habitat stages (e.g. early successional habitats) (1 pts.)		
Step II: Ecological Importance	0	8
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	no evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	no evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	7,8,9
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.)	3	7,8,9
16. Population Density □ occurs only as small, sporadic populations or individuals (1 pts.)	1	7,8
17. Role in Succession in Natural Areas □ successional information is unknown (0 pts.)	0	8
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	8
Total Score	36	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch?keywordquery=morus+alba&mode=sciname&submit.x=0&submit.y=0 Accessed 8-14-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=6050 Accessed 8-14-12

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 8-14-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 8-14-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 8-14-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 8-14-12.

7. Ohio Perennial and Biennial Weed Guide, OARDC - Ohio State University: http://www.oardc.ohio-state.edu/weedguide/singlerecord.asp?id=200 Accessed 8-14-12.

8. Stone, Katharine R. 2009. Morus alba. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, August 14].

9. Burgess, K.S., Morgan, M. and Husband, B.C. (2008). "Interspecific seed discounting and the fertility cost of hybridization in an endangered species". *The New phytologist* (0028-646X), 177 (1), p. 276.

Question # for Step I	Notes for *Morus alba*
2	Species has naturalized in natural areas, but population sizes are not documented.
3	This is debatable because the species has naturalized in natural areas. It is considered a threat to the native red mulberry due to its ability to hybridize with it. This is a population level, not ecosystem level, effect. Further, it is important to note that this species is considered more of a problem in areas of no-till farming than in forests (where its populations tend to be low).
4	IN,KY,PA (on "watch list")
Question # for Step II	**Notes for *Morus alba***
2	It is naturalized in all but 2 counties.
3	IN,KY,PA (on "watch list")
5	The species produces seeds annually, but no evidence was found to conclude that seed production did not vary from year to year. More long-term research into this species seed output could change this answer to the 5 point answer.
6	It is clear that plants produce more than 11 viable seeds per year from these two references, but actual average seed set numbers were not found.
7	Flowering occurs for 2 to 3 months. Reference 8 says the duration is *generally* 2 months, thus the 1 point answer.
8	Dispersed by birds and mammals.
9	References state species is fast growing, but average maturation age was not found
10	Species has been observed within different habitat stages (not *only* in early successional habitats), but its population levels outside of early successional habitats appeared to be low (not aggressive).
11	There is little evidence that supports ecosystem-level process alterations. The species has been observed once forming a dense thicket that excluded understory vegetation (S. Carolina), but all other observations maintain the species rarely becomes dominant in natural areas
14	Species hybridizes with native red mulberry. There is evidence that the white mulberry species is acting as a "genetic sink" to the red mulberry, causing the red mulberry populations to decline - and possibly become locally extinct.
15	See notes for question 14

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Pastinaca sativa*	Outcome:	Not Invasive	**References**	
Common Name:	Wild Parsnip	Score:	34		
Family Name:	Apiaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		7	
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.			
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	8
□ plant occurs in natural areas away from sit of planting (3 pts.)					

2. State Distribution[a] □ plant is naturalized in five regions in Ohio (5 pts.)	5	1,2
3. Regional/US Distribution □ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)	3	5,6
Step II: Biological Characters 4. Vegetative Reproduction □ no vegetative reproduction (0 pts.)	0	8
5. Sexual Reproduction □ infrequent sexual reproduction (1 pts.)	1	8,9,10
6. Number of Viable Seeds or Propagules per Plant □ prolific (>1,000) (5 pts.)	5	8
7. Flowering Period □ two months(1 pts.)	1	10
8. Dispersal Ability □ low potential for long-distance seed/propagule dispersal (>1km) (0 pts.)	0	8
9. Generation Time □ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)	3	9,10,11
10. Establishment □ aggressively colonizes and establishes in edge habitats (3 pts.)	3	10,11
Step II: Ecological Importance 11. Impact on Ecosystem Processes □ no known effect on ecosystem-level processes (0 pts.)	0	No evidence
12. Impact on Rare Organisms □ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)	0	No evidence
13. Impact on Native Animals □ documented direct or indirect negative effects on animal taxa (3 pts.)	3	8,11
14. Impact on Native Plants □ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)	3	8
15. Hybridization	0	8

□ no known instances of hybridization with other plant species (0 pts.)		
16. Population Density	3	8
□ typically forms small, monospecific patches (3 pts.)		
17. Role in Succession in Natural Areas	0	No evidence
□ successional information is unknown (0 pts.)		
18. Number of Habitats Invaded	1	11
□ only found in 1 broad category (1 pts.)		
Total Score	34	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=PASA2 Accessed 1-9-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at:http://www.invasive.org/browse/subinfo.cfm?sub=6147Accessed 1-9-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-9-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-9-13.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-9-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-9-13

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. N. Cain, S Darbyshire, A. Francis, R Nurse, M Simard . The Biology of Canadian weeds. 144. Pastinaca sativa L.. Canadian Journal of Plant Science, Volume 90, Number 2 (January 2010), pp. 217-240, <http://ejournals.ebsco.com/direct.asp?ArticleID=499BB87A370158F9BB14>

9. Vasques, E.C. and Meyer, G.A. (2011) Relationships among leaf damage, natural enemy release and abundance in exotic and native prairie plants. *Biological Invasions* 13:621-633.

10. Baskin, J.M. and Baskin, C.M. (1979) Studies on the autecology and population biology of the weedy monocarpic perennial *Pastinaca sativa. Journal of Ecology* 67(2): 601-610.

11. Illinois Natural History Survey, Prairie Research Institute; Vegetation Management Guideline for Wild Parsnip (*Pastinaca sativa).* http://www.inhs.uiuc.edu/research/VMG/parsnip.html Accessed 1-28-13

Question # for Step I	Notes for *Pastinaca sativa*
1	On Ohio's Noxious Weed list
2	species widespread, but population sizes information lacking
3	ecosystem impact unclear
4	MI, PA
Question # for Step II	**Notes for *Pastinaca sativa***
3	MI, PA
5	Species is considered a biennial, but under certain conditions, it may remain as a basal rosette for several years.
6	~2,000 seeds/plant average
7	May and June
9	Species is considered a biennial, but under certain conditions, it may remain as a basal rosette for several years.
13	Species can cause photo-activated dermatitis for humans and livestock, as well as microinvertabrates.
14	"Species out-competes other lower-growing herbaceous vegetation."
15	*Pastinaca sativa* includes both cultivated and wild varieties which hybridize with each other. Unlikely to impact Ohio natives or crops. "Clearly, there are different wild and cultivated forms, the former behaving as a weed with highly toxic biochemical properties, and the latter being edible and significantly less toxic (Berenbaum etal. 1984).
16	Occurs as single plants in some instances, and as a dominant species in other instances. The 3 point answer reflects a compromise between the two realities.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Paulownia tomentosa*	Outcome:	Plant of Concern	**References**	
Common Name:	Princess tree	Score:	36		
Family Name:	Paulowniaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**References**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	1,2,3,7,8

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	3	1,2
□ plant is naturalized in three regions in Ohio (3 pts.)		
3. Regional/US Distribution	5	3,4,6,8
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	3	8
4. Vegetative Reproduction		
□ has runners or spreading rhizomes that root easily (3 pts.)		
5. Sexual Reproduction	3	8
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	7,8
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	0	8
□ one month or less per year (0 pts.)		
8. Dispersal Ability	5	7,8
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	0	7,8
□ long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (0 pts.)		
10. Establishment	1	8
□ can only colonize certain habitat stages (e.g. early successional habitats) (1 pts.)		
Step II: Ecological Importance	0	8
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	3	7
□ negatively impacts listed species, such as through displacement or interbreeding (3 pts.)		
13. Impact on Native Animals	0	no evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	7
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	no evidence
16. Population Density □ occurs only as small, sporadic populations or individuals (1 pts.)	1	8
17. Role in Succession in Natural Areas □ is an early successional species that temporarily invades a disturbed site but does not persist as the site matures (0 pts.)	0	7,8
18. Number of Habitats Invaded □ only found in 1 broad category (1 pts.)	1	8
Total Score	36	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch?keywordquery=paulownia+tomentosa&mode=sciname&submit.x=0&submit.y=0 Accessed 8-14-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=6050 Accessed 8-14-12

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 8-14-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 8-14-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 8-14-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 8-14-12.

7. Kuppinger, D.M., Jenkins, M.A. and White, P.S. (2010). "Predicting the post-fire establishment and persistence of an invasive tree species across a complex landscape". Biological invasions (1387-3547), 12 (10), p. 3473.

8. Innes, Robin J. 2009. Paulownia tomentosa. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, August 14].

Question # for Step I	Notes for *Paulownia tomentosa*
2	Reference 1: 2 regions (4 & 5); Reference 2: 3 regions (3,4 & 5). Widespread dispersion and establishment information is not included in the references.
3	Species is known to form self-replicating populations outside of cultivation, but its ability to alter natural ecosystems is unclear.
4	IN,KY,PA
Question # for Step II	**Notes for *Paulownia tomentosa***
1	Species is a long-distance disperser, able to colonize disturbed habitats.
2	Reference 2 is considered more up-to-date, so the answer is in conjunction with reference 2 instead of reference 1 (which only states 2 regions).
3	IN, KY, PA
4	8=>Has adventitious buds on stems and roots which play important role in species "reproductive success and invasiveness."
5	Sexual reproduction occurs after ~10 years of age, but it is unclear how variable seed production is (light plays an important role), therefore, a conservative answer of 3 points is used. Further research is likely to increase this answer to 5 points.
6	a single tree can produce millions of seeds.
7	1 month
8	7=>the small seeds "have been measured at 3.5 km from the nearest mature individual."
9	8-10 years
10	8=>" Princesstree seedling establishment may be infrequent and widely scattered." The species depends on high-light for germination and development
12	This species creates a displacement concern for *Liatris helleri* and *Hudsonia montana,* 2 federally threatened plant species in North Carolina
14	Is able to outcompete many native plants in rocky outcrop areas where resources are limited.
16	Species rarely forms monospecific stands
17	7=>Species very intolerant of shade and does not "compete well in forest understories", but it "has been observed in xeric *Pinus*-dominated forests following fires.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Persicaria perfoliata*	Outcome:	Invasive	**References**	
Common Name:	Mile-a-minute weed	Score:	40		
Family Name:	Polygonaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1	
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		2,7,9,10	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-**

Step II: Invasion Status		ences
1. Current Invasion in Ohio	3	2,7
□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	2	2
□ plant is naturalized in two regions in Ohio (2 pts.)		
3. Regional/US Distribution	5	3,4,6
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	0	9,10
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	10
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	3	7,10
□ moderate (11-1,000) (3 pts.)		
7. Flowering Period	1	8,10
□ two months(1 pts.)		
8. Dispersal Ability	5	7,8,10
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	3	8,10
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)		
10. Establishment	3	7,10
□ aggressively colonizes and establishes in edge habitats (3 pts.)		
Step II: Ecological Importance	0	no evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	no evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	no evidence
□ no known negative impact on animals (0 pts.)		

14. Impact on Native Plants □ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)	3	8,10
15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	no evidence
16. Population Density □ forms an extensive, monospecific stand (absolute cover >50%) (5 pts.)	5	8,10
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	8,10
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	10
Total Score	40	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch?keywordquery=persicaria+perfoliata&mode=sciname&submit.x=0&submit.y=0 Accessed 8-14-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3065 Accessed 8-14-12

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 8-14-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 8-14-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 8-14-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 8-14-12.

7. Hough-Goldstein, Lake, E. and Reardon, R. (2012). "Status of an ongoing biological control program for the invasive vine, Persicaria perfoliata in eastern North America". BioControl (Dordrecht, Netherlands) (1386-6141), 57 (2), p. 181.

8. Hough-Goldstein J, Lake E, Reardon R, Wu Y (2008a) Biology and biological control of mile-a-minute weed. USDA Forest Service FHTET-2008–2010

9. Stone, Katharine R. 2010. Polygonum perfoliatum. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, August 14].

Question # for Step I	Notes for *Persicaria perfoliata*
1	The state of Ohio calls the species *Polygonum perfoliatum.*
2	Documented in 2 regions (3 and 4), but no population densities were found for the counties. In addition, I observed the species in California Woods and Embshoff Woods (region 5).
3	The species is not cultivated, in 3 regions, and does alter the structural and compositional aspects of the ecosystems it inhabits.
4	IN, KY, PA, CT, MA

Question # for Step II	Notes for *Persicaria perfoliata*
1	Species is not cultivated. It's occurrence is not considered a result of escaped planting.
2	Reference 2 shows the species to be in 2 regions (3 &4), but I have observed it in forests in region 5. More accurate and up-to-date data collection will probably increase this score to at least 3.
3	IN, KY, PA
5	Seed set has been documented as little as 7 seeds/plant/year to 3,500seeds/plants/year.
6	See notes for question 5.
8	Dispersed by birds, deer and water. Seeds can remain buoyant for 7 days.
9	Species is an annual
14	Species smothers native vegetation, including tree saplings.
17	Where the species forms dense mats, successional trajectories can be altered because of the changes in plant diversity and abundances. It is important to note that the species ability to form mats varies with location, so successional changes will vary with location.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Plantago major*	Outcome:	Pending Further Review	**References**	
Common Name:	Broad Leaf Plantain	Score:	37		
Family Name:	Plantaginaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	2,10
□ plant occurs in natural areas away from sit of planting (3 pts.)					

2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	2, 8, 9,10
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	0	2,10
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	2,10
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	3	2,10
□ moderate (11-1,000) (3 pts.)		
7. Flowering Period	2	2,10
□ three to five months (2 pts.)		
8. Dispersal Ability	5	2,10
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	3	10
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)		
10. Establishment	3	10
□ aggressively colonizes and establishes in edge habitats (3 pts.)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	0	No evidence
□ no known negative effects on native plants (0 pts.)		
15. Hybridization	0	10

□ no known instances of hybridization with other plant species (0 pts.)		
16. Population Density □ typically forms small, monospecific patches (3 pts.)	3	10
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	10
18. Number of Habitats Invaded □ only found in 1 broad category (1 pts.)	1	10
Total Score	37	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=PLMA2. Accessed 12-5-12.

2.Cardina, J., Herms, C., Koch, T. and Webster, T. (n.d.) Ohio Perennial & Biennial Weed Guide: Broad Leaf Plantain Weed Guide. The Ohio State University OARDC Extension. http://www.oardc.ohio-state.edu/weedguide/singlerecord.asp?id=791. Last accessed December 5, 2012.

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 12-5-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 12-5-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 12-5-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 12-5-12.

7. University of California Agriculture and Natural Resources Statewide Integrated Pest Management Program Weed Photo Gallery http://www.ipm.ucdavis.edu/PMG/WEEDS/broadleaf_plantain.html. Accessed 12-5-12.

8. Purdue Master Gardener Guide to Common Lawn and Garden Weeds. http://www3.ag.purdue.edu/extension/mglinks/Documents/Purdue%20Master%20Gardener%20Guide%20to%20Common%20Lawn%20and%20Garden%20Weeds.pdf

9. The University of Texas at Austin Lady Bird Johnson Wildflower center. http://wildflower.org/plants/result.php?id_plant=PLMA2. Accessed 12-5-12.

10. Hawthorn, W.R. (1974) The biology of Canadian weeds. 4. Plantago major and P. rugelii Canadian Journal of Plant Science 54:383-396.

Question # for Step I	Notes for *Plantago major*
2	Is present in numerous counties in all 5 regions, but no abundance data.
3	Plant has self-replicated populations, but no info found on ecosystem effects, if any.
4	Not labeled 'invasive' in IN, KY, MI, or PA.
Question # for Step II	**Notes for *Plantago major***
3	Plant is considered a lawn weed across the country. I hesitate to give the 5 point answer, but it *is* considered a weed throughout the US and Canada.
4	Can reproduce by root fragments, but the root does not fragment often or easily.
5	One long event per year, but information on seed production variance was not found, so default score is 3.
6	Average of 565 (10), but can produce up to 14,000 seeds/year (2). The variation in these two numbers indicates the 3 pt. answer is conservative, but probably more appropriate.
7	June-Sept. (2)
8	Seeds dispersed by wind and birds. When wet, seed become sticky and will adhere to animals, tires, etc.
10	Can quickly colonize disturbed areas.
17	Plant readily invades disturbed habitat, but its role in succession is unclear.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Polygonum cespitosum*	Outcome:	Pending further review	**References**	
Common Name:	Oriental lady's thumb (Asiatic smartweed)	Score:	39		
Family Name:	Polygonaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		8	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6,7	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					

1. Current Invasion in Ohio □ plant occurs in natural areas away from sit of planting (3 pts.)	3	8
2. State Distribution[a] □ plant is naturalized in five regions in Ohio (5 pts.)	5	1
3. Regional/US Distribution □ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)	3	4,6
Step II: Biological Characters 4. Vegetative Reproduction □ no vegetative reproduction (0 pts.)	0	11
5. Sexual Reproduction □ frequent sexual reproduction, but high variation among years in seed production (3 pts.)	3	8,11
6. Number of Viable Seeds or Propagules per Plant □ Information unknown (U)	U	No evidence
7. Flowering Period □ three to five months (2 pts.)	2	9,10
8. Dispersal Ability □ high potential for long-distance seed/propagule dispersal (5 pts.)	5	11
9. Generation Time □ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)	3	8
10. Establishment □ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)	5	8,11
Step II: Ecological Importance 11. Impact on Ecosystem Processes □ no known effect on ecosystem-level processes (0 pts.)	0	No evidence
12. Impact on Rare Organisms □ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)	0	No evidence
13. Impact on Native Animals □ no known negative impact on animals (0 pts.)	0	No evidence
14. Impact on Native Plants	3	10

□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		
15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ typically forms small, monospecific patches (3 pts.)	3	10
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	11
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	8,11
Total Score	39	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=POCE4 Accessed 1-9-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=20414 Accessed 1-9-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed1-9-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-9-13.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-9-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-9-13

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. Matesanz S, Horgan-Kobelski T, Sultan SE (2012) Phenotypic Plasticity and Population Differentiation in an Ongoing Species Invasion. PLoS ONE 7(9): e44955.

9. Paterson AK (2000) Range Expansion of Polygonum caespitosum var. longisetum in the United States. Bartonia 60: 57–69.

10. Mehrhoff LJ, Silander JAJ, Leicht SA, Mosher ES, Tabak NM (2003) IPANE. Invasive plant atlas of New England. Department of Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT, USA. http://www.ipane.org. Accessed 1-29-13

11. Stone, Katharine R. 2010. Persicaria longiseta. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, January 29].

Question # for Step I	Notes for *Polygonum cespitosum*
2	Ref. 1 show species in all 5 regions, ref. 2 do not show the species in Ohio. I observed it in 9 different forests in southwestern Ohio. The variety of scientific names associated with this plant is possibly the reason for the inconsistency.
3	Species is not under cultivation, so it's distribution is a result of something else. The impacts on ecosystem processes and functions are unclear.
4	CT(7),KY ("bunchy knotweed"=*Polygonum cespitosum*), PA (*Persicaria longiseta*)
Question # for Step II	**Notes for *Polygonum cespitosum***
1	Plant is not cultivated.
3	KY, PA
5	Seed output varies with changes in the environment (soil moisture, solar exposure).
8	"seeds germinated from white-tailed deer fecal pellets."
9	Species is an annual.
10	Species *can* be aggressive, but historically the species can invade healthy, natural areas without being aggressive (so far).
14	Can out-compete native plants that "thrive in moist, shaded habitats."
17	"It is not clear whether Oriental lady's thumb may influence the successional trajectories of native plant communities where it establishes. The documentation of Oriental lady's thumb establishing at both low and high abundance [35] suggests that its impact on plant community succession probably varies by location. "

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Pyrus calleryana*	Outcome:	Invasive	**References**	
Common Name:	Callery Pear	Score:	45		
Family Name:	Rosaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,7,8	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		4,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	2,7

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a] □ plant is naturalized in three regions in Ohio (3 pts.)	3	2
3. Regional/US Distribution □ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)	3	4,6
Step II: Biological Characters 4. Vegetative Reproduction □ no vegetative reproduction (0 pts.)	0	No evidence
5. Sexual Reproduction □ frequent sexual reproduction, but high variation among years in seed production (3 pts.)	5	9
6. Number of Viable Seeds or Propagules per Plant □ moderate (11-1,000) (3 pts.)	5	9
7. Flowering Period □ two months(1 pts.)	1	8
8. Dispersal Ability □ high potential for long-distance seed/propagule dispersal (5 pts.)	5	7,8
9. Generation Time □ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)	3	7,8
10. Establishment □ aggressively colonizes and establishes in edge habitats (3 pts.)	3	7,8
Step II: Ecological Importance 11. Impact on Ecosystem Processes □ no known effect on ecosystem-level processes (0 pts.)	0	No evidence
12. Impact on Rare Organisms □ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)	0	No evidence
13. Impact on Native Animals □ no known negative impact on animals (0 pts.)	0	No evidence
14. Impact on Native Plants □ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)	3	7,8

15. Hybridization □ can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.)	3	9
16. Population Density □ typically forms small, monospecific patches (3 pts.)	3	7,8
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	7,8
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	7,8
Total Score	45	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=PYCA80 Accessed 8-15-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=10957 Accessed 8-15-12

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 8-15-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 8-15-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 8-15-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 8-15-12.

7. Culley, T.M. and Hardiman, N.A. (2007) The beginning of a new invasive plant: a history of the ornamental callery pear in the United States. *BioScience* 57(11): 956-964.

8. Vincent, M.A. (2005) On the spread and current distribution of Pyrus calleryana in the US. *Castanea* 70(1):20-31

9. Theresa Culley, pH.d, University of Cincinnati, Department of Biology. Personal Communication, 1-23-13

Question # for Step I	Notes for *Pyrus calleryana*
2	Reference shows only 1 county with species naturalized, but reference 2 shows 20, spanning 3 regions. Size of the populations is not clear.
3	Species has self-replicating populations and can alter the composition and structure of natural ecosystems by creating dense thickets.
4	KY,PA
Question # for Step II	**Notes for *Pyrus calleryana***
6	8=>"frequent large fruit set"
7	Reference 8 states species can have a second flowering in Sept.-Oct. brought about by drought and other stresses. Because this seems to be unusual, it is not added to the flowering time span. It is possible that this answer could receive more points if the second flowering appears to become more usual.
8	Dispersed by birds.
9	3 years
10	Species is not shade-tolerant, so it's ability to invade a variety of habitats is limited, but in open areas, such as forest light-gaps and edges, as well as wetlands, species can aggressively invade. The 3 point answer is considered a middle-ground answer.
14	By creating dense, thorny thickets, native species diversity can be degraded.
16	Species can form dense, thorny thickets, but no absolute cover values were discovered. More information about escaped populations will likely increase the score for this question.
17	Species invades disturbed sites, but the impact to successional trajectories in unclear. More research may change this answer to the 3 point answer.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Rhamnus cathartica*	Outcome:	Pending further review	**References**	
Common Name:	Common buckthorn, European buckthorn	Score:	43		
Family Name:	Rhamnaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.			
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6,7	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				U	1,2

□ Information unknown (U)		
2. State Distribution[a]	4	1,2
□ plant is naturalized in four regions in Ohio (4 pts.)		
3. Regional/US Distribution	3	5,6
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)		
Step II: Biological Characters	0	10
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	10
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	3	10
□ moderate (11-1,000) (3 pts.)		
7. Flowering Period	1	10
□ two months(1 pts.)		
8. Dispersal Ability	5	8, 10
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	0	10
□ long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (0 pts.)		
10. Establishment	5	10
□ aggressively colonizes and establishes in intact and healthy natural areas (5 pts.)		
Step II: Ecological Importance	3	8,9, 10
11. Impact on Ecosystem Processes		
□ moderate effects on ecosystem-level processes (e.g., changes in nutrient cycling)(3 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	8
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.)	3	10
16. Population Density □ forms an extensive, monospecific stand (absolute cover >50%) (5 pts.)	5	8, 10
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	9,10
18. Number of Habitats Invaded □ found in 3 broad categories or 3 rare habitat types (4 pts.)	4	8,9,10
Total Score	43	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=RHCA3 Accessed 1-10-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3070 Accessed 1-10-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-10-13

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-10-13

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-10-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-10-13

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. Becker, R.H., Zmijewski, K.A. and Crail, T. (2013) Seeing the forest for the invasives: mapping buckthorn in the oak openings. *Biological Invasions*15:315-326.

9. Klionsky, S.M., Amatangelo, K.L. and Waller, D.M. (2010) Above- and Belowground Impacts of European Buckthorn (*Rhamnus cathartica*) on Four Native Forbs. *Restoration Ecology* 19(6):728-737

10. Zouhar, Kris. 2011. Rhamnus cathartica, R. davurica. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, January 29].

Question # for Step I	Notes for *Rhamnus cathartica*
2	Species occurs in 4 regions of Ohio, but population sizes are not documented.
3	Species occurs in 4 regions of Ohio, but impacts on ecological processes and functions are not documented.
4	CT, IL, MA, NH, VT, MI, PA
Question # for Step II	**Notes for *Rhamnus cathartica***
1	Species exists in natural areas, but the extent in which it exists outside of planting is unclear. I believe species occurs in areas away from site of planting, but evidence is necessary for confirmation.
3	MI, PA
5	Site conditions impact fruit set
6	fruit set variable - but plants that do produce seed produce more than 11 viable seeds, with very few accounts describing more than 1000 seeds per plant (and those were in Europe)
7	May to June
8	dispersed by birds, water, deer, small mammals. The seeds produce a "severe laxative effect" that help distribute the seed.
11	Influx of nutrients, create favorable soil conditions for exotic earthworms (positive feedback loop between the two) 9=>"affects soil chemistry by acidifying soil, increasing nitrogen content, and lowering soil C:N." also "The results presented here support observations that *R. cathartica* changes the soil environment in ways that often depress the germination growth, and flowering of forest herbs." the authors of ref. 9 believe that species is allelopathic, but more studies are necessary.
14	Species can cause a reduction in species richness, inhibition of seedling germination, growth, and flowering.
15	Species can hybridize with other *Rhamnus* species - in Michigan, species was observed hybridizing with Chinese buckthorn (*R. utiis*)
17	ref 9 indicates that the persistence of this species in an area will likely change the successional trajectory of Wisconsin forests, but time and more data are needed.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Rosa multiflora*	Outcome:	Pending Further Review	**References**	
Common Name:	Multiflora Rose	Score:	44		
Family Name:	Rosaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2,8	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.		1,2,7,8,9	
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**References**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	1,2,8

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	5	3,4,5,6
□ plant has been reported to be a widespread problem in 3 or more adjoining states (5 pts.)		
Step II: Biological Characters	3	7,8,9,10
4. Vegetative Reproduction		
□ has runners or spreading rhizomes that root easily (3 pts.)		
5. Sexual Reproduction	3	8,9,10
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	8,10
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	1	10
□ two months(1 pts.)		
8. Dispersal Ability	5	7,9,10
□ high potential for long-distance seed/propagule dispersal (5 pts.)		
9. Generation Time	U	No evidence
□ Information unknown (U)		
10. Establishment	3	8,9,10
□ aggressively colonizes and establishes in edge habitats (3 pts.)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	7,8,10
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	8,9,10
17. Role in Succession in Natural Areas □ readily invades disturbed sites and persists, but does not interfere with succession (1 pts.)	1	9,10
18. Number of Habitats Invaded		
□ found in 2 broad categories or 2 rare habitat types (3 pts.)	3	8,9,10
Total Score	44	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch?keywordquery=rosa+multiflora&mode=sciname&submit.x=0&submit.y=0 Accessed 8-15-12

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=3071 Accessed 8-15-12

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 8-15-12.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 8-15-12.

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).: http://mnfi.anr.msu.edu/education/factsheets.cfm. Accessed on 8-15-12

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 8-15-12.

7. Jesse, L.C., Nason, J.D., Obrycki, J.J. and Moloney, K.A. (2010) Quantifying the levels of sexual reproduction and clonal spread in the invasive plant, *Rosa multiflora*. *Biological Invasions* 12:1847-1854.

8. Ohio Department of Natural Resources Invasive Plants of Ohio Fact Sheet 8: http://ohiodnr.com/dnap/invasive/8multirose/tabid/2003/Default.aspx Accessed 8-15-12

9. Banasiak, S.E. and Meiners, S.J. (2009) Long term dynamics of *Rosa multiflora*in a successional system. *Biological Invasions* 11:215-224

10. Munger, Gregory T. 2002. Rosa multiflora. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, August 15].

Question # for Step I	Notes for *Rosa multiflora*
2	Thickets of this species dislocate native species in Ohio, particularly in "pastures, woodlots and non-cropland. (8)"
3	See notes for question 2
4	IN,KY,MI,PA
Question # for Step II	**Notes for *Rosa multiflora***
4	Arching stems produce roots once they arch to the ground, creating new plants (layering)
5	Creates viable seed, but seed production varies based on precipitation and light variables.
6	8=>1million seeds/plant/year; 10=>up to 500,000seeds/plant/year
8	Dispersed by birds and rodents
10	Species can aggressively invade open habitats. It also has the ability to form populations in more mature forests, but these populations are rarely considered aggressive, therefore the answer receives 3 points.
14	Species forms dense, impenetrable thickets which can displace native vegetation
16	Species forms dense, impenetrable thickets. Reference 9 states that species can vary its absolute cover from 0-100%, with an average mean plot cover of 30% in a 28 year old abandoned pasture. The mean plot cover was used to determine the answer for this question.
17	Reference 9 states that species ability to invade mature woodlands should not be considered great, but adds the caveat that large canopy opening events could allow the species to "arrest succession at the shrub stage."
18	8=>"This plant readily invades open woodlands, forest edges, successional fields, savannas and prairies."; 9=>riparian areas, woodlands, and some mature forests

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Taraxacum officinale*	Outcome:	Not invasive	References	
Common Name:	Dandelion	Score:	28		
Family Name:	Asteraceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,7	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.			
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		2,3,4,5	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**References**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	1,7

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	5	1
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	0	2,3,4,5,6
□ plant is not considered to be a problem in any other state (0 pts.)		
Step II: Biological Characters		
4. Vegetative Reproduction	1	7
□ reproduces readily within the original site (1 pts.)		
5. Sexual Reproduction	0	6
□ no sexual reproduction (0 pts.)		
6. Number of Viable Seeds or Propagules per Plant	5	7
□ prolific (>1,000) (5 pts.)		
7. Flowering Period	2	6,8
□ three to five months (2 pts.)		
8. Dispersal Ability	3	6,7,8
□ medium potential for long-distance seed/propagule dispersal (3 pts.)		
9. Generation Time	3	8
□ short juvenile period (<5 years for trees, <3 years for other forms) (3 pts.)		
10. Establishment	1	6
□ can only colonize certain habitat stages (e.g. early successional habitats) (1 pts.)		
Step II: Ecological Importance		
11. Impact on Ecosystem Processes	0	
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	0	No direct evidence
□ no known negative effects on native plants (0 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	9
16. Population Density □ is a dominant plant in area where population occurs (absolute cover 15-50%) (4 pts.)	4	6
17. Role in Succession in Natural Areas □ is an early successional species that temporarily invades a disturbed site but does not persist as the site matures (0 pts.)	0	6
18. Number of Habitats Invaded □ only found in 1 broad category (1 pts.)	1	6
Total Score	28	

Reference

1. USDA PLANTS database, PLANTS Profile page: http://plants.usda.gov/java/profile?symbol=TAOFO Accessed 2-27-13

2. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 2-27-13

3. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 2-27-13

4. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed 2-27-13

5. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 2-27-13

6. Esser, Lora L. 1993. Taraxacum officinale. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ Accessed 2-27-13

7. Ohio State University, Ohio Perennial and Biennial Weed Guide: http://www.oardc.ohio-state.edu/weedguide/singlerecord.asp?id=950 Accessed 2-27-13

8. Martinkova, Z., Honek, A. and Lukas, J. (2011) Viability of *Taraxacum officinale* seeds after anthesis. *Weed Research* 51: 508-515.

9. Brock, M.T. (2009) Prezygotic barriers to gene flow between *Taraxacum ceratophorum* and the invasive *Taraxacum officinale* (Asteraceae). *Oecologia* 161: 241-251.

10. Collier, M.H., Keane, B. and Rogstad, S.H. (2010) Productivity differences between dandelion (*Taraxacum officinale*; Asteraceae) clones from pollution impacted versus non-impacted soils. *Plant Soil* 329: 173-183.

Question # for Step I	Notes for *Taraxacum officinale*
2	Mainly an agricultural weed in no-till and/or organic farms. Has been reported as an early successional problem in Montana forests, displacing conifer seedlings.
3	I found no documentation that the species alters the composition, structure, or normal processes of functions of a natural ecosystem.
Question # for Step II	**Notes for *Taraxacum officinale***
3	It does occur as a weed in all 50 states. 6=>"In Montana, common dandelion seedlings compete with conifer seedlings on forest sites. Grass seeding on these sites will eventually decrease the common dandelion population in 4 to 5 years."
4	Root fragments will generate new plants.
5	Species reproduces apomictically through parthenogenesis.
6	3,000-23,000 seeds per plant per year
7	approx. 5 months
8	Species is wind dispersed
15	Species can hybridize with a native alpine *Taraxacum* species, but no native Ohio species.
16	The 4 point score was selected because the species does not form monospecific stands, and has been documented as 17.2% cover in some places.
17	Species can invade a natural area, but it often loses its competitive ability after several years.
18	6=> Prairie, Wet grasslands, Annual grasslands

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Ulmus pumila*	Outcome:	Not invasive	**References**	
Common Name:	Dwarf elm, Siberian elm, littleleaf elm	Score:	28		
Family Name:	Ulmaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?	☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.				
	☐ No. Continue on to question 2.				
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]	☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			1,2	
	☐ No. Continue on to question 3.				
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?	☐ Yes.			1,2	
	☐ No.				
	☐ Unknown.				
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]	☐ Yes.			3,4,5,6	
	☐ No.				
	☐ Unknown.				
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				U	1,2

□ Information unknown (U)		
2. State Distribution[a]	5	1,2
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	3	3,6,8,10
□ plant has been reported to be a widespread problem in 1-2 adjoining states (3 pts.)		
Step II: Biological Characters	0	No evidence
4. Vegetative Reproduction		
□ no vegetative reproduction (0 pts.)		
5. Sexual Reproduction	3	10
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	U	No evidence
□ Information unknown (U)		
7. Flowering Period	1	9
□ two months(1 pts.)		
8. Dispersal Ability	3	8,10
□ medium potential for long-distance seed/propagule dispersal (3 pts.)		
9. Generation Time	0	8
□ long juvenile period (>5 or more years for trees, 3 or more years for other growth forms) (0 pts.)		
10. Establishment	3	10
□ aggressively colonizes and establishes in edge habitats (3 pts.)		
Step II: Ecological Importance	0	No evidence
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	10
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ can hybridize with native Ohio plants or commercially-available species, producing viable seed (3 pts.)	3	8
16. Population Density □ typically forms small, monospecific patches (3 pts.)	3	10
17. Role in Succession in Natural Areas □ successional information is unknown (0 pts.)	0	No evidence
18. Number of Habitats Invaded □ only found in 1 broad category (1 pts.)	1	9
Total Score	28	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=ULPU Accessed 1-10-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3479 Accessed 1-10-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-10-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-10-13

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-10-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-10-13.

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. Zalapa, J.E., Brunet, J. and Guries, R.P. (2010) The extent of hybridization and its impact on the genetic diversity and population structure of an invasive tree, *Ulmus pulmila* (Ulmaceae). *Evolutionary Applications* 3(2):157-168.

9. Moore, L.M. USDA, NRCS Plant Guide: Siberian Elm (*Ulmus pumila*): http://plants.usda.gov/plantguide/pdf/cs_ulpu.pdf Accessed 1-30-13

10. Susan Wieseler, Minnesota Department of Natural Resources, Rochester, MN_Plant Conservation Alliance's Alien Plant Working Group Least Wanted Plant Fact Sheet: http://www.nps.gov/plants/alien/fact/ulpu1.htm Accessed 1-30-13

Question # for Step I	Notes for *Ulmus pumila*
2	species occurs in regions 1 through 4 according to ref.s 1 & 2. I observed species in region 5. There is a lack of population size evidence
3	Species occurs outside of cultivation, but information on impacts to ecological processes and functions are unclear.
4	IN, PA
Question # for Step II	**Notes for *Ulmus pumila***
1	Plant is found in natural areas, but how it arrived is undocumented.
2	Ref.s 1 & 2 show species in regions 1-4, and I saw it in region 5.
3	IN, PA, species is considered invasive in 25 states, as well as Canada, Mexico, Argentina and Spain.
5	Species produces viable seed each year, but no data was found regarding the variance in production, therefore the default answer is the 3 point answer.
6	I could find no documentation about seed set. This score will likely contribute 3 or 5 points to the total score, once the data is found.
7	March-April
8	Seeds are wind dispersed (3 point default score).
9	10 years
10	Species is capable of establishing in a large variety of environmental conditions. Once established, species can form thickets. It is particularly invasive in dry and mesic prairies and riparian zones. More data may cause the score for this question to increase.
14	Species can form large thickets and "overtake native vegetation, especially shade-intolerant species."
15	Hybridizes with *Ulmus rubra*.
16	Species can form thickets but no data was found regarding the size and extent of these, therefore the 3 point answer was given. It is considered a conservative answer, and the score may increase with more information.
18	Invades dry and mesic prairies.

Ohio Invasive Plant Assessment Protocol					
Botanical Name:	*Veronica officinalis*	Outcome:	Not invasive	**References**	
Common Name:	Common speedwell, gypsyweed	Score:	31		
Family Name:	Plantaginaceae	Protocol conducted by Allison Mastalerz			
1. Is this plant known to occur in the state and listed as "noxious" on any federal or Ohio Department of Agriculture plant list?		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.			
		☐ No. Continue on to question 2.			
2. Has this plant demonstrated widespread dispersion and establishment (i.e. high numbers of individuals forming dense stands) in natural areas across two or more regions in Ohio?[a]		☐ Yes. Place on invasive plant list, no further investigation needed. Stop here.		1,2	
		☐ No. Continue on to question 3.			
3. Does this plant form self-replicating populations outside of cultivation in Ohio and is it documented to alter the composition, structure, or normal processes or functions of a natural ecosystem?		☐ Yes.			
		☐ No.			
		☐ Unknown.			
4. Is the plant listed as invasive in an adjoining state or a nearby state east of the Mississippi within the USDA Plant Hardiness zones 5-6?[b,c]		☐ Yes.		3,4,5,6	
		☐ No.			
		☐ Unknown.			
If the answer was yes for both questions 3 and 4, the plant is placed on the invasive plant list and no further research is needed. Stop here. If the answer is no for both questions 3 and 4, the plant is not considered invasive and no further investigation is warranted. Otherwise, proceed to Step II				**Score**	**Refer-ences**
Step II: Invasion Status					
1. Current Invasion in Ohio				3	8

□ plant occurs in natural areas away from sit of planting (3 pts.)		
2. State Distribution[a]	5	1
□ plant is naturalized in five regions in Ohio (5 pts.)		
3. Regional/US Distribution	0	
□ plant is not considered to be a problem in any other state (0 pts.)		
Step II: Biological Characters	3	9, 10, 11
4. Vegetative Reproduction		
□ has runners or spreading rhizomes that root easily (3 pts.)		
5. Sexual Reproduction	3	11
□ frequent sexual reproduction, but high variation among years in seed production (3 pts.)		
6. Number of Viable Seeds or Propagules per Plant	3	8
□ moderate (11-1,000) (3 pts.)		
7. Flowering Period	2	10, 11
□ three to five months (2 pts.)		
8. Dispersal Ability	U	No evidence
□ Information unknown (U)		
9. Generation Time	U	No evidence
□ Information unknown (U)		
10. Establishment	3	8
□ aggressively colonizes and establishes in edge habitats (3 pts.)		
Step II: Ecological Importance	0	8
11. Impact on Ecosystem Processes		
□ no known effect on ecosystem-level processes (0 pts.)		
12. Impact on Rare Organisms	0	No evidence
□ no known negative impact on Ohio State-listed or federal-listed plants or animals (0 pts.)		
13. Impact on Native Animals	0	No evidence
□ no known negative impact on animals (0 pts.)		
14. Impact on Native Plants	3	8
□ negatively impacts some native plants (increasing their mortality and/or recruitment of certain taxa) (3 pts.)		

15. Hybridization □ no known instances of hybridization with other plant species (0 pts.)	0	No evidence
16. Population Density □ typically forms small, monospecific patches (3 pts.)	3	8
17. Role in Succession in Natural Areas □ successional information is unknown (0 pts.)	0	8
18. Number of Habitats Invaded □ found in 2 broad categories or 2 rare habitat types (3 pts.)	8	11
Total Score	31	

Reference

1. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=VEOF2 Accessed 1-10-13

2. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=23162 Accessed 1-10-13

3. Indiana's "Most Wanted" Invasive Plant Pests: Indian Cooperative Agricultural Pest Survey (CAPS) Program: http://extension.entm.purdue.edu/caps/browsePest.html. Accessed 1-10-13.

4. Kentucky Exotic Pest Plant Council: http://www.se-eppc.org/ky/list.htm. Accessed 1-10-13

5. Michigan State University Extension; The Michigan Natural Features Inventory (MNFI) has partnered with MISIN to provide the information in this fact sheet. Original content was taken with permission from the MNFI field guide entitled: A Field Identification Guide to Invasive Plants in Michigan's Natural Communities (PDF).:http://mnfi.anr.msu.edu/invasive-species/factsheets.cfm Accessed on 1-10-13

6. Pennsylvania Dept. Of Conservation and Natural Resources: Invasive Plants in Pennsylvania: http://www.dcnr.state.pa.us/ucmprd2/groups/public/documents/document/dcnr_002477.pdf. Accessed 1-10-13

7. Germplasm Resources Information Network (GRIN): http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 1-8-13

8. Jordan, M.J., G. Moore and T.W. Weldy. 2008. Invasiveness ranking system for non-native plants of New York. Unpublished. The Nature Conservancy, Cold Spring Harbor, NY;

9. Dale, M.P. and Causton, D.R. (1992) The ecophysiology of *Veronica chamaedrys, Veronica montana* and *V. officinalis*. I. Light quality and light quantity. *Journal of Ecology* 80:483-492.

10. Robert W. Freckmann Herbarium Plant Fact Sheet: http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=VEROFF Accessed 1-30-13

11. Cowbrough, M. (Agriculture and Agri-Food Canada) weedinfo.ca website: Speedwell Fact Sheet: http://www.weedinfo.ca/en/weed-index/view/id/verof Accessed 1-30-13

Question # for Step I	Notes for *Veronica officinalis*
2	Ref. 1 show species naturalized in all regions, Ref. 2 does not show it in any regions.
Question # for Step II	**Notes for *Veronica officinalis***
1	Species is not cultivated
4	Species is a clonal perennial with spreading rhizomes
5	Species reproduces by seed and is a perennial, but no documentation was found about the variation in seed set, therefore default score is 3.
7	April/May - July
14	8=>"Can reduce the number of individuals in native species."
17	influences natural community herb layer
18	8=>Forested wetlands/riparian, beaches &/or coastal dunes, Grasslands, Forests, Roadsides; 11=>"pastures, meadows, open woodlots, waste areas and occasionally lawns"

Appendix V: Completed Individual Australian Weed Risk Assessments

Modified A-WAR Form B

Botanical Name:	*Acer campestre* L.	Outcome:	Invasive
Common Name:	Hedge Maple	Score:	13
Family Name:	Aceraceae	Your name: Allison Mastalerz	

History/Biogeography				**Points**	**References**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and *Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b[a]	Y	2	11
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		9,11
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6,7
	3.02	Garden/amenity/disturbance weed	U		
	3.03	Weed of agriculture/horticulture/forestry	U		
	3.04	Environmental weed	U		
	3.05	Congeneric weed	Y	2	10
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	Y	1	8
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	U		
	4.05	Toxic to animals	U		
	4.06	Host for recognized pests and pathogens	U		

	4.07	Causes allergies or is otherwise toxic to humans	U		
	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	12
	4.10	Grows on any soil order representing >5% cover in Ohio[d]	Y	1	9
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	U		
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	8, 12
	6.02	Produces viable seed	Y	1	8,9,11,12
	6.03	Hybridizes naturally	Y	1	8
	6.04	Self-fertilization	U		
	6.05	Requires specialist pollinators	N	0	12
	6.06	Reproduction by vegetative propagation	N	-1	
	6.07	Minimum generative time (years)	-1	-1	12
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	1,9,11
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	Y	1	9,11,12
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispersed	U		
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	U		
8 *Persistence attributes*	8.01	Prolific seed production	U		
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	N	-1	8
	8.03	Well controlled by herbicides	U		
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	12

	8.05	Effective natural enemies present in Ohio	U	
References; 1-5 accessed on 2-7-13			Total Score:	13
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en			Outcome:	Invasive
2. IT IS: http://www.itis.gov/				
3. Kew: http://www.theplantlist.org/browse/A/				
4. Tropicos: http://www.tropicos.org/Home.aspx				
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do				
6. USDA Plants database, plant profiles: http://plants.usda.gov/java/profile?symbol=ACCA5 Accessed 2-11-113				
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.eddmaps.org/distribution/usstate.cfm?sub=12452 Accessed 2-11-13				
8. van Gelderen, D.M., de Jong, P.C. and Oterdoom Maples of the World Ed. Theodore R. Dudley. Portland: Timber Press, 1994.				
9. Brand, Mark H. "UCONN Plant Database of trees, shrubs, and vines" http://www.hort.uconn.edu/plants/a/acecam/acecam1.html Accessed 2-11-13				
10. Munger, Gregory T. 2003. Acer platanoides. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, February 11].				
11. Dave's Garden Website: http://davesgarden.com/guides/pf/go/75525/ Accessed 2-11-13				
12. Jones, E.W. (1945) Acer Campestre L. *Journal of Ecology* 32(2): 239-252.				

Modified A-WAR Form B

Botanical Name:	*Acer ginnala*	Outcome:	Invasive
Common Name:	Amur Maple	Score:	16
Family Name:	Aceraceae (also in Sapindaceae)	Your name: Allison Mastalerz	

				Points	References
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zone 5b, 6a, and 6b[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		10, 11
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6,7, 11
	3.02	Garden/amenity/disturbance weed	Y	2	11
	3.03	Weed of agriculture/horticulture/forestry	U		
	3.04	Environmental weed	U		
	3.05	Congeneric weed	Y	2	
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	Y	1	8,11
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	U		
	4.05	Toxic to animals	U		
	4.06	Host for recognized pests and pathogens	U		
	4.07	Causes allergies or is otherwise toxic to humans	U		

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	9, 11
	4.10	Grows on any soil order representing >5% cover in Ohio[d]	Y	1	9, 11
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	U		
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	8, 11
	6.02	Produces viable seed	Y	1	8,9, 11
	6.03	Hybridizes naturally	U		
	6.04	Self-fertilization	U		
	6.05	Requires specialist pollinators	U		
	6.06	Reproduction by vegetative propagation	N	-1	
	6.07	Minimum generative time (years)	U		
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	1, 8, 9,10,11
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	Y	1	8,9
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispersed	U		
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	U		
8 *Persistence attributes*	8.01	Prolific seed production	U		
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	U		
	8.03	Well controlled by herbicides	Y	-1	11
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	12
	8.05	Effective natural enemies present in Ohio.	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	16
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database, plant profiles:http://plants.usda.gov/java/nameSearch Accessed 2-11-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=3965 Accessed 2-11-13		
8. van Gelderen, D.M., de Jong, P.C. and Oterdoom Maples of the World Ed. Theodore R. Dudley. Portland: Timber Press, 1994.		
9. USDA & NRCS Plant Guide, Amur Maple, *Acer ginnala* http://plants.usda.gov/plantguide/pdf/pg_acgi.pdf Accessed 2-11-13		
10. Dave's Garden Website: http://plants.usda.gov/java/nameSearch Accessed 2-11-13		
11. Global Invasive Species Database: http://www.issg.org/database/species/ecology.asp?fr=1&si=1134 Accessed 2-11-13		
12. Dirr, M.A. Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses, 5ed. Stipes Publishing, L.L.C.; Champaign, Illinois		

Modified A-WAR Form B

Botanical Name:	*Acer platanoides*	Outcome:	Invasive
Common Name:	Norway Maple	Score:	17
Family Name:	Aceraceae	Your name: Allison Mastalerz	

				Points	References
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a, & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		8,9,10,11, 12
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	9, 10, 12
	3.02	Garden/amenity/disturbance weed	U		
	3.03	Weed of agriculture/horticulture/forestry	U		
	3.04	Environmental weed	Y	4	9, 12, 13
	3.05	Congeneric weed	Y	2	
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	U		8, 13
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	U		
	4.05	Toxic to animals	U		
	4.06	Host for recognized pests and pathogens	U		
	4.07	Causes allergies or is otherwise toxic to humans	U		

	4.08	Creates a fire hazard in natural ecosystems	N	0	
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	9, 12
	4.10	Grows on any soil order representing >5% cover in Ohio[d]	Y	1	9
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	U		
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	8
	6.02	Produces viable seed	Y	1	8, 12
	6.03	Hybridizes naturally	U		
	6.04	Self-fertilization	N	-1	9
	6.05	Requires specialist pollinators	N	0	9
	6.06	Reproduction by vegetative propagation	N	-1	
	6.07	Minimum generative time (years)	-1	-1	13
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	12, 13
	7.02	Propagules dispersed intentionally by people	Y	1	8, 12
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	Y	1	8, 9, 10, 12
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispersed	U		
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	U		
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	9, 13,14
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	N	-1	8
	8.03	Well controlled by herbicides	U		
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	9, 13
	8.05	Effective natural enemies present in Ohio.	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	17
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=ACPL Accessed 2-11-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=3002 Accessed 2-11-13		
8. van Gelderen, D.M., de Jong, P.C. and Oterdoom Maples of the World Ed. Theodore R. Dudley. Portland: Timber Press, 1994.		
9. Munger, Gregory T. 2003. Acer platanoides. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2013, February 12].		
10. Brand, Mark H. Uconn Plant Database, *Acer platanoides:*http://www.hort.uconn.edu/plants/a/acepla/acepla1.html Accessed 2-12-13		
11. Amazon Website, page for purchasing Norway Maple seeds: http://www.amazon.com/Acer-platanoides-Norway-Maple-Seeds/dp/B0002I8G88 Accessed 2-12-11		
12. Webb, S.L., Dwyer, M, Kaunzinger, C.K. and Wyckoff, P.H. (2000) The myth of the resilient forest: case study of the invasive Norway Maple (*Acer platanoides*). *Rhodora* 102(911):332-354.		
13. Galbraith-Kent, S.L. and Handel, S.N. (2008) Invasive *Acer platanoides* inhibits native sapling growth in forest understory communities. *Journal of Ecology* 96:293-302.		
14. Forest Service Weed of the Week Plant fact sheet: Produced by the USDA Forest Service, Forest Health Staff, Newtown Square, PA. WOW 11-15-04 Invasive Plants website: http://www.na.fs.fed.us/fhp/invasive_plants Accessed 2-12-13		

Modified A-WAR Form B

Botanical Name:	*Ailanthus altissima* (Mill.)Swingle	Outcome:	Reject	
Common Name:	Tree-of-heaven	Score:	25	
Family Name:	Simaroubaceae	Your name: Allison Mastalerz		

				Score	References
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	2	2	7
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6
	3.02	Garden/amenity/disturbance weed	Y	2	6
	3.03	Weed of agriculture/horticulture/forestry	Y	4	6
	3.04	Environmental weed	Y	4	6,13
	3.05	Congeneric weed	N	0	
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	Y	1	13
	4.03	Parasitic	N	1	
	4.04	Unpalatable to grazing animals	N	-1	
	4.05	Toxic to animals	N	0	
	4.06	Host for recognized pests and pathogens	N	0	
	4.07	Causes allergies or is otherwise toxic to humans	N	0	

	4.08	Creates a fire hazard in natural ecosystems	N	0	
	4.09	Is a shade tolerant plant at some stage of its life cycle	N	0	
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	
	6.03	Hybridizes naturally	U	0	
	6.04	Self-fertilization	N	-1	
	6.05	Requires specialist pollinators	N	0	
	6.06	Reproduction by vegetative propagation	Y	1	
	6.07	Minimum generative time (years)	-1	-1	
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	
	7.02	Propagules dispersed intentionally by people	Y	1	
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	Y	1	
	7.05	Propagules buoyant	Y	1	
	7.06	Propagules bird dispersed	Y	1	
	7.07	Propagules dispersed by other animals (externally)	N	-1	
	7.08	Propagules dispersed by other animals (internally)	N	-1	
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	N	-1	8
	8.03	Well controlled by herbicides	N	1	
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	
	8.05	Effective natural enemies present in Ohio	N	1	

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	25
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. Philip D. Pannill "Tree of Heaven Control" Forest Service Information, Maryland Dept. of Natural Resources - Forest Service http://www.naturalresources.umd.edu/Publications/PDFs/Other/TreeOfHeaven.pdf		
7. National Invasive Species Center (USDA) http://www.invasivespeciesinfo.gov/plants/treeheaven.shtml		
8. Tree of Heaven - Plant Invaders of Mid-Atlantic Natural Areas (2002) DOI http://www.nps.gov/plants/alien/pubs/midatlantic/aial.htm		
9. USDA Forest Services Silvics Manual vol. 1&2 Agricultural Handbook 654 http://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_2/ailanthus/altissima.htm		
10.Del Tredici, Peter (2010) Wild Urban Plants of the Northeast: a field guide. Comstock Publishing Associates: Ithica		
11. California Invasive Plant Council: http://www.cal-ipc.org/ip/management/ipcw/pages/detailreport.cfm@usernumber=3&surveynumber=182.php		
12. Fryer, Janet L. 2010. Ailanthus altissima. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, February 20].		
13. Gómez-Aparicio, L. and Canham, C.D. (2008) Neighborhood analyses of the allelopathic effects of the invasive tree *Ailanthus altissima* in temperate forests. *Journal of Ecology* 96(3): 447-458.		

Modified A-WAR Form B

Botanical Name:	*Alliaria petiolata*(M. Bieb.) Cavara & Grande	Outcome:	Reject
Common Name:	Garlic Mustard	Score:	23
Family Name:	Brassicaceae	Your name: Allison Mastalerz	

		History/Biogeography		Score	References
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		1,2,4,
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	1,2
	3.02	Garden/amenity/disturbance weed	Y	2	1,2
	3.03	Weed of agriculture/horticulture/forestry	Y	4	
	3.04	Environmental weed	Y	4	
	3.05	Congeneric weed	N	0	
		Biology/Ecology			
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	Y	1	8
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	Y	1	
	4.05	Toxic to animals	N	0	
	4.06	Host for recognized pests and pathogens	N	0	
	4.07	Causes allergies or is otherwise toxic to humans	N	0	

	4.08	Creates a fire hazard in natural ecosystems	N	0	
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	
	6.03	Hybridizes naturally	U	0	
	6.04	Self-fertilization	Y	1	
	6.05	Requires specialist pollinators	N	0	
	6.06	Reproduction by vegetative propagation	N	-1	
	6.07	Minimum generative time (years)	0	0	
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	
	7.02	Propagules dispersed intentionally by people	N	-1	
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	N	-1	
	7.06	Propagules bird dispersed	Y	1	9
	7.07	Propagules dispersed by other animals (externally)	Y	1	
	7.08	Propagules dispersed by other animals (internally)	N	-1	
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	9
	8.03	Well controlled by herbicides	N	-1	9
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	U	0	
	8.05	Effective natural enemies present in Ohio	No	1	

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	23
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. National Invasive Species Center (USDA) http://www.invasivespeciesinfo.gov/plants/garlicmustard.shtml		
7. Ohio Invasive Plant Council: http://www.dnr.state.oh.us/dnap/invasive/3garlicmustard/tabid/1998/Default.aspx		
8. Lankau, R. " Soil microbial communities alter allelopathic competition between Alliaria petiolata and a native species." *Biological Invasions* Volume 12, Issue 7, July 2010, Pages 2059-2068		
9. Wixted, K.L. , McGraw, J.B. "Competitive and allelopathic effects of garlic mustard (Alliaria petiolata) on American ginseng (Panax quinquefolius)." *Plant Ecology* Volume 208, Issue 2, June 2010, Pages 347-357		
10. Hahn, P.G. (2011). "Exotic consumers interact with exotic plants to mediate native plant survival in a Midwestern forest herb layer". Biological invasions (1387-3547), p. 1.		
11.Cipollini, K., Titus, K. and Wagner, C. (2012) Allelopathic effects of invasive species (*Alliaria petiolata, Lonicera maackii, Ranunculus ficaria*) in the Midwestern United States. *Allelopathy Journal* 29(1): 63-76.		
12. Alaska Natural Heritage Program: Nonnative Plant Species Biographies: http://aknhp.uaa.alaska.edu/botany/akepic/non-native-plant-species-biographies/		

Modified A-WAR Form B

Botanical Name:	*Ampelopsis brevipedunculata* (Maxim.) Trautv.	Outcome:	Invasive
Common Name:	Porcelain berry	Score:	21
Family Name:	Vitaceae	Your name: Allison Mastalerz	

		History/Biogeography		Score	References
1 *Domestication / cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	6,7, 8
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		8, 9
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6,7,8
	3.02	Garden/amenity/disturbance weed	Y	2	8,9,10
	3.03	Weed of agriculture/horticulture/forestry	U		
	3.04	Environmental weed	Y	4	8, 10, 11
	3.05	Congeneric weed	N	0	6
		Biology/Ecology			
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	U		
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	U		
	4.05	Toxic to animals	U		
	4.06	Host for recognized pests and pathogens	U		

	4.07	Causes allergies or is otherwise toxic to humans	U		
	4.08	Creates a fire hazard in natural ecosystems	N	0	8
	4.09	Is a shade tolerant plant at some stage of its life cycle	N	0	8
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	Y	1	8, 10
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	8
	6.02	Produces viable seed	Y	1	8.00
	6.03	Hybridizes naturally	U		
	6.04	Self-fertilization	U		
	6.05	Requires specialist pollinators	U		
	6.06	Reproduction by vegetative propagation	Y	1	8
	6.07	Minimum generative time (years)	U		
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	8,9
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	Y	1	8
	7.06	Propagules bird dispersed	Y	1	8, 10
	7.07	Propagules dispersed by other animals (externally)	N	-1	
	7.08	Propagules dispersed by other animals (internally)	Y	1	8,10
8 *Persistence attributes*	8.01	Prolific seed production	U		
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	U		
	8.03	Well controlled by herbicides	N	1	8
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	8

	8.05	Effective natural enemies present in Ohio	U	10
Resources			Total Score:	21
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/tax_search.pl Accessed 2-7-13			Outcome:	Invasive
2. IT IS: http://www.itis.gov/ Accessed 2-7-13				
3. Kew: http://www.theplantlist.org/browse/A/ Accessed 2-7-13				
4. Tropicos: http://www.tropicos.org/Home.aspx Accessed 2-7-13				
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do Accessed 2-7-13				
6. USDA Plants database: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=AMBR7 Accessed 2-7-13				
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=3007 Accessed 2-7-13				
8. Waggy, Melissa A. 2009. Ampelopsis brevipedunculata. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ 2-7-13				
9. Dave's Garden: http://davesgarden.com/guides/pf/go/1524/ Accessed 2-7-13				
10. USDA Forest Service, Forest Health Staff, Newtown Square, PA. Weed of the Week Plant factsheet: http://www.na.fs.fed.us/fhp/invasive_plants/weeds/porcelain-berry.pdf Accessed 2-7-13				
11. U.S. Department of Agriculture, Forest Service, Eastern Region. 2004. Eastern Region invasive plants ranked by degree of invasiveness, [Online]. In: Noxious weeds and non-native invasive plants. Section 3: Invasive plants. Milwaukee, WI: Eastern Region (Producer). Available: http://www.fs.fed.us/r9/wildlife/range/weed/Sec3B.htm Accessed 2-7-13				
12. Roberston, D.J., Robertson, M.C. and Tague, T. (1994) Colonization Dynamics of Four Exotic Plants in a Northern Piedmont Natural Area. *Bulletin of the Torrey Botanical Club* 121(2): 107-118.				

Modified A-WAR Form B

Botanical Name:	*Arctium minus* (Hill) Bernh.	Outcome:	Invasive	
Common Name:	Common burdock	Score:	19	
Family Name:	Asteraceae	Your name: Allison Mastalerz		

				Score	Reference
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zones 5b, 6a and 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	Default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		8
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	8
	3.02	Garden/amenity/disturbance weed	Y	2	8
	3.03	Weed of agriculture/horticulture/forestry	N	0	8
	3.04	Environmental weed	N	0	
	3.05	Congeneric weed	Y	2	8
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	Y	1	8,9
	4.02	Allelopathic	U		
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	N	-1	8
	4.05	Toxic to animals	Y	1	1
	4.06	Host for recognized pests and pathogens	Y	1	8
	4.07	Causes allergies or is otherwise toxic to humans	Y	1	8

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	U		
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	8
	4.11	Climbing or smothering growth habitat	Y	1	8
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	8
	6.02	Produces viable seed	Y	1	8, 9
	6.03	Hybridizes naturally	Y	1	8
	6.04	Self-fertilization	Y	1	8
	6.05	Requires specialist pollinators	N	0	8
	6.06	Reproduction by vegetative propagation	N	-1	8,9
	6.07	Minimum generative time (years)	0	0	8
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	8,9
	7.02	Propagules dispersed intentionally by people	N	-1	8
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	Y	1	8
	7.06	Propagules bird dispersed	N	-1	8
	7.07	Propagules dispersed by other animals (externally)	Y	1	8,9
	7.08	Propagules dispersed by other animals (internally)	N	-1	
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	8
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	8
	8.03	Well controlled by herbicides	U		
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	8
	8.05	Effective natural enemies present in Ohio	Y	-1	8

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	19
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=ARMI2 Accessed 2-9-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=5140 Accessed 2-9-13		
8. Gross, R.S., P.A. Werner and W. R. Hawthorn (1980) The biology of Canadian weeds. 38. Actium minus and Arctium lappa. Canadian Journal of Plant Science 60: 621-634		
9. Del Tredici, P. (2010) Wild Urban Plants of the Northeast: a field guide. Cornell University Press, Ithica & London.		

Modified A-WAR Form B						
Botanical Name:	*Barbarea vulgaris* W.T. Aiton	Outcome:	Invasive			
Common Name:	yellowrocket, bittercress	Score:	27			
Family Name:	Brassicaceae	Your name: Allison Mastalerz				
History/Biogeography					**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01		N	0	
	1.02	Has the species become naturalized where grown				
	1.03	Does the species have weedy races				
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b?[a]		Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)		2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]		Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]		Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range		Y		8
3 *Weed elsewhere*	3.01	Naturalized beyond native range		Y	2	8
	3.02	Garden/amenity/disturbance weed		Y	2	8
	3.03	Weed of agriculture/horticulture/forestry		Y	4	8
	3.04	Environmental weed		U		
	3.05	Congeneric weed		Y	2	6
Biology/Ecology						
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs		N	0	8
	4.02	Allelopathic		U		
	4.03	Parasitic		N	0	
	4.04	Unpalatable to grazing animals		Y	1	8
	4.05	Toxic to animals		N	0	8
	4.06	Host for recognized pests and pathogens		Y	1	8
	4.07	Causes allergies or is otherwise toxic to humans		N	0	8

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	U		8
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	8
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	8
	6.02	Produces viable seed	Y	1	8.00
	6.03	Hybridizes naturally	U		8
	6.04	Self-fertilization	Y	1	8
	6.05	Requires specialist pollinators	N	0	8
	6.06	Reproduction by vegetative propagation	Y	1	8
	6.07	Minimum generative time (years)	Y	1	8
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	8
	7.02	Propagules dispersed intentionally by people	N	-1	8
	7.03	Propagules likely to disperse as a produce contaminant	Y	1	8
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	Y	1	8
	7.06	Propagules bird dispersed	N	-1	
	7.07	Propagules dispersed by other animals (externally)	Y	1	8
	7.08	Propagules dispersed by other animals (internally)	Y	1	8
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	8
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	8
	8.03	Well controlled by herbicides	Y	-1	8
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	8
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	27
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=BAVU Accessed 2-8-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=5175 Accessed 2-9-13		
8. MacDonald, M. A. and Cavers, P. B. 1991. The biology of Canadian weeds. 97. Barbarea vulgaris. Canadian Journal of Plant Science 79: 149-166		
9. Virginia Tech Weed Identification Guide. http://www.ppws.vt.edu/scott/weed_id/barvu.htm Accessed 2-9-13		

Modified A-WAR Form B

Botanical Name:	*Berberis thunbergii* DC.	Outcome:	reject		
Common Name:	Japanese Barberry	Score:	25		
Family Name:	Berberidaceae	Your name: Allison Mastalerz			
History/Biogeography				**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	6
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	2	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		7, 8
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	1, 7
	3.02	Garden/amenity/disturbance weed	N	0	7
	3.03	Weed of agriculture/horticulture/forestry	N	0	
	3.04	Environmental weed	Y	4	7
	3.05	Congeneric weed	Y	2	9, 11
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	Y	1	7, 10
	4.02	Allelopathic	N	0	10
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	low	0	7, 10, 12, 15
	4.05	Toxic to animals	N	0	7
	4.06	Host for recognized pests and pathogens	Y	1	1, 7
	4.07	Causes allergies or is otherwise toxic to humans	N	0	7, 10

	4.08	Creates a fire hazard in natural ecosystems	N	0	7
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	7, 12, 13
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	7, 8, 10
	4.12	Forms dense thickets	Y	1	7, 9, 11, 13, 15
5 *Plant type*	5.01	Aquatic	N	0	1, 7
	5.02	Grass	N	0	1, 7, 10
	5.03	Nitrogen fixing woody plant	N	0	7, 10
	5.04	Geophyte	N	0	10
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	7,10
	6.03	Hybridizes naturally	Y	1	7, 11
	6.04	Self-fertilization	U	0	
	6.05	Requires specialist pollinators	N	0	14
	6.06	Reproduction by vegetative propagation	Y	1	7, 10, 12, 14
	6.07	Minimum generative time (years)	U	0	
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	7 thru 15
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	N	-1	
	7.06	Propagules bird dispersed	Y	1	7, 9, 12,
	7.07	Propagules dispersed by other animals (externally)	Y	1	7
	7.08	Propagules dispersed by other animals (internally)	Y	1	7,9
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	7, 15
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	6, 7, 15
	8.03	Well controlled by herbicides	Y	-1	7, 9, 13
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	7, 9

	8.05	Effective natural enemies present in Ohio	N	1	7, 8, 9, 13
References, Websites for 1-5 Accessed on 2-7-13			Total Score:		25
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en			Outcome:		reject
2. IT IS: http://www.itis.gov/					
3. Kew: http://www.theplantlist.org/browse/A/					
4. Tropicos: http://www.tropicos.org/Home.aspx					
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do					
6. Knight, T.M., Havens, K., Vitt, P. " Will the use of less fecund cultivars reduce the invasiveness of perennial plants?" BioScience Volume 61, Issue 10, October 2011, Pages 816-822					
7. USDA Forest Service Fire Effects Information: http://www.fs.fed.us/database/feis/plants/shrub/berthu/all.html					
8. University of Connecticut Plant Database of trees, shrubs and vines : http://www.hort.uconn.edu/plants/index.html					
9. Plant Conservation Alliance's Alien Plant Working Group: http://www.nps.gov/plants/alien/fact/beth1.htm					
10. USDA PLANTS profile: http://plants.usda.gov/java/nameSearch?keywordquery=berberis+thunbergii&mode=sciname&submit.x=0&submit.y=0					
11. USDA Natural Resources Conservation Service, Invasive Species Identification Sheets: ftp://ftp-fc.sc.egov.usda.gov/CT/invasives/japanese_barberry.pdf					
12. Del Tredici, P. (2010) Wild Urban Plants of the Northeast: a field guide. Cornell University Press, Ithica & London.					
13. Global Invasive Species Database: http://www.issg.org/database/welcome/					
14. Gretchen Lebuhn and Gregory J. Anderson; Dame Anther Tripping and Pollen Dispensing in Berberis thunbergii. American Midland Naturalist, Vol. 131, No. 2 (Apr., 1994), pp. 257-265					
15. Lubell, Jessica D and Brand, Mark H "Germination, growth and survival of Berberis thunbergii DC. (Berberidaceae) and Berberis thunbergii var. atropurpurea in five natural environments" Biological Invasions, ISSN 1387-3547, 01/2011, Volume 13, Issue 1, pp. 135 - 141					

Modified A-WAR Form B

Botanical Name:	*Celastrus orbiculatus*Thunb.	Outcome:	reject			
Common Name:	Oriental Bittersweet	Score:	21			
Family Name:	Celastraceae	Your name: Allison Mastalerz				
History/Biogeography					**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01		N	0	
	1.02	Has the species become naturalized where grown				
	1.03	Does the species have weedy races				
2 Cl*imate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]		Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)		2	2	
	2.03	Broad climate suitability (environmental versatility)[b]		Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]		Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range		Y		1,6, 9, 12
3 *Weed elsewhere*	3.01	Naturalized beyond native range		Y	2	1,6,7,8,9
	3.02	Garden/amenity/disturbance weed		Y	2	6, 9, 12
	3.03	Weed of agriculture/horticulture/forestry		Y	4	6, 12
	3.04	Environmental weed		Y	4	6, 7,9, 11
	3.05	Congeneric weed		N	0	8
Biology/Ecology						
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs		N	0	10
	4.02	Allelopathic		N	0	8
	4.03	Parasitic		N	0	
	4.04	Unpalatable to grazing animals		Y	1	6
	4.05	Toxic to animals		N	0	6, 8
	4.06	Host for recognized pests and pathogens		Y	1	6
	4.07	Causes allergies or is otherwise toxic to humans		U	0	6

	4.08	Creates a fire hazard in natural ecosystems	N	0	6
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	6,8, 12
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	Y	1	6,9,12
	4.12	Forms dense thickets	Y	1	6,9,12
5 *Plant type*	5.01	Aquatic	N	0	1, 8
	5.02	Grass	N	0	8
	5.03	Nitrogen fixing woody plant	N	0	8
	5.04	Geophyte	N	0	8
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	6
	6.02	Produces viable seed	Y	1	6, 8, 9
	6.03	Hybridizes naturally	Y	1	6, 9, 10, 12
	6.04	Self-fertilization	N	-1	6, 12
	6.05	Requires specialist pollinators	N	0	6,
	6.06	Reproduction by vegetative propagation	Y	1	6, 8, 9,
	6.07	Minimum generative time (years)	0	0	6
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	6, 9, 12
	7.02	Propagules dispersed intentionally by people	Y	1	1,6,7,8,9, 12
	7.03	Propagules likely to disperse as a produce contaminant	Y	1	1
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	Y	1	6,12
	7.06	Propagules bird dispersed	Y	1	6,9,12
	7.07	Propagules dispersed by other animals (externally)	N	-1	
	7.08	Propagules dispersed by other animals (internally)	Y	1	6
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	6, 8, 9, 12
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	N	-1	6, 8
	8.03	Well controlled by herbicides	Y	-1	6, 9, 13
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	6, 9, 13

	8.05	Effective natural enemies present in Ohio	N	1	6,9, 13
References, Websites for 1-5 Accessed on 2-7-13			Total Score:		21
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en			Outcome:		reject
2. IT IS: http://www.itis.gov/					
3. Kew: http://www.theplantlist.org/browse/A/					
4. Tropicos: http://www.tropicos.org/Home.aspx					
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do					
6. Fryer, Janet L. 2011. Celastrus orbiculatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, February 14].					
7. USDA National Invasive Species Information Center: http://www.invasivespeciesinfo.gov/plants/bittersweet.shtml					
8. USDA PLANT Database: http://plants.usda.gov/java/charProfile?symbol=CEOR7					
9. Plant Conservation Alliance's Alien Plant Working Group: http://www.nps.gov/plants/alien/fact/ceor1.htm					
10. USDA Natural Resources Conservation Service: Invasive Species Identification Sheet: ftp://ftp-fc.sc.egov.usda.gov/CT/invasives/asiatic_bittersweet.pdf					
11. Lett, C.N. (2011). "Mycorrhizae and soil phosphorus affect growth of Celastrus orbiculatus". Biological invasions (1387-3547), 13 (10), p. 2339.					
12. IPANE: http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specieId=27					
13. The Connecticut Invasive Plant Working Group Invasive Plant Management Guide : http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/x06oriental.html					

Modified A-WAR Form B

Botanical Name:	*Elaeagnus umbellata* Thunb.	Outcome:	reject		
Common Name:	Autumn-olive	Score:	23		
Family Name:	Elaeagnaceae	Your name: Allison Mastalerz			
History/Biogeography				**Score**	**Reference**
1 *Domestication / cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	6,8,9
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	y		1,6,7,8,9,11
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	1,6,7,8,9,11
	3.02	Garden/amenity/disturbance weed	Y	2	8,9,12
	3.03	Weed of agriculture/horticulture/forestry	Y	4	8
	3.04	Environmental weed	Y	4	1,7, 8, 9,11, 12
	3.05	Congeneric weed	Y	2	9,11,12
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	8,9,10,11,12
	4.02	Allelopathic	N	0	6,8-12
	4.03	Parasitic	N	0	6,8-12
	4.04	Unpalatable to grazing animals	N	-1	6, 8
	4.05	Toxic to animals	U	0	
	4.06	Host for recognized pests and pathogens	N	0	1,6,8-12
	4.07	Causes allergies or is otherwise toxic to humans	N	0	6,8-12

	4.08	Creates a fire hazard in natural ecosystems	U	0	8
	4.09	Is a shade tolerant plant at some stage of its life cycle	U	0	6,8
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	6,8,9,12
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	7,8,9
5 *Plant type*	5.01	Aquatic	N	0	6,8
	5.02	Grass	N	0	6,8
	5.03	Nitrogen fixing woody plant	Y	1	6,8-12
	5.04	Geophyte	N	0	6,8
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	10
	6.02	Produces viable seed	Y	1	6, 8-12
	6.03	Hybridizes naturally	U	0	
	6.04	Self-fertilization	U	0	8
	6.05	Requires specialist pollinators	N	0	8, 11
	6.06	Reproduction by vegetative propagation	N	-1	6, 8,9,11,12
	6.07	Minimum generative time (years)	0	0	8,12
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	6-9, 11,12
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	N	-1	10
	7.06	Propagules bird dispersed	Y	1	8,9,10,11,12
	7.07	Propagules dispersed by other animals (externally)	N	-1	
	7.08	Propagules dispersed by other animals (internally)	Y	1	8, 9, 10
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	6, 8
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	N	-1	6, 8, 10
	8.03	Well controlled by herbicides	N	1	12
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	6,8,9,12
	8.05	Effective natural enemies present in Ohio	N	1	8

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	23
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA PLANT database: http://plants.usda.gov/java/profile?symbol=ELUM		
7. USDA National Invasive Species Information Center: http://www.invasivespeciesinfo.gov/plants/autmnolive.shtml		
8. Munger, Gregory T. 2003. Elaeagnus umbellata. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, February 14].		
9. IPANE: http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specieId=28		
10. Kohri, M. (2011). "Spatial-temporal distribution of ornithochorous seeds from an Elaeagnus umbellata community dominating a riparian habitat". Plant species biology (0913-557X), 26 (2), p. 174.		
11. Goldstein, C.L. (2009). "Impact of an invasive exotic species on stream nitrogen levels in southern Illinois". Journal of the American Water Resources Association (1093-474x), 45 (3), p. 664.		
12. Illinois Natural History Survey, Prairie Research Institute: http://www.inhs.uiuc.edu/research/VMG/autolive.html		

Modified A-WAR Form B

Botanical Name:	*Euonymus alatus* (Thunb.) Siebold	Outcome:	reject	
Common Name:	Winged Burning Bush	Score:	22	
Family Name:	Celastraceae	Your name: Allison Mastalerz		

				Score	Reference
History/Biogeography					
1 *Domestication / cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	8
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		6,7,8,9
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6,7,8,9
	3.02	Garden/amenity/disturbance weed	Y	2	6,7,10
	3.03	Weed of agriculture/horticulture/forestry	N	0	
	3.04	Environmental weed	N	0	6,7,9,10
	3.05	Congeneric weed	Y	2	
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	N	0	11
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	Y	1	7
	4.05	Toxic to animals	N	0	11
	4.06	Host for recognized pests and pathogens	N	0	11
	4.07	Causes allergies or is otherwise toxic to humans	U	0	

	4.08	Creates a fire hazard in natural ecosystems	U	0	7
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	6,7,10
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	7,9,10
5 *Plant type*	5.01	Aquatic	N	0	11
	5.02	Grass	N	0	11
	5.03	Nitrogen fixing woody plant	N	0	11
	5.04	Geophyte	N	0	7
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	7,9,10
	6.03	Hybridizes naturally	U	0	7
	6.04	Self-fertilization	U	0	7
	6.05	Requires specialist pollinators	U	0	7
	6.06	Reproduction by vegetative propagation	Y	1	9
	6.07	Minimum generative time (years)	U	0	7,11
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	6,7,8,9,10
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	Y	1	8
	7.06	Propagules bird dispersed	Y	1	6,7,8,9,10
	7.07	Propagules dispersed by other animals (externally)	U	0	
	7.08	Propagules dispersed by other animals (internally)	U	0	
8 *Persistence attributes*	8.01	Prolific seed production	U	0	7,8
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	8
	8.03	Well controlled by herbicides	N	1	7
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	7,11
	8.05	Effective natural enemies present in Ohio	N	1	7

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	22
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. Randall, J.M., and J. Marinelli. 1996. Invasive Plants: Weeds of the Global Garden. Brooklyn Botanic Garden, Brooklyn, NY. 112 pp.		
7. Fryer, Janet L. 2009. Euonymus alatus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ [2012, March 26].		
8. Thammina, C., Mingyang He, Hao Yu, Yongqin Chen, Ying Gai, Kaishuang Cao, Litang Lu, Degang Zhao, Yuejin Wang, Richard McAvoy, Donna Ellis, and Yi Li (2012). "Continuous biosynthesis of abscisic acid (ABA) may be required for maintaining dormancy of isolated embryos and intact seeds of Euonymus alatus". Plant Cell, Tissue and Organ Culture (PCTOC) (0167-6857), 108 (3), p. 493.		
9. Swearingen, J., B. Slattery, K. Reshetiloff, and S. Zwicker. 2010. Plant Invaders of Mid-Atlantic Natural Areas, 4th ed. National Park Service and U.S. Fish and Wildlife Service. Washington, DC. 168pp.		
10. IPANE: http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specieId=20, accessed March 27,2012		
11. USDA PLANTS database: http://plants.usda.gov/java/charProfile?symbol=EUAL8, accessed March 27, 2012		

Modified A-WAR Form B						
Botanical Name:	*Euonymus fortunei* (Turcz.) Hand.-Mazz		Outcome:	reject		
Common Name:	Wintercreeper		Score:	22		
Family Name:	Celastraceae		Your name: Allison Mastalerz			
History/Biogeography					**Score**	**Reference**
1 *Domestication / cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01		N	0	
	1.02	Has the species become naturalized where grown				
	1.03	Does the species have weedy races				
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]		Y	2	6
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)		2	2	
	2.03	Broad climate suitability (environmental versatility)[b]		Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]		Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range		Y		8,10
3 *Weed elsewhere*	3.01	Naturalized beyond native range		Y	2	7,8,10
	3.02	Garden/amenity/disturbance weed		Y	2	8,10
	3.03	Weed of agriculture/horticulture/forestry		N	0	10
	3.04	Environmental weed		Y	4	7,8,10
	3.05	Congeneric weed		Y	2	10
Biology/Ecology						
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs		N	0	6,8
	4.02	Allelopathic		N	0	6
	4.03	Parasitic		N	0	10
	4.04	Unpalatable to grazing animals		N	-1	10
	4.05	Toxic to animals		N	0	6
	4.06	Host for recognized pests and pathogens		N	0	10
	4.07	Causes allergies or is otherwise toxic to humans		N	0	6

	4.08	Creates a fire hazard in natural ecosystems	U	0	10
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	6,8,10
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	Y	1	6,7,8,10
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	6
	5.02	Grass	N	0	6
	5.03	Nitrogen fixing woody plant	N	0	6
	5.04	Geophyte	N	0	6
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	8,10
	6.03	Hybridizes naturally	U	0	
	6.04	Self-fertilization	U	0	10
	6.05	Requires specialist pollinators	U	0	
	6.06	Reproduction by vegetative propagation	Y	1	6,8,10
	6.07	Minimum generative time (years)	U	0	
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	6,7,8,10
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	Y	1	8,10
	7.06	Propagules bird dispersed	Y	1	8,10
	7.07	Propagules dispersed by other animals (externally)	N	-1	
	7.08	Propagules dispersed by other animals (internally)	Y	1	10
8 *Persistence attributes*	8.01	Prolific seed production	U	0	
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	U	0	10
	8.03	Well controlled by herbicides	U	0	10
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	10
	8.05	Effective natural enemies present in Ohio	N	1	10

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	22
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA PLANTS database: http://plants.usda.gov/java/profile?symbol=EUFO5 ACCESSED 3-29-12.		
7. Smith, Lauren M. and Reynolds, Heather L. (2012) Positive plant-soil feedback loop may drive dominance of a woodland invader, *Euonymus fortunei*. *Plant Ecology* DOI 10.1007/s11258-012-0047-z		
8. Swearingen J, Slattery B, Reshetiloff K, Zuicker S (2010) Plant Invaders of Mid-Atlantic Natural Areas 4th ed, 4th edn. National Park Service and U.S, Fish and Wildlife Service, Washington, DC		
9. Ningen, S.S., Cole, J.C. and Smith, M.W. (2005). "Increased shade intensity and afternoon irrigation decrease anthracnose severity on three Euonymus fortunei cultivars". HortScience (0018-5345), 40 (1), p. 111		
10. Zouhar, Kris. 2009. Euonymus fortunei. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ [2012, March 30].		

Modified A-WAR Form B

Botanical Name:	*Frangula alnus*Mill.	Outcome:	Reject		
Common Name:	Glossy Buckthorn	Score:	28		
Family Name:	Rhamnaceae	Your name: Allison Mastalerz			
History/Biogeography				**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	No	0	6
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		6,7,8,9
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6,7,8,9,10,11
	3.02	Garden/amenity/disturbance weed	Y	2	6,7,8,9,10,11
	3.03	Weed of agriculture/horticulture/forestry	Y	4	8
	3.04	Environmental weed	Y	4	6,8,9,10,11
	3.05	Congeneric weed	N	0	
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	6,8,9,10,11
	4.02	Allelopathic	N	0	7,8
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	U	0	
	4.05	Toxic to animals	Y	1	1
	4.06	Host for recognized pests and pathogens	Y	1	8,12

	4.07	Causes allergies or is otherwise toxic to humans	U	0	
	4.08	Creates a fire hazard in natural ecosystems	N	0	8
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	8
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	7
	4.12	Forms dense thickets	Y	1	6,8,9,10,11, 12
5 *Plant type*	5.01	Aquatic	N	0	7
	5.02	Grass	N	0	7
	5.03	Nitrogen fixing woody plant	N	0	7,8
	5.04	Geophyte	N	0	7
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	6 thru 12
	6.03	Hybridizes naturally	U	0	
	6.04	Self-fertilization	N	-1	8
	6.05	Requires specialist pollinators	N	0	8
	6.06	Reproduction by vegetative propagation	N	-1	8
	6.07	Minimum generative time (years)	1	1	8
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	6 thru 12
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U	0	8
	7.06	Propagules bird dispersed	Y	1	6,8-12
	7.07	Propagules dispersed by other animals (externally)	U	0	
	7.08	Propagules dispersed by other animals (internally)	Y	1	8
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	6,7,8,
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	8
	8.03	Well controlled by herbicides	N	1	8,10
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	8,10,12

	8.05	Effective natural enemies present in Ohio	N	1	8,10
References, Websites for 1-5 were accessed on 2-7-13			Total Score:	28	
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en			Outcome	reject	
2. IT IS: http://www.itis.gov/					
3. Kew: http://www.theplantlist.org/browse/A/					
4. Tropicos: http://www.tropicos.org/Home.aspx					
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do					
6. TIFFANY M. KNIGHT, KAYRI HAVENS, AND PATI VITT "Will the use of less fecund cultivars reduce the invasiveness of perennial plants?" 2011 BioScience 61 (10) , pp. 816-822					
7. USDA PLANTS Database: http://plants.usda.gov/java/nameSearch?keywordquery=frangula+alnus&mode=sciname&submit.x=0&submit.y=0					
8. Gucker, Corey L. 2008. Frangula alnus. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ [2012, February 16].					
9. Nagel, L.M., Corace III, R.G., Storer, A.J. (2008) "An experimental approach to testing the efficacy of management treatments for glossy buckthorn at Seney National Wildlife Refuge, upper Michigan". Ecological restoration (1543-4060), 26 (2), p. 136.					
10. Illinois Natural History Survey: http://www.inhs.uiuc.edu/research/VMG/buckthorn.html					
11. Nagel, L.M., Corace III, R.G., Storer, A.J. An experimental approach to testing the efficacy of management treatments for glossy buckthorn at Seney National Wildlife Refuge, upper Michigan 2008 Ecological Restoration 26 (2) , pp. 136-142					
12. IPANE: http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specieId=21#repro					

Modified A-WAR Form B					
Botanical Name:	*Hedera helix* L.	Outcome:	24		
Common Name:	English Ivy	Score:	reject		
Family Name:	Araliaceae	Your name: Allison Mastalerz			
History/Biogeography				**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	Y	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		6, 10, 11,12
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	1, 6,9, 10, 11,12
	3.02	Garden/amenity/disturbance weed	Y	2	11
	3.03	Weed of agriculture/horticulture/forestry	Y	4	7
	3.04	Environmental weed	Y	4	6,7,9,10, 11
	3.05	Congeneric weed	Y	2	8,11
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	N	0	8
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	Low	0	8,11
	4.05	Toxic to animals	Y	1	1, 11
	4.06	Host for recognized pests and pathogens	Y	1	9, 11
	4.07	Causes allergies or is otherwise toxic to humans	Y	1	9, 11,12
	4.08	Creates a fire hazard in natural ecosystems	U	0	11

	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	7,8, 10,11, 12
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	Y	1	6,7,8,9,10, 11,12
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	7
	5.02	Grass	N	0	8
	5.03	Nitrogen fixing woody plant	N	0	8
	5.04	Geophyte	N	0	11
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	12
	6.02	Produces viable seed	Y	1	6,7
	6.03	Hybridizes naturally	U	0	
	6.04	Self-fertilization	N	-1	11
	6.05	Requires specialist pollinators	N	0	9, 11, 12
	6.06	Reproduction by vegetative propagation	Y	1	6,8,11, 12
	6.07	Minimum generative time (years)	-1	-1	10, 11
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	1,8,11
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U	0	
	7.06	Propagules bird dispersed	Y	1	6,9, 11, 12
	7.07	Propagules dispersed by other animals (externally)	N	-1	
	7.08	Propagules dispersed by other animals (internally)	U	0	11,12
8 *Persistence attributes*	8.01	Prolific seed production	N	-1	11
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	N	-1	8, 11, 12
	8.03	Well controlled by herbicides	U	0	9,11
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	1,8, 11
	8.05	Effective natural enemies present in Ohio	N	1	9,11
References, Websites for 1-5 Accessed on 2-7-13			Total Score:		24

1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome	Reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. Dlugosch, K.M. Understory community changes associated with English ivy invasions in Seattle's urban parks. 2005 Northwest Science 79 (1) , pp. 53-60		
7. Thomas, L. K. 1980. The Impact of Three Exotic Species on a Potomac Island. National Park Service Monograph Series: Number 13. United States Department of the Interior.: http://www.cr.nps.gov/history/online_books/science/13/chap4.htm		
8. USDA PLANT Database: http://plants.usda.gov/java/profile?symbol=HEHE		
9. PAC: http://www.nps.gov/plants/alien/fact/hehe1.htm		
10. Randall, J. M., and Marinelli, J. 1996. Invasive Plants: Weeds of the Global Garden. Brooklyn Botanic Garden, Handbook #149. p. 93		
11. Waggy, Melissa A. 2010. Hedera helix. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer): http://www.fs.fed.us/database/feis/ [2012, February 24].		
12. Metcalfe, Daniel J (06/01/2005). "Hedera helix L". The Journal of ecology (0022-0477), 93 (3), p. 632.		

Modified A-WAR Form B						
Botanical Name:	*Ipomoea purpurea* L. Roth		Outcome:	Invasive		
Common Name:	Common Morningglory		Score:	27		
Family Name:	Convolvulaceae		Your name: Allison Mastalerz			
History/Biogeography					**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01		N	0	
	1.02	Has the species become naturalized where grown				
	1.03	Does the species have weedy races				
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b[a]		Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)		2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]		Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]		Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range		Y		8
3 *Weed elsewhere*	3.01	Naturalized beyond native range		Y	2	6,7, 8
	3.02	Garden/amenity/disturbance weed		Y	2	8
	3.03	Weed of agriculture/horticulture/forestry		Y	4	8, 10
	3.04	Environmental weed		U		
	3.05	Congeneric weed		Y	2	12
Biology/Ecology						
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs		N	0	
	4.02	Allelopathic		U		
	4.03	Parasitic		N	0	
	4.04	Unpalatable to grazing animals		U		
	4.05	Toxic to animals		U		
	4.06	Host for recognized pests and pathogens		U		
	4.07	Causes allergies or is otherwise toxic to humans		Y	1	8

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	8
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	8
	4.11	Climbing or smothering growth habitat	Y	1	8, 9
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	8
	6.02	Produces viable seed	Y	1	8, 9
	6.03	Hybridizes naturally	U		
	6.04	Self-fertilization	Y	1	8, 9, 10
	6.05	Requires specialist pollinators	N	0	8, 9, 10
	6.06	Reproduction by vegetative propagation	N	-1	11
	6.07	Minimum generative time (years)	1	1	8
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	1
	7.03	Propagules likely to disperse as a produce contaminant	Y	1	1
	7.04	Propagules adapted to wind dispersal	U		
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispersed	U		
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	U		
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	8, 10
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	8, 9
	8.03	Well controlled by herbicides	U		
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	U		
	8.05	Effective natural enemies present in Ohio	N	1	8

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	27
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=IPPU2 Accessed 2-12-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=10092 Accessed 2-12-13		
8. Defelice, M.S. (2001) Tall Morningglory, *Ipomoea purpurea* (L.) Roth - Flower or Foe? *Weed Technology* 15(3):601-606.		
9. Guertin, Patty (2003) USGS Weeds in the West project: Status of Introduced Plants in Southern Arizona Parks. Factsheet for: *Ipomoea purpurea* (L.) Roth http://sdrsnet.srnr.arizona.edu/data/sdrs/ww/docs/ipom_spp.pdf Accessed 2-12-13.		
10. Chaney, L. and Baucom, R.S. (2012) The evolutionary potential of Baker's weediness traits in the common morning glory, *Ipomoea purpurea* (Convolvulaceae). *American Journal of Botany* 99(9):1-7.		
11. Regina Baucom Ph.D., Professor, University of Cincinnati, Biology department. Personal correspondence. 1-22-13		
12. USDA PLANTS Profile: Wright's morning-glory: http://plants.usda.gov/java/profile?symbol=IPWR Accessed 2-12-13		

Modified A-WAR Form B

Botanical Name:	*Ligustrum japonicum*Thunb.	Outcome:	Invasive	
Common Name:	Japanese Privets	Score:	13	
Family Name:	Oleaceae	Your name: Allison Mastalerz		

				Score	Reference
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Cl*imate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	N	0	10
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	N	0	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		6, 8, 9, 11
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	1	10,11
	3.02	Garden/amenity/disturbance weed	U		
	3.03	Weed of agriculture/horticulture/forestry	U		
	3.04	Environmental weed	Y	1	8, 9, 11
	3.05	Congeneric weed	Y	1	8,9,11
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	U		
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	U		9
	4.05	Toxic to animals	U		8
	4.06	Host for recognized pests and pathogens	N	0	10
	4.07	Causes allergies or is otherwise toxic to humans	Y	1	9,11

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	6,11
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	y	1	8,9,11
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	6,8,10,11
	6.03	Hybridizes naturally	U		
	6.04	Self-fertilization	U		
	6.05	Requires specialist pollinators	U		
	6.06	Reproduction by vegetative propagation	Y	1	11
	6.07	Minimum generative time (years)	U		
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	1, 6, 8, 11
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispersed	Y	1	8,9,10, 11
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	Y	1	8, 9, 11
8 *Persistence attributes*	8.01	Prolific seed production	U		9
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	U		
	8.03	Well controlled by herbicides	Y	-1	8,9
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	6,8
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	13
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch Accessed 2-13-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3034 Accessed 2-13-13		
8. Munger, Gregory T. 2003. Ligustrum spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory http://www.fs.fed.us/database/feis/ Accessed 2-13-13/		
9. Maddox, V. Byrd, J. Jr. and Serviss, B. (2010) Identification and Control of Invasive Privets (*Ligustrum* spp.) in the Middle Southern United States. *Invasive Plant Science and Management* 3(4): 482-488.		
10. Gilman, E.F. and Watson, D. G. (2007) *Ligustrum japonicum*: Japanese Privet. University of Florida IFAS Extension, Fact sheet ENH-511. http://edis.ifas.ufl.edu/pdffiles/ST/ST35200.pdf Accessed 2-13-13.		
11. Miller, J.H., Chambliss, E.B. and Loewenstein, N.J. (2010) A Field Guide for the Identification of Invasive Plants in Southern Forests. USDA Forest Service Southern Research Station General Technical Report SRS-119 http://www.forestpests.org/pdf/A%20Field%20Guide%20for%20the%20Identification%20of%20Invasive%20Plants%20in%20Southern%20Forests.pdf Accessed 2-13-13		

Modified A-WAR Form B

Botanical Name:	*Ligustrum obtusifolium* Siebold & Zucc.	Outcome:	Invasive	
Common Name:	Border Privet	Score:	24	
Family Name:	Oleaceae	Your name: Allison Mastalerz		

				Score	Reference
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		6,8,9,10
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6,7,8,9,10,12,13
	3.02	Garden/amenity/disturbance weed	Y	2	6,8,9,10
	3.03	Weed of agriculture/horticulture/forestry	N	0	
	3.04	Environmental weed	Y	4	6,8,9,10,12, 13
	3.05	Congeneric weed	Y	2	6,8,9,10,12, 13
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	8,11
	4.02	Allelopathic	N	0	
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	N	-1	6
	4.05	Toxic to animals	Y	1	6,12
	4.06	Host for recognized pests and pathogens	Y	1	10

	4.07	Causes allergies or is otherwise toxic to humans	U	0	
	4.08	Creates a fire hazard in natural ecosystems	U	0	
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	6
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	6,8,9,10,12
5 *Plant type*	5.01	Aquatic	N	0	11
	5.02	Grass	N	0	11
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	6,8,12,13
	6.03	Hybridizes naturally	U	0	8,13
	6.04	Self-fertilization	U	0	
	6.05	Requires specialist pollinators	U	0	
	6.06	Reproduction by vegetative propagation	Y	1	6,9,12,13
	6.07	Minimum generative time (years)	0	0	13
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	6,12
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U	0	
	7.06	Propagules bird dispersed	Y	1	6,8,9,10,12
	7.07	Propagules dispersed by other animals (externally)	U	0	
	7.08	Propagules dispersed by other animals (internally)	Y	1	10
8 *Persistence attributes*	8.01	Prolific seed production	N	-1	6,13
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	U	0	
	8.03	Well controlled by herbicides	N	1	6,13
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	9,10

	8.05	Effective natural enemies present in Ohio	N	1	6, 10
References, Websites for 1-5 Accessed on 2-7-13			Total Score:		24
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en			Outcome:		reject
2. IT IS: http://www.itis.gov/					
3. Kew: http://www.theplantlist.org/browse/A/					
4. Tropicos: http://www.tropicos.org/Home.aspx					
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do					
6. Maddox, V. (2010). "Identification and control of invasive privets (Ligustrum spp.) in the middle Southern United States". Invasive plant science and management (1939-7291), 3 (4), p. 482.					
7. USDA PLANTS Database: http://plants.usda.gov/java/profile?symbol=LIOB					
8. IPANE: http://nbii-nin.ciesin.columbia.edu/ipane/icat/browse.do?specieId=61					
9. DCNR PA: http://www.dcnr.state.pa.us/forestry/invasivetutorial/border_privat.htm					
10. USDA Forest Service, Forest Health Staff, Newtown Square, PA. WOW 09-28-05 Invasive Plants website: http://www.na.fs.fed.us/fhp/invasive_plants					
11. Dirr, Michael A. Manual of Woody Landscape Plants: their identification, ornamental characteristics, culture, propagation and uses 5th ed.. Stipes Publishing L.L.C., Champaign, IL. 1998					
12. Swearingen, J., B. Slattery, K. Reshetiloff, and S. Zwicker. 2010. Plant Invaders of Mid-Atlantic Natural Areas, 4th ed. National Park Service and U.S. Fish and Wildlife Service. Washington, DC. 168pp.					
13. Official Assessment of Privet (Ligustrum obtusifolium, L. vulgare, L. ovalifolium, L. sinense, and L. amurense) In Indiana's Natural Areas, Results are from an assessment meeting held 4/12/05. Meeting attendees: Ellen Jacquart (TNC), Phil O'Connor (DoF), Hilary Cox (Leescapes Garden Design), Kate Howe (Midwest Invasive Plant Network) http://www.in.gov/dnr/files/Assessment_Ligustrum.pdf					

Modified A-WAR Form B

Botanical Name:	*Ligustrum ovalifolium* Hassk.	Outcome:	Invasive	
Common Name:	California privet, garden privet	Score:	25	
Family Name:	Oleaceae	Your name: Allison Mastalerz		

				Score	Reference
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 *Climate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	9
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		8, 11
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	8,11
	3.02	Garden/amenity/disturbance weed	Y	2	8
	3.03	Weed of agriculture/horticulture/forestry	U		
	3.04	Environmental weed	Y	4	11
	3.05	Congeneric weed	Y	2	
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	U		
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	U		
	4.05	Toxic to animals	U		
	4.06	Host for recognized pests and pathogens	U		
	4.07	Causes allergies or is otherwise toxic to humans	Y	1	11

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	11
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	8, 9, 11
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	6, 8, 11
	6.03	Hybridizes naturally	U		
	6.04	Self-fertilization	U		
	6.05	Requires specialist pollinators	U		
	6.06	Reproduction by vegetative propagation	Y	1	11
	6.07	Minimum generative time (years)	U		
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	8,11
	7.03	Propagules likely to disperse as a produce contaminant	U		
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispersed	Y	1	10, 11
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	Y	1	11
8 *Persistence attributes*	8.01	Prolific seed production	U		
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	U		
	8.03	Well controlled by herbicides	U		
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	6
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	25
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch Accessed 2-13-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3034 Accessed 2-13-13		
8. Missouri Botanical Garden Plant Finder, Plant details pages: *Ligustrum obalifolium*http://www.missouribotanicalgarden.org/gardens-gardening/your-garden/plant-finder/plant-details/kc/c323/ligustrum-ovalifolium.aspx Accessed 2-13-13		
9. Dirr, M.A. 1998 Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses. (5th ed.) Stipes Publishing L.L.C., Champaign, Illinois		
10. Invasive Plant Atlas of New England Plant Factsheet http://www.eddmaps.org/ipane/ipanespecies/shrubs/Ligustrum_ovalifolium.htm. Accessed 2-13-13		
11. Miller, J.H., Chambliss, E.B. and Loewenstein, N.J. (2010) A Field Guide for the Identification of Invasive Plants in Southern Forests. USDA Forest Service Southern Research Station General Technical Report SRS-119 http://www.forestpests.org/pdf/A%20Field%20Guide%20for%20the%20Identification%20of%20Invasive%20Plants%20in%20Southern%20Forests.pdf Accessed 2-13-13		

Modified A-WAR Form B

Botanical Name:	*Ligustrum sinense*	Outcome:	reject			
Common Name:	Chinese Privet	Score:	24			
Family Name:	Oleaceae	Your name: Allison Mastalerz				
History/Biogeography					**Score**	**Reference**
1 *Domestication / cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01		N	0	
	1.02	Has the species become naturalized where grown				
	1.03	Does the species have weedy races				
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b[a]		Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)		2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]		Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]		Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range		Y		8,9
3 *Weed elsewhere*	3.01	Naturalized beyond native range		Y	2	8,9
	3.02	Garden/amenity/disturbance weed		Y	2	10
	3.03	Weed of agriculture/horticulture/forestry		U		
	3.04	Environmental weed		Y	4	8
	3.05	Congeneric weed		Y	2	
Biology/Ecology						
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs		N	0	
	4.02	Allelopathic		U		
	4.03	Parasitic		N	0	
	4.04	Unpalatable to grazing animals		U		
	4.05	Toxic to animals		U		8
	4.06	Host for recognized pests and pathogens		U		
	4.07	Causes allergies or is otherwise toxic to humans		Y	1	10

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	8, 10
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	8, 10
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	8.00
	6.03	Hybridizes naturally	Y	1	10
	6.04	Self-fertilization	U		
	6.05	Requires specialist pollinators	U		
	6.06	Reproduction by vegetative propagation	Y	1	8, 10
	6.07	Minimum generative time (years)	U		
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	8,9,10
	7.03	Propagules likely to disperse as a produce contaminant	U		
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispersed	Y	1	8, 9, 10
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	Y	1	8, 10
8 *Persistence attributes*	8.01	Prolific seed production	U		8
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	N	-1	8
	8.03	Well controlled by herbicides	Y	-1	8
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	8
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	24
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch Accessed 2-13-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3034 Accessed 2-13-13		
8. Munger, Gregory T. 2003. Ligustrum spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/ Accessed 2-13-13/		
9. Maddox, V. Byrd, J. Jr. and Serviss, B. (2010) Identification and Control of Invasive Privets (*Ligustrum* spp.) in the Middle Southern United States. *Invasive Plant Science and Management* 3(4): 482-488.		
10. Miller, J.H., Chambliss, E.B. and Loewenstein, N.J. (2010) A Field Guide for the Identification of Invasive Plants in Southern Forests. USDA Forest Service Southern Research Station General Technical Report SRS-119 http://www.forestpests.org/pdf/A%20Field%20Guide%20for%20the%20Identification%20of%20Invasive%20Plants%20in%20Southern%20Forests.pdf Accessed 2-13-13		

Modified A-WAR Form B

Botanical Name:	*Ligustrum vulgare*L.	Outcome:	Invasive			
Common Name:	Common privet	Score:	24			
Family Name:	Oleaeceae	Your name: Allison Mastalerz				
History/Biogeography					**Score**	**Reference**
1 *Domestication / cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01		N	0	
	1.02	Has the species become naturalized where grown				
	1.03	Does the species have weedy races				
2 Cl*imate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]		Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)		2	2	Default
	2.03	Broad climate suitability (environmental versatility)[b]		Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]		Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range		Y		8,10
3 *Weed elsewhere*	3.01	Naturalized beyond native range		Y	2	6
	3.02	Garden/amenity/disturbance weed		Y	2	8
	3.03	Weed of agriculture/horticulture/forestry		U		
	3.04	Environmental weed		Y	4	10
	3.05	Congeneric weed		Y	2	
Biology/Ecology						
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs		N	0	
	4.02	Allelopathic		U		
	4.03	Parasitic		N	0	
	4.04	Unpalatable to grazing animals		U		
	4.05	Toxic to animals		U		
	4.06	Host for recognized pests and pathogens		U		
	4.07	Causes allergies or is otherwise toxic to humans		Y	1	10

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	8,10
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	8
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	10
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	8, 10
	6.03	Hybridizes naturally	Y	1	10
	6.04	Self-fertilization	U		
	6.05	Requires specialist pollinators	U		
	6.06	Reproduction by vegetative propagation	Y	1	10
	6.07	Minimum generative time (years)	U		
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	1,10
	7.03	Propagules likely to disperse as a produce contaminant	U		
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispersed	Y	1	8
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	Y	1	8
8 *Persistence attributes*	8.01	Prolific seed production	U		8
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	N	-1	8
	8.03	Well controlled by herbicides	Y	-1	8
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	8
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	24
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database, plant profiles: http://plants.usda.gov/java/nameSearch Accessed 2-13-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3034 Accessed 2-13-13		
8. Munger, Gregory T. 2003. Ligustrum spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: http://www.fs.fed.us/database/feis/ Accessed 2-13-13/		
9. Maddox, V. Byrd, J. Jr. and Serviss, B. (2010) Identification and Control of Invasive Privets (*Ligustrum* spp.) in the Middle Southern United States. *Invasive Plant Science and Management* 3(4): 482-488.		
10. Miller, J.H., Chambliss, E.B. and Loewenstein, N.J. (2010) A Field Guide for the Identification of Invasive Plants in Southern Forests. USDA Forest Service Southern Research Station General Technical Report SRS-119 http://www.forestpests.org/pdf/A%20Field%20Guide%20for%20the%20Identification%20of%20Invasive%20Plants%20in%20Southern%20Forests.pdf Accessed 2-13-13		

Modified A-WAR Form B

Botanical Name:	*Liriope muscari* (Decne.) L. H. Bailey	Outcome:	invasive	
Common Name:	big blue lilyturf	Score:	13	
Family Name:	Asparagaceae (also Convallariaceae)	Your name: Allison Mastalerz		

		History/Biogeography		Score	Reference
1 *Domestication / cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Cl*imate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	N	0	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		1, 6
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6
	3.02	Garden/amenity/disturbance weed	U		
	3.03	Weed of agriculture/horticulture/forestry	U		
	3.04	Environmental weed	U		
	3.05	Congeneric weed	Y	2	8
		Biology/Ecology			
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	U		
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	U		
	4.05	Toxic to animals	U		
	4.06	Host for recognized pests and pathogens	U		
	4.07	Causes allergies or is otherwise toxic to humans	U		

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	6, 8, 9
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	U		
	6.03	Hybridizes naturally	U		
	6.04	Self-fertilization	U		
	6.05	Requires specialist pollinators	U		
	6.06	Reproduction by vegetative propagation	Y	1	6
	6.07	Minimum generative time (years)	U		
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	1, 6
	7.03	Propagules likely to disperse as a produce contaminant	U		
	7.04	Propagules adapted to wind dispersal	U		
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispersed	U		
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	U		
8 *Persistence attributes*	8.01	Prolific seed production	U		
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	U		
	8.03	Well controlled by herbicides	U		
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	U		
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	13
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database, plant profiles: http://plants.usda.gov/java/profile?symbol=LIMU6 Accessed 2-12-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=11612 Accessed 2-12-13		
8. Missouri Botanical Garden Plant Details Page, *Liriope muscari*: http://www.missouribotanicalgarden.org/gardens-gardening/your-garden/plant-finder/plant-details/kc/l100/liriope-muscari.aspx Accessed 2-12-13		
9. FLORIDATA webpage: http://www.floridata.com/ref/l/liri_mus.cfm Accessed 2-12-13		

Modified A-WAR Form B

Botanical Name:	*Lonicera japonica* Thunb.		Outcome:	reject		
Common Name:	Japanese honeysuckle		Score:	32		
Family Name:	Caprifoliaceae		Your name: Allison Mastalerz			
History/Biogeography					**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01		N	0	
	1.02	Has the species become naturalized where grown				
	1.03	Does the species have weedy races				
2 Cl*imate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]		Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)		2	2	
	2.03	Broad climate suitability (environmental versatility)[b]		Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]		Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range		Y		6,8,10,11
3 *Weed elsewhere*	3.01	Naturalized beyond native range		Y	2	6,7,8,9,10,11
	3.02	Garden/amenity/disturbance weed		Y	2	9,11
	3.03	Weed of agriculture/horticulture/forestry		Y	4	6,8,9,11
	3.04	Environmental weed		Y	4	6,8,10,11
	3.05	Congeneric weed		Y	2	6
Biology/Ecology						
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs		N	0	
	4.02	Allelopathic		Y	1	10
	4.03	Parasitic		N	0	
	4.04	Unpalatable to grazing animals		N	-1	6,8,9,11
	4.05	Toxic to animals		N	0	8,9,11
	4.06	Host for recognized pests and pathogens		Y	1	9,11
	4.07	Causes allergies or is otherwise toxic to humans		Y	1	8,11

	4.08	Creates a fire hazard in natural ecosystems	N	0	9
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	6,8,9,11
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	Y	1	7,8,9,10,11
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	7,9,11
	6.03	Hybridizes naturally	U	0	8,11
	6.04	Self-fertilization	N	-1	7,8,9,11
	6.05	Requires specialist pollinators	N	0	7,9,11
	6.06	Reproduction by vegetative propagation	Y	1	7,8,9,11
	6.07	Minimum generative time (years)	1	1	8
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	11
	7.02	Propagules dispersed intentionally by people	Y	1	6,8,11
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U	0	
	7.06	Propagules bird dispersed	Y	1	8,9,11
	7.07	Propagules dispersed by other animals (externally)	N	-1	
	7.08	Propagules dispersed by other animals (internally)	Y	1	8,9,11
8 *Persistence attributes*	8.01	Prolific seed production	U	0	
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	8,11
	8.03	Well controlled by herbicides	N	1	8,11
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	8,9,11
	8.05	Effective natural enemies present in Ohio.	N	1	8,9,11

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	32
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. Lemke, D. (2011). "Distribution modeling of Japanese honeysuckle (Lonicera japonica) invasion in the Cumberland Plateau and Mountain Region, USA". Forest ecology and management (0378-1127), 262 (2), p. 139.		
7. Larson, K.C., Fowler, S.P. and Walker, J.C. (2002) "Lack of Pollinators Limits Fruit set in the Exotic Lonicera Japonica." *American Midland Naturalist,* 148 (1), pp. 54-60.		
8. Schierenbeck, K.A. (2004). "Japanese honeysuckle (Lonicera japonica) as an invasive species; history, ecology, and context". Critical reviews in plant sciences (0735-2689), 23 (5), p. 391.		
9. Munger, Gregory T. 2002. Lonicera japonica. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: http://www.fs.fed.us/database/feis/ [2012, March 6].		
10. Skulman, B.W. (2004). "Evidence for allelopathic interference of Japanese honeysuckle (Lonicera japonica) to loblolly and shortleaf pine regeneration". Weed science (0043-1745), 52 (3), p. 433		
11. Larson, B.M.H. (2007). "The biology of Canadian weeds. 135. Lonicera japonica Thunb." Canadian journal of plant science (0008-4220), 87 (2), p. 423.		

Modified A-WAR Form B

Botanical Name:	*Lonicera maackii* (Rupr.) Maxim.	Outcome:	reject	
Common Name:	Amur Honeysuckle	Score:	24	
Family Name:	Caprifoliaceae	Your name: Allison Mastalerz		

				Score	Reference
History/Biogeography					
1 *Domestication / cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		1,6,7,8,9,10
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	1,6,7,8,9,10
	3.02	Garden/amenity/disturbance weed	Y	2	7,8
	3.03	Weed of agriculture/horticulture/forestry	N	0	
	3.04	Environmental weed	Y	4	6,7,8,9,10
	3.05	Congeneric weed	Y	2	8,9
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	Y	1	13
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	N	-1	9
	4.05	Toxic to animals	N	0	12
	4.06	Host for recognized pests and pathogens	U	0	
	4.07	Causes allergies or is otherwise toxic to humans	N	0	

	4.08	Creates a fire hazard in natural ecosystems	U	0	9
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	8,9
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	7,8
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	8
	6.02	Produces viable seed	Y	1	8,9
	6.03	Hybridizes naturally	U	0	9
	6.04	Self-fertilization	Y	1	11
	6.05	Requires specialist pollinators	N	0	11
	6.06	Reproduction by vegetative propagation	N	-1	
	6.07	Minimum generative time (years)	0	0	8,9
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	7,8
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U	0	
	7.06	Propagules bird dispersed	Y	1	7,8,9
	7.07	Propagules dispersed by other animals (externally)	N	0	
	7.08	Propagules dispersed by other animals (internally)	Y	1	9
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	7,8,9
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	U	0	9
	8.03	Well controlled by herbicides	N	1	9
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	8,9
	8.05	Effective natural enemies present in Ohio	N	1	9

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	24
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. Trammell, T.L.E. and Margaret M. Carreiro (2011). "Vegetation composition and structure of woody plant communities along urban interstate corridors in Louisville, KY, U.S.A.". Urban ecosystems (1083-8155), 14 (4), p. 501.		
7.Hartman, K.M. & McCarthy, B.C. (2008). "Changes in forest structure and species composition following invasion by a non-indigenous shrub, Amur honeysuckle (Lonicera maackii)". The journal of the Torrey Botanical Society (1095-5674), 135 (2), p. 245.		
8. Luken, J.O. & Thieret, J.W. (1996). "Amur Honeysuckle, its fall from grace". Bioscience (0006-3568), 46 (1), p. 18.		
9. Munger, Gregory T. 2005. Lonicera spp. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: http://www.fs.fed.us/database/feis/ [2012, March 14].		
10. McEwan, R.W., Arthur-Paratley, L.G., Rieske, L.K. and Arther, M.A. (2010). "A multi-assay comparison of seed germination inhibition by Lonicera maackii and co-occurring native shrubs". Flora. Morphologie, Geobotanik, Oekophysiologie (0367-2530), 205 (7), p. 475.		
11. Karen Goodell, Amy M. McKinney, Chia-Hua Lin (2010) "Pollen limitation and local habitat-dependent pollinator interactions in the invasive shrub Lonicera maackii". International journal of plant sciences (1058-5893), 171 (1), p. 63.		
12. Watling, J.I. (2011). "Extracts of the invasive shrub Lonicera maackii increase mortality and alter behavior of amphibian larvae". Oecologia (0029-8549), 165 (1), p. 153.		
13.Cipollini, K., Titus, K. and Wagner, C. (2012) Allelopathic effects of invasive species (*Alliaria petiolata, Lonicera maackii, Ranunculus ficaria*) in the Midwestern United States. *Allelopathy Journal* 29(1): 63-76.		

Modified A-WAR Form B

Botanical Name:	*Microstegium vimineum*(Trin.) A. Camus	Outcome:	reject	
Common Name:	Japanese stilt grass	Score:	32	
Family Name:	Poaceae	Your name: Allison Mastalerz		

		History/Biogeography		Score	Reference
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		1,6,7,10
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	1,6,7,10
	3.02	Garden/amenity/disturbance weed	Y	2	7,8,10
	3.03	Weed of agriculture/horticulture/forestry	Y	4	10
	3.04	Environmental weed	Y	4	6,10
	3.05	Congeneric weed	N	0	
		Biology/Ecology			
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	Y	1	9,10
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	Y	1	8,10
	4.05	Toxic to animals	U	0	
	4.06	Host for recognized pests and pathogens	U	0	
	4.07	Causes allergies or is otherwise toxic to humans	U	0	

	4.08	Creates a fire hazard in natural ecosystems	U	0	10
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	6,7,10
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	Y	1	1,6
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	6,7,10
	6.03	Hybridizes naturally	U	0	
	6.04	Self-fertilization	Y	1	6,7,10
	6.05	Requires specialist pollinators	N	0	
	6.06	Reproduction by vegetative propagation	Y	1	10
	6.07	Minimum generative time (years)	1	1	6,7,8,10
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	10
	7.02	Propagules dispersed intentionally by people	N	-1	
	7.03	Propagules likely to disperse as a produce contaminant	Y	1	1
	7.04	Propagules adapted to wind dispersal	Y	1	10
	7.05	Propagules buoyant	Y	1	10
	7.06	Propagules bird dispersed	U	0	
	7.07	Propagules dispersed by other animals (externally)	Y	1	8,10
	7.08	Propagules dispersed by other animals (internally)	U	0	
8 *Persistence attributes*	8.01	Prolific seed production	N	-1	6
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	6,10
	8.03	Well controlled by herbicides	Y	-1	6
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	10
	8.05	Effective natural enemies present in Ohio	N	1	10

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	32
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. Ward, J.S. and Mervosh, T.L. (2012). "Nonchemical and herbicide treatments for management of Japanese stiltgrass (Microstegium vimineum)". Invasive plant science and management (1939-7291), 5 (1), p. 9.		
7. Huebner, C.D. (2011). "Seed mass, viability, and germination of Japanese stiltgrass (Microstegium vimineum) under variable light and moisture conditions". Invasive plant science and management (1939-7291), 4 (3), p. 274.		
8. Knight, T.M., Dunn, J.L., Smith, L.A., Davis, J. and Kalisz, S.(2009). "Deer facilitate invasive plant success in a Pennsylvania forest understory". Natural areas journal (0885-8608), 29 (2), p. 110.		
9. Pisula, N.L. and Meiners, S.J. (2010). "Relative allelopathic potential of invasive plant species in young disturbed woodland". The journal of the Torrey Botanical Society (1095-5674), 137 (1), p. 81.		
10. Fryer, Janet L. 2011. Microstegium vimineum. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: http://www.fs.fed.us/database/feis/ [2012, April 3].		

Modified A-WAR Form B

Botanical Name:	*Morus alba* L.	Outcome:	reject		
Common Name:	White Mulberry	Score:	19		
Family Name:	Moraceae	Your name: Allison Mastalerz			

		History/Biogeography		Score	Reference
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		6,7,8
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	1,6,7,8
	3.02	Garden/amenity/disturbance weed	N	0	
	3.03	Weed of agriculture/horticulture/forestry	N	0	8
	3.04	Environmental weed	Y	4	6,8
	3.05	Congeneric weed	N	0	9
		Biology/Ecology			
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	Y	1	7,8
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	N	-1	8
	4.05	Toxic to animals	N	0	8,9
	4.06	Host for recognized pests and pathogens	U	0	8
	4.07	Causes allergies or is otherwise toxic to humans	N	0	8
	4.08	Creates a fire hazard in natural ecosystems	U	0	8

	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	8,9
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	8
5 *Plant type*	5.01	Aquatic	N	0	9
	5.02	Grass	N	0	9
	5.03	Nitrogen fixing woody plant	N	0	9
	5.04	Geophyte	N	0	9
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	6,8,9
	6.03	Hybridizes naturally	Y	1	6
	6.04	Self-fertilization	N	-1	6,8
	6.05	Requires specialist pollinators	N	0	6,8
	6.06	Reproduction by vegetative propagation	N	-1	8,9
	6.07	Minimum generative time (years)	U	0	
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	8
	7.02	Propagules dispersed intentionally by people	Y	1	7,8,9
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U	0	
	7.06	Propagules bird dispersed	Y	1	8
	7.07	Propagules dispersed by other animals (externally)	U	0	
	7.08	Propagules dispersed by other animals (internally)	Y	1	8
8 *Persistence attributes*	8.01	Prolific seed production	U	0	
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	8
	8.03	Well controlled by herbicides	N	-1	8
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	8,9
	8.05	Effective natural enemies present in Ohio	N	1	8
References, Websites for 1-5 Accessed on 2-7-13			Total Score:		19

1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. Burgess, K.S., Morgan, M. and Husband, B.C. (2008). "Interspecific seed discounting and the fertility cost of hybridization in an endangered species". The New phytologist (0028-646X), 177 (1), p. 276.		
7. Haq, R.A., Hussain, M., Cheema, Z.A., Mushtaq, M.N. and Farooq, M. (2009). "Photosynthetic characteristics involved in adaptability to Karst soil and alien invasion of paper mulberry (Broussonetia papyrifera (L.) Vent.) in comparison with mulberry (Morus alba L.)". Photosynthetica (0300-3604), 47 (1), p. 155.		
8. Stone, Katharine R. 2009. Morus alba. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, April 4].		
9. USDA PLANTS Database**: http://plants.usda.gov/java/charProfile?symbol=MOAL,** Accessed 4-6-12		

Modified A-WAR Form B

Botanical Name:	*Pastinaca sativa*L.	Outcome:	invasive			
Common Name:	Wild Parsnip	Score:	26			
Family Name:	Apiaceae	Your name: Allison Mastalerz				
History/Biogeography					**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01		N	0	
	1.02	Has the species become naturalized where grown				
	1.03	Does the species have weedy races				
2 Cl*imate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]		Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)		2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]		Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]		Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range		Y		8, 9, 10, 11
3 *Weed elsewhere*	3.01	Naturalized beyond native range		Y	2	8, 9, 10, 11
	3.02	Garden/amenity/disturbance weed		U		
	3.03	Weed of agriculture/horticulture/forestry		Y	4	8, 9, 11
	3.04	Environmental weed		Y	4	8
	3.05	Congeneric weed		N	0	8
Biology/Ecology						
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs		N	0	
	4.02	Allelopathic		U		8
	4.03	Parasitic		N	0	
	4.04	Unpalatable to grazing animals		Y	1	8, 9
	4.05	Toxic to animals		Y	1	8, 9
	4.06	Host for recognized pests and pathogens		Y	1	8, 9
	4.07	Causes allergies or is otherwise toxic to humans		Y	1	8, 11

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	U		8
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	8,9, 11
	6.03	Hybridizes naturally	N	-1	8
	6.04	Self-fertilization	Y	1	8
	6.05	Requires specialist pollinators	N	0	8
	6.06	Reproduction by vegetative propagation	N	-1	8
	6.07	Minimum generative time (years)	0	0	8,9,10, 11
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	
	7.03	Propagules likely to disperse as a produce contaminant	U		
	7.04	Propagules adapted to wind dispersal	Y	1	8
	7.05	Propagules buoyant	Y	1	8
	7.06	Propagules bird dispersed	Y	1	8
	7.07	Propagules dispersed by other animals (externally)	N	-1	
	7.08	Propagules dispersed by other animals (internally)	N	-1	
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	8
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	8
	8.03	Well controlled by herbicides	U		8
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	8
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	26
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database, plant profiles: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=PASA2 Accessed 2-14-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at:http://www.invasive.org/browse/subinfo.cfm?sub=6147Accessed 2-14-13		
8. N. Cain, S Darbyshire, A. Francis, R Nurse, M Simard . The Biology of Canadian weeds. 144. Pastinaca sativa L.. Canadian Journal of Plant Science, Volume 90, Number 2 (January 2010), pp. 217-240		
9. Vasques, E.C. and Meyer, G.A. (2011) Relationships among leaf damage, natural enemy release and abundance in exotic and native prairie plants. *Biological Invasions* 13:621-633.		
10. Baskin, J.M. and Baskin, C.M. (1979) Studies on the autecology and population biology of the weedy monocarpic perennial *Pastinaca sativa. Journal of Ecology* 67(2): 601-610.		
11. Illinois Natural History Survey, Prairie Research Institute; Vegetation Management Guideline for Wild Parsnip (*Pastinaca sativa).* http://www.inhs.uiuc.edu/research/VMG/parsnip.html Accessed 2-14-13		

Modified A-WAR Form B

Botanical Name:	*Paulownia tomentosa*(Thunb.) Steud.	Outcome:	reject	
Common Name:	Princess tree	Score:	21	
Family Name:	Paulowniaceae	Your name: Allison Mastalerz		

		History/Biogeography		Score	Reference
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		6,7,8,9,10,11
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	1,6,7,8,9,10,11
	3.02	Garden/amenity/disturbance weed	Y	2	7,10
	3.03	Weed of agriculture/horticulture/forestry	N	0	
	3.04	Environmental weed	Y	4	7,10,11
	3.05	Congeneric weed	N	0	10
		Biology/Ecology			
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	8
	4.02	Allelopathic	N	0	6
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	N	-1	10
	4.05	Toxic to animals	N	0	
	4.06	Host for recognized pests and pathogens	N	0	8
	4.07	Causes allergies or is otherwise toxic to humans	N	0	6

	4.08	Creates a fire hazard in natural ecosystems	N	0	10
	4.09	Is a shade tolerant plant at some stage of its life cycle	N	0	6,7,9
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	6,9
	5.02	Grass	N	0	6,9
	5.03	Nitrogen fixing woody plant	N	0	6,9
	5.04	Geophyte	N	0	6,9
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	9
	6.02	Produces viable seed	Y	1	6, 8,9,10
	6.03	Hybridizes naturally	U	0	
	6.04	Self-fertilization	U	0	
	6.05	Requires specialist pollinators	N	0	10
	6.06	Reproduction by vegetative propagation	N	-1	6
	6.07	Minimum generative time (years)	-1	-1	7,9,11
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	1,7,10,11
	7.03	Propagules likely to disperse as a produce contaminant	Y	1	1
	7.04	Propagules adapted to wind dispersal	Y	1	7,9,10,11
	7.05	Propagules buoyant	Y	1	10,11
	7.06	Propagules bird dispersed	U	0	
	7.07	Propagules dispersed by other animals (externally)	U	0	
	7.08	Propagules dispersed by other animals (internally)	U	0	
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	7,8,9,10,11
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	10
	8.03	Well controlled by herbicides	N	1	10
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	6,7,9,10,11
	8.05	Effective natural enemies present in Ohio	N	1	10

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	114
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA PLANTS Database: http://plants.usda.gov/java/nameSearch?keywordquery=paulownia+tomentosa&mode=sciname&submit.x=0&submit.y=0 Accessed 4/12/12		
7. Kuppinger, D.M., Jenkins, M.A. and White, P.S. (2010). "Predicting the post-fire establishment and persistence of an invasive tree species across a complex landscape". Biological invasions (1387-3547), 12 (10), p. 3473.		
8. Dirr, M.A. Manual of Woody Landscape Plants: Their identification, Ornamental characteristics, culture, propagation and uses. 5th edition. Stipes Publishing: Champaign, Illinois 1998		
9. Burns, Russell M., and Barbara H. Honkala, tech. coords. 1990. Silvics of North America: 1. Conifers; 2. Hardwoods. Agriculture Handbook 654. U.S. Department of Agriculture, Forest Service, Washington, DC. vol.2, 877 p.		
10. Innes, Robin J. 2009. Paulownia tomentosa. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: http://www.fs.fed.us/database/feis/ [2012, April 12].		
11. Swearingen, J., B. Slattery, K. Reshetiloff, and S. Zwicker. 2010.Plant Invaders of Mid-Atlantic Natural Areas, 4th ed. National Park Service and U.S. Fish and Wildlife Service. Washington, DC. 168pp.		

Modified A-WAR Form B						
Botanical Name:	*Persicaria perfoliata*(L.) H. Gross		Outcome:	reject		
Common Name:	Mile-a-minute weed		Score:	29		
Family Name:	Polygonaceae		Your name: Allison Mastalerz			
History/Biogeography					**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01		N	0	
	1.02	Has the species become naturalized where grown				
	1.03	Does the species have weedy races				
2 Cl*imate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]		Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)		2	2	
	2.03	Broad climate suitability (environmental versatility)[b]		Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]		Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range		N		6,7,8
3 *Weed elsewhere*	3.01	Naturalized beyond native range		Y	2	6,7,8
	3.02	Garden/amenity/disturbance weed		Y	2	7,8
	3.03	Weed of agriculture/horticulture/forestry		Y	4	8
	3.04	Environmental weed		Y	4	7,8
	3.05	Congeneric weed		N	0	6
Biology/Ecology						
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs		Y	1	6,8
	4.02	Allelopathic		U	0	8
	4.03	Parasitic		N	0	
	4.04	Unpalatable to grazing animals		Y	1	8
	4.05	Toxic to animals		U	0	
	4.06	Host for recognized pests and pathogens		U	0	
	4.07	Causes allergies or is otherwise toxic to humans		N	0	8

	4.08	Creates a fire hazard in natural ecosystems	U	0	
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	7,8
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	Y	1	6,7,8
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	8
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	Y	1	6
	6.02	Produces viable seed	Y	1	7,8
	6.03	Hybridizes naturally	U	0	
	6.04	Self-fertilization	Y	1	8
	6.05	Requires specialist pollinators	N	0	7,8
	6.06	Reproduction by vegetative propagation	N	-1	8
	6.07	Minimum generative time (years)	Y	1	6,7,8
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	6,8
	7.02	Propagules dispersed intentionally by people	N	-1	
	7.03	Propagules likely to disperse as a produce contaminant	Y	1	6,7,8
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	Y	1	6,7,8
	7.06	Propagules bird dispersed	Y	1	6,7,8
	7.07	Propagules dispersed by other animals (externally)	U	0	
	7.08	Propagules dispersed by other animals (internally)	Y	1	6,7,8
8 *Persistence attributes*	8.01	Prolific seed production	N	-1	6
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	6,8
	8.03	Well controlled by herbicides	N	1	8
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	U	0	
	8.05	Effective natural enemies present in Ohio	Y	-1	6,7

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	29
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. Hough-Goldstein, Lake, E. and Reardon, R. (2012). "Status of an ongoing biological control program for the invasive vine, Persicaria perfoliata in eastern North America". BioControl (Dordrecht, Netherlands) (1386-6141), 57 (2), p. 181.		
7. Hough-Goldstein, J., Schiff, M., Lake, E and Butterworth, B. (2008). "Impact of the biological control agent Rhinoncomimus latipes (Coleoptera: Curculionidae) on mile-a-minute weed, Persicaria perfoliata, in field cages". Biological control (1049-9644), 46 (3), p. 417.		
8. Stone, Katharine R. 2010. Polygonum perfoliatum. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: http://www.fs.fed.us/database/feis/ [2012, April 13].		

Modified A-WAR Form B

Botanical Name:	*Plantago major*	Outcome:	invasive	
Common Name:	Broad Leaf Plantain	Score:	25	
Family Name:	Plantaginaceae	Your name: Allison Mastalerz		

				Score	Reference
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and *Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		10
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6, 7, 8, 10
	3.02	Garden/amenity/disturbance weed	Y	2	8, 9, 10
	3.03	Weed of agriculture/horticulture/forestry	Y	4	7, 8,9, 10
	3.04	Environmental weed	U		
	3.05	Congeneric weed	Y	2	7, 8, 9,10
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	U		
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	N	-1	10
	4.05	Toxic to animals	N	0	10
	4.06	Host for recognized pests and pathogens	Y	1	10
	4.07	Causes allergies or is otherwise toxic to humans	N	0	10
	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	10

	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	6, 7
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	7, 8, 9
	6.03	Hybridizes naturally	N	-1	10
	6.04	Self-fertilization	Y	1	10
	6.05	Requires specialist pollinators	N	0	10
	6.06	Reproduction by vegetative propagation	Y	1	7, 10
	6.07	Minimum generative time (years)	1	1	10
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	7, 10
	7.02	Propagules dispersed intentionally by people	N	-1	
	7.03	Propagules likely to disperse as a produce contaminant	Y	1	10
	7.04	Propagules adapted to wind dispersal	Y	1	7
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispered	Y	1	7
	7.07	Propagules dispersed by other animals (externally)	Y	1	7, 10
	7.08	Propagules dispersed by other animals (internally)	U		
8 *Persistence attributes*	8.01	Prolific seed production	N	-1	7, 10
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	7, 10
	8.03	Well controlled by herbicides	Y	-1	10
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	7, 10
	8.05	Effective natural enemies present in Ohio	U		
References, Websites for 1-5 Accessed on 2-7-13			Total Score:		25
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en			Outcome:		Invasive

2. IT IS: http://www.itis.gov/
3. Kew: http://www.theplantlist.org/browse/A/
4. Tropicos: http://www.tropicos.org/Home.aspx
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do
6. USDA Plants database: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=PLMA2. Accessed 2-14-12.
7.Cardina, J., Herms, C., Koch, T. and Webster, T. (n.d.) Ohio Perennial & Biennial Weed Guide: Broad Leaf Plantain Weed Guide. The Ohio State University OARDC Extension. http://www.oardc.ohio-state.edu/weedguide/singlerecord.asp?id=791. Accessed 2-14-13.
8. University of California Agriculture and Natural Resources Statewide Integrated Pest Management Program Weed Photo Gallery http://www.ipm.ucdavis.edu/PMG/WEEDS/broadleaf_plantain.html. Accessed 2-14-13.
9. Purdue Master Gardener Guide to Common Lawn and Garden Weeds. http://www3.ag.purdue.edu/extension/mglinks/Documents/Purdue%20Master%20Gardener%20Guide%20to%20Common%20Lawn%20and%20Garden%20Weeds.pdf
10. Hawthorn, W.R. (1974) The biology of Canadian weeds. 4. Plantago major and P. rugelii Canadian Journal of Plant Science 54:383-396.

Modified A-WAR Form B

Botanical Name:	*Polygonum cespitosum*	Outcome:	invasive	
Common Name:	Oriental Ladysthumb	Score:	20	
Family Name:	Polygonaceae	Your name: Allison Mastalerz		

		History/Biogeography		Score	Reference
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		9,10
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	8,9,10
	3.02	Garden/amenity/disturbance weed	Y	2	9
	3.03	Weed of agriculture/horticulture/forestry	U		
	3.04	Environmental weed	Y	4	10
	3.05	Congeneric weed	Y	2	6
		Biology/Ecology			
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	U		
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	N	-1	11
	4.05	Toxic to animals	N	0	11
	4.06	Host for recognized pests and pathogens	U		
	4.07	Causes allergies or is otherwise toxic to humans	N	0	11

	4.08	Creates a fire hazard in natural ecosystems	U		11
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	8, 10,11
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	8,11
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	8
	6.02	Produces viable seed	Y	1	8,11
	6.03	Hybridizes naturally	U		
	6.04	Self-fertilization	Y	1	8
	6.05	Requires specialist pollinators	U		
	6.06	Reproduction by vegetative propagation	N	-1	11
	6.07	Minimum generative time (years)	Y	1	8,10,11
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	9,11
	7.02	Propagules dispersed intentionally by people	N	-1	
	7.03	Propagules likely to disperse as a produce contaminant	U		
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	Y	1	9
	7.06	Propagules bird dispered	U		
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	Y	1	11
8 *Persistence attributes*	8.01	Prolific seed production	U		
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	11
	8.03	Well controlled by herbicides	N	-1	11
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	U		
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	20
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=POCE4 Accessed 2-14-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=20414 Accessed 2-14-13		
8. Matesanz S, Horgan-Kobelski T, Sultan SE (2012) Phenotypic Plasticity and Population Differentiation in an Ongoing Species Invasion. PLoS ONE 7(9): e44955.		
9. Paterson AK (2000) Range Expansion of Polygonum caespitosum var. longisetum in the United States. Bartonia 60: 57–69.		
10. Mehrhoff LJ, Silander JAJ, Leicht SA, Mosher ES, Tabak NM (2003) IPANE. Invasive plant atlas of New England. Department of Ecology & Evolutionary Biology, University of Connecticut, Storrs, CT, USA. http://www.ipane.org. Accessed 2-14-13		
11. Stone, Katharine R. 2010. Persicaria longiseta. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: http://www.fs.fed.us/database/feis/ 2-141-3		

Modified A-WAR Form B

Botanical Name:	*Pyrus calleryana*Decne.	Outcome:	reject	
Common Name:	Callery pear	Score:	16	
Family Name:	Rosaceae	Your name: Allison Mastalerz		

				Score	Reference
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Cl*imate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		7,8,10
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	7,8,9,10
	3.02	Garden/amenity/disturbance weed	Y	2	7,8
	3.03	Weed of agriculture/horticulture/forestry	N	0	
	3.04	Environmental weed	N	0	7,8
	3.05	Congeneric weed	N	0	
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	Y	1	7,8,9
	4.02	Allelopathic	N	0	6
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	U	0	7
	4.05	Toxic to animals	N	0	
	4.06	Host for recognized pests and pathogens	N	0	7,8,9
	4.07	Causes allergies or is otherwise toxic to humans	Y	1	6

	4.08	Creates a fire hazard in natural ecosystems	U	0	
	4.09	Is a shade tolerant plant at some stage of its life cycle	N	0	6,7
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	7,8,10
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	6
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	7
	6.02	Produces viable seed	Y	1	7,8,9,10
	6.03	Hybridizes naturally	Y	1	8
	6.04	Self-fertilization	N	-1	7,8,9
	6.05	Requires specialist pollinators	N	0	7
	6.06	Reproduction by vegetative propagation	N	-1	6
	6.07	Minimum generative time (years)	0	0	7,8
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	
	7.02	Propagules dispersed intentionally by people	Y	1	6,7,8,9
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U	0	
	7.06	Propagules bird dispered	Y	1	7,8,9,10
	7.07	Propagules dispersed by other animals (externally)	U	0	
	7.08	Propagules dispersed by other animals (internally)	U	0	9,10
8 *Persistence attributes*	8.01	Prolific seed production	U	0	
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	7
	8.03	Well controlled by herbicides	U	0	7
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	6
	8.05	Effective natural enemies present in Ohio	N	1	7,8

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	16
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA PLANTS Database: http://plants.usda.gov/java/charProfile?symbol=PYCA80 Accessed on 4/17/12		
7. Culley, T.M. and Hardiman, N.A. (2007) The Beginning of a New Invasive Plant: A History of the Ornamental Callery Pear in the United States. *BioScience* 57(11): 956-964.		
8. Vincent, M.A. (2005) On the Spread and Current Distribution of Pyrus calleryana in the United States. *Castanea* 70(1): 20-21		
9. Rhoads, A.F. and Block, T.A. DCNR Invasive Exotic Plant Tutorial for Natural Lands Managers. http://www.dcnr.state.pa.us/forestry/invasivetutorial/callery_pear.htm Accessed 4/17/12.		
10. Swearingen, J., B. Slattery, K. Reshetiloff, and S. Zwicker. 2010. Plant Invaders of Mid-Atlantic Natural Areas, 4th ed. National Park Service and U.S. Fish and Wildlife Service. Washington, DC. 168pp.		

Modified A-WAR Form B

Botanical Name:	*Rhamnus cathartica* L.	Outcome:	invasive	
Common Name:	Common Buckthorn	Score:	32	
Family Name:	Rhamnaceae	Your name: Allison Mastalerz		

				Score	Reference
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and *Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	High	2	Default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		9,10
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6,10
	3.02	Garden/amenity/disturbance weed	Y	2	8,9
	3.03	Weed of agriculture/horticulture/forestry	Y	4	8
	3.04	Environmental weed	Y	4	8,9,10
	3.05	Congeneric weed	Y	2	6
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	Y	1	10
	4.02	Allelopathic	Y	1	9
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	Y	1	10
	4.05	Toxic to animals	N	0	10
	4.06	Host for recognized pests and pathogens	Y	1	1,8,10
	4.07	Causes allergies or is otherwise toxic to humans	U		

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	10
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	6
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	8,9,10
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	9
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	10
	6.02	Produces viable seed	Y	1	10.00
	6.03	Hybridizes naturally	Y	1	10
	6.04	Self-fertilization	N	-1	10
	6.05	Requires specialist pollinators	N	0	10
	6.06	Reproduction by vegetative propagation	N	-1	10
	6.07	Minimum generative time (years)	-1	-1	10
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	8, 10
	7.03	Propagules likely to disperse as a produce contaminant	N	-1	
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	Y	1	8, 10
	7.06	Propagules bird dispered	Y	1	8, 10
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	Y	1	10
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	10
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	10
	8.03	Well controlled by herbicides	N	1	10
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	10
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	32
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6.. USDA Plants database: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=RHCA3 Accessed 2-14-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3070 Accessed 2-14-13		
8. Becker, R.H., Zmijewski, K.A. and Crail, T. (2013) Seeing the forest for the invasives: mapping buckthorn in the oak openings. *Biological Invasions*15:315-326.		
9. Klionsky, S.M., Amatangelo, K.L. and Waller, D.M. (2010) Above- and Belowground Impacts of European Buckthorn (*Rhamnus cathartica*) on Four Native Forbs. *Restoration Ecology* 19(6):728-737		
10. Zouhar, Kris. 2011. Rhamnus cathartica, R. davurica. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: http://www.fs.fed.us/database/feis/ [2013, February 14].		

Modified A-WAR Form B

Botanical Name:	*Rosa multiflora*Thunb.	Outcome:	reject		
Common Name:	Multiflora Rose	Score:	28		
Family Name:	Rosaceae	Your name: Allison Mastalerz			
History/Biogeography				**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Cl*imate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		1,6,7,8,9,10,11,12
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	1,6,7,8,9,10,12,14
	3.02	Garden/amenity/disturbance weed	Y	2	8, 9,12
	3.03	Weed of agriculture/horticulture/forestry	Y	4	6,7,13,14
	3.04	Environmental weed	Y	4	7,8,9,10,11,12,13, 14
	3.05	Congeneric weed	Y	2	
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	Y	1	6,7,8,9,10,11
	4.02	Allelopathic	U	0	
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	N	-1	13
	4.05	Toxic to animals	N	0	
	4.06	Host for recognized pests and pathogens	Y	1	13
	4.07	Causes allergies or is otherwise toxic to humans	N	0	9

	4.08	Creates a fire hazard in natural ecosystems	U	0	6
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	13
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	10
	4.11	Climbing or smothering growth habitat	Y	1	9
	4.12	Forms dense thickets	Y	1	6,7,9,10,12,13,14
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	7,8,9,12
	6.03	Hybridizes naturally	U	0	
	6.04	Self-fertilization	N	-1	14
	6.05	Requires specialist pollinators	N	0	8,10,14
	6.06	Reproduction by vegetative propagation	Y	1	6,7,8,9,10,12,13
	6.07	Minimum generative time (years)	U	0	
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	N	-1	13
	7.02	Propagules dispersed intentionally by people	Y	1	1,7,8
	7.03	Propagules likely to disperse as a produce contaminant	Y	1	1
	7.04	Propagules adapted to wind dispersal	N	-1	
	7.05	Propagules buoyant	U	0	
	7.06	Propagules bird dispered	Y	1	6,7,8,9,10,12,13
	7.07	Propagules dispersed by other animals (externally)	N	-1	
	7.08	Propagules dispersed by other animals (internally)	Y	1	7,10,12,13
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	6,9,10,12,13,14
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	6,8,9,13
	8.03	Well controlled by herbicides	Y	-1	11,13
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	13
	8.05	Effective natural enemies present in Ohio	Y	-1	13

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	28
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. Munger, Gregory T. 2002. Rosa multiflora. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: http://www.fs.fed.us/database/feis/ [2012, April 17].		
7. Jesse, L.C., Nason, J.D., Obrycki, J.J. and Moloney, K.A. (2010) Quantifying the levels of sexual reproduction and clonal spread in the invasive plant, *Rosa multiflora*. *Biological Invasions* 12:1847-1854.		
8. Banasiak, S.E. and Meiners, S.J. (2009) Long term dynamics of Rosa multiflora in a successional system. *Biological Invasions* 11:215-224.		
9. The Ohio State University OARDC Extension "Ohio Perennial and Biennial Weed Guide." http://www.oardc.ohio-state.edu/weedguide/singlerecord.asp?id=370 Accessed 4-19-12.		
10. BIOLOGY OF MULTIFLORA ROSE. Jerry D. Doll, Weed Scientist Emeritus, University of Wisconsin, Department of Agronomy, Madison, WI 53706. 2006 North Central Weed Science Society Proceedings 61:239 Accessed 4-19-12.		
11. Nancy Eckardt and TunyaLee Martin, Global Invasive Species Team, The Nature Conservancy. Bugwood Wiki. http://wiki.bugwood.org/Rosa_multiflora Accessed 4-19-12		
12. Wisconsin Department of Natural Resources; "Invasive Species: Multiflora Rose (*Rosa multiflora)"* http://dnr.wi.gov/invasives/fact/rose.htm Accessed 4-20-12		
13. Loux, M.M., Underwood, J.F., Amrine, J.W. Jr., Bryan, W.B. and Chandran, R (2005) OSU Extension Bulletin 857: Multiflora Rose Control. http://ohioline.osu.edu/b857/pdf/b857.pdf Accessed 4-20		
14. Jesse, L.C., Moloney, K.A. and Obrycki J.J. (2006) Insect pollinators of the invasive plant, *Rosa multiflora* (Rosaceae), in Iowa, USA. *Weed Biology and Management* 6:pp. 235-240		

Modified A-WAR Form B						
Botanical Name:	*Taraxacum officinale* F. H. Wigg.		Outcome:	Invasive		
Common Name:	Dandelion		Score:	23		
Family Name:	Asteraceae		Your name: Allison Mastalerz			
History/Biogeography					**Score**	**Reference**
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01		N	0	
	1.02	Has the species become naturalized where grown				
	1.03	Does the species have weedy races				
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zones 5b, 6a and 6b.[a]		Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)		2	2	Default
	2.03	Broad climate suitability (environmental versatility)[b]		Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]		Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range		Y		10
3 *Weed elsewhere*	3.01	Naturalized beyond native range		Y	2	1,7, 10,11
	3.02	Garden/amenity/disturbance weed		Y	2	7,11
	3.03	Weed of agriculture/horticulture/forestry		Y	4	8,11
	3.04	Environmental weed		U		
	3.05	Congeneric weed		N	0	6
Biology/Ecology						
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs		N	0	
	4.02	Allelopathic		U		
	4.03	Parasitic		N	0	
	4.04	Unpalatable to grazing animals		N	-1	7
	4.05	Toxic to animals		N	0	7
	4.06	Host for recognized pests and pathogens		U		
	4.07	Causes allergies or is otherwise toxic to humans		N	0	11

	4.08	Creates a fire hazard in natural ecosystems	N	0	7
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	11
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	N	0	
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	7,8,9,10,11
	6.03	Hybridizes naturally	Y	1	9
	6.04	Self-fertilization	N	-1	7
	6.05	Requires specialist pollinators	N	0	9
	6.06	Reproduction by vegetative propagation	Y	1	7,8
	6.07	Minimum generative time (years)	1	1	
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	
	7.02	Propagules dispersed intentionally by people	U		
	7.03	Propagules likely to disperse as a produce contaminant	Y	1	1
	7.04	Propagules adapted to wind dispersal	Y	1	7,8
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispered	U		
	7.07	Propagules dispersed by other animals (externally)	U		
	7.08	Propagules dispersed by other animals (internally)	U		
8 *Persistence attributes*	8.01	Prolific seed production	Y	1	7, 11
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	7
	8.03	Well controlled by herbicides	Y	-1	7
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	7
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	23
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	reject
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA PLANTS database, PLANTS Profile page: http://plants.usda.gov/java/profile?symbol=TAOFO		
7. Esser, Lora L. 1993. Taraxacum officinale. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory: http://www.fs.fed.us/database/feis/ [2013, February 26].		
8. Martinkova, Z., Honek, A. and Lukas, J. (2011) Viability of *Taraxacum officinale* seeds after anthesis. *Weed Research* 51: 508-515.		
9. Brock, M.T. (2009) Prezygotic barriers to gene flow between *Taraxacum ceratophorum* and the invasive *Taraxacum officinale* (Asteraceae). *Oecologia* 161: 241-251.		
10. Collier, M.H., Keane, B. and Rogstad, S.H. (2010) Productivity differences between dandelion (*Taraxacum officinale*; Asteraceae) clones from pollution impacted versus non-impacted soils. *Plant Soil* 329: 173-183.		
11. Ohio State University, Ohio Perennial and Biennial Weed Guide: http://www.oardc.ohio-state.edu/weedguide/singlerecord.asp?id=950 Accessed 2-26-13		

Modified A-WAR Form B

Botanical Name:	*Ulmus pumila* L.	Outcome:	invasive
Common Name:	Siberian elm	Score:	21
Family Name:	Ulmaceae	Your name: Allison Mastalerz	

				Score	Reference
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Cl*imate and Distribution*	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	Y		8,9,10
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6, 7,8,9,10
	3.02	Garden/amenity/disturbance weed	Y	2	9,10,11,12
	3.03	Weed of agriculture/horticulture/forestry	U		
	3.04	Environmental weed	Y	4	
	3.05	Congeneric weed	Y	2	6
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	N	0	6
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	N	-1	6
	4.05	Toxic to animals	N	0	6
	4.06	Host for recognized pests and pathogens	Y	1	12
	4.07	Causes allergies or is otherwise toxic to humans	U		
	4.08	Creates a fire hazard in natural ecosystems	U		

	4.09	Is a shade tolerant plant at some stage of its life cycle	N	0	6
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	
	4.12	Forms dense thickets	Y	1	9
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	8
	6.02	Produces viable seed	Y	1	8,9
	6.03	Hybridizes naturally	Y	1	8
	6.04	Self-fertilization	U		
	6.05	Requires specialist pollinators	N	0	8
	6.06	Reproduction by vegetative propagation	N	-1	6
	6.07	Minimum generative time (years)	-1	-1	8
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	U		
	7.02	Propagules dispersed intentionally by people	Y	1	6,8
	7.03	Propagules likely to disperse as a produce contaminant	U		
	7.04	Propagules adapted to wind dispersal	Y	1	6, 8,10
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispered	U		
	7.07	Propagules dispersed by other animals (externally)	N	-1	
	7.08	Propagules dispersed by other animals (internally)	U		
8 *Persistence attributes*	8.01	Prolific seed production	U		
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	U		
	8.03	Well controlled by herbicides	N	1	12
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	Y	1	10,12
	8.05	Effective natural enemies present in Ohio	U		
References, Websites for 1-5 Accessed on 2-7-13			Total Score:		21

1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=ULPU Accessed 2-15-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasive.org/browse/subinfo.cfm?sub=3479 Accessed 2-15-13		
8. Zalapa, J.E., Brunet, J. and Guries, R.P. (2010) The extent of hybridization and its impact on the genetic diversity and population structure of an invasive tree, *Ulmus pulmila* (Ulmaceae). *Evolutionary Applications* 3(2):157-168.		
9. Moore, L.M. USDA, NRCS Plant Guide: Siberian Elm (*Ulmus pumila*): http://plants.usda.gov/plantguide/pdf/cs_ulpu.pdf Accessed 2-15-13		
10. Susan Wieseler, Minnesota Department of Natural Resources, Rochester, MN_Plant Conservation Alliance's Alien Plant Working Group Least Wanted Plant Fact Sheet: http://www.nps.gov/plants/alien/fact/ulpu1.htm Accessed 2-15-13		
11. Trees of Wisconsin, Herbarium Cofrin Center for Biodiversity: http://www.uwgb.edu/biodiversity/herbarium/trees/ulmpum01.htm Accessed 2-15-13		
12. Brand, M. (1997-2001) UConn Plant Database, Siberian Elm Factsheet: http://www.hort.uconn.edu/plants/u/ulmpum/ulmpum1.html Accessed 2-15-13		

Modified A-WAR Form B

Botanical Name:	*Veronica officinalis*L.	Outcome:	invasive	
Common Name:	Common speedwell, gypsyweed	Score:	18	
Family Name:	Plantaginaceae	Your name: Allison Mastalerz		

				Score	Reference
History/Biogeography					
1 *Domestication/ cultivation*	1.01	Is the species highly domesticated. If answer is 'no' go to question 2.01	N	0	
	1.02	Has the species become naturalized where grown			
	1.03	Does the species have weedy races			
2 Climate and Distribution	2.01	Species suited to USDA Hardiness Zone 5b, 6a & 6b.[a]	Y	2	
	2.02	Quality of climate match data (0-low; 1-intermediate; 2-high)	2	2	default
	2.03	Broad climate suitability (environmental versatility)[b]	Y	1	
	2.04	Native or naturalized in regions with an avg. 35-50" of annual precipitation[c]	Y	1	
	2.05	Does the species have history of repeated introductions outside its natural range	U		
3 *Weed elsewhere*	3.01	Naturalized beyond native range	Y	2	6,8,10
	3.02	Garden/amenity/disturbance weed	U		
	3.03	Weed of agriculture/horticulture/forestry	U		
	3.04	Environmental weed	Y	4	8
	3.05	Congeneric weed	Y	2	6
Biology/Ecology					
4 *Undesirable traits*	4.01	Produces spines, thorns, or burrs	N	0	
	4.02	Allelopathic	U		
	4.03	Parasitic	N	0	
	4.04	Unpalatable to grazing animals	U		
	4.05	Toxic to animals	U		
	4.06	Host for recognized pests and pathogens	U		
	4.07	Causes allergies or is otherwise toxic to humans	U		

	4.08	Creates a fire hazard in natural ecosystems	U		
	4.09	Is a shade tolerant plant at some stage of its life cycle	Y	1	8,9
	4.10	Grows on any soil order representing >5% cover in Ohio.[d]	Y	1	
	4.11	Climbing or smothering growth habitat	N	0	8
	4.12	Forms dense thickets	N	0	8
5 *Plant type*	5.01	Aquatic	N	0	
	5.02	Grass	N	0	
	5.03	Nitrogen fixing woody plant	N	0	
	5.04	Geophyte	N	0	
6 *Reproduction*	6.01	Evidence of substantial reproductive failure in native habitat	N	0	
	6.02	Produces viable seed	Y	1	11.00
	6.03	Hybridizes naturally	U		
	6.04	Self-fertilization	U		
	6.05	Requires specialist pollinators	U		
	6.06	Reproduction by vegetative propagation	Y	1	8,9,10,11
	6.07	Minimum generative time (years)	U		
7 *Dispersal mechanisms*	7.01	Propagules likely to be dispersed unintentionally	Y	1	8
	7.02	Propagules dispersed intentionally by people	U		
	7.03	Propagules likely to disperse as a produce contaminant	U		
	7.04	Propagules adapted to wind dispersal	U		
	7.05	Propagules buoyant	U		
	7.06	Propagules bird dispered	U		
	7.07	Propagules dispersed by other animals (externally)	Y	-1	8
	7.08	Propagules dispersed by other animals (internally)	U		
8 *Persistence attributes*	8.01	Prolific seed production	N	-1	8
	8.02	Evidence that a persistent propagule bank is formed (>1 yr)	Y	1	8
	8.03	Well controlled by herbicides	U		
	8.04	Tolerates or benefits from mutilation, cultivation, or fire	U		
	8.05	Effective natural enemies present in Ohio	U		

References, Websites for 1-5 Accessed on 2-7-13	Total Score:	18
1. GRIN: http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl?language=en	Outcome:	Invasive
2. IT IS: http://www.itis.gov/		
3. Kew: http://www.theplantlist.org/browse/A/		
4. Tropicos: http://www.tropicos.org/Home.aspx		
5. IPNI: http://www.ipni.org/ipni/plantnamesearchpage.do		
6. USDA Plants database: http://plants.usda.gov/java/county?state_name=Ohio&statefips=39&symbol=VEOF2 Accessed 2-15-13		
7. EDDMapS. 2012. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: http://www.invasiveplantatlas.org/subject.html?sub=23162 Accessed 2-15-13		
8. Jordan, M.J., G. Moore and T.W. Weldy. 2008. Invasiveness ranking system for non-native plants of New York. Unpublished. The Nature Conservancy, Cold Spring Harbor, NY;		
9. Dale, M.P. and Causton, D.R. (1992) The ecophysiology of *Veronica chamaedrys, Veronica montana* and *V. officinalis*. I. Light quality and light quantity. *Journal of Ecology* 80:483-492.		
10. Robert W. Freckmann Herbarium Plant Fact Sheet: http://wisplants.uwsp.edu/scripts/detail.asp?SpCode=VEROFF Accessed 2-15-13		
11. Cowbrough, M. (Agriculture and Agri-Food Canada) weedinfo.ca website: Speedwell Fact Sheet: http://www.weedinfo.ca/en/weed-index/view/id/verof Accessed 2-15-13		