THE RESTRUCTURING OF ARTHROPOD TROPHIC RELATIONSHIPS IN RESPONSE TO PLANT INVASION

by

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A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Entomology and Wildlife Ecology

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DEDICATION

I dedicated my master's thesis to my parents, whose love of the outdoors made me who I am today. As my graduate career comes to a close, I wish to dedicate this dissertation to my fiancée, Victoria Gomba-Netta, for all of her compassion and unyielding love thoughout these many years, and many more ahead in the future. Here's to the next step in our journey together.

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ABSTRACT

Arthropod populations are declining across the globe, and biological invasions are one of the contributing factors to arthropod biodiversity loss. The effects of invasive plant species have been well-documented among plant-feeding arthropods, but many questions remain. How non-native plants affect trophic structure and how we can best predict shifts in trophic structure have not been well-documented. The purpose of my research is to investigate how arthropod trophic structure is altered through changes in plant origin, as well as to provide empirical evidence to support predictions of shifts in arthropod trophic structure based on an evolutionary experience concept. For my first chapter, I proposed that non-native plants shift the direction of arthropod trophic structure from an herbivore-driven "green" food web to a "brown" food web, i.e., driven by detritivores. I predicted this "green-to-brown" shift to be the common mode of restructuring arthropod communities following plant invasion. To test my hypothesis, I developed a field study comparing arthropod communities between native plant communities and plant assemblages dominated by a suite of non-native plants in the Mid-Atlantic region. I observed sweeping declines in herbivore species richness and density in 7 of 8 non-native plant assemblages, increased detritivore densities in 5 of 8 non-native plant assemblages, and declines in both species richness and density for predators associated with the green food web for all non-native plants. Furthermore, I found 2-to-24-fold decreases in the ratio of herbivores to detritivores following plant invasion, offering substantial support

for a "green-to-brown" shift in arthropod trophic structure. Many arthropods collected with non-native plants were either non-native themselves or shared home distributions with non-native plants, suggesting that, in addition to non-native plants promoting dominance of detritivores in their introduced range, non-native plants may also facilitate further invasions and promote community homogeneity. In my second chapter, I developed an empirical study to test my prediction for the evolutionary-experience concept from a non-native plant, native arthropod perspective. The framework posits that an invader's success can be predicted based on its evolutionary familiarity with organisms in its introduced range as well as how familiar native species are to the invader ("high" for familiar, "low" for naïve). In a "high-low" scenario, I predicted that herbivorous arthropods will decrease in abundance due to a lack of coevolution between herbivores and hosts; in contrast, I predicted that detritivores would increase following an abundant food source (i.e., plant litter). I compared non-native plants without congeners of functionally similar native species in the landscape. In a "low-high" scenario, I compared non-native crop or forage plants with native refugia and I predicted a decrease in detritivores and an increase in herbivores due to an abundant and susceptible food source. Finally, in a "high-high" scenario, I expected no difference in arthropod abundance between non-native plants and their native congeners. I provide evidence to support the "high-low" scenario, as herbivores decreased while detritivores increased following plant invasion, consistent with my findings for a "green-to-brown" shift in arthropod trophic structure. However, I was unable to support my hypotheses for the "low-high" or "high-high" scenario with all non-native plants selected; instead, non-native plants either reduced or maintained the richness or abundance of arthropod functional groups where dominant. Arthropods provide vital ecosystem services, and the trophic restructuring of native arthropod communities following plant invasion can have negative consequences to energy flow, nutrient cycling, and the quality of habitat for organisms at higher trophic levels. I provide evidence for "green-to-brown" shifts in arthropod trophic structure as a common mode of restructuring in native arthropod communities across landscapes in the Mid-Atlantic and suggest that this trend may occur with plant invasions among other landscapes beyond the scope of my study. I recommend management strategies that limit successful invasions for non-native plants that demonstrate traits of a "green-to-brown" shift in arthropod trophic structure.

Chapter 1

TROPHIC RELATIONSHIPS OF ARTHROPOD ASSEMBLAGES IN LANDSCAPES DOMINATED BY NON-NATIVE PLANTS

Introduction

The introduction of aggressive, non-native plants alters native biodiversity and ecosystem services (Vitousek 1990; D'Antonio & Vitousek 1992; Ewel et al. 1999; Chornesky & Randall 2003; Bryson & Carter 2004). Once established, non-native plants can reduce the richness and abundance of native plants and change vegetation structure (Levine et al. 2003; Gaertner et al. 2009; Hejda et al. 2009; Vilà et al. 2011). These changes in structure and composition of plant communities alter the availability and quality of habitat for organisms at higher trophic levels, especially arthropods.

Where non-native plants are dominant, the composition and diversity of plant-feeding arthropods are negatively affected (Tallamy 2004; Burghardt et al. 2010; Tallamy et al. 2010; Williams et al. 2011; Burghardt & Tallamy 2013, 2015; Richard et al., in press). This is due, in part, to the strong coevolutionary relationship that exists between a native herbivore and its native plant host (Ehrlich and Raven 1964; Jermy 1993; Futuyma & Agrawal 2009). The majority of plant-feeding arthropods specialize on consuming plant species from the same genus or family (Bernays & Graham 1988; Forister et al. 2015), and loss of native plant hosts to non-native competitors results in indirect impacts on herbivore abundance and richness (Bezemer et al. 2014; Litt et al. 2014; van Hengstum et al. 2014; Richard et al., in press).

Herbivores may not be capable of adapting to novel plant defenses within ecological time frames (Graves & Shapiro 2003; Fortuna et al. 2013; Litt et al. 2014) or may fail to recognize novel hosts entirely (Tallamy 2004; Bezemer et al. 2014). Alternatively, herbivores may recognize novel hosts, but fall into “ecological traps” that reduce overall fitness; arthropods that are not adapted to their novel hosts risk reductions in development rate and reproductive success (Casagrande & Dacey 2007; Castells & Berenbaum 2008; Keeler & Chew 2008; Ding & Blossey 2009; Harvey et. al 2010; Tallamy et al. 2010). In either case, the quality of habitat for native plant-feeding arthropods decreases following plant invasion, and a reduction in the diversity or density of herbivores would contribute to a decrease in consumed plant biomass where non-native plants are dominant.

Any plant tissue unconsumed by herbivores accumulates in the litter layer and may increase litter resources for the detritivore or litter-dwelling arthropod community. Generally, detritivores abundance is positively correlated with litter abundance (Litt et al. 2014; but see Mitchell & Litt 2016). Plant invasions increase rates of decomposition and nutrient cycling (Huenneke 1990; Vitousek 1990; Ehrenfield 2003), the process of which may be facilitated by detritivorous arthropods. In addition to supplying food, plant litter may alter chemical or physical properties of the soil (e.g., soil pH, soil moisture) to more favorable conditions for arthropod taxa (McGrath & Binkley 2009; Wolkovich 2010; Alerding & Hunter 2013). As a consequence, plant invasions may cause detritivores to supplant herbivores as the dominant functional group in an arthropod community.

Changes in prey availability following plant invasion can indirectly affect predaceous arthropods. A decrease in the abundance of herbivorous prey could drive predators to reduce diet breadth (Hansen et al. 2009), shift to detritivores (Gratton & Denno 2006), resort to intraguild predation or cannibalism (deHart & Strand 2012), or become displaced from the landscape (Levin et al. 2006). As such, shifts in community composition following plant invasion, from "green" food webs (i.e., food webs dominated by herbivores) to "brown" food webs (i.e., food webs dominated by detritivores) can have profound effects on overall trophic structure and community diversity.

Although shifts in arthropod trophic structure following plant invasion have been demonstrated in aquatic ecosystems (Brusati & Grusholz 2006; Gratton & Denno 2006; Levin et al. 2006), examples in terrestrial landscapes are few. Furthermore, it is unknown if a "green to brown" shift in the food web is a general pattern where non-native plants have become dominant. Understanding how plant invasions impact trophic structure will provide insight into determining effective tools for restoration (Gratton & Denno 2005; McCary et al. 2016).

Objectives

I developed a field-based study to investigate changes in arthropod trophic structure following plant invasion by comparing assemblages of arthropods associated with native plants to arthropod assemblages associated with a suite of non-native plants that are dominant throughout the Mid-Atlantic region of the United States. Specifically, I asked:

1. How does the richness, abundance, or composition of herbivores, detritivores, and/or predators differ between areas dominated by native plants vs. non-native plants?
2. Does the ratio of herbivores to detritivores differs in non-native and native plant communities? That is, if non-native plants are not consumed by herbivores, do we observe a “green to brown” shift in the food web?

I hypothesized that non-native plant assemblages reduce the abundance and diversity of arthropods, consistent with previous studies. Following this, I expected arthropod communities in non-native plant assemblages to exhibit a “green to brown” shift in the food web: a decrease in herbivore richness and density due to a lack of native plant hosts, followed by increased abundance and dominance of detritivores in the community. I expected predators that depended on herbivore prey to decrease in richness and abundance, whereas predators that fed on detritivores would increase with an abundant source of prey. Finally, I expected to observe evidence of a “green to brown” shift regardless of the non-native plant species being compared.

Methods

I selected communities dominated by a suite of invasive plant species to serve as model assemblages for plant invasions. I determined plants to be ‘invasive’ based on their non-native origin and their negative impacts to native plant communities (Vilà et al. 2011). I identified candidates from a pool of plant species that are widely distributed across the Mid-Atlantic and are locally abundant (Kaufman & Kaufman 2007; Invasive Plant Atlas 2015). I selected a total of eight plant species as candidates: autumn olive (*Elaeagnus umbellata*), bush honeysuckle complex (*Lonicera maackii*, *L. morrowii*, *L. tatarica*), Callery pear (*Pyrus calleryensis*), Japanese knotweed (*Fallopia japonica*), Japanese stilt grass (*Microstegium vimineum*), multiflora rose (*Rosa multiflora*), orchardgrass (*Dactylis glomerata*), and porcelain berry (*Ampelopsis brevipedunculata*). These candidates vary in both growth form (3 herbaceous plants, 4 woody plants, 1 vine) and native range (encompassing Europe, North Africa, Eurasia, and Asia), and any patterns of change in arthropod community characteristics that I detect across all plant candidates could help infer general impacts of plant invasion.

Site Selection

In summer 2015, I established a series of sites dominated either by one of the eight candidate plants or communities of native plants in order to quantify differences in arthropod community characteristics associated with native or non-native plants. I selected sites across 4 states in the Mid-Atlantic (DE, MD, PA, NY) in an attempt to account for variation of non-native populations across multiple landscapes. I limited my study to only include grassland or scrubland plant communities as opposed to forest communities because I would be unable to isolate the effects of the forest canopy on arthropod characteristics.

For each plant candidate, I established 6, 30 x 30-m sites (48 non-native sites) and paired each site with a community dominated by native plants (48 native sites, 96 sites total). I determined dominance in the plant community prior to sampling by randomly placing 3, 5-m transects within each site and measuring horizontal canopy cover for plants with 1 x 1-m^2 quadrats at every meter of the transect (18 transects total for each candidate). I alternated quadrats on either side of the transect. Within each quadrat, I measured horizontal canopy cover of all plants by species beneath a height of 2 meters. I classified candidate plants as "dominant" in the site if the candidate had ≥33% of relative canopy cover averaged among all transects in the site. I did not resample sites for additional comparisons when multiple candidate species were dominant in a given site. I selected sites dominated by native plants either adjacent to candidate non-native species sites or in close approximation (< 3 km) to serve as paired comparisons (Appendix A).

I placed 5 quadrats at random within sites to sample arthropods and vegetation. I used 1-m^2 quadrats for comparisons between herbaceous plants, and I made comparisons for woody plants by selecting trees at randomy with a 1-m radius. I excluded woody plants with heights greater than 2m to ensure I could sample the entire plant for arthropods for the study. I identified all plants to species within each quadrat to assist in identifying arthropods by host plant and improve host plant records when applicable.

Arthropod Sampling

I sampled for arthropods only once in each quadrat and sampled all quadrats in a given site at the same time. I sampled for arthropods in a site dominated by non-native plants at the same time as I sampled for arthropods in their native plant comparison. However, I sampled different sites across the growing season to account for seasonal variability in arthropod communities.

Multiple sampling techniques were required to obtain a precise estimate of the arthropod community and reduce taxonomic bias through single sampling techniques (Greenslade 1964; Southwood 1982; Standen 2000). I used four techniques in total: pitfall traps, vacuum sampling, Berlese-Tullgren funnels, and a total search method. I waited at least

24 hours between employing each sampling technique to allow the arthropod community to recover.

I used pitfall traps to sample the detritivore assemblage, as well as predators associated with detritivores. Pitfall sampling is an effective technique to capture terrestrial arthropods, such as beetles (Greenslade 1964), harvestmen (Sabu et al. 2011), and arachnids (Uetz & Unzicker 1975; Goetze et al. 2001; Work et al. 2002). I placed four 266-ml plastic cups within each quadrat, one at each cardinal direction, and ensured that pitfall traps were flush with the soil surface. I filled each trap halfway with diethylene glycol (Prestone Low Tox® Antifreeze/Coolant) as a temporary preservative. I left traps undisturbed for 24 hours, after which I collected each trap and its contents.

I used vacuum sampling to measure the herbivore assemblage and their associated predators. Vacuum sampling is a useful method for sampling arthropods in dense vegetation (Standen 2000; Brook et al. 2008). I used a leaf vacuum (Craftsman 25 cc Gas Blower/VAC) outfitted with a 3.8-L paint strainer bag to sample each quadrat for 30 seconds, and then transferred specimens in bags to containers lined with cotton soaked with ethyl acetate to prevent predation within each bag before processing.

Berlese-Tullgren funnels are considered an efficient method for sampling diversity of soil-dwelling arthropods (Sakchoowong et al. 2007; Smith et al. 2008), and I used these funnels to measure belowground diversity associated with each quadrat. I collected soil cores (473 ml at 15 cm depth) randomly from each quadrat and placed soil cores inside the funnel. I exposed soil and funnels to low-intensity heat (40W incandescent light bulbs) for 72 hours to facilitate extraction.

Finally, I used a standardized total search method to sample arthropods in vegetation that would not have been collected by vacuum sampling, such as arthropods that bore into plant tissues, form galls, or hold fast to plant tissues like caterpillars (Wagner 2005; Burghardt et al. 2010; Alerding & Hunter 2011). In each quadrat, I hand-collected arthropods fitting the above description in each quadrat for five minutes.

I identified all arthropods to morphospecies to increase taxonomic resolution; I considered specimens that I could not identify beyond family (e.g., many Acari) as a single taxon for conservative analysis. Arthropods that did not originate in the sampling quadrats I removed from the study as by-catch. I determined by-catch based on the arthropod's natural history (e.g., species with aquatic origins due to nearby bodies of water) and plant host records (e.g., species that did not feed on plants within the quadrat but did feed on adjacent host plants). I also assigned arthropods to a single functional group to represent feeding guilds. I classified herbivores as arthropods that consume living vegetation as the majority of their diet. I classified detritivores as arthropods that either consume dead animal or plant matter as the majority of their diet, or consume the microorganisms (i.e., bacteria and fungi) associated with detritus (Clarholm 1985; Brussaard 1997). I classified arthropods that fed on fungi infecting living plant tissues as herbivores instead of detritivores, as this feeding guild does not depend directly on brown food webs. I classified predators as arthropods that consume other arthropods during at least part of their life cycle, and I also included parasitoids in this group. I designated ants (family Formicidae) as their own functional group, as ants perform multiple roles in ecosystems and serve as a proxy for omnivores (Wilson 1987; Brussaard 1997; Folgarait 1998).

Data Analysis

I standardized sampling effort for each technique to measure arthropods (# individuals or species/unit sampled) as a measure of change in arthropod assemblages following plant invasion. I compared predatory arthropods between plant communities within their method of capture (i.e., pitfall with pitfall, vacuum sampler with vacuum sampler) to represent the predator assemblage for the prey in the respective sampling technique. I measured species richness and abundance of all arthropods within each functional group, as well as Shannon-Weaver (*H*) and Pielou's evenness (*J*) indices as coarse measures of diversity and composition between non-native plants and their paired native communities.

To determine changes in arthropod trophic structure following plant invasion, I examined differences in arthropod characteristics between native and non-native plant assemblages using generalized mixed effects models. I considered plant origin (categorical with two levels) and plant community (categorical with eight levels) as my fixed effects and included site as my random effect to account for nested sampling. I explored evidence for two-way interactions between plant origin and plant community (origin*community) and I removed interactions from the model when $P > 0.008$, based on Bonferroni adjustment to account for multiple comparisons. Evidence to remove the two-way interactions suggested that differences in arthropod characteristics between native and non-native plant assemblages are not dependent on the plant species. I kept all simple terms in the model.

I transformed response variables when necessary to meet model assumptions and used the appropriate distributions for each response variable for arthropod characteristics. I used a Poisson distribution and log-link to analyze differences in both arthropod richness and abundance, and I used a quasi-likelihood method to test for overdispersion in the Poisson model (Ramsey & Schafer 2002; Zuur et al. 2009). If overdispered, I considered a negative binomial distribution; all models analyzing differences in arthropod abundance showed evidence for negative binomial distribution. I used a binomial count of herbivore to detritivore abundance to obtain an herbivore-detritivore ratio (H:D ratio).

I also examined presence and abundance of influential taxa between native and non-native plant assemblages, where presence and abundance serve as coarse measurements of habitat preference and quality, respectively. I determined influence of arthropods by calculating the average contribution of each taxon to a Bray-Curtis dissimilarity between arthropod communities in native and non-native plant assemblages (Clarke 1993). I constructed generalized linear mixed effects models of abundance for each arthropod taxon discerned as important to describing the dissimilarity. I used a binomial distribution with a logit link for presence and either a Poisson or a negative binomial distribution with a log link, determined by model fit, for abundance counts. When necessary, I accounted for zero-inflation in abundance counts through hurdle models (Fletcher et al. 2005; Zeileis et al. 2008) before testing for overdispersion. I determined best fit for hurdle models through a likelihood ratio test.

I analyzed data using the following packages in R: car, lme4, lsmeans, MASS, nmle, and vegan (Venables & Ripley 2002; Zeileis & Hothorn 2002; Fox & Weisberg 2011; Bates et al. 2014; Lenth 2016; Jackson 2017; Oksanen et al. 2018; Pinheiro et al. 2018; R Development Core Team 2018).

Results

Summary

In total, I collected and identified 106,991 individuals representing 1,114 unique taxa for the study (Appendix B). I identified 21 species of gastropod and 2 species of earthworms (representing 1.4% of all individuals collected); I removed these taxa from further analyses to focus on the effects of plant invasion on arthropod characteristics. I removed an additional 1,683 arthropods (1.6%) from analyses I determined to be bycatch.

I collected 41,663 individuals in assemblages dominated by non-native plants, comprising 2,734 (6.6%) ants, 31,263 (75.0%) detritivores, 3,151 (7.6%) herbivores, and 4,515 (10.8%) predators. A total of 2,646 (6.4%) arthropods collected in non-native plant assemblages represented non-native taxa (49 species). For arthropods in assemblages dominated by native plants, I collected 61,979 individuals, comprising 6,394 (10.5%) ants, 37,864 (61.1%) detritivores, 11,361 (18.3%) herbivores, and 6,360 (10.3%) predators. A total of 1,558 (2.5%) arthropods collected in native plant assemblages represented non-native taxa (59 species).

The Brays-Curtis dissimilarity analysis identified 50 taxa as influential to differences observed between native and non-native plant assemblages (Table 1.3), which included 12 species of herbivores, 16 species of detritivores, 9 species of predators, and 13 species of ants. These taxa represented 65.2% (69,788 individuals) of all arthropods collected.

Changes in community composition

I observed differences in total arthropod species richness in 4 of 8 plant comparisons (Table 1.1). When compared to native plants, I observed 51.0% fewer species of arthropod in assemblages dominated by Japanese knotweed (-21.1 species/m^2), 41.9% fewer in orchardgrass (-25.8), 32.2% fewer in Japanese stiltgrass (-13.5), and 25.9% fewer in porcelain berry (-13.3, Figure 1.1).

Differences in arthropod abundance occurred for 3 of 8 plant comparisons (Table 1.2). When compared to native plants, there were 67.2% fewer arthropods in assemblages dominated by Japanese stiltgrass (-127.1 individuals/m^2) and 46.4% fewer in Japanese knotweed (-58.39, Figure 1.1). However, assemblages dominated by Callery pear had 17.6% more arthropods/m^2 (82.4) compared to assemblages of native plants (Figure 1.1).

Both the direction and magnitude of difference in diversity (*H*) and evenness (*J*) for arthropod communities in plant assemblages depended on the plant species (Table 1.1). For 5 of 8 plant assemblages, plant invasion reduced mean arthropod diversity (Figure 1.2). I did not detect differences in mean diversity between assemblages dominated by bush honeysuckle (Z = 1.67, P = 0.953), Japanese stiltgrass (Z = 0.94, P = 0.999), and porcelain berry (Z = 0.14, P =1.00) when compared to native plants. Similarly, for 5 of 8 plant assemblages, plant invasion reduced mean arthropod evenness (Figure 1.2). I did not detect differences in mean arthropod community evenness between native plant assemblages and assemblages dominated by bush honeysuckle (Z = 1.45, P = 0.987), Japanese knotweed (Z = 2.63, P = 0.384), Japanese stiltgrasss (Z = 0.83, P = 1.00), or porcelain berry (Z = 0.73, P = 1.00). For all other non-native assemblages, arthropod communities were significantly less even than in assemblages dominated by native plants (Figure 1.2).

Plant invasion reduced the ratio of herbivores to detritivores for all plant comparisons, although the magnitude of reduction differed by plant species (Table 1.1). The highest rates of change occurred in plant assemblages dominated by Japanese stiltgrass and Japanese knotweed; for every detritivore present, native plant assemblages had 23.6 and 21.11 times as many herbivores compared to assemblages dominated by Japanese stiltgrass and Japanese knotweed, respectively. The lowest rate of change occurred in plant assemblages dominated by porcelain berry; for every detritivore present, native plant assemblages had 2.11 (2.10—2.12) times as many herbivores compared to assemblages dominated by porcelain berry.

Herbviores

Non-native plant assemblages had fewer species of herbivore taxa compared to native plants in 7 of 8 plant comparisons (Table 1.1). The greatest change in mean herbivore richness occurred in plant assemblages invaded by Japanese knotweed, which had 95.5% fewer herbivores (-46.1 species/m^2) than its native comparison (Figure 1.3). I did not detect differences in herbivore species richness for plant assemblages dominated by multiflora rose (Z = 1.57, P = 0.976). Similar to herbivore species richness, I observed fewer herbivores/m^2 for non-native plant assemblages in 7 of 8 plant candidate comparisons (Table 1.2) but did not detect differences in abundance for plant assemblages dominated by multiflora rose (Z = 0.63, P = 1.00). Plant assemblages dominated by Japanese knotweed and Japanese stiltgrass had the greatest change in mean herbivore abundance compared to native plants, a loss of 94.5% (-56.8 herbivores/m^2) and 91.6% (-90.6), respectively (Figure 1.3).

Nine of twelve herbivore taxa differed in presence between native and non-native assemblages. Six taxa were more frequently encountered with native plants: *Rhopalosiphum* sp., *Stirellus bicolor*, *Liburniella ornata*, *Agallia quadripunctata*, *Draceulacephala antica*, and *Deltocephalus* sp., with no individuals of *Stirellus bicolor* and *Liburniella ornata* collected in non-native plant assemblages (Table 1.4). In contrast, three taxa were more frequently encountered in non-native plant assemblages: *Polyamia weedi*, *Graphocephala versuta*, and *Metcalfa pruinosa* (Table 1.4). I did not detect differences in mean presence for *Empoasca* sp., *Mumetopia occipitalis*, or *Acanalonia bivittata* between native and non-native plants (Table 1.3).

Herbivores differed in abundance between native and non-native assemblages in ten out of twelve taxa (Table 1.5). Non-native plant assemblages had fewer herbivores compared to native plants in 7 taxa: *Polyamia weedi* (-1.9 individuals/m^2), *Stirellus bicolor* (-7.0), *Agallia quadripunctata* (-4.7), *Liburniella ornata* (-5.6), *Mumetopia occipitalis* (-3.1), *Draeculacephala antica* (-2.8), and *Deltocephalus* sp. (-3.1; Table 1.5). In comparison, non-native plant assemblages had more herbivores compared to native plants in 3 taxa: *Acanalonia bivittata* (2.5 individuals/m^2), *Graphocephala versuta* (2.0), and *Metcalfa pruinosa* (5.3; Table 1.5). I did not detect differences in abundance between native and non-native plants in *Rhopalosiphum* sp. or *Empoasca* sp. (Table 1.3). However, plant assemblages dominated by orchardgrass had 10.3 fewer herbivores/m^2 of *Rhopalosiphum* sp. (95% CI =2.6—41.3) than native plants (Table 1.5).

Detritivores

I detected differences in mean detritivore species richness between native and non-native plant assemblages for only 2 of 8 plant comparisons; however, the direction of differences in detritivore richness depended on the plant species (Table 1.1). Compared to native plants, assemblages dominated by orchardgrass had 34.4% fewer species of detritivores (-4.3 species/m^2), whereas assemblages dominated by Japanese stiltgrass had 63.5% more species of detritivores (3.3 species/m^2; Figure 1.4). I observed more detritivores/m^2 in assemblages dominated by non-native plants in 5 of 8 plant comparisons (Figure 1.4). Assemblages dominated by Callery pear had the greatest change in detritivore abundance, with 879.3% more detritivores (105.7 detritivores/m^2) than native plants (Figure 1.4). I did not detect differences in assemblages dominated by bush honeysuckle (Z = 1.25, P = 0.997), Japanese knotweed (Z = 0.99, P = 1.00), or porcelain berry (Z = 1.28, P = 0.997; Figure 1.4).

I detected differences in mean arthropod presence between native and non-native plant assemblages in 6 of 15 taxa. Four taxa were more frequently encountered with native plants: *Isotoma* sp., *Oxidus gracillus*, *Trachelipus rathkii*, and *Galumna* sp (Table 1.4). In contrast, only two taxa were more commonly found with plant assemblages dominated by non-native plants: *Allonemobius fasciatus* and *Elachiptera erythropleura* (Table 1.4). *Entomobrya* species 1 was not collected in native plant communities paired with porcelain berry, Japanese knotweed, or multiflora rose, but otherwise did not differ in mean presence between native and non-native plant assemblages (Table 1.4).

In contrast, the abundance of detritivores differed between native and non-native plant assemblages in 13 of 15 taxa. Non-native plant assemblages had more detritivores compared to native plant assemblages in 9 taxa: *Lepidocyrtus paradoxus* (15.9 individuals/m^2), *Porcellio laevis* (1.8), *Entomobrya* species 1 (1.5), *Desoria* sp. (144.4), *Philoscia muscorum* (1.3), *Isotoma* sp. (41.2), *Oxidus gracillus* (3.5), *Trachelipus rathkii* (2.6), and *Galumna* sp. (9.4; Table 1.5). In contrast, non-native plant assemblages had fewer detritivores compared to native plant assemblages in 4 taxa: *Allonemobius fasciatus* (-10.2 individuals/m^2), *Liohippelates* sp. (-4.0), *Leucophenga varia* (-1.5), and *Elachiptera erythropleura* (-2.3; Table 1.5). I did not detect differences in abundance between native and non-native plant assemblages for *Lepidocyrtus cyaneus* and *Pogonognathellus elongatus* (Table 1.3).

Predators

I did not detect differences in species richness between native and non-native plants for predators associated with either green food webs or brown food webs (Table 1.1; Figures 1.5 & 1.6). However, non-native plant assemblages had fewer predators/m^2 associated with green food webs compared to native plants, and this difference did not vary by plant species (Table 1.2). In general, assemblages dominated by non-native plants had 43.1%

fewer predators collected in the green food web (-8.0 predators/m^2, Figure 1.5). In contrast, I did not detect differences in the abundance of predators collected in the brown food web between native and non-native plant assemblages (Table 1.2; Figure 1.6).

I detected differences in mean presence between native and non-native plant assemblages in only a single predator taxon. Mean presence decreased in assemblages dominated by non-native plants for *Elaphrothrips* sp (Table 1.4). In contrast, 5 of 9 predator taxa differed between native and non-native plants. Non-native plant assemblages had more predators than native plants in *Gladicosa gulosa* (0.6 individuals/m^2) and *Aphelinus* sp. (1.5), whereas non-native plant assemblages had fewer predators than native plants only in *Elaphrothrips* sp. (-1.4) and *Orius insidiosus* (-5.5; Table 1.5). I did not detect differences in abundance between native and non-native plant assemblages for *Trimorus* sp., *Baeus* sp., *Pardosa* sp., *Erigone* sp., and *Leiobunum nigropalpi* (Table 1.3).

Ants

I did not detect differences in ant species richness between non-native plant assemblages and native plant communities (Table 1.1). In contrast, I did detect differences in mean ant abundance between native and non-native plants, but only for assemblages dominated by Japanese stiltgrass (Z = 7.85, P = <0.001) and orchardgrass (Z = 4.83, P = <0.001); when compared to native plants, assemblages of Japanese stiltgrass and orchardgrass had 90.8% (-12.0 ants/m^2) and 70.6% (-14.2 ants/m^2) fewer ants, respectively (Figure 1.7).

I detected differences in mean presence for ants between native and non-native plant assemblages between only three of 13 taxa. I observed three taxa more commonly encountered in communities dominated by native plants: *Pheidole pilifera*, *Monomorium minimum*, and *Formica incerta* (Table 1.4). However, ant abundance differed between native and non-native plant assemblages in 10 of 13 ant taxa. Non-native plant assemblages had more ants than native plants for three taxa: *Ponera pennsylvanica* (0.5 ants/m^2), *Prenelopsis imparis* (5.9), and *Formica neonegates* (1.4; Table 1.5). In contrast, non-native plant assemblages had fewer ants than native plants for seven taxa: *Solenopsis molesta* (-36.5), *Nylanderia flavipes* (-2.0), *Lasius neoniger* (-4.2), *Pheidole pilifera* (-5.6), *Monomorium minimum* (-3.4), *Tapinoma sessile* (-7.0), and *Myrmica* sp. AF-smi (-3.5; Table 1.5). I did not detect differences in ant abundance between native and non-native plant assemblages for *Aphaenogaster rudis* complex, *Formica incerta*, and *Formica pergandei* (Table 1.3).

Discussion

The primary productivity of plants creates a cap in available energy for both green and brown food webs in terrestrial settings. That is, the amount of energy that flows from plant tissues to herbivore to predator and then to detritivore will never be greater than the energy produced by the plant material. As such, shifting trophic structure from an herbivore-driven food web to one driven by detritivores following invasion has significant consequences for ecosystem function. As energy from non-native plants flows at a reduced rate, if at all, into green food webs, less energy would be available for consumption by secondary consumers (predators), leading to reductions in both the diversity and presence of organisms at higher trophic levels. At the other end of the spectrum, increased energy flow into the brown food web would promote dominance of detritivores in the community and may even accelerate decomposition and nutrient cycling. These changes in ecosystem function can lead to feedback loops that promote the persistence of non-native plants and make efforts to restore native structure and function more difficult (D'Antonio & Vitousek 1992; Chornesky & Randall 2003; Reed et al. 2005).

I provide evidence to support a "green to brown" shift in arthropod trophic structure following plant invasion, where non-native plant assemblages reduce the diversity and abundance of plant-feeding arthropods while either increasing the abundance of detritivores in the community or allowing detritivore density to remain constant. Furthermore, I offer evidence that plant invasions in the Mid-Atlantic can have detectable and severe consequences for trophic interactions (see McCary et al. 2016). Many of the patterns I observed in arthropod community composition were driven by certain taxa within each functional group, highlighting the importance of a refined taxonomic resolution to tease apart specific impacts of disturbance (Mitchell & Litt 2016).

Herbivores

Nearly 90% of all plant-feeding arthropods have specialized life strategies that limit their feeding to a single plant lineage (Bernays & Graham 1998; Forister et al. 2015). Non-native plants pose a novel danger to herbivores by reducing the presence and density of native plants as well as by being either unrecognizable or unavailable as a food source (Bezemer et al. 2014; Litt et al. 2014). Consistent with this hypothesis, non-native plants decreased the number of species and density of herbivores for most, if not all, plant comparisons in my study.

Although non-native plant assemblages decrease the quality of habitat for specialist herbivores, results are mixed for generalist feeders. Herbivores with broad diets and high tolerance to plant defenses may underperform on novel hosts (Joshi & Vrieling 2005; Leger & Forister 2005; Tallamy et al. 2010; Burghardt & Tallamy 2013), whereas others may not only recognize novel hosts as a food source but perform just as well or better on novel hosts than native plants (Parker & Hay 2005; Morrison & Hay 2011; Zhang et al. 2018). The inability of novel plants to defend against herbivores in the plants' introduced range may be due to naïvité (Colautti et al. 2004; Parker et al. 2006; Verhoeven et al. 2009; Morrison & Hay 2011; Zhang et al. 2018) or tradeoffs between defenses and reproductive success (Blossey & Nötzold 1995; Siemann & Rogers 2003). The majority of herbivores collected in non-native plant assemblages consisted of planthoppers and leafhoppers (Hemiptera: Auchenorrhyncha), including highly polyphagous herbivores as

Acanalonia bivittata, *Graphocephala versuta*, and *Metcalfa pruinosa* (Wilson & McPherson 1981a,b; Chandler & Hamilton 2017), that I observed in higher densities in non-native plant assemblages, albeit small. A common feature among these herbivores is their mode of feeding; they had haustellate (sucking) mothparts that may be able to circumvent constitutive plant defenses located in leaves by piercing the xylem or phloem of plant tissue (Miles and Peng 1989). Haustellate insects are predicted to be less affected by plant invasion compared to mandibulate (chewing) insects that cannot avoid encountering phytochemical defenses as they chew through plant tissues (Verhoeven et al. 2009; Burghardt & Tallamy 2013; Bezemer et al. 2014). Under these circumstances, non-native plants may be naïve to attacks from many Hemiptera and this generalized feeding strategy may be responsible for the increased or similar densities of insect herbivores between native and non-native plant assemblages.

Although pollinator insects consume plant parts (e.g., pollen and nectar), many studies differentiate pollinators as a separate functional group due to their unique ecosystem service. Generally, non-native plants reduce pollinator densities, richness, and habitat (Potts et al. 2010; Williams et al. 2011; Litt et al. 2014; White 2016). I did not collect enough pollinators to analyze the functional group as separate from herbivores because many of the non-native plants were not in flower during the time of sampling, and the sampling techniques I selected were not designed to sample pollinator assemblages. More effective methods of collecting pollinators include bee pan traps (Westphal et al. 2008;

Wilson et al. 2008), although these traps attract pollinators and individuals collected would not be limited to the sampling space. Additionally, pollinators (especially bees) are distributed temporally across the growing season, so multiple sampling dates would be required across the season to obtain a more thorough estimate of pollinators in native and non-native vegetation (Cane et al. 2000).

Detritivores

I had generally assumed that detritivores would exhibit less preference for plant species than herbivores because phytochemical defenses leach out of plant tissues following senescence (Chapin et al. 2011). Thus, over time, detritus bears less and less of the chemical signature of its parent plant and should be more available to arthropods without specialized adaptations. Based on literature review (Litt et al. 2014), detritivore densities increase following the introduction of non-native plant species, even when the presence or abundance of native plants are reduced, which is consistent with my assumption. Instead, detritivores may select for microbial communities on the plant than the plant host itself (Bärlocher 1979; Cummins & Klug 1979), as microbes may serve as a food source for some detritivores and demonstrate stronger host specificity for litter in comparison. Thus, although plant diversity may not improve habitat quality for detritivores (Wardle et al. 1997; Spehn et al. 2000; Salamon et al. 2004), plant identity can be a driving factor (Seastedt 1984).

Among detritivores, by far the most abundant taxa I collected consisted of springtails (Order Collembola). Although the majority of springtails consume microflora (i.e., fungi, bacteria, algae), the density or composition of springtails can change following shifts in plant dominance or even the introduction of non-native plants (Greenslade 2007; Alerding & Hunter 2013; Salamonen et al. 2014). The most common species of springtails I collected was *Lepidocyrtus paradoxus*, which drove the majority of patterns exhibited by detritivores in the study. Springtails in this genus have high mobility (Dunger et al. 2002) and high tolerance for disturbance (Frampton 2000; Dombos 2001), which would help explain its presence throughout all sites and in landscapes impacted by plant invasion. *Lepidocyrtus paradoxus* also has a Holarctic distribution (Salmon 1964) and shares its native range with many of the non-native plants in my study (Kaufman & Kaufman 2007). I observed increased densities of *L. paradoxus* in plant assemblages dominated by orchardgrass; even in plant assemblages where other non-native plants were dominant, orchardgrass tussocks were present at varying densities in the understory where *L. paradoxus* was abundant. Although many springtails aggregate across habitat gradients (Hågvar 1982), which may help explain why some taxa (e.g., *Desoria* sp. and *Isotoma* sp.) were poorly represented but locally abundant, the high densities of *L. paradoxus* when orchardgrass is present suggests some evolutionary association, either with the plant itself or the microbial communities feeding on dead plant tissue. The litter of orchardgrass is consumed by springtails of other species in greenhouse settings (Bakonyi 1998), and *L. paradoxus* may select microbial communities associated with orchardgrass in the wild as a food source. Confirming use and preference of orchardgrass would require controlled feeding preference experiments with both live plants and litter from other plant species within the Holarctic range of *L. paradoxus*, as well as identification of local microbial taxa.

Outside of Collembola, the majority of detritivore taxa I collected were woodlice (Isopoda). Woodlice taxa, which include *Armadillidium vulgare*, *Philoscia muscorum*, *Porcellio laevis*, and *Trachelipus rathkii*, facilitate decomposition rates and increase soil microbial activity (Hassall 1977; Teuben & Roelofsma 1990; Kautz & Topp 2000; Snyder & Hendrix 2009) in their native range. When introduced as non-native species, however, terrestrial isopods can decouple mineralization rates and displace native detritivores (Paris 1964; Ellis et al. 2000; Frouz et al. 2008; David & Handa 2010; Singer et al. 2012). All woodlice collected in the study were non-native and were observed in greater densities within non-native plant assemblages, consistent with my hypothesis that non-native plants promote habitat for detritivores (but see Mitchell & Litt 2016). However, this pattern also suggests the importance of plant identity, given the shared home ranges between the two taxa. The association between non-native detritivores and non-native plants supports the 'invasional meltdown' hypothesis (Simberloff & Van Holle 1999), where one non-native species facilitates the introduction of another. Although invasional meltdowns between arthropods and non-native plant species are common (Aizen et al. 2008; Barthell et al. 2001; Holway et al. 2002; O'Dowd et al. 2003;

Ness & Bronstein 2004; Heimpel et al. 2010), most non-native isopods are too widespread outside their native range to determine where and when a meltdown might have occurred. Instead, I propose further research to determine the additive or synergistic impacts non-native plants and non-native arthropods have on native arthropod communities.

Although I did collect earthworms from pitfall traps and Berlese-Tulgren funnels during the study, I did not include earthworms in analyses because I was not convinced that these sampling techniques were effective at capturing accurate estimates of earthworm densities in the landscape. More effective techniques for collecting epigeic and endogeic earthworms include the introduction of chemicals like mustard or formaldehyde to encourage earthworms to surface (chemical expulsion, Raw 1954; Gunn 1992; Lawrence & Bowers 2002; Zaborski 2003) and conducting electricity through a ring of metallic stakes to force worms to the surface (Rushton & Luff 1984; Weyers et al. 2008). There are limits to both techniques; electroshock is inhibited by low soil moisture and underestimates adult densities (Čoja et al. 2008), whereas chemical expulsion may radically harm arthropod populations (Eichinger et al. 2007; Čoja et al. 2008). Many earthworms collected in the study were non-native, and past studies suggest non-native earthworms show preference to, as well as encourage, the introduction of non-native plants (Heneghan et al. 2007; Nuzzo et al. 2009; Quackenbush et al. 2012; Craven et al. 2017). I observed a similar pattern with non-native gastropods, although these too were removed to focus on arthropod communities. Earthworms play an important role in nutrient cycling, plant composition, and soil engineering (Edwards & Lofty 1977; Snyder & Hendrix 2009; Forey et al. 2011). Thus, I recommend additional studies that incorporate non-destructive collecting methods for earthworms in addition to an arthropod sampling scheme to assess patterns of change in the detritivore community following plant invasion, and to assess any additive or synergistic effects earthworms and other detritivore taxa may have on ecosystem processes (Zimmer et al. 2005).

Predators

Generally, it is assumed that predaceous arthropods are prey-limited in the landscape (Foelix 2011; Price et al. 2011), where changes in prey availability or abundance would have concomitant effects on predator assemblages. Likewise, I had assumed that the direction and magnitude of change for predator assemblages following plant invasion would be largely determined by changes in prey abundance. In a “green to brown” shift, I would expect predators that depend on herbivore prey to decrease with non-native plants but expect predators in the litter layer to increase with an abundance of detritivore prey. Consistent with my hypothesis, predators collected on vegetation for non-native plants decreased in density, suggesting a decrease in complexity for the green food web (i.e., loss of secondary consumers). However, predator densities collected in the litter layer remained similar following plant invasion, suggesting that for most taxa, the increase in detritivore density did not improve habitat quality for predators.

My sampling scheme assumed predators in the green food web and brown food web were discrete; that is, predators that forage in the litter layer would not forage on vegetation (or vice-versa) and would only consume prey associated with their given food web. However, the lack of response of predators to plant invasion may be due to method in which predators capture their prey. The bulk of predators collected in this study consisted of web-building spiders, which capture flying insects that originate outside of sampling plots or landscapes independent from invasive plants (e.g., aquatic insects). This result would lower my ability to detect the impact of plant invasion on predators, and I propose a separate analysis that separates predators by foraging strategy (e.g., web-builder vs. active hunting) to improve precision on predator response to non-native plants.

As such, it is important to understand a predator's natural hsitroy and behavior to predict patterns of change associated with plant invasion (Litt et al. 2014). For example, many arthropods regarded as generalists exhibit ominovorous behavior by consuming plant material (Price et al. 2011), requiring the need of increasing taxonomic resolution and life history information to reduce this bias. Selecting taxa with specific feeding and foraging strategies may better serve as indicators of environmental change. For example, wolf spiders primarily forage on the ground or low vegetation for prey (Foelix 2011) and would likely benefit from increased epigeic prey densities. The wolf spider *Gladicosa gulosa* increased in density concomitant with increased detritivore dominance in non-native plant assemblages. Wolf spiders may provide evidence of a "green to brown" trophic shift, and additional studies into how wandering spiders (and predators with similar habits) change in response to plant invasion may yield a stronger signal.

Another example of specialized predation among arthropods are parasitoids, taxa that are internal predators during their immature forms and free-living as adults (Price et al. 2011). Given their host specificity, parasitoids can be indirectly affected by plant invasion through the loss of hosts that would normally feed on native plants (Simao et al. 2010). The wasp *Aphelinus* sp. was found in greater densities in non-native plant assemblages, but this species has a broad range of hosts it can parasitize (Triplehorn & Johnson 2005). Moreover, many parasitoids feed on nectar as adults (Price et al. 2011); I did not control for plant flowering during my study but sampling when non-native plants are in bloom could result in large numbers of parasitoids collected in assemblages independent of their predaceous categorization. For these reasons, I do not feel confident suggesting that the *Aphelinus* parasitoids collected in my study were selecting for herbivores in non-native plant assemblages.

Ants

Similar to predaceous arthropods, identifying patterns for how ants respond to plant invasion is difficult due to the functional diversity within the family. Nevertheless, ants provide essential ecosystem services that include herbivory, pollination, predation, seed dispersal, and soil engineering (Wheeler 1910; Wilson 1987; Folgarait 1999).

Investigating the effects of plant invasion on ant assemblages may provide valuable insight into ecosystem impacts following invasion (Wolkovich et al. 2009; Litt et al. 2014). Ant response to plant invasion was variable in the study, and any differences in ant characteristics between native and non-native plant assemblages may be due to differences in ant species' life history.

Many ants have broad, omnivorous diets (Wheeler 1910; Ellison et al. 2012) that might buffer them against changes in plant composition following invasion. *Aphaenogaster rudis* is a generalist scavenger and granivore with broad seasonal activity (Lynch et al. 1980; Lubertazzi 2012) and *Formica incerta* feeds on nectar and honeydew from multiple taxa (Trager et al. 2007). This broad range in diet may explain why these ants did not respond to changes in plant origin. The ant *F. pergandei* enslaves the nests of other *Formica* species (Ellison et al. 2012) and given that *Formica* ants were found in nearly all samples, it is unlikely that the presence of non-native plants limited *F. pergandei* habitat.

In contrast, many ants in the study differed in their densities between native or non-native plant assemblages, regardless of omnivory. While these differences were statistically important, the difference were quite small and may not represent ecological changes. Although colony size varies by species, most ant colonies incorporate workers in the hundreds or thousands (Wheeler 1910; Beckers et al. 1989), where the difference of less than ten individuals/m^2 is not likely to be biologically significant. Some ant colonies, like

Solenopsis molesta, may include multiple queens that inflate colony size (Ellison et al. 2012), so differences in ant density may be misleading. Ants may also modify foraging times or densities throughout the growing season (Lynch et al. 1980), which require additional sampling dates to improve precision. I would caution against using abundance counts as a sole metric for habitat preference in this case and suggest an understanding of the ant's life history to improve interpretation.

With this in mind, some ants have unique diets or feeding strategies that would provide insight into how changes in plant composition following invasion may affect specialized taxa. Big-headed ants (*Pheidole pilifera*) are granivores of native plants in the understory (i.e., forbs and grasses, Wheeler 1910; Ellison et al. 2012) and non-native plants may either reduce the availability of native seeds or non-native propagules may be less desirable to granivorous ants. In contrast, *Ponera pennsylvanica* is a subterranean species that forms small colonies (less than one-hundred individuals) and actively feeds on microarthropods, such as springtails (Wheeler 1910; Ellison et al. 2012). Although densities of *P. pennsylvanica* did increase following plant invasion, concomitant with increased detritivore (springtail) abundance, the rate at which the ants increased was relatively small. If these ants are not prey limited, it is likely that other factors may be influencing the quality of habitat for *P. pennsylvanica* in non-native plant assemblages such as changes in soil structure or microclimate (Wolkovich et al. 2009). It is possible that additional environmental variables would provide a stronger signal in determining the impact of non-native plants on ant communities.

Conclusions

I present evidence that arthropod trophic structure differs between native and non-native plant assemblages and provides support for the “green to brown” hypothesis. I found non-native plants to disproportionately alter the alpha diversity and composition of arthropod functional groups, with the two most substantial changes being a loss in both richness and density of plant-feeding arthropods and increased density of detritivores. I found the direction of this pattern to be consistent across multiple assemblages of non-native plants in multiple landscapes of the Mid-Atlantic region of the United States, suggesting the impacts of plant invasion on arthropod trophic structure observed in this study may be widespread phenomena. Arthropods are a biologically and ecologically diverse group of organisms that are essential to the integrity of ecosystem function (Wilson 1987; Brussaard 1997; Folgarait et al. 1999; Synder & Hendrix 2009; Price et al. 2011). Thus, changes in arthropod communities following plant invasion may impede the quality or abundance of ecosystem services, that is, ecosystem productivity. In particular, changes in arthropod trophic structure can lead to a loss of habitat quality for wildlife at higher trophic levels that depend on arthropods as a food source (Tallamy 2004; Flanders et al. 2006; Burghardt et al. 2009; Narango et al. 2017, 2018). Arthropods are experiencing severe declines across the globe (Dirzo et al. 2014; Fox et al. 2014; Hallmann et al. 2017;

Lister & Garcia 2018), and although the displacement of native plants with non-native species is but one variable contributing to this decline, it is underappreciated. It is important to understand how arthropod communities respond to biological invasions to better inform efforts aimed at insect conservation.

Table 1.1 Characteristics of arthropod species richness, diversity, and evenness in native and non-native plant communities.

Characteristics	***Origin***		***Community***		***Origin*Community***	
Richness	$F_{1,280}$	*P*	$F_{7,21}$	*P*	$F_{7,280}$	*P*
Total	141.71	<0.001	6.42	<0.001	9.61	<0.001
Herbivores	229.17	<0.001	10.01	<0.001	10.45	<0.001
Detritivores	1.75	0.188	4.78	0.002	6.51	<0.001
Predators (Green)	5.61[a]	0.018	10.18	<0.001		
Predators (Brown)	6.18[b]	0.014	2.37	0.060		
Ants	4.16[b]	0.042	2.92	0.027		
Diversity						
H:D Ratio	310.80	<0.001	3.62	0.010	10.44	<0.001
Shannon's (H)	146.89	<0.001	3.23	0.017	10.18	<0.001
Pielou's Evenness (J)	107.36	<0.001	1.88	0.124	15.20	<0.001

[a]$F_{1,\,308}$ [b]$F_{1,287}$

Table 1.2. Characteristics of relative arthropod abundance in native and non-native plant communities.

Characteristics	***Origin***		***Community***		***Origin*Community***	
	$X^2_{1,\,n=301}$	*P*	$X^2_{7,\,n=301}$	*P*	$X^2_{7,\,n=301}$	*P*
Total	11.21	<0.001	63.30	<0.001	76.42	<0.001
Herbivores	254.02	<0.001	288.49	<0.001	117.03	<0.001
Detritivores	18.70	<0.001	141.54	<0.001	65.01	<0.001
Predators (Green)	33.43[a]	<0.001	183.45[a]	<0.001		
Predators (Brown)	1.96	0.161	28.48	<0.001		
Ants	30.92	<0.001	81.23	<0.001	53.98	<0.001

[a] $X^2_{(x,\,n=308)}$

Table 1.3. Percentage of similarity and test statistics for arthropod taxa deemed influential by Bray-Curtis dissimilarity between native and non-native plant assemblages. Simple terms were retained in models unless the model failed to converge after 10^{10} iterations.

Functional Group/Arthropod Taxa	***Similarity (%)***	***Origin***		***Community***		***Origin*Community***	
Herbivores		X_1	*P*	X_7	*P*	X_1	*P*
Rhopalosiphum sp. (Hemiptera: Aphididae)	40.76	1.28	0.258	109.16	<0.001	28.75	<0.001
Polyamia weedi (Hemiptera: Cicadellidae)	42.85	48.86	<0.001				
Stirellus bicolor (Hemiptera: Cicadellidae)	48.61	5.80	0.044				
Empoasca sp. (Hemiptera: Cicadellidae)	51.65	0.01	0.988	80.30	<0.001		
Agallia quadripunctata (Hemiptera: Cicadellidae)	53.32	33.41	<0.001				
Acanalonia bivittata (Hemiptera: Acanaoloniidae)	53.87	31.14	<0.001				
Liburniella ornata (Hemiptera: Delphacidae)	54.93	5.97	0.037				
Mumetopia occipitalis (Diptera: Anthomyzidae)	56.43	16.70	<0.001	34.62	<0.001		

(Table 1.3 Continued)

Functional Group/Arthropod Taxa	***Similarity (%)***	***Origin***		***Community***		***Origin*Community***	
Herbivores		X_1	P	X_7	P	X_1	P
Graphocephala versuta (Hemiptera: Cicadellidae)	57.41	6.39	0.011				
Metcalfa pruinosa (Hemiptera: Flatidae)	58.83	7.74	0.005				
Draeculacephala antica (Hemiptera: Cicadellidae)	65.16	9.82	<0.001				
Deltocephalus sp. (Hemiptera: Cicadellidae)	67.66	16.32	<0.001				
Detritivores							
Lepidocyrtus paradoxus (Collembola: Entomobryidae)	19.73	798.20	<0.001	645.63	<0.001		
Porcellio laevis (Isopoda: Porcellionidae)	23.30	121.30	<0.001	449.53	<0.001		
Entomobrya species 1 (Collembola: Entomobryidae)	26.70	214.20	<0.001	822.69	<0.001	42.44	<0.001
Desoria sp. (Collembola: Isotomidae)	41.07	105.2	<0.001				
Philoscia muscorum (Isopoda: Philosciidae)	31.98	25.31	<0.001	258.25	<0.001		

(Table 1.3 Continued)

Functional Group/Arthropod Taxa	***Similarity (%)***	***Origin***		***Community***		***Origin*Community***	
Detritivores		X_1	P	X_7	P	X_1	P
Armadillidium vulgare (Isopoda: Armadillidiidae)	35.36	8.153	0.004	265.17	<0.001		
Allonemobius fasciatus (Orthoptera: Gryllidae)	36.91	10.14	0.001	177.97	<0.001	32.71	<0.001
Isotoma sp. (Collembola: Isotomidae)	39.63	74.29	<0.001				
Liohippelates sp. (Diptera: Chloropidae)	44.76	50.12	<0.001	116.14	<0.001		
Oxidus gracillus (Polydesmida: Paradoxosomatellidae)	47.23	11.68	<0.001				
Trachelipus rathkii (Isopoda: Trachelipodidae)	49.86	18.23	<0.001				
Galumna sp. (Acari: Galumnidae)	55.43	57.14	<0.001				
Lepidocyrtus cyaneus (Collembola: Entomobryidae)	57.88	0.53	0.468	57.79	<0.001		
Pogonognathellus elongatus (Collembola: Tomoceridae)	58.36	2.45	0.117	16.64	0.020		
Leucophenga varia (Diptera: Drosophilidae)	64.40	12.73	<0.001	22.02	0.003		

(Table 1.3 Continued)

Functional Group/Arthropod Taxa	***Similarity (%)***	***Origin***		***Community***		***Origin*Community***	
Detritivores		X_1	*P*	X_7	*P*	X_1	*P*
Elachiptera erythropleura (Diptera: Chloropidae)	68.33	11.37	<0.001				
Predators							
Trimorus sp. (Hymenoptera: Platygastridae)	41.81	0.01	0.919	77.81	<0.001		
Gladicosa gulosa (Araneae: Lycosidae)	45.64	53.44	<0.001	299.18	<0.001		
Baeus sp. (Hymenoptera: Platygastridae)	47.93	0.21	0.64	43.70	<0.001		
Pardosa sp. (Araneae: Lycosidae)	56.92	0.22	0.637	20.19	0.005		
Erigone sp. (Araneae: Linyphiidae)	60.22	2.23	0.136	15.08	0.035		
Leiobunum nigropalpi (Opiliones: Sclerosomatidae)	61.12	0.12	0.733	14.03	0.051		
Aphelinus sp. (Hymenoptera: Aphelinidae)	63.63	5.54	0.019	16.57	0.020		
Elaphrothrips sp. (Thysanoptera: Phlaeothripidae)	64.78	6.52	0.011	22.64	0.002		
Orius insidiosus (Hemiptera: Anthocoridae)	66.60	29.02	<0.001				

(Table 1.3 Continued)

Functional Group/Arthropod Taxa	*Similarity (%)*	*Origin*		*Community*		*Origin*Community*	
Ants							
Aphaenogaster rudis complex	33.81	0.02	0.878	55.56	<0.001	13.94	0.052
Solenopsis molesta	38.30	118.62	<0.001	39.8	<0.001		
Nylanderia flavipes	46.52	8.58	0.003				
Lasius neoniger	49.24	43.96	<0.001				
Pheidole pilifera	51.06	28.72	<0.001				
Tapinoma sessile	52.21	29.57	<0.001	83.27	<0.001		
Ponera pennsylvanica	52.77	24.93	<0.001	33.37	<0.001		
Monomorium minimum	54.40	20.03	<0.001				
Formica incerta	59.30	3.82	0.051	93.45	<0.001		
Myrmica sp. *AF-smi*	61.56	18.84	<0.001	34.33	<0.001		
Prenelopsis imparis	62.00	23.35	<0.001				
Formica pergandei	68.67	0.68	0.410	29.73	<0.001		
Formica neonegates	69.32	8.20	0.004				

Table 1.4. Least square mean presence and 95% confidence intervals for arthropod taxa deemed influential by Bray-Curtis dissimilarity between native and non-native plant assemblages. When Community is not significant to taxa abundance, I report only differences in Origin. Assemblage abbreviations are AB = *Ampelopsis brevipedunculata*, DG = *Dactylis glomerata*, EA = *Elaeagnus umbellata*, FJ = *Fallopia japonica*, LO = *Lonicera* spp., MV = *Microstegium vimineum*, PC = *Pyrus calleryensis*, RM = *Rosa multiflora*. Superscripts denote groups of similar means based on Tukey HSD pairwise comparisons by arthropod species.

Taxa/Community	***Origin***	***AB***	***DG***	***EA***	***FJ***	***LO***	***MV***	***PC***	***RM***
Herbivores									
Rhopalosiphum sp.	*Invaded*	0.35^{A} (0.18—0.57)	0.35^{A} (0.13—0.66)	0.0^{C}	0.0^{C}	0.0^{C}	0.10^{A} (0.02—0.38)	0.30^{A} (0.11—0.61)	0.30^{A} (0.11—0.61)
	Native	0.80^{B} (0.49—0.94)	0.75^{AB} (0.29—0.96)	0.0^{C}	0.0^{C}	0.0^{C}	0.40^{AB} (0.07—0.86)	0.14^{A} (0.02—0.55)	0.30^{A} (0.06—0.75)
Polyamia weedi	*Invaded*	0.06^{A} (0.03—0.10)							
	Native	0.20^{B} (0.10—0.35)							
Stirellus bicolor	*Invaded*	0.0^{A}							
	Native	0.22^{B} (0.06—0.54)							
Empoasca sp.	*Invaded*	0.20^{A} (0.10—0.36)	0.05^{AB} (0.01—0.21)	0.12^{AB} (0.04—0.32)	0.10^{AB} (0.03—0.28)	0.05^{AB} (0.01—0.21)	0.20^{AB} (0.08—0.42)	0.15^{AB} (0.06—0.35)	0.0^{C}
	Native	0.20^{A} (0.12—0.33)	0.05^{B} (0.3—0.10)	0.13^{AB} (0.07—0.22)	0.10^{B} (0.06—0.18)	0.05^{B} (0.03—0.10)	0.20^{A} (0.12—0.33)	0.15^{AB} (0.09—0.26)	0.0^{C}

(Table 1.4 Continued)

Taxa/Community	*Origin*	AB	DG	EA	FJ	LO	MV	PC	RM
Herbivores									
Agallia quadripunctata	*Invaded*	0.10[A] (0.06—0.16)							
	Native	0.22[B] (0.13—0.35)							
Acanalonia bivittata	*Invaded*	0.21[A] (0.15—0.28)							
	Native	0.22[A] (0.15—0.33)							
Liburniella ornata	*Invaded*	0.0[A]							
	Native	0.22[B] (0.06—0.54)							
Mumetopia occipitalis	*Invaded*	0.14[A] (0.06—0.29)	0.31[AB] (0.14—0.55)	0.03[A] (0.01—0.15)	0.05[A] (0.01—0.18)	0.03[A] (0.01—0.15)	0.0[C]	0.0[C]	0.10[A] (0.03—0.27)
	Native	0.26[A] (0.15—0.42)	0.49[B] (0.32—0.66)	0.07[A] (0.03—0.13)	0.10[A] (0.05—0.19)	0.07[A] (0.03—0.13)	0.0[C]	0.0[C]	0.20[A] (0.11—0.33)
Graphocephala versuta	*Invaded*	0.22[A] (0.16—0.28)							
	Native	0.06[B] (0.03—0.11)							

(Table 1.4 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Herbivores									
Metcalfa pruinosa	*Invaded*	0.13^{A} (0.09—0.19)							
	Native	0.03^{B} (0.01—0.08)							
Draeculacephala antica	*Invaded*	0.06^{A} (0.03—0.10)							
	Native	0.13^{B} (0.07—0.25)							
Deltocephalus sp.	*Invaded*	0.10^{A} (0.06—0.16)							
	Native	0.21^{A} (0.12—0.34)							
Detritivores									
Lepidocyrtus paradoxus	*Invaded*	0.66^{A} (0.49—0.80)	0.87^{B} (0.67—0.95)	0.89^{B} (0.71—0.97)	0.26^{C} (0.12—0.48)	0.48^{AC} (0.27—0.70)	0.43^{C} (0.23—0.65)	0.81^{AB} (0.61—0.93)	0.89^{B} (0.71—0.97)
	Native	0.70^{A} (0.57—0.79)	0.88^{B} (0.82—0.93)	0.91^{B} (0.85—0.94)	0.29^{C} (0.19—0.41)	0.52^{C} (0.39—0.65)	0.47^{C} (0.34—0.60)	0.84^{B} (0.75—0.90)	0.91^{B} (0.85—0.94)

(Table 1.4 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Detritivores									
Porcellio laevis	*Invaded*	0.20^{A} (0.10—0.36)	0.10^{A} (0.03—0.29)	0.40^{AB} (0.20—0.65)	0.43^{B} (0.22—0.67)	0.43^{B} (0.22—0.67)	0.38^{AB} (0.18—0.62)	0.40^{AB} (0.20—0.65)	0.35^{AB} (0.17—0.60)
	Native	0.20^{A} (0.13—0.28)	0.10^{A} (0.06—0.15)	0.40^{B} (0.29—0.51)	0.43^{B} (0.31—0.54)	0.42^{B} (0.31—0.54)	0.37^{B} (0.27—0.49)	0.40^{B} (0.29—0.51)	0.35^{B} (0.25—0.46)
Entomobrya species 1	*Invaded*	0.60^{A} (0.38—0.79)	0.75^{A} (0.44—0.92)	0.85^{AC} (0.55—0.96)	0.35^{A} (0.13—0.66)	0.50^{A} (0.22—0.77)	0.35^{A} (0.13—0.66)	0.70^{AC} (0.39—0.94)	0.21^{AC} (0.07—0.98)
	Native	0.0^{B}	0.89^{AC} (0.51—0.98)	0.94^{C} (0.63—0.99)	0.0^{B}	0.73^{AC} (0.28—0.95)	0.59^{A} (0.16—0.91)	0.86^{A} (0.47—0.90)	0.0^{B}
Desoria sp.	*Invaded*	0.11^{A} (0.10—0.11)							
	Native	0.10^{A} (0.08—0.12)							
Philoscia muscorum	*Invaded*	0.39^{A} (0.24—0.56)	0.0^{B}	0.47^{A} (0.26—0.68)	0.38^{A} (0.27—0.51)	0.57^{A} (0.35—0.76)	0.03^{BC} (0.00—0.20)	0.49^{A} (0.28—0.71)	0.31^{A} (0.15—0.54)
	Native	0.31^{A} (0.21—0.43)	0.0^{B}	0.38^{A} (0.27—0.51)	0.36^{A} (0.18—0.59)	0.48^{A} (0.36—0.61)	0.02^{C} (0.01—0.03)	0.41^{A} (0.29—0.54)	0.24^{A} (0.16—0.35)
Armadillidium vulgare	*Invaded*	0.19^{A} (0.09—0.35)	0.0^{B}	0.49^{C} (0.26—0.72)	0.39^{AC} (0.19—0.63)	0.14^{AD} (0.05—0.35)	0.05^{AD} (0.01—0.20)	0.0^{B}	0.22^{AC} (0.09—0.45)
	Native	0.21^{A} (0.13—0.32)	0.0^{B}	0.51^{C} (0.37—0.65)	0.41^{C} (0.28—0.55)	0.16^{A} (0.09—0.25)	0.05^{D} (0.3—0.09)	0.0^{B}	0.23^{A} (0.15—0.35)

(Table 1.4 Continued)

Taxa/Community	***Origin***	***AB***	***DG***	***EA***	***FJ***	***LO***	***MV***	***PC***	***RM***
Detritivores									
Allonemobius fasciatus	*Invaded*	0.40^{A} (0.21—0.62)	0.45^{A} (0.19—0.74)	0.0^{B}	0.15^{A} (0.04—0.45)	0.0^{B}	0.55^{A} (0.26—0.81)	0.60^{A} (0.30—0.84)	0.20^{A} (0.03—0.64)
	Native	0.65^{A} (0.34—0.87)	0.85^{A} (0.44—0.98)	0.0^{B}	0.25^{A} (0.04—0.72)	0.0^{B}	0.0^{B}	0.35^{A} (0.08—0.77)	0.05^{A} (0.00—0.42)
Isotoma sp.	*Invaded*	0.09^{A} (0.06—0.15)							
	Native	0.02^{B} (0.01—0.06)							
Liohippelates sp.	*Invaded*	0.27^{A} (0.15—0.44)	0.27^{A} (0.13—0.48)	0.01^{BC} (0.00—0.11)	0.19^{A} (0.08—0.38)	0.0^{BC}	0.13^{A} (0.05—0.29)	0.0^{BC}	0.0^{BC}
	Native	0.13^{A} (0.07—0.34)	0.13^{A} (0.07—0.13)	0.01^{BC} (0.00—0.01)	0.08^{A} (0.05—0.14)	0.0^{BC}	0.06^{B} (0.03—0.10)	0.0^{BC}	0.0^{BC}
Oxidus gracillus	*Invaded*	0.22^{A} (0.17—0.30)							
	Native	0.5^{B} (0.02—0.11)							
Trachelipus rathkii	*Invaded*	0.24^{A} (0.18—0.31)							
	Native	0.12^{B} (0.07—0.20)							

(Table 1.4 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Detritivores									
Galumna sp.	*Invaded*	0.90^{A} (0.89—0.92)							
	Native	0.66^{B} (0.57—0.75)							
Lepidocyrtus cyaneus	*Invaded*	0.08^{A} (0.03—0.21)	0.24^{AB} (0.08—0.52)	0.12^{AB} (0.04—0.36)	0.12^{AB} (0.04—0.36)	0.21^{AB} (0.07—0.49)	0.06^{AB} (0.01—0.24)	0.04^{A} (0.01—0.20)	0.17^{AB} (0.05—0.42)
	Native	0.12^{A} (0.07—0.20)	0.31^{B} (0.20—0.46)	0.018^{AB} (0.10—0.28)	0.18^{AB} (0.10—0.29)	0.29^{B} (0.18—0.43)	0.09^{A} (0.05—0.15)	0.06^{A} (0.03—0.11)	0.23^{AB} (0.14—0.36)
Pogonognathellus elongatus	*Invaded*	0.45^{A} (0.29—0.62)	0.28^{AB} (0.13—0.52)	0.53^{A} (0.40—0.74)	0.31^{A} (0.21—0.55)	0.22^{AB} (0.14—0.45)	0.0^{C}	0.28^{A} (0.19—0.52)	0.40^{A} (0.28—0.71)
	Native	0.30^{A} (0.20—0.42)	0.17^{AB} (0.10—0.25)	0.37^{A} (0.24—0.50)	0.19^{B} (0.11—0.28)	0.13^{B} (0.07—0.20)	0.0^{C}	0.17^{B} (0.10—0.25)	0.25^{AB} (0.12—0.36)
Leucopehnga varia	*Invaded*	0.23^{AB} (0.12—0.40)	0.33^{AB} (0.16—0.56)	0.12^{B} (0.04—0.30)	0.17^{AB} (0.10—0.28)	0.06^{B} (0.02—0.20)	0.21^{AB} (0.09—0.42)	0.0^{C}	0.0^{C}
	Native	0.32^{A} (0.20—0.46)	0.42^{A} (0.29—0.57)	0.18^{AB} (0.10—0.28)	0.23^{AB} (0.14—0.36)	0.09^{B} (0.05—0.15)	0.29^{AB} (0.18—0.43)	0.0^{C}	0.0^{C}
Elachiptera erythropleura	*Invaded*	0.09^{A} (0.05—0.14)							
	Native	0.24^{B} (0.14—0.38)							

(Table 1.4 Continued)

Taxa/Community	***Origin***	***AB***	***DG***	***EA***	***FJ***	***LO***	***MV***	***PC***	***RM***
Predators									
Trimorus sp.	*Invaded*	0.40^{A} (0.21—0.62)	0.45^{AB} (0.19—0.74)	0.65^{AB} (0.34—0.87)	0.65^{AB} (0.34—0.87)	0.25^{A} (0.08—0.56)	0.20^{A} (0.06—0.51)	0.25^{A} (0.08—0.56)	0.95^{B} (0.68—0.99)
	Native	0.30^{A} (0.10—0.61)	0.75^{AB} (0.32—0.95)	0.75^{AB} (0.31—0.95)	0.75^{AB} (0.31—0.95)	0.0^{C}	0.10^{A} (0.01—0.51)	0.25^{AB} (0.05—0.70)	0.80^{AB} (0.22—0.98)
Gladicosa gulosa	*Invaded*	0.44^{A} (0.28—0.60)	0.61^{A} (0.39—0.79)	0.44^{A} (0.24—0.65)	0.38^{A} (0.20—0.61)	0.25^{AB} (0.11—0.47)	0.39^{A} (0.21—0.60)	0.46^{A} (0.26—0.68)	0.38^{A} (0.29—0.61)
	Native	0.36^{A} (0.27—0.48)	0.54^{A} (0.42—0.65)	0.36^{A} (0.27—0.48)	0.32^{A} (0.23—0.42)	0.20^{B} (0.14—0.28)	0.32^{A} (0.23—0.42)	0.39^{A} (0.29—0.50)	0.32^{A} (0.23—0.42)
Baeus sp.	*Invaded*	0.21^{A} (0.11—0.36)	0.39^{AB} (0.20—0.63)	0.55^{B} (0.31—0.76)	0.08^{A} (0.02—0.23)	0.0^{C}	0.14^{A} (0.06—0.33)	0.30^{AB} (0.14—0.53)	0.57^{B} (0.34—0.78)
	Native	0.29^{A} (0.20—0.41)	0.51^{B} (0.38—0.63)	0.65^{B} (0.53—0.76)	0.12^{A} (0.08—0.19)	0.0^{C}	0.21^{A} (0.13—0.31)	0.40^{B} (0.28—0.53)	0.68^{B} (0.56—0.78)
Pardosa sp.	*Invaded*	0.32^{A} (0.19—0.49)	0.57^{B} (0.35—0.77)	0.23^{A} (0.11—0.43)	0.30^{A} (0.14—0.52)	0.05^{C} (0.01—0.22)	0.0^{D}	0.22^{A} (0.09—0.43)	0.19^{A} (0.07—0.40)
	Native	0.28^{A} (0.18—0.40)	0.53^{B} (0.39—0.66)	0.19^{A} (0.13—0.30)	0.26^{A} (0.17—0.37)	0.05^{C} (0.03—0.08)	0.0^{D}	0.18^{A} (0.12—0.28)	0.16^{A} (0.10—0.25)
Erigone sp.	*Invaded*	0.24^{A} (0.13—0.40)	0.45^{AB} (0.25—0.68)	0.22^{A} (0.09—0.43)	0.10^{A} (0.04—0.27)	0.17^{A} (0.07—0.37)	0.28^{A} (0.13—0.51)	0.13^{A} (0.05—0.31)	0.56^{B} (0.33—0.76)
	Native	0.31^{A} (0.21—0.43)	0.55^{B} (0.42—0.67)	0.28^{A} (0.19—0.40)	0.15^{A} (0.09—0.22)	0.23^{A} (0.15—0.33)	0.37^{A} (0.26—0.49)	0.17^{A} (0.11—0.26)	0.64^{B} (0.52—0.75)

(Table 1.4 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Predators									
Leiobunum nigropalpi	*Invaded*	0.38^{A} (0.23—0.55)	0.08^{B} (0.02—0.26)	0.43^{AD} (0.23—0.66)	0.08^{B} (0.02—0.26)	0.0^{C}	0.19^{A} (0.08—0.40)	0.0^{C}	0.63^{AD} (0.41—0.81)
	Native	0.32^{A} (0.21—0.45)	0.07^{B} (0.04—0.11)	0.37^{A} (0.25—0.51)	0.07^{B} (0.04—0.11)	0.0^{C}	0.16^{A} (0.10—0.25)	0.0^{C}	0.57^{AD} (0.43—0.70)
Aphelinus sp.	*Invaded*	0.20^{A} (0.10—0.35)	0.22^{A} (0.10—0.43)	0.11^{A} (0.04—0.29)	0.06^{C} (0.01—0.19)	0.0^{D}	0.04^{C} (0.01—0.16)	0.09^{AC} (0.03—0.26)	0.0^{D}
	Native	0.30^{AB} (0.19—0.44)	0.33^{AB} (0.21—0.47)	0.39^{B} (0.26—0.54)	0.10^{C} (0.05—0.16)	0.0^{D}	0.06^{C} (0.04—0.11)	0.16^{AC} (0.09—0.25)	0.0^{D}
Elaphrothrips sp.	*Invaded*	0.14^{A} (0.07—0.28)	0.31^{AB} (0.14—0.54)	0.16^{A} (0.07—0.35)	0.07^{A} (0.02—0.19)	0.07^{A} (0.02—0.19)	0.13^{A} (0.05—0.30)	0.0^{D}	0.0^{D}
	Native	0.36^{B} (0.23—0.51)	0.59^{C} (0.44—0.73)	0.39^{B} (0.25—0.54)	0.18^{A} (0.11—0.30)	0.18^{A} (0.11—0.30)	0.32^{B} (0.20—0.47)	0.0^{D}	0.0^{D}
Orius insidiosus	*Invaded*	0.08^{A} (0.05—0.13)							
	Native	0.11^{A} (0.06—0.21)							
Ants									
Aphaenogaster rudis complex	*Invaded*	0.60^{A} (0.38—0.79)	0.15^{B} (0.04—0.45)	0.85^{C} (0.55—0.96)	0.40^{A} (0.16—0.70)	0.50^{A} (0.22—0.78)	0.35^{AB} (0.09—0.75)	0.55^{A} (0.26—0.81)	0.90^{C} (0.62—0.98)
	Native	0.60^{A} (0.30—0.84)	0.50^{ABC} (0.12—0.88)	0.55^{ABC} (0.15—0.90)	0.45^{AB} (0.12—0.83)	0.40^{AB} (0.09—0.80)	0.55^{AC} (0.17—0.88)	0.25^{A} (0.05—0.68)	0.70^{AC} (0.21—0.95)

(Table 1.4 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Ants									
Solenopsis molesta	*Invaded*	0.09^{A} (0.03—0.22)	0.32^{AB} (0.13—0.60)	0.11^{A} (0.03—0.31)	0.15^{A} (0.05—0.37)	0.04^{A} (0.01—0.17)	0.11^{A} (0.03—0.31)	0.04^{A} (0.01—0.12)	0.09^{A} (0.03—0.27)
	Native	0.16^{A} (0.09—0.26)	0.48^{B} (0.33—0.62)	0.19^{A} (0.11—0.30)	0.25^{A} (0.15—0.38)	0.06^{A} (0.04—0.11)	0.19^{A} (0.11—0.30)	0.07^{A} (0.04—0.13)	0.16^{A} (0.09—0.26)
Nylanderia flavipes	*Invaded*	0.16^{A} (0.11—0.23)							
	Native	0.22^{A} (0.13—0.35)							
Lasius neoniger	*Invaded*	0.16^{A} (0.11—0.23)							
	Native	0.21^{A} (0.13—0.31)							
Pheidole pilifera	*Invaded*	0.08^{A} (0.04—0.13)							
	Native	0.17^{B} (0.09—0.30)							
Tapinoma sessile	*Invaded*	0.08^{A} (0.03—0.23)	0.03^{AB} (0.0—0.22)	0.45^{C} (0.18—0.76)	0.0^{B}	0.08^{A} (0.02—0.32)	0.25^{AC} (0.08—0.57)	0.08^{A} (0.02—0.32)	0.08^{A} (0.02—0.32)
	Native	0.07^{A} (0.03—0.12)	0.02^{A} (0.01—0.04)	0.40^{C} (0.25—0.56)	0.0^{B}	0.07^{A} (0.03—0.12)	0.20^{A} (0.12—0.34)	0.07^{A} (0.03—0.12)	0.07^{A} (0.03—0.12)

(Table 1.4 Continued)

Taxa/Community	***Origin***	***AB***	***DG***	***EA***	***FJ***	***LO***	***MV***	***PC***	***RM***
Ants									
Ponera pennsylvanica	*Invaded*	0.05^{A} (0.02—0.19)	0.03^{A} (0.01—0.11)	0.09^{A} (0.03—0.27)	0.0^{B}	0.06^{A} (0.02—0.21)	0.08^{A} (0.02—0.24)	0.06^{A} (0.02—0.21)	0.0^{B}
	Native	0.04^{A} (0.02—0.07)	0.02^{A} (0.01—0.05)	0.07^{A} (0.04—0.13)	0.0^{B}	0.05^{A} (0.02—0.09)	0.06^{A} (0.03—0.11)	0.05^{A} (0.2—0.09)	0.0^{B}
Monomorium minimum	*Invaded*	0.09^{A} (0.06—0.15)							
	Native	0.18^{B} (0.10—0.30)							
Formica incerta	*Invaded*	0.04^{A} (0.01—0.13)	0.12^{AB} (0.04—0.31)	0.06^{A} (0.02—0.20)	0.02^{A} (0.01—0.10)	0.0^{D}	0.06^{A} (0.02—0.20)	0.02^{A} (0.01—0.10)	0.0^{D}
	Native	0.21^{B} (0.10—0.39)	0.43^{C} (0.24—0.65)	0.29^{BC} (0.14—0.49)	0.13^{AB} (0.06—0.26)	0.0^{D}	0.29^{BC} (0.14—0.49)	0.13^{AB} (0.06—0.26)	0.0^{D}
Myrmica sp. *AF-smi*	*Invaded*	0.04^{A} (0.01—0.15)	0.02^{A} (0.00—0.18)	0.04^{A} (0.01—0.23)	0.0^{B}	0.0^{B}	0.16^{AB} (0.04—0.49)	0.10^{AB} (0.02—0.38)	0.20^{AB} (0.11—0.56)
	Native	0.06^{A} (0.03—0.13)	0.03^{A} (0.01—0.07)	0.06^{A} (0.03—0.13)	0.0^{B}	0.0^{B}	0.24^{B} (0.08—0.52)	0.15^{AB} (0.08—0.26)	0.30^{B} (0.08—0.46)
Prenelopsis imparis	*Invaded*	0.07^{A} (0.04—0.12)							
	Native	0.06^{A} (0.02—0.13)							

(Table 1.4 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Ants									
Formica pergandei	*Invaded*	0.09^{A} (0.03—0.22)	0.48^{BC} (0.18—0.79)	0.22^{AB} (0.07—0.50)	0.11^{AC} (0.03—0.33)	0.09^{AC} (0.03—0.36)	0.13^{AC} (0.04—0.37)	0.15^{AC} (0.05—0.40)	0.15^{AC} (0.05—0.40)
	Native	0.11^{A} (0.06—0.20)	0.55^{B} (0.40—0.70)	0.28^{C} (0.17—0.42)	0.14^{A} (0.08—0.23)	0.11^{A} (0.06—0.19)	0.17^{A} (0.10—0.27)	0.20^{AC} (0.12—0.31)	0.20^{AC} (0.12—0.31)
Formica neonegates	*Invaded*	0.06^{A} (0.04—0.8)							
	Native	0.11^{A} (0.05—0.23)							

Table 1.5. Least square mean abundance (arthropods/m^2) and 95% confidence intervals for arthropod taxa deemed influential by Bray-Curtis dissimilarity between native and non-native plant assemblages. When Community is not significant to taxa abundance, I report only differences in Origin. Cells marked by an asterisk (*) indicates a taxon's absence in the assemblage. Assemblage abbreviations are AB = *Ampelopsis brevipedunculata*, DG = *Dactylis glomerata*, EA = *Elaeagnus umbellata*, FJ = *Fallopia japonica*, LO = *Lonicera* spp., MV = *Microstegium vimineum*, PC = *Pyrus calleryensis*, RM = *Rosa multiflora*. Superscripts denote groups of similar means based on Tukey HSD pairwise comparisons by arthropod species.

Taxa/Community	***Origin***	***AB***	***DG***	***EA***	***FJ***	***LO***	***MV***	***PC***	***RM***
Herbivores									
Rhopalosiphum sp.	*Invaded*	7.7^{A} (5.9—10.1)	0.5^{B} (0.1—2.0)	*	*	*	2.2^{AB} (0.8—6.4)	0.5^{B} (0.1—1.8)	0.7^{B} (0.2—2.1)
	Native	6.4^{A} (4.6—8.9)	10.9^{A} (2.7—43.3)	*	*	*	4.1^{A} (1.3—12.6)	1.9^{AB} (0.4—9.5)	2.5^{AB} (0.7—8.6)
Polyamia weedi	*Invaded*	2.4^{A} (1.5—3.8)							
	Native	12.9^{B} (8.1—20.5)							
Stirellus bicolor	*Invaded*	*							
	Native	7.0^{A} (1.6—29.5)							
Empoasca sp	*Invaded*	3.0^{A} (1.8—4.9)	5.0^{A} (2.2—11.1)	15.1^{B} (7.9—28.8)	2.5^{A} (1.0—12.2)	0.9^{AB} (0.7—33.0)	1.4^{A} (0.6—3.2)	1.1^{A} (0.4—3.2)	*
	Native	3.0^{A} (1.5—5.8)	5.0^{A} (2.2—11.0)	15.0^{B} (7.9—28.6)	2.5^{A} (1.0—12.2)	0.9^{AB} (0.7—33.1)	1.4^{A} (0.6—3.2)	1.1^{A} (0.4—3.1)	*

(Table 1.5 Continued)

Taxa/Community	***Origin***	***AB***	***DG***	***EA***	***FJ***	***LO***	***MV***	***PC***	***RM***
Herbivores									
Agallia quadripunctata	*Invaded*	1.8^{A} (1.2—2.7)							
	Native	6.5^{B} (4.2—10.1)							
Acanalonia bivittata	*Invaded*	4.0^{A} (3.4—4.8)							
	Native	1.4^{B} (1.0—2.0)							
Liburniella ornata	*Invaded*	*							
	Native	5.6^{A} (1.3—23.9)							
Mumetopia occipitalis	*Invaded*	2.2^{A} (1.3—3.7)	3.7^{AB} (2.5—5.4)	8.5^{BC} (4.2—17.0)	2.0^{ABC} (1.0—17.1)	0.5^{AB} (0.2—8.1)	*	*	0.9^{A} (0.5—1.9)
	Native	5.3^{B} (3.5—8.1)	8.7^{C} (5.8—13.2)	20.2^{D} (13.3—30.7)	4.8^{BC} (3.2—13.2)	1.2^{A} (0.8—1.8)	*	*	0.9^{A} (0.6—1.4)
Graphocephala versuta	*Invaded*	3.1^{A} (2.5—3.7)							
	Native	1.1^{B} (0.5—2.4)							

(Table 1.5 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Herbivores									
Metcalfa pruinosa	*Invaded*	5.7^{A} (4.8—6.8)							
	Native	0.4^{B} (0.1—0.5)							
Draeculacephala antica	*Invaded*	1.3^{A} (0.7—2.6)							
	Native	4.1^{B} (2.0—8.4)							
Deltocephalus sp.	*Invaded*	0.4^{A} (0.1—1.1)							
	Native	3.5^{B} (1.2—10.8)							

(Table 1.5 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Detritivores									
Lepidocyrtus paradoxus	*Invaded*	17.0^{A} (14.8—19.4)	125.5^{C} (109.2—144.2)	206.1^{E} (179.4—236.9)	104.0^{C} (79.2—136.6)	6.6^{D} (6.2—7.0)	5.3^{D} (4.0—7.0)	299.8^{F} (261.6—343.6)	399.1^{G} (348.2—457.4)
	Native	1.1^{B} (1.0—1.1)	8.0^{BD} (1.1—8.5)	13.1^{A} (12.4—14.0)	6.6^{D} (6.2—7.0)	0.4^{B} (0.4—1.1)	0.3^{BE} (0.3—0.4)	19.1^{A} (18.0—20.3)	25.4^{H} (23.9—27.0)
Porcellio laevis	*Invaded*	2.8^{A} (1.3—5.8)	0.7 (0.1—5.1)	9.0 (4.1—19.5)	33.1 (15.6—70.4)	19.4 (9.1-26.4)	8.3 (3.8—18.)	2.4 (1.0-5.7)	2.9 (1.3—6.8)
	Native	1.0^{B} (0.8—1.1)	0.2 (0.2—0.3)	3.2 (2.7—3.4)	12.0 (10.0—12.7)	7.0 (1.2—14.9)	3.0 (2.5—3.2)	0.9 (0.7—0.9)	1.1 (0.9—1.1)
Entomobrya species 1	*Invaded*	1.5^{A} (0.9—2.0)	36.8^{B} (27.1—46.5)	23.5^{C} (18.7—28.4)	1.0^{A} (0.4—1.9)	1.3^{A} (0.7—1.8)	1.6^{A} (0.5—2.7)	18.3^{C} (12.7—24.0)	54.5^{D} (51.3—57.8)
	Native	*	1.3^{A} (0.8—1.7)	0.9^{A} (0.1—1.9)	*	1.6^{A} (0.6—2.7)	*	0.7^{A} (0.1—1.4)	*
Desoria sp.	*Invaded*	153.1^{A} (147.3—159.1)							
	Native	7.7^{B} (6.5—9.3)							
Philoscia muscorum	*Invaded*	3.0^{A} (2.2—4.2)	*	2.8^{AB} (1.7—4.7)	3.9^{A} (2.5—6.2)	1.6^{AB} (1.1—2.2)	2.8^{AB} (0.4—17.6)	2.9^{AB} (1.8—4.7)	1.3^{AB} (0.6—2.7)
	Native	1.7^{B} (1.4—1.8)	*	1.6^{B} (1.3—2.0)	2.2^{AB} (1.8—2.8)	8.9^{AB} (1.2—11.0)	1.6^{B} (1.3—2.0)	1.7^{AB} (1.3—2.1)	0.7^{B} (0.6—0.9)

(Table 1.5 Continued)

Taxa/Community	***Origin***	***AB***	***DG***	***EA***	***FJ***	***LO***	***MV***	***PC***	***RM***
Detritivores									
Armadillidium vulgare	*Invaded*	2.0^{A} (1.6—2.5)	*	1.9^{AB} (0.9—3.7)	21.7^{C} (12.1—38.6)	0.4^{ABD} (0.1—2.7)	6.1^{AE} (2.5—14.9)	*	2.2^{AB} (1.0—4.8)
	Native	1.5^{B} (1.2—1.8)	*	2.5^{A} (2.0—3.1)	1.6^{AB} (1.3—2.0)	0.3^{D} (0.1—0.3)	4.4^{E} (3.6—5.5)	*	1.6^{AB} (1.3—2.0)
Allonemobius fasciatus	*Invaded*	3.1^{A} (2.0—4.7)	0.8^{C} (0.5—1.3)	*	0.6^{AC} (0.1—4.1)	*	1.5^{AC} (0.7—3.0)	3.1^{A} (1.8—5.3)	0.9^{AC} (0.2—3.5)
	Native	13.3^{B} (8.6—20.7)	0.9^{C} (0.6—1.4)	*	0.5^{AC} (0.1—4.9)	*	*	2.3^{A} (1.0—5.2)	*
Isotoma sp.	*Invaded*	56.5^{A} (52.9—60.5)							
	Native	15.3^{B} (11.4—20.6)							
Liohippelates sp.	*Invaded*	1.1^{A} (0.7—1.8)	1.3^{A} (0.9—2.1)	2.8^{AB} (0.7—10.7)	4.1^{B} (3.0—5.7)	*	0.9^{A} (0.6—1.4)	*	*
	Native	5.1^{B} (3.4—7.6)	6.0^{B} (4.0—9.0)	12.5^{C} (8.3—18.8)	18.3^{C} (12.1—27.6)	*	4.4^{B} (2.9—6.7)	*	*
Oxidus gracillus	*Invaded*	4.6^{A} (3.9—5.3)							
	Native	1.1^{B} (0.9—1.2)							

(Table 1.5 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Detritivores									
Trachelipus rathkii	*Invaded*	4.3^{A} (3.7—5.1)							
	Native	1.7^{B} (1.1—2.6)							
Galumna sp.	*Invaded*	11.9^{A} (6.8—21.0)							
	Native	2.5^{B} (1.1—5.5)							
Lepidocyrtus cyaneus	*Invaded*	1.1^{A} (0.4—3.7)	0.3^{A} (0.1—0.8)	3.7^{A} (1.2—11.5)	8.3^{AC} (2.8—24.8)	1.2^{A} (0.4—4.2)	1.1^{A} (0.4-3.2)	0.7^{A} (0.2—2.9)	0.6^{A} (0.2—1.9)
	Native	1.3^{A} (0.9—2.0)	0.3^{A} (0.2—0.5)	4.3^{AC} (2.9—6.6)	9.7^{C} (6.4—14.7)	1.4^{A} (0.9—2.2)	1.3^{A} (0.9—2.0)	0.9^{A} (0.6—1.3)	0.7^{A} (0.5—1.1)
Pogonognathellus elongatus	*Invaded*	1.7^{A} (1.1—2.7)	1.1^{A} (0.4—2.9)	2.7^{A} (1.5—8.3)	0.2^{AB} (0.0—1.6)	0.3^{AB} (0.0—2.0)	*	2.5^{A} (1.3—10.0)	2.8^{A} (0.9—8.6)
	Native	1.2^{A} (0.8—1.9)	0.8^{AB} (0.5—1.2)	1.9^{A} (1.2—2.9)	0.2^{B} (0.1—0.2)	0.2^{B} (0.0—0.3)	*	1.8^{A} (1.1—2.8)	2.0^{A} (1.0—3.1)
Leucopehnga varia	*Invaded*	0.7^{A} (0.3—1.5)	1.7^{AB} (1.0—3.0)	0.3^{A} (0.1—1.1)	1.1^{ABC} (0.6—10.9)	0.9^{ABC} (0.7—10.9)	0.5^{A} (0.2—1.4)	*	*
	Native	2.2^{B} (1.2—4.2)	5.6^{C} (2.9—10.7)	0.9^{A} (0.5—1.7)	3.7^{BC} (1.9—10.7)	2.8^{BC} (1.5—5.4)	1.5^{AB} (0.8—3.0)	*	*

(Table 1.5 Continued)

Taxa/Community	***Origin***	***AB***	***DG***	***EA***	***FJ***	***LO***	***MV***	***PC***	***RM***
Detritivores									
Elachiptera erythropleura	*Invaded*	0.5^{A} (0.2—1.3)							
	Native	2.8^{B} (1.1—7.2)							
Predators									
Trimorus sp.	*Invaded*	1.4^{A} (0.7—2.8)	1.9^{AB} (0.8—4.5)	5.5^{B} (2.7—14.8)	0.4^{A} (0.0—2.8)	1.2^{AB} (0.3—3.5)	1.0^{AB} (0.3—3.6)	3.0^{AB} (1.4—6.4)	4.5^{B} (2.2—9.2)
	Native	2.0^{AB} (0.8—5.1)	3.6^{B} (1.9—6.8)	5.1^{B} (1.9—9.7)	1.6^{AB} (0.2—15.9)	*	1.0^{AB} (0.2—6.0)	1.1^{AB} (0.3—3.9)	4.7^{AB} (1.8—12.6)
Gladicosa gulosa	*Invaded*	3.2^{A} (2.2—4.5)	15.3^{C} (10.5—22.2)	1.4^{AB} (0.7—2.9)	2.5^{A} (1.4—4.4)	0.9^{BE} (0.1—1.3)	1.4^{AB} (0.8—2.7)	1.2^{AB} (0.6—2.6)	1.1^{ABE} (0.5—2.6)
	Native	1.0^{B} (0.8—1.4)	5.0^{D} (3.8—6.8)	0.5^{E} (0.3—0.6)	0.8^{B} (0.6—1.1)	0.3^{E} (0.2—0.4)	0.5^{E} (0.3—0.6)	0.4^{E} (0.3—0.6)	0.4^{E} (0.3—0.5)
Baeus sp.	*Invaded*	2.2^{A} (1.3—3.7)	1.2^{A} (0.6—2.3)	4.6^{B} (2.8—7.6)	0.8^{AC} (0.2—3.4)	*	0.3^{AC} (0.0—1.9)	2.7^{AB} (1.5—4.8)	3.0^{AB} (1.8—5.0)
	Native	2.1^{A} (1.6—2.7)	1.2^{A} (1.0—1.6)	4.3^{B} (3.3—5.6)	0.8^{A} (0.6—1.0)	*	0.3^{C} (0.2—0.3)	2.6^{A} (2.0—3.3)	2.8^{A} (2.2—3.7)
Pardosa sp.	*Invaded*	1.3^{A} (0.7—2.5)	0.5^{AB} (0.3—1.0)	2.0^{A} (1.0—4.1)	2.1^{A} (1.0—4.4)	0.9^{AB} (0.1—5.7)	*	1.1^{AB} (0.4—3.0)	0.8^{AB} (0.2—2.7)
	Native	1.2^{A} (0.8—1.7)	0.6^{B} (0.4—0.8)	2.2^{A} (1.5—3.1)	2.3^{A} (1.6—3.2)	0.8^{AB} (0.6—1.1)	*	1.0^{AB} (0.7—1.4)	0.7^{AB} (0.5—1.0)

(Table 1.5 Continued)

Taxa/Community	***Origin***	***AB***	***DG***	***EA***	***FJ***	***LO***	***MV***	***PC***	***RM***
Predators									
Erigone sp.	*Invaded*	1.1^{A} (0.5—2.1)	2.0^{AB} (1.0—3.9)	0.6^{A} (0.2—1.9)	0.3^{A} (0.0—2.3)	0.9^{ABC} (0.4—3.3)	0.8^{AC} (0.3—2.0)	1.0^{AC} (0.3—3.0)	1.2^{AB} (0.6—2.5)
	Native	1.4^{A} (1.0—2.2)	2.7^{B} (1.8—4.1)	0.9^{A} (0.6—1.3)	0.4^{C} (0.3—0.6)	1.2^{A} (0.8—1.8)	1.1^{A} (0.8—1.8)	1.4^{A} (0.9—2.1)	1.7^{AB} (1.1—2.6)
Leiobunum nigropalpi	*Invaded*	2.9^{A} (2.1—4.1)	2.0^{AB} (0.7—6.0)	1.6^{A} (0.8—3.2)	0.6^{AB} (0.1—4.4)	*	2.8^{A} (1.6—5.0)	*	0.5^{B} (0.2—1.2)
	Native	2.9^{A} (1.5—5.5)	2.0^{A} (1.1—3.8)	1.6^{A} (0.8—3.0)	0.6^{B} (0.3—1.1)	*	2.8^{A} (1.5—5.4)	*	0.5^{B} (0.3—1.0)
Aphelinus sp.	*Invaded*	2.6^{A} (1.9—3.4)	2.2^{AB} (0.9—5.4)	2.4^{AB} (0.9—6.1)	4.3^{A} (2.0—9.0)	*	0.5^{ABC} (0.1—4.0)	0.9^{ABC} (0.1—6.4)	0.7^{ABC} (0.2—3.2)
	Native	1.1^{B} (0.7—1.8)	1.1^{B} (0.6—1.9)	1.2^{B} (0.7—2.1)	2.2^{AB} (1.3—3.8)	*	0.3^{C} (0.2—0.5)	0.5^{BC} (0.3—0.9)	0.5B^{C} (0.3—0.9)
Elaphrothrips sp.	*Invaded*	1.1^{A} (0.6—2.3)	1.9^{A} (1.1—3.3)	0.1^{C} (0.0—0.2)	1.4^{A} (0.7—2.9)	0.2^{AC} (0.1—1.2)	0.5^{AC} (0.2—1.4)	*	*
	Native	2.5^{AB} (1.4—4.5)	4.1^{B} (2.2—7.4)	0.2^{C} (0.1—0.4)	3.0^{AB} (1.7—5.5)	0.4^{C} (0.2—0.7)	1.2^{A} (0.6—2.1)	*	*
Orius insidiosus	*Invaded*	1.2^{A} (0.6—2.1)							
	Native	6.7^{B} (3.5—12.6)							

(Table 1.5 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Ants									
Aphaenogaster rudis complex	*Invaded*	3.5^{A} (2.5—4.8)	1.6^{AD} (0.5—4.7)	6.0^{B} (4.1—8.7)	6.3^{ABD} (0.5-13.8)	5.3^{AB} (3.4—7.7)	2.7^{A} (1.5—4.8)	1.8^{AD} (1.2—2.6)	5.5^{B} (3.8—8.0)
	Native	3.0^{A} (1.9—4.8)	2.1^{AD} (0.6—7.2)	5.8^{AB} (3.3—10.2)	17.0^{C} (7.7—37.4)	5.1^{AB} (2.7—9.5)	2.6^{AD} (1.2—5.7)	1.1^{D} (0.5—2.1)	5.6^{AB} (3.2—9.7)
Solenopsis molesta	*Invaded*	25.0^{A} (20.7—30.2)	20.4^{A} (17.6—23.8)	0.8^{C} (0.4—1.6)	2.0^{D} (1.7—2.3)	0.4^{C} (0.1—5.6)	0.3^{C} (0.1—1.3)	0.3^{C} (0.1—1.0)	0.5^{C} (0.2—1.6)
	Native	61.5^{B} (52.3—72.3)	50.3^{B} (42.8—59.1)	2.0^{D} (1.7—2.3)	2.7^{E} (2.3—3.2)	0.9^{C} (0.7—1.0)	0.9^{C} (0.7—1.0)	0.9^{C} (0.7—1.0)	1.3^{C} (1.1—1.6)
Nylanderia flavipes	*Invaded*	4.6^{A} (3.8—5.5)							
	Native	6.6^{A} (5.2—8.5)							
Lasius neoniger	*Invaded*	2.2^{A} (1.6—2.9)							
	Native	6.4^{B} (4.7—8.8)							
Pheidole pilifera	*Invaded*	1.2^{A} (0.7—2.3)							
	Native	6.8^{B} (3.7—12.8)							

(Table 1.5 Continued)

Taxa/Community	***Origin***	***AB***	***DG***	***EA***	***FJ***	***LO***	***MV***	***PC***	***RM***
Ants									
Tapinoma sessile	*Invaded*	1.1^{A} (0.3—4.1)	0.2^{A} (0.0—2.3)	0.3^{A} (0.1—1.5)	*	0.2^{AB} (0.1—13.5)	2.4^{AB} (0.6—10.4)	0.1^{A} (0.0—1.2)	0.2^{A} (0.0—1.5)
	Native	8.1^{B} (4.0—16.4)	1.6^{A} (0.8—3.2)	2.4^{A} (1.2—4.8)	*	1.3^{A} (0.7—2.7)	17.2^{B} (8.4—35.0)	0.8^{A} (0.4—1.6)	1.5^{A} (0.7—3.1)
Ponera pennsylvanica	*Invaded*	0.7^{A} (0.4—1.3)	9.7^{AC} (1.4—65.3)	9.8^{AC} (1.5—65.2)	*	0.7^{AB} (0.0—1.2)	0.7^{ABC} (0.1—6.8)	1.8^{ABC} (0.2—14.6)	*
	Native	0.2^{B} (0.1—0.3)	2.4^{C} (1.4—4.1)	2.4^{C} (1.4—4.2)	*	0.2^{B} (0.1—0.3)	0.2^{B} (0.1—0.3)	0.4A^{B} (0.3—0.8)	*
Monomorium minimum	*Invaded*	2.0^{A} (1.4—3.0)							
	Native	5.4^{B} (3.5—8.3)							
Formica incerta	*Invaded*	0.2^{A} (0.0—1.2)	0.1^{A} (0.0—0.1)	0.3^{A} (0.1—0.6)	0.2^{AB} (0.0—7.8)	*	3.7^{B} (1.0—14.0)	0.5^{AB} (0.1—3.4)	*
	Native	0.7^{A} (0.2—2.9)	0.1^{A} (0.0—0.6)	1.2^{AB} (0.3—5.0)	0.8^{A} (0.2—3.2)	*	15.0^{B} (3.7—61.1)	2.1^{AB} (0.5—8.7)	*
Myrmica sp. *AF-smi*	*Invaded*	1.5^{A} (0.7—3.5)	1.6^{ABD} (0.2—11.5)	3.9^{ABC} (1.3—11.8)	*	*	0.2^{D} (0.1—0.9)	4.2^{B} (2.1—8.5)	2.3^{A} (1.1—4.6)
	Native	5.0^{B} (3.0—8.3)	5.2^{ABC} (0.7—37.7)	12.8^{BC} (4.3—38.4)	*	*	0.8^{AD} (0.2—2.8)	13.8^{C} (6.9—27.7)	7.5^{BC} (3.7—14.9)

(Table 1.5 Continued)

Taxa/Community	*Origin*	*AB*	*DG*	*EA*	*FJ*	*LO*	*MV*	*PC*	*RM*
Ants									
Prenelopsis imparis	*Invaded*	8.1^{A} (6.6—10.0)							
	Native	2.2^{B} (1.3—3.7)							
Formica pergandei	*Invaded*	0.5^{A} (0.1—3.1)	4.5^{AB} (0.5—37.8)	1.2^{A} (0.1—9.3)	0.6^{A} (0.1—6.3)	0.3^{A} (0.1—17.9)	2.0^{AB} (0.2—17.8)	0.4^{A} (0.0—4.7)	0.6^{A} (0.1—5.9)
	Native	0.7^{A} (0.3—1.7)	14.5^{B} (5.8—36.3)	3.8^{AB} (1.5—9.5)	1.9^{A} (0.8—4.9)	1.1^{A} (0.4—2.8)	6.6^{B} (2.7—16.6)	1.4^{A} (1.3—1.5)	2.0^{A} (0.8—5.1)
Formica neonegates	*Invaded*	2.8^{A} (1.9—4.3)							
	Native	1.4^{B} (0.9—2.3)							

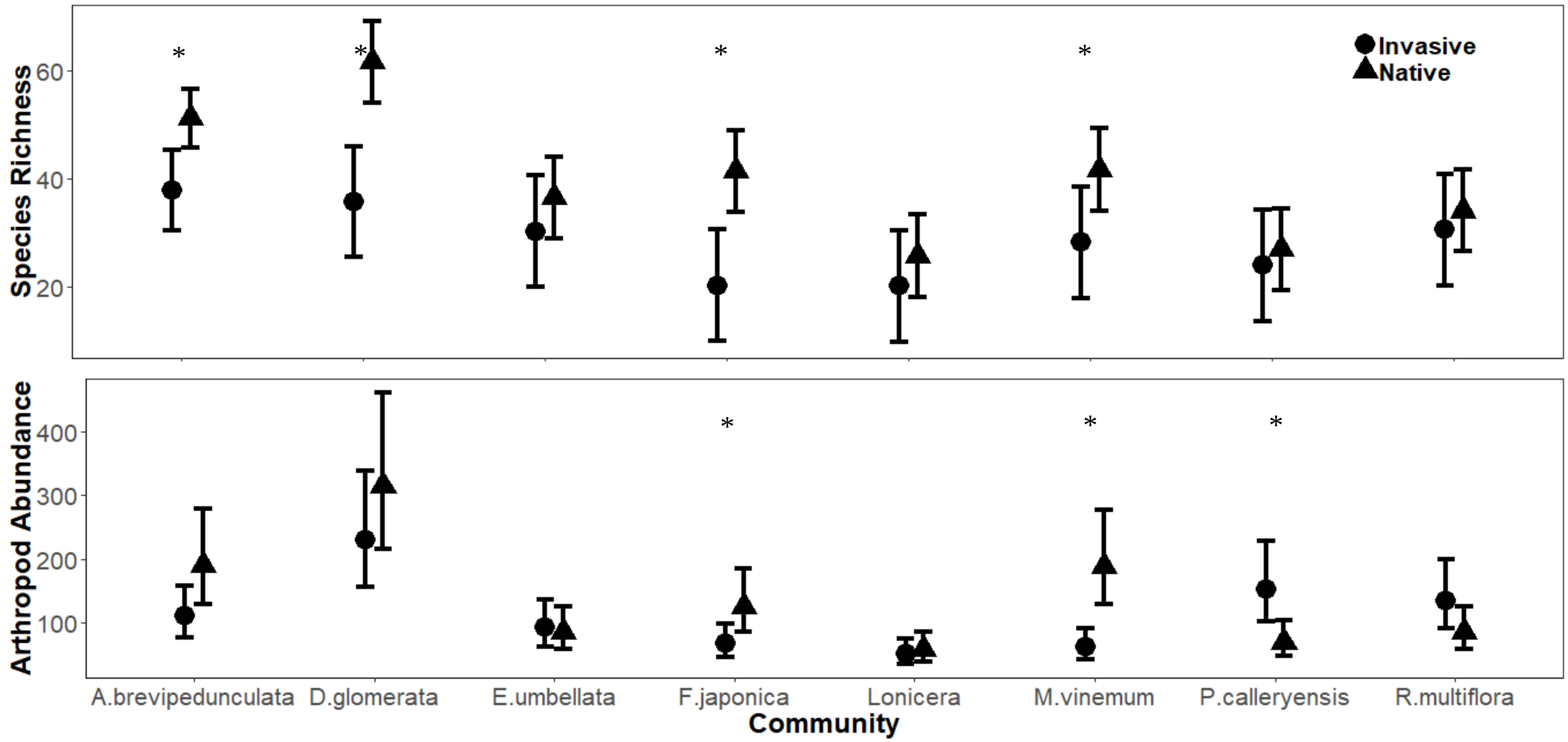

Figure 1.1. Least square means and 95%confidence intervals (*n* = 30) of total arthropod species richness (species/m^2) and abundance (arthropods/m^2) for native and non-native plant assemblages. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

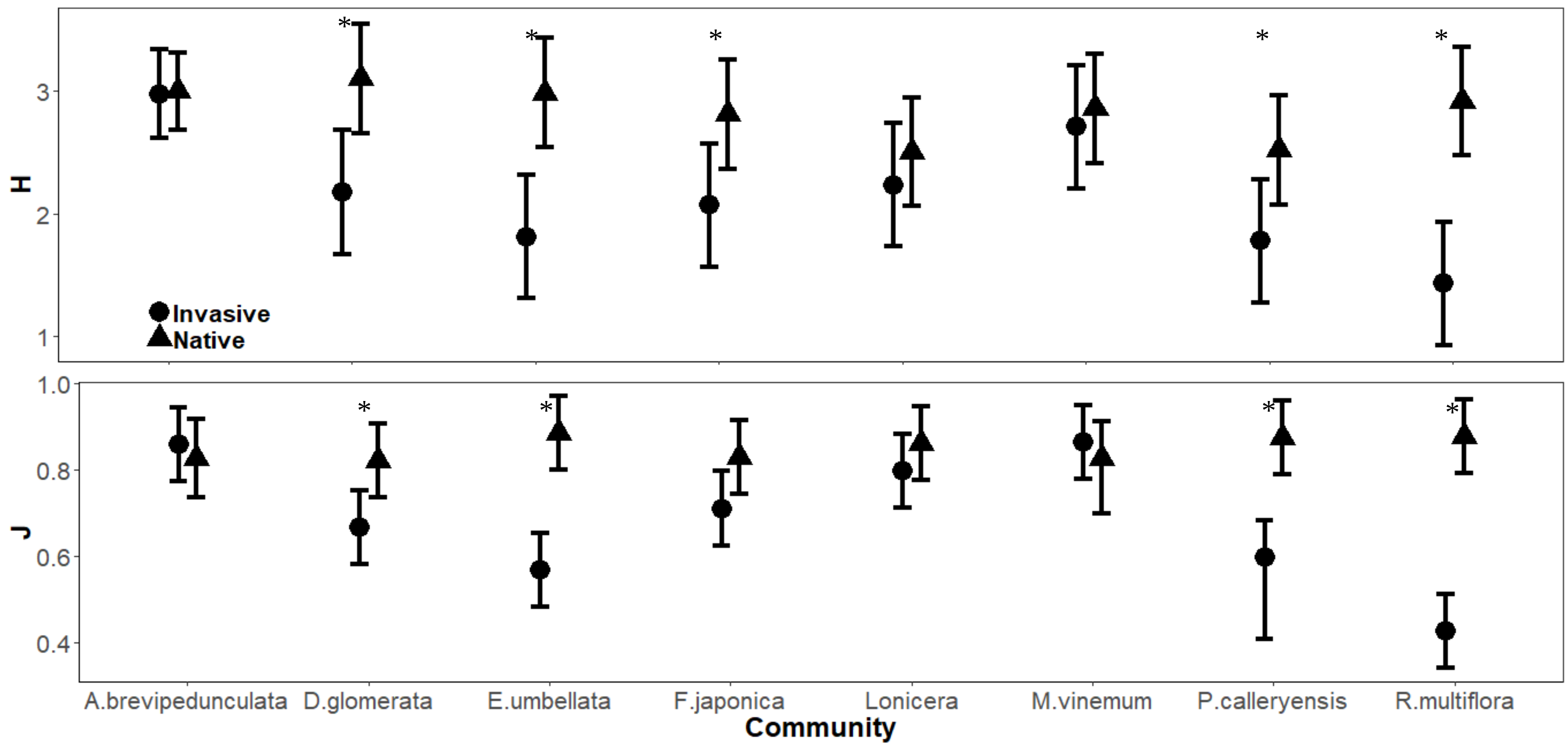

Figure 1.2. Least square means and 95%confidence intervals (*n* = 30) of Shannon's diversity index (*H*) and Pielou's evenness index (*J*) for native and non-native plant assemblages. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

* * * * * * *

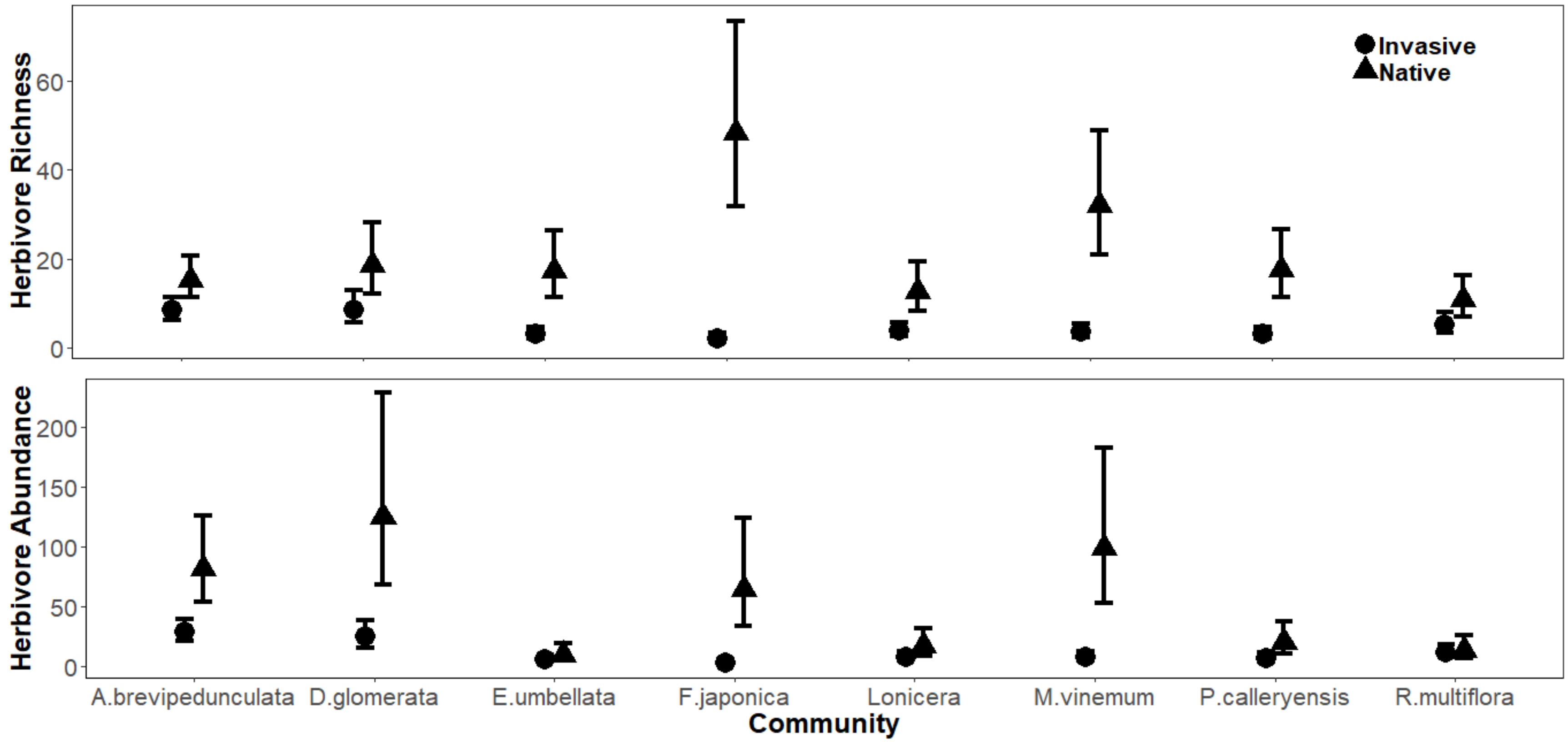

Figure 1.3. Least square means and 95%confidence intervals (*n* = 30) of herbivore species richness (species/m^2) and abundance (herbivores/m^2) for native and non-native plant assemblages. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

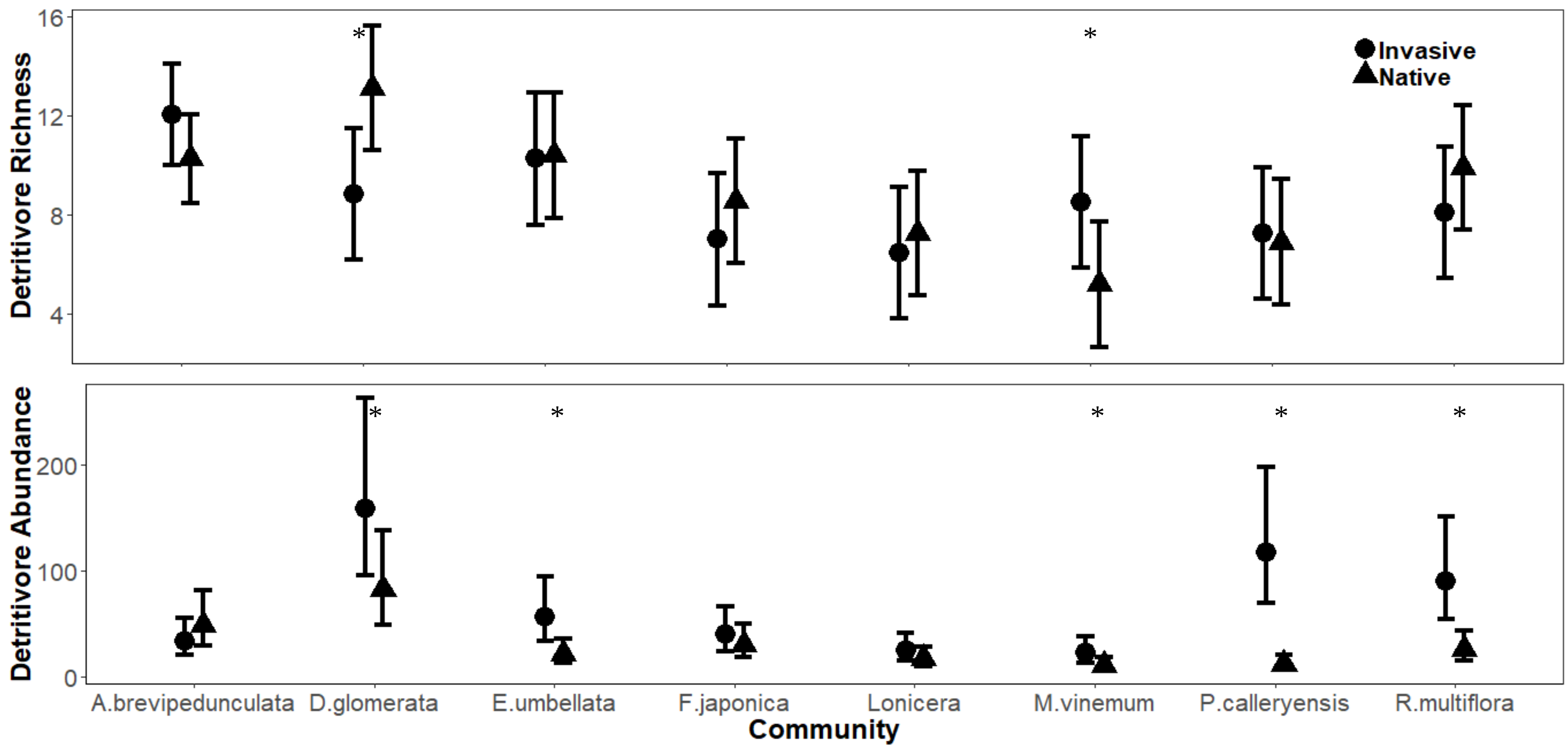

Figure 1.4. Least square means and 95%confidence intervals of detritivore species richness (species/m^2) and abundance (detritivores/m^2) for native and non-native plant assemblages. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

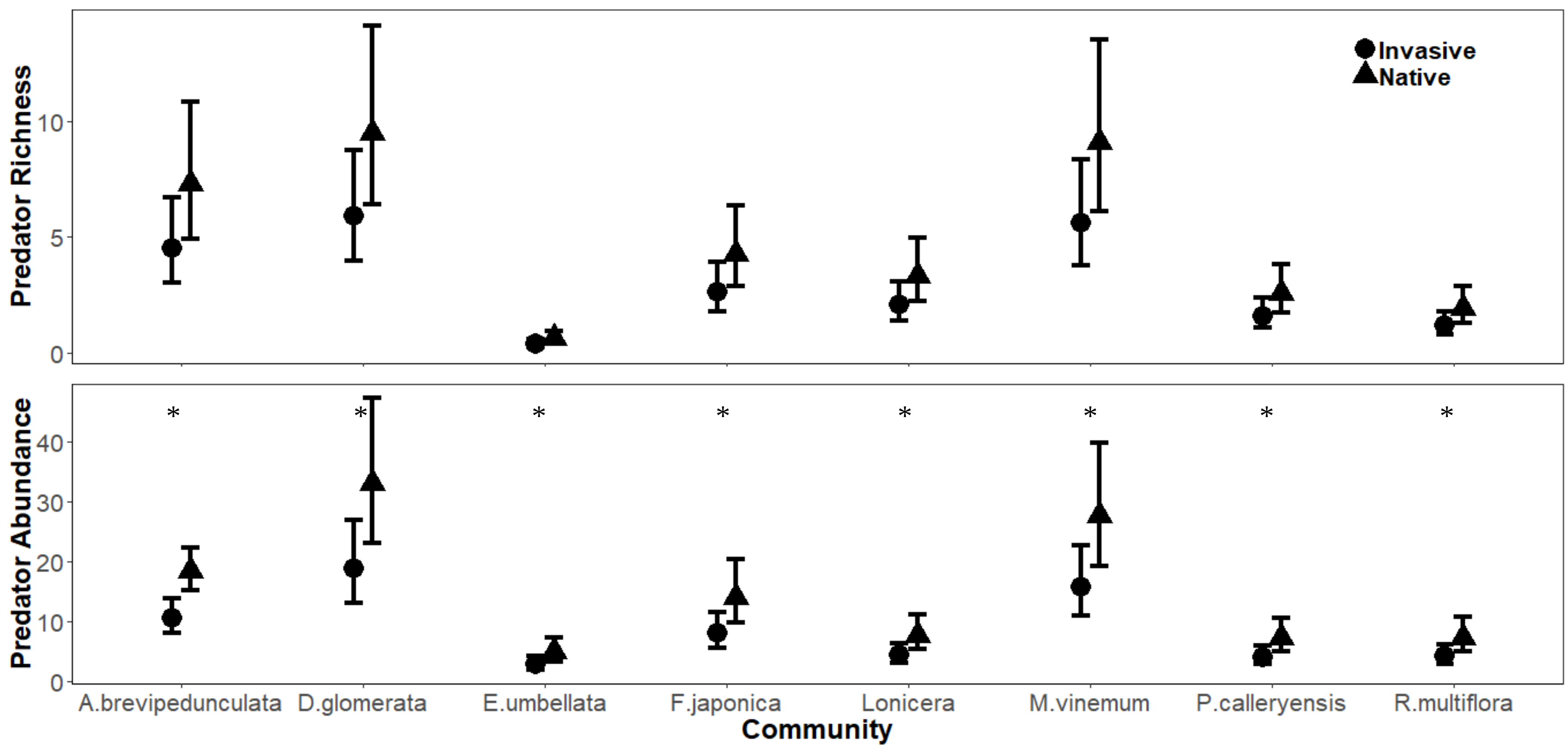

Figure 1.5. Least square means and 95%confidence intervals of predator species richness (species/m^2) and abundance (predators/m^2) collected in green food webs for native and non-native plant assemblages. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

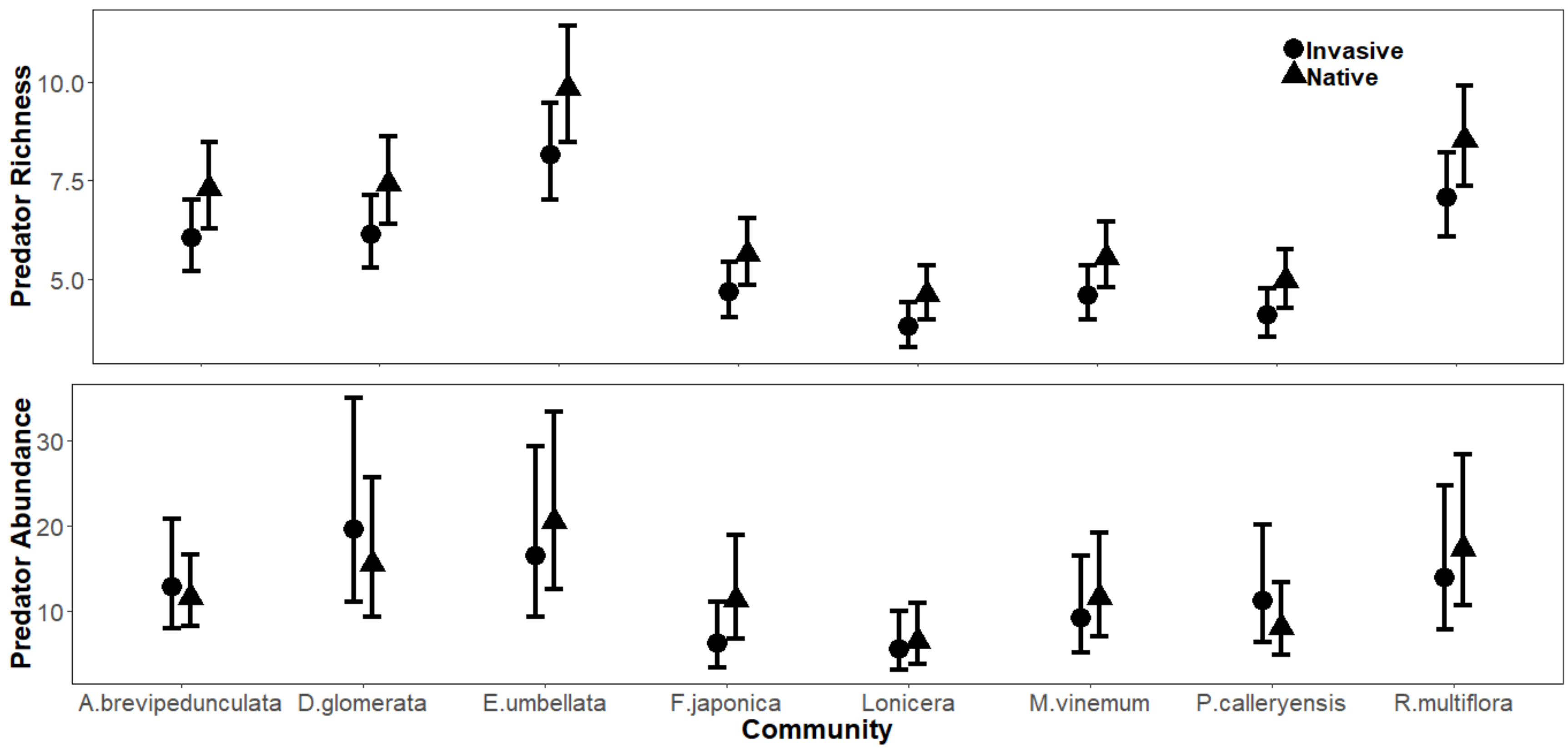

Figure 1.6. Least square means and 95% confidence intervals of predator species richness (species/m^2) and abundance (predators/m^2) collected in brown food webs for native and non-native plant assemblages. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

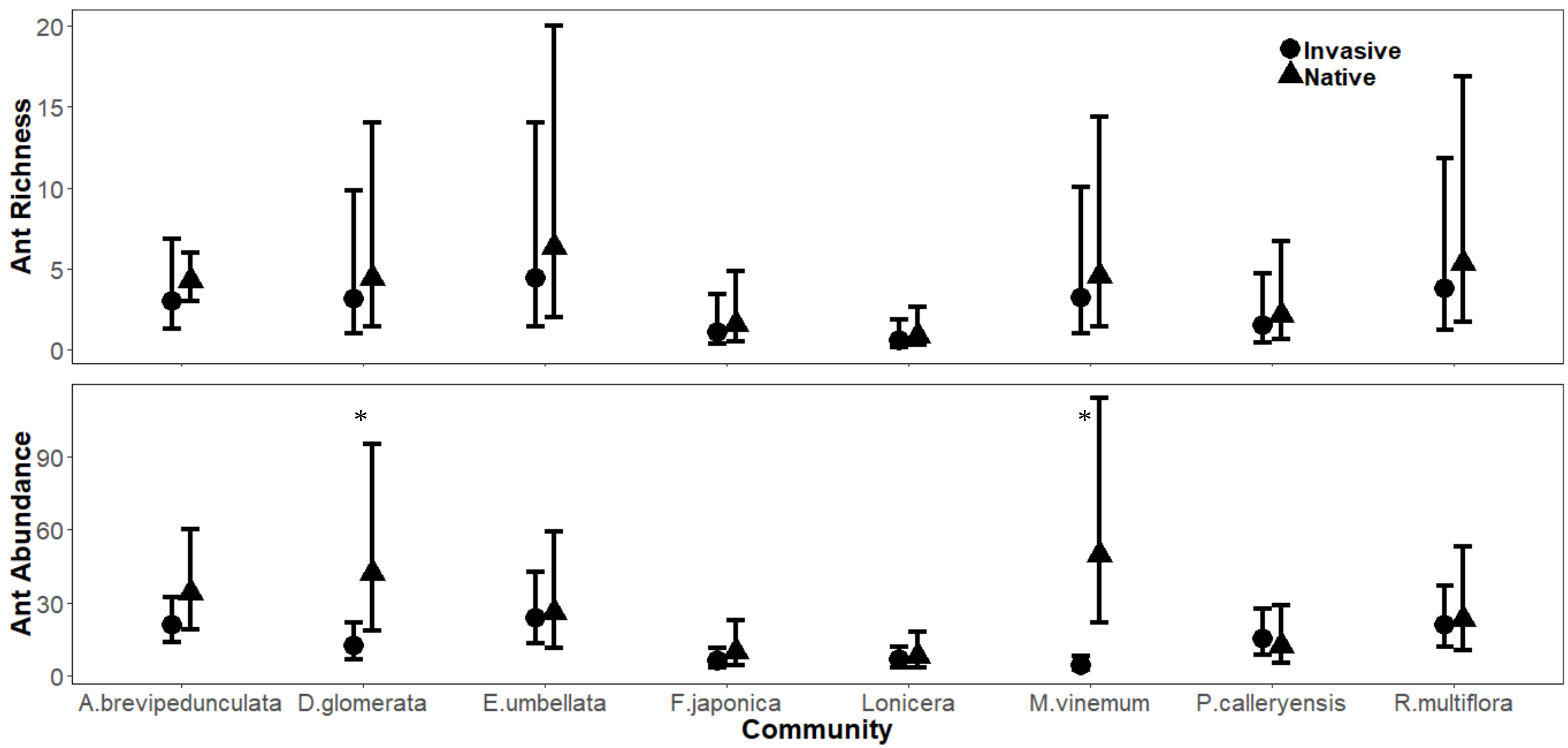

Figure 1.7. Least square means and 95%confidence intervals of ant species richness (species/m^2) and abundance (ants/m^2) for native and non-native plant assemblages. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

Chapter 2

USING AN ECO-EVOLUTIONARY FRAMEWORK TO PREDICT PATTERNS OF CHANGE IN ARTHROPOD TROPHIC STRUCTURE FOLLOWING PLANT INVASION

Introduction

Though the persistence of non-native plants in native landscapes cause economic loss on a national scale (Piementel et al. 2000; Perrings et al. 2002; Chornesky & Randall 2003; Olson 2006), mitigating the impact of plant invasion can be both a financially expensive and labor-intensive undertaking (Panetta & Lawes 2005; Hoffberg et al. 2018). As such, it is crucial for conservation efforts to be able to accurately predict the impacts of invasive species, as well as how successful a non-native species could be at establishing within its introduced range (Simberloff et al. 2013).

One of the most common explanations for how invasive species succeed is that invaders lack natural enemies (i.e., herbivores and pathogens) in their introduced range and are released from the top-down controls that would reduce competitive performance (Keane & Crawley 2002). Many non-native plants are not recognized as hosts because herbivores have developed highly specialized diets through evolutionary time (Callaway et al. 2004; Sax et al. 2007). Novel host plants either inhibit or reduce consumption by native herbivores due to the herbivore's naïvity (Coulatti et al. 2004). Free of natural enemies, non-native plants can allocate resources from phytochemical defenses to growth and reproductive success, thereby increasing the number of offspring that can colonize adjacent sites (Callaway & Ridenour 2004; Joshi & Vrieling 2005; Lockwood et al. 2005; Alpert 2006).

Although non-native plants may be initially successful at establishing in landscapes, after a lag period, populations may decline as a result of stressors from native competitors, herbivores, and pathogens (Maron & Vilà 2001; Levine et al. 2004; Simberloff & Gibbons 2004; Alpert 2006). Herbivores without specialized diets or exhibit behaviors to avoid novel plant defenses can reduce the competitive ability of non-native plants in their introduced range (Parker & Hay 2005; Alpert 2006; Tallamy et al. 2010; Bezemer et al. 2014). Furthermore, non-native plants may lack adaptations to confront these new pressures due to genetic bottlenecks (Coulatti et al. 2004). In these instances, non-native plants persist at low densities in native plant communities.

In view of these different and conflicting hypotheses, predicting the impact of non-native plants on organisms in higher trophic levels can be difficult. As a potential framework, the impact of an invader on native species can be predicted by considering prior adaptations to biotic and abiotic conditions that the non-native species has accumulated in its native range that may be adaptive in its introduced range (Duncan & Williams 2002; Melbourne et al. 2007). This framework is articulated by Saul and Jeschke's (2015) "evolutionary experience concept", which posits that an invader's prior evolutionary experiences may confer invasion success if the invader's introduced range is similar to its native range. Likewise, a native species' prior evolutionary experience may confer resistance to invasion if the traits possed by an invader is similar to traits that the native species has encountered from other natives (i.e., native competitors, predators, pathogens, etc.). Four "invasion risk scenarios" are provided that describe the interaction between the invader and a given native species based on their prior evolutionary experience with each other (Saul & Jeschke 2015; Figure 2.1).

When non-native species have high experience and native species have low experience ("high-low"), the risk of invasion is predicted to be high because the invader has novel traits that native species either does not recognize or cannot tolerate. Novel predators, such as the brown tree snake (*Boiga irregularis*, Fritts & Rodda 1998) and Burmese python (*Python bivittatus*, Dorcas et al. 2012) serve as examples of the "high-low" scenario, as these predators eradicate native vertebrates that lack the adaptations to escape predation. Non-native plants may release chemicals from roots or plant tissues that inhibit or reduce the growth or development of native plants ("novel weapons", Callaway & Aschehoug 2000). Finally, non-native plants may lack top-down stressors that limit growth and reproduction due to a subsequent lack of natural enemies in their introduced range ("enemy release", Keane & Crawley 2002).

When non-native species have low experience and native species have high experience ("low-high"), the risk of invasion is predicted to be low either because the invader lacks the adaptations needed to favorably compete against organisms in its introduced range or because native species can adapt to conditions imposed by the invasive. Non-native plants may lack the necessary defenses to reduce attack by herbivores or pathogens in their introduced range ("increased susceptibility", Coulatti et al. 2004). Generalist-feeding crayfish demonstrate preference for non-native plants over natives and may reduce the plant's ability to compete with other natives (Parker & Hay 2005).

Alternatively, ruderal plants may have high reproduction and growth that contribute to their spread, but a lack of adaptations against environmental variation that limits persistence in the landscape (“reckless invader”, Alpert 2006). Finally, a diverse community may lack available niches for new species to invade, especially if new species cannot compete favorably against multiple species for a given resource (“biotic resistance”, Levine et al. 2004).

When neither non-native nor native species have high experience (“low-low”), the impact of the invader to native species is highly variable because neither the invader nor the native recognize one another and may fail to interact. The absence of essential mycorrhizal fungi in a non-native plant’s introduced range may limit its ability to compete favorably against native plants (Klironomos 2002); “missed mutualisms” (Alpert 2006) such that this may serve as examples for the “low-low” scenario. Another example is described by the “empty niche hypothesis” (Hierro et al. 2005), where an invasive species exploits a resource not in competition with other species.

When both native and non-native species have high experience (“high-high”), both organisms recognize one another and their interactions may be similar to those between two native species. Less experienced species adapt to interactions with more experienced species over short (ecological) and long (evolutionary) time scales, such that all species eventually would more toward a “high-high” scenario over time (Siemann et al. 2006; Saul and Jeschke 2015).

I propose that these invasion risk scenarios presented by Saul & Jeschke (2015) could be a useful framework for predicting how trophic structure in native arthropod communities may change following plant invasion. I exclude “low-low” scenarios from my test of this prediction, as there are few, if any, real world examples of where no interaction exists between non-native plants and arthropods. For the purpose of my model, I consider non-resident species as non-native plant species and differing functional groups of native arthropods as “resident species”, as arthropod response to invasion may be specific to functional group (Burghardt et al. 2010; Litt et al. 2014).

Predictions

The evolutionary experience concept from a non-resident plant, resident herbivore perspective (Figure 2.2)

In a “high-low” scenario, the richness and abundance of herbivorous arthropods should decrease because herbivores either have not coevolved with and/or fail to recognize the novel host. In contrast, herbivores are predicted to increase in richness and abundance in a “low-high” scenario, where non-native plants lack the appropriate defenses, or where generalist herbivores dominate the functional group. Finally, no change is expected in specialist herbivore abundance or richness between communities dominated by native vegetation and communities dominated by non-native vegetation in a “high-high” scenario, where non-native plants are congeners of native hosts.

The evolutionary experience concept from a non-resident plant, resident detritivore perspective (Figure 2.3)

In a “high-low” scenario, plant biomass accumulates in the litter layer and increases food availability for detritivores. Thus, the abundance and richness of detritivores should increase. In a “low-high” scenario, the richness and abundance of detritivores is expected to decrease as herbivores reduce living plant biomass that will create plant litter upon senescence. Finally, I expect no change in detritivore abundance or richness between communities dominated by native vegetation and communities dominated by non-native vegetation in a "high-high" scenario.

The evolutionary experience concept from a non-resident plant, resident predator approach (Figure 2.4)

When herbivore species are displaced by non-native plants in a "high-low" scenario, predaceous arthropods will be negatively affected. In a "low-high" scenario, predators benefit from an increase in prey availability and would increase in abundance (Lau 2013). No change in predator abundance or richness is expected in "high-high" scenarios, as the availability of prey is not expected to change with the presence of non-native plants.

Objectives

I conducted a field-based study to provide an empirical test of the evolutionary experience concept described in Saul and Jeschke (2015) in the context of non-native plant invasions and their impact on native arthropods. Specifically, I asked:

1. Do the hypotheses provided in Saul and Jeschke (2015) accurately predict arthropod responses to plant invasions?

2. Do herbivores with low experience to non-native plants decrease in abundance or richness compared to their native hosts? Do we observe the opposite effect for herbivores with high experience to naïve, non-native plants? Do we observe any

change in density or richness for herbivores with high experience on non-native plants with high experience?

3. How do the changes observed in herbivore assemblages, if any, affect detritivores and predators for all three invasion scenarios?

Methods

I selected a suite of non-native plants to serve as candidates for each of three proposed invasion scenarios: “high-low”, “low-high”, and “high-high”. I determined candidacy of the non-native plants for each scenario based on natural history and the presence of native congeners in the Mid-Atlantic region of the United States (Invasive Plant Atlas 2015). For “high-low” scenarios, I selected non-native plant species that lacked native congeners in the Mid-Atlantic (Kaufman & Kaufman 2007; Invasive Plant Atlas 2015): autumn olive (*Elaeagnus umbellata*), Callery pear (*Pyrus calleryensis*), and porcelainberry (*Ampelopsis brevipedunculata*). I selected native plants that were functionally similar to non-native plants for comparison, which represented species that are likely to be locally extirpated by non-natives following invasion (Vilà et al. 2011; Appendix C).

I selected the following three candidate plant species for “low-high” scenarios from non-native plants used as agriculture and forage crops, as plant defenses in these non-resident plants have either been reduced or lost through artificial selection (Whyte et al. 1959; Pedigo & Rice 2009; Turcotte et al. 2016): alfalfa (*Medicago sativa*), orchardgrass (*Dactylus glomerata*), and Queen Anne’s lace/wild carrot (*Daucus carota*). I chose landscapes where plant candidates were either intentionally planted or left as wild forage and I ensured plant candidates were not sprayed or actively managed for insect pests. I sampled adjacent native plant communities used as refugia as comparisons.

For the “high-high” scenario, I selected non-native plants that had local congeners native to the Mid-Atlantic region (Invasive Plant Atlas 2015) and compared arthropod assemblages on native congeners to assemblages on non-native congeners. Although plant-feeding arthropods may consume plant species that are confamilials (Forister et al. 2015), I considered only congeners for the purpose of this hypothesis due to the wide breadth of species in certain plant families (i.e., Poaceae). Due to sampling constraints I was only able to select two non-native plant species for study: Norway maple (*Acer platanoides*) and wineberry (*Rubus phoenicolasius*).

Site Selection

In summer 2016, I established a total of 64, 30 x 30-m sites in plant communities dominated either by one of the eight candidate plant species (4 sites per candidate, 32 sites total) for the three invasion scenarios or by communities of native plants (32 sites total), using the same method to determine sites as in the previous chapter. A list of plant species identified in each site can be found in Appendix C.

Arthropod Sampling

I used the same sampling techniques as in Chapter 1 (e.g., pitfall traps, vacuum sampling, Berlese-Tullgren funnels, and opportunistic sampling) to collect and identify arthropods during the summer 2016. Although I did not make predictions regarding changes in richness or abundance for ants for the evolutionary experience hypothesis, I did separate ants from other functional groups to determine the direction and magnitude of change of ant communities associated with each invasion scenario. Unlike in the previous chapter, however, I did not separate predators by collecting method (i.e., predators were not sorted into “green” or “brown” food webs).

Data Analysis

I analyzed differences in arthropod characteristics for each invasion scenario using generalized linear mixed effects models. For each invasion scenario, I considered plant origin (categorical with two levels) and plant community (categorical with two or three levels, depending on invasion scenario) as my fixed effects and included site as my random effect to account for nested sampling. As in the Chapter 1, I explored evidence for two-way interactions between plant origin and plant community (origin*community), but removed interactions when $P > 0.0125$, based on the Bonferonni adjustment estimate. I used the same transformations and distributions for response variables when necessary as in the previous chapter; this included a Poisson distribution with a log link for richness counts and a negative binomial distribution with a log link for abundance counts. I analyzed data using the following packages in R: car, lme4, lsmeans, MASS, and nmle (Venables & Ripley 2002; Zeileis & Hothorn 2002; Fox & Weisberg 2011; Bates et al. 2014; Lenth 2016; Jackson 2017; Pinheiro et al. 2018; R Development Core Team 2018).

Results

I collected 51,330 individuals representing 1,115 unique taxa (Appendix D). I identified 11 species of gastropods and 2 species of earthworms (representing 3.1% of all individuals collected); I removed these taxa from further analyses to focus on testing the evolutionary experience hypothesis on arthropods. Furthermore, I removed an additional 4,159 individuals (representing 8.1% of all individuals collected) that were identified as non-native taxa so that I could examine changes for native arthropod trophic structure.

The “high-low” scenario

I found evidence to support my predictions for the eco-evolutionary hypothesis under the “high-low” scenario; however, arthropod characteristics varied between native and non-native plants by both plant species and functional group (Table 2.1; Figure 2.5). In general, native plants had more herbivores species than non-native plants (Figure 2.5a). Assemblages dominated by porcelain berry had 3.7 fewer detritivore species/m^2, 4.5 fewer predator species/m^2, and 2.4 fewer ant species/m^2 compared to native plants, but no other non-native plant differed in the number of predator or ant species between native and non-native plants (Figure 2.5b-d).

All non-native plants had fewer herbivores than their native plant counterparts (Figure 2.6a), but for all other arthropod functional groups, the differences in abundance between native and non-native plants in the “high-low” scenario varied by plant species (Table 2.2). With the exception of porcelain berry, all non-native plants had more detritivores than their native counterparts (Figure 2.6b). I did not detect differences in mean predator abundance between native plant communities and non-native plant assemblages (Table 2.2; Figure 2.6c). Plant assemblages dominated by porcelain berry had 47.0 fewer ants/m^2 compared to native plants, but otherwise, non-native plants did not differ in ant abundance (Figure 2.6d).

The "low-high" scenario

My results did not support the eco-evolutionary hypothesis for the "low-high" scenario for most non-native plants. Differences observed in arthropod species richness between native and non-native plants depended on the plant species and the functional group observed (Table 2.1). I did not observe differences in the number of herbivore species between plant assemblages dominated by alfalfa and native plants, but for all other plant comparisons, non-native plants had fewer species of herbivores than native plants (Figure 2.7a). With the exception of alfalfa, detritivore species richness did not differ between non-native plant assemblages and native plant communities; plant assemblages dominated by alfalfa had 3.5 more species/m^2 compared to native plants (Fig 2.7b). Both assemblages dominated by orchardgrass and Queen Anne's Lace had fewer species of predators than native plants, but assemblages of alfalfa had 9.5 more predator species/m^2 than its native comparison (Figure 2.7c). All non-native plant assemblages had fewer ant species than native plants (Figure 2.7d).

My results also did not provide evidence to support the eco-evolutionary hypothesis with arthropod abundance under the "low-high" scenario; differences in arthropod abundance between native and non-native plants varied across functional groups and plant species (Table 2.2). The direction of change in herbivore abundance varied by functional group; non-native plants had either more herbivores/m^2 than native plants for alfalfa (81.2 herbivores/m^2), fewer herbivores than native plants for orchardgrass (-69.5), or did not differ compared to native plants for Queen Anne's lace (Z = 1.90, P = 0.396; Figure 2.8a). Non-native plants did not differ in mean detritivore abundance from native plant communities (Fig 2.8b). In contrast, alfalfa had 64.4 more predators/m^2 than native plants, but all other non-native plants had fewer arthropods than native plants (Fig 2.8c). Non-native plants had fewer ants/m^2 than native plants for all comparisons (Figure 2.8d).

The "high-high" scenario

I did not find evidence to support the eco-evolutionary hypothesis under the "high-high" scenario for arthropod species richness. The direction and magnitude of change in species richness between native and non-native plants depended on functional group (Table 2.3). In general, non-native plants had fewer herbivore and detritivore species compared to native plants (Fig 2.9a & b). However, I did not detect differences in species richness between native and non-native plants for predators or ants (Table 2.3; Figure 2.9c & d).

Similar to species richness, my results did not support the eco-evolutionary hypothesis for the "high-high" scenario, and the direction and magnitude of change in arthropod abundance between native and non-native plants varied by functional groups (Table 2.4). Non-native plants had fewer herbivores, detritivores, and ants than native plants (Figures 2.10a, b, & d). There were no differences in mean predator abundance between native and non-native plants for any plant comparisons (Table 2.4; Figure 2.10c).

Discussion

Within the past twenty years, numerous hypotheses have been proposed to explain how invasive organisms become dominant in novel landscapes, some of which are contradictory or similar in practice to others (Jeschke 2014). Many syntheses have called for a "culling" of hypotheses to help illuminate central concepts to the field of invasion biology, reducing or branching hypotheses which are redundant or lack empirical evidence with well-supported hypotheses (Catford et al. 2009; Foxcroft et al. 2011;

Gurevitch et al. 2011; Jeschke et al. 2012; Saul et al. 2013; Enders et al. 2018). Therefore, providing evidence for new models of invasion success may provide insight into how we might reduce the impact of future invasions. Specifically, by providing evidence to support the eco-evolutionary hypothesis, we could determine the impact of a non-native plant species on native arthropod communities based on natural history and interactions among related taxa. My study supports my hypothesis for plant invasions under the "high-low" scenario, where native herbivores are naïve to novel plants but detritivores benefit. In contrast, I did not find consistent evidence to support invasion success under the "low-high" or "high-high" scenario, as the response of native arthropods differed by the plant species selected.

Evidence for the eco-evolutionary experience hypothesis under the "high-low" scenario

Given that the majority of plant-feeding arthropods are restricted to few plant lineages (Bernays & Graham 1988; Forister et al. 2015), specialists on native plants would have low experience when encountering a novel plant host, and predicting the response of herbivores to plant invasion would depend on the relatedness of the host plant to species in its introduced range. I selected non-native plants without local native congeners and demonstrated a lower abundance in native plant-feeding arthropods with novel plant hosts, consistent with previous studies (Bezemer et al 2014; Litt et al 2014). Fewer primary consumers in the food web could reduce the flow of energy through trophic levels and would therefore limit both the diversity and complexity of secondary consumers (i.e., predators) that depend on herbivores as a food source. I observed a lower richness and density of predaceous arthropods within only one non-native plant assemblage, suggesting that the magnitude of indirect effects of plant invasion under the "high-low" scenario may vary by the non-native plant studied.

I also observed an increase in detritivores for the "high-low" scenario, consistent with my findings in the previous chapter to support a "green" to "brown" shift in arthropod trophic structure following plant invasion. An abundance of detritivores following plant invasion may result in accelerated rates of decomposition and nutrient flow in the environment, which can alter plant community composition (Chapin et al 2011; Bardget & van der Putten 2014). A shift in detritivore prey abundance following a loss of herbivore prey may allow predaceous arthropods to persist in the landscape by switching to a more available resource (i.e., the detritivore). This may explain why predator abundance did not change between native and non-native plant communities, despite a loss of herbivore prey. As a shift in the direction of energy flow for food webs can have negative impacts on ecosystem function (Gratton & Denno 2006), it is important to consider management strategies that reduce the likelihood of introducing non-congeneric and aggressive, non-native plants into native landscapes, in agreement with Saul and Jeschke's (2015) predictions for the "high-low" scenario.

The eco-evolutionary experience hypothesis under the "low-high" scenario

I assumed that some species of non-native plants would be susceptible to herbivory due to evolutionary naïvity against native enemies from either a lack of genetic diversity for developing a defense or from allocating of resources from plant defense to reproductive success (Maron & Vilà 2001; Coulatti et al. 2004; Turcotte et al. 2015, 2016). Following introduction, native herbivores can develop shifts in host range to utilize and perform better on novel hosts (Tabashnik 1983; Graves & Shapiro 2003; Strauss et al. 2006; Jahner et al. 2011; Powell et al. 2013). However, I did not observe a clear pattern of herbivore richness or density between non-native plants considered for the “low-high” scenario and native plants and could not support the hypotheses suggesting increased susceptibility.

One reason that may have limited the detection of differences in arthropod communities under the “low-high” scenario is the choice of native comparisons. I had assumed that the plant community best suited for competiting with non-native plants under the same environmental conditions would be adjacent native plants. However, native plant communities expressed different plant traits from non-native plants that may have contributed to its persistence following invasion. Orchardgrass, for example, is a cool-season perennial bunchgrass that becomes dormant by mid-to-late summer in the Mid-Atlantic (Mitchell personal obs.), whereas many of the native grasses planted as refugia were warm-season species that did not exhibit dormancy until the fall. Differences in plant senescence influence nitrogen content in plant tissues and thereby limit host quality for herbivores (Prestidge & McNeil 1983; Gimingham 1985; Huusela-Veistola & Vasarainen 2000). Thus, there may be temporal differences in herbivore densities associated with novel hosts, and to improve signal accuracy, it would be necessary to compare species that do not differ in seasonal phenology. Sampling at different times to capture arthropod assemblages during peak seasonal activity for non-native plants may yield results closer to the predictions, and I recommend multiple samples over the growing season as a future study.

Only one non-native plant studied, alfalfa (*Medicago sativa*), exhibited the patterns I predicted for herbivores in the "low-high" scenario. Like many agricultural crops, alfalfa was artificially selected to increase plant growth at the cost of lowering phytochemical defenses, which made the species an ideal candidate for this study. Previous studies report native insects switching host preference from native legumes to alfalfa, with some considered attaining pest status (Tabashnik 1983; Nice et al. 2002; Graves & Shapiro 2003). The dominant herbivore I collected in alfalfa assemblages was the potato leafhopper (*Empoasca fabae*), a native Cicadellid that has become a major pest of alfalfa and other introduced crops (Pedigo & Rice 2009). The alfalfa fields in which I sampled arthropods were not managed for insect pests, which may have allowed *E. fabae* populations to increase to high densities and drive the patterns I observed, including the increase in predator densities. This concomitant increase in the abundance of primary and secondary consumers has been observed from invasions involving other species of *Medicago* (Lau 2013) and may be a common pattern for non-native plants that exhibit high productivity in the short-term. However, I did not detect a decrease in detritivore abundance associated with alfalfa. The main detritivores in this study were springtails (Collembola: Entomobryidae), and it is possible that the alfalfa helped retain soil moisture or improve microbial activity, all traits that improve habitat for springtails (Hopkin 1997; Maurun et al. 2003; Bedano et al. 2006). I did not sample soil or microbial characteristics for this study, however, so I cannot confirm these assumptions.

The eco-evolutionary experience hypothesis under the "high-high" scenario

Given host specialization, I had assumed that plant-feeding arthropods would be able to recognize and use novel hosts that are phylogenetically and phytochemically similar to their native hosts. As such, I did not expect herbivory to change in a “high-high” scenario, as both herbivores and host plants would have evolutionary experience with one another, even if indirect. However, I observed lower densities of herbivores, as well as other functional groups, in non-native plants under the “high-high” scenario, which did not support my hypothesis, and these differences may be due to limitations in sampling, the plant species chosen for the study, or a logical flaw in the hypothesis.

Although congeners should be recognized by native herbivores if chemical defenses are similar throughout the genus, specialization in herbivores may not be limited to species within the same genera. An argument has been made that plant-feeding insects should be capable of recognizing and consuming plant tissues from taxa within the same family (i.e., confamilials, Forister et al. 2015). By widening taxonomic resolution, it may be possible that native and non-native confamilials may not differ in herbivory. However, I investigated differences between native and non-native confamilials for other invasion scenarios (e.g., orchardgrass and native grasses, Callery pear and other trees in the rose family) and did not observe the differences I predicted for a “high-high” scenario. Many plant families are hyperdiverse (e.g., Asteraceae, Fabaceae, Poaceae), and given the variation of traits within these families, it is unlikely that specialist feeders on a hyperdiverse family would respond similarly to novel confamilials as native hosts. I would not consider widening the taxonomic resolution as a means of improving precision in my study.

A second argument can be made that too few plant species were selected for the “high-high” scenario to determine an accurate representation of arthropod responses. As such, previous work could help elucidate patterns involving native insects and non-native congeners; however, results are mixed (Bezemer et al. 2014). Studies investigating differences in herbivore performance between non-native congener, native congener, and non-congener plants have shown that herbivores perform better on non-natives when compared to non-congeners, but do not perform as well as they would on native congeners (Leger & Forister 2005; Parker et al. 2006; Liu et al. 2007; Han et al. 2008; Zeufel et al. 2008; Burghardt et al. 2010; Ballard 2016). At the same time, herbivores may demonstrate equal or greater preference for non-native congeners compared to native species (Agrawal et al. 2003; Coulatti et al. 2004; Parker & Gilbert 2007; Dostál et al. 2013). Discerning general patterns of herbivore response to non-native congeners may not be possible in such a broad context, but partitioning herbivores into categories based on diet breadth (i.e., specialists and generalists) and feeding modes (i.e., haustellate and mandibulate mouthparts) may help reveal patterns in the study (Burghardt & Tallamy 2013; Bezemer et al. 2014; Litt et al. 2014). Unfortunately, both the composition of diet breadth and feeding modes for herbivores collected for the "high-high" scenario were fairly even, so I cannot explain the results observed in the study using these additional traits. Instead, I offer support for previous work that highlight the consequences of introducing non-native congeners to native arthropod communities.

Limitations of the "low-low" scenario from a non-resident plant, resident arthropod perspective

One difficulty of broadening the eco-evolutionary hypothesis from a single-species interaction to multiple species interactions is that arthropods encompass a broad suite of ecological roles in the environment (Triplehorn & Johnson 2005; Price et al. 2011), and there would be very few, if any, instances where a non-native plant would not have some direct or indirect effect on arthropods within a landscape. Accordingly, I did not consider the “low-low” scenario outlined by Saul and Jeschke (2015) in my experiment, but I acknowledge that, by modifying the scale of “resident species”, cases where a “low-low” scenario could be a predictive tool. There are numerous cases where arthropods fail to recognize non-native plants as an available resource (Bezemer et al. 2014; Litt et al. 2014). This phenomenon may occur in pollinator networks when the relationship between specialist pollinators and their host plants following disturbance becomes asynchronized (Burkle & Knight 2012; Simanonok & Burkle 2014). Provided that native flowering plants have been displaced by non-natives that do not depend on insects as pollinators (i.e., pollen is dispersed by wind or water), there would be indirect negative consequences for pollinators associated with plant invasion (Traveset & Richardson 2006). With this example, both non-native plant hosts and pollinator insects would have low experience interacting with the other, but only one side may experience a negative effect, which does not fulfill the requirements of a “low-low” scenario (Saul & Jeschke 2015). Thus, I propose an additional study to explore evidence of asynchronization between native pollinator species and potential non-native flowering plant hosts to provide evidence of a “low-low” invasion scenario from a non-resident plant, resident pollinator perspective.

Limitations in the eco-evolutionary hypothesis for predators: plant structure

The eco-evolutionary hypothesis made the assumption that the greatest impact plant invasions would have on predaceous arthropods would be limiting the availability of prey in the landscape. However, I cannot discount the possibility that changes in vegetation structure through the introduction of non-native plants may also impact predator communities, and I did not incorporate the impact of plant characteristics (beyond plant origin) into the study. An increase in plant cover or stem density can impede a predator's ability to forage and find prey in the environment (Samways et al. 1996; Crist et al. 2006; Wolkovich et al. 2009; Wu et al. 2009). In contrast, species that depend on vegetation for prey capture (i.e., web-building spiders) may benefit from taller or denser non-native plants entering the landscape (Pearson 2009). These differences suggest that predator response to plant invasion may be dependent on how non-native plant structure influences prey capture and investigating changes in predators as a single functional group may be too coarse. I would propose an alternate study that restructures the four "invasion scenarios" based on the native predator's familiarity to novel vegetation structure (i.e., changes in plant cover, stem density, plant height, etc.). I would use the native plant communities I sampled in this study as a baseline for how predators respond to native vegetation structure and seek out non-native plant communities that differ in the plant characteristics suggested above.

The eco-evolutionary hypothesis from a non-resident plant, resident ant perspective

Among the insects, ants are one of the most ecologically diverse taxa in the world (Wheeler 1910; Wilson 1987; Folgarait 1999) and attempts to predict the impact of plant invasion on ant communities can be difficult. As I did not consider the role of ants in relation to non-native plants in the eco-evolutionary hypothesis, I can only provide *post-hoc* information on how ants respond to non-native plants in each invasion scenario. Furthermore, reporting differences in ant abundance can be misleading due to variation of colony size by taxa (Beckers et al. 1989), and may require a finer taxonomic resolution than what I considered for this study. As such, I exercise caution in discussing the impacts of plant invasion on ant communities that are unlikely to be biologically significant, and do not discuss results from the “high-high” scenario.

Among the plant candidates selected in the “high-low” invasion scenario, only assemblages dominated by porcelain berry (*Ampelopsis brevipedunculata*) differed in ant abundance and richness from their native counterparts. Porcelain berry grows through spreading vines that form thick mats in open spaces (Kaufman & Kaufman 2007), which limit the availability of light and space for native plants. Both *Aphaenogaster rudis* and *Lasius neoniger* made up the majority of ants collected in the community dominated by native plants (211 individuals and 305 individuals, respectively) compared to assemblages of porcelain berry (52 individuals and 33 individuals, respectively). Both species of ants consume seeds as part of their diet (Wheeler 1910; Elliot et al. 2012) and as porcelain berry reduces plant diversity where it is dominant, it is possible that the loss of native plant propagules reduced densities of these granivorous ants.

Similar to my findings in porcelain berry, seed-eating ant species (*A. fulva* and *L. neoniger*) were collected at higher densities in native plants than any of the other non-native plants for the “low-high” scenario. In contrast, the majority of ants collected in non-native plants consisted of omnivorous taxa (i.e., *Myrmica americana, Tapinoma sessile*, and *Temnothorax ambiguous*), which consume plant material, harvest honeydew from aphids, or scavenge for dead invertebrates in the litter layer (Wheeler 1910; Elliot et al. 2012). However, I collected either similar or greater densities of each generalist species in native plant communities. The presence and abundance of native plants likely produce higher habitat quality for both specialist and generalist ant species when compared to landscapes dominated by non-native flora.

Non-native taxa

I designed my hypotheses for each invasion scenario to predict changes in native arthropod functional groups, which required the removal of multiple non-native arthropod species from analyses. Accordingly, any predictions made assumed that the presence or abundance of native arthropods was influenced largely by changes in plant origin. The majority of non-native arthropods collected in the study were associated with non-native plants, which may contribute to a lower detection of differences under each invasion scenario. Furthermore, many of the non-native arthropods I collected (e.g., *Capitophorus elaeagni*) depend on non-native plant hosts during part of their life cycle (Blackman & Eastop 1994), and these associations can lead to 'invasional meltdowns' that have strong, synergistic effects on native communities (Simberloff & Von Holle 1999). An attempt to predict the success of multiple non-native taxa, in addition to the presence or absence of meltdowns associated with each taxon, is beyond the scope of this study, but it would be valuable for the conservation of arthropods to investigate the additive or synergistic impact of multiple invasions on native arthropod communities (Mitchell 2014).

Summary

I designed an empirical test for the eco-evolutionary hypothesis from a non-resident plant, resident arthropod perspective and investigated differences in native arthropod functional groups for three of the four "invasion scenarios" proposed by Saul and Jeschke (2015). I found support for the "high-low" scenario in my study; when native arthropods have low prior evolutionary experience with novel plant hosts, plant-feeding arthropods decrease where non-native plants are dominant and are replaced in dominance by detritivores. In contrast, I found no support for the predicted changes in arthropod functional groups following plant invasion under the “low-high” and “high-high” scenario. With the exception of alfalfa, arthropod functional groups either responded neutrally or negatively to non-native plants, providing evidence for well-supported hypotheses like enemy release (Keane & Crawley 2002). Empirical evidence for or against theoretical frameworks in the field of invasion biology offers insight into both the management of non-native species that alter or impede ecological processes, and the restoration of those processes following invasion. As arthropods perform a diverse array of ecosystem services, management strategies should prioritize efforts that restore habitat for native arthropods to promote ecosystem integrity (Wilson 1987). Plant invasions in a “high-low” scenario demonstrate a “green to brown” shift in trophic structure (Chapter 1), which can have negative consequences for secondary consumers that dependent on arthropods in the green food web for survival (Tallamy 2004; Burghardt et al. 2009; Narango et al. 2017, 2018). Any plant taxa that might fall under a “high-low” invasion scenario, i.e., plants not phylogenetically related to native plants in the landscape, should be targeted for removal or managed to reduce their spread. Land managers should promote restoration strategies that aim to reduce the dominance of “high-low” invaders, thereby reducing the impact these non-native plants may have on ecosystem structure and function.

Table 2.1. Characteristics of arthropod species richness for the "high-low" and "low-high" invasion scenarios.

Characteristics	***Origin***		***Community***		***Origin*Community***	
High-Low	$F_{1,111}$	***P***	$F_{2,111}$	***P***	$F_{2,111}$	***P***
Herbivore Richness	46.53	<0.001	38.18	<0.001	5.05	0.008
Detritivore Richness	0.80[a]	0.373	1.10[b]	0.393	5.45[a]	0.006
Predator Richness	3.89[c]	0.023	14.62[c]	<0.001		
Ant Richness	8.22[c]	0.005	3.07[c]	0.050		
Low-High						
Herbivore Richness	101.26	<0.001	23.36	<0.001	34.24	<0.001
Detritivore Richness	1.26	0.265	9.63	0.013	8.89	<0.001
Predator Richness	0.45	0.5036	3.00	0.125	54.53	<0.001
Ant Richness	105.43	<0.001	0.17	0.846	6.39	0.002

[a]$F_{1,105}$ [b]$F_{2,6}$ [c]$F_{x,112}$

Table 2.2. Characteristics of relative arthropod abundance for the "high-low" and "low-high" invasion scenario.

Characteristics	***Origin***		***Community***		***Origin*Community***	
High-Low	$X^2_{1,\ n=111}$	***P***	$X^2_{2,\ n=111}$	***P***	$X^2_{2,\ n=111}$	***P***
Herbivores	12.50[a]	<0.001	30.28[a]	<0.001		
Detritivores	42.86	<0.001	22.25	<0.001	13.20	0.001
Predators	0.24	0.621	26.43	<0.001	10.09	0.006
Ants	11.77	<0.001	18.21	<0.001	33.40	<0.001
Low-High						
Herbivores	0.21	0.651	138.71	<0.001	82.98	<0.001
Detritivores	5.71[a]	0.017	72.82[a]	<0.001		
Predators	1.30	0.254	10.44	0.005	140.52	<0.001
Ants	72.51	<0.001	1.04	0.594	9.79	0.007

[a] $X^2_{x,\ n=112}$

Table 2.3. Characteristics of arthropod species richness in the "high-high" scenario.

Characteristics	***Origin***		***Community***		***Origin*Community***	
High-High	$F_{1,73}$	P	$F_{1,73}$	P	$F_{1,73}$	P
Herbivore Richness	31.84	<0.001	8.15	0.006	6.90	0.011
Detritivore Richness	18.30	<0.001	1.26	0.343		
Predator Richness	0.25[a]	0.619	1.30[a]	0.257		
Ant Richness	0.01	0.950	2.03	0.158		

[a] $F_{x,\,74}$

Table 2.4. Characteristics of relative arthropod abundance for the "high-high" invasion scenario. I did not detect evidence for Origin* Community interactions for all models.

Characteristics	***Origin***		***Community***	
High-High	$X^2_{1,\,n=74}$	***P***	$X^2_{1,\,n=74}$	***P***
Herbivores	20.66	<0.001	0.49	0.483
Detritivores	39.66	<0.001	6.22	0.013
Predators	0.76	0.383	3.68	0.055
Ants	9.75	0.002	0.01	0.937

Experience of Resident Species		*Experience of Non-Resident Species*	
		Low	**High**
	Low	Missed Mutualisms, Empty Niche	Novel Predator/Weapon, Enemy Release
	High	Biotic Resistance, Reckless Invader, Increased Susceptibility	Resident-Resident Interactions

Figure 2.1. A diagram of four possible pathways that influence the risk of invasion. Revised from Saul and Jeschke (2015).

Experience of Herbivore		*Experience of Non-Native Plant*	
		Low	**High**
	Low		Novel Plant Host, Unpalatable/Unrecognized (-)
	High	Increased Susceptibility, Congeneric Host (+)	Resident-Resident, Congeneric Host (0)

Figure 2.2. The four invasion pathways adapted from Saul and Jeschke (2015) for a plant-herbivore perspective. The symbols in parentheses depict the direction of change for herbivorous arthropods, where a “+” describes a general increase in the abundance or richness of herbivorous arthropods, “-” describes a decrease, and “0” describes no change in the herbivorous arthropod assemblage following plant invasion compared to a community with native vegetation.

		Experience of Non-Native Plant	
		Low	**High**
Experience of Herbivore	**Low**		Increased Litter Input, (+)
	High	Decreased Litter Input (-)	Resident-Resident, Congeneric Plant Litter (0)

Figure 2.3. The four invasion pathways adapted from Saul and Jeschke (2015) for a plant-detritivore perspective. The symbols in parentheses depict the direction of change for arthropods, where a "+" describes a general increase in the abundance or richness of arthropods, "-" describes a decrease, and "0" describes no change in the arthropod assemblage following plant invasion compared to a community with native vegetation.

		Experience of Non-Native Plant	
		Low	**High**
Experience of Herbivore	**Low**		Herbivore Prey Decrease (-) Detritivore Prey Increase (+)
	High	Herbivore Prey Increase (+) Detritivore Prey Decrease (-)	Resident-Resident, (0)

Figure 2.4. The four invasion pathways adapted from Saul and Jeschke (2015) for a plant-predator perspective. The symbols in parentheses depict the direction of change for arthropods, where a "+" describes a general increase in the abundance or richness of arthropods, "-" describes a decrease, and "0" describes no change in the arthropod assemblage following plant invasion compared to a community with native vegetation.

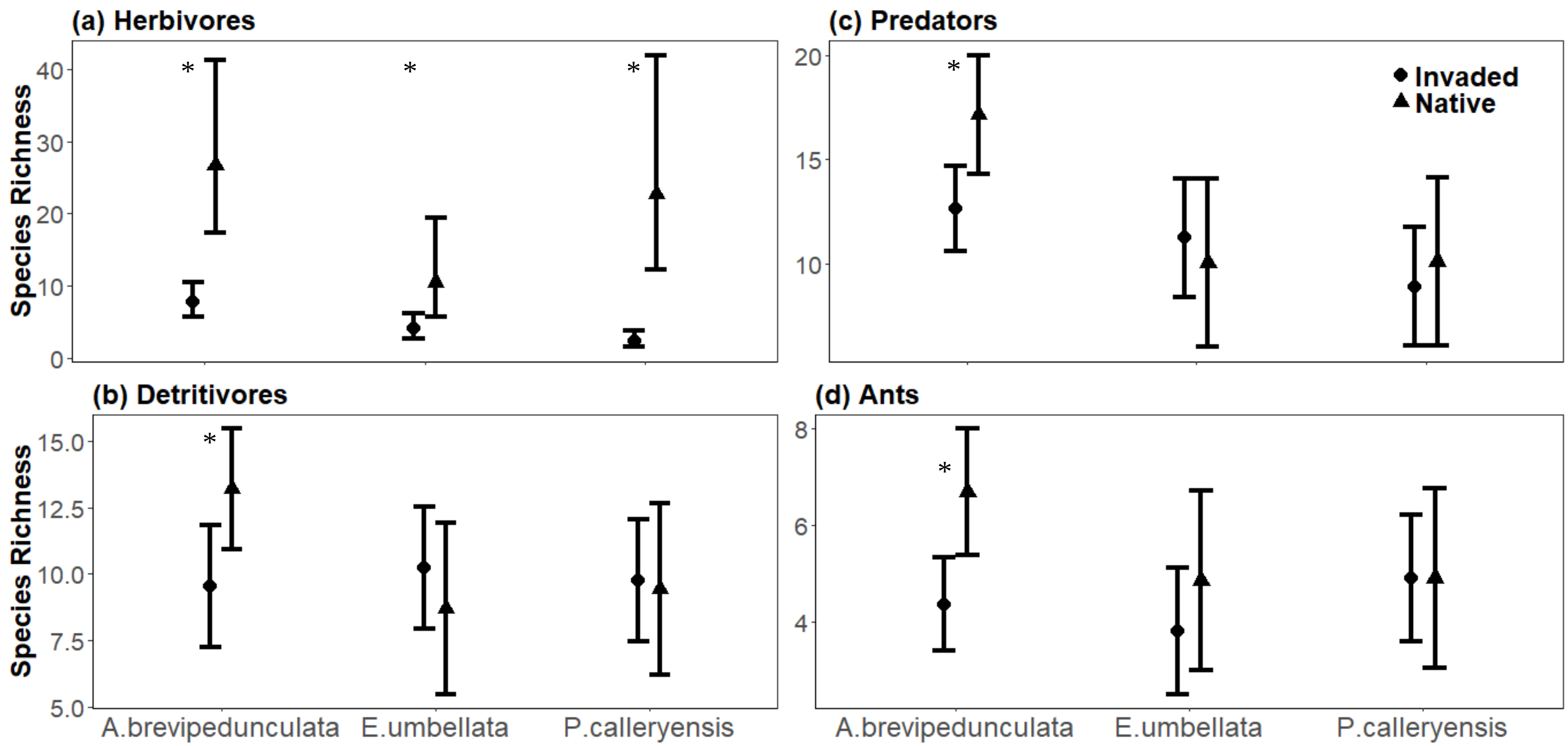

Figure 2.5. Least square means and 95% CIs (*n* = 20) for arthropod species richness (species/m^2), by functional group, for plant comparisons under the "high-low" scenario. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

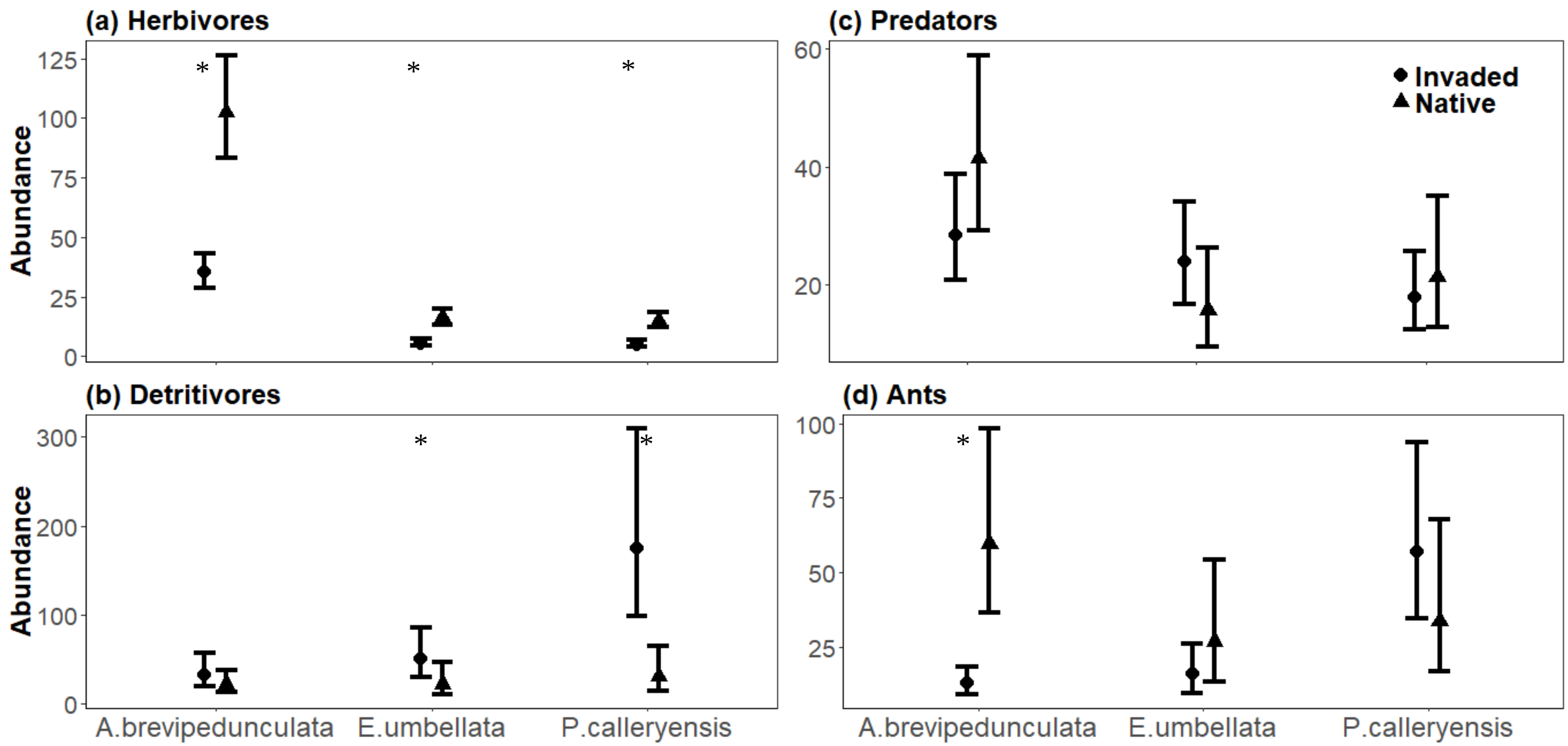

Figure 2.6. Least square means and 95% CIs (n = 20) for arthropod abundance (individuals/m^2), by functional group, for plant comparisons under the "high-low" scenario. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

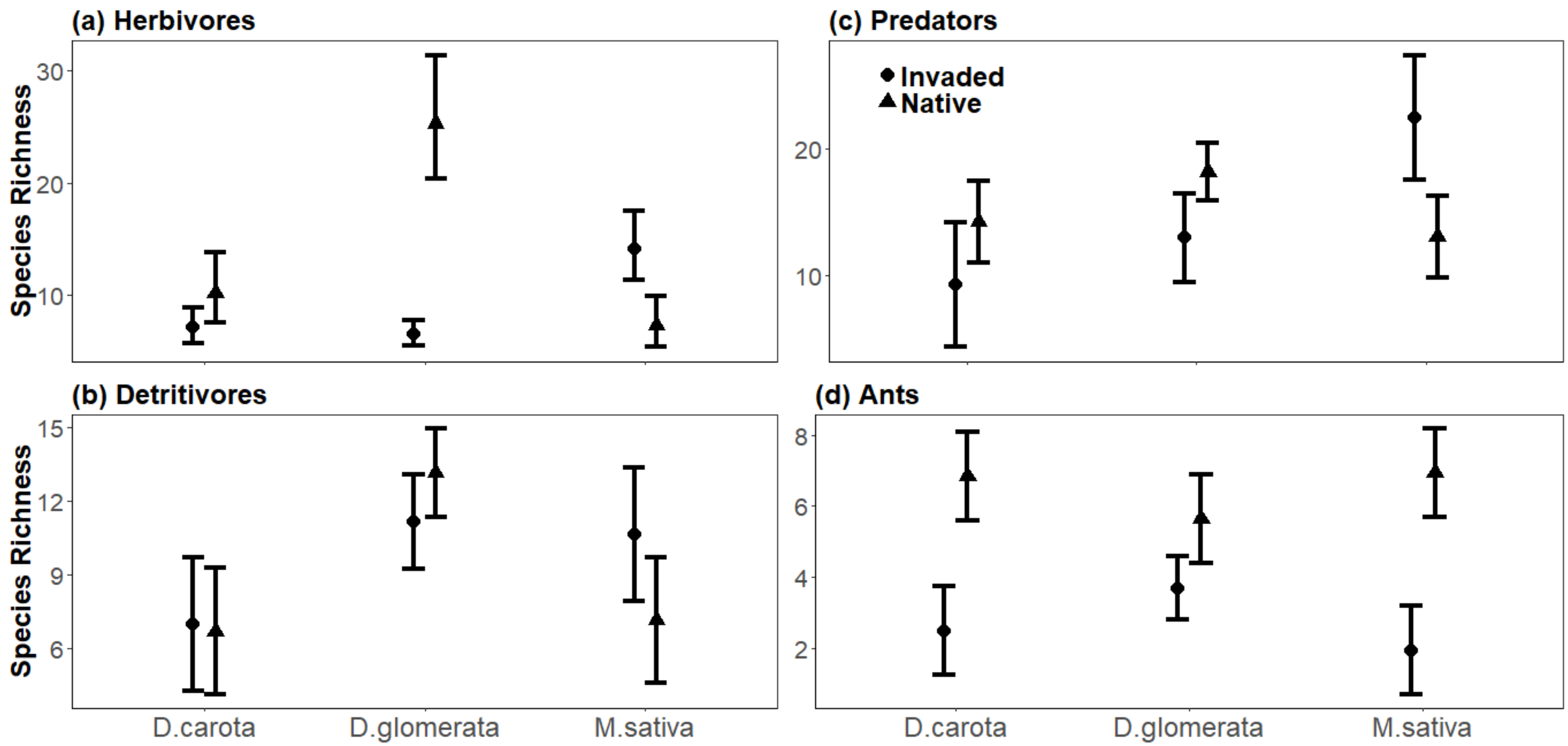

Figure 2.7. Least square means and 95% CIs (n = 20) for arthropod species richness (species/m^2), by functional group, for plant comparisons under the "low-high" scenario. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

* * * * *

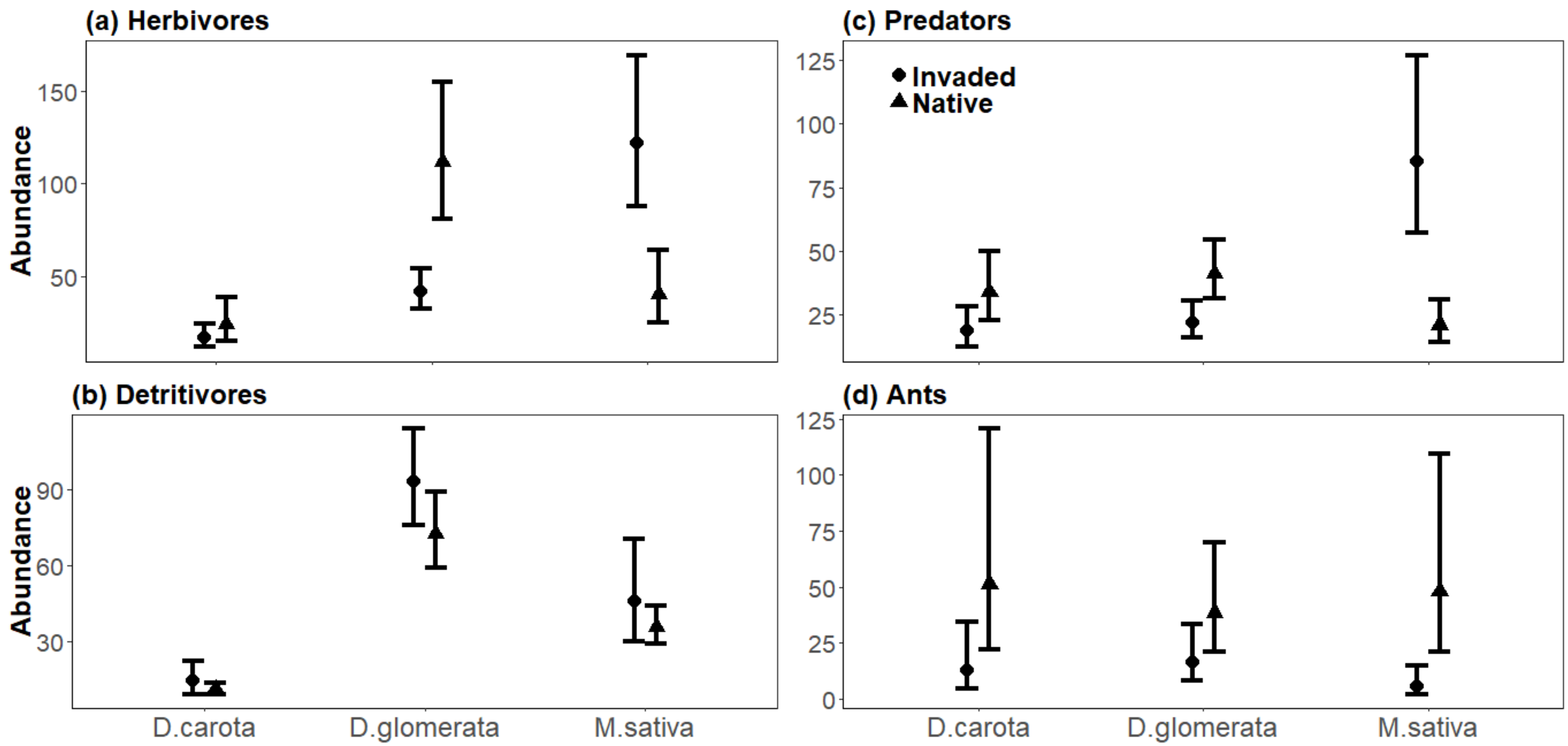

Figure 2.8. Least square means and 95% CIs (*n* = 20) for arthropod abundance (individuals/m^2), by functional group, for plant comparisons under the "low-high" scenario. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

*

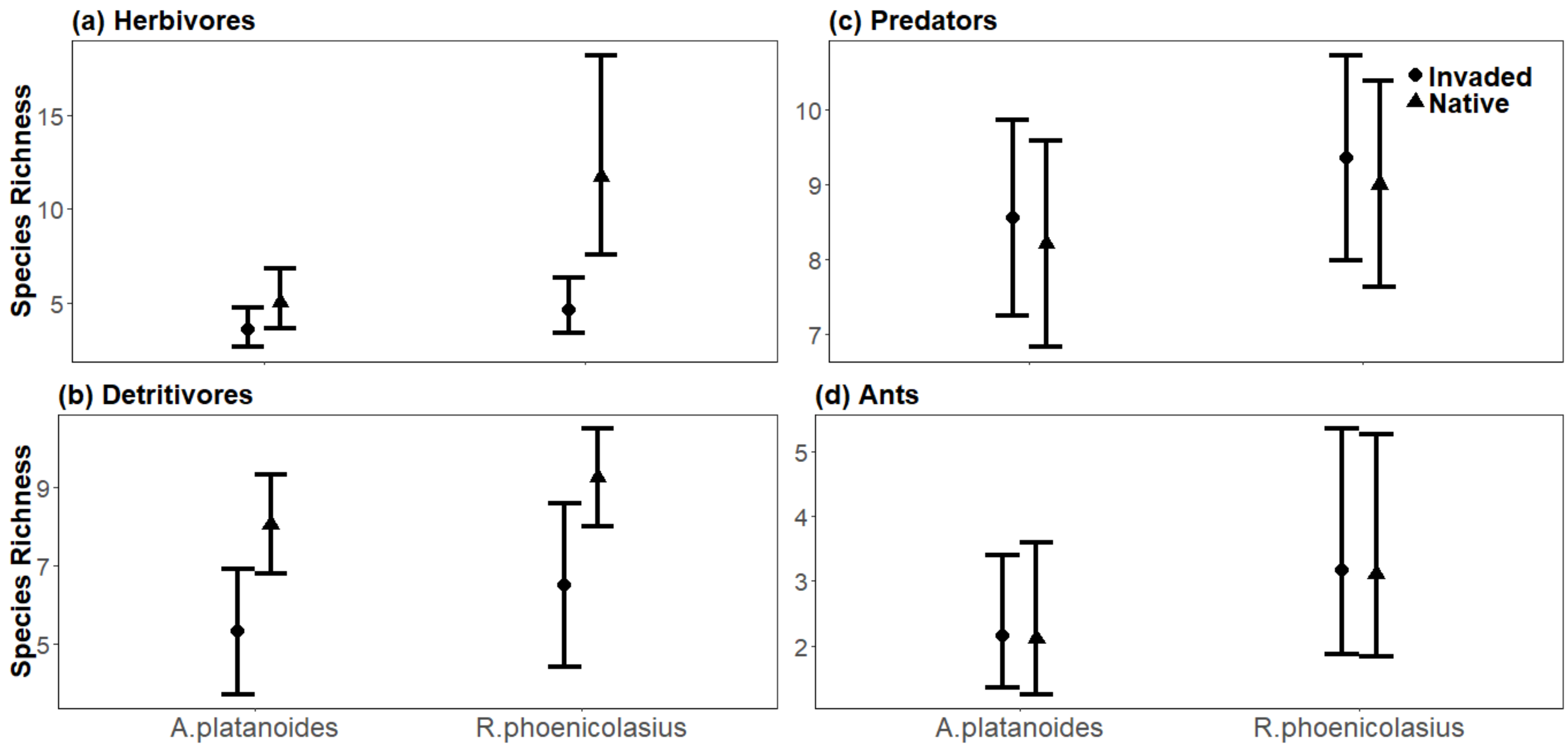

Figure 2.9. Least square means and 95% CIs (n = 20) for arthropod species richness (species/m^2), by functional group, for plant comparisons under the "high-high" scenario. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

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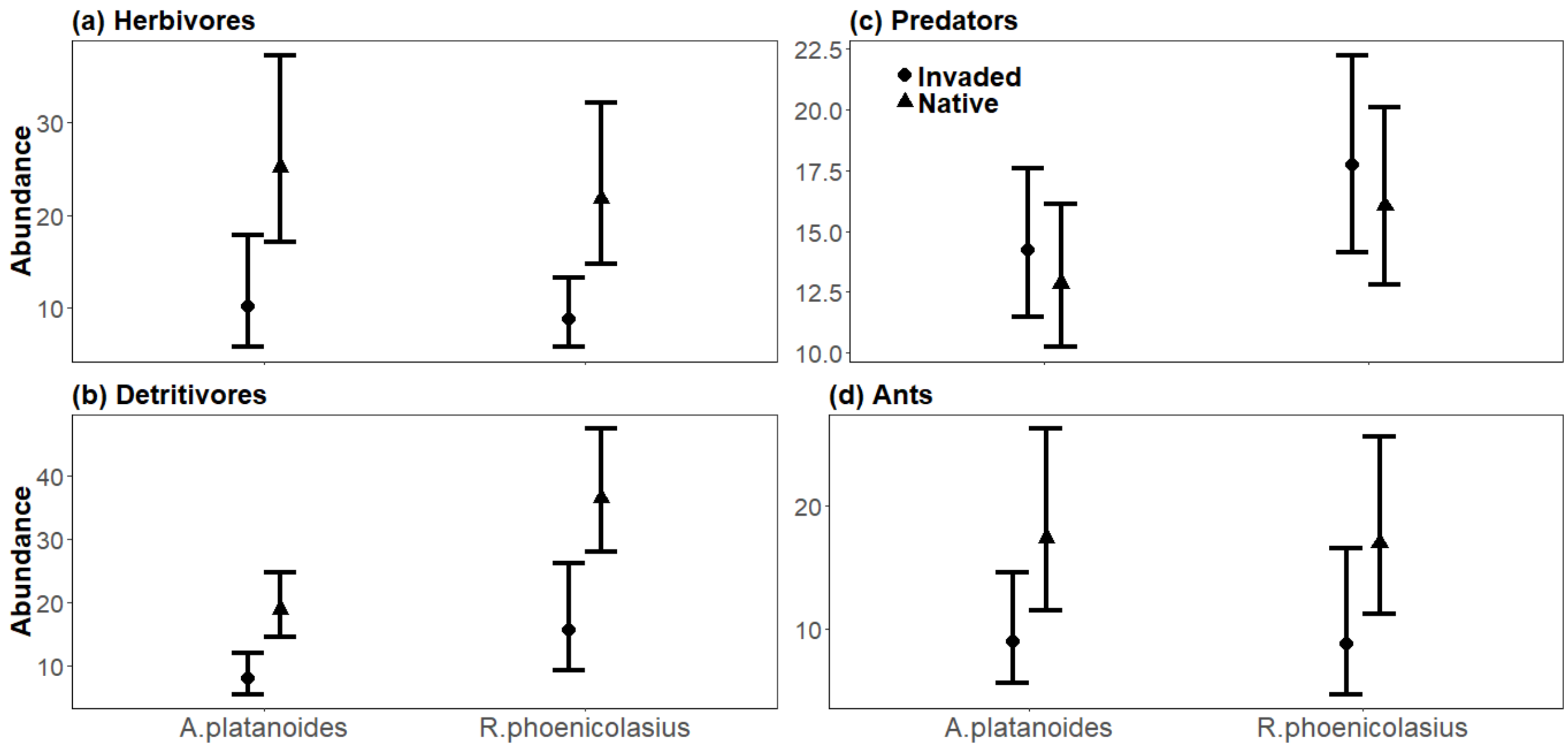

Figure 2.10. Least square means and 95% CIs (*n* = 20) for arthropod abundance (individuals/m^2), by functional group, for plant comparisons under the "high-high" scenario. Asterisks (*) note significance in plant origin based on Tukey HSD pairwise comparisons.

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APPENDIX A: LIST AND COMPOSITION OF VEGETATION SAMPLED FR THE SUMMER 2015 STUDY IN THE MID-ATLANTIC REGION OF THE UNITED STATES.

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Porcelain berry	1	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	85.71
		Asclepiadaceae	*Asclepias syriaca*	Common milkweed	3.81
		Nyssaceae	*Nyssa sylvatica*	Black tupelo	2.86
		Asteraceae	*Latuca canadensis*	Wild lettuce	2.86
		Rosaceae	*Rubus idaeus*	Raspberry	1.90
		Asteraceae	*Solidago canadensis*	Canada goldenrod	0.95
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	0.95
		Polygonaceae	*Persicaria perfoliata*	Mile-a-minute weed	0.95
	2	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	93.46
		Rosaceae	*Rubus idaeus*	Raspberry	3.74
		Rosaceae	*Rubus flagellaris*	Dewberry	1.87
		Asclepiadaceae	*Asclepias syriaca*	Common milkweed	0.93
	3	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	100.00
	4	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	83.33
		Apiaceae	*Daucus carota*	Queen Anne’s lace	5.67
		Fabaceae	*Trifolium pratense*	Red clover	3.54
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	3.54
		Rosaceae	*Rubus flagellaris*	Dewberry	1.76
		Convolvulaceae	*Convolvulus sepium*	Bindweed	0.89
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.53
		Convolvulaceae	*Ipomoea purpurea*	Morning glory	0.35
		Poaceae	*Panicum virgatum*	Switchgrass	0.35
	5	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	81.97
		Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	4.92
		Rosaceae	*Rosa multiflora*	Multiflora rose	3.28
		Rosaceae	*Rubus allegheniensis*	Blackberry	3.28

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Porcelain berry	5	Solanaceae	*Solanum carolinense*	Carolina horsenettle	3.28
		Vitaceae	*Vitis aestivalis*	Wild grape	2.46
	6	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	65.79
		Vitaceae	*Vitis aestivalis*	Wild grape	15.79
		Polygonaceae	*Persicaria perfoliata*	Mile-a-minute weed	12.50
		Rosaceae	*Rubus allegheniensis*	Blackberry	5.26
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	0.66
	1	Poaceae	*Sorghastrum nutans*	Indiangrass	50.55
		Poaceae	*Panicum virgatum*	Switchgrass	24.59
Native Comparison		Fabaceae	*Trifolium repens*	White clover	6.83
(Porcelain berry)		Poaceae	*Schizachyrium scoparium*	Little bluestem	6.83
		Poaceae	*Andropogon gerardi*	Big bluestem	5.46
		Fabaceae	*Trifolium pretense*	Red clover	3.42
		Solanaceae	*Solanum dulcamara*	Nightshade	1.37
		Apocynaceae	*Apocynum cannabinum*	Dogbane	0.68
		Fabaceae	*Desmodium canescens*	Beggar-ticks	0.14
		Asteraceae	*Solidago odora*	Sweet goldenrod	0.14
	2	Poaceae	*Sorghastrum nutans*	Indiangrass	69.09
		Poaceae	*Panicum virgatum*	Switchgrass	13.64
		Poaceae	*Andropogon gerardi*	Big bluestem	4.55
		Poaceae	*Setaria viridis*	Bristlegrass	4.55
		Poaceae	*Schizachyrium scoparium*	Little bluestem	1.82
		Fabaceae	*Desmodium canescens*	Beggar-ticks	0.91
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	0.91
	3	Poaceae	*Panicum virgatum*	Switchgrass	49.28
		Poaceae	*Setaria viridis*	Bristlegrass	14.34

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native Comparison (Porcelain berry)	3	Poaceae	*Sorghastrum nutans*	Indiangrass	12.54
		Fabaceae	*Trifolium pretense*	Red clover	8.96
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	5.38
		Asteraceae	*Cirsium arvense*	Canada thistle	4.84
		Fabaceae	*Trifolium repens*	White clover	3.58
		Oxalidaceae	*Oxalis stricta*	Woodsorrel	0.90
		Solanaceae	*Solanum dulcamara*	Nightshade	0.18
	4	Poaceae	*Andropogon virginicus*	Broomsedge	17.42
		Poaceae	*Schizachyrium scoparium*	Little bluestem	17.42
		Poaceae	*Sorghastrum nutans*	Indiangrass	15.68
		Poaceae	*Agrostis stolonifera*	Bentgrass	13.94
		Poaceae	*Panicum virgatum*	Switchgrass	12.20
		Cyperaceae	*Cyperus esculentus*	Yellow nutsedge	6.27
		Poaceae	*Poa pratensis*	Bluegrass	5.23
		Asteraceae	*Solidago odora*	Sweet goldenrod	3.48
		Asteraceae	*Ambrosia artemisiifolia*	Ragweed	1.74
		Plantaginaceae	*Plantago major*	Plantago	1.74
		Athyrioiceae	*Diplazium pycnocarpon*	Fern	0.87
		Rosaceae	*Rubus flagellaris*	Dewberry	0.87
		Asteraceae	*Achillea millefolium*	Common yarrow	0.87
		Poaceae	*Dactylis glomerata*	Orchardgrass	0.87
		Poaceae	*Elymus virginicus*	Virginia wildrye	0.87
		Poaceae	*Digitaria cognata*	Witchgrass	0.35
		Fabaceae	*Baptisia australis*	False indigo	0.18
	5	Poaceae	*Panicum virgatum*	Switchgrass	38.56
		Asteraceae	*Rudbeckia hirta*	Black-eyed susan	18.95
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	14.38
		Fabaceae	*Trifolium pratense*	Eastern red clover	11.11
		Oxalidaceae	*Oxalis stricta*	Woodsorrel	7.19

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native Comparison (Porcelain berry)	5	Fabaceae	*Trifolium repens*	White clover	3.27
		Poaceae	*Andropogon gerardi*	Big bluestem	1.96
		Brassicaceae	*Lepidium virginicus*	Virginia pepperweed	1.95
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	1.31
		Amaryllidaceae	*Allium canadense*	Wild onion	0.65
	6	Asteraceae	*Solidago canadensis*	Canada goldenrod	39.22
		Asteraceae	*Rudbeckia hirta*	Black-eyed susan	22.48
		Asteraceae	*Solidago hispida*	Hairy goldenrod	16.97
		Fabaceae	*Trifolium pratense*	Red clover	9.74
		Brassicaceae	*Lepidium virginicus*	Virginia pepperweed	8.60
		Asteraceae	*Solidago gigantean*	Giant goldenrod	1.72
		Fabaceae	*Chamaecrista fasciculata*	Partridge pea	0.57
		Poaceae	*Dactylis glomerata*	Orchardgrass	0.57
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	0.11
Orchardgrass	1	Poaceae	*Dactylis glomerata*	Orchardgrass	74.80
		Apiaceae	*Daucus carota*	Queen Anne’s lace	10.24
		Lamiaceae	*Monarda fistulosa*	Beebalm	9.84
		Solanaceae	*Solanum dulcamara*	Nightshade	2.95
		Oxalidaceae	*Oxalis stricta*	Woodsorrel	1.97
		Rosaceae	*Pyrus calleryensis*	Callery pear	0.20
	2	Poaceae	*Dactylis glomerata*	Orchardgrass	97.62
		Apiaceae	*Daucus carota*	Queen Anne’s lace	1.98
		Poaceae	*Festuca rubra*	Creeping red fescue	0.40

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Orchardgrass	3	Poaceae	*Dactylis glomerata*	Orchardgrass	93.20
		Amaranthaceae	*Amaranthus hybridus*	Smooth pigweed	2.91
		Asteraceae	*Taraxacum officinale*	Common dandelion	1.94
		Fabaceae	*Trifolium pretense*	Eastern red clover	0.97
		Convolvulaceae	*Convolvulus sepium*	Bindweed	0.58
		Convolvulaceae	*Ipomoea purpurea*	Morning glory	0.19
	4	Poaceae	*Dactylis glomerata*	Orchardgrass	90.52
		Bignoniaceae	*Campsis radicans*	Trumpet vine	3.02
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	3.02
		Euphorbiaceae	*Euphorbia* sp.	Euphorbia	2.02
		Fabaceae	*Chamaecrista fasciculata*	Partridge pea	1.01
		Pinaceae	*Pinus palustris*	Longleaf pine	0.20
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.20
	5	Poaceae	*Dactylis glomerata*	Orchardgrass	84.43
		Poaceae	*Festuca rubra*	Creeping red fescue	5.63
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	4.69
		Solanaceae	*Solanum carolinense*	horsenettle	3.94
		Fabaceae	*Lepedeza bicolor*	Shrub lespedeza	1.13
		Apocynaceae	*Apocynum androsaemifolium*	Dogbane	0.19
	6	Poaceae	*Dactylis glomerata*	Orchardgrass	82.49
		Poaceae	*Festuca rubra*	Creeping red fescue	8.42
		Poaceae	*Setaria italica*	Foxtail millet	4.71
		Solanaceae	*Solanum carolinense*	Horsenettle	2.69
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	1.68
Native comparison (Orchardgrass)	1	Poaceae	*Sorghastrum nutans*	Indiangrass	42.91
		Poaceae	*Panicum virgatum*	Switchgrass	41.04
		Apiaceae	*Daucus carota*	Queen Anne’s Lace	5.60

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	3.71
(Orchardgrass)		Poaceae	*Setaria italica*	Foxtail millet	2.80
	1	Poaceae	*Schizachyrium scoparium*	Little bluestem	0.93
		Poaceae	*Tridens flavus*	Purple tridens	0.93
		Fabaceae	*Trifolium pretense*	Eastern red clover	0.93
		Asteraceae	*Cirsium arvense*	Canada thistle	0.93
		Asclepiadaceae	*Asclepias syriaca*	Common milkweed	0.19
	2	Poaceae	*Panicum virgatum*	Switchgrass	36.43
		Poaceae	*Sorghastrum nutans*	Indiangrass	23.87
		Fabaceae	*Trifolium pretense*	Red clover	18.84
		Fabaceae	*Trifolium repens*	White clove	8.79
		Asteraceae	*Euthamia graminifolia*	Grassleaf goldenrod	5.65
		Fabaceae	*Desmodium canescens*	Beggar-ticks	3.77
		Apiaceae	*Heracleum maximum*	Cow parsnip	2.01
		Apiaceae	*Daucus carota*	Queen Anne's lace	0.63
	3	Fabaceae	*Trifolium pretense*	Red clover	43.20
		Poaceae	*Echinochloa crus-galli*	Barnyardgrass	36.18
		Poaceae	*Panicum virgatum*	Switchgrass	5.40
		Poaceae	*Festuca arundinaceae*	Tall fescue	5.40
		Poaceae	*Setaria italica*	Foxtail millet	3.24
		Fabaceae	*Trifolium repens*	White clover	1.08
		Asteraceae	*Taraxacum officinale*	Common dandelion	0.11
	4	Poaceae	*Andropogon gerardi*	Big bluestem	60.60
		Poaceae	*Andropogon virginicus*	Broomsedge	15.15
		Anacardiaceae	*Rhus glabra*	Smooth sumac	12.88
		Onagraceae	*Oenothera biennis*	Evening primrose	10.61
		Poaceae	*Panicum virgatum*	Switchgrass	0.76

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison (Orchardgrass)	5	Poaceae	*Panicum virgatum*	Switchgrass	46.27
		Asteraceae	*Euthamia graminifolia*	Grassleaf goldenrod	32.84
		Ranunculaceae	*Thalictrum thalictroides*	Meadow-rue	10.45
		Rosaceae	*Rubus idaeus*	Raspberry	4.48
		Asteraceae	*Engelmannia peristenia*	Engelmann daisy	5.97
	6	Poaceae	*Panicum virgatum*	Switchgrass	47.06
		Euphorbiaceae	*Croton monanthogynus*	Prairie tea	25.74
		Asteraceae	*Solidago canadensis*	Canada goldenrod	15.44
		Asteraceae	*Engelmannia peristenia*	Engelmann daisy	4.41
		Oxalidaceae	*Oxalis stricta*	woodsorrel	2.94
		Asteraceae	*Leucanthemum vulgare*	Oxeye daisy	2.21
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	1.47
		Onagraceae	*Oenothera biennis*	Evening primrose	0.74
Autumn olive	1	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	51.23
		Poaceae	*Dactylis glomerata*	Orchardgrass	34.83
		Rosaceae	*Rubus armeniacus*	Himalayan blackberry	3.07
		Rosaceae	*Rosa multiflora*	Multiflora rose	2.05
		Rosaceae	*Rubus idaeus*	Raspberry	2.05
		Lamiaceae	*Monarda fistulosa*	Beebalm	1.02
		Rosaceae	*Pyrus calleryensis*	Callery pear	1.02
		Asteraceae	*Euthamia graminifolia*	Grassleaf goldenrod	1.02
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	1.02
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	1.02
		Vitaceae	*Vitis labrusca*	Fox grape	0.51
		Fabaceae	*Lepedeza bicolor*	Shrub lepedeza	0.51
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	0.51
		Magnoliaceae	*Liriodendron tulipifera*	Tulip poplar	0.10

(Appendix A continued)

Community	*Site*	*Family*	*Species name*	*Common name*	*% individuals*
Autumn olive	2	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	52.36
		Poaceae	*Dactylis glomerata*	Orchardgrass	40.31
		Poaceae	*Festuca rubra*	Creeping red fescue	4.19
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	3.14
	3	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	76.39
		Poaceae	*Panicum virgatum*	Switchgrass	17.36
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	3.47
		Fabaceae	*Trifolium pratense*	Eastern red clover	1.74
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	0.35
		Bignoniaceae	*Campsis radicans*	Trumpet vine	0.35
		Fabaceae	*Vicia sativa*	Narrowleaf vetch	0.17
		Apiaceae	*Daucus carota*	Queen Anne's lace	0.17
	4	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	48.0
		Poaceae	*Dactylis glomerata*	Orchardgrass	12.49
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	10.09
		Rosaceae	*Rubus allegheniensis*	Blackberry	9.61
		Poaceae	*Festuca rubra*	Creeping red fescue	6.72
		Rosaceae	*Rubus flagellaris*	Dewberry	6.72
		Rosaceae	*Rosa multiflora*	Multiflora rose	2.88
		Rosaceae	*Pyrus calleryensis*	Callery pear	0.96
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	0.96
		Poaceae	*Festuca arundinaceae*	Tall fescue	0.96
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	0.48
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	<0.01
	5	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	71.95
		Poaceae	*Sorghastrum nutans*	Indiangrass	9.35
		Rosaceae	*Rubus idaeus*	Raspberry	5.04

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Autumn olive	5	Rosaceae	*Pyrus calleryensis*	Callery pear	3.60
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	3.60
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	2.16
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	2.16
		Asteraceae	*Cirsium virginianum*	Thistle	1.43
		Asteraceae	*Leucanthemum vulgare*	Oxeye daisy	0.72
	6	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	79.37
		Rosaceae	*Rubus phoenicolasius*	Wineberry	8.73
		Asteraceae	*Eupatorium perfoliatum*	Boneset	5.56
		Rosaceae	*Rosa multiflora*	Multiflora rose	3.17
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	0.79
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	0.79
Native comparison (Autumn olive)	1	Platanaceae	*Platanus occidentalis*	American sycamore	46.38
		Poaceae	*Dactylis glomerata*	Orchardgrass	28.76
		Rosaceae	*Rubus allegheniensis*	Blackberry	6.96
		Rosaceae	*Rubus flagellaris*	Dewberry	6.96
		Asteraceae	*Solidago odora*	Sweet goldenrod	6.49
		Lamiaceae	*Monarda fistulosa*	Beebalm	2.78
		Rosaceae	*Rosa multiflora*	Multiflora rose	0.93
		Onagraceae	*Oenothera biennis*	Evening primrose	<0.01
		Fabaceae	*Lepedeza bicolor*	Shrub lepedeza	<0.01
		Apiaceae	*Daucus carota*	Queen Anne’s lace	<0.01
	2	Fagaceae	*Quercus alba*	White oak	0.50
		Poaceae	*Dactylis glomerata*	Orchardgrass	46.5
		Asteraceae	*Solidago odora*	Sweet goldenrod	1.50
		Rosaceae	*Rubus allegheniensis*	Blackberry	1.00
		Rosaceae	*Rosa multiflora*	Multiflora rose	0.50
		Lamiaceae	*Monarda fistulosa*	Beebalm	0.50

(Appendix A continued)

Community	*Site*	*Family*	*Species name*	*Common name*	*% individuals*
Native comparison (Autumn olive)	2	Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	<0.01
	3	Rosaceae	*Prunus serotina*	Black cherry	31.54
		Poaceae	*Panicum virgatum*	Switchgrass	31.02
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	14.20
		Anacardiaceae	*Rhus glabra*	Smooth sumac	10.51
		Anacardiaceae	*Rhus typhina*	Staghorn sumac	10.51
		Myricaceae	*Myrica pensylvanica*	Wax myrtle	1.58
		Fabaceae	*Vicia sativa*	Narrowleaf vetch	0.53
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	0.10
	4	Oleaceae	*Fraxinus americana*	White ash	47.78
		Poaceae	*Dactylis glomerata*	Orchardgrass	33.87
		Rosaceae	*Rubus allegheniensis*	Blackberry	4.79
		Rosaceae	*Rubus flagellaris*	Dewberry	3.82
		Aceraceae	*Acer rubrum*	Red maple	2.39
		Rosaceae	*Rosa multiflora*	Multiflora rose	1.91
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	1.91
		Fabaceae	*Lepedeza bicolor*	Shrub lepedeza	1.91
		Asteraceae	*Solidago canadensis*	Canada goldenrod	0.95
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.57
		Asclepiadaceae	*Asclepias syriaca*	Common milkweed	0.48
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	0.48
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	0.48
	5	Salicaceae	*Salix nigra*	Black willow	53.48
		Cyperaceae	*Cyperus esculentus*	Yellow nutsedge	26.20
		Asteraceae	*Helianthus tuberosa*	Jerusalem artichoke	11.76
		Poaceae	*Echinochloa crus-galli*	Barnyardgrass	3.21
		Polygonaceae	*Polygonum pensylvanicum*	Pink smartweed	3.21
		Poaceae	*Panica dichotomiflorum*	Fall panicum	2.14

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison (Autumn olive)	6	Nyssaceae	*Nyssa sylvatica*	Black tupelo	30.74
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	24.59
		Asteraceae	*Solidago canadensis*	Canada goldenrod	12.37
		Platanaceae	*Platanus occidentalis*	American sycamore	11.34
		Rosaceae	*Prunus serotine*	Black cherry	10.31
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	4.61
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	4.10
		Asteraceae	*Symphyotrichum ericoides*	Heath aster	1.02
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.51
Japanese knotweed	1	Polygonaceae	*Fallopia japonica*	Japanese knotweed	72.00
		Poaceae	*Panicum virgatum*	Switchgrass	10.00
		Poaceae	*Sorghum halepense*	Johnsongrass	6.00
		Oxalidaceae	*Oxalis stricta*	Woodsorrel	6.00
		Poaceae	*Dactylis glomerata*	Orchardgrass	5.00
		Poaceae	*Festuca rubra*	Creeping red fescue	1.00
	2	Polygonaceae	*Fallopia japonica*	Japanese knotweed	44.84
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	23.54
		Fabaceae	*Melilotus officinalis*	Yellow sweetclover	5.72
		Fabaceae	*Trifolium pretense*	Eastern red clover	4.60
		Caprifoliaceae		Bush honeysuckle	4.48
		Asclepiadaceae	*Asclepias syriaca*	Common milkweed	2.24
		Poaceae	*Phalaris arundinacea*	Reed canarygrass	2.24
		Asteraceae	*Lactuca canadensis*	Wild lettuce	2.24
		Athyrioiceae	*Diplazium pycnocarpon*	Fern	1.79
		Asteraceae	*Leucanthemum vulgare*	Oxeye daisy	1.23
		Asteraceae	*Eupatorium capillifolium*	Dogfennel	1.12
		Anacardiaceae	*Rhus glabra*	Smooth sumac	1.12
		Commelinaceae	*Commelina erecta*	Dayflower	1.12
		Oxalidaceae	*Oxalis stricta*	Woodsorrel	1.12

(Appendix A continued)

Community	Site	Family	Species name	Common name	% individuals
Japanese knotweed	2	Rosaceae	*Rubus allegheniensis*	Blackberry	0.56
		Rosaceae	*Rubus flagellaris*	Dewberry	0.56
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	0.56
		Scrophulariaceae	*Verbascum thapsus*	Woolly mullein	0.56
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	0.11
		Asteraceae	*Symphyotrichum novae-angliae*	New England aster	0.11
		Asteraceae	*Cirsium virginianum*	Thistle	0.11
	3	Polygonaceae	*Fallopia japonica*	Japanese knotweed	99.00
		Fabaceae	*Melilotus officinalis*	Yellow sweetclover	1.00
	4	Polygonaceae	*Fallopia japonica*	Japanese knotweed	80.72
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	13.18
		Balsaminaceae	*Impatiens capensis*	Jewelweed	3.29
		Platanaceae	*Platanus occidentalis*	American sycamore	1.65
		Fabaceae	*Robinia pseudoacacia*	Black locust	0.82
		Vitaceae	*Vitis vulpine*	Wild grape	0.33
	5	Polygonaceae	*Fallopia japonica*	Japanese knotweed	90.09
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	8.11
		Araliaceae	*Aralia elata*	Japanese Angelica tree	1.8
		Amaranthaceae	*Froelichia gracilis*	Snakecotton	1.8
	6	Polygonaceae	*Fallopia japonica*	Japanese knotweed	73.96
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	17.01
		Balsaminaceae	*Impatiens capensis*	Jewelweed	4.44
		Polygonaceae	*Persicaria perfoliata*	Mile-a-minute weed	2.96
		Urticaceae	*Urtica dioica*	Stinging nettle	1.48
		Vitaceae	*Vitis vulpine*	Wild grape	0.15

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison	1	Poaceae	Schizachyrium scoparium	Little bluestem	62.79
(Japanese knotweed)		Poaceae	Sorghastrum nutans	Indiangrass	17.27
		Poaceae	Poa pratensis	Bluegrass	10.99
		Poaceae	Panicum virgatum	Switchgrass	3.14
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	1.57
		Poaceae	Elymus virginicus	Virginia wildrye	1.57
		Fabaceae	Baptisia australis	False indigo	0.78
		Rosaceae	*Rubus allegheniensis*	Blackberry	0.16
		Equisetaceae	Equisetum sp.	Horsetail	0.16
	2	Poaceae	Panicum virgatum	Switchgrass	33.83
		Oxalidaceae	Oxalis stricta	Woodsorrel	11.72
		Poaceae	Sorghastrum nutans	Indiangrass	9.09
		Poaceae	Andropogon virginicus	Broomsedge	8.25
		Asteraceae	Solidago bicolor	Silver goldenrod	5.78
		Poaceae	Andropogon gerardi	Big bluestem	4.13
		Asteraceae	Ambrosia artemisiifolia	Common ragweed	4.13
		Poaceae	Tridens flavus	Purple tridens	4.13
		Plantaginaceae	Plantago major	Plantago	3.30
		Fabaceae	Trifolium pretense	Eastern red clover	2.64
		Asteraceae	Rudbeckia hirta	Black-eyed susan	2.48
		Asteraceae	Euthamia graminifolia	Grassleaf goldenrod	2.48
		Polygonaceae	Polygonum pensylvanicum	Pink smartweed	1.65
		Poaceae	Setaria italica	Foxtail millet	0.83
		Solanaceae	*Solanum carolinense*	Horsenettle	0.83
		Fabaceae	Senna hebecarpa	Wild senna	0.83
		Poaceae	Digitaria cognata	witchgrass	0.83
		Celastraceae	Celastrus orbiculatus	Oriental bittersweet	0.33
		Poaceae	Lolium multiflorum	Italian ryegrass	0.17
		Apiaceae	Daucus carota	Queen Anne’s lace	0.17

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison (Japanese knotweed)	3	Poaceae	*Schizachyrium scoparium*	Little bluestem	62.96
		Poaceae	*Panicum virgatum*	Switchgrass	11.11
		Poaceae	*Sorghastrum nutans*	Indiangrass	8.33
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	4.63
		Fabaceae	*Trifolium pretense*	Red clover	4.63
		Oxalidaceae	*Oxalis stricta*	Woodsorrel	3.70
		Plantaginaceae	*Plantago major*	Plantago	1.85
		Fabaceae	*Baptisia australis*	False indigo	0.93
		Asteraceae	*Solidago bicolor*	Silver goldenrod	0.93
		Poaceae	*Elymus virginicus*	Virginia wildrye	0.93
	4	Poaceae	*Panicum virgatum*	Switchgrass	34.01
		Apiaceae	*Daucus carota*	Queen Anne's lace	22.11
		Poaceae	*Schizachyrium scoparium*	Little bluestem	15.31
		Asteraceae	*Echinacea purpurea*	Purple coneflower	7.65
		Apocynaceae	*Apocynum cannabinum*	Dogbane	5.10
		Solanaceae	*Solanum carolinense*	Horsenettle	3.57
		Asteraceae	*Rudbeckia hirta*	Black-eyed susan	1.70
		Fabaceae	*Senna hebecarpa*	Wild senna	1.70
		Asclepiadaceae	*Asclepias syriaca*	Common milkweed	0.17
		Fabaceae	*Trifolium pretense*	Red clover	0.17
	5	Poaceae	*Panicum virgatum*	Switchgrass	57.07
		Poaceae	*Sorghastrum nutans*	Indiangrass	23.55
		Poaceae	*Schizachyrium scoparium*	Little bluestem	9.06
		Asteraceae	*Echinacea purpurea*	Purple coneflower	4.53
		Asteraceae	*Leucanthemum vulgare*	Oxeye daisy	1.81
		Fabaceae	*Melilotus officinalis*	Yellow sweetclover	1.81
		Poaceae	*Elymus virginicus*	Virginia wildrye	1.27
		Solanaceae	*Datura stramonium*	Jimsonweed	0.91

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison (Japanese knotweed)	6	Poaceae	*Sorghastrum nutans*	Indiangrass	50.77
		Poaceae	*Panicum virgatum*	Switchgrass	23.95
		Poaceae	*Andropogon gerardi*	Big bluestem	18.94
		Apiaceae	*Daucus carota*	Queen Anne's Lace	4.02
		Solanaceae	*Solanum dulcamara*	nightshade	0.19
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	0.19
Bush honeysuckle	1	Caprifoliaceae	*Lonicera morrowii*	Bush honeysuckle	87.00
		Asteraceae	*Solidago bicolor*	Silver goldenrod	5.42
		Rosaceae	*Rubus allegheniensis*	Blackberry	2.72
		Myricaceae	*Myrica pensylvanica*	Wax myrtle	2.72
		Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	1.81
	2	Caprifoliaceae	*Lonicera morrowii*	Bush honeysuckle	94.19
		Apiaceae	*Daucus carota*	Queen Anne's lace	2.33
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	2.33
		Anacardiaceae	*Rhus glabra*	Smooth sumac	1.16
	3	Caprifoliaceae	*Lonicera morrowii*	Bush honeysuckle	70.92
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	12.77
		Brassicaceae	*Alliaria petiolata*	Garlic mustard	4.26
		Juglandaceae	*Juglans nigra*	Black walnut	3.54
		Rosaceae	*Rubus armeniacus*	Himalayan blackberry	3.54
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	3.54
		Asteraceae	*Eupatorium purpureum*	Joe-pye weed	1.42
	4	Caprifoliaceae	*Lonicera maackii*	Bush honeysuckle	91.74
		Rosaceae	*Rosa multiflora*	Multiflora rose	7.34
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	0.92

(Appendix A continued)

Community	Site	Family	Species name	Common name	% individuals
Bush honeysuckle	5	Caprifoliaceae	*Lonicera maackii*	Bush honeysuckle	54.95
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	41.76
		Phytolaccaceae	*Phytolacca rigida*	Pokeberry	2.20
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	1.10
	6	Caprifoliaceae	*Lonicera maackii*	Bush honeysuckle	86.14
		Asteraceae	*Solidago canadensis*	Canada goldenrod	7.91
		Rosaceae	*Rubus allegheniensis*	Blackberry	3.95
		Phytolaccaceae	*Phytolacca rigida*	Pokeberry	1.98
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	0.20
Native comparison (Bush honeysuckle)	1	Anacardiaceae	*Rhus copallinum*	Winged sumac	36.64
		Poaceae	*Panicum virgatum*	Switchgrass	25.42
		Adoxaceae	*Viburnum dentatum*	Arrowood viburnum	11.82
		Myricaceae	*Myrica pensylvanica*	Wax myrtle	11.82
		Poaceae	*Sorghastrum nutans*	Indiangrass	7.68
		Asteraceae	*Eupatorium perfoliatum*	Boneset	3.55
		Juncacea	*Juncus tenuis*	Common rush	1.77
		Polygonaceae	*Persicaria perfoliata*	Mile-a-minute weed	0.59
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.59
		Convolvulaceae	*Convolvulus sepium*	Bindweed	0.12
	2	Rosaceae	*Prunus serotina*	Black cherry	48.90
		Poaceae	*Panicum virgatum*	Switchgrass	12.97
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	7.98
		Rosaceae	*Rubus allegheniensis*	Blackberry	7.49
		Rosaceae	*Rubus flagellaris*	Dewberry	5.99
		Myricaceae	*Myrica pensylvanica*	Wax myrtle	3.99
		Apiaceae	*Daucus carota*	Queen Anne’s lace	3.49
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	3.09
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	2.99

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison	2	Poaceae	*Festuca rubra*	Creeping red fescue	2.00
(Bush honeysuckle)		Poaceae	*Poa pratensis*	Bluegrass	1.00
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	<0.01
	3	Rosaceae	*Prunus serotina*	Black cherry	31.58
		Aquafoliaceae	*Ilex verticillata*	Winterberry	25.79
		Asteraceae	*Solidago canadensis*	Canada goldenrod	12.63
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	12.11
		Rosaceae	*Rubus allegheniensis*	Blackberry	7.37
		Rosaceae	*Rosa multiflora*	Multiflora rose	6.32
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	3.58
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	0.53
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.53
	4	Altingiaceae	*Liquidambar styraciflua*	American sweetgum	57.79
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	22.42
		Fagaceae	*Quercus virginiana*	Live oak	14.95
		Caprifoliaceae	*Lonicera morrowii*	Bush honeysuckle	1.49
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	1.05
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	0.30
	5	Fagaceae	*Fagus grandifolia*	American beech	23.49
		Fagaceae	*Quercus virginiana*	Live oak	17.07
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	17.07
		Altingiaceae	*Liquidambar styraciflua*	American sweetgum	12.20
		Fagaceae	*Quercus velutina*	Black oak	12.20
		Smilacaceae	*Smilax rotundifolia*	Greenbrier	3.66
		Fagaceae	*Quercus palustris*	Pin oak	3.66
		Lauraceae	*Sassafras albidum*	Sassafras	3.66
		Simaroubaceae	*Alianthus altissima*	Tree of heaven	3.05
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	1.83

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native Comparison (Bush honeysuckle)	5	Athyrioiceae	*Diplazium pycnocarpon*	Fern	1.22
	6	Altingiaceae	*Liquidambar styraciflua*	American sweetgum	26.99
		Rosaceae	*Prunus serotine*	Black cherry	17.54
		Rosaceae	*Rubus allegheniensis*	Blackberry	14.17
		Fagaceae	*Quercus virginiana*	Live oak	13.50
		Clethraceae	*Clethra alnifolia*	Sweet clethra	9.45
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	6.75
		Asteraceae	*Solidago canadensis*	Canada goldenrod	4.05
		Cornaceae	*Cornus sericea*	Red-osier dogwood	3.37
		Rosaceae	*Rosa multiflora*	Multiflora rose	2.02
		Platanaceae	*Platanus occidentalis*	American sycamore	0.67
		Solanaceae	*Solanum carolinense*	Horsenettle	0.67
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	0.67
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.13
Japanese stiltgrass	1	Poaceae	*Microstegium vimineum*	Japanese stiltgrass	92.93
		Berberidaceae	*Podophyllum peltatum*	Mayapple	5.45
		Rosaceae	*Fragaria virginiana*	Wild strawberry	1.01
		Rosaceae	*Rubus allegheniensis*	Blackberry	0.20
		Balsaminaceae	*Impatiens capensis*	Jewelweed	0.20
		Polygonaceae	*Polygonum pensylvanicum*	Pink smartweed	0.20
	2	Poaceae	*Microstegium vimineum*	Japanese stiltgrass	99.01
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	0.99
	3	Poaceae	*Microstegium vimineum*	Japanese stiltgrass	88.82
		Polygonaceae	*Polygonum pensylvanicum*	Pinksmartweed	10.98
		Berberidaceae	*Podophyllum peltatum*	Mayapple	0.20

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Japanese stiltgrass	4	Poaceae	*Microstegium vimineum*	Japanese stiltgrass	94.81
		Polygonaceae	*Polygonum pensylvanicum*	Pink smartweed	3.99
		Asteraceae	*Achillea millefolium*	Common yarrow	1.00
		Fagaceae	*Quercus velutina*	Black oak	0.2
	5	Poaceae	*Microstegium vimineum*	Japanese stiltgrass	91.84
		Polygonaceae	*Polygonum pensylvanicum*	Pink smartweed	4.08
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	2.04
		Fabaceae	*Robinia pseudoacacia*	Black locust	1.02
		Moraceae	*Morus alba*	White mulberry	1.02
	6	Poaceae	*Microstegium vimineum*	Japanese stiltgrass	92.00
		Polygonaceae	*Polygonum pensylvanicum*	Smartweed	8.00
Native comparison (Japanese stiltgrass)	1	Poaceae	*Schizachyrium scoparium*	Little bluestem	51.89
		Brassicaceae	*Lepidium virginicus*	Virginia pepperweed	17.53
		Poaceae	*Digitaria cognata*	witchgrass	11.22
		Euphorbiaceae	*Croton monanthogynus*	Prairie tea	9.26
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	6.31
		Bignoniaceae	*Campsis radicans*	Trumpet vine	2.10
		Poaceae	*Setaria italica*	Foxtail millet	1.40
		Poaceae	*Andropogon virginicus*	Broomsedge	0.28
	2	Poaceae	*Schizachyrium scoparium*	Little bluestem	47.34
		Brassicaceae	*Lepidium virginicus*	Virginia pepperweed	15.78
		Poaceae	*Andropogon virginicus*	Broomsedge	14.20
		Poaceae	*Panicum virgatum*	Switchgrass	11.83
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	7.89
		Euphorbiaceae	*Croton monanthogynus*	Prairie tea	1.97
		Fabaceae	*Chamaecrista fasciculata*	Partridge pea	0.99

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison	3	Poaceae	*Schizachyrium scoparium*	Little bluestem	76.42
(Japanese stiltgrass)		Poaceae	*Digitaria cognate*	witchgrass	23.58
	4	Poaceae	*Schizachyrium scoparium*	Little bluestem	53.46
		Asteraceae	*Euthamia graminifolia*	Grassleaf goldenrod	16.51
		Fabaceae	*Rubus allegheniensis*	Blackberry	7.86
		Rosaceae	*Prunus serotina*	Black cherry	4.72
		Euphorbiaceae	*Croton monanthogynus*	Prairie tea	4.72
		Poaceae	*Sorghastrum nutans*	Indiangrass	3.93
		Asteraceae	*Achillea millefolium*	Common yarrow	3.14
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	2.36
		Fabaceae	*Lepedeza bicolor*	Shrub lepedeza	1.73
		Apocynaceae	*Apocynum cannabinum*	Dogbane	0.79
		Fabaceae	*Chamaecrista fasciculata*	Partridge pea	0.79
	5	Poaceae	*Panicum virgatum*	Switchgrass	45.53
		Poaceae	*Sorghastrum nutans*	Indiangrass	32.97
		Asteraceae	*Euthamia graminifolia*	Grassleaf goldenrod	6.44
		Poaceae	*Setaria viridis*	Bristlegrass	5.49
		Fabaceae	*Trifolium pretense*	Eastern red clover	3.92
		Rosaceae	*Fragaria virginiana*	Wild strawberry	3.14
		Asteraceae	*Achillea millefolium*	Common yarrow	0.78
		Apiaceae	*Daucus carota*	Queen Anne’s lace	0.78
		Oxalidaceae	*Oxalis stricta*	Woodsorrel	0.78
		Asteraceae	*Eupatorium perfoliatum*	Boneset	0.16
	6	Poaceae	*Panicum virgatum*	Switchgrass	53.94
		Poaceae	*Sorghastrum nutans*	Indiangrass	30.82
		Poaceae	*Schizachyrium scoparium*	Little bluestem	4.30
		Asteraceae	*Solidago bicolor*	Silver goldenrod	4.28
		Apiaceae	*Daucus carota*	Queen Anne’s lace	2.57

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison	6	Hypericaceae	*Hypericum perforatum*	St. John's wort	2.57
(Japanese stiltgrass)		Poaceae	*Elymus virginicus*	Virginia wildrye	0.86
		Asteraceae	*Leucanthemum vulgare*	Oxeye daisy	0.34
		Fabaceae	*Desmodium canescens*	Beggar-ticks	0.17
		Asteraceae	*Cirsium virginianum*	Thistle	0.17
Callery pear	1	Rosaceae	*Pyrus calleryensis*	Callery pear	49.47
		Poaceae	*Dactylis glomerata*	Orchardgrass	24.47
		Poaceae	*Festuca rubra*	Creeping red fescue	10.64
		Poaceae	*Panicum virgatum*	Switchgrass	4.26
		Asteraceae	*Achillea millefolium*	Common yarrow	4.26
		Rosaceae	*Rubus flagellaris*	Dewberry	2.66
		Apiaceae	*Daucus carota*	Queen Anne's lace	2.13
		Rosaceae	*Rubus allegheniensis*	Blackberry	1.60
		Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	0.53
	2	Rosaceae	*Pyrus calleryensis*	Callery pear	54.49
		Poaceae	*Dactylis glomerata*	Orchardgrass	17.42
		Poaceae	*Festuca rubra*	Creeping red fescue	11.80
		Asteraceae	*Achillea millefolium*	Common yarrow	3.37
		Lamiaceae	*Monarda punctata*	Horsemint	2.81
		Rosaceae	*Rubus flagellaris*	Dewberry	2.25
		Asteraceae	*Solidago canadensis*	Canada goldenrod	1.69
		Poaceae	*Panicum virgatum*	Switchgrass	1.69
		Fabaceae	*Cercis canadensis*	Eastern redbud	1.12
		Rosaceae	*Rosa multiflora*	Multiflora rose	1.12
		Asclepiadaceae	*Asclepias syriaca*	Common milkweed	0.56
		Apiaceae	*Daucus carota*	Queen Anne's lace	0.56
		Fabaceae	*Lepedeza bicolor*	Shrub lepedeza	0.56
		Magnoliaceae	*Liriodendron tulipifera*	Tulip poplar	0.56

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Callery pear	3	Rosaceae	*Pyrus calleryensis*	Callery pear	66.01
		Poaceae	*Dactylis glomerata*	Orchardgrass	17.61
		Poaceae	*Festuca rubra*	Creeping red fescue	5.81
		Rosaceae	*Rosa multiflora*	Multiflora rose	5.65
		Poaceae	*Lolium multiflorum*	Italian ryegrass	4.91
	4	Rosaceae	*Pyrus calleryensis*	Callery pear	54.81
		Asteraceae	*Solidago canadensis*	Canada goldenrod	34.71
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	8.54
		Asteraceae	*Centaurea maculosa*	Spotted knapweed	1.83
		Asteraceae	*Xanthium strumarium*	Cocklebur	0.12
	5	Rosaceae	*Pyrus calleryensis*	Callery pear	57.29
		Asteraceae	*Solidago canadensis*	Canada goldenrod	37.36
		Rosaceae	*Rubus idaeus*	Raspberry	4.98
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	0.25
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	0.12
	6	Rosaceae	*Pyrus calleryensis*	Callery pear	57.14
		Poaceae	*Sorghastrum nutans*	Indiangrass	27.88
		Asteraceae	*Solidago odora*	Sweet goldenrod	7.27
		Fabaceae	*Coronilla varia*	Crown vetch	4.85
		Poaceae	*Tridens flavus*	Purple tridens	3.03
		Rosaceae	*Rubus idaeus*	Raspberry	2.42
Native comparison (Callery pear)	1	Platanaceae	*Platanus occidentalis*	American sycamore	47.71
		Poaceae	*Dactylis glomerata*	Orchardgrass	28.15
		Asteraceae	*Solidago odora*	Sweet goldenrod	5.34
		Rosaceae	*Rosa multiflora*	Multiflora rose	4.29
		Rosaceae	*Rubus allegheniensis*	Blackberry	3.89
		Poaceae	*Festuca rubra*	Creeping red fescue	2.86

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison (Callery pear)	1	Lamiaceae	*Monarda fistulosa*	Beebalm	2.00
		Rosaceae	*Pyrus calleryensis*	Callery pear	1.43
		Rosaceae	*Rubus flagellaris*	Dewberry	0.95
		Magnoliaceae	*Liriodendron tulipifera*	Tulip poplar	0.95
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.48
		Apiaceae	*Daucus carota*	Queen Anne's lace	<0.01
	2	Fagaceae	*Quercus montana*	Chestnut oak	49.35
		Poaceae	*Dactylis glomerata*	Orchardgrass	28.63
		Poaceae	*Festuca rubra*	Creeping red fescue	12.83
		Rosaceae	*Rosa multiflora*	Multiflora rose	4.94
		Asteraceae	*Solidago odora*	Sweet goldenrod	1.97
		Amaryllidaceae	*Allium canadense*	Wild onion	0.99
		Lamiaceae	*Monarda fistulosa*	Beebalm	0.59
		Apiaceae	*Daucus carota*	Queen Anne's lace	0.59
		Vitaceae	*Vitis aestivalis*	Wild grape	<0.01
	3	Oleaceae	*Fraxinus americana*	White ash	34.28
		Poaceae	*Dactylis glomerata*	Orchardgrass	14.29
		Aceraceae	*Acer rubrum*	Red maple	12.57
		Rosaceae	*Malus angustifolia*	Southern crabapple	11.43
		Poaceae	*Festuca rubra*	Creeping red fescue	10.86
		Rosaceae	*Rubus allegheniensis*	Blackberry	8.00
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	4.57
		Asteraceae	*Solidago odra*	Sweet goldenrod	4.00
	4	Altingiaceae	*Liquidambar styraciflua*	American sweetgum	37.97
		Asteraceae	*Solidago canadensis*	Canada goldenrod	35.44
		Rosaceae	*Crataegus* sp.	American hawthorn	12.66
		Rosaceae	*Rubus allegheniensis*	Blackberry	12.66
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	1.27

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison (Callery pear)	5	Altingiaceae	*Liquidambar styraciflua*	American sweetgum	67.48
		Adoxaceae	*Viburnum dentatum*	Arrowood viburnum	13.50
		Asteraceae	*Solidago odora*	Sweet goldenrod	12.96
		Rosaceae	*Crataegus sp.*	American hawthorn	4.05
		Asteraceae	*Achillea millefolium*	Common yarrow	1.35
		Asteraceae	*Vernonia noveboracensis*	New York ironweed	0.67
	6	Adoxaceae	*Viburnum dentatum*	Arrowood viburnum	38.20
		Rosaceae	*Crataegus sp.*	American hawthorn	15.73
		Asteraceae	*Solidago canadensis*	Canada goldenrod	12.92
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	11.24
		Aquafoliaceae	*Ilex verticillata*	Winterberry	11.24
		Rosaceae	*Rubus allegheniensis*	Blackberry	5.62
		Rosaceae	*Prunus virginiana*	Chokecherry	3.37
		Asteraceae	*Achillea millefolium*	Common yarrow	1.12
		Rosaceae	*Rosa multiflora*	Multiflora rose	1.12
Multiflora rose	1	Rosaceae	*Rosa multiflora*	Multiflora rose	49.58
		Poaceae	*Dactylis glomerata*	Orchardgrass	31.16
		Asteraceae	*Solidago odora*	Sweet goldenrod	5.10
		Asteraceae	*Achillea millefolium*	Common yarrow	4.96
		Lamiaceae	*Monarda fistulosa*	Beebalm	4.96
		Rosaceae	*Rubus flagellaris*	Dewberry	1.42
		Asteraceae	*Engelmannia peristenia*	Engelmann Daisy	1.42
		Apiaceae	*Daucus carota*	Queen Anne's lace	1.42
	2	Rosaceae	*Rosa multiflora*	Multiflora rose	51.80
		Poaceae	*Dactylis glomerata*	Orchardgrass	46.51
		Asteraceae	*Solidago canadensis*	Canada goldenrod	1.06
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	0.63

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Multiflora rose	3	Rosaceae	*Rosa multiflora*	Multiflora rose	44.93
		Poaceae	*Dactylis glomerata*	Orchardgrass	33.82
		Poaceae	*Festuca rubra*	Creeping red fescue	13.74
		Rosaceae	*Crataegus* sp.	American hawthorn	2.11
		Rosaceae	*Pyrus calleryensis*	Callery pear	2.11
		Asteraceae	*Solidago canadensis*	Canada goldenrod	2.11
		Lamiaceae	*Monarda fistulosa*	Beebalm	1.05
		Amaryllidaceae	*Allium canadense*	Wild onion	0.11
	4	Rosaceae	*Rosa multiflora*	Multiflora rose	62.74
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	31.37
		Berberidaceae	*Podophyllum peltatum*	Mayapple	2.51
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	1.38
		Oleaceae	*Fraxinus pennsylvanica*	Green ash	1.25
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	0.75
	5	Rosaceae	*Rosa multiflora*	Multiflora rose	51.72
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	19.83
		Balsaminaceae	*Impatiens capensis*	Jewelweed	13.79
		Asteraceae	*Solidago canadensis*	Canada goldenrod	6.90
		Rosacea	*Rubus allegheniensis*	Blackberry	3.45
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	1.72
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	1.72
		Solanaceae	*Solanum carolinense*	Horsenettle	0.86
	6	Rosaceae	*Rosa multiflora*	Multiflora rose	73.53
		Lauraceae	*Lindera benzoin*	Spicebush	11.70

(Appendix A continued)

Community	**Site**	**Family**	**Species name**	**Common name**	**% individuals**
	6	Anacardiaceae	*Toxicodendron radicans*	Poison ivy	10.23
		Apiaceae	*Daucus carota*	Queen Anne's lace	2.92
		Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	0.74
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	0.73
Native comparison (Multiflora rose)	1	Rosaceae	*Rubus allegheniensis*	Blackberry	49.93
		Poaceae	*Dactylis glomerata*	Orchardgrass	27.43
		Poaceae	*Festuca rubra*	Creeping red fescue	13.36
		Rosaceae	*Rubus flagellaris*	Dewberry	3.52
		Apiaceae	*Daucus carota*	Queen Anne's lace	2.81
		Lamiaceae	*Monarda fistulosa*	Beebalm	1.41
		Asteraceae	*Lactuca canadensis*	Wild lettuce	0.70
		Amaryllidaceae	*Allium canadense*	Wild onion	0.70
		Pinaceae	*Picea rubens*	Spruce	0.14
	2	Rosaceae	*Rubus allegheniensis*	Blackberry	51.50
		Poaceae	*Dactylis glomerata*	Orchardgrass	39.11
		Poaceae	*Festuca rubra*	Creeping red fescue	5.22
		Asteraceae	*Solidago odora*	Sweet goldenrod	1.96
		Apiaceae	*Daucus carota*	Queen Anne's lace	1.43
		Apocynaceae	*Apocynum cannabinum*	Dogbane	0.65
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	0.13
	3	Rosaceae	*Rubus allegheniensis*	Blackberry	70.00
		Poaceae	*Dactylis glomerata*	Orchardgrass	25.00
		Poaceae	*Festuca rubra*	Creeping red fescue	3.00
		Apiaceae	*Daucus carota*	Queen Anne's lace	2.00
	4	Lauraceae	*Lindera benzoin*	Spicebush	59.70

(Appendix A continued)

Community	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Native comparison (Multiflora rose)	4	Magnoliaceae	*Liriodendron tulipifera*	Tulip poplar	14.93
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	11.94
		Rosaceae	*Rubus idaeus*	Raspberry	8.96
		Fagaceae	*Fagus grandifolia*	American beech	1.49
		Solanaceae	*Physalis virginiana*	Ground cherry	0.75
		Rosaceae	*Rosa multiflora*	Multiflora rose	0.75
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	0.75
		Phytolaccaceae	*Phytolacca rigida*	Pokeberry	0.75
	5	Lauraceae	*Lindera benzoin*	Spicebush	58.06
		Berberidaceae	*Podophyllum peltatum*	Mayapple	16.13
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	14.19
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	5.81
		Polygonaceae	*Polygonum pensylvanicum*	Pink smartweed	4.52
		Rosaceae	*Prunus serotina*	Black cherry	1.29
	6	Lauraceae	*Lindera benzoin*	Spicebush	50.00
		Aquafoliaceae	*Ilex opaca*	American holly	16.67
		Aquafoliaceae	*Ilex verticillate*	Winterberry	16.67
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	12.50
		Berberidaceae	*Podophyllum peltatum*	Mayapple	1.67
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	1.67
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	0.83

APPENDIX B: LIST OF ARTHROPOD TAXA, AS WELL AS GRASTROPODS AND EARTHWORMS, COLLECTED DURING SUMMER 2015 IN THE MID-ATLANTIC REGION OF THE UNITED STATES. Taxa marked with an asterisk (*) are recognized as non-native in the Mid-Atlantic region.

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Acari	Ixodida		Ixodidae		*Amblyomma americanum*
					Ixodes scapularis
	Mesostigmata	Parasitina	Parasitidae		*Poecilochirus* sp.
					Unknown spp.
		Oribatida	Damaeidae		Unknown spp.
			Euphthiracaridae		Unknown spp.
			Galumnidae		Unknown spp.
			Mochlozetidae		Unknown spp.
			Nothridae		Unknown spp.
			Oribatulidae		Unknown spp.
	Trombidiformes	Prostigmata	Anystidae		Unknown spp.
			Bdellidae		Unknown spp.
			Eriophyidae		*Aculops rhois*
			Erythraeidae	Leptinae	*Leptus* sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Acari	Trombidiformes	Prostigmata	Trombidiidae		*Dinotrombidium* sp.
			Trombidiidae		*Trombidium* sp.
			Tydeidae		Unknown spp.
Arachnida	Araneae	Araneomorphae	Agelenidae		*Agelenopsis pennsylvanica*
			Agelenidae		*Tegenaria domestica*
			Amaurobiidae		Unknown spp.
			Anyphaenidae		*Acantheperia stellata*
					Anyphaena fraterna
					Arachosia cubana
					Hibana gracillus
			Araneidae		*Araneus gemma*
					Araneus marmoreus
					Araneus thaddeus
					Araneus trifolium

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Araneidae		*Araniella displicata*
					Argiope trifasciata
					Cyclosa turbinate
					Hypsosinga pygmaea
					Hyposinga sp.
					Neoscona arabesca
					Neoscona sp.
			Clubionidae		*Clubiona* sp.
			Corinnidae		*Falconia gracilus*
					Myrmecotypus lineatus
					Trachelas sp.
			Ctenidae		*Anahita punctulate*
			Cybaeidae		*Cybaeus giganteus*
			Gnaphosidae		*Cesonia bilineata*

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Gnaphosidae		*Gnaphosa* sp.
					Hespyllus ecclesiastiucs
					Micaria sp.
					Zelotes sp.
			Linyphiidae	Erigoninae	*Erigone* sp.
				Linyphiinae	*Microlinyphia mandibulata*
					Neriene sp.
			Lycosidae		*Alopecosa* sp.
					Allocosa funeralis
					Arctosa littoralis
					Geolycosa sp.
					Gladicosa gulosa
					Gladicosa sp.
					Hogna sp.
					Pardosa sp.
					Pirata spiniger

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Lycosidae		*Pirata* sp.
					Rabidosa rabida
					Schizocosa sp.
					Schizolycosa sp.
					Trebacosa marxi
					Trochosa sepulchralis
			Oxyopidae		*Oxyopes aglossus*
					Oxyopes salticus
					Oxyopes scalaris
					Peucetia viridans
			Philodromidae		*Philodromus* sp.
					Tibellus maritimus
			Pholcidae		*Pholcus* sp.
			Pisauridae		*Dolomedes tenebrosus*
					Pisaura mira
			Salticidae		*Chalcoscirtus* sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Salticidae		*Chinattus parvulus*
					Colonus sylvanus
					Eris militaris
					Habronattus sp.
					Hentzia sp.
					Maevia sp.
					Marpissa formosa
					Menemerus bivittatus
					Messua sp.
					Metaphidippus galathea
					Peckhamia sp.
					Pelegrina sp.
					Phanius sp.
					Phidippus audax
					Phidippus clarus
					Phidippus regius

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Salticidae		*Phidippus* sp.
					Platycryptus undatus
					Platycryptus sp.
					Plexippus sp.
					Salticus scenicus
					Sassacus sp.
					Sitticus sp.
					Synemosyna formica
					Tutelina elegans
					Zygoballus rufipes
			Tetragnathidae		*Meta ovalis*
					Pachygnatha sp.
					Tetragnatha sp.
			Theridiidae		*Enoplognatha ovata*
					Enoplognatha sp.
					Theridion sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Thomisidae		*Bassaniana versicolor*
					Mecaphesa asperata
					Misumena sp.
					Misumenoides sp.
					Ozyptila sp.
					Xysticus elegans
					Xysticus sp.
	Araneae	Mygalomorphae	Atypidae		*Sphodros niger*
	Opiliones	Eupnoi	Scleosomatidae		*Hadrobunus* sp.
					Leiobunum nigripalpi
					Leiobunum sp.
	Pseudoscorpiones	Epiocheirata	Chtoniidae		*Apochthonius* sp.
		Iocheirata	Neobisiidae		*Microbisium* sp.
Chilopoda	Geophilomorpha		Geophilidae		*Arenophilus bipuncticeps*
					Geophilus sp.
	Lithobiomorpha		Henicopidae		Unknown spp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Chilopoda	Lithobiomorpha		Lithobiidae		*Lithobius* sp.
					Unknown spp.
Clitellata	Haplotaxida	Lumbricina	Lumbricidae		*Lumbricus terrestris*
					Unknown spp.
			Megascolecidae		*Amynthas* sp.
Diplopoda	Callipodida		Abacionidae		*Abacion* sp.
	Julida		Blaniulidae		*Blaniulus guttulatus**
			Julidae		Unknown spp.
	Polydesmida		Paradoxosomatidae		*Oxidus gracillus**
			Xystodesmidae		Unknown spp.
Gastropoda	Stylommatophora	Elasmognatha	Succineidae		*Catinella circumscripta**
					Succinea sp.*
		Orthurethra	Pupillidae*		Unknown spp.
			Vallonidae		*Vallonia pulchella**
		Sigmurethra	Arionidae		*Arion circumscriptus**
					*Arion intermedius**

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Gastropoda	Stylommatophora	Sigmurethra	Bradybaenidae		*Bradybaena similaris**
			Helicidae		*Cochllicella ventrosa**
					*Helicella caperata**
					*Capaea nemoralis**
					*Hygromia cinctella**
					*Hygromia hispida**
					*Hygromia striolata**
					Unknown spp.
			Limacidae		*Limax maximus**
					Limax sp.*
			Polygyridae		*Mesodon mitchellia*
					Mesodon thyroids
					Stenotrema sp.
			Haplotrematidae		*Haplotrema concavum**
			Zontidae		*Vitrina limpida**

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Blattodea		Blattellidae		*Parcoblatta pennsylvanica*
			Blattidae		*Blatta orientalis**
Insecta	Coleoptera	Adephaga	Carabidae	Brachinae	*Brachinus* sp.
				Carabinae	*Calosoma sayi*
					*Carabus nemoralis**
					Sphaeroderus stenostomus
				Cicindelinae	*Cicindelidia punctulata*
				Harpalinae	*Agonum ferreum*
					Agonum sp.
					Acupalpus testaceus
					Amara rubrica
					Amara sp.
					Ambygnathus sp.
					Amphasia interstitialis
					Anisodactylus caenus
					Anisodactylus laetus

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Adephaga	Carabidae	Harpalinae	*Anisodactylus merula*
					Anisodactylus ovularis
					Anisodactylus sp.
					Calathus opaculus
					Chlaenius aestivus
					Chlaenius laticollis
					Chlaenius niger
					Chlaenius pennsylvanicus
					Chlaenius sericeus
					Chlaenius tomentosus
					Chlaenius tricolor
					Chlaenius sp.
					Cyclotrachelus sp.
					Cymindis americana
					Cymindis platicollis
					Cymindis sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Adephaga	Carabidae	Harpalinae	*Dicaelus dilatatus*
					Dicaelus purpuratus
					Galerita bicolor
					Galerita janus
					Gaerita sp.
					Gastrellarius sp.
					Harpalus caliginosus
					Harpalus compar
					Harpalus erraticus
					Harpalus nigritarsis
					Harpalus pensylvanicus
					Harpalus opacipennis
					Harpalus paratus
					Harpalus rubripes
					*Harpalus rufipes**
					Harpalus sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Adephaga	Carabidae	Harpalinae	*Lebia ornata*
					Lebia sp.
					Loxandrus rectus
					Loxandrus sp.
					Morion monilicornis
					Myas coracinus
					Myas cyanescens
					Notiobia maculicornis
					Notiobia sayi
					Notiobia sp.
					*Ophonus puncticeps**
					Poecilus chalcites
					Poecilus lucublandus
					Pterostichus adoxus
					Pterostichus diligensis
					Pterostichus haemotopus

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Adephaga	Carabidae	Harpalinae	*Pterostichus mutus*
					Pterostichus pennsylvanicus
					Pterostichus rostratus
					Pterostichus stygicus
					Pterostichus superciliosus
					Pterostichus sp.
					Selenophorus granaries
					Stenolophus comma
					Stenolophus sp.
				Nebriinae	*Notiophilus novemstriatus*
				Scaritinae	*Clivina americana*
					Scarites subterraneus
				Trechinae	*Bembidion* sp.
					Pericompsus ephippiatus
		Polyphaga	Anthicidae	Anthicinae	*Anthicus flavicans*
					Anthicus sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
			Anthicidae	Anthicinae	*Ischyropalpus sturmi*
				Notoxinae	*Notoxus planicornis*
					Notoxus sp.
					Tomoderus sp.
			Anthribidae	Anthribinae	*Trigonorhinus rotundatus*
					Trigonorhinus sp.
				Choraginae	*Choragus zimmermanni*
			Attelabidae	Rhynchitinae	*Eugnamptus angustatus*
					Merhynchites bicolor
			Brentidae	Apioninae	*Ischnopterapion virens**
				Brentinae	*Arrhenodes minutus*
			Buprestidae	Agrilinae	*Taphrocerus schaefferi*
				Buprestinae	*Melanophila* sp.
			Cantharidae	Cantharinae	*Podabrus rugosulus*
				Chauliognathinae	*Chauliognathus pensylvanicus*
			Cerambycidae	Lepturinae	*Pidonia aurata*

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Chrysomelidae	Bruchinae	*Acanthoscelides* sp.
					Bruchidius villosus
				Cassidinae	*Charidotella sexpunctata*
					Deloyala guttata
					Glyphuroplata pluto
					Microrhopala vittata
					Stronglyocassis atripes
					Sumitrosis inaequalis
				Chrysomelinae	*Leptinotarsa decemlineata*
					Leptinotarsa juncta
					*Plagiodera versicolor**
				Criocerinae	*Oulema melanopus**
				Cryptocephalinae	*Diachus auratus*
					Exema canadensis
					Neochlamisus sp.
					Triachus atoma

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Chrysomelidae	Eumolpinae	*Paria fragariae*
					Tymnes sp.
				Galerucinae	*Altica bimarginata*
					Altica knabii
					Altica sp.
					*Aphthona flava**
					*Aphthona lacertosa**
					Cerotoma trifurcata
					Chaetocnema confinis
					Chaetocnema cribifrons
					Chaetocnema denticulate
					Chaetocnema ectypa
					Chaetocnema irregularis
					Chaetocnema minuta
					Chaetocnema opulenta
					Chaetocnema protensa

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Chrysomelidae	Galerucinae	*Chaetocnema pulicaria*
					Crepidodera sp.
					Diabolia borealis
					Diabrotica undecimpunctata
					Disonycha xanthomelas
					Epitrix brevis
					Epitrix cucumeris
					Epitrix fasciata
					Epitrix hirtipennis
					Epitrix humeralis
					Epitrix nitens
					Glyptina sp.
					Kuschelina vians
					Longitarsus suspectus
					Longitarsus testaceus
					Longitarsus sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Chrysomelidae	Galerucinae	*Margaridisa atriventris*
					Orthaltica copalina
					Psylliodes punctulata
					Psylloides sp.*
					Systena frontalis
			Cleridae	Hynocerinae	*Isohydnocera curtipennis*
				Tilinae	*Cymatodera* sp.
			Coccinellidae	Coccinellinae	*Adalia bipunctata*
					Coleomegilla maculata
					Cycloneda munda
					*Harmonia axyridis**
					*Propylea quaturodecimpunctata**
					Psyllobora vigintimaculata
				Scymninae	*Brachiacantha* sp.
					Diomus terminates
					Hyperaspis undulata

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Coccinellidae		Larvae
			Corylophidae		*Orthoperus* sp.
					Unknown sp.
			Curculionidae	Baridinae	*Ampeloglypter ampelopsis*
				Ceutorhynchinae	*Apteromechus* sp.
				Ceutorhynchinae	*Ceutorhynchus rapae**
				Cryptorhynchinae	*Cophes* sp.
					Cryptorhynchus sp.
					Tyloderma sp.
				Curculioninae	*Anthonomus elongatus*
					Anthonomus sp.
					Phyllotrox ferrugineus
					*Tychius picirostis**
				Dryophthorinae	*Dryophthorus americanus*
					Sphenophorus minimus
					Sphenophorus sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Curculionidae	Entiminae	*Aphrastus taeniatus*
					*Barypeithes pellucidus**
					*Cyrtepistomus castaneus**
					*Myosides seriehispidus**
					Myosides sp.*
					*Naupactus cervinus**
					*Otiorhynchus cribicollis**
					*Otiorhynchus ovatus**
					*Otiorhynchus rugosostriatus**
					*Otiorhynchus sulcatus**
					Phyxelis sp.*
					*Pseudocneorhinus bifasciatus**
					*Pseudoedophrys hilleri**
					*Sciaphilus asperatus**
					Sitona cylindricollis
					Sitona lineatus

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Curculionidae	Entiminae	*Tropiphorus* sp.
				Mesoptiliinae	*Magdalis* sp.
				Molytinae	Unknown spp.
				Scolytinae	*Xyloterinus* sp.
					Unknown spp.
			Dermestidae		*Cryptorhopalum* sp.
			Elateridae	Agrypninae	*Aeolus* sp.
					Conoderus bellus
					Conoderus lividus
					Conoderus vespertinus
					Conoderus sp.
				Elaterinae	*Argiotes* sp.
					Ampedus sp.
			Erotylidae	Xenoscelinae	*Toramus pulchellus*
			Histeridae	Dendrophilinae	*Paromalus seminulum*
				Histerinae	*Platysoma carolinum*

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Histeridae	Histerinae	*Psiloscelis perpunctat*
					Psiloscelis repletus
				Saprininae	*Euspilotus* sp.
					Saprinus sp.
			Lampyridae	Lampyrinae	*Photinus* sp.
					Photuris sp.
			Latridiidae	Corticariinae	*Corticarina* sp.
				Corticariinae	*Melanophthalma picta*
				Corticariinae	*Melanophthalma* sp.
			Leiodidae	Cholevinae	*Ptomaphagus* sp.
				Leiodinae	*Anisotoma* sp.
			Melandryidae		Unknown sp.
			Meloidae	Meloinae	*Epicauta* sp.
			Mordellidae		*Mordella* sp.
					Falsomordellistena sp.
					Mordellistena sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Melyridae		Unknown spp.
			Nitidulidae	Cillaeinae	*Colopterus* sp.
				Nitidulinae	*Nitidula bipunctata*
					Nitidula sp.
					Seronia sp.
					Stelidota coenosa
					Stelidota geminate
			Phalacridae		*Acylomus* sp.
					Olibrus sp.
					Stilbus sp.
					Unknown spp.
			Ptildactylidae	Ptilodactylinae	*Ptilodactyla* sp.
			Ptiliidae		Unknown spp.
			Ptinidae	Dorcatominae	*Caenocara* sp.
			Scarabaeidae	Aphodiinae	*Aphodius lutulentus*
					Aphodius pinguis

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
			Scarabaeidae	Aphodiinae	*Aphodius truncates*
					Ataenius sp.
				Melolonthinae	*Diplotaxis* sp.
					*Maladera castanea**
					Phyllophaga sp.*
					Serica sp.*
				Rutelinae	*Exomala orientalis**
					*Popillia japonica**
				Scarabaeinae	*Boreocanthon* sp.
					Copris minutus
					Copris sp.
					Melanocanthon bispinatus
					Onthophagus orpheus
					Onthophagus striatulus
					Onthophagus tuberculifrons
					Phanaeus vindex

(Appendix B continued)

Class/Subclass	*Order*	*Suborder*	*Family*	*Subfamily*	*Genus & Species*
Insecta	Coleoptera	Polyphaga	Silphidae		*Nicrophorus carolinus*
					Necrophila americana
			Silvanidae	Brontinae	*Telephanus atricapillus*
			Staphylinidae	Aleocharinae	*Gyrophaena* sp.
					Gymnusa brevicollis
					Meronera venustula
					Phanerota fasciata
					Unknown spp.
				Euaesthetinae	*Edaphus* sp.
					Euaesthetus sp.
				Oxytelinae	*Apocellus* sp.
					Carpelimus sp.
					Oxytelus sp.
				Paederinae	*Achenomorphus corticinus*
					Astenus spectrum
					Lathrobium sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Staphylinidae	Paederinae	*Lobrathium* sp.
					Rugilus sp.
				Staphylininae	*Heterothops* sp.
					Philonthus politus
					Platydracus cinnamopterus
					Platydracus comes
					Platydracus exulans
					Platydracus fossator
					Platydracus maculosus
					Platydracus mysticus
					Platydracus praelongus
					Quedius caseyi
					Quedius sp.
					Tasgius ater
					Tasgius melanarius
					Tasgius winkleri

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Staphylinidae	Staphylininae	*Tasgius* sp.
					Xantholinus sp.
				Steninae	*Stenus crocaetus*
					Stenus sp.
				Tachyporinae	*Tachinus addendus*
					Tachinus sp.
					Tachyporus sp.
			Tenebrionidae	Lagriinae	*Paratenetus punctatus*
				Stenochiinae	*Alobates pensylvanica*
				Tenebrioninae	*Opatrinus minimus*
			Tetratomidae		*Penthe obliquata*
			Trogidae		*Trox variolatus*
					Trox sp.
	Collembola		Dicyrtomidae		Unknown spp.
			Entomobryidae	Entomobryinae	*Entomobrya confusa*
					Entomobrya intermedia

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Collembola		Entomobryidae	Entomobryinae	*Entomobrya multifasciata*
					Entomobrya species 1
					Entomobrya species 2
					Entomobrya species 3
					Homidia sauteri
Insecta	Collembola		Entomobryidae	Lepidocyrtinae	*Lepidocyrtus cyaneus*
					Lepidocyrtus paradoxus
				Orchesellinae	*Orchesella cincta*
					Seira sp.
			Hypogastruridae		*Ceratophysella* sp.
					Unknown spp.
			Isotomidae		*Desoria* sp.
					Isotoma sp.
			Sminthuridae		*Sminthurus fitchi*
					Unknown spp.
			Tomoceridae		*Pogonognathellus elongatus*

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Collembola		Tomoceridae		*Pogonognathellus* sp.
					Tomocerus longicornis
					Tomocerus minor
					Tomocerus sp.
	Dermaptera		Forficulidae		*Forficula auricularia**
	Diptera	Brachycera	Agromyzidae	Agromyzinae	*Agromyza* sp.
					Calycomyza sp.
					Japanagromyza sp.
					Melanagromyza sp.
				Phytomyzinae	*Aulagromyza cornigera*
					Aulagromyza sp.
					Phytomyza sp.
			Anthomyiidae		*Chirosia* sp.
					Eremomyioides sp.
					Fucellia sp.
					Unknown spp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Anthomyzidae		*Anthomyza* sp.
					Arganthomyza sp.
					Mumetopia occipitalis
			Asilidae	Asilinae	*Efferia aestuans*
				Dasypogoninae	*Diogmites neoternatus*
				Leptogastrinae	*Leptogaster* sp.
			Calliphoridae		*Lucilia illustris*
			Chamaemyiidae		Unknown spp.
			Chloropidae	Chloropinae	*Chlorops* sp.
					Diplotoxa sp.
					Lasiosina sp.
					Meromyza sp.
					Neodiplotoxa sp.
				Oscinellinae	*Apallates* sp.
					Ceratobarys eulophus
					Chaetochlorops inquilinus

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Chloropidae	Oscinellinae	*Dasyopa* sp.
					Dicraeus sp.
					Elachiptera erythropleura
					Elachiptera sp.
					Eugaurax floridensis
					Fiebrigella sp.
					Gaurax dorsalis
					Hippelates sp.
					Liohippelates sp.
					Monochaetoscinella sp.
					Neoscinella sp.
					Olcella parva
					Oscinella sp.
					Psilacrum arpidia
					Rhopalopterum sp.
					Stenoscinis sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Chloropidae	Oscinellinae	*Tricimba* sp.
			Clusiidae		Unknown spp.
			Dolichopodidae	Dolichopodinae	*Dolichopus* sp.
					Gymnopternus albiceps
					Gymnopternus propiofacies
					Gymnopternus sp.
					Tachytrechus sp.
				Sciapodinae	*Condylostylus parvicauda*
					Condylostylus sp.
					Sciapus sp.
			Drosophilidae	Drosophilinae	*Chymomyza amoena*
					Chymomyza sp.
					Drosophila guttifera
					*Drosophila immigrans**
					Drosophila quinaria
					Drosophila species 1

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Drosophilidae	Drosophilinae	*Drosophila* species 2
					Drosophila species 3
					Drosophila species 4
					Drosophila species 5
					Scatpomyza sp.
				Steganinae	*Leucophenga pulcherrima*
					Leucophenga varia
			Dryomyzidae		*Dryomyza* sp.
			Empididae	Hemerodromiinae	*Neoplasta* sp.
					Unknown spp.
			Ephydridae		Unknown spp.
			Fanniidae	Fanniinae	*Fannia canicularis*
					Fannia sp.
			Heleomyzidae	Heleomyzinae	*Heleomyza* sp.
				Suilliinae	*Suillia* sp.
			Hybotidae	Tachydromiinae	*Megagrapha* sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Hybotidae		Unknown spp.
			Lonchopteridae		*Lonchoptera bifurcata*
			Muscidae	Azeliinae	*Muscina assimilis*
				Coenosiinae	Unknown spp.
			Phoridae	Metopininae	*Apocephalus coquilletti*
					Gymnophora sp.
					Megaselia sp.
					Phalacrotophora longifrons
					Puliciphora sp.
				Phorinae	*Beckerina* sp.
					Borophaga sp.
					Chaetopleurophora sp.
					Conicera sp.
					Diplonevra nitidula
					Diplonevra species 1
					Dohriniphora incisuralis

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Phoridae	Phorinae	*Dohriniphora* species 1
				Phorinae	*Dohriniphora* species 2
				Phorinae	*Phora* sp.
				Phorinae	*Sphinophora spinulosa*
				Phorinae	*Triphleba* sp.
			Pipunculidae	Pipunculinae	*Tomosvaryella* sp.
			Platystomatidae		Unknown spp.
			Rhagionidae		Unknown spp.
			Scathophagidae	Scathophaginae	*Gonarcticus* sp.
			Sarcophagidae	Sarcophaginae	*Blaesoxipha hunteri*
					Unknown spp.
			Sepsidae		*Orygma* sp.
					Sepsis sp.
			Sphaeroceridae	Limosininae	*Halidayina* sp.
					Leptocera sp.
					Pterogramma sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Sphaeroceridae	Limosininae	*Rachispoda* sp.
				Sphaerocerinae	*Parasphaerocera* sp.
					Sphaerocera curvipes
			Stratiomyidae		Unknown spp.
			Syrphidae	Syrphinae	*Epistrophe* sp.
					Melangyna sp.
					Syrphus sp.
			Syrphidae	Toxomerinae	*Toxomerus marginatus*
			Tachinidae	Dexiinae	*Estheria* sp.*
				Exoristinae	*Leschenaultia* sp.
					Unknown spp.
				Tachininae	*Archytas* sp.
					Clausicella sp.
					Mauromyia sp.
					Unknown spp.
			Tephritidae	Tephritinae	*Rhynencina longirostris*

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Tephritidae	Tephritinae	*Terellia* sp.
				Tephritinae	*Trupanea texana*
				Tephritinae	*Trupanea* sp.
				Tephritinae	*Trypeta* sp.
				Tephritinae	*Urophora* sp.*
			Ulidiidae	Otitinae	*Tritoxa flexa*
				Otitinae	*Tritoxa incurva*
				Ulidiinae	*Chaetopsis* sp.
		Nematocera	Cecidomyiidae	Lasiopteridinae	*Sackenomyia commota*
					Unknown spp.
			Ceratopogonidae		Unknown spp.
			Chironomidae		Unknown spp.
			Culicidae		*Anopheles* sp.
					Culex sp.
			Mycetophilidae	Ditomyiinae	*Ditomyia* sp.
				Mycetophilinae	*Mycetophila* sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Nematocera	Psychodidae		
			Scatopsidae	Aspistinae	*Aspistes* sp.
			Sciaridae		*Bradysia* sp.
					Epidapus atomarius
					Epidapus johnstoni
					Lycoriella sp.
					Pnyxia sp.
					Pseudosciara sp.
					Schwenkfeldina sp.
					Sciara sp.
					Zygoneura sp.
			Simuliidae		*Prosimulium* sp.
					Simulium sp.
			Tipulidae		Unknown spp.
Insecta	Hemiptera	Auchenorrhyncha	Acanaloniidae		*Acanalonia bivittata*
					Acanalonia conica

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Aphrophoridae		*Lepyronia anguilifera*
					Lepyronia quadrangularis
					Neophilaenus lineatus
					Philaenarcys bilineata
					*Philaenus spumaris**
					Philaronia canadensis
			Caliscelidae		*Bruchomorpha oculata*
			Clastopteridae		*Clastoptera obtusa*
					Clastoptera octonotata
					Clastoptera proteus
			Cercopidae		*Prosapia bicincta*
			Cicadellidae	Aphrodinae	*Anoscopus albiger**
					*Anoscopus serratulae**
					Driotura gammaroides
					Xestocephalus brunneus
					Xestocephalus superbus

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Cicadellidae	Aphrodinae	*Xestocephalus* sp.
				Cicadellinae	*Cuerna striata*
					Draeculacephala antica
					Draeculacephala constricta
					Draeculacephala paludosa
					Draeculacephala sp.
					Graphocephala versuta
					Neokolla dolobrata
					Neokolla hieroglyphica
					Oncometopia orbona
					Paraulacizes irrorata
					Tylozygus bifidus
				Coelidiinae	*Jikradia* sp.
				Deltocephalinae	*Amblysellus* sp.
					*Athysanus argentarius**
					Bandara sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Cicadellidae	Deltocephalinae	*Chlorotettix* sp.
					Cicadula saliens
					Cicadula sp.
					Deltocephalus flavocostatus
					Deltocephalus sp.
					Eutettix marmonatus
					*Exitianus exitiosus**
					Hebecephalus sp.
					*Latalus ocellaris**
					Lonatura sp.
					*Orientus ishida**
					Osbornellus auronitens
					Paraphlepsius sp.
					Polyamia weedi
					Scaphoideus sp.
					Scaphytopius frontalis

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Cicadellidae	Deltocephalinae	*Scaphytopius* sp.
					Stirellus bicolor
					Texananus sp.
				Gyponinae	*Gypona* sp.
				Idiocerinae	*Idiocerus* sp.
				Macropsinae	*Pediopsoides distinctus*
				Megophthalminae	*Agallia constricta*
					Agallia quadripunctata
					Agalliopsis sp.
					Ceratagallia sp.
				Typhlocybinae	*Alebra* sp.
					Dikraneura sp.
					Empoasca sp.
					Eratoneura sp.
					Erythridula dorsalis
					Erythridula sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Cicadellidae	Typhlocybinae	*Erythroneura tricincta*
					Erythroneura sp.
			Cixiidae	Cixiinae	*Cixius* sp.
					Haplaxius pictifrons
					Oecleus sp.
			Delphacidae	Delphacinae	*Delphacodes caerulata*[†]
					Delphacodes mcateei
					Delphacodes nigripennata[†]
					Delphacodes puella
					Isodelphax basivitta
					Kosswigianella lutulenta
					Liburniella ornata
					Muellerianella laminalis
					Muirodelphax arvensis

[†]New state record (Barringer & Bartlett 2018)

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Delphacidae	Delphacinae	*Muirodelphax parvulus*
					Pissonotus aphidioides
					Pissonotus guttatus
					Pissonotus marginatus
					Syndelphax alexanderi
			Derbidae	Cedusinae	*Cedusa* sp.
				Otiocerinae	*Anotia kirkaldyi*
					Anotia sp.
			Dictyopharidae	Dictyopharinae	*Scolops sulcipes*
			Flatidae	Flatinae	*Flatomenis proxima*
					*Metcalfa pruinosa**
					Ormenoides venusta
			Issidae		*Thioina* spp.
			Membracidae	Membracinae	*Campylenchia latipes*
				Smiliinae	*Acutalis tartarea*
					Acutalis sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Membracidae	Smiliinae	*Entylia carinata*
					Micrutalis dorsalis
					Micrutalis sp.
					Stictocephala bisonia
		Heteroptera	Alydidae	Alydinae	*Alydus eurinus*
			Anthocoridae		*Cardiastethus* sp.
					Orius insidiosus
			Berytidae	Berytinae	*Neoneides muticus*
				Metacanthinae	*Jalysus wickhami*
			Coreidae	Coreinae	*Acanthocephala terminalis*
					Euthochtha galeator
			Cydnidae	Cydninae	*Amnestus* sp.
					Pangaeus bilineatus
			Enicocephalidae		Unknown spp.
			Geocoridae		*Geocoris uliginosus*
			Lygaeidae	Lygaeinae	*Lygaeus turcicus*

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Heteroptera	Lygaeidae	Orsillinae	*Xyonysius basalis*
			Miridae	Bryocorinae	Unknown spp.
				Cylapinae	*Fulvius slateri*
				Deraeocorinae	Unknown spp.
				Mirinae	*Lygus lineolarius*
					Lygus sp.
					*Megaloceroea reticornis**
					Neolygus sp.
					Polymerus basalis
					Stenodema sp.
					Taylorilygus apicalis
					Trigonotylus caelestialium
				Orthotylinae	*Microtechites bractatus*
					Paraproba capitata
					Parthenicus juniperi
				Phylinae	*Orectoderus obliquus*

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Heteroptera	Miridae	Phylinae	*Plagiognathus chrysanthemi**
					Reuteroscopus ornatus
			Nabidae	Nabinae	*Lasiomerus annulatus*
					Nabis sp.
			Pachygronthidae		*Phlegyas abbreviatus*
			Pentatomidae	Asopinae	*Podisus maculiventris*
					Stiretrus anchorago
				Pentatominae	*Brochymena* sp.
					Chinavia hilaris
					Cosmopepla lintneriana
					Euschistus servus
					Euschistus tristigmus
					Euschistus variolarius
					*Halyomorpha halys**
					Holcostethus limbolarius
					Menecles insertus

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Heteroptera	Pentatomidae	Pentatominae	*Mormidea lugens*
					Oebalus pugnax
					Thyanta custator
					Trichopepla semivittata
			Pentatomidae	Podopinae	*Amaurochorous brevitylus*
			Reduviidae	Emesinae	*Barce* sp.
				Emesinae	*Emesaya brevipennis*
				Harpactorinae	*Sinea* sp.
					Zelus sp.
				Phymatinae	*Phymata* sp.
				Stenopodainae	*Oncocephalus* sp.
			Rhopalidae	Rhopalinae	*Arhyssus nigristernum*
					Harmostes reflexulus
			Rhyparochromidae	Rhyparochrominae	*Antillocoris* sp.
					Atrazonotus umbrosus
					Drymus crassus

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Heteroptera	Rhyparochromidae	Rhyparochrominae	*Eremocoris ferus*
					Ligyrocoris sp.
					Myodocha serripes
					Ozophora picturata
					Pseudopachybrachius basalis
					Pseudopamera sp.
					Ptochiomera nodosa
			Scutelleridae	Pachycorinae	*Homaemus parvulus*
			Thyreocoridae		*Galgupha* sp.
			Tingidae		*Corythucha* sp.
Insecta	Hemiptera	Sternorrhyncha	Aleyrodidae		Unknown spp.
			Aphididae	Aphidinae	*Rhopalosiphum* sp.
				Eriosomatinae	Unknown spp.
			Triozidae		Unknown spp.
Insecta	Hymenoptera	Apocrita	Aphelinidae	Aphelininae	*Aphelinus* sp.
			Apidae	Apinae	*Apis mellifera**

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Apidae	Apinae	*Bombus occidentalis*
			Bethylidae	Bethylinae	*Bethylus* sp.
				Epyrinae	*Holepyris* sp.
				Pristocerinae	*Pristocera* sp.
					Unknown spp.
			Braconidae	Alysiinae	*Alysia* sp.
					Aphaereta sp.
					Phaenocarpa sp.
				Aphidiinae	*Aphidius* sp
					Toxares sp.
					Xenostigmus bifasciatus
				Braconinae	Unknown spp.
				Cheloninae	*Chelonus* sp.
				Helconinae	*Vadum* sp.
				Hormiinae	Unknown spp.
				Macrocentrinae	*Macrocentrus* sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Braconidae	Microgastrinae	Unknown spp.
				Opiinae	*Opius* sp.
				Rogadinae	*Stiropius* sp.
			Ceraphronidae		Unknown spp.
			Chalcididae		*Conura* sp.
			Colletidae		*Colletes* sp.
					Hylaeus sparsus
			Cynipidae		*Acrapsis pezomachoides*
					Unknown spp.
			Diapriidae	Belytinae	*Belyta* sp.
				Diapriinae	*Basalys* sp.
			Dryinidae	Dryininae	*Dryinus alatus*
				Gonatopodinae	Unknown spp.
			Encyrtidae	Encyrtinae	*Encyrtus* sp.
			Eucharitidae	Eucharitinae	*Pseudometagea* sp.
			Eulophidae	Eulophinae	*Elachertus* sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Eulophidae	Eulophinae	*Euplectrus* sp.
					Pnigalio sp.
				Tetrastichinae	*Aprostocetus* sp.
					Tetrastichus sp.
			Eupelmidae	Eupelminae	*Anastatus* sp.
					Arachnophaga sp.
					Brasema sp.
					*Eupelmus versicularis**
			Eurytomidae	Eurytominae	*Eurytoma gigantea*
					Eurytoma obtusiventris
					Sycophila sp.
			Evaniidae		*Hyptia* sp.
			Figitidae		Unknown spp.
			Formicidae	Dolichoderinae	*Forelius pruinosus*
					Tapinoma sessile
					Technomyrmex difficilis

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Formicidae	Formicinae	*Brachymyrmex depilis*
					Camponotus castaneus
					Camponotus chromaiodes
					Camponotus herculeanus
					Camponotus novaeboracensis
					Formica aserva
					Formica creightoni
					Formica difficilis
					Forica impexa
					Formica incerta
					Formica inflexa
					Formica lasioides
					Formica neonegates
					Formica pallidefulva
					Formica pergandei
					Formica subaenescens

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Formicidae	Formicinae	*Formica subserica*
					Formica species 1
					Formica species 2
					Lasius alienus
					Lasius claviger
					Lasius flavus
					Lasius latipes
					Lasius neoniger
					Lasius pallitarsis
					*Nylanderia flavipes**
					Nylanderia parvula
					*Paratrechina longicornis**
					Polyergus longicornis species
					Prenolepis impairs
				Myrmicinae	*Aphaenogaster fulva*
					Aphaenogaster lamellidens

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Formicidae	Myrmicinae	*Aphaenogaster picea*
					Aphaenogaster rudis
					Aphaenogaster treatae
					Crematogaster cerasi
					Myrmecina Americana
					Myrmica Americana
					Myrmica detrinodis species 1
					Myrmica detrinodis species 2
					Myrmica fracticornis
					Myrmica incomplete
					Myrmica latifrons
					Myrmica nearctica
					*Myrmica rubra**
					Myrmica scabrinodis
					Myrmica sculptilis species 1
					Myrmica scultpilis species 2

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Formicidae	Myrmicinae	*Monomorium minimum*
					Pheidole pilifera
					Pyramica pulchella
					Solenopsis molesta
					Stenamma brevicorne
					Stenamma schmitti
					Temnothorax ambiguous
					Temnothorax curvispinosus
					Temnothorax pergandei
					*Tetramorium bicarnatum**
					*Tetramorium caespitum**
					Veromessor sp.
				Ponerinae	*Hypoponera* sp.
					Ponera pennsylvanica
			Halictidae	Halictinae	*Augochlorella aurata*
					Augochlorella sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Halictidae	Halictinae	*Halictus metallica*
					Lasioglossum sp.
					Sphecodes sp.
			Ichneumonidae	Anomaloninae	*Erigorgus* sp.
					Therion sp.
				Brachycyrtinae	*Brachycyrtus* sp.
				Cryptinae	*Gelis* sp.
					Pachysomoides sp.
				Eucerotinae	*Euceros* sp.
				Hybrizontinae	Unknown spp.
				Ichneumoninae	*Coelichneumon* sp.
				Ochinellinae	Unknown spp.
				Orphioninae	Unknown spp.
				Pimplinae	*Theronia hilaris*

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Ichneumonidae	Tersilochinae	Species 1
					Species 2
				Tryphoninae	Unknown spp.
			Megaspilidae		Unknown spp.
			Mutillidae		*Dasymutilla* sp.
			Mymaridae		*Anaphes* sp.
					Gonatocerus sp.
					Mymar sp.
					Ooctonus sp.
					Polynema sp.
			Perilampidae		Unknown spp.
			Platygastridae	Platygastrinae	*Inostemma* sp.
					Platygaster sp.
					Synopeas sp.
				Scelioninae	*Baeus* sp.
					Calliscelio sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Platygastridae	Scelioninae	*Gryon* sp.
					Idris sp.
					Macroteleia sp.
					Scelio sp.
				Teleasinae	*Trimorus* sp.
				Telenominae	*Eumicrosoma* sp.
					Phanuromyia sp.
					Telenomus sp.
					Trissolcus basalis
					Trissolcus brochymena
					Trissolcus sp.
			Pompilidae	Pepsinae	*Auplopus* sp.
					Pepsinae menechma
				Pompilinae	*Agenioides humilis*
					Poecilopompilus interruptus
			Proctotrupidae		Unknown spp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Pteromalidae	Cleonyminae	*Cleonymus* sp.
					Epistenia sp.
				Diparinae	Unknown spp.
				Miscogastrinae	Unknown spp.
				Pteromalinae	*Lyrcus* sp.
					Pachyneuron sp.
				Spalangiinae	*Spalangia* sp.
			Thynnidae	Myzininae	*Myzinum* sp.
			Tiphiidae		Unknown spp.
			Torymidae	Toryminae	*Torymus* sp.
					Megastimus sp.
			Trichogrammatidae		Unknown spp.
			Vespidae	Eumeninae	*Euodynerus schwarzi*
				Polystinae	*Polistes dorsalis*
				Vespinae	*Vespula* sp.
		Symphyta	Tenthredinidae	Nematinae	*Hoplocampa* sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Symphyta	Tenthredinidae	Nematinae	*Nematus* sp.
			Xiphydriidae		*Xiphydria tibialis*
	Isoptera		Rhinotermitidae		*Reticulitermes flavipes*
	Lepidoptera		Apatelodidae		*Apatalodes torrefacta*
			Attevidae		*Atteva aurea**
			Coleophoridae	Coleophorinae	*Coleophora duplicis*
			Crambidae		Unknown spp.
			Depressariidae		*Psiolocorsis quercicella*
			Epipyropidae		*Fulgoraecia exigua*
			Erebidae	Arctiinae	*Grammia arge*
					Halysidota tessellaris
					Hyphantria cunea
					Spilosoma virginica
					Spilosoma sp.
				Erebinae	*Caenurgina crassiuscula*
					Phoberia atomaris

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Lepidoptera		Erebidae	Herminiinae	*Idia aemula*
			Gelechiidae	Gelechiinae	*Arogalea cristifasciella*
					Coleotechnites
			Geometridae	Ennominae	*Iridopsis humaria*
					Phigalia sp.
				Geometrinae	*Chlorochlamys* sp.
					Synchlora aerata
				Larentiinae	*Costaconvexa centrostrigaria*
					Eupithecia miserulata
			Gracillariidae	Lithocolletinae	*Phyllonorycter* sp.
				Phyllocnistinae	*Phyllocnistis vitegenella*
			Hesperiidae	Hesperiinae	*Anatrytone logan*
			Limacodidae		*Acharia stimulea*
					Isa sp.
					Parasa indetermina
			Nepticulidae		*Stimella rhoifoliella*

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Lepidoptera		Nepticulidae		*Stigmella* sp.
			Noctuidae	Acronictinae	*Cerma cerintha*
				Cuculliinae	*Cucullia asteroides*
					Cucullia sp.
				Heliothinae	*Heliothis* sp.
					Heliocheilus sp.
				Noctuinae	*Dargida diffusa*
					Elaphria sp.
					Galgula partita
					Mythimna unipuncta
					Orthosia sp.
					Spodoptera sp.
			Notondontidae	Notodontinae	*Notodonta scitipennis*
			Nymphalidae	Satyrinae	Unknown spp.
			Plutellidae		Unknown spp.
			Pyralidae	Epipaschiinae	*Epipaschia superatalis*

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Lepidoptera		Pyralidae	Epipaschiinae	*Pococera militella*
				Phycitinae	*Sciota uvinella*
			Psychidae		*Psyche casta*
			Saturniidae	Hemileucinae	*Automeris io*
			Tineidae		Unknown spp.
			Tortricidae	Tortricinae	*Acleris schalleriana*
	Mantodea		Mantidae		*Mantis religiosa**
	Mecoptera		Panorpidae		*Panorpa* sp.
	Microcoryphia		Machilidae	Petrobiinae	*Pedotontus* sp.
	Neuroptera		Chrysopidae		Unknown spp.
			Hemerobiidae	Hemerobiinae	*Hemerobius* sp.
	Odonata	Zygoptera	Coenagrionidae		Unknown spp.
	Orthoptera	Califera	Acrididae	Gomphocerinae	*Chloealtis conspersa*
				Melanoplinae	*Melanoplus confusus*
					Melanoplus sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Orthoptera	Califera	Acrididae	Oedipodinae	*Psinidia fenestralis*
			Tetrigidae	Batrachideinae	*Tettigidea lateralis*
			Tetrigidae	Tetriginae	*Terix arenosa*
		Ensifera	Gryllidae	Gryllinae	*Acheta domesticus*
					Gryllus sp.
					Miogryllus saussurei
					*Velarifictorus micado**
				Hapithinae	*Hapithus agitator*
				Nemobiinae	*Allonemobius fasciatus*
					Neonemobius sp.
				Oecanthinae	*Oecanthus* sp.
				Trigonidiinae	*Anaxipha litarena*
					Falcicula hebardi
			Rhapidophoridae	Ceuthophilinae	*Ceuthophilus* sp.
			Tettigoniidae	Conocephalinae	*Conocephalus* sp.
					Orchelimum sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Orthoptera	Ensifera	Tettigoniidae	Conocephalinae	*Neoconocephalus retusus*
					Neoconocephalus sp.
				Tettigoniinae	*Atlanticus americanus*
					Atlanticus testaceus
	Psocoptera	Psocomorpha	Amphipsocidae		*Polypsocus corruptus*
			Epipsocidae		*Bertkauia lepicidinaria*
			Lachesillidae		*Lachesilla* sp.*
			Myopsocidae		*Lichenomima* sp.
			Philotarsidae		*Aaroniella badonneli*
			Pscodiae	Psocinae	*Indiopsocus* sp.
		Troctomorpha	Liposcelidae		*Liposcelis* sp.
			Pachytroctidae		*Nanopscosus oceanicus**
	Siphonaptera		Ceratophyllidae		Unknown spp.
	Strepsiptera		Elenchidae		Unknown spp.
	Thysanoptera	Terebrantia	Aeolothripidae		Unknown spp.
			Thripidae		*Caliothrips* sp.

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Thysanoptera	Terebrantia	Thripidae		*Konothrips polychaeta*[‡]
					Unknown spp.
		Tubilifera	Phlaeothripidae		*Elaphrothrips* sp.
	Trichoptera				Unknown spp.
	Zygentoma		Lepismatidae		Unknown spp.
Malacostraca	Isopoda	Oniscidea	Armadillidiidae		*Armadillidium nasatum**
					*Armadillidium vulgare**
			Cylisticidae		*Cylisticus convexus**
			Detonidae		*Armadilloniscus* sp.
			Oniscidae		*Oniscus asellus**
			Philosciidae		*Philoscia muscorum**
			Porcellionidae		*Porcellio laevis**
					*Porcellio scaber**
					*Porcellionides pruinosus**
			Trachelipodidae		*Trachelipus rathkii**

[‡]New species reported (Goldarazena et al. 2016)

(Appendix B continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Malacostraca	Isopoda	Oniscidea	Trichoniscidae		*Trichoniscus pusillus**
Symphyla		Symphyla	Scutigerellidae		

APPENDIX C: LIST OF VEGETATION SAMPLED FOR THE ECO-EVOLUTIONARY HYPOTHESIS STUDY, SUMMER 2016.

Scenario	*Site*	*Family*	*Species name*	*Common name*	*% individuals*
High-Low Porcelainberry	1	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	80.98
		Rosaceae	*Rubus allegheniensis*	Blackberry	11.30
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	5.65
		Balsaminaceae	*Impatiens capensis*	Jewelweed	1.88
		Polygonaceae	*Persicaria perfoliata*	Mile-a-minute weed	0.19
	2	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	75.76
		Rosaceae	*Rubus idaeus*	Raspberry	18.18
		Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	2.27
		Vitaceae	*Vitis aestivalis*	Wild grape	2.27
		Rosaceae	*Rosa multiflora*	Multiflora rose	1.52
	3	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	77.52
		Rosaceae	*Rosa multiflora*	Multiflora rose	15.50
		Rosaceae	*Rubus idaeus*	Raspberry	4.65
		Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	2.33
	4	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	82.64
		Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	9.09
		Rosaceae	*Rubus idaeus*	Raspberry	8.26
Native comparison (Porcelainberry)	1	Poaceae	*Andropogon gerardi*	Big bluestem	43.67
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	24.82
		Poaceae	*Panicum virgatum*	Switchgrass	11.68
		Poaceae	*Sorghastrum nutans*	Indiangrass	10.22
		Asteraceae	*Cirsium virginianum*	Thistle	5.97
		Asteraceae	*Euthamia graminifolia*	Grassleaf goldenrod	1.46
		Fabaceae	*Vicia sativa*	Narrow-leaf vetch	1.46

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
High-Low Native comparison (Porcelain berry)	1	Asclepiaceae	*Asclepias syriaca*	Common milkweed	0.73
		Lamiaceae	*Monarda fistulosa*	Beebalm	0.15
	2	Poaceae	*Sorghastrum nutans*	Indiangrass	29.19
		Poaceae	*Andropogon gerardi*	Big bluestem	17.77
		Lamiaceae	*Glechoma hederacea*	Ground ivy	12.69
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	11.42
		Asteraceae	*Solidago odora*	Sweet goldenrod	8.88
		Poaceae	*Setaria italica*	Foxtail millet	6.47
		Asteraceae	*Cirsium virginianum*	Thistle	4.44
		Poaceae	*Poa pratensis*	Blue poa	1.90
		Fabaceae	*Trifolium repens*	White clover	1.90
		Solanaceae	*Solanum carolinense*	Carolina horsenettle	1.27
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	1.27
		Fabaceae	*Trifolium pratense*	Red clover	1.27
		Fabaceae	*Chamaecrista fasciculata*	Partridge pea	0.25
		Apiaceae	*Heracleum maximum*	Cow parsnip	0.25
	3	Poaceae	*Panicum virgatum*	Switchgrass	38.78
		Lamiaceae	*Monarda fistulosa*	Beebalm	28.04
		Fabaceae	*Trifolium pratense*	Red clover	12.15
		Apiaceae	*Daucus carota*	Queen Anne’s lace	5.60
		Asteraceae	*Rudbeckia hirta*	Black-eyed susan	7.94
		Apocynaceae	*Apocynum cannabinum*	Dogbane	7.01
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	0.47
	4	Lamiaceae	*Monarda fistulosa*	Beebalm	26.87
		Asteraceae	Solidago sempervirens	Seaside goldenrod	26.87
		Poaceae	*Andropogon gerardi*	Big bluestem	17.91
		Poaceae	*Panicum virgatum*	Switchgrass	15.67

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
High-Low					
Native comparison	4	Cyperaceae	*Cyperus esculentus*	Yellow nutsedge	4.48
(Porcelain berry)		Poaceae	*Elymus virginicus*	Virginia wildrye	3.73
		Asteraceae	*Cirsium arvense*	Canada thistle	2.24
		Poaceae	*Sorghastrum nutans*	Indiangrass	1.49
		Fabaceae	*Desmodium canescens*	Beggar-ticks	0.75
Autumn olive	1	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	54.03
		Platanaceae	*Platanus occidentalis*	American sycamore	10.81
		Asteraceae	*Solidago canadensis*	Canada goldenrod	10.09
		Rosaceae	*Rosa multiflora*	Multiflora rose	6.38
		Rosaceae	*Rubus armeniacus*	Himalayan blackberry	5.40
		Rosaceae	*Pyrus calleryensis*	Callery pear	4.03
		Rosaceae	*Rubus idaeus*	Raspberry	3.93
		Fabaceae	*Lepedeza bicoloor*	Shrub lepedeza	2.20
		Vitaceae	*Parthenocissus quinquefolia*	Virginia Creeper	1.73
		Poaceae	*Dactylis glomerata*	Orchardgrass	1.08
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	0.32
	2	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	90.91
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	5.45
		Poaceae	*Dactylis glomerata*	Orchardgrass	1.82
		Poaceae	*Poa pratensis*	Blue poa	1.82
	3	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	46.86
		Poaceae	*Dactylis glomerata*	Orchardgrass	14.40
		Asteraceae	*Solidago canadensis*	Canada goldenrod	10.90
		Poaceae	*Festuca rubra*	Creeping red fescue	7.48
		Asclepiaceae	*Asclepias syriaca*	Common milkweed	5.08
		Rosaceae	*Rosa multiflora*	Multiflora rose	4.11
		Apiaceae	*Daucus carota*	Queen Anne’s lace	3.28

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
High-Low Autumn olive	3	Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	2.40
		Vitaceae	*Parthenocissus quinquefolia*	Virginia Creeper	1.89
		Lamiaceae	*Monarda fistulosa*	Beebalm	1.85
		Rosaceae	*Rubus allegheniensis*	Blackberry	1.75
	4	Elaeagnaceae	*Elaeagnus umbellata*	Autumn olive	79.37
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	16.67
		Rosaceae	*Rosa multiflora*	Multiflora rose	3.96
Native comparison (Autumn olive)	1	Magnoliaceae	*Liriodendron tulipifera*	Tulip poplar	16.93
		Fagaceae	*Quercus alba*	White oak	16.93
		Asteraceae	*Solidago canadensis*	Canada goldenrod	10.44
		Rosaceae	*Rubus allegheniensis*	Blackberry	9.25
		Aceraceae	*Acer rubrum*	Red maple	8.83
		Platanaceae	*Platanus occidentalis*	American sycamore	8.46
		Rosaceae	*Rosa multiflora*	Multiflora rose	5.44
		Rosaceae	*Rubus idaeus*	Raspberry	4.23
		Poaceae	*Dactylis glomerata*	Orchardgrass	3.22
		Poaceae	*Elymus virginicus*	Virginia wildrye	2.93
		Amaryllidaceae	*Allium canadense*	Wild onion	2.23
		Poaceae	*Festuca rubra*	Creeping red fescue	1.95
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	1.81
		Rosacea	*Crataegus* sp.	Hawthorn	1.72
		Vitaceae	*Vitis aestivalis*	Wild grape	1.72
		Fagaceae	*Quercus macrocarpa*	Blackjack oak	1.21
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.79
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	0.71
		Apiaceae	*Daucus carota*	Queen Anne’s lace	0.71
		Lamiaceae	*Monarda fistulosa*	Beebalm	0.28
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	0.23

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
High-Low					
Native comparison	2	Rosaceae	*Prunus serotina*	Black cherry	55.25
(Autumn olive)		Poaceae	*Panicum virgatum*	Switchgrass	37.57
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	3.31
		Rosaceae	*Rubus allegheniensis*	Blackberry	1.66
		Asteraceae	*Solidago hispida*	Hairy goldenrod	1.10
		Rosaceae	*Rubus idaeus*	Raspberry	1.10
	3	Magnoliaceae	*Liriodendron tulipifera*	Tulip poplar	32.79
		Platanaceae	*Platanus occidentalis*	American sycamore	21.86
		Asteraceae	*Solidago canadensis*	Canada goldenrod	21.31
		Rosaceae	*Rosa multiflora*	Multiflora rose	5.46
		Rosaceae	*Rubus allegheniensis*	Blackberry	4.37
		Roseaceae	*Rubus flagellaris*	Dewberry	2.73
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	2.19
		Lamiaceae	*Monarda fistulosa*	Beebalm	1.64
		Fabaceae	*Lepedeza bicoloor*	Shrub lepedeza	1.09
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.55
		Poaceae	*Elymus virginicus*	Virginia wildrye	0.55
		Amaryllidaceae	*Allium canadense*	Wild onion	0.55
	4	Nyssaceae	*Nyssa sylvatica*	Black tupelo	29.70
		Asteraceae	*Solidago canadensis*	Canada goldenrod	22.28
		Aquafoliaceae	*Ilex verticillata*	Winterberry	16.83
		Juglandaceae	*Juglans nigra*	Black walnut	9.91
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	7.43
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	5.44
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	3.96
		Rosaceae	*Rubus idaeus*	Raspberry	2.48
		Rosaceae	*Rosa multiflora*	Multiflora rose	1.98

(Appendix C continued)

Scenario	*Site*	*Family*	*Species name*	*Common name*	*% individuals*
High-Low Callery Pear	1	Rosaceae	*Pyrus calleryensis*	Callery pear	46.54
		Poaceae	*Elymus virginicus*	Virginia wildrye	18.01
		Poaceae	*Dactylis glomerata*	Orchardgrass	12.41
		Lamiaceae	*Monarda fistulosa*	Beebalm	6.64
		Asteraceae	*Solidago odora*	Sweet goldenrod	4.85
		Poaceae	*Festuca rubra*	Creeping red fescue	4.10
		Rosaceae	*Rosa multiflora*	Multiflora rose	3.98
		Poaceae	*Lolium multiflorum*	Italian ryegrass	3.46
	2	Rosaceae	*Pyrus calleryensis*	Callery pear	56.01
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	13.51
		Asteraceae	*Solidago odora*	Sweet goldenrod	10.13
		Rosaceae	*Rubus armeniacus*	Himalayan blackberry	4.73
		Poaceae	*Dactylis glomerata*	Orchardgrass	4.59
		Lamiaceae	*Monarda fistulosa*	Beebalm	4.32
		Solanaceae	*Solanum carolinense*	Carolina horsenettle	3.60
		Fabaceae	*Desmodium canescens*	Beggar-ticks	2.75
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	0.86
	3	Rosaceae	*Pyrus calleryensis*	Callery pear	53.76
		Asteraceae	*Solidago canadensis*	Canada goldenrod	35.48
		Rosaceae	*Rubus allegheniensis*	Blackberry	10.75
	4	Rosaceae	*Pyrus calleryensis*	Callery pear	54.95
		Asteraceae	*Solidago canadensis*	Canada goldenrod	39.10
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	3.30
		Poaceae	*Sorghastrum nutans*	Indiangrass	2.74
Native comparison (Callery Pear)	1	Aceraceae	*Acer rubrum*	Red maple	22.10
		Fagaceae	*Quercus alba*	White oak	22.10

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
High-Low					
Native comparison	1	Poaceae	*Elymus virginicus*	Virginia wildrye	17.13
(Callery Pear)		Platanaceae	*Platanus occidentalis*	American sycamore	11.05
		Asteraceae	*Solidago canadensis*	Canada goldenrod	7.18
		Rosaceae	*Rosa multiflora*	Multiflora rose	7.18
		Roseaceae	*Rubus flagellaris*	Dewberry	4.42
		Lamiaceae	*Monarda fistulosa*	Beebalm	3.31
		Poaceae	*Lolium multiflorum*	Italian ryegrass	2.21
		Amaryllidaceae	*Allium canadense*	Wild onion	1.66
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	1.10
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.55
	2	Platanaceae	*Platanus occidentalis*	American sycamore	31.65
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	14.31
		Asteraceae	*Solidago canadensis*	Canada goldenrod	13.43
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	10.90
				Chestnut oak	10.55
		Aceraceae	*Acer rubrum*	Red maple	10.55
		Rosaceae	*Rubus allegheniensis*	Blackberry	5.20
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	2.78
		Lamiaceae	*Monarda fistulosa*	Beebalm	0.63
	3	Altingiaceae	*Liquidambar styraciflua*	American sweetgum	51.28
		Asteraceae	*Solidago canadensis*	Canada goldenrod	37.95
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	7.69
		Rosaceae	*Rubus idaeus*	Raspberry	3.08
	4	Adoxaceae	*Viburnum dentatum*	Arrowood viburnum	40.00
		Asteraceae	*Solidago odora*	Sweet goldenrod	15.00
		Rosaceae	*Rubus idaeus*	Raspberry	12.50
		Myricaceae	*Myrica pensylvanica*	Wax myrtle	12.50

(Appendix C continued)

Scenario	*Site*	*Family*	*Species name*	*Common name*	*% individuals*
High-Low Native comparison (Callery Pear)	4	Anacardiaceae	*Toxicodendron radicans*	Poison ivy	7.50
		Rosaceae	*Malus angustifolia*	Crabapple	3.50
		Apocynaceae	*Apocynum cannabinum*	Dogbane	3.50
		Poaceae	*Andropogon gerardi*	Big bluestem	2.50
		Aceraceae	*Acer rubrum*	Red maple	2.50
		Poaceae	*Panicum virgatum*	Switchgrass	0.50
Low-High Orchardgrass	1	Poaceae	*Dactylis glomerata*	Orchardgrass	54.98
		Poaceae	*Festuca rubra*	Creeping red fescue	39.52
		Poaceae	*Elymus virginicus*	Virginia wildrye	5.15
		Amaryllidaceae	*Allium canadense*	Wild onion	0.34
	2	Poaceae	*Dactylis glomerata*	Orchardgrass	45.73
		Poaceae	*Festuca rubra*	Creeping red fescue	31.81
		Poaceae	*Elymus virginicus*	Virginia wildrye	21.61
		Asclepiaceae	*Asclepias syriaca*	Common milkweed	0.20
		Amaryllidaceae	*Allium canadense*	Wild onion	0.20
	3	Poaceae	*Dactylis glomerata*	Orchardgrass	52.10
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	24.64
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	9.12
		Ulmaceae	*Ulmus pumila*	Siberian elm	6.39
		Asteraceae	*Verbesina encelioides*	Cowpen daisy	1.82
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	1.82
		Poaceae	*Poa trivialis*	Bluegrass	1.82
		Asclepiadaceae	*Vincetoxicum nigrum*	Black swallow-wort	0.91
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	0.91
		Rosaceae	*Rubus allegheniensis*	Blackberry	0.18
		Asteraceae	*Cirsium arvense*	Canada thistle	0.18

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Low-High Orchardgrass	4	Poaceae	*Dactylis glomerata*	Orchardgrass	64.16
		Poaceae	*Tridens flavus*	Purple tridens	13.65
		Poaceae	*Poa trivialis*	Bluegrass	12.97
		Ranunculaceae	*Thalictrum thalictroides*	Meadow-rue	5.12
		Convolvulaceae	*Convolvulus sepium*	Bindweed	1.19
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	1.02
		Fabaceae	*Robinia pseudoacacia*	Black locust	0.85
		Brassicaceae	*Alliaria petiolata*	Garlic mustard	0.85
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	0.17
		Amaranthaceae	*Amaranthus hybridus*	Smooth pigweed	0.17
Native comparison (Orchardgrass)	1	Poaceae	*Andropogon gerardi*	Big bluestem	39.41
		Poaceae	*Panicum virgatum*	Switchgrass	39.41
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	12.36
		Asteraceae	*Solidago odora*	Sweet goldenrod	3.09
		Apocynaceae	*Apocynum cannabinum*	Dogbane	2.47
		Asteraceae	*Cirsium vulgare*	Bull thistle	0.77
		Fabaceae	*Trifolium repens*	White clover	0.77
		Amaryllidaceae	*Allium canadense*	Wild onion	0.15
		Poaceae	*Lolium perenne*	Winter ryegrass	0.15
	2	Poaceae	*Andropogon gerardi*	Big bluestem	45.88
		Poaceae	*Panicum virgatum*	Switchgrass	23.62
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	17.54
		Cyperaceae	*Cyperus esculentus*	Yellow nutsedge	3.37
		Asteraceae	*Solidago odora*	Sweet goldenrod	0.13
	3	Poaceae	*Panicum virgatum*	Switchgrass	27.93
		Poaceae	*Andropogon gerardi*	Big bluestem	19.55
		Ranunculaceae	*Thalictrum thalictroides*	Meadow-rue	14.66

(Appendix C continued)

Scenario	*Site*	*Family*	*Species name*	*Common name*	*% individuals*
Low-High					
Native comparison	3	Cyperaceae	*Cyperus esculentus*	Yellow nutsedge	12.57
(Orchardgrass)		Convolvulaceae	*Convolvulus sepium*	Bindweed	11.31
		Bignoniaceae	*Campsis radicans*	Trumpet vine	1.40
		Lamiaceae	*Glechoma hederacea*	Ground ivy	0.69
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	0.69
		Fabaceae	*Vicia sativa*	Narrow-leaf vetch	0.69
		Commelinaceae	*Tradescantia ohiensis*	Ohio spiderwort	0.69
	4	Rubiaceae	*Galium aparine*	Common bedstraw	21.82
		Poaceae	*Digitaria cognate*	Witchgrass	20.46
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	19.46
		Poaceae	*Tridens flavus*	Purple tridens	12.97
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	11.20
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	4.72
		Poaceae	*Schizachyrium scoparium*	Little bluestem	4.13
		Convolvulaceae	*Convolvulus sepium*	Bindweed	1.30
		Fabaceae	*Robinia pseudoacacia*	Black locust	1.18
		Fabaceae	*Trifolium pratense*	Red clover	1.18
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.59
		Rosaceae	*Rubus allegheniensis*	Blackberry	0.12
		Commelinaceae	*Tradescantia ohiensis*	Ohio spiderwort	0.12
Alfalfa	1	Fabaceae	*Medicago sativa*	Alfalfa	87.59
		Amaranthaceae	*Amaranthus hybridus*	Smooth pigweed	7.30
		Euphorbiaceae	*Euphorbia* sp.	Euphorbia	2.43
		Amaranthaceae	*Amaranthus retroflexus*	Hairy pigweed	2.43
		Asclepiaceae	*Asclepias syriaca*	Common milkweed	0.24
	2	Fabaceae	*Medicago sativa*	Alfalfa	99.74
		Amaranthaceae	*Amaranthus hybridus*	Smooth pigweed	0.26

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Low-High Alfalfa	3	Fabaceae	*Medicago sativa*	Alfalfa	88.93
		Amaranthaceae	*Amaranthus hybridus*	Smooth pigweed	6.02
		Amaranthaceae	*Amaranthus retroflexus*	Hairy pigweed	4.08
		Asteraceae	*Taraxacum officinale*	Common dandelion	0.97
	4	Fabaceae	*Medicago sativa*	Alfalfa	81.67
		Amaranthaceae	*Amaranthus hybridus*	Smooth pigweed	16.67
		Amaranthaceae	*Amaranthus retroflexus*	Hairy pigweed	1.67
Native comparison (Alfalfa)	1	Lamiaceae	*Monarda fistulosa*	Beebalm	22.56
		Poaceae	*Andropogon gerardi*	Big bluestem	14.02
		Poaceae	*Schizachyrium scoparium*	Little bluestem	12.20
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	12.20
		Asteraceae	*Solidago canadensis*	Canada goldenrod	8.53
		Apiaceae	*Daucus carota*	Queen Anne’s lace	7.93
		Anacardiaceae	*Rhus glabra*	Smooth sumac	6.10
		Asclepiaceae	*Asclepias syriaca*	Common milkweed	5.49
		Asteraceae	*Rudbeckia hirta*	Black-eyed susan	4.88
		Asteraceae	*Verbesina encelioides*	Cowpen daisy	3.66
		Fabaceae	*Chamaecrista fasciculata*	Partridge pea	1.22
		Plantaginaceae	*Plantago major*	Plantain	1.22
	2	Lamiaceae	*Monarda fistulosa*	Beebalm	53.66
		Asteraceae	*Rudbeckia hirta*	Black-eyed susan	15.73
		Apiaceae	*Daucus carota*	Queen Anne’s lace	11.80
		Rubiaceae	*Galium aparine*	Common bedstraw	6.74
		Poaceae	*Elymus virginicus*	Virginia wildrye	6.74
		Fabaceae	*Trifolium pratense*	Red clover	5.62
		Fabaceae	*Chamaecrista fasciculata*	Partridge pea	3.37
		Convolvulaceae	*Convolvulus sepium*	Bindweed	0.56

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Low-High Native comparison (Alfalfa)	3	Lamiaceae	*Monarda fistulosa*	Beebalm	31.25
		Apiaceae	*Daucus carota*	Queen Anne's lace	19.38
		Asteraceae	*Rudbeckia hirta*	Black-eyed susan	13.13
		Poaceae	*Andropogon gerardi*	Big bluestem	12.50
		Fabaceae	*Chamaecrista fasciculata*	Partridge pea	12.50
		Rubiaceae	*Galium aparine*	Common bedstraw	7.50
		Fabaceae	*Trifolium pratense*	Red clover	3.75
	4	Lamiaceae	*Monarda fistulosa*	Beebalm	50.63
		Poaceae	*Andropogon gerardi*	Big bluestem	12.66
		Rubiaceae	*Galium aparine*	Common bedstraw	9.49
		Fabaceae	*Trifolium pratense*	Red clover	8.86
		Plantaginaceae	*Plantago major*	Plantain	3.80
		Asteraceae	*Rudbeckia hirta*	Black-eyed susan	3.16
		Poaceae	*Sorghastrum nutans*	Indiangrass	3.16
		Fabaceae	*Chamaecrista fasciculata*	Partridge pea	1.90
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	1.90
		Apiaceae	*Daucus carota*	Queen Anne's lace	1.90
		Poaceae	*Elymus virginicus*	Virginia wildrye	1.90
		Asteraceae	*Euthamia graminifolia*	Grassleaf goldenrod	0.63
Queen Anne's lace	1	Apiaceae	*Daucus carota*	Queen Anne's lace	62.64
		Caprifoliaceae	*Lonicera morrow*	Bush honeysuckle	14.87
		Anacardiaceae	*Rhus typhina*	Staghorn sumac	9.92
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	9.09
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	3.31
		Rosaceae	*Prunus serotina*	Black cherry	0.17

(Appendix C continued)

Scenario	*Site*	*Family*	*Species name*	*Common name*	*% individuals*
Low-High					
Queen Anne's lace	2	Apiaceae	*Daucus carota*	Queen Anne's lace	51.83
		Asteraceae	*Euthamia graminifolia*	Grassleaf goldenrod	21.34
		Poaceae	*Panicum virgatum*	Switchgrass	12.20
		Anacardiaceae	*Rhus copallinum*	Winged sumac	12.20
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	1.22
		Asteraceae	*Achillea millefolium*	Common yarrow	0.61
		Poaceae	*Spartina alternifolia*	Cordgrass	0.61
	3	Apiaceae	*Daucus carota*	Queen Anne's lace	65.17
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	21.38
		Caprifoliaceae	*Lonicera morrowii*	Bush honeysuckle	12.22
		Rosaceae	*Rubus allegheniensis*	Blackberry	1.02
		Rosaceae	*Prunus serotina*	Black cherry	0.20
	4	Apiaceae	*Daucus carota*	Queen Anne's lace	65.96
		Asteraceae	*Euthamia graminifolia*	Grassleaf goldenrod	31.91
		Asteraceae	*Rudbeckia hirta*	Black-eyed susan	2.13
Native comparison	1	Poaceae	*Panicum virgatum*	Switchgrass	40.20
(Queen Anne's lace)		Poaceae	*Andropogon gerardi*	Big bluestem	28.48
		Asteraceae	*Solidago sempervirens*	Seaside goldenrod	16.08
		Fabaceae	*Chamaecrista fasciculata*	Partridge pea	5.86
		Asteraceae	*Solidago bicolor*	Silver goldenrod	4.19
		Fabaceae	*Vicia sativa*	Narrow-leaf vetch	3.52
		Anacardiaceae	*Rhus copallinum*	Winged sumac	1.68
	2	Poaceae	*Sorghastrum nutans*	Indiangrass	45.76
		Poaceae	*Panicum virgatum*	Switchgrass	18.33
		Poaceae	*Andropogon gerardi*	Big bluestem	12.45
		Fabaceae	*Desmodium canescens*	Beggar-ticks	12.45

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
Low-High					
Native comparison	2	Anacardiaceae	*Toxicodendron radicans*	Poison ivy	9.18
(Queen Anne's lace)		Bignoniaceae	*Campsis radicans*	Trumpet vine	1.83
	3	Poaceae	*Panicum virgatum*	Switchgrass	69.09
		Asteraceae	*Solidago bicolor*	Silver goldenrod	13.64
		Fabaceae	*Senna hebecarpa*	Wild senna	6.64
		Oxalidaceae	*Oxalis stricta*	Woodsorrel	4.99
		Poaceae	*Andropogon gerardi*	Big bluestem	2.82
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	1.91
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	0.91
	4	Poaceae	*Andropogon virginicus*	Broomsedge	52.75
		Poaceae	*Digitaria cognata*	witchgrass	22.39
		Poaceae	*Andropogon gerardi*	Big bluestem	5.33
		Asteraceae	*Ambrosia artemisiifolia*	Common ragweed	5.33
		Fabaceae	*Trifolium pretense*	Red clover	5.46
		Asteraceae	*Rudbeckia hirta*	Black-eyed susan	3.42
		Asteraceae	*Euthamia graminifolia*	Grassleaf goldenrod	2.37
		Asteraceae	*Solidago bicolor*	Silver goldenrod	1.68
		Poaceae	*Setaria italica*	Foxtail millet	0.64
		Solanaceae	*Solanum carolinense*	Carolina horsenettle	0.64
High-High					
Norway maple	1	Aceraceae	*Acer platanoides*	Norway maple	56.46
		Aceraceae	*Acer rubrum*	Red maple	35.30
		Rosaceae	*Rosa multiflora*	Multiflora rose	5.14
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	3.10
	2	Aceraceae	*Acer platanoides*	Norway maple	62.37
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	12.89

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
High-High					
Norway maple	2	Anacardiaceae	*Toxicodendron radicans*	Poison ivy	11.45
		Lamiaceae	*Monarda punctata*	Horsemint	7.21
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	4.33
		Bignoniaceae	*Campsis radicans*	Trumpet vine	1.75
	3	Aceraceae	*Acer platanoides*	Norway maple	97.25
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	2.75
	4	Aceraceae	*Acer platanoides*	Norway maple	87.13
		Poaceae	*Festuca rubra*	Creeping red fescue	6.66
		Bignoniaceae	*Paulownia tomentosa*	Empress tree	5.75
		Fabaceae	*Cercis canadensis*	Eastern redbud	0.46
Native comparison	1	Aceracea	*Acer saccharinum*	Silver maple	73.47
(Norway maple)		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	12.49
		Aceraceae	*Acer rubrum*	Red maple	7.50
		Amaranthaceae	*Amaranthus hybridus*	Smooth pigweed	3.31
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	2.07
		Poaceae	*Festuca rubra*	Creeping red fescue	1.16
	2	Aceracea	*Acer saccharinum*	Silver maple	92.00
		Vitaceae	*Vitis aestivalis*	Wild grape	4.00
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	2.00
		Fabaceae	*Robinia pseudoacacia*	Black locust	2.00
	3	Aceraceae	*Acer rubrum*	Red maple	52.17
		Asteraceae	*Solidago canadensis*	Canada goldenrod	22.42
		Rosaceae	*Rubus idaeus*	Raspberry	8.90
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	8.90
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	4.33

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
High-High Native comparison (Norway maple)	3	Apocynaceae	*Apocynum cannabinum*	Dogbane	1.18
		Asteraceae	*Leucanthemum vulgare*	Oxeye daisy	1.05
		Poaceae	*Oplismenus undulatifolius*	Wavy-leaf basketgrass	0.95
	4	Aceracea	*Acer saccharum*	Sugar maple	46.95
		Lauraceae	*Lindera benzoin*	Spicebush	26.64
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	14.44
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	11.97
Wineberry	1	Rosaceae	*Rubus phoenicolasius*	Wineberry	52.63
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	12.16
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	10.03
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	8.77
		Asteraceae	*Solidago canadensis*	Canada goldenrod	7.64
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	6.02
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	2.76
	2	Rosaceae	*Rubus phoenicolasius*	Wineberry	68.40
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	25.79
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	3.51
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	2.30
	3	Rosaceae	*Rubus phoenicolasius*	Wineberry	83.22
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	16.78
	4	Rosaceae	*Rubus phoenicolasius*	Wineberry	46.25
		Rosaceae	*Rosa multiflora*	Multiflora rose	31.96
		Lauraceae	*Lindera benzoin*	Spicebush	11.35
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	9.76
		Vitaceae	*Parthenocissus quinquefolia*	Virginia creeper	0.79

(Appendix C continued)

Scenario	***Site***	***Family***	***Species name***	***Common name***	***% individuals***
High-High Wineberry	4	Athyrioiceae	*Diplazium pycnocarpon*	Fern	
Native comparison (Wineberry)	1	Rosaceae	*Rubus allegheniensis*	Blackberry	62.80
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	13.39
		Asteraceae	*Solidago odora*	Sweet goldenrod	10.24
		Vitaceae	*Ampelopsis brevipedunculata*	Porcelain berry	8.89
		Apocynaceae	*Apocynum cannabinum*	Dogbane	4.61
	2	Rosaceae	*Rubus allegheniensis*	Blackberry	66.05
		Asteraceae	*Solidago canadensis*	Canada goldenrod	18.89
		Asteraceae	*Solidago odora*	Sweet goldenrod	10.92
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	4.15
	3	Rosaceae	*Rubus allegheniensis*	Blackberry	51.01
		Poaceae	*Panicum dichotomiflorum*	Fall panicum	19.60
		Poaceae	*Panicum virgatum*	Switchgrass	8.74
		Hypericaceae	*Hypericum perforatum*	St. John's Wort	7.88
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	5.00
		Celastraceae	*Celastrus orbiculatus*	Oriental bittersweet	4.71
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	3.07
	4	Rosaceae	*Rubus allegheniensis*	Blackberry	71.33
		Poaceae	*Microstegium vimineum*	Japanese stiltgrass	11.74
		Balsaminaceae	*Impatiens capensis*	Jewelweed	8.24
		Anacardiaceae	*Toxicodendron radicans*	Poison ivy	6.45
		Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	1.97
		Poaceae	*Poa pratensis*	Blue poa	0.27

APPENDIX D: LIST OF ARTHROPOD TAXA, AS WELL AS GASTROPODS AND EARTHWORMS, COLLECTED FOR THE ECO-EVOLUTIONARY HYPOTHESIS STUDY, SUMMER 2016. Taxa marked with an asterisk (*) are recognized as non-native in the Mid-Atlantic region.

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Acari	Astigmata	Acaridia	Acaridae		Unknown spp.
	Ixodida		Ixodidae		*Dermacentor variabilis*
					Ixodes scapularis
	Mesostigmata	Dermanyssina	Phytoseiidae		Unknown spp.
		Parasitina	Parasitidae		*Poecilochirus* sp.
					Unknown spp.
	Sarcoptiformes	Oribatida	Damaeidae		Unknown spp.
			Euphthiracaridae		Unknown spp.
			Euzetidae		*Euzetes* sp.
			Galumnidae		Unknown spp.
			Lohmanniidae		Unknown spp.
			Mochlozetidae		Unknown spp.
			Nothridae		Unknown spp.
			Oribatulidae		Unknown spp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Acari	Sarcoptiformes	Oribatida	Phthiracaridae		Unknown spp.
	Trombidiformes	Prostigmata	Anystidae		Unknown spp.
			Bdellidae		Unknown spp.
			Eriophyidae		*Eriophyes emerginatae*
			Erythraeidae	Balaustiinae	*Balaustium* sp.
				Leptinae	*Leptus* sp.
			Eupodidae		Unknown spp.
			Smardidae		Unknown spp.
			Tetranychidae	Tetranychinae	*Tetranychus* sp.
					Dinothrombium sp.
					Trombidium sp.
			Tyeidae		Unknown spp.
Arachnida	Araneae	Araneomorphae	Agelenidae		*Agelenopsis pennsylvanicus*
			Amaurobiidae		Unknown spp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Anyphaenidae		*Anyphaena* sp.
					Arachnosa sp.
					Hibana gracillus
					Lupettiana mordax
			Araneidae		*Acacesia hamata*
					Araneus thaddeus
					Araneus sp.
					Araniella displicata
					Hyposinga rubens
					Larinia borealis
					Leucauge versuta
					Mastophora sp.
					Neoscona arabesca
			Clubionidae		*Clubiona* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Clubionidae		*Elaver* sp.
			Corinnidae		*Castianeira* sp.
					Drassinella sp.
					Scotinella fraternella
					Unknown spp.
			Ctenidae		*Anahita punctulate*
			Cybaeidae		*Cybaeus giganteus*
			Gnaphosidae		*Gnaphosa* sp.
					Herpyllus ecclesiasticus
					Micaria longipes
					Zelotes sp.
			Linyphiidae	Erigoninae	*Ceratinospidis Formosa*
					Ergione sp.
					Grammonota gentilis
					Hypselistes sp.
				Linyphiinae	*Diplostyla concolor*

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Lycosidae		*Allocosa funerea*
					Geolycosa pikei
					Gladicosa gulosa
					Hesperocosa unica
					Hogna carolina
					Hogna sp.
					Pardosa moesta
					Pardosa mackenziana
					Pardosa sternalis
					Pardosa xerampelina
					Pardosa sp.
					Pirata sp.
					Rabidosa rabida
					Schizocosa species 1
					Schizocosa species 2
					Sossipes sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Oxyopidae		*Oxyopes aglossus*
					Oxyopes salticus
					Peucetia viridans
			Philodromidae		*Tibellus maritimus*
			Phrurolithidae		*Phrurotimpus* spp.
					Scotinella fraternella
					Scotinella redempta
					Scotinella sp.
			Pisauridae		*Pisaurina* sp.
			Salticidae		*Colonus puerperus*
					Colonus sylvanus
					Eris militaris
					Habronattus coecatus
					Habronattus sp.
					Hentzia palmarum
					Hentzia sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Salticidae		*Maevia* sp.
					Marpissa formosa
					Messua sp.
					Peckhamia americana
					Pelegrina galathea
					Phidippus audax
					Phidippus clarus
					Phidippus sp.
					Sitticus sp.
					Synageles noxiosus
					Synageles sp.
			Tetragnathidae		*Glenognatha foxi*
					Meta ovalis
					Pachygnatha tristriata
					Pachygnatha sp.
					Tetragnata spp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Arachnida	Araneae	Araneomorphae	Theridiidae		*Asagena americana*
					Crustulina sticta
					Dipoena nigra
					Enoplognata ovalis
					Robertus pumilis
					Theridion sp.
					Theridula emertoni
					Theridula opulenta
					Thymoites sp.
			Thomisidae		*Bassaniana versicolor*
					Misumena vatia
					Misumena sp.
					Misumenoides sp.
					Misumessus oblongatus
					Ozyptila sp.
					Xysticus elegans

(Appendix D continued)

Class/Subclass	Order	Suborder	Family	Subfamily	Genus & Species
Arachnida	Araneae	Araneomorphae	Thomisidae		*Xysticus ferox*
					Xysticus sp.
			Trachelidae		*Trachelas tranquillus*
		Mygalomorphae	Atypidae		*Atypus snetsingeri*
					Sphodros atlanticus
	Opiliones	Eupnoi	Phalangiidae		*Phalangio opillio*
			Sclerosomatidae		*Hadrobunus* spp.
					Leiobunum nigripalpi
	Pseudoscorpiones	Epiocheirata	Chtoniidae		*Apochthonius* sp.
					Chthonius sp.
		Iocheirata	Cheliferidae		*Chelifer* sp.
			Neobisiidae		*Microbisium parvulum*
Chilopoda	Geophilomorpha		Geophilidae		*Arenophilus bipuncticeps*
					Geophilus flavus
			Schendylidae		*Schendyla nemorensis*
	Lithobiomorpha		Henicopidae		Unknown spp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Chilopoda	Lithobiomorpha		Lithobiidae		*Lithobius* sp.
	Scolopendromorpha		Scolopendridae		*Hemiscolopendra marginata*
Clitellata	Haplotaxida	Lumbricina	Lumbricidae*		Unknown spp.
			Megascolecidae		*Amynthas* sp. *
Diplopoda	Callipodida		Abacionidae		*Abacion magnus*
	Julida		Blaniulidae		*Blaniulus guttulatus**
			Julidae		*Cylindroiulus* spp.
					Unknown spp.
			Parajulidae		*Uroblaniulus carolinensis*
	Polydesmida		Paradoxosomatidae		*Oxidus gracillis**
			Xystodesmidae		*Sigmoria* sp.
					Unknown spp.
	Spirobolida		Spirobolidae		*Narceus americanus*
Gastropoda	Stylommatophora	Elasmognatha	Succineidae		*Succinea* sp.*
		Orthurethra	Pupillidae*		Unknown spp.
		Sigmurethra	Arionidae		*Arion circumscriptus**

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Gastropoda	Stylommatophora	Sigmurethra	Arionidae		*Arion intermedius**
			Bradybaenidae		*Bradybaena similaris**
			Helicidae		*Helicella caperata**
					*Hygromia hispida**
					*Hygromia striolata**
			Limacidae		*Limax maximus**
			Polygyridae		*Mesodon mitchellia*
			Zontidae		*Vitrina limpida**
Insecta	Blattodea		Blattellidae		*Parcoblatta pennsylvanica*
	Coleoptera	Adephaga	Carabidae	Carabinae	*Callisthenes calidus*
					*Carabus nemoralis**
					Sphaeroderus stenostomus
				Cicindelinae	*Cicindelidia punctulata*
				Harpalinae	*Acupalpus indistinctus*
					Acupalpus nanellus
					Acupalpus testaceus

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Adephaga	Carabidae	Harpalinae	*Acupalpus* spp.
					Agonum cupripenna
					Agonum errans
					Agonum ferreum
					Agonum octopuncatum
					Agonum spp.
					Amara aenea
					Amara musculis
					Amara sp.
					Anisodactylus merula
					Anisodactylus ovularis
					Anisodactylus sanctaecrucis
					Bradycellus sp.
					Calathus opaculus
					Chlaenius aestivus
					Chlaenius pennsylvanicus

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Adephaga	Carabidae	Harpalinae	*Chlaenius tomentosus*
					Chlaenius tricolor
					Colliuris pensylvanica
					Cyclotrachelus sp.
					Cymindis americanus
					Cymindis laticollis
					Dicaelus dilatatus
					Dicaelus purpuratus
					Dromius piceus
					Galerita bicolor
					Galerita janus
					Galerita sp.
					Gastrellarius sp.
					Harpalus affinis
					Harpalus caliginosus
					Harpalus erraticus

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Adephaga	Carabidae	Harpalinae	*Harpalus faunus*
					Harpalus nigritarsus
					Harpalus pennsylvanicus
					Harpalus rubripes
					*Harpalus rufipes**
					Lebia fuscata
					Lebia ornata
					Myas coracinus
					Myas cyanescens
					Notiobia maculicornis
					Notiobia sayi
					Plochionus timidus
					Poecilus chalcites
					Poecilus lucublandus
					Pterostichus adoxus
					Pterostichus diligensis

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Adephaga	Carabidae	Harpalinae	Pterostichus rostratus
					Pterostichus stygicus
					Pterostichus sp.
					Selenophorus sp.
					Stenolophus sp.
					Stomis pumicatus
					Xestonotus lugubris
				Nebriinae	Notiophilus aeneus
				Scaritinae	Clivina americana
					Paraclivina bipustulata
					Pasimachus americana
					Scarites subterraneus
				Trechinae	Bembidion tetracolum
					Bembidion sp.
					Elaphropus xanthopus
					Tachys sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Anthicidae	Anthicinae	*Anthicus flavicans*
					Anthicus sp.
				Notoxinae	*Notoxus* sp.
				Tomoderinae	*Tomoderus* sp.
			Attelabidae	Rhynchitinae	*Eugnamptus angustatus*
			Brentidae	Apioninae	*Apion* sp.
					Coleocephalapion sp.
					*Ischnopterapion virens**
			Buprestidae	Agrilinae	*Agrilus* sp.
					Taphocerus schaefferi
				Chrysochroinae	*Dicerca tenebrosa*
			Cantharidae	Cantharinae	*Rhagonycha angulata*
				Chauliognathinae	*Chauliognathus pensylvanicus*
			Cerambycidae	Lamiinae	*Tetraopes terophthalmus*
			Chrysomelidae	Bruchinae	*Acanthoscelides* sp.
				Cassidinae	*Anisostena nigrita*

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Chrysomelidae	Cassidinae	*Cassida piperata**
					Charidotella sexpunctata
					Gratiana pallidula
					Microrhopala vittata
					Sumitrosis inaequalis
				Chrysomelinae	*Calligrapha californica*
					Chrysolina sp.
					Leptinotarsa juncta
					*Plagiodera versicolora**
				Cryptocephalinae	*Cryptocephalus* sp.
					Neolasioptera farinosa
				Eumolpinae	*Brachypnoea* sp.
					Colaspis recurva
					Colaspis sp.
					Paria fragariae
					Paria thoracica

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Chrysomelidae	Eumolpinae	*Paria* sp.
					Xanthonia sp.
				Galerucinae	*Acalymma vittatum*
					Altica sp.
					Aphthona insolita
					Chaetocnema confinis
					Chaetocnema cribifrons
					Chaetocnema minuta
					Chaetocnema obtusa
					Chaetocnema pinguis
					Chaetocnema protensa
					Derospidea brevicollis
					Diabrotica undecimpunctata
					Disonycha glabrata
					Disonycha xanthomelas
					Epitrix cucumeris

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Chrysomelidae	Galerucinae	*Epitrix hirtipennis*
					Epitrix sp.
					Glyptina cyanipennis
					Glyptina sp.
					Longitarsus sp.
					Luperaltica sp.
					Psylloides sp.*
			Cleridae	Hydnocerinae	*Isohydnocera curtipennis*
			Coccinellidae	Coccinellinae	*Coccinella septempunctata*
					Coccinella undecimpunctata
					Coleomegilla maculata
					Cycloneda munda
					*Harmonia axyridis**
					Hippodamia parenthesis
					*Propylea quatuordecimpunctata**
					Psyllobora vigintimaculata

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Coccinellidae	Scymaeninae	*Brachiacantha* sp.
					Hyperaspis undulata
					Scymus sp.
			Corylophidae		
			Curculionidae	Baridinae	*Cosmobarius* sp.
					Geraeus picumnus
				Cryptorhynchinae	*Cryptorhynchus* sp.
					Tyloderma sp.
				Curculioninae	*Anthonomus signatus*
					Anthonomus sp.
					Myrmex sp.
				Curculioninae	*Orchestes pallicornis*
				Dryophthorinae	*Tychius picirostris**
					Sphenophorus minimus
					Sphenophorus parvulus
					Sphenophorus straticollis

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Curculionidae	Dryophthorinae	*Sphenophorus venatus*
					Sphenophorus sp.
				Entiminae	*Aphrastus taeniatus*
					*Barypeithes pellucidus**
					*Calomycterus setarius**
					*Cyrtepistomus castaneus**
					*Myosides seriehispidus**
					*Otiorhynchus cribicollis**
					*Otiorhynchus ovatus**
					Phyxelis sp.*
					*Pseudocneorhinus bifasciatus**
					*Pseudoedophrys hilleri**
					*Sciaphilus asperatus**
					*Sitona hispidulus**
				Hyperinae	*Hypera postica**
				Molytinae	*Conotrachelus* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Curculionidae	Scolytinae	*Scolytus rugulosus*
					Scolytus sp.
			Cybocephalidae		*Cybocephalus* sp.
			Dermestidae		*Attagenus* sp.
			Elateridae	Agrypninae	*Aeolus* sp.
					Conoderus bellus
					Conoderus lividus
					Conoderus sp.
				Dendrometrinae	*Hemicrepidius* sp.
				Elaterinae	*Megapenthes* sp.
					Melanotus sp.
			Endomychidae	Lycoperdininae	*Aphorista vittata*
					Lycoperdina ferruginea
			Erotylidae	Xenoscelinae	*Cryptophilus seriatus*
			Eucnemidae	Macraulacinae	*Deltometopus amoenicornis*
			Histeridae	Saprininae	*Euspilotus* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Histeridae	Saprininae	*Saprinus pennsylvanicus*
					Saprinus sp.
			Hybosoridae	Hybosorinae	*Hybosorus roei*
			Lampyridae	Lampyrinae	*Lucidota atra*
					Photinus sp.
			Latridiidae	Corticariinae	*Corticaria* sp.
					Corticarina sp.
					Melanophthalma picta
					Melanophthalma sp.
				Latridiinae	*Dienerella ruficollis**
			Lycidae		Unknown spp.
			Melandryidae		Unknown spp.
			Melyridae		*Colops quadrimaculatus*
			Monotomidae		*Rhizophagus* sp.
			Mordellidae	Mordellinae	*Mordella* sp.
					Mordellistena ornata

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Mordellidae	Mordellinae	*Mordellistena* sp.
			Mycetophagidae		*Litargus balteatus*
			Nitidulidae	Carpophilinae	*Carpohilus sayi*
				Nitidulinae	*Seronia* sp.
					Stelidota coenosa
					Stelidota geminata
			Phalacridae		*Acylomus* sp.
					Olibrus sp.
					Stilbus sp.
			Ptiliidae		Unknown spp.
			Ptilodactylidae		*Ptilodactylus* sp.
			Scarabaeidae	Aphodiinae	*Aidophus parcus*
					Aphodius concavus
					Aphodius stercorosus
					Aphodius sp.
					Ataenius ovatulus

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Scarabaeidae	Aphodiinae	*Ataenius* sp.
				Dynastinae	*Dyscinetus morator*
				Melolonthinae	*Maladera castanea**
					Phyllophaga sp.*
					Serica sp.*
				Rutelinae	*Anomala* sp.
					*Exomala orientalis**
					*Popillia japonica**
					Strigoderma arbicola
				Scarabaeinae	*Copris minutus*
					Onthophagus hecate
					Onthophagus orpheus
			Silphidae		*Necrophila Americana*
					Nicrophorus carolinus
					Nicrophorus orbicollis
			Silvanidae	Brontinae	*Telephanus atricapillus*

(Appendix D continued)

Class/Subclass	*Order*	*Suborder*	*Family*	*Subfamily*	*Genus & Species*
Insecta	Coleoptera	Polyphaga	Staphylinidae	Aleocharinae	*Drusilla* sp.
					Eumicrota sp.
					Gymnusa campbelli
					Gymnusa sp.
					Gyrophaena sp.
					Oxypoda sp.
					Phanerota fasciata
					Phanerota sp.
					Philotus sp.
					Phloeba sp.
					Phloeopora sp.
					Unknown species 1
					Unknown species 2
				Euaesthetinae	*Euaesthetus* sp.
				Omaliinae	*Brathinus* sp.
				Oxytelinae	*Anotylus* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Staphylinidae	Oxytelinae	*Apocellus* sp.
					Carpelimus sp.
					Oxytelus sp.
				Paederinae	*Astenus spectrum*
					Echiaster brevicornes
					Lathrobium sp.
					Lobrathium sp.
					Rugilus sp.
				Pselaphinae	*Batriasymmodes* sp.
				Staphylininae	*Bisnius* sp.
					Philonthus sp.
					Platydracus comes
					Platydracus exulans
					Platydracus maculosus
					Platydracus mysticus
					Quedius sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Coleoptera	Polyphaga	Staphylinidae	Staphylininae	*Tasgius ater*
					Tasgius sp.
				Steninae	*Stenus* sp.
				Tachyporinae	*Tachinus* sp.
					Tachyporus sp.
			Tenebrionidae	Tenebrioninae	*Alaetrinus minimus*
					Blapstinus sp.
	Collembola		Bourletiellidae		*Bourletiella* sp.
			Entomobryidae	Entomobryinae	*Entomobrya atrocincta*
					Entomobrya bicolor
					Entomobrya clitellaria
					Entomobrya intermedia
					Entomobrya multifasciata
					Entomobrya unostrigata
					Entomobrya species 1

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Collembola		Entomobryidae	Entomobryinae	*Entomobrya* species 2
					Entomobrya species 3
					Entomobrya species 4
					Homidia sauteri
			Entomobryidae	Lepidocyrtinae	*Lepidocyrtus cyaneus*
					Lepidocyrtus paradoxus
					Seira sp.
			Hypogastruridae		*Ceratophysella* sp.
			Isotomidae		*Desoria* sp.
			Neanuridae		Unknown spp.
			Neelidae		Unknown spp.
			Sminthurididae		*Sminthurides* sp.
			Sminthuridae		*Sminthurus* sp.
			Tomoceridae		*Pogonognathellus elongatus*
					Pogonognathellus sp.
					Tomocerus longicornis

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Collembola		Tomoceridae		*Tomocerus minor*
					Tomolonus reductus
	Dermaptera		Forficulidae		*Forficula auricularia**
	Diplura		Campodeidae		Unknown spp.
			Japygidae		Unknown spp.
	Diptera	Brachycera	Agroymzidae	Agromyzinae	*Agromyza* sp.
					Japanagromyza sp.
					Ophiomyza sp.
				Phytomyzinae	*Liriomyza trifolii*
					Liriomyza sp.
					Nemorimyza sp.
					Phytomyza sp.
			Anthomyiidae		*Chirosia* sp.
					Leuchophora sp.
			Anthomyzidae		*Anthomyza* sp.
					Mumetopia occipitalis

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Asilidae	Dasypogoninae	*Diogmites basalis*
			Bombyliidae	Phthiriinae	*Poecilognathus* sp.
			Calliphoridae		*Pollenia* sp.
			Chloropidae	Chloropinae	*Chlorops* sp.
					Meromyza sp.
					Parectecephala sp.
					Thaumatomyia glabra
					Thaumatomyia sp.
				Oscinellinae	*Apallates* sp.
					Ceratobarys eulophus
					Chaetochlorops inquilinus
					Conioscinella sp.
					Gaurax dorsalis
					Hippelates sp.
					Liohippelates sp.
					Lipara sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Chloropidae	Oscinellinae	*Olcella parva*
					Oscinella sp.
					Psilacrum arpidia
					Rhopalopterum sp.
					Stenoscinis sp.
			Coelopidae		*Coelopa frigida*
			Dolichopodidae	Diaphorinae	*Chrysotus* sp.
				Diaphorinae	*Diaphorus* sp.
				Dolichopodinae	*Dolichopus* sp.
				Dolichopodinae	*Gymnopternus* sp.
				Sciapodinae	*Conodostylus occidentalis*
					Conodostylus sp.
					Sciapus sp.
			Drosophilidae	Drosophilinae	*Chymomyza amoena*
					Drosophila guttifera
					*Drosophila immigrans**

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Drosophilidae	Drosophilinae	*Drosophila* species 1
					Drosophila species 2
					Drosophila species 3
					Drosophila species 4
				Steganinae	*Leucophenga maculosa*
					Leucophenga varia
					Leuchophenga sp.
			Empididae	Hemerodromiinae	*Chelipoda* sp.
					Unknown spp.
			Ephydridae	Ephydrinae	*Scatella* sp.
					Unknown spp.
			Fanniidae	Fanniinae	*Fannia canicularis*
					Fannia sp.
			Heleomyzidae	Heleomyzinae	*Amoebaleria helvola*
				Sullinae	*Sullia* sp.
			Hybotidae	Tachydromiinae	*Platypalpus* species 1

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Hybotidae	Tachydromiinae	*Platypalpus* species 2
			Hybotidae		Unknown spp.
			Lauxaniidae		*Homoneura* sp.
			Lonchaeidae		*Lonchaea* sp.
			Lonchoptera		*Lonchoptera bifurcata*
			Muscidae		Unknown spp.
			Opomyzidae		*Geomyza tripunctata*
			Phoridae	Metopininae	*Apocephalus coquilletti*
					Apocephalus sp.
					Conicera sp.
					Gymnophora sp.
					Puliciphora sp.
					Conicera sp.
				Phorinae	*Diplonevra nitidula*
					Diplonevra sp.
					Dohrniphora incisuralis

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Phoridae	Phorinae	*Dohrniphora* sp.
					Hypocera sp.
					Phora sp.
					Triphleba sp.
			Pipunculidae	Pipunculinae	*Tomosvaryella* sp.
			Platystomatidae		*Rivellia* sp.
			Rhinophoridae		Unknow spp.
			Sarcophagidae	Sarcophaginae	*Blaesoxipha hunteri*
					Sarcophaga sp.
			Scathophagidae	Scathophaginae	*Gonarcticus* sp.
			Sciomyzidae		*Limnia* sp.
			Sepsidae		*Sepsis* sp.
			Sphaeroceridae	Limosininae	*Leptocera* sp.
					Pterogramma sp.
					Rachispoda sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Brachycera	Sphaeroceridae	Sphaerocerinae	*Parasphaerocera* sp.
			Stratiomyiidae	Sarginae	*Cephalochrysa* sp.
					Unknown spp.
			Syrphidae	Toxomerinae	*Toxomerus marginatus*
					Toxomerus sp.
			Tachinidae	Exoristinae	Unknown spp.
				Phasiinae	*Leucostoma* sp.
				Tachininae	*Tachinus* sp.
					Unknown spp.
			Tephritidae	Tephritinae	*Eutreta* sp.
					Trupanea texana
			Ulidiidae	Otitinae	*Tritoxa flexa*
					Tritoxa incurva
				Ulidiinae	*Euxesta* sp.
					Stenomyia sp.
		Nematocera	Bibionidae		Unknown spp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Nematocera	Cecidomyiidae	Cecidomyiinae	*Asteromya carbonifera*
					Dasinerua communis
					Macrodiplosis sp.
					Neolasioptera farinosa
					Phyllonorycter sp.
			Ceratopogonidae		
			Chironomidae	Chironominae	*Chironomus* sp.
			Culicidae		*Culex* sp.
			Limoniidae		
			Mycetophilidae		
			Scatopsidae		*Cobldia fuscipes*
			Sciaridae		*Epidapus atomarius*
					Epidapus johnstoni
					Lycoriella sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Diptera	Nematocera	Sciaridae		*Scatopsciara* sp.
					Schwenkfeldina sp.
					Sciara sp.
			Simuliidae		Unknown spp.
			Tipulidae	Tipula sp.	Unknown spp.
					Unknown spp.
Insecta	Hemiptera	Auchenorrhyncha	Acanaloniidae		*Acanalonia conica*
					Acanalonia bivitatta
			Achillidae		Unknown spp.
			Aphrophoridae		*Lepyronia quadrangularis*
					Neophilaenus lineatus
					Philaenarcys bilineata
					*Philaenus spumaris**
			Caliscelidae		*Bruchomorpha oculata*
			Cicadellidae	Aphrodiinae	*Anoscopus albiger**
					*Anoscopus serratulae**

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Cicadellidae	Aphrodinae	*Aphrodes bicinctus*
					Xestocephalus brunneus
					Xestocephalus superbus
					Xestocephalus sp.
				Cicadellinae	*Draeculacephala antica*
					Draeculacephala paludosa
					Draeculacephala sp.
					Graphocephala coccinea
					Graphocephala versuta
					Neokolla hieroglyphica
					Oncometopia orbona
					Paraulacizes irrorate
					Tylozygus bifidus
				Coelidiinae	*Jikradia olitoria*
				Deltocephalinae	*Amblysellus curtisii*
					Athysanus argentarius

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Cicadellidae	Deltocephalinae	*Bandara* sp.
					Chlorotettix sp.
					Cicadula sp.
					Colladonus sp.
					Deltocephalus flavocostatus
					Deltocephalus sp.
					Doratura stylata
					Exitianus exitiosus
					Extrusanus extrusus
					Graminella sp.
					Japananus hyalinus
					Macrosteles quadrilineatus
					Macrosteles sp.
					Orientus ishidae
					Osbornellus rotundus
					Osbornellus sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
					Polyamia interrupta
					Polyamia weedi
					Polyamia sp.
					Scaphoideus sp.
					Scaphytopius frontalis
					Scaphytopius sp.
					Stirellus bicolor
					Texanus longipennis
				Iassinae	*Gypona* sp.
					Gyponana sp.
				Megophthalminae	*Agallia constricta*
					Agallia quadripunctulata
					Agalliopsis sp.
					Ceratagallia sp.
				Typhlocybinae	*Alebra* sp.
					Empoasca fabae

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Cicadellidae	Typhlocybinae	*Empoasca* sp.
					Erasmoneura sp.
					Unknown spp.
					Erythroneura bistrata
					Erythroneura tricincta
					Erythroneura sp.
					Typhlocyba sp.
			Cixiidae	Cixiinae	*Haplaxius fulvus*
					Haplaxius sp.
					Melanoliarus sp.
			Clastopteridae		*Clastoptera obtusa*
					Clastoptera xanthocephala
					Clastoptera sp.
			Delphacidae	Delphacinae	*Copicerus irroratus*
					Delphacodes caerulata
					Delphacodes mcateei

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Delphacidae	Delphacinae	*Delphacodes puella*
					Delphacodes recurvata
					Delphacodes trimaculata
					Kosswigianella lutulenta
					Liburniella ornata
					Muirodelphax arvensis
					Muirodelphax lautus
					Muirodelphax luteus
					Muirodelphax parvulus
					Pareuidella weedi
					Pissonotus sp.
					Prokelisia crocea
					Prokelisia marginata
					Stenocranus lautus
					Syndelphax sp.
			Derbidae	Cedusinae	*Cedusa* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Auchenorrhyncha	Derbidae	Otiocerinae	*Anotia kirkaldyi*
					Anotia sp.
			Dictyopharidae		*Scolops sulcipes*
			Flatidae	Flatinae	*Flatomenis proxima*
					Metcalfa pruinosa
					Ormenoides venusta
			Issidae		*Thionia* spp.
			Membracidae	Smiliinae	*Acutalis tartarea*
					Acutalis sp.
					Entylia carinata
					Entylia sp.
					Stictocephala bisoni
		Heteroptera	Alydidae	Alydinae	*Alydus eurinus*
			Anthocoridae		*Amphiaereus obscuriceps*
					Anthocoris sp.
					Orius insidiosus

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Heteroptera	Anthocoridae		*Xylocoris* sp.
			Berytidae	Berytinae	*Berytinus minor*
				Metacanthinae	*Jalysus spinosus*
					Jalysus wickhami
			Blissidae		*Ischnodemus falicus*
			Coreidae	Coreinae	*Acanthocephala terminalis*
					Euthochtha galeator
					Leptoglossus sp.
			Corixidae	Corixinae	*Hesperocorixa* sp.
			Cydnidae	Cydninae	*Amnestus* sp.
					Microporus nigrita
					Pangaeus bilineatus
			Geocoridae		*Geocoris uliginosus*
			Lygaeidae	Ischnorhychinae	*Kleidocerys* sp.
				Lygaeinae	*Lygaeus kalmii*
			Miridae	Cylapinae	*Fulvius imbecilis*

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Heteroptera	Miridae	Cylapinae	*Fulvius slateri*
				Deraeocorinae	*Deraeocoris poecilus*
				Mirinae	*Adelphocoris lineolatus*
					Barberiella sp.
					Garganus fusiformis
					Leptopterna dolabrata
					Lygocoris sp.
					Lygus lineolarius
					Lygus sp.
					Neolygus sp.
					Neurocolpus nubilus
					Polymerus basalis
					Stenodema sp.
					Stenotus binotatus
				Orthotylinae	*Halticus* sp.
					Microtechites bractatus

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Heteroptera	Miridae	Orthotylinae	*Slaterocoris stygicus*
			Nabidae	Nabinae	*Hoplistoscelis pallescens*
					Lasiomerus annulatus
					Nabis sp.
				Prostemmatinae	*Pagasa fusca*
			Pachygronthidae		*Oedancala dorsalis*
			Pentatomidae	Pentatominae	*Brochymena quadripustulata*
					Chinavia hilaris
					Coenus delius
					Euschistus servus
					Euschistus tristigmus
					*Halyomorpha halys**
					Mormidea lugens
					Neottiglossa undata
					Oebalus pugnax
					Thyanta custator

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Heteroptera	Pentatomidae	Podopinae	*Amaurochorous brevitylus*
					Amaurochorous cinctipes
			Piesmatidae		*Parapiesma* sp.
			Reduviidae	Emesinae	*Emesaya brevipennis*
				Harpactorinae	*Rocconota annulicornis*
					Sinea sp.
					Zelus sp.
				Phymatinae	*Phymata* sp.
				Stenopodainae	*Stenopoda spinulosa*
			Rhopalidae	Rhopalinae	*Arhyssus nigristernum*
					Harmostes reflexulus
					Liohryssus hyalinus
					Stictopleurus sp.
				Serinethinae	*Boisea trivittata*
			Rhyparochromidae	Rhyparochrominae	*Antillocoris minutus*
					Antillocoris pilosulus

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Heteroptera	Rhyparochromidae	Rhyparochrominae	*Cryphula trimaculata*
					Ligyrocoris sp.
					Myodocha serripes
					Pachybrachius sp.
					Pseudopachybrachius basalis
					Ptochiomera nodosa
			Saldidae	Chiloxanthinae	*Pentacora signoreti*
				Saldinae	*Saldula* sp.
			Scutelleridae	Pachycorinae	*Homaemus parvulus*
			Thyreocoridae		*Corimelaena agrella*
					Corimelaena lateralis
					.Corimelaena obscura
					Galgupha sp
			Tingidae		*Corythucha* sp.
		Sternorrhyncha	Aleyrodidae		Unknown spp.
			Aphalaridae	Aphalarinae	*Aphalara* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hemiptera	Sternorrhyncha	Aphalaridae	Aphalarinae	*Craspedolpeta* sp.
			Aphididae	Aphidinae	*Acyrthosiphon pisum*
					*Capitophorus elaeagni**
					Rhopalomyzus sp.
					Rhopalosiphum sp.
					Uroleucon sp.
					Unknown spp.
			Coccidae		*Pulvinaria innumerabilis*
					Unknown spp.
			Pseudococcidae		*Stemmatomerinx* sp.
					Unknown spp.
			Psyllidae	Psyllinae	*Psylla* sp.
					Unknown spp.
			Trozidae		Unknown spp.
	Hymenoptera	Apocrita	Andrenidae	Andreninae	*Andrena* sp.
			Aphelinidae	Aphaelininae	*Aphelinus* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Apidae	Apinae	*Apis mellifera*
					Bombus occidentalis
					Bombus sp.
			Aulacidae		*Aulacus* sp.
			Bethylidae	Bethylinae	*Bethylus* sp.
					Goniozus sp.
				Pristocerinae	*Pristocera* sp.
			Braconidae	Agathinae	Unknown spp.
				Alysiinae	*Alysia* sp.
					Chorebus sp.
					Unknown spp.
				Aphidiinae	*Aphidius* sp.
					Unknown spp.
				Cheloninae	*Chelonus* sp.
					Unknown spp.
				Euphorinae	*Chrysopopthorus americanus*

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Braconidae	Gnamptodontinae	Unknown spp.
				Hormiinae	Unknown spp.
				Opiinae	*Opius* sp.
				Rogadinae	*Stiropius* sp.
			Ceraphronidae		*Ceraphron* sp.
			Chalcididae	Chalcidinae	*Conura amoena*
					Conura dema
					Conura side
					Conura sp.
			Cynipidae	Cynipinae	*Andricus* sp.
					Disholcaspis quercusglobulus
			Diapriidae		*Zygota* sp.
					Unknown spp.
			Dryinidae	Gonatopodinae	Unknown spp.
			Embolemidae		*Embolemus nearcticus*
			Encyrtidae	Encyrtinae	*Copidosoma* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Encyrtidae	Encyrtinae	*Microterys* sp.
			Encyrtidae		Unknown spp.
			Eucharitidae	Eucharitinae	*Pseudometagea* sp.
			Eulophidae	Eulophinae	*Elachertus* sp.
					Eulophus sp.
					Euplectrus sp.
					Zagramosoma sp.
				Tetrastichinae	*Tetrastichus* sp.
					Unknown spp.
			Eupelmidae	Eupelminae	*Anastatus flavans*
					Anastatus sp.
					Brasema rhadinosa
					Brasema sp.
					Eupelmus dryohizoxeni
					Eupelmus versicolor
					Eupelmus sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Eupelmidae	Eupelminae	*Metapelma* sp.
			Eurytomidae	Eurytominae	*Eurytoma* sp.
					Sycophila sp.
			Figitidae	Eucoilinae	*Gronotoma* sp.
					Unknown spp.
				Figitinae	Unknown spp.
			Formicidae	Amblyoponinae	*Stigmatomma pallipes*
				Dolichoderinae	*Dolichoderus plagiatus*
					Dolichoderus sp.
					Forelius pruinosus
					Tapinoma sessile
					Technomyrmex sp.
				Formicinae	*Brachymyrmex depilis*
					Camponotus castaneus
					Camponotus chromaoides
					Camponotus herculeans

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Formicidae	Formicinae	*Camponootus novaeboracensis*
					Camponotus pennsylvanicus
					Formica cf. fossaceps
					Formica creightoni
					Formica difficilis
					Formica dolosa
					Formica impexa
					Formica incerta
					Formica lasiodes
					Formica neogagates
					Formica obscuriventris
					Formica pallidefulva
					Formica subintegra
					Formica subsericea
					Formica species 1
					Formica species 2

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Formicidae	Formicinae	*Formica* species 3
					Lasius alienus
					Lasius claviger
					Lasius flavus
					Lasius interjectus
					Lasius neoniger
					Lasius pallitarsus
					*Nylanderia flavipes**
					Nylanderia parvula
					*Paratrechina longicornis**
					Polygerus longicornis species
					Prenelopsis imparis
				Myrmicinae	*Aphaenogaster fulva*
					Aphaenogaster picea
					Aphaenogaster rudis
					Aphaenogaster treatae

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Formicidae	Myrmicinae	*Aphaenogaster* sp.
					Crematogaster cerasi
					Monomorium minimum
					Myrmecina americana
					Myrmica AF-scu
					Myrmica AF-smi
					Myrmica americana
					Myrmica detritinoids species 1
					Myrmica detritinoids species 2
					Myrmica nearctica
					*Myrmica rubra**
					Myrmica sculptilis species 2
					Pheidole pilifera
					Pyramica metazytes
					Pyramica pulchella
					Stenamma brevicorne

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Formicidae	Myrmicinae	*Stenamma schmitti*
					Strumigenys sp.
					Temnothorax ambiguus
					Temnothorax curvispinosus
					Temnothorax longispinosus
					Temnothorax pergandei
					Temnothorax schaumii
					Temnothorax texana
					Veromessor sp.
				Ponerinae	*Ponera penssylvanica*
			Halictidae	Halictinae	*Agapostemon texanus*
					Augochlora pura
					Augochlora sp.
					Augochlorella sp.
					Lasioglossum sp.
					Sphecocodes sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Ichneumonidae	Anomalinae	Unknown spp.
				Campopleginae	Unknown spp.
				Cryptinae	*Gelis* sp.
					Messatoporus sp.
					Unknown spp.
				Diplazontinae	*Diplazon laetatorius*
				Ichneumonidae	*Coelichneumon* sp.
					Cratichneumon sp.
				Ophioninae	*Ophion* sp.
				Tersilochinae	Unknown spp.
				Tryphoninae	*Phytodietus* sp.
					Unknown spp.
			Megaspilidae		Unknown spp.
			Megastigmidae		*Megastigmus* sp.
			Mutillidae		*Dasymutilla* sp.
					Ephuta sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Mutillidae		*Pseudomethoca simillima*
			Mymaridae		*Anagrus* sp.
					Anaphes sp.
					Gonatocerus sp.
					Mymar sp.
			Ormyridae		*Ormyrus* sp.
			Perilampidae		*Perilampus* sp.
			Platygastridae	Platygastrinae	*Inostemma* sp.
					Platygaster rubi
					Platygaster sp.
				Scelioninae	*Baeus* sp.
					Calliscelio sp.
					Gryon sp.
					Idris sp.
					Macoteleia sp.
					Scelio sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Platygastridae	Teleasinae	*Trimorus* sp.
				Telenominae	*Eumicrosoma* sp.
					Telenomus basalis
					Telenomus sp.
					Trissolcus euschisti
					Trissolcus sp.
			Pompilidae	Pepsinae	*Auplopus* sp.
					Caliadurgus fasciatellus
				Pompilinae	*Ageniella* sp.
			Proctotrupidae		*Exallonyx* sp.
			Pteromalidae	Cleonyminae	Unknown spp.
				Miscogastrinae	Unknown spp.
				Pteromalinae	Unknown spp.
			Rhopalosomatidae		*Olixon banksia*
			Sierolomorphidae		*Sierolomorpha* sp.
			Tiphiidae	Tiphiinae	*Tiphia* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Hymenoptera	Apocrita	Torymidae	Toryminae	*Torymus flavicoxa*
					Torymus sp.
			Trichogrammatidae		Unknown spp.
			Vespidae	Polistinae	*Polistes dorsalis*
				Vespinae	*Vespula pennsylvanica*
		Symphyta	Tenethredinidae	Tenethredininae	*Macrophya* sp.
	Lepidoptera		Acrolophidae		Unknown spp.
			Adelidae		*Adela* sp.
			Coleophoridae	Coleophorinae	*Coleophora* sp.
			Crambidae	Crambinae	*Crambus* sp.
					Microcrambus elegans
			Elachistidae	Elachistine	*Perittia* sp.
			Erebidae	Arctiinae	*Grammia* sp.
					Halysidota harrisii
					Halysidota tessellaris
					Hypantria cunea

(***Appendix D continued)***

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Lepidoptera		Erebidae	Arctiinae	*Lophocampa caryae*
					Pyrrharctia Isabella
					Spilosoma virginica
					Spilosoma sp.
					Virbia sp.
					Unknown spp.
				Erebinae	*Caenurgina erechtea*
					Parallelia bistriaris
				Herminiinae	*Idia* sp.
				Lymantriinae	*Orgyia leucostigma*
			Gelechiidae		Unknown spp.
			Geometridae	Ennominae	*Erranius* sp.
			Geometridae	Ennominae	*Glena cribrataria*
			Geometridae	Ennominae	*Iridopsis humaria*
			Geometridae	Ennominae	*Iridopsis* sp.
			Geometridae	Geometrinae	*Chlorochlamys chloroleucaria*

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Lepidoptera		Geometridae	Geometrinae	*Synchlora aerata*
				Larentiinae	*Costaconvexa centrostrigaria*
					Eulithis diversilineata
					Eupithecia sp.
					Unknown spp.
			Gracillariidae	Phyllocnistinae	*Phyllocnistis liquidambarisella*
					Phyllocnistis liriodendronella
					Unknown spp.
			Heliozelidae		*Coptodisca splendoriferella*
			Hesperiidae	Hesperiinae	*Thymelicus lineola*
			Incurvariidae		*Paraclemensia acerifoliella*
			Limacodidae		*Parasa indetermina*
			Nepticulidae		*Ectoedemia platanella*
					Glaucolepis saccharella
					Stigmella prunifoliella
			Noctuidae	Acronictinae	*Acronicta americana*

(Appendix D continued)

Class/Subclass	Order	Suborder	Family	Subfamily	Genus & Species
Insecta	Lepidoptera		Noctuidae	Acronictinae	*Acronicta hasta*
					Acronicta retardtata
				Agaristinae	*Alypia octomaculata*
				Cucullinae	*Cucullia asteroides*
					Cucullia sp.
				Heliothinae	*Heliocheilus lupatus*
					Schinia sp.
					Unknown spp.
				Noctuinae	*Crocigrapha normani*
					Crocigrapha sp.
					Dargida diffusa
					Dargida sp.
					Elaphria sp.
					Loscopia velata
					Spodoptera fruiperda
					Spodoptera ornithogalli

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Lepidoptera		Noctuidae	Noctuinae	*Spodoptera* sp.
					Unknown spp.
				Plusiinae	*Autographa precationis*
					Plusia putnami
					Unknown spp.
			Notodontidae	Heterocampinae	*Heterocampa umbrata*
					Misogada unicolor
					Schizura concinna
				Notodontinae	*Furcula borealis*
				Phalerinae	*Nadata gibbosa*
			Pieridae	Coliadinae	*Phoebis sennae*
			Psychidae	Naryciinae	*Dahlica* sp.
				Oiketicinae	*Thyridopteryx ephemeraeformis*
				Psychinae	*Psyche americana*
					Psyche casta
			Pterophoridae	Pterophorinae	*Geina* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Lepidoptera		Pterophoridae		Unknown spp.
			Pyralidae	Epipaschiinae	*Pococera* sp.
					Unknown spp.
			Sphingidae	Macroglossinae	*Darapsa myron*
			Tineidae		Unknown spp.
			Tortricidae		Unknown spp.
			Zygaenidae	Procridinae	*Acoloithus falsarius*
	Mantodea		Mantidae	Mantinae	*Mantis religolosus**
					*Tenodera sinensis**
	Mecoptera		Bittacidae		Unknown spp.
			Meropeidae		*Merope tuber*
	Microcoryphia		Machilidae	Petrobiinae	*Pedotontus* sp.
	Neuroptera		Chrysopidae		*Chrysopa* sp.
			Coniopterygidae	Coniopteryginae	Unknown spp.
			Hemerobiidae	Hemerobiinae	Unknown spp.
	Orthoptera	Califera	Acrididae	Gomphinae	*Chloealtis conspersa*

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Orthoptera	Califera	Acrididae	Melanoplinae	*Melanoplus confusa*
					Melanoplus sp.
				Oedipodinae	*Arphia sulphurea*
					Arphia xanthoptera
					Arphia sp.
					Dissoteria carolina
					Unknown spp.
			Tetrigidae	Batrachideinae	*Tettigidea acuta*
		Ensifera	Gryllidae	Gryllinae	*Gryllus* sp.
					*Velarifictorus micado**
				Hapithinae	*Hapithus agitator*
				Nemobiinae	*Allonemobius fasciatus*
					Neonemobius sp.
				Oecanthinae	*Oecanthus* sp.
				Trigonidiinae	*Falcicula hebardi*
			Rhapidophoridae	Ceuthophilinae	*Ceuthophilus* sp.

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Orthoptera	Ensifera	Tettigoniidae	Conocephalinae	*Conocephalus* sp.
					Neoconocephalus retusus
				Phaneropterinae	*Scudderia* sp.
				Tettigoniinae	*Atlanticus americanus*
	Psocoptera	Psocomorpha	Amphipsocidae		*Polypsocus corruptus*
			Caeciliusidae		Unknown spp.
			Ectopsocidae		*Ectopsocopsis cryptomeriae*
			Philotarsidae		*Aaroniella badonneli*
			Psocidae		*Cerastipsocus* sp.
			Stenopsocidae		*Graphopsocus cruciatus*
		Troctomorpha	Liposcelidae		*Liposcelis* sp.
			Pachytroctidae		Unknown spp.
	Thysanoptera	Terebrantia	Aeolothripidae		Unknown spp.
			Thripidae		*Caliothrips* sp.
					Konothrips polychaeta
					Selenothrips rubrocinctus

(Appendix D continued)

Class/Subclass	***Order***	***Suborder***	***Family***	***Subfamily***	***Genus & Species***
Insecta	Thysanoptera	Tubilifera	Phlaeothripidae		*Elaphrothrips* sp.
Insecta	Thysanoptera	Tubilifera	Phlaeothripidae		Unknown spp.
Insecta	Trichoptera				Unknown spp.
Malacostraca	Isopoda	Oniscidea	Armadillidiidae		*Armadillidium nasatum**
					*Armadillidium vulgare**
			Cylisticidae		*Cylisticus convexus**
			Detonidae		*Armadilloniscus* sp.
			Oniscidae		*Oniscus asellus**
			Philosciidae		*Philoscia muscorum**
			Porcellionidae		*Porcellio laevis**
					*Porcellio scaber**
					*Porcellionides pruinosus**
			Trachelipodidae		*Trachelipus rathkii**
			Trichoniscidae		*Trichoniscus pusillus**
Symphyla		Symphyla	Scutigerellidae		Unknown spp.

APPENDIX E. LITERATURE CITED FOR THE IDENTIFICATION OF INVERTEBRAE TAXA COLLECTED IN THE MID-ATLANTIC REGION, USA, SUMMERS 2015-2016.

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