Maryland Department of Agriculture

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Version 1

Weed Risk Assessment for *Lonicera maackii* (Caprifoliaceae) – Amur honeysuckle

Left: Amur honeysuckle shrubs at a field edge. Top right: mature fruits. Bottom right: Flowers. (source: Sylvan Kaufman).

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Introduction The Maryland Department of Agriculture regulates terrestrial ornamental invasive plants under the authority of Md. AGRICULTURE Code Ann. §9.5-101 et seq. Invasive Plant Prevention and Control. An invasive plant is defined as "a terrestrial plant species that a) did not evolve in the State, and b) if introduced within the State, will cause or is likely to cause, as determined by the Secretary: economic, ecological, environmental harm or harm to human health."

Maryland's Invasive Plant Advisory Committee (IPAC) was established by legislative mandate in October 2011. The IPAC's primary responsibility is to advise the Secretary of Agriculture on regulating the sale of invasive plants, and on preventing them from entering Maryland or from spreading further in the state. IPAC evaluates the risk potential of plants already present in Maryland, newly detected in the Maryland or the United States, those proposed for import, and those emerging as weeds elsewhere in the world.

IPAC evaluates the potential invasiveness of plants using the weed risk assessment (WRA) process developed by the Plant Protection and Quarantine (PPQ) Program of the US Department of Agriculture's Animal and Plant Health Inspection Service ((Koop et al. 2012). PPQ's risk model uses information about a species' biological traits and behavior to evaluate its risk potential (Koop et al. 2012).

Because the PPQ WRA model is geographically and climatically neutral, it can be used to evaluate the baseline invasive/weed potential of any plant species for the entire United States, or for any specific region in the United States. In the PPQ process, the geographic potential of the species is evaluated separately so that risk managers can make decisions appropriate for their regions. With respect to Maryland's evaluation process, we use PPQ's Geographic Information System overlays of climate to evaluate the potential for a plant to establish and grow in Maryland. The PPQ weed risk assessment also uses a stochastic simulation to evaluate how the uncertainty associated with the assessments affects the model's predictions. Detailed information on the PPQ WRA process is available in the document, *Guidelines for the USDA-APHIS-PPQ Weed Risk Assessment Process* (APHIS PPQ 2015), which is available upon request.

IPAC uses a second tool, the Maryland Filter, to assign plant species that score as highly invasive either Tier 1 or Tier 2 status. Maryland regulations define Tier 1 plants as "invasive plant species that cause or are likely to cause severe harm within the State" and Tier 2 plants as "invasive plant species that cause or are likely to cause substantial negative impact within the State." The Maryland Filter considers the actual and potential distribution of the species in Maryland, its threat to threatened and endangered ecosystems and species in the state, the difficulty of control of the species, and whether added propagule pressure would be likely to increase its persistence and spread significantly. IPAC then

recommends regulations to reduce the risk of the Tiered invasive plants in Maryland.

	***Lonicera maackii* (Rupr.) Maxim. – Amur honeysuckle**
Species Information	Family: Caprifoliaceae (ARS 2014). Synonyms: *Xylosteon maackii* Rupr. (ARS 2014). Botanical description: Amur honeysuckle is a deciduous shrub that grows up to 15 feet tall that colonizes fields, grasslands, woodland edges, and forests. Its ovate leaves are opposite and have long pointed tips. It flowers in spring in pairs on short stems attached to the main branches just above the leaves, with white corollas turning yellow with age. It produces numerous red fleshy berries. For a full description, see Rhoads and Block 2007. Initiation: This plant is listed on the MD Department of Natural Resources (DNR) Do Not Plant List, a policy document available from MD DNR, which lists approximately 90 plant species that may not be planted on DNR land or for DNR projects (MD DNR 2010). Foreign distribution: This species is native to temperate Asia (ARS 2014) and cultivated in Europe (Luken and Thieret 1996). It is naturalized in Canada (Hidayati et al. 2000). U.S. distribution and status: Amur honeysuckle is naturalized in 31 states (BONAP 2016). The species is banned from sale in Connecticut and Massachusetts (USDA-NRCS 2015) and in New York (NY DEC 2015). It is listed as a class B noxious weed in Vermont (USDA-NRCS 2015). WRA area[1]: Entire United States, including territories.

Summary Statement

Amur honeysuckle is assessed as a High Risk species because of its rapid growth and spread, alteration of nutrient cycles, and its ability to form dense thickets that alter native plant and animal habitat. It has the potential to occupy any of Maryland's physiographic regions. Amur honeysuckle is ranked as a Tier 1 species because it occurs in the same habitats as several Maryland threatened and endangered species.

1. *Lonicera maackii* analysis

Establishment/Spread Potential

Amur honeysuckle has a demonstrated ability to establish and spread in 31 states in the U.S. (BONAP 2016). It produces seeds prolifically (Baker 1974; Trisel 1997), which are dispersed by birds, deer and other animals (Miller et al. 2010, Nickell 2004). Although we found no direct evidence of accidental dispersal by people, seeds are likely moved in soil and garden waste. Plants are pollinated by generalist pollinators (Barriball et al. 2014). Uncertainty was high

[1] "WRA area" is the area in relation to which the weed risk assessment is conducted [definition modified from that for "PRA area"] (IPPC, 2012).

for self-compatibility because of varying reports (e.g. Deering and Vankat 1999, Goodell and Iler 2007). We had moderate uncertainty regarding shade tolerance as well because of conflicting reports among mostly secondary references (Miller et al. 2010; Swearingen et al. 2010).
Risk score = 14 Uncertainty index = 0.10

Impact Potential Amur honeysuckle plants increase densities of soil organic carbon and nitrogen, related to alteration of microbial community composition (Kolbe et al. 2015). Leaf litter decomposition is altered in its presence (Schuster and Dukes 2014) and the plants produce allelopathic chemicals (Loomis et al. 2015, Miller and Gorchov 2004). The species reduces mycorrhizal fungi of native plant roots (Shannon et al. 2014). It forms dense thickets and changes both community structure (Swearingen et al. 2010, Weber 2003) and composition (Collier et al. 2002, Orrock et al. 2015). Amur honeysuckle plants can modify ephemeral wetlands and habitat availability for amphibians by altering system transpiration rates (Boyce et al. 2012). Amur honeysuckle threatens several Maryland listed threatened and endangered species, including veiny skullcap, white trout lily, tall dock, tall tickseed, riverbank goldenrod and leatherwood (Kyde 2016, Steury and Davis 2003) and grows in several U.S. Globally Outstanding Ecoregions (GBIF 2015, Thompson and Poindexter 2011). Impacts to anthropogenic and production systems carried higher uncertainties in general because of a lack of availability of direct evidence or detailed information. Allen et al. (2010) found that deer preferentially use areas invaded by Amur honeysuckle, increasing the abundance of lone star ticks in those areas and increasing the resulting risk of human exposure to the bacterial pathogens ticks carry, in particular erlichiosis.
Risk score = 3.9 Uncertainty index = 0.18

Geographic Potential Based on three climatic variables, we estimate that about 56 percent of the United States is suitable for the establishment of *Lonicera maackii* (Fig. 1). This predicted distribution is based on the species' known distribution elsewhere in the world and includes point-referenced localities and areas of occurrence. The map for *Lonicera maackii* represents the joint distribution of Plant Hardiness Zones 4-9, areas with 10-100 inches of annual precipitation, and the following Köppen-Geiger climate classes: Mediterranean, Humid subtropical, Marine west coast, Humid continental warm summers, and Humid continental cool summers. The area estimated likely represents a conservative estimate as it only uses three climatic variables. Other environmental variables, such as soil and habitat type, may further limit the areas in which this species is likely to establish. *Lonicera maackii* is found in full and open canopy forests and along field, stream and road edges. Naturalized individuals are often associated with floodplains.

Entry Potential We did not assess the entry potential of *Lonicera maackii* because it is already present in the United States (Swearingen et al. 2010).

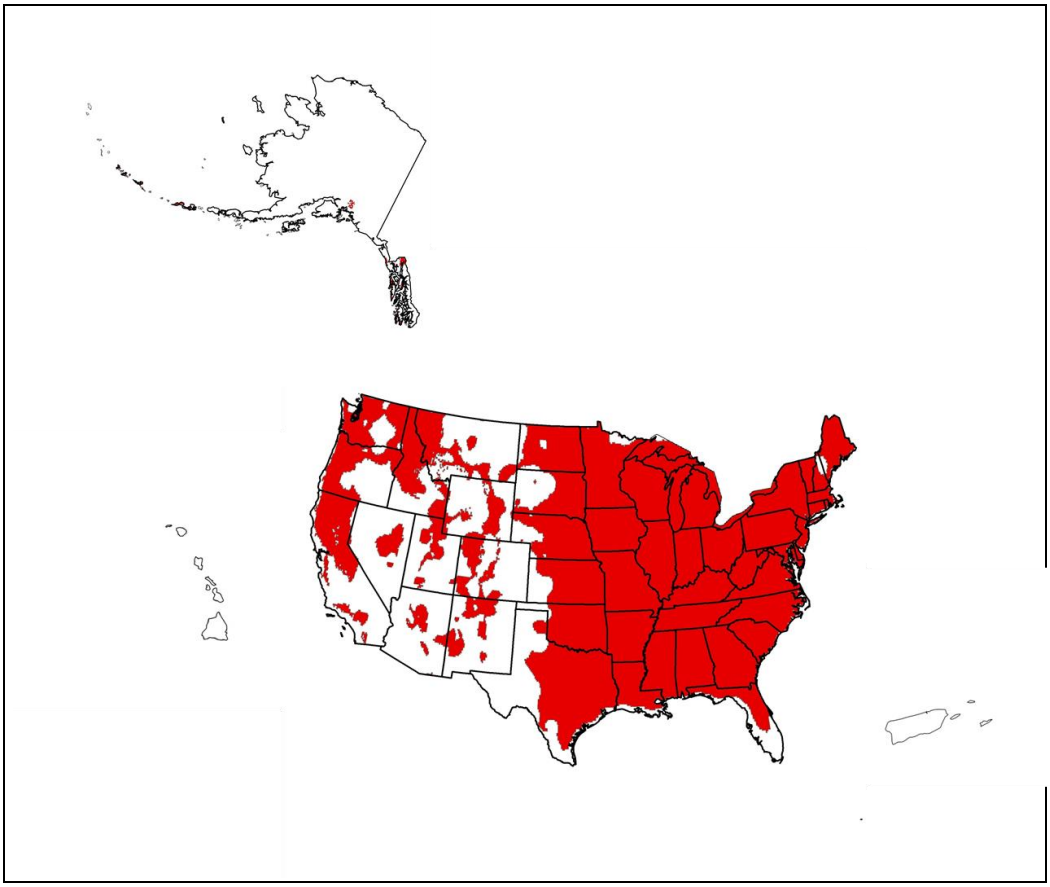

Figure 1. Predicted distribution of *Lonicera maackii* in the United States. Map insets for Alaska, Hawaii, and Puerto Rico are not to scale.

2. Results

Model Probabilities: P(Major Invader) = 81.9%
P(Minor Invader) = 17.4%
P(Non-Invader) = 0.1%

Risk Result = High Risk

Secondary Screening = Not applicable

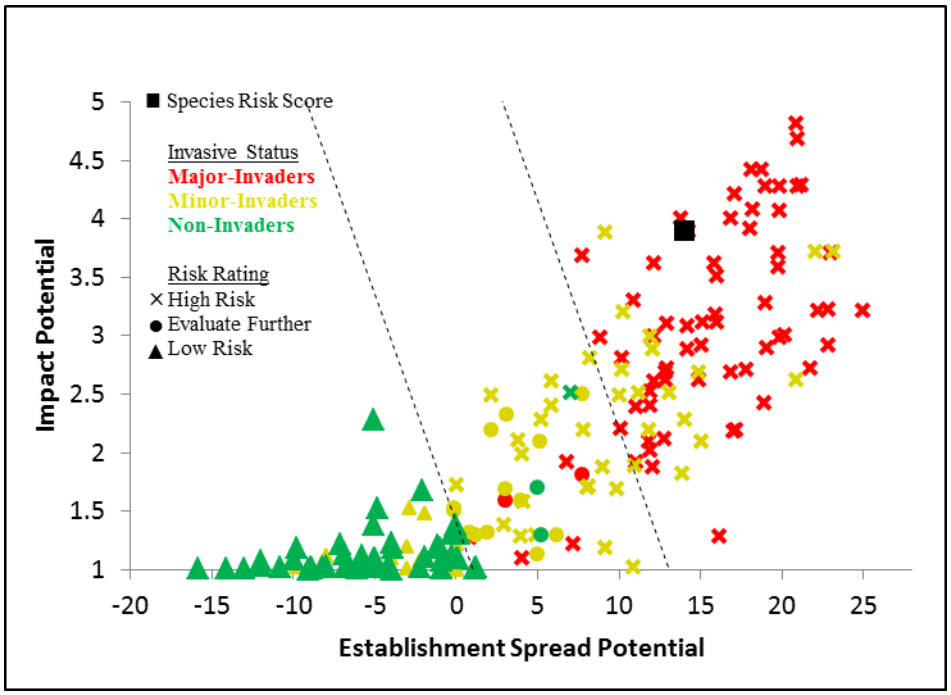

Figure 2. *Lonicera maackii* risk score (black box) relative to the risk scores of species used to develop and validate the PPQ WRA model (other symbols). See Appendix A for the complete assessment.

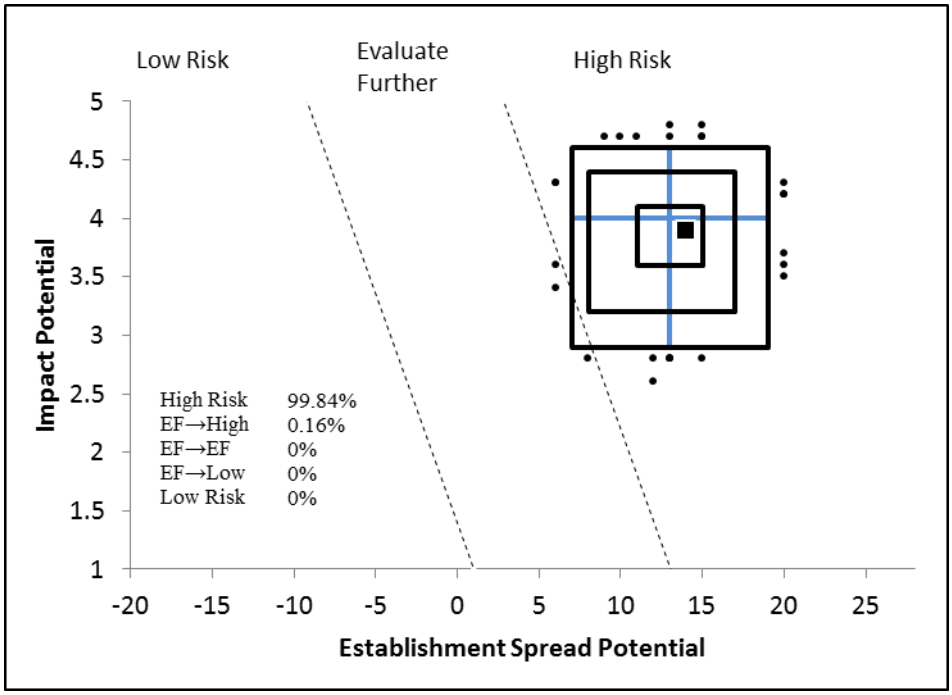

Figure 3. Model simulation results (N=5,000) for uncertainty around the risk score for *Lonicera maackii*. The blue "+" symbol represents the medians of the simulated outcomes. The smallest box contains 50 percent of the outcomes, the second 95 percent, and the largest 99 percent.

3. Discussion

The result of the weed risk assessment for *Lonicera maackii* is High Risk. *Lonicera maackii* shares traits in common with other major invaders (Fig. 2) used to develop and validate the PPQ WRA model. More than 99% of the simulated risk scores received a rating of High Risk (Fig. 3), indicating that our assessment is extremely robust. Naturalized in 31 US states (BONAP 2016), the species can persist in shaded conditions (Luken et al. 1995), form dense thickets (Boyce 2015, Gorchov and Trisel 2003, Luken et al. 1997) and produce large quantities of seed that are dispersed by animals (Munger 2005, Nickell 2004, Velland 2003). Although it does not form long-term seed banks (Hidayati et al. 2000), *Lonicera maackii* resprouts easily after stem damage (Luken and Mattimiro 1991). It is fertilized by generalist pollinators (Barriball et al. 2014). *Lonicera maackii* demonstrates allelopathic capability (Miller and Gorchov 2004, Dorning and Cipollini 2006). It changes ecosystems processes (Kolbe et al. 2015, Pfeiffer and Gorchov 2015, Shannon et al 2014), habitat structure (Loomis et al. 2015, Meiners 2007) and species diversity (Collier et al. 2002, Gould and Gorchov 2000) in habitats where it establishes. It directly threatens several species listed by Maryland as threatened or endangered (Kyde 2016, Steury and Davis 2003), and occurs within multiple Globally Outstanding Ecoregions. Gardeners report it as a target for removal for its aggressive growth in gardens (GardenWeb 2015).

Lonicera maackii ranks as a Tier 1 species (Appendix B). The species is documented as naturalizing in Maryland and has a potentially wide distribution here. *Lonicera maackii* occurs in the same locations as a number of Maryland state listed threatened or endangered species (Kyde 2016). Control of the species is relatively straightforward, if time-consuming, using repeated mechanical, manual or chemical control methods (Miller et al. 2010).

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Appendix A. Weed risk assessment for *Lonicera maackii* (Rupr.) Maxim. (Caprifoliaceae). The following information came from the original risk assessment, which is available upon request (full responses and all guidance). We modified the information to fit on the page.

Question ID	Answer - Uncertainty	Score	Notes (and references)
ESTABLISHMENT/SPREAD POTENTIAL			
ES-1 [What is the taxon's establishment and spread status outside its native range? (a) Introduced elsewhere =>75 years ago but not escaped; (b) Introduced <75 years ago but not escaped; (c) Never moved beyond its native range; (d) Escaped/Casual; (e) Naturalized; (f) Invasive; (?) Unknown]	f - low	5	*Lonicera maackii* is native to temperate Asia (ARS 2014). Naturalized in 31 states in US, particularly in midwest, mid-Atlantic and south central US (BONAP 2016). "Readily invades open woodlands, old fields and other disturbed sites" (Invasive Plant Atlas 2014). Spreads into forest patches in Ohio (Hutchinson and Vankat 1997). First reported in 1960 in one county in Ohio and by 1997 had spread to 34 counties (Collier et al. 2002). Naturalized in Ontario, Canada (Runkle et al. 2004). Spreading rapidly in Canada (Hidayati et al. 2000). Amur honeysuckle has been intensively cultivated since the 1800s in Europe with no reported naturalization (Luken and Thieret 1996). Alternative answers for Monte Carlo simulation both "e."
ES-2 (Is the species highly domesticated)	n - mod	0	We found no evidence of domestication. At least two cultivars were developed by the USDA but both produce fruits (Luken and Thieret 1996).
ES-3 (Weedy congeners)	y - negl	1	There are about 180 species of *Lonicera* (Mabberly 2008). Randall (2007) lists 13 species as weedy or invasive. *Lonicera tatarica* and *L. morrowii* are vigorously growing shrubs that are serious weeds of riparian habitats, forests, and grasslands. These species build up dense stands that shade out other species, displacing native shrubs and trees and impeding forest regeneration (Weber 2003). *Lonicera fragrantissima* is an occasional invader (Kaufman and Kaufman 2013). *Lonicera japonica* is considered a significant weed throughout much of the United States (Kaufman and Kaufman 2013) as well as in Australia, New Zealand and central Europe (Weber 2003).
ES-4 (Shade tolerant at some stage of its life cycle)	y - mod	1	Most studies show that *Lonicera maackii* performs better with more light (Hutchinson and Vankat 1997, Luken et al. 1995). Luken et al. (1995) concluded that the species "is a relatively shade-intolerant species. Seedlings that do establish in…shade...will grow slowly and even show negative growth in the absence of disturbances that increase light availability." Swearingen et al. (2010) state, "Adaptable to a range of conditions from sun to deep shade." Relatively shade tolerant (Miller et al. 2010). We answered yes with moderate uncertainty, since shrubs can persist under low light conditions even if they cannot establish in low light.
ES-5 (Plant a vine or scrambling plant, or forms tightly appressed basal rosettes)	n - low	0	Amur honeysuckle does not have a climbing or smothering growth habit. It is an upright and many-stemmed shrub growing either tall and tree-like or short and densely branched, up to 5 meters tall

			(Weber 2003).
ES-6 (Forms dense thickets, patches, or populations)	y - negl	2	"Escape from cultivation...led to the development of dense thickets in forests and open sites" (Luken et al. 1997) Dense growth competes with woody and herbaceous plants (Gorchov and Trisel 2003, Swearingen et al. 2010). In an Ohio research study of Amur honeysuckle in plots with heavy to very heavy percent cover, cover was 145-221% (Boyce 2015).
ES-7 (Aquatic)	n - negl	0	This species is a shrub in the Caprifoliaceae (ARS 2014) and is not aquatic.
ES-8 (Grass)	n - negl	0	The species is not a grass because it is in the Caprifoliaceae family (ARS 2014).
ES-9 (Nitrogen-fixing woody plant)	n - negl	0	Plants in the Caprifoliaceae are not known to fix nitrogen (Martin and Dowd 1990; Santi et al. 2013).
ES-10 (Does it produce viable seeds or spores)	y - negl	1	This species reproduces by seed (Luken and Thieret 1996, Weber 2003). Luken and Goessling (1995) discuss seed germination percentages and seedling densities.
ES-11 (Self-compatible or apomictic)	y - high	1	Amur honeysuckle is largely reported as self-incompatible, however, some evidence contradicts that assertion. Flowers are self-incompatible (Deering and Vankat 1999, Luken and Thieret 1995). "...our mating system study indicated that *Lonicera maackii* is partially self-compatible and requires pollinators for full seed set (Goodell and Iler 2007). This shrub has been described as self-incompatible within its native range (Luken and Thieret 1996), but the degree of self-incompatibility appears to vary within its nonnative range (McNutt 2010). Barriball et al. (2015) describe the species as having "a predominantly outcrossing mating system." We are answering yes with high uncertainty since there is evidence for self-compatibility in some plants.
ES-12 (Requires specialist pollinators)	n - low	0	Pollinators of *Lonicera maackii* were represented by bees of eight genera, with honey bees most frequent, followed by small generalist native bees (Barriball et al. 2014, Goodell et al. 2008).
ES-13 [What is the taxon's minimum generation time? (a) less than a year with multiple generations per year; (b) 1 year, usually annuals; (c) 2 or 3 years; (d) more than 3 years; or (?) unknown]	c - low	0	Fruit will not be produced until plants are 3-5 years old (Luken and Thieret 1996). Alternate answers for the Monte Carlo simulation are both "d."
ES-14 (Prolific reproduction)	y - low	1	"Numbers of seeds/fruit, sampled from several shrubs at this site, averaged 5 to 7, indicating that a "typical" plant may produce >20,000 seeds annually." (Munger 2005) Assuming bushes are 2 by 2 meters wide, this would represent about 5000 seeds per square meter.
ES-15 (Propagules likely to be dispersed unintentionally by people)	? - max	0	There is no direct evidence of unintentional dispersal by people, but plants often grow in human-occupied areas where seeds could be moved in soil or yard waste.
ES-16 (Propagules likely to disperse in trade as contaminants or hitchhikers)	n - low	-1	We found no evidence of seeds dispersing in trade as contaminants or hitchhikers.
ES-17 (Number of natural dispersal	2	0	Fruits are shiny dark red, juicy, globose berries, 1/4"

vectors)			in diameter. Each fruit contains 2 - 3 seeds with tiny concave dots (efloras 2016, Swearingen et al. 2010).
ES-17a (Wind dispersal)	n - low		There is no evidence of wind dispersal. Amur honeysuckle fruit has no obvious adaptations for wind dispersal. Seeds are larger than minute and are without wings (Kirkbride et al. 2006).
ES-17b (Water dispersal)	n - mod		We found no evidence for water dispersal.
ES-17c (Bird dispersal)	y - negl		In one Ohio study, 9 of 26 bird species showed evidence of feeding on Amur honeysuckle fruits (Ingold and Craycraft 1983). Seeds are dispersed by birds (Weber 2003). American robins consume and disperse viable seeds (Bartuszevige and Gorchov 2006).
ES-17d (Animal external dispersal)	n - low		We found no evidence for external dispersal nor do seeds have a mechanism for external dispersal by animals.
ES-17e (Animal internal dispersal)	y - negl		Animals disperse seeds (Miller et al. 2010). White-tailed deer (*Odocoileus virginianus* Zimm.) disperse seeds (Nickell 2004). Vellend (2003) confirmed the presence of Amur honeysuckle seeds in white-tailed deer scat.
ES-18 (Evidence that a persistent (>1yr) propagule bank (seed bank) is formed)	n - high	-1	Experimental work indicates that *L. maackii* does not have the capacity to form a long-term (more than 1 year) seed bank (Hidayati et al. 2000). Seeds in the soil are not long-lived (Luken and Mattimiro 2003, Weber 2003). However, Miller et al. (2010) state that seeds are long-lived in the soil. Most reports are that seeds do not have a persistent seed bank, but uncertainty is high.
ES-19 (Tolerates/benefits from mutilation, cultivation or fire)	y - negl	1	"... *L. maackii* maintains resprouting potential in both forests and open sites (Luken and Mattimiro 1991)."The shrub easily resprouts after fire or other damage" (Weber 2003). Control efforts require several years because of resprouting and suckering (Munger 2005).
ES-20 (Is resistant to some herbicides or has the potential to become resistant)	n - low	0	We found no evidence of herbicide resistance and the species is not listed in Heap (2014).
ES-21 (Number of cold hardiness zones suitable for its survival)	6	0	
ES-22 (Number of climate types suitable for its survival)	5	2	
ES-23 (Number of precipitation bands suitable for its survival)	9	1	
IMPACT POTENTIAL			
General Impacts			
Imp-G1 (Allelopathic)	y - mod	0.1	Miller and Gorchov (2004) reported that *L. maackii* reduced growth and final size of *Allium burdickii*, *Thalictrum thalictroides*, and *Viola pubescens* under field conditions while reducing the proportion of live plants flowering individuals in *A. burdickii* and *V. pubescens*. Dorning and Cipollini (2006) found leaf and root extracts to have allelopathic properties. Shannon et al. (2014) found that the species reduces mycorrhizae of native plant roots.
Imp-G2 (Parasitic)	n - negl	0	Plants in the Caprifoliaceae (ARS 2014) are not

			known to be parasitic.
Impacts to Natural Systems			
Imp-N1 (Changes ecosystem processes and parameters that affect other species)	y - negl	0.4	A high density of fine roots and leaf interception of rainfall led to higher drought stress for seedlings growing under Amur honeysuckle (Pfeiffer and Gorchov 2015). Leaf litter changes nitrogen decomposition rates (Schuster and Dukes 2014). Causes changes to leaf litter decomposition rates (Kuebbing et al. 2014). Arthur et al. (2012) found that Amur honeysuckle leaf litter decomposes more rapidly than that of native tree species and that the microbial community on honeysuckle leaf litter remained distinct from that on native species. Increases in soil organic carbon and nitrogen were found in plots invaded by honeysuckle and were determined by plant size and time since introduction (Kolbe et al. 2015). Transpiration rates could reduce water in ephemeral wetlands (Boyce et al. 2012).
Imp-N2 (Changes habitat structure)	y - negl	0.2	Amur honeysuckle forms a denser and more extensive shrub layer with leaves that are held longer into the fall compared to native understory vegetation (Loomis et al. 2015). Amur honeysuckle was shown to indirectly affect trees by increasing seed predation of tree seeds by white-footed mice (*Peromyscus leucopus*) compared to plots where Amur honeysuckle had been removed (Meiners 2007). Forms a dense shrub layer (Swearingen et al. 2010). "Transforms native prairies into scrub" (Weber 2003).
Imp-N3 (Changes species diversity)	y - negl	0.2	Studies in southern Ohio have shown that plant species richness is greatly reduced under a canopy of Amur honeysuckle, and that the shrub reduced survival and fecundity of three annual herbaceous plants (Collier et al. 2002; Gould and Gorchov 2000). Growth and reproduction of three perennial herbs was also reduced (Miller and Gorchov 2004). Tree seedling mortality increased despite some protection that Amur honeysuckle provided from deer browsing (Gorchov and Trisel 2003). Another study found lower survival of sugar maple seedlings in the presence of Amur honeysuckle independent of the presence or absence of deer (Loomis et al. 2015). Radial and basal growth of existing trees declined in invaded forests (Hartman and McCarthy 2008). Native plant abundance and species richness were reduced in a study in Missouri of direct competition with Amur honeysuckle (Orrock et al. 2015). There is reduced species diversity in an oak-hickory woodland in central Kentucky dominated by *Lonicera maackii* (Thompson and Poindexter 2011). Shrub architecture changes nesting success for birds compared to nest success in native shrub species (Rodewald et al. 2010).
Imp-N4 (Is it likely to affect federal Threatened and Endangered species?)	y - low	0.1	Because Amur honeysuckle invades a wide range of natural habitats from prairies to forests and causes

			significant changes to ecosystem processes and community structure and composition (Munger 2005) we are answering yes. Amur honeysuckle occurs in the same locations and habitats as several Maryland listed threatened and endangered species, among them, veiny skullcap, white trout lily, tall dock, tall tickseed, riverbank goldenrod and leatherwood (Kyde 2016, Steury and Davis 2003).
Imp-N5 (Is it likely to affect any globally outstanding ecoregions?)	y - mod	0.1	Based on the geographic potential and its occurrence across hardiness zones (below) and its impact on species diversity, habitat structure and ecosystem properties, this species could impact globally outstanding ecoregions across the continental United States, specifically Central tall grasslands and Flint Hills tall grasslands, Appalachian Blue Ridge forests, Appalachian mixed mesophytic forests, and Southeastern mixed forests.
Imp-N6 [What is the taxon's weed status in natural systems? (a) Taxon not a weed; (b) taxon a weed but no evidence of control; (c) taxon a weed and evidence of control efforts]	c - negl	0.6	Amur honeysuckle is a weed of forests and forest edges, and grasslands that reduces native plant diversity, prevents the growth of tree seedlings, and becomes dominant in the shrub layer in forest habitats, while transforming native prairies into scrub (Munger 2005, Weber 2003). There are numerous reports of control in natural areas (Kyde pers. com, Munger 2005, Swearingen et al. 2010). Alternate answers for the Monte Carlo simulation are both "b."
Impact to Anthropogenic Systems (cities, suburbs, roadways)			
Imp-A1 (Negatively impacts personal property, human safety, or public infrastructure)	n - mod	0	There is potential for *Lonicera maackii* to harbor high numbers of deer ticks that carry human diseases (Allen et al. 2010). Because the evidence is indirect we are answering no with moderate uncertainty.
Imp-A2 (Changes or limits recreational use of an area)	n - high	0	We found no evidence, but because these shrubs can form dense stands in natural areas used for recreation we are answering no with high uncertainty.
Imp-A3 (Affects desirable and ornamental plants, and vegetation)	y - mod	0.1	There were a few reports of removal of Amur honeysuckle from gardens on GardenWeb (2015) because plants were crowding out more desirable species.
Imp-A4 [What is the taxon's weed status in anthropogenic systems? (a) Taxon not a weed; (b) Taxon a weed but no evidence of control; (c) Taxon a weed and evidence of control efforts]	b - mod	0.1	Amur honeysuckle frequently occurs in urban and suburban areas and there is some evidence of control (GardenWeb 2015). Alternate answers for the Monte Carlo simulation are both "c."
Impact to Production Systems (agriculture, nurseries, forest plantations, orchards, etc.)			
Imp-P1 (Reduces crop/product yield)	y - mod	0.4	The presence of Amur honeysuckle reduces regeneration of hardwood seedlings in plantations (Siefert et al. 2007).
Imp-P2 (Lowers commodity value)	n - mod	0	We found no evidence for this impact.
Imp-P3 (Is it likely to impact trade?)	n - mod	0	We found no evidence for this impact.
Imp-P4 (Reduces the quality or availability of irrigation, or strongly competes with plants for water)	n - mod	0	We found no evidence for this impact.
Imp-P5 (Toxic to animals, including	n - high	0	Extracts of phenolic compounds in the leaves affect

livestock/range animals and poultry)			growth of other plants, feeding behavior of insects, and survival and behavior of amphibians in several experiments (Boyce et al. 2012, Cipollini et al. 2008, Watling et al. 2011). However, we found no evidence of toxicity to livestock, range animals or poultry.
Imp-P6 [What is the taxon's weed status in production systems? (a) Taxon not a weed; (b) Taxon a weed but no evidence of control; (c) Taxon a weed and evidence of control efforts]	c - high	0.6	Amur honeysuckle may impact hardwood production systems (Siefert et al. 2007). Alternative answers for the Monte Carlo simulation are "a" and "b."
GEOGRAPHIC POTENTIAL			Unless otherwise indicated, the following evidence represents geographically-referenced points obtained from the Global Biodiversity Information Facility (GBIF).
Plant hardiness zones			
Geo-Z1 (Zone 1)	n - negl	N/A	We found no evidence that this species occurs in this zone.
Geo-Z2 (Zone 2)	n - negl	N/A	We found no evidence that this species occurs in this zone.
Geo-Z3 (Zone 3)	n - low	N/A	We found no evidence that this species occurs in this zone.
Geo-Z4 (Zone 4)	y - negl	N/A	One point was found in Jilin, China from 1937 and several occurrences from Primorsky Krai in Russia, most of the land mass of which occurs in this zone. One non-georeferenced USFS report occurs from Aroostock County, ME, which contains both Zones 4 and 5, and there are reports in MN from a trained invasive plant technician (EDDMapS 2016).
Geo-Z5 (Zone 5)	y - negl	N/A	Points reported from China, North Korea and the US from VT to NE.
Geo-Z6 (Zone 6)	y - negl	N/A	Widespread in China, Japan, North and South Korea, and the US (CT, DC, IL, KS, KY, MA, MD, MI, MO, NJ, OH, OK, PA, VA). One point in Ontario Canada south of Toronto. Single reports from the northern and eastern counties of ME (EDDMapS 2016).
Geo-Z7 (Zone 7)	y - negl	N/A	Points occur in China, Germany and the US in AL, CT, KY, MO, NJ, NY, OK, TN; occurrence data are reported from Japan and South Korea (GBIF 2016, occ.).
Geo-Z8 (Zone 8)	y - negl	N/A	Points occur in China, Japan, and the US, occurrence reported for South Korea (GBIF 2016, occ.).
Geo-Z9 (Zone 9)	y - negl	N/A	Points are reported from China, Japan, Spain and the US in CA. Occurs in the Netherlands in Zuid Holland, and in South Korea (GBIF 2016, occ.).
Geo-Z10 (Zone 10)	n - low	N/A	We found no evidence that this species occurs in this zone.
Geo-Z11 (Zone 11)	n - negl	N/A	We found no evidence that this species occurs in this zone.
Geo-Z12 (Zone 12)	n - negl	N/A	We found no evidence that this species occurs in this zone.
Geo-Z13 (Zone 13)	n - negl	N/A	We found no evidence that this species occurs in this zone.
Köppen -Geiger climate classes			
Geo-C1 (Tropical rainforest)	n - negl	N/A	We found no evidence that this species occurs in this

			climate class.
Geo-C2 (Tropical savanna)	n - negl	N/A	We found no evidence that this species occurs in this climate class.
Geo-C3 (Steppe)	n - negl	N/A	We found no evidence that this species occurs in this climate class.
Geo-C4 (Desert)	n - negl	N/A	We found no evidence that this species occurs in this climate class.
Geo-C5 (Mediterranean)	y - negl	N/A	Points in the western US.
Geo-C6 (Humid subtropical)	y - negl	N/A	Points in China, Japan, and southeastern and midwestern US. Occurrence data from South Korea (GBIF 2016, occ.).
Geo-C7 (Marine west coast)	y - negl	N/A	Points in China, Germany and Spain, an occurrence in the Netherlands.
Geo-C8 (Humid cont. warm sum.)	y - negl	N/A	Widespread in China, North Korea and across the eastern US; occurrences in Japan and South Korea (GBIF 2016, occ.).
Geo-C9 (Humid cont. cool sum.)	y - negl	N/A	Points in China and throughout mid-Atlantic and into northeastern US.
Geo-C10 (Subarctic)	n - negl	N/A	We found no evidence that this species occurs in this climate class.
Geo-C11 (Tundra)	n - negl	N/A	We found no evidence that this species occurs in this climate class.
Geo-C12 (Icecap)	n - negl	N/A	We found no evidence that this species occurs in this climate class.
10-inch precipitation bands			
Geo-R1 (0-10 inches; 0-25 cm)	n - mod	N/A	We found no evidence that this species occurs in this zone.
Geo-R2 (10-20 inches; 25-51 cm)	y - low	N/A	At least two points, both preserved specimens, in China. Presence in Mongolia reported (NGRP 2016).
Geo-R3 (20-30 inches; 51-76 cm)	y - negl	N/A	Points in China, Russia and western and midwestern US: CA, KS, NE, OK, TX
Geo-R4 (30-40 inches; 76-102 cm)	y - negl	N/A	Points in China, Germany, North Korea, Spain and multiple US states. Occurrences reported from the Netherlands, Russia, South Korea (GBIF 2016, occ.)
Geo-R5 (40-50 inches; 102-127 cm)	y - negl	N/A	Points in China and across the US; Occurrences in South Korea (GBIF 2016, occ.).
Geo-R6 (50-60 inches; 127-152 cm)	y - negl	N/A	Points in China and across the US; Occurrences in South Korea (GBIF 2016, occ.).
Geo-R7 (60-70 inches; 152-178 cm)	y - low	N/A	Points in China and the US, in OR. Reported from South Korea (GBIF 2016, occ.).
Geo-R8 (70-80 inches; 178-203 cm)	y - low	N/A	Points in China and in Japan, where the zone is interpolated, as no zone data show in GBIF.
Geo-R9 (80-90 inches; 203-229 cm)	y - mod	N/A	A single point in Japan at a forest experimental station, which may be planted, and occurrences from Hunan and Jiangxi provinces in China (GBIF 2016, occ.).
Geo-R10 (90-100 inches; 229-254 cm)	y - mod	N/A	Two points in Hubei in China, and a single point in Japan at a forest experimental station, which may be planted.
Geo-R11 (100+ inches; 254+ cm)	n - negl	N/A	We found no evidence that this species occurs in this zone.
ENTRY POTENTIAL			
Ent-1 (Plant already here)	y - negl	1	Introduced to the US in 1896 and widely planted (Luken and Thieret 1995).

Ent-2 (Plant proposed for entry, or entry is imminent)	-	N/A
Ent-3 (Human value & cultivation/trade status)	-	N/A
Ent-4 (Entry as a contaminant)		
Ent-4a (Plant present in Canada, Mexico, Central America, the Caribbean or China)	-	N/A
Ent-4b (Contaminant of plant propagative material (except seeds))	-	N/A
Ent-4c (Contaminant of seeds for planting)	-	N/A
Ent-4d (Contaminant of ballast water)	-	N/A
Ent-4e (Contaminant of aquarium plants or other aquarium products)	-	N/A
Ent-4f (Contaminant of landscape products)	-	N/A
Ent-4g (Contaminant of containers, packing materials, trade goods, equipment or conveyances)	-	N/A
Ent-4h (Contaminants of fruit, vegetables, or other products for consumption or processing)	-	N/A
Ent-4i (Contaminant of some other pathway)	-	N/A
Ent-5 (Likely to enter through natural dispersal)	-	N/A

Appendix B. Maryland filter assessment for *Lonicera maackii* (Rupr.) Maxim. (Caprifoliaceae).

Maryland Filter questions	Answer	Instructions/Result	Notes
1. Is the plant currently cultivated in Maryland? Yes OR no	yes	Go to Question 2	Amur honeysuckle is documented outside cultivation in Maryland (EDDMapS 2016)
2. What is the species' potential distribution in Maryland? wide OR narrow	wide	Go to Question 3	Amur honeysuckle currently occurs in the Coastal Plain, Piedmont, and Ridge and Valley provinces of Maryland
3. How feasible is control of the species? easy OR difficult	easy	Go to question 4	Amur honeysuckle does not exhibit herbicide resistance, does not create a seed bank and does not reproduce through tip rooting or excessive suckering.
4. Does or could the species harm threatened or endangered Maryland species or community types or CITES listed species occurring in MD? yes OR no	yes	Tier 1	Amur honeysuckle co-occurs with several Maryland listed threatened and endangered species (Kyde 2016, Steury and Davis 2003).
5. Is added propagule pressure from sales significantly increasing potential of the species to persist and spread? yes OR no			Question not applicable because of answer to Question 3.