# An Analysis of the Risk of Japanese Honeysuckle (*Lonicera japonica* Thunb.) to the State of Oklahoma

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## ABSTRACT

Invasive species have profound impacts on the wildlife of the habitats they invade. One such invasive that has had an impact on the state of Oklahoma is Japanese Honeysuckle (*Lonicera japonica* Thunb.). This vine suppresses the growth of new seedlings and young plants by twining around them thus cutting off circulation of water and nutrients within the plant and reducing the sunlight available to the host plant. The vine has become one of the most prevalent invasive plant in the southeastern United States. The purpose of this project was to provide a guide for identifying the plant, map the current distribution of the plant throughout the state, and develop a plan to contain and reduce the density of the vine in habitats where it already exists. To meet these objectives, the vine was observed at Lake Sanborn in Stillwater alongside 2 other species of the genus. In addition to this, scientific literature was synthesized to provide a broader understanding of how the vine interacts with native ecosystems. While complete eradication of the vine within the state is economically impractical, efforts to suppress the vine are necessary to preserve the state's natural resources.


*Key words: Invasive plant species, Non-native, Semi-evergreen, woody vine, Japanese Honeysuckle, Honeysuckle.*

# INTRODUCTION

In order for any non-native species to be considered truly invasive, it has to meet certain criteria. First, the species needs to be restricted to its native habitat by some sort of biogeographical barrier, within which it has various predators that it adapts certain defensive traits against. Invasive species have overcome this barrier through some sort of outside action, typically that of humans (Hickman 2016). Once the species has been introduced into a new habitat, it must successfully become established within that habitat, typically requiring multiple introductions for individuals to persist and reproduce successfully. Furthermore, new individuals of the species must disperse beyond the site of this initial introduction intruding into new habitats. Finally, the species must have some sort of negative impact on the ecology of the habitats in which it is present. If, and only if, a species meets all these requirements can it be considered an invasive species (Hickman 2016). One species that exhibits all these features within the state of Oklahoma is Japanese honeysuckle (*Lonicera japonica* Thunb.).

Japanese honeysuckle's invasion is a prime example of one theory for invasive success referred to as enemy release (Mitchell et al. 2006). In areas where it has been introduced, Japanese honeysuckle has fewer predators than in its native range or than species native to these habitats. There are few herbivores in the state known to graze the hairy leaves of the vine. This benefits the invasive because while native species have to defend themselves from the native herbivores that consume them, the invasive remains untouched. This means that native species have to allocate more of their energy budget towards defense and repairs. Instead, Japanese honeysuckle is able to allocate more of its energy to growth and reproduction, enabling it to dominate the areas it enters and spreading to new ones quickly. This is where the vine becomes problematic, because it is then able to produce roots and new individuals by propagation at

points where the nodes touch the ground. Given that Japanese honeysuckle is an invasive vine that twines up host plants, this means the plant can also quickly overwhelm native trees and shrubs. The vine is also capable of suppressing seedling growth by twining around and smothering developing trees (Munger 2002). Further, the vine is capable of rooting at the leaf axes meaning that the vine can expand its range by growing and rooting again. All this means that this increased energy budget makes Japanese honeysuckle a fiercely competitive plant capable of altering the composition of Oklahoma's ecosystems.

There were 4 main objectives set for this project. The first was to provide a set of characteristics that would help amateur botanists distinguish Japanese honeysuckle from native species. The second objective was to document how Japanese honeysuckle is spread within the state and provide a map illustrating its current distribution. The next objective was to explain the economic risks that the vine poses to the counties it is present in. The final objective was to suggest a best management practice for eradicating colonies of the plant.

## METHODS

For the first objective of this project, 3 species of the genus *Lonicera* were observed at Lake Sanborn located in Stillwater, Oklahoma. The species observed included 2 invasives, *L. japonica* and *L. maackii*, as well as the native *L. sempervirens*. Specimens of these three species were pressed and dried for comparison. Comparing these 3 species helped identify characteristics for distinguishing L. japonica from the commonly misidentified native. For the remaining objectives, a literary review was performed. Data from the Oklahoma Vascular Plants Database and the University of Georgia's EDDMapS service was used to produce a composite map illustrating the density of recorded colonies of *L. japonica* within the state by county. The map was created using ArcMap software. Literature examined for this project were found using the

Agricola and Web of Science Database as well as information from various state and federal organizations.

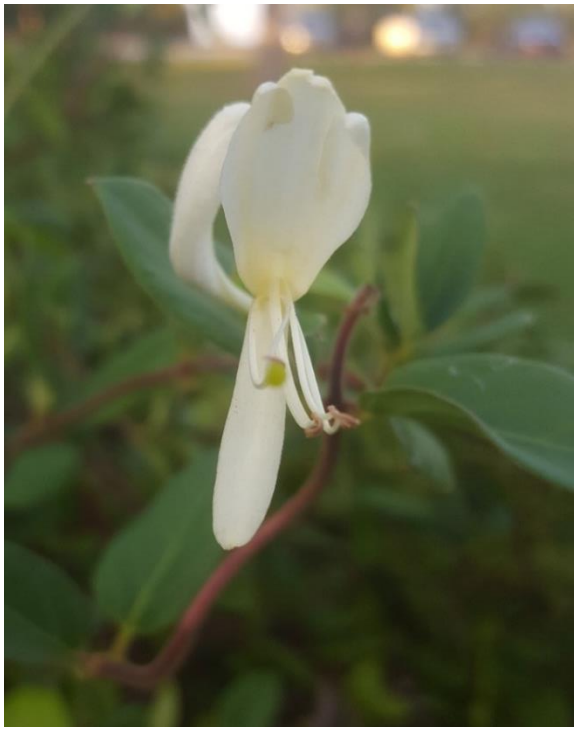

Figure 1: Photograph of L. japonica flower taken by J Phillips at Lake Sanborn, Stillwater OK

Figure 2: Photograph of the black berries of *L. japonica* taken by J Phillips at Lake Sanborn in Stillwater, OK.

## IDENTIFICATION

Japanese honeysuckle is a semi-evergreen perennial vine that belongs to the plant family Caprifoliaceae, a family comprised of herbs, woody vines and shrubs. *Lonicera* is the largest genus of this family represented in Oklahoma. Young leaves of Japanese honeysuckle may be elliptic in shape, while older leaves appear more ovate and are pubescent. Stems of Japanese honeysuckle are a reddish-brown and are also hairy, with older stems becoming grey, fissured, and sloughing. Japanese has white, bilaterally symmetrical flowers that turn yellow with age and are borne in axillary pairs (Figure 1). The corollas are tubular and are comprised of 5 fused petals that form 2 lips, with the upper of 4 petals and a single-petaled bottom lip. Stamens are also 5, are longer than petals and project outward. Pistils are compound. These flowers bloom from May to as late as October. The fruits produced are glossy, black, multiseeded berries (Figure 2).

There are eight species of the genus *Lonicera* known to be present in the state of Oklahoma, 3 of which are considered to be invasive to the state*: L. fragrantissima, L. maackii*, and *L. japonica* (Miller 2010). These three species each have their flowers borne axillary, whereas all other native species of *Lonicera* have terminal inflorescences. Trumpet honeysuckle (*Lonicera sempervirens* L.) is the native species most frequently mistaken for Japanese honeysuckle (). This vine however can be distinguished by its glabrous leaves and stems and by its terminal inflorescences. Inflorescences of Trumpet honeysuckle are spikes of tubular flowers with 5 petals that are bright red on the abaxial surface and yellow on the adaxial surface (Tyrl et al. 2015). These inflorescences are also subtended by perfoliate leaves (Tyrl et al. 2015).

## INVASION AND DISPERSAL

Japanese honeysuckle is native to Eastern Asia. Best estimates of the original introduction of the plant into the US put its arrival in the early 19$^{th}$ century (Schierenbeck 2004). The vine was originally introduced as an ornamental valued for its sweet smelling flowers and thick covering (USDA 2016). The vine also has a history of being used for soil erosion control, because of its ability to produce thick mattes (OKIPC n.d.). Because of these traits, Japanese honeysuckle continues to be used by landscapers and horticulturalists. Despite this, its high plasticity enables the vine to adapt to the tremendously variable habitats present throughout the state (Munger 2002).

The vine is successful in many soil types, including soils that lack much organic matter or minerals (Schierenbeck 2004). The only factors that seem to limit the growth of Japanese honeysuckle are precipitation and mean annual temperature. The vine thrives best where there is more than 100 cm of precipitation each year and the average annual temperature exceeds at least -1°C (Munger 2002). This means that optimal conditions for Japanese honeysuckle are primarily

located in the southeastern to eastern portion of the state (Oklahoma Mesonet 2012). Because the vine has leaves that persist through most if not all of the state's winter months, it has a competitive edge on natives (Munger 2002). This trait, in addition to producing new leaves earlier in the spring, allows the vine to expand it range further during the open canopy while native plants are dormant for the winter.

The vine and its foliage are also frequently used as browse for white-tailed deer and eastern cottontail rabbits (Miller 2005) the only documented herbivores of the vine in the state. The nectaries present in the flowers of species of *Lonicera* encourage pollination by hawkmoths and hummingbirds. The berries of the vine may be eaten by some birds that may ingest the seeds disperse them to new locations, typically underneath trees in which they roost. Wild turkeys, northern bobwhite quails and various songbirds are all known to eat the fruits of the vine (Miller 2005). In addition to seed dispersal, Japanese honeysuckle is capable of spreading through vegetative means. The vine is able to sprout roots at low nodes and sprout new individuals from rhizomes, further increasing its ability to spread beyond its initial site of introduction.

Currently, colonies of the vine are present in 51 counties in the state of Oklahoma. As expected, most of these counties are in the eastern half of the state where the most precipitation is received and exceeds 100 cm per year. Figure 3 represents the current dispersal of Japanese honeysuckle at the county level. Data represented in this map is a composite of data from the Oklahoma Vascular Plants Database and the University of Georgia's EDDMapS Service. As expected, counties with sightings of Japanese honeysuckle reside primarily in the eastern half of the state where precipitation is more abundant and temperatures stay warmer. This is not to say, however, that the remaining counties could not currently have undocumented colonies or be

subject to future invasion.

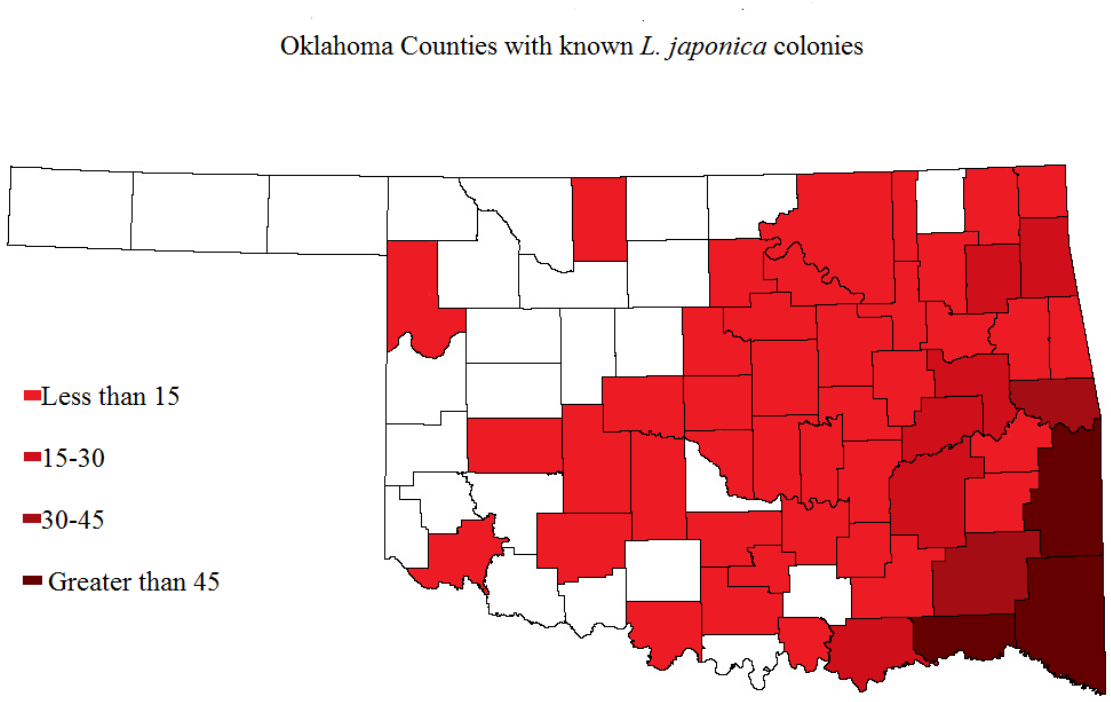


Figure 3 A map showing the current range of *L japonica* in the state of Oklahoma. Data represents a composite of data provided by the Oklahoma Vascular Plants Database and EDDMapS and produced using ArcMap.

## ECONOMIC RISKS

Oklahoma has long been a state that prides itself on the diversity of its landscape. Japanese honeysuckle has become a threat to this diversity, presenting a great risk to our state parks and other natural resources. Japanese honeysuckle does have a negative impact on the intrinsic value of our state parks, by establishing monocultures and lowering the aesthetics by making the landscape monotonous. The vine damages natural parks ecologically by driving out native plant species and the native fauna that depend on them. It also becomes an additional cost to land managers once it works its way into open fields. Given how rapidly the vine spreads, it can make keeping land for its intended purposes difficult and is a poor food source for livestock (Munger 2002).

In addition to this, some studies even suggest that the plant may serve as a winter host for agricultural pests such as tobacco budworm and corn earworm in states like Tennessee (Munger 2002). Other studies suggest that the plant may have some form of allelopathy that influences which native species can grow in the soil even after the plant is removed (Skulman et al. 2004). These traits suggest that the vine could affect the productivity of our largely agricultural state and more attention should be given to its risk to our yields of these crops.

It is prudent that the citizens of the state begin to act now in reducing colonies of the vine in order to prevent the cost of management from increasing beyond what it already has. The longer the issue goes unchecked, the further Japanese honeysuckle spreads within native habitats. It is clear that the vine depreciates the various natural resources produced by native ecosystems, and poses a financial risk to land managers and farmers alike.

## MANAGEMENT PLAN

Complete eradication of Japanese honeysuckle within the state seems to be an insurmountable task because management is both labor intensive and economically unfeasible. Nonetheless, there are several options for controlling existing populations. For small stands, hand pulling of the vine can prove effective in eradication so long as the roots are removed. For larger colonies, cutting, mowing and burning can all decrease its density in the short run, but unless the roots are eliminated the vine may resprout. Because of this, herbicides are typically used to prevent regrowth. In cases where herbicides can be used responsibly, they are typically used in combinations and are usually applied on root stumps after cutting to prevent regrowth.

The use of herbicides, however, may be ill suited in many cases. Because of how closely the vine wraps around its host plant, herbicides have a high likelihood of affecting non-target native species. Also, given the plants historic use in soil erosion control, it is ill-advised to use

herbicides in areas where they will not stay confined to the soil and may end up in adjacent water bodies and cause even more severe ecological damage. To avoid the use of herbicides in management, the site will need to be monitored closely and any new sprouting stems will need to be trimmed until the resources stored in the roots have been depleted (Schierenbeck 2004). Because the plant can root at low nodes, cuttings should be burned or bagged and transported to a landfill (USDA 2016). Controlled burning of affected habitats is not an effective means of managing the vine as it can regrow from the root systems faster than some native species (Munger 2002). Goats may also be used as a biological control for the vine but will still leave the roots, allowing the vine to resprout (Bravo 2009). Because of this the goats would have to be allowed to graze the vine periodically to yield a similar effect to that of cutting. In addition, goats would need to be confined in their range, as they could be an added risk to the habitat if they roam freely.

In areas where the vine has been used for soil erosion control it is also important to consider replacing the vine with native species such as Carolina snailseed (*Cocculus carolinus*) or Virginia creeper (*Parthenocissus quinuefolia*) (Elmore et al. n.d.) as well as Trumpet honeysuckle (*Lonicera sempervirens*). This is necessary to prevent soil erosion which can also have adverse reaction on native ecosystems such as pollution of waterbodies and subsequent eutrophication and hypoxia. Trumpet honeysuckle will remain as a native food source for hummingbirds and hawkmoths and can fill the various ecological niches the invasive currently holds.

## DISCUSSION

It should be noted that Japanese honeysuckle invasion is strongly driven by habitat disturbance. For example, Japanese honeysuckle appeared to thrive the greatest in areas of Lake

Sanborn that had recently been cleared to provide hiking paths and provided an open canopy. The vine also thrived in regions where other plant debris had been piled to decompose. This disturbance explains why a site such as Lake Sanborn has become a novel ecosystem for invasive species like Giant Reed, Chinese privet, Sericea Lespedeza, Amur honeysuckle and Japanese honeysuckle. Extensive human traffic, the proximity of residential areas, and the extensive disturbance of native habitats are all reasonable explanations to the development of an ecosystem that is dominated by invasive species. This novel ecosystem becomes hostile and uninhabitable to the wildlife that once thrived there and can alter other biogeochemical aspects of the ecosystem.

One of the greatest complications to combating *L. japonica* invasion is the fact that many landscapers still use the plant for ornamental purposes. Retailers continue to sell the vine even despite the increasing amount of literature that documents its risks as an invasive. Connecticut, Massachusetts, New Hampshire and Vermont have all placed the vine on their state noxious weed lists, making it illegal to buy, sell or trade the vine (PLANTS database). However, this would also require land owners to manage it on their property or face a fine, and given the pervasiveness of the plant, this would seem unreasonable for many landowners. In order to inhibit the introduction and subsequent invasion of non-native species, more efforts need to be taken towards educating the public and reducing anthropogenic disturbances of native ecosystems. To assist in this, a fact sheet detailing the identification traits, impact, and management plan for the vine was compiled.

Furthermore, there are various organizations in the state that ecologically aware citizens should be made familiar with to report any unmanaged colonies of *L. japonica*. Two prominent agencies currently advocating for the management of Japanese honeysuckle and other invasives

within the state are the Oklahoma Native Plant Society (ONPS) and the Oklahoma Invasive Plant Council (OKIPC), the latter of which recently named the vine in its top "dirty dozen" invasive plants. The OKIPC has a link on their website (okinvasives.org) where alert citizens can report plants that they believe are invasive. Encouraging the early detection of and initiating a rapid response to new colonies of *L. japonica* is Oklahoma's best course of action to preventing further spread of the vine.

ACKNOWLEDGEMENTS

The author would like to thank M Fishbein and A McDonnell for their insights on the characteristics necessary to distinguish species of the genus. The author would also like to thank K Hickman for her guidance in the development of this project. Appreciation is also given to the City of Stillwater for the use of Lake Sanborn from which various invasive species were identified, studied, and collected. Finally, the author would so like to thank the OSU Department of Plant Biology, Evolution and Ecology for the use of their plant press and drying rack for preserving specimens. Plant specimens have been kept with other student collections further education and in the OSU herbarium.

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