UT Extension

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Identification and Control of Non-native Invasive Forest Plants in Tennessee

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Invasive, exotic plants can cause significant displacement of native vegetation. But exactly what are exotic plants? What makes them invasive? To find out, let's start with some basic definitions.

The vegetation historically found in a local area is termed **native vegetation**. These plants have traditionally been found in the area and are well-suited to maintain themselves in their environs. **Exotic plants** are those plants found in a particular area, but which originate from another continent or country. These plants can also be referred to as non-native. However, non-native plants are not always exotic. **Non-native plants** may also be native elsewhere in the same country, but not found in the local area. For example, redwoods are native to California and would be non-native in Tennessee, but not exotic. **Invasive plants** are plants, native, non-native or exotic, that can cause significant ecological or economic damage. Invasive plants can displace more ecologically and economically valuable plants. These plants are typically characterized by a rampant rate of spread. This rate of dispersal is due to both human activity and vegetative characteristics. Humans assist in the dispersal of plants by moving plant materials to and from locations. Humans also cause significant disturbances to native plant communities that provide opportunities for the establishment of exotic and/or non-native invasives. The seeding and sprouting characteristics of the plants also significantly contribute to the rate of dispersal. Though a negative term, "invasive" plants can also be native plants that we usually do not consider to be a problem. Examples of this type of native plant are sumac (*Rhus spp.*), poison ivy (*Toxicodendron radicans*) and redbud (*Cercis canadensis*).

The Introduction of Exotics and Non-Natives and How Invasive Plants Spread

The introduction of many non-native or exotic plants has occurred both intentionally, as with ornamental plantings, and accidentally, as a by-product of commerce. For example, the movement of hay, carrying seeds of invasive plants, can introduce exotic and/or non-native invasive plants to new areas. Intentional plantings occur in both ornamentals, whose foliage, form and/or flowers make them attractive additions to landscaping, and other plants introduced to be used as erosion control or wildlife forage. Often, these plants exhibit reproductive traits that enable them to spread rapidly.

Leaves of the tree-of-heaven.

Flowers and leaves (left) and seed pod (right) of royal paulownia.

One reproductive tool of many invasive plants is the production of thousands of light, wind-blown seeds per plant that can rapidly disseminate to other areas. Other types of invasive plants have seeds with very hard seed coatings. This seed coat protects the seed and allows it to remain viable for several years after being dropped by the parent plant. Invasive plants with hard seed coats can lay dormant in the soil for years, waiting for the seed coat to wear away and for appropriate weather and site conditions to occur for germination. Conditions that facilitate seed sprouting can include several consecutive wet growing seasons, site disturbance that increases light availability and/or clears the soil surface of other vegetation, or droughts.

Scarification of the seed coat, by animals or other means of abrasion, can also stimulate sprouting. Scarification occurs when the seed passes through an animal's digestive track. The fruits and seeds produced by invasive plants are usually very attractive to wildlife as a food source, which aids in subsequent seed dispersal. Birds, in particular, play a large role in disseminating seeds over broad areas. Another reproductive characteristic of invasive plants is the ability to sprout from roots and root nodes along the stems. If the aboveground vegetation of an invasive plant is killed, the roots can rapidly send up a replacement sprout. Some plants reproduce by root nodes located along the aboveground stem. When one of the root nodes comes into contact with the soil surface, a new root system begins to develop and eventually forms another plant.

Where Non-native Invasives Usually Occur

Invasive plants quickly colonize areas that are frequently disturbed, such as road embankments and construction areas. They can also be found along field edges, riparian areas and other unmanaged places. With a few exceptions, these types of plants are not found in shaded areas, such as the interior of forests. Most invasive plants are better suited for sunny sites and are considered intolerant of shade. However, species such as privet and Japanese grass can present major problems in forested and shaded areas. Forest disturbances, such as ice storms, fires, insect and disease infestations, harvests or any canopy-removing event, can open forested areas to exotic plant invasions.

Control of Non-native Invasives

Controlling non-native, invasive plants can be a difficult task. Although cutting and mowing vegetation will retard the growth and competitiveness of invasive plants, they never really solve the problem. Most professionals recommend using an herbicide to control invasive plants. Herbicides, when used properly, have several benefits in controlling problem plants. When applied, the chemicals are absorbed by the plant through leaves, bark or cuts in the wood and are translocated to the root of the plant. The primary advantage of systemic herbicide use on invasive plants is that they kill the root of the plant, not just the aboveground vegetation, eliminating any chance of re-sprouting. Another advantage is the ability of certain herbicides to be selective about which plants are killed. For example, many herbicides only kill woody plants and leave herbaceous plants untouched. Sometimes, multiple applications of herbicide are needed to control certain plants. No matter which herbicide is used, carefully read and follow the product label and consult with a professional for application rates and other directions. Herbicides differ in selectivity, method of plant kill and their duration in the soil. Most herbicides recommended for use in this publication are to be specifically applied to the plant to be controlled or removed. They are not to be applied in a broadcast fashion. Each situation must be carefully evaluated before any herbicide is used.

Invasive, exotic and/or non-native plants are found in a variety of forms. The list includes trees, vines, shrubs, forbs and grasses. This publication will primarily cover trees and those plants that can directly influence trees. It will provide some basic descriptions for each plant as well as control options.

Tree-of-Heaven

Tree-of-Heaven (*Ailanthus altissima)* originated in Asia and was introduced to the United States from Europe in the late 1700s. A tree that grows very rapidly, it can reach a maximum height of 80 feet and is typically found along road edges or in disturbed areas. It is also allelopathic, meaning it emits a chemical from its roots that discourages the growth of other vegetation immediately surrounding the tree. Tree-of-heaven is a rapid reproducer, producing viable seed in less than three years from germination. A common invasive plant that can be found throughout Tennessee, tree-of-heaven is considered to be the most prevalent invasive plant problem for trees in the state.

The leaves, found on very strong tan-colored twigs, are pinnately compound. There are many leaflets per leaf, ranging from 10 to 41 on any given tree. The leaf scars, where the leaves attach to the twig, are very large and heart-shaped. One of the key characteristics of the twigs and leaves of the tree-of-heaven is their pungent odor. Crushed leaves and broken twigs smell of strong or burned peanut butter. The tree flowers in the late spring and has large clusters of yellow-green to red-tinged green flowers. The seeds developing from these flowers are winged and have a "twisted" look near the tip. One tree can have several hundred thousand of these wind-dispersed seeds, making it easily disseminated. This tree also reproduces prolifically by sprouting from its own roots.

Royal Paulownia

Also known as the princess tree, royal paulownia, (*Paulownia tomentosa),* is another exotic tree species found throughout Tennessee. Originating in China, the tree, known for its giant heart-shaped leaves, will reach a maximum height of 60 feet. The leaves can be up to 20 inches across with fine hairs on their surfaces that give them a fuzzy feel. Leaves are opposite in arrangement on the twigs, which are gray with white spots, called lenticels, and do not have a terminal bud.

The tree flowers in early to mid-spring and has large, erect clusters of light purple or lavender flowers. The flowers are very showy and led to the introduction of the tree as an ornamental. The seeds of the royal paulownia are found in shells that form clusters, much like a bunch of grapes. Within each of these nut-like shells, there are thousands of tiny, winged seeds that disperse in late summer and early fall. These clusters of seedpods can be seen throughout fall and winter, long after the leaves have fallen off. Some studies have shown that a single tree can produce 20 million seeds. These seeds are spread easily by wind and water. Seedlings grow very rapidly, often out-competing other native vegetation for valuable growing space. The tree can also reproduce by rapidly growing root sprouts, some reaching more than 15 feet tall in one year. Royal paulownia is often confused with the catalpa tree. However, the seedpod of the catalpa is very different and looks much like a bean pod.

Paulownia seed readily colonizes disturbed areas with exposed soil. The seed requires bare, mineral soil for germination. However, the seeds do not germinate and survive unless the seed falls on sterile soil. New germinates of Paulownia have a high rate of mortality from damping-off disease caused by a variety of soil fungi. Generally, Paulownia does not colonize open areas unless sterile soil is exposed. Common examples are following burning, in construction activities and road cuts. Rarely does Paulownia colonize other areas because of the ever-present fungi.

Mimosa

Mimosa (*Albizia julibrissin*) is an exotic, invasive plant introduced from Asia in the mid-1700s for its showy flower. The tree, also known as silktree, can reach 50 feet in height, and exhibits smooth brown bark. It is a legume, so the seeds appear in large, flat, bean-like pods in the summer and fall. The tree is best known for its fuzzy pink blossoms that appear in the early summer. The leaves are very fern-like and are classified as bipinnately compound.

Mimosa occurs on a wide variety of sites. It prefers open areas with high levels of light, but can also occur in more shady conditions. Seeds are dispersed by animals and water movement. Seeds produced by this tree can remain viable in the soil for many years due to a very thick and hard seed coating. Mimosa also forms dense thickets through its highly prolific root sprouts.

Privet

Several species of exotic privets can be found throughout Tennessee; however, the two found most are common privet (*Ligustrum vulgare*) and Chinese privet (*Ligustrum sinense*). These plants were introduced to this country in the late 1800s from China and Europe. The shrubs are mostly evergreen and rarely reach their maximum height of 30 feet. Very shade-tolerant, privet spreads rapidly in both forested and open areas by seed and sprouts. Privets are aggressive growers and tend to form dense thickets where left uncontrolled. They are most invasive in riparian areas, where they can dominate the forest understory.

The leaves of the privet are opposite in arrangement on the twig. These leaves, with an oval-shaped base, are very dark green on the upper surface and pale green on the underside. Privet flowers in the late spring and into summer, with clusters of white flowers at the ends of the twigs. The fruit is a green drupe (fleshy fruit with a seed in the center) that appears in late summer. It will turn deep purple or even black in fall and winter. Wildlife, such as small birds, feed on the fruit and spread the seeds. Privets can also reproduce from the stumps of damaged or cut stems.

Amur (Bush) Honeysuckle

First planted in the United States as a wildlife food source in the mid-1800s, this Asian plant is rather different than its cousin, the Japanese honeysuckle. The amur bush honeysuckle (*Lonicera maakii)* is a deciduous shrub than can reach heights of 16 feet.

Bush honeysuckle has oppositely arranged leaves and the flowers appear in late spring, ranging from white to pink. The fruit, a drupe, changes from green in summer to a bright red-orange in fall and winter. More than 20 species of birds are known to feed on bush honeysuckles and are primarily responsible for dispersing the plant to new sites. Found mainly in upland habitats, but occasionally in riparian areas, the plant grows in clumps and also is allelopathic, both characteristics that inhibit other vegetation. Several other species of bush honeysuckle are also considered invasive, including Morrow's honeysuckle.

Japanese Honeysuckle

Fairly common in Tennessee, the Japanese honeysuckle (*Lonicera japonica*) is a woody vine that is generally evergreen. This honeysuckle was introduced from Japan in the early 1800s, primarily to control erosion.

The oppositely arranged branches have bark that becomes deeply fissured as the plant ages. Relatively

Control Recommendations			
Species	**Large Trees**	**Saplings**	**Seedlings**
Tree-of-Heaven	Stem injections with Garlon 3A, Pathway*, Pathfinder II or Arsenal AC*. Midsummer application is best. Apply herbicide to stumps of felled trees to prevent resprouting.	Apply Garlon 4 as a solution in a basal oil to the bark of saplings. Basal oil will help keep the herbicide on the tree. A penetrant would help the herbicide get through the bark.	Wet leaves in late summer with a water-herbicide mixture with surfactant (helps herbicide adhere to the leaf and be more effective). Herbicides include Arsenal AC*, Krenite S or Garlon 4.
Royal Paulownia	Stem injections with Arsenal AC* or a glyphosate herbicide. Apply any time besides March and April. Apply herbicide to stumps of felled trees to prevent sprouting.	Apply Garlon 4 in a basal oil to the bark of saplings. Use a bark penetrant.	In late summer and early fall, apply Arsenal AC*, a glyphosate herbicide, Garlon 3A or Garlon 4 with surfactant to leaves.
Mimosa	Stem injections with Garlon 3A or Arsenal AC*, both applied by the label at any time but late spring. Apply herbicide to stumps of felled trees.	Apply Garlon 4 in a basal oil to the bark of saplings. Use a bark penetrant.	In late summer and early fall, apply Garlon 3A, Garlon 4 or glyphosate herbicide with surfactant to leaves.
Privet	Apply Garlon 4 in a basal oil to the bark of larger plants. Use a bark penetrant. Can also cut stems and treat stumps with Arsenal AC*, Velpar L*, a glyphosate herbicide or Garlon 3A.	Apply a glyphosate herbicide or Arsenal AC* with surfactant in August though December. Wet all leaves.	
Amur Honeysuckle	Cut stems and treat stumps with Arsenal AC* or a glyphosate herbicide.	Apply a glyphosate herbicide with surfactant to leaves in August – October. Garlon 4 in basal oil can be used on stems.	
Japanese Honeysuckle	Cut large vines and treat stumps with a glyphosate herbicide or Garlon 3A in late summer and early fall. Prescribed fire in spring also can control vines.	Spray leves with Escort* and a surfactant in late summer. Treat foliage with a surfactant and glyphosate herbicide or Garlon 3A or 4 in July through October.	
Kudzu	Apply a glyphosate herbicide or Garlon 4 with surfactant to leaves and stumps. Can apply Garlon 4 with penetrant and basal oil to bark of large vines in January – April.	Wet all leaves with the following herbicides in a surfactant-water mix: Tordon 101*♦ or Tordon K*♦ in July – October, Escort* in July – September, or Transline+.	
Sericea or Chinese Lespedeza	Wet all leaves with the following herbicides in water with a surfactant in July through September: Garlon 4, Escort*, Transline+, glyphosate herbicide or Velpar L*. Mowing the vegetation at least a month before treatment makes the herbicide more effective.		
Japanese Grass	Apply a glyphosate herbicide in a water-and-surfactant mix in late summer. Vantage can be used according to its label for more protection of surrounding plants. Repeat treatments will be necessary over several years.		

* Use may kill or injure non-target surrounding vegetation by root uptake of this herbicide.

+ Transline controls the leguminous group of plant species.

♦ For Tordon herbicides to be effective, rainfall must occur within six days following application for soil activation. Tordon herbicides are Restricted Use Pesticides.

Precautionary Statement:

To protect people and the environment, herbicides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store or dispose of an herbicide. ***According to laws regulating herbicides, they must be used only as directed by the label.***

Disclaimer:

Herbicides recommended in this publication were registered for the prescribed uses when printed. Herbicide registrations are continuously being reviewed. Should registration of a recommended herbicide be cancelled, it would no longer be recommended by the University of Tennessee. Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others, which may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product.

small leaves, less than 2½ inches long, are also oppositely arranged on the stems. The vine flowers throughout the spring and summer months. White and yellow flowers appear in pairs, with a long, trumpet shape. Honeysuckle fruits are drupes and turn from green in summer to dark purple or black in fall and winter. Animals are primarily responsible for seed dispersal. It also reproduces by vegetative means through root nodes

The Japanese honeysuckle is one of the most common exotic invasive plants in the Southeast. It is shade-tolerant and can be found on a wide range of sites, from field and road edges to deep within a forested canopy. It may die back in full shade, only to resume growth when released to full light.

Kudzu

Kudzu (*Pueraria montana*) is a very large, trailing vine, supported by a very extensive root system. Introduced from Asia in the early 1900s, it was planted for erosion control. However, experience has shown us that it does not prevent erosion, only concealing the problem with a dense cover of vines while continuing to allow soil movement underneath.

The stems of the deciduous vine are typically covered in fine hairs in golden or silver hues. The alternately arranged leaves have three leaflets that may or may not be lobed. Long stalks topped with lavender flowers appear throughout the summer. The seeds are produced in a flat, legume-type seedpod, with a golden color. Generally, very few of the seeds produced are viable and actually germinate. Thus, the primary means of reproduction or spread is through vegetative means. The root sends out runners that can start new root systems and the vines themselves also contain root nodes that will start new rootstocks. Kudzu roots are tubers, growing much like potatoes, and can be very large.

The plant will colonize disturbed areas and completely mat the area with its growth. The mat can cover and kill existing vegetation and trees.

Sericea or Chinese Lespedeza

Sericea lespedeza (*Lespedeza cuneata*), also known as Chinese lespedeza, was planted in the United States in 1899 as an erosion control measure. Although proven effective for this and other uses, such as food for wild quail populations, it is considered an exotic invasive species.

This perennial forb can grow to 6 feet in height, though it is commonly much shorter. The plant has several stems, all radiating from a central stalk. Leaves are alternately arranged on the stem and contain three leaflets. Sericea lespedeza flowers in the late summer; the flowers are light yellow with purple spots. The seedpod is very legume-like, but each pod only contains one seed. The plant is spread by people, animals and by sprouting readily from the root collar, making it less susceptible to killing by mowing or cutting. It is commonly found in both open and shaded areas.

Japanese Grass

This Asian grass was first identified in the United States around 1919. This first identification was made near Knoxville, TN and the plant has since spread all over the southeastern U.S.

Japanese grass (*Microstegium vimineum)* can range in height from 6 inches to 3 feet. It is characterized by short, flat leaves with veins that are not centered on the leaf. These leaves are arranged alternately on the stems, which occur in an alternate pattern on the main stalk of the grass. The seed head of the plant is fairly small and thin. Seeds will remain viable for several years and can ensure annual growth and spread of the plant. The grass is actually an annual that flowers in mid- to late summer. If seed heads are removed by mowing or weed-eating before maturity, the plant will die

Flowers and fruit (inset) of Japanese honeysuckle.

Fruit (left) and leaves and flowers (right) of Chinese privet.

without producing seed. However, seeds produced in previous years are likely to germinate. It also spreads through root nodes found along the main stem.

A shade-tolerant species, Japanese grass can do well in most any situation. However, it does best under a forest canopy in a very moist area. The grass can form a dense mat of vegetation on the forest floor and will preclude any other vegetation from growing.

Other Potential Problem Plants

In addition to those introduced here, there are many other plants in Tennessee that could become severe problems in the near future due to their invasive nature. The table below lists some additional plants that are potential threats to our state. A more detailed list can be obtained from the Tennessee Exotic Pest Plant Council (http://www.tneppc.org/).

Plant Type	Common Names
Trees	Chinaberry, tallowtree
Shrubs	Autumn olive, barberry, multiflora rose, spirea, burningbush, nandina, Japanese knotweed
Vines	Oriental bittersweet, English ivy, periwinkle, non-native wisteria, crown vetch, winter creeper, Chinese yam
Forbs	Garlic mustard, thistles, purple loosestrife;
Grasses	Johnsongrass, congongrass

For more information:

Please contact your county Extension office for more information or help in identifying and controlling non-native, invasive plants around your home or property. Your county Extension agent will be able to provide you with assistance as needed.

Information in this publication is adapted from:

Miller, James H. 2003. *Nonnative invasive plants of Southern forests: a field guide for identification and control*. Revised. Gen. Tech. Rep. SRS-62. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southern Research Station. 93 p.

Fruits and leaves of amur honeysuckle

Chinese lespedeza (left) and Japanese grass (right)

References:

Miller, James H. and Karl V. Miller. 1999. *Forest plants of the Southeast and their wildlife uses.* Southern Weed Science Society. 454 p.

Tennessee Exotic Pest Plant Council. 1996. Tennessee exotic plant management manual. Tennessee Exotic Pest Plant Council, Warner Parks Nature Center, Nashville, TN. 121 p.

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Invasive.org. http://www.invasive.org/. November 2003. Any commercial or other use of the images requires the written permission of the photographer or contact organization, and the University of Georgia.

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