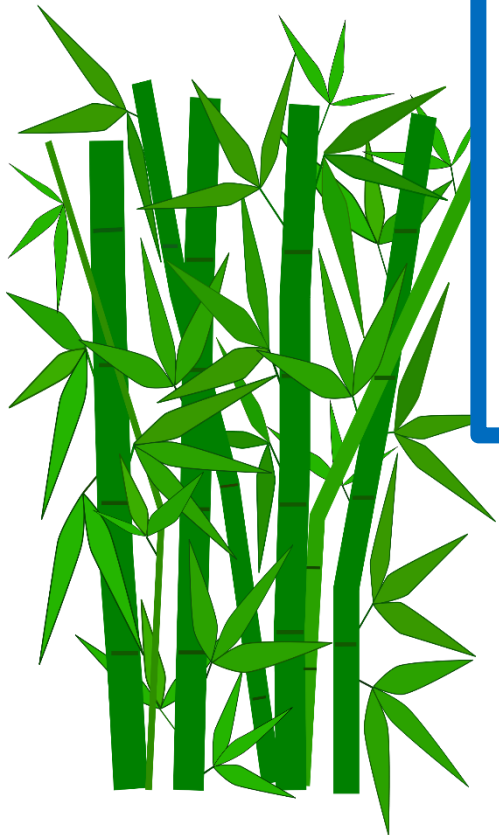




Invasive Plant Management, Inc.



Invasive Plants:
Like Watching an Explosion
In Slow Motion



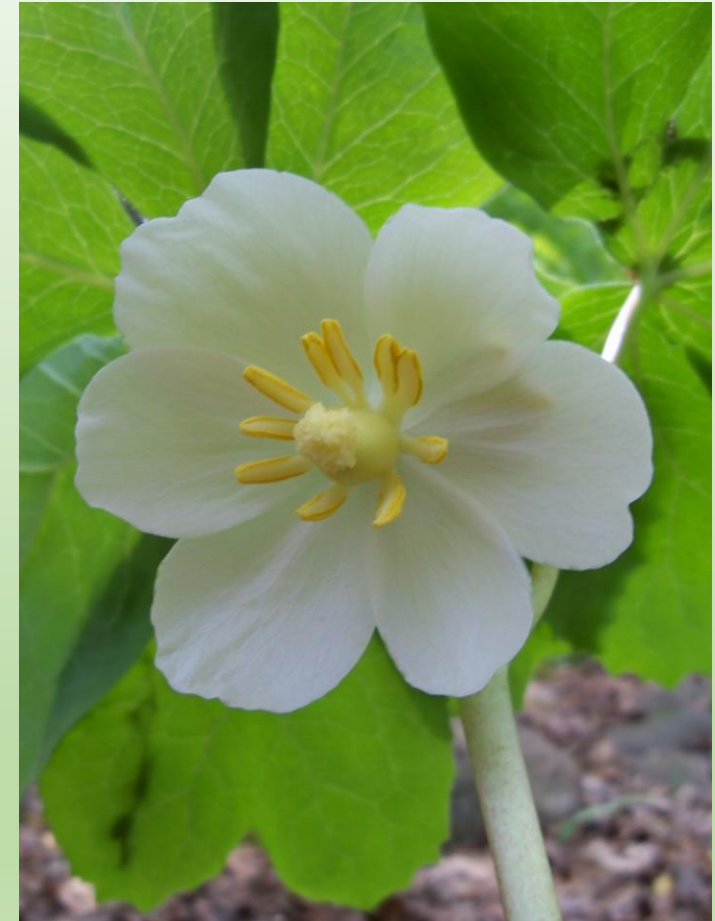
Presented by:
Steven Kirkpatrick
Water Quality Committee
Nansemond River Preservation Alliance

Virginia's Flora



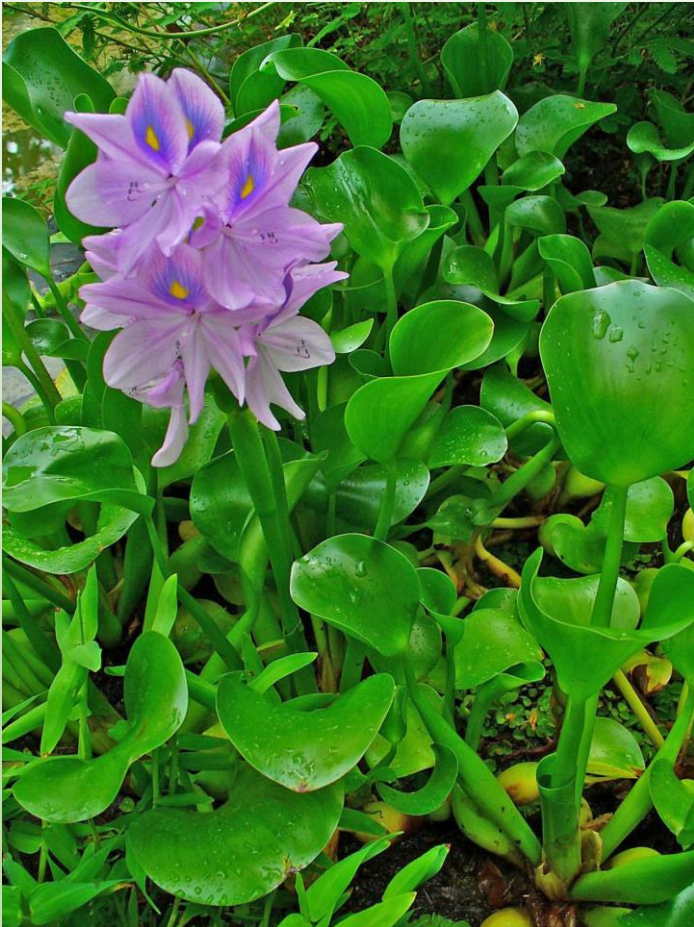
Dogwood

- ✓ Virginia is home to nearly 2600 native vascular plant species.
- ✓ There are also about 600 species that are naturalized – non native plants imported into Virginia and flourish here without human assistance.
- ✓ About 90 species (3% of Virginia's flora) are assessed to be invasive in Virginia – naturalized and out of control. About 45 of these plants are considered highly invasive.



Mayapple

What is an invasive plant?



Water hyacinth

- ✓ Invasive plants are species intentionally or accidentally introduced by human activity into a region in which they did not evolve and cause harm to natural resources, economic activity or humans.
- ✓ Invasive plants proliferate and displace native plant species, reduce wildlife habitat and alter natural processes.
- ✓ Lives outside its historic range AND has a detrimental effect on natural ecosystems.
- ✓ Economists have estimated that all invasive species - plants, animals and diseases - cause \$120 billion in losses each year in the USA.

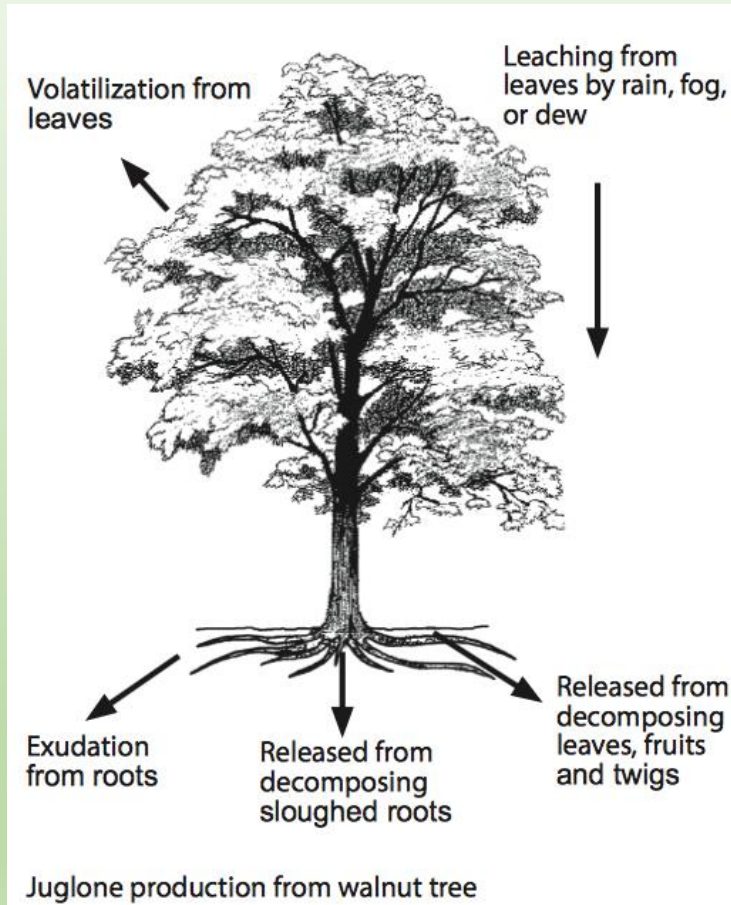
The Most Aggressive Invasive Plants:



Kudzu smothering a utility pole

- ✓ Cause dramatic changes to ecosystems, often impacting animal as well as other plant species.
- ✓ Have few or no natural predators.
- ✓ Are extremely difficult to control.
- ✓ Prolific reproductive capability:
 - ➔ High seed production
 - ➔ Effective seed dispersal
 - ➔ Long term seed viability
 - ➔ Extensive lateral spreading: vines, nodes, roots & rhizomes
 - ➔ Reproduction through fragmentation
- ✓ Often have *allelopathic* properties.

What is “Allelopathy”?



Black Walnut – *Juglans nigra*

- ✓ Chemical inhibition of one plant by another.
- ✓ Caused by releasing germination inhibitors and toxins into the environment.
- ✓ Used as a defense mechanism by plants to suppress competition.
- ✓ Synthetic allelopaths are very popular for farmers and gardeners.



Trifluralin is a synthetic allelopath

How Did We Get Into This “Fine Mess” in the First Place?



Oliver Hardy and Stan Laurel in the classic comedy: “Another Fine Mess”

- ✓ The world is a smaller place than it used to be.
- ✓ Modern transportation makes it much easier to ship things like plants and animals around the world.
- ✓ Many pernicious invasive species were introduced intentionally, before they were recognized as being a problem.
- ✓ Even with many controls in place, organisms accidentally “hitchhike” around the world.
- ✓ Invasive plants love “disturbed soils,” most of which is caused by human activity (construction, farming, roads, logging, etc).

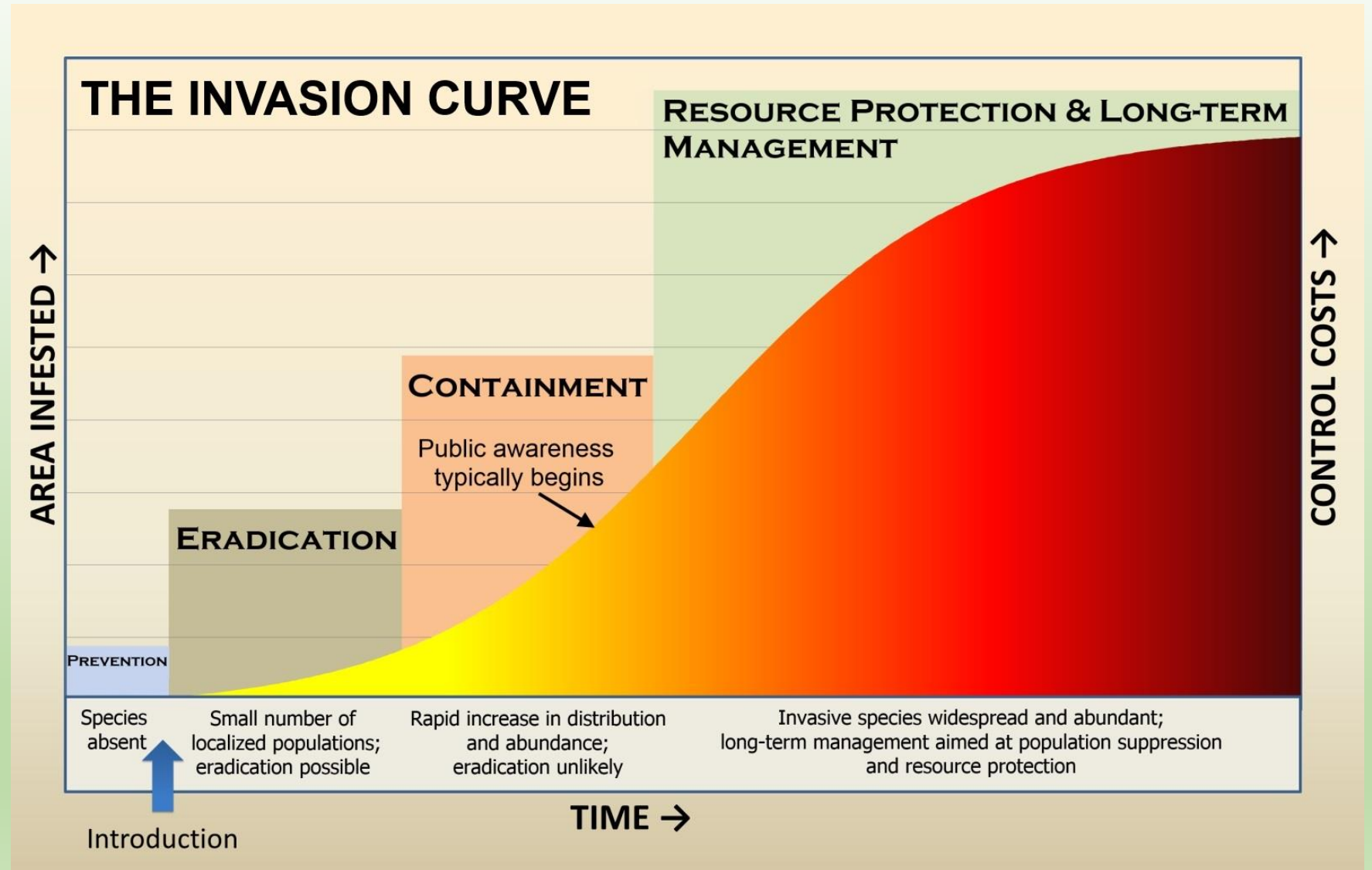


All invasions start out small.

By the time the general public becomes aware, the invader is almost certainly here to stay.

Most species spread at exponential growth rates until they start to “max out” of invaded habitat

It is generally impossible to “undo” a widespread invader. All we can hope for is to find a cost effective, long term management solution.





Highly Invasive Vascular Plants Found in Coastal Virginia

Tree-of-heaven	<i>Ailanthus altissima</i>
Waterwheel	<i>Aldrovanda vesiculosa</i>
Garlic Mustard	<i>Alliaria petiolata</i>
Alligator Weed	<i>Alternanthera philoxeroides</i>
Porcelain Berry	<i>Ampelopsis brevipedunculata</i>
Japanese Sand Sedge	<i>Carex kobomugi</i>
Oriental Bittersweet	<i>Celastrus orbiculatus</i>
Spotted Knapweed	<i>Centaurea jacobina</i>
Canada Thistle	<i>Cirsium arvense</i>
Cinnamon Vine	<i>Dioscorea polystachya</i>
Water Hyacinth	<i>Eichhornia crassipes</i>
Autumn Olive	<i>Elaeagnus umbellata</i>
Lesser Celandine	<i>Ficaria verna</i>
Hydrilla	<i>Hydrilla verticillata</i>
Cogon Grass	<i>Imperata cylindrica</i>
Yellow Flag	<i>Iris pseudacorus</i>
Chinese Bushclover	<i>Lespedeza cuneata</i>
Chinese Privet	<i>Ligustrum sinense</i>

Japanese Honeysuckle	<i>Lonicera japonica</i>
Amur Honeysuckle	<i>Lonicera maackii</i>
Large flower primrose willow	<i>Ludwigia grandiflora</i>
Purple Loosestrife	<i>Lythrum salicaria</i>
Japanese Stiltgrass	<i>Microstegium vimineum</i>
Marsh Dewflower	<i>Murdannia keisak</i>
Parrot Feather	<i>Myriophyllum aquaticum</i>
Eurasian Water-milfoil	<i>Myriophyllum spicatum</i>
Wavyleaf Grass	<i>Oplismenus hirtellus</i>
Mile-a-minute	<i>Persicaria perfoliata</i>
Common Reed	<i>Phragmites australis</i>
Kudzu	<i>Pueraria montana</i>
Japanese knotweed	<i>Reynoutria japonica</i>
Multiflora Rose	<i>Rosa multiflora</i>
Wineberry	<i>Rubus phoenicolasius</i>
Johnson Grass	<i>Sorghum halepense</i>
European Stinging Nettle	<i>Urtica dioica</i>
Beach Vitex	<i>Vitex rotundifolia</i>

Tree of Heaven – *Ailanthus altissima*



All parts of the tree, especially the flowers, have a strong, offensive odor, which some have likened to cat urine or rotting peanuts or cashews.

Ailanthus is dioecious, with male and female flowers being borne on different individuals. Male trees produce three to four times as many flowers as the females, making the male flowers more conspicuous. Furthermore, the male plants emit a foul-smelling odor while flowering to attract pollinating insects.

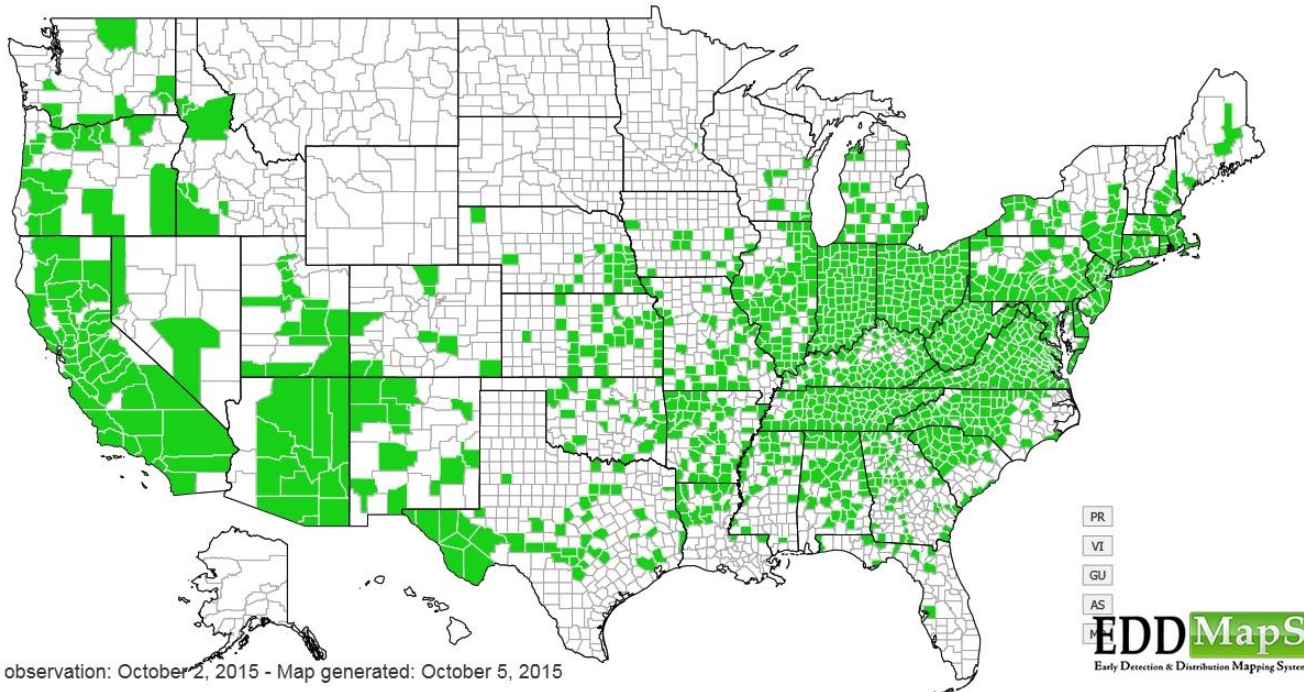
It spreads aggressively both by seeds and vegetatively by root sprouts, re-sprouting rapidly after being cut.



Tree of Heaven – Origin & Status

Ailanthus altissima

Tree of Heaven Invasion



- ✓ The Tree of Heaven originated from the regions of Northern and Central China, as well as Taiwan (located in Southern China) and North Korea. In these regions, it was a native plant species and had optimal conditions to grow.
- ✓ It was brought to the United States as a decorative garden plant in 1784; however it soon began to uncontrollably reproduce.
- ✓ It currently inhabits 41 of the 50 states in the US.

Tree of Heaven – Fun Facts



- ✓ Ailanthus is among the most pollution-tolerant of tree species in the world.
- ✓ While most trees are either male or female, a few perverts are bisexual. (Insert laugh here).
- ✓ It can grow in harsh urban environments.
- ✓ It is the tree featured in the novel “A Tree Grows in Brooklyn.”
- ✓ It is among the fastest growing trees in the USA – Trees can grow three to six feet per year during the first few years of growth.
- ✓ A tree can produce huge quantities of seeds – up to 350,000 per year, and even more in some cases.
- ✓ In China, the bark is a popular remedy for many ailments, particularly dysentery and other complaints of the bowels

Chinese Privet – *Ligustrum sinense*



Chinese Privet has become so widely dispersed throughout the southern mid Atlantic region (and other parts of the country) that most people don't recognize it as an invasive plant.

It grows rapidly; prefers full sun but also thrives in part shade. Plants can form very dense thickets that are almost impenetrable.

There are many related species and cultivars that are not invasive, and are popular landscaping plants. Some varieties are very popular as Bonzai plants.

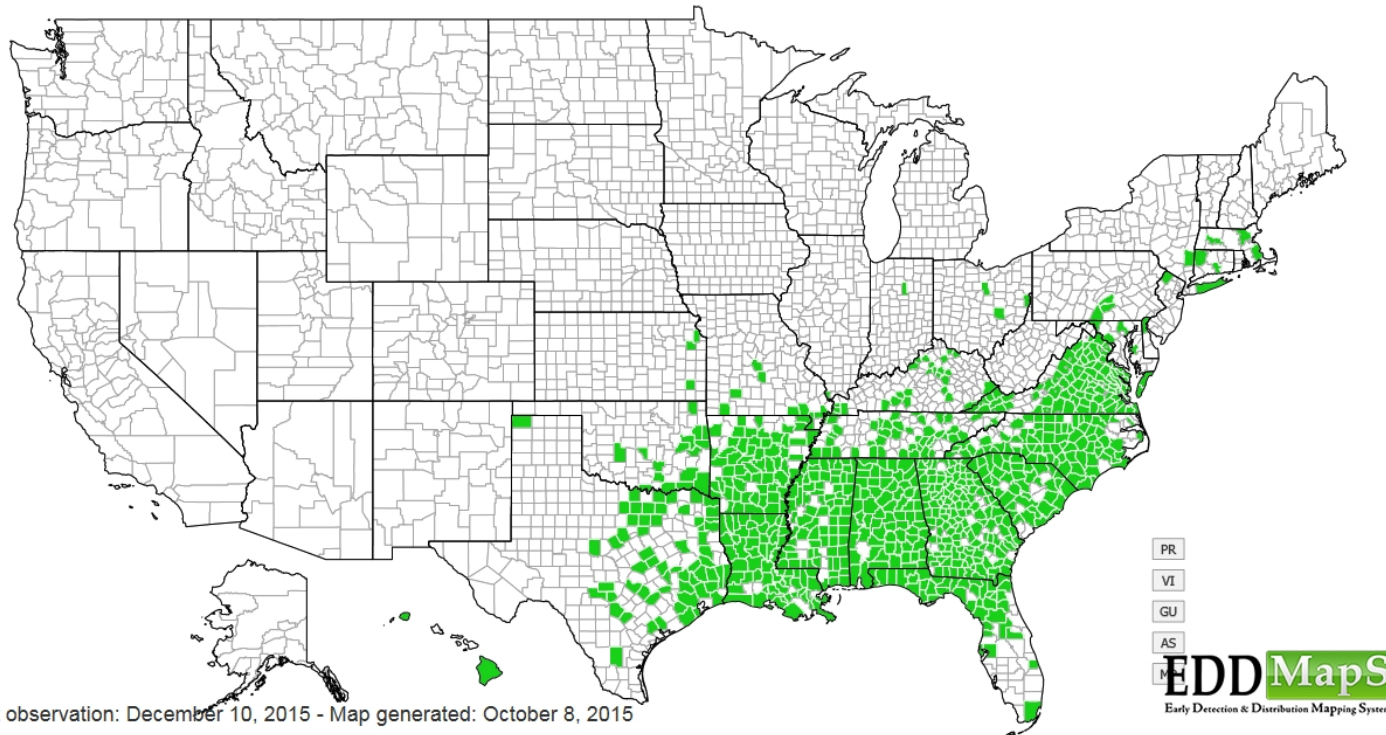
Chinese Privet produces abundant, fragrant flowers in the spring, followed by profuse amounts of dark, almost black seeds in the fall. They remain viable for up to three years, and are moderately toxic to humans. Seeds are commonly eaten by birds, thereby increasing propagation.



Chinese Privet – Origin & Status

Ligustrum sinense

Chinese Privet Invasion



Chinese privet is a species of privet native to China, Taiwan, and Vietnam. It was introduced to the United States in 1852 for use as an ornamental shrub, and is still commonly used as a hedge. It has become one of the most widespread, aggressive, and problematic plants in our region.

Approximately 2.5 million acres of land are infested with Chinese privet. Alabama is particularly hard hit, with over one million acres infested.

Explosive Growth

A graph of Chinese privet expansion exhibits a classic “hockey stick” growth pattern.





Like most invasives, Chinese privet grows quickly. The plant at left covering the entrance sign to Sleepy Hole Park is about three years old.

Small plants are easy to remove by hand pulling, especially after a rain when the soil is soft. Larger plants can be killed with foliar herbicides and also basal bark spraying.

If you cut a privet and leave the roots in the ground, it won't simply re-sprout, but will instead send up several shoots that will grow into an even denser shrub.



Alligator Weed – *Alternanthera philoxeroides*

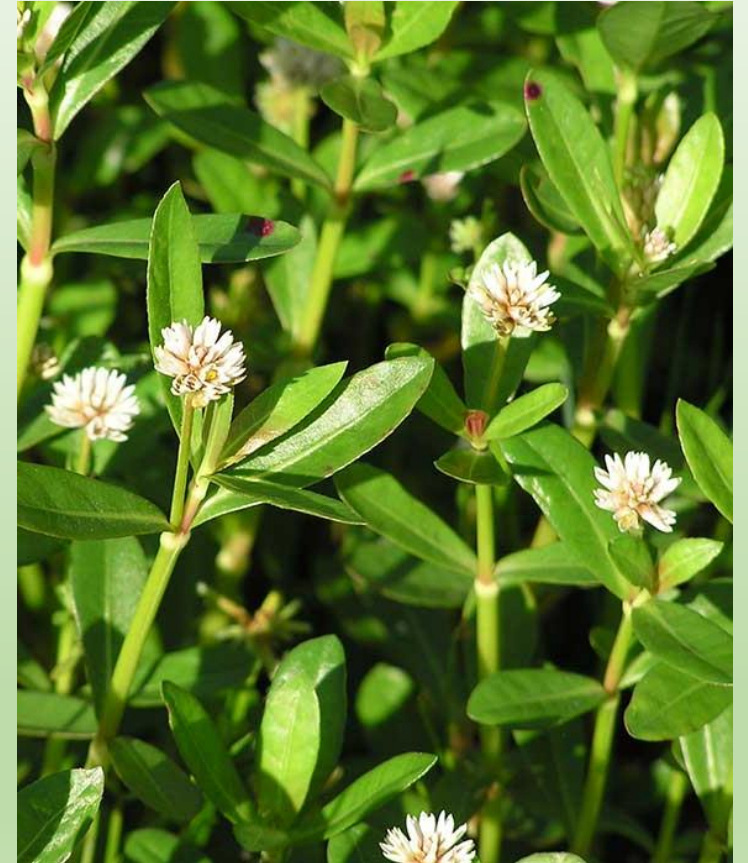


Dense mat of Alligator weed along a stream

Alligator weed thrives in moist soils and shallow water around ponds, streams, and ditches. It often forms dense floating mats.

The hollow stems often inflate with air, bulging outward. It produces extensive horizontal stems (also hollow) called stolons up to 30 feet in length. Floating stolons and stems create thick monoculture mats that block out other plants.

The weed's intricate root system can either allow them to hang free in the water to absorb nutrients or directly penetrate the soil/sediment and pull their nutrients from below.



White, papery flows resemble clover

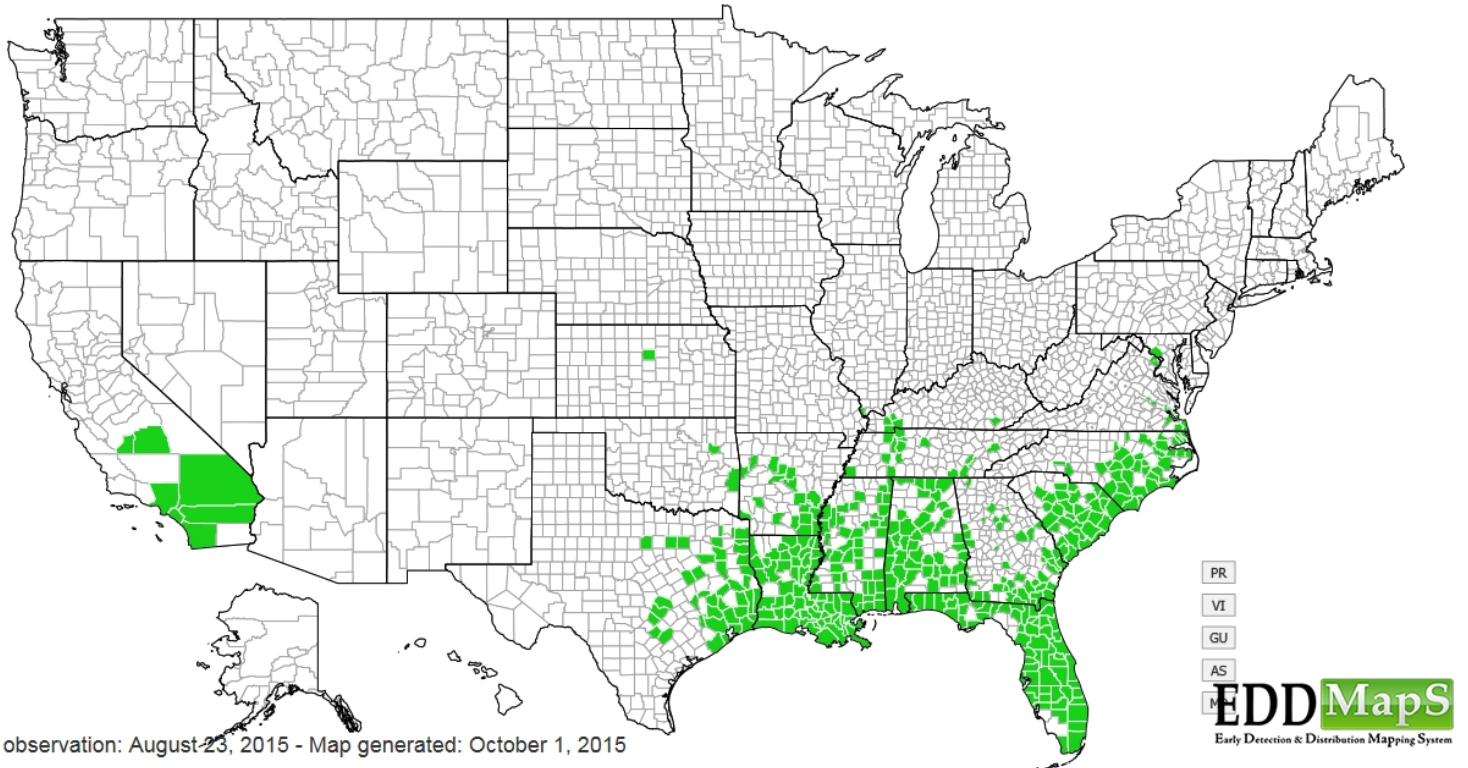


Alligator Weed flowers are actually a collection of several flowers packed together on a single stem.

Alligator Weed – Origin & Status

Alternanthera philoxeroides

Alligator Weed Invasion



- ✓ A native of South America. Alligator Weed was first reported in Alabama in 1897. It probably came from sediment on hulls of cargo ships.
- ✓ A nuisance weed in 32 countries.
- ✓ Approximately one million acres in the USA are affected, with Florida and Louisiana hardest hit.
- ✓ It is a relatively new invader to Hampton Roads, but is already very common in drainage ditches in Chesapeake and Virginia Beach.

Chinese Bushclover – *Lespedeza cuneata*

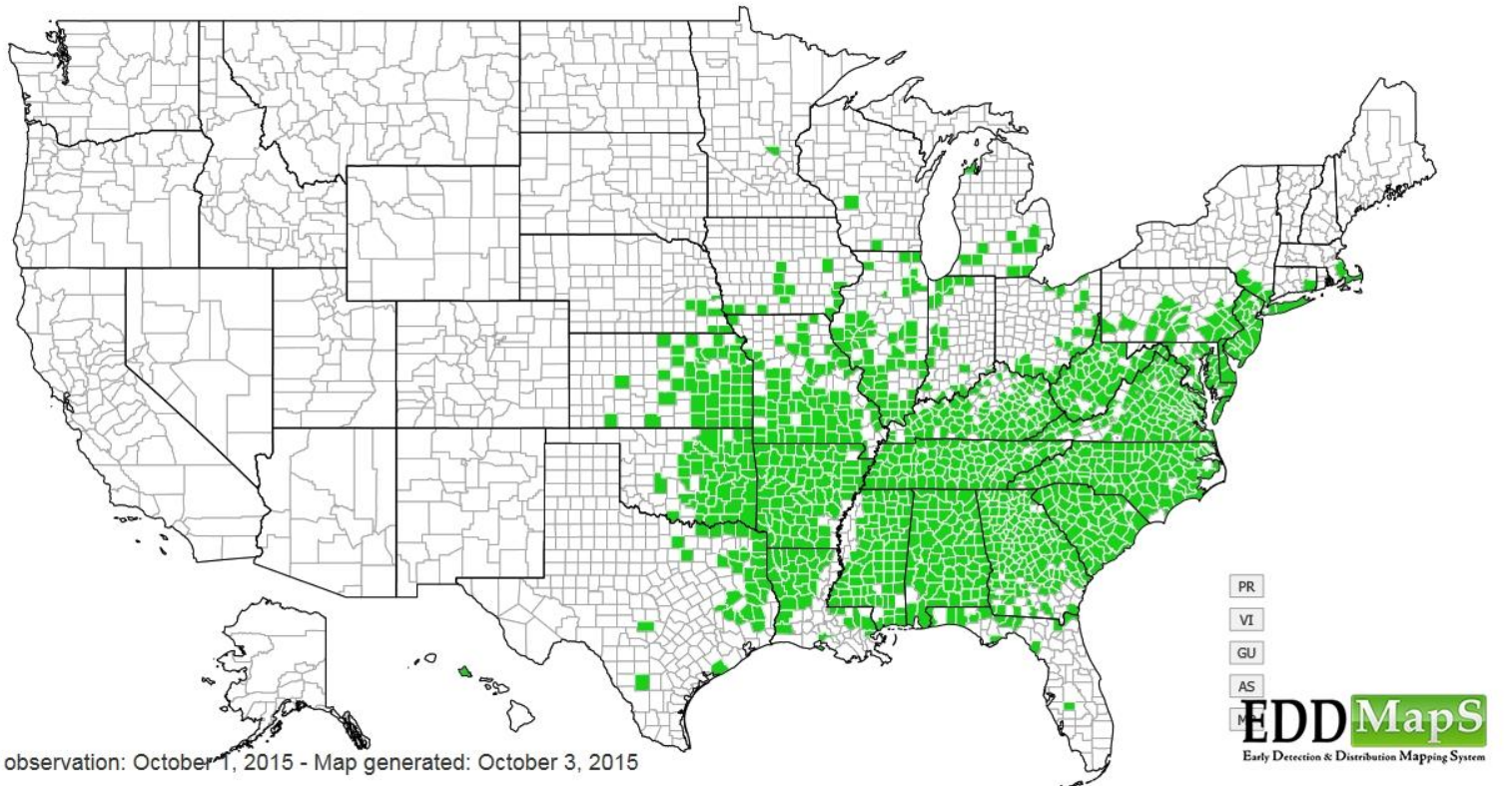
This plant is spreading rapidly in the Hampton Roads area. It is a perennial, woody herbaceous plant that generally grows to about three feet high. It produces many small flowers, usually white and lavender. Leaves are compound, and grow in groups of three. It forms dense stands that choke out native plant species. Like many other members of the pea family, it adds nitrogen to the soil resulting in a richer soil.



Chinese Bush Clover – Origin and Status

Lespedeza cuneata

Chinese Bush Clover Invasion



- ✓ Native to Asia and eastern Australia, Chinese Bush Clover was introduced from Japan in 1896 in North Carolina to be tested as an agricultural crop.
- ✓ Since that time it has been used as livestock forage, erosion control, in wildlife plots, and to improve eroded soil.
- ✓ It is especially common in the piedmont and coastal plain. It was useful in areas susceptible to drought because its deep tap roots can keep it alive.



Chinese Bushclover – Fun Facts

- ✓ It is taking over my driveway in Chuckatuck.
- ✓ Its seeds can remain viable for 20 years or more. In controlled settings, seeds can remain viable for over 60 years.
- ✓ The plants make great habitat for bobwhite quail (seeds are a big part of their diet).
- ✓ It can be used for ruminant forage – it is a favorite of goats.
- ✓ Grows in poor soil conditions and has often been used in mine reclamation.
- ✓ Not as rapidly growing as most other invasives. Its ability to thrive in poor quality soil and survive modest drought conditions gives it a strong competitive advantage.
- ✓ It has several uses in Asian herbal medicine, including killing parasites within the body, and to “purify and detoxify” the body.

Japanese Knotweed – *Fallopia japonica* or *Reynoutria japonica*



- ✓ Considered by many to be the worst (non aquatic) invasive plant in the world, Japanese knotweed emerges in early spring and grows rapidly to heights of six to nine feet.
- ✓ It forms dense stands that crowd out other plants. It reproduces almost solely from rhizomes. The stems and rhizomes can regenerate from very small fragments. Fragments are transported to new sites by water and by humans moving soil as fill dirt.
- ✓ The deep roots enable it to outcompete other plants for water and nutrients. Once established, Japanese knotweed is very difficult to eradicate.

Japanese Knotweed is Like an “Herbaceous Terrorist”

It is truly amazing how destructive this plant can be. It can push its way through asphalt, brick walls, and even concrete.

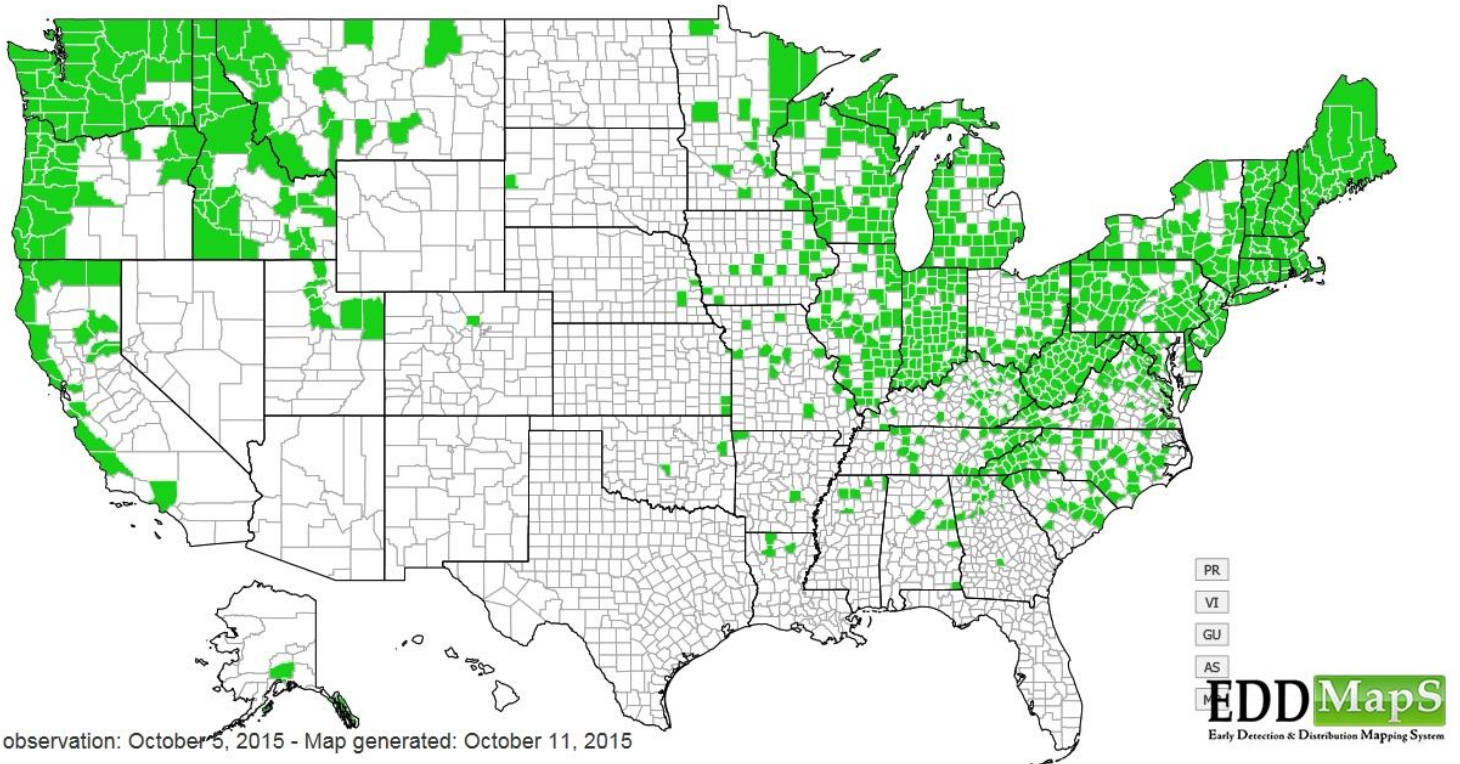
Dead plants are highly allelopathic, preventing other plants from growing on its “turf” during periods of dormancy.



Japanese Knotweed – Origin and Status

Reynoutria japonica

Japanese Knotweed Invasion



- ✓ Japanese Knotweed is native to Japan, where it is most common growing in harsh volcanic soils.
- ✓ Samples from Japan were sent to Kew Gardens in 1850, then to the Royal Botanic Gardens in Edinburgh in 1854. From there, it was sold to commercial nurseries and began to spread throughout the UK, then to Europe.
- ✓ Was first discovered in the northeastern USA in the 1890's and is now found in 42 states. It is classified as a noxious weed in at least 32 countries.

Japanese Knotweed – Fun Facts



- ✓ Japanese Knotweed is “gynodioecious,” a rare breeding system that is found in certain flowering plant species in which female and hermaphroditic plants coexist within a population
- ✓ The parentage of most specimens in the UK can be traced to a single plant – the one sent to Kew Gardens in 1850.
- ✓ It has devastated much of the U.K., where Annual eradication costs and other economic losses are over \$250 million per year.
- ✓ New hybrid varieties began appearing naturally in the 1980’s, suggesting that we face an ever increasing threat of this dreadful plant.



Japanese Knotweed Eradication – A Major Industry in the United Kingdom



Kudzu - *Puerari montana*



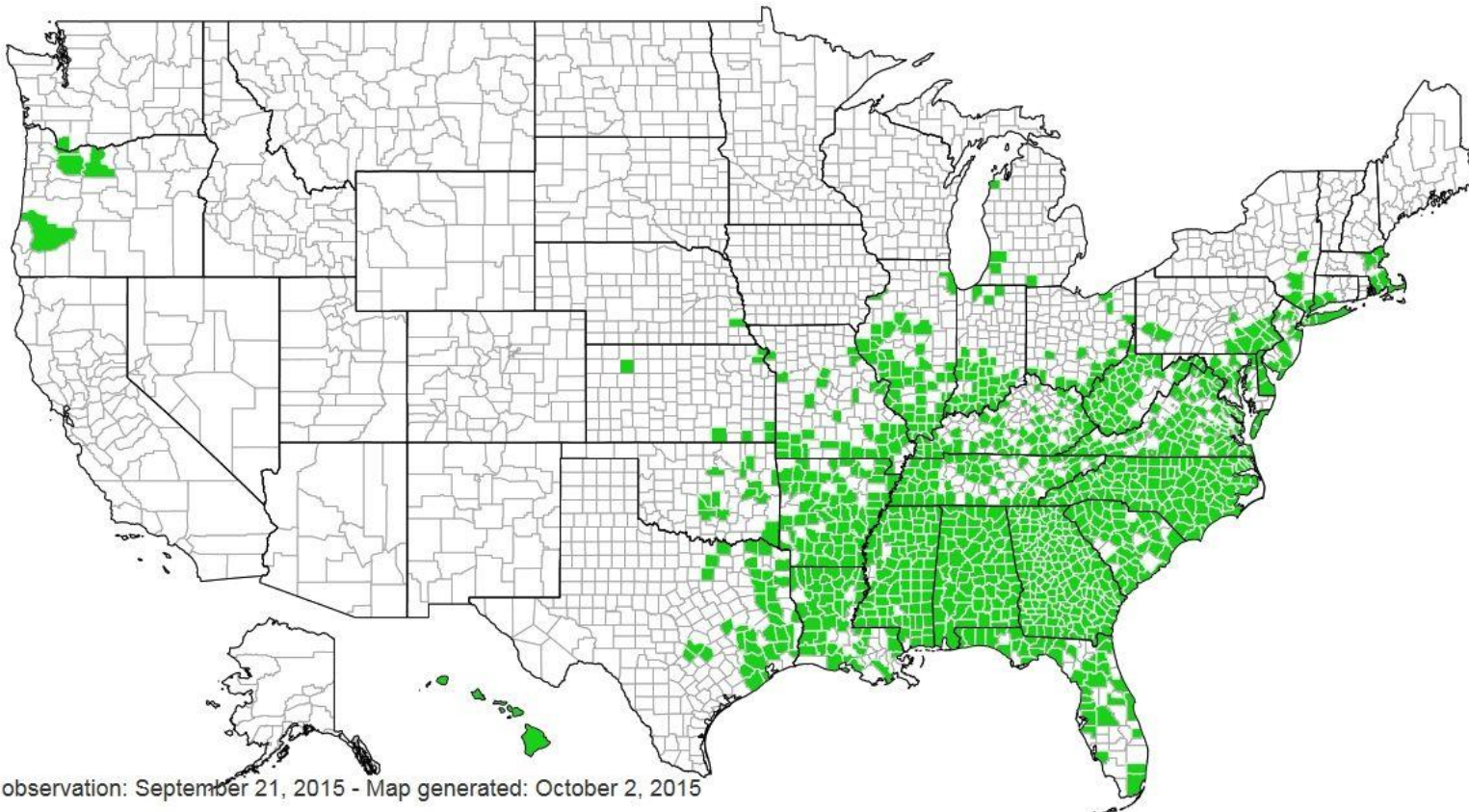
- ✓ The infamous vine that is taking over large swaths of the southeaster USA.
- ✓ Also known as “The Vine That Ate the South.” It can grow about one foot per day.
- ✓ A member of the legume family (peas and beans); it fixes nitrogen in the soil – basically making its own fertilizer.
- ✓ The plant climbs over trees or shrubs and grows so rapidly that it kills them by heavy shading.
- ✓ The roots, leaves and flowers of this plant is edible.



Kudzu – Origin & Status

Pueraria montana var. lobata

Kudzu Invasion



- ✓ Kudzu is native to Japan and southeast Asia.
- ✓ It was introduced from Japan into the United States at the Japanese pavilion in the 1876 Centennial Exposition in Philadelphia.
- ✓ It was promoted as a way for farmers to stop soil erosion and for use as ruminant fodder.
- ✓ It presently covers about 7 million acres, mostly in the southeast, and is spreading at roughly 120,000 acres per year.

Kudzu – Fun Facts



Kudzu root starch is considered by many chefs to be far superior to corn starch or arrowroot as a thickener for sauces and confections. It works particularly well in lemon meringue pie.



Kudzu flowers can be used to make jams and jellies. They have a sweet smell reminiscent of concord grapes.



Kudzu roots can become quite large. This specimen was harvested in eastern China.

Kudzu – More Fun Facts



Kudzu extracts are very popular in China and Japan for use in a variety of breast augmentation products (creams, ointments, capsules, etc)



During peak growth periods in early summer, the total biomass of kudzu vines in the USA will grow about 1.5 million miles per day.



Pensacola Journal, circa 1908

Japanese Stiltgrass - *Microstegium vimineum*

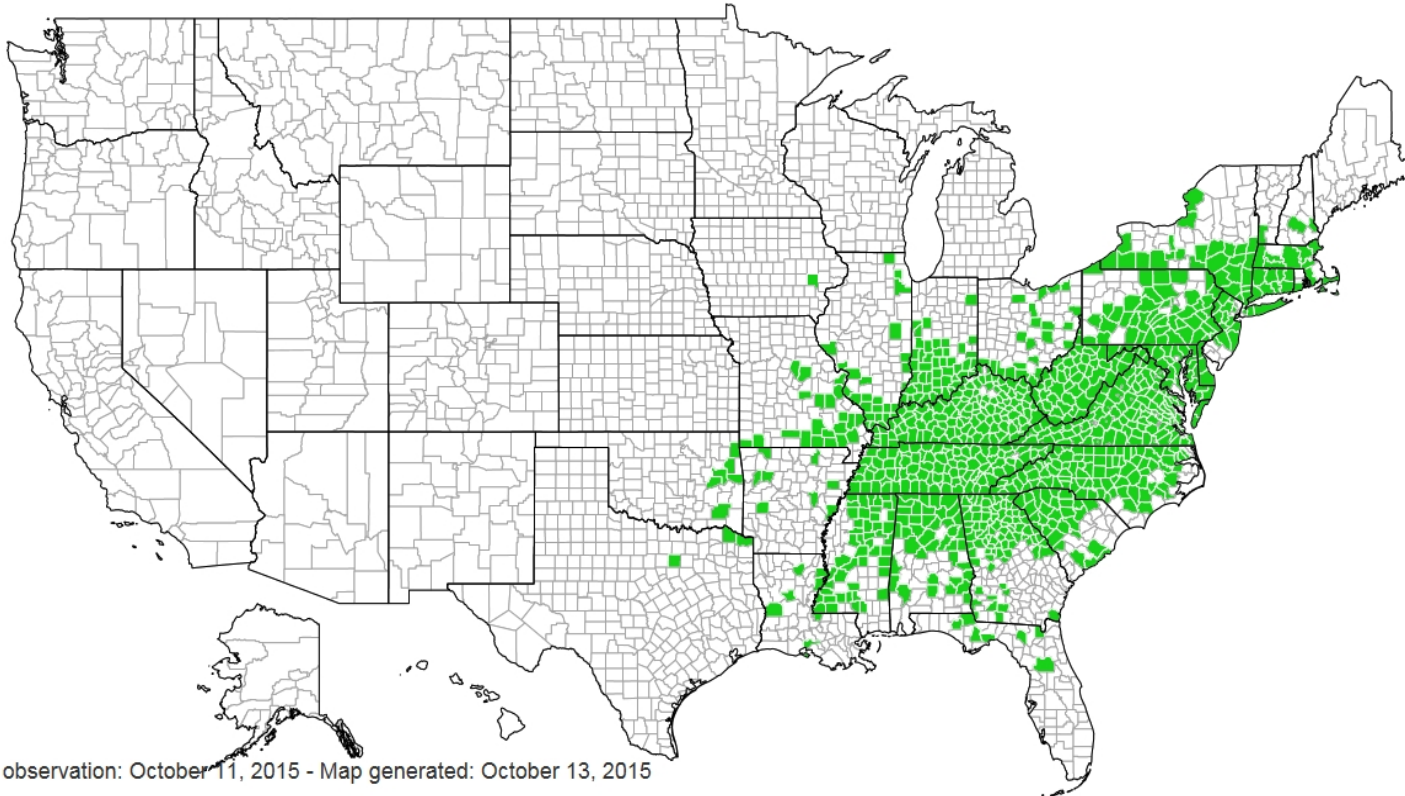


- ✓ Annual grass; seeds germinate in spring; plants grow about 2 feet high before dying back in the fall.
- ✓ Life cycle is similar to crabgrass.
- ✓ Leaves and stems resemble tiny bamboo plant, with thin, wiry stems.
- ✓ Grows well in medium to low light conditions, and can spread laterally via rooting at stem nodes.
- ✓ Its ability to thrive in low light conditions enables Stiltgrass to be an aggressive invader of forest understory habitat.
- ✓ Each plant can produce up to 1,000 seeds from both self-fertilizing and cross-fertilizing flowers.

Japanese Stiltgrass – Origin & Status

Microstegium vimineum

Japanese Stiltgrass Invasion



Last observation: October 11, 2015 - Map generated: October 13, 2015

- ✓ Japanese stiltgrass was first documented in Tennessee in 1919.
- ✓ Introduced packing material in shipments from Asia, most likely to protect fragile porcelain items arriving from China.
- ✓ Rapidly spreading throughout Hampton Roads.
- ✓ Stiltgrass has shallow roots, and can easily be removed by hand pulling.
- ✓ Once in the soil, seeds can remain viable for up to 5 years.



A section of my back yard in Chuckatuck – almost completely covered in Japanese Stiltgrass.

There was no trace of this plant in this area five years ago.

Common Reed – *Phragmites australis*



Lake Michigan – Upper Peninsula

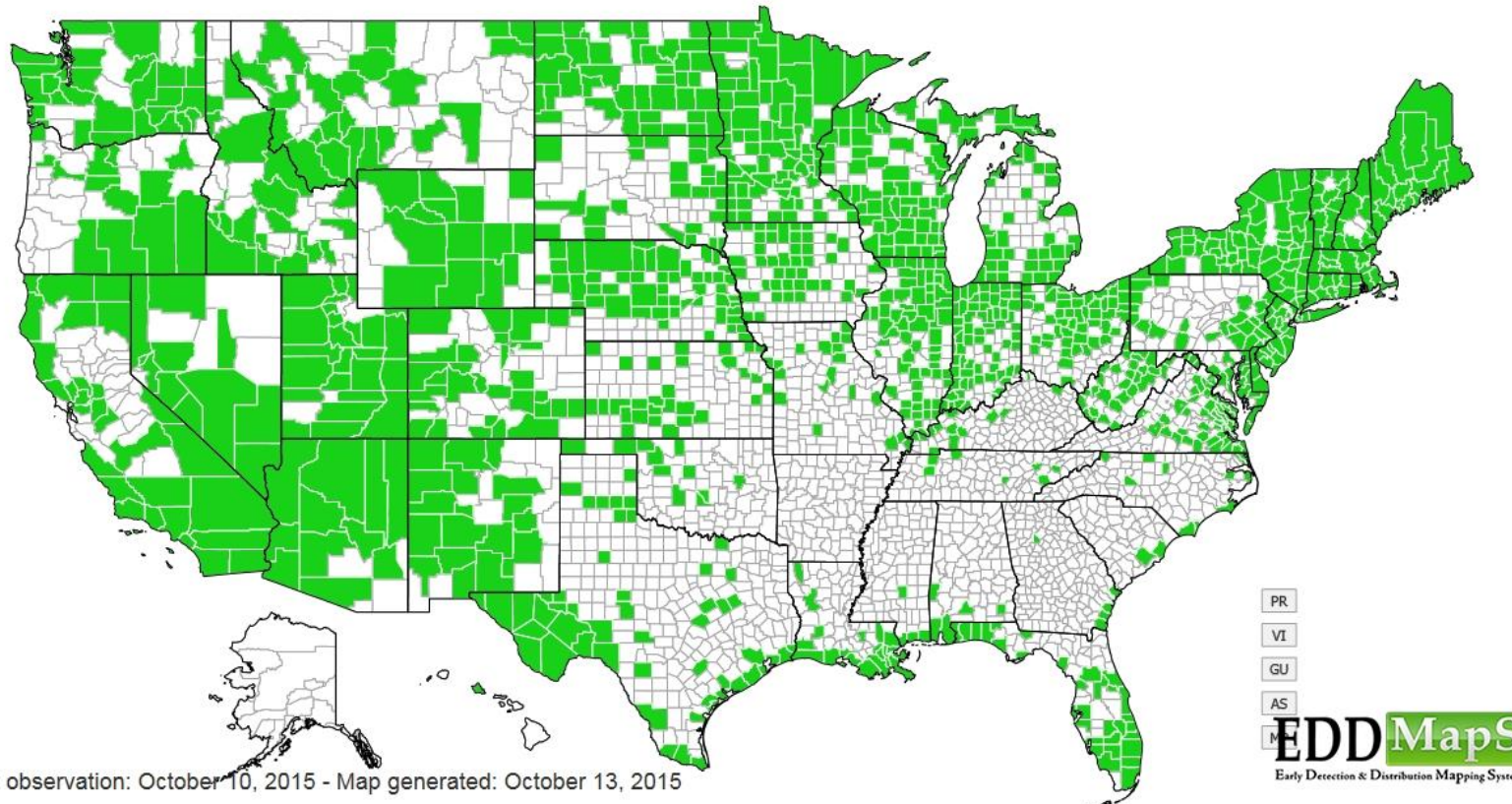
- ✓ Perennial grass that likes “wet feet.” Grows in moist soils and shallow waters.
- ✓ Grows about 10 to 15 feet high.
- ✓ Thrives in both fresh and brackish waters.
- ✓ Creates thick, dense stands that form “monocultures” that prevent the growth of other plants.
- ✓ Spreads primarily through its extensive, deep rhizomes.
- ✓ High seed production, but low germination rate.
- ✓ Very difficult to eradicate – repeated applications of herbicides are required.



Ragged Island Wildlife Area

Common Reed – Origin & Status

Phragmites australis ssp. australis



- ✓ Believed to come from Europe in 19th century.
- ✓ Similar to a native American subspecies, but a much more prolific and aggressive plant.
- ✓ American subspecies has been here for thousands of years.
- ✓ A major problem in most of Michigan, Wisconsin, and other states along the Great Lakes.
- ✓ Spreading rapidly in coastal Virginia.
- ✓ Possibly allelopathic (gallic acid).

Burning is a common, yet very ineffective, method of attempting to control Phragmites.



West of Sandbridge in Pungo

Controlling Invasives – Mechanical

- ✓ Pulling – tedious, but effective for small infestations
- ✓ Mowing – can help to suppress seed production
- ✓ Cutting (stumps) – use in tandem with herbicides.
- ✓ Ruminants may help
- ✓ Forget about burning!



Controlling Invasives – Chemical

- ✓ Pre-Emergent herbicides – many types – narrow and broad spectrum
 - Examples of pre-emergents: Preen, pendimethalin (for crabgrass and stiltgrass)
- ✓ Post-emergent: Glyphosate (Roundup) and many others
 - Best for herbaceous plants
 - For tough plants, triclopyr is often used (e.g. Poison Ivy Killer)
- ✓ Foliar spray, Basal bark application, Cut stump treatment
- ✓ Broad vs Narrow Spectrum Herbicides
- ✓ 2,4-Dichlorophenoxyacetic acid (a/k/a 2,4-D) was the first herbicide to be used widely.
 - Discovered in the 1940's.
 - Kills herbaceous dicots





Acclaim Herbicide from Bayer is an excellent example of a “narrow spectrum” or “selective” herbicide that kills only a few specific plants, including Japanese stiltgrass. You can buy it online for a mere \$600 per gallon!

Biological Control of Alligator Weed

Biological controls use organisms to combat invasive plants. In this case, two insects that feed on Alligator Weed were imported from South America. This has helped curb propagation, but success of this program is limited.



Alligator Weed Flea Beetle



Alligator Weed Stem Borer Moth



Online Resources

Virginia Department of Conservation and Recreation – dcr.virginia.gov/natural-heritage/invspinfo

Virginia Department of Agriculture and Consumer Services: <http://www.vdacs.virginia.gov/pesticides.shtml>

United States Department of Agriculture: <https://www.invasivespeciesinfo.gov>

Center for Invasive Species and Ecosystem Health: <https://www.invasive.org>

Early Detection and Distribution Maps: <https://www.eddmaps.org>



Questions?