



Georgia First Detectors Guide to Invasive Species

Introduction, Identification & Monitoring

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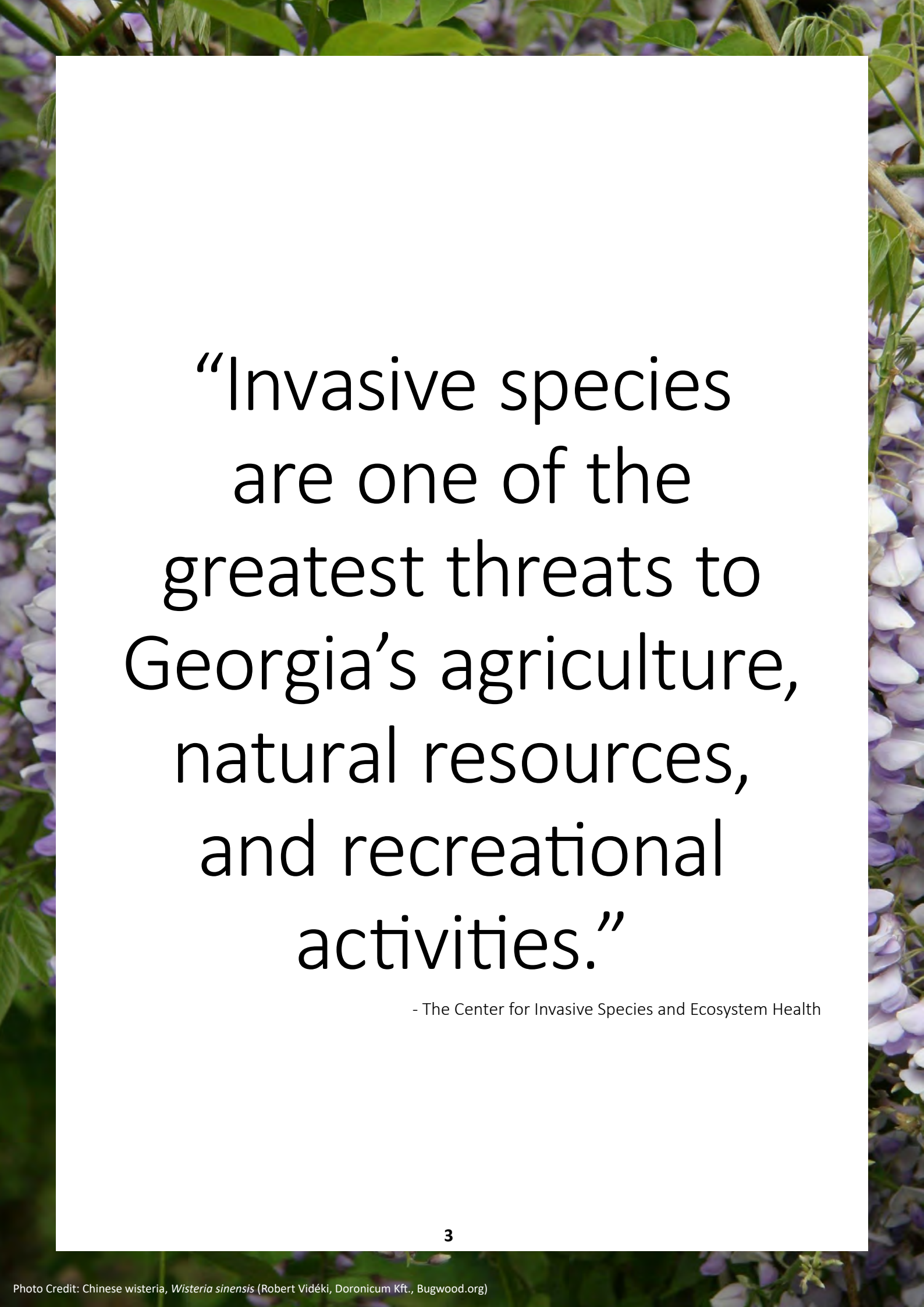
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Cogongrass, *Imperata cylindrical* (Chris Evans, University of Illinois, Bugwood.org)

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**Center for Invasive Species
and Ecosystem Health**
UNIVERSITY OF GEORGIA



“Invasive species
are one of the
greatest threats to
Georgia’s agriculture,
natural resources,
and recreational
activities.”

- The Center for Invasive Species and Ecosystem Health

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Georgia First Detectors Program

Overview

Invasive species are one of the greatest threats to Georgia's agriculture, natural resources, and recreational activities. As a response to the estimated \$138 billion per year in damages and management costs across the United States (Pimentel et al. 2000), the University of Georgia (UGA) Center for Invasive Species and Ecosystem Health, in partnership with Georgia Forestry Commission, USDA APHIS-PPQ, Georgia Department of Agriculture, and Georgia Department of Natural Resources established the Georgia First Detector Program to train volunteers to detect and monitor invasive species in the state. Georgia First Detectors learn the necessary skills to identify invasive species of concern in Georgia and submit records to the appropriate authorities for research and management purposes.





Photo Credit: Mimosa, *Albizia julibrissin* (Robert Vidéki, Doronicum Kft., Bugwood.org)

Program Goals

The primary goal of the Georgia First Detectors program is to establish a network of well-trained and dedicated citizen science volunteers, also known as “First Detectors” that will:

1. Assist in the ongoing collection of invasive species detections in the state,
2. Identify new infestations to help Early Detection and Rapid Response (EDRR) programs stop and/or control an invasive species before it becomes unmanageable.



Photo Credit: Left: Sarah Jean Swain, University of Georgia, Bugwood.org; Right: Mimosa, *Albizia julibrissin* (James H. Miller, USDA Forest Service, Bugwood.org)

Roles and Responsibilities of Volunteers

Volunteers must attend a Georgia First Detectors program to become certified. Programs are offered as in-person one-day introductory or two-day advanced workshops. Online eLearning opportunities are also available.

Information collected from volunteers in the program includes a working email, address, and phone number. Georgia First Detectors must agree to the following terms:

- *Georgia First Detectors must NEVER enter private property without permission from the owner.* Volunteers are not given permission to enter private property through this program. If permission is received from the landowner, it is recommended that the owner accompany the volunteer for safety and legal reasons.
- *The Georgia First Detectors program is voluntary. Volunteers are not compensated or reimbursed for the time they spend surveying areas or traveling.* Continuing education credits and pesticide applicator recertification credits are available for certain trainings. To request credits, please inform the instructor before the program begins as forms must be received from the professional organizations along with the decided number of earnable credits. For more information, along with a detailed process for receiving credits, please contact the professional organization in which you are interested.



Terms to Know

Invasive species — any non-native species that causes, or is likely to cause, environmental or ecological harm and/or harm to human health. This includes seeds, eggs, spores, or other propagative materials.

Non-native species — any species that occurs outside its natural, native range. These species are sometimes referred to as 'exotic' or 'alien' but the term non-native is preferred.

Native species — a species that evolved or moved naturally into a habitat and was present before Europeans arrived in America. A species can be native to one part of a continent or region but not occur naturally in a different part, where it would be considered non-native.

Generalist — able to survive and reproduce in a wide variety of environmental conditions

Disturbance — a change in environmental conditions, either natural (floods, droughts, wildfires) or unnatural or human-induced (urbanization, mining, deforestation)

Allelopathy — production of chemicals that inhibit the growth of other surrounding plants and commonly alter soil and habitat conditions

Pathways — the means or routes through which invasive species are introduced

- *Natural pathways* — movement through natural events such as wind, waterways, hurricanes, and tornadoes
- *Man-made pathways* — movements aided by humans, such as introduction of ornamental plants and live fishing bait
 - o *Intentional pathways* — deliberate introduction events
 - o *Unintentional pathways* — accidental movement (e.g., hitch-hikers) through travel and tourism, and commerce including horticulture and aquaculture

Ecosystem services — direct and indirect benefits that ecosystems provide to human well-being (TEEB, 2010). The four main categories of ecosystem services are provisioning, regulation, habitat, and culture services.



Photo Credit: Kudzu, *Pueraria montana* var. *lobata* (Chris Evans, University of Illinois, Bugwood.org)

Part 1: Understanding Invasive Species

What are Invasive Species?

Invasive species are any non-native species (including its seeds, eggs, spores, or other propagative material) that cause, or are likely to cause, environmental or ecological harm and/or harm to human health. This description is based on the definition of invasive species as written by USDA National Invasive Species Information Center and Executive Order 13751. The term 'invasive' is used to describe the most aggressive non-native species.

Non-native species are species that are accidentally or intentionally introduced into a new area. In contrast, *native species* have evolved or moved naturally into a habitat and were present before Europeans arrived in America. These species can be native to one part of a continent or region but non-native in a different part.

Traits for Success

Not all non-native species become invasive species. There are many characteristics that contribute to a species becoming a successful invader. For instance, non-native species lack natural predators, pests, and diseases because they did not evolve in the area where they were introduced. Furthermore, many invasive species are *generalists*, with strong reproductive abilities, effective dispersal mechanisms, and the capability to thrive and compete following *disturbance*. *Allelopathy* is found in some successful invasive plants.

The Ten's Rule is a suggested explanation for predicting the number of non-native species that go on to become invasive. This popular hypothesis states that out of every 1,000 introduced non-native species only 100 will manage to escape captivity. Of those 100 non-native species only 10 will become established and living within the ecosystem, and finally, of those 10 only 1 will become an invasive species. With the number of introduced non-native species estimated in the tens of thousands (Pimentel et al. 2004), the fraction of non-native species becoming invasive adds up quickly. These invasives then affect recreational activities, agriculture, and other land use activities if left uncontrolled.

Pathways of Movement

Understanding how invasive species are introduced is vital for prevention and reducing their spread. Invasive species can move into an area via natural pathways or man-made pathways. *Natural pathways* involve natural movement events such as wind, waterways, hurricanes, and tornadoes. *Man-made pathways* are movements aided by human activities.

Man-made pathways are further categorized as either *accidental* or *intentional* introduction events. Accidental introduction events include unintended pathways of movement through travel and tourism, commerce, horticulture, and aquaculture. Examples of accidental or unintentional movement of invasive species include zebra mussels (*Dreissena polymorpha*) via recreational water equipment, red imported fire ants (*Solenopsis invicta*) via shipping materials, chestnut blight (*Cryphonectria parasitica*) on infested nursery stock, and the emerald ash borer (*Agrilus planipennis*) traveling through firewood.

Intentional introduction events involve deliberate pathways of movement. Many non-native species are intentionally brought in as forage crops for cattle, ornamental plants for landscaping, released for sport fisheries or aquaculture purposes, or imported for the pet trade. Intentional introduction events also include the release of nutria (*Myocastor coypus*) for the fur trade, Chinese wisteria (*Wisteria sinensis*) as an ornamental landscape plant, and johnsongrass (*Sorghum halepense*) as a forage crop.



Photo Credits: (top left to right) Natural movement of non-native species can include hurricanes (Tony Pernas, USDI National Park Service, Bugwood.org) and waterways (Chris Evans, University of Illinois, Bugwood.org) while man-made movement can include travel and tourism (Joseph LaForest, University of Georgia, Bugwood.org), agriculture (Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org), livestock (Scott Bauer, USDA Agricultural Research Service, Bugwood.org) and recreation (Karen Brown, University of Florida, Bugwood.org).

Environmental and Economic Harm

Invasive species can negatively affect all ecosystem services (Pejchar and Mooney 2009). Services at risk include, but are not limited to, water purification and regulation, disease regulation, nutrient cycling, timber production, recreation and tourism, livestock forage, and air quality. These harmful consequences cause ecological and economic issues that are far-reaching and costly. Billions of dollars are lost yearly due to direct and indirect damages. Billions more are invasive species research, management and control, prevention, EDRR programs, habitat restoration, and outreach.

Environmental Issues

Invasive species impede natural ecological processes causing a cascade of environmental issues. Invasive species influence fire disturbance regimes (Vitousek 1990; Brooks et al. 2004), alter habitat of native animal and plant species (Kimbrow et al. 2009; Pimentel 2014), and threaten hydrological quality and supply (Griffiths et al. 1991). With over 100 million acres in the United States already invaded by 2000, and an additional 3 million acres added to the tally each year (USDA Forest Service), the ecological damage caused by invasive species is extensive.

Economic Issues

Farmlands and croplands (Oliveira et al. 2001), livestock forage (Eagle et al. 2007), timber production, and recreation and tourism (Dudley 2000; Gutrich et al. 2007) are all affected by invasive species. Other economic costs include the degradation of property value, health consequences to humans, and reduction of aesthetic value. Furthermore, there are costs associated with the management and control efforts of invasive species. For example, leafy spurge (*Euphorbia esula*) has reduced grazing capacity for livestock in the western states (Leistritz et al. 2004) causing substantial costs to the agricultural industry.



Photo Credit: Left: Cattle grazing (Keith Weller, USDA Agricultural Research Service, Bugwood.org); Right: Uncontrolled wildfire in Georgia (Georgia Forestry Commission, Georgia Forestry Commission, Bugwood.org).

Part 2: Invasive Species Resources

Invasive Species Prevention Programs

The public plays an important role in helping prevent the spread and introduction of invasive species. As mentioned, many invasive species are moved accidentally or intentionally by human activities. National invasive species campaigns seek to educate the public about the activities that facilitate the spread of invasive species.

National Campaigns

PlayCleanGo

PlayCleanGo is an international education and outreach campaign that promotes the awareness, understanding, and cooperation of invasive species programs among outdoor recreationalists. The program is a call to action for the public to be informed, attentive, and accountable for preventing the spread of invasive species. The key messages of the program are to:

- 1) continue playing in the outdoors
- 2) clean your gear before you leave
- 3) continue on to your next adventure



STOP INVASIVE SPECIES IN YOUR TRACKS.

National Invasive Species Awareness Week



Help Prevent The Spread Of Invasive Plants And Animals.

- Arrive with clean gear.
- Burn local or certified firewood.
- Use local or weed-free hay.
- Stay on the trails.
- Before leaving, remove mud and seeds.



STOP INVASIVE SPECIES IN YOUR TRACKS.
PlayCleanGo

Clean Drain Dry

Clean Drain Dry is a national campaign to prevent the spread of aquatic invasive species. It is a cooperative effort between the public and multiple agencies that are involved with recreational water activities. The procedures are:

CLEAN off all water equipment of visible aquatic plants, animals, and mud before leaving water access sites

DRAIN the motor, bilge, livewell, and other water containing devices before leaving water access sites

DRY water equipment for at least five days or wipe with a towel before reuse



Photo Credit: Giant salvinia, *Salvinia molesta*, infestation (Ted D. Center, USDA Agricultural Research Service, Bugwood.org).

Don't Let it Loose!

The greatest pathway by which non-native animal species find their way into new habitats is through intentional or unintentional release by pet owners. Burmese pythons, now established throughout south Florida and the Everglades, are eating native mammals and birds. Small mammal populations in the Everglades National Park have declined dramatically as python populations have increased (Dorcas et al. 2012). Additionally, releasing non-native pets can introduce novel diseases and parasites which can infest native species (Miller et al. 2017). If you are no longer able to care for a pet, find it a new home. Never release your pet into the wild. If you are unable to find a new home with a family member or friend, contacting a local animal shelter, agency, or pet store is the best course of action.



Photo Credit: Immature Savannah monitor lizards, *Varanus exanthematicus*, for sale (Joseph LaForest, University of Georgia, Bugwood.org).

Don't Move Firewood

The Don't Move Firewood campaign is an outreach partnership managed by The Nature Conservancy. The aim of the campaign is to protect trees and forests from invasive insects and diseases that can travel in or on contaminated firewood. The Georgia Forestry Commission, Georgia State Parks, and Georgia Department of Natural Resources all advise that all campers and travelers within Georgia buy and use locally harvested firewood to prevent the spread of pests within the state. Additionally, out-of-state visitors should never bring their firewood to Georgia.

Further, it is illegal to remove firewood or ash tree materials from Georgia into a non-quarantined state or region as it is within the federal emerald ash borer (EAB) quarantined area. Georgia and Florida are also under quarantine to reduce the spread of citrus disease. Firewood that has been stored outside may not be transported to a state or area not infested by imported fire ants as in Georgia firewood is a regulated item. For up-to-date information on Georgia's regulations and laws, as well as those of other states, visit the Don't Move Firewood website.



Photo Credit: Firewood for sale at a gas station (Joseph OBrien, USDA Forest Service, Bugwood.org)

**BUY IT WHERE
YOU BURN IT.**
**DON'T MOVE
FIREWOOD.org**

**MOVING FIREWOOD
can transport forest
insects and diseases.**

**BUY IT WHERE
YOU BURN IT.**

If you're a camper heading out for a trip — or just getting firewood for your stove — do nature a favor. Don't potentially transport invasive species.



- ▶ Buy locally harvested firewood.
- ▶ Gather on site where permitted.
- ▶ Ask a park ranger or campground host about where to get local firewood.

The forest will thank you.

**DON'T MOVE
FIREWOOD.org**

Tools to Help Identify Invasive Species

The ability to identify invasive species while out surveying an area is important for reporting accurate invasive species occurrences. With a plethora of identification resources available in print, video, and online format, it is easier than ever to learn how to identify key species in your area as well as potential future invaders. If you are new to invasive species, start by learning to identify 3-5 well known invasives in your area first. Once you feel confident in your ability to identify the first set of species, add additional species. This will prevent you from feeling overwhelmed.

Online Resources

Georgia Invasive Species Task Force: <https://www.gainvasives.org/>

Invasive.Org: <https://www.invasive.org/species/list.cfm?id=2>

EDDMapS: <https://www.eddmaps.org/>

Bugwood Publications: <https://www.bugwood.org/publications.cfm>

Part 3: Invasive Species to Watch Out For

Aquatic Species

Hydrilla (*Hydrilla verticillata*)

Hydrilla grows underwater and can root in depths of up to 20 feet. The leaves grow in a circle around the stem in bunches of 3-8. It forms dense mats on the surface of the water. Hydrilla was first introduced into the U.S. as an aquarium plant in the 1950s. Since then it has spread throughout the southeastern and coastal states. This plant can cause significant ecological and economic damage. It restricts native vegetation growth, irrigation, recreation, hydroelectric production, and water flow. Hydrilla can reproduce by root tubers and plant fragments, allowing it to spread between waterways on boating equipment and in live wells.

*Hydrilla is a federal noxious weed; any occurrence should be promptly reported to EDDMapS or your local county extension specialist.



Photo Credit: Foliage of hydrilla, *Hydrilla verticillata* (Leslie J. Mehrhoff, University of Connecticut, Bugwood.org).



Photo Credit: Giant salvinia, *Salvinia molesta*, foliage (Top: Keith Bradley, Botanist/Conservation Biologist, Bugwood.org) and root system (Bottom: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org).

Giant salvinia (*Salvinia molesta*)

Giant salvinia is an aquatic fern with oblong floating leaves, which can be green, yellow, or brown and are 0.5 to 1.5 inches long. They grow in chains that run together to form thick mats. The surfaces of the leaves have rows of arching hairs that look like tiny egg-beaters. Giant salvinia is native to South America and was first introduced into the U.S. as an ornamental water garden plant. It now occurs across the warmer parts of the southern U.S. This plant invades almost any type of aquatic habitat. The dense thick mats restrict oxygen and light, disrupting the aquatic food chain. It also interferes with recreation, hydroelectric production, drinking water supplies, and aquaculture.

*Giant salvinia is a federal noxious weed; any occurrence should be promptly reported to EDDMapS or your local county extension specialist.

Water hyacinth (*Eichhornia crassipes*)

Water hyacinth is a free-floating aquatic plant that has invaded the eastern and southern U.S. The leaves are oval, thick and waxy. The showy blue-purple flowers grow in upright spikes. Water hyacinth is native to South America and was first introduced as an ornamental into the U.S. in 1884. It now grows throughout the southeastern U.S. and sporadically in the Northeast and Southwest. Water hyacinth invades lakes, ponds, rivers, marshes, and other types of wetland habitats. It usually reproduces vegetatively and can form dense floating mats of vegetation, which shades the underwater environment. This reduces the light available to submersed plants and invertebrates, and depletes oxygen levels.



Photo Credit: Water hyacinth, *Eichhornia crassipes*, flowers (Left: Graves Lovell, Alabama Department of Conservation and Natural Resources, Bugwood.org) and infestation (Right: James R. Holland, Bugwood.org).

Alligatorweed (*Alternanthera philoxeroides*)

Alligatorweed has invaded aquatic areas throughout the southern United States. It has opposite leaves at swollen nodes and clusters of small white flowers occurring on short stalks. Alligatorweed is native to South America and was first introduced into the U.S. around 1900. Alligatorweed roots in wet soils or shallow water and grows out into waterways. The floating mats expand along the surface where they can displace native vegetation, clog waterways, restrict oxygen levels, increase sedimentation, interfere with irrigation, and prevent drainage. Alligatorweed can also grow on dry ground, where it grows smaller, thicker leaves.



Photo Credit: Alligatorweed, *Alternanthera philoxeroides*, infestation (Left: Chris Evans, University of Illinois, Bugwood.org) and foliage with flowers (Right: Chris Evans, University of Illinois, Bugwood.org).

Eurasian water milfoil (*Myriophyllum spicatum*)

Eurasian water milfoil is an underwater plant that invades lakes, ponds, and other open waters throughout the United States. Plants are rooted, but the stems grow to the surface, and can be as long as 30 feet. It is often recognized by the dense mats formed by the bright green, feathery leaves. Eurasian water milfoil is native to Europe, Asia, and northern Africa. It was introduced into the U.S. in the early 1900s. It requires stagnant-to-slowly moving water. Once established it can form dense mats of leaves which restrict light, thereby making conditions difficult for native underwater plants to survive. It displaces the native species of water milfoil, and reduces fish spawning and feeding habitats.



Photo Credit: Eurasian water milfoil, *Myriophyllum spicatum*, submerged (Left: Alison Fox, University of Florida, Bugwood.org) and above (Right: Graves Lovell, Alabama Department of Conservation and Natural Resources, Bugwood.org) the surface of the water.

Invaders of Forests and Ornamental Trees

Walnut twig beetle (*Pityophthorus juglandis*) / Thousand Cankers disease (*Geosmithia morbida*)

Walnut twig beetles are small beetles native to Arizona, California, New Mexico, and northern Mexico. Adults cause damage by boring into the outer bark, the main stems, and the phloem of the branches of walnut trees as well as through larval feeding. It is associated with widespread mortality of black walnut (*Juglans nigra*) introduced to the western United States. Walnut twig beetles are vectors of a pathogenic fungus that causes thousand cankers disease. Thousand cankers disease has been found in many Western States and is spreading. The first confirmation of the beetle and fungus within the native range of black walnut was in Tennessee (July 2010). The potential damage to eastern forests could be great because of the widespread distribution of black walnut, the susceptibility of this tree to the disease, and the capacity of the fungus and beetle to invade new areas.



Photo Credit: An adult walnut twig beetle, *Pityophthorus juglandis* (Left: Steven Valley, Oregon Department of Agriculture, Bugwood.org), and the visible dark amber to black staining symptom of thousand cankers disease, *Geosmithia morbida* (Right: Troy Kimoto, Canadian Food Inspection Agency, Bugwood.org).

Hemlock woolly adelgid (*Adelges tsugae*)

Hemlock woolly adelgid is a small sapsucking insect native to eastern Asia. Insects have caused a widespread decline of hemlock trees in the eastern United States. Hemlock woolly adelgid feeds on the sap of hemlock needles causing a change in nutrient flow subsequently making the needles fall off and trees to die in 3-5 years. Infestations are easily recognizable because white, waxy tiny balls that appear at the base of infected needles.



Photo Credit: The white woolly wax protecting Hemlock woolly adelgid, *Adelges tsugae*, eggs is the first sign of an infestation (Leslie J. Mehrhoff, University of Connecticut, Bugwood.org).

Redbay ambrosia beetle (*Xyleborus glabratus*) / Laurel wilt (*Raffaelea lauricola*)

The Redbay Ambrosia beetle is native to Asia and was first discovered in the U.S. in 2002. It was most likely introduced in solid wood packing materials. By 2005, it was found to be consistently associated with redbay (*Persea borbonia*) mortality in an expanded area of coastal South Carolina and Georgia, and it continues to expand across the South. Female ambrosia beetles store fungal spores (species-specific) in specialized compartments on their bodies. The spores are introduced into the tree as the beetles bore into it. This fungus is “farmed” by the beetles and is used by the developing larvae as a food source. As the introduced fungus spreads through the tree it can clog the water and nutrient conducting tissues and lead to branch, limb and tree mortality. Native U.S. ambrosia beetles normally attack dying or weakened trees.

The introduced redbay ambrosia beetle attacks healthy trees in the laurel family (*Lauraceae*), which in the southeastern U.S. includes redbay, spicebush, sassafras, threatened and endangered pondspice and pondberry, and avocado. Larvae are white, C-shaped, legless grubs with an amber colored head capsule. Adults are minute (1 / 16 inch long), slender, and brown-black in color. Upon emergence, only the females seek a new host. Attacks are made evident by pinhole-sized holes in the bark associated with either sap flow or light-colored boring dust. The fungus carried by and associated with the redbay ambrosia beetle is *Raffaelea lauricola*, a virulent plant pathogen new to the U.S. that causes laurel wilt disease and tree mortality. Laurel wilt has killed thousands of redbays and is a threat to the U.S. avocado industry.



Photo Credit: An adult redbay ambrosia beetle, *Xyleborus glabratus* (Left Top: Rachel Osborn, Southeast Asian Ambrosia Beetle ID, USDA APHIS PPQ, Bugwood.org). Evidence of redbay ambrosia beetles include sawdust tubs (Left Bottom: Albert Mayfield, USDA Forest Service, Bugwood.org) and pinhole-sized holes in the bark (Right: Ronald F. Billings, Texas A&M Forest Service, Bugwood.org).

Emerald ash borer (*Agrilus planipennis*)

According to the Emerald Ash Borer Information Network, emerald ash borer has been found in 35 states (including Georgia) and five Canadian provinces. It probably arrived in the U.S. on solid wood packing material from its native Asia. Introduction pathways include movement of infested live ash trees, limbs, firewood, logs, and untreated ash lumber. Hosts include all ash species (*Fraxinus* spp.), but green ash, white ash, and black ash are more susceptible than Asian varieties. This pest has also been found attacking fringetree (*Chionanthus virginicus*).

Females lay eggs two weeks after emergence. During this time, adults feed on ash leaves, creating irregular notches. Eggs are initially light yellow, turning to brownish-yellow before hatching. Eggs hatch in 1 to 2 weeks, and the tiny, cream-colored larvae chew through the bark into the cambium and sapwood where they grow to 1 to 1¼ inches long with flat, broad, segmented bodies as they feed, creating S-shaped frass-packed tunnels. Adults begin emerging in mid-June, leaving D-shaped emergence holes 0.1 to 0.2 inch in diameter. Adults are small, brassy-green, metallic beetles measuring ⅓ to ½ inch in length. Symptoms include vertical splits in the bark resulting from the host forming callus tissue in response to larval feeding, general yellowing and thinning of foliage, crown dieback, epicormic branching and woodpecker activity. After 1 to 2 years of infestation, the bark often falls off in pieces, exposing the insect galleries as the host dies. The life cycle of EAB in North America takes between 1 and 2 years depending on the climate.



Photo Credit: An adult stage (Left Top: Debbie Miller, USDA Forest Service, Bugwood.org) and larva(e) stage (Left Bottom: David Cappaert, Bugwood.org) of the Emerald ash borer (*Agrilus planipennis*). Damage from the emerald ash borer can be seen from aerial images (Right Top: Troy Kimoto, Canadian Food Inspection Agency, Bugwood.org) with adults creating frass filled tunnels (Right Bottom: Eric R. Day, Virginia Polytechnic Institute and State University, Bugwood.org) while feeding on the bark.

Asian longhorned beetle (*Anoplophora glabripennis*)

Asian longhorned beetle is native to Asia (principally China). It is invasive in parts of western Europe and in several American states, where eradication efforts are underway. This borer attacks a variety of hardwood trees. In China, Asian longhorned beetles are not damaging in forests, but following extensive planting of non-native poplars that proved highly susceptible to the beetles, the insect increased in abundance. This in turn facilitated the beetle's dissemination to other countries as infested wood was used for packing and shipping material.

Adult Asian longhorned beetles are glossy jet black in color with irregular white spots. The antennae are long, black with white bands. Female antennae are approximately the same length as the body, while male antennae are much longer. The total body adult length is approximately 1-1.5 inches.

Unlike many native longhorned beetles, *A. glabripennis* attacks healthy trees as well as those under stress. Several generations can develop within an individual tree, eventually killing it. In the United States, adults emerge over an extended period from spring to fall, but especially in late June to early July. Adults remain on or near their emergence tree and feed on leaves, petioles, and tender bark. Eggs are laid singly under the bark in egg sites prepared by females. Larvae begin feeding in the cambium layer of the tree and then move into the heartwood. Larvae also dig pupation chambers inside the tree. These may be filled with frass. The round exit holes (0.4 inches (1 cm) in diameter) through which adults emerge are a visible sign of infestation. Other signs include crown defoliation and death, saw dust at the base of the trunk and branch crotches, and galleries under the bark.



Photo Credit: An adult stage (Left Top: Joe Boggs, Ohio State University, Bugwood.org) and larva(e) stage (Right Top: Joe Boggs, Ohio State University, Bugwood.org) Asian longhorned beetle, *Anoplophora glabripennis*. Evidence of infestation include exit holes (Left Bottom: Pennsylvania Department of Conservation and Natural Resources - Forestry, Bugwood.org) and galleries under the bark (Right Bottom: Kenneth R. Law, USDA APHIS PPQ, Bugwood.org).

Crapemyrtle bark scale (*Acanthococcus lagerstroemiae*)

Crapemyrtle bark scale is an insect pest native to Asia. It was introduced in 2004 on infested crapemyrtles (*Lagerstroemia* spp.) imported into Texas. It is rapidly spreading throughout the southeastern states. Infestations appear as white or gray waxy scales on the stems, twigs, and trunks. Honeydew is produced as a sugary waste that facilitates the growth of a black sooty mold. Bark scale infestations do not always result in plant death, but plants will suffer aesthetic damage (e.g., reduced flowering).



Photo Credit: Crapemyrtle bark scale, *Acanthococcus lagerstroemiae*, leaves plants with aesthetic damage (Left Top: Jim Robbins, University of Arkansas CES, Bugwood.org; Right: Jim Robbins, University of Arkansas CES, Bugwood.org). Infestations appear as white or gray waxy scales (Left Bottom: Helene Doughty, Virginia Polytechnic Institute and State University, Bugwood.org).

Boxwood blight (*Cylindrocladium pseudonaviculatum*)

Boxwood blight is a fungus disease that affects healthy and stressed or damaged boxwoods (*Buxus* spp.), and it was first found in the United States in 2011. Infested boxwoods initially appear with leaf spots that continue to grow and cover the entire leaf until they are completely brown. Defoliation occurs quickly after the onset of foliage spots. Stems of infected plants develop black streaking. No treatment for boxwood blight currently exists.



Photo Credit: Boxwood blight, *Cylindrocladium pseudonaviculatum*, initially appears as leaf spots (Left: David L. Clement, University of Maryland, Bugwood.org) until the entire plant is completely brown (Right: Mary Ann Hansen, Virginia Polytechnic Institute and State University, Bugwood.org).

Wildlife Species

Burmese pythons (*Python molurus* ssp. *bivittatus*)

Burmese pythons are native to Southeast Asia and entered the ecosystem as either escaped or released pets. Burmese pythons can grow up to 20 feet long. They pose a threat to native wildlife and ecosystems. Competing with native predators for food, habitat, and space, their presence has led to severe declines in mammal populations in the Everglades. Other nonnative constrictors have been found in Florida including the reticulated python (*Python reticulatus*), ball python (*Python regius*), green anaconda (*Eunectes murinus*), and yellow anaconda (*Eunectes notaeus*) however, none of these species are believed to be reproducing or established. Burmese pythons require long-term management and resource protection where they have invaded. To help prevent the spread of Burmese pythons and other nonnative constrictors, pet owners should never release unwanted pets into the ecosystem and the public should learn to identify native Florida snakes.



Photo Credit: An adult Burmese python, *Python molurus* ssp. *bivittatus* (Left Top: Skip Snow, National Park Service, Bugwood.org) has a strong reproductive ability with mature females laying large numbers of eggs yearly (Left Bottom: Lori Oberhofer, National Park Service, Bugwood.org). Educational demonstrations occur where the public can learn about this species and its issues (Right: Carli Segelson, Florida Fish and Wildlife Conservation Commission, Bugwood.org).

Argentine black and white tegu (*Salvator merianae*)

Argentine black and white tegus (*Salvator merianae*) are big, fast-moving lizards native to South America. Black to dark gray with white speckled bands across the back and tail, these reptiles can grow 4 feet long, weigh up to 10 pounds or more and live 20 years. Hatchlings have bright green on their heads, a coloration that fades at about 1 month old. Tegus are active during the day. Tegus can react quickly, and have sharp teeth and claws and strong jaws. Adult tegus have few predators and can multiply quickly. Argentine black and white tegu poses a threat to Georgia's birds, small mammals and reptiles, and insects. Tegus also eat fruit, vegetables, plants, pet food, carrion, and the eggs of chickens, ground-nesting birds, and other reptiles, including American alligators and gopher tortoises, both protected species. Tegus are legal as pets in Georgia but it is against the law to re-release non-native animals into the wild. Unfortunately, tegus have already been reported in Toombs and Tattnall counties where the Georgia Department of Natural Resources (DNR) is working with the U.S. Geological Survey and Georgia Southern University to address the situation. Early detection and rapid response are key to preventing the spread and impact of tegus and other invasive species.



Photo Credit: An adult stage (Left: Hillsborough County Parks, Recreation and Conservation Department, Bugwood.org) and juvenile stage (Right: Joseph LaForest, University of Georgia, Bugwood.org) Argentine black and white tegu (*Salvator merianae*).

Giant African snail (*Lissachatina fulica*)

Giant African snails are often kept as aquarium pets even though they are prohibited in the U.S. Adult snails can be up to 8 inches long, with a 4-inch shell. Shell color varies greatly, but is often striped with brown and cream bands. These snails were introduced into the U.S. twice in the mid-1900s. The first population was successfully eradicated, but the second population is still being managed. While the giant African snail is a tropical species, it can survive cold temperatures and could potentially survive throughout the U.S. Adult snails have both male and female reproductive organs and can produce up to 1,200 eggs per year, and can live for 9 years. They eat a wide variety of vegetation, from commercially important vegetable crops to tree bark and fallen leaves. Special care should be taken when handling as Giant African snail can carry the parasite rat lungworm (*Angiostrongylus cantonensis*).

*Giant African snail is a federally regulated pest; any occurrence should be promptly reported to EDDMapS or your local county extension specialist.



Photo Credit: An adult stage giant African snail, *Lissachatina fulica*, (Top: Andrew Derksen, USDA-APHIS, Bugwood.org) and examples of hatched eggs (Bottom: Pest and Diseases Image Library, Bugwood.org).

Feral pig (*Sus scrofa*)

European wild boar, feral pigs, and crossbreeds of the two can be found in the wild. Feral pigs are domestic pigs that either escaped or were released for hunting. Feral pigs continue to grow in numbers and have spread broadly across much of the US and into Canada. Adult feral pigs can weigh from 110 to 770 lbs. Females can give birth to litters of 1–12 piglets beginning at about 9 months of age. Life span in the wild is about 10 years, but feral pigs have been recorded living as long as 27 years. Feral pigs are indiscriminate omnivores which allows them to survive across a wide range of habitats, limited only by scarcity of water and severely cold temperatures. They are considered to be intelligent and can be very aggressive when threatened. Trapping and hunting are the main forms of control. Because of their destructive feeding habits and potential to spread disease, feral pigs are a substantial liability to agriculture, native wildlife, and natural areas. Unfortunately, these animals are also sought for recreational hunting and commercial harvest, which contributes to their spread.



Photo Credit: Example of a feral pig (*Sus scrofa*) family group (Top: Billy Higginbotham, Texas AgriLife Extension Service, Bugwood.org) and the damage they cause on the landscape when foraging (Bottom: Karan A. Rawlins, University of Georgia, Bugwood.org).

Nutria (*Myocastor coypus*)

Nutria are large, herbivorous, semi-aquatic mammals and native to South America. Adults weigh from 15-20 lbs. and are 2 ft (61 cm) long including their rounded, almost hairless tail. Males are larger than females. Adults have large yellow to orange teeth and a life span of 8-10 years. They are nocturnal, but will feed during the day if food is scarce. Nutria are found in 22 states and are most abundant in coastal states. They prefer marshes and other wetlands with a large amount of emergent aquatic vegetation as well as semi-aquatic environments. They will create burrows, land nests, and platforms out of vegetation in shallow water. Nutria are controlled using exclusions (e.g., fences, walls, and other structures) and habitat modifications (e.g., vegetation control and draining) which can reduce numbers and damage but are costly. Harvesting (e.g., trapping and hunting) can provide managers a financially feasible opportunity to control nutria.



Photo Credit: Adult nutria (*Myocastor coypus*) (Left: Royal Tyler, Pro Pest and Lawn Store, Bugwood.org) and the damage they can cause in wetlands, waterways, and coastal regions (Right: Gerald J. Lenhard, Louisiana State University, Bugwood.org).

Georgia's Dirty Dozen + 1

The thirteen invasive plants considered to be the most harmful invasive plants in Georgia are known as the Dirty Dozen*. The ranking of the Dirty Dozen List of Nonnative Invasive Species was determined based on the total acres occupied by each species according to U.S. Forest Service Forest Inventory and Analysis data. Cogongrass (*Imperata cylindrical*) is included due to intensive control efforts by the Georgia Forestry Commission. The Georgia Forestry Commission treats Cogongrass in Georgia at no charge to landowners

* Japanese honeysuckle (*Lonicera japonica*) and fescue (*Festuca* spp.) are not included in this list.



1. Nonnative privet



Photo Credit: Chinese privet, *Ligustrum sinense*, foliage (Left: Karan A. Rawlins, University of Georgia, Bugwood.org), flowers (Right Top: Karan A. Rawlins, University of Georgia, Bugwood.org), and example of an infestation (Right Bottom: Chris Evans, University of Illinois, Bugwood.org).

Several species of privet occur and they are often very hard to distinguish. Privet species include: Amur privet (*Ligustrum amurense*), Japanese privet (*Ligustrum japonicum*), Glossy privet (*Ligustrum lucidum*), Chinese privet (*Ligustrum sinense*), and European privet (*Ligustrum vulgare*).

All species commonly form dense thickets in fields or in the understory of forests. They shade and out-compete many native species, and once established, are very difficult to remove. Privet is still commonly used as an ornamental shrub and for hedgerows.

2. Japanese stiltgrass (*Microstegium vimineum*)

Japanese stiltgrass is native to Asia and was accidentally introduced into the United States around 1920. It has previously been used as packing material for porcelain, possibly explaining its accidental introduction. Although commonly an invader of forested floodplains, Japanese stiltgrass is also found in ditches, forest edges, fields, and trails. It is very shade tolerant and can completely displace native vegetation. This plant is a delicate, sprawling, annual grass that is 0.5-3.5 ft (0.2-1.1 m) tall. The stems can root at the nodes. The leaves are pale-green, alternate, lance-shaped, 1-3 inches (2.5-7.6 cm) long, asymmetrical with a shiny, off-center midrib. Upper and lower leaf surface is slightly pubescent. Stems usually droop. Flowering begins in September, when delicate flower stalks develop in the axils of the leaves or at the top of the stems. Fruit is produced from late September through early October.

Photo Credit: Japanese stiltgrass, *Microstegium vimineum*, infestation (Top: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org) and foliage (Bottom: Richard Gardner, Bugwood.org).



3. Chinaberry (*Melia azedarach*)

Chinaberry is native to Southeast Asia and northern Australia. It was introduced to the United States in the mid-1800s for ornamental purposes. Chinaberry has the potential to grow in dense thickets that restricts the growth of native vegetation. It invades disturbed areas and is commonly found along roads and forest edges. Chinaberry is a deciduous tree growing up to 50 feet (15.2 m) tall and 2 feet (0.6 m) in diameter. Leaves are alternate, bi-pinnately compound, 1-2 feet (0.3-0.6 m) long, and turn golden-yellow in fall. Flowering occurs in the spring, when showy, lavender, 5-petaled flowers develop in panicles. Fruit are hard, yellow, marble-sized, stalked berries that can be dangerous on sidewalks and other walkways. The seeds, which are spread by birds, are poisonous.



Photo Credit: An example of Chinaberry, *Melia azedarach*, tree (Left: Chuck Barger, University of Georgia, Bugwood.org), flowers (Right Top: Emily Earp, FloridaNature.org, Bugwood.org), and fruit (Right Bottom: Franklin Bonner, USFS (ret.), Bugwood.org).

4. Nonnative lespedeza (*Lespedeza* spp.)

Sericea lespedeza (Chinese lespedeza, *Lespedeza cuneata*)

Sericea lespedeza is native to Asia. This plant was introduced to the United States in the late 1800s for erosion control, mine reclamation, and wildlife habitat. It is an extremely aggressive invader that out competes native vegetation. Once established, sericea lespedeza is difficult to remove due to the seed bank that remains viable for decades. It is an upright semi-woody forb reaching 3-6 feet (0.9-1.8 m) tall with one to many slender stems. Stems are often gray green with lines of hairs along the stem. Leaves are thin, alternate, abundant, and three-parted. Leaflets have wedge-shaped bases and are 0.5-1 inch (1.3-2.5 cm) long and hairy. Flowering occurs from July to September, when small, creamy-white flowers with purple throats develop in clusters of two to four. Fruit is a flat ovate to round single-seeded pod 0.12-0.15 inch (3-4 mm) wide. Pods are clustered in terminal axils, scattered along the stem, and clasped by persistent sepals.



Photo Credit: Foliage of sericea lespedeza, Chinese lespedeza, *Lespedeza cuneata*, (Top: Richard Gardner, Bugwood.org) and example of an infestation (Bottom: Chris Evans, University of Illinois, Bugwood.org).

Shrubby lespedeza (*Lespedeza bicolor*)

Shrubby lespedeza is native to Asia and was introduced into the United States in the late 1800s. It was widely planted for wildlife habitat. This plant is an extremely aggressive invader of open areas, forming dense thickets, which displace native vegetation. Shrubby lespedeza is an upright semi-woody forb, 3-10 feet (0.9-3 m) tall with many slender stems and arching branches. Leaves are elliptical, alternate, abundant and three-parted. Leaflets are oval with the lower surface lighter than the upper surface. Flowering occurs in the summer, when purple, pea-like flowers develop in clusters. Flowers are less than 0.5 inch (1.3 cm) long. The fruit are flat, indehiscent pods and contain one seed that measures 0.31 inch (8 mm) long.

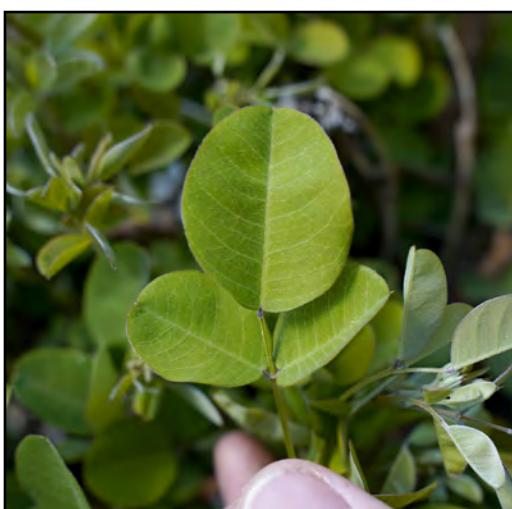


Photo Credit: Examples of shrubby lespedeza, *Lespedeza bicolor*, foliage (Left: James H. Miller, USDA Forest Service, Bugwood.org; Right: Paul Langlois, Live Botanical Collections, USDA APHIS PPQ, Bugwood.org).

5. Kudzu (*Pueraria montana* var. *lobata*)

Kudzu is native to Asia and was first introduced into the United States in 1876 at the Philadelphia Centennial Exposition. It was widely planted throughout the eastern United States in an attempt to control erosion. Kudzu prefers open disturbed areas such as roadsides, right-of-ways, forest edges, and old fields. Kudzu often grows over, shades out, and kills all other vegetation, including trees. It is a climbing, deciduous woody vine capable of reaching lengths of over 100 feet (30.5 m) in a single season. Its fleshy tap roots can reach 7 inches (18 cm) in width and grow to 9' (3.8 m) deep. These roots can weigh up to 400 lbs. (180 kg). Leaves are alternate, compound (with three often slightly lobed leaflets), and up to 5.4 inches (15 cm) long. Petioles (leaf stems) and stems are hairy. Flowering occurs in mid-to late-summer, when 0.5 inch (1.3 cm) long, purple, fragrant flowers are upright in clusters. Fruit are brown, hairy, flat, 3 inches (7.6 cm) long, 0.3 inch (0.8 cm) wide seed pods. Each pod can contain 3-10 hard seeds.



Photo Credit: Foliage of kudzu, *Pueraria montana* var. *lobata* (Top: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org) and example of an infestation (Bottom: Patricia M. Ciesla, Forest Health Management International, Bugwood.org).

6. Chinese tallowtree (*Triadica sebifera*)



Chinese tallowtree is native to China and was introduced to the United States as an ornamental plant and for seed oil production. It is a serious threat because of its ability to invade high quality, undisturbed forests as well as wet areas such as stream banks and ditches but can also invade drier upland sites. It can displace native vegetation as well as alter soil conditions due to the high amount of tannins present in the leaf litter. Chinese tallowtree is a deciduous tree reaching 60 feet (18.3 m) tall and 3 feet (0.9 m) in diameter. Leaves are alternate, soft triangle to diamond-shaped, 2-3 inches (5.1-7.6 cm) long with a pointed tip. Flowering occurs from April to June. The yellow flowers occur on 3-8 inches (8-20 cm) long, upright or dangling spikes. Three-lobed, green fruit are found in clusters at the end of branches. Fruit mature to black and then open to reveal white wax-covered seeds.

Photo Credit: Chinese tallowtree, *Triadica sebifera*, fruit (Top: Chris Evans, University of Illinois, Bugwood.org) and flowers (Bottom: Chuck Barger, University of Georgia, Bugwood.org).

7. Japanese climbing fern (*Lygodium japonicum*)

Japanese climbing fern is native to eastern Asia and was first introduced into the United States during the 1930s for ornamental purposes. It occurs along highway right-of-ways, especially under and around bridges, invading into open forests, forest road edges, and stream and swamp margins. Plants may be scattered in open stands and plantations, but infestations can increase in cover to form mats, especially after burns, smothering shrubs and trees. Japanese climbing fern is a perennial climbing fern that can reach lengths of 90' (30 m). Vines are thin, wiry green to orange to black and usually die back in the winter. The fronds (leaves of a fern) are opposite, compound, usually triangular in shape, 3-6 inches (8-15 cm) long, 2-3 inches (5-8 cm) wide and finely dissected. Fertile fronds bear sporangia that produce tiny, wind-dispersed spores that may also be spread in pine straw. Plants are also spread by rhizomes.



Photo Credit: An example of Japanese climbing fern, *Lygodium japonicum*, infestation (Left: Florida Division of Plant Industry, Florida Department of Agriculture and Consumer Services, Bugwood.org) and its foliage (Right: Karan A. Rawlins, University of Georgia, Bugwood.org).

8. Nonnative olives (*Elaeagnus* spp.)

Silverthorn or thorny olive (*Elaeagnus pungens*)

Silverthorn or thorny olive is native to eastern Asia and was first introduced into the United States as an ornamental in 1830. It is highly shade tolerant which allows it to invade both open areas and under forest canopies. Thorny olive is a dense evergreen shrub that invades natural areas throughout the southeastern United States. The shrub is often multi-stemmed and short. Sharp shoots give it a thorny appearance. Shrubs can range from 3-26 feet (1-8 m) tall, often with long shoots extending from the top. The leaves are alternate, 2-4 inches (5-10 cm) long and leathery, oval to elliptical, with irregular wavy margins. The underside of the leaves are covered with silvery scales and scattered brown. The axillary clusters of small, sweet-smelling, white to brownish flowers develop in the fall. Plant fruit are 1-1.5 inches (2.54-3.8 cm) long, red and dotted with small silver scales.



Photo Credit: An example of thorny olive, *Elaeagnus pungens*, infestation (Top: Rebekah D. Wallace, University of Georgia, Bugwood.org) and foliage (Bottom: Joseph LaForest, University of Georgia, Bugwood.org).

Autumn olive (*Elaeagnus umbellata*)

Autumn olive is native to China and Japan. It was introduced for wildlife habitat, strip mine reclamation, and shelterbelts. Autumn olive prefers drier sites, is shade tolerant, and is spread by animal-dispersed seeds. It is a nonleguminous nitrogen fixer. This plant is a deciduous shrub from 3-20 feet (0.9-6.1 m) in height with thorny branches. Leaves are alternate, 2-3 inches (5-8 cm) long and 1 inch (2.5 cm) wide, bright green to gray green above and silver scaly beneath with entire to wavy margins and short petioles. Small, white to yellowish tubular flowers are abundant and occur in clusters of 5 to 10 near the stems from February to June. Fruits are round, red, juicy drupes which are finely dotted with silvery to silvery-brown scales. Fruits ripen from August to November.



Photo Credit: An example of autumn olive, *Elaeagnus umbellata*, infestation (Left: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org) and flower (Right: Chris Evans, University of Illinois, Bugwood.org).

9. English ivy (*Hedera helix*)

English ivy is an aggressive invader threatening forested and open areas. It is an evergreen perennial that occurs as a ground cover and a high-climbing vine. Leaves are alternate, dark green, waxy, somewhat leathery; extremely variable leaf forms, from unlobed to 3-5 lobed; typically green with whitish veins. Flowering occurs in late summer to early fall, typically under full sun conditions; flowers are small, greenish- yellow and occur in globular starburst type inflorescence at tips of flowering stems. Fruits are black with a fleshy outer layer and stone-like seeds. New plants grow easily from cuttings or stem fragments that make contact with the soil. Vines climb up tree trunks and envelop branches and twigs, blocking sunlight, and impeding photosynthesis. The weight of vines also makes trees susceptible to windthrow during storms. It has been confirmed as a reservoir for bacterial leaf scorch (*Xylella fastidiosa*), which affects a wide variety of trees.



Photo Credit: English ivy, *Hedera helix*, foliage (James H. Miller, USDA Forest Service, Bugwood.org).

10. Mimosa (silktree, *Albizia julibrissin*)

Mimosa is native to Asia and was first introduced into the United States in 1745. It has been widely used as an ornamental. Mimosa invades open disturbed habitats and is commonly found in old fields, along stream banks, and roadsides. Once established, mimosa is difficult to eradicate due to the long lived seeds and its ability to re-sprout vigorously. It is a small tree from 10-50 feet (3-15.2 m) tall, often having multiple trunks. It has alternate, bi-pinnately compound leaves. Flowering occurs in early summer, when very showy, fragrant, pink flowers develop in groups at the ends of the branches. Fruit are flat, 6 inches (15.2 cm) long seed pods that develop during late summer.



Photo Credit: Mimosa, *Albizia julibrissin*, flowers (Left: John D. Byrd, Mississippi State University, Bugwood.org) and seeds (Right: Chris Evans, University of Illinois, Bugwood.org).

11. Trifoliate orange (*Citrus trifoliata*)

Trifoliate orange is native to northern China and Korea. It is a deciduous shrub or small tree that grows from 8-30 feet (2.4-9.1 m) tall. The leaves are alternate, compound (trifoliate), up to 2 inches (5.1 cm) long and have a winged petiole. The twigs are green with stout, 1-2 inch (2.5-5 cm) long thorns. The bark is conspicuously green-striped. Spring flowers are white, 5-petaled, 1-2 inches (2.5-5.1 cm) in diameter and showy. Fruit is a 1.5-2 inches (3.8-5.1 cm) diameter and dull yellow orange in color. Trifoliate orange invades woodlands, forest edges, fence rows and urban green spaces.



Photo Credit: Trifoliate orange, *Citrus trifoliata*, foliage and unripe fruit (Left: James H. Miller, USDA Forest Service, Bugwood.org) and ripe fruit (Right: James H. Miller, USDA Forest Service, Bugwood.org).

12. Non-native wisteria

(Chinese wisteria (*Wisteria sinensis*), Japanese wisteria (*Wisteria floribunda*), Hybrid wisteria (*Wisteria x formosa*))

Chinese wisteria is native to China while Japanese wisteria is native to Japan. Both were introduced into the United States during the 1800s for ornamental purposes. They can displace native vegetation and kill trees and shrubs by girdling them. The vine has the ability to change the structure of a forest by killing trees and altering the light availability to the forest floor. Non-native wisteria is a deciduous woody vine capable of growing to 40 feet (12.2 m) tall. Stems can be up to 10 inches (25.4 cm) in diameter with smooth, gray-brown bark. When looking down on the vine, Chinese wisteria twines in a counter clockwise direction around the host while Japanese wisteria twines in a clockwise direction. Alternate, pinnately compound (Chinese wisteria 7-13 leaflets, Japanese wisteria 13-19 leaflets) leaves are tapered at the tip with wavy edges. Leaflets are approximately 3 inches (7.6 cm) long. Lavender, purple or white flowers are fragrant, very showy and abundant and occur in long, dangling clusters in the spring. Seeds are contained in flattened, velvety, 6 inch (15.2 cm) long, bean-like pods. Invasions often occur around previous plantings.



Photo Credits: Chinese wisteria, *Wisteria sinensis*, flowers (Left: Rebekah D. Wallace, University of Georgia, Bugwood.org) and foliage (Right: Rebekah D. Wallace, University of Georgia, Bugwood.org).

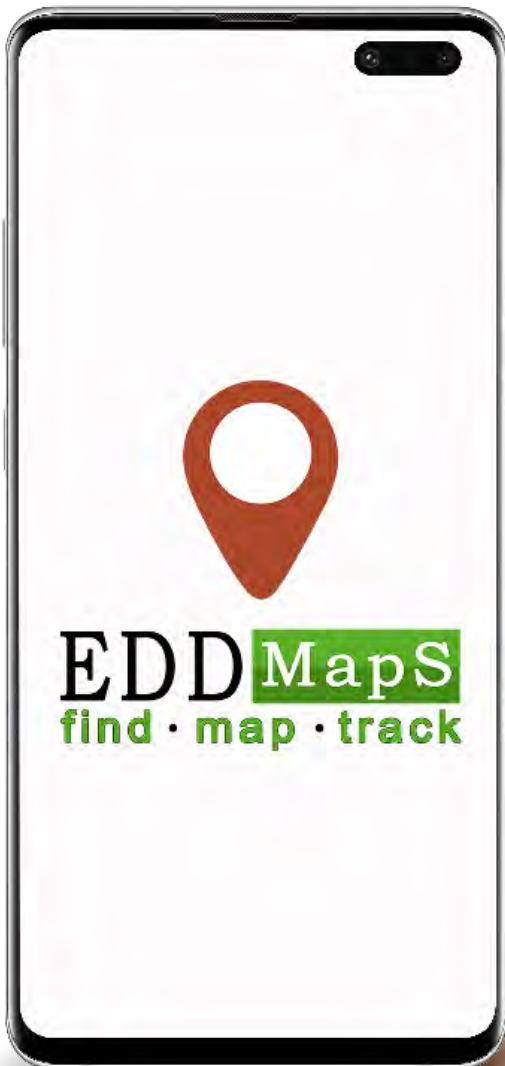
13. Cogongrass (*Imperata cylindrica*)

Cogongrass is native to Southeast Asia and was accidentally introduced into the southeast United States in packing material in the early 1900s. It was also intentionally introduced for erosion control and livestock forage. Cogongrass is a perennial, colony-forming grass which can grow to 4-6 feet (1.3-1.8 m) tall, but it is typically less than 3 feet (1 m). Leaves have a whitish midrib that may be off center, and are finely serrated margins. Leaves are 4-6 feet (1.3-1.8 m) long, 0.5-0.75 inch (1.3-1.9 cm) wide, and have a sharp, pointed apex. Rhizomes are whitish, branched, scaly and sharp at the tips. Flower heads are cylindrical, 2-8 inches (5.1-20.3 cm) long, becoming silvery-white. Identification is easiest in the spring when the large fuzzy panicles of flowers and seeds give the plant a cottony or silky look.



Photo Credit: An example of a cogongrass, *Imperata cylindrica*, infestation (Left: Chris Evans, University of Illinois, Bugwood.org) and its root system (Right: Chuck Barger, University of Georgia, Bugwood.org).

Part 4: How to Report Invasive Species



Reporting the occurrence of invasive species is important for slowing their spread and minimizing negative effects. To aid in this effort, the Early Detection and Distribution Mapping System (EDDMapS) was developed by the University of Georgia's Center for Invasive Species and Ecosystem Health. EDDMapS provides an easy way to track and map invasive species infestations with smartphones. EDDMapS provides distribution maps for invasive species across the United States.

Reports submitted to EDDMapS allow for real-time tracking of non-native species. The ability to track the movement of species into new areas facilitates EDRR programs. Tracking and identifying the leading edge of spread is critical information needed for controlling invasive species before they cause significant economic and environmental harm. Reports submitted to EDDMapS are available for public use once they are verified by experts. Reports appear on maps, go out as alerts, are included in data downloads, and more. Landowners, invasive species managers, and other professionals commonly use these reports for management purposes.

For more information on how to use EDDMapS please refer to the EDDMapS Handbook.



Photo Credit: Peter Frey, University of Georgia

Part 5: Field Safety

The following section is a general guide to assist Georgia First Detector volunteers in the planning of data collection. This is not an all-inclusive guide to field safety, however, and we suggest volunteers spend time assessing their own physical health. Knowing your own limitations or challenges and the potential dangers inherent in the natural areas you are entering are imperative so please plan accordingly.

There are inherent physical risks associated with working in a natural environment, while traveling to surveying areas, and while collecting data. Listed here are some examples of precautions all volunteers should take:

1. Inspect transportation vehicles and water crafts to make sure they are in good operating condition to avoid transportation hazards. Wear protective clothing and assess the survey area for any biological hazards such as insects, snakes, alligators, bears, poison ivy, poison oak, and poison sumac. Being able to identify common wildlife and plants that may inflict harm will help Georgia First Detector volunteers avoid attacks, stings, and rashes.
2. Volunteers should be mindful of forecasted weather events by checking the weather before heading out to survey an area. If caught in a thunderstorm, take shelter inside your vehicle or a building. It is not safe to be out on water during a thunderstorm. Georgia First Detector volunteers should be aware of the effects of excessive heat in the form of heat exhaustion and stroke. Knowing symptoms can prevent potential fatalities. Volunteers need to carry plenty of water and avoid strenuous activity during hot weather or during the heat of the day.

Field Kits

A well-equipped field kit should include the following:

- Backpack
- Camera
- Camera memory card
- Extra batteries
- GPS Unit
- Clipboard
- Blank data sheets
- Buggy spray
- Maps
- Seed removal brush
- EDDMapS handbook
- First Aid kit
- Pencils, pens, and/or markers
- Species ID cards
- Cellphone/Smartphone
- Water and snacks



Photo Credit: *Top:* Peter Frey, University of Georgia; *Bottom:* Karan A. Rawlins, University of Georgia, Bugwood.org

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CleanDrainDry: <https://stopaquatic hitchhikers.org/>

Don't Let It Loose: <https://www.dontletitloose.com/>

Don't Move Firewood: <https://www.dontmovefirewood.org/>

Georgia Invasive Species Task Force: <https://www.gainvasives.org/>

Invasive.Org: <https://www.invasive.org/species/list.cfm?id=2>

EDDMapS: <https://www.eddmaps.org/>

Bugwood Publications: <https://www.bugwood.org/publications.cfm>

Bugwood Image Database: <https://images.bugwood.org/>

The Economics of Ecosystems and Biodiversity: <http://www.teebweb.org/>

