CLEMSON
PUBLIC SERVICE ACTIVITIES

Department of Plant Industry



CLEMSON UNIVERSITY

JUNIOR INVASIVE INSPECTORS

A partnership to protect your natural resources.

Sherry Aultman

Invasive Species Program Manager, Clemson University DPI



"Regulation" "education"

Objectives of Junior Invasive Inspectors Program:

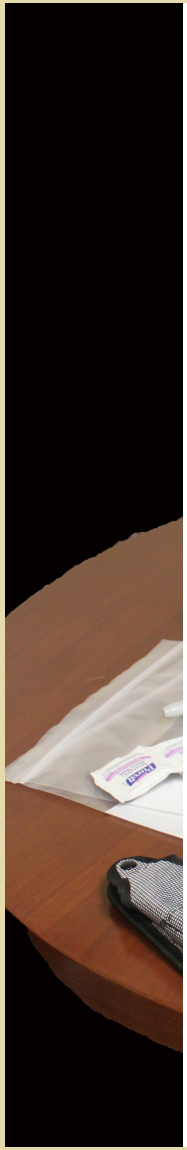
- Raise awareness of the threat invasive species pose to SC forests

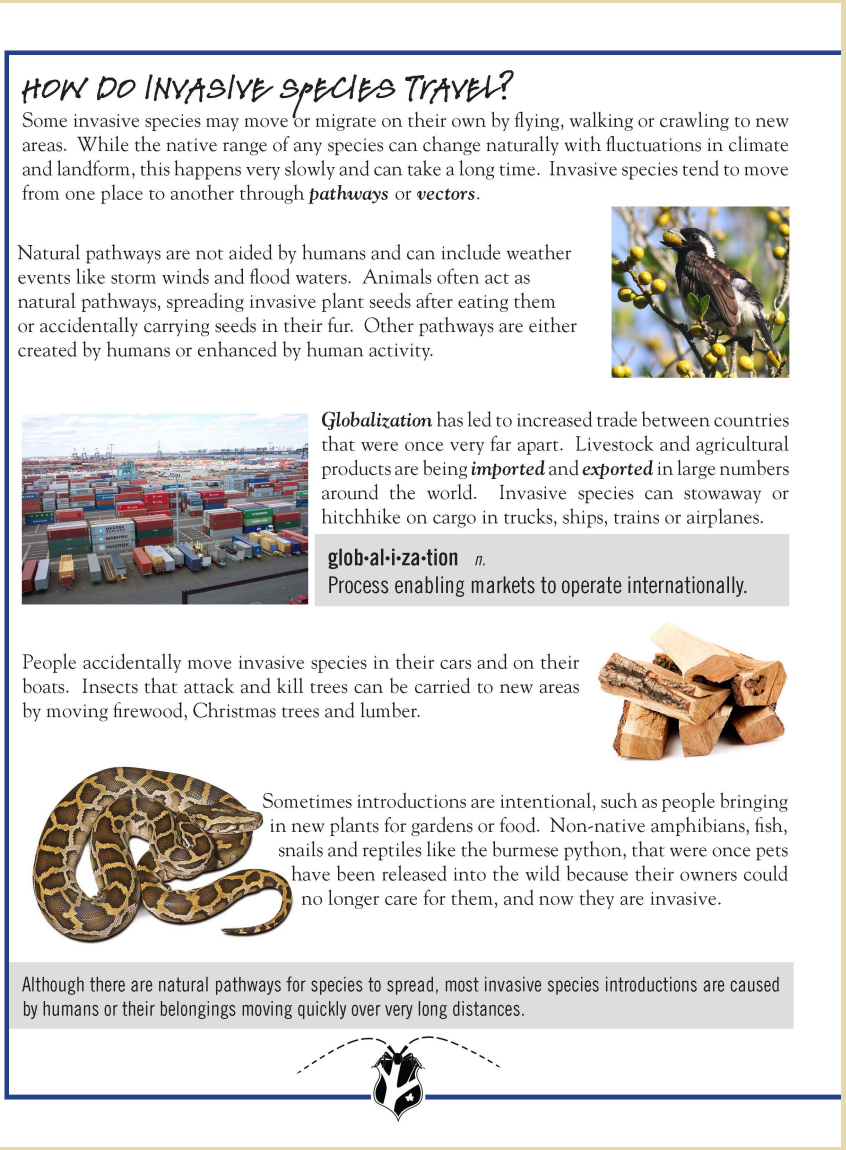
- Mobilize youth that are already using our forests in the detection of invasive species



Components of Junior Invasive Inspector Program

- Curriculum given to the group leader or taught by inspector
  - What is an invasive species?
  - Explain introduction pathways and ways to avoid transporting pests
  - Develop tree and insect identification skills
  - Provide basic understanding of latitude and longitude
- Loan out supplies for forest pest surveys
- Host online database for reporting





HOW DO INVASIVE SPECIES TRAVEL?

Some invasive species may move or migrate on their own by flying, walking or crawling to new areas. While the native range of any species can change naturally with fluctuations in climate and landform, this happens very slowly and can take a long time. Invasive species tend to move from one place to another through ***pathways*** or ***vectors***.

Natural pathways are not aided by humans and can include weather events like storm winds and flood waters. Animals often act as natural pathways, spreading invasive plant seeds after eating them or accidentally carrying seeds in their fur. Other pathways are either created by humans or enhanced by human activity.

Globalization has led to increased trade between countries that were once very far apart. Livestock and agricultural products are being ***imported*** and ***exported*** in large numbers around the world. Invasive species can stowaway or hitchhike on cargo in trucks, ships, trains or airplanes.

glob·al·i·za·tion *n.*
Process enabling markets to operate internationally.

People accidentally move invasive species in their cars and on their boats. Insects that attack and kill trees can be carried to new areas by moving firewood, Christmas trees and lumber.

Sometimes introductions are intentional, such as people bringing in new plants for gardens or food. Non-native amphibians, fish, snails and reptiles like the burmese python, that were once pets have been released into the wild because their owners could no longer care for them, and now they are invasive.

Although there are natural pathways for species to spread, most invasive species introductions are caused by humans or their belongings moving quickly over very long distances.

Who are Junior Inspectors?



Targeting youth who have:

- Completed 4th grade (9-13)
- An interest in the outdoors, biology, entomology, or GPS
- Adult supervision
- Access to deciduous forests with appropriate hosts

What are the target pests?



















Females lay their eggs on the bark of a host tree. The **larvae** emerge from the egg, burrow into the tree and feed. Under the bark, they will **pupate** and emerge as fully formed adult **beetles**. Look for **D-shaped exit holes**.

pupae



emerging adult



larva



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JUNIOR INVASIVE INSPECTORS

A partnership to protect your natural resources.

A handy field guide to host trees and target insects

WHITE OAK (*Quercus alba*)

Questions?


Clemson University
Junior Invasive Inspectors Program
CLEMSON
PUBLIC SERVICE AND AGRICULTURE
www.clemson.edu/invasives
nspect to protect.
ants, animals and diseases are introduced new environments, on purpose and by dent, everyday. Some of these exotic or native species have characteristics that them to outcompete or destroy the native species. These animals, insects, plants and/or diseases that threaten our environment and threaten human health are invasive species.
Invasive species spread quickly once they are introduced into an area. Monitoring our forests with early detection and rapid response programs is the best way to protect our trees from invasive pests. As Junior Inspectors, middle school youth conduct forest pest surveys to assess the health of host trees such as maple, walnut, ash, oak, and beech, and look for signs and symptoms of the target pests.
Junior Inspectors will learn about:
Invasion biology and pathways of introduction
Tree and insect identification
Symptoms of decline and signs of infestation
Using GPS units to report location data
ipes.
noticeable Asian longhorned ora glabripennis) kills maple le out. Like many other bark es the most damage during of its life.
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adult beetle has k and white striped nae that can be than its body!
Fungus among us.
Walnut twig beetle (Pityophthorus juglandis) is the tiniest beetle Junior Inspectors may find. They may be smaller than a grain of rice, but these beetles are still killing walnut trees just next door in North Carolina!
These tiny bark beetles live in the small branches at the tops of walnut trees and carry a deadly fungus. Wherever the beetles crawl around in the bark, the fungus begins to grow into a canker, like an infected wound. The infection spreads until the tree dies from thousand cankers disease.
A killer family.
Junior Inspectors look for three exotic invasive beetles in the Buprestidae family. All three have similar body shapes and life cycles, resulting in characteristic D-shaped exit holes.
Egg
Larva
Adult exiting
Emerald ash borer (Agrilus glabripennis) kills ash trees. The shiny green EAB was first detected in Michigan in 2002 and has since spread all the way to Georgia and North Carolina! Look for the metallic green color of the EAB.
Oak Splendor Beetle (Agrilus biguttatus) has never been found in the U.S., but it kills oak trees. Oaks are very common and important trees in South Carolina, so we have to watch out for beetles that like to eat them! OSB has two white spots, one on the inside edge of each wing cover.
Gold Spotted Oak Borer (Agrilus auroguttatus) is another pest on oak trees. GSOB has only been detected in California, but it can easily move on wood products like lumber and firewood. Look for six gold spots on the GSOB's wing covers.
The silhouettes are the actual size of each pest.

Inspect to protect.

Plants, animals and diseases are introduced to new environments, on purpose and by accident, everyday. Some of these **exotic** or **non-native** species have characteristics that allow them to outcompete or destroy the native species. These animals, insects, plants and/or diseases that threaten our environment and threaten human health are **invasive species**.



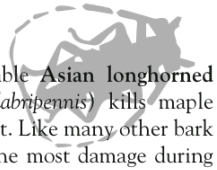
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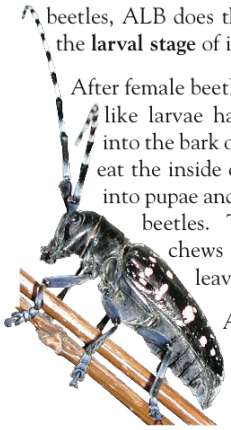


Spot the stripes.



The large and noticeable **Asian longhorned beetle** (*Anoplophora glabripennis*) kills maple trees from the inside out. Like many other bark beetles, ALB does the most damage during the **larval stage** of its life.

After female beetles lay their eggs, worm-like larvae hatch and eat their way into the bark of a host tree. The larvae eat the inside of the tree as they grow into pupae and then mature into adult beetles. The adult ALB then chews its way out of the tree, leaving a **large, oval hole**.



An adult beetle has **black and white striped antennae** that can be longer than its body!

Fungus among us.

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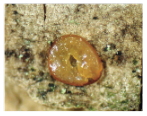
These tiny bark beetles live in the small branches at the tops of walnut trees and carry a deadly fungus. Wherever the beetles crawl around in the bark, the fungus begins to grow into a **canker**, like an infected wound. The infection spreads until the tree dies from **thousand cankers disease**.



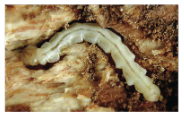
A killer family.



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Egg



Larva



Adult exiting

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Program Update and Plans

Present

- ☑ Several test runs with various materials
- ☑ Backpack supplies and tiered awards
- ☑ Advertising

- ☐ Online database
- ☐ Curriculum

Future

- ☐ Official start date: June 1, 2014!
- ☐ Replenish supplies and awards as needed
- ☐ Advertising

- ☐ Hand-off to local leaders?



Today, we will all be Junior Inspectors:

1. What is an invasive species?
2. Host identification
3. Pest identification
4. Survey tools
5. Forest pest survey!

What is an invasive species?

- An organism that can outcompete
  - reproduction rate, food availability, lack of predation, growth rate, special adaptations, etc.
- Establishment harms the environment and/or people
  - destroys natives, changes ecology, impedes industry, threatens human health
- For our purposes, we will focus on exotic (non-native) invasive species that are tree pests
  - insects that kill trees or **vector** a disease that kills trees

How do invasive species get here?



Corridors

How do invasive species get here?



International trade

How do invasive species get here?



Intentional introduction

How do invasive species get here?



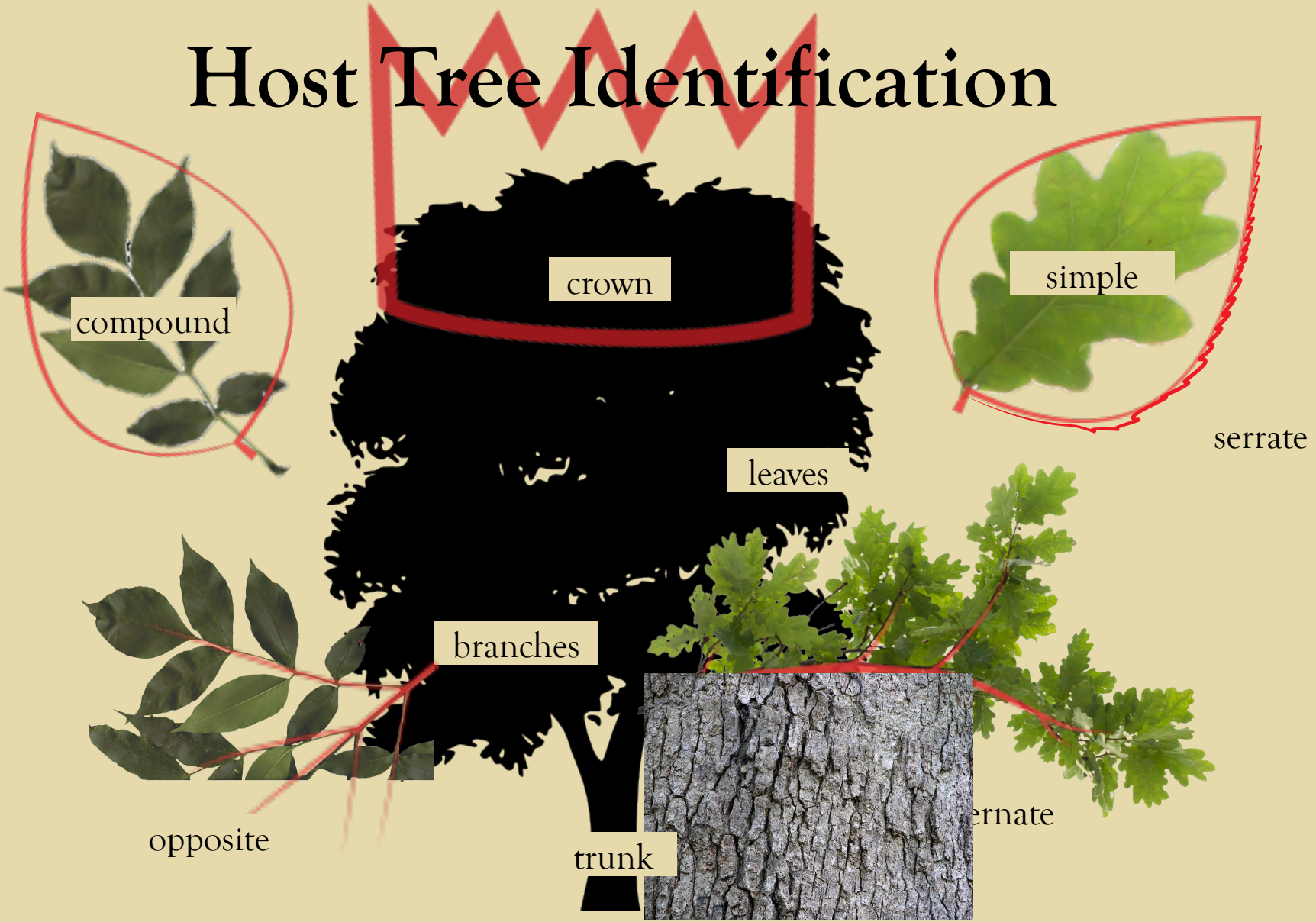
Plant material

How do invasive species get here?



Contaminated equipment

Host Tree Identification



Identifying a host:
Oaks (*Quercus* spp.)

- One of the most common trees in our forests
- Broad range of growth habits and leaf shapes
- Two groups:
  - **White oaks** usually have lighter bark, especially towards the top of the trunk
  - **Red oaks** typically have a sharp spine on the tip of each lobe
- **All oaks have acorns!**



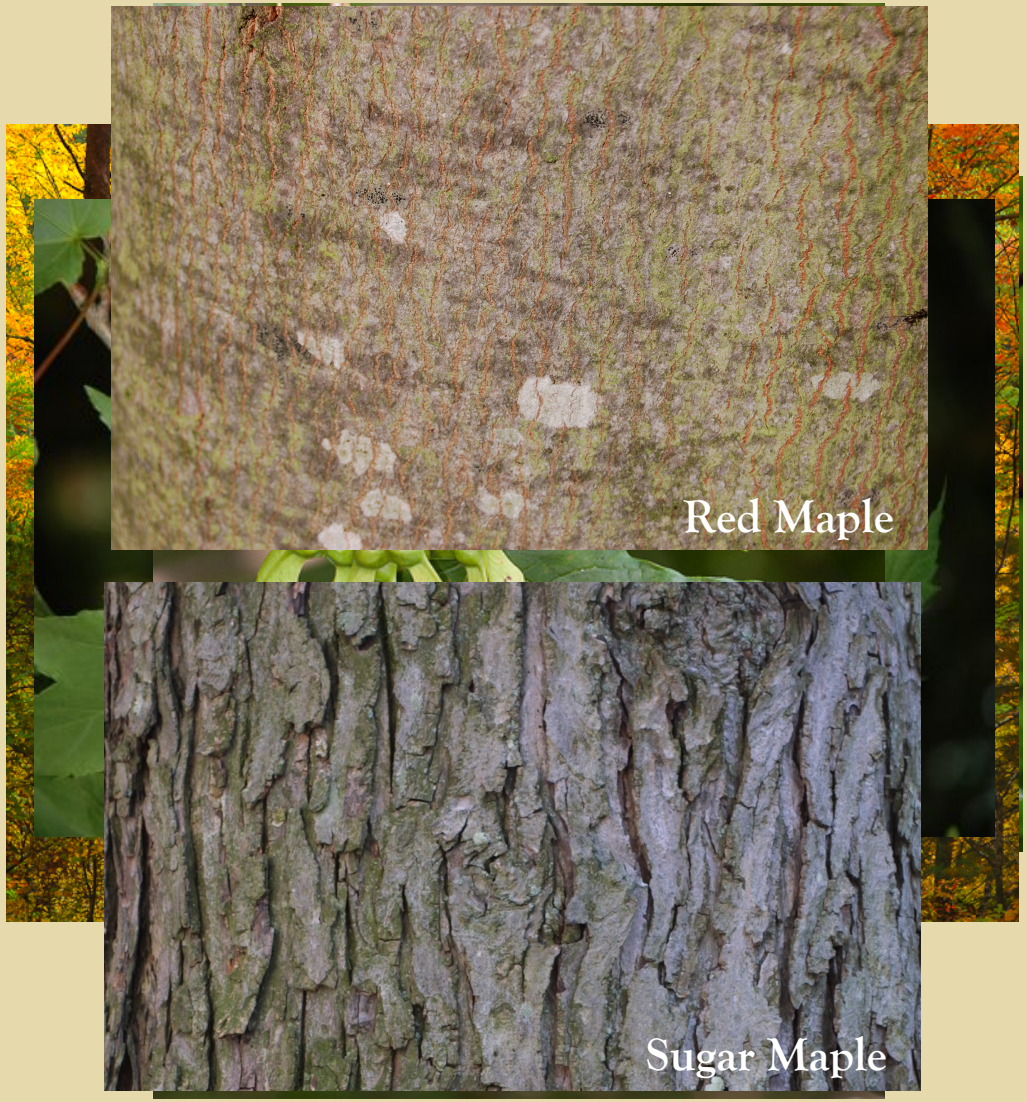
Identifying a host:
American beech (*Fagus grandifolia*)

- Shade tolerant, often found in moist slopes and bottomlands
- Smooth, **pale gray** bark, sometimes wrinkled like elephant skin
- Shorter trunk; branches usually touch ground
- Leaves are simple, serrate; dark green above and light green underneath
- **Beech nuts** are small (1/2 – 1 inch) and oval, 3-winged
- Autumn leaves are coppery bronze, often the last deciduous leaves in the winter



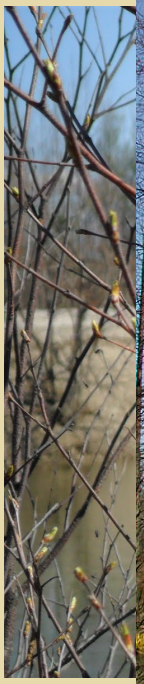
Identifying a host: Maple (*Acer* spp.)

- Shade tolerant, deciduous trees that turn brilliant yellows and reds in the fall
- Maple bark varies by species. Two of the more common are smooth (red maple) and shaggy (sugar maple)
- **Opposite** branching
- Simple, **palmately lobed** leaves
- The winged fruit, often called a helicopter seed, is a **samara**



Identifying a host:
River birch (*Betula nigra*)

- Deciduous tree that typically grow along side water
- **Papery bark** that peels off **multiple trunks**
- Alternate branching
- Flowers are **catkins**
- **Serrate leaves**





Identifying a host: Buckeye (*Aesculus* spp.)

- Deciduous genus with a range from large trees to small shrubs
- Inside the covering, the fruit is a **buckeye**: round, deep brown with a pale spot. Horse chestnut has a spiky covering
- Opposite branching
- **Palmately compound** leaves
- Flowers are arranged in **cone-shaped inflorescences**



Identifying a host:
Green ash (*Fraxinus pennsylvanica*)

- Prefers low, wetlands
- Bark is deeply, neatly furrowed so that it forms a **diamond pattern**
- **Opposite branching**
- Compound leaves with **seven leaflets**
- Fruit is a **samara**, but single samaras, **not paired** like a maple

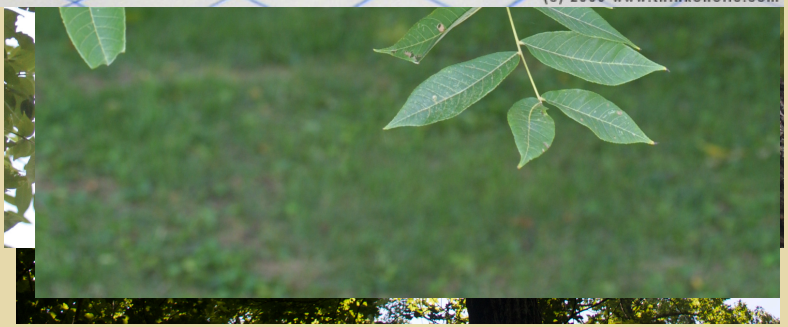


Identifying a Host:
Black walnut (*Juglans nigra*)

- Can grow very tall in forest canopy near water; much shorter in landscape settings
- Bark is deeply furrowed and braided; inside is **chocolate brown**
- **Tennis ball-sized** and colored fruit contains the walnut
- Large **compound leaf with 12-20** leaflets, the largest in the center
- **Chambered pith!**





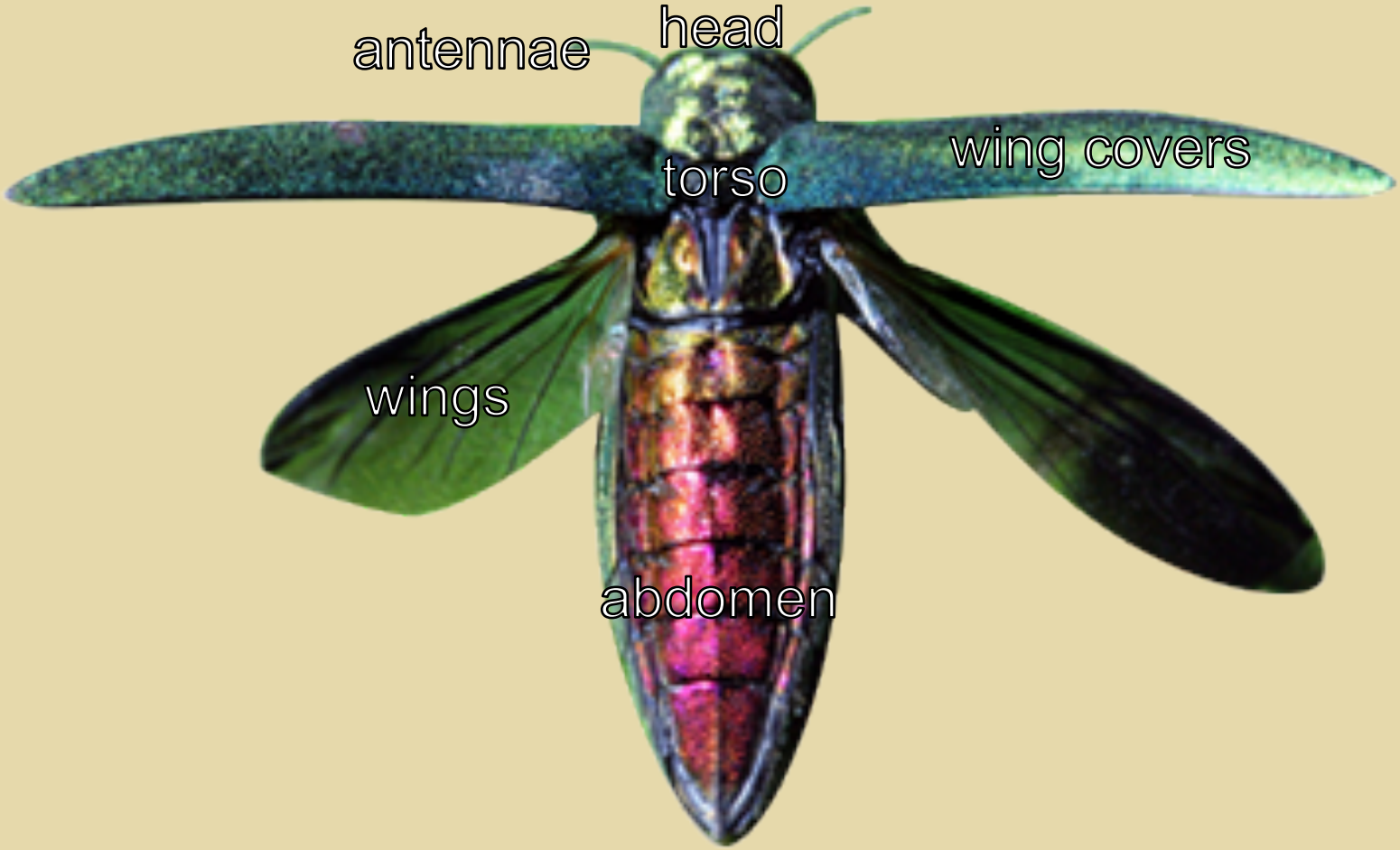


What does a sick tree look like?

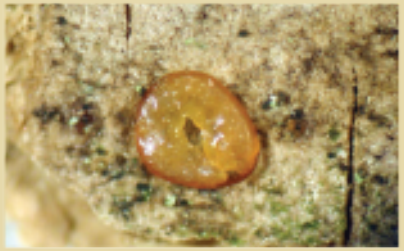
- Damaged leaves
- Crown or branch dieback
- Early fruit drop
- Epicormic shoots
- Woodpecker holes and scratching



Pest Identification



A Family of Killers



Life Cycle

Worm-like larvae hatch from the eggs and eat their way through the bark of host trees, creating tunnels called **larval galleries**. These galleries block the tree's movement of food water so the tree eventually starves to death.



The larvae grow into pupae, then adult beetles and exit the bark of the tree through a **D-shaped exit hole.**



The adults fly, feeding on trees' leaves and looking for a mate. A mated female lays her eggs on the bark of a **host tree.**







Identifying a pest: Gold spotted oak borer (*Agrilus auroguttatus*)

- Hosts: oaks and beech; prefers red oaks
- Native to Arizona; invaded California in 2004
- Description:
  - Bullet-shaped, dark body
  - Six gold spots on wing covers
- Larvae have bulbous head with hardened mandibles
- Signs of infestation:
  - Adults feed on leaves
  - Larval galleries
  - D-shaped exit holes



Identifying a pest:
Oak splendor beetle
(*Agrilus biguttatus*)

- Hosts: oaks and beech
- Native to UK; not currently found in US
- Description:
  - Bullet-shaped, metallic green body
  - Pair of white spots on inside edge of wing covers
- Segmented larvae
- Signs of infestation:
  - Adults feed on leaves
  - Larval galleries
  - D-shaped exit holes



Identifying a pest: Emerald ash borer (*Agrilus glabripennis*)

- Host: ash
- Native to Asia; found in NC and GA in 2013!
- Description:
  - Bullet-shaped, metallic green body
  - Reddish-purple abdomen under wing covers
- Segmented larvae
- Signs of infestation:
  - Adults feed on leaves
  - Larval galleries
  - D-shaped exit holes

A Sticky Situation





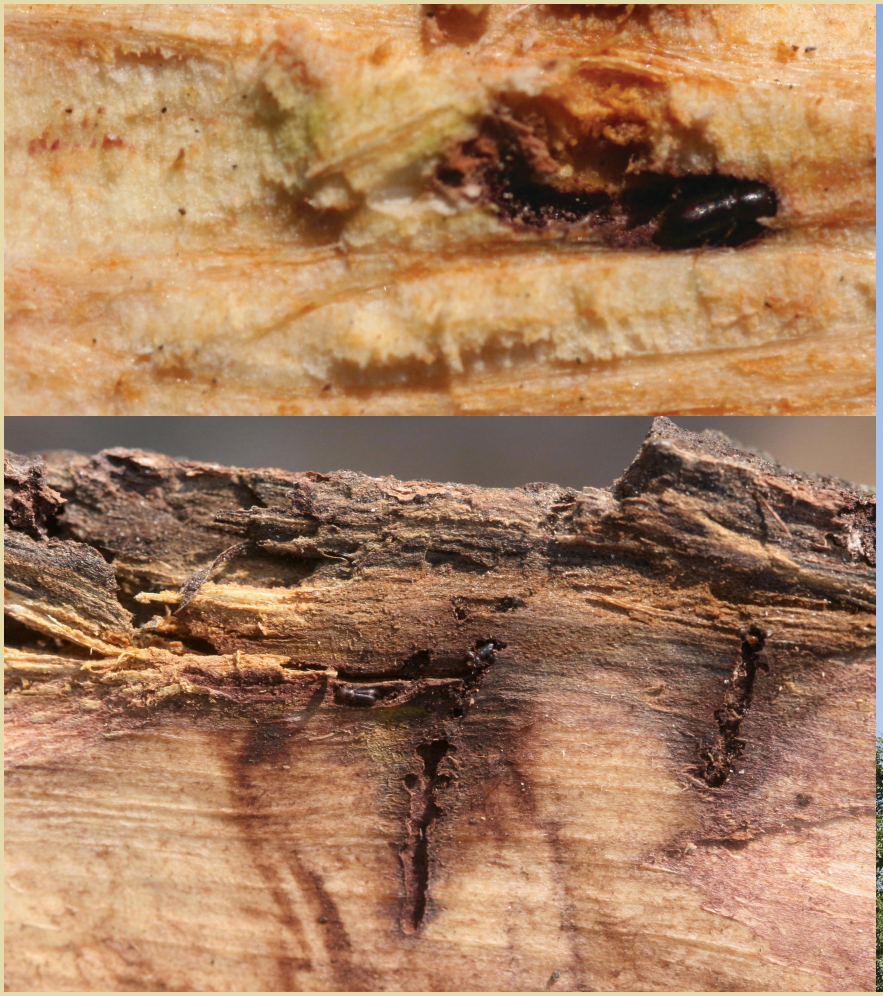




Identifying a pest: Asian longhorned beetle (*Anoplophora glabripennis*)

- Hosts: maple, buckeye, and birch
- Native to Asia; have invaded Chicago and NY
- Description:
  - Large, spotted beetle
  - Striped antennae, longer than body length
  - Bluish white legs
- Segmented larvae
- Signs of infestation:
  - Adults feed on leaves
  - Wide larval galleries
  - Large, round exit holes and frass
  - Shallow oviposit sites

A Vector for Disease







Identifying a pest: Walnut twig beetle (*Pityophthorus juglandis*)

- Host: black walnut
- Native to Arizona; found in NC, TN, VA!
- Description:
  - Brownish red with hairs
  - Smaller than a grain of rice
- Signs of infestation:
  - Pinprick holes on small twigs
  - Larval galleries
  - Cankers just under the surface of the bark


JUNIOR
INVASIVE
INSPECTORS

Photo Sources

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