Office of the
State Entomologist

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"Invade it!" curriculum by: Blake Newton
blaken@uky.edu

The Buzz on BUGS

Invasive insects in the Bluegrass

Activities for entomologists ages 9-14

A note for educators and parents

This activity book was designed for kids approximately ages 9-14, but younger kids in that age group may need a little help from you! Most of the information needed to complete the various activities is located in the book.

Kentucky Keepers website and resources link:
https://entomology.ca.uky.edu/kykeepersresources

Facebook:
Kentucky Office of the State Entomologist
Kentucky Bugs

INVADE IT! Lesson Plan
Located in the latter half of the book is a complete, two-part lesson plan called Invade It. It is designed to be given to kids who can complete it on their own or with help from others. This lesson plan is aligned with Next Generation Science Standards (NGSS) and is also formatted with simple black-and-white artwork to facilitate easy copying. If you would like to print additional copies, you can find the free PDF at the website listed above. Also on that website is a link to a video "instructor's guide" to the lesson plan, which includes answers for all the questions.

Become a Kentucky Keeper!
If you are a formal or nonformal educator or a parent, you can become certified as a "Kentucky Keeper." This online, 6-hour certification program gives you the tools to teach Kentucky youth about invasive species and how to slow their spread. To learn more about this certification program and to get started learning, visit the link above.


CERTIFICATE OF COMPLETION

The Kentucky Office of the State Entomologist and The University of Kentucky Department of Entomology recognizes

4-H Staff or Volunteer

as a

Kentucky Keeper

This individual has completed the Kentucky Keeper certification program and is hereby certified to instruct other Kentuckians about the importance of invasive arthropods and how to slow their spread.

Department of Entomology

Office of the State Entomologist

Share Your Invasion!
When the kids that you work with complete parts of this book (especially when they color pages or create drawings), send us a digital image to blaken@uky.edu and we'll post it on one of our social media pages!

WHOA!!

Did you know that insects are **older than DINOSAURS**?!

The first group of insects emerged about 480 million years ago, but the insects we see today are very different from the ones back then. Insects develop through a process called **evolution**.

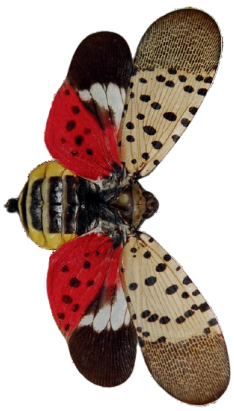
Evolution is how plants, animals, and other living things change over a very long time. These changes help living things survive and thrive in their **environment**, or the place they live.

We can identify insects by their **species**. A species is a group of living things that are the same in many ways. They can have babies that grow up to be like them.

Different insect species live in different parts of the world. Occasionally, though, an insect can make a home in a new place that is very far from where it used to live. When this happens, things get tricky!

In Kentucky, there are some insects that don't belong here and they cause problems. These are called **exotic** or **invasive** insects. They eat crops we grow for food or harm the trees in our forests.

This activity book will teach you all about invasive insects here in Kentucky. Some of them might even be in your own backyard! If you track them down, you'll help protect our crops and forests. You can make a difference!



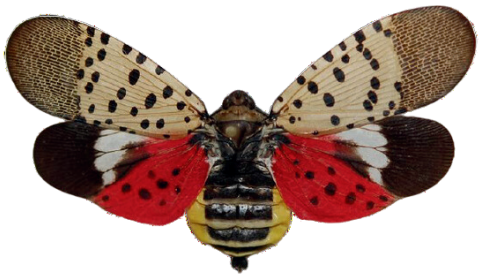
FUN FACTS ABOUT INSECTS

- All insects have:
  - 3 body parts: head, thorax, and abdomen
  - 1 pair of antennae
  - 6 legs
- The number of insect species worldwide is thought to be between 6 and 10 million.
- Insect poop is called frass. Eww!
- If a flea were a human, it could jump over a 480-foot-tall building.
- Some cicadas can make sounds at nearly 120 decibels. That's as loud as a nearby thunderclap!
- Insects do not breathe through their mouth or nose, but through special holes in their body called spiracles.
- Bees are found on every continent except Antarctica.
- Dragonflies are estimated to have been on earth for 300 million years.
- A bee's wings beat 190 times in a second. That's 11,400 times in a minute.
- Monarch butterflies are toxic to birds because, as caterpillars, they feed on milkweed plants.
- Male mosquitoes do not bite; so when you get a mosquito bite, it is from a female.
- Some aphids give birth to live young.
- It is estimated that for every human in the world, there are 1.4 million ants.
- Insect and human eyes see colors differently. For instance, an insect cannot see the color red.
- Flies have sticky pads on their feet that allow them to walk on walls and ceilings.

UNWANTED KY INVADERS!

Some of the invasive insects mentioned in this book are more likely to be seen than others. If you think that you see any of the ones listed in this book (especially the ones listed on this page) you can report them to the Kentucky Office of the State Entomologist by taking a digital picture of the creature and sending it to **ReportAPest@uky.edu**. Include in your email the date and location where the creature was found in Kentucky.

IMPORTED FIRE ANT (IFA)



SPOTTED LANTERFLY (SLF)

ASIAN LONGHORNED BEETLE (ALB)

ReportAPest@uky.edu

MAJOR INVASIVE INSECTS

larva

adult

Asian longhorned beetle (ALB)

- Attacks hardwood trees such as maple and elm.
- Grows inside trees and feed on the living tissues that carry nutrients.
- ALB has not been found in KY

caterpillar

adult male

adult female

Spongy moth

- Can defoliate 300 species of trees and shrubs.
- Currently established in 21 states, but hasn't made it to KY.

larva

adult

Emerald ash borer (EAB)

- As of 2024, EAB has been found in 36 states and has killed millions of ash trees!
- It can be found in almost all of the 120 counties in KY.
- Known as a "jewel beetle" because of its shimmering colors.

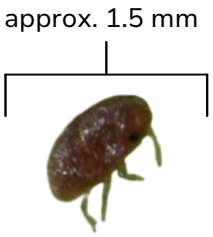
nymphs

adult

Spotted lanternfly

- Feeds on grapes, tree fruits, and hardwood trees.
- First found in PA in 2014.
- Populations have now spread to 17 states, recently including KY.

MAJOR INVASIVE INSECTS



nymph

adults

Hemlock woolly adelgid (HWA)

- A tiny soft-bodied insect that attacks hemlock trees.
- First detected in KY in 2006.
- The white "wool" on hemlock shoots is actually wax secreted by HWA for protection.

Mediterranean

Mexican

Oriental

Fruit flies

- Cause damage to many types of fruits and vegetables, especially citrus crops.
- Able to spread quickly in new habitats.

caterpillar

adult

European grapevine moth

- Eats grape flowers, grapes, berries, and other berry-like fruits.
- Its native habitat is Italy, a country filled with large vineyards.
- So far, it has only been found in one US state: CA.

larvae

adult

Imported fire ant (IFA)

- IFAs are related to bees and wasps and can sting repeatedly, causing painful bumps on the skin.
- This pest is currently established in 18 US states.
- Established in southeastern KY in 2022.

MOST BUGS ARE GOOD!

lady beetle

lady beetle larva

green lacewing larva

It's true, there are some insects that really "bug" us. These types of insects are called **pests**.

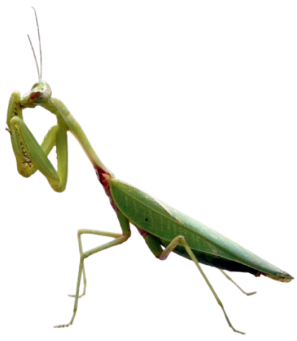
Pests cause problems for plants. They might eat the leaves, roots, or fruits, making it hard for plants to grow strong and healthy. Just like how we don't like bugs biting us, plants don't like insect pests munching on them!

BUT... not all insects are pests! In fact, only 1-3% of the over 1 million named insect species are considered pests. There are many insects actually help us defend against pests. We call these insects **beneficial**.

One well-known beneficial insect is the **lady beetle**, or **ladybug**. Although they may not look like it, these little beetles are fierce **predators**, meaning they're a bug that eats other bugs. Beneficial insects eat pests, and then pests don't eat plants! Just like how a superhero saves the day, insect predators help keep our plants safe and healthy.

assassin bug

parasitoid wasp



praying mantis

BECOME A CITIZEN SCIENTIST!

If you enjoy exploring nature, hiking, or even just relaxing in your own backyard, you can become a citizen scientist! Extension professionals and entomologists alike have known for years that YOU, the public, are usually the first to find invasive pests. Your involvement is vital in our survey work! You can help us slow the spread of invasive species.

What is CITIZEN SCIENCE?

Citizen science is when the public voluntarily helps conduct scientific research. The data they collect helps professional scientists and resource managers answer specific questions and solve important problems. It also helps citizens like you learn more about science... which is pretty cool.

Anyone can be a citizen scientist, regardless of where they're from. It doesn't matter how old you are or what your background is. All it takes is some time, curiosity, and a sense of wonder.

What can you do as a citizen scientist? Most likely, you'll collect data and upload it into a database. In some cases, you can explore, graph, and even analyze data. In ALL cases, you will learn and experience real science - and you'll do it in the places you love! You can help us slow the spread of unwanted pests one site at a time!

Curious about the program?

Scan the QR code above
OR visit https://ose-uky-edu.hub.arcgis.com/pages/citizen-scientist
to get started!

OUTDOOR ADVENTURE: LOCAL TREE ID

Kentucky is home to over 300 native species of trees as well as around 145 invasive tree species. A tree species is considered **native** if it has always lived in a certain place. For example, trees that are native to Kentucky have always lived in Kentucky. On the other hand, **invasive** species were brought here from somewhere else.

Visit your backyard or other green spaces close to where you live. Choose a tree you like, find a leaf from that tree, and sketch it below. You'll use this to help identify your tree.

Kentucky Coffee Tree
Native

Tulip Poplar
Native

Tree of Heaven
Invasive

Sugar Maple
Native

Bradford Pear
Invasive

Mimosa Tree
Invasive

Black Walnut
Native

American Sycamore
Native

Black Locust
Invasive

Eastern Red Cedar
Native

Pin Oak
Native

Cucumber Magnolia
Native

Draw your tree's leaf:

My tree's species is:

_____

This species is (circle one):
NATIVE INVASIVE

ADOPT-A-TREE

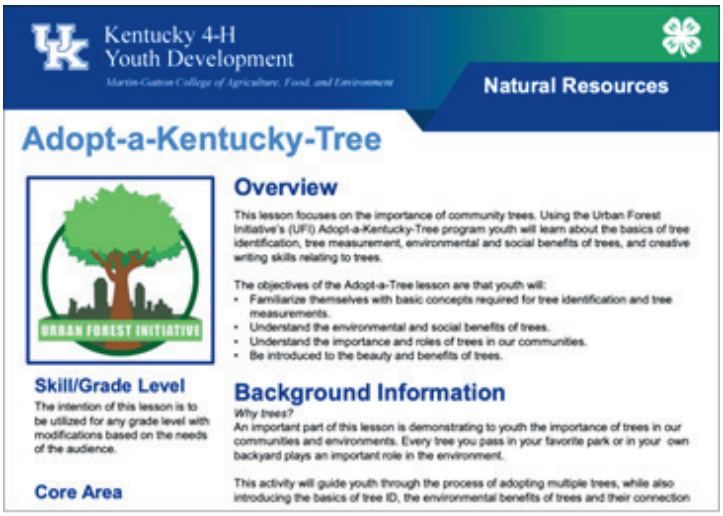
Is there a tree that you walk past everyday, or one that you've sat under to enjoy a picnic? Maybe you know of one that is home to a nest of birds or other interesting creatures.

GET STARTED! Adopt-A-Tree by visiting the Urban Forest Initiative (UFI) submission form:

https://ufi.ca.uky.edu/adopt-a-tree

Adopting a tree acknowledges that particular tree has enhanced your quality of life. Participating in this program gives you the opportunity to join a community of tree stewards around Kentucky and beyond, who recognize the benefits and beauty that trees provide us. Adopting a tree is also a way to explore nature in your neighborhood, play outside, and learn interesting things about ecosystems.

Why should you adopt a tree? For one, it's a fun group activity! You'll also learn about the benefits trees provide. There are a lot! Most importantly, you'll be protecting the greenspaces around you. That makes you a steward of the environment AND the community!


Kentucky 4-H Youth Development
Martin-Gatton College of Agriculture, Food and Environment
Natural Resources

Adopt-a-Kentucky-Tree

URBAN FOREST INITIATIVE

Overview

This lesson focuses on the importance of community trees. Using the Urban Forest Initiative's (UFI) Adopt-a-Kentucky-Tree program youth will learn about the basics of tree identification, tree measurement, environmental and social benefits of trees, and creative writing skills relating to trees.

The objectives of the Adopt-a-Tree lesson are that youth will:
- Familiarize themselves with basic concepts required for tree identification and tree measurements.
- Understand the environmental and social benefits of trees.
- Understand the importance and roles of trees in our communities.
- Be introduced to the beauty and benefits of trees.

Skill/Grade Level

The intention of this lesson is to be utilized for any grade level with modifications based on the needs of the audience.

Background Information

Why trees?
An important part of this lesson is demonstrating to youth the importance of trees in our communities and environments. Every tree you pass in your favorite park or in your own backyard plays an important role in the environment.

This activity will guide youth through the process of adopting multiple trees, while also introducing the basics of tree ID, the environmental benefits of trees and their connection

Core Area

Adopt-A-Tree 4-H Project Book

Want to learn even more about trees? The 4-H "Adopt-a-Tree" project is part of the UK Cooperative Extension Service and Kentucky 4-H Youth Development Program. It engages youths in adopting trees and provides step-by-step instructions along the way. Learn more about the Adopt-A-Tree project at your local extension office, or here on the web: **https://forestry.ca.uky.edu/sites/forestry.ca.uky.edu/files/AdoptaTree.pdf**

UFI Tree Library

Do you need a project for a class or some other program? How about marking the tree species along a local trail or sidewalk? Download free visual signs (PDF) for different tree species from the Urban Forest Initiative (UFI) Tree Library from **https://ufi.ca.uky.edu/treelibrary**.


You found an **Eastern hemlock!**

Learn more!

Scientific name: *Tsuga canadensis*

The **longest living** tree in the Eastern U.S., well over 500 years

Leaves are flat needles

The **hemlock wooly adelgid** (HWA) is an invasive insect that feed on the sap of the tree, eventually killing it

Many species of **animals** rely on hemlocks for **shelter**

Use the signs to create your own educational tree walk by printing and placing them next to trees. These signs can be printed on paper and posted temporarily, or put onto permanent signs.

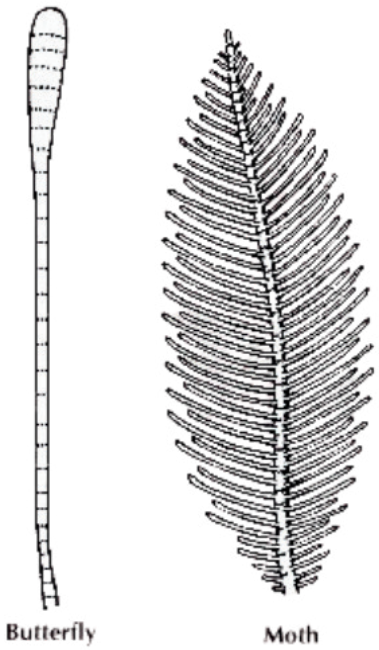
Adopt-A-Tree and the Tree Library are a part of the Urban Forest Initiative:

Urban Forest Initiative (UFI)
University of Kentucky
Web: https://ufi.ca.uky.edu/
Mail: ufi@uky.edu

URBAN FOREST INITIATIVE

ANTENNAE: WHAT'S THE DEAL?

Photo: Rebekah D. Wallace, University of Georgia, Bugwood.org

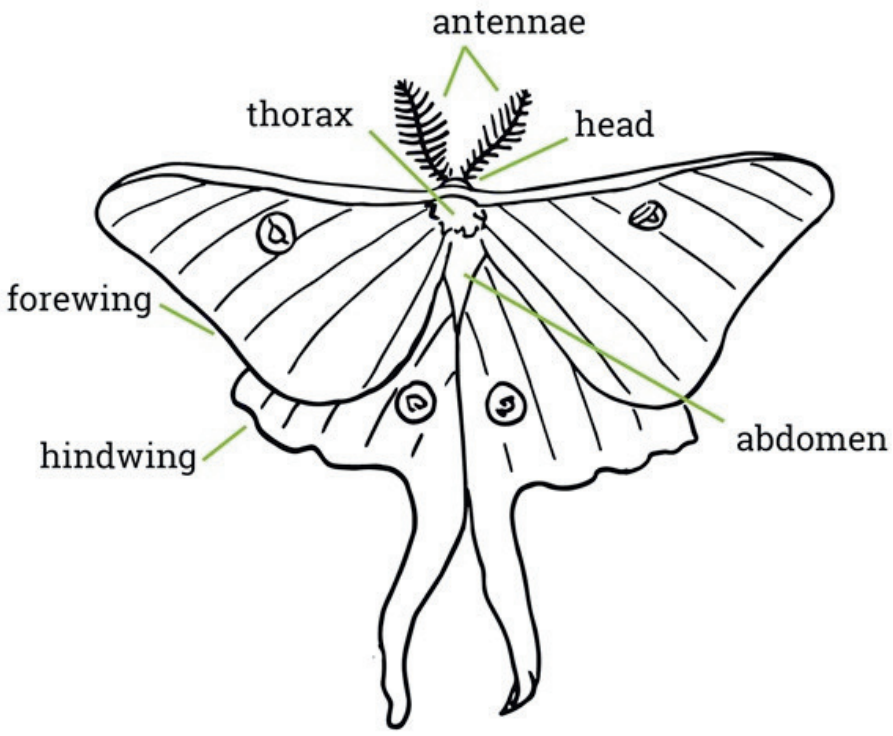


Although butterflies and moths look similar, they are different in many ways! One main difference is their **antennae**.

Butterflies have thin, skinny antennae that look like little clubs. These antennas help them smell things and keep their balance.

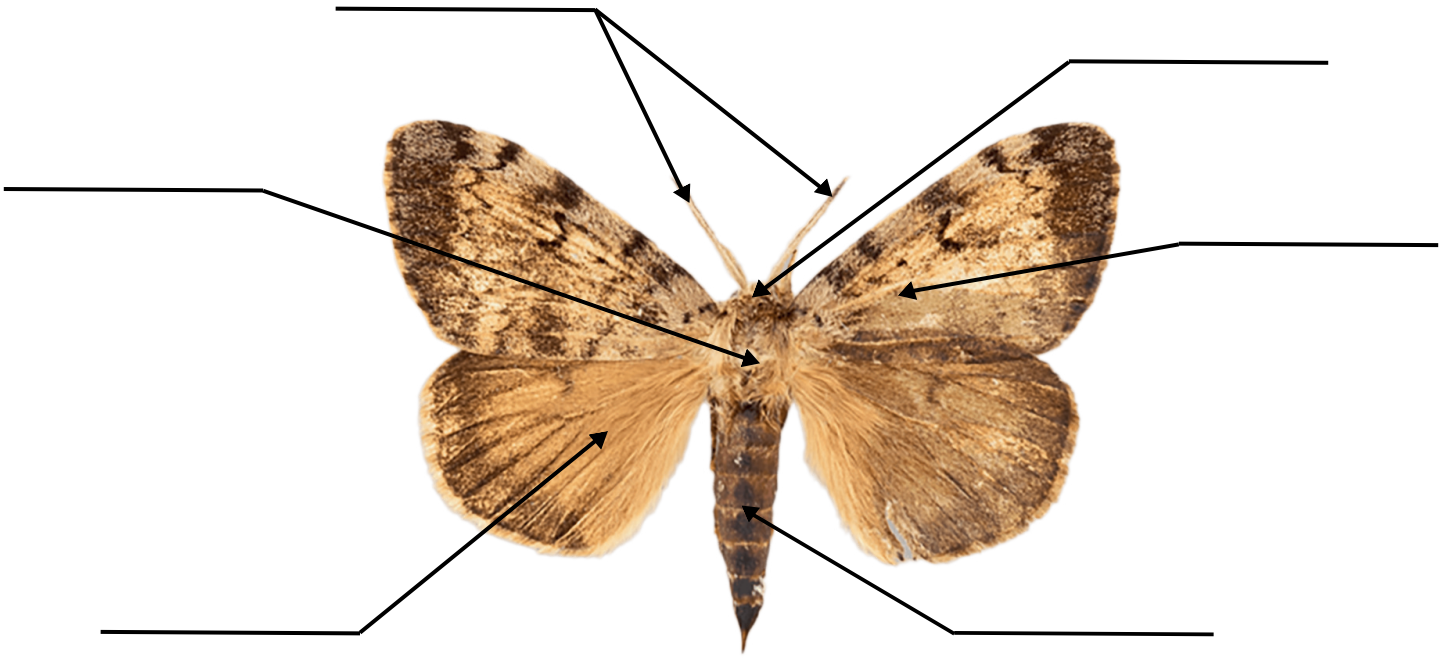
Moths have antennae that look like tiny combs or feathers. Like butterflies, they use their antennae to find their way around. Moths also use their antennae to smell food and find mates. Their sense of smell is very strong. Some male moths can smell a female moth from over six miles away!

Luna moth (*Actias luna*)



Each part of a moth has a name! Although there are at least 160,000 different species of moths, they all share similar **anatomy**, or body parts. Using the diagram of the luna moth above, label the parts of the spongy moth below.

Spongy moth (*Lymantria dispar*)

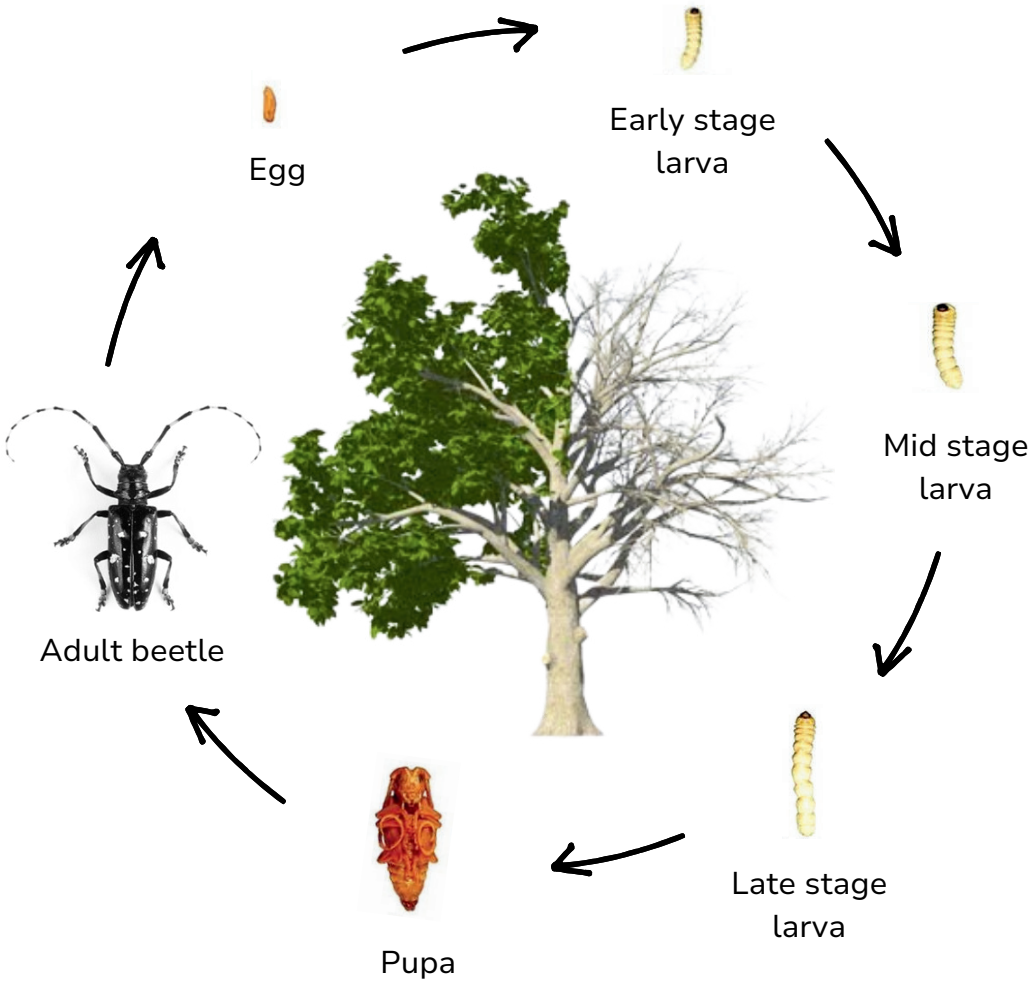


Drawing courtesy of Chiara Jeanfils, Friends of Acadia, NPS

LIFE CYCLE OF THE ASIAN LONGHORNED BEETLE

The Asian longhorned beetle (ALB) completes its life cycle inside a tree!

ALB starts as a tiny **egg** on a tree trunk. Then, the egg hatches into a small white worm called a **larva**. The larva eats the wood of the tree creating a tunnel, then goes inside and grows bigger. Next, it changes into a **pupa** where it rests and develops. After some time, the pupa turns into an **adult** beetle. The adult beetle chews its way out of the tree and flies to new trees. The life cycle keeps going when the beetle lays new eggs.



ALBs feed on living tissues inside the tree, causing damage the tree cannot heal from. Eventually, the tree will die. This is bad! Trees are very important parts of nature, providing food and shelter to many living things. They also help keep our air clean.

We have to do everything we can to preserve our trees and forests!

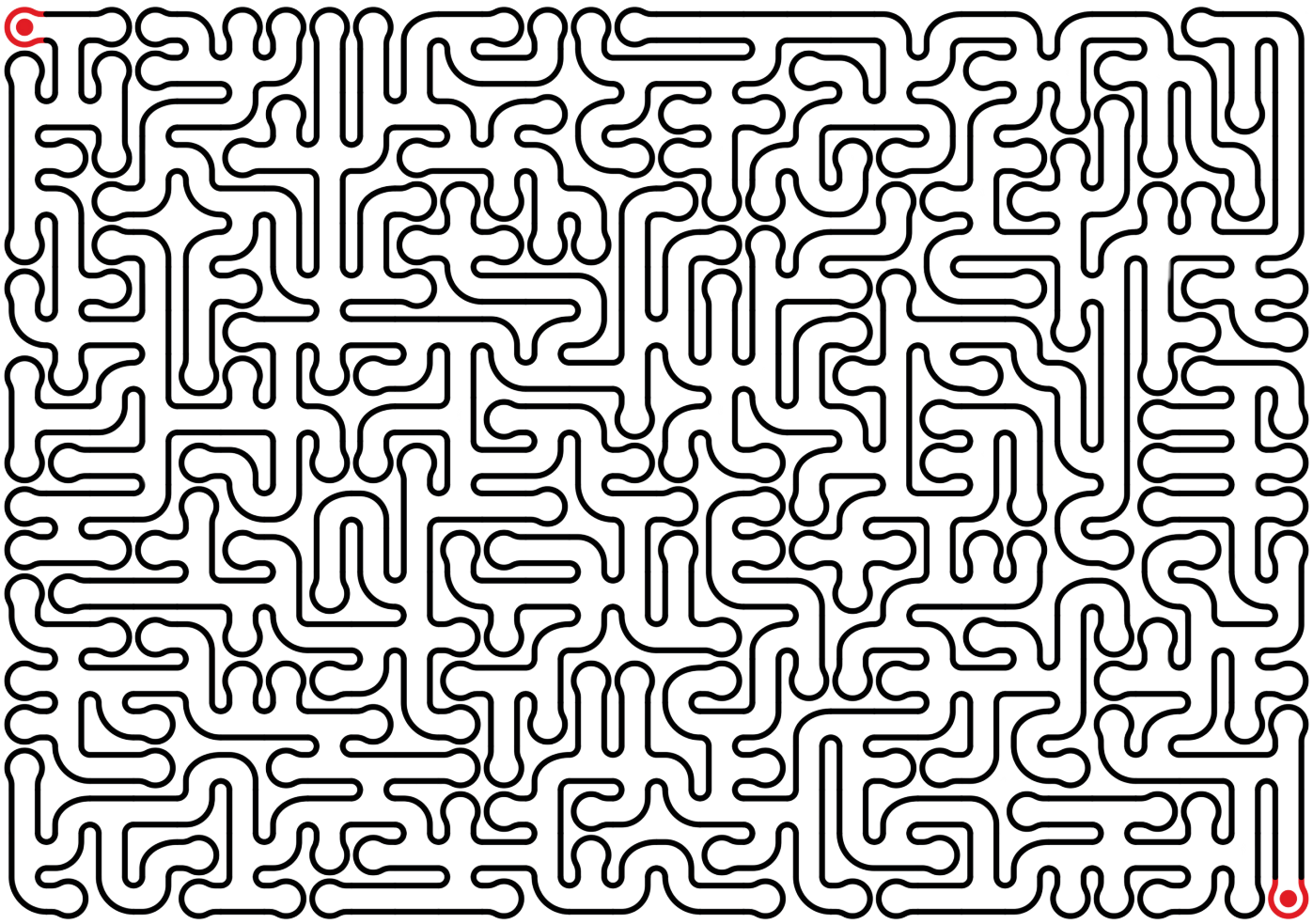
Diagram: Michael Bohne, University of Vermont, Bugwood.org

EMERALD ASH BORER GALLERY MAZE

The emerald ash borer (EAB) is a bright green beetle that feeds on ash trees. It's an invasive species native to northeast Asia.

EABs lay eggs on trees. When the larvae hatch, they bore inside the tree just under the bark. As they eat, they make squiggly tunnels called **galleries**. These galleries stop the tree from getting water and nutrients, which can make the tree very sick or even die. That's why we need to do all we can to stop EAB from spreading!

Make your way through the maze below and see just how complex EAB galleries can be!



Photos: (tree) Eric R. Day, Virginia Polytechnic Institute and State University, Bugwood.org;
(EAB) Leah Bauer, USDA Forest Service Northern Research Station, Bugwood.org

STOP BEETLES, SAVE TREES!

S T V D E T O A M E D B S G S R E U
G A S A E B U A I S E T E G A M A D
I A E C C I P N N T T U C M N M E A
I E I I O E O O O P E S T A G O R G
T A D G E P R S R V C V G D I T E O
T S B L S G U E I S T S L S L D V G
C N A L A G V S O L I M H U P S M A
I R N P B E A V B V V G D U P O P W
A U N R N V E L E S E A A T E I T U
G A E T N V A E I E P A M I S E E S
A T U I A N B E T U T E A S T L X T
L M E T A M O R P H O S I S S O O N
L V D E S E T C E A E P W E E R T E
E E N T O M O L O G I S T A L E I I
R E T L S L E L A R V A V I T O C R
I A I S T T S M E E I T E U E E A T
E A A A O O W G P S T T S M E T R U
S O V E I N A O A O D I U N B L U N

The Asian long horned beetle (**ALB**) and the Emerald ash borer (**EAB**) are **beetles** from the continent of **Asia**. Since they're not from North America, we call them **exotic**. These **pests** move quickly through places once they're introduced. That's why we consider them **invasive**.

All beetles go through complete **metamorphosis**. This means they transition from an **egg**, to a **larva**, to a **pupa**, and finally to an **adult** phase.

The larvae of both beetles cause serious **damage** to trees by creating **galleries** inside them, which **prevent** the tree from taking in any **water** or **nutrients**. Larvae are safe in the galleries and able to grow. Then, adult beetles cause **minor** damage as they exit the tree.

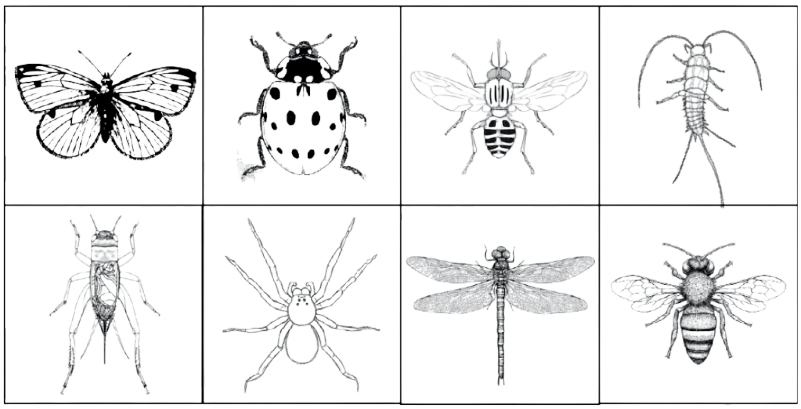
Everyone can be a pest **detective**! If you think you may have seen ALB or EAB, take a picture and email us at ReportAPest@uky.edu. That's the email for the Office of the State **Entomologist**. We work with the **USDA** to try and detect exotic pests as early as possible. Help us spread the word!

INSECT IDENTIFICATION: DICHOTOMOUS KEY

Key and worksheet: https://www.studocu.com/

Scientists use dichotomous keys to help identify plants and animals. A **dichotomous key** is a series of YES or NO questions that we can answer by observing characteristics of living things until we have narrowed down its identity.

Choose a creature pictured below. Beginning with question 1, observe the creature and answer the question. Continue following along until you have successfully identified it. You can write its name next to its picture.



1. Does the creature have 6 legs?
a. Yes.....go to step 2
b. No.....**Not an insect**

2. Does the insect have wings?
a. Yes.....go to step 3
b. No.....**Silverfish (Zygentoma)**

3. Does the insect have parallel wings? (wings that don't stick out to the side)
a. Yes.....go to step 4
b. No.....go to step 5

4. Does the insect have a parallel line down the back that divides the wings?
a. Yes.....**Beetle (Coleoptera)**
b. No .....**Grasshopper or cricket (Orthoptera)**

5. Does the insect have 4 total wings?
a. Yes.....go to step 6
b. No.....**Fly (Diptera)**

6. Does the insect have long antennae?
a. Yes.....go to step 7
b. No.....**Dragonfly (Odonata)**

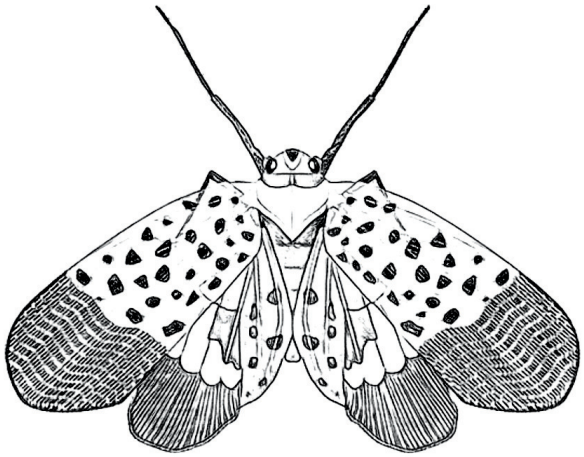
7. Does the insect have a small body with large fan–shaped wings?
a. Yes.....**Butterfly or moth (Lepidoptera)**
b. No.....**Wasp, bee, or ant (Hymenoptera)**

SPOTTED LANTERN... FLY?

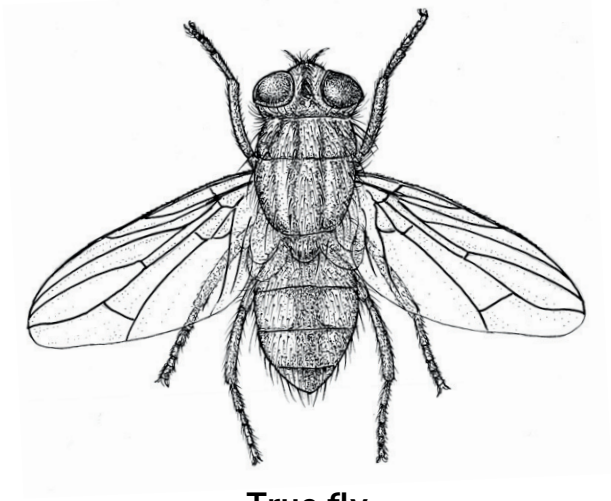
The spotted lanternfly isn't actually a fly at all! Flies have two wings, but the spotted lanternfly has four wings. That's one reason why it's not a true fly!

Flies and spotted lanternflies also have different patterns on their wings and body. If you look very closely, you'll be able to see the differences!

Study the pictures on the next page. Using the key below, can you tell the difference between a spotted lanternfly and a true fly?



Spotted lanternfly



True fly

- Four wings
- Hops and glides more than flying long distances
- Has a long tube-like mouth resembling a tube or straw
- Feeds on plant sap, or the liquid inside plants
- Short, orange antennae that are often mistaken for eyes
- Small, compound eyes on the sides of its head

- Two wings
- Flies quickly and smoothly over long distances
- Has sponge-like mouthparts to absorb liquids, or sharp mouthparts for piercing
- Eats sugary liquids, fruits, or sometimes blood!
- Some have short, bristle-like antennae while others are long and segmented
- Large, compound eyes that provide a wide field of vision

TRUE FLY OR LANTERNFLY?

Lawrence Barringer, Pennsylvania Department of Agriculture, Bugwood.org

1. _____

Pest and Diseases Image Library , Bugwood.org

2. _____

Paul Langlois, USDA APHIS PPQ, Bugwood.org

3. _____

Rebekah D. Wallace, University of Georgia, Bugwood.org

4. _____

Rebekah D. Wallace, University of Georgia, Bugwood.org

5. _____

Whitney Cranshaw, Colorado State University, Bugwood.org

6. _____

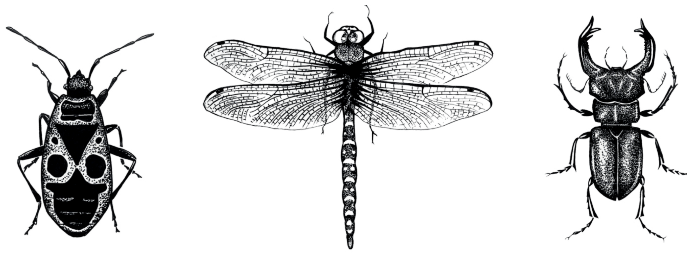
MAPPING SPECIES RICHNESS

Activity modeled after “Making Species Maps” at www.sciencebuddies.org

How do conservation biologists know which places are important to protect? How do nature guides know which animals can be found in which places? In this activity you can discover how maps can be used to show how different animals are distributed in a local environment.

DO SCIENCE!

- **Choose a local observation site. It should be a place where you think you might find a diverse group of organisms including plants, birds, and insects. Good places to choose are:**
  - **a backyard**
  - **community garden**
  - **open field**
  - **park**
  - **pond, lake, or stream**
  - **wooded area**



- Draw a map of your location on a piece of plain white paper. Include noticeable landmarks such as large trees, rocks, or bodies of water.
- **Explore your observation site. Look at any interesting plant life and notice the birds in the trees. Carefully pick up or dig under rocks with a shovel. Use a magnifying glass to examine small organisms.**
- Mark the location of each organism you observe on the map you created. Use a different color for each organism and remember to include a color key, or legend. Assemble the information into a large map that includes all of your data.
- **Next, write down some notes about each organism: what it looks like, where you saw it, and what you think it is. Don't worry if you can't identify something right away, if you write it down and take a picture, you can figure out what it is later.**
- When you are done, you will have a notebook full of different organisms, some pictures, their locations and distributions, and some notes and information about them.

MAPPING SPECIES RICHNESS

1. How many different species were in your location?

2. Which areas of your observation site had the most different kinds of species?

3. Are there areas with invasive species on your map?

4. Are there any interesting native species on your map?

5. Can you think of a project to invite more native species in your project area?

6. Share your map with others! Email a picture or PDF of your map to **sarah.clark@uky.edu** and we will share it on the Office of the State Entomologist Facebook page!

INVASIVE SPECIES SCAVENGER HUNT

Not all invasive species are insects. An **invasive species** is any creature or plant that causes problems in an area where it is not supposed to live. In Kentucky, invasive species are all around us. The animals and plants shown below can be invasive species in some situations. Which ones can you find around your home or neighborhood? Ask adults or use other resources to figure out what problems they cause and how you can help. Can you find out where they came from originally, and how they got to Kentucky?

BUSH HONEYSUCKLE

Problems caused by bush honeysuckle:

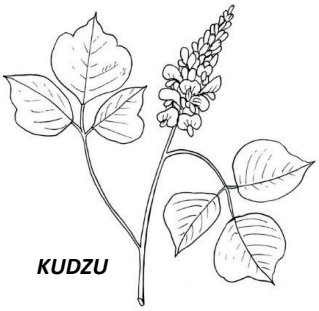
How did it get here?

What can I do?

Problems caused by kudzu:

How did it get here?

What can I do?



KUDZU

Problems caused by invasive carp:

How did they get here?

What can I do?

INVASIVE CARP

Problems caused by European starlings:

How did they get here?

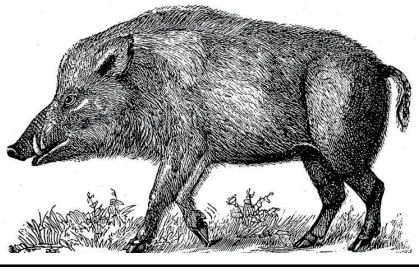
What can I do?

EUROPEAN STARLING

Problems caused by feral pigs:

How did they get here?

What can I do?



FERAL PIG

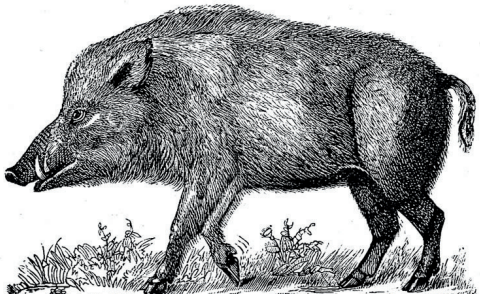
INVASIVE SPECIES SCAVENGER HUNT - DISCUSSION

BUSH HONEYSUCKLE can be found in many Kentucky neighborhoods, especially along fence rows and streams. Honeysuckle harms the environment by stealing space and sunlight from native plants. It grows fast and soon takes over areas. Because of its fast growth and attractive appearance, bush honeysuckle was planted exclusively in the USA in the previous century, before its problems became apparent. It is originally from Asia and Europe. People can help by finding bush honeysuckle in their yards and removing all traces of it.

INVASIVE CARP (bighead carp, black carp, grass carp, and silver carp) originating from Asia are collectively known as Asian carp or invasive carp. These fish were imported into the US for use in aquaculture ponds, but found their way to the Mississippi River system through flooding and accidental releases. These invasive carp species are causing issues in the Mississippi River and can be found in both Kentucky Lake and Lake Barkley. Asian carp are fast-growing, prolific feeders that out-compete native fish, leaving a trail of environmental destruction in their wake. They have no natural predators and females can produce up to one million eggs annually.

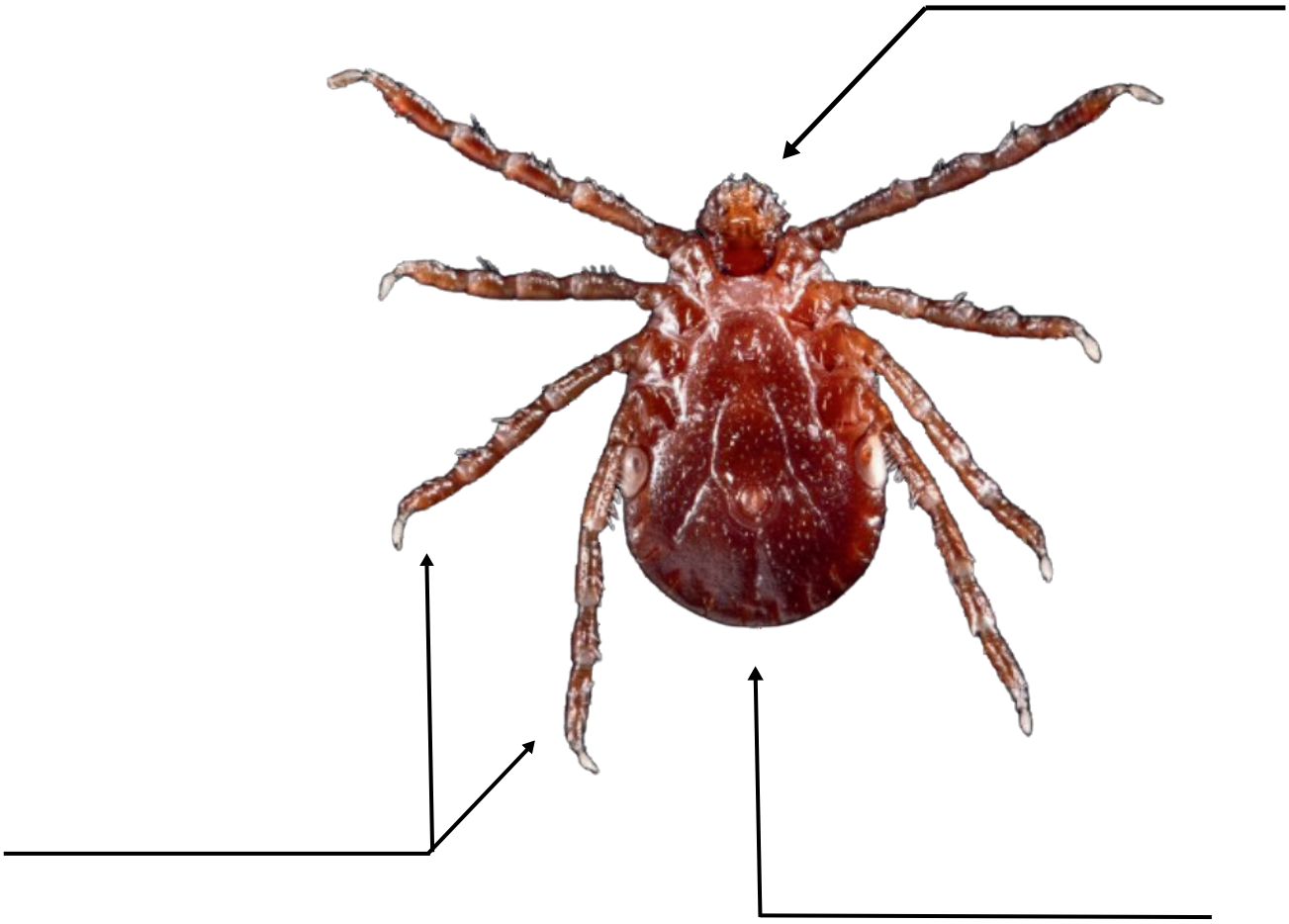
EUROPEAN STARLINGS are commonly seen flying in massive flocks in Kentucky, especially in the fall and winter when northern populations move into our area. Starlings cause many problems, including feeding on crops and out-competing native birds for food and space. Starlings were first released in the US by Eugene Schieffelin in New York in the 1800s, who was reportedly interested in bringing all birds mentioned by Shakespeare here to the United States. Homeowners are urged to refrain from killing or poisoning starlings but can help by promoting native birds. One way to do this is by installing native wildflower gardens or bluebird houses.

KUDZU is one of the most notorious invasive plants. Kudzu is a fast-growing vine that takes over habitats by growing over the tops of native plants (including trees) and stealing sunlight from them, eventually killing almost all the plants around it. Kudzu is very common in southeastern Kentucky, but it is originally from Asia. It was planted extensively during the last century to control erosion and also as an ornamental plant. Homeowners can help by locating and removing any kudzu on their properties.



Familiar to Kentuckians in the western part of the state, **FERAL PIGS** are becoming a big problem in the US. Feral pigs occur any time that farm pigs escape into the wild and begin reproducing. Feral pigs are also sometimes released into an area on purpose for hunting opportunities. Feral pigs originated from domestic pigs, which were brought by colonists to North America during the colonial era and originated as wild boars in Europe. Feral pigs destroy crops and native trees, kill native and domesticated animals, and damage property. Kentuckians are urged NOT to hunt for feral pigs. Instead, report populations to the KY Dept of Fish & Wildlife Resources at 1-800-858-1549.

INVADING TICKS!



Many of Kentucky's invasive species are threats to native plants, but some can be threats to humans, livestock, and pets! Shown above is the **ASIAN LONGHORNED TICK**, a new tick species that was found in Kentucky in 2019. This tick is notable because it can clone itself! Asian longhorned ticks aren't known to carry diseases in the US, but other ticks can.

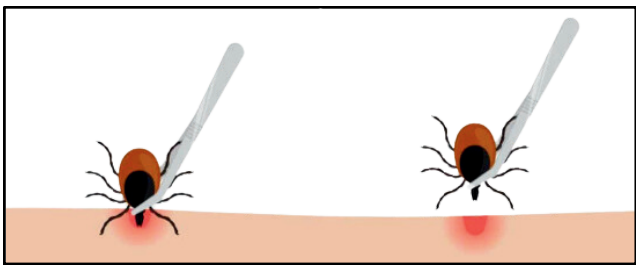
ALL tick encounters can be reduced by wearing tick repellants. Visit www.epa.gov/insect-repellents/find-repellent-right-you to find out more information!

In addition, hikers should do 'tick checks" once every few hours. They should also remove ticks with tweezers by grasping firmly just at the site of attachment (pictured right).

Label the tick parts - there are only 3!

- **Legs** (like spiders, ticks have 8 legs)
- **Abdomen**
- **Cephalothorax** (a tick's head and thorax are fused!)

TICK REMOVAL



INVADE IT!

The following section of this book is a set of questions and activities called INVADE IT! Complete the following activities to learn more about invasive insects in Kentucky.

WHAT YOU'LL NEED:

- Internet access
- Pen or pencil
- Scissors
- Glue or tape

I TOAD you that invasive species harm the environment!

HOP TO IT!

- Watch this video about voracious cane toads: https://www.youtube.com/watch?v=tuX5vgH-Rdo
- Turn to the next page and begin!

Parents and educators: INVADE IT is designed so that kids in grades 3-5 can complete it on their own, but they might need a little help! It can also be used as an in-class lesson. Feel free to copy and share it. You can also find the black-and-white PDF at: https://entomology.ca.uky.edu/kykeepersresources

INVADE IT addresses the following components of Next Generation Science Standards:

- 3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
- 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reprodution.

INVADE IT! PART 1

Read the info below, then complete the sections on this sheet and the following sheet.

READ IT!

What are invasive species?
Sometimes, animals or plants move from one part of the world to another. When this new plant or animal becomes a problem, it's called an invasive species. Invasive species sometimes move by accident. However, other times people move them on purpose (like cane toads!)

Invasive species often have a few of the following characteristics:

FAST REPRODUCTION: Invasive species often lay lots of eggs or make lots of seeds. Since local animals are not adapted to eating these new eggs or seeds, LOTS of invasive babies survive, causing the invasive species to move rapidly.

BIG EATERS & FAST GROWTH: Invasive species often eat a lot and grow quickly. Invasive plants may grow roots quickly, which can allow them to spread and take over other plants. Sometimes they grow OVER other plants.

TOXIC: Many invasive species have poisons inside them that kill animals who try to eat them; or they may have defenses like thorns, spines, or shells that protect them from predators.

DRAW IT!

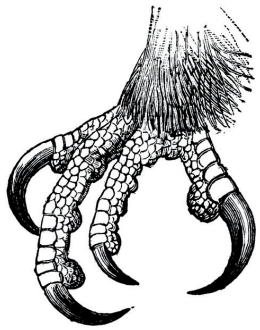
Below or on another sheet, draw a real animal or plant and change its body or behavior to make it better at invading new places (use the **WORD & PHRASE BANK** on the **RESOURCE PAGE** in the back of this book for ideas).

INVADE IT! PART 1

BRAINSTORM IT!

Explain how the structures or traits below might be adapted to help a species invade a new environment.

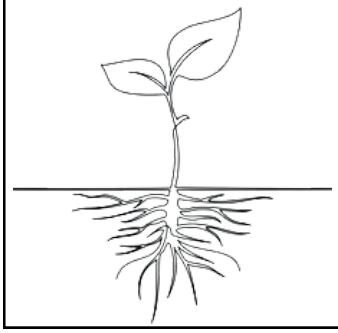
SHARP CLAWS:



SEEDS:

POISON OR VENOM:

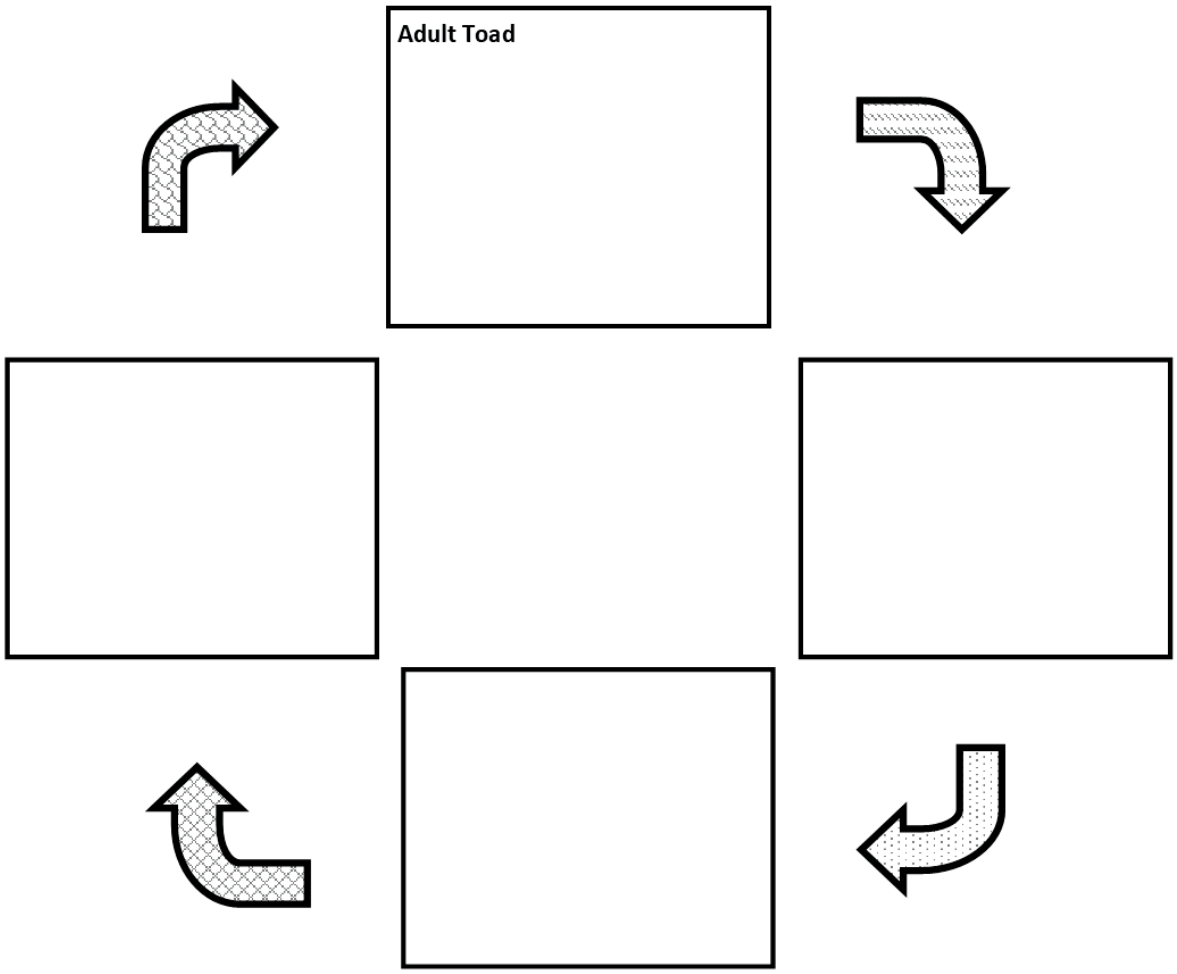
ROOTS:



INVADE IT! PART 1

LIVE IT!

Using the images from the **LIFE CYCLE** section of the **RESOURCE PAGE** in the back of this book, cut out the steps of the cane toad life cycle and glue or tape them into the cycle below. Make sure they are in order, with the adult toad at the top.



Pick one of the life stages above. Describe at least one adaptation of that life stage that helps the cane toad invade new environments:

INVADE IT! PART 1

Using the **RESOURCE PAGE**, complete the sections on this sheet and the following sheet.

ANSWER IT!

After watching the cane toad video, answer these questions:

1. Why were cane toads brought to Australia?

2. Which US state did Australians bring the cane toads from?

3. Name any one native Australian animal that is threatened by the cane toad.

4. What are at least two reasons why the cane toad is so “good” at being an invasive species?

From the cane toad video and from your own research and experience, name any 5 invasive species found anywhere in the world.

1.

2.

3.

4.

5.

INVADE IT! PART 2: KENTUCKY "KREEPERS"

Visit https://entomology.ca.uky.edu/content/invasive-species-4-h-ky-keepers and fill in the missing info on this page and the following pages about some of the invasive insect species that threaten Kentucky.

ASIAN LONGHORNED BEETLE

From:

Found in US (date):

In Kentucky yet?

Life cycle:

Main host plant(s): hardwood trees such as maple and birch

Cut out and attach a picture of the insect from the **KENTUCKY INVADERS** section of the **RESOURCE PAGE** in the back of this book.

PROBLEMS CAUSED BY ASIAN LONGHORNED BEETLE:

INVADE IT! PART 2: KENTUCKY "KREEPERS"

SPOTTED LANTERNFLY

From:

Found in US (date):

In Kentucky yet?

Life cycle:

Main host plant(s): tree of heaven, grapes, hops, fruit trees

Cut out and attach a picture of the insect from the **KENTUCKY INVADERS** section of the **RESOURCE PAGE** in the back of this book.

PROBLEMS CAUSED BY SPOTTED LANTERNFLY:

INVADE IT! PART 2: KENTUCKY "KREEPERS"

SPONGY MOTH

From:

Found in US (date):

In Kentucky yet?

Life cycle:

Main host plant(s): hardwood trees such as oak, birch, and maple

Cut out and attach a picture of the insect from the **KENTUCKY INVADERS** section of the **RESOURCE PAGE** in the back of this book.

PROBLEMS CAUSED BY SPONGY MOTH:

INVADE IT! PART 2: KENTUCKY "KREEPERS"

IMPORTED FIRE ANT

From:

Found in US (date):

In Kentucky yet?

Life cycle:

Cut out and attach a picture of the insect from the **KENTUCKY INVADERS** section of the **RESOURCE PAGE** in the back of this book.

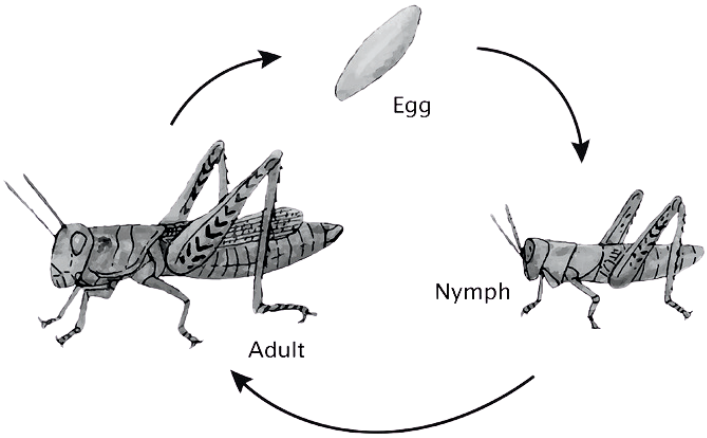
PROBLEMS CAUSED BY IMPORTED FIRE ANT:

LIFE CYCLES OF INSECTS

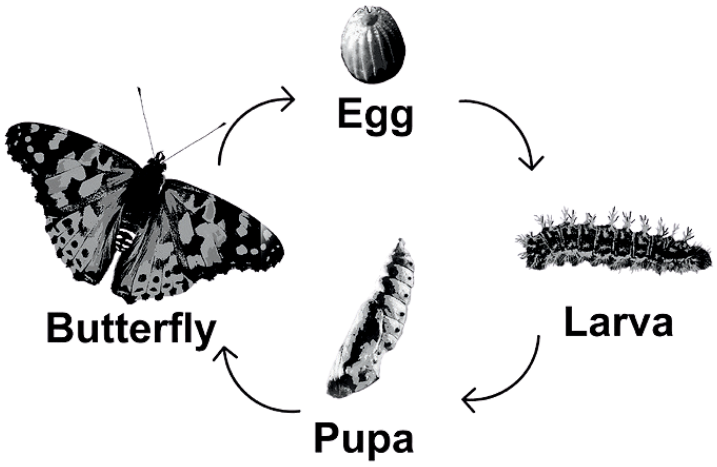
Invasive species, like all other insects, have **life cycles**. Many of the invasive species that threaten Kentucky are insects. You may already know this, but all insects have either **incomplete** or **complete** life cycles. Read about insect life cycles on this page, and then complete the next two pages.

INCOMPLETE LIFE CYCLE

Insects with incomplete life cycles don't change very much as they go from babies to adults. Insects with this life cycle have 3 main stages: egg, nymph, and adult. The nymphs look a lot like the adults except that they are smaller and don't have wings. They also can't lay eggs! Grasshoppers, crickets, roaches, walkingsticks, praying mantids, and many other insects have incomplete life cycles.



Grasshopper life cycle: https://naturalresources.extension.iastate.edu/files/page/images/iowas_nature_metamorphosis_two_striped_grasshopper_melanopus_bivittatus.png



COMPLETE LIFE CYCLE

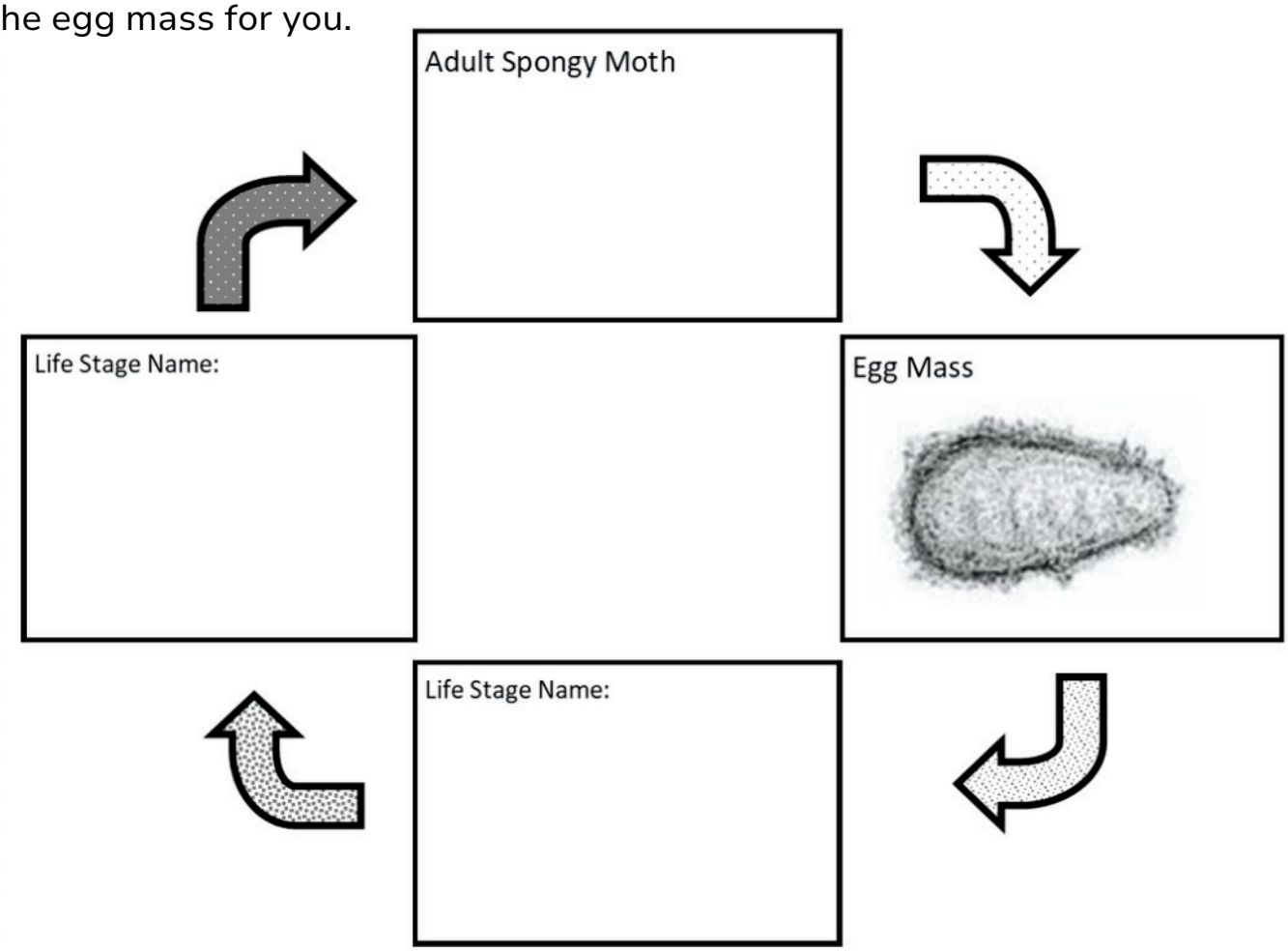
Insects with a complete life cycle <u>completely</u> change form when they go from babies to adults. They do this inside a pupa or cocoon stage where their body liquifies and reforms into a totally new shape! Insects with this life cycle have 4 main stages: egg, larva, pupa, and adult. Sometimes the larvae have other names, like caterpillars or maggots. All butterflies, moths, beetles, ants, bees, wasps, and flies have complete life cycles.

Butterfly life cycle: https://lsintspl3.wgbh.org/en-us/lesson/Nat36-Butterfly/4

LIFE CYCLES OF INSECTS

LIVE IT!

The spongy moth is a kind of insect with complete metamorphosis. They completely change form as they grow. Using the images from the **LIFE CYCLE** section of the **RESOURCE PAGE** in the back of this book, cut out the steps of the spongy moth life cycle and glue or tape them in the cycle below, in order. We put in the egg mass for you.

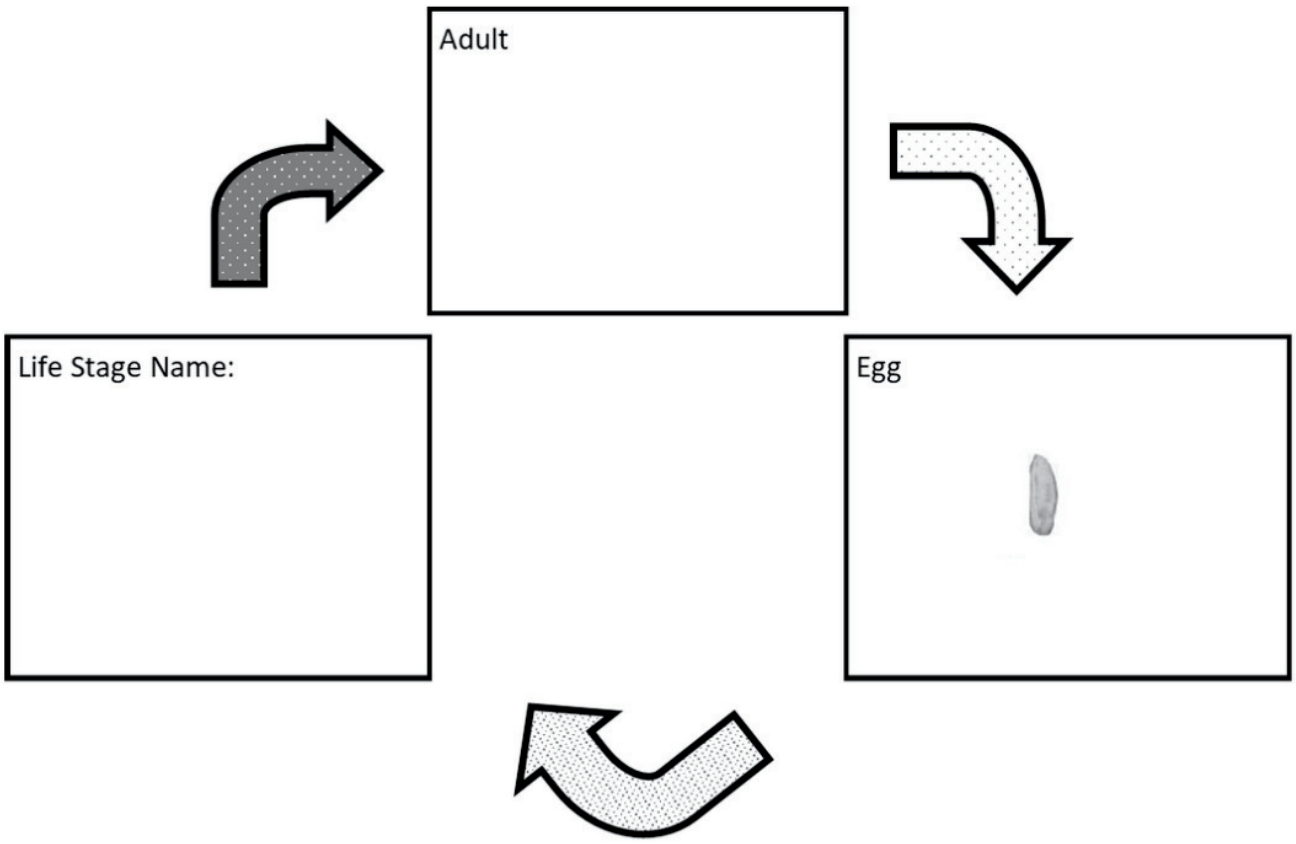


Pick one of the life stages above. Describe at least one adaptation of that life stage that helps the spongy moth invade new environments:

LIFE CYCLES OF INSECTS

LIVE IT!

The spotted lanternfly is an insect with incomplete metamorphosis. They do not completely change form as they grow. Using the images from the **LIFE CYCLE** section of the **RESOURCE PAGE** in the back of this book and clues from https://entomology.ca.uky.edu/content/invasive-species-4-h-ky-keepers cut out the steps of the spotted lanternfly life cycle and glue or tape them in the cycle below, in order. We put in the egg for you.



Pick one of the life stages above. Describe at least one adaptation of that life stage that helps the spotted lanternfly invade new environments:

SLOW IT!

Listed on this page are strategies used to slow down or stop invasive species. Using information from https://entomology.ca.uky.edu/content/invasive-species-4-h-ky-keepers (or other invasive species that you know about), find an example of each strategy.

PREVENTION

Invasive species can be prevented from entering a new area by laws and regulations. For instance, it is illegal to import certain types of plants and animals into the US. Sometimes, plants that get moved around from one place to another are inspected to make sure that no invasive species are tagging along.

Name an invasive species and describe a method that's being used to PREVENT it from spreading:

MONITORING

When an invasive species is very close to moving into a new area, sometimes traps or other monitoring methods are used to see if and when the invasive species starts to arrive. Once the pest is found, other steps are taken to keep it from spreading even more.

Name an invasive species and describe a method that's being used to MONITOR its arrival:

EDUCATION

Often, the best weapon to stop an invasive species is knowledge. When the public knows about invasive species, they can take steps to keep from accidentally spreading them. Also, when the public knows what invasive species look like, they can report them if they see them.

Name an invasive species and describe a method that's being used to EDUCATE the public about it:

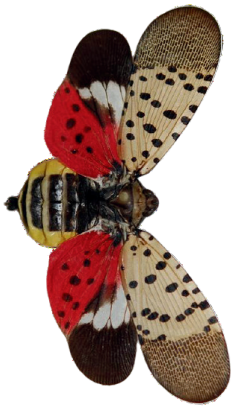
CONTROL

Once an invasive species moves into an area, steps are often taken to control it, often by finding and killing the invasive species.

Name an invasive species and describe a method that's being used to CONTROL it once it is found:

INFORMATION INVASION!

One of the best ways to **SLOW THE SPREAD** is to **SPREAD THE WORD**! You can share what you've learned about invasive species with other people, like at your school or in your neighborhood. Use this sheet to plan an **INFORMATION INVASION** of your own! Maybe this can be part of another project that you already have to do for school.




PICK A PEST!

1. Pick one of the invasive pests that currently threaten Kentucky like the Asian longhorned beetle, imported fire ant, spongy moth, or spotted lanternfly. Alternatively, you can pick another invasive pest that you are interested in.

NAME OF INVASIVE SPECIES: _____

2. This of a way to teach people about your pest. You might try a live presentation with an audience, a poster, or even a work of art! You could also post on social media (Facebook, YouTube, or Instagram) or make your own website. Be creative!

TYPE OF PRESENTATION: _____

3. Learn about your pest. Some of the information that you need is in this book, but you may want to learn even more! Wikipedia has accurate information about all of these creatures. Also, check out the "Hot Topics" section of UnluckyForKentucky.com to learn how these creatures threaten Kentucky.

4. What do people need to know about your pest? Make an outline to plan your presentation using the following questions as a guide. Be sure to share our "ReportAPest@uky.edu" email, where people can send their photos of suspected invasive insects!

How did the pest get into the United States? Is it in Kentucky yet?

What does it look like?

What harm does it cause to people, animals, or plants?

What adaptations helps it invade new places? How does it spread to new places?

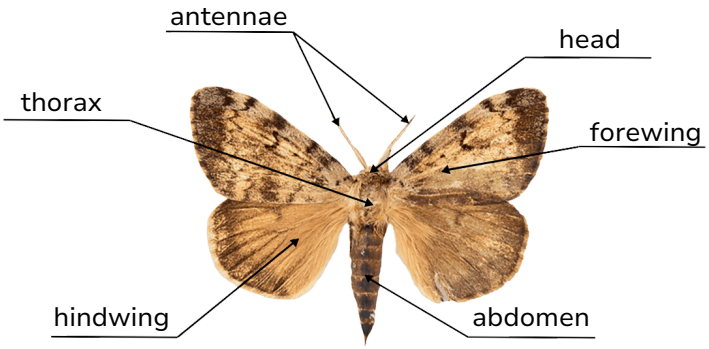
What is being done to stop it?

What can regular people do to help slow the spread of this species?

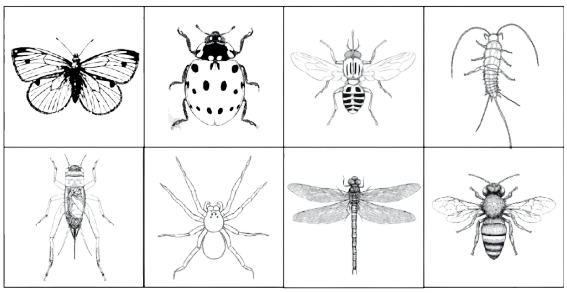
5. Share your information with the world! Let us know about all your hard work by sending us a message at **Kentucky Office of the State Entomologist** on Facebook (https://facebook.com/KyStateEnt).

ANSWER KEY

pg. 13 - Spongy moth labeling



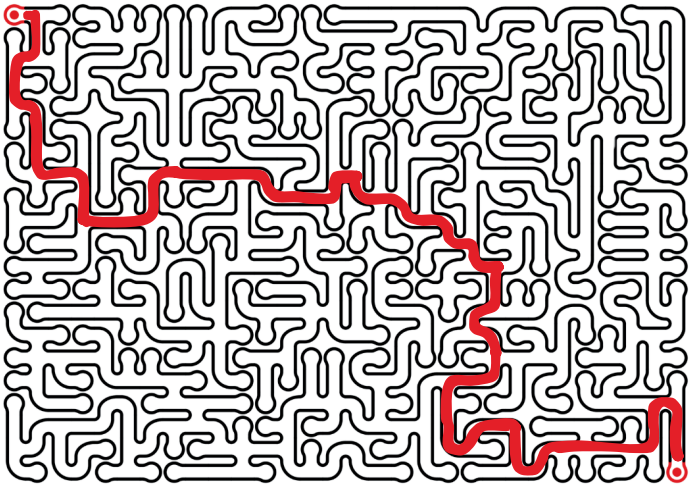
pg. 13 - Dichotomous Key



Top left to top right:
Lepidoptera; Coleoptera; Diptera; Zygentoma

Bottom left to bottom right:
Orthoptera; Not an insect; Odonata; Hymenoptera

pg. 15 - EAB maze



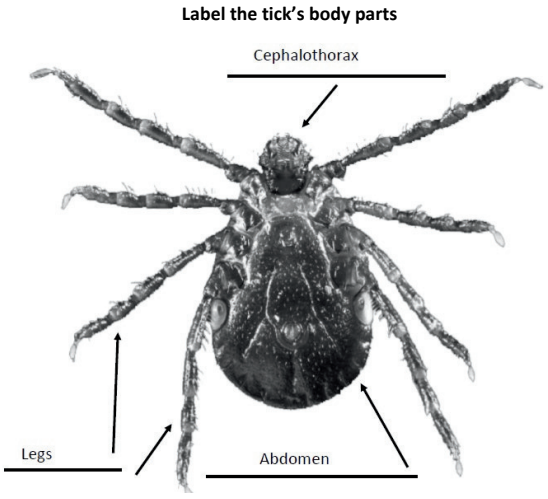
pg. 16 - Beetle word search

S	T	V	D	E	T	O	A	M	E	D	B	S	G	S	R	E	U
G	A	S	S	A	E	B	U	A	I	S	E	T	E	G	A	M	A	D
I	A	E	C	C	I	P	N	N	T	T	U	C	M	N	M	E	A
I	E	I	I	O	E	O	O	O	P	E	S	T	A	G	O	R	G
T	A	D	G	E	P	R	S	R	V	C	V	G	D	I	T	E	O
T	S	B	L	S	G	U	E	I	S	T	S	L	S	L	D	V	G
C	N	A	L	A	G	V	S	O	L	I	M	H	U	P	S	M	A
I	R	N	P	B	E	A	V	B	V	V	G	D	U	P	O	P	W
A	U	N	R	N	V	E	L	E	S	E	A	A	T	E	I	T	U
G	A	E	T	N	V	A	E	I	E	P	A	M	I	S	E	E	S
A	T	U	I	A	N	B	E	T	U	T	E	A	S	T	L	X	T
L	M	E	T	A	M	O	R	P	H	O	S	I	S	S	O	O	N
L	V	D	E	S	E	T	C	E	A	E	P	W	E	E	R	T	E
E	E	N	T	O	M	O	L	O	G	I	S	T	A	L	E	I	I
R	E	T	L	S	L	E	L	A	R	V	A	V	I	T	O	C	R
I	A	I	S	T	T	S	M	E	E	I	T	E	U	E	E	A	T
E	A	A	A	O	O	W	G	P	S	T	T	S	M	E	T	R	U
S	O	V	E	I	N	A	O	A	O	D	I	U	N	B	L	U	N

pg. 19 - True fly or lanternfly?

1. lanternfly
2. fly
3. fly
4. lanternfly
5. lanternfly
6. fly

pg. 22 - Invading ticks



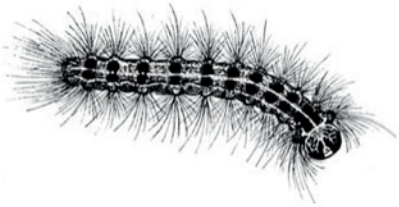
INVADE IT! RESOURCE PAGE

LIFE CYCLE IMAGES







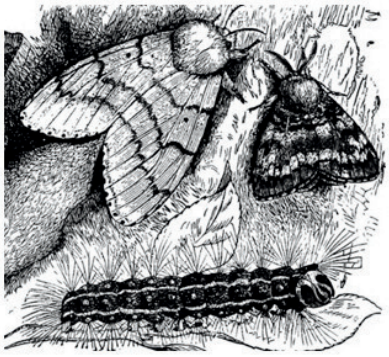


Frog egg image: used with permission under Creative Commons Attribution-Share Alike 3.0 Unported: https://commons.wikimedia.org/wiki/File:Frog-spawn-Rana-temporaria-11d.svg

WORD & PHRASE BANK

thorns	poisonous leaves	shell	floating seeds	bad tasting
lots of eggs	fast growth	poison glands	jumping legs	creeping vine
spikes	protective seed case	hidden babies	poisonous skin	camouflage
venomous spines	claws	fast-spreading roots	bad tasting	invasive species adaptations
waxy leaves	venomous fangs	poisonous eggs	creeping vine	

KENTUCKY INVADERS

ALB: https://www.flickr.com/photos/usdagov/, https://creativecommons.org/licenses/by/2.0/

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ANSWERS AND DESCRIPTIONS FOR ACTIVITY ON BACK COVER

SPOTTED LANTERNFLIES are a new invasive insect in America and have a long, straw-like mouthpart that they use to suck juice out of trees, plants, and fruits. They are closely related to aphids. Unfortunately, SLF is now spreading throughout Kentucky. Help us monitor their spread by taking a picture, collecting them, or contacting your local county extension office!

DRAGONFLIES are an important predator in the ecosystem and one of the oldest insects for which we have records. Some fossils of dragonflies have wingspans of over 2 feet!

SPONGY MOTHS were brought to this country in the 1800's by a man who thought he would make silk out of their cocoons. That plan did not work, and now they are an invasive pest of oak trees. The caterpillars gather together and eat oak leaves, making the tree weak over time.

JAPANESE BEETLES came to America around 1916, and have been destroying rose gardens ever since. There are people that inspect planes leaving the east coast to make sure this invasive insect does not hitchhike to the west coast and eat all of the grapes!

The **VICEROY** butterfly is nearly identical to the Monarch butterfly. A black line across the hind wing distinguishes it from a Monarch butterfly. Did you know that the Viceroy is Kentucky's state butterfly? It is also the butterfly pictured on the Kentucky Nature's Finest specialty license plate.

MAYFLIES are aquatic insects. Adults emerge in masses, only live for about a day, and do not eat a thing!

The **TWICE-STABBED LADYBEETLE** is an excellent hunter, eating aphids and other pests we do not want in the garden. It is a beneficial insect.

ASIAN LONGHORNED BEETLE is an invasive beetle from Asia. This insect eats the wood of maple trees, destroying the tree's ability to take up water and nutrients. If found, please collect the insect, or take a picture, and contact your local county extension office!

The **HONEY BEE** is thought by many to be a native insect, but it is actually from Europe. European colonists brought hives with them in the 1600's. It took about 200 years for honey bees to reach the west coast. They are now an important pollinator of many crops, and are farmed much like cattle in some areas. Kentucky has many other native pollinating bees as well.

The **BROWN MARMORATED STINK BUG** is the one you might find crawling on your ceiling! This insect was accidentally introduced from Asia, and quickly became invasive in some parts of North America. It is simply a nuisance in the home, but can damage many crops.

PRAYING MANTIDS are fun to find! They are a predator, and eat many different insects that are pests in the garden. If you see one, consider yourself lucky, and leave it be!

CIRCLE THE INSECTS THAT ARE INVASIVE

Spotted lanternfly

Spongy moth

Hercules beetle

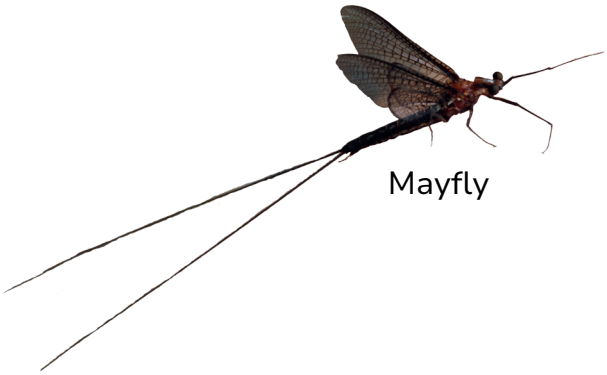
Dragonfly

Japanese beetle

Viceroy

Asian longhorned beetle

Twice-stabbed lady beetle



Mayfly

Honey bee

Brown marmorated stink bug

Praying mantis

See inside back cover for answers and descriptions!

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