Insects: Harmful or Helpful?

KEY CONCEPT:

A small minority of insects can be harmful to humans and other animals, but even those we consider pests often have important roles in the ecosystem and to other organisms.

OBJECTIVES:

Students will be able to:

- Compare and contrast beneficial and pest insects.
- Identify and describe the ways that insects are beneficial and/or detrimental.
- Understand that many of the insects we consider pests play important roles in our ecosystem.

BACKGROUND INFORMATION:

Insects are a critically important part of our environment and are vital to all life on earth. The majority of insects are beneficial or are neutral (do not cause harm, but are not considered "beneficial"); however, an important minority of insects do cause great harm to humans and other animals.

There are several beneficial roles that insects play in the ecosystem and for humans and other animals. First, insects are extremely important to pollinating our food crops, as well as a variety of other plants. Almost three-quarters (75%) of all food crops are pollinated by insects and other animals. Another benefit of insects is that they are food providers, comprising 50-60% of the diet of birds, 40-90% of the diet of freshwater fish, and are an important component to the diet of lizards, amphibians, and mammals. Additionally, many humans (largely in Africa, South and Central America, Australia, and Asia) rely on insects as a source of protein. Another benefit that humans receive from insects is from the form of commercial products produced from substances collected or synthesized by insects, including silk, honey, shellac, beeswax, inks and dyes, and medicines.

Another essential role of insects is aiding in decomposition and nutrient recycling. Many insects are scavengers that feed on wastes, such as decaying plants and animals and feces. Although bacteria and fungi are the most important decomposers, insects typically start the process and enhance the effectiveness of other decomposers. Insects are also vital

LEARNING CONCEPT:

- Environmental Understanding

GRADE LEVEL: 6-8

SUBJECT: Biological science

SETTING: Indoors; classroom with desks or tables

TIME NEEDED: 45 minutes

ENTOMOLOGY SKILL:
Recognizing the ways insects affect people and other organisms

LIFE SKILL:
Critical thinking, teamwork

SUNSHINE STATE STANDARDS:
SC.6.N.1.1, SC.7.N.1.1, SC.8.1.1

MATERIALS NEEDED:
Insect cards (found at end of lesson), internet access, and/or insect specimens

Worksheet and pens/pencils

TEACHER REVIEW:
Section 1.1-1.10

as natural pest controllers. Many insects help control the populations of invasive plants, crop pests, or other organisms that humans find detrimental or annoying. Lastly, humans have found insects to be important in the use as subjects of scientific experiments. Insects have greatly increased our understanding of genetics, physiology, medicine, forensics, and a variety of other scientific areas.

As previously mentioned, a minority of insects are considered pests because they are harmful to humans or other animals. One reason insects can be harmful is because some can sting, bite, or even spread disease. Bees and wasps can sting, and for those who are allergic, these stings can be deadly. Bed bugs, mosquitoes, horseflies, yellow flies, fleas, tsetse flies, lice, and other insects feed on humans and other animals, which can leave behind annoying and itchy bites. When these insects feed on us, they can sometimes inject deadly germs into our bloodstream that can cause serious illness and even death. In addition, some of the most deadly diseases are transmitted by insects. Malaria (transmitted by mosquitoes), infects 200 million people or more each year, with an estimated 3 million people a year dying of the disease. Typhus (spread by lice), sleeping sickness (spread by tsetse flies), black plague (spread by fleas), dengue fever (spread by mosquitoes), and West Nile Virus (spread by mosquitoes) are just a few of the other diseases transmitted by insects. Humans are not alone in their susceptibility to insect transmitted diseases. Most vertebrates are at risk, including livestock and domestic animals.

Another problem caused by insects is that some are pests to plants growing in farms, orchards, forests, gardens, and yards. These insects cause damage by feeding, and some can also transmit diseases to plants causing them to be unsellable or even causing the plants to die. Lastly, some insects are household pests. Termites, ants, cockroaches, clothes moths, booklice, and silverfish are just a few of the insects that have found niches in our homes. Some eat the timbers of our houses and buildings, causing millions of dollars of structural damage each year. Others destroy our clothes or books and papers. A few get into our kitchens and feed on our food; their feces and shed exoskeletons are often a serious cause of allergies and asthma. No area of the home is completely immune to them.

Activity Introduction:

Ask students to define a “pest” and to brainstorm a list of insects they believe are pests, as well as insects they feel are beneficial (either to us, or to the ecosystem). Write these examples on the board to return to after the students have completed the activity.

Let’s Do:

Allow students to view a variety of different insects. This can achieved using one of the following methods:

1. Have students view pictures of insects online. Insect information and photos can be downloaded from http://entomology.ifas.ufl.edu/bug_club/100_insects/index.shtml.

2. Alternatively, teachers can make copies of the insect photographs and information cards provided at the end of this lesson.

Providing students with access to a pinned insect collection would be a great supplement to using online technology and/or the insect information cards. Students could be shown the insect collection first and asked to make predictions based on what they observe. They students could then confirm or revise their predictions based on the information they learn online or by using the information cards. Insects may be obtained from a local county extension office, ordering them from an online supplier, or by collecting them yourself!

Students should view and discuss the insects in small groups. Ask each group to complete the worksheet provided, then discuss their answers.

Let's Reflect:

Return to the examples of pest and beneficial insects that the students provided at the beginning of the lesson. As a group, discuss the following questions:

Think about the insects that were listed as pests. Why do you consider it to be a pest?
They transmit diseases, they eat our crops, cause allergies, infest our homes, or are annoying.

Think about the insects you listed as being beneficial. Why are they beneficial?
They help pollinate our plants and food crops, are important to food webs, help control plant and animal populations, are decomposers and nutrient recyclers, can be an important protein source to humans, provide products that humans use, and can be used in scientific studies.

Let's Apply:

Are the pests that you listed always pests, or only in certain contexts or situations? What about the beneficials? Are they always beneficial, or can they become a pest in certain situations?
Insects may be pests in some situations, but not in others. For example, some herbivorous insects are only pests when they reach very high numbers. When their population growth is kept in check, then they may provide valuable services by helping to maintain (or even encouraging) plant growth and development and could be considered a "beneficial" in these situations. The same is true of beneficial insects—they may be beneficial in some, but not all, cases.

Can you think of a possible benefit (either from a human perspective or from another organism's perspective) for each of the insects you previously listed as pests?

The concept of what constitutes "pest" and "beneficial" organisms is a human construct and therefore is open to interpretation. Almost every organism has some important role in its environment, whether by maintaining the population growth of plants or other animals, providing food for other animals, providing pollination services for plants, or helping to decompose decaying matter and recycle nutrients back to the ecosystem for other organisms to use.

What about bed bugs? They are parasitic on humans and other vertebrates, feeding on our blood! Can you think of any reason or situation in which they might be beneficial?
Bed bugs are a food source to other organisms, such as spiders, ants, some predators from the order Hemiptera (true bugs), and centipedes.

Would your definition of a pest change based on today's discussions?

Insects: Harmful or Helpful?

Insect or related arthropod	Where would you find this organism?	What do you think it eats?	What adaptations does it have to help it survive?	Identify as a pest, beneficial, or neither (neutral)
Multicolored Asian Lady Beetle				
Earwig				
Silverfish				
Green bottle fly				
American Cockroach				
Florida Woods Cockroach				
Brown Dog Tick				
Cat Flea				
Anopheles mosquito				

Insects: Harmful or Helpful?

Insect or related arthropod	Where would you find this organism?	What do you think it eats?	What adaptations does it have to help it survive?	Identify as a pest, beneficial, or neither (neutral)
Red Imported Fire Ant				
Honey Bee				
Saw-toothed Grain Beetle				
Carpenter Bee				
Deer Fly				
Syrphid Fly				
Assassin Bug				
Green Stink Bug				
Giant Water Bug				

Insects: Harmful or Helpful?

Insect or related arthropod	Where would you find this organism?	What do you think it eats?	What adaptations does it have to help it survive?	Identify as a pest, beneficial, or neither (neutral)
Bed Bug				
Praying mantid				
Green Lacewing				
Lubber Grasshopper				
Field Cricket				
Burying Carrion Beetle				

Insects: Harmful or Helpful?

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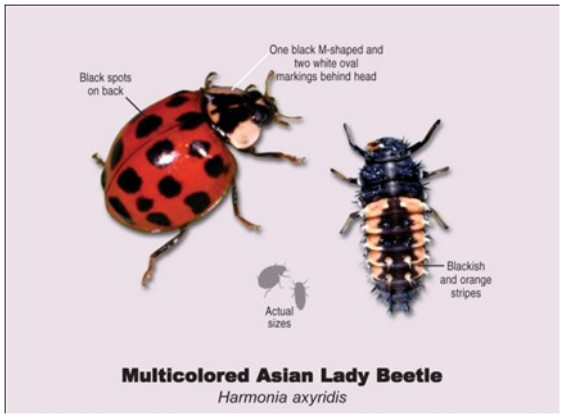
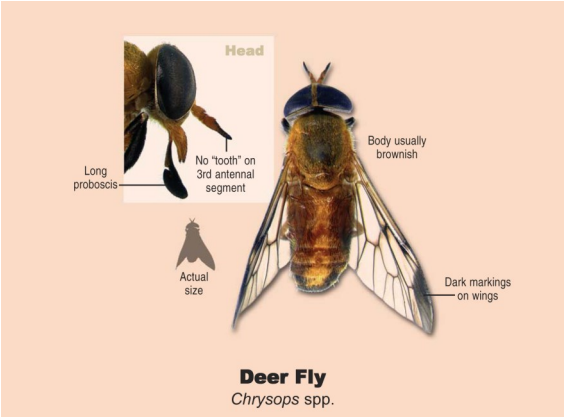
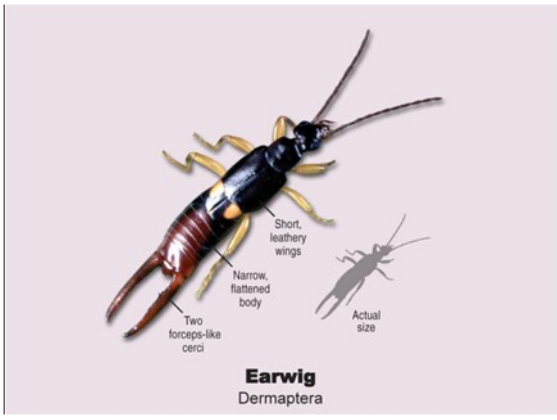
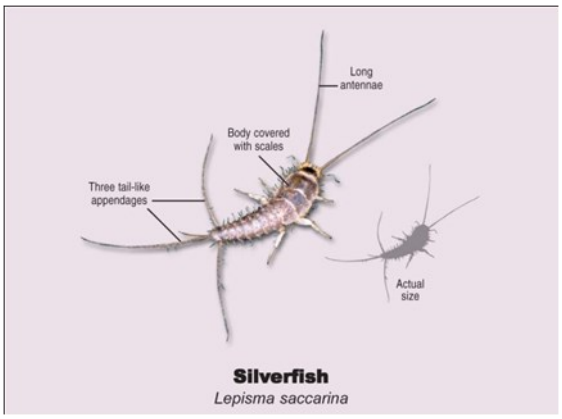
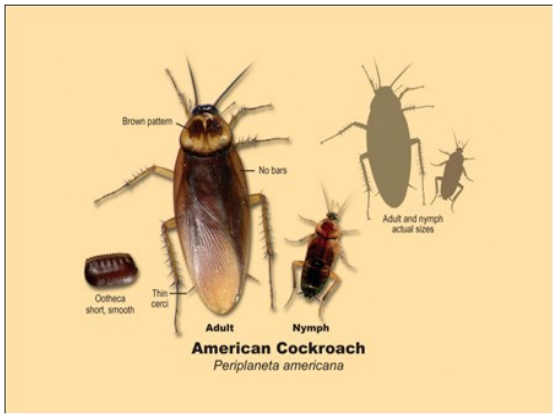
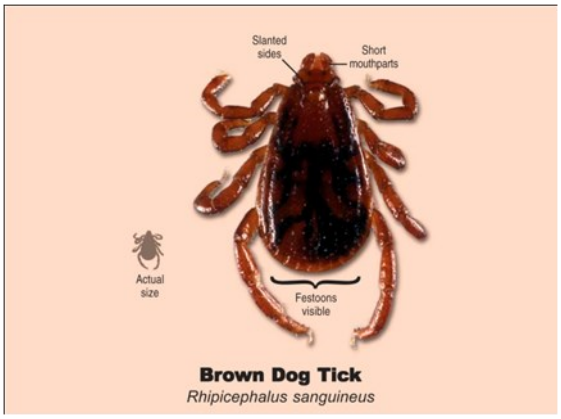
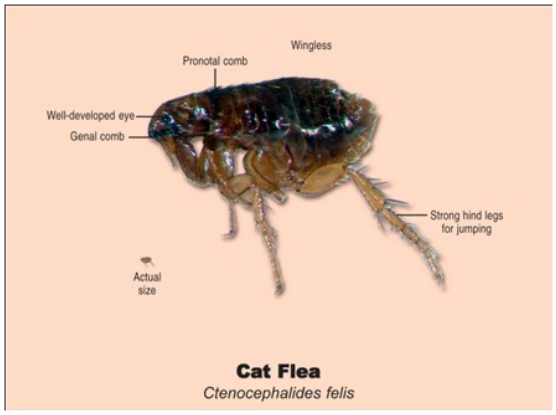
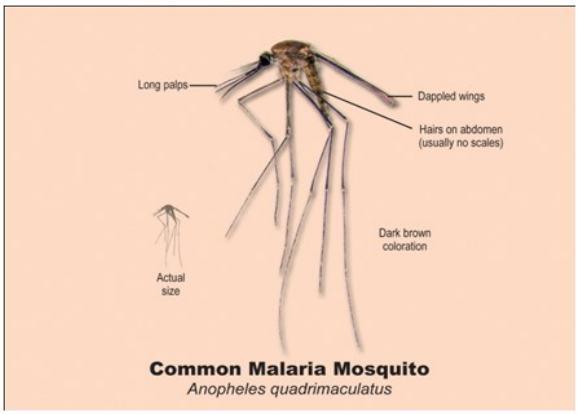
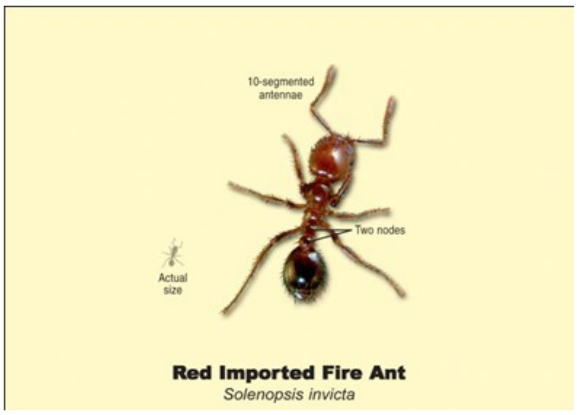
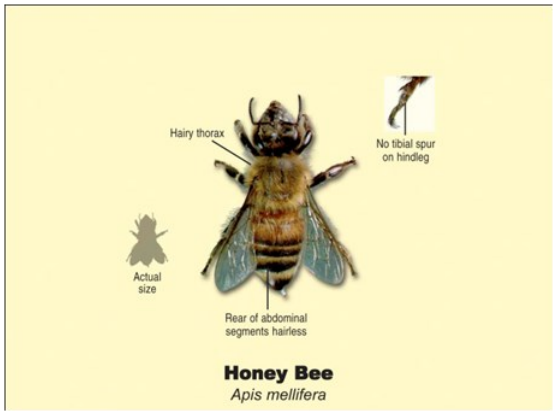
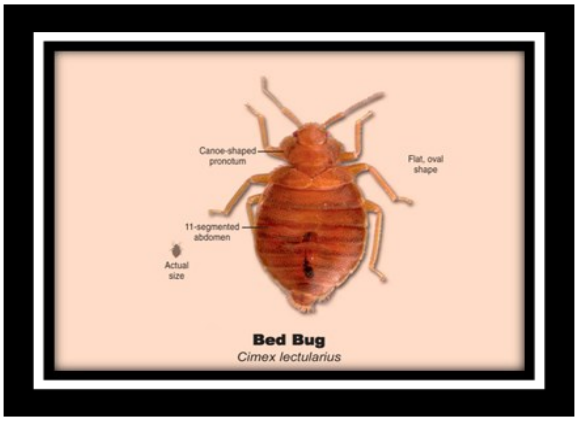
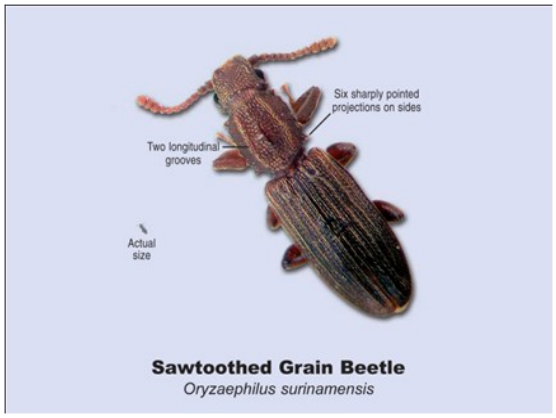
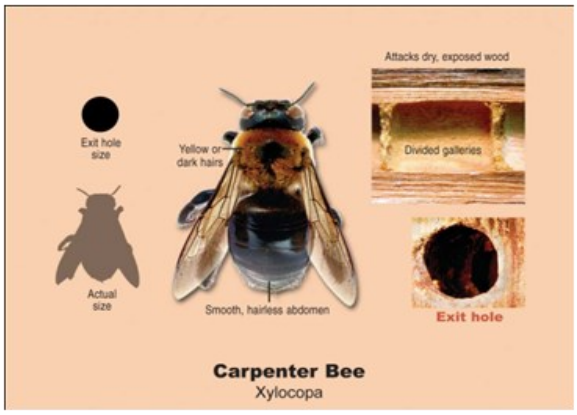
	
Lady beetles feed on aphids and scale insects. They come in many colors, ranging from dark red to mustard yellow and generally, but not always, have black spots on their wing covers. Notice the larva is orange and black and has an alligator shape	Deer flies can be found within and along the edges of wooded habitats. The female flies feed on the blood of vertebrates (including humans) to lay their eggs. The male flies feed on plant material. Deer fly larvae are aquatic and prey on various aquatic invertebrates.
	
Earwigs are active at night, and are often attracted to lights. During the day, they hide under stones, logs, sidewalks and leaf litter. They can be easily identified by their two forceps-like appendages at the end of their abdomen.	Silverfish are small and can hide inside cracks and crevices. They can be identified by the gray scales along the body and three long, tail -like appendages. They feed on books, papers, wallpaper paste, mold and fungi and can live for two to three and a half years.

	
Giant water bugs are true bugs sometimes confused with cockroaches or beetles. The giant water bug is a predator of aquatic invertebrates and even tadpoles, frogs, salamanders, and fish! The female lays her eggs on the back of the male, who then carries the eggs until they hatch.	Syrphid flies visit flowers for nectar and are thought to be important in pollination of some plants. The larvae are predators, feeding on aphid species that are pests of many different kinds of crop plants.
	
The burying carrion beetle can be found feeding on animal carrion and fly larvae. Interestingly, these beetles are one of the few examples of biparental care in the insect world—both the male and the female work together to bury the carcass of a small animal (usually bird or small mammal) for their larvae to feed upon.	Assassin bugs can be found in many types of habitats and are skilled hunters of a wide variety of prey, including other bugs, flies, caterpillars, and many other types of insects. Because of their proficient hunting skills, these bugs are helpful to have in your garden!

	
The green stink bug can be found across North America. This bug can feed on many different types of host plants, many of which are of economic importance, such as corn, cotton, tomato, peas, soybean, apple, and peach crops.	Bottle flies are found near fresh carcasses, road-kill, rotting vegetation, animal feces, garbage dumps, and meat wastes. Blow flies lay their eggs on fresh carrion (dead animals) and are among the first insects to colonize a body once it has died.
	
The American cockroach is associated with moist areas and is commonly found in sewers and basements. It is also commonly found in homes, factories, hospitals and zoos.	This cockroach is commonly found in leaf mulch, wood piles and under rotting logs. It is often referred to as a palmetto bug, but may be called the stinking cockroach because it produces a foul-smelling fluid to protect it from predation.

	
The brown dog tick is the most important tick in and around houses. It feeds on mammals including humans, deer, rodents, and especially dogs. Ticks must feed on blood to develop.	Praying mantids are formidable predators, feeding on anything they can catch. They primarily eat other insects and arthropods, but they have also been reported to feed on small reptiles and amphibians and birds. They can also sometimes be cannibalistic.
	
Fleas are found on are around their host (usually cats, dogs, humans, livestock or wildlife). Both males and females require a blood meal, but females must have blood to produce eggs.	Green lacewings can be found in a wide variety of habitats. The adults feed on honeydew, pollen, and other insects, such as aphids. The larvae are important predators and will feed on small, soft-bodied insects, mites, insect eggs, and insect pupae.

	
Adults fly at dusk and dawn and females seek a blood meal so she can lay eggs. Hosts include mammals and birds. These mosquitoes are the primary carriers of malaria in the United States and are also vectors of dog heartworm.	Red imported fire ants feed on sweets, fats, and proteins. They feed upon living and dead insects and animals. Foraging ants form tightly linked trails. Workers are extremely aggressive when the nest is disturbed, and will readily sting.
	
Lubber grasshoppers feed on herbaceous vegetation. These grasshoppers can sometimes be of economic importance, causing serious damage to vegetable and citrus crops and to other plants.	Field crickets can be found mainly in grassy habitats, such as pastures and lawns. These crickets feed on various types of plant and animal matter. They can sometimes invade homes or damage plants, however, they also scavenge dead animals and eat the eggs and pupae of insect pests.

	
Honey bees feed on nectar and produce wax and honey in their nest. Honey bees are beneficial insects, and control is often unwarranted. Feral colonies of honey bees construct their nests from trees and, often, within wall voids in structures.	Bed bugs live in urban environments in cracks of structures. They are great hitchhikers and can be picked up in almost any urban location. They typically feed at night and prefer to feed on humans. Although they bite and feed on blood, they are not known to transmit disease.
	
The saw-toothed grain beetle is a stored product pest that damages grains. It attacks many items including cereal, bread, breakfast foods, macaroni, dried fruit, nuts, sugar, chocolate, dried meat, candy bars, drugs, tobacco, and snuff.	Females carpenter bees prefer to excavate nest tunnels in exposed, unfinished wood. They overwinter in old nest tunnels and create new tunnels in the spring. They rarely sting.