

Where the GRASS is GREENER

Good Bugs: Groundcover and Beneficial Insects

INTENDED AUDIENCE:

6th-12th graders

TIME: 45 minutes

GROUP SIZE: 5-20 youth

EDUCATIONAL STANDARDS:

- NGSS MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- NGSS HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- NGSS HS-LS4-6: Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*

MATERIALS:

- Matching terms and definitions activity sheet

INTRODUCTION

Perennial groundcover is a cropping system that has year-round groundcover with crops planted in tilled strips. This cropping system offers benefits such as lower costs, weed suppression, reduced soil loss, increased nutrient sequestration, and decreased soil carbon loss. The presence of plants year-round can also increase the numbers of natural enemies of crop pests and potentially reduce crop damage from insect pests.

In this activity, youth will learn about natural enemies and their benefits to crop production. They will collect and identify insects and explore strategies for using natural enemies as a pest control method.

LEARNING OBJECTIVES

- Define terms related to biocontrol.
- Compare and contrast different insects, their characteristics, and roles in the ecosystem.
- Explain the importance of natural enemies for pest management.
- Consider ways to enhance biocontrol with perennial plants.

PREPARATION

1. Print handouts and photos.
2. Select a location with natural plant cover such as a park or field to collect insects, or prepare specimens or printed photos in advance.

Photos of pest and beneficial insects can be used as an alternative to collecting insects in winter or when collecting outside is not possible. Or insects could be collected in advance and stored in a freezer.



ACTIVITY DIRECTIONS AND DISCUSSION

- Area to collect insects: field, garden, or other area with plants (large grass areas like sports fields may not be best, but a park with grass, bushes, and other plantings would work)
- Sweep nets (optional, but an easy way to collect)
- Resealable plastic bags or jars to collect insects
- IPM 0001 Corn and Soybean Field Guide <http://shop.iastate.edu/ipm1.html> (optional)

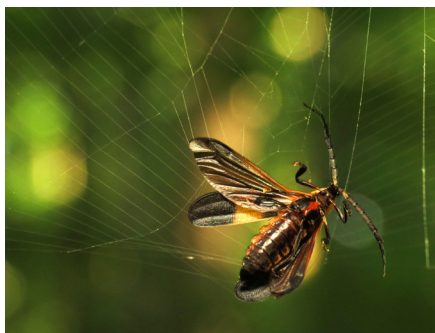
RELATED CAREERS:

- **Entomologist:** Studies insects and their interactions with plants, animals, and ecosystems. Entomologists often work in agriculture, conservation, or public health.
- **Agronomist:** Focuses on crop production and soil management. Agronomists help farmers improve yields while protecting the environment, using strategies such as perennial groundcover and biological pest control.
- **Integrated Pest Management (IPM) Specialist:** Develops and implements pest control strategies that minimize chemical use and promote natural enemies. Works with farmers, schools, and communities.
- **Conservation Biologist:** Works to protect biodiversity and natural habitats. May study how plant diversity supports insect populations and ecosystem health.

Have an introductory discussion with participants.

Ask:

1. What is this a photo of?
2. Why do spiders spin webs?



Say: You have probably seen insects caught in a spider web. That's because spiders are predators—they catch and eat other insects. Spiders can be beneficial in some situations, as they catch and eat insects that are pests to humans.

Ask: What is a pest?

Explain that a pest is any living thing, such as an insect, animal, or plant, that is harmful or annoying to humans. In crops, pests can damage leaves, eat fruits and vegetables, or spread diseases that hurt plants.

DO

Part 1: Matching Activity – What Do These Words Mean?

Let's learn some key terms related to insect biology and pest control by matching them with their definitions.

Have youth work in pairs to complete the term matching sheet. Have one activity sheet for each pair.

Answers:

Term	Definition
Biological Control	Using the natural enemy of a pest to stop the pest from causing damage.
Natural Enemies	Organisms that feed on a pest (predator, parasitoid, or pathogen).
Predators	Hunt, kill, and eat other organisms.
Parasitoids	Lay their eggs in another organism, which is then eaten by the young.
Pathogens	Microbes that infect another organism and cause disease.
Pests	Any organism that is harmful to humans.
Pesticides	A type of chemical that is used to kill pests.

Part 2: Insect Collection:

Say: Let's explore the different roles of insects. We will collect some insects, identify them, and see which roles they might play. Which ones might be pests and which ones might be beneficial for humans?

Review the handouts of common insect pest natural enemies found at the end of this lesson.

- **Ecologist:** Studies ecosystems and how organisms interact with their environment. Ecologists often conduct field research, like the insect collection activity.

ADDITIONAL RESOURCES:

- Iowa State University Integrated Pest Management YouTube Channel: <https://go.iastate.edu/7FTMGO>
- Iowa State University Department of Entomology Bug Guide: <https://go.iastate.edu/UPRPIJ>
- U.S. Department of Agriculture Natural Resources Conservation Service PLANTS Database: <https://go.iastate.edu/R1YV4G>
- National Association of County Agricultural Agents Corn Scouting Guide: <https://go.iastate.edu/2D5KUD>
- Crop Protection Network Crop Scouting Basics for Corn and Soybean: <https://go.iastate.edu/T0VP3Y>
- NDSU Common Natural Enemies of Insect Pests Handout: <https://go.iastate.edu/V1YD56>

Instructions:

1. Collect insects in a natural area (crop field, garden, or park).
2. Use sweep nets or jars to collect insects. Bring resealable plastic bags or jars to put insects in so you can get a better look.
3. Use the handout or a field guide to identify which insects are pests, which are predators, and which are natural enemies.
4. Share the findings with the large group.

REFLECT

Have the youth pair up with someone near them and discuss the following reflection questions. Have them use their insect collection notes and habitat drawings to guide their conversation.

- Did you find any natural enemies from the handout?
- Did you find any insects that might be pests?
- Did you find a lot of different types of insects?
- Do you think you might find a greater insect diversity in a different habitat? Why or why not?
- Did you find more natural enemies or pests? Why do you think that is?
- How did the habitat affect what you found?
- What ideas do you have for increasing the number of natural enemies or other beneficial insects in fields?
- How can farmers protect their crops from pests while conserving beneficial insects?

APPLY

Activity: Designing a Habitat for Natural Enemies

Ask: How can people use natural enemies to help protect plants or crops in fields, gardens, and parks?

Explain that some natural enemies can be purchased in large numbers for release. While this approach may offer short-term benefits, the introduced insects typically do not remain in the area for long. A more effective long-term strategy is to create a habitat that supports these beneficial insects year-round, providing a place where they can live and thrive.



Photo of a field with conventional tillage.



Photo of field with perennial groundcover tillage.

A good way to maintain a suitable habitat for natural enemies is to keep an area nearby with plants that grow throughout the entire season. If you think about crop fields or even gardens, at certain times of the season, there are few or no live plants growing in them. This is a field that has been tilled in the spring, before planting.

Perennial groundcover is one strategy for increasing habitat for beneficial insects. Perennial groundcover is a cropping system that has year-round groundcover with crops planted in tilled strips. This is a field with a perennial groundcover. In the spring, strips are tilled through the plants to plant the crop, but the other plants remain there throughout the year.

Activity Directions:

1. Create a list of resources natural enemies need to survive.
2. Answers should include food (prey insects), water, shelter/protection (usually plants or trees), and a place to lay their eggs.
3. On a blank sheet of paper, draw a large square to represent a field or garden.
4. Add ideas for incorporating perennial plants (plants that grow throughout the season and return every year). These plants help attract natural enemies to stay nearby. Draw on or around the field to show your ideas.
5. Explain your plan and how it increases beneficial insects.

Ideas to get started:

- Plant native habitat (prairie) around the edge of the field.
- Add trees or flowers around the edge.
- Include strips of perennial plants in between crop rows.
- Grow cover crops before or after the primary crop season.

OPTIONAL EXTENSION ACTIVITIES

If time allows, consider these:

Insect Investigation: Collect insects in two different locations and compare the types of insects collected and how many kinds of insects are present. An example might be to collect insects in a soybean field and compare them to insects collected in a prairie. It is likely that the greater the plant diversity, the greater the insect diversity. A prairie will likely have a greater variety of insects compared to a soybean field.

Community Action: Encourage youth to share what they learned with family or community members. Could they help start a pollinator garden or suggest changes to a local green space?

ASSESSMENT

Choose either a pest or a beneficial insect to learn more about. Research the insect and write a paragraph about its habitat, diet, role in the ecosystem, and role in agriculture.

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Matching Terms and Definitions Activity Sheet

Match each term in the left column with the correct definition from the definition bank. Write the letter of the correct definition in the right column.

Term	Definition Letter
Biological Control	
Natural Enemies	
Predators	
Parasitoids	
Pathogens	
Pests	
Pesticides	

Definition Bank

Letter	Definition
A.	Organisms that feed on a pest (predator, parasitoid, or pathogen).
B.	Hunt, kill, and eat other organisms.
C.	Lay eggs in another organism, which is then eaten by the young.
D.	Microbes that infect another organism and cause disease.
E.	Any organism that is harmful to humans.
F.	A type of chemical that is used to kill pests.
G.	Using the natural enemy of a pest to stop the pest from causing damage.

Insect Identification Guide

Look at the insect you collected. Compare its shape, wings, legs, and mouthparts with the categories below. Use the quick labels to determine whether it is mostly:



Beneficial

(predator, pollinator, parasitoid)



Pest

(feeds on crops or causes harm)



Mixed

(can be either depending on growth state or species)

True Bugs (Order: Hemiptera)

What to Look For:

- Piercing-sucking mouthparts
- Wings that cross over their back like an X, or make a tent shape



Aphids

What to Look For: Tiny pear-shaped insects; often found in clusters on stems or leaves.

Role: ■ Pests

Reason: Damage plants through feeding on plant juices; spreads plant diseases.

Fun Fact: Some aphids give birth to babies that are already pregnant!



Leafhoppers

What to Look For: Wedge shaped body; jumps quickly.

Role: ■ Pests

Reason: Sucks plant sap and spreads plant diseases.

Fun Fact: Leafhoppers can “skip” away sideways faster than most predators can follow.



Assassin Bugs

What to Look For: Narrow head, long legs, curved “beak” for piercing prey.

Role: ■ Beneficial

Reason: Preys on many insects, including pests.

Fun Fact: Some assassin bugs camouflage themselves with debris or insect corpses.



Brown Marmorated Stink Bug

What to Look For: Shield-shaped body; emit odor when threatened

Role: ■ Pests

Reason: Pests suck plant juices; their feeding can deform seeds and create spots leading to crop loss; brown marmorated stink bugs are invasive.

Fun Fact: Stink bugs can overwinter inside homes by hiding behind walls.

Grasshoppers and Crickets (Order: Orthoptera)

What to Look For:

- Big “jumping” back legs
- Chewing mouthparts
- Leathery wings



Grasshopper

What to Look For: Large jumping legs; chewing mouthparts.

Role: ■ Pests

Reason: Eats leaves and other plant parts, especially in dry years.

Fun Fact: They can eat up to half their body weight in a single day!



Cricket

What to Look For: Long antennae; a rounder body than a grasshopper; chirping sound; often brown or black in color and hide under objects.

Role: ■ Mixed

Reason: Many are scavengers, some eat plants, and some are predators.

Fun Fact: Only male crickets chirp – they rub their wings together to make sound.



Katydid

What to Look For: Leaf-shaped body; long antennae; green or brown.

Role: ■ Mixed

Reason: Many eat plants but are not serious pests.

Fun Fact: Their wings resemble leaves so perfectly that predators often overlook them.

Flies (Order: Diptera)

What to Look For:

- One pair of wings
- Short antennae
- Large eyes



House Fly

What to Look For: Gray body; red eyes; rapid flight; one pair of clear wings.

Role: ■ Pests

Reason: Spread bacteria; lay eggs in decaying material.

Fun Fact: House flies taste with their feet.



Mosquito

What to Look For: Long legs; slender body; needle-like mouthparts; one pair of clear wings.

Role: ■ Pests

Reason: Females bite and can spread disease; larvae live in water.

Fun Fact: Only female mosquitoes bite. Males only drink plant nectar.



Hoverfly/Syrphid Fly (also called Flower Flies)

What to Look For: Often yellow and black, mimicking bees or wasps; large eyes, short antennae, one pair of clear wings.

Role: ■ Beneficial

Reason: Adults are excellent pollinators. Larvae of many species are major aphid predators, capable of eating hundreds during development, making them important biological control insects.

Fun Fact: Hoverflies mimic bees and wasps to avoid predators, but they cannot sting – their warning colors are just for protection!



Robber Fly

What to Look For: Large eyes and a bearded face; long, slender or stout body (varies by species); strong, bristly legs.

Role: ■ Beneficial

Reason: Robber flies are top insect predators. They catch beetles, wasps, grasshoppers, flies, moths, and other pests in mid-air. Their strong mouthparts allow them to inject enzymes that immobilize prey quickly.

Fun Fact: Robber flies are such effective hunters that they can catch wasps and bees in flight – even insects with stingers!

Butterflies and Moths (Order: Lepidoptera)

What to Look For:

- Adults have straw-like mouthparts and colorful wings covered in scales.
- Caterpillars are worm-shaped and have legs.

Role:

- Caterpillars → ■ Often Pests (feed on plants), depending on the species
- Adult butterflies/moths → ■ Usually beneficial (pollinators)

Fun Fact: Butterflies can see colors humans can't, including ultraviolet!



Monarch Butterflies/Caterpillars

What to Look For:

- Adult: orange and black wings
- Caterpillar: yellow, black, and white stripes

Role:

- Adult: ■ Beneficial (pollinators)
- Caterpillar: ■ Neutral (exclusively feeds on milkweed, not crops)

Fun Fact: Monarch migrate up to 3,000 miles to Mexico every winter.



Swallowtail Butterflies/Caterpillars

What to Look For:

- Adult: large wings with tail-like extensions
- Caterpillar: smooth green body with eye spots

Role:

- Adult: ■ Beneficial (pollinators)
- Caterpillar: ■ Mixed (may feed on herbs like dill or parsley)

Fun Fact: Their caterpillars have an orange "osmeterium" they pop out when threatened.



Hawkmoths (Sphinx Moths)/Caterpillars

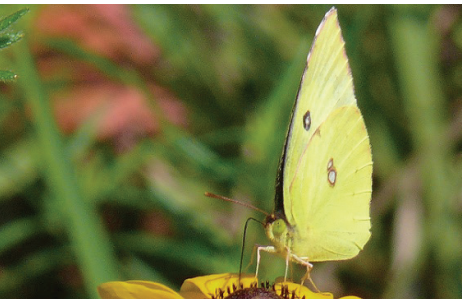
What to Look For:

- Adult: fast-flying, thick-bodied moth
- Caterpillar: large, green, horned

Role:

- Adult: ■ Beneficial (strong flyers, visit many flowers—pollinators)
- Caterpillar: ■ Pest for some crops (like tomato hornworms)

Fun Fact: Adult hawkmoths can hover like hummingbirds.



Sulfur Butterflies/Caterpillars

What to Look For:

- Adult: Yellow or orange wing coloring
- Caterpillar: may be green or yellow with various black or white markings

Role:

- Adult: ■ Beneficial (pollinators)
- Caterpillar: ■ Mixed (feed on different types of plants, sometimes crops)

Fun Fact: Cloudless sulfur caterpillars can change color, green or yellow, depending on what they eat.

Beetles (Order: Coleoptera)

What to Look For:

- Hard shell-like wings
- Straight line down the back
- Chewing mouthparts



Japanese Beetle

What to Look For: Metallic green body with copper wings.

Role: ■ Pest

Reason: Eats more than 300 plant species, including fruits, flowers, and crops.

Fun Fact: Their grubs live underground and eat grass roots.



Lady Beetle (Ladybugs)

What to Look For: Round dome-shaped body; red or orange with black spots.

Role: ■ Beneficial

Reason: Major consumer of aphids.

Fun Fact: A single lady beetle may eat 5,000+ aphids in its lifetime.



Ground Beetle

What to Look For: Dark, shiny body; fast runner.

Role: ■ Beneficial

Reason: Hunts pests in soil.

Fun Fact: Many ground beetles can't fly, they rely on speed instead.



Click Beetle

What to Look For: Elongated body; "clicks" when flipped onto back.

Role: ■ Mixed

Reason: Adults are often harmless; larvae ("wireworms") can damage plant roots.

Fun Fact: They jump into the air using a spine on their body to right themselves.

Bees, Wasps, and Ants (Order: Hymenoptera)

What to Look For:

- Two pairs of clear wings with few veins that are hooked together (bees and wasps)
- Usually have chewing mouthparts
- Narrow “waist” between their lower body parts
- Ants usually do not have wings

Role:

Bees → ■ Beneficial (important pollinators, eating pollen and nectar from flowers)
Wasps → ■ Mixed (some are parasitoids; others are predators)
Ants → ■ Mixed (some protect aphids; some predators)



Mason Bee

What to Look For: Small, dark, metallic; carries pollen on belly.

Role: ■ Beneficial

Reason: Extremely efficient pollinators of fruit trees.

Fun Fact: One mason bee can pollinate as well as 100 honey bees.



Yellow Jacket Wasp

What to Look For: Black or yellow striped body; fast aggressive flight .

Role: ■ Mixed

Reason: Predators of insects (good), but aggressive around humans (nuisance).

Fun Fact: Yellow jackets can remember locations of food sources.



Carpenter Ant

What to Look For: Large black ant; smooth body; found in wood.

Role: ■ Pest

Reason: Tunnel into wood to build nests (don't eat wood, but weaken structures).

Fun Fact: Carpenter ants can create “sawdust piles” called frass.

Other Predators and Helpful Insects



Mantids (Praying Mantises)

What to look for: Large, folded front legs; long body; triangular head; slow-moving.

Role: ■ Beneficial (strong predators)

Reason: Feeds on many pest insects, including caterpillars and flies. They can be used as biological controls and are sometimes released in greenhouses to help control pests.

Fun Fact: Some mantids can turn their heads nearly all the way around!



Lacewings (Green and Brown)

What to look for: Clear, transparent net-like wings – these are a network of veins; slender body.

Role: ■ Beneficial (strong predators)

Reason: Lacewing larvae eat aphids, mites, and soft-bodied pests.

Fun Fact: Lacewing eggs are laid on skinny stalks to keep them safe from predators.