

THE EDIBLE SCHOOLYARD PROJECT

Biotic Interactions

Summary: In this lesson, students complete a card sort activity that introduces them to the various *biotic interactions*, or interactions between organisms, that may occur in a garden ecosystem. Then they make observations of their own garden, with a focus on seeing which interactions they can observe examples of in action. Students consider whether any organism can truly be “bad” for a garden ecosystem (an idea they’ll explore in much greater depth in [L8_Weeding By Hand](#)), and reflect on how understanding the biotic interactions in their garden may support them in developing a planting plan for the garden.

This is the seventh of a 12-lesson series in which students will explore the basic ecological principle of interdependence through the lens of common organic farming practices.

Time: 45 minutes

Teacher Notes:

- For sections that instruct students to READ, you can record yourself reading aloud and send it to students. Invite them to read along with the recording. This is a helpful strategy for differentiating learning that supports all students, especially English Language Learners.
- If you are teaching this lesson in the garden, we suggest completing the sections as a whole class or in small groups. The garden is a great place for discussion-based lessons.
- An optional extension for this lesson invites students to apply what they have learned about biotic interactions between organisms to better understand the agricultural technique of integrated pest management as an alternative to conventional pesticides and fungicides.



Biotic Interactions

TEACHING NOTE: This lesson includes a lot of vocabulary words that may or may not be reviewed for your students. Encourage students to not worry too much about memorizing these terms if they are totally new—the most important part of this lesson is to get a sense of the vast diversity of interactions that can occur in a garden, and to critically reflect on how understanding these interactions may support the central project aim. The key here is to have students engage firsthand with the ecological principle of interdependence.

Vocabulary

- **Biotic interaction:** the effect that a pair of organisms living together in a biological community have on each other. Biotic interactions can occur between organisms of the same species, or of different species.
- **Predator:** an animal that hunts, kills, and eats other organisms in order to survive.
- **Prey:** an animal that is hunted and killed by another for food.
- **Predator-prey:** One organism (the predator), kills and eats another organism (the prey).
- **Mutualism:** An interaction between two or more species where all species benefit.
- **Pollination:** Pollinators (such as insects, some birds, and some bats) transfer pollen from a male flower part to a female flower part, enabling fertilization and reproduction in plants.
- **Commensalism:** An interaction between two or more species where one species benefits and the others neither benefit nor are harmed.
- **Competition:** An interaction between organisms or species in which they compete for food, water, territory, or access to females for reproduction. Competition only occurs when resources are scarce.
- **Parasitism:** An interaction in which one organism (the parasite) lives on or in another organism (the host) and causes it harm.

OBSERVE: Take some time to visit the bed that you planted in [L3_Cultivation](#). Write or draw your observations about the plants and soil on the [Plant Start Investigation worksheet](#). You will be spending more time at this bed in the following lesson.

- Do you notice any differences between plant growth in the cultivated vs. uncultivated areas? In the areas with compost vs. without compost?
- What other observations can you make?



Biotic Interactions

READ: Everything in the garden ecosystem is interconnected—this is the biological principle of *interdependence*. Any change, even a small one, to one part of an ecosystem will have ripple effects that impact every other part of that system in some way. Today we’re going to explore some of the relationships that make up a garden ecosystem and reflect on how understanding these relationships can help you plan your project.

In the previous lesson you learned about the practice of intercropping or growing different crops together. This practice has been used by farmers for thousands of years to support the well-being of crops. Today we are going to explore some of the other kinds of relationships that make up an ecosystem. In particular, we’re going to be looking at the many types of **biotic** interactions that occur between organisms in an ecosystem. As part of this exploration, we are going to practice the farming technique of **weeding by hand**. This technique is one of the most basic in organic agriculture, but the questions it prompts about what we value in the garden ecosystem can be complex and fascinating.

Then we will see which relationships we can observe in our garden. At the end of the lesson, you will reflect on how understanding this web of interdependent relationships can help you develop a planting plan for the garden.

TEACHER NOTE: When reviewing the READ section, make sure to review any of the vocabulary terms that might be new to students.

EXAMINE: Take some time to explore these [Biotic Interaction cards](#). For each card, discuss:

- Have you personally observed any of these relationships before? Do any of them remind you of interactions you have observed?
- How do you think the organisms on each of these cards impacts one another?
- Who (if either) benefits from the relationship?
- Who (if either) is harmed?



Biotic Interactions

READ: Consider the terms and definitions below.

Types of Biotic Interactions

- **Predator-prey:** One organism (the predator), kills and eats another organism (the prey).
- **Mutualism:** An interaction between two or more species where all species benefit.
- **Pollination:** Pollinators (such as insects, some birds, and some bats) transfer pollen from a male flower part to a female flower part. Pollination is an example of a *mutualistic* relationship. It enables fertilization and reproduction in plants and rewards the pollinator with pollen or nectar.
- **Commensalism:** An interaction between two or more species where one species benefit and the others neither benefit nor are harmed.
- **Competition:** An interaction between organisms or species in which they compete for food, water, territory, or access to females for reproduction. Competition only occurs when resources are scarce.
- **Parasitism:** An interaction in which one organism (the parasite) lives on or in another organism (the host) and causes it harm.

SORT: Work in small groups to sort the Biotic Interaction Cards into the category from the list above that you think best describes the relationship pictured. It's okay if you're not sure—just make your best guess based on your observations. If different members of the group have different opinions, see if you can talk it out (using evidence to support your position) and come to a consensus.

CHECK: Compare how you sorted your cards to the categories on this [answer key](#).

DISCUSS: In groups or as a full class, discuss:

- Which of these relationships do you still have questions about?
- Can you think of any examples of relationships from the garden that are not included in the cards? Who benefits or is harmed in these relationships?
- Are there any examples of organisms in these cards that are *bad* for the garden? Explain.



Biotic Interactions

TEACHER NOTE: Students might notice that many of the organisms are interconnected. For example, aphids and caterpillars and slugs are all poor for crop health (parasites), but they support organisms that are beneficial in the garden ecosystem. This principle of interconnection means that it could be argued that no organisms can be wholly *bad* for the garden, even if they harm crops, because they are all integral components of the larger system. Students may bring up “weeds” here. If they do, you can let them know you will explore this idea in much greater depth in the following lesson.

OBSERVE: Take some time to wander through the garden.

- What biotic interactions can you observe here? List as many as you can, then choose 2-3 relationships to illustrate with a drawing. Make sure to label your drawings.
- Who is benefiting in these interactions? Are any organisms harmed? Support your answer with evidence.
- What impacts do these interactions have on the crops growing here? Do you think they have any impacts that you can't see?
- Are there any interactions or relationships that you think might be occurring but you can't see?

PAIR-SHARE: Discuss with a partner:

- What interactions and relationships did you observe?
- Do you think there might be interactions and relationships that you were unable to see?
- How could your observations from today help you in your final project?



Biotic Interactions

OPTIONAL EXTENSION: How might the practice of planting perennial borders to annual beds affect crop health?



Images (clockwise from top left) Soybean monoculture field outside Hanoi, Vietnam. Soybean crops “alley cropped” with Walnut trees in Missouri, USA. Farmer tending to soybean crops, intercropped with cassava. Farmers in soybean fields intercropped with wheat crops and eucalyptus forest in the background, outside Delhi, India. (See page for larger)

- Compare the images above. All four images picture soybean crops.
 - What similarities do you notice?
 - What differences do you notice?
 - How do you think the **biodiversity** (number and variety of organisms) in these two ecosystems might compare? Explain your reasoning.
- Do some research into different practices farmers use to attract pollinators to their crops.
 - Why are pollinators important in a farm or garden?
 - Can you observe any of these practices already at work in your garden?
 - Are there any you don't observe that you think might work well in your garden?
 - Are there any you would like to put into practice for your project?

Biotic Interaction Cards



A bald eagle catches a mink in its talons



This honey bee goes from flower to flower, eating nectar and picking up pollen.



An oxpecker bird eats fleas and lice off of a water buffalo



The remora fish follow the manatee, eating leftover food scraps from the manatee's meals, and skin and poop particles that the manatee leaves behind.

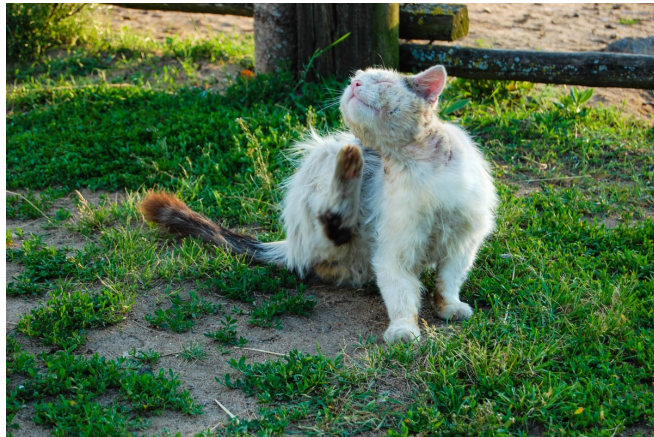
Biotic Interaction Cards



This bear and wolf both primarily hunt deer.



This robin eats worms.



This cat is itchy because of the fleas that live in its coat and suck its blood.



This ant eats the sugar-rich liquid excreted by the smaller aphids, and in return, the ant protects the aphids from predators.



This beetle goes from flower to flower, eating nectar and picking up pollen.



This snail eats lettuce and other leafy greens.



These scale insects live on the stems of plants and feed by sucking sap through their long, needle-like mouth parts (6 to 8 times longer than the scale insects themselves!)



The bermuda grass, tomato plants, and collard greens in this garden all require nutrients and water from the soil to grow.

PREDATOR-PREY



A bald eagle catches a mink in its talons

COMMENSALISM



The remora fish follow the manatee, eating leftover food scraps from the manatee's meals, and skin and poop particles that the manatee leaves behind.

MUTUALISM



An oxpecker bird eats fleas and lice off of a water buffalo

COMPETITION



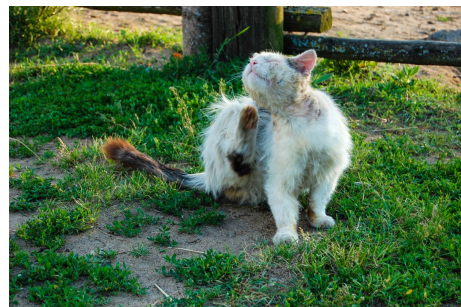
This bear and wolf both primarily hunt deer.

POLLINATION (MUTUALISM)



This honey bee goes from flower to flower, eating nectar and picking up pollen.

PARASITISM



This cat is itchy because of the fleas that live in its coat and suck its blood.

PREDATOR-PREY



This robin eats worms.

PARASITISM



These scale insects live on the stems of plants and feed by sucking sap through their long, needle-like mouth parts (6 to 8 times longer than the scale insects themselves!)

MUTUALISM



This ant eats the sugar-rich liquid excreted by the smaller aphids, and in return, the ant protects the aphids from predators.

PREDATOR-PREY (HERBIVORY)



This snail eats lettuce and other leafy greens.

POLLINATION (MUTUALISM)



This beetle goes from flower to flower, eating nectar and picking up pollen.

COMPETITION



The bermuda grass, tomato plants, and collard greens in this garden all require nutrients and water from the soil to grow.

Biotic Interactions Glossary

Predator-prey: One organism (the predator), kills and eats another organism (the prey). When one of the “prey” in this interaction is a plant, it is considered *herbivory*.

Mutualism: An interaction between two or more species where all species benefit. (Ex. oxpecker bird eating the ticks off a water buffalo, the beneficial bacteria that live in our guts and help us digest food and absorb nutrients, and nitrogen fixation by bacteria in the root nodules of legumes.)

Pollination: Pollinators (such as insects, some birds, and some bats) transfer pollen from a male flower part to a female flower part. Pollination is an example of a mutualistic relationship. It enables fertilization and reproduction in plants, and rewards the pollinator with pollen or nectar.

Commensalism: An interaction between two or more species where one species benefits and the others neither benefit nor are harmed. (Ex. the remora fish that feeds on the manatee’s feces—the remora benefits and the manatee is neither helped nor harmed from the interaction).

Competition: An interaction between organisms or species in which they compete for food, water, territory, or access to females for reproduction. Competition only occurs when resources are scarce.

Parasitism: An interaction in which one organism (the parasite) lives on or in another organism (the host), and causes it harm. (Ex. fleas on dogs, tapeworms in humans).

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