





Resourceful Animal Relationships

LESSON PLAN

This lesson will teach students about different kinds of organism interactions and how those interactions affect the ways in which organisms gain or lose resources.

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OVERVIEW

ESTIMATED TIME

60 to 70 minutes

VOCABULARY

- Organism
- Resources
- Competition
- Symbiosis
- Mutualism
- Parasitism
- Host
- Endoparasite
- Ectoparasite
- Defense mechanism

OBJECTIVES

- 1. Describe the differences between mutualism, parasitism, and competition.
- 2. Explain the different effects that relationships have on an organism and their resources.

NEXT GENERATION SCIENCE STANDARDS

<u>3-LS2-1</u>	<u>3-LS4-2</u>	<u>MS-LS1-4</u>	<u>HS-LS2-8</u>
<u>3-LS3-2</u>	<u>MS-LS2-2</u>	<u>MS-LS1-5</u>	

CORE STANDARDS

English/Language Arts Standards

CCSS.ELA-LITERACY.W.3.7 CCSS.ELA-LITERACY.W.4.2 CCSS.ELA-LITERACY.W.5.2

Math Standards CCSS.ELA-LITERACY.W.3.7

REQUIRED MATERIALS

- Two pre-/post Assessments per student (see the assessment tab for this unit at www.purdue.edu/nature)
- **Optional** Animal Relationships PowerPoint at www. purdue.edu/nature
- Scenario cards (enough for one per student)
- Several cups of dry beans
- One cup per student, plus one cup for each scenario card used
- Two dice
- One identity tag per student
- Yarn for identity tags
- Six coins
- Four pages of "Sick" stickers printed on labels
- One Resourceful Animal Relationships Vocabulary
 Worksheet per student
- One Data Collection Worksheet per student (extras are recommended)
- One of each Data Collection Graphing Worksheet per student
- **Optional** Calculators
- ** Optional** Select readings: Symbiosis: How Different Animals Relate by Bobbie Kalman; Animal Partners by Scotti Cohn; Big Friend, Little Friend: A Book About Symbiosis by Susan Sussman and Robert James
- **Optional** Video by the Amoeba Sisters: https://youtu. be/rNjPI84sApQ

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TEACHERS' NOTES

This lesson will teach students about different kinds of organism interactions and how those interactions affect the ways in which those organisms gain or lose resources.

VOCABULARY

- Organism: any living thing.
- **Resources:** things an organism needs for survival (e.g., shelter, food and water for animals, and water, sun, and nutrients for plants).
- **Competition:** when organisms compete for the same resource (e.g., two bighorn sheep fighting over rights to mate with a female).
- **Symbiosis:** when two dissimilar organisms live together and interact.
- Mutualism: when two or more organisms are in a symbiotic relationship in which both organisms benefit.
- **Commensalism:** when two or more organisms are in a symbiotic relationship in which one organism benefits while the other is neither harmed nor helped.
- **Parasitism:** when two or more organisms are in a symbiotic relationship where one organism benefits (the parasite) and one is harmed (the host).
- **Host:** the organism from which a parasite takes its resources.
- **Endoparasite:** a parasite that lives inside a host's body (e.g., a tapeworm).
- **Ectoparasite:** a parasite that lives outside the host's body (e.g., a mosquito or tick).
- Defense mechanism: a method to help an organism prevent parasites from taking its resources (e.g., wild turkeys taking dust baths as protection from insects).

ANIMAL RELATIONSHIPS

Organisms interact in many ways, and these interactions can have both positive and negative effects. The purpose of this lesson plan is to teach students how **competition** and **symbiotic** relationships affect the lives of animals.

Competition is when organisms compete for **resources**. An example of this is when two birds fight each other over a bird feeder. Competition does not necessarily include a physical confrontation but can be considered a race to gain the most resources. The outcome of competition is often determined by an organism's health. Sick animals have less energy than healthy animals and are thus less likely to win competitive interactions. A resource must be limited for competition to

occur over that resource. Oak trees produce more acorns some years than others. If acorns are plentiful in a mast year, small mammal populations (such as squirrels) will increase. If acorns are not plentiful in a poor year, small mammal populations will decrease, and there will be more competition over the available acorns.

Mutualism, parasitism, and **commensalism** are all types of **symbiosis,** or instances in which two different types of organisms live together and interact.

Mutualism is a symbiosis in which both organisms benefit. An example of mutualism would be white-tailed deer and eastern phoebe. The eastern phoebe eats small invertebrates like ticks and insects (including parasitic ones) that have found their way into the deer's hair, helping the deer stay clean and healthy.

Commensalism is another kind of symbiosis in which one organism benefits but another organism's outcome is neutral — meaning it is neither harmed or helped. An example is when barnacles attach to a whale or a sea turtle. The barnacle gets a free ride during which it siphons nutrients from the water, but it neither helps nor harms the whale or sea turtle. Another example of commensalism is when cattle egret follow bison around, eating insects from the grass as the bison graze and stir up the insects. This can also be considered mutualism, as the cattle egret are directly eating insects off the bison.

Parasitism is a symbiosis in which one organism benefits and the other is harmed. A parasite siphons resources from a **host** organism, causing it harm. Parasites are classified as either **endoparasites** (those that live inside the host) or ectoparasites (those that live outside the host). **Ectoparasites** usually do not cause enough harm to directly kill the host but can give them diseases (e.g., Lyme disease) or dramatically reduce their health (e.g., scabies or sarcoptic mange). Endoparasites can sometimes have a greater effect on the host, such as a tapeworm that lives inside a host's intestines and steals ingested food, depriving the host of nutrients and calories.

Some organisms develop **defense mechanisms** to keep a parasite at bay. These defenses can be avoidance, maintenance, resistance, or tolerance of the parasite. For example, a common maintenance defense for wild turkeys against fleas and ticks is to roll on the ground and take a dust bath. As humans, our defense mechanisms include avoidance (e.g., wearing bug spray to ward off mosquitoes or avoiding areas with ticks).



ACTIVITY: RESOURCEFUL ANIMAL RELATIONSHIPS

The purpose of the game is for students to understand what will happen to an animal in different scenarios. In the game, each student receives a role to play an individual animal, a partner animal in a mutualistic relationship, or an individual animal with a defense mechanism against parasites.

All animals start healthy, but some cards will infect them with a parasite and they will become sick until they are made healthy by another card. Each student will start out with 15 "resources" (beans).

Because sick animals' ability to compete is reduced, and they use up more energy to obtain a resource, "sick" students must give up more resources and gain fewer with each draw of a scenario card. They also are less likely to win competitions.

The mutualistic students work in pairs so both partners can harvest more resources and are less likely to lose resources or spend as much time "sick."

Students with a defense mechanism will have defense against parasites and are less likely to become "sick" or are "sick" for a reduced amount of time.

During the game, students will rotate around the scenario cards (number of spaces moved is determined by dice rolls), depositing or taking beans from a cup as the card instructs. The game is designed so that a few roles within it should run out of resources and "die." Those roles will most likely be "sick" when they "die," but those in healthy roles can also "die."

At the end of the game, the students meet in groups (designated by their role type) to count their remaining beans and then calculate a group average of remaining resources and an average number of turns spent "sick." They will work with the class to make a bar graph for the average number of remaining resources and the average number of turns spent "sick" based on role type.

There is no commensalism represented in the game because this kind of partnership happens more typically in aquatic species — such as between barnacles and whales, or between animals and plants (e.g., birds using tree hollows as nests).



LESSON



PROCEDURE

- 1. Ask the students for examples of **resources** that **organisms** might need to survive in the wild. Animals need food, water, shelter, and space. Plants need water, nutrients, and sunlight. Explain that resources are necessary for an organism's survival and if an organism runs out of resources, it dies.
- Ask the students if they have ever fought over the last piece of pizza with their brother or sister. Explain that this is a form of **competition** for a resource (in this case, food). Use the first slide from the Animal Relationships PowerPoint provided at www.purdue.edu/nature for visuals. As an alternative or addition, have students watch the first 3 ½ minutes of this video by the Amoeba Sisters: https://youtu.be/rNjPI84sApQ
- 3. Explain to students that there are other kinds of relationships that organisms have with each other in which the organisms live together or interact in some way. These relationships are called **symbiosis**. Introduce the terms **mutualism, commensalism, parasitism,** and **host** using slides 2 through 4 of the PowerPoint as visuals. As an alternative or addition, have students watch the last three minutes of the Amoeba Sisters video.
- 4. Explain that there are **endoparasites** and **ectoparasites** (noting the differences between them) and that some hosts develop **defense mechanisms** to protect them from parasites. An example of this is when wild turkeys take dust baths to keep insects away or when humans use bug spray to repel mosquitoes. Use slides 4 through 6 of the PowerPoint as a visual.
- 5. Have the students fill in or match the definitions on the Resourceful Animal Relationships Vocabulary Worksheet.
- 6. Play Resourceful Animal Relationships (see Directions for Activity below).
- Review vocabulary. It may be useful to use some of the scenario cards as examples when reviewing the game. Discuss how the different interactions, positive or negative, affected the students with different roles.



DIRECTIONS FOR ACTIVITY: RESOURCEFUL ANIMAL RELATIONSHIPS

- Arrange desks in a large circle or square around the room. Make sure there is at least one desk per student. If arranging desks around the room is not an option, scenario cards can be placed anywhere along the perimeter of the classroom. Place scenario cards on desktops at random, one per desk. If there are not enough scenario cards, print duplicates. Where there are "Gain" cards, leave a cup full of beans. Where there are "Lose" cards, leave a trashcan or some other way for students to dispose of sick stickers. Where there are "Parasite" cards, leave one page of sick stickers. Where there are "Competition" cards, leave one coin and one half-full cup of beans.
- 2. Randomly distribute identity tags to the students, one tag per student. The tags indicate a student's status as an individual, a mutualistic partner, or an individual with a defense mechanism against parasites. Explain that their tags determine the number of resources they will gain or lose each round. When they land on a "Parasite" card, they may become "sick" until they become healthy again. "Sick" individuals will lose more resources, gain fewer resources, and be less likely to win competitions. Mutualistic partners travel together, collect more and lose less resources, and are sick from parasites for shorter amounts of time. Eastern phoebes should be paired with white-tailed deer. Individuals within the game that have defense mechanisms are less likely to become sick and are sick for less time.
- 3. Give one cup that holds 15 beans (resources) to each student.
- 4. Give one Data Collection Worksheet to each student. Then, have each student (with their partner if mutualistic) stand before a scenario card.
- 5. The facilitator will roll the dice to determine how many spaces the students will move each time.

- 6. With each scenario card, the student will either gain or lose beans (resources) as the card instructs them. Have the students record how many resources they lost or gained each round on the Data Collection Worksheet. They can also become "sick" from a parasite. In these scenarios, students must take a "sick" sticker and wear it until they land on a card that says they are no longer "sick." Have students record the turns they spend "sick" on the Data Collection Worksheet. After they have completed the task given on each card, have the students face the inside of the circle. Some of the roles in the game may run out of resources and "die." They must "die" dramatically, then sit and watch the game until it is done. **Optional: Students in the roles of organisms that "die" can read select books on animal relationships until the game is done.**
- 7. After 15 rounds, have each student calculate his/her remaining resources and number of turns spent "sick" using their data sheets.
- 8. Divide students into groups based on their roles (individual, mutualistic partner, defense mechanism). Pass out one calculator to each group. Then, have each group average their number of remaining resources and their average number of turns "sick." If they do not know how to calculate an average, explain the process.
- 9. Have group members raise their hands to tell the class their group averages. Have the class work together to create one graph on the average number of remaining resources by role type and one graph on the average number of turns "sick" by role type using their Data Collection Graphing Worksheet.
- 10. Ask students what roles had the most remaining resources and why. Ask students what roles spent the most time sick and why. Ask the students to raise their hands if they "died." Ask them why they think this happened. What role type were they, and were they "sick" when they "died"?



RESOURCEFUL ANIMAL RELATIONSHIPS VOCABULARY KEY

NAME: Example

Match the word on the left to the correct definition on the right.





Write whether the given interaction is good or bad for Organism 1 and Organism 2.

	ORGANISM 1	ORGANISM 2	
Parasitism	Host Bad	Parasite Good	
Defense Mechanism	Host Good	Parasite Bad	
Mutualism	Good	Good	
Commensalism	Good	Not good or bad	
Competition	Winner Good	Loser Bad	



RESOURCEFUL ANIMAL RELATIONSHIPS VOCABULARY WORKSHEET

NAME: ____

Match the word on the left to the correct definition on the right.

1) Resources	a) when one organism takes resources from another organism, causing it harm
2) Competition	b) the organism from which a parasite takes its resources
3) Parasitism	c) when organisms fight for the same resource
4) Mutualism	d) when two or more organisms work together to get resources they would be less likely to get individually
5) Defense Mechanism	e) a method used to protect an animal from parasites
6) Host	f) things an organism needs for survival
7) Commensalism	g) when one organism benefits and one organism is neither helped nor harmed



Write whether the given interaction is good or bad for Organism 1 and Organism 2.

	ORGANISM 1	ORGANISM 2	
Parasitism	Host	Parasite	
Defense Mechanism	Host	Parasite	
Mutualism			
Commensalism			
Competition	Winner	Loser	



DATA COLLECTION WORKSHEET KEY

NAME: Example

ANIMAL: De	er	Role:	Mutualistic Partner	
Round	Plus or minus	Start with 15	Why did you gain or lose resources?	Sick?
1	+ or -	2		
	=	17	Won Competition	
	+ or -	2		
2	=	15	Tick	yes
	+ or -	3	-	
3	=	12	Lost Competition	yes
	+ or -			
4	=	12	Healthy	
_	(+) or -	2		
5	=	14	Won Competition	
C	+ or -			
6	=			
_	+ or -		_	
/	=			
	+ or -		_	
8	=			
_	+ or -		_	
9	=			
	+ or -			
10	=			
	+ or -			
11	=			
	+ or -			
12	=			
13	+ or -			
	=			
14	+ or -			
	=]	
	+ or -			
15	=		1	
End Totals				



DATA COLLECTION WORKSHEET

NAME: ____

ANIMAL:		Role:		
Round	Plus or minus	Start with 15	Why did you gain or lose resources?	Sick?
	+ or -			
1	=			
	+ or -			
2	=			
	+ or -			
3	=			
	+ or -			
4	=			
	+ or -			
5	=			
	+ or -			
6	=			
	+ or -			
7	=			
	+ or -			
8	=			
	+ or -			
9	=		-	
	+ or -			
10	=			
	+ or -			
11	=			
12	+ or -			
	=			
13	+ or -			
	=			
14	+ or -			
	=			
	+ or -			
15	=			
End Totals				



LESSON WORKSHEET

DATA COLLECTION GRAPHING SHEETS



What role types had the most remaining resources? Why?



LESSON WORKSHEET

DATA COLLECTION GRAPHING SHEETS



ROLE TYPE

What role types were sick the most? Why?



LESSON sick stickers





SCENARIO cards

Cause: A tick attaches to you in the forest.

PARASITE

Individual: Become sick, lose 2 resources Already Sick: Lose 3 resources Mutualistic: Become sick, lose 2 resources Defense: Stay healthy, do nothing

Cause: You drink dirty water filled with bad bacteria.

PARASITE

Individual: Become sick, lose 2 resources Already Sick: Lose 3 resources Mutualistic: Become sick, lose 2 resources Defense: Become sick, lose 2 resources

HEAL OR STAY SICK?

Individual: Get healthy! Mutualistic: Get healthy! Defense: Get healthy!

Cause: You compete for territory with another animal. Will you win?

COMPETITION

Flip the coin (If "sick," flip twice; must be tails both times to win)

Heads: Lose 3 resources (if "sick," lose 4) Tails: Gain 3 resources (if "sick," gain 2)

Cause: A mosquito bites you.

PARASITE

Individual: Become sick, lose 2 resources Already Sick: Lose 3 resources Mutualistic: Become sick, lose 2 resources Defense: Stay healthy, do nothing **Cause:** You pick up a tapeworm that lives inside your stomach and takes your resources.

PARASITE

Individual: Become sick, lose 2 resources Already Sick: Lose 3 resources Mutualistic: Become sick, lose 2 resources Defense: Stay healthy, do nothing

HEAL OR STAY SICK?

Individual: Stay sick Mutualistic: Get healthy! Defense: Get healthy!

HEAL OR STAY SICK?

Individual: Get healthy!

Mutualistic: Get healthy!

Defense: Get healthy!

Cause: You fight for the right to mate

with another animal. Will you succeed?

COMPETITION

Flip the coin (If "sick," flip twice; must

be tails both times to win)

Heads: Lose 2 resources (if "sick," lose 3)

Tails: Gain 2 resources (if "sick," gain 1)

HEAL OR STAY SICK?

Individual: Stay sick Mutualistic: Get healthy!

Defense: Get healthy!

Cause: You compete for acorns or meat with another animal. Who will win?

COMPETITION

Flip the coin (If "sick," flip twice; must be tails both times to win)

Heads: Lose 2 resources (if "sick," lose 3) Tails: Gain 2 resources (if "sick," gain 1)

Cause: There is competition for a patch of clover or hunting ground. Who will win?

COMPETITION

Flip the coin (If "sick," flip twice; must be tails both times to win)

Heads: Lose 2 resources (if "sick," lose 3) Tails: Gain 2 resources (if "sick," gain 1)



SCENARIO cards

Cause: There is competition for a patch of blueberries or hunting ground. Who will win?

COMPETITION

Flip the coin (If "sick," flip twice; must be tails both times to win)

Heads: Lose 2 resources (if "sick," lose 3) **Tails:** Gain 2 resources (if "sick," gain 1)

Cause: There was a controlled prairie fire last year, resulting in new plant growth.

GAIN

Healthy: Gain 3 resources Sick: Gain 2 resources Mutualistic: Gain 4 resources Defense: Gain 3 resources

Cause: It has not rained in weeks, so water and food are hard to find.

LOSE

Healthy: Lose 3 resources Sick: Lose 4 resources Mutualistic: Lose 2 resources Defense: Lose 3 resources

Cause: Your shelter is flooded. LOSE Healthy: Lose 3 resources

Sick: Lose 4 resources Mutualistic: Lose 2 resources Defense: Lose 3 resources **Cause:** Another animal moves into your shelter. Can you fight them off?

COMPETITION

Flip the coin (If "sick," flip twice; must be tails both times to win)

> Heads: Lose 3 resources Tails: Gain 3 resources

Cause: You find a new shelter. GAIN

Healthy: Gain 3 resources Sick: Gain 2 resources Mutualistic: Gain 4 resources Defense: Gain 3 resources

Cause: An ice storm makes it hard to find shelter.

LOSE

Healthy: Lose 3 resources Sick: Lose 4 resources Mutualistic: Lose 2 resources Defense: Lose 3 resources **Cause:** You find a chipmunk's stash of acorns or scavenge some meat.

GAIN

Healthy: Gain 3 resources Sick: Gain 2 resources Mutualistic: Gain 4 resources Defense: Gain 3 resources

Cause: You find a new water source.

GAIN

Healthy: Gain 3 resources Sick: Gain 2 resources Mutualistic: Gain 4 resources Defense: Gain 3 resources

Cause: You cannot find enough acorns to eat or you cannot hunt enough meat to eat.

LOSE

Healthy: Lose 3 resources Sick: Lose 4 resources Mutualistic: Lose 2 resources Defense: Lose 3 resources



DEFENSE MECHANISM Fox Grooming



DEFENSE MECHANISM Turkey Dust Bath



MUTUALISTIC PARTNERS White-tailed Deer



MUTUALISTIC PARTNERS Eastern Phoebe





INDIVIDUAL Bobcat



INDIVIDUAL Gray Squirrel



INDIVIDUAL Rabbit







