The Young Scientist Program - Teaching Kits
http://ysp.wustl.edu
Washington University School of Medicine
Funding provided by The Leon Lowenstein Foundation

Ecological Interactions Activity

Student Handout

Background

A **niche** is the way of life of a species, or its role in an ecological community (what it eats, where it lives, how it interacts with other species, etc). For example, the niche of a honey bee is the time of day it is active, the type of flowers it gets nectar from, the temperature range it can survive, where it builds its hive, which other species it interacts with, and how it interacts with those other species (mutualism, parasitism, commensalism, etc). Another way of thinking about a niche is that it is the sum of the **biotic** (living) and **abiotic** (nonliving) resources that a species uses.

Species do not live by themselves—they live in ecological communities and are constantly interacting with other species. Something that affects one species will impact all the other species it interacts with. For example, if a frog species goes extinct in a community, then the snakes that usually eat it will have to find another food source or they will go extinct as well. And since there are no more frogs left to eat the moths, the moth population might increase so dramatically that it becomes out of control and eats all of the plants in the community, leaving no food for other plant eaters.

Species can have many different types of interactions with each other, some interactions help both species, some help just one of the species, and some can be negative for one or both of the species. All of these interactions are needed to maintain balance in an ecosystem. **Symbiosis** means “to live together,” and happens when two species have a close relationship with each other. Interactions that fall under the category of symbiosis are *mutualism*, *parasitism*, and *commensalism*.

Parasitism is an interaction that harms one species and benefits the other species. A parasite lives on or in a host organism. For example, tarantula wasps lay eggs in tarantulas. This benefits the wasps because the larvae eat the tarantula’s tissues, killing the tarantula. Other types of interactions that harm one species and benefit the other are **predation** (where a predator eats its prey) and **herbivory** (where the consumer eats a plant species).

Competition is an interaction that harms both species. Two species are competing for a limited resource. This reduces the fitness of one or both of the species. For example, hyenas chase away vultures that are trying to eat the remains of the same zebra.

Mutualism is a type of interaction where both species benefit each other. For example, bees and flowers have a mutualistic relationship. The flowers need to bees to pollinate them so their seeds can be fertilized. Bees need flowers to make honey for their hives.

Commensalism is an interaction that benefits one species and does not affect the other species at all. For example, while cattle graze in fields they unintentionally stir up insects that were resting in the grass. Cattle egrets follow the cows’ paths and eat these insects. The egrets benefit because cows help them find food. The cows are not benefitted or harmed by the egrets.

Some species are **generalists**, meaning they can eat many different types of foods. Raccoons are generalists, since they can eat many different foods such as eggs, bugs, nuts, birds, and berries. Other species are **specialists**, meaning they eat only a certain type of food. Koalas are specialists, since almost their entire diet is eucalyptus leaves.

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A **niche** is: _____

_____

Symbiosis means "_____" and happens when two species have

_____.

Interaction	Species 1	Species 2	Definition and example
Parasitism, Predation, and Herbivory			
Competition			
Mutualism			
Commensalism			

A **generalist** is: _____

A **specialist** is: _____

Which vocab words from above describe the interactions going on in the images below?

1. _____ 2. _____ 3. _____

Images from: http://www.cals.ncsu.edu/course/ent525/close/goodbuddies.html

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Activity

Methods/Protocol:

You will need

-1 bowl of M&Ms
-3 empty cups (one per student)
-3 plastic spoons (one per student)
-3 stacks of note cards (one per student)
-student worksheet (one per student)

Each person in your group represents a different species (Species A, Species B, and Species C). Each round you will read instructions from your note card about how your species can survive the winter—don't let anyone else see the instructions on your card, or they'll have a better chance of beating you. Put the bowl of M&Ms in the center of your group. You will use a spoon to collect the M&Ms you need to survive during the allotted time and place them into your cup. Once an M&M is in someone else's cup, you are not allowed to touch it.

Rounds 1- 3 will last 1 minute; round 4 will last 2 minutes. At the end of the round, count how many M&Ms you got into your cup. You will record your group's numbers in the data table, and then identify what ecological relationships your group had. Then put all of your M&Ms back into the community bowl. You will get new instruction cards and start the next round.

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Round 1			
	Species A	Species B	Species C
Number of M&Ms in the cup			
Did this species collect enough food to survive the winter?			

a) What ecological relationship do Species A and Species B have? (Use the data and what was on your group members' cards to decide) *(mutualism/parasitism/competition/commensalism)*

b) Which two species occupied the same niche in this community? How do you know?

c) Explain why no two species can occupy the same niche in a community for very long.

Round 2			
	Species A	Species B	Species C
Number of M&Ms in the cup			
Did this species collect enough food to survive the winter?			

d) Did you get more M&Ms this time than in Round 1? Why do you think that is?

e) What ecological relationship do Species A and Species B have? What about Species B and Species C? (Use the data and what was on your group members' cards to decide) *(mutualism/parasitism/competition/commensalism)*

f) What would happen if a new invasive species came into your ecosystem that ate blue, red, and orange M&Ms and was better at collecting food than all three of your species?

Round 3			
	Species A	Species B	Species C
Number of M&Ms in the cup			
Did this species collect enough food to survive the winter?			

g) Which species was a generalist? How do you know?

h) Which species was a specialist? How do you know?

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i) If the environment changed suddenly, would generalists or specialists be more likely to adapt and survive?

Round 4			
	Species A	Species B	Species C
Number of M&Ms in the cup			
Did this species collect enough food to survive the winter?			

j) What ecological relationship does Species C have with Species A? How do you know? (Use the data and what was on your group members' cards to decide) *(mutualism/parasitism/competition/commensalism)*

k) How could this activity be modified to demonstrate parasitism?

l) Using what you've learned about ecosystem interactions, think about how this can be applied to humans.

→ What is an example of a species that humans interact with mutually?

→ What is an example of a species that has a parasitic relationship with humans?

→ What is an example of a species that humans interact with competitively?

m) Do you agree with the statement below? Why or why not?
"All populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem."

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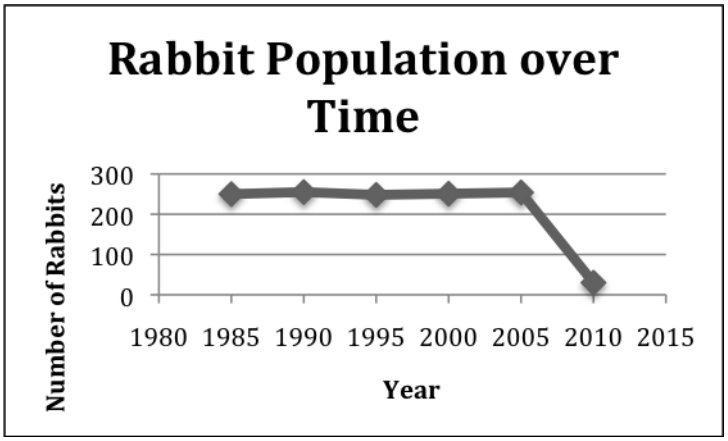
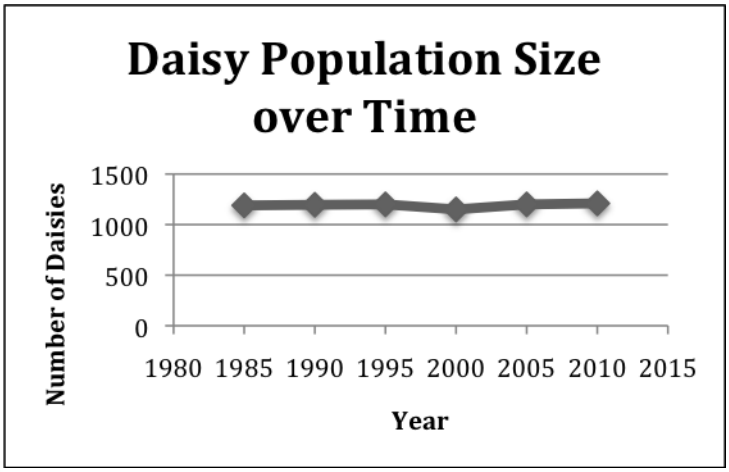
Synthesis

1. The graph to the right tracks a rabbit population over 20 years. Make a hypothesis about what could have happened between 2005 and 2010 to cause the change in rabbit population size.



2. Daisies are pollinated by bees. The graph to the right tracks a daisy population over 20 years. Predict what will happen to the daisy population size if bees go extinct? Why?



3. Explain why this comic is funny.