Squirrels: Servants of the Seed

Teacher Instructions

Grade Level:
Upper elementary

Subject Areas:
Science, ELA

Duration:
Two class periods

Setting:
Outside and in the classroom

Vocabulary:
Adaptation
Caching
Dispersal
Forage
Germinate
Granivore
Seed disperser
Seed predator

Overview:
In this lesson, students will learn about seed adaptation and dispersal. Students will observe squirrels in their natural environment and conduct an experiment to attempt to identify these squirrels as seed dispersers or seed predators.

Learning Objectives:
The students will:

- Analyze and understand the concepts of adaptation and dispersal.
- Understand different dispersal strategies of seeds.
- Understand how squirrels help with the dispersal of seeds in an environment.
- Understand the role of squirrels as predators to seeds through a two-day experiment.

Materials:

- Five large trays, such as lunch trays **(teacher provides)**
- 1 liter of sand **(teacher provides)**
- 100 sunflower seeds or corn kernels **(teacher provides)**

Grade Level Expectations:
Third Grade
Science
1. Ask questions about objects and events in the environment (e.g., plants, rocks, storms). (SI-E-A1)
2. Pose questions that can be answered by using students' own observations, scientific knowledge and testable scientific investigations. (SI-E-A1)
3. Use observations to design and conduct simple investigations or experiments to answer testable questions. (SI-E-A2)
4. Predict and anticipate possible outcomes. (SI-E-A2)
9. Express data in a variety of ways by constructing illustrations, graphs, charts, tables, concept maps and oral and written explanations, as appropriate. (SI-E-A5) (SI-E-B4)
10. Combine information, data and knowledge from one or more of the science content areas to reach a conclusion or make a prediction. (SI-E-A5)

English
ELA.3.42. Use active listening strategies, including asking questions and responding to ideas/opinions.

Fifth Grade
28. Explain and give examples of predator/prey relationships. (LS-M-C4)

Common Core State Standards:
Third Grade
Science
3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well and some cannot survive at all.

English
SL.3.6. Speak in complete sentences, when appropriate to task and situation, in order to provide requested detail or clarification.

Fifth Grade
LS2.A. Interdependent relationships in ecosystems.

Vocabulary Definitions:
Adaptation – Any physical or behavioral changes in an organism that allow it to survive in a particular habitat, defend itself from prey or more easily reproduce.

Caching – Food storing behavior of animals

Dispersal – The spread of organisms over a wide area by various methods.

Forage – To search for food or provisions.

Germinate – The sprouting of a seed.

Granivore (Seed Predator) – A specialized type of omnivore (an animal that eats both plants and animals) whose diet consists largely of seeds.

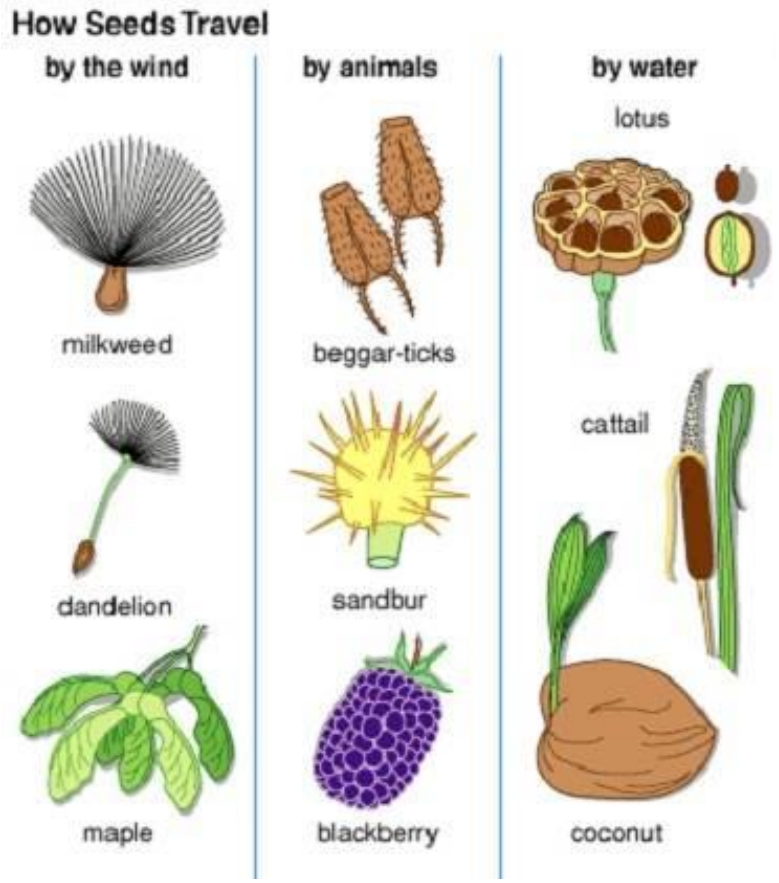
Seed Disperser – An animal that carries a seed away from the parent plant.

Background Information:
Spreading the Seed

Many plants have adapted methods for spreading their seeds across the landscape. Some plants use wind, water or animals to carry their "offspring," or seeds, into new areas. This movement is called **dispersal**, or the spread of offspring of organisms that are not mobile over a wide area by various methods. Dispersal is important for increasing or establishing populations and avoiding predators, disease and competition with other organisms.

Plants and their seeds have specific **adaptations** for accomplishing dispersal. Growth form, or the way the plant grows, is important when considering how a plant disperses its seeds. For example, trees and grasses may have different dispersal tactics because of the types of animals or elements the seeds of the plants are exposed to. In addition, this may influence the type of seed produced by a plant. In general, the larger the seeds, the fewer produced by the plant, and vice versa.

There are three general dispersal strategies of seeds. The dispersal strategy often is reflected in size and shape of the seeds. One strategy is wind dispersal in which a seed is carried by the wind to a new location. Wind-dispersed seeds usually have wings or wind-catching structures to assist in their travels, such as the red maple (*Acer rubrum*) seed. Another method is water dispersal in which a seed is moved by water, usually by floating to a new location, like the cattail (*Typha* spp.). Seeds that are dispersed by other organisms are animal-dispersed. Animal dispersal of seeds may take on many forms, whether the seeds are eaten, buried or snag a ride on an animal's hair. Seeds eaten by dispersers often are inside sweet colorful fruit. Seeds that are buried may have hard protective covers hiding sweet creamy flesh, like acorns. Seeds that are carried on animals' coats often have hooks or stickiness to latch onto passing animals.



Adapted from 2006 Encyclopedia Britannica Inc.

Organisms may be **seed dispersers**, **seed predators** or both. Another word for seed predator is **granivore**, a specialized type of omnivore (an animal that eats both plants and animals) whose diet consists largely of seeds. Seed dispersers and predators include many different types of animals, including white-tailed deer, some birds, insects and rodents.

Squirrels and Acorns

Squirrels are a type of rodent and generally are found in forested areas where they forage in trees and on the ground. Squirrels are granivores, or seed predators, but also feed on a variety of other foods including insects, fruits and tubers of plants.

Two species of squirrel inhabit Louisiana's wetlands. The gray squirrel is the smaller, more common species that lives in a variety of forested and urban environments. The eastern fox squirrel, so named for its reddish color, is larger and sometimes has a white patch on its nose or ears. Both species can be seen in a black color phase, although that is rare for the gray squirrel. Albino coloration of the gray squirrel often is seen, and a few of those live in the live oak trees at Louisiana State University in Baton Rouge. Eastern fox squirrels are found in many of the areas where gray squirrels can be found and they often compete for habitat and resources. While both species are active during the day, gray squirrels prefer to **forage** at dawn and dusk.

Squirrels are well known for their love of nuts, especially acorns from oak trees (*Quercus* spp.). Squirrels have developed a strategy for storing food called **caching,** in which seeds are buried to save for a later date. Some of these seeds are eaten, but others are forgotten, buried safely underground where they may germinate and one day become another oak tree. This relationship between squirrels and oaks benefits both organisms, allowing the squirrels to survive when food is sparse and helping the oak trees to spread their seed.

Advance Preparation:

1. Have sand, seeds and trays for seed experiment.
2. Make copies of *Seed Collection Recording Sheet* (one per student).

Procedure:

Guiding Questions:

- What are the gray and fox squirrels' roles in seed dispersal?
- What is adaptation, and how does it affect seed dispersal?
- Are these squirrels more of a predator or a disperser for the seeds in their natural environment?

Day 1:

1. Discuss as a class: What is adaptation? We think of adapting to something as getting used to certain places, situations and changes. But in the natural environment, what is adaptation? Define adaptation. (*Any physical or behavioral changes in an organism that allow it to survive in a particular habitat, defend itself from prey or more easily reproduce.)*
2. Tell the students animals and humans are not the only organisms that have adapted to changes in their environments. Plants and seeds experience adaptation, too!
3. Ask the students why plants and seeds might need different adaptations. (*Protection from weather or animals that would eat them, plants and seeds need to be able to move from place to place, etc*.)
4. Tell students they are going to explore the different adaptations of seeds by going outside and collecting seeds from the ground.
5. Briefly discuss what a seed is and what features it may have, using the background information. This will help the students know what to look for. (*Seeds are the "offspring" of plants. Some have wings. Others may be colorful. Some might have protective coverings. Examples of seeds they may find are: acorns, berries, pine cones, etc.*)
6. Divide students into five equal groups. Provide each group with a tray.
7. Take students outside for seed collection.

8. Sit students on the ground as one large group. Explain to the students they are going to be given five minutes to collect "seeds" from the environment. Tell students any and all seeds on the ground should be collected and placed on the tray for their group.
9. Allow students to walk around and collect seeds. After five minutes, return to the classroom.
10. Pass out a *Seed Collection Recording Sheet* to every student. Students should use their *Seed Collection Recording Sheets* to sketch the seeds they have on their trays, according to the directions in Part 1 of the sheet.
11. Give the students about 10 minutes to complete Part 1 of the *Seed Collection Recording Sheets* in their groups.
12. After about 10 minutes, ask students "Why is there so much diversity in seed shape and size?" (*Seeds have adapted many traits to interact with other species. Some adaptations might make them attractive to animals, some may protect them, etc. Many seeds need to be moved to new areas where they can grow without competition with parent or sibling plants*.)
13. Define dispersal and go through the examples of different dispersal strategies, using the background information (*Dispersal – Spread of offspring of organisms that are not mobile over a wide area by various methods. Dispersal strategies may include wind, water or animals.*)
14. Ask students why dispersal is important. (*Dispersal allows seeds to escape predators and disease focused around the parent plant and to escape competition with siblings*.)
15. Tell students they will now focus on a specific wetland animal that disperses seeds – the squirrel. Ask students what they know about squirrels. Review background, as needed. (E*xamples include: they like nuts, they bury their food in the ground, they live in trees, they have bushy tails, etc.)*
16. Tell students squirrels are seed dispersers by moving seeds from place to place but that squirrels also eat the seeds, as well. Discuss how seed dispersers also can be seed predators. (*Squirrels don't always eat the seeds right away. Sometimes they store seeds in a safe location so they can eat them later. This behavior is called caching.* See background for more information.)
17. Tell students they will now perform an experiment about seeds, squirrels and dispersal. A tray will be placed outside containing 100 seeds and 1 liter of sand. In the next few days, the tray will be checked to see what the squirrels have eaten, taken or left behind. (If multiple classes only lay out one tray per class, make sure you label them for each class.)
18. As a class, count out 100 sunflower seeds or corn kernels.
19. To assemble the seed tray, sprinkle seeds onto the tray and then cover with a fine layer of sand. Make sure that a few seeds are exposed.
20. Take the class outside to place the tray near a tree (areas further from human activity are best). Make sure to bring the students' *Seed Collection Recording Sheets*.
21. Explain that each student should make an individual hypothesis about what they think will happen to the seeds, as directed in Part 2 of the *Seed Collection Recording Sheet* . Give the students five to seven minutes to do so. (Encourage students to sketch where they think the seeds will go. They can write the number of seeds they predict will be left on the tray after 24 hours.)
22. After everyone is done, have the students discuss where they predict the seeds will go, sharing their predictions with classmates. Tell students they will find out if each hypothesis is correct during the next class period.

23. Collect the *Seed Collection Recording Sheets* Leave the trays out until the next class period (at least 24 hours and no more than 48).

Day 2:

1. Take students outside. From a distance, have students observe the squirrels' behavior at the tray and in the surrounding area. For five minutes, have students write what they observe in Part 3 of their *Seed Collection Recording Sheets*. (Encourage students to remain still and quiet, so they will be more likely to see squirrels.)
2. After observation for five minutes, collect the tray and bring inside to record seed data. Disregard seeds and seed coats outside of the tray.
3. Explain to the class that they will be determining if the squirrels acted more as seed dispersers or seed predators. They will look at the number of seeds that have been eaten (indicated by empty seed coats) and the number of seeds not eaten that are left in the tray (intact seeds) to determine how many seeds were carried off and dispersed by the squirrel.
4. As a class, count the number of empty seed coats; assemble fragments of seed coats to make the best estimate of a complete seed coat. Have students record their data in Part 4 of the *Seed Collection Recording Sheet*.
5. Next, count the number of seeds that are intact (unopened/uneaten). Have students record their data in Part 4 of the *Seed Collection Recording Sheet*.
6. Now that you've estimated the number eaten and the number intact in the tray, you can estimate how many were carried off by a squirrel.
    a) To do so, add the number not eaten and the number eaten (number of seed coats) and subtract from the total number that was placed in the tray. (For example: 100 total seeds placed in tray – (20 seeds eaten + 60 seeds not eaten) = 20 seeds that were dispersed by squirrels.)
7. Were there any interesting trends in the data? How many seeds were eaten? How many seeds did the squirrel carry off?
8. Tell students to complete Part 5 of the *Seed Collection Recording Sheet*.
9. When everyone has completed Part 5, discuss their answers. Did squirrels behave more like seed predators or seed dispersers in the environment? How can we tell? (*If students found many seed coats without the seeds inside, these seeds were eaten while the squirrel was standing in the tray. If, however, there are no seeds or coats left in the trays, squirrels may have cached the seeds and are acting as dispersal agents.*)
10. Discuss the relationship between squirrel behavior (caching), dispersal and germination using the following questions:
    a) How do the squirrels disperse the seeds? (*By burying them in different areas to eat later*)
    b) What might happen to the cached acorns squirrels forgot about? (*The seeds are more likely to germinate and become oak trees.*)
    c) Do squirrels act as seed dispersers, seed predators or both? How? (*Squirrels are seed predators because they eat some of the seeds, but they also are seed dispersers because some seeds are forgotten and may become new trees.*)
11. Assessment: Collect and analyze student data on student work sheets. Make informal assessment based on class discussion questions at the end of the lesson.

Blackline Masters:

- Seed Collection Recording Sheet

References:

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Name _____ Date_____

Seed Collection Recording Sheet

Part 1.

Directions: Sketch the seeds your group collected in your tray. If you know the name of a seed, write it beside the sketch.

Part 2.

Create a hypothesis for the tray your class laid out. What might happen to the seeds? You may write your hypothesis in the box below; also, be sure to write the location of the tray below the box.

Location: _____

Name _____ Date_____

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seed collection recording sheet (continued)

Part 3.

Observe the squirrels' behavior at the trays. How many squirrels are in the area? What do they look like? How are they acting? Write your observations in the box below.

Part 4.

Now that your tray has been outside for at least 24 hours, it is time to record your data. Record the number of seeds that have been eaten and the number of seeds not eaten in the box below. Assemble fragments of seed coats to make the best estimate of a complete seed coat. Subtract these numbers from the total number of seeds put in the tray to figure out how many seeds were carried off by the squirrel. (For example: 100 seeds - # eaten - # not eaten = number carried off.)

Part 5.

Final Thoughts: Did squirrels act more as seed predators or seed dispersers? Explain your answer with your observations about the squirrels and data from the seed trays.

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