NatureHoods | 2nd Grade

Plants and Pollinators: Spreading the Seeds of Diversity

▸ Objective: To develop an understanding of the complex processes of pollination and seed dispersal; to understand adaptations and explore the diversity of life in different habitats; to practice making observations and drawing conclusions.

▸ Next Generation Science Standards:
2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

Lesson 1: To Eat or Not be Eaten | Predator - Prey Relationships

Objective: 2-LS4-1. Explore the diversity of adaptations in the animal kingdom; understand how adaptations help animals to survive; explore predator-prey relationships and how adaptations play into it

Materials: Colored bandanas, cones, camouflage photos, laminated adaptation animal photos, skulls and/or pelts (if available)

Terms: Predator, prey, camouflage, adaptation, structure, function

Part 1: In Class Discussion (20 min)
Introduce the concept of adaptations by showing the class photos of camouflaged animals from a distance. Direct students to observe with their eyes and not say anything to allow all students to find the animals. What can you see here?

What is this strategy called? **Camouflage!** Camouflage conceals an animal by using physical traits and/or behavioral traits to blend in with its surroundings. Why do some animals use this strategy? How does camouflage help these animals to survive? Consider both prey animals and predators. Prey animals are able to stay hidden from predators to avoid being eaten, while predators can stay hidden to have a better chance of catching prey.

Camouflage is an example of an adaptation. **Adaptations** are special traits, adapted over time, that help a plant or animal to better survive in its habitat (like an animal “super power”). An adaptation represents a special **structure** that serves a **function** for

the animal. However, adaptations may be physical, physiological, or behavioral. Briefly share more examples of animal adaptations while referring to pictures or props (skulls/pelts/tracks), making sure to explain the *structure* that serves a *function*.

Examples:
Rufous Hummingbird

1. Long, thin beak for reaching into flowers
2. Long, straw-like tongue for sucking up nectar

Grizzly Bear

1. Powerful sense of smell to find food
2. Thick fur to stay warm
3. Large, powerful claws/paws for digging, defense, or killing prey

Next, turn it over to the class to come up with their own ideas of animal adaptations. Break up class into small groups of 3-4 and pass out an animal photo to each group. Give the groups a few minutes to discuss and come up with at least 2 adaptations.

What special traits (structure) does the animal have and how (function) are they helping them survive? After discussing, have each group quickly present their ideas of adaptations.

Guiding questions if needed:

- What do you know about this animal?
- What does the animal eat?
- What structure may help them get food?
- What structure may help them in defense?
- How could the shape of its body help the animal?

Animal Adaptation Examples:
Goldenrod Spider (Flower Spider)

1. Camouflage to catch food and evade predators
2. Venom to stun prey and liquify insides
3. Using a flower as a different shelter than webs

Honey Bee

1. Stinger for defense
2. Pollen sacs and stiff hairs to collect pollen
3. Taste with feet
4. Excellent sense of smell

River Otter

1. Thick, waterproof (air-trapping) fur to stay warm and dry
2. Streamlined body for better swimming
3. Webbed feet to help swimming, but with ability to walk on land
4. Sharp teeth for eating meat and cracking shells
5. Ability to hold breath

Western Rattlesnake

1. Rattle on tail for warning and defense
2. Heat sensing to locate prey
3. Long, sharp, retractable fangs
4. Camouflage
5. Poisonous venom

Great Blue Heron

1. Long, skinny legs for wading in water
2. Long, spear-like beak for spearing fish
3. Long neck for reaching into water

Turkey Vulture

1. Strong sense of smell to locate carrion
2. Naked head to help prevent disease from carrion
3. Strong, acidic stomach for digesting and strong immune system

Townsend's Mole

1. Wide forefoot and long claws for digging, like shovels
2. Short fur that can bend in any direction
3. Dark, camouflaged fur
4. Streamlined body for tunneling
5. Strong sense of touch, sensitive vibrissae for sensing surroundings

Hoary Bat

1. Echolocation to find and catch prey at night
2. Large, broad ears for excellent hearing
3. Sharp teeth for catching insects

Part 2: Lizard Tail Tag (30-35 min outside)

Many adaptations have a lot to do with getting food and not getting eaten, like why animals use camouflage. Lizards have an amazing adaptation that helps them to escape from hungry predators. Lizards often have a long tail, and predators chasing a lizard may catch their long tail first. Many lizards can detach their tails (most of it actually falls off) if they are caught to help them escape. The predator is left with the tail, and the lizard is left with its life. The missing tail can re-grow (3-5 weeks) and is usually shorter.

Disclaimer to students: DO NOT TRY THIS ON REAL LIZARDS. Detaching a tail is extremely stressful and energy costing for the lizard.

In this game, students will be lizards and predators. **Lizards wear a green bandana tail** tucked into the back of their waistband/pants. Students wearing dresses can stick it into a pocket, jacket, or other alternative spot. **Predators wear a red bandana** tied around their wrist. Predators are trying to steal lizard tails, while lizards are trying to escape and retrieve any lost tails.

If a lizard's tail is stolen, they must FREEZE. But they can steal their tail back and get back in the game via two ways: (1) steal a green tail of anyone running by you (lizard or predator), or (2) a fellow lizard may steal back a tail from a predator and give it to a lizard in need. Predators that have stolen lizard tails must also wear them in their waistband/pants so that they can be stolen back.

Students will often hold on to the bandanas after stealing or tuck them too far in, so make sure to remind students throughout the game that they must be tucked/easily pulled off.

Play 3-4 Rounds:

1. Create boundaries using cones or markers (not too big otherwise they can run too far)
2. Create a "home base" line. This will be the starting point before each round and can also act as a safety zone if students need a break during a game.
3. Assign each student a bandana as their role (predator or lizard), **assign 4-7 predators, most students will be lizards.**
4. At your signal, lizards run out first within the boundary zone, then release the predators.
5. Play for 5 minutes or less, keeping an eye on all players to make sure they are playing correctly and not being too aggressive.
6. Re-group and assign new predators for the next round.

Wrap-Up Questions:

- Was it scary to be chased by predators as a lizard? Why or why not?
- Is it helpful for prey animals to be afraid of predators to survive? Yes, this fear response makes the lizard run and escape; otherwise, it would be caught.
- What is the word for special traits that help an animal to survive?

Lesson 2: Diversity of Habitats in Central Oregon

Objective: 2-LS4-1. K-ESS3-1. Learn about the diversity of habitats in Central Oregon and the local animals that live there. Understand the importance of a habitat for an animal's survival (access to basic needs) and realize the negative impacts of habitat destruction/fragmentation.

Materials: Central Oregon Habitat Photos on stakes (5), photos of animals, Hula hoops (8-10), cones

Terms: habitat, basic needs, forest, grassland, wetland, rocky outcrop, alpine, migration

Part 1: In Class Discussion (20 min)
Ask the class if they are familiar with the word "habitat." What does it mean? A **habitat** is the natural home where a plant or animal lives. Habitats are a very important part of an animal's survival because they contain all of the basic needs that an animal/plant needs to survive.

Habitats widely range in size, location, climate, and what kinds of living and nonliving things that exist there. A habitat may be as big as the Pacific Ocean or as small as a puddle. A habitat may be as vast as a forest or simply a single fallen tree. For a blue whale, the largest animal on earth, an entire ocean is its habitat. For a bark beetle, a single tree is its habitat where it lives underneath the bark.

What are some other habitats?
Brainstorm habitats from around the world.

Can animals live in any habitat in the world?
Would you see a giraffe living in the Arctic? A polar bear in the rainforest? An otter in the desert? Why not? Because if the habitat doesn't have the basic needs that the animal needs to survive, then the animal can't live there. Plus, their specialized adaptations must be appropriate for their habitat. A giraffe won't have green, leafy food to eat in the Arctic and would get too cold. A polar bear can't find the plump seals they like to eat in the rainforest and could overheat.

What are the 4 basic needs that an animal needs in its habitat?
Food, water, shelter, and space. If an animal cannot get these things in a habitat, then it may not be able to survive there.

Introduce 5 main habitats found within the High Desert of Central Oregon.
These are by no means the only types of habitat in Central Oregon, but the most general.

Ask the class, what do you notice about each habitat?

1. **Forest** is dominated by trees and abundant, layered plant life, providing lots of shelter and food opportunities.
2. **Wetlands/Rivers/Lakes** have abundant plant life and lots of water access.
3. **Grassland/Shrub** is dry and open with low-growing plants (many shelter opportunities are underground).
4. **Alpine** is a high elevation mountain with extreme seasons, sparing plant life, and snow may be present all year.
5. **Rocky outcrop** is visible exposed rock, which provides many shelter spots, limited plant life, and lots of rock (common nesting and hunting sites).

Next, introduce 5 animal photos. **In which habitat would this animal live?** Call on students to come up and match the animal to the correct habitat.

1. River otter (Wetland)
2. Douglas Squirrel (Forest)
3. Mountain Goat (Alpine)
4. Western Fence Lizard (Rocky Outcrop)
5. Western Meadowlark (Grassland)

Part 2: Habitat Match (15 min)
Head outside to match some “mystery” animals to the appropriate habitat that they would live, while incorporating movement. Students will see some familiar animals and be introduced to some unfamiliar animals.

A. Place 5 photos of habitats on stakes in the ground, spread out enough to run to each one.
B. Students will line up shoulder-to-shoulder along a designated “home base” line, which they will return to after each animal.
C. Walk along the line, showing a photo of a “mystery” animal. In which habitat would this animal live? Don’t identify it and don’t let them say their answer out loud. Tell students to keep their thoughts in their heads! Encourage students to make their best guess, to not follow the group, and to think for themselves.
D. On your signal, students will run to the habitat where they think the animal would live. After dispersing, reveal which habitat was correct and have all students run to the correct habitat.

E. Quickly share how the animal's needs are being met in that habitat (What does it eat? Where does it find shelter?), plus a fun fact about the animal.
F. Meet back at home base, and repeat for up to 8 animals.

Notes:

- Try to avoid animals that live in a wide range of habitats to keep it more straightforward.
- Students enjoy the more challenging animals, they are often overly confident :)
- Have students mark a point in their head for each correct match for a more competitive option.

Alpine: Calliope hummingbird, Mountain goat, American Pika, Mountain lion

Forest: Gray Jay, American Marten, Snowshoe hare, Black bear, Douglas squirrel, Mule deer, Spotted woodpecker, Sapsucker, Steller's Jay, Mountain bluebird, Chipmunk, Millipede

Grassland: Black-tailed jackrabbit, Pronghorn, Western Meadowlark, Burrowing owl, Golden eagle, Western sage grouse, American Badger, Sage sparrow, Mule deer

Wetland: River Otter, Beaver, Muskrat, Trout, Western grebe, Red-winged blackbird, Yellow-headed blackbird, Cinnamon teal, Common merganser, Oregon Swallowtail, Kingfisher, Cascades frog, Osprey

Rocky Outcrop: Western rattlesnake, Western fence lizard, Bobcat, Turkey vulture, Raven, Yellow-bellied marmot

Part 3: Shrinking Habitat (15 min or time permitted)
In this activity, students will understand how important an animal's habitat is to its survival and how human development impacts animal habitat. Introduce the concept of **migration**. Many animals make regular, seasonal movements to find enough food and to combat the changing seasons. Students will be migrating birds that travel long distances to follow food and nesting sites. Along this journey, the students will need to find safe habitat to survive, but habitat space will slowly disappear due to human activity.

A. All students start out as a migrating animal of their choosing.
B. Lay out hula hoops in a large circular pattern. The hula hoops represent safe habitat space where the animal can find adequate food, water, and shelter.

C. Similar to musical chairs, the “animals” will walk in a circle on the outside of the hula hoops. When you call out “HABITAT” the animals must find a hula hoop to stand in. Up to two students may be in one hula hoop.
D. Start out with as many hula hoops as possible (10) so ideally all animals survive the first round.
E. Gradually remove one hula hoop at a time and explain the reason for removing it: pollution, building roads/houses/shopping centers/stores, cutting down forest for lumber, or clearing land for farming or cattle.
F. Continue until only 2 animals are left in 1 hula hoop. Ask the class, why did this happen?
G. Repeat the game if time permits.

Wrap up Questions:

- How do humans impact animal habitat?
- How can we improve animal habitat? Even in our own backyards.

Lesson 3: Pollination

Objective: 2-LS2-2. Understand the process of pollination, including the parts of a flower, the function of pollinators, and its importance to the natural world; model pollination by playing a game

Materials: Pollination display board, pictures of flowers and pollinators, yellow bucket, yellow pom-poms, glass beads, timer, yellow bee bandanas (12), fake flowers (2), fake bee, apple

Terms: pollination, seed, fruit, flower, pistil, ovule (egg), stamen, pollen, pollinator, nectar, adaptation

Part 1: In Class Discussion (25 min)
Invite the class to raise their hands if they have eaten fruit today [showing apple]. Have you ever wondered where our fruit comes from? How did it start to grow?

Pollination is how many plants are able to grow seeds and fruit, that can grow into new plants! To be specific, **pollination** is the movement of pollen from one flower (stamen) to another flower (pistil).

Have you ever looked at the parts inside a flower? Flowers actually have male and female parts. The **stamen** is the male part of a flower, and it makes the pollen. **Pollen**

looks like yellow dust, a little sticky, very light, and can make us sneeze. Pollen contains the important DNA to make a new plant. The **pistil** is the female part of a flower, and the top is sticky. Why would that be? This is where the pollen will stick. Deep down inside the pistil are **ovules (eggs)**, which will combine with the pollen to grow into seeds. For the flower to make seeds and fruit, the pollen needs to move from the stamen of one flower to the pistil of another. [Explain on a real or fake flower or diagram]

Pollen can't move by itself, so how does this happen? Pollinators! **Pollinators** are "pollen helpers", that help to spread and exchange pollen among flowers. Most pollinators are animals. Call on students to name animal pollinators: bees, butterflies, moths, beetles, bats, hummingbirds, ants, flies. Other things, like wind and water, also help to spread pollen. [Show pictures of pollinators when introduced]

How do pollinators spread pollen?
Pollen is all over the stamen of a flower, so when a pollinator comes to visit a flower, pollen gets stuck to its hairs, head, and body. The pollinator will then go visit another flower, and all that pollen sticks to the pistil of the other flower. The pollen then travels down inside the flower to meet the eggs. This flower has been pollinated and now it can make seeds and fruit! [Exhibit this with student participation: have 2 students be the flowers and 1 student be the pollinator]

Why are the pollinators visiting the flowers in the first place?
Pollinators are looking for food. The flower offers **nectar** as a trade, a sweet liquid packed with sugar and energy. Many pollinators eat the pollen too, which is packed with protein. Honeybees collect both pollen and nectar to make honey.

The flower's job is to attract pollinators to come to them. **Flowers** are adaptations for pollination, attracting pollinators with bright colors, elaborate shapes, and attractive scents. [Show pictures of flowers]

Pollinators depend on the flowers for food, and the flowers depend on the pollinators to make seeds and new plants. It's a win-win situation!

[Cut the apple in 1/2 to show seeds inside, the sepals and stem give a clue to where the flower was] As the seeds develop, **fruit** grows around the seeds and the petals fall off. The surrounding fruit protects the seeds inside, and serves as a way to disperse the seeds later on. Fruit provides food for animals all over the world, like us. We have pollination and pollinators (especially bees) to thank for that!

Part 2: Pollination Tag (30 min outside)
Students will model pollination, playing the roles of flowers and honey bees. By changing the number of pollinators in each round, students will understand how having **more or fewer pollinators** affects the time and efficiency to pollinate a given number of flowers. The more pollinators, the better!

A. Divide students into “honey bees” and “flowers”, starting with 2 bees and increasing by 2 each round. Bees are given yellow bandanas to wear around their wrist and will stay at “the hive” (the yellow bucket).
B. Mark the “hive” as home base for all, the starting point for each round. Establish boundaries.
C. Flowers are given 2 yellow cotton balls (pollen) and 2 glass rocks (nectar), holding one of each in each hand. Flowers spread out within the boundary zone and “find a spot to grow.” They cannot move once they’ve been rooted in the ground. Flowers position themselves with arms held out like petals holding the nectar/pollen. Remind students to be careful with cotton balls/glass to not lose them.
D. You will be timing how long it takes for the bees to pollinate ALL flowers. To pollinate the flowers, bees will run to the flowers and collect **one set of pollen/nectar** and deliver it to the hive. When a flower has given both sets of pollen/nectar, it has been “pollinated” and will turn into a fruit by sitting down. They can choose any fruit and try to form the shape with their body while sitting.
E. When all flowers are rooted in position, release the bees to start pollinating and begin timer. Flowers may “attract” bees to come to them by dancing or hollering at the bees. As flowers are turning into fruit, walk around and have each student tell you what fruit they are.
F. When all flowers have become fruit, stop the timer and regroup all at home base. Share the time it took for that # of bees.
G. For each round, increase the number of pollinators by 2 (4, 6, 8, 10, 12), making sure that every student has the opportunity to be a bee.

Wrap up Questions:

- Was it better to have *more or fewer* pollinators?
- What happened when there were *fewer* pollinators?
- What happened when there were *more* pollinators?

Lesson 4: Seed Dispersal

Objective: 2-LS2-2. Understand the function of seed dispersal and its importance for a plant's life cycle; explore the diversity of seed dispersal methods and observe real seeds to determine their method of dispersal

Materials: Seed samples (10-15), "Seed Dispersal" poster or photos, clipboards, seed dispersal worksheets, # cards for stations

Terms: seed, seed dispersal, adaptation, fruit, cache, serotinous, resin, hitchhiker, parent plant

Part 1: In Class Discussion (20 min)
Remind students about the process of pollination or call on students to test their knowledge. Pose the question: after a flower is pollinated, what will become of the seed? The seed can grow into a new plant!

However, all of the seeds that the "parent plant" produces cannot grow exactly where the parent plant grows. Why not? Each seed needs its own space to fully grow and meets its needs for survival: nutrients from the soil, water, sunlight, and space. Otherwise, plants must compete for resources if grown too closely.

To put this into perspective, a single Ponderosa Pine tree may have hundreds of seeds within their cones. Could 300 trees all grow in the same spot? No way! So these "baby" seeds need to "move out" away from their parents to a new spot to grow.

How does the seed relocate?
The traveling of the seed away from the parent plant is called **seed dispersal**. Plants have developed all sorts of strategies to do this. Remember **adaptations**? Plants have developed a variety of adaptations in their seeds and fruits to help disperse their seeds. Each dispersal method comes with its own benefits and challenges.

Share and discuss seed dispersal methods while showing photos or real seeds/fruit:
1. Wind
Wind-dispersed seeds have special adaptations to catch the wind: wings, gliders, helicopters, feathery parts, parachutes. These seeds are very light and numerous to aid in flight and increase chances for planting. Heavier, bulkier seeds do not travel as far. If the wind is right, these seeds can travel long distances. However, these seeds often

land in bad spots, like on a roof or in a puddle, so having numerous seeds ensures that some will plant.
Examples: Dandelion, Maple, Cottonwood, Thistle, Milkweed

2. Water
Plants that live in or near water may have seeds that float away. Water-dispersed seeds could float across the ocean, between islands, or downstream from a river. Size doesn't matter, big or small, as long as they can float.
Examples: Coconut, Mangrove, Water Lily

3. Animals
A. Eating fruit

Edible, sweet, juicy fruit entices animals to eat it. Animals may eat the fruit and discard the seed or will eat the whole fruit including the seeds. Seeds have a hard, protective coating around them to protect them from being broken down in the acidic stomachs of an animal's digestive system. That animal will carry the seeds inside and move along, potentially miles away until the animal releases the seeds in its poop. The seeds are in a new location with fertile poop to offer nutrients.
Examples: Apples, berries, peaches, pears, plums

B. Storing Nuts in Caches

Nuts are a kind of fruit! Nuts are mainly consumed by rodents and birds and are high in nutrition. Nuts do not open to release their seeds inside. When a nut is eaten, the seed loses its opportunity to grow into a new plant. How do they get a chance to grow? These animals often store or bury **caches** of them in large quantities. Sometimes the animal forgets or dies and does not return to the nuts, allowing the buried seeds to grow.
Examples: Acorns, hazelnuts, chestnuts

C. Hitchhikers

"Hitchhiker" seeds are equipped with special structures like spines, burs, hooks, and barbs to literally hitch a ride on passing animals by getting stuck in their fur or feathers. The animal may travel for miles and miles before the seed falls off.
Examples: Cocklebur, Beggar-ticks, thistles

4. Explosion
Exploding fruit disperse their seeds with powerful force. For most, the heat of the sun will build pressure inside the fruit, until it bursts and shoots the seeds outward. This method takes a lot of built-up pressure and specialized adaptations to shoot seeds far

enough, so it's not common. The Sandbox Tree has exploding pumpkin-like fruit that can launch seeds up to 330 feet away at 160 mph!
Examples: Sandbox tree, Pea pods, Witch Hazel

5. Fire
Fire-adapted plants have developed seeds that are activated by wildfire, or even post-wildfire smoke and charred plant material. Some pine trees have **serotinous** cones, which only open to release seeds by exposure to fire or high heat. Cones will be tightly sealed with **resin** (nature's super glue), until being exposed to the right temperature. A tree may wait 10 or more years for a wildfire to pass through, but fires also cannot be too frequent or the plant may die. A wildfire will eliminate much of the undergrowth of a forest, minimizing competition for space, sunlight, nutrients, and water. The soil may also be nutrient and mineral rich post-wildfire.
Examples: Lodgepole pine, Jack pine, Eucalyptus

Gravity also plays a role in *all* seed dispersal, by felling seeds to the ground, no matter the dispersal method.

Part 2: Seed Investigation (30-40 min)
In this hands on learning activity, students will investigate various seeds and determine how they think the seeds are dispersed.

NOTES: Clearly explain to the class which seeds may be handled and which may not. Some are too delicate, too pokey, too messy, or cannot be reused if not handled carefully, keep these contained in jars. Students LOVE to touch them, so allow as many to be handled as possible or showcase some seeds to the class yourself. If you allow students to handle the seeds, monitor this carefully between yourself and the teacher.

This activity takes 10-15 minutes to set up prior to the lesson. Be prepared to arrive early to set up and work out the best location with the teachers. This activity has been successful both outside (although be weary of wind) and inside in empty classrooms (be weary of mess). Ideally, plan to leave setup for all classes and break down at the end.

A. [10-15 minutes prior] Set up 10-15 stations of different seeds exhibiting various seed dispersal methods, labeling each station with a numbered card and sticky tack. Don't label the plants/seeds, the focus should be on observing the "mystery" seeds and making the best guess for how they are dispersed. Equip each station with 1-2 magnifying glasses.

B. Break students into pairs, each pair will work together, sharing a clipboard and "Seed Investigation" worksheet.
C. Assign each pair a station number as a starting point. They will rotate to the next number on your call.
D. Pairs will have 2-3 minutes at each seed station, examining the seeds and determining which method the seed is dispersed (their best guess). Students will mark their answer on the worksheet. Rotate stations.
E. After the students observe all seed stations, re-group the class and discuss the findings.

Wrap Up:

- What was the most common seed dispersal method observed?
- What was the least common?
- What was your favorite seed?

Alternative Activity: Paper Plane Seed Dispersal (30 min)
In this activity, students will design and draw their own original seed, then turn their paper into a wind-dispersed seed (paper airplane) for a game outside. The game will break students into teams (each team a plant) to see which team can disperse their seeds the farthest.

A. Pass out blank paper to each student in the classroom. Allow ~5 minutes for students to design and draw their own seed/fruit. They may come up with a new seed dispersal method or use a method discussed. Encourage endless creativity!
B. Then, turn the papers into "wind-dispersed seeds" by making paper airplanes. Direct the class step-by-step for building the plane. All students must make it the same way.
C. Follow YouTube video (https://youtu.be/veyZNyurlwU): "How to make a paper airplane that flies far"
D. Head outside for the game. Break the class into teams of 4 students. Each team represents a plant. All teams will get into a line at the same starting point. Align the starting line so students will throw the planes in the direction the wind blows, not against it.
E. The first throwers for each team will throw their "seed" straight forward as best they can. They will sit where their seed landed.
F. The next throwers will throw from where the **previous seed landed**, getting farther and farther out. The team who gets their last seed the farthest wins! Play multiple rounds.

Notes: Help direct throwers when they can throw and help lead students to where the previous seed fell. This game can be difficult to play in certain wind conditions, sometimes it worked very well, sometimes not well, but still fun!