



Ecology in Classrooms & Outdoors

COLD WEATHER ANIMALS PT. I

TEACHER GUIDE

Introduction

In this two-part lesson, students will learn how different animals survive in cold environments using their physical, behavioral, and physiological adaptations. First, students are introduced to ectothermic animals, or animals that rely on external sources of heat. They will discover that ectotherms are typically more reliant on their behavioral adaptations to keep warm during the colder months of the year. Then, students are introduced to endothermic animals, or animals that maintain their internal temperature through biological processes. For these animals, students will focus on how physical adaptations help them to survive in cold climates. After each lesson, students have activity options to act out, draw a diagram, build a model, write an explanation, or a combination of these to create their own perfectly-adapted cold weather animal.

Materials

- Cold Weather Animals Pt I presentation
- Student activity sheet (2 pages)
- Pencil, paper
- Coloring supplies (optional)
- Other craft materials: fabric, paint, construction paper, collage, yarn, etc. (optional)

Lesson Length

30-40 min asynchronously or
synchronously

Standards

NGSS

2-LS4-1 Biological Evolution: Unity and Diversity

Make observations of plants and animals to compare the diversity of life in different habitats.

3-LS3-2 Heredity: Inheritance and Variation of Traits

Use evidence to support the explanation that traits can be influenced by the environment.

4-LS1-1 From Molecules to Organisms: Structures and Processes

Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

MS-LS1-4 From Molecules to Organisms: Structures and Processes

Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.



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TEACHER GUIDE

Lesson Procedure

1. WEATHER VS. CLIMATE

To begin, it is important that students understand the difference between weather and climate. **Weather** is defined as the atmospheric state at a specific time or season, such as the temperature (hot/cold) or precipitation level (rain, sleet, snow, hail, dry). **Climate** is defined as the weather conditions that prevail in an area in general over long periods of time.

Animals living in cold-climate ecosystems have adaptations that help them live in these harsh conditions year-round, while animals that live in regions with more varied temperatures throughout the year have adapted to endure the colder winter months in different ways. As students learn about examples of each, keep in mind how this idea applies to different animal adaptations.

2. WHAT ARE ADAPTATIONS?

All living organisms have **adaptations**, or defining traits that species have passed down through generations that help them survive in a particular environment. For animals, this means adaptations are what help them to find food, hide from predators, attract mates for reproduction, and survive various weather conditions.

Adaptations can be:

- **Physical:** special body parts that help a plant or animal survive in an environment (e.g. the thickness of the fur, structure of the beak)
- **Behavioral:** actions animals take to survive in their environments (e.g. the way an animal builds a den, migrates from one part of the world to another)
- **Physiological:** internal body processes to regulate and maintain homeostasis for an organism to survive in the environment in which it exists (e.g. the release of toxins or poisons to ward off predators)

Animals that live in cold environments rely on key adaptations that help them survive the cold, whether it's wintertime or they live in a cold-climate ecosystem like the mountainous alpine or the arctic tundra.

3. DEFINE ECTOTHERMS

Animals that rely on external sources of heat to maintain their body temperature are known as **ectotherms**. Ectotherms are also often called “cold-blooded” animals, because they do not produce heat through biological processes. Therefore, the temperature of the environment around them is somewhat the same as the temperature of their bodies.

Because of this, ectotherms often rely on **behavioral adaptations** to help them maintain their body temperature during the winter months. Some **physiological adaptations** come into play with select ectotherms. In general, ectotherms are found in regions closer to the equator, and are less common in very cold climates such as either pole, or high up in the mountains.

Begin by asking students if they can think of any examples of ectotherms, or “cold blooded” animals. Types of ectotherms include reptiles, amphibians, invertebrates (insects, arachnids, mollusks, crustaceans), and fish.

Then, go through the presentation titled **Cold Weather Animals, Pt I**, to learn more about some fascinating ectothermic animals and the adaptations they use to survive in the cold.



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COLD WEATHER ANIMALS PT. I TEACHER GUIDE

Lesson Procedure, cont.

4. DISCUSS ADAPTATIONS & EXAMPLES

As you go through the presentation slides, take note of the behavioral and/or physiological adaptations listed.

Some common behavioral adaptations include:

- **Dormancy** - entering an inactive state away from predators and out of the elements. When entering a dormant state, bodily functions such as heart rate, breathing rate, and metabolism slow down*
- **Migration** - physically moving from one environment to another, where food sources, breeding habitat, and other resources are available
- **Kleptothermy** - huddling together with another individual or group of individuals to share body heat
- **Basking** - laying out on a rock or other exposed surface to soak up thermal heat from the sun
- **Caching** - storing/hiding food for later use

*Dormancy is often used interchangeably with the term **hibernation**, yet ectotherms do not enter “true” hibernation, because they are not able to actively regulate their body temperature. In the next lesson, students will learn about true hibernation for **endothermic** animals, or animals that regulate their temperature internally.

Although many insects die off in the winter, colonies of **honey bees** will keep their queen alive by replacing the colony members with winter bees (which are larger and have a longer lifespan than summer worker bees), caching honey for when flower nectar and pollen is scarce, and huddling together and buzzing for warmth.

Snakes, like the rattlesnake pictured, often go dormant in underground holes or underneath rocks. Some snakes will huddle together in groups, sometimes with different species in the same huddle! When the sun is shining on cold days, snakes will bask on rocks or bare ground to absorb heat.

Some species of **butterflies**, like the monarch, live through the winter months as adults by migrating south to warmer climates. In Mexico, monarch butterflies are able to find plenty of food to fuel their return to North America to breed. Other butterfly and moth species time their reproductive cycle so that their larvae form a chrysalis or cocoon during the winter, emerging as adults during the spring.

Turtles use behaviors and physiological processes to survive the winter in their aquatic environments. Many turtles go dormant at the bottom of frozen ponds, as water insulates better than air. As turtles' metabolic processes slow down, and the pond becomes less oxygenated throughout the winter, some turtles have adapted to use their rear-ends to take in oxygen instead of their lungs! Others enter a state of dormancy in shallow holes in the ground. Like snakes, turtles also surface during sunny periods and bask on rocks or logs.

Frogs, although seemingly fragile, live in a wide range of habitats from the arctic circle to the hottest deserts. To survive cold temperatures, frogs employ a variety of behavioral and physiological adaptations depending on the species. Some frogs enter a state of dormancy under oxygen-rich water and occasionally swim around, while others lay partially buried in mud or under leaf litter. Wood frogs, as shown in the video, create a “natural antifreeze” that protects their cells and organs in freezing temperatures!

5. HOW TO HELP ECTOTHERMS IN YOUR OWN COMMUNITY

Ectotherms come in many shapes and sizes and are found in a variety of habitats, even in our own backyards! To help play a role in protecting local animals like reptiles, amphibians, insects, and fish, there are a few things students can do to keep ectotherms safe during the winter.



Ecology in Classrooms & Outdoors

COLD WEATHER ANIMALS PT. I TEACHER GUIDE

Lesson Procedure, cont.

This is important because, like the examples of honey bees and butterflies, some ectotherms are pollinators. And, all animals play a key role in the food web.

Here are some ways students can protect native ectotherms this winter:

1. Leave fallen leaves on the ground. Bugs, slugs, frogs, salamanders, snakes, and other animals burrow under leaf litter for protection from the cold. For more information on this, read [this blog post from the Xerces Society](#).
2. Create a bug “hotel”. Many bugs seek safe, cozy holes to lay their eggs in, incubate larvae, or protect themselves from the cold of winter. To learn how to make a DIY bug “hotel” out of recycled materials, [here is a great tutorial](#).
3. Protect fish habitat. Salmon lay their eggs in cold freshwater streams and creeks, where they remain over the winter. Planting native plants along stream banks helps shade the stream and keep the water cool when spring returns. Ask your local watershed council which native plants are best for planting alongside stream banks.

6. ACTIVITY: CREATE A COLD WEATHER ECTOTHERM

For this activity, students will get creative and build their own ectotherm using the activity sheet to record their ideas or their choice of materials (drawing, painting, 3D craft supplies, costume pieces).

Students will determine a habitat, real or imaginary, where their animal species lives. Looking at the examples provided in the presentation and on the activity sheet, or after doing additional research on their own, students will create their ectothermic animal and label the adaptations it uses to survive cold temperatures.

Use these guiding questions to get students started (also found on the student activity sheet):

1. What habitat does the animal live in (arctic, boreal forest, wetland pond, alpine, tundra, cold desert?)
2. What happens to this species when it gets cold outside, either during the winter or nighttime?
3. How does the animal use external sources of heat and/or behaviors to maintain their body temperature?
4. What other adaptations does this animal have to survive through the winter or in a cold climate?

7. SHARE

Invite students to share their ectothermic animal with the group, in person or over your preferred digital learning platform.