

Where are the Wolves?



Teacher's Guide

Interdependent Relationships in Ecosystems

Teacher's Guide

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Written by teachers and administrators
from public school districts within
the borders of the NYS Midwest Joint
Management Team in conjunction with
the BOCES 4 Science Educators

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Where are the Wolves?

Foreword

BOCES 4 Science is a collaboration between four New York State BOCES (Board of Cooperative Educational Services). This collaborative of science educators came together to respond to the need for instructional resources based on the New York State pK-12 Science Learning Standards (NYSSLS). The research behind the Next Generation Science Standards (NGSS) and the NRC publication, A Framework for K-12 Science Education is the basis for the NYSSLS.

We believe that the future health and well-being of our world depends on scientifically literate people making informed decisions. The development of literacy in science begins at the earliest grades. Elementary children must have concrete experiences upon which to hook their understanding and new vocabulary – this is especially true in the discipline of science. We embrace the notion that students should experience phenomena and solve real problems to learn about the world. We strive to present lessons and materials that will make high quality science instruction available for all students through cost-effective resources for teachers.



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Where are the Wolves?

About this Unit

Overview

The Where are the Wolves Unit is designed for 3rd grade. The main focus of this unit are how organisms survive in an ecosystem. The anchoring phenomenon is the wolves of Yellowstone. Students learn about how bringing wolves back to Yellowstone National Park changed the park's ecosystem. Students are posed with the question, "Should wolves be brought back to Adirondack Park in New York State?" To help them make their argument, students learn about the concerns of New York State citizens and animal adaptations. Specifically, students focus on animals that survive in groups vs. solitary animals and why some organisms survive well in a habitat while others survive less well or not at all. Fossils included in this unit represent other animals that are no longer found in New York State. Through data gathered while studying fossils, students figure out through data what New York State was like long ago. Deforestation is also focused on as an environmental change. Students investigate whether solutions to deforestation have merit and would make a positive impact to a changed ecosystem.

Scheduling

This unit is scheduled to be in the classroom for 12 weeks. There are approximately 25 science instructional sessions in this unit, based on 30-40 minutes each. Adjust your schedule accordingly. Please return the unit promptly or to request an extension, call 585-352-1140.

Materials to Obtain Locally

Some lessons require materials that are NOT supplied in the kit. These materials can be easily obtained by the teacher or the students. Materials that will need to be provided are indicated with an asterisk in the lesson materials list and are also listed below:

8 ½"x 11" paper or larger (Lesson 1)	Index cards (Lesson 4)	Paper bags or small container (Lesson 8)
8 ½"x 14" paper (Lesson 7)	Interactive Whiteboard or projector screen (Lesson 1, 2, 4, 5, 6, 7, 8, 9)	Post-it notes (3"x 3" or larger) (Lesson 1, possibly Lesson 4)
Chart paper (Lesson 1, 2, 4, 5, 6, 7)	Markers (Lesson 1, 2, 4, 5, 6, 7)	Resource books and/or websites on wolf adaptations (Lesson 5)
Computers or iPads (Lesson 8)	Masking tape (Lesson 6)	Water (Lesson 4, 5)
Freezer (Lesson 5)	Meter stick (Lesson 6)	
Ice (ice cube tray provided) (Lesson 5)		

Three Dimensions

Each of the BOCES 4 Science lessons includes at least one element from each of the three dimensions identified in the NYSSLS. The lesson page identifies the specific elements targeted; the NYSSLS topic page is included at the back of the Teacher's Guide.

Science and Engineering Practices (SEP)

– These are the major practices that scientists employ as they investigate and build models of their understanding of the world. They also include key practices used by engineers as they design and build systems.

Disciplinary Core Ideas (DCI)

– Selected to represent four major domains: the physical sciences; the life sciences; the earth and space sciences; and engineering technology, and the applications of sciences.

Crosscutting Concepts (CCC)

– These big ideas have application across all domains of science and provide one way of linking across the domains of the DCI's. In addition, they link to ideas that are parts of other elementary subjects.

Where are the Wolves?

NYSSLS Shifts in Instruction

It is the intention of BOCES 4 Science that this unit provides lessons that demonstrate the following shifts in instruction:

- **Explaining Phenomena or Designing Solutions to Problems:** The unit focuses on supporting students to make sense of a phenomenon or design solutions to a problem.
- **Three Dimensions:** The unit helps students develop and use multiple grade-appropriate elements of the SEPs, CCCs, and DCIs which are deliberately selected to make sense of phenomena or design a solution to a problem.
- **Integrating the Three Dimensions for Instruction and Assessment:** The unit will elicit student artifacts that show direct, observable evidence of three dimensional learning.
- **Relevance and Authenticity:** By taking advantage of student questions and experiences in the context of their homes, neighborhood and community, the lessons in this unit will motivate student sense-making or problem-solving.
- **Student Ideas:** This unit provides opportunities for students to express clarify, justify, interpret or represent their ideas and to respond to peer and teacher feedback.
- **Building on Students' Prior Knowledge:** Since student understanding grows over time, this unit identifies and builds on students' prior learning in three dimensions in such a way as it is explicit to both students and teachers.

Assessment:

Providing opportunities for assessment of learning and feedback to students is an important step in the educational process. This unit includes embedded formative assessments and a final summative assessment of learning. The teacher is encouraged to use a variety of informal or anecdotal assessment strategies as well, such as: portfolios of artifacts, "thumbs up" & "thumbs down", "ticket out the door", regular perusal of student science journals or having students keep an additional notebook to contain their reflections.

Additional Features of this Unit:

The *Where are the Wolves* unit also includes Science Journal pages that are available online at the BOCES 4 Science website. (A web address and password are located within the science kit.)

Additional resources for the teacher, such as the specific assessments, ELA and/or ELL supports, direct links to videos or websites mentioned in the teacher's guide, etc. can also be found on the BOCES 4 Science website.

Where are the Wolves?

Features that Support 3-D Learning

Look for these features in the Teacher's Guide:

NYS pK – 12 Science Learning Standards within each lesson provide the teacher with specific information about the Performance Expectation and the 3-Dimensions that are targeted by the instruction in this lesson.

Performance Expectations:

K-2-ETS1-2 – Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Science and Engineering Practices

Developing and Using Models

Develop a simple model based on evidence to represent a proposed object or tool.

Disciplinary Core Ideas

ETS1.B: Developing Possible Solutions

- Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

Crosscutting Concepts

Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s).

ELA/Math/Social Studies Connections:

ELA: 2R1

Math: NY-2.MD

Social Studies:

Throughout the Teacher's Guide, the 3-Dimensional Domains are color coded within the text so that teachers know to emphasize or explicitly point out to students this connection to either the **Science and Engineering Practices (SEPs)** and the **Crosscutting Concepts (CCCs)**. In addition, small boxes on the side of the Procedure serve as a visual reminder as well.

In addition, a small picture of the page(s) of the Student Science Journal (with answers) that students are using for each lesson has been included on the appropriate pages in the Teacher's Guide (see box to the right). This keeps the teacher from needing to go back and forth between various documents pertaining to a particular lesson.

Lesson 6 - Animal Groups

1. How do you think living in a group could help protect the chacma baboon from its predator, the leopard?
Answers vary but may include that the chacma baboons could group together to fight off the predator (leopard).

2. How do you think being a solitary animal helps the leopard hunt?
Answers vary but may include that hunting alone allows the leopard to control his surroundings. He can be very quiet without a companion making noise and alerting the prey.

3. The video mentions physical and behavioral adaptations of the chacma baboon and the leopard in the video. Write them in the chart below.

Leopard	Chacma baboon
Strong climber Long back legs Thick padded feet Moves quietly in the night Night vision Claws	Fierce fighter Runs 35 mph Climbs to the top of the trees

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CCC: Crosscutting Concept(s):

Cause and Effect:

Events have causes that generate observable patterns.

New York State P-12 Science Learning Standards

Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

- 3-LS2-1. Construct an argument that some animals form groups that help members survive.** [Clarification Statement: Examples of groups could include a herd of cattle, a swarm of bees, a flock of geese, a pod of whales, etc.]
- 3-LS4-1. Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.** [Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.]
- 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.** [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]
- 3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.** * [Clarification Statement: Examples of environmental changes could include both natural and human-influenced changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Analyzing and Interpreting Data:

Analyzing data in 3-5 builds on K-2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.

- Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS4-1)

Disciplinary Core Ideas

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet other move into the transformed environment, and some die. (secondary to 3-LS4-4)

LS2.D: Social Interactions and Group Behavior

- (NYSED) Being part of a group helps some animals obtain food, defend themselves, and survive. Groups may serve different functions and vary dramatically in size. (Note: Moved from K-2) (3-LS2-1)

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change. (3-LS2-1), (3-LS4-3)

Scale, Proportion, and Quantity

- Observable phenomena exist from very short to very long time periods. (3-LS4-1)

Systems and System Models

- A system can be described in terms of its components and their interactions. (3-LS4-4)

New York State P-12 Science Learning Standards

Engaging in Argument from Evidence

Engaging in argument from evidence in 3-5 builds on K-2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed worlds.

- Construct an argument with evidence, data, and/or a model. (3-LS2-1)
- Construct an argument with evidence (3-LS3-4)
- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-LS4-4)

LS4.A: Evidence of Common Ancestry and Diversity

- Some kinds of plants and animals that once lived on Earth are no longer found anywhere. (*Note: Moved from K-2*) (3-LS4-1)
- Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. (3-LS4-1)

LS4.C: Adaptation

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3)

LS4.D: Biodiversity and Humans

- Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Knowledge of relevant scientific concepts and research findings is important in engineering. (3-LS4-4)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes consistent patterns in natural systems. (3-LS4-1)

Connections to other DCIs in second grade: **3.ESS2.D** (3-LS4-3), **3.ESS3.B** (3-LS4.4)

Articulation of DCIs across grade-levels: : **K.ESS3.A** (3-LS4-3)(3LS4-4); **K.ETS1.A** (3-LS4-4); **1.LS1.B** (3-LS2-1); **2LS2.A** (3-LS4-3),(3-LS4-4); **2.LS4.D** (3-LS4-3),(3-LS4-4); **4.ESS1.C** (3-LS4-1); **4ESS3.B** (3-LS4-4); **MS.LS2.A** (3-LS2-1),(3-LS4-1),(3-LS4-3),(3-LS4-4); **MS.LS2.C** (3-LS4-4); **MS.LS4.A** (3-LS4-1); **MS.LS4.B** (3-LS4-3); **4.ETS1** (3-LS4-4); **MS.LS4.C** (3-LS4-3),(3-LS4-4); **MS.ESS1.C** (3-LS4-1),(3-LS4-3),(3-LS4-4); **MS.ESS2.C** (3-LS4-1); **MS.ESS3.C** (3-LS4-4)

Common Core State Standards Connections:

ELA/Literacy –

- RI.3.1** Ask and answer questions to demonstrate understanding of text, referring explicitly to the text as the basis for the answers. (3-LS2-1),(3-LS4-1),(3-LS4-3),(3-LS4-4)
- RI.3.2** Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS4-1),(3-LS4-3),(3-LS4-4)
- RI.3.3** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause and effect. (3-LS2-1),(3-LS4-1),(3-LS4-3),3-LS4-4)
- W.3.1** Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-LS2-1), (3-LS4-1), (3-LS4-3),(3-LS4-4)
- W.3.2** Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS4-1),(3-LS4-3),(3-LS4-4)
- W.3.8** Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories (3-LS4-1)
- SL.3.4** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS4-3, (3-LS4-4)

New York State P-12 Science Learning Standards

Mathematics –

- MP.2** Reason abstractly and quantitatively. (3-LS4-1), (3-LS4-3), (3-LS4-4)
- MP.4** Model with mathematics. (3-LS2-1), (3-LS4-1), (3-LS4-3), (3-LS4-4)
- MP.5** Use appropriate tools strategically. (3-LS4-1)
- 3.NBT** Number and Operations in Base Ten (3-LS2-1)
- 3.MB.B.3** Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step “how many more” and “how many less” problems using information presented in scaled bar graphs (3-LS4-3)
- 3.MB.B.4** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units – whole numbers, halves, or quarters. (3-LS4-1)

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea. The text in the “Disciplinary Core Ideas” section is reproduced verbatim from A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas unless it is preceded by (NYSED).

Lesson 5

Animal Adaptations



Focus Question:

How are animal adaptations important to survival? How do wolves adapt to their environment?

Lesson Synopsis

Learning Target(s):

I can compare the effectiveness of fat as an adaptation against the cold temperatures.

I can compare the effectiveness of waterproofing fur/feathers as an adaptation against water/precipitation.

I can research the adaptations of wolves in their environment.

Lesson Description:

This lesson takes four sessions to complete. Students investigate the effects of animal insulation on temperature by placing their hand in ice water, with and without insulation. Students investigate the effects of oil as a waterproofing agent by using paper towel feathers, with and without petroleum jelly (oils), and comparing the behavior of water when applied to each feather. Students then research wolves and how they adapt to the environment.

Management

Materials

For the class:

1 empty mitt
1 fat mitt
1 thermometer
2 buckets
Animal Fur PowerPoint (BOCES 4 Science website)
Can You Guess the Adaptation? (BOCES 4 Science website)
Petroleum jelly
Video: Sound Frequencies (Links to Resources page – BOCES 4 Science website)
Video: Veterinarian Video (Links to Resources page – BOCES 4 Science website)
Vinyl gloves
Chart paper*
Freezer*
Ice* (1 ice cube tray provided)

Interactive whiteboard or screen*
Markers*
Question Chart from Lesson 1*
Resource books and/or websites on wolf adaptations* (Sample websites on Links to Resources page - BOCES 4 science website)
Water*

For each pair of students:

1 paper plate
2 pieces of paper towel (cut into a feather shape)
Water dropper bottle

For each student:

Where are the Wolves? Student Science Journal
Wolf Research Scientist Notebook

*provided by teacher/student

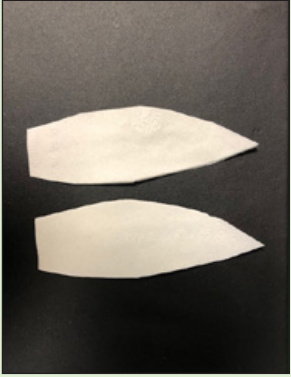
Vocabulary:

adaptation
behavior
adaptation
camouflage
hibernation
insulator
migration
physical adaptation
waterproof

Safety:

Students can wear vinyl gloves to improve sanitation while using the different mitts.

Lesson 5 Animal Adaptations *cont.*



Preparation:

The day before completing Part 2 of this lesson, add water to the ice cube tray and place it in the freezer. Ice from bags purchased at a store can also be used.

When ready to use, fill the buckets half way with water. Add equal amounts of ice to each bucket. Each bucket of water should be approximately the same temperature.

The fat mitt and empty mitt the students use are pre-assembled. The fat mitt contains hardened vegetable shortening.

Fill dropper bottles with water.

Cut paper towels into the shape of a feather (2 per student)

Teacher Background:

Adaptations help animals survive in their habitat. Animals have both physical and behavioral adaptations.

Physical Adaptations:

Mammals and birds typically prepare for winter by eating constantly throughout the fall while food availability is high. The extra body weight is stored in the animal's body as fat. The fat can provide an insulating layer that helps keep the body warm. The fat is also the body's way to store food. When animals cannot find food in the winter, their bodies break down fat for energy to stay alive.

Most mammals go into the winter season with a thicker fur coat. This coat may be a different color than their fur coat throughout the rest of the year. Many mammals have an undercoat of curly fur. Birds have down feathers. The undercoat and the down feathers are both designed to trap and hold in air. Air is an excellent **insulator** as it blocks the transfer of heat from the animal's body to the outside.

Another physical adaptation is that some animals have a strong sense of hearing. Dogs have better hearing than humans because they can hear high-frequency sounds. A dog whistle, which sounds silent to humans, produces sounds in the 50-kHz range that dogs can hear. Dogs can hear these high-pitched sounds primarily because of the way they have evolved. Wild dogs hunted for a living and their main prey were little rodents that make very high-pitched sounds. They also can hear sounds from a farther distance away. This is due to the way their ears are designed. Their ears are made to cup and move sound inward. Humans can cup their ear with their hand for a similar effect. Dogs can also move their ears around to focus in on sounds coming from different directions.

Another physical adaptation that students may be familiar with is **camouflage**. Animals often use camouflage to hide from predators. The camouflage helps the animals blend in with the environment so it goes unnoticed. For example, arctic foxes have brown fur most of the year, but their fur turns white in the winter to blend in with the snowy landscape.

Lesson 5 Animal Adaptations *cont.*

Behavioral Adaptations

Animals also prepare for winter in other ways. If an animal changes the way it acts to stay alive, this is called a behavioral adaptation. Most animals become less active in winter. When they are less active, they use less calories and need to eat less food. This is helpful when food is scarce. Some animals enter a sleep-like stage called **hibernation**. When animals hibernate, their body temperature, heartbeat, and rate of respiration drops significantly. Animals in hibernation cannot be awakened from their sleep. For this reason, bears are not true hibernators because they can be awakened. However, their bodies undergo many of the changes that true hibernators experience. In addition to putting on an extra layer of regular fat, mammals that sleep through winter also develop a special type of fat called brown fat. Brown fat surrounds the organs of the heart, lungs and brain. When an animal awakens, this brown fat is broken down quickly to provide energy to the organs.

Some animals prepare for winter by avoiding it and **migrating** to other locations. Geese, robins, hummingbirds are familiar birds that fly south in the fall. Monarch butterflies are also known to fly south to Mexico to avoid the winter cold. This behavior allows them to stay warm and find food during the winter.

Standards

Performance Expectations:

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. *[Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]*

Science and Engineering Practices

Asking Questions and Defining Problems:

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.

Analyzing and Interpreting Data

- Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.

Obtaining, Evaluating, and Communicating Information

- Obtain and combine information from books and/or other reliable media to explain phenomenon.

Disciplinary Core Ideas

LS4.C:

Adaptation

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change.

Structure and Function

- Substructures of natural objects have shapes and parts that serve functions.

ELA/Math/Social Studies Connections:

ELA: : 3R5, 3W2, 3W6, 3SL1

Lesson 5 Animal Adaptations *cont.*

Vocabulary:

- **adaptation** - a trait or behavior which helps an animal or plant survive in an environment
- **behavioral adaptation** - a change an organism makes in the way it acts to stay alive
- **camouflage** - an adaptation that allows animals to blend in with their environment.
- **hibernation** - spend the winter in a resting state
- **insulator** - a material that blocks heat or cold from leaving an area
- **migration** - movement of animals from one place to another for survival
- **physical adaptation** - a physical feature of an organism that helps it survive in its environment
- **waterproof** - not letting water through

Misconceptions:

Students may have the misconception that traits for survival are developed by organisms in response to the individual organism. Instead, these traits are developed across generations in response to environmental demands.

Procedure

Part 1

Phenomenon:

Remind students that in the last lesson the class decided to focus on how animals survive in an ecosystem and animal adaptations. This information will also help with their training as an Environmental Student Officer. Not only do Environmental Officers need to know what animals live in the state, they need to know how they survive and in what environments they survive best. Ask students to listen to the sounds on a video that will play at different frequencies. The link for the Sound Frequencies video can be found on the Links to Resources page on the BOCES 4 Science website for this unit. Explain to students that the numbers on the video are showing each sound's frequency. (Frequency is the speed of the vibration, and this determines the pitch of the sound. The concept of frequency can be reviewed from the BOCES 4 Science unit on Grade 1 Waves: Sending Messages with Light and Sound.) As the frequency goes up, students will hear the sound change. Ask students to raise their hands when they hear the sound on the video and to put their hands down when they no longer hear the sound.

Discuss with students why they think they can no longer hear the sound and if they think any person or animal could hear the sound. Students who have dogs may be familiar with a dog whistle and how a dog can hear a dog whistle but a human cannot hear it. Expand on that concept and explain that an animal such as a dog or a wolf can hear the sounds at a higher frequency. They have excellent hearing as an adaptation. Discuss with students why they think excellent hearing would be a helpful adaptation to have. Accept all student ideas at this time. After students learn more about adaptations, they will revisit this phenomenon.

Lesson 5 Animal Adaptations *cont.*

1. Ask students what **questions** they have about the video or other ways animals survive in the environment. The teacher can also contribute to the **questioning** to help the conversation stay focused on the topic.
2. Add **questions** to the Question Chart from Lesson 1 or create a separate chart for **questions** on adaptations to be answered during the course of the lesson.
3. Show students the PowerPoint presentation titled Can You Guess the Adaptation? found on the BOCES 4 Science website for this unit/lesson. This presentation shows pictures of various animals, including a wolf, that are camouflaged in their environment. After looking at the pictures see if students can identify the adaptation as camouflage.

Discussion Questions:

- Can you see the animals in the pictures easily? Why or why not? (Answers vary but may include that the animals are harder to see because their coloring is the same as their environment.)
 - What adaptation is being shown here? (camouflage)
 - What is the **effect** of **camouflage (structure)** on an animal's survival? (**Because** the animal is camouflaged within its environment, it is protected and is able to **hide from its predators (effect/function)**)
4. Discuss with students that camouflage is a physical adaptation and what they think that means. Confirm that it means that the adaptation is referring to something on the animal's body.
 5. Show students the other slides in the PowerPoint following the camouflage slides showing additional examples of physical adaptations and discuss the pictures.

Discussion Questions:

- What if the **chameleon could not change colors**? (Answers vary but may include that it would be seen easily by predators in certain environments.)
 - What if the **giraffe had a short neck**? (Answers vary but may include that it wouldn't be able to eat the types of leaves it likes to eat.)
 - What if the **cow had different types of teeth**? (From an earlier lesson, we saw that a carnivore's teeth are sharper than the herbivore's teeth. The cow wouldn't be able to grind down plant material when it eats.)
6. Show students Slide 13 on the PowerPoint Presentation that defines behavioral adaptation. Ask students to turn and talk with a partner and see if they can come up with examples they already know about a type of behavioral adaptation for a plant and/or animal. After students have discussed their ideas with their partner, discuss as a whole class.



SEP: Science and Engineering Practice(s):

Asking Questions and Defining Problems:

Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.



CCC: Crosscutting Concept(s):

Cause and Effect:

Cause and effect relationships are routinely identified and used to explain change.



CCC: Crosscutting Concept(s):

Structure and Function:

Substructures of natural objects have shapes and parts that serve functions.

Lesson 5 Animal Adaptations *cont.*

7. Show students the slides of the behavioral adaptations mentioned in the class discussion:

- Slide 14: migration
- Slide 15: hibernation
- Slide 16: animals stop moving if possible predator near by
- Slide 17: animals can conserve water and fat for energy in their body
- Slide 18: animals can appear larger by “puffing up” their body to scare predators
- Slide 19: blood squirting lizard video

8. Students may be more familiar with migration and hibernation adaptations. Show the other slides even if students do not mention that adaptation. Discuss other behavioral adaptations students may mention that are not on the slides. One example may be animals that live in groups. That is a behavioral adaptation that will be included in a later lesson.

Part 2

9. After students are familiar with the different types of adaptations, it is their job as Environmental Student Officers to turn their attention, again, to the wolves. If students are figuring out whether or not wolves could live in New York State again, they need to **conduct research** on the adaptations of wolves using books and websites. Sample websites on wolf adaptations can be found on the Links to Resources page on the BOCES 4 science website for this unit. Students should complete pages 5-6 of their Wolf Research Scientist Notebook. On these pages, they list various physical and behavioral adaptations of wolves.



SEP: Science and Engineering Practice(s):

Obtaining, Evaluating, and Communicating Information:

Develop and/or use models to describe and/or predict phenomena.



CCC: Crosscutting Concept(s):

Structure and Function:

Substructures of natural objects have shapes and parts that serve functions.

What **physical adaptations** do wolves have?

Physical adaptations can include but are not limited to:

-Heavy fur to provide insulation

-Long guard hairs to keep out moisture (waterproof fur)

-Large paws have fleshy pads to help with walking

-Claws for traction on snow and ice

-Extra layer of fat for warmth

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What **behavioral adaptations** do wolves have?

Behavioral adaptations can include but are not limited to:

-Amazing hearing to communicate and hear their prey

-Hunt in packs

-Can howl in different ways based on need

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10. After students have completed their research, they can share their information with the class. A class anchor chart on wolf physical and behavioral adaptations can be created during the discussion. Students will refer to this research information later in the unit.

Lesson 5 Animal Adaptations *cont.*

Part 3

11. Review the class list of the physical and behavioral adaptations of wolves. Focus in on the physical adaptation of how wolves use an extra layer of fat for warmth and energy in cold temperatures.
12. Demonstrate the role of an **extra layer of fat** on an animal as an **insulator**. Place the empty mitt in a bucket of ice water and the fat mitt in a bucket of ice water. With the thermometer, show students how the water in both buckets are approximately the same temperature.
13. Ask students to take turns placing their hands in the mitts (use the vinyl gloves provided for sanitation purposes) to feel the difference of what it would feel like being out in the cold without a fat layer vs. with the fat layer.
14. Ask students to respond to question 1 on page 9 in the Student Science Journal. Students write an explanation about the **cause and effect** relationship between fat insulation and the animal keeping warm when outside.
15. **Analyze** student results as a class.

Lesson 5 - Animal Adaptations

1. Since animals have fat insulation (cause):
Effect: Animals can stay warm in cold climates.

2. Since animals have waterproofing on their fur or feathers (cause):
Effect: Animals can stay drier in wet, cold climates.

3. Wolf Waterproof Fur:
Cause: The wolf has waterproof fur.

Effect: The waterproof fur helps the wolf stay drier if it is out in wet weather. Drier fur helps keep the wolf warmer as it roams in the cold temperatures of the polar/tundra climate.

9

Discussion Questions

- As mentioned in the research, wolves use an **extra layer of fat** as an **insulator**. How would you explain what an insulator is and how it is related to animal adaptations? (Answers vary but may include that an insulator holds in heat. Air is an example of an insulator. Birds have **feathers** that **trap air that acts as an insulator**. An **undercoat of fur** can also hold in air and can act as an **insulator**.)
- Are these insulators physical or behavioral adaptations? (physical)



CCC: Crosscutting Concept(s):

Structure and Function:

Substructures of natural objects have shapes and parts that serve functions.



CCC: Crosscutting Concept(s):

Cause and Effect:

Cause and effect relationships are routinely identified and used to explain change.



SEP: Science and Engineering Practice(s):

Analyzing and Interpreting Data:

Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation



CCC: Crosscutting Concept(s):

Structure and Function:

Substructures of natural objects have shapes and parts that serve functions.

Lesson 5 Animal Adaptations *cont.*

Part 4

16. Next, ask students to think about the fur found on various animals. Explain to students that fur and feathers on various animals are waterproof or water rolls off of it.
17. Ask students to think about when they have touched an animal's fur and how it felt.

Discussion Questions:

- How does an animal's fur feel? (soft, thick, coarse, etc.)
- Does the fur of different animals feel different? (Yes, some fur is softer than others, coarser than others, lengths of the fur are different, etc.)

18. Tell students we are going to focus on animal fur of one kind of dog they may know and a wolf. Discuss with students the **information** on Slides 1-6 on the Animal Fur PowerPoint found on the BOCES 4 Science website under this unit/lesson.

19. Begin discussing the characteristics of fur on the Labrador retriever and discussing the questions shown on the presentation.

Discussion Questions:

- Who has or has seen a Labrador retriever? (Answers vary)
- If you have one at home how does its fur feel? (Answers vary but may include soft, smooth, silky, etc.)
- Does the fur feel oily? (Answers vary)
- Why would having an oily fur be important for a Labrador? (Labs like the water so having waterproofing on their fur helps keep the animal drier as the water is able to run off the fur. This is similar to a waterproof rain coat for humans.)

20. Show students Slide 7 of the Animal Fur PowerPoint. Ask students to discuss with a partner if they think it would help a wolf to have **waterproof fur** like the Labrador. Students should conclude that it would be helpful for the wolf because it is outside in wet, snowy areas in colder temperatures. It would help **keep the wolf drier/warmer**.

21. Discuss as a class if waterproof fur is a physical or behavioral adaptation. Conclude it is a physical adaptation.

22. Read Slide 8 on the Animal Fur PowerPoint for **information** about wolf fur and discuss further as a class.

23. Show students slide 9 and explain that we are going to explore this adaptation further. Distribute two paper towels cut into the shape of a feather and a paper plate to each pair of students. We are using feathers because birds, such as ducks, have feathers that are waterproof, as well.

24. Distribute a dollop of petroleum jelly to each pair of students. Students should then use their finger to spread the petroleum jelly on one of the paper feathers.



SEP: Science and Engineering Practice(s):

Obtaining, Evaluating, and Communicating Information:

Develop and/or use models to describe and/or predict phenomena.



CCC: Crosscutting Concept(s):

Structure and Function:

Substructures of natural objects have shapes and parts that serve functions.



SEP: Science and Engineering Practice(s):

Obtaining, Evaluating, and Communicating Information:

Develop and/or use models to describe and/or predict phenomena.

Lesson 5 Animal Adaptations *cont.*

25. To demonstrate the effects of waterproofing fur/feathers ask student pairs to place a few drops of water on each paper towel feather.
26. Ask students to respond to question 2 on page 9 in the Student Science Journal. Students write an explanation about the **cause and effect** relationship between the waterproofing of fur/feathers and keeping warm when outside.

Lesson 5 - Animal Adaptations

1. Since animals have fat insulation (cause):
Effect: Animals can stay warm in cold climates.

2. Since animals have waterproofing on their fur or feathers (cause):
Effect: Animals can stay drier in wet, cold climates.

3. Wolf Waterproof Fur:
Cause: The wolf has waterproof fur.

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9

27. **Analyze student results** as a class.

Discussion Questions:

- By **analyzing the data**, how did the petroleum jelly have an effect on the "feather"? (The water seemed to stay on the surface of the feather instead of soaking into the towel)
- Why do you think waterproof fur/feathers is a helpful adaptation for animals? (Waterproof fur/feathers keeps the animal drier in the environment. Birds, like ducks, don't get waterlogged while in the water. Wolves don't keep water on their skin that may cause them to freeze in colder locations where they live.)
- What **cause and effect** relationship did you see in the data? (Because the fur/feathers of animals are waterproof, the effect is an animal that can survive cold, wet environmental conditions.)



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Cause and Effect:
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SEP: Science and Engineering Practice(s):

Analyzing and Interpreting Data:
Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.



CCC: Crosscutting Concept(s):

Cause and Effect:
Cause and effect relationships are routinely identified and used to explain change.

Lesson 5 Animal Adaptations *cont.*

Closing the Lesson

Remind students of the video with the high frequency sounds. Ask students if the ability to hear high frequency sounds is a physical adaptation or a behavioral adaptation. Discuss with students why it is a physical adaptation and how it helps the animal (dog) that is hearing the sounds to survive in their environment. By being able to hear both predators and prey and to hear sounds at higher frequencies and farther distances, it can help with the animal's survival. Play for students the video of the veterinarian explaining this concept. The link to the Veterinarian Video can be found on the Links to Resources page on the BOCES 4 Science website for this unit.

After the video, ask students to discuss what we have learned so far. Go back to the questions students asked in the beginning of this lesson to see what questions have been answered. Also, go back to Lesson 1 and answer any questions about adaptations of animals and discuss the idea of an organism's ability to live in different environments. Ask students if they think animals can live anywhere they want. Students may mention how land animals cannot live in water habitats (This learning is from the Grade 2 BOCES 4 Science Interdependent Relationships in Ecosystems unit Save the Bees) and not all animals can live in very cold areas. Discuss with students about exploring this concept further – how/why organisms are able to live in certain environments.

Assessment:

The response to question 3 on page 9 in the Student Science Journal can be used as a formative assessment tool to evaluate the students' ability to identify the **cause and effect** relationship between an animal adaptation and how it helps the animal. Students should identify that **because** the wolf has waterproofing on their fur it is able to get wet and the water will run off the wolf's body. The water won't soak the layers of fur so the wolf is able to stay warmer in colder temperatures (**effect**).

Connections

Differentiation:

Students who need help during the research could be paired with another student and/or provided extended time.

Research books/resources of various levels should be provided for students.

Specific data charts to record research information can be used to help students focus.

For the formative assessment, allow dictation if necessary.

Students with difficulty reading and writing can listen to the text of resources using audio tools/apps. Student responses can also be in an audio and/or video format.

Students with high levels of interest in the topic of animal adaptations could move into the topic of biomes around the world and investigate the animals that live there.



CCC: Crosscutting Concept(s):

Cause and Effect:

Cause and effect relationships are routinely identified and used to explain change.

Lesson 5 Animal Adaptations *cont.*

Cross-Discipline:

ELA: Read more about other animal adaptations, including those animals that live in different climates around the world.

Social Studies: Use a globe or map to identify various locations on a map with different climates and the adaptations of animals that live there.

Next Lesson Preparation

Preview the next lesson to find locations around the room for the group vs. solitary animals simulation.