



Winter

Middle Level Lesson Plan

Overview

Winter is considered by many to be the most challenging season in New England in terms of animal and plant survival. Some animal species can avoid hardship by migrating, but most plant and animal species have evolved over time in other ways that have allowed for their winter survival. *QUEST: Winter* helps students examine some of these adaptations in our New England wildlife. Compelling information from scientists who have been studying the effects of winter on organisms sheds light on the variety of survival mechanisms that have been developed over time.

Introduction

This teaching unit introduces middle-school students to a variety of ways in which organisms – in particular the white-tailed deer – have adapted to survive the harsh New England winters. Students will also learn about some characteristics of their winter habitat that are a challenge to deer, and how humans can have an impact on deer survival – in either a positive or a negative way.

Time Allotment

This lesson requires approximately four 45-minute class periods to complete.

Accessing Prior Knowledge

In order to derive the maximum benefit from this *QUEST* unit, students should be reasonably familiar with the concept that different plants and animals have features that help them to thrive in different environments. Students should know some of the ways in which organisms differ from habitat to habitat and some of the ways in which those differences increase the chances for survival.

Concepts to Clarify

Middle- and high-school students may have difficulties with the various uses of the word *adaptation*. In everyday usage, people are spoken of as “adapting” deliberately to certain situations. In the theory of natural selection, however, populations change or “adapt” inadvertently – and over the course of generations. Students of all ages often believe that adaptations result from some overall purpose or design, or they describe adapta-



QUEST lessons are developed in partnership with Maine Mathematics and Science Alliance



Major funding for Quest is provided by the National Science Foundation. Additional funding is provided by the Maine Department of Inland Fisheries and Wildlife, Maine Forest Products Council, and Irving Woodlands LLC.





INVESTIGATING OUR WORLD

tion as a conscious process to fulfill some need or want. Elementary- and middle-school students also tend to confuse noninherited adaptations acquired during an individual's lifetime with adaptive features that are inherited in a population.

Middle- and high-school students may believe that organisms are able to effect changes in bodily structures to exploit particular habitats, or that they respond to a changed environment by seeking a more favorable environment. Many students also incorrectly believe that environmental conditions are directly responsible for changes to traits, or that organisms develop new traits because they need them to survive.

It has been suggested that the language about "adaptation" used by teachers or textbooks to make biology more accessible to students may cause or reinforce these beliefs. It is important to be aware of these issues and to use care when discussing the "adaptations" of deer to their winter environment.

CONNECTIONS TO THE STANDARDS

National Science Education Standards	Benchmarks for Science Literacy	Maine Learning Results	New Hampshire Curriculum Framework	Vermont Learning Standards
<p>B. Structure and Properties of Matter</p> <p>C. Life Sciences: Regulation and Behavior (pp. 156-157)</p> <ul style="list-style-type: none"> – All organisms must be able to obtain and use resources, grow, reproduce, and maintain stable internal conditions while living in a constantly changing environment. – Regulation of an organism's internal environment involves sensing the internal environment and changing physiological activities to keep conditions within the range required to survive. 	<p>4D. Structure of Matter</p> <p>5A. Diversity of Life; #2 (p. 104)</p> <ul style="list-style-type: none"> – Animals and plants have a great variety of body plans and internal structures that contribute to their being able to make or find food and reproduce. 	<p>Science and Technology</p> <p>A. Classifying Life Forms, #3</p> <ul style="list-style-type: none"> – Describe some structural and behavioral adaptations that allow organisms to survive in a changing environment. 	<p>Life Science</p> <p>3a. Demonstrate an increasing ability to recognize patterns and products of evolution, including genetic variation, specialization, adaptation and natural selection.</p> <ul style="list-style-type: none"> – Relate different kinds of animals and plants to their habitat by observing their physical characteristics. 	<p>The Living World: Organisms, Evolution and Interdependence</p> <p>7.13dd. Describe evolution in terms of diversity and adaptation, variation, extinction and natural selection.</p>

Materials Needed

- TV with VCR
- *QUEST Winter* video
- Computers with Internet access for student or teacher use (to download articles)
- Chart paper and markers or overhead transparencies and markers
- Colored markers or pencils, white paper
- Adhesive notes, 1 or 2 per student
- Student Handout 1: Show What You Know
- Student Handout 2: Quest At Home: More Harm Than Good

I. Introducing the Concepts

The purpose of this introductory activity is to engage students and to first learn what they already know about the characteristics of the northern New England forest in winter.

This part of the lesson is also designed to help students learn about the many adaptive features that help animals and plants of the New England forest to survive in their winter habitat.

Activity I

Step 1

Explain the following key concept to students:

“If you look at any animals that are native, year-round inhabitants of the New England forest, you will observe features on (and in) their bodies, as well as behaviors, that are in some way helpful to the animals’ survival. They didn’t *choose* these features, but instead, the individual animals that happened to have those features managed to survive better than the ones who did not. So, the features got passed down to the animals’ offspring, and then to *their* offspring, until more and more animals in the population looked or behaved in that way.

“Let’s begin by thinking about one of the biggest challenges to survival in the New England forest: winter.”

Step 2

Post the following two questions to students. (**Note:** In order to support all learners, it is best to present these questions visually, as either an overhead transparency or in writing on the board. Reading them aloud as well will be helpful to auditory learners.)

- What are the characteristics of winter that are so challenging to the survival of New England’s wild animals?
- Why is each one a challenge?



Have students first brainstorm their responses individually, then share their thoughts with the class. Accept all responses. If they need prompting, guide students to consider answers to the questions above that include such factors as temperature (cold temperatures freeze cells and affect the quantity of available food), snow (inhibits travel, covers over the food, allows tracks and smells to be more noticeable), wind (loss of heat), and so on.

Step 3

Now proceed in a manner similar to the following:

“Keeping in mind this list of characteristics of the winter, let’s see what you know about native New England plants and animals. What structures and behaviors do they have that support their survival in winter conditions?”

Allow students to brainstorm and list their ideas individually in their notebooks or journals.

2. Exploring the Concepts

Note: After previewing the *QUEST* video yourself, you may decide to show the entire one-hour program. However, you may also choose to fast forward and begin the video just after the section about the Cold Regions Research and Engineering Laboratory work, beginning with *subnivean creatures*. It is at this point in the program that adaptations of organisms are addressed.

Activity 2

Step 1

Ask students to watch the video and take notes about the kinds of organisms they see. They should be recording the features of those organisms that help them survive in winter conditions. (Again, a visual/auditory prompt would be most helpful for all students.)

Step 2

Debrief by having students share their observations either with partners or in small groups of four, alternating so that each person shares one adaptation until all of the ideas of the group have been uncovered.

As a final wrap-up, have each small group or pair share their most unusual or surprising example with the whole class.

3. Developing the Concepts

In the following activity, students will develop a deeper understanding of the structural and behavioral adaptations of white-tailed deer that help these deer survive the winters of New England. Students will also be guided to consider the effects of additional human “assistance” on the survival of the white-tailed deer.



Activity 3

Step 1

Post the following quote from the *QUEST Winter* videotape:

“It’s easy to see why scientists think that winter is responsible for the evolutionary design of the somewhat odd-looking, but very successful northern animal – the white-tailed deer.”

Ask students to review their notes from watching the videotape and share what they learned and wrote about deer.

Step 2

Explain to students that there is a controversy among some northern New Englanders as to whether and why the numbers of healthy deer may be declining, and whether deer need additional help from humans in order to survive in their habitat.

Tell students that their first task will be to learn all that they can about the natural, advantageous body structures and behaviors of deer that have evolved over time. They will then learn about efforts that some well-meaning homeowners have been taking to “help” the deer during the winter. (**Note:** Use caution when introducing this subject; some students may, indeed, be among the families that are providing supplemental feed to deer.) Students will have a chance to decide and explain for themselves whether these activities are actually helpful.

Step 3

Have students select one or more of the following articles *from each category* to read and take notes on. (Students may also opt to do their own search of the Web for comparable sites.)

Structural and Behavioral Adaptations of White-Tailed Deer in Winter

White-tailed deer in winter www.anr.state.vt.us/reflect/jan13.htm

Deer conservation in winter www.mnr.gov.on.ca/MNR (scroll down and select “Publications”)

Winter survival www.schoolnet.ca/vp-pv/mammals/e/pg16.html

Feeding Deer in Winter: To Feed or Not to Feed?

More harm than good www.wildlife.state.nh.us/newsdeerfeed.htm

Supplemental feeding of white-tailed deer during winter www.state.me.us/ifw/hunt/deerfeed.htm

A question of feeding deer www.gov.ns.ca/natr/wildlife/lgmams/feeddeer.htm

4. Synthesizing the Concepts

The purpose of the following activity is to help students combine all of their ideas and to develop a complete picture of all the structural and behavioral adaptations of deer that help them survive in their winter environment.

Activity 4

Step 1

Ask students to share some examples of structural adaptations and behavioral adaptations that they have learned about in their research. As they share their ideas, record them on chart paper or on an overhead transparency in one of two columns labeled *Structural Adaptations* and *Behavioral Adaptations*.

Step 2

Provide students with plain white paper, pencils with erasers, and markers or colored pencils. Have them sketch and label a deer in its winter deer-yard habitat. Encourage them to identify as many cold-weather adaptations of the deer as possible. (Explain that labels can be especially helpful in identifying and describing behavioral adaptations that may be difficult to draw. Ask students to label each relevant feature of the deer, including structures, and to include explanatory text whenever necessary.)

Step 3

Conduct a debriefing discussion by first asking students if they have included any features of the deer that they don't fully understand or that don't necessarily seem to be helpful to the deer. Such features might include antlers (visit www.mountainnature.com/Articles/antlers.htm), or the white "flag" of the deer's tail when it senses danger and about to run (visit www.schoolnet.ca/vp-pv/mammals/ellist2.html and select "I see you"). Discuss as needed.

Step 4

Have students post their drawings on the board and on classroom walls. Then hold a "gallery walk," providing each student with one or two sticky notes that they can use to post questions that they might have about particular features on other students' drawings.

Facilitate the wrap-up by synthesizing the results: point out key adaptations, request explanations of drawings that have received multiple sticky-note questions.

5. Applying the Concepts

In the following activity, students will be able to apply what they have learned to a real-world situation – a letter written to a newspaper editor about the plight of the white-tailed deer in northern New England.

Activity 5

Step 1

Tell students that they will now be able to reconsider all that they have learned about the adaptations of deer for winter survival. They will also be reconsidering the evidence they have gathered on how humans can have an impact – either positive or negative – on that survival.



Step 2

Distribute Student Handout 1 (Show What You Know). Read the assignment together with the class, and clarify all instructions before they begin their work. Set a deadline for completion of the letter.

Step 3

When students have completed their letters, you may choose to have them share their work with their peers. If the letters are to be graded, the following Proficiency notes can serve as a guide.

Proficiency Guidelines

A student's work on this assignment would demonstrate proficiency if the letter clearly explains several adaptations of the white-tailed deer (including how those features are conducive to deer survival). The letter should also include information about how humans can best support survival of the deer (by providing the appropriate natural cover and habitat, and in sufficient quantity, to support the local deer population).

6. Extending the Concepts

Students, especially those who live in rural or suburban areas, may have families who are involved either in hunting or in wildlife observation and who care deeply about the success of the region's deer herd. The following take-home family activity can help to educate both students and family members about the best ways in which to promote the survival of these herds.

Activity 6

Step 1

Provide students with copies of Student Handout 2 Quest at Home: More Harm Than Good. Review the handout in class with students; then have them take it home to discuss with their families.

Step 2

Follow up by discussing whether any of students and their families discovered anything new about deer. Let students compare observations.

Community Connections

The Maine Wildlife Park in Gray, Maine, provides an opportunity for students to view and learn about a variety of live animals representative of the northern forest environment.

Visit their Web site to learn about upcoming activities: <http://www.state.me.us/ifw/education/wildlifepark.htm>



Career Opportunities

- Have students visit the search engine www.google.com. There they can conduct a career search related to the content in this lesson by using the key terms *Wildlife Biologist* or *Wildlife Biology*. Have them consider the many locations/field sites and projects that one might become involved with as a practicing wildlife biologist.
- Encourage students to visit each state's fish and wildlife Web site. At these sites, they can search for scientific projects and reports that might indicate the kinds of work that wildlife biologists do. (Related Web sites can be found in the Resources section below.)

Resources

Content Background

Basic Deer Ecology and Conservation

www.anr.state.vt.us/reflect/jan13.htm
www.schoolnet.ca/vp-pv/mammals/ellist2.html
www.mountainnature.com/Articles/antlers.htm

Issues Related to Supplemental Feeding of Deer

www.state.me.us/ifw/hunt/deerfeed.htm
www.wildlife.state.nh.us/newsdeerfeed.htm
www.gov.ns.ca/natr/wildlife/lgmams/feeddeer.htm

State Fish and Game Websites for Northern New England

www.wildlife.state.nh.us
www.state.me.us/ifw/index.html
www.anr.state.vt.us/fw/fwhome/index.htm

National Science Standards Documents

There are two major standards documents at the national level for K-12 science:

Benchmarks for Science Literacy were created by the American Association for the Advancement of Science (Oxford University Press, 1-800-222-7809):

<http://www.project2061.org/tools/benchol/ch5/ch5.htm>.

National Science Education Standards were developed by the National Research Council. (National Academy Press, 1-800-624-6242): <http://www.nap.edu/catalog/4962.html>.



Show What You Know

“Predation, not starvation, is the major cause of winter mortality among deer in Maine...”

–Position statement of the Maine Department of Inland Fisheries and Wildlife

“Important deer conservation measures will only succeed with public awareness of the habitat requirements of wintering deer and with public support for sound deer management.”

–John Hall, Vermont Agency of Natural Resources

“During winter, cover – not forage – becomes the key to deer survival!”

–Article on New Hampshire Fish and Game Web site

“Landowners in areas with deer winter range can have a direct influence on deer survival. The effects can be positive or negative.”

–Article from the Ontario Ministry of Natural Resources

Throughout northern New England and Canada, numerous families and individuals show that they care deeply about the survival of the white-tailed deer. Many people think that the deer cannot survive through the winter on their own without human assistance. Winter is the harshest time of year for these large mammals; people therefore often think that they are being most helpful by feeding the deer living in their neighborhoods or regions.

Your task is to write a letter to the editor of your local newspaper, explaining the following:

- The adaptations of deer – both on and in their bodies as well as in their behavior – that help them survive the winters.
- Reasons why feeding deer at home is not the same as feeding birds – and may, in fact, be more harmful than helpful to these large mammals.
- Suggestions of ways in which landowners can be helpful to deer by being sure that there is enough appropriate habitat. (Be sure to explain what that habitat requirement is.)



More Harm Than Good

You're on a Quest!

Discover the world of deer in northern New England by examining their habits as well as human habits! Learning about the natural abilities and adaptations of deer helps us determine what we should – and should not – do for wildlife during the winter months.

Materials needed:

- Computer with Internet access
- Pen and paper for notes
- State map

Investigate with your family!

- Talk with family members, neighbors, relatives, and community members about deer wandering into their area or yards. What are the deer eating? Do any deer have antlers? How many deer do they see at one time? Are there young deer?
- Discuss with your family what might be the factors that cause deer population decline. Why is the winter season the most difficult for deer?

Which predators might be the biggest threat to deer:	Make a list of what deer might eat:	Create a list of reasons why people like to feed deer:

These Web sites will help you locate your state government's fish and wildlife agency to identify deer feeding sites:

- In Maine:** <http://www.state.me.us/ifw/index.html>
- In Vermont:** <http://www.anr.state.vt.us/fw/fwhome/index.htm>
- In New Hampshire:** <http://www.wildlife.state.nh.us/>

