



Wilderness

High School Lesson Plan

Overview

The word *wilderness* has many meanings. It conjures up a variety of experiences and emotions for different individuals. This program, QUEST: Wilderness, is an exploration of the need to establish wilderness areas in northern New England. The activities in this teaching unit will help students learn more about the concepts of natural areas and wilderness areas and the differences between them. Students will also examine the value that humans place on such areas. The QUEST video shows current and proposed wilderness sites in Maine, New Hampshire, and Vermont.

Introduction

This teaching unit allows students to explore their feelings about natural areas and wilderness. They will determine the differences between these two concepts as well as the importance of each to society.

Using a modeling process, students will study the impact of humans on a natural area. They will examine how the building of a road between the breeding area and the terrestrial habitat of wood frogs affects the frogs' population. Students will also explore the potential impact of genetic variations on wood frog populations, thus investigating the process of natural selection.

Next, students will consider one of the predators of the wood frog: the barred owl. They will determine the needs of a barred owl population for successful breeding. They will then design either a natural area or a wilderness area to protect barred owls.

Time Allotment

This teaching unit requires approximately five to seven 45-minute class sessions to complete.

Accessing Prior Knowledge

Students will be most successful in understanding the concepts presented in this unit if they already have a good understanding about ecosystems and food webs. It would also be beneficial if they have had an introduction to the concept of natural selection.



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Maine Forest Products Council





Concepts to Clarify

Students sometimes have preconceptions about how plants and animals respond to various impacts on their habitat. Some students may believe that animals can change food sources as easily as humans change grocery stores or the menu for their evening meal. Students may also believe that the populations of certain organisms are numerous because they are necessary to support a predator population nearby (just as a grocery store stocks up on turkeys because they know that many will be eaten at Thanksgiving). In fact, however, the inverse occurs in the natural world: A large population of predator organisms can survive in a particular location because there is a large food source there. In addition, many students are able to comprehend only food chains, not food webs. They often cannot see the impact of food hierarchies on various habitats throughout an ecosystem.

Some students struggle with the concept of natural selection. They may feel that organisms can physically change themselves when their environment changes, rather than understanding that an organism's having a differing structure in a changing environment may actually help it to survive. Students also have difficulty understanding that structural changes occur due to genetic variations or mutations. Such mutations often occur in organisms but often are not expressed until those organisms have offspring. In conjunction with this preconception, students may also think that all individuals within a population of organisms slowly change to meet the demands of their environment -- instead of recognizing that the offspring of a few individuals in that population are more likely to succeed, reproduce, and supply the preferential genetic basis for the population.

Students may also feel a distinction between the opinions they give as science students and their perceptions as community members. Many students feel that scientists and engineers know everything, that they can solve any problem that arises, and that they are not influenced by emotions or personal beliefs. It is beneficial to break down these stereotypes so that students understand the concept of bias in science and have a more pragmatic view of the professionals in this (or any) field.



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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.4e. Human beings live within the world's ecosystems. Increasingly, humans modify ecosystems as a result of population growth, technology and consumption. Human destruction of habitats through direct harvesting, pollution, atmospheric changes, and other factors is threatening current global stability, and if not addressed, ecosystems will be irreversibly affected.</p>	<p>4D. Structure of Matter</p> <p>3C.4. The human species has a major impact on other species in many ways: reducing the amount of the earth's surface available to those species; interfering with their food sources, changing the temperature and chemical composition of their habitats, introducing foreign species into their ecosystems, and altering organisms directly through selective breeding and genetic engineering.</p>	<p>Science and Technology</p> <p>B.4. Analyze the impact of human and other activities on the type and pace of change in ecosystems.</p>	<p>Life Science</p> <p>4c. Students will be able to: – Investigate how human activities, such as reducing the amount of forest cover and increasing the amount and variety of chemicals released into the atmosphere, have changed the Earth's land, ocean, and atmosphere</p> <ul style="list-style-type: none"> •Describe possible consequences of reducing or eliminating some of the Earth's natural resources •Identify natural, as well as human-induced, factors which contribute to changes in the Earth's systems. 	<p>The Living World: Organisms, Evolution and Interdependence</p> <p>7.13ccc. Describe, model, and explain the principles of the interdependence of all systems that support life (e.g., flow of energy, ecosystems, life cycles, cooperation and competition, human population impacts on the world ecological system), and apply them to local, regional, and global systems.</p>
<p>F.4a. Natural ecosystems provide an array of basic processes that affect humans. Those processes include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes and recycling of nutrients. Humans are changing many of these processes, and the changes may be detrimental to humans.</p>	<p>5D.3. Human beings are part of the earth's ecosystems. Human activities can, deliberately or inadvertently, alter the equilibrium in ecosystems.</p>	<p>M.2. Demonstrate the importance of resource management, controlling environmental impacts and maintaining natural ecosystems.</p>		<p>7.15eee. Analyze and explain natural resource management and demonstrate an understanding of the ecological interactions and interdependence between humans and their resource demands on environmental systems (e.g., production, consumption).</p>



Materials Needed

- TV and VCR
- *QUEST Wilderness video*
- Chart paper and markers
- 6 varieties of beans (10 of each variety per team), or paper in 6 different colors (cut into ten 1-cm squares of each color per team)
- 1 black marker per team
- 1 paper plate per team
- Student Handout 1: Exploring Ideas About Natural Areas and Wilderness
- Student Handout 2: Wood Frog Key
- Student Handout 3: Map of New Road
- Student Handout 4: Natural History of Wood Frogs
- Student Handout 5: Wood Frog Population Scenario
- Student Handout 6: Wood Frog Population Model
- Student Handout 7: Wood Frog Population Data Sheet and Questions
- Student Handout 8: Natural History of the Barred Owl
- Student Handout 9: Quest At Home: In Search of Wilderness

I. Introducing the Concepts

Activity I

This activity will introduce students to the idea of wilderness, allow them to explore the values they place on wilderness, and reflect on the differences between natural areas and wilderness.

Step 1

Begin the activity by asking students: How do you value wilderness?

Have students to reflect on this question individually. Have them first think about the value they place on natural areas; then prompt them to try to differentiate between natural areas and wilderness. Next have students write individual journal entries describing a personal experience in a natural area. Encourage them to be as descriptive as possible of their chosen area and the sensations they experienced there (how it felt, smelt, looked, and sounded).

Ask if any students are willing to share their writing with the whole class. Have them read their journal entries aloud.



Step 2

Arrange students in small teams in pairs, or in groups of three or four students, who will work together throughout this unit. Have teams select one member to be the recorder and one to be the timer. Then ask team members to take turns sharing one idea from either their journal entries or their notes on how they value wilderness. Each student should be granted up to two minutes to report his or her thoughts. The recorder should list these ideas. (If your class has whiteboards, recorders can use these; otherwise, chart paper can be used.)

Once teams have finished sharing ideas within their groups, they should report out to the whole class. Help them make a common list to post in the classroom.

Step 3

Distribute copies of Student Handout 1 (Exploring Ideas About Natural Areas and Wilderness). Students should work in their teams to complete both parts of the handout. When teams have finished listing people's values about natural areas/wilderness and have filled in their T-charts, have them share their answers with the whole class. Help students create a common T-chart of differences to keep posted in the classroom throughout the course of this unit.

Possible answers to Student Handout 1 include the following:

1. Values placed on natural areas/wilderness:
 - Open space – place for solitude, relaxation, contemplation
 - Recreation – hiking, hunting, swimming, boating, camping
 - Economic potential – wood industry, vacation homes, tourism
 - Maintaining quality of the atmosphere – oxygen-producing trees and plants
 - Generation of soils – slow process of rock breaking down to soil
 - Control of hydrologic cycle – wetlands protect against flooding, vegetation traps moisture, uses and releases moisture
 - Disposal of wastes – certain species of vegetation absorb heavy metals, removing toxins from soil and water
 - Recycling of nutrients – through decomposition
 - Genetic resources for agriculture – place for the development of modified species that suit varying climates and provide food resources for communities
 - Substances for medical applications – research can be done on medicinal plants and genetic tolerances to disease

2. **Natural Area**

Parks, national forests
Broad use for recreation – hunting, ATVs, mountain biking, etc.
Goal to provide natural open space

Sometimes used for timber harvest
Public encouraged to use

Wilderness

Designations within parks & forests
Restricted activities

Goal to preserve plants and animals, frequently rare species
No commercial use
Limited access to public



Step 4

If, in the course of their discussions, students have not yet considered local and/or regional values regarding natural areas and wilderness areas, have teams discuss these now and then share their thoughts with the whole class. As new ideas come up, add them to the class list begun in Step 2. Take this opportunity to ascertain whether students recognize the variety of opinions and feelings that citizens have about wilderness, and how these feelings may influence the value placed on such areas.

Step 5

Show the *QUEST: Wilderness* video to the class. Have students take notes as they watch the tape, paying particular attention to the values that others have placed on wilderness. Students should also note any differences mentioned on the video between natural areas and wilderness. When viewing has finished, have a class discussion about students' reactions and findings. Add or modify the two common class lists as needed.

2. Exploring the Concepts

Every day, humans make changes to the natural landscape. They lay new roads, clear land, drain or divert waterways, and more. The next activities help students investigate one type of change to a wetland and examine its impact on the population of wood frogs.

Activity 2

In teams, students will conduct a modeling experiment to see how a population of wood frogs is affected by the construction of a road.

Step 1

Give each team of students a paper plate and 10 beans of each variety. A key to the beans is in Students Handout 2 (Wood Frog Key). (Any type of bean can be substituted if one is not locally available as long as there are six varieties that are readily distinguishable. Six different colors of paper squares can also be used. They should be less than 1 cm squares. Students can make these as part of the activity if scissors are available. They do not all have to be the exact same shape. Have students discuss how these various differences influence the activity.) Also distribute Student Handout 3 (Map of New Road), showing the new road that passes the small wetland. Students will be using these handouts with the other upcoming readings and activities.

Step 2

Distribute Student Handout 4 (Natural History of Wood Frogs) and ask students to read the article. Have student teams read Student Handout 5. Clarify any questions. Have them use the map (Student Handout 3) showing the new road that passes the small wetland. As a team, have them go through modeling the fluctuation in Wood Frog Populations as described in Student Handout 6 (Wood Frog Population Model). Circulate to see that each team has determined the right series of actions to take and is interpreting the results properly. Have students record their data on Student Handout 7 (Wood Frog



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Population Data Sheet and Questions) and then have each individual students answer the series of questions before discussing the answers as a team, and as a class.

Step 3

Have each student answer the series of questions on Student Handout 7 individually. When everyone has had time to consider their answers, have students share their thoughts with other team members. Finally, have teams report out to the whole class.

Possible answers to Student Handout 7:

Year	North Woods	South Woods	Total
Original	12	0	12
End Year 1	14	3	17
Year 2: Breeding Adults	11	3	14
Year 2: Adults and Offspring	14	4	18
Year 4: Breeding Adults	11	4	15
Year 4: Adults and Offspring	14	12	26
Year 6: Breeding Adults	11	23	34
Year 6: Adults and Offspring	9	23	32

1. The northern population first remained steady but then started to decline.
2. The northern frog population will continue to decrease, and the southern population will continue to increase. With mortality considered, the rates of decline would increase and the rates of increase would slow.
3. The northern wood frog population could not increase because the road always impacts their numbers. If there had not been the mutation, the entire group of frogs breeding in this vernal pool might have been eliminated.
4. It seems that the variety remains. No specific trends can be noted. It would be good to maintain the variety, though, as this would increase the likelihood of a survival characteristic occurring in case of another change in the environment.
5. If the mutation had not occurred, or was not within the population, the entire population would eventually be eliminated. The rate at which frogs die on the road is moderate. If it were higher, they would be eliminated faster and might not ever be able to establish a southern pool population with as high a genetic variation. With a slower rate of change, the northern pool population might survive.
6. Perhaps the route of the road could be changed. Or, through education of adjacent landowners, their driving habits might be altered during the frogs' mating season. A culvert might also be installed under the road for the frogs to use.
7. The model holds true to the natural history of wood frogs because it has the females maturing every two years. It also has them travel to their breeding grounds. It is a very limited model for predicting



true circumstances, however. It does not allow for any variations from the rules. The model is representative in that it does not record a true number of offspring (20% of 1700 eggs). It has all offspring returning to the same pool. It has every pair mating successfully. It also has every mating pair producing two offspring, and every offspring of a mutated individual inheriting and expressing that mutation. The model also does not incorporate mortality into the population rate and size.

3. Developing the Concepts

In the following activity, students will further explore changes in natural areas. They will be introduced to the concepts of short-term, sudden, and long-term impacts.

Activity 3

Step 1

Ask students to reread Student Handout 4 (Natural History of Wood Frogs).

Step 2

As a team, and then as a class, brainstorm a list of other types of human impacts that might effect the wood frog population.

Step 3

Now each team should select one of the human impacts that they listed in Step 2 and prepare a brief (no more than five minutes) presentation in which they identify the following:

- What is the impact of this human activity?
- What is the source of the impact?
- Is it man-made or natural?
- Does this have a short-term or long-term impact?
- Was it a sudden change or a slow change over a long time?
- What might be done to lessen the impact?

You may want to select one of the impacts students have listed and do this type of analysis as a whole-class activity before individual teams work independently.

4. Synthesizing and Applying the Concepts

Students will now have the opportunity to apply what they have learned to a new situation. In preparation for establishing either a natural area or a wilderness area to protect the barred owl, students will learn about the owl's natural history. They will identify its habitat needs and requirements (including food sources). Students will then identify a list of requirements that must be included within an area that is protected for barred owls. Finally, they will identify what types of human activities may occur within the designated area.

Activity 4

Step 1

Explain to students that the barred owl is a predator of the wood frog. Let them know that they will be learning which natural resources might be needed in an area that protects barred owls so that they can live and reproduce adequately. Tell students that they will be given a summary of the natural history of barred owls. They will need to draw upon their prior knowledge about the owl's prey if further research (during class or as homework) is not possible.

Step 2

Distribute copies of Student Handout 8 (Natural History of the Barred Owl). Have students read the handout. Then ask each team to list all of the natural resources they feel the barred owl would require in order to thrive.

Step 3

Have each team diagram a food web for the barred owl (provide them with chart paper for this purpose if possible). For each prey that they identify, teams should also identify what the prey requires for survival.

Step 4

Refer students back to the T-chart made in Activity 1, Step 3. Have each team decide whether they want to create a wilderness area or a natural area for the barred owl.

Step 5

Using their list of natural resources and their food web diagram, each team should now draw a model of either an ideal natural area or an ideal wilderness area for the barred owl. They should identify all of the resources required in this environment, labeling each item and identifying where the various prey species and their needs are located.

Step 6

Have teams prepare to give presentations on the areas they have created. Each presentation should include the following:

- A one-page summary about the model area that also addresses what types of activities would be permitted and when
- A labeled poster illustrating the model area
- An oral presentation describing the area, listing permissible activities and justifying why these activities are compatible with the environment

Before beginning their work, the class should identify together the criteria by which they will be assessed, along with descriptors of quality work within each criterion.



Proficiency Guidelines

Students should demonstrate good teamwork skills. The individual contributions of each team member should include an assessment of how well that team member related to the others.

As a whole, each team should present one coherent design with supportive arguments. Individual components of the presentation should complement each other to form a well-integrated, persuasive thesis. These components include the following:

- *One-Page Summary:* This should highlight key features of the team's design. The summary, used as a handout, should include bulleted supportive reasoning for the design components and for the activities permitted in the area. The summary should be easily understood; teams should avoid using technical language in the handout, yet they must demonstrate a sound understanding of the needs of a barred owl population. The amount of text on the handout should not be overly dense, nor should it be so scant that it must be greatly enlarged in order to fill space. The summary may include a minor visual for emphasis, but it may not be redundant of the visual presentation (described below) unless it is to convey a particular identity for the team.
- *Visual:* This component should be substantive to the overall argument, presenting a visual representation of data that clarifies and enriches the team's overall presentation. The visual should complement and reinforce both the oral presentation and the handout. All parts should be well labeled. Limited text may be used, but it should not be redundant of any text on the handout.
- *Oral Presentation:* This should clearly communicate the team's design by enhancing the information in the handout and tying it to the visual presentation of the data. The oral presenter should not read from either the summary or the visual, but should refer to both. Facts should be presented, and the design explained, with a clear understanding of the audience -- who are interested in the topic but do not have a related background. The presenter's use of analogies and demonstrations can be assessed as going above and beyond the proficiency level.

5. Extending the Concepts

The following take-home activity allows students to link their classroom learning with the broader community and to share their knowledge with family members.

Activity 5

Step 1

Distribute copies of Student Handout 9 (Quest at Home: In Search of Wilderness). Review the handout with students, clarifying as needed. Assign a due date for all students to return to class with the results of their research.



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Step 2

On the assigned day, have students come to class with their findings. Discuss their research results, and explore how much students and their families have learned about the wilderness areas in their own community and state. Elicit from students whether the value that they place on wilderness areas has been changed by this activity and the other activities in this teaching unit.

Career Opportunities

It takes a team of individuals with a wide variety of expertise to manage natural resources. In a wilderness area, for instance, the monitoring of wildlife species could require a botanist to examine the plant species, a herpetologist to study the reptiles and amphibian populations, a mammalogist to investigate the mammals, and an ornithologist to watch the bird species. In addition, there may be a need for a cartographer to map the plant and animal communities. Finally, it is the responsibility of the manager of the preserve to take the findings from this team of scientists and work with state and federal agencies as well as neighboring communities to protect the area.

Community Connections

Many local, state, and federal agencies that manage natural areas are in need of volunteer help. Tasks for volunteers may include greeting visitors, handing out brochures, leading guided tours, maintaining trails, or monitoring wildlife. You or your students can contact your local park or recreation area, or the state agency that oversees natural areas in your region.

Many communities in the vicinity of ponds, lakes, streams, or rivers also have water quality monitoring programs. Volunteers go regularly to collect water samples and test for temperature, dissolved oxygen, and bacteria. See if there is a local lakes association or stream watch group in your area. Often your state department of environmental protection has information on such organizations. More suggestions can be found in the Resources section below.



Resources

Maine Department of Inland Fisheries and Wildlife (<http://www.state.me.us/ifw/index.html>)

Maine Land Trust Network

<http://www.mltn.org/>

Maine Wildlife Management Areas

<http://www.state.me.us/ifw/wma/table/index.htm>

Maine Volunteer Lake Monitoring

<http://www.state.me.us/dep/blwq/doclake/vm.htm>

New England Regional Volunteer Water Quality Monitoring Program

http://www.usawaterquality.org/newengland/Focus_Areas/volunteer/default.html

New Hampshire Division of Forests and Lands – State Reservations (public lands)

http://www.nhdf.org/for_mgt_bureau/fm_dredlands.htm

New Hampshire Fish and Game Department

(<http://www.wildlife.state.nh.us/>)

The Trust for Public Land

http://www.tpl.org/tier2_rl.cfm?folder_id=209

Vermont Department of Fish and Wildlife

(www.anr.state.vt.us/fw/fwhome/index.htm)

Vermont Wildlife Management Areas – Maps

<http://www.anr.state.vt.us/wmamaps/index.html>



**Exploring Ideas About
Natural Areas and Wilderness**

1. In the space below, list some of the values that people place on natural areas and wilderness.

2. In the T-chart below, list some differences between natural areas and wilderness areas.

Natural Area	Wilderness



Wood Frog Key

■ Female Wood Frogs

Three different female species are represented by the following:

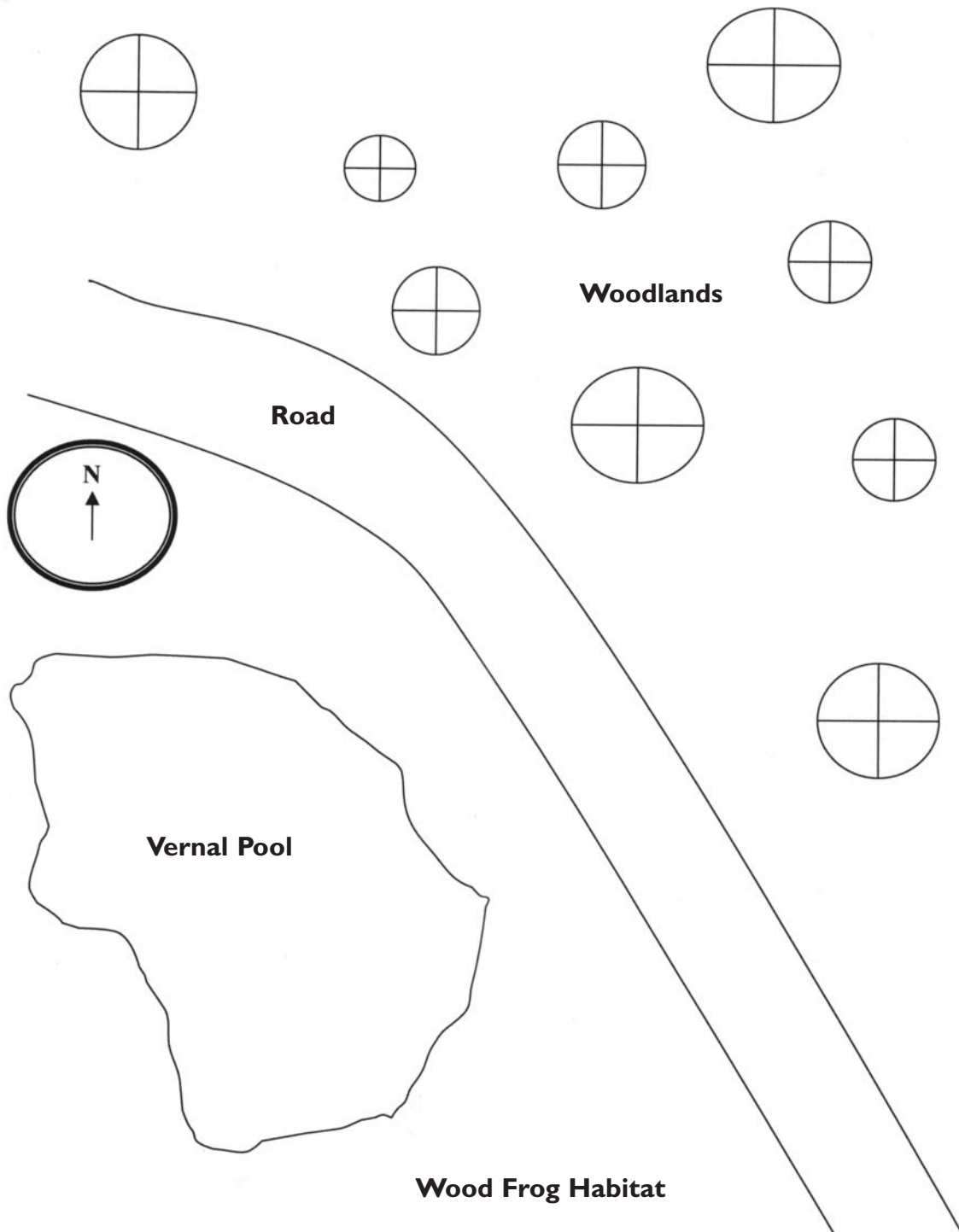
- 2 lima beans
- 2 red kidney beans
- 2 pinto beans

■ Male Wood Frogs

Three different male species are represented by the following:

- 2 green split peas
- 2 yellow split peas

Map of New Road





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Natural History of Wood Frogs

The wood frog (*Rana sylvatica*) is not quite as small as its more vocal neighbor the spring peeper, but its size does not usually exceed 2 1/2 inches. The wood frog is most readily identified by the black “mask” on its face extending from the eyes down toward the jaw. Its skin is smooth; during mating season, it ranges in color from dark reddish brown to pale pinkish tan. In its regular wooded habitat the wood frog is a more subdued gray.

Wood frogs are one of the most cold-tolerant species of frog. They have the northern-most range of territory of any North American frog, extending all the way up to Labrador and across to Alaska. They are thought to live as far north as the tree line on the Arctic tundra. They are able to withstand their bodies freezing for up to 48 hours. Because of their ability to withstand the cold, wood frogs are the first frogs to migrate to wetland mating grounds in the spring.

Wood frogs live in moist woodlands except during the mating season, when they migrate to vernal pools – small bodies of water that appear for only a short period of time during the wettest seasons of the year. The frogs prefer these pools for laying their eggs because the pools do not support any fish populations, thus reducing the threat of predators on their young. If vernal pools are not available, the females will lay their eggs in small wetlands such as ditches, cattail swamps, and even slow-moving streams. The frogs are thought to find their way to the pools through a combination of celestial cues from the sun and stars, smells, and humidity gradients. Adult wood frogs are nearly 100 percent faithful to the pond in which they first breed. However, about 20 percent of first-year frogs may go to a pond other than their one of origin.

The onset of the breeding cycle is triggered by weather conditions and varies from year to year. In northern New England the first migration usually begins in late March or early April, ranging to later April in the North Woods. The swiftness of the frogs’ migration-to-egg-laying cycle is well recorded in research and is thought to last 21 days from the first migration to the first hatching of tadpoles.

Females lay up to 1700 eggs, but on average only 30 percent of these will reach adulthood. In some instances, low water levels increase predation and only 4 percent will survive. Male wood frogs reach maturity and can mate at one year; females generally do not reproduce for two years.

Reference:

Hunter, Malcolm L.; Calhoun, Aram J. K.; and Mark McCollough. *Maine Amphibians and Reptiles*. Orono, Maine: University of Maine Press, 1999.



Wood Frog Population Scenario

The map on Student Handout 3 shows a piece of property in Anywhere, Northern New England. The road was built a few years ago to provide access to a housing development. To the east is the main highway. To the west are twelve building lots, each about an acre in size. Three of the lots have houses on them. It is the traffic from these families that travels up and down the road.

The area is populated with wood frogs. They live in the woodlands to the north of the road. In the early spring, they migrate from their woodlands down to the vernal pool to mate, then return to their woodlands.

The population to the north of the road seems to be decreasing. The neighbors have commented that a number of frogs have been hit by traffic on the road.

The following observations have been made:

- After the frog migration was monitored for a week, it was determined that approximately one third of them were being killed on the road between the woodlands and the vernal pool.
- All but a few of the frogs returned to the northern woodlands by the exact same route they took to get there, again causing the same rate of mortality.
- A very small number of frogs went to the south from the pond, not recrossing the road.

It is conjectured that the frogs going south may have had a crossover genetic mutation that has changed their genetic patterning for returning to the same woodland. It appears that this is a dominant trait; hence all offspring from this population will return to the south.

Directions: You will be modeling and examining the changes in size of the northern wood frog population (from crossing the road) and the southern wood frog population (from not crossing the road). Using the information on this handout, create a wood frog population model as described on Student Handout 6. Then, complete the data table on Student Handout 7 and answer the questions.

Note: The model provided in these handouts is based on examples only, not on fact. Models reflect some things that coincide with natural occurrences and some things that do not. When you are working with models, it is important that you recognize their limitations.

Wood Frog Population Model

The following is a model of population growth and dispersal based on the natural history of the wood frog. It is a simulation, and therefore does not represent data collected from field studies. Instead of using actual numbers in a frog population and the number of their offspring, the model presents a number to represent the movements of the wood frog population.

Materials for Each Team

- 10 beans of each of 6 varieties, or
- 10 squares of each of 6 different-colored papers, cut to 1 cm
- 1 felt-tip pen
- 1 small paper bag
- 1 paper plate

Activity

1. Select two beans of each variety. Arrange them by sex as described on Student Handout 2. Each bean variety represents a genetic variation of the wood frog species (similar to humans having red hair or black hair, blue eyes or green eyes, an inherited probability of diabetes or heart disease, etc.)

On one of the lima beans representing a female, place a black mark. This female has had a crossover genetic mutation that alters her navigation abilities – making her go south from the vernal pool rather than north, back to her original woodlands. This trait is found to be a dominant gene on her DNA. Hence, all of the offspring from a parent with this mutation will inherit this characteristic.

2. Toss the 12 beans on the plate, which represents the vernal pool. Match the closest males and females; these are the mating pairs. For each mating pair, one female and one male are born. To keep this model simple, the offspring of these mating pairs will be the same variety as their same-sex parent. Add these offspring beans to the plate.

There should now be 24 beans on the plate. However, remember that the genetic mutation (the black dot) in the female is a dominant trait. This means that both of her offspring will inherit the characteristic. Mark both of her offspring with a black mark.

3. It is now time for the frogs to return to their terrestrial habitat. It has been determined that one in three frogs do not make it across the road. Hence, every time the frogs cross the road, they lose about one third of their population. Use your map to place the “frogs” back in their terrestrial habitat. Since the individuals with the mutation (three lima beans with a black mark) go south, they do not go across the road. Place all of them on the map south of the wetland. Place the 21 other beans in the small paper bag. Without looking, remove one third (7 beans), leaving 14 beans in the northern woodlands across the road. Write your data in the data table on Student Handout 7.



Student Handout 6 continued

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4. Two years later, the frogs are all mature. Repeat the migration and reproduction process as described below. Remember: The frogs lose one-third of their population every time they cross the road – both going to and returning from the wetland.

Place the 14 breeding adults from the northern population in the paper bag. Without looking, remove one third – this is the breeding population for Year 2. Toss them on the plate with the beans from the southern wood frog population, and arrange them in pairs as you did in step 2 above. Repeat the offspring process. If there is an uneven number of beans, do not add offspring for the remaining single bean. Make sure to mark all of the offspring of the southern population. Move them all south.

5. *Repeat this entire process* two more times for Year 4 and Year 6. Place all your data in the table on Student Handout 7.

6. Read and discuss the questions on Student Handout 7 with your team. Then write your answers to share later with the whole class.



Wood Frog Population Data Sheet and Questions

Year	North Woods	South Woods	Total
Original			
End Year 1			
Year 2: Breeding Adults			
Year 2: Adults and Offspring			
Year 4: Breeding Adults			
Year 4: Adults and Offspring			
Year 6: Breeding Adults			
Year 6: Adults and Offspring			

Questions

1. What trends can you identify in the data?
2. What do you conjecture will happen to the two populations of frogs in future years? What if you factored in mortality (frogs dying due to the aging process)?
3. Describe what happens to the populations of wood frogs. Explain the impact of the road as well as the impact of the genetic mutation on their population.
4. What is the genetic variability in the two populations? Could this have an impact on their future population size?
5. Can you draw any conclusions about how populations might respond to human impacts?
6. Can you suggest anything that could be done to lessen the impact of the road on the wood frog population?
7. How is this model similar to what might really happen to the wood frog population? How does the model differ?

Natural History of the Barred Owl

The barred owl (*Strix varia*), like most owls, is relatively secretive. One is more likely to hear this bird than to see it. The barred owl is medium-sized, about 21 inches in length and chunky in appearance. The wings have brown and white spots. This species of owl is named for its breast pattern, which has dark barring on the upper breast and dark streaking below. The barred owl has dark brown eyes.

Barred owls live from the Atlantic Coast of the United States up through the Northeast and over central Canada to British Columbia and the Pacific Northwest. They live in mature forests of either conifers or mixed hardwoods. They nest in large, predominately deciduous trees or snags of broken or dead trees in a fairly closed canopy. Barred owls have been considered common in undisturbed mature and old-growth woodlands. However, it is believed that they are decreasing in number because of the loss of mature and old-growth forests within their range.

Barred owls have a broad diet. They prefer to hunt in mature woodlands with a relatively closed canopy but an open understory, which allows for broader flying spaces. Their prey include voles, shrews, mice, squirrels, small birds, frogs, and insects. The hunt diet of barred owls is predominately mammals (46%), followed by birds (26%), amphibians (26%), and invertebrates (5%).

Nesting begins in March and continues through May. Barred owls prefer to nest near water, perhaps due to the variety of species in available in these lowlands. They nest in tree cavities, in the abandoned nests of hawks or other raptors, or even in abandoned squirrel nests. The trees they nest in are usually around 75 feet in height, with their nests placed at about 50 feet. Barred owls keep their nests at least 600 feet from human disturbances or openings in the woods. They stay even farther away from roads.

Home ranges for barred owls are greater in the winter than in the summer. In New England, they are thought to require 2500 acres per pair in winter -- nearly 4 square miles. Research has shown that 7 acres are recommended as a buffer between a nest site and any human disturbance (defined as roads and trails with motorized access, railroads, camps, industrial activity, and human settlements). A buffer zone of 30 acres is recommended between the nest and an opening in the woods.

Reference:

Olsen, Ben, et al. Barred Owl Reproductive Habitat Suitability Index Model, Version 3. (19999)
http://www.fmf.ab.ca/pdf/h_bowl.pdf



In Search of Wilderness

You're on a Quest!

Land classification is how we describe the ways in which land is used – such as agriculture, single-family homes, commercial use, natural resource areas, and so on. By learning about land classification, you will learn how northern New England's natural treasures are protected and preserved.

Materials needed:

- Computer with Internet access
- Pen and paper for notes
- Local map showing mountains and foothills

Investigate with your family!

- Where is your town or city located in relationship to at least one wilderness area?
- What rare animals exist in your state? Where are these rare animals located?

Here is a list of reliable Web sites that will help you research wilderness areas in your state:

Maine

Maine Department of Inland Fisheries and Wildlife
<http://www.state.me.us/ifw/index.html>

Maine Wildlife Management Areas
<http://www.state.me.us/ifw/wma/table/index.htm>

New Hampshire

New Hampshire Fish and Game Department
[\(http://www.wildlife.state.nh.us/\)](http://www.wildlife.state.nh.us/)

New Hampshire Division of Forest and Lands
http://www.nhdf.org/for_mgt_bureau/fm_dredlands.htm

Vermont

Vermont Department of Fish and Wildlife
www.anr.state.vt.us/fw/fwhome/index.htm

Vermont Wildlife Management Area Maps
<http://www.anr.state.vt.us/wmamaps/index.html>

The Natural Resources Conservation Services of the U.S. Department of Agriculture provides information to help people conserve, maintain, and improve our natural resources and environment – on everything from soils to having a database of all sorts of plants and alternative crops! <http://www.nrcs.usda.gov/>

Map it out!

Go through a local map and mark all areas of wilderness that you find. Then answer the following questions:

- Where are wilderness areas in your state? Can you picnic, hike, canoe, or fish in these areas? What about berry picking or hunting?

Figure it out!

Go to your local town hall and talk to an individual with the conservation commission or planning board. Ask about land classification and the ways in which land is used in your town and state. Find out:

- Do these areas permit public access for certain types of recreation?

- What types of wildlife can be found in these areas?

- Are there tracts of land large enough for species to remain undisturbed throughout their life cycles?

Too Many People?

Now consider what your town or region's wilderness area(s) would be like if the population of your town doubled. Would there still be adequate resources for all the wildlife? Would the populations of these species be able to survive?

Electronic Quest!

Here are some other excellent sources of information about Northern New England's Wilderness areas!

Outdoor New England

<http://www.outdoornewengland.com/links-dfws.html>

New England Wildlife Center

<http://www.newwildlife.com/NEWC/>

National Parks of New England

<http://www.bec.com.au/armiddle/natnpark.htm>

New England Forestry Foundation

<http://www.newenglandforestry.org/neff/home/index.asp>



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