Wilderness

Middle Level Lesson Plan

Overview

QUEST Wilderness takes students on a journey through northern New England, where they will learn about the many kinds of areas categorized as "wilderness" according to eastern United States standards. (In contrast, in many western states the concept of "wilderness" involves mainly federally owned lands.)

In the *QUEST Wilderness* video, students will hear from a number of New England scientists and conservationists who are researching and working to identify new potential wilderness areas. The video will help students begin to see the many purposes for designating an area as "wilderness."

In addition, throughout this teaching unit students are given examples of ways in which humans have – both deliberately and inadvertently – had an impact on the northern New England landscape, and of ways in which these effects may be ameliorated.

Introduction

This teaching unit provides middle-level students with an opportunity first to think about their own notions of "wilderness," and then to study a natural area in depth. They will be using some of the same kinds of techniques that are used by the scientists they observe in the *QUEST Wilderness* video.

Students' research and data collection will focus on the basic living and nonliving factors at their site, but they will also go further by determining the interactions among these factors as well as the interactions and impact of humans on that natural system.

Finally, students will analyze their data and will use the results to make a reasoned recommendation as to whether their natural area might or might not serve any of the purposes of a designated wilderness area.

Time Allotment

This teaching unit requires approximately eight 45-minute class sessions (including two to watch the videotape). Teachers with longer block scheduling may adapt the sessions to best suit their circumstances.

Maine MATHEMATICS and SCIENCE Alliance

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Accessing Prior Knowledge

In order to develop an understanding of the interactions within an ecosystem, students must first have knowledge of the individual survival needs of a variety of organisms and of the limiting conditions within their habitats. It is especially important for students to have access to and experiences with the natural environment, especially within their own local ecosystem.

Portions of this lesson involve students in data collection and analysis, first within a schoolyard environment and then in a forested ecosystem. In order to identify the types of organisms (especially of trees) growing at their study sites, students will need to know how to use a field guide and key. If you intend to implement these activities during the winter, it will be important that the key include the identification of trees by twig.

Concepts to Clarify

Many students believe that organisms are able to affect changes in bodily structure to exploit particular habitats, or that they respond to a changed environment by seeking a more favorable environment. This lesson will allow students to glimpse the ways in which the inhabitants of a natural area in their own region have changed over the years, depending on how various factors (such as amount of sunlight, temperature, and moisture) have changed.

CONNECTIONS TO THE STANDARDS

National Science Education Standards	Benchmarks for Science Literacy	Maine Learning Results	New Hampshire Curriculum Framework	Vermont Learning Standards
Life Science 4. Populations and Ecosystems: d. The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as the quantity of light and water, range of temperatures and soil composition. …. Lack of resources and other factors…limit the growth of populations in specific niches in the ecosystem.	Chapter 5D: Interdependence of Life 3. Human beings are part of the earth's ecosystems. Human activities can, deliberately or inadvertently, alter the equilibrium in an ecosystem.	M. Implications of Science & Technology 4. Describe an individual's biological and other impacts on an environmental system.	Life Science 3b. Trace the history of an interaction between man and the environment that demonstrates how human activities can deliberately or inadvertently alter the equilibrium in an ecosystem.	The Universe, Earth, and The Environment Theories, Systems, and Forces: 7.15ee. 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.

Materials Needed

- TV and VCR
- *QUEST Wilderness video*
- Notebook or journal for each student
- Chart paper and markers or blank overhead transparency
- A one-tenth-acre study area on the school yard (see Activity 3)
- An additional study area within a forested location, either within the schoolyard or nearby (see Activity 5 for description of appropriate locations)
- Measuring tape or measuring wheel (of the type frequently used by coaches or athletic directors to measure playing fields)
- Material to mark off boundaries of study area and to mark individual blocks within area (such as small stakes or flagging tape tied onto the tops of tongue depressors)
- Tree "cookies" (optional; cross-sectional cuttings from one or more trees, particularly trees growing in varied conditions, such as in the open and in shade, in moist soil and on dry land, etc.; these can frequently be obtained from local loggers, foresters, or neighbors who use firewood for their woodstoves)
- Clipboards – 1 per pair of students (sheets of corrugated cardboard with a large clip on the top to hold field notes can also be used)
- Field guides to local trees and other plants and animals (insects, mammals, birds, etc.)
- (optional) Increment borer (tool used by foresters and other ecologists to extract a tree-ring core from live, standing trees; these might also be borrowed from a local private or state forester or university researcher, or may be purchased through a forestry supply catalog or science education catalog) (optional) Plastic drinking straws for storing and protecting increment cores
- Hand lens (1 per pair of students)
- Student Handout 1: Wilderness Act of September 3, 1964
- Student Handout 2: Wilderness: What Is It? Why Do We Need It?
- Student Handout 3: Conducting a Forest Study
- Student Handout 4: Tree Rings: A Record of History
- Student Handout 5: The Life of a Tree, The Life of a Forest
- Student Handout 6: Exploring the Forest Ecosystem – Sample Plot Study
- Student Handout 7: To Be Wilderness or Not To Be Wilderness? That Is the Question!
- Student Handout 8: Quest At Home: Hunting Down the Big Trees

1. Introducing the Concepts

Activity 1

This activity invites students to begin to ponder the uniquely human notion of wilderness. It also elicits their current thinking about the meaning of *wilderness* specific to the New England region. On a deeper level, it allows them to begin to recognize some of the ways in which humans have had an impact on the ecosystems of New England.

Step 1
Begin by asking students to sketch, in their notebooks or journals, a place that represents their idea of what *wilderness* is.

Step 2
When students have finished their drawings, ask the following discussion prompt: "What features did you include in your drawing that characterize what you think of as a typical wilderness area?"

Record students' ideas on the board. Then ask the following prompt to refine and clarify their definitions: "What would be the opposite of wilderness for you?" (Students will probably describe urban or suburban kinds of features.) If students need further prompting, ask questions like the following:

- Would there be dirt roads in your wilderness area?
- Would you find tree stumps there?
- Could people hike there?
- Would you allow hunting?

Point out that different people might have different ideas about what wilderness is, depending on their own personal histories and experiences.

Step 3
Conclude this initial activity by explaining that the United States Congress passed an official Wilderness Act in 1964. Distribute copies of Student Handout 1 (Wilderness Act of September 3, 1964), which includes some of the key phrasing from the Act. Point out that this legislation refers to land owned mainly by the U.S. government, not to state-owned land or private land, which is more typically found in the New England landscape. Then have students read the handout.

Step 4
Ask students to guess and to record in their notebooks the percentage of northern New England land that would be considered wilderness according to this 1964 law. Explain that you will begin the next day's lesson by discussing students' estimates and the reasoning behind them.

2. Exploring the Concepts

[**Note:** The next activity involves previewing, watching, and debriefing a one-hour videotape on wilderness. If your school's schedule is made up of 45- to 55-minute periods, you will probably want to divide this activity into two segments as described below.]

Activity 2

In this activity, students will begin to consider how wilderness is defined and designated in northern New England (as opposed to the western United States, where much of the nation's federal land is located). They will also think about the various purposes for setting aside certain land areas and designating them as wilderness.

Step 1

Arrange students in small groups of pairs, or 3-4 students. In these groups, students should then discuss the results of their homework assignment from Activity 1 (the "guesstimate" of the percentage of land in northern New England that is designated as wilderness according to the 1964 Wilderness Act).

Step 2

After members of individual groups have shared and discussed their answers, have each group figure out their average estimated percentage of land that is designated wilderness in northern New England. Each group should also select one member to report out to the whole class.

Step 3

Selected students should now report their group's average estimated percentage as well as their reasons for making the original guesstimates. At this time, you may want to inform students that no more than 2 to 2 1/2 percent of the land area in Maine, New Hampshire, and Vermont is used as wilderness (although it may not all be under legal protection), and that, in fact, no more than 1 1/2 percent of the land area in this region is legally designated as wilderness.

Step 4

Explain to students that they will shortly be watching an hour-long video to learn more about northern New England's wilderness areas. Point out that one thing they will notice in the video is the difference between how wilderness is defined in the eastern part of the United States and how it is described in Student Handout 1 (where it is given a national designation through the 1964 Wilderness Act). Tell students that the Wilderness Act they read earlier pertains only to federal land – land owned by the U.S. government. In northern New England, wilderness land can also be owned by states, paper companies, or even individual families.

Step 5

Ask students: Where, in our state, do you think you could find federally designated wilderness land? Allow time for students to respond; discuss their answers briefly. Then share with them the following officially designated locations:

- **Vermont** – Bristol Cliffs, Lye Brook, Big Branch, Bread Loaf, George Aiken, and Peru Peak
- **New Hampshire** – Great Gulf, Presidential-Dry Range, Pemigewasset, and Sandwich Range National Forests
- **Maine** – Baxter State Park, Acadia National Park, Caribou-Speckled Mountain, and two areas in eastern Maine (these are not identified by name in the video)

Distribute copies of Student Handout 2 (Wilderness: What Is It? Why Do We Need It?). Review the questions on the handout with students. Tell them that they will be making notes and answering the questions on the handout as they view the video. Remind them to pay close attention to the video so that they can answer the handout questions as thoroughly as possible.

Step 6

If your class periods are 45-50 minutes long, show the first 30 minutes or so of the *QUEST Wilderness* video; then facilitate a short debriefing conversation so that students can discuss what they have noted so far on their handouts. Explain to the class that they will be viewing the rest of the video during the next class period.

Step 7

To begin the second day's lesson, review the major wilderness areas in your state. Ask students to name other places they learned about in the video that might be considered wilderness areas. Suggest that students think about those kinds of places as they continue viewing the video – and that they think about how the place that they sketched during Activity 1 might fit into one of these definitions of wilderness. Then play the second half of the videotape.

Step 8

Upon completion of the video, have students share their responses to the questions on Student Handout 2. Record representative responses on chart paper or on an overhead tranparency. (You will need to display this list during the final activity of the unit, so please store students' recorded results.) If students have had trouble answering the questions with enough accuracy, prompt them for definitions and purposes based on the answers provided below.

Answers to Student Handout 2 might include the following:

1. What are some of the definitions of wilderness presented in the video? What kinds of wilderness areas are there in northern New England?

- Areas left alone by humans where nature's processes are allowed to reign
- Areas with no roads or development but where people are able to hike, hunt, fish, snowshoe
- Roadless areas
- Federal land set aside with a wilderness designation
- Ecological reserves: areas of special significance that are set aside (such as special land forms, plant/animal communities)
- Areas that are buffered from areas that humans use (towns) and connected to each other by zones of connectivity (corridors that animals can migrate through)
- Conservation easements: special agreements that allow certain uses of the land (like logging or farming) but do not allow other uses (like building houses)
- Undeveloped land (not build on, no people living there)

2. What are some of the reasons/purposes for designating a specific place as wilderness?

- To allow recovery of severely damaged places in an ongoing way
- To maintain a watershed in its wild condition – clean waters
- To keep an area wild so that our children and grandchildren can experience it
- To maintain an area that feels wild and peaceful to humans, where they can get off the beaten track by hiking and recreating

- To protect areas of ecological importance
- To keep "snags" – areas with dead tree – around for use as wildlife habitats
- As a study site – to provide information to scientists about the ancient forest – to see what the natural growth in an area is like
- To protect biological diversity (all of the many different kinds of life) so that there is a mixture of genes and so that larger organisms needing a lot of space can still survive
- To save an entire landscape containing many kinds of ecosystems – wetlands, lowlands, hardwood ridges (for example, the St. John River system)
- A reminder to humans of our place in the universe: we are not all-powerful or always in charge
- A way of improving us and making us whole

Step 9

Ask students: In what ways does the idea of officially calling places wilderness show (or reflect) the impact of humans on their natural environment? (In other words, why do we even need to name some of our forest areas wilderness?)

Have students keep their copies of Student Handout 2 in a safe place so that they can be used during the final activity of this teaching unit.

3. Developing the Concepts

Note: The following activity will take approximately two class periods.

Activity 3

During this activity, students will learn to use a process for collecting data about the current status of both living and nonliving features of a natural area. In later activities, students will seek evidence of change over time within this natural area and will try to use that evidence to create a plausible history of the site. They will particularly focus on the impact that humans have had on the natural site.

Step 1

Begin by asking students to think back to their original drawings of a wilderness area. Now they should try to picture themselves in that place.

Pose the following challenge to the class: Suppose that the Northern Forest Wilderness Alliance[1] came to you and told you that they were thinking about including your imagined wilderness place in their designated reserve area. In order to decide whether or not it was worth spending the money to conserve this land, they would first need to know more about it. For example, what is this area like now? And, what is its land-use history?

1 This is an imaginary organization, but the challenge could be posed to students as if it were real.

Then ask: This organization would expect you to collect data about your area and to write a report and/or to provide an oral presentation. In the report you should tell them about the plants and animals that are living in your area now. You should also tell them the history of the area – what has most likely happened in the past, in terms of both natural and human-created impact.

Step 2

Ask students to brainstorm possible responses to this challenge. They should brainstorm first on their own, then in the small groups formed during Activity 2. Encourage them to consider how they might collect enough data to present an accurate report on all of the living and nonliving features of an entire area like the ones that they have individually pictured.

Step 3

Have groups share their responses with the whole class. Discuss students' ideas about how they could study and collect data about the current status of their selected areas as well as how they could learn their areas' histories.

Step 4

Explain that a forest is a very complex community of living things that depend on each other and also on the nonliving things in their environment (like climate, water, and sunlight). Tell students that when they collect their data about the organisms living in their areas, they will need to know not just the names of the organisms but also where each one is in relation to the others and in relation to factors in the non-living environment (like the sunlight).

Further inform your students that a forest usually has several layers; different plants and animals live in each layer. Now tell students that *the most important factor in determining where a plant or tree will survive is its tolerance to shade and moisture (or lack of moisture).* If they can learn to recognize some of the important kinds of plants and recall (or know where to look up) information about them – such as a plant's ability to survive in the shade or in wet/dry areas – then they can piece together a fairly accurate basic history of how their forest has developed to its current status.

Step 5

Refer students back to the ideas they brainstormed in Step 2 above. Explain that it would be almost impossible to identify, measure, and record every single plant/tree and animal in an entire forest area. Therefore, scientists like conservation biologists David and Julie from the Manomet Center for Conservation Sciences (whom they saw in the *QUEST* video) usually engage in some sort of scientific sampling of a few representative portions of the whole forest area.

Tell students that they will be learning one way in which scientific sampling can be done: On one day, they will take some sample data from a one-tenth-acre area on their school grounds. On another day, they will use the same technique to study a local forested ecosystem. Explain that scientists can mark off forest areas into one-tenth-acre blocks like this and then use a mathematical process to randomly select just a few of the blocks to study in detail. The data from these few representative blocks can then be analyzed and will provide an accurate picture of the status of the forest.

[**Preparation:** Before taking your students out onto the school grounds to conduct their research, you will want to mark off the one-tenth-acre study area (21' x 21') that will be sampled by the entire class. In order to make the task meaningful to all students, the study block should be further broken down into subplot segments that can each be assigned to a pair of students. To do this, figure out how many student pairs you have in your class and then divide the one-tenth-acre block into that many sections. Helpful materials for marking off sections will be a measuring tape or measuring wheel (the type used by coaches to measure ball fields), and something to mark off the subplot grid lines, such as sticks, stakes, or tongue depressors.]

Step 6

Take students out to the study area on the school grounds. Distribute copies of Student Handout 3 (Conducting a Forest Study) and read the instructions together. Arrange students in pairs. Then assign each pair to collect data from a different subplot in the one-tenth-acre block.

Step 7

Back in the classroom, conclude the activity by debriefing students on their results. Question prompts include the following:

- What kinds of plants and animals did you find in the one-tenth-acre study plot?
- Were they growing in the open sun or in shade? (*If you are doing this before spring leaf-out, ask students to imagine the area in full leaf-out and to respond accordingly.*)
- If you had never been on these school grounds before and you looked at the recorded results from the one sample, would you be able to create a fairly accurate picture in your mind of what the whole area looks like? Does the sample provide a true representation?
- What evidence do you see that humans have used the area or have had an influence on this place?
  - Are there any roads or paths?
  - Is the area kept open by mowing or by the cutting of plants and/or trees?
  - Are there any non-native kinds of plants or animals here, such as ornamental shrubs, etc?

Direct this final question to students either for classroom discussion or for homework:

- We have been studying this area on the school grounds so that you could learn a scientific procedure that we will use later in a forested area. Based on the data that you have collected, could you ever actually recommend this particular school area as consideration for a wilderness designation? Why or why not?

Note: If you are on a playground or ball field, the answer to the question above may seem obvious, but this is still an important discussion to have. Students should be able to recognize that there may be too much human intervention in the area to call it *wilderness*. An interesting ending to the class would be to pose the following questions:

- How much evidence of human existence is "too much"?
- When should you call something *wilderness*, and when should you not?

Activity 4

In the following activity, students will learn about a data-collection process that can provide them with a snapshot of the history of an individual tree. When considered together with data from other trees and from other evidence in the area, this information gives students a picture of the area's history, including the impact that humans might have made.

Step 1

Introduce the activity by discussing the notion of forest succession – the natural series of changes in orest vegetation that will happen on any site over many years. Explain that the process of succession may be started when a forest fire clears out an area, when an old farm field is abandoned, after a timber harvest, or after any kind of disturbance that clears a site of its existing trees.

Tell students that on bare ground, succession may begin first with lichens and then mosses, grasses, and other herbaceous (nonwoody) plants. The first forest to "pioneer" the area will be trees and plants that need a lot of sun and warmth and can grow in drier soil. These trees and plants are generally very fast growers.

Inform students that the next thing to happen will be that the pioneer trees will increase in height, causing more shade. This will help keep the soil moist, since there won't be as much direct sun to dry it out. These fast-growing trees do not fare as well in shady areas, even within their own shade. Thus, their seeds will not compete well once they germinate (sprout), and the resulting offspring plants will be over-topped by other, more shade-tolerant species. Tree and plant species that are more shade-tolerant *will* grow successfully. (These new species grow more slowly than the pioneers, but they can often live for years in shade until the pioneers die off. Then the shade-tolerant species take over and dominate the area.)

Explain that by knowing these natural patterns, scientists can look at a forest area, collect a little data about it, and then make a fairly accurate hypothesis about how that forest environment has developed. They can also estimate the extent to which natural or human-created disturbances may have influenced the forest.

[**Note:** This activity is more informative and more enjoyable for students if they can have access to some real "tree cookies" (cross-sectional pieces from different trees) and/or an increment borer that can be used to extract a tree ring core from different living trees in order to study their growth rings. If you have the latter, you may either wish to extract cores from a variety of trees yourself ahead of time (trying to include old and young trees, large and small, trees in sun and in shade, healthy and less healthy trees, etc.), or you may wish to have the students visit a site with many trees and extract the cores themselves. In either case, the samples can be saved and reused in future years. To avoid having them crack and split as they dry out, you may wish to cure the cores in a microwave oven.[2]]

Step 2

Arrange students in pairs. (You may choose to use the pairings already formed in Activity 3, or you may

2 This is done by placing dividers (like wooden slats) between the tree cookies so that moisture can escape during the drying process. The samples will be damp when you remove them after cooking in the microwave for approximately 10-20 minutes. Let them air-dry for a day or so before storing.

regroup as needed.) Distribute copies of Student Handout 4 (Tree Rings: A Record of History). After reading the beginning of the handout together, provide each pair or students with a hand lens, a copy of Student Handout 5 (The Life of a Tree, The Life of a Forest), and one or more of the following if possible:

- A collection of real "tree cookies" taken from trees of varying conditions
- A set of core borings that you have extracted from standing trees using an increment borer (or have ordered from a science education supply company)
- An outdoor area that contains many tree stumps or fence posts (so that students can observe the growth rings on the stumps or posts)
- The optional page from Student Handout 5, which contains a series of tree cookie images

Step 3

Provide students with enough time to observe all of their samples and to count and record the age and other evidence that is revealed in each one. Have student pairs develop individual hypotheses to explain the history of growth for each of their specimens.

Step 4

Debrief the lesson by having students present the history of one of their specimens.

Step 5

Explain that students will now wrap up this Wilderness unit by combining their two new study procedures – site sampling and tree ring observations. They will be researching and making a recommendation about whether or not an unclassified forested study site should be designated as wilderness.

4. Synthesizing the Concepts

In the next activity, students will visit an unfamiliar wooded study site and will apply their research skills while collecting data that can help them determine the area's current status. They will also interpret the past history of the area's forest ecosystem. The final activity of this teaching unit (Applying the Concepts, Activity 6) will involve students in interpreting their study site data to make a reasoned response to the following question: Should the area be designated as official "wilderness" or not?

Activity 5

[**Preparation:** You will need to locate a wooded study site and mark off a one-tenth-acre (21' x 21') sample plot similarly to the way in which you marked off the school-based site used in Activity 3. Each pair of students should have their own sample subplot within the one-tenth-acre study site, just as they did in the earlier lesson.]

(**Hint:** Many school systems have one or more cross-country trails in the vicinity that could be used as wooded "field trip" sites. Although this sort of expedition can sometimes be challenging to arrange, national science standards strongly recommend that students have opportunities to experience and to study local ecosystems in person.)

Step 1

Begin the activity by explaining to students that they will now have an opportunity to study a true forested area – much in the way that the scientists and naturalists in the QUEST *Wilderness* video did.

Inform the class that their task will be to work first in pairs and then together with all of their classmates. They will be collecting and interpreting data about what is currently living in their study area; then, using some of the evidence they have collected, they will infer the history (including any human impact) of the area's ecosystem.

Step 2

Distribute copies of Student Handout 6 (Exploring the Forest Ecosystem – Sample Plot Study). Be sure that each pair of students has a clipboard and pencils. Also bring along a set of field guides for trees, plants, insects, and so on. Proceed to the study site.

Step 3

Have each pair of students collect data about their own individual subplots within the class's one-tenth-acre block. Be sure that they look carefully for evidence of any human impact. If there are tree stumps in any of the subplots, have students record data about the growth rings on those stumps. (One interesting and telling feature of tree stumps can be their height: If they are very tall, this may be an indicator that the tree was cut down in the winter, during high snow pack.) If you have been able to obtain an increment borer, have each pair of students take a turn extracting a core from one of the trees in their subplot. (They can either observe the data on site or, better yet, they can store the cores in drinking straws and analyze them later in the comfort of the classroom.)

Step 4

Back in the classroom, conduct a debriefing session to conclude the activity. Depending on the amount of time that you have, ask students to share their quick impressions about:

- The nonliving features of the site (e.g., sunlight, moisture, temperature)
- The current living organisms that inhabit the site (the kinds of plants, trees, animals, etc., and the extent to which there is/is not a variety of different species of each)
- The ways in which the nonliving factors have affected the kinds and amounts of living organisms that are present

End by noting that students should prepare for the final lesson by thinking about the interactions among the living organisms in their forest, and about any human impact that they have noticed.

5. Applying the Concepts

Activity 6

This culminating activity enables students to connect what they have learned about the interactions within an ecosystem (including the interactions and impact of humans) with their understanding of the purposes for designating areas as wilderness.
Students will interpret the data they have collected from their study site, and they will use their interpretations to decide whether or not their site might be given a *wilderness* designation.

Step 1

Begin by having students consider the following questions individually in their notebooks or journals:

- In what ways did the nonliving features of your study area (for example, sunlight, moisture, and temperature) have an influence on the kinds and amounts of organisms (plants and animals) that you found there?
- How might the kinds and amounts of trees and other plants have had an influence on the organisms that you found at your study site?
- Finally, what about the human impact? What evidence did you find of human impact on your study area? (Evidence might include human-made items, or it might be evidence shown in the tree rings; for example, if humans had opened up an area through farming or forestry, the tree rings might appear to be growing farther apart – as described on Student Handout 4.)

Step 2

Now have students consider the same questions with their partners from the previous activity. Pairs should then report their conclusions to the whole class. Help them record these results on the board or on chart paper.

Step 3

Distribute copies of Student Handout 7 (To Be Wilderness or Not To Be Wilderness? That Is the Question!). Having students work individually, review the directions with students. Reiterate that they should use as much evidence and data interpretation as possible to back up the recommendation that they are making about their forested study area. (You can also have students coordinate with their partner on final information that they record.)

Proficiency Guidelines

Students will demonstrate proficiency on this task if they are able to show the following:

- Use of evidence collected about living and nonliving factors at the site to interpret interactions among organisms and also between humans and the ecosystem
- Further use of the evidence to provide a reasoned recommendation about the potential wilderness designation

6. Extending the Concepts

Activity 8

The following activity allows students to share their classroom learning and field-work experiences with family members. It also helps them link the information they learn at school with real-world situations.

Step 1

Distribute copies of Student Handout 8 (Quest At Home: Hunting Down the Big Trees). Review the handout with students, clarifying as needed. If possible, suggest sources of field guides to trees that might be available – either as a loan or from the school or from your town library or university. Assign a day for students to return with their results.

Step 2

On the appointed day, have students bring their completed assignments in to class. Allow them to share and discuss their results, and help them determine whether any of the trees might be submitted as candidate Champion Big Trees.

Career Opportunities

Have students determine the types of careers that are dedicated to protecting the environment, for example a forest ranger, an environmental lobbyist, a camp ground manager, a museum specialist, a national or state park technician, or even a conservation educator. Have students research a career, the educational degrees necessary, and the roles these positions play in protecting the environment. Have students create a brochure that advertises a particular career and describes the roles and responsibilities of the position, interviews with someone in their community for quotes, and job opportunities in the field.

Community Connections

Ask students to determine what it takes to maintain public awareness on their local and state's wilderness. What does their state do to be sure that the public stays informed? Ask a conservation specialist or public relations individual from the town hall to provide an overview of what is done on a state, local, and national level to maintain public awareness on protected lands.

Resources

History with Fire in Its Eye
http://www.nhc.rtp.nc.us:8080/tserve/nattrans/ntuseland/uselinksfire.htm#history
http://www.nhc.rtp.nc.us:8080/tserve/nattrans/ntuseland/uselinksfire.htm
The first Web address above is a page from the National Humanities Center, which provides an interesting overview of the impact of fire on the American landscape. The second listing is a page from the same site which includes many links to other fire-related sites. These sites provide key information about the impact of the wilderness designation on official decisions to manage and fight wildfires in *wilderness* areas that border human settlements.

The Northern Forest Alliance
http://www.northernforestalliance.org/
The Northern Forest Alliance is a coalition of conservation, recreation, and forestry organizations united in their commitment to protect the Northern Forest of Maine, New Hampshire, Vermont, and New York.

The Wilderness Society
http://www.wilderness.org/links/list.htm#educational
This page provides links to a vast variety of wilderness-related sites.

The Wilderness Society Quiz
http://www.wilderness.org/quiz/quiz.htm
This Web site includes a quiz to test your knowledge about wilderness in the United States.

Wilderness Act of September 3, 1964

To establish a National Wilderness Preservation System for the permanent good of the whole people and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled.

WILDERNESS SYSTEM ESTABLISHED STATEMENT OF POLICY

Sec. 2. (a) In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States…leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness.

For this purpose there is hereby established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as "wilderness areas" and these shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness and so as to provide for the protection of these areas, the preservation of their wilderness character and for the gathering and dissemination of information regarding their use and enjoyment as wilderness.

DEFINITION OF WILDERNESS

(c) A wilderness, in contrast with those areas where (humans) and their own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by humans, where humans themselves are visitors who do not remain. An area of wilderness is further defined to mean in this chapter an area of underdeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which 1) generally appears to have been affected primarily by the forces of nature, with the imprint of human's work substantially unnoticeable; 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; 3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and 4) may also contain ecological, geological or other features of scientific, educational, scenic or historical value.

Wilderness: What Is It? Why Do We Need It?

The video that you are about to watch will feature several scientists and conservationists from northern New England. These professionals study natural areas and are responsible for trying to designate some of those areas as **wilderness**.

Listen carefully to what the people in the video are saying. Then try to respond to each of the following questions with as many different examples as possible.

1. What are some of the definitions of *wilderness* presented in the video?

What kinds of wilderness areas are there in northern New England?

2. What are some of the reasons/purposes for designating a specific place as wilderness?

Conducting a Forest Study

In order to provide the Northern Forest Wilderness Alliance with an accurate and reasoned recommendation about your potential wilderness area, you must provide them with data and an analysis report about what is growing in the area now. You will also need to give them some information about the land-use history of the area, which you can infer from your data.

Today, you will learn and practice a research-study technique that can later be used to study a similar area within an actual local forest.

Rather than try to identify and record every single tree, plant, and animal in an entire forest, scientists study smaller **sample plots**. Then they **infer** from these results a picture of what the whole forest is probably like. It is important that scientists select their study plots randomly so that they don't sway the results in favor of features that they might be expecting or hoping to find.

An example of one random-sampling technique is the procedure that you will be using today.

One-Acre Study Plot

1	2	3	4	5
6	7	8	9	10

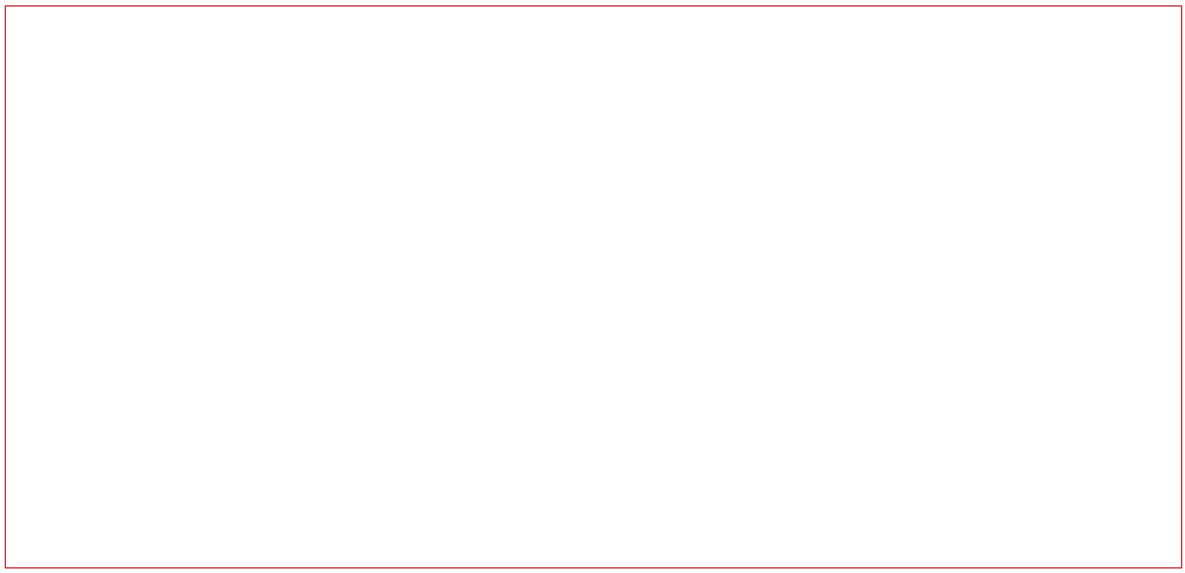
Imagine that the whole rectangular grid above is a map of *1 acre* in a forest that has then been divided into 10 equal sections. Each numbered section is therefore one tenth (1/10) of an acre in size.

You could randomly select a subplot section to study by doing the following: Write the subplot number for each one-tenth-acre section (numbers 1-10) on separate slips of paper. Put the papers into a hat, and then draw out one of the numbers at random. That subplot would be the one that you would study in detail in order to gather data that are representative of the whole acre.

Your class will be studying one of these one-tenth-acre blocks today. (One tenth of an acre is a block that measures 21'x 21' see the diagram below.)

A Sample Study Goes a Long Way!

21'



21'

Your class as a whole will record all of the plants and animals that are found within this area. To make the work go faster (and to make it more interesting for all of you), you and your partner will have your own small section within that one-tenth-acre block.

Directions:

1. Go to your pair's subplot within the class's one-tenth-acre study block.

2. Record the date and time. Then write some general impressions in your notebook or journal in response to the following questions:
   - Is the ground typically dry, damp, or wet?
   - During the growing season (when there are leaves on the trees), is the area mostly in open sun, is it slightly shaded, or is it in deep shade?
   - Is the land here flat, hilly, or steep?

3. Next, in your notebook or journal, draw a grid block like the one pictured above. Use it to record the types, amounts, and distributions of plants and animals in your study space. (Be sure to label the dimensions of your subplot in feet in the same way that the whole-class grid above is labeled.)

Hint: If you see only one, or just a few, of any particular plant or animal during your observations, indicate it with a labeled sketch on the diagram so that you will have a record of where it was located within the block. Then add its name, description, and other pertinent information to the Sample Date Table below. (You will want to create a data table like this one in your notebook and use it to *record all information about your study plot.*)

How will you know what kind of plant or animal you have found? Like scientists, you can use a field guide or key to identify any organisms that you do not recognize. If it is a tree, you will also want to find its listing on the table at the end of this handout and record its shade tolerance (which will be on a scale ranging from 1 to 10).

If there are too many of a particular plant or animal to draw clearly, sketch just a few to show their areas of distribution. Then count them all and *record their actual amounts* in the data table.

Sample Data Table

Type of plant or animal	Number of this species found within your subplot	Description: Condition or general health; size (height, width, or space that it takes up); shade tolerance rating;etc,.

Shade Tolerance Rationg of Some Typical New England Tree Species

Scale:
1= Cannot live in shade
10 = Tolerates deep shade

Shade Tolerance Rating	Tree Species
1	Aspen (Poplar), Birch
2	Red Pine, Black Ash, Black Cherry
3	Red Maple, White Ash
4	Red Oak, American Elm
5	White Pine, White Oak, Norther White Cedar
6	Black Spruce
7	White Spruce
8	Flowering Dogwood,
9	Sugar Maple, Red Spruce, Balsm Fir
10	Eastern Hemlock, American Beech

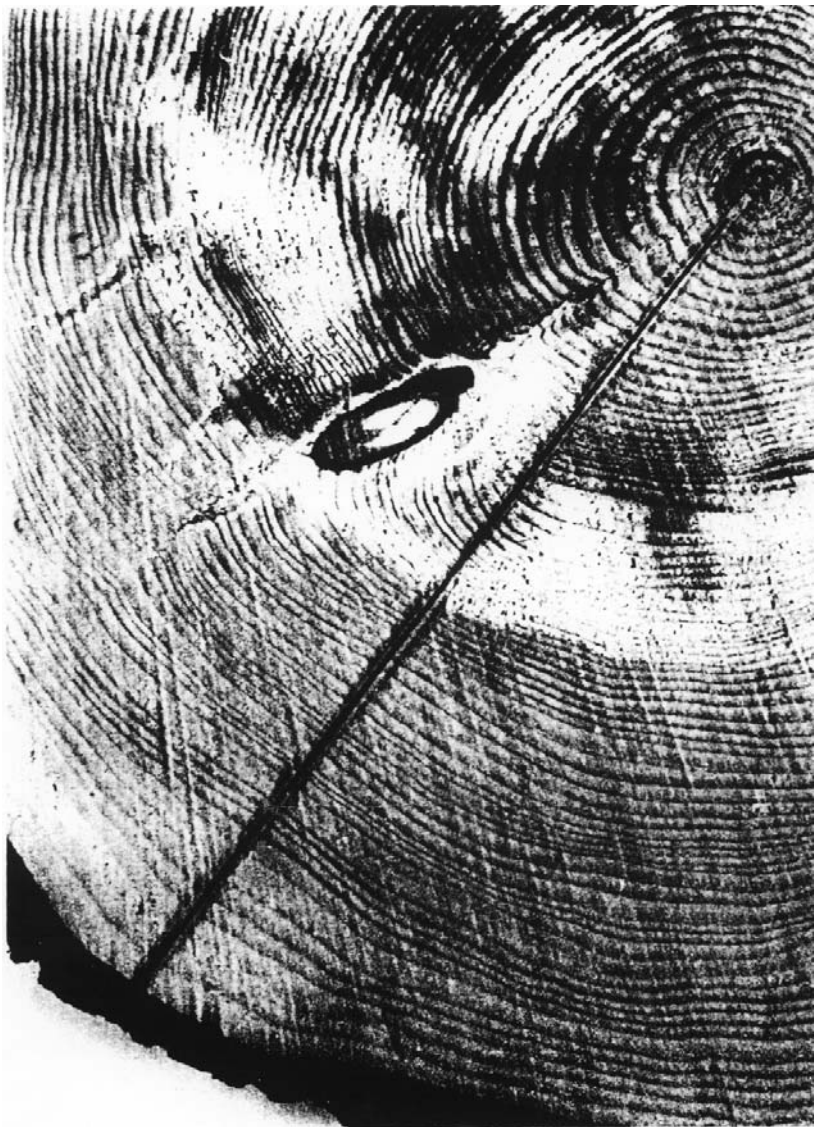
Tree Rings: A Record of History

Many foresters and naturalists use their observations of "tree cookies" (the cross-sections of tree trunks) to look into the past and to learn about the lives of these trees and of the forests in which they lived.

The secret to understanding a tree's history can be found in its "growth rings."

Directions: Look at the picture below. It was taken from a "tree cookie." What do you notice? **Record** all that you notice about the tree cookie in the space below.

(**Hint:** You may wish to include such things as the widths of the various rings, changes in ring width during certain times, unusual features of the rings, or other markings.)



■ **Did you notice that there are light and dark concentric rings within the bark of the tree?**

Here's why: In order to grow, trees add new living tissue just under their bark. They typically do this between the time their buds open in the spring and the time they drop their leaves in the fall.

The amount that trees grow each year depends partly on the amount of soil moisture. This is usually higher in the spring and lower (or drier) by the end of the summer. In the spring, when there is a healthful amount of moisture, trees form large, new, light- colored cells that have thin walls. Later in the season, their new cells are small, thick-celled, and dark.

So, each light/dark combination represents one "ring," or one year's growth. Therefore, starting from just inside the bark and working in toward the center, you can count each of the dark rings and estimate the age of a tree.

■ **Did you also notice that some rings are much wider than others on the same tree?**

Look at some of the wider rings. Why do you think the tree did so well during those particular years? It is probably because the tree had more sunlight during those years; therefore, its leaves could make more food. It also probably had a healthful amount of moisture.

Why would a tree have more sunlight during some parts of its life than during others? Perhaps it was one of the first trees to grow after the original disturbance to the forest, so it got a lot of sunlight in the beginning of its life. (This means that the wider rings would be toward the center of the tree.) Then, as it and the other trees grew taller, they began to shade each other out and their growth slowed down. (This means that their growth rings would be narrower toward the outer edges.)

Another reason for the wider rings appearing farther out toward the edge, near the bark, might be that the tree suddenly received more sun later in its life. This could have happened because some or all of the trees near it were either cut down by people or blown down in a hurricane or other windstorm. (If you had weather records for your area, you would be able to increase the accuracy of your hypothesis by confirming which kind of disturbance was more likely.)

■ Did you also notice some very narrow growth rings?

During some years, a tree might not receive enough moisture. This can happen because of drought or because, for some other reason, the tree has not produced enough food. An example would be an infestation of leaf-eating insects: no leaves, no food; no food, no new growth rings!

■ What are some other interesting features on a tree cookie?

– Evidence of a fire (black "charcoal" within one or more growth rings)
– Places where rings are very tight on one side of the tree and very far apart on the other side, during the same growth year

(This can occur if the tree is growing sideways out of a hill; it is straightened out by growing more on one side than on the other. It can also occur if a second tree leans or falls against it, causing it to grow irregularly in order to once again straighten itself out.)

Why study tree rings?

Some scientists, like Charles Cogbill, researcher of the Big Reed old growth forest in Maine (whom you saw in the *QUEST* video), want to learn more about how a forested area grows. They use what they know about the interaction of the different tree species. (such as whether they can tolerate each others' shade or not). Then they add what they have learned from tree-ring evidence to create a hypothesis about the "big picture" of the whole area.

In order to become more familiar with this process of developing a "story" to describe the trees' (and the forest's) life, you will now have an opportunity to explore more tree cookies.

The Life of a Tree, The Life of a Forest

This activity will give you an opportunity to learn more about how a tree cookie can tell the story of not just one tree, but also of the forested ecosystem in which that tree lives.

Directions

1. Create a data table in your notebook – one that looks like the sample below. Leave a space under the table so that you can jot down notes and specific details about your hypothesized story of the tree's life. Create as many tables as you need, depending on how many tree-cookie images, actual tree cookies, tree growth increments, or tree stumps you are analyzing.

2. Use a hand lens to observe each tree's cross-section.

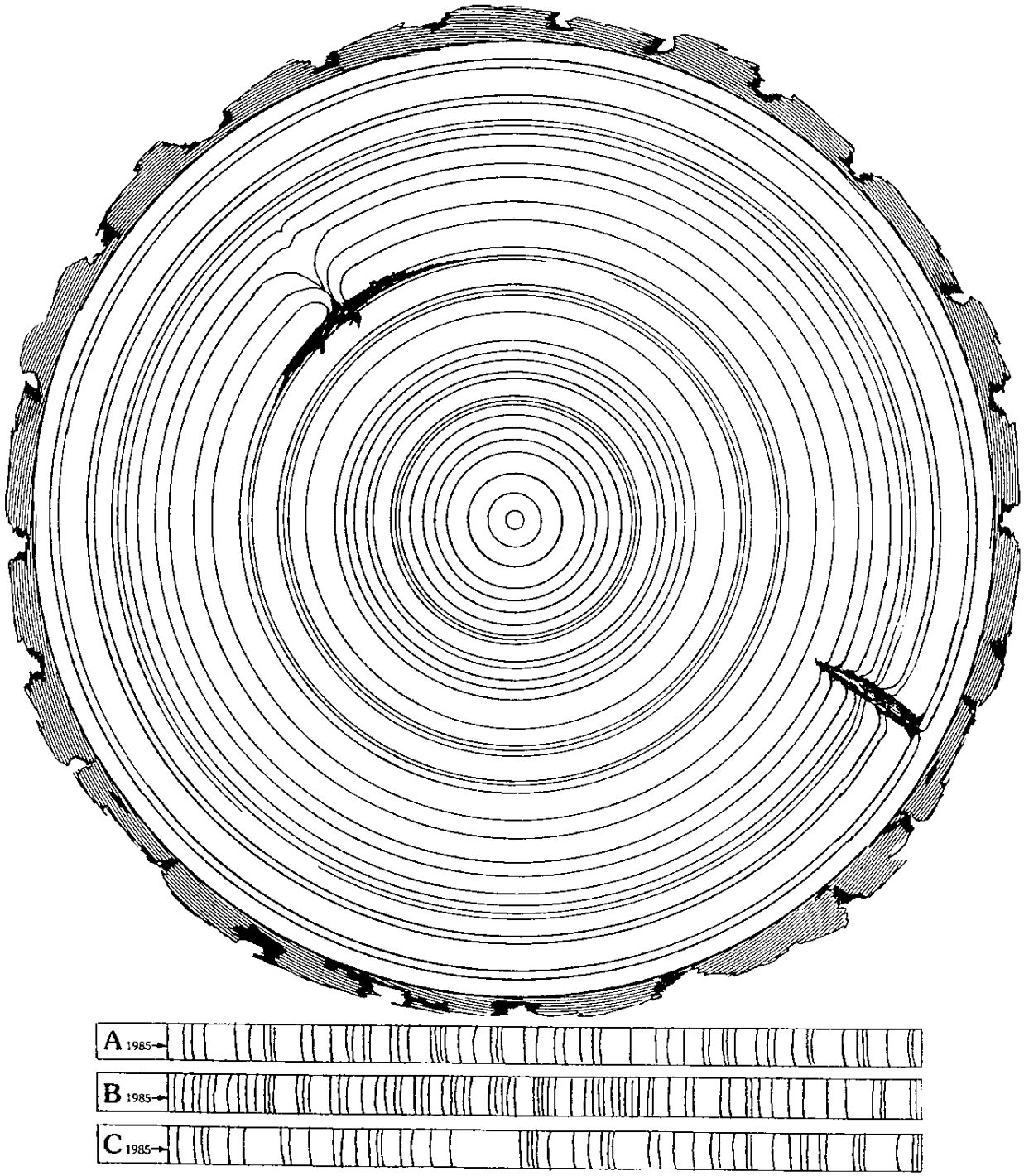
3. Record each piece of evidence that you can gather from the tree ring sample, including the following:
   - Total number of rings on the tree
   - Various growth stages of the tree's life
   - Any unusual occurrences (insect infestation, drought, fire, leaning trees, human impact, etc.) For each of the occurrences, be sure to indicate the year(s) during which they happened. Also, describe the specific evidence that leads you to hypothesize that this is what occurred.

Sample Data Table (*Including Sample Data*)

The History of Tree # 5

Estimated Age of Tree: 48 years old

Year(s) of its life	Growth Ring Evidence (Descriptions)	Inference(s) from the evidence
1-5	Very wide rings (each approximately 1.5_wide)	Tree grew out in the open
5-12	Slightly narrower rings (not quite 1"), but mostly the same width across the 7-year span	Tree continued to grow steadily, but may have been in more shade. Water seemed to be plentiful, or at least not a problem, since there was still pretty good growth
13-14	Darker, somewhat rotten-looking ring	Could be a fire, or else an insect attacked the bark
Etc.		


A 1985
B 1985
C 1985

Exploring the Forest Ecosystem
Sample Plot Study

Directions

Your challenge is to collect and analyze data about the current and past life of a particular forest ecosystem in northern New England. Later, you will use your interpretation of the data to make a decision about whether to recommend that the area be designated as wilderness.

1. Use the boxed space below to record data you have collected about (or, you can draw or record the boxed diagram in your own science notebook/journal).

- The type, amount, and location of each plant and animal in your sample subplot
- The general nonliving features in your forest ecosystem (sunlight, moisture, warmth, etc.)
- The specific historical information that you can gather from each tree stump (or tree core, if you have an increment borer)

The width of our subplot is _____

The length of our subplot is _____

2. General information:

- Is the ground typically dry, damp or wet?

_____

_____

- During the growing season (when there are leaves on the trees), is the area mostly in open sun, is it slightly shaded, or is it in deep shade?

_____

_____

- Is the land here flat, hilly or steep?

_____

_____

3. Tree data:

- Assign each separate tree in your subplot a number (1, 2, 3, etc.).
- Mark the location of each numbered tree in the boxed space above.
- Record the specific tree-ring history in your notebook or journal (using a data table like the one below).
- If you have any tree stumps that are recently cut, do your best to identify their species. Try looking at other trees in the area that you can identify; compare and try to match their bark. (Also, assign each tree stump a number, and record the tree-ring data for each stump.)
- Below your data table, record other notes about the tree rings (see note below data table for suggested information to include).
- Finally, record any evidence of human impact on the ecosystem: trails or roads, tree stumps that are obviously cut by a saw or an axe rather than blown down naturally, stonewalls or barbed wire fences, planted species of trees (species that are not native to northern New England), cleared areas, etc.

Tree Data

Assigned Tree Number	Tree Species	Age of Tree (in years)	Interesting Tree-Ring Data (Copy similar columns for each tree)	
			Age of Feature	
			Description of Feature	
1				
2				
3				
Etc.				

4. Other tree data:

In your notebook, record any other possible interpretations that come to mind about what might have happened to cause the changes in tree rings that you noticed. For example, is there a taller tree standing beside a tree in which you suddenly noticed a narrowing of the growth rings? Is there a tree leaning onto one in which you noted lopsided growth rings? Is there a stone wall that might indicate your land was once open pasture? (This could be indicated by very wide growth rings in a tree's early life, before other trees had a chance to shade it out.)

5. Evidence of human impact on the forested ecosystem:

To Be Wilderness or Not To Be Wilderness? That Is the Question!

The Northern Forest Wilderness Alliance has held a series of meetings to ask the public for ideas about places that should be considered for a *wilderness* designation. One of the areas that has been recommended is the area that your class recently visited and studied.

The Alliance has a very small staff. They are asking various groups to help them by collecting data about each area first. Then these groups should recommend whether or not the Alliance should send out scientists from their small staff to do a final study of the area.

Your class has been asked to create a report for the area that you just studied.

Directions: Please consider and respond by jotting down notes about each of the following prompts. Then use the suggested outline that follows to write a report including your own personal recommendation.

1. Look back at the notes that you collected while watching the QUEST *Wilderness* video. Which of the purposes for designating an area as wilderness might apply to the area that you just studied? (List all of the possible purposes.)

2. Review your own field notes from the study site:
   - Are there any unusual features of the site (special kinds of plants or animals, old-growth trees, clear streams that need protecting, etc.)?
   - What evidence is there of human impact on the site (either specific features or things that you interpreted from your data, such as impact on tree or other plant growth)?

3. Use all of this information to write a report to the Northern Forest Wilderness Alliance. In this report you should include a recommendation as to whether the Alliance should or should not do further research on this particular location. Include the following in your report:
   - Begin by explaining your own definition of *wilderness*.
   - Describe the purpose(s) of the wilderness designation that you thought could be met if your area received this designation. (**Note:** It is fine to state that you considered your area for specific purposes – which you should name – but that, upon a closer look at the data, you found that the site would not really serve that purpose.)
   - State your recommendation: Either the area should or should not be further studied because it could possibly meet those purposes of wilderness.
   - Provide a "snapshot" of the data that you collected that support your recommendation. For example, were there any rare or unusual species of plants or animals living there? (Describe them, including their quantity and distribution in the area.) Was there evidence of human impact suggesting either that the area could not be wilderness, or that it needs to be designated as wilderness in order to protect it further?
   - State any other considerations that the Alliance should give to your site. Also describe any further study of the site that you would recommend.

Hunting Down the Big Trees

You're on a Quest!

There are patterns of tree growth that will cause trees to increase in height. This, in turn, will create more shade, which keeps the soil moist. The species of trees that are shade-tolerant grow more slowly, but they live for many years in shaded forests. Learning about trees will allow us to learn more about how trees impact our air, water, and public lands.

Materials needed:
- Computer with Internet access
- Pen and paper for notes
- Local map showing parks or wilderness land (optional)
- String or measuring tape

Investigate with your family!

- What is the largest tree any of your family members has discovered? In which state was the tree located?
- Where might you and your family find big old trees in your state?

Here is a list of helpful official Champion Big Trees lists that you can find on the Web:

The Big Trees of Vermont
http://www.vermonttreesociety.org/listnoframes.htm

Champion Trees by Species
http://www.championtrees.org/champions/champions.htm

Smithsonian Magazine
To be a champion, a tree must measure up to high standards that introduce the search for champion trees.
http://www.smithsonianmag.si.edu/smithsonian/issues96/oct96/bigtrees.html

Michigan Botanical Club: Information on Trees and State Champion Lists
http://michbotclub.org/big_trees/champion_list.htm

Big Trees Across America
http://www1.br.cc.va.us/murray/Urban_Forestry/Big_Trees/default.htm

Now, make a plan to hunt down the biggest old tree!

1. Think about the places where you've seen large trees in your own neighborhood, in your town, or in your region. **Locate the tree** – and be sure to bring a measuring tape or ball of string.

2. Record the following information about the tree:

■ What kind of tree is it? If you can't get your hands on a field guide – either at home or at the library – you can always collect a twig with leaves on it, or a few leaves from the ground, and use the field guide at school to identify your tree.

■ Describe the soil, landscape, and moisture where the tree is located. For example, is the soil wet, damp, or dry? Is the landscape mostly natural or mostly human-designed? Is it in the open or in a forest?

■ Describe the types of plants and animals near the tree.

■ Measure the circumference of the tree. You can do this using either a measuring tape or a ball of string: Wrap the string once around your tree; then use a ruler or yardstick to measure how long the string is. Do you have any idea how old the tree might be?

Electronic Quest!

You may want to submit information about your tree if it seems really spectacular!

To download an official nomination form, visit *http://www.americanforests.org/resources/bigtrees/.* click on "Download the Nomination Form." Then complete the form and submit your proposal. Good luck!

Maine MATHEMATICS and SCIENCE Alliance

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