Wisconsin Forestree . . .

Bridging the Gap Between Environment and Economy

-- a product of the Central Wisconsin Environmental Station --

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The Wisconsin Forestree Initiative

Wisconsin's forests have a proud heritage of providing for a prosperous local economy. In 1848, as Wisconsin became a state, the timber industry was responsible for attracting an ever-growing workforce. From the toils of their labor came the building materials necessary for the construction of prosperous industries and communities throughout the United States. Settlement patterns in the pineries of Northern Wisconsin were a direct consequence of the forest industry. Towns like Drummond, Laona, Stevens Point, Wausau, and Rhinelander sprouted overnight as a need for goods and services to support logging and mill working developed.

As the state continued to grow over the next half-century, so did the need for lumber. The timber industry's boom was about to bust as the great white pineries disappeared. By the early 1900's, the supply of these large trees had run out. Layoffs at the logging camps and sawmills drastically affected the prosperity of the communities that depended on the timber industry. An abandonment of countless dwellings resulted and the very land that had supported them was barren.

As these great industries suffered from a lack of raw material, a new era emerged. For the first time, we began to understand that our forests can truly be a renewable resource. Abandoned lands were replanted and we began to manage our forests with production and the future in mind. Additional research over this past century has provided an understanding of the important ecological benefits these managed forests provide. Forests protect our soils and watersheds. They provide habitat for a diversity of plants and animals, strengthening the links that keep an ecosystem strong.

Today our forests yield a renewable commodity used to provide consumers a variety of wood products and to employ over 97,000 workers in the second largest industry in the state. Recreational use of Wisconsin's forests continues to grow and diversify. Both the forest and tourism industries are important and interrelated components of Wisconsin's economy and environment.

Over the past few decades, the average citizen of Wisconsin has become removed from the land as we have evolved into a more urban and technological society. With this removal has come a lack of understanding of the historic importance of the timber industry, of the continued need for forest products, and of how sound management practices can provide for a balance between forest economic and ecological benefits. High-visibility forest issues such as the spotted owl, mountain clearcuts, tropical deforestation, and the Yellowstone and Los Alamos fires, coupled with this lack of understanding, have precipitated a growing segment of the population that is anti-timber industry. As we look to the future health of our economy and our environment, the importance of helping educate the public that these may exist in harmony is imperative.

Throughout the last year, the Central Wisconsin Environmental Station has developed this ten-lesson, multidisciplinary forest education unit entitled *Wisconsin Forestree.... Bridging the Gap Between Environment and Economy*. It is a comprehensive unit that contains all of the background information and activities necessary to accurately teach the material. It is a multidisciplinary unit involving science, math, social studies, language arts, and art activities. The lessons are designed to maintain a logical progression, allowing students to consistently expand upon the knowledge they have acquired. This Unit conveys a balanced and comprehensive understanding of forest economy and ecology in Wisconsin and has the potential to help thousands of Wisconsin's middle school students and teachers better understand the relationships between people, forests, and forestry practice.

Acknowledgments

Wisconsin Forestree Content Reviewers

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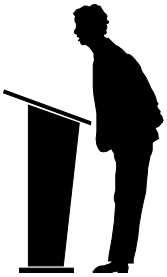
Unit Layout
Working with Wisconsin Forestree



Unit Design

Wisconsin Forestree was developed as a "Unit-Based" curriculum. Many other curriculum materials offer a variety of activities developed to work as individual classroom lessons in a specific subject area. Curriculums from Project Learning Tree and Project WILD are developed in this fashion. WI Forestree is designed to be taught as an entire 'Unit' with each lesson building off of and supporting previous lessons. It is multi-disciplinary, meaning that it contains math, science, social studies, art, and history lessons. The lessons can be taught either by one teacher or in teaching teams involving the appropriate teacher for each subject. WI Forestree is also Wisconsin-specific, dealing with the history, people, trees, forests, landscape, and issues that affect our region. Each of these qualities helps WI Forestree to be a comprehensive and powerful teaching tool for forestry educators throughout the state.

Lesson Design

There are ten lessons in the Wisconsin Forestree Unit encompassing fourteen 50-minute class periods. Each lesson addresses a specific aspect of forestry in our State. Throughout each lesson, a set of classroom activities is used to convey the lesson concepts and achieve the student objectives. Each of the ten lessons are presented in the following format:

Nutshell

This section summarizes the lesson.

Concepts

This list illustrates the main points that the lesson conveys.

Objectives

The activities in the lesson are designed to teach the students the objectives listed in this section. After completion of the lesson, students should be able to fulfill all of the objectives in this list.

Teaching Site and Preparation

These sections list the site requirements and the preparation needed to make the activities work smoothly and effectively. Many activities require rooms with access to large wall space or overhead projectors. Lessons may also require you to have a good understanding of the background information or the rules of a specific game.

Materials

A list of all of the necessary activity materials (overheads, handouts, markers, butcher paper, etc.) will be listed in this section.

Vocabulary

The terms and definitions for important vocabulary will be listed in this section. A master list is also supplied at the end of the Unit and can be used for handouts and/or overheads for your students.

Lesson Time

Details the classroom time required to teach the lesson.

Background Information
This information supports, accentuates, and expands on all of the information that goes into each activity. The background information for each lesson is extensive and in many cases covers more information than needed for the activity. The additional information is provided to enable you to expand on lessons and answer difficult questions that the students may pose.

Activities
This is the heart of the lesson. The activities section outlines the actual process that you will take your class through. Each activity will have a step-by-step description narrated in a question and answer format that mimics the possible interactions that you may have with your class.

Conclusion
This section reviews the concepts presented in the lesson and ties in to the next lesson in the sequence.

Student Log Books
Each lesson in WI Forestree concludes with the Student Log Book section. The log book is designed for students to take notes, write vocabulary definitions, formulate questions, expand on concepts, and to complete homework assignments in. It is their personal forestry journal. Log books can be made by stapling loose-leaf paper together, using old notebooks, or designing them with construction paper and markers. Small, journal-style notebooks can also be purchased.

The log book should be used as a tool to keep students active with the lessons. At the beginning of each lesson, have the students open their log books and record the day of the week, date, teacher name, and name of the lesson that they will be working on. Log books can be used in a variety of formats and may also be used to assess the progress of your students throughout the lessons.

Seeds to Grow
This section details suggested extension activities for some of the lessons.

The Big Picture
The WI Forestree Unit has two field companions designed to better facilitate both you and your student's learning. The Central Wisconsin Environmental Station (CWES) offers both a Wisconsin Forestree Field Experience for students and the Wisconsin Forestree Teacher Institute for forestry educators.

The field experience is designed to work hand–in–hand with the teaching of the Unit. The first six lessons within the Unit add to the knowledge base of the students and prepare them for the more difficult lessons that involve greater background information along with teamwork, compromise, and critical thinking. After the completion of these lessons, an on-site field experience is available at CWES. The field experience promotes teamwork, gives students practical experience in the science of forestry, and provides insight into many principles in forest ecology. This experience better prepares students for the completion of the Unit.

The Teacher Institute is conducted in early summer on-site at CWES and is designed to prepare teachers to utilize the WI Forestree Unit. Teachers work through each lesson in the Unit, participate in Field Experience activities, meet natural resource professionals, and receive additional support materials and possible extension activities for the Unit.

Why Get Hung Up in the Classroom this Year?

Bring your class to the Central Wisconsin Environmental Station for the WI Forestree Field Experience. Your students will learn to identify native trees, use modern equipment to test and measure forest attributes, estimate the monetary value of an acre of timber, assess the biologic diversity of two forest stands, and determine a forest's habitat suitability for different animal species.

The Field Experience was piloted with four separate Wisconsin Schools from April 26 to May 10, 2000. Ken Wochos, a sixth grade science teacher from Pier School in Fond du Lac, said, "I've been teaching for 26 years and this field trip was by far the best trip I've ever done with any class. I'll see you next spring."

A Little More About Us

Since 1975, the Central Wisconsin Environmental Station (CWES) has served as a model residential environmental center, conducting quality outdoor and environmental education programs for school groups and summer camps. Nearly a quarter of a million K-12 youth and more than 12,000 teachers from throughout Wisconsin have participated in these programs.

Throughout the last 25 years, CWES has trained more than 800 UW-Stevens Point students and 500 K-12 teachers to become environmental educators.

We are a 300-acre field station located 18 miles east of Stevens Point, Wisconsin, on glacial Sunset Lake amid towering pines and oaks. We are operated by the UW-SP College of Natural Resources, the largest college of natural resources in North America. Its forestry and environmental education programs have been internationally recognized for excellence.

For more Information on the Wisconsin Forestree Field Experience write to:

The Central Wisconsin Environmental Station
Attn: Wisconsin Forestree Field Experience
10186 County Road MM
Amherst Junction., WI 54407

fax- (715) 824-3201
phone- (715) 824-2428
http://www.uwsp.edu/cnr/cwes

The Station's primary purpose is to provide practical environmental education and natural resource experiences for university students. These students are studying to become leaders in the fields of soils, forestry, water science, wildlife, and natural resource management. CWES also serves as a center for environmental education outreach, helping to support and model excellence in natural resource and environmental education.

Please Return Me !!!

The hardworking folks at the Central Wisconsin Environmental Station refuse to stop working on educational materials for Wisconsin's forestry educators. We have plans to further supplement and enhance this Wisconsin Forestree Unit. Possible additions may include a teacher's forestry reference library on CD-ROM, a Wisconsin Forestree home page, and a virtual field experience. By filling out the information below and returning this letter to the Central Wisconsin Environmental Station, you can assure that you receive all of the new materials as they become available. Thank you.

Teacher Name _____

Mailing Address _____

_____

_____

Please send this letter to:
Central Wisconsin Environmental Station
10186 County Road MM
Amherst Junction, WI 54407

Master Vocabulary List

Lesson 1 – The Science of Forests and Trees

- **Leaf litter** –This first layer of a forest is found on the forest floor and is comprised of dead and decaying matter also known as humus.
- **Forb Layer** – The second layer of a forest; it contains herbaceous plants (plants that have no woody parts) like ferns, wildflowers and vines.
- **Shrub Layer** – This layer is home to plants with woody stems that are not trees such as raspberries and poison ivy.
- **Understory** – This layer is comprised of immature trees and smaller shade tolerant trees. These trees are waiting for a break in the canopy so that they can take advantage of the space and sunlight created when a mature tree dies or is harvested.
- **Canopy** – The tallest layer of a forest; it consists of mature trees that partially or completely block out direct sunlight with their foliage.
- **Individual** – a single tree.
- **Species –** a population of individuals with similar characteristics that usually only interbreed among themselves. Species groups are usually given a scientific, Latin name (for example: *Acer* = Maple, *Quercus* = Oak, *Pinus* = Pine).

Lesson 2 – A Competitive Edge

- **Tree characteristics** – the identifying traits (physical, biological, or chemical) of a tree.
- **Disturbance** – a natural or human caused event that causes forest change.
- **Disturbance regime** – the intensity, duration, and frequency of a disturbance.
- **Tree establishment** – growing of a tree onto a piece of land.
- **Tolerance** – a tree's ability to handle natural and/or human influences upon its environment; usually refers to a tree's tolerance to shade.
- **Germination** – the sprouting of a tree seedling from a seed.
- **Nutrients** – the elements found in the forest floor and soil that trees require for growth.
- **Moisture** – the amount of water present.
- **Competition** – the interactions formed between trees while acquiring their essential needs for growth and reproduction.
- **Maturity** – a period of time in a tree's life-span when it reaches near maximum size and slows in growth.
- **Succession** – the change in forest structure and/or composition through time.
- **Primary succession** – forest establishment that starts on bare rock or a land surface with no plant material.
- **Secondary succession** – forest establishment that starts from seed beds, roots, or other types of tree reproduction.
- **Steady-state** – a period of time in forest aging when forest growth slows and the changes in composition and structure are minimal. This is the old-growth forest, the last stage of forest succession

Lesson 3 – Forests of Wisconsin

- **Deciduous forests** – forests composed of trees that survive winter in a dormant (inactive) state; losing their leaves in the fall and regaining them once again in the spring.
- **Coniferous forests** – forests composed of trees that have cones and needles. Most coniferous trees in Wisconsin, with the exception of tamarack trees, keep their needles throughout the winter season.
- **Mixed coniferous and deciduous forests** – a forest in which both coniferous and deciduous trees are present.
- **Boreal forest** – a forest composed of mostly cold-tolerant coniferous trees. A boreal forest occurs when cold temperatures stop the growth of most or all deciduous trees, leaving only coniferous trees.
- **Oak woodland** – a dense stand of trees very similar to a deciduous forest, but containing mostly oak tree species.
- **Oak savanna** – a forest composed of a mixture of widely spaced oak trees and prairie grasses. It can be visualized as intermediate to a prairie and an oak woodland.
- **Oak-pine barrens** – a forest composed of jack pine and/or oak trees usually of a similar age and height (even-aged). These barrens are dependent on fire disturbances and sandy soil to maintain the oak and jack pine composition and the even-aged structure.

Lesson 4 – Wisconsin Forest History

*No vocabulary for this lesson

Lesson 5 – Forest Utility

*No vocabulary for this lesson

Lesson 6 – Forest Value

- **Value** – the worth that someone places on something.
- **Economic value** – a forest's worth in financial terms.
- **Aesthetic value –** the worth of a forest in terms of its natural beauty.
- **Recreational value –** the worth of a forest in terms of its use for leisure.
- **Educational value –** the worth of a forest in terms of its instructional benefit.
- **Egocentric value –** the worth of a forest in terms of an individual's personal connection to it (e.g. I value this forest because I played here as a child).
- **Ecological value** – the worth of a forest in terms of preserving the ecosystem.
- **Cultural value –** the worth of a forest in terms of the way a person was raised to believe in it.

Lesson 7 – Natural Resource Careers: A Game of Life

*No vocabulary for this lesson

Lesson 8 – Forest Management

- **Acre** – the most common unit of measurement used by foresters in Wisconsin. A football field is about 1.2 acres in size.
- **Cutting rate** – the rate of timber harvesting that produces a sustainable harvest.
- **Cutting (Harvesting) method** – timber harvesting method used to encourage the re-growth of specific trees (clearcutting, shelterwood cutting, and selection cutting).
- **Dot grid** – a grid composed of squares and dots that foresters use to measure area on a map.
- **Ecosystem management** – use of ecological concepts to predict the effects of management actions on the ecosystem and to guide management planning and actions for use into the future. This type of management occurs over large areas of land through long periods of time.
- **Multiple-use management** – the practice of managing forest resources for a variety of benefits including water quality, timber yield, wildlife habitat, recreation, and wilderness.
- **Sustainable harvest** – forest management practices that ensure the constant and continuous production of forest resources through time.
- **Sustainable forestry** - the practice of managing forest ecosystems to provide ecological, economic, and social benefits for present and future generations.

Lesson 9 – Forestry Issues Investigation

- **Problem** – a situation or experience that is difficult to deal with.
- **Issue** – an issue occurs when there are at least two different viewpoints based on a problem.
- **Belief –** a belief is something that a person thinks is true about an issue.
- **Persuasion –** involves verbally motivating people to take action.
- **Consumerism –** involves putting economic pressures on a business or industry in attempt to force a change in how they do business.
- **Political action –** involves trying to persuade an elected official or government agency to conform to your same values.
- **Legal action –** taking legal action, such as a lawsuit, or taking out a legal restraint, such as an injunction, to prevent a person or organization from carrying out an undesirable environmental behavior.
- **Ecomanagement –** involves physically maintaining or improving the existing ecosystem.

Lesson 10 – The Wisconsin Forestry Summit

*No vocabulary for this lesson

Master Materials List

Lesson 1 – The Science of Forests and Trees

Large easel paper or butcher paper, pictures of a forested area, **Forest Layer Worksheet**, and **Four Common Wisconsin Trees Handout**

Lesson 2 – A Competitive Edge

Day 1 – Overhead projector, pencils ,vocabulary list taken from the master vocabulary list, 4 dice, **Disturbance cards**, **Tree Limit Cards** (1 or 2 for each group), **Competition Rules**, and **Forester's Record Worksheets**

Day 2 – Completed **Forester's Record Sheets**, **Forest Timeline** (must be made), and **Tree Silhouette Cutouts** for all six tree species

Lesson 3 – Forests of Wisconsin

Copies for each student of the:
Natural Divisions Information Chart Handout, **Landforms of Wisconsin Map**

Overhead transparencies of the:
Natural Divisions of Wisconsin Map, **Wisconsin Tension Zone Map**, **Landforms of Wisconsin Map**, **Wisconsin Glaciation Map**, **Wisconsin Continental Divide Map**, **Current Land Use Map**, and **Forest Type Pictures**

Lesson 4 – Wisconsin Forest History

Day 1 – **Wisconsin Forest History Passage**, history pictures as overhead transparencies, and copy of **Questions and Answers for Reading Sheet**

Day 2 – **Forest History Timeline** (must create), colored construction paper, markers/pens/colored pencils, glue, scissors, old magazines (optional), and masking tape

Lesson 5 – Forest Utility

Chalkboard and chalk, list of Wisconsin forest products (found in the activity portion of the lesson), copies of **Jobs in Wisconsin Worksheet** for each student, calculators for each two students

Lesson 6 – Forest Value

Chalkboard and chalk, **Forest Value Category Worksheet** for each student

Lesson 7 – Natural Resource Careers: A Game of Life

One large piece of paper and pencil/marker for each student group, chalkboard and chalk, overhead projector (optional), transparency of resume template (optional), sample or real job announcement bulletins, copies of real sample resume (optional), copy of **Some Key Job Titles Sheet,** set of the **Game of Life Cards** for each student group,, and **Search and Screen Committee Evaluation Checklist**

Lesson 8 – Forest Management

Day 1 - Forest Area - calculators, rulers, transparent dot grids for students, forest area worksheets for students. Harvesting Methods – all 5 **Harvesting Methods Overheads.** Sustainable Harvest – **Sustainable Harvest Worksheet 1 and 2** as worksheets for students and as overhead transparencies

Day 2 - Forest Management Simulation – calculators, rulers, red/green/blue/brown colored pencils, transparent dot grid handouts, **Shady River State Forest Map** as handouts, **Worksheets 1-2** as handouts and teacher copy for reference, **Management Objectives for Wildlife, Recreation and Forestry** as handouts, **Best Management Practices and Rules for Map Drawing** as handout

Day 3 - Decision and Discussion – calculators, **Worksheet 3** as handout, **Who owns Wisconsin's Forests Pie Chart** as an overhead transparency

Lesson 9 – Forestry Issues Investigation

Chalkboard and chalk, copies of the article for every two students, copies of the **Forestry Issues Investigation Worksheet** for every two students, paper and pencils

Lesson 10 – The Wisconsin Forestry Summit

List of summit questions, overheads of all supporting pictures and quotes, chalkboard/chalk or large easel pad and pen

Academic Standards

Wisconsin Forestree addresses Wisconsin Model Academic Standards in Environmental Education , English, Language Arts, Mathematics, Science, and Social Studies. On the following pages, you will find the standards listed by lesson along with how they are met or addressed by each lesson.

Lesson 1: The Science of Forests and Trees

Environmental Education B.8.4 *Levels of Organization*

Students discover that individuals having exactly the same characteristics make up a species. They learn about the layers of a forest and what role each layer plays in the community.

English Language Arts B.8.1 *Writing to Communicate*

Students use a log book to record information learned.

Science F.8.8 *Populations and Ecosystems*

Students understand the structure of a typical forest as they investigate the layers found within the forest and the interactions between them.

Science F.8.9 *Diversity and Adaptation of Organisms*

Students investigate how species are adapted for the role they play in the forest ecosystem.

Lesson 2: A Competitive Edge

Environmental Education B.8.6 & B.8.8 *Energy and Ecosystems*

Students investigate interactions between living things as they participate in a role-playing game. Trees compete with each other to establish themselves. The concept of 'succession' is addressed.

English Language Arts B.8.1 *Writing to Communicate*

Students write a short autobiography of the life of their tree.

Science F.8.9 *Diversity and Adaptation of Organisms*

Students investigate how environmental changes affect the survival or population growth of individual species of plants and animals. By role-playing tree species, students gain an understanding of how trees compete for resources following an environmental disturbance.

Social Studies A.8.6 *Geography: People, Places, and Environments*

Students experience the effects caused by natural disturbances such as fire, insects, floods, and wind and their impact on the ecosystem.

Lesson 3: Forests of Wisconsin

Environmental Education A.8.4 & A.8.5 *Questioning and Analysis*

Students use maps to gather and synthesize information to arrive at an explanation for the distribution of forest ecosystems throughout the state.

Environmental Education B.8.2, B.8.6, & B.8.10 *Energy and Ecosystems*

Students learn that succession is a natural process of change over time and that human use of the land over time affects the make-up of natural systems. They identify major forest types in Wisconsin.

English Language Arts B.8.1 *Writing to Communicate*

Students write a paragraph describing the natural influences on Wisconsin's forest types.

Science C.8.2 *Science Inquiry*

Students extract relevant information from a passage about a tree's characteristics in order to fill in a successional diagram.

Science E.8.1 *Structure of Earth System*

Using maps of Wisconsin's soils, topography and vegetation, students show where glaciation occurred in Wisconsin during the last ice age.

Science E.8.5 *Earth's History*

Students determine the influence that natural divisions in Wisconsin have on forest ecosystems present and learn about the resultant 'tension zone.'

Social Studies A.8.1 & A.8.6 *Geography: People, Places, and Environments*

Students use maps to differentiate six natural divisions in Wisconsin and determine the effects these parameters have on forest ecosystems that are present.

Lesson 4: Wisconsin Forest History

Environmental Education B.8.10 *Energy and Ecosystems*

Students learn from a reading how human activity can shape the environment.

Environmental Education B.8.15 & B.8.24 *Natural Resources and Environmental Quality*

Students learn from a reading that humans have impacted the environment of Wisconsin through resource use. Students create a timeline of forestry history based on the passage they read.

English Language Arts A.8.3 *Read and discuss in order to understand human experience*

Students identify common historical and cultural themes by carefully reading the passage.

English Language Arts B.8.1 *Writing to Communicate*

Students re-write Wisconsin's logging history by changing one aspect of the story they read.

Science E.8.6 *Earth's History*

Students describe the changes in resource use over the past 150 years and explain how conservation efforts came about.

Social Studies A.8.4 *Geography: People, Places, and Environments*

Students discuss historical land use in Wisconsin and describe some of its effects on the environment.

Social Studies B.8.2, B.8.4, B.8.12 *History: Time, Continuity, and Change*

Students use information and a timeline from the reading to discuss how logging efforts in Wisconsin influenced it development.

Lesson 5: Forest Utility

WI Environmental Education A..8.4 *Questioning & Analysis*

Students interpret information provided concerning the use of forest products and the economic value of related employment.

WI Environmental Education B.8.14 *Natural Resources and Environmental Quality*

Students identify and examine the utility of Wisconsin's forest resources.

WI Mathematics B.8.3 & 8.5 *Number Operations*

Students use their knowledge of mathematics to convert percents to whole numbers and vice versa in an exercise that shows land ownership and economic impact.

WI Social Studies D.8.3 *Economics: Production, Distribution, Exchange, Consumption*

After discussing the many uses of Wisconsin's forests, students discuss what economic impacts result from the forest industry, both within the state and on a global scale.

Lesson 6: Forest Value

WI Environmental Education C.8.1 *Environmental Issue Investigation Skills*
Students begin to understand what a value is and how differing values can create conflict in environmental issues.

English Language Arts B.8.1 *Writing to communicate*
Students write a paragraph about how a forest is most valuable to them.

English Language Arts C.8.3 *Participate effectively in discussion*
Students participate in a discussion about different types of values and how they can lead to conflict.

Social Studies A.8.11 *Geography: People, Places, and Environments*
Students identify differing values and the effect they have on resource use.

Lesson 7: Natural Resource Careers: A Game of Life

Environmental Education B.8.22 *Natural Resources and Environmental Quality*
Students learn about careers related to managing natural resources by participating in "The Game of Life."

English Language Arts B.8.1 *Writing to communicate*
Students write a resume for a specific natural resource career field.

English Language Arts C.8.3 *Participate Effectively in Discussion*
Students contribute to the discussion on forestry careers and within small groups about forestry practices and methods.

Science G.8.1 *Science Applications*
Students identify the skills they will need for a career in managing natural resources.

Lesson 8: Forest Management

Environmental Education A.8.2 & A.8.5 *Question and Analysis*
Students read background information on the land that they are to manage, as well as information regarding specific needs to manage for, then develop a suitable management plan. Students share information with each other, revise their management plans and challenge their personal opinions about land management.

Environmental Education B.8.16, B.8.17, & B.8.23 *Natural Resources and Environmental Quality*
Through the management activity, students begin to understand the various political, economic and environmental factors that influence land use decisions.

English Language Arts B.8.1 *Writing to communicate*
Students write about the sources of conflict that arose when forming a management plan and relate these to real life situations that exist.

English Language Arts C.8.3 *Participate Effectively in Discussions*
Students work in small groups, communicating with each other to share their opinions and goals for the management activity, as well as listening to others.

Mathematics D.8.2 *Measurements*
Students use math skills to convert acres, miles, and feet during the management activity.

Science H.8.2 *Science in Social and Personal Perspectives*
Students use consensus to create a management plan that meets differing goals.

Lesson 9: Forestry Issues Investigation

Environmental Education C.8.1 & C.8.3 *Environmental Issue Investigation Skills*
Students identify the issue as well as the people involved, their values, goals and methods of attaining those goals, the decisions reached and the outcomes.

Environmental Education D.8.1, D.8.5, & D.8.7 *Decision and Action Skills*
Students use the sample issue to examine how beliefs and values will influence options for addressing environmental issues, determining the type of action to be taken, and dealing with consequences of that action.

English Language Arts A.8.1 & A.8.4 *Use Effective Reading Strategies & Read to Acquire Information*
Students use their reading skills to extract relevant information from an article dealing with forestry issues.

WI Language Arts C.8.3 *Participate Effectively in Discussions*
Students discuss with classmates the issues addressed in the article, being sure to allow everyone the opportunity to speak.

WI Science H.8.1 *Science in Social and Personal Perspectives*
Students decide whether scientific evidence in the articles is relevant or correct, the reliability of the source and how any biases the source may have would affect his/her presentation of the material.

Lesson 10: Wisconsin Forestry Summit

Environmental Education C.8.1 & C.8.3 *Environmental Issue Investigation Skills*
Students identify and evaluate environmental problems and issues presented by the teacher.

English Language Arts B.8.1 *Writing to Communicate*
Students reflect on knowledge and skills developed during the Wisconsin Forestree unit and write a short essay detailing how the information might be used through their own life.

English Language Arts C.8.3 *Participate Effectively in Discussion*
Students draw on all they have learned in this unit and contribute appropriate comments to the discussion.

Science A.8 *Science Connections*
Students explain how the management theories in forestry developed, what their limitations are and how they might change again in the future.

Science C.8.1 & C.8.11 *Science Inquiry*
Students ask themselves and each other further questions about the future of forestry and resource use in Wisconsin and around the world.

Science F.8.10 *Diversity and Adaptations of Organisms*
Students predict how trends in forestry and resource management will affect the environment and their quality of life as the human population continues to grow.

Science H.8.2 *Science in Social and Personal Perspectives*
Students pose possible solutions to environmental problems and work together to achieve consensus.

Social Studies A.8.11 *Geography: People, Places, and Environment*
Students give examples of the causes and effects of global resource use and how those things will affect Wisconsin's people, plants, wildlife, and land.

Social Studies D.8.3 & D.8.11 *Economics: Production, Distribution, Exchange, Consumption*
Students describe Wisconsin's role in the global economy and environment, and how their personal decisions can affect the environment, both in Wisconsin and around the world.

Lesson One

The Science of Forests and Trees

Concepts
1. Forests contain many components in addition to trees.
2. There are five major structural layers in a forest.
3. A tree species is a group of individual trees that have the same characteristics.
4. Trees can be identified by their physical characteristics.

Objectives
Students will be able to:
1. Define a forest in their own words.
2. Name and describe the five layers of a forest.
3. Explain the difference between an individual tree and a tree species

Teaching Site
Indoor or outdoor classroom; optional wooded area (school forest) with a variety of tree species.

Materials
Large easel paper or butcher paper; pictures of a forested area, Forest Layer Worksheet, and Four Common Wisconsin Trees Handout.

Lesson Time
One 50-minute class period

Nutshell
As a class, students will create a diagram illustrating the components that make up a *forest*. Students will learn about the five layers in a forest by examining diagrams and discuss the differences between individuals and species.

Teacher Preparation
Read background information, gather materials, and copy the **Forest Layer Worksheet** and **Four Common Wisconsin Tree Handout** for each student.

Vocabulary
- **Leaf litter** –This first layer of a forest is found on the forest floor and is comprised of dead and decaying matter.
- **Forb Layer** – The second layer of a forest; it contains herbaceous plants (non-woody) like ferns, wildflowers, and grasses.
- **Shrub Layer** – This layer is home to plants with woody stems that are not trees, such as raspberries and poison ivy.
- **Understory** – This layer is comprised of immature trees and smaller shade-tolerant trees. These trees are waiting for a break in the canopy so that they can take advantage of the space and sunlight created when a mature tree dies or is harvested.
- **Canopy** – The tallest layer of a forest. It consists of mature trees that partially or completely block out the sunlight with their foliage.
- **Individual** – a single tree.
- **Species** – a population of individuals with similar characteristics that usually only interbreed among themselves. Species groups are usually given a scientific, Latin name (for example: *Acer* = Maple, *Quercus* = Oak, *Pinus* = Pine).

Background Information
A Forest Defined
There are many ways to define a forest. Some people think of forests as places to go for rest and solitude. Many people see forests as a wealth of resources to be harvested. Still others see forests as an important habitat for plants and animals. A **forest** is often defined by whatever special interest a person may have. Here are several technical definitions of a forest:

1) A **forest** is a land-based ecosystem characterized by the complex interactions between soil, water, air, plant, and animal components and the dominance of woody plants.
2) A **forest** is an area of land covered primarily by trees, and includes soil, water, and wildlife.

3) A **forest** is at least one acre in size and has at least 10% tree cover.
4) **Forestland** is land covered by at least 10% live trees or land formerly having such cover and not currently developed for non-forest use.
5) **Timberland** is forestland capable of producing 20 cubic feet/ acre/year of industrial wood and not withdrawn from timber utilization.
6) **Reserved timberland** is private or public timberland withdrawn – or deferred by law – from timber production or utilization.

The first activity in this lesson will allow students the opportunity to create their own definitions of a forest.

Forest Layers

There are five major structural layers in a forest. The **leaf litter**, or humus, on the forest floor is comprised of dead and decaying plant matter. This layer provides food to some animals, shelter to others, and replenishes the nutrients in the soil.

The **forb** layer contains herbaceous plants (non-woody stems) like ferns, wildflowers, and vines. This layer is also an important food source for animals. The species that make up the forb layer can be used to indicate how much sunlight or moisture an area receives.

The third layer of a forest is the **shrub** layer. This layer is home to plants with woody stems and some tree saplings. Examples include raspberry, sumac, and elderberry bushes along with sugar maple and hemlock saplings. The shrub layer is an important source of food and habitat for many animals, especially birds.

The next layer is the **understory.** It is comprised mostly of immature trees and smaller, shade-tolerant trees. These trees are waiting for a break in the canopy so that they can take advantage of the space and sunlight created when a mature tree dies or is harvested.

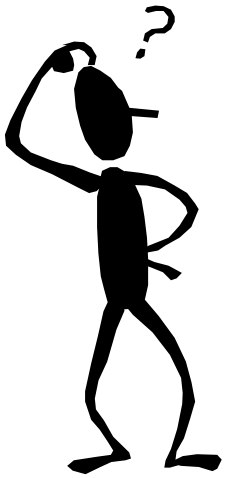
The final layer of the forest is the **canopy**. This layer is made up of mature trees that partially or completely block out the sunlight with their foliage. Both the understory and canopy trees are habitat to innumerable animals as well as valuable economic resources. The vertical distribution of these layers is known as the **structure** of a forest. The structural characteristics of a forest create microclimates, determine habitat suitability for many forest animals, and distinguish many different forest types.

Forest Composition

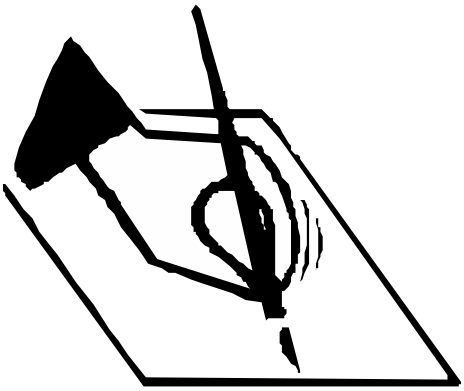
The **composition** of a forest refers to the mix of plant species (trees, shrubs, and forbs) present in a forested area at a specific point in time. A forest's tree composition refers only to the tree species present. Forested areas throughout Wisconsin have many different compositions. Forests can have a composition of one tree species such as a jack pine in a jack pine barren, or they can be made up of ten or twenty different tree species.

The number of species within a given forested area reflects species **richness**. The abundance of these species reflects the forests **evenness**. A forest may have a species richness of 30 different tree species, but 90% of those trees might be aspen trees. This would leave 29 tree species making up only 10% of the forest area, resulting in a low value for species evenness. If each of the 30 tree species made up about 3% of the forest composition, however, the evenness value would be very high because the abundance of each of the trees would be almost the same. The evenness of a forest together with the richness is known as the **diversity** of a forested area.

Activities



1. **What do *you* think a forest is?** (5 minutes)
Before delving into the WI Forestree Unit, you will want to have a measure of what your students' current knowledge about forests is. Ask them the question "What is a forest?" Do not discuss this out loud, but have them write down their own definition of a forest in their log book. At the end of the Forestree Unit, you will ask students to write their definition of a forest again and compare their new definition with the one they wrote in the beginning. This method will serve as one measure of the information your students have learned over the course of the unit.



2. **Concept Mapping** (10 minutes)
To continue assessing your students' knowledge of forestry concepts, you will create a concept map pertaining to forests with the entire class. Begin by writing the word ***forest*** in the middle of a large easel pad or piece of butcher paper. Ask students "What do you think of when you hear the word forest?"' A variety of answers will emerge from this question (trees, deer, timber, paper, leaves, raccoons, birds, beauty, mountain biking, hiking, hardwood, evergreen, etc.). These answers may fall under many different concepts, including: forest makeup, forest types, organisms found in forests and/or values of a forest.

As you add each idea or word to the paper, try to group words based on concepts such as those above. Connect ideas that fall under a concept together, but make sure they all lead back to the word ***forest*** in the middle (refer to the example concept map for ideas on what words should be included). Encourage students to think of things that may not be immediately obvious, perhaps building on ideas that other students have had. When students' ideas are exhausted, tell them that "When working with forests, there are many issues that need to be considered, both environmentally and economically." During this Wisconsin Forestree Unit, they will become detectives searching for ways that the forest environment and forest economy can maintain a balance. They will start first, though, with the most evident part of a forest…the tree. If possible, leave the concept map in an easily viewed space on the wall for reference throughout the Forestree Unit.

3. **Layers of a Forest** (20 minutes)
In this activity, students will be introduced to the **structure** of a typical forest. A good way to discuss this concept to students is to relate a forest to a house. Tell them to think of a typical two-story house. What would the lowest layer in the house be? *The basement!* What's in the basement? *Pipes, storage, etc.* What about the next level? *Kitchen, dining room, living room, etc.* The next? *Bedrooms, a study, etc.* What's at the top of the house? *The attic, and then the roof.* Well, a forest has layers just like a house does, only the layers are called different things.
Discuss these layers with your students. Ask, "What's at the bottom of a forest?" *Dead leaves,*

soil, etc. The dead leaves are called **leaf litter** – this is the first layer of a forest. This layer has a variety of insects, microorganisms and bacteria present. What do you think they do? *They break down leaves and replenish nutrients in the soil*.

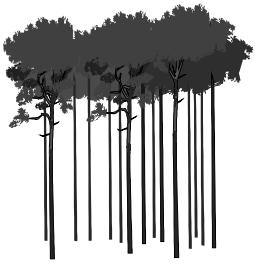
Moving up, what's the next thing you would find? *Small plants, ferns, flowers, etc*. This layer of non-woody plants is called the **forb layer**. What is the forb layer useful for? *Important food source for animals, habitat.* Another use for the forb layer is to tell us what kind of forest we are in. How do you think it does this? Think about the rooms in your house. How do you tell what to call each room? *By the furniture and appliances you find in that room – you can tell your kitchen from the bathroom from the bedroom.* You can tell the type of forest that you are in by the trees and plants that grow there. Trees grow on land that has all of the tree's requirements available for them to use. What are some of these requirements? *Sunlight, nutrients, space, moisture.* The tree species that are found in a forest depend on the availability of the sunlight, nutrients, space, and moisture within that forest. By knowing what amounts of these factors are available, scientists can tell what kind of forest they are in. The types of forbs present can give scientists a good estimation of the availability of sunlight, moisture, and nutirients and help them to determine the type of forest that they are in.

The next layer up is the shrub layer. Can you think of some plants that would be included in this layer? *Blueberries, raspberries, sumac, tree saplings (sugar maple, hemlock).* The shrub layer provides more food for animals, as well as important shelter to lots of animals, especially birds.

What's in the next layer? *Small trees, young trees.* These trees don't get a lot of something they need to survive – what is it? *Sunlight*. This layer is called the **understory**, and the trees in this layer can survive with only small amounts of sunlight. They are shade-tolerant. Does anyone know what the word tolerant means? One way to explain tolerance is to ask students if they have ever tried to watch TV or read with a little brother or sister making a lot of noise…how did they handle it? If they got mad and couldn't read or watch TV, they didn't tolerate the noise very well – they couldn't handle it. If they could still concentrate on what they were doing, then they were tolerant – they could deal with the distraction. Well, the trees in the understory can tolerate a lack of sunlight. Many of them are just waiting for a larger tree to die and fall down, then they will shoot up into the sunlight, and become larger themselves.

Does anyone know what the last layer is called? *The **canopy**.* This layer is made up of mature trees. These trees are the tallest in a forest, and get the majority of the sunlight. They also receive the strongest winds and rain. What do you think this layer is used for? *Timber, shelter, habitat for a few animals (generally birds), photosynthesis (light capture) for the tree.* When you put all the layers together, you have the **structure** of a forest, just like putting all of the rooms of the house together would create the structure of the house.

After discussing these concepts and terms with your students, divide them into groups of three. Give each group a copy of the **Forest Layers Worksheet**. A picture of the forest layers is on the worksheet, with five blanks corresponding with each layer. Students need to fill out the blanks on the worksheet with the correct name for each layer. Give students a few minutes to complete this task, then bring them all back together. Discuss with students what their answers were and why they put them in a particular order. Then discuss the correct answers with the entire group, making sure that everyone understands the concepts and terms outlined above.
***Option**: If you have access to a forested area, you can do this same activity outside in the forest. Conduct your discussion outside, pointing out different layers to students and asking them to brainstorm what they think the uses for a particular layer are. Then bring them back inside to complete the worksheet.*



4. **Species vs. Individuals** (5 minutes)
As preparation for the rest of the unit, students will need to understand the difference between individual organisms and different species. Ask students what a species is. How is a species different from an individual? *A species is made of many individuals that have the same characteristics*. One white pine tree is an individual, but all white pine trees are in the same species.

Knowing the kinds of trees that are in a forest is important when you are trying to determine the forest **composition**. What do you think I mean when I say forest composition? *All of the different species of trees in a forest make up the forest composition.* Direct your students to look back at the Layers of a Forest worksheet. Next to each layer is a box with a number of different kinds of trees and plants listed. Explain to your students that these are trees and plants that are usually found in that layer of forest. Ask if your students are familiar with any of these types of trees.

5. **Forest Visualization** (10 minutes)
Hand out the **Common Wisconsin Trees Sheet**. This will give additional information including tree silhouettes and leaf shapes. Tell the class that the individual pictures of the trees on the worksheet represent 4 different types of trees species found in Wisconsin. Have the class read over the tree descriptions and look at the pictures. Have the students close their eyes and envision a forest made up of those 4 tree species. Describe each separate tree using information from the worksheet. Use the information to help the students form a mental picture of the trees and the forest. Have them make the canopy trees (white pine and red maple) large and dominant and the younger trees (white oak and aspen) small and overtopped. Tell them the season to place the forest in and give them an animal (deer, porcupine, chipmunk, etc.) to place in the scene. Use elements like landscape and weather to solidify the forest in their mind. Once the students have the picture in their mind, ask them to visualize each of the 4 separate trees that they have put in their forest. Which is the biggest? Which is the smallest? Can you see the structure of the forest? Recite these trees that they have placed in the forest scene and tell the class that these 4 trees make up the **tree composition** and help to create the structure of their imaginary forest.

Conclusion

Forests can be defined by the structure and composition that they have. Many forests contain different trees and combinations of trees and have different structural characteristics. These differences from forest to forest influence the different types of animals that live there and the forestry practices that are used. There are many factors that help to create the structure and composition of a forest. Ask the class to brainstorm the reasons why forests differ in the trees that they contain and the structure that they have. Tell them that they will learn more about these influences in the next class.

Student Log Book

Throughout the lesson students should have their log book accessible. They should write the name of the lesson (The Science of Forests and Trees) and the date. They should write down vocabulary along with definitions. The log book should also be used for students to take notes in during class and to answer the Log Book question that accompanies each lesson (on their own time). For this lesson, have students describe how the layers of a forest are similar to the levels of a house.

Seeds to Grow (*This extension lesson will be covered with your students if they participate in the Wisconsin Forestree Field Experience at the Central Wisconsin Environmental Station)*

Identifying Tree Species

This extension activity will allow students to identify more of the common trees found in Wisconsin. An important part of forestry is being able to identify what tree species are present in an area. Knowing tree types and their characteristics helps foresters determine which trees to manage for a particular reason. A good tool used to identify trees is the dichotomous key.

Explain to students what a dichotomous key is and show them the tree key included. At each step there are two descriptions of a particular characteristic. The user chooses the description that best matches the tree they are trying to identify. Each step narrows down the choices until the tree is identified. To help students become acquainted with dichotomous keys, use the example key provided to let them key out each other. The key uses the characteristics of the students to separate the class into groups, just as a dichotomous key for trees uses the tree characteristics to separate the forest into different tree species.

You will need to explain some of the vocabulary used with dichotomous keys (included in a separate vocabulary list). You can then use the tree key provided to identify several species of trees. You can also use field guides to identify trees based on the same characteristics. Use leaves and branches that are brought in to the classroom. If you do use real samples or go outside to identify real trees, make sure that all of the samples are included on the key you are using.

Web Links

Wisconsin Department of Natural Resources—www.dnr.wi.state.us

American Forest Foundation (Project Learning Tree—www.affoundation.org

Wisconsin Forestry Resources Education Association—www.wfrea.org

Michigan State University—www.forestry.msu.edu/uptreeid

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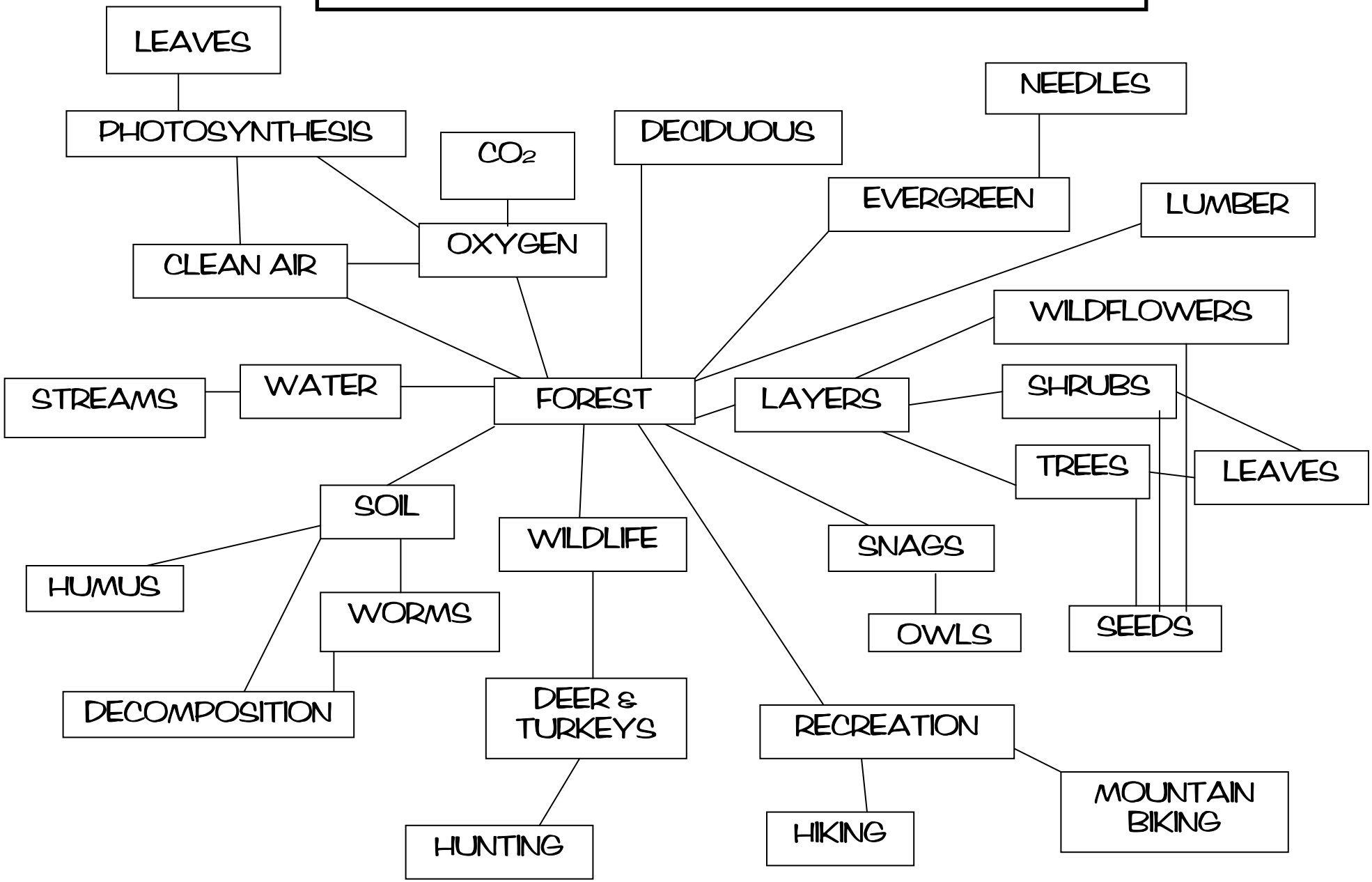
Perry, David A. 1994. Forest Ecosystems. John Hopkins University Press. London.

Petrides, George A. 1958. Peterson Field Guide: Trees and Shrubs of Eastern North America. Houghton Mifflin Co., Boston.

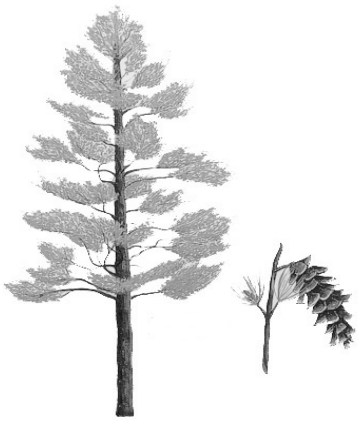
Platt, Rutherford. 1987. 1001 Questions Answered About Trees. Dover Publications Inc. New York.

Wisconsin Department of Natural Resources Bureau of Forestry. 1990. Forest Trees of Wisconsin and How to Know Them.

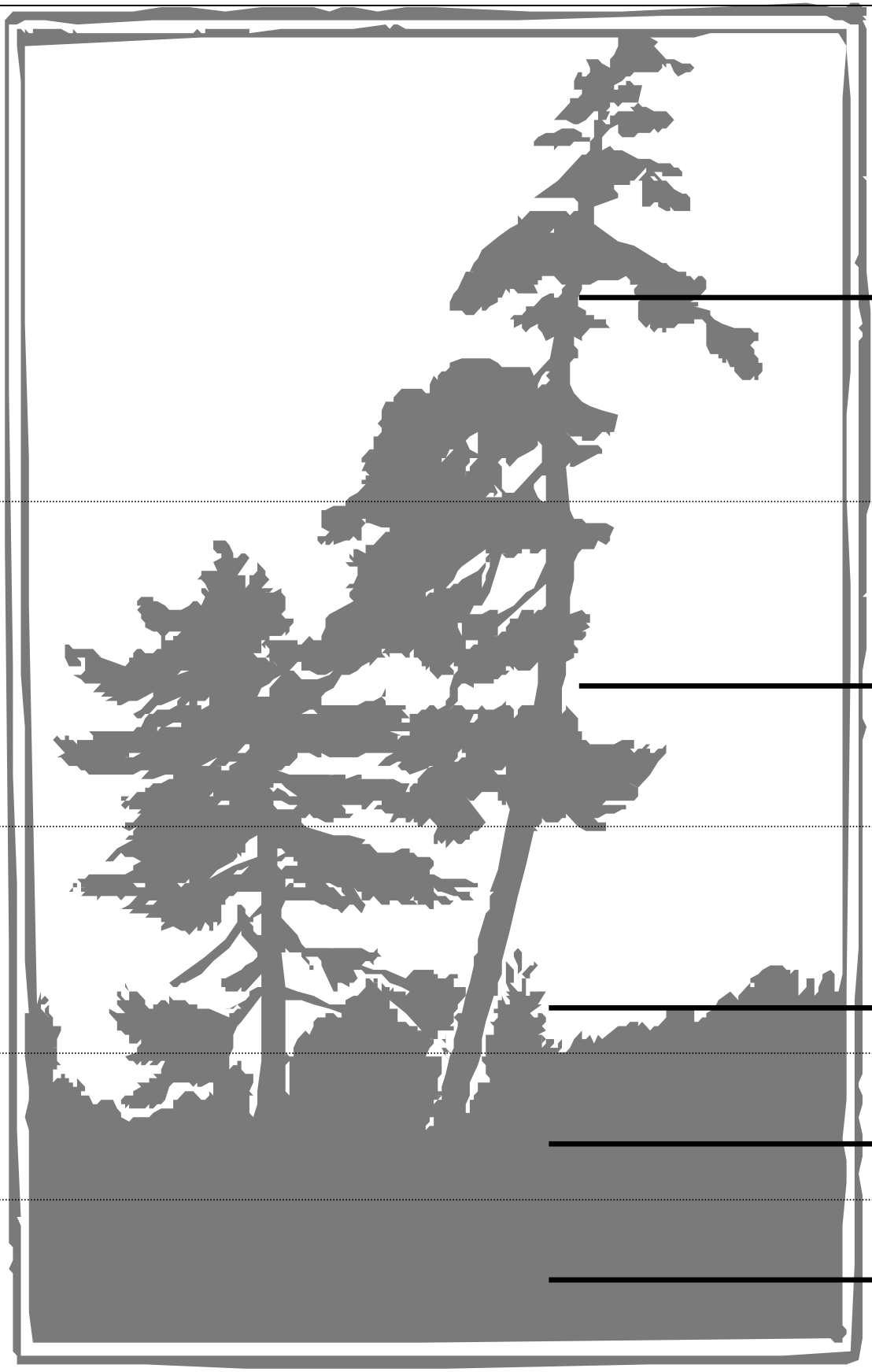
WHEN YOU HEAR THE WORD FOREST, WHAT DO YOU THINK OF?



Four Common Tree Species in Wisconsin

White Pine		• Found in the canopy • Can live up to 400 years • Used to be the major lumber tree in WI • Can reach up to 150 ft. in height • Usually the dominant tree in mature forests
Red Maple		• Found in the canopy • Turns a brilliant red in the fall • Very tolerant of different environmental conditions • Important food source for wildlife • Increasing importance as a lumber tree
White Oak		• Usually found in the understory • Best all-around multipurpose hardwood tree in America • Can live up to 600 years • Found in the southern 2/3 of WI • Root system and canopy have a very large spread
Big-Tooth Aspen		• A pioneer tree found in younger forests • Needs full sunlight to grow • Can create very thick stands called “dog-hair” stands • Lives up to 80 years • Reaches 80 feet in height • Valuable as pulpwood • Important food source for wildlife

Layers of a Forest



Forest Composition
Red Pine White Pine Sugar Maple Eastern Hemlock
Paper Birch Black Cherry White Ash Red Maple
Raspberry Elderberry Poison Ivy
Snow Trillium Bracken Fern Pink Lady Slipper
Leaves, twigs, nuts, needles, and other decomposed plant material

Vocabulary for the Dichotomous Keys

- **Dichotomous key**: a tool for identifying tree species by the process of elimination using leaf, twig, fruit, or bark characteristics.
- **Alternate branching**: a branching pattern where side branches, leaves and leaf scars do not grow directly across from each other.
- **Broad-leafed**: Trees that have flat leaves as opposed to trees with needles. These trees usually lose their leaves in the fall.
- **Bundles**: Trees in the pine family have groups of needles held together at the base by a small papery wrap called a fascicle. White pines have five needles wrapped together, while other pine trees have only two. Larches appear to have needles in bundles, but they are really just clusters of needles.
- **Compound leaf**: A single leaf with numerous leaflets. A leaf actually begins where the leaf stem attaches to the twig.
- **Conifer**: An evergreen tree that bears cones.
- **Deciduous**: Trees that lose their leaves in the fall and bear flowers in the spring. These trees are also called broad-leafed.
- **Evergreen**: A tree that retains its leaves or needles throughout the winter. Also called conifers.
- **Leaf scar**: The mark left on a twig after the leaf drops off in the fall. The bundle scars are the points where the leaf vessels, which carry water and nutrients, passed into the twig.
- **Leaf stem**: This is usually a small stem that attaches the leaf to the twig. They can be round, flat, or square.
- **Leaflets**: These smaller parts of leaves often resemble leaves themselves, and join together along the leaf stem. The leaf starts where the woody twig ends.
- **Lobes**: These are like fingers on a leaf that make the leaf an irregular shape. Think of an oak leaf as an example. The spaces between the lobes are called sinuses.
- **Margins**: This is the edge of the leaf. The edge can be toothed or smooth, lobed or entire.
- **Opposite branching**: A branching pattern where side branches, leaves, and leaf scars grow from the stem directly across from each other. Maples and ashes have this characteristic.
- **Scaly**: Evergreen needles that are flat and overlapping, like fish scales, are called scaly. Northern white cedars have scaly needles.
- **Simple leaves**: The leaf stem is the same as the mid-rib for that leaf.
- **Sinuses**: The spaces in between lobes on a leaf.
- **Toothed margins**: The edges, or margins, of some leaves appear to have teeth. Single-toothed means that all the teeth are about the same size. Double-toothed means that between each tooth there is a smaller tooth. Serrated means that the leaf margin looks like a saw blade.
- **Whorled:** the leaves originate at the same point on a branch and form a circular pattern around the branch or twig.

Dichotomous Key to Identify Students

1. Female…2
   Male…17

2. Brown hair…3
   Not brown hair…6

3. Brown eyes…4
   Not brown eyes…9

4. Earlobes attached…5
   Earlobes unattached…11

5. Freckles…student is_____
   No freckles…student is_____

6. Brown eyes…7
   Not brown eyes…12

7. Earlobes attached…8
   Earlobes unattached…14

8. Freckles…student is_____
   No freckles…student is_____

9. Earlobes attached…10
   Earlobes unattached…15

10. Freckles…student is_____
    No freckles…student is_____

11. Freckles…student is_____
    No freckles…student is_____

12. Earlobes attached…13
    Earlobes unattached…16

13. Freckles…student is_____
    No freckles…student is_____

14. Freckles…student is_____
    No freckles…student is_____

15. Freckles…student is_____
    No freckles…student is_____

16. Freckles…student is_____
    No freckles…student is_____

17. Brown hair…18
    Not brown hair…21

18. Brown eyes…19
    Not brown eyes…24

19. Earlobes attached…20
    Earlobes unattached…26

20. Freckles…student is_____
    No freckles…student is_____

21. Brown eyes…22
    Not brown eyes…27

22. Earlobes attached…23
    Earlobes unattached…29

23. Freckles…student is_____
    No freckles…student is_____

24. Earlobes attached…25
    Earlobes unattached…30

25. Freckles…student is_____
    No freckles…student is_____

26. Freckles…student is_____
    No freckles…student is_____

27. Earlobes attached…28
    Earlobes unattached…31

28. Freckles…student is_____
    No freckles…student is_____

29. Freckles…student is_____
    No freckles…student is_____

30. Freckles…student is_____
    No freckles…student is_____

31. Freckles…student is_____
    No freckles…student is_____

Dichotomous Keys for Common Wisconsin Trees

Begin here:

Tree has needles…use Coniferous Tree Key
Tree has broad leaves…use Deciduous Tree Key

Coniferous Tree Key

1. Needles in bundles or groups (2)
1. Needles single or flattened and scaly (5)
    2. Needles in clusters…**Tamarack**…Larix laricina
    2. Needles 2-5 per bundle (3)
3. Five needles per bundle…**White Pine**…Pinus strobus
3. Needles in pairs (4)
    4. Needles 3-4 inches long…**Red Pine**…Pinus resinosa
    4. Needles under 2 inches, bark dark gray…**Jack Pine**…Pinus banksiana
5. Needles square, round or scaly (6)
5. Needles flat (8)
    6. Needles scaly and flattened…**Northern White Cedar**…Thuja occidentalis
    6. Needles square or round (7)
7. Needles 1/3 - 3/4 inch long, twig hairless…**White Spruce**…Picea glauca
7. Needles 1/4 - 3/4 inch long, new twigs have hair, grows in wet areas…**Black Spruce**…Picea mariana
    8. Needles 1/2 inch long with short stem…**Eastern Hemlock**…Tsuga canadensis
    8. Needles 3/4 - 1 and 1/4 inches long, no stem…**Balsam Fir**…Abies balsamea

Deciduous Tree Key

1. Opposite branching (2)
1. Alternate branching (5)
    2. Compound leaves (3)
    2. Simple leaves (4)
3. 9-11 leaflets, leaflets do not have stems…**Black Ash**…Fraxinus nigra
3. 5-9 leaflets, leaflets have stems, smile-shaped leaf scar…**White Ash**…Fraxinus americana
    4. Leaf margins smooth, 5 lobes…**Sugar Maple**…Acer saccharum
    4. Leaf margins notched, 3-5 lobes…**Red Maple**…Acer rubrum
5. Compound leaves (6)
5. Simple leaves (8)
    6. Leaflets over 2 inches long, 5-7 hairless leaflets, egg-shaped nut…**Shagbark Hickory**…Carya ovata
    6. Leaflets over 2 inches long, 7-17 slightly hairy (below) leaflets, leaf 12-36 inches long…**Black Walnut**…Juglans nigra
7. Leaves lobed, smooth or toothed margins (8)
7. Leaves not lobed (9)
    8. Pointed lobes, leaves hairless, sinuses no closer than 1/2 inch to mid-vein…**Red Oak**…Quercus rubra
    8. Rounded lobes, even lobes, and sinuses, leaves hairless…**White Oak**…Quercus alba
9. Leaves toothed, papery bark (10)
9. Leaves toothed, bark not papery (11)

10. Leaves single-toothed, white peeling bark…**White Birch**…Betula papyrifera
10. Leaves double-toothed, yellow or bronzed bark…**Yellow Birch**…Betula alleghaniensis

11. Leaf stems flat (12)
11. Leaf stems round (13)

12. Leaves have small, fine teeth < 1/16 inch, bark usually white…**Trembling Aspen**…Populus tremuloides
12. Leaves have large teeth, bark usually white...**Big-Toothed Aspen**...Populus grandidentata
12. Leaf is triangular-shaped with course teeth…**Cottonwood**…Populus deltoides

13. Leaves long and narrow (14)
13. Leaves almost as wide as long…**Basswood**…Tilia americana

14. 5-6 inches long, hairy leaves, fringe along rib on bottom of leaf, bark very dark…**Black Cherry**…Prunus serotina
14. 3-5 inch long leaves, smooth gray bark…**American Beech**…Fagus grandifolia

The vocabulary definitions and the dichotomous keys for the tree identification are adapted from a tree identification website created by Bill Cook, extension forester at Michigan State University.

Forest Visualization

Lesson 1, activity 5

Read this description after reviewing the "Four Common Tree Species in Wisconsin" handout with students. Help them to visualize a forest of white pine, red maple, white oak, and quaking aspen.

You are standing on a small hill inside a forest. High above you are the tops of the giant white pine trees reaching 100 feet into the air. They are many of these white pines in the forest and they have thick, rough bark and trunks so large you can't touch the tips of your fingers together as you reach around the trunk. Dry, brown needles are scattered along the path where you are standing and long pinecones with sticky sap on them are scattered everywhere.

Also in the canopy are large red maple trees. You remember times when you threw their helicopter-like seeds into the air and watched them spin to the ground. These seeds are an important food source for wildlife, which you can't see but can hear. The 'caw-caw' of a crow, the screechy cry of a blue jay, and rustling in the dry leaves on the ground from a squirrel running from tree to tree looking for food are sounds around you. Seeing the red maples and hearing the rustle of leaves makes you think of the forest in the fall when all the maple leaves have turned to a brilliant shade of red.

The sun is shining, creating spots of light on the forest floor where it is not blocked by branches and leaves. Summer is near so all the trees are full with leaves rustling and needles whistling in the breeze. The white pines and red maples are not the only trees you can see as you look toward the sky. You can also find the leaves of a white oak with their rounded, finger-like tips. These trees can live up to 600 years but in this forest the oak are still young and haven't reached the canopy yet. They fill the understory and add to the variety found in the litter layer when their acorns drop. These brown, shiny nuts with rough little caps are a favorite to the gray squirrels running on the forest floor.

Near the edge of the forest where you first entered is another kind of tree. The triangular leaves with toothed edges fluttering back and forth in the wind help to identify this tree as a quaking aspen. Its bark is smooth and gray and its leaves are a bright shiny green on the top. The quaking aspen needs a lot of light to grow, which is why it is on the edge of the forest, not deep inside where it would be shaded by other trees. The aspen are young pioneer species that only reach 80

feet in height when mature. These aspen are small in size compared to the towering white pines in the heart of the forest.

Together all of these trees are part of a balanced community. Over time the larger trees will die and create openings in the forest for younger saplings to sprout and reach the canopy. The cycle of the forest will continue.

Now visualize each of the four trees in the forest separately. *White pine, red maple, white oak, quaking aspen.* Which is the biggest? *White pine.* Which is the smallest? *Quaking aspen.* Can you see the structure of the forest? *The four trees-white pine, red maple, white oak, and quaking aspen make up the tree composition and help to create the structure of this forest.*

White Pine

Red Maple

White Oak

Quaking Aspen

Lesson Two

A Competitive Edge

Concepts
- Trees and plants within a forest ecosystem compete for nutrients, sunlight, and energy.
- The characteristics of a plant or tree determine how competitive it is under certain environmental conditions.
- Natural disturbances influence plant and tree competition.

Objectives
Students will be able to:
- Name the main types of disturbance that influence forests in Wisconsin.
- Define forest succession and explain the role that disturbances and tree characteristics play in this process.

Teaching Site
Indoor classroom

Materials
Day 1 – Overhead projector, pencils ,vocabulary list taken from the master vocabulary list, 4 dice, **Disturbance cards**, **Tree Limit Cards** (1 or 2 for each group), **Competition Rules**, and **Forester's Record Worksheets**.

Day 2 – Completed **Forester's Record Sheets**, **Forest Timeline** (must be made), and **Tree Silhouette Cutouts** for all six tree species.

Lesson Time
Two 50-minute class periods

Nutshell
Students will play a tree species role-playing game with dice and cards. The trees (students) will compete with each other to establish themselves on abandoned farmland surrounded by forest. Time (role of the dice), disturbances (cards), and the species characteristics assigned to the students will determine who remains in the competition.

Teacher Preparation
Day 1 – Read through all of the materials. Make copies of the vocabulary list (optional). Photocopy the species cards to hand out to students (one of each tree species: six total). Obtain four dice. Make a copy of the Forester's Record Sheets. Copy and cut out the disturbance cards.

Day 2 – Make an overhead transparency of the completed Forester's Record Sheets. Make copies of the tree cutouts. Use butcher paper to draw a timeline that will illustrate the forest succession that occurred throughout the competition (See the Example Timeline attachment).

Vocabulary
- **Tree characteristics** – the identifying traits (physical, biological, or chemical) of a tree.
- **Disturbance** – a natural or human caused event that causes a forest to change.
- **Disturbance regime** – the intensity, duration, and frequency of a disturbance.
- **Tree establishment** – the growing of a tree onto a piece of land.
- **Tolerance** – a tree's ability to handle natural and/or human influences upon its environment, usually referring to a tree's ability to live in shade.
- **Germination** – the sprouting of a tree seedling from a seed.
- **Nutrients** – the elements found in the forest floor and soil that trees require for growth.
- **Moisture** – the amount of water present.
- **Competition** – the interactions formed between trees while acquiring their essential needs for growth and reproduction.
- **Maturity** – a period of time in a tree's life span when growth slows and the tree reaches near maximum size.
- **Succession** – the change in forest structure and/or composition through time.
- **Primary succession** – forest establishment that starts on bare rock or any other surface without plant material.

- **Secondary succession** – forest establishment that starts from seed beds, roots, or other types of tree reproduction that are already present on the landscape
- **Steady-state** – a period of time in forest aging when forest growth slows and changes in composition and structure are minimal. This is the old-growth forest, the last stage of forest succession

This game is modeled after the AViO forest habitat type suggested by John Kotar et al in The Field Guide to Forest Habitat Types of Northern Wisconsin. All tree information was taken directly from information in The Silvics of North American Trees produced by United States Department of Agriculture.

Background Information

Disturbance and Forest Succession

Forest succession is a change in forest composition and structure over time. This change is often influenced by **disturbance**. Fire, clearcutting, wind-throw, insect infestation, animal browsing, and hail damage are all examples of disturbances common throughout Wisconsin.

Different disturbances affect a forest in different ways. Insects may kill the tree species which forms the canopy. As a result, sunlight would be available for all of the suppressed trees. These trees would then form an entirely new and different canopy, resulting in a change in the forest composition and structure.

Intense fires often eliminate all of the trees in the forest. A nutrient-rich layer is formed on top of the soil and the land becomes exposed to direct sunlight. Some trees grow very well in these conditions (especially aspen and jack pine). Intense fire usually results in a forest containing only one tree species, all having the same age. When all of the trees have the same age and the same height, this is called an **even-aged** structure (e.g. red pine plantations and aspen stands).

Wind-throw, the knocking down of trees by intense winds, can have the opposite effect of intense fire. While intense fires reduce the number of trees and structural layers in the forest, wind-throw can increase both. Wind often knocks down trees in patches. These patches create gaps in the canopy, bringing sunlight to the forest floor. These gaps allow different trees to grow, adding to the diversity of the forest composition and structure. A forest with trees of varying age and height is said to have an **uneven-aged** structure (e.g. mature mixed forests and northern hardwood forests).

Natural Regeneration

The reestablishment of tree species in a forest is called natural regeneration. **Natural regeneration** occurs when mature trees in a forest are able to establish seedlings and ensure the growth of new trees. This usually happens when the environmental conditions resulting from the disturbance are ideal for the requirements of seedling establishment and growth. For example, eastern hemlock trees have been unable to regenerate naturally in many forests throughout Wisconsin. It has been speculated that white-tailed deer populations are so high that young hemlock seedlings have little to no chance of survival in many forests. It has also been shown that hemlock needles, as they accumulate in the forest floor, create poor conditions for the germination of the hemlock seeds. The lack of many historical disturbances such as fire, and the increase in many recent disturbances such as herbivory by deer, make the natural regeneration of eastern hemlock very difficult.

Types of Succession

Two types of succession can occur within a forest ecosystem – primary and secondary succession. **Primary succession** is the establishment of forest in an environment (bare rock) with no biological influence. Primary succession occurs after lava flows, severe fire, glaciation, or any event that eliminates all reproductive sources of plants. **Secondary succession** is forest establishment influenced by preexisting biological influences when a disturbance does not remove all of the plant reproductive sources. These sources can be seedbeds, root suckers (aspen), seedlings, saplings, or any live flora remaining after the disturbance.

Disturbances that can cause secondary succession include fire, clearcutting, insect infestations, animal browsing, and flooding.

Succession also occurs in the absence of major disturbances. These changes are influenced by the characteristics of the trees present. For example, certain trees can tolerate shade better than others. This makes them better suited for surviving under a canopy of dense trees. As the trees in the canopy grow old and die, the trees that survived in their shade will most likely be the next trees to form the canopy layer. Certain trees also live much longer than other trees. These trees will outlive the other trees, competing with them for sunlight and soil nutrients and will most likely become the dominant trees. Trees differ in their abilities to reproduce, disperse seed, grow tall, grow old, absorb nutrients, and tolerate shade. These differences determine how a forest will change over time.

The Stages of Succession

Forests are always changing. Old trees die and new trees grow in their place. These changes are reflected in a series of stages that lead to an equilibrium or steady state. These stages (seres) include the pioneer, successional, mature and steady state stages.

The **pioneer stage** starts with bare ground after a disturbance. Seeds that find their way to the soil or root shoots that extend from underground invade and colonize the area. These plants reorganize a pattern of vegetation on the landscape and begin the accumulation of organic matter (biodegrading plant material) necessary for forest establishment.

The **successional stage** is recognized by the rapid growth and accumulation of living plant material (biomass). These forests change relatively quickly in composition and structure due to increased availability of nutrients, rapid growth spurts, and susceptibility to disturbances.

The **mature stage** is achieved when the tree accumulation rates begin to decline and tree composition and structure stabilize.

The **steady-state stage** is reached when a forest's plant mass, composition, and structure remain relatively constant through time. This is the old-growth or climax stage of a forest.

Activities

1) **A Competitive Edge** (50 minutes)

In this lesson you will be introducing the concept of competition in forest communities and how disturbances can alter the composition of a forest. Start by telling the students that you would like them to think about a football or softball team. Ask them to tell you what makes up a football or softball team. Guide their answers to individual players and the positions they play. Remind the students that in the last lesson they learned about the structure and composition of the forest. Ask students to recite the layers of the forest. *Leaf litter, forb, shrub, understory, & canopy*. Ask the students if they see any comparison to a football or softball team. P*ositions on the team are like the layers.* Ask the students if they can define what the composition of a forest is. *The species of trees present in a given area.* Tell them that the composition of a football or softball team is made up of a variety of different players.

Ask the students how someone gets to be chosen to play a position on a team. *They have to try out for the position.* Ask if everyone who tries out gets to play. *No because they only need so many of a particular position.* Ask how two people trying out for the same position are related. *They are competitors*. Ask what would happen if the best player broke a leg. *Someone else would have to replace him or her in that position.*

Tell the students that the composition of the forest is determined by the ability of trees and other plants to grow and compete with other species. Like the football or softball team, what trees are present in the different layers is determined by their ability to play the same game or coexist together and out-compete other species. Tell the students that just like the composition of the team is changed by player injuries, the composition of the forest is altered by disturbances. Ask the students if they can think of possible disturbances that alter a forest. *Wind, fire, harvest of trees, animal browsing, insects, and disease.*

Tell the students that today they will be playing a game to see how the composition of a forest changes over time. They will work as teams of tree species. The trees that are present during the game will be determined by the disturbances that take place and the ability of the trees to survive a disturbance and compete with the other trees. Relate to the students that this process of the forest changing over time in response to aging and disturbances is called succession.

Competition Background For Students

(*Read the following to the class*)

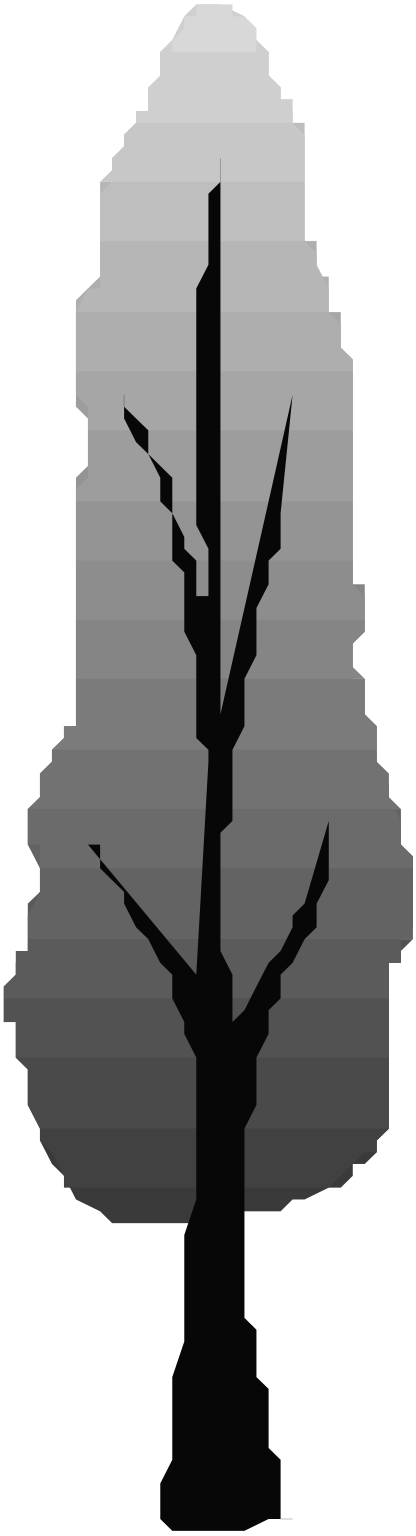
"It is the early 1900's and many farmers are moving to the great Northwoods of Wisconsin. The soil is fertile but the land is full of large rocks left by glaciers and large tree stumps left from logging. Many farmers are having a very difficult time making a living and many fields are being left unplanted. A local farmer has come upon hard times and left his land unworked. The bare soil that you are standing on will not be farmed again and will be left as property of the state. The field will be unmanaged and left to turn into forest. The trees around the edge of the forest are going to compete for the space, nutrients, water, and sunlight available in the field. You are those trees. Each of you is one of six different tree species: black cherry, white ash, paper birch, sugar maple, American basswood, and eastern hemlock. You will need all of your strengths and resources to compete against each other and establish yourself. You will also work against the forces of nature and time. The field is very fertile and has enough moisture and nutrients to allow you to reach your maximum age and height if you can win the competition. A forester from the Wisconsin Department of Natural Resources will record all of the changes in the field through time."

Game Setup

2) Select one student to serve as Mother Nature and one to serve as Father Time. Explain that Father Time will control how much time passes by rolling the number of years that pass on four dice and that Mother Nature will control natural events such as fires and storms by handing out disturbance cards. Divide the remaining students into six groups. Tell each group what tree species they are and hand them their **Tree Characteristic Sheets**. Explain the tree characteristic sheets to them. Tell them that the top half of the sheet describes their characteristics and gives background about their strengths and weaknesses. Tell them that the box at the bottom of the sheet lists the events that limit how they play the game.

To explain how these limits work, go through some examples by asking each group to tell the class 1) when they can enter the game, 2) what disturbances eliminate them from the game, and 3) how long they can live.

Ask them to turn over their tree game sheets and put them down on their desks. Put the competition rules on an overhead projector for all of the class to see. Go though each rule individually, using the groups and specific students as examples to illustrate the rules.



Explain to them that you are the forester. Your job is to keep track of what is happening throughout the game by making sure that the players are following their tree rules. To do this, stop the game after each dice roll. Tell the students how many years have elapsed. Ask the trees to raise their hands when they have determined how old they are. Help the trees that don't know. Some trees may die of old age, so they must compare their age to their tree's age limit. If they are older than their age limit, they are eliminated. Then ask Mother Nature to pull a disturbance card and announce it. Have the trees look at their limits and figure out if they can tolerate the disturbance. If they can, they stay in the game. If not, they are eliminated. Ask the groups if any of them can enter the game now. If they are not breaking any limits, let them into the game.

Before beginning the next round, record the species present after the disturbance by putting a **P** for those species present in the preceding round, **N** for those trees that just entered the game this round, and **A** for those trees absent from the game. Also record the elapsed time and disturbance type from the previous round. Once you have completed entering this data, Father Time can again roll the dice.

Complete the game in this fashion. There are 12 disturbance cards. Each will represent one round of the game. You will play 100 more years after the last disturbance card has been drawn. Father Time will continue to roll dice and trees will compete without disturbance cards for 100 years. After 100 years pass, decide the final stand composition and the ages of the trees and declare the winning groups.

The Forester's Record: There are two record sheets. Each must be completed by you (the teacher) as the game progresses. The first one outlines the forest's composition change during the periods of disturbance, and the second one outlines the forest's composition change after the disturbances run out. These records will be the basis for the next activity.

Notes to Mother Nature: Mother Nature plays a large part in directing the game. Make sure that she can properly keep track of the ages on the disturbance cards that require ages. Make sure that she announces and explains each disturbance. She must also announce when the pests (deer, fungus, etc.) leave the game.

After the Game (30-40 minutes)

3) Roll out the piece of butcher paper on which you have already drawn a timeline (see Example Timeline attachment) and attach it to your classroom wall. With the completed Forester's Record on the overhead for the students to review, help them locate the points along the timeline where disturbances occurred. Mark these points on the timeline for the students by drawing a line from the timeline to the top of the paper. Label these lines with the disturbance that occurred.

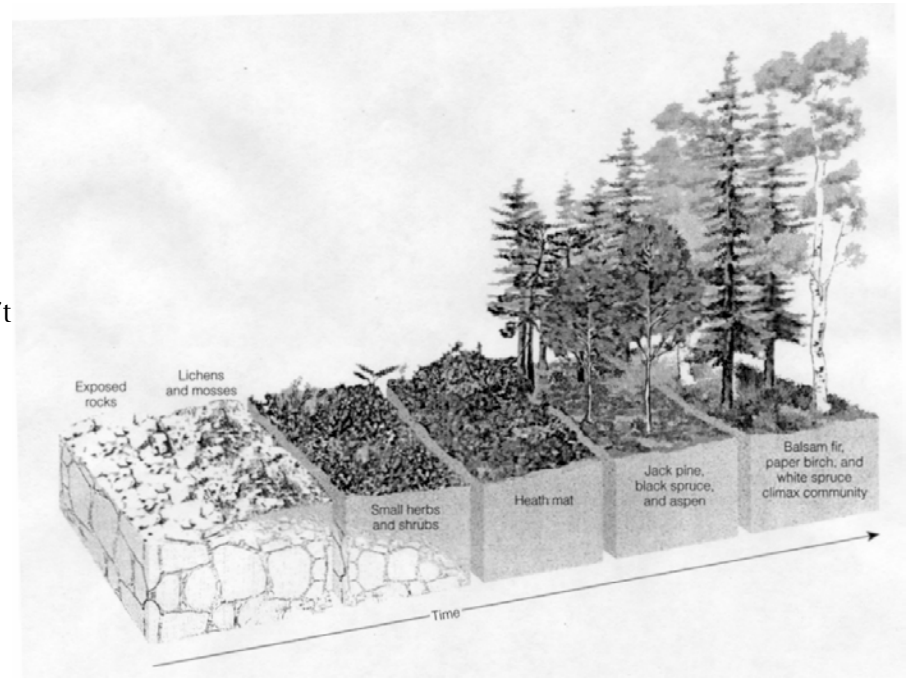
Hand out the tree cutout pages to each group. Each page has small and large pictures of the same tree. There is a specific tree page for all six different tree species. Have the students cut apart the small and large trees on their page. A representative of each tree group will bring up their tree when called upon and tape it in the appropriate location. *The small trees will be placed on the timeline at the point where the trees initially entered or re-enter the game (at the beginning or after a disturbance, etc.). The large trees will be used for any other point in time that the tree remained in the game.*

Start at the beginning of the timeline. Ask all tree groups to come up that had trees present at the first round of the game. Once they have taped up their trees, ask each group why their tree was present. Ask those trees not present, why they were not. Discuss with the students what the disturbance was. Ask students to come up whose trees remained after the disturbance and add their tree pictures to the timeline. Ask why their trees were still present. Ask if there are any new trees that can join the forest after the disturbance and have those tree representatives add that tree picture to the timeline. Continue the discussion and timeline development until it is completed.

Conclusion (10-15 minutes)

4) After you have completed the timeline, tell your students that they have just participated in a process that all natural systems go through. Ask the students how the random role of the dice might represent the real world. *Disturbances and natural events like fire, flooding, drought, etc. are unpredictable. We have no way to predict if and when they might happen.* Ask if anyone can remember what the process is called where the composition and structure of a forest is changed over time or changed by a disturbance. *Succession.*

Tell the students that there are two types of succession that can occur within a forest ecosystem. They are called primary and secondary succession.



Ask the students to again think of a football or softball team. Would it take longer to start a team if you don't have any equipment and people that know how to play, or if you already have the equipment and people that know how to play? *Starting a team from scratch would be much harder and take longer.*

Tell the students that **primary succession** is like starting that team from scratch. Primary succession is the establishment of a forest in an

environment (bare rock) with no topsoil and seeds present. Primary succession occurs after lava flows, severe fire, glaciation, or any event that removes topsoil and plant seeds, root shoot, or other means of a new plant starting. Tell the students that like starting a ball team when you have the equipment and people, **secondary succession** takes place much faster.

Secondary succession takes place where there is already soil developed and where the disturbance has not removed all seed beds, root suckers, seedlings, or other living plants. Disturbances that cause secondary succession include fire, clearcutting, insect infestations, animal browsing, and flooding.

Ask your students how a human changes as it ages. Have them start with a baby and give you characteristics until older age. Tell your students that just like a human goes through a variety of stages during their life, so too succession in a forest goes through several stages. When a forest starts in a new area, this is called the pioneer stage. This stage is characterized by the first plants to arrive on the site, much like the pioneers were the first Americans to settle the land. Tell them that as succession continues it goes through a rapid growth stage, just like children grow during their teenage years. As time progress, the forest reaches a maturity stage similar to the slowing in growth that humans experience before age 30. During this time, the forest composition doesn't change much and trees grow slowly. Eventually, given enough time and no disturbance, a forest reaches its final stage called the steady-state stage. During this stage, the trees grow very slowly and only very minor changes occur. Steady-state or 'old growth' forest are usually have an uneven-aged structure with a variety of different tree species with different ages. These forests are dominated by the climax tree species. These are the trees that win the competition and grow to great size and age.

Direct the students attention back at the timeline from the game. Ask the students which trees were present during the pioneer stage. How did the trees/forest react to disturbances? What did the disturbances do to the succession of the forest? *The disturbances kept the forest young and constantly changed the trees that were in the competition.* Ask the students what happened after the last disturbance card was drawn. *The forest was allowed to mature and eventually reached the steady-state stage. The forest was dominated by very large, old eastern hemlock and sugar maple trees.*

Tell the students that our forests are typed or given a name based on the dominant species of trees that are present or will be present during the steady-state stage. Ask the students what they think the name of the forest type is in the competition. *Most likely it will be hemlock/sugar maple*. Tell the students that in the next lesson they will be learning the different types of forests in Wisconsin and looking at the reasons why specific forest types are found where they are.

Student Log Book

Using the information on the timeline, have students write a short autobiography of the life of their tree in their daily log. Each autobiography should include observations of how the forest changed, the effects of disturbances on them, effects of time, and the strengths and weaknesses of their specific tree species.

Have students compare the time it took for the forest in the competition to mature (the time during the competition when the sugar maple and hemlock trees reached maturity) to the time it takes a person to mature. Use the timeline to help the class find their age, their parents age, grandparents and so on. Have them research their family history throughout the life of this forest (this could be as far back as 300+ years). Ask them to comment on how the time that it takes a forest to grow and mature might affect the way that people view the forest. If you plant a tree will you ever get to see it grow very big?

Web Links

U.S. Forest Service, North Central Forest Experiment Station—http://www.ncfes.umn.edu

Forest management company in British Columbia has developed a computer model to show a forest after logging – www.forestnet.com/forest_management.htm

US Forest Service: Silvics of North American Trees on line—
http://willow.ncfes.umn.edu/silvics_manual/Table_of_contents.htm

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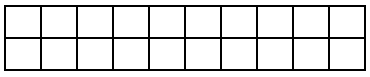
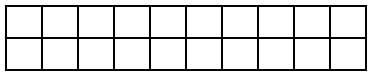
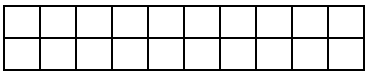
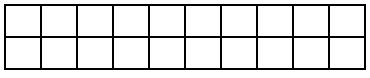
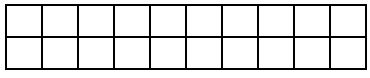
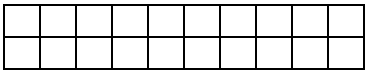
Whelan, Robert J. 1995. The Ecology of Fire. Cambridge University Press. Cambridge, U.K.

Rules of the Competition

- Read all of the rules carefully.
- All the trees in one tree species group work as a team against all other trees. Help each other throughout the game.
- You may not talk to any other tree species group.
- No tree is ever permanently eliminated from the competition.
- You must follow all of the limits given to you on your card.
- You must keep track of your own age.
- You can enter the competition at the beginning, immediately after disturbances, or after the roll of the dice if there are no disturbances.
- The time is controlled by Father Time and only Father Time.
- The Disturbance Cards are controlled by Mother Nature and only Mother Nature.
- Pests will stay in the game as long as is stated on the disturbance card. Once they are gone, if all other conditions are right, you may re-enter the game.
- All trees must obey the forester or they will be cut down.
- The competition ends 100 years after the last disturbance card is drawn.
- Any and all tree species left in the competition at the end win the competition.
- If you need to ask a question, RAISE YOUR HAND, and the forester will stop the game to answer you.

Disturbance Cards

Low Intensity Ground Fire	High Intensity Fire	Windstorm
50 Year Storm!! Extreme Flooding & Extreme Winds	The Dam Broke!! Flash Flooding	Black Knot of Cherry Fungus Kills All Living Cherry Trees
White-Tailed Deer Populations Expand and Remain for 20 Years 	Porcupine Population Invades and Remains for 20 Years 	Rabbit Populations Expand and Remain for 20 Years 
Tent Caterpillars Are Introduced and Remain for 20 years 	The Gypsy Moth Is Introduced and Remains for 20 years 	Bronze Birch-Borer Beetle Invades for 20 years 

σ For the animals and insects use the boxes below the names to keep track of the time that they remain in the game. (Each box represents one year. Once the boxes are full, the pest is gone from the game)

Eastern Hemlock

(*Tsuga canadensis*)

Max age: 400 years

Max height: 100 feet

Maturity: 300 years

Growth: Extremely slow

Reproduction: Hemlock seeds require shade and a decomposing leaf layer on the forest floor in order to germinate. One or more trees must form a canopy for at least 30 years until the climate and forest floor conditions are right. Hemlock trees only grow from seeds.

Shade tolerance: Hemlocks are a very shade tolerant tree species and can remain in shade for any length of time at any stage in growth.

Tolerance to disturbance: Hemlocks are resistant to wind at young ages, but as they grow taller, wind can topple some trees. Hemlocks are tolerant of fire when old BUT even then will be killed by intense fire. Flooding will damage their roots and encourage disease.

Damaging agents: Root rot affects the ability of the tree's roots to absorb soil nutrients and usually causes death soon after flooding. White-tailed deer mice and voles eat young hemlock saplings and seedlings. If any two of these animals are present while the tree is young, it will be impossible for it to grow new branches and collect enough sunlight for food.

Competitive edge: Hemlock's extreme tolerance of shade and remarkably long life span give them a competitive edge. As a hemlock, you will most likely be one of the final contestants in the competition.

Your limits during the game:

1. You may not enter the game until at least one tree has lived 30 years.
2. After you are killed by a disturbance you may only re-enter the game if there is at least one tree that is 30 years old.
3. Fire will eliminate you if you are younger than 100.
4. If you are younger than 100 and deer are present, you will be eliminated.
5. Intense fire will immediately eliminate you.
6. You will die of root rot 10 years after a flood event.
7. You will be 100 feet tall at 300 years of age.
8. You will die at 400 years of age.

* Use the side of this sheet to keep track of your age

*Age Tally	
Round	Age
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White Ash

(*Fraxinus americana*)

Max age: 110 years

Max height: 100 feet

Maturity: 80 years

Growth: Average growth rate, which slows down as the tree ages.

Reproduction: White ash are pioneer species whose seeds grow readily in full sunlight. After establishment, white ash are usually overtopped by other pioneer species. Ash require partial sunlight from gaps formed in the canopy, and will not survive if the canopy remains closed for long periods of time. Ash have the ability to sprout new trees from their own roots, but can only sprout successfully in full sunlight.

Shade tolerance: Ash are somewhat shade tolerant but this tolerance decreases with age. After their initial surge of growth ash will not survive long in complete shade.

Tolerance to disturbance: Ash have a deep root system and are resistant to wind. Ash are killed by fire at all ages and die immediately. Ash are tolerant of most flooding and remain unaffected unless flooding is severe.

Damaging agents: The tent caterpillar and white-tailed deer use ash buds and leaves as a food source. This reduces the tree's ability to sprout new branches and produce food. Porcupines will also girdle (remove a strip of bark from) ash tree trunks. Combinations of these agents weaken the tree's natural defense systems and eventually kill it.

Competitive edge: Resistance to wind and flood damage allow ash trees to get established in areas where other tree species have died.

Your limits during the game:

1. You may only enter the game if less than 2 tree species are in the competition.
2. At 40 years of age, if more than 2 tree species are older than you are, you will be eliminated.
3. You will die at 80 years of age if any tree is taller than you are.
4. If both tent caterpillars and porcupines are present at the same time, you will be eliminated.
5. All fire events will eliminate you.
6. You will be 100 feet tall at 80 years of age.
7. You will die at 110 years of age.

*Use the side of this sheet to keep track of your age

*Age Tally	
Round	Age
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American Basswood

(*Tilia americana*)

Max age: 180 years

Max height: 140 feet

Maturity: 100 years

Growth: Average, but basswood grow very quickly in canopy gaps created by the death of other trees.

Reproduction: Basswood produce seeds every year. These seeds germinate poorly. In order for basswood seeds to germinate, they must remain dormant in a cool forest floor for approximately 20 years. After dormancy, the seedlings require warmth and light for at least ten years in order to grow. Once established, basswood trees have the ability to sprout new trees from their roots and will return to the forest immediately after most disturbances.

Shade tolerance: Tolerant of shade at all ages except during the first 10 years of life.

Tolerance to disturbance: Basswoods have extensive root systems that allow the tree to survive strong winds. Basswoods are affected by fire at all ages and will eventually die. They can not tolerate wet soil and are killed by flooding.

Damaging agents: Most pests do not affect basswoods, but they are prime habitat for gypsy moths. If gypsy moths are present the tree will be weakened and may eventually die.

Competitive edge: Basswood's ability to tolerate shade and sprout from roots give them a competitive edge. If your seeds can establish themselves in the stand and possibly reestablish themselves after a flood, you will survive until the end of the competition.

Your limits:

1. In order for you to get into the competition at the beginning of the game and after flooding events, at least one tree must die that is older than 20 years of age.
2. You can return to the competition immediately after a disturbance except after a flooding event.
3. You will be eliminated by all fire events.
4. If the gypsy moth is present at the same time as you, you will be eliminated.
5. You will be 140 feet tall at 100 years of age.
6. You will die at 180 years of age.

*Use the side of this sheet to keep track of your age

*Age Tally	
Round	Age
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Paper Birch

(*Betula papyrifera*)

Max age: 120 years

Max height: 90 feet

Maturity: 65 years

Growth: Fast until 65 years of age. At this age they become overtopped by other trees.

Reproduction: Birch seeds can grow under a canopy or in direct sun and have no requirements for germination. They can also sprout new trees from roots and stumps and can even grow through black cherry seedbeds. After a young tree reaches the age of ten years, they require full sunlight. After this age if the tree is under the canopy or overtopped by another tree they will die.

Shade tolerance: Birch trees cannot grow in shade.

Tolerance to disturbance: Birches have shallow roots, so they are vulnerable to strong winds. Birch bark is extremely flammable and catches fire easily. Birch roots don't do well in water and the tree will die shortly after a flood.

Damaging agents: The bronze birch borer feeds on the birch tree's bark for food and weakens the tree. The gypsy moth, tent caterpillar, and white-tailed deer eat birch leaves and buds, reducing the tree's ability to produce food and grow new branches. Porcupines can girdle (remove the bark from around) birch trunks and kill them.

Competitive edge: A birch's ability to sprout new trees immediately after disturbances gives them a competitive edge. This allows birch to successfully compete with newly growing black cherry trees and other pioneer species.

Your limits:

1. You may enter immediately at the beginning of the competition.
2. You may only enter the competition twice while other tree species are present and all of those species must die within10 years or you will be eliminated.
3. After you turn 65, if any tree is taller than you are, you will be eliminated.
4. All fire, flood, and wind events will eliminate you.
5. If 2 or more of the following are present you will be eliminated: gypsy moth, tent caterpillar, white-tailed deer, and bronze birch borer.
6. You will be 90 feet tall at 65 years of age.
7. You will die at 120 years of age.

*Use the side of this sheet to keep track of your age

*Age Tally	
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Sugar Maple

(*Acer saccharum*)

Max age: 350 years

Max height: 120 feet

Maturity: 150 years

Growth: Slow at all stages.

Reproduction: Sugar maple seeds need moist soil to germinate. A well established tree canopy provides the most favorable forest floor conditions for their growth. Their seedlings also require partial shade in order to survive. This shade helps to limit the competition of other tree seedlings.

Shade tolerance: Very shade tolerant. Sugar maple can tolerate shade at all ages.

Tolerance to disturbance: Sugar maples have a well developed root system and are resistant to wind at all ages. Flooding weakens the root system and eventually causes death. They are tolerant of fire only if they have grown into the upper canopy. Intense fires will usually spread through the canopy and kill the tree.

Damaging agents: Sugar maples are resistant to insects, but their seedlings provide food for both rabbits and deer.

Competitive edge: Shade tolerance, wind resistance, and a long life span give sugar maples a competitive advantage. This allows sugar maples to outlive most other trees and often become the dominant tree species.

Your limits:

1. You may only enter the competition if another tree is 20 years old or older.
2. After entering the competition, if all other tree species die before you turn 15, you will be eliminated.
3. All flood events will eliminate you.
4. You can tolerate fire if you are older than 40, but severe fires will eliminate you at any age.
5. If both rabbits and white-tailed deer are present you can not enter the game.
6. You will be 120 feet tall at 150 years of age.
7. You will die at 350 years of age.

*Use the side of this sheet to keep track of your age

*Age Tally	
Round	Age
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Black Cherry

(*Prunus serotina*)

Max age: 100 years

Max height: 100 feet

Maturity: 60 years

Growth: Extremely fast until maturity.

Reproduction: Black cherry seeds do not compete well with seeds from other trees. They require shade and moisture to grow. They usually store large amounts of seeds in the ground to better compete. Black cherry can sprout new trees from roots and stumps.

Shade tolerance: Black cherry trees are shade intolerant. The seeds need shade to grow but the saplings need partial light to survive. Gaps in the tree canopy must form (other trees must die) for the saplings to live. Black cherry trees are extremely intolerant of shade after maturity. If other trees overtop the tree by this age they will die.

Tolerance to disturbance: Shallow roots make black cherry extremely vulnerable to wind events. Their bark is vulnerable to all fire events. They are sensitive to drought and flooding.

Damaging agents: Deer, mice, and moles eat black cherry leaves, twigs, fruit and bark. Tent caterpillars use the leaves for food. These damaging agents weaken the tree's health.

Competitive edge: Black cherry are very good at storing large amounts of seeds in the ground. Because they can sprout new trees from the stumps of dead ones, they are able to compete well with other pioneer species.

Your limits:

1. You can only enter the game if one and only one tree species is present.
2. After 60 years of age you will be eliminated if any trees are older than you are.
3. Any wind, fire, or flooding events will eliminate you.
4. If deer are present at the same time as you, you will be eliminated.
5. You will be 100 feet tall at 60 years of age.
6. You will die at 100 years of age.

*Use the side of this sheet to keep track of your age

*Age Tally

Round	Age
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Forester's Record With Disturbances

	First Trees Present Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Round 8	Round 9	Round 10	Round 11	Round 12	Round 13
Black Cherry													
Eastern Hemlock													
White Ash													
American Basswood													
Paper Birch													
Sugar Maple													
Time Elapsed													
Disturbance													

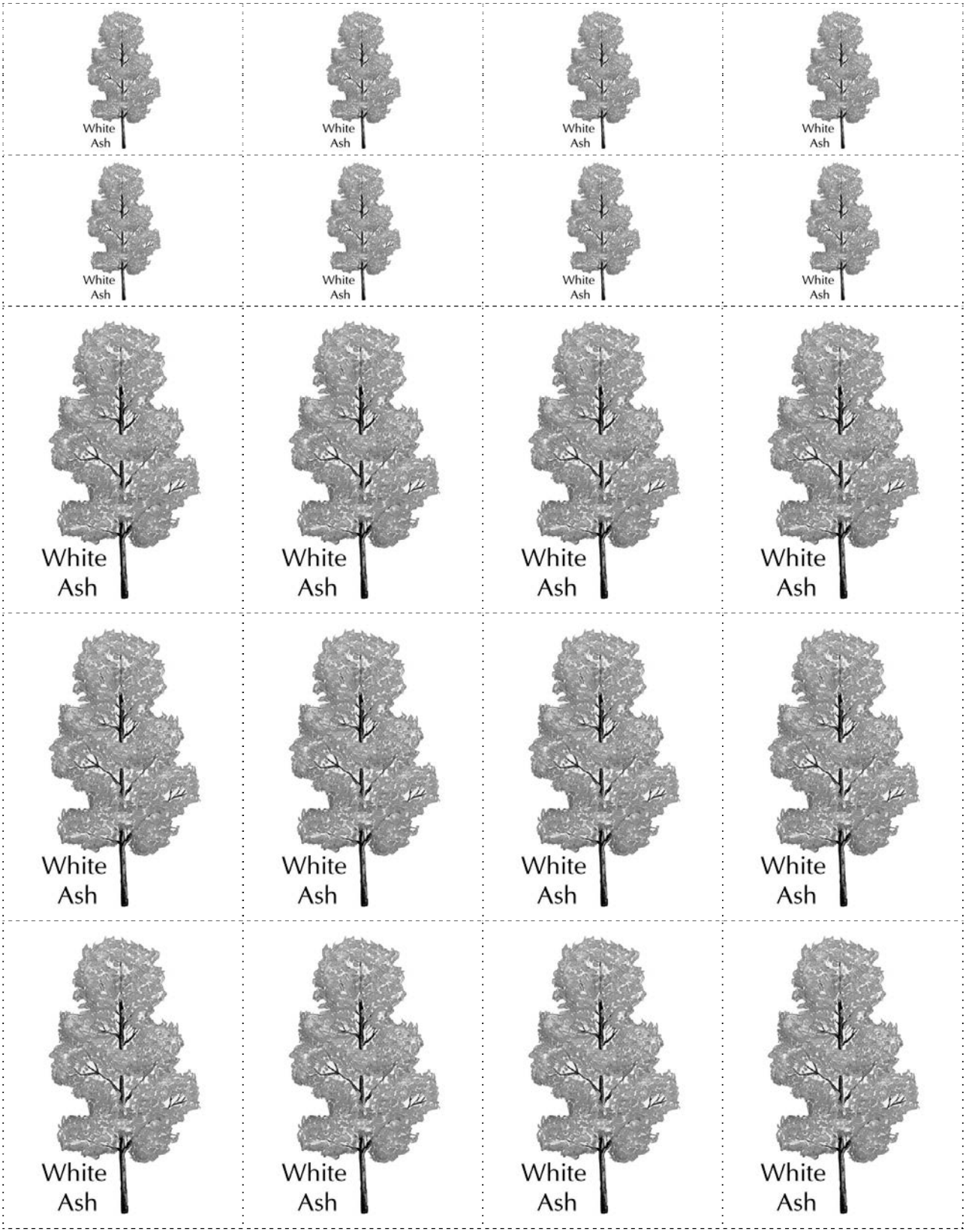
In the tree boxes, label them as N for new trees present, P for trees that were present the round before, and A for trees absent that round.

Forester's Record Without Disturbances

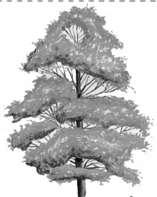
	Round 14	Round 15	Round 16	Round 17	Round 18	Round 19	Round 20	Round 21	Round 22	Round 23	Round 24	Round 25
Black Cherry												
Eastern Hemlock												
White Ash												
American Basswood												
Paper Birch												
Sugar Maple												
Time Elapsed												

In the tree boxes, label them as N for new trees present, P for trees that were present the round before, and A for trees absent that round.

White Ash

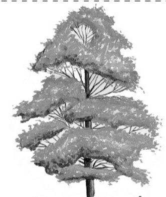


Basswood


Basswood


Basswood


Basswood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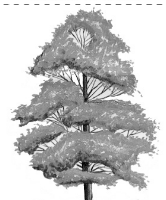
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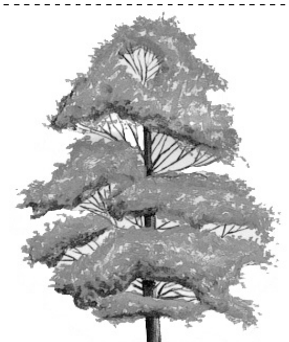
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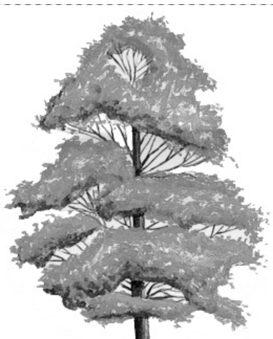
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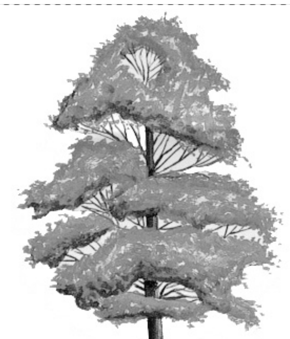
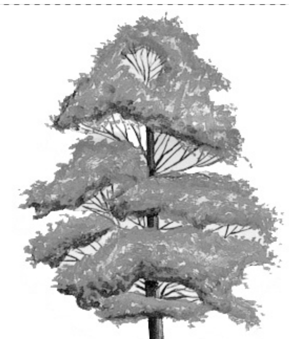
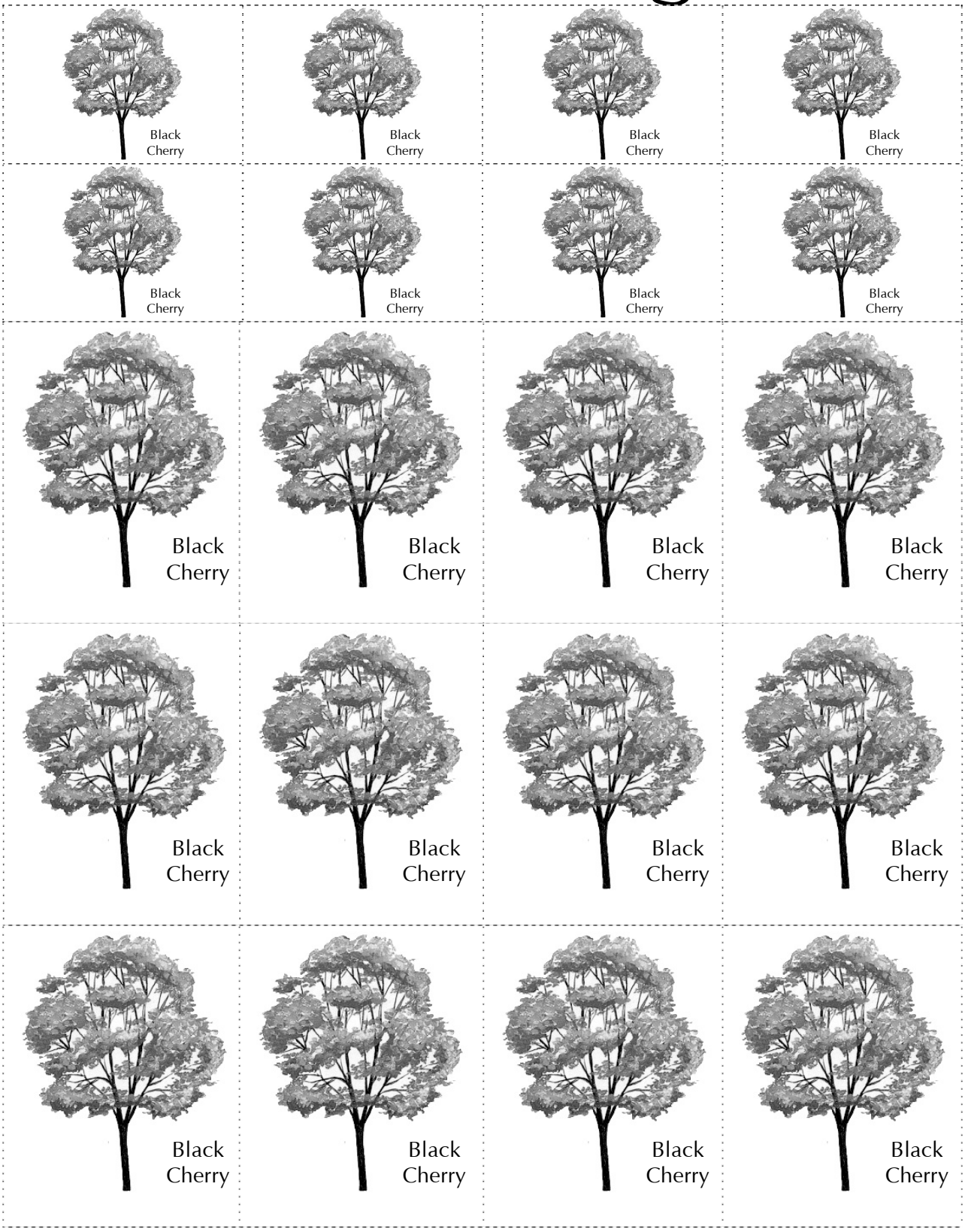
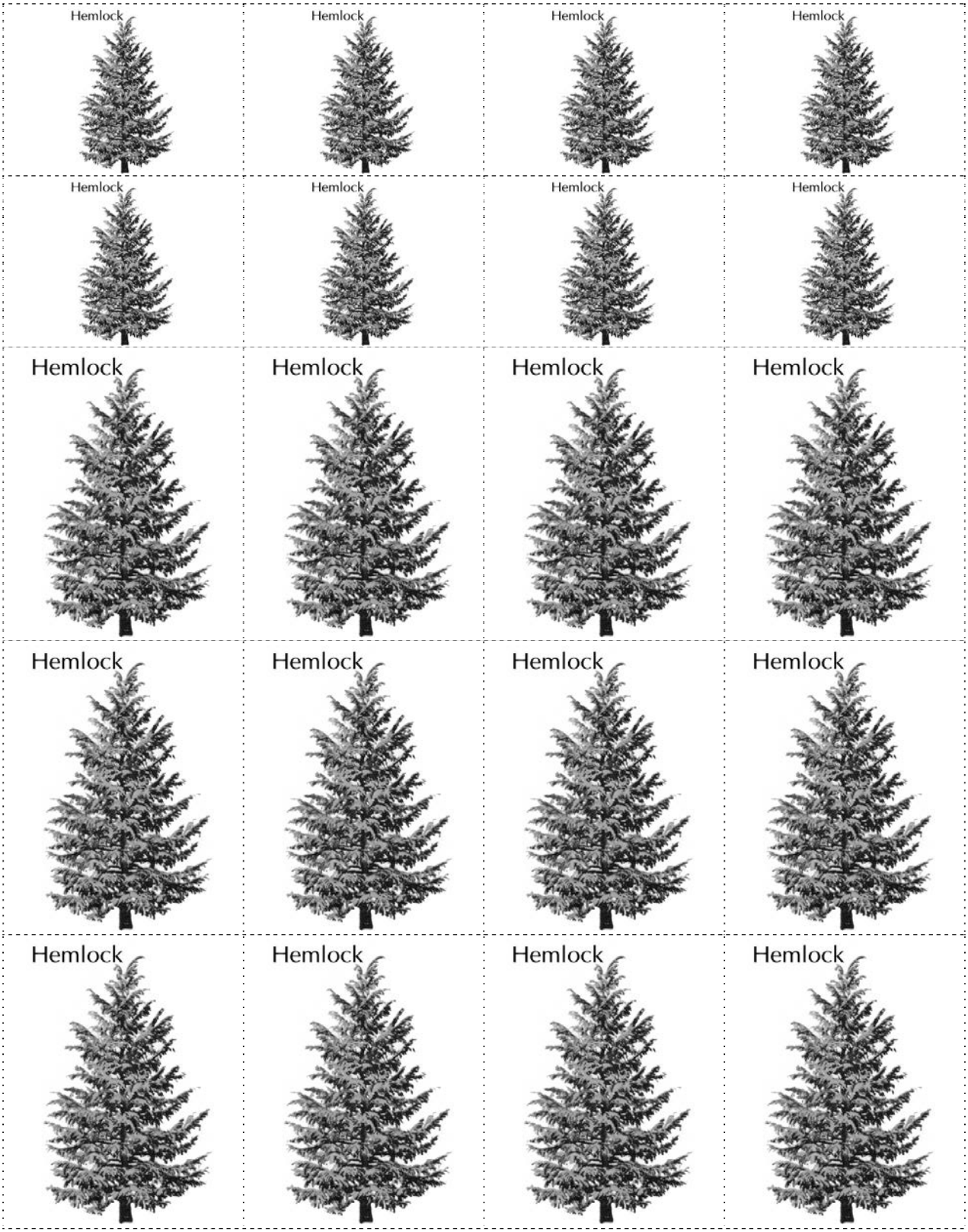

Basswood


Basswood

Black Cherry



Hemlock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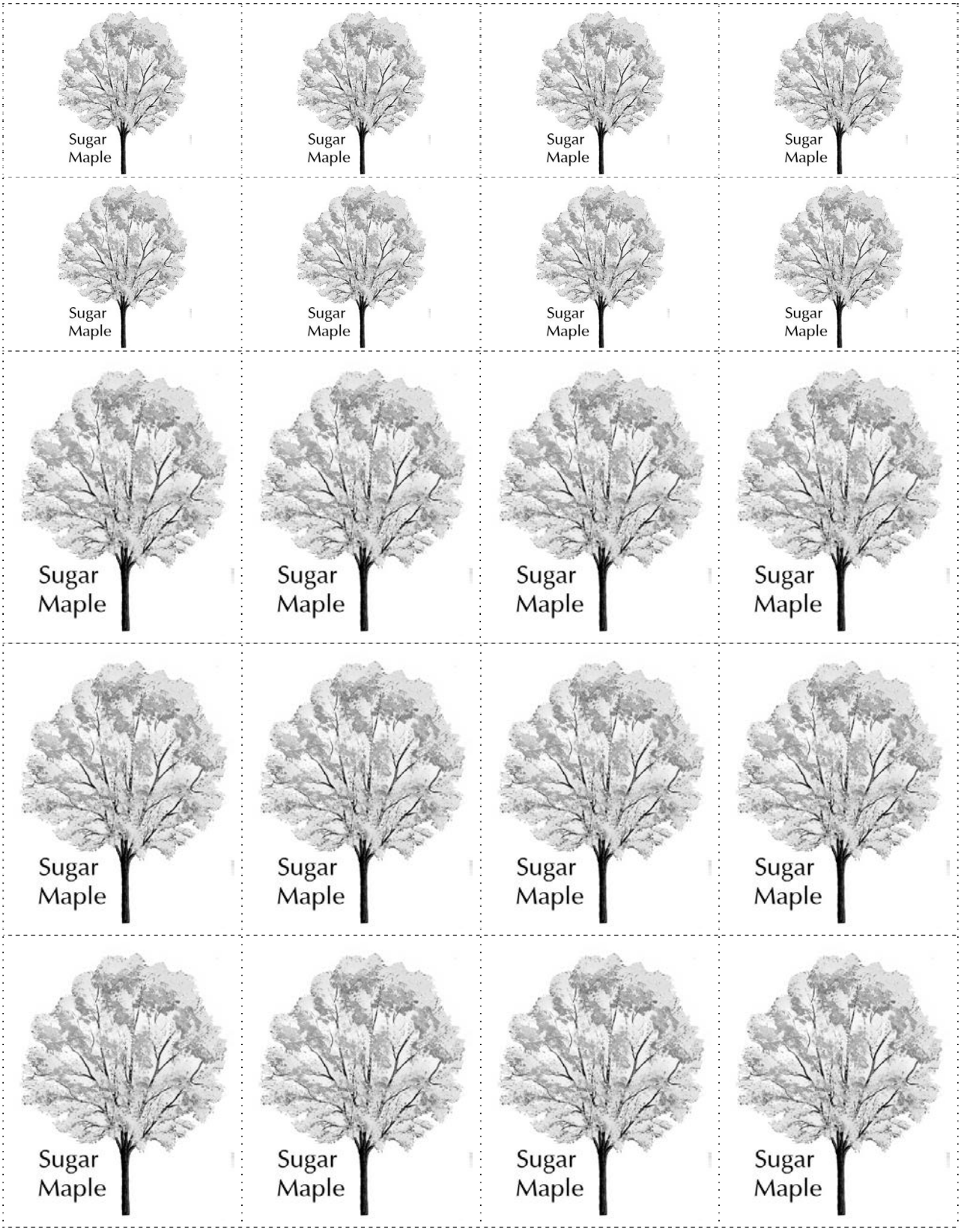
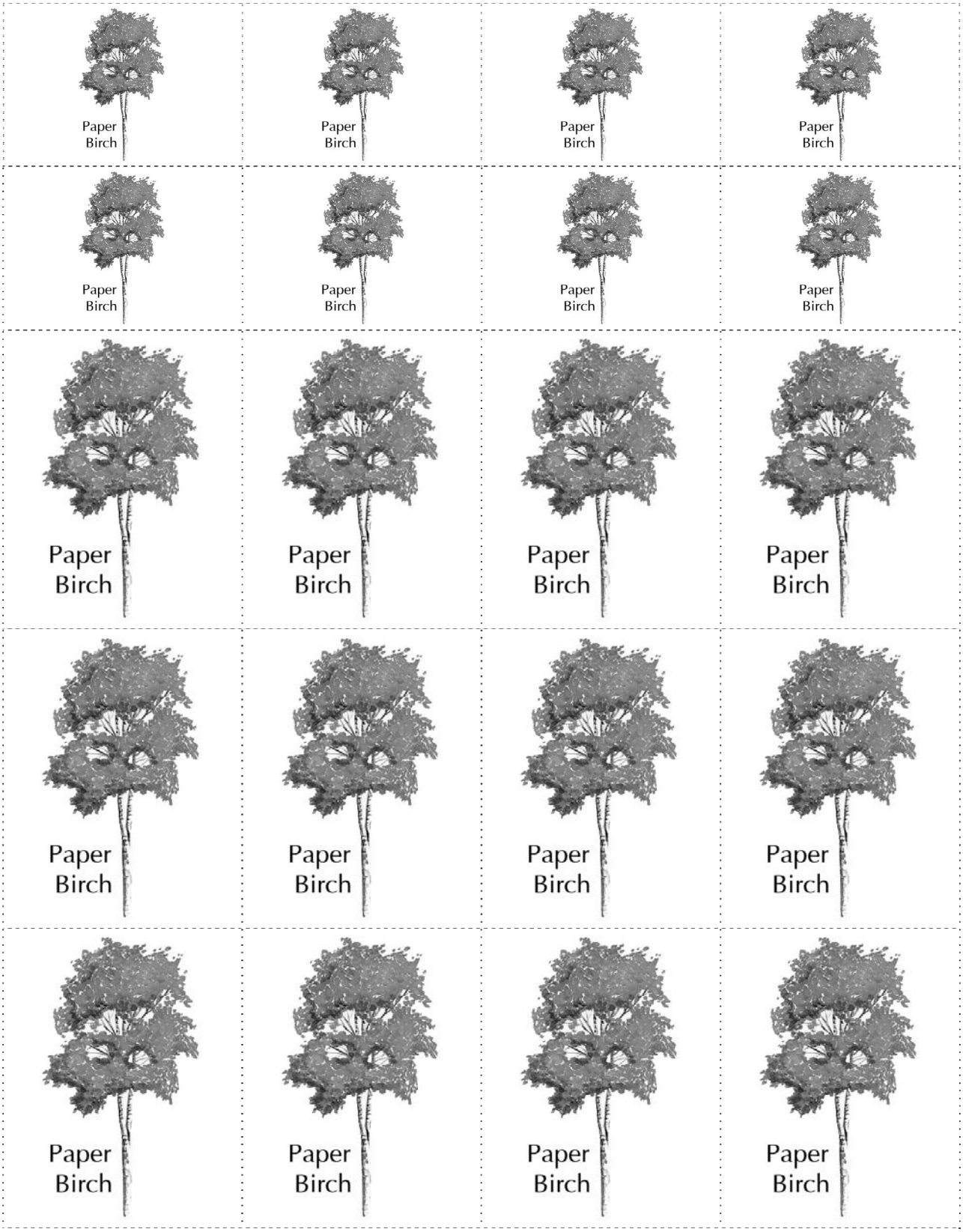
Sugar Maple

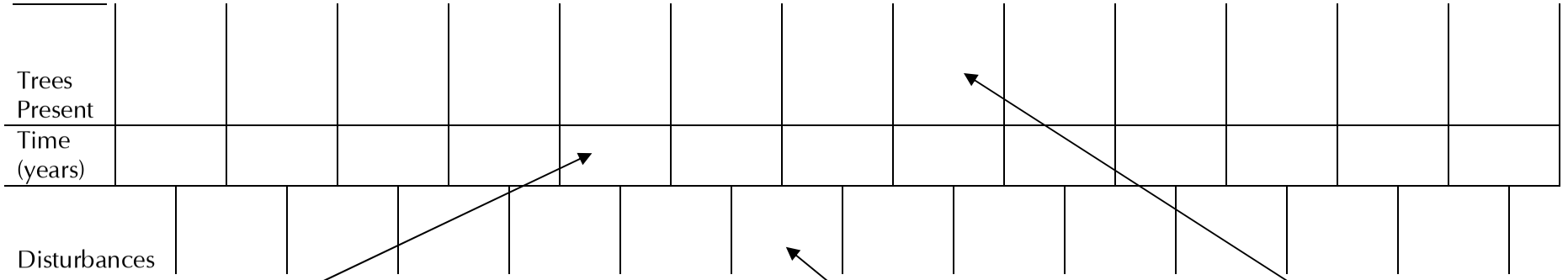


Paper Birch



Example Timeline

Forest Succession with Disturbances (first 12 rounds)

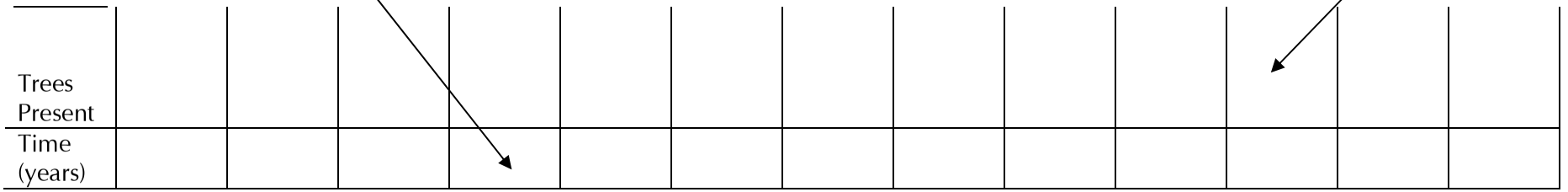


Write the time that passed between rounds inside of these boxes. It may be helpful to record both the number of years that passed between rounds and the total number of years that passed.

Write the disturbances that occurred during the competition in these boxes. The disturbance cards were drawn after each of the first 12 rolls of the dice. These disturbances caused the forest to change.

Have students place the tree cutouts in these boxes. These represent the trees that remained after each round.

Forest Succession without Disturbances (last 100 years of the competition)



Helpful hints for playing *A Competitive Edge*
Lesson 2

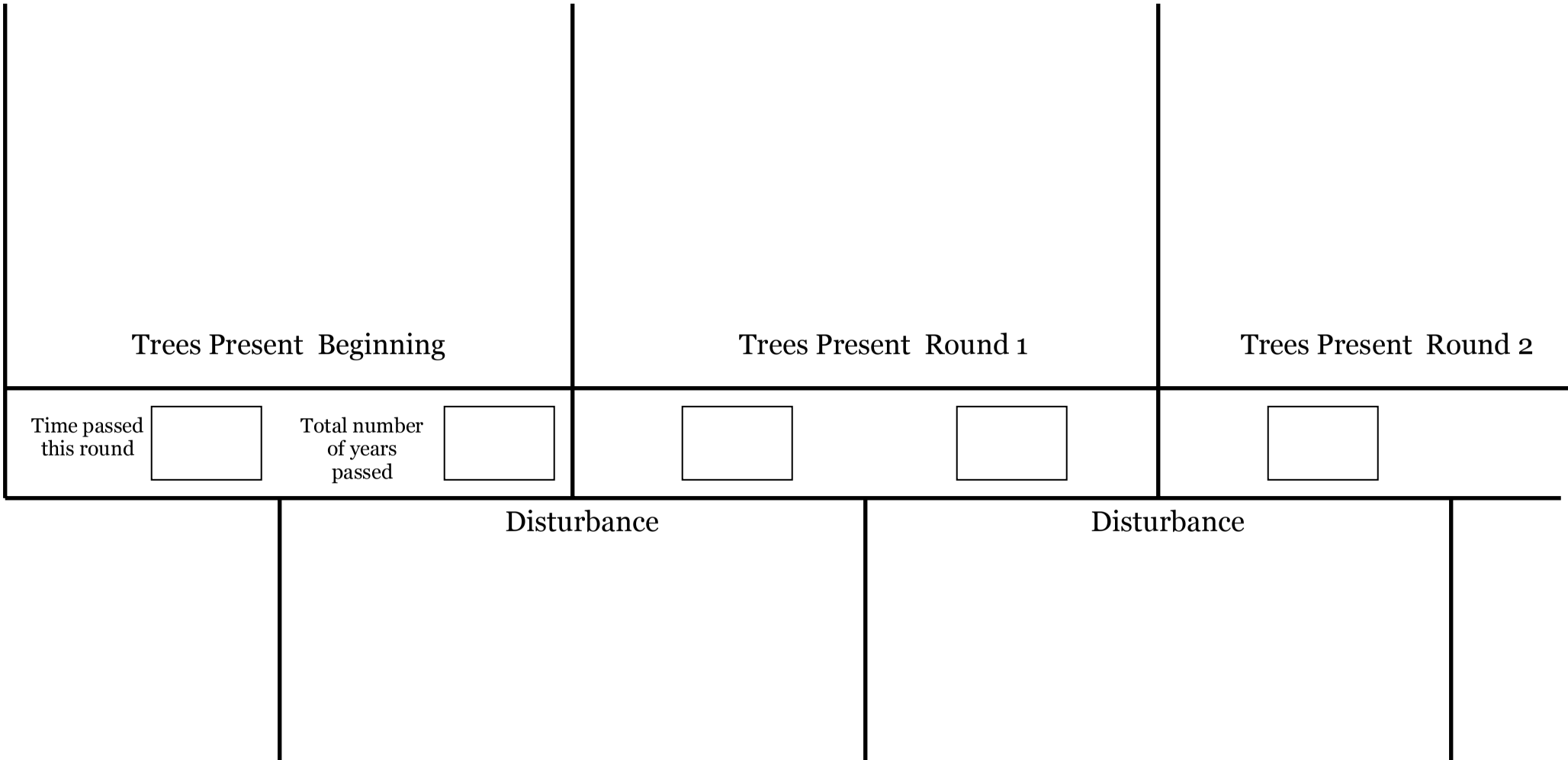
- Make sure each tree group is familiar with <u>all</u> of their limits before starting the game. Students may have a tendency to focus on one or two limits and not realize that more than one disturbance or action of another tree group affects them.

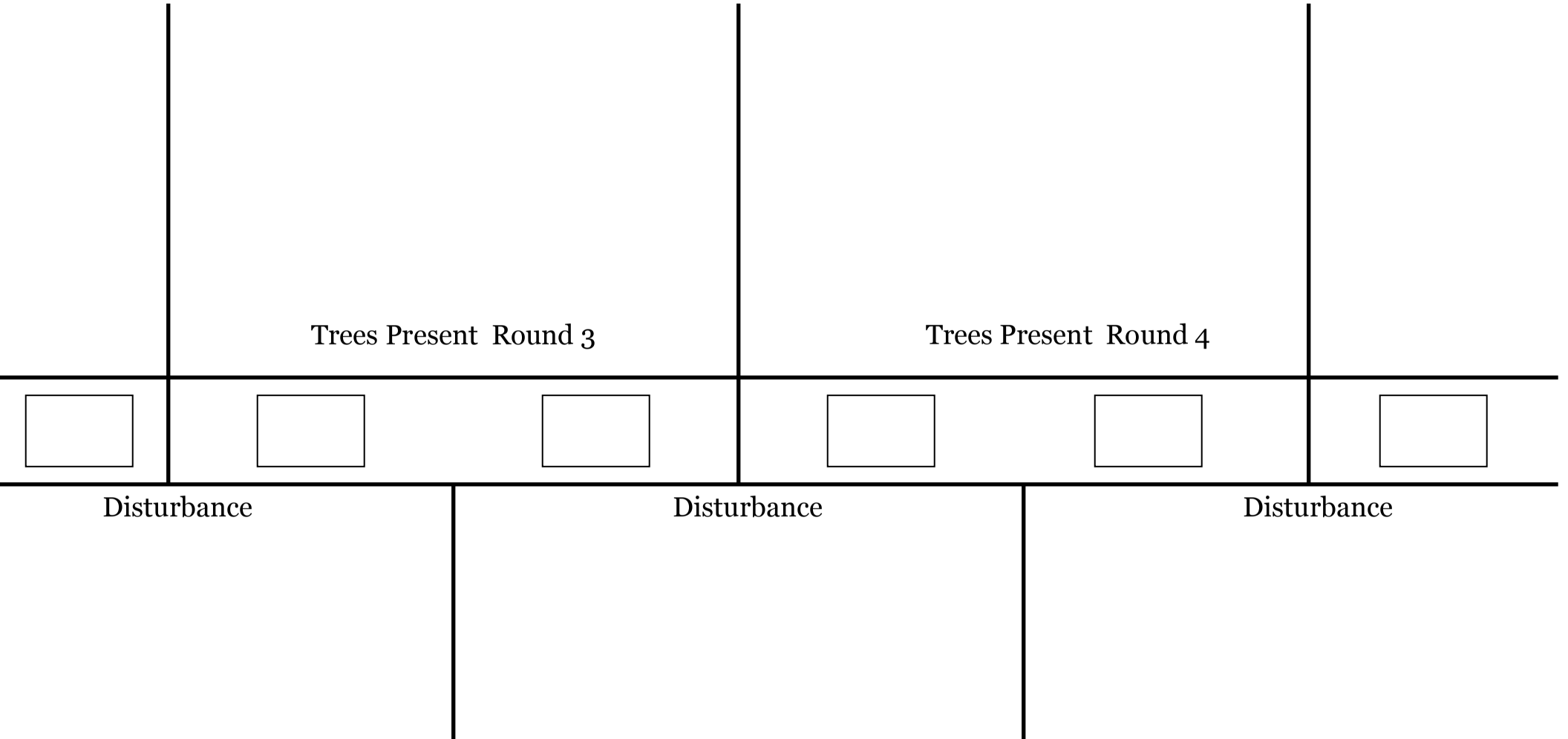
- With a large class allow extra time for explaining rules. It is vital to the game that each tree group understands how to play before beginning the game. If one group doesn't understand the rules their mistakes can influence the actions of all the other tree groups.

- Make the roles of Mother Nature and Father Time fun with hats, props, or costumes. These roles can seem daunting because these students have to wait for each round to pass while the tree groups decided their fate for the round.

- Follow a pattern for allowing when trees can enter the game or leave the game.
    1. The dice are rolled. Who can enter?
    2. Disturbance card pulled. Who must leave?
    3. Who is left?
    4. Can anyone new enter? They enter at the age of the last roll of the dice.
    5. (This is because in X number of years a disturbance eliminated one tree which allowed another to grow. It is impossible to say how many years one tree was living before the disturbance knocked it out and how many of the X years it took for the new tree to establish.)
    6. The dice are rolled. Who can enter?
    7. etc.

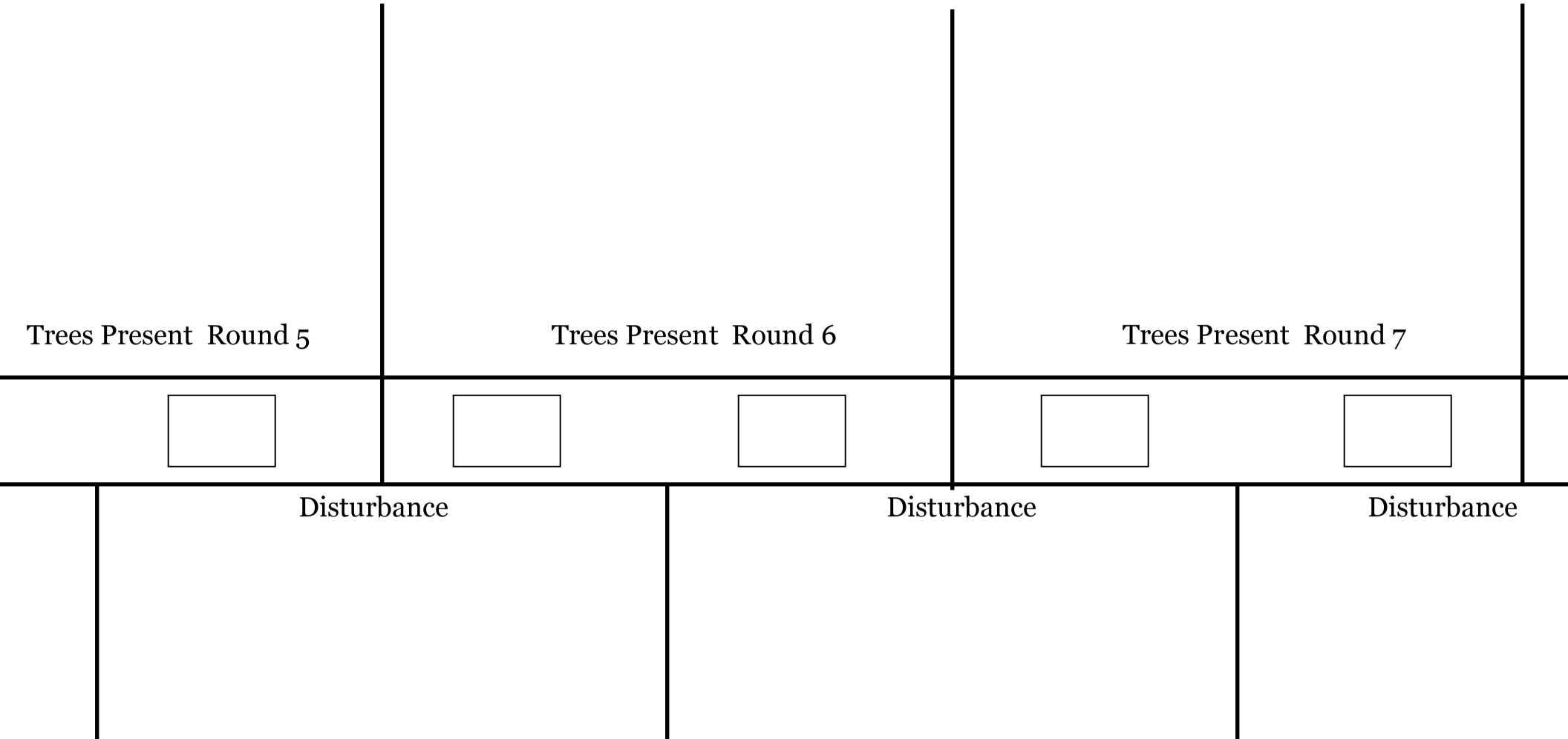
- If a pest disturbance card expires in the middle of a round (for example, 12 is rolled and there were only 4 years left on a disturbance card) trees that can enter if that pest is not present can enter with the remaining number of years left. For example, sugar maple limit number 5 says *If both rabbits and white-tailed deer are present you can not enter the game.* If both rabbits and white-tailed deer were present and the rabbit card expired after 4 of the 12 years rolled on the dice, the sugar maple can now enter at 8 years old (assuming all other limits are followed).

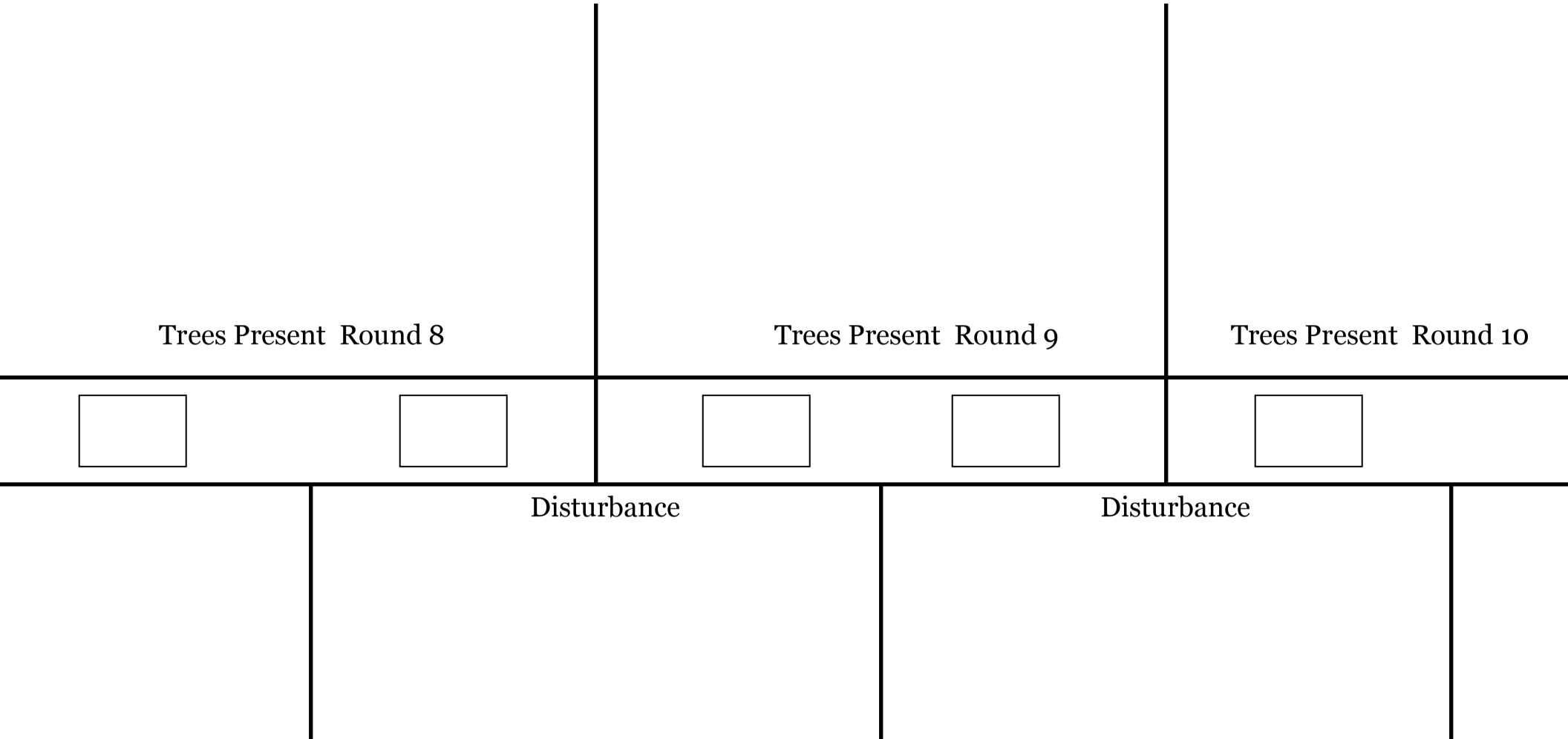

Trees Present Beginning
Trees Present Round 1
Trees Present Round 2
Time passed this round
Total number of years passed
Disturbance
Disturbance

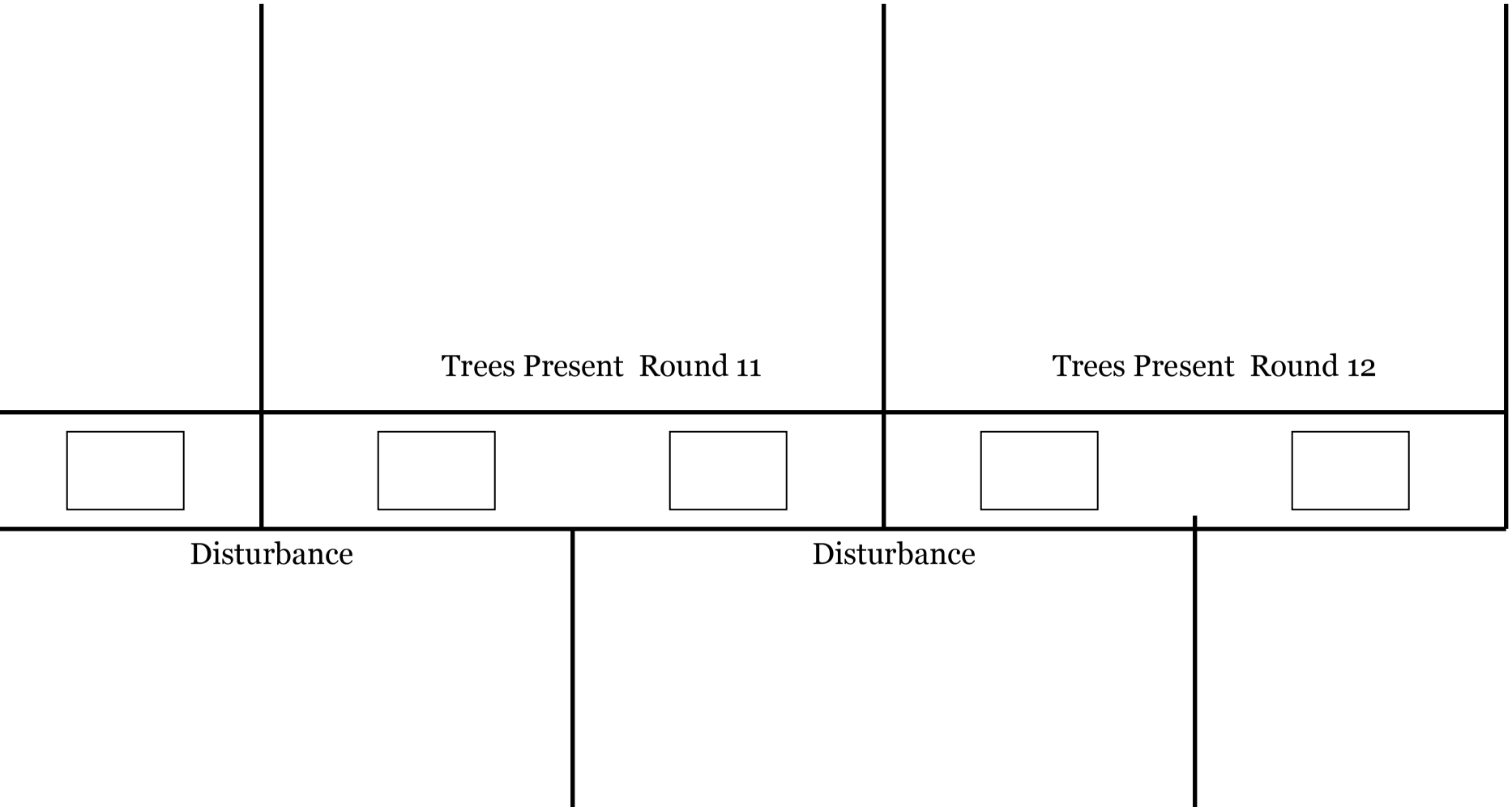

Trees Present Round 3
Trees Present Round 4
Disturbance
Disturbance
Disturbance

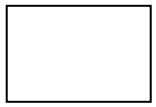
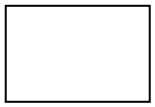
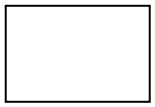
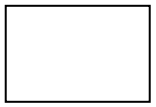
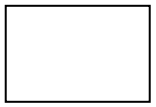
Forest Succession with Disturbances Timeline

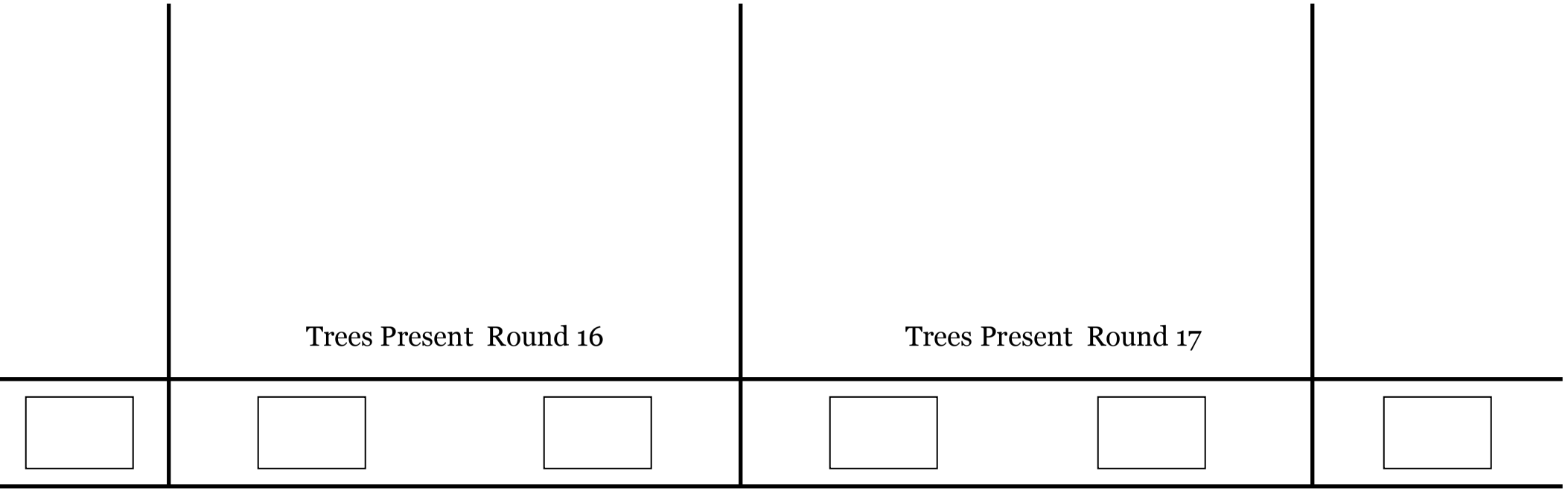
(first twelve rounds)




Trees Present Round 8
Trees Present Round 9
Trees Present Round 10
Disturbance
Disturbance

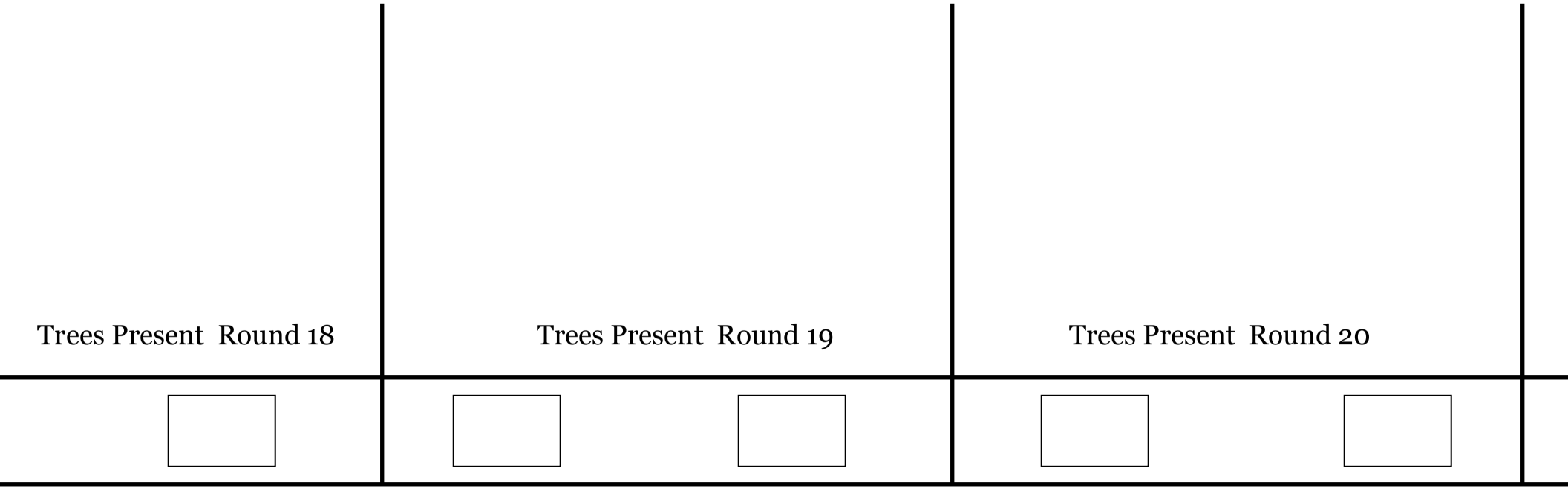

Trees Present Round 11
Trees Present Round 12
Disturbance
Disturbance

Trees Present Round 13	Trees Present Round 14	Trees Present Round 15
Time passed this round  Total number of years passed 	 	

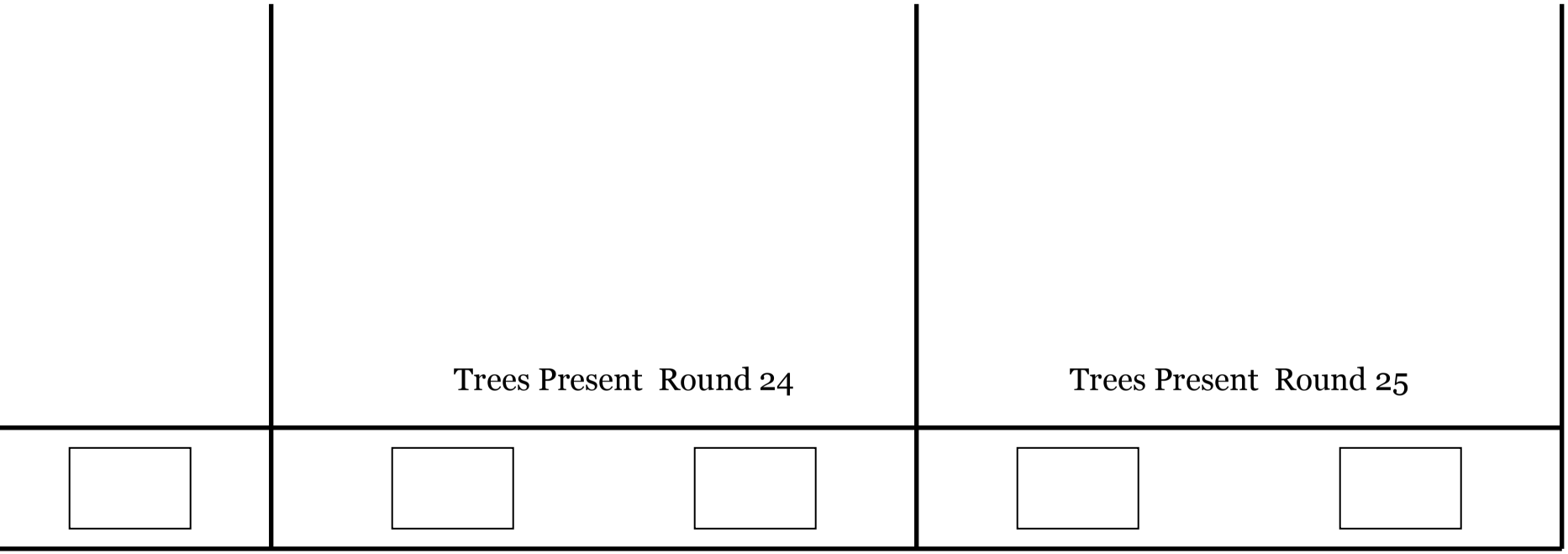

Trees Present Round 16
Trees Present Round 17

Forest Succession without Disturbances Timeline

(last 100 years of competition)



Trees Present Round 21	Trees Present Round 22	Trees Present Round 23


Trees Present Round 24
Trees Present Round 25

Lesson Three

The Natural Divisions of Wisconsin

Concepts

- There are six major natural divisions of forested areas in Wisconsin, each with distinct forest types.
- The distribution of forest types in Wisconsin is directly related to glacial history, topography, climate, soil types, human activity, and other disturbance factors.
- Humans have dramatically altered the location, extent, and composition of our forests.

Objectives

Students will be able to:

- Recognize Wisconsin's major forest types and list two tree species from each.
- Differentiate the six natural divisions in Wisconsin and describe the major forest types present.
- Describe the influence that the tension zone and landscape have on Wisconsin's natural divisions and resultant vegetative types.

Teaching Site

Indoor classroom with overhead projector and chalkboard.

Materials

Copies for each student of the:

- Natural Divisions Information Chart Handout
- Landforms of Wisconsin Map

Transparencies of the:

- Natural Divisions of Wisconsin Map
- Wisconsin Tension Zone Map
- Landforms of Wisconsin Map
- Wisconsin Glaciation Map
- Wisconsin Continental Divide Map
- Current Land Use Map
- Forest Type Pictures

Lesson Time

One 50-minute class period

Nutshell

Students will be introduced to the major forest types of Wisconsin and the trees that compose them. They will transpose features from glacial history and climatic maps onto a map of Wisconsin. They will compare these features with the boundaries of Wisconsin's forest types. Upon completion, they will compare the natural divisions of the Wisconsin map to a current land-use map.

Teacher Preparation

Copy all handouts and transparencies listed in the Materials section. Read the background information and review the background information from the last lesson.

Background Information

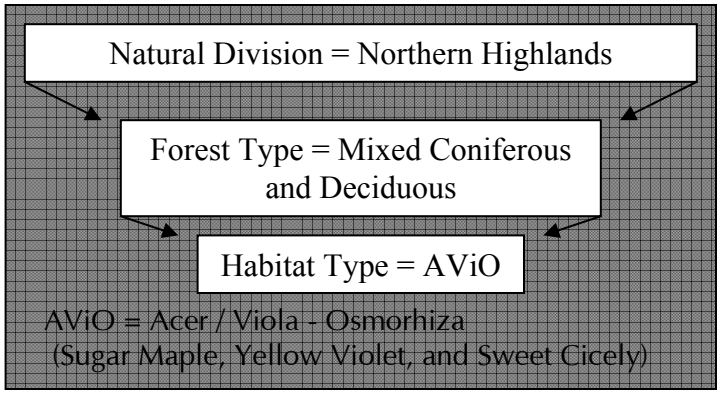
Natural Divisions in Wisconsin

Forests progress through different successional stages as they grow older. Each stage differs in forest composition and structure. The forest game in the last lesson gave a simplified view of the possible successional pathway that a particular forest undergoes through time. There are many different forests types in Wisconsin, each having different trees, disturbances, and site conditions. In the competition game, the forest type used is found in the Northern Highlands Area of Wisconsin. The Northern Highlands Area represents one of six natural divisions in Wisconsin, including the Superior Lowland, Lake Michigan Shoreland, Central Sand Plains, Southeastern Ridge and Lowlands, and the Southwestern Upland. Each of these divisions is separated from the others based on differences in climate, past glaciation, resultant topography, and soils.

Forest Classification

Forest classification throughout Wisconsin can be visualized as a hierarchy, with the natural division being the broadest category, then the forest type (coniferous, deciduous, etc.), and lastly the forest habitat type (usually labeled with the first initials of the scientific names of the dominant trees and plants present). For example, the site for our competition can be seen as having the hierarchy that is shown on the next page.

This hierarchy suggests that on a forest type map of Wisconsin you would initially see very large generalized forested divisions in Wisconsin (the natural divisions). Within these large divisions it would then be possible to see the different forest types that occur throughout the regions (coniferous, deciduous, etc.). The forest types would then also be divided into smaller forested areas based on the dominant trees that are there or the potential dominant trees that will occur there. These smallest divisions are the habitat types.



Potential habitat types are determined by the plant communities that exist in the forest at that particular point in time. More recently the Department of Natural Resources and the U.S. Forest Service have been working on a system of forest classification known as the National Hierarchy of Ecological Units. This method of dividing the landscape is proving to be the foundation of sound ecosystem management. The system is much more complex than the hierarchy presented here, but is based on the same general principles. As computer technology advances and more is known about our natural landscapes, systems such as these will be in use for much of Wisconsin and the United States.

Forest Types

The natural divisions of Wisconsin contain one or more forest types. The major forest types found throughout Wisconsin are deciduous, coniferous, boreal, pine and oak barrens, oak woodland, and oak savanna. **Deciduous** forests are composed of trees that survive winter by having a dormant period, losing their leaves in the fall and regaining them once again in the spring. **Coniferous** forests are composed of trees that have cones and needles. Most coniferous trees in Wisconsin, with the exception of tamarack, keep their needles throughout the winter season. Many forests in Wisconsin are **mixed coniferous and deciduous** forests meaning that both coniferous and deciduous trees are present. A **boreal forest** is made up of mostly cold-tolerant coniferous trees. A boreal forest occurs when cold temperatures stop the growth of most or all deciduous trees, leaving only coniferous trees. An **oak woodland** is a dense stand of trees very similar to a deciduous forest, but contains mainly oak tree species. An **oak savanna** is a shaded mixture of oak trees and grasses. It can be visualized as intermediate to a prairie and an oak woodland. Today in Wisconsin, oak savannas make up less than 0.1% of their original distribution. **Oak-pine barrens** are composed of jack pine and/or oak trees usually of a similar age and height (even-aged). These barrens are dependent on fire disturbances and particularly sandy soils to maintain the oak and jack pine composition and the even-aged structure.

Factors That Define Natural Divisions and Resulting Forest Types

The Natural Divisions of Wisconsin and their specific forest types are caused predominantly by differences in climate and topography. *The natural divisions may be best understood by using the maps provided within the activity in order to visualize the relationships.*

Climatic Zones

The state is divided climatically into a Northern and Southern Climatic Zones. The Tension Zone, shown as a band on the map, divides these two zones. North of the tension zone, the climate is characterized by a high frequency of cool, dry arctic air from Canada. Winters are longer with more snow and colder temperatures. South of the tension zone, climate is controlled by air from the

Pacific Ocean meeting with tropical air from the Gulf of Mexico. These interactions produce warmer winters with less snow and longer summers with more rainfall. The Wisconsin Tension Zone forms the division line between the northern forests of the state and the southern forests, savannas, and prairies. The zone is represented as a band. The northern line of the band represents the farthest extent that southern forest types are found. The southern line of the band similarly represents the farthest south that the northern forest types are found. Within the Tension Zone, both types may be found interspersed.

An additional climatic zone exists in northern Wisconsin in the **Lake Superior Lowland**. This area in the northwest corner of the State is subject to the cold winds that blow over Lake Superior. This "lake effect" lowers the temperature, increases snowfall, and as a result influences the vegetation that grows there. The climate throughout the lowland creates the boreal forest that characterizes the vegetation within this natural division.

Glaciation

The glacial history of Wisconsin has also helped to form the natural divisions of the state. Glaciation has created three natural dividing features within the state. Those features are: 1) the division between the driftless area (unglaciated) and the rest of the state, 2) the sand deposits that distinguish the central portion of the state, and 3) the continental divide.

The **Southwestern Upland** division, otherwise known as the "driftless area", was never subject to glaciation and remains rugged with old, well-formed river valleys. This older landscape hosts a unique pattern of vegetation. As the glaciers moved across the rest of the State, the old surface features of the State were smoothed over and a new young soil began to form. These younger soils host the trees and plants of the rest of the state.

The southern movement of the glaciers across the state formed elevated ridges known as moraines. These moraines work to divide the state into different regions. One major moraine forms a natural division in Wisconsin's forested land. The north-south ridge divides the state into an eastern 1/3 and a western 2/3. Another ridge in the northern part of the state is also a result of Wisconsin's historic topography and most recent ice-age. This ridge separates the **Lake Superior Lowland** from the rest of the state.

Each of these ridges acts as a continental divide that separates the state into three distinct water basins. Water north of the east-west ridge drain to Lake Superior. Water south of this ridge is divided by the north-south ridge. Water east of this divide drains to Lake Michigan; water west of the divide drains to the Mississippi River. This separation creates differences in climate patterns and soil types.

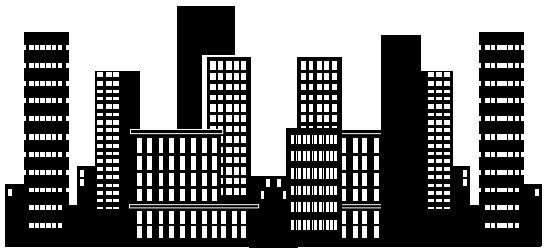
The continental divide separates the **Northern Highland** from the **Lake Michigan Shoreland** and also helps to separate the **Southeastern Ridge and Lowland** from the **Central Sand Plain** and **Southwestern Upland**. The divide that borders the **Lake Superior Lowland** confines the lake effect climate of that area.

The glaciers that moved over the state also deposited different materials on the landscape. One major deposit lies in the middle of the state. As the glaciers melted and retreated northward, large amounts of sand and water washed into the central area of Wisconsin. This outwash created what geologist call Glacial Lake Wisconsin. The action of the water and sand in the lake deposited the sands and created the flat, sandy area known as the **Central Sand Plain**. The soils throughout this area have high amounts of sand and create a unique environment for trees and plants.

Activities

1. Begin the activity by asking your students why they live in their community. Have them share what reasons they have for living where they do. If needed, guide their answers with additional questions so they come up with most of the following answers:

   My parents live here, my grandparents live here, my parent's jobs are here, this is a safe place for kids to grow up, the schools are great in this community, everything we need to live is within driving distance, etc.
   Tell your students that each of these factors relate to why they live in their community.



   Using another community in Wisconsin that would be very different than yours, ask them if they think it would be easy for them to live in the other community, *i.e. would it be easy for them to live in Milwaukee instead of Amherst Junction?* Ask them what differences there would be between these two communities. *Size, jobs, crime, goods and services, etc.*

   Tell the students that just like these two communities are different, so too are our forest communities different in Wisconsin. Whether a person lives in either a rural community or a city community is dictated by many factors that occur before they arrive, such as the job market, family ties, or activities the individual enjoys. Tell the students that in their community it may be a parent's job or family ties that keep them in their particular community. Ask the students if they can think of reasons why different types of forest communities are found in different regions of the state. *Climate, soil type, topography, glaciation, disturbances, human activity*. Tell the students that today they will be discover what factors influence the location of forest types in Wisconsin.

2. Pass out the **Natural Divisions Information Chart** and the **Landforms of Wisconsin Map**. Using an overhead of the **Forest Type Pictures** and referring to the **Natural Divisions Chart**, discuss with your students what forest types are found in the six natural divisions of Wisconsin. Highlight the specific tree species present in each forest type. Refer back to the previous lesson on succession. Ask students in which natural division they think the hemlock/sugar maple forest would have been found. *Northern Highland.* Ask them if they think that the entire Northern Highland area has only these species of trees. Tell them that the area is made up of many different trees, each competing with the other species present.

   Tell them that although there may be many different kinds of forests throughout a natural division, the environmental conditions within the natural division are very similar. Again ask the students to brainstorm what factors or environmental conditions limit where certain trees may grow. *This list should include temperature and moisture (climate), soil characteristics (rocky, sandy, mucky, etc), the shape of the land (topography/landforms), and the types of disturbances that occur.*

3. Tell the students that climatic differences across the U.S. produce what's known as a tension zone in Wisconsin. Ask them if they have ever taken an ice cube out of the freezer and let it melt. Ask them why it melted. Tell the students that the climate inside the freezer is very different from the climate outside the freezer and as a result, an ice cube does not last outside of the freezer. Tell them that the freezer door separates the outside warmth from the inside cold. The thickness of the freezer door spans an area that separates two very distinct climates. In nature, we refer to an area that separates two distinct climates as a **tension zone**.

   Put the map of the **Wisconsin Tension Zone** on the overhead. Explain to the students that the tension zone separates the cool northern climate brought by arctic air from the warm southern climate produced by Pacific and gulf air. Tell the students that the areas above the tension zone and below the tension zone represent two different climates. Ask the students what effects they think the difference in climate has on determining the species of trees present. Refer back to the ice cube. Tell them that just like the ice cube many tree species can only prosper and survive in the northern or southern climates. Referring to the overhead, tell them that the top line of the tension zone represents the maximum distance northward that many southern trees can survive and the bottom line represent the max distance southward for many northern trees. Tell them that in between the two lines is a mixing zone made up of both southern and northern tree species. Have the students draw the tension zone onto their **Landforms of Wisconsin Map**.

4. Put up an overhead of the **Landforms of Wisconsin Map**. Ask your students if they see different patterns. Help them discriminate between flat and rough areas. Brainstorm the reasons for why the landscape looks the way that it does. Tell them that glaciers have had the most significant influence on the shape of Wisconsin's land. Ask them to identify any major features on the map.

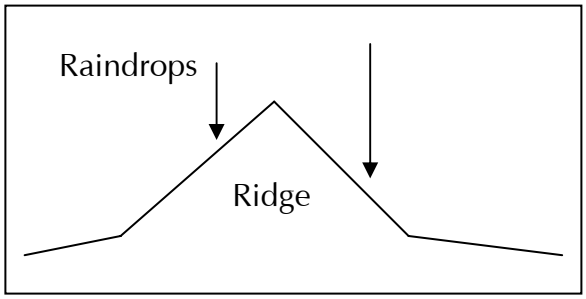
   Put up the overhead of the **Wisconsin Glaciation Map**. Point out the driftless area of southwest Wisconsin and the sandy outwash area in the center of the state. Tell the students that glaciers never reached into these areas. Ask students how these areas differ from other regions of the state.

   Ask students to identify the difference between the Central Sand Area and the Driftless Area. Point out the well-defined streambeds in the Driftless Area and the patterns that result. Ask the students if these valleys took a long period of time or a short period of time to form. Tell the students that this area of land was never scraped away by glaciers; therefore it is much older than the rest of the state.

   Ask the students why the Central Sand Plain and the Driftless Area look so different if both of them remained unglaciated. Explain that as the glaciers melted they created large streams and rivers. The large amounts of water eventually formed Glacial Lake Wisconsin. The actions of these water bodies deposited sand throughout the region. Tell the students that this sand filled up all of the valleys and features in central Wisconsin creating this flat featureless area. Tell them that even today all of the soil in this area is made up mostly of sand. Have them draw both of these areas on their **Landforms of Wisconsin Map**.

Referring to your copy of the **Wisconsin Continental Divide Map** (don't put this overhead up yet), show your students the distinct wavy line that runs east to west in the most northern part of the state and the ridge that runs north to south in the eastern part of the state (it begins just east of the Central Sand Plain and runs northward). Explain to them that these are high points or ridges left behind by the glaciers. Draw a cross section of a ridge on the chalkboard that looks like the diagram below.

Tell the students that this drawing represents the end-view of a ridge. The arrows represent raindrops falling from the sky. Draw just one arrow at a time and ask the students which way they think the raindrop is going to flow after it hits the ridge. Tell them that all of the water that hits on the left of the peak will flow left and all of the water that lands on the right of the peak will flow right. Tell them that the top of the ridge is called a divide because it divides the way in which the water flows. Put up the **Wisconsin Continental Divide Map**.



Ask the students why it might be called the continental divide. Tell the students that all of the water that lands to the north and east of the continental divides will flow into streams and rivers that eventually flow into the Great Lakes. Likewise, all of the water that lands to the south and to the west of the continental divides will flow into streams and rivers that eventually flow into the Mississippi River.

Have them draw the continental divide onto their **Wisconsin Landforms Map**. Explain that the divide creates differences in temperatures and weather patterns. Tell the students that the colder temperatures and higher snowfall in the Lake Superior Lowland provides the conditions needed for the boreal forest. These cold temperatures are a result of the cold air coming off of Lake Superior. This "lake effect" cold air and snowfall is stopped by the ridge.

5. Put up the overhead of the **Natural Divisions of Wisconsin**. Ask your students if they see any similarities between the **Natural Divisions of Wisconsin** and their **Wisconsin Landform Maps** on which they have drawn boundaries of glaciation and climate. Invite students up to the overhead to show where these lines correlate. Have your students use their map to fill in the **Natural Divisions Information Chart**.

   After the chart is filled in, overview the differences between each of the areas. Explain that the factors outlined on the map create differences in environmental conditions and affect the types of trees that grow within each area.

Conclusion

Tell your students that they have just looked at how the physical environment of Wisconsin has affected where and what types of forests grow in our state. Ask them if they can think of any other factors that we have not talked about today that might affect where and what types of forests are present. *Human impact*. Put up the overhead of the **Current Land Use Map**. Have your students compare the **Current Land Use Map** to their **Wisconsin Landforms Map**. Ask if any similarities exist.

Have the students look at their **Natural Divisions Landform Chart**. Tell the students that before Wisconsin was settled, the forest types shown on their chart covered the landscape. Ask the students if they think that human use of the land over time has affected the distribution of forests in each of the natural divisions. Ask the students where on the map they think humans have changed the forest. They will most likely recognize the area listed as agriculture, but may not recognize the forested Northwoods. Tell them that in fact, all of our forests have been altered over time. Tell the students that they will be introduced to our land-use history in the next class.

Student Log Book

Ask students to write a paragraph describing the natural influences on Wisconsin's forest types. Students should incorporate their knowledge of the tension zone, glacial history, and general landscape of Wisconsin in their discussion.

Web Links

Wisconsin Department of Natural Resources— http://www.dnr.state.wi.us

US Forest Service—http://www.fs.fed.us

The Department of Botany at the University of Wisconsin-Madison— http://www.wisc.edu/botit/links.html

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Hole, Francis D. 1980. Soil Guide for Wisconsin Land Lookers. Geological and Natural History Survey and University of Wisconsin Extension. Bulletin 88. Soil Series 63.

Hole, Francis D. and Germain, Clifford E. 1994. Natural Divisions of Wisconsin. WDNR Publication. Madison, Wisconsin.

Wisconsin Forest Types

1) **Prairie** – notice the absence of trees

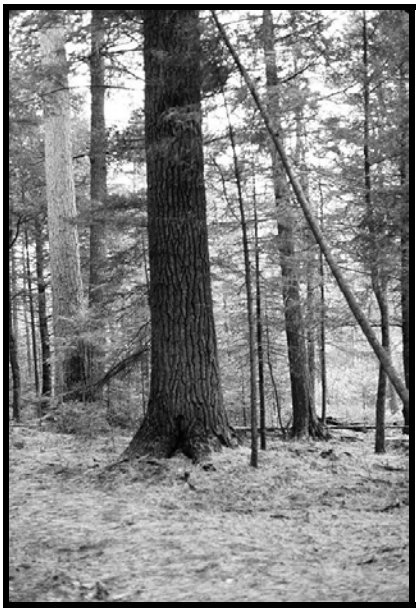
2) **Deciduous Forest** – mixture of broadleaf trees with no evergreen trees

3) **Boreal Forest** – all northern evergreen trees

4) **Oak Savanna** – widely spaced, mixed oak trees with no understory

5) **Pine Barren** – even aged stand of jack pine trees

6) **Mixed Forest** – a mixture of deciduous and coniferous trees



7) **Coniferous Forest** – mixed evergreen trees

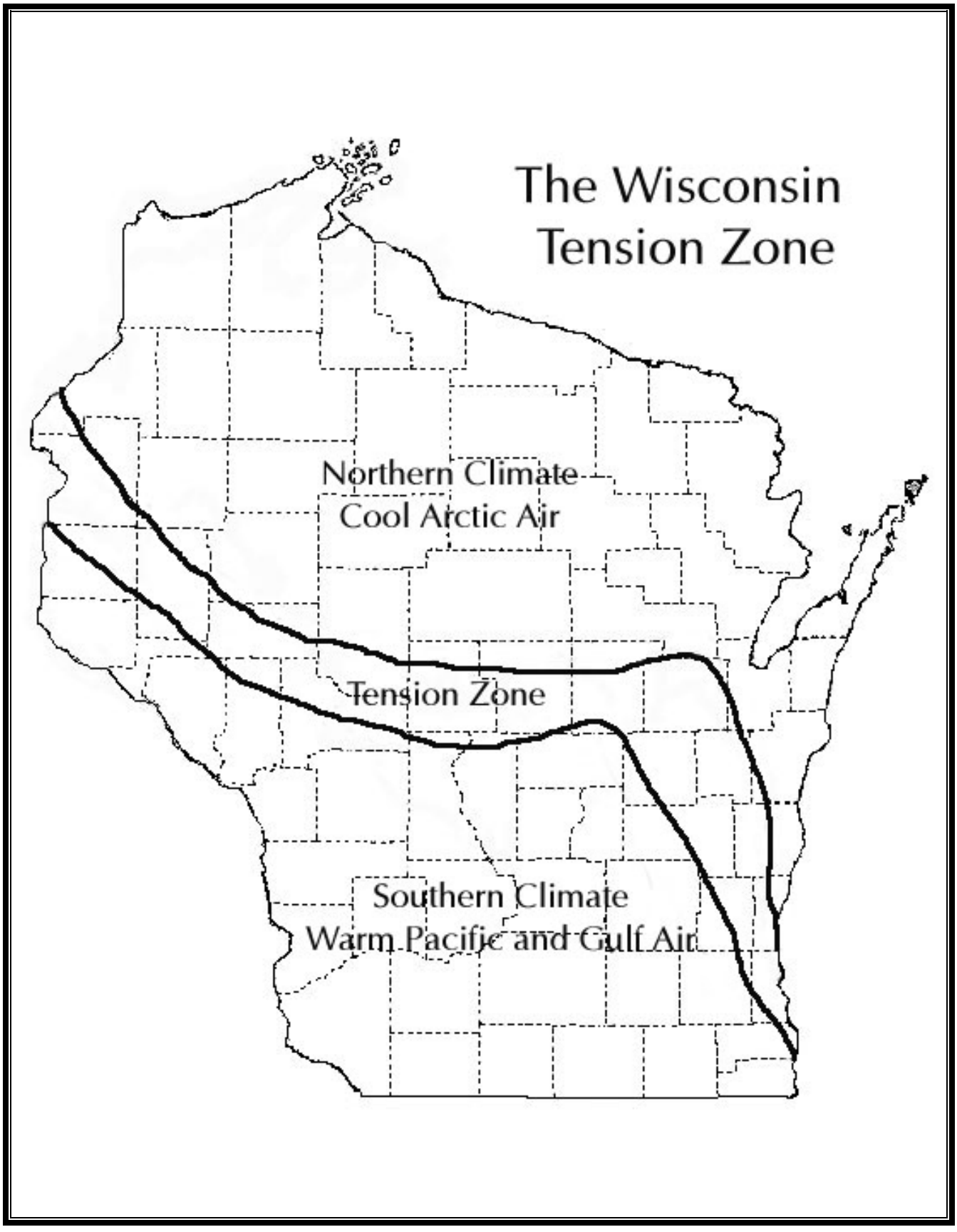
8) **Oak Woodlands** – forested area with mixed oak trees

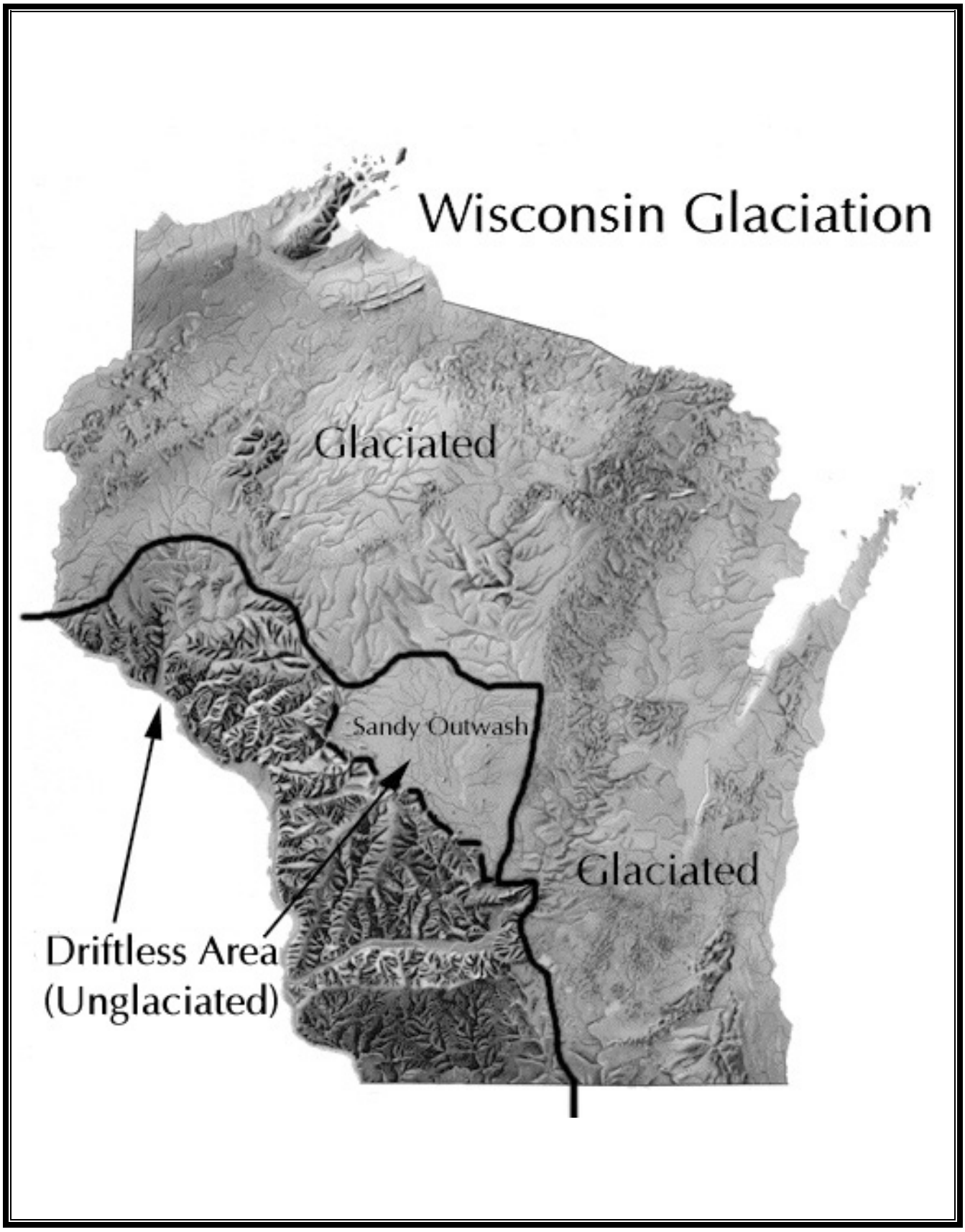
Natural Divisions Information Chart

Natural Divisions	Superior Lowland	Northern Highlands	Lake Michigan Shoreland	Central Sand Plains	Southeastern Ridge and Lowlands	Southwestern Highlands
Forest Types with Examples of Tree Composition	**Boreal –** Balsam Fir White Spruce Black Spruce White Cedar White Pine Tamarack	**Coniferous –** White Pine Red Pine Hemlock Balsam Fir	**Coniferous –** White Pine Hemlock White Cedar White Spruce	**Oak/ Pine Barrens –** Jack Pine Hill's Oak Black Oak	**Oak Savanna –** White Oak Bur Oak Black Oak Red Oak	**Oak Savanna –** Bur Oak White Oak Hill's Oak
		Deciduous – Sugar Maple White Birch Yellow Birch White Ash Basswood	**Deciduous –** Beech Sugar Maple Yellow Birch	**Oak Woodland –** Hill's Oak Black Oak White Oak Bur Oak Pin Oak	**Deciduous –** Sugar Maple Basswood Elm Hickory Red Oak	**Deciduous –** Sugar Maple Silver Maple Basswood Willow
Climate Zone (Southern, Northern or Lake Effect)						
Glacial History (Glaciated, Sandy Outwash or Unglaciated)						
Continental Divide (North, Northeast or Southwest)						

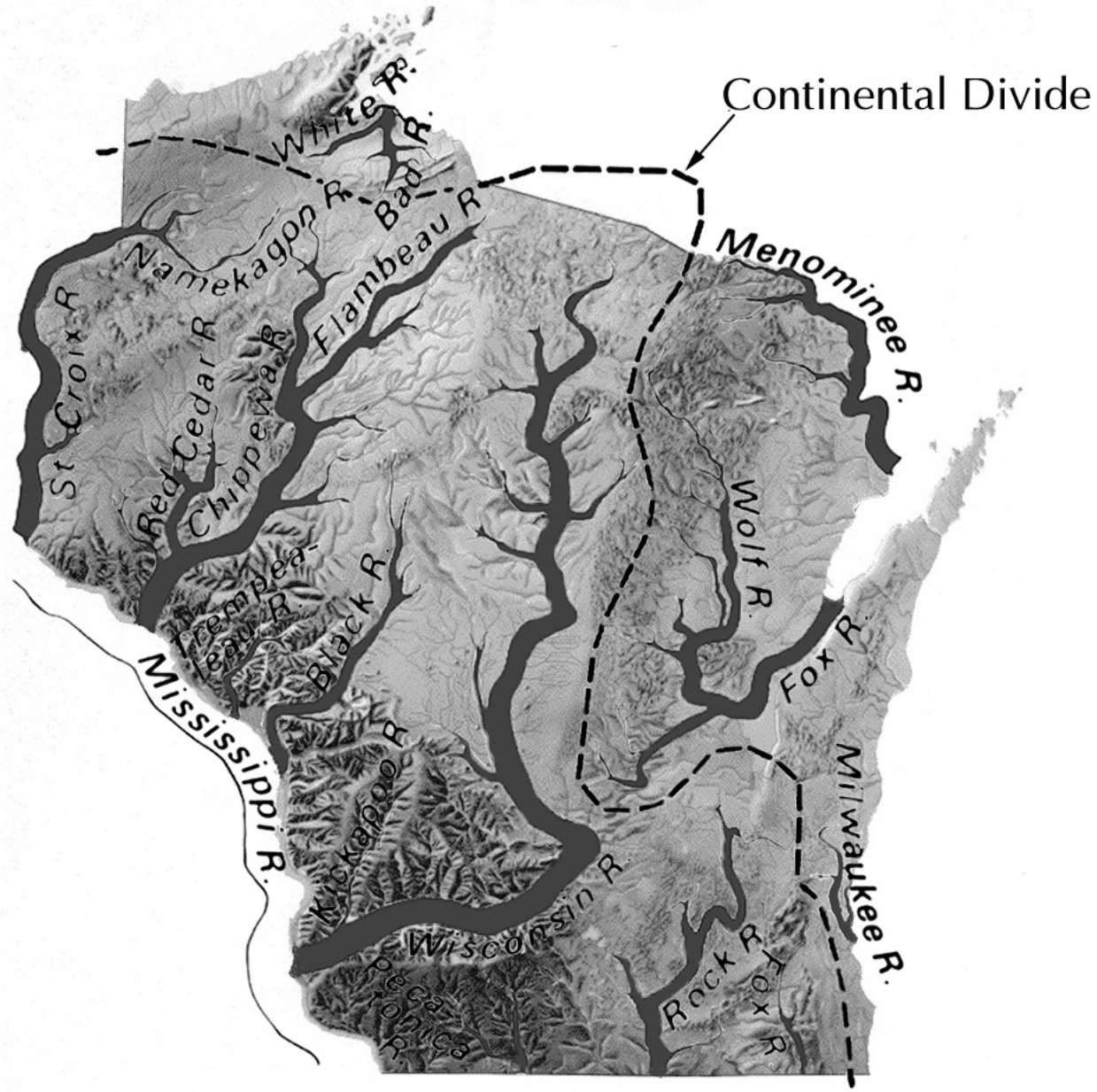

Landforms
of Wisconsin

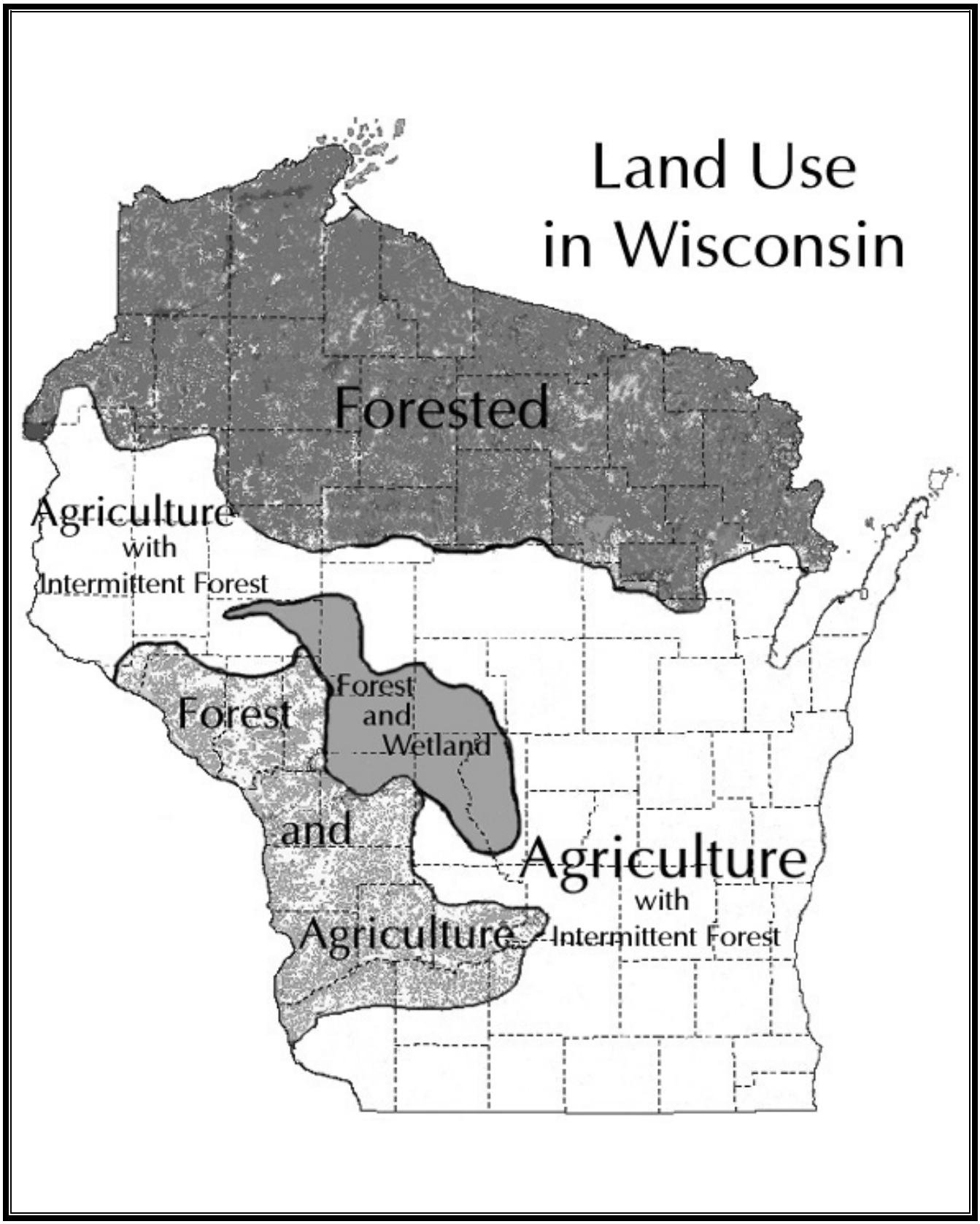

Natural Divisions of Wisconsin
Lake Superior Lowland
Boreal Forest
Northern Highland
Deciduous and Coniferous Forest
Lake Michigan Shoreland
Northern Deciduous & Coniferous Forest
Southwestern Upland
Central Sand Plain
Oak Pine Barrens, Oak Forest and Wetlands
Deciduous Forest, Oak Savanna, and Prairie
Southeastern Ridge & Lowlands
Deciduous Forest, Savanna, and Prairie


The Wisconsin
Tension Zone
Northern Climate
Cool Arctic Air
Tension Zone
Southern Climate
Warm Pacific and Gulf Air


Wisconsin Glaciation
Glaciated
Sandy Outwash
Glaciated
Driftless Area
(Unglaciated)

Wisconsin Continental Divide Map




Land Use
in Wisconsin
Forested
Agriculture
with
Intermittent Forest
Forest
and
Wetland
Forest
and
Agriculture
Agriculture
with
Intermittent Forest

Natural Divisions Information Chart (Answer Key)

Natural Divisions	Superior Lowland	Northern Highlands	Lake Michigan Shoreland	Central Sand Plains	Southeastern Ridge and Lowlands	Southwestern Highlands
Forest Types with Examples of Tree Composition	**Boreal –** Balsam Fir White Spruce Black Spruce White Cedar White Pine Tamarack	**Coniferous –** White Pine Red Pine Hemlock Balsam Fir	**Coniferous –** White Pine Hemlock White Cedar White Spruce	**Oak/ Pine Barrens –** Jack Pine Hill's Oak Black Oak	**Oak Savanna –** White Oak Bur Oak Black Oak Red Oak	**Oak Savanna –** Bur Oak White Oak Hill's Oak
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Climate Zone (Southern, Northern or Lake Effect)	Lake effect or northern (lake effect is not on the map but the concept is in the background information so students may have either answer)	Northern	Northern or lake effect	Southern	Southern	Southern
Glacial History (Glaciated, Sandy Outwash or Unglaciated)	Glaciated	Glaciated	Glaciated	Sandy outwash	Glaciated	Unglaciated
Continental Divide (North, Northeast or Southwest)	North	Southwest	Northeast	Southwest	Southwest	Southwest

Lesson Four

Wisconsin Forest History

Concepts
1. Nineteenth century logging greatly influenced Wisconsin's forested land.
2. The logging industry has played a major role in shaping Wisconsin's cultural geography, industry, transportation systems, economy, and location of communities.
3. Many consequences and benefits have resulted from the logging of Wisconsin's forests.

Objectives
Students will be able to:
1. Describe the role humans have played in altering Wisconsin's forests.
2. Explain the effects that logging and land-use have had on Wisconsin's forests.
3. Create a timeline of Wisconsin's forestry history.
4. Describe, in their own words, several consequences and benefits resulting from the exploitation of forests in Wisconsin.

Teaching Site
Classroom with overhead projector and wall space or chalkboard for hanging the Forest History Timeline

Materials
Day 1 – **Wisconsin Forest History passage**, history pictures as overhead transparencies, and copy of **Questions and Answers for the Reading Sheet**.

Day 2 – Forest History Timeline (must create), colored construction paper, markers/pens/colored pencils, glue, scissors, old magazines (optional), and masking tape

Lesson Time
Two 50-minute class periods

Nutshell
In this lesson, students will read a history passage and use the information they have acquired to create a timeline of Wisconsin's forestry history.

Teacher Preparation
Read the History passage, copy story for students, make transparencies of the story pictures, gather timeline materials for day two and prepare the history timeline.

Activities: Day One
Tell students they will be learning about the history of Wisconsin forestry through a fictional story that incorporates factual history of Wisconsin. It is told through the eyes of a young girl who has learned about Wisconsin history from her grandfather. Tell students they may want to take notes in their log books as you read the story because they will have an assignment to complete after the story. You can either read the story to the students, or have them take turns reading it to the class. Either way, make sure you provide them with a copy of the story to follow.

Pictures have been included that correspond with different parts of the story. As you read through the story, you will notice numbers preceded by a "P" in parentheses. The pictures included at the end of this lesson have corresponding numbers. Show the appropriate pictures on an overhead projector as you read through the story.

As you read through the story, you will find numbers preceded by a "Q" after certain paragraphs. These numbers correspond to the questions found on the **Questions and Answers for the Reading sheet**. Ask the questions as you read through the story, giving students a few minutes to discuss and reflect on the information they have just heard.

At the end of the story is a quote by Aldo Leopold. Aldo Leopold was a renowned conservationist from Wisconsin. He believed strongly in finding a harmonious balance between humans and the components of the earth. In his book, A Sand County Almanac, Leopold describes life through the seasons on his Wisconsin farm and attempts to impart three basic concepts to the reader:

- That 'land is a community' is the basic concept of ecology
- That 'land is to be loved and respected' is an extension of ethics
- That land yields a cultural (aesthetic) harvest

Once students have read through the story and discussed the questions, explain to them who Aldo Leopold was and have them read the quote. Discuss its meaning in relationship to the story with your students. Questions to guide this discussion can be found on the **Questions and Answers for the Reading sheet**.

Finally, let students know that they will be coming back to the story the next day, to complete a timeline based on the information which that they were introduced to today.

Activities: Day Two

Prior to class create the **Wisconsin Forest History Timeline** with the events and dates supplied in the activity. Use a long piece of butcher paper and a thick black marker to designate the events and dates on the butcher paper. Students will be creating a visual representation of events that took place within the story and pasting them onto this timeline. Leave enough space between the events to fit the students representations of the history story onto or around the timeline.

At the beginning of class take a moment to review with students the main parts of the history story. Show the class the Wisconsin Forest History Timeline that you have created and go through the dates and events on the timeline.

Explain to the students that the events in the story and the events on the timeline relate to one another. Tell students that as a final project for the history lesson, they will use the **Wisconsin Forest History Timeline** and the story to create a visual timeline that highlights the events from Wisconsin's forest history. The most important events can be taken directly from the story and timeline. It may be beneficial to discuss the story and timeline with the class and come to a consensus on the events that should be included.

Have students get in pairs or groups. Either let them choose a section or assign a section of the history story to each pair or group. It is fine to have more than one group work on the same section of a story, but make sure the entire story is covered.

Once students have a story section, tell them that they need to make a visual representation of their section. The goal of this assignment is to help the other students further understand the reading. The visual can be a drawing, a collage or some other type of visual, but it must focus on their section and be understandable to the rest of the class. Give students about 25 minutes to use colored paper, markers, glue, tape, old magazines and/or other art supplies that you have available for the students to use.

Once the students have completed their visual, have each group present their picture and explain how it relates to their section of the story and how it relates to the actual events listed at that point of time on the timeline. As each group finishes their presentation, have them place their visual on the timeline, so that each visual is in the correct chronological order and correlates with the timeline. When all visuals are up on the timeline, students will have a visual timeline they can refer to for the rest of the unit.

Student Log Book

Tell students that they have the opportunity to change a small portion of Wisconsin's logging history. Ask them to explain at least one thing about Wisconsin's logging history that they would change. They should justify their explanation by using information presented throughout the story that concerns the benefits and consequences of our logging history.

Resources

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Photography

The historic photos used throughout this lesson are part of a large collection of historic photos available at the State Historical Society in Madison, Wisconsin.

Questions and Answers for the Reading

Q1. Why were settlers coming to Wisconsin? *(In the beginning, to start a new life with land, wealth and adventure, later for work and to start over after the Civil War, still later for land and work)* What did they do when they arrived here? *(many worked in some aspect of the timber industry, then much later, when the trees were all harvested, they began farming)*

Q2. Describe how you think Native American land use impacted Wisconsin's forest structure and composition. *(Used fire to burn small clearings, to attract game and new plants, creating a patchwork of different, younger plants and trees interspersed with the older forest. These patches had different composition and structure than the forests around them. The fire also created the vast prairies and oak savannas that were once a large portion of Southern WI)*

Q3. What do you think the white pines, with their special characteristics were used for? *(Masts, building materials for houses, etc.)*

Q4. Why didn't the settlers want England to have first choice of the white pines? *(They couldn't get as much of a profit, were going to war with them shortly – Americans would have to fight against ships with the white pine masts that had been harvested in America)*

Q5. How did the transportation system in Wisconsin change? *(From rivers to railroads)* What effect did this have on the timber industry and the northern forests? *(They could access the northern forests that were too difficult to get to by other methods)*

Q6. How could these fires have started? *(Besides farmers - lightning, careless match, etc.)*

Q7. Where did the rocks come from that the farmers had such problems with? *(Glaciers left them behind – review lesson three)*

Q8. How can you distinguish most replanted forests from natural forests? (I*n replanted forests, the trees are planted in straight lines and usually all of the same type – plantations)*

Q9. What did you learn from this story about how our ancestors treated the land? With the advantage of the knowledge you now have, would you have done anything differently?

Questions for the Leopold Quote

> *"When some remote ancestor of ours invented the shovel, he became a giver; he could plant a tree. And when the axe was invented, he became a taker; he could chop it down. Whoever owns land has thus assumed, whether he knows it or not, the divine functions of creating and destroying plants."*
>
> Aldo Leopold, 1949 - *A Sand County Almanac*

Ask students what they think Leopold means by this statement. Analyze the quote with the following questions: A giver to whom? What is he giving? A taker of what and from whom? What has man assumed? Ask the class to correlate this quote to what they know about Wisconsin's forest history and ask the same questions again. Ask the students if, from what they have learned, they think humans have had an impact on the forests of Wisconsin. Brainstorm these impacts with the entire class.

One of the strongest memories of my childhood is the summer my younger brother and I spent with our grandfather in the Northwoods of Wisconsin. I was about 11 years old that summer, and my brother was 4. We lived down in Milwaukee at the time, and Grandpa's house - really old, wooden, two stories, set back in the woods - always scared me a little bit. One thing about the house I really remember is all the long hallways filled with doors leading to different rooms. I remember thinking that some of those rooms probably hadn't been used in years.

Grandpa would always doze off in the afternoons in his big leather chair, and as soon as I noticed this, I would make my brother sneak upstairs with me. I always felt safer when he was with me, even though he was only 4 years old. I remember staring down the long hallway at the top of the stairs and wondering what was behind some of the closed doors of the rooms. More furniture? Who once slept there? Why were the doors shut?

We could never gather the courage to open one of the doors. Inevitably, we would end up back in the living room whispering, "Grandpa wake up." Finally one day towards the end of the summer, I nervously sputtered a request to my Grandfather.

"Grandpa, I was wondering if you would tell me what is in some of the rooms upstairs?"

He stared at his morning paper for a long time, taking his glasses off and then putting them on again. I wondered if he hadn't heard me.

"Grandpa, I was..."
"Yes," he said slowly. "I think I would like to show you some of the things in the rooms upstairs."

I sat on the living room couch, half frozen and half ready to make a mad dash up the stairs. I helped Grandpa out of his chair and ascended the stairwell slowly with him. The upstairs was dark except for a little light coming through the window at the end of the hallway. Grandpa led me to one of the first doors and slowly opened it. We entered a room that was darker than the hallway. I immediately sneezed as I breathed in the musty smell.

"Just a minute, kiddo, I have a lamp over here."

I heard Grandpa fumbling around for the lamp and then a dim light appeared, showing me a room crammed full of boxes, pictures, and furniture. It seemed that every square inch of space was taken up. Elaborately framed pictures were leaning on many of the boxes. I carefully followed Grandpa to a dusty desk that was beside the bed. He sat in the chair by the desk and I found a stable seat atop one of the boxes next to him.

I vividly remember the time we spent in the room that day. Grandpa spent hours telling me stories about my family – about my ancestors. I didn't understand everything he told me, but I was interested in what he was sharing because he was very emotional about it all. Sometimes he would laugh out loud when he showed me old photographs; other times he was very serious about the connections our family has to the land and trees of Wisconsin.

One of the first stories Grandpa told me was how my distant relatives came to be some of the first settlers of Wisconsin. My great- great- great- grandparents, Sven and Lena Anderson, came to Wisconsin from Sweden in 1832. They were hoping to find a new way of life that included land, wealth and, of course, adventure. There were a lot of other immigrants coming into southeast Wisconsin as part of that first wave of people, which lasted from 1830 to1850. Sven and Lena found some success here, and apparently sent letters to their brothers and sisters back in Sweden. These letters spoke of the good farming and the endless white pines and the money that could be made by logging and clearing the land up North. Their nephew, Erik Olsen, found his way to Wisconsin from the east coast in 1856. He had heard about the lumber mills and logging companies that paid good wages for hard workers from his aunt and uncle. He was part of the second major wave of people who came to Wisconsin between 1850 and 1860.

Erik left Wisconsin in 1861 to fight in the Civil War. He managed to survive through four years of fighting, and brought his brother Nels back to Wisconsin with him in 1866. Many others were travelling to Wisconsin, looking for work in the logging industry, which was really booming by this time. This third wave of people lasted from 1865 at the end of the Civil War to about 1880.

One last major group of settlers came into Wisconsin between 1880 and 1920. Grandpa showed me a picture of his mother and my great-grandmother, Ingrid Peterson. She had come to Wisconsin with her parents from Sweden in 1890. The trees had all been logged out by this time, and the government was pushing for more people to come and farm this cleared land. Many of the loggers had moved out west, looking for more trees, but my relatives decided to stay and try to farm the land they had previously logged. Grandpa told me that my great-grandfather Carl Anderson met Ingrid at a dance one night, and they eventually got married and had children, including my Grandpa. **(Q1)**

Grandpa told me lots of stories throughout the last few weeks of the summer. I just couldn't get enough information about my relatives. Another story was about how when Sven and Lena moved into Wisconsin. **(P1)** Their first impression of the trees was that they were inexhaustible and that once logging started, it would never end. My relatives realized how valuable the trees were and how they could profit from them. **(P2)** Grandpa told me, "There were so many trees in Wisconsin. Imagine a land with no roads or homes. Just trees, after trees, after trees. Some trees were wider than you are tall. It was said that a squirrel could travel across the state without ever coming down from those trees."

Sven and Lena realized they were sitting on a gold mine of opportunity. Almost all of the money made by them and the other early settlers came from logging. There were many jobs related to the lumber industry: cutting the trees down, hauling them out of the forest, and sawing them into lumber which could be sold.

These settlers, however, disrupted the lives of the Native Americans who had been living in Wisconsin for thousands of years. These tribes believed in using the land, not owning it. They did not believe that humans could own the land. This view was very much at odds with how settlers viewed the land. The settlers were removing the trees from their own land as fast as they could to make money. Once all the trees were gone, they would sell or abandon their land and move on to repeat the process in a new place. They didn't seem to think about the effect their rapid removal of trees would have.

I asked Grandpa how Native Americans used the land differently than the settlers. He asked me how much I thought a tree was worth. I thought it was a strange question, but I told him, maybe

100 dollars. He told me that Native Americans didn't view a tree's worth in dollars and cents. They valued trees for the resources they provided, like shelter, food, and habitat for game animals. He gave me an example of how the Native Americans used fire to clear only small parts of the forest. These clearings attracted game animals that were looking for food. Young plants would also become established in this newly cleared area. The Native Americans used these plants and animals for food and clothing. (Q2)

(P3) One of the framed pictures in that old musty room was a black and white photo of Erik Olssen. When grandpa and I looked at it under the dim light, it wasn't Erik that amazed me, but the tree he was standing under. "That tree is huge," I remember telling Grandpa. "Yes it is. That's a white pine – they reached 150 feet in height, half the length of a football field. They were all over Wisconsin when your relatives first came here," Grandpa said.

(P4) Grandpa continued to tell me that the white pines' popularity started in the New England states, in the mid-1700's, before the Revolutionary War. The white pine is very special because the wood is very light and soft compared to other wood. The best part, though, was that the trees were so tall and straight. (Q3)

Because of this, the wood was in demand all over the world, especially to the Queen of England and her subjects. They were interested in reserving the very largest and mightiest trees for the Royal Navy of England. Since the white pines were straight, light, and sturdy, they were perfect for ship masts. Loggers in New England didn't want to have to save the best trees for some distant Queen, thousands of miles away.

Because of this and similar disagreements, England began announcing trade regulations and rules that affected all kinds of products important to the colonies, such as tea and lumber. No one was pleased with England's demands. This unhappiness led to our country wanting independence from England. As it became obvious that a war was going to break out soon, the loggers realized that Americans could end up fighting English ships fitted with white pine masts that they had logged.

In 1774 Congress stopped the export of everything to England, including the white pine. The American Revolution began one year later. Other nations, like Spain and Portugal, kept up the demand for American white pines. They wanted them for shipbuilding and construction and were willing to pay top dollar. "As your relatives came to Wisconsin, the logging companies they worked for were making quite a profit selling these huge trees at a top price on the market," Grandpa said. (Q4)

In 1836, after Sven and Lena had been here for four years, the Wisconsin Territory was created. Twelve years later, in 1848, Wisconsin was established as a state. (P5) When Erik arrived in 1856, lumber mills had popped up all over Wisconsin and the state's rivers made up the major transportation system. Once the logs were cut, men would float them down river to the sawmill. The logging industry created many mill towns along Wisconsin¹s rivers. Towns such as Appleton, Green Bay, and Stevens Point were known for transforming logs into lumber for our growing nation.

At first, the pineries farther north were not popular lumbering areas because of the steep and winding waterways. These waterways made it difficult to transport logs down the river. (P6) That all changed when railroads arrived in the mid-1800s and there was access to the north country for transporting timber. Many of these railroad lines are still transporting logs for lumber and paper

companies today. The railroads were usually built on the flat stretches of land. (P7) This terrain also happened to be perfect for highways. Many highways were built over old railroad lines. Sometimes you can see old railroad tracks running along side the highway. (Q5)

Another effect the lumber mills had on Wisconsin can be seen in the buildings and homes that surround the state. The white pine proved to be the most generally useful wood in Wisconsin's and America's history. Thousands of homes all across Wisconsin had been built with white pine by 1905. In fact, I learned that Grandpa's house had been built from white pine trees that his father, Carl Anderson, had logged.

(P8) At turn of the century, over ninety percent of Wisconsin's forest trees had been logged. They were either utilized for development, exported to other states or countries, lost at the bottom of lakes and rivers, or left on the forest floor to fuel enormous wildfires. The mass logging of the forests produced many ecological changes in Wisconsin's forests. The mass removal of trees allowed much of our soil to be lost into rivers and streams and washed away. Not only the soil, but logs and tremendous amounts of sawdust and wood chips clogged our waterways. Just looking at the pictures of the old forests with Grandpa, I could tell that the forests then were totally different than our forests today.

(P9) By the time Grandpa was born, in 1898, his parents had been trying to farm the land that had been logged off for about 4 years. This was the only work left. There just weren't any trees left to be harvested. "Farmers used fire to do a lot of their work," Grandpa told me. They used it to burn cut land so that it would be ready for planting. Fire was used to clear away the leftover tree stumps and slash. Deposits of valuable soil nutrients were left by the fires. The farmers hoped their crops would be successful, after being planted in this rich soil.

All the dead wood, or slash as the lumbermen called it, was left on the ground by the loggers and became a big problem. (P10) This dry slash fueled the most severe fires in Wisconsin's history. Fires started by the farmers could get out of control very easily with all of that fuel ready to burn. One such fire, the Peshtigo Fire in 1871, has been called one of our country's greatest catastrophes. It killed 1400 people and burned 1,250,000 acres of land - an area larger than one million football fields! (Q6)

As the occurrences of fires increased throughout Wisconsin's forests, the environmental conditions throughout many areas began to change. Grandpa told me that some trees need fire to reproduce, while others are destroyed by fire. The seeds of the white and red pine trees could not survive the heat of the fires. They could not reproduce. On the other hand, most jack pine cones would *release* seeds if exposed to fire. These seeds spread across the burned land and grew in abundance. Grandpa said that today the jack pine is found in areas where it wasn't found before the logging companies came through Wisconsin.

(P11) Making the transition to farming in these burned and cut-over areas wasn't easy for my great-grandfather, or for the other farmers in Wisconsin. Over time, the soil began to lose nutrients and harvests became smaller and smaller. The colder weather up north meant a shorter growing season. The farmers had a lot of large rocks to work around when plowing their soil, some that were too large to move. (P12) By the 1920s most farmers had abandoned their land and started to look for work elsewhere. In their abandoned fields aspen and white birch trees started to grow where the oaks, maples, and other trees originally thrived. (Q7)

With the original forests cleared and farms abandoned, many people wondered what to do with all this land. **(P13)** A man by the name of Edward M. Griffith became the Wisconsin Forestry Commissioner in the early 1900s. He was one of the first to realize the benefits of replanting trees. Mr. Griffith had a hard time convincing people how replanting the trees would be helpful to the state. Grandpa said it was a hard sell. As far as he was concerned, his ancestors had worked very hard to cut the trees down. After all that hard work, what was to be gained by replanting?

Griffith found plenty of opposition to his tree-planting scheme and was kicked out of office shortly after his work began. Eventually though, his idea caught on, and replanting became very popular. **(P14)** By the late 1920s, tree farms, including the one Grandpa planted on my family's land, began to spring up in the state and seedlings planted on these farms were reforesting the clear-cut land of Wisconsin. New laws protected the trees from being cut down too soon.

Prosperity didn't last for long after the stock market crashed in 1929. Wisconsin farmers were in the midst of the Great Depression for the next six years. During this time, many of the farmers couldn't pay the taxes on their tree farms. Grandpa said that he and my Grandma had to sell some of their land off, but were able to keep the farmhouse. He said that many of the farmers around him had to let all their property go to the government. Many of the county and national forests in Wisconsin started from this land that was taken by the government.

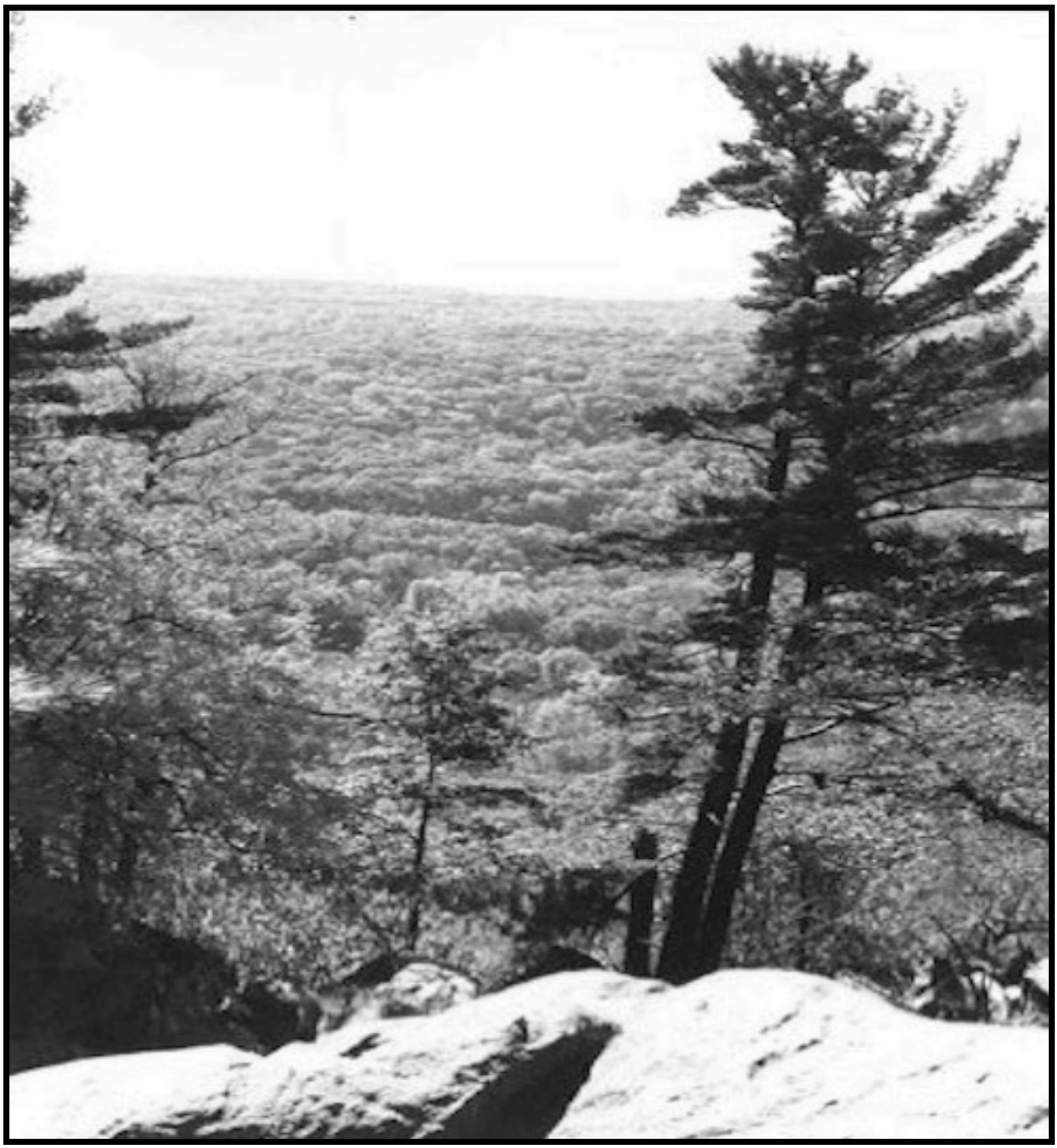
One way that people were able to find work in these hard times was through the Civilian Conservation Corps, otherwise known as the CCC. The CCC was put in charge of replanting a lot of the national and county forests. Friends of Grandpa's worked for the CCC replanting land up north with trees after they had lost their farms in the Depression. Grandpa told me that due to workers like his friends, the Northwoods was replanted with the trees that make it so beautiful today. In fact, by the 1960's over two-thirds of Northern Wisconsin was forested again, largely due to these replanting efforts and the natural regeneration now encouraged by the northern counties. **(Q8)**

Before that summer, I hadn't really understood the connections that my family had to the North woods. I eventually became a high school science teacher, partly because of the interest in the forest that my Grandpa sparked in me. Now I try to help my students understand the connections *they* have to the Northwoods, whether their family has lived in Wisconsin for 2 years or 150 years. I tell my classes the stories that my grandfather told me, and we often wonder what it was like back then. I try to help them understand the value of looking back at what our ancestors have done and learning from their mistakes and from their successes. I hope that you will take a moment to think about what your connections with the Northwoods of Wisconsin may be. Think about what you have learned that will help your generation live in balance with the forests. **(Q9)**

Events for The Wisconsin History Timeline

1809 First saw mill in Wisconsin at De Pere on Fox River.
1832 Black Hawk War ends. First surge of European settlement.
1836 Creation of Wisconsin Territory. Timber harvest began as native people lost their land.
1848 Wisconsin statehood. First Wisconsin paper mill built in Milwaukee.
1850 First railroad in Wisconsin built from Milwaukee to Waukeesha.
1861-65 Civil War
1871 Peshtigo Fire
1880 Logging becomes number 1 industry in Wisconsin (continues for 30 years).
1899 Wisconsin becomes highest timber producer in the nation. Produced 9.7% of all lumber.
1903 State Forestry Commission established and within two years acquired ¼ million acres of tax delinquent land.
1904 Edward Griffith appointed State Forester.
1906 State Reforestation Fund created.
1911 First Wisconsin tree nursery established at Trout Lake.
1913 Representatives of five northern Wisconsin counties formed an opposition to state forestry work.
1914 -18 WW I
1915 Wisconsin Supreme Court decides no further state funds to be spent on forestry.
1924 Referendum passed allowing state to spend money on forestry.
1925 Federal government purchases land for two national forests in Wisconsin, to be later named Chequamegon and Nicolet.
1928 First school forests in the nation are dedicated at Crandon and Leona. First county forest established in Langlade County.
1929-35 Great Depression
1933 Civilian Conservation Corps (CCC) created to fight forest fires and plant trees.
1941-45 WWII
1953-present Wisconsin becomes number one paper making state.
1960-present Fire used as a forest management tool.
1960 Over 2/3 of northern Wisconsin was reforested.

P1



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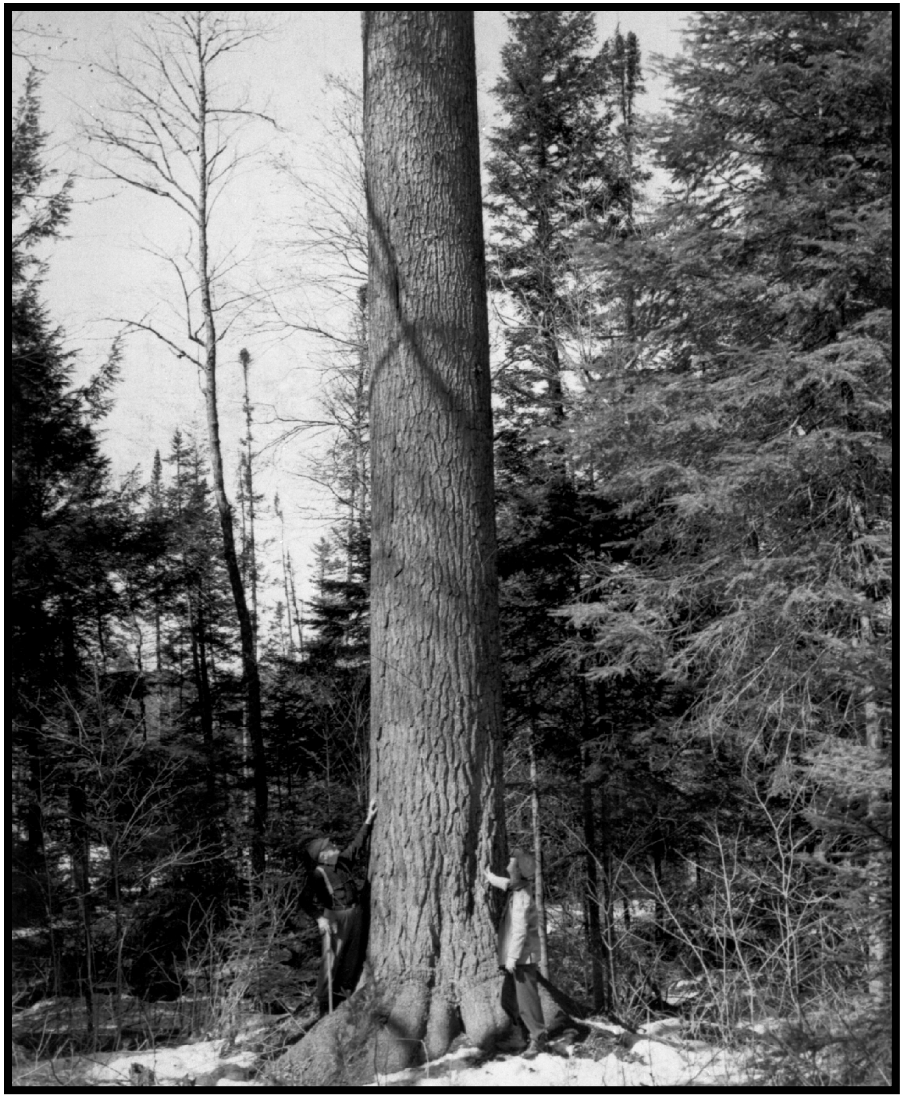
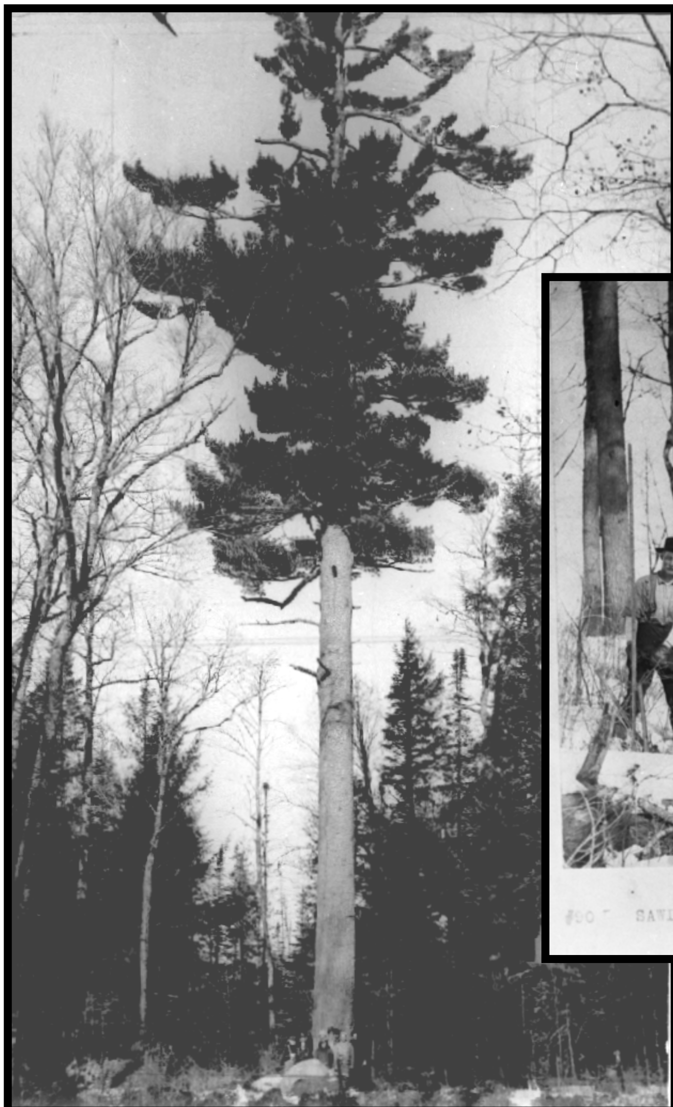


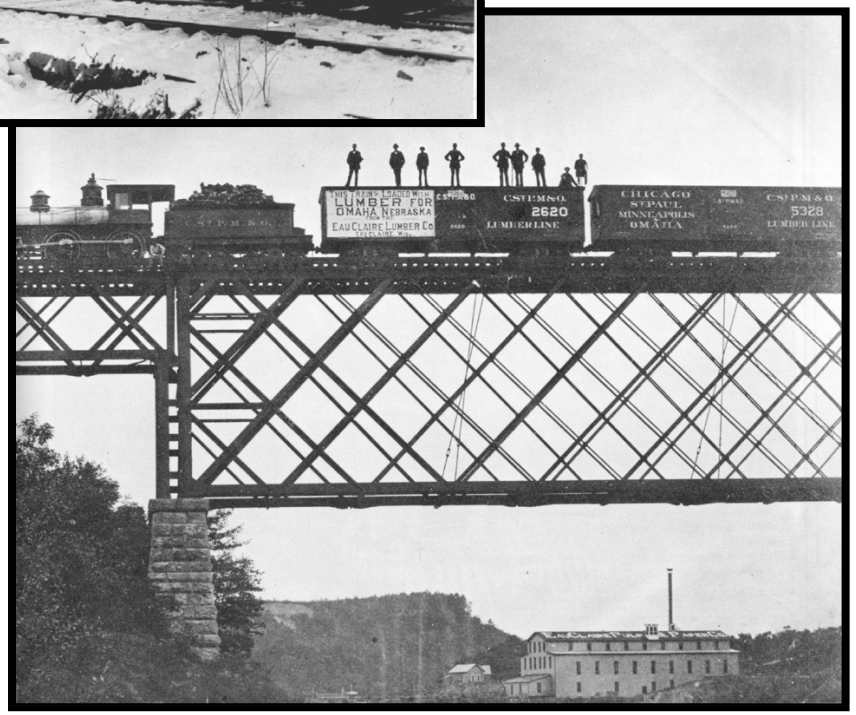



SAWING DOWN TIMBER. MOSES & GAYNOR CAMP. LOST LAKE, WIS. 1900

P4

P5

P6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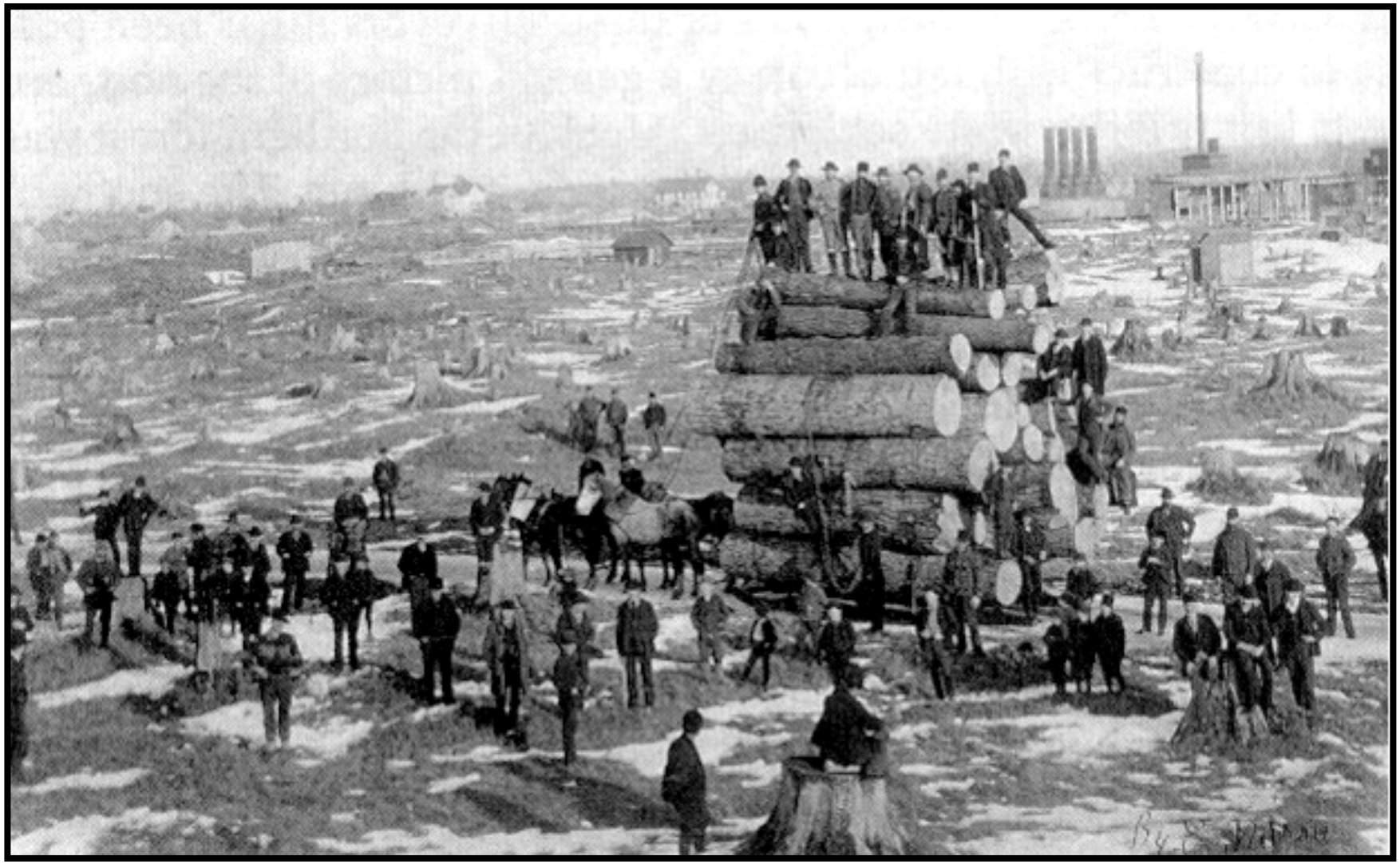

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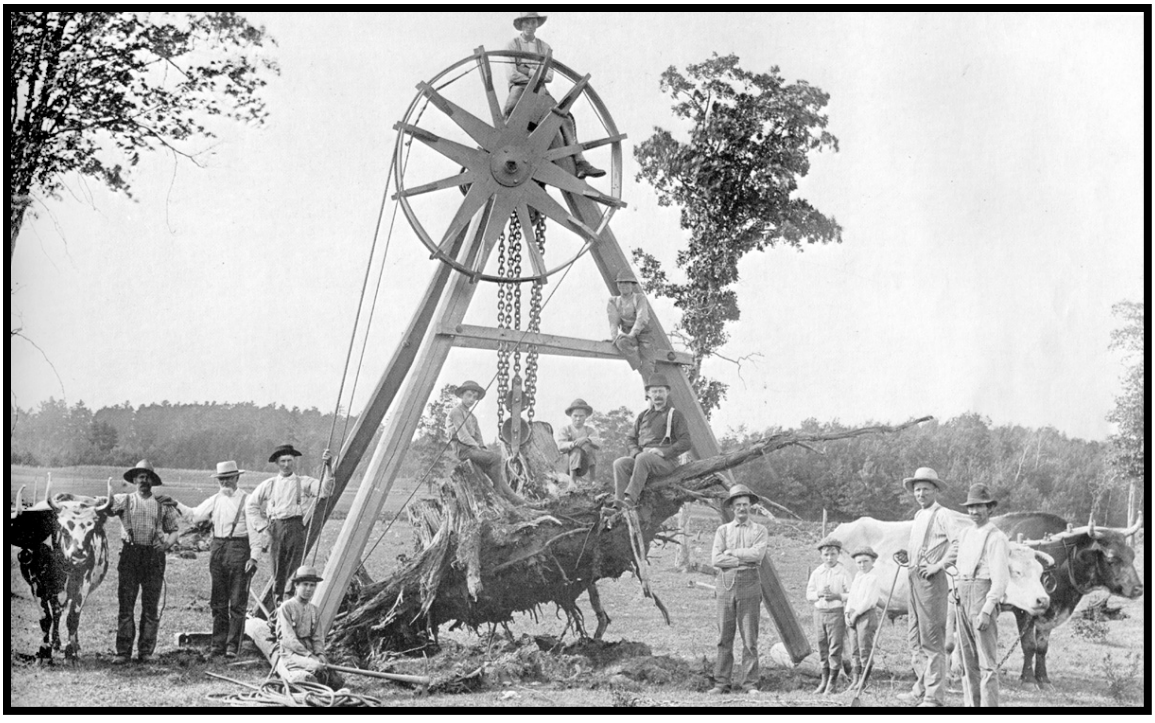


P12

P13

P14

Cut these cards apart and hang them in order to create a timeline. They can be spaced to fit the artwork created by the students during **day two of lesson four** of Wisconsin Forestree.

Wisconsin Forest History Timeline

1809

First saw mill in Wisconsin at De Pere on the Fox River.

1832

Black Hawk war ends. First surge of European settlement.

1836

Creation of Wisconsin Territory. Timber harvest began as native people lost their land.

1848

Wisconsin statehood. First Wisconsin paper mill built in Milwaukee.

1850

First railroad in Wisconsin built from Milwaukee to Waukesha.

1861-65

Civil War.

1871

Peshtigo fire.

1880

Logging becomes number 1 industry in Wisconsin. This continues for 30 years.

1899

Wisconsin becomes highest timber producer in the nation--produced 9.7% of all lumber.

1903

State Forestry Commission established and within two years acquired 1/4 million acres of tax delinquent land.

1904

Edward Griffith appointed first Wisconsin Forestry Commissioner (State Forester).

1906

State Reforestation Fund created.

1911

First Wisconsin tree nursery established at Trout Lake.

1913

Representatives of five northern Wisconsin counties formed an opposition to state forestry work.

1914-18

World War I.

1915

Wisconsin Supreme Court decides no further state funds to be spent on forestry.

1924

Referendum passed allowing the state to spend money on forestry.

1925

Federal government purchases land for two national forests in Wisconsin, to be later named Chequamegon and Nicolet.

1928

First school forests in the nation are dedicated at Crandon and Leona. First county forest established in Langlade County.

1929-35

Great Depression.

1933

Civilian Conservation Corps (CCC) created to fight forest fires and plant trees.

1941-45

World War II.

1953-present

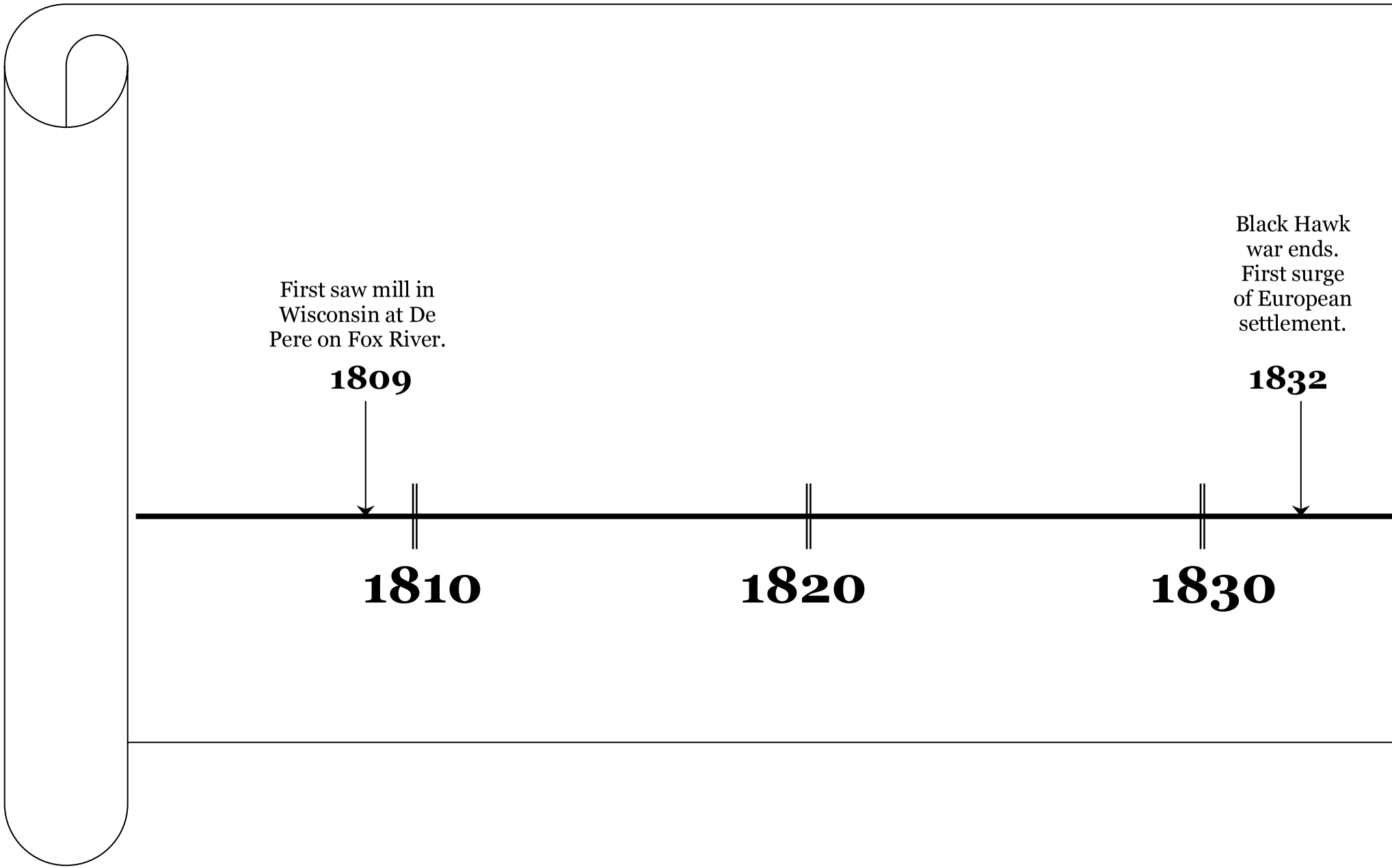
Wisconsin is number one paper making state.

1960-present

Fire used as a forest management tool.

1960

Over 2/3 of northern Wisconsin had been reforested.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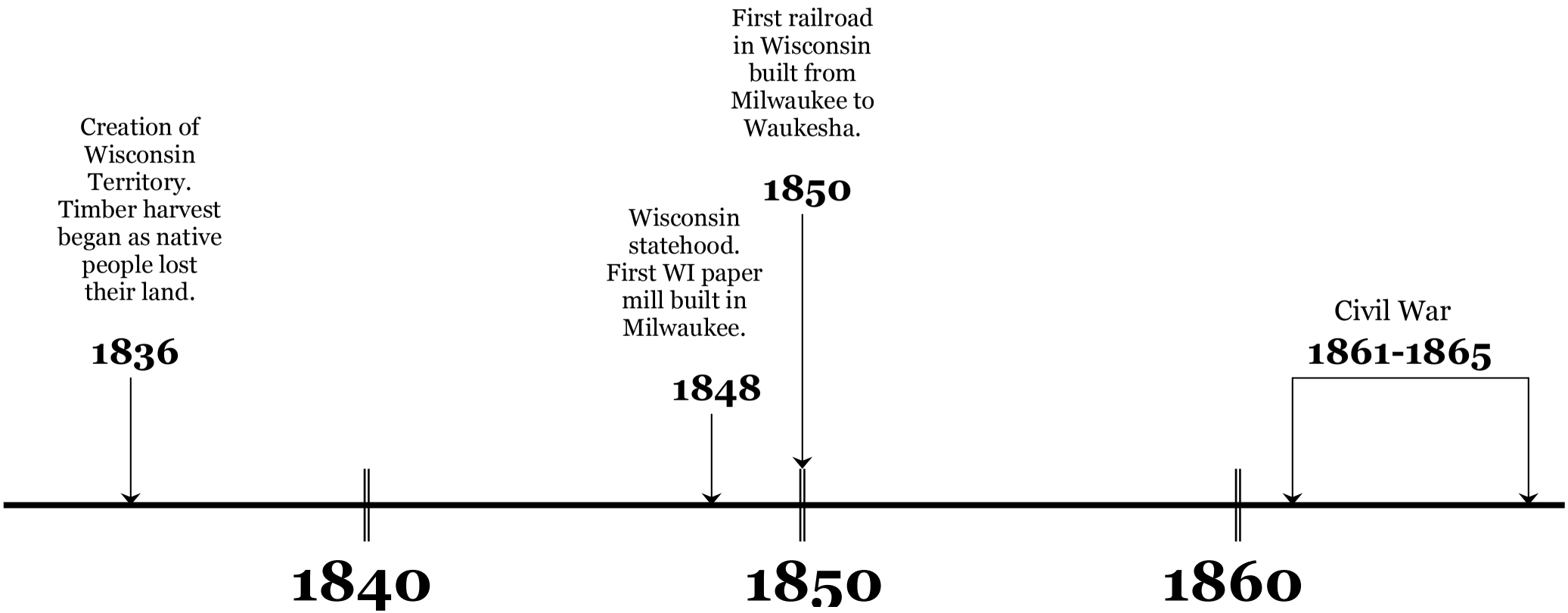
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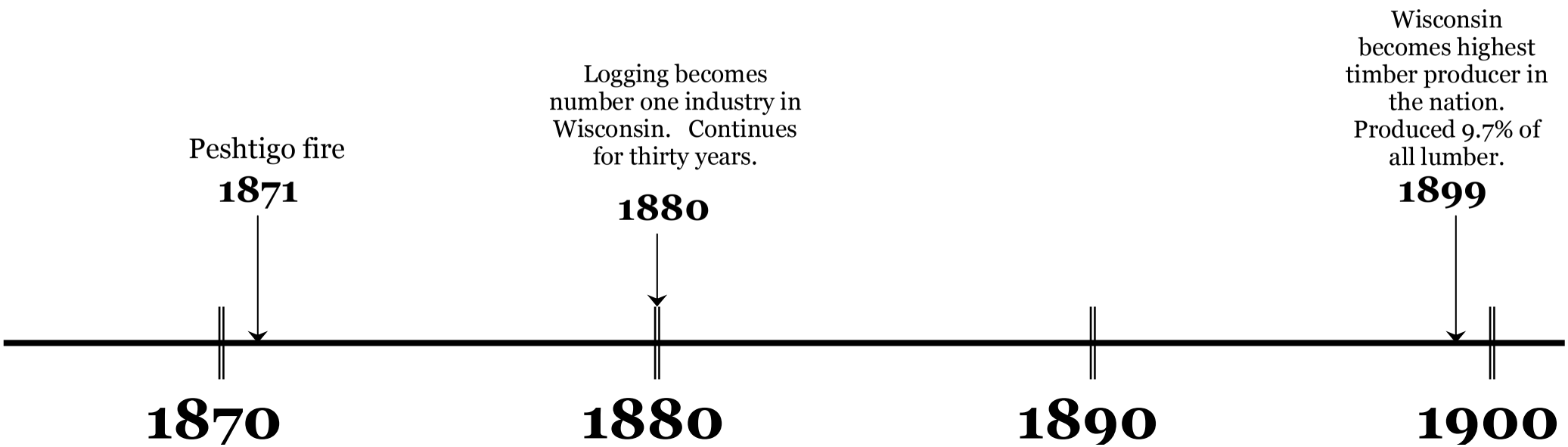
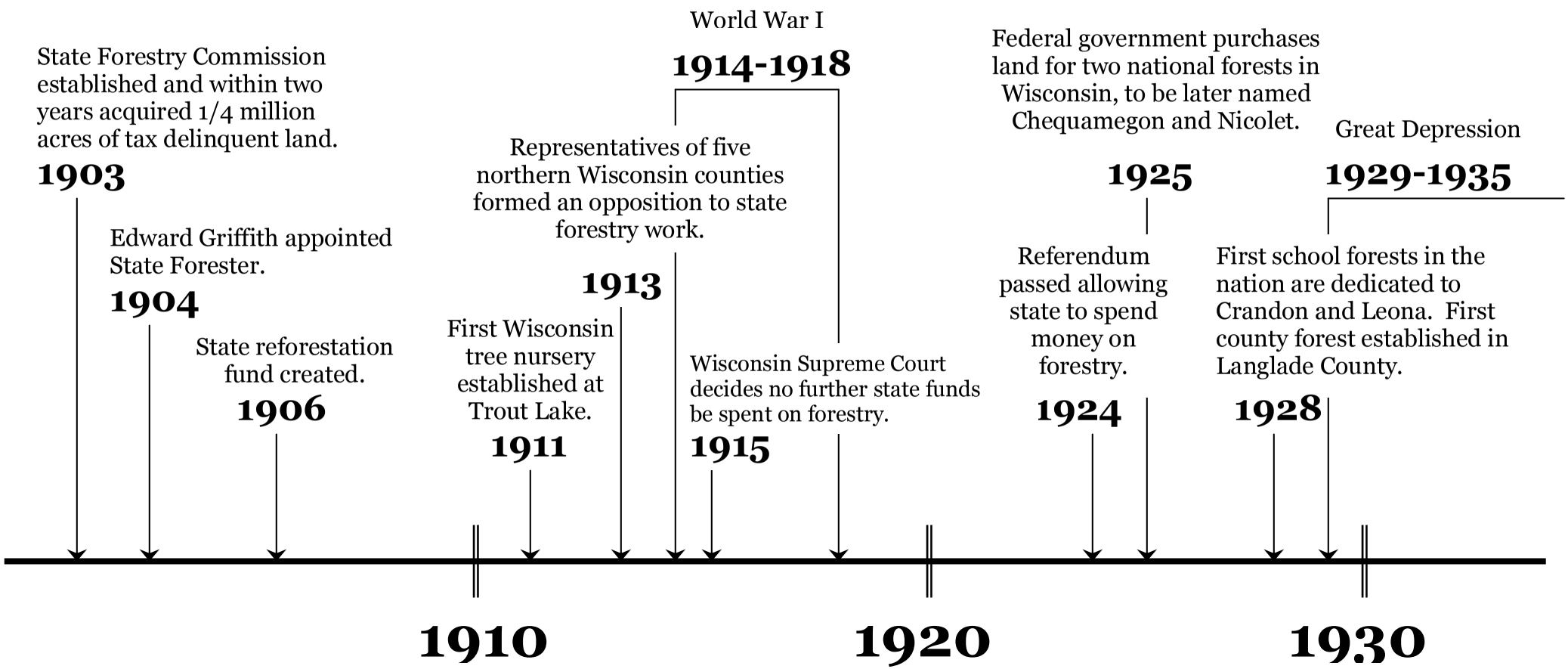
1850
Civil War
1861-1865
1840
1850
1860

Wisconsin Forest History Timeline

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1913
World War I
1914-1918
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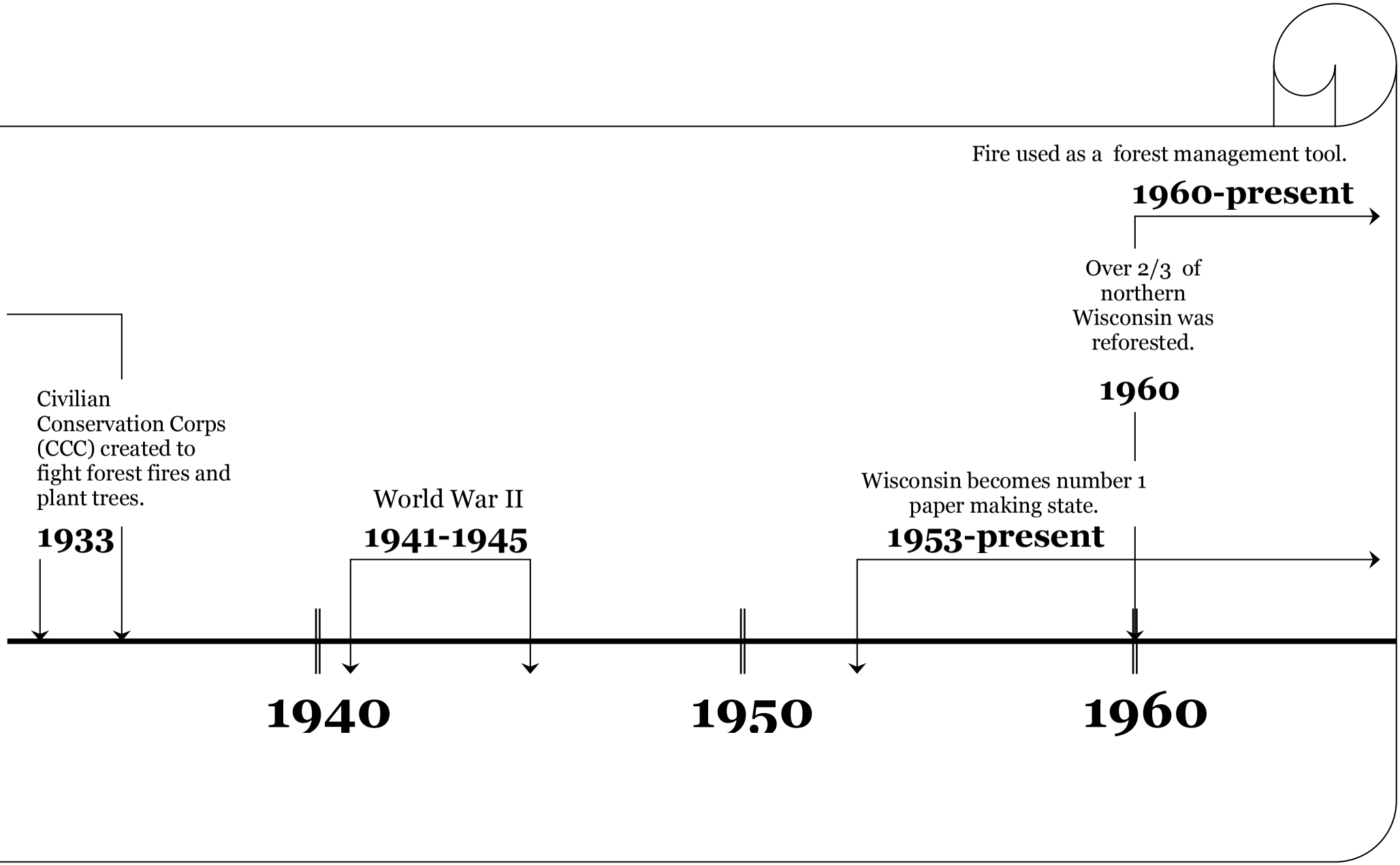
1915
Federal government purchases land for two national forests in Wisconsin, to be later named Chequamegon and Nicolet.
1925
Referendum passed allowing state to spend money on forestry.
1924
Great Depression
1929-1935
First school forests in the nation are dedicated to Crandon and Leona. First county forest established in Langlade County.
1928
1910
1920
1930


Fire used as a forest management tool.
1960-present
Over 2/3 of northern Wisconsin was reforested.
1960
Civilian Conservation Corps (CCC) created to fight forest fires and plant trees.
1933
World War II
1941-1945
Wisconsin becomes number 1 paper making state.
1953-present
1940
1950
1960

Lesson Five

Forest Utility

Concepts
1. Humans rely on forest products for a variety of everyday uses.
2. The forests of Wisconsin provide an indispensable source of employment.
3. Wisconsin's forests provide an important source of material for a variety of industries.

Objectives
Students will be able to:
List and categorize everyday items that come from trees.
1. Differentiate all of the industries affected by the production of one forest product.
2. Calculate the percentage of Wisconsin's workforce by industry and analyze which jobs are forest related.
3. Visually represent the economic output of land-based industries.

Teaching Site
Indoor classroom conducive to group work and class discussion.

Materials
Chalkboard and chalk, list of Wisconsin forest products found in the activity portion of the lesson, Copies of Jobs in Wisconsin Worksheet. Calculators for each two students.

Lesson Time
One 50-minute class period.

Nutshell
In this lesson students will discuss how forest products are used in their everyday lives. Students will examine the economic impact of the forestry industry in Wisconsin in relation to employment and economic output and compare it to other Wisconsin industries.

Teacher Preparation
Review the calculations of percentage as listed in the lesson. Make enough copies of the **Jobs in Wisconsin Worksheet** for students to work in pairs.

Background Information
As we look to our past for answers on how to manage our forests, sustainability becomes an extremely important goal for the future. Our forested landscapes need to provide a sustained production of a variety of goods and services. From our forests we provide jobs, timber products, fish and wildlife habitat, high quality of water and recreational opportunities, hunting, trapping, range values, visually attractive landscapes, landscape and community protection, and to an increasing extent, a sink for the atmospheric 'greenhouse gas', CO_2.

The value of some of these products, like lumber and jobs, can easily be measured monetarily, while others, like high quality water and aesthetics, are harder to quantify. In this lesson, we will concentrate our study on the economics of our forests from a forest product and job standpoint. There are many things that we do not normally think of as being a wood product. For example, cellulose is mixed with other chemicals to make film, sponges, and molded plastic. Product engineers continue to find additional uses for forest product byproducts, such as sawdust and chips, designing new construction materials that make use of smaller dimensions of wood.

As an economic industry in Wisconsin, there are approximately 1,800 forest product companies that employ 98,000 people with a total payroll of 3.2 million dollars. These companies produce a total of 19.7 billion dollars of products annually. The forest product industry is the #1 employer in 28 counties, the second largest employer in an additional 9 counties, and the #3 employer in 5 more counties. That's 42 out of the 72 counties found in Wisconsin. To sum it up monetarily, forestry is an important industry in Wisconsin.

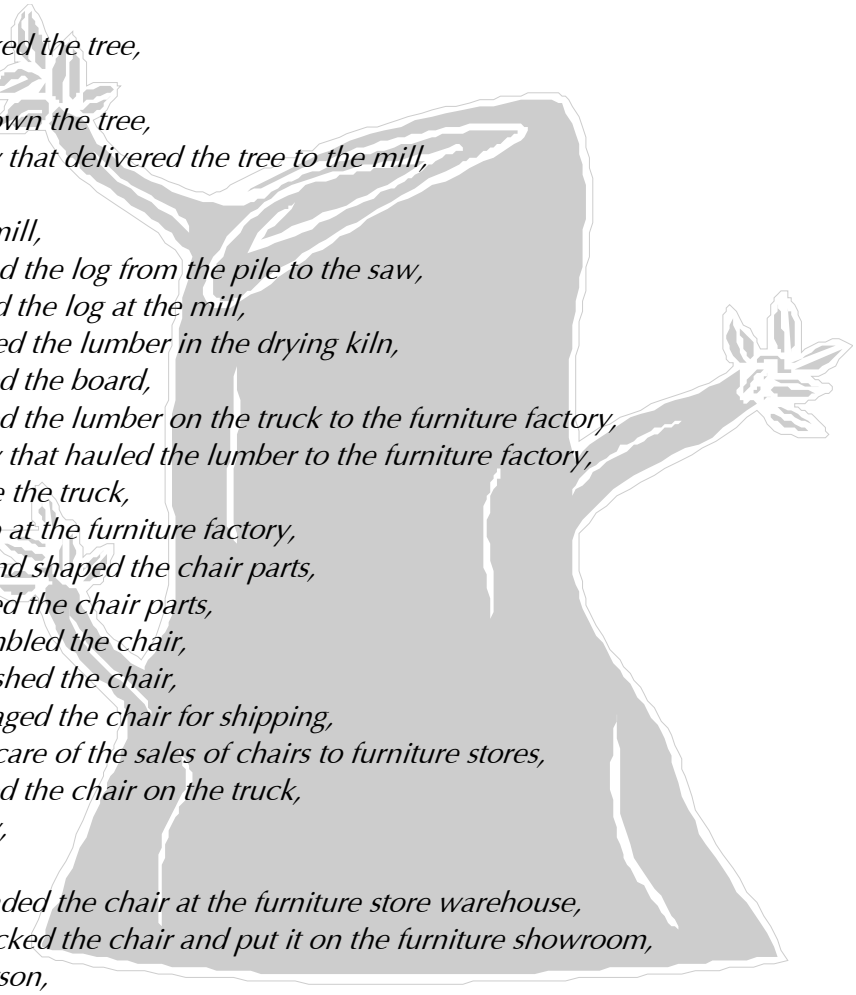
Activities

1. Tell your students that a rich landowner is giving away large tracts of forested land to anyone who can find a "use" for the land. Ask your students in what ways they might use this piece of property. Guide their answers so they might include: *harvesting trees for lumber, wildlife habitat, hunting, camping, hiking, or preserving for future generations, etc*. Tell your students that our forests have many uses. Ask your students what is meant by the economic value of the land. Ask if they think it is easy to determine what the property is worth in dollars. Ask what they would base their price on. Discuss with them that it would be fairly easy to estimate the value of the timber for lumber. Ask if it would be easy to put a price on the value of the land for hiking, hunting, preservation, etc. Tell your students that the value of the property can't always be put in terms of dollars and cents.

2. Tell your students that during the next few lessons they will be looking at the different values of Wisconsin forests. In this lesson, we will be looking primarily at those uses of a forest on which it is easy to place a dollar value. Ask your students to brainstorm a list of products made from trees. List these items on the board or on a large piece of butcher paper. Remind your students that there are products other than wood that come from a forest. Trees are used for their tannins, resins, syrups, fruits, nuts, cambium, bark, and leaves. Tannins are the oils found throughout different parts of the tree. These oils are used for nail polish, shoe polish, hair spray, and the production of clothes and some plastic products. Cambium is the soft material under a tree's bark and is used for many different products including cork for wine bottles and tack boards. Trees also produce resins and syrups that help to store nutrients and protect trees from insects. Many of these are very useful, such as rubber and maple syrup. Once your students have exhausted their list, add the following items to the list. Tell them that each of these items have ingredients coming from trees.

Book or magazine	Muffin mix	Birdhouse
Coffee filter	Apple	Mineral spirits
Milk carton	Real maple syrup	Hair spray
Playing cards	Candy bar with almonds	Vanilla
Bottle cork	Rubber gloves	Rayon clothing
Shoe polish	Baby food	Cellophane
Nail polish	Cinnamon sticks	Film
Wooden chair	Toothpicks	Hard hat

3. Tell your students that all of these products from trees have an economic value. You can buy them at the store for money. Use the wooden chair as an example. Ask your students what economic impact do they think a $150 wooden chair has. Ask them to trace how many different people received money from the time the chair was part of a growing tree to when it was sitting in someone's house. Invite your students up to the chalk or dry erase board to draw a diagram that connects where money would have changed hands. As they go along, use the trail of money listed below to remind them of any money transactions that they have forgotten.



- *the forester who marked the tree,*
- *the owner of the tree,*
- *the logger who cut down the tree,*
- *the trucking company that delivered the tree to the mill,*
- *the truck driver,*
- *the log grader at the mill,*
- *the person who moved the log from the pile to the saw,*
- *the person who sawed the log at the mill,*
- *the person who stacked the lumber in the drying kiln,*
- *the person who graded the board,*
- *the person who loaded the lumber on the truck to the furniture factory,*
- *the trucking company that hauled the lumber to the furniture factory,*
- *the trucker who drove the truck,*
- *the loading dock help at the furniture factory,*
- *the person who cut and shaped the chair parts,*
- *the person who sanded the chair parts,*
- *the person who assembled the chair,*
- *the person who varnished the chair,*
- *the person who packaged the chair for shipping,*
- *the person who took care of the sales of chairs to furniture stores,*
- *the person who loaded the chair on the truck,*
- *the trucking company,*
- *the trucker,*
- *the person who unloaded the chair at the furniture store warehouse,*
- *the person who unpacked the chair and put it on the furniture showroom,*
- *the furniture sales person,*
- *the furniture store owners,*
- *and now its in your home.*

4. Now that the chair is finally in someone's home, ask your students if they think there are still more economic impacts. *At each of the points above, you can attach additional connections such as fuel, office help, electricity, etc.* Tell your students that the forest industry is tied to many other industries. Each of these industries provides jobs for thousands of workers. Pose the question, how important do you think forest related industries are to providing employment for people in Wisconsin? Tell the students that they will be analyzing some information published by the state of Wisconsin to determine this answer.

   Divide the class into working pairs. See that each pair has a calculator to use. Hand out the Forest Economic Impact Worksheet. Tell the students that they will be calculating the percentage of the Wisconsin workforce that is employed in the major industries in Wisconsin. Show them how to do the calculations by using the first several as examples. *To do this you will divide the number of jobs in a particular industry (J) by the total number of jobs in Wisconsin (T). This will produce a decimal number. Take this number times 100 and this value is the percent of the workforce employed by a particular industry.*

J/ T X 100 = % of total workforce
J = the number of people employed in a given industry
T = the total number of people employed in Wisconsin

5. Once your students have finished their calculations, ask them what exactly does a percent of the workforce mean. Use dairy as an example. Ask them to explain what 6% of the workforce working in dairy means. *That in a group of 100 people, 6 are employed in the dairy industry.* Ask them which of the industries listed are directly related to the forest industry. *Timber production, paper and allied products.* How many jobs out of one hundred jobs are related to these two industries? *Three out of every 100 jobs.* Refer back to the drawing of the money trail on the board. Ask what other industries are also related to the forest product industry. *Government (DNR employees), retail trade, tourism, transportation, hunting, fishing, wildlife watching, public education (college professors of forestry), printing, and furniture.* Ask your students how significant they feel our forest industry is to each of these additional industries. Take each industry at a time and have students relate how they are connected. Once you have looked at each of these industries, ask how many of the students' parents or relatives work in one of these industries.

6. Now that the class has looked at employment in Wisconsin, you are going to have them look at the economic output from the sales of goods related to Wisconsin forestry. Start by asking the students, "Why does someone seek employment?" *So they have money to live, to buy the things they need and want.* Remind the students that not only do our forest industries provide jobs, they also provide products that we all need. Tell the students that they will be comparing the total dollar amount of products produced annually from various land-based industries. Ask them what you mean by land based industries. *Those that produce products that come from the land.*

Direct your student's attention to the bottom of the worksheet. Again working in the same pairs, ask the students to create a bar graph that shows the dollar output from each industry. To do this, ask them to place their dollar amounts along the Y-axis (vertical) and the different industries along the X-axis (horizontal). You will need to probably help them with the graduations for the Y-axis. There are 10 spaces on the Y-axis. If you divide the largest number of dollars ($40 billion) by 10, each graduation is 4 billion. Give the group several minutes to complete the graph.

7. Upon completion of the graphing, ask the students how important they feel forestry is to the state of Wisconsin. They will no doubt list jobs and products. Ask them, "but what about the sate of Wisconsin itself?" Tell them that the sale of products and the incomes from jobs generate income to the state through income and sales taxes. In this way, forestry helps pay for education, health care, roads, and all the other services provided by the state. Forestry in National Forests also supports education in the counties where the forests are located by donating a percentage of each timber sale.

Conclusion

Recap the economic impact of forestry on the Wisconsin economy. Share the following figures:

- The number of forest product industries companies in Wisconsin is 1,800.
- The number of employees within these companies is 97,805.
- The total payroll of these companies is $3,223,243,543.
- The total shipment value of these products is $19,738,300,000.
- Primary and secondary forest industry is the #1 employer in 28 counties, the #2 employer in 9 counties, and the #3 in 5 counties. There are 72 counties in Wisconsin.

Tell the students that today we have looked at the economic value of our forests for forest products. It has been somewhat easy to assign a dollar value to these products. In our next lesson, we will be looking at the other values of a forest that are not as easy to put a dollar amount upon.

Student Log Book

Ask the students as a homework assignment to go home and research how their family may be connected to the forest industry. Tell them that this may be as a direct employee, as an employee of a related company such as a furniture store, or as a consumer.

Web Links

There is a huge list of tree products on this site—http://www.forestinfo.org/CoolFacts/fromtree.htm

Forest Product Laboratory in Madison, WI— www.fpl.fs.fed.us/

Consolidated Paper Co.—http://www.consolidatedpapers.com

Wisconsin Paper Council— http://www.wipapercouncil.org

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Lindbeis, Richard and Hovind, James H. 1985. Wisconsin's Forest: An assessment. DNR Bureau of Forestry.

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Wisconsin Department of Natural Resources. 1998. A Look at Wisconsin's Forests. PUB-FR-122.

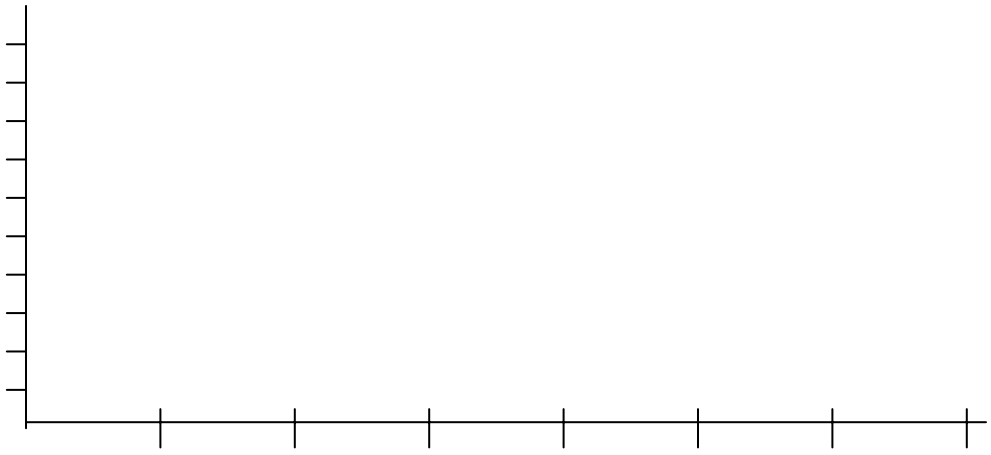
JOBS IN WISCONSIN *1996 statistics from Wisconsin Blue Book*

Employees	Industry Group	% of Total Workforce
531,000	Agriculture	_____
466,000	Retail trade	_____
383,000	Government	_____
190,000	Dairy	_____
182,000	Tourism	_____
138,000	Finance, insurance and real estate	_____
121,000	Transportation and public utilities	_____
97,000	Industrial machinery and equipment	_____
93,000	Hunting, fishing, and wildlife watching	_____
63,000	Public education instructional staff	_____
49,000	Printing and publishing	_____
48,000	Timber production	_____
46,000	Paper and allied products	_____
29,000	Transportation equipment	_____
14,000	Furniture and fixtures	_____
417,000	Other professions	_____
2,917,600	Total people employed in Wisconsin	100%

J/ T X 100 = % of total workforce
J = the number of people employed in a given industry
T = the total number of people employed in Wisconsin

Dollar Output

40 billion	Agriculture
19.7 billion	Reconstituted wood products
17 billion	Dairy
13.2 billion	Tourism
9.7 billion	Timber production
6.8 billion	Hunting, fishing, and wildlife watching
0.2 billion	Cranberries



Answer Key

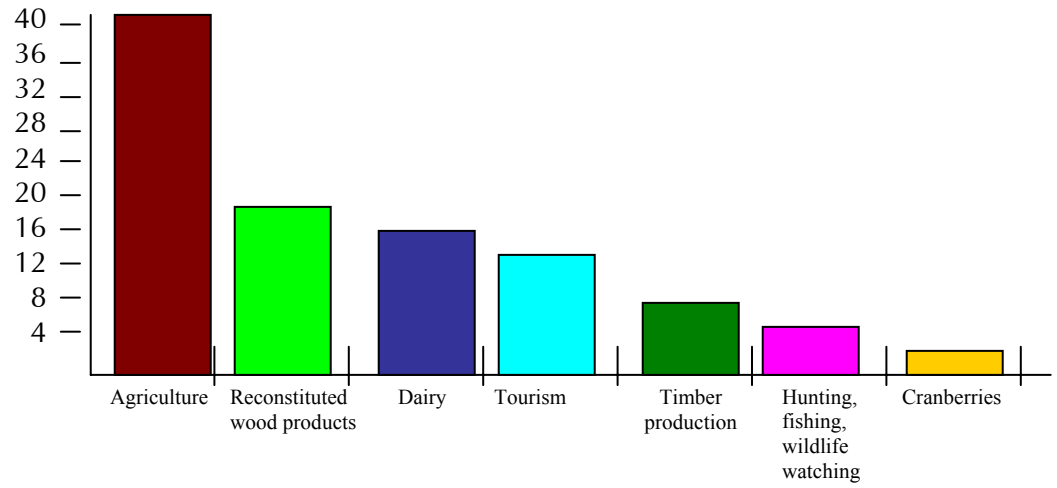
JOBS IN WISCONSIN *1996 statistics from Wisconsin Blue Book*

Employees	Industry Group	% of Total Workforce
531,000 (J)	Agriculture	18.2%
466,000 (J)	Retail trade	16.0
383,000 (J)	Government	13.1
190,000 (J)	Dairy	6.5
182,000 (J)	Tourism	6.2
138,000 (J)	Finance, insurance and real estate	4.7
121,000 (J)	Transportation and public utilities	4.1
97,000 (J)	Industrial machinery and equipment	3.3
93,000 (J)	Hunting, fishing, and wildlife watching	3.2
63,000 (J)	Public education instructional staff	2.2
49,000 (J)	Printing and publishing	1.7
48,000 (J)	Timber production	1.6
46,000 (J)	Paper and allied products	1.6
29,000 (J)	Transportation equipment	1.0
14,000 (J)	Furniture and fixtures	0.5
417,000 (J)	Other professions	14.3
2,917,600 (T)	Total people employed in Wisconsin	100%

J/ T X 100 = % of total workforce
J = the number of people employed in a given industry
T = the total number of people employed in Wisconsin

Dollar Output

40 billion	Agriculture
19.7 billion	Reconstituted wood products
17 billion	Dairy
13.2 billion	Tourism
9.7 billion	Timber production
6.8 billion	Hunting, fishing, and wildlife watching
0.2 billion	Cranberries



Lesson Six

Forest Value

Concepts

1. Forests are valuable to different people for different reasons.
2. Forests can have economic, recreational, aesthetic, egocentric, educational, ecological, and cultural values.

Objectives

Students will be able to:

1. Differentiate between the measurable and non-measurable attributes of a forest.
2. Describe the seven value categories.
3. Place forest attributes within the seven value categories.
4. Discuss why some forest attributes can be placed into more than one value category.

Teaching Site

Indoor classroom

Materials

Chalkboard and chalk, Forest Value Category worksheet for each student.

Lesson Time

One 50-minute class period

Nutshell

In this lesson, students will examine the values associated with forests. They will learn about seven value categories and place examples of forest attributes into these categories.

Teacher Preparation

Read background information; copy student worksheet.

Vocabulary

- **Value** – the worth that someone places on something.
- **Economic value** – a forest's worth in financial terms (dollars and cents).
- **Aesthetic value –** the worth of a forest in terms of its natural beauty.
- **Recreational value –** the worth of a forest in terms of its use for leisure.
- **Educational value –** the worth of a forest in terms of its benefit for teaching and learning.
- **Egocentric value –** the worth of a forest in terms of what it offers an individual.
- **Ecological value** – the worth of a forest in terms of preserving the ecosystem.
- **Cultural value –** the worth of a forest in terms of the way a person was raised to believe in it.

Background Information

It should be clear by now that Wisconsin's forests are valuable to many people, but often for different reasons. A value is the worth that someone places on something. Values cannot be proven to be right or wrong with facts or numbers. Values are perceptions. They are also subject to different interpretation by different people. As we go through life, our values often change due to exposure to new experiences, observations and perceptions.

The many ways in which we value our forests can be simplified into the following 7 categories:

Economic: This is a forest's worth in financial terms.
Example: This forest can produce five million board feet of lumber.
Aesthetic: The worth of a forest in terms of its natural beauty.
Example: This forest has a beautiful array of fall colors.
Recreational: The worth of a forest in terms of its use for leisure.
Example: This forest is popular for hiking and cycling.

Educational: The worth of a forest in terms of its instructional benefit.
Example: This forest is a good place to teach succession to sixth grade students.
Egocentric: The worth of a forest in terms of what it offers an individual.
Example: This forest is where I grew up and is my favorite place to explore.
Ecological: The worth of a forest in terms of preserving the ecosystem.
Example: This forest is a habitat to timber wolves, which are one of the last remaining large predators in Wisconsin.
Cultural: The worth of a forest in terms of the way a person was raised to believe in it.
Example: I believe that we are all connected to this forest and the animals and trees are my brothers and sisters.

Value conflicts can arise when people value the same resource for different reasons. For example, a teacher may value the forest which neighbors the school because the class uses it to identify trees (Educational), while the landowner who owns the trees values them for timber production (Economic). It is easy to see how these values may conflict.

Many people also interpret the value categories differently when examining a forest. For example, a person may find great pleasure in watching a white-tailed deer feed in the neighboring forest (Aesthetic), while another person takes great pleasure in growing and tending new trees (Aesthetic). Though both of these people appreciate the same forest for its aesthetic qualities, it may become impossible to maintain both deer populations and new tree growth since the deer feed on many of the tree seedlings.

It is important to note that many of these values are also complimentary. Many forestry practices that extract trees from the forest for economic gain may also improve the wildlife habitat for different animal species. While a forest area that is protected from logging operations may retain all of its ecological, aesthetic, and cultural values.

Activities

1. Begin class by asking students how they would define value. *Values are the worth that someone places on something. If a person values something, it is more desirable to them.* Allow several students to share their ideas. Ask students if they think that a person's values are always the same. *No – values can change in response to changing conditions and new information. They should be constantly reassessed.* Students should also understand that values cannot be proven to be right or wrong – they are just a person's perception of the relative worth of something. Keeping this in mind, ask students why they value forests. Brainstorm a list of reasons on the chalkboard. O*xygen recharge, mountain biking, timber, flood control, climate control, wildlife habitat, beauty, soil protection, nutrient recycling, hiking.* Try to guide their answers so that they include examples from each value category (economic, aesthetic, recreational, educational, egocentric, ecological). Once their ideas are exhausted, write the seven values categories on the board.

As you introduce each category ask students what they think it means. Their answers may vary, but be sure to guide them toward the definition explained in the background information. To help students understand the categories, go through the examples on the board and have students label each as it fits into a particular value category.

2. Pass out the **Value Category Worksheet** to each student or divide the students into groups of 4 or 5. On the worksheet is a list of example values of a forest and a list containing the seven values categories. Students should go through each list and connect every example value with the category that fits. Students will probably find that some example values will fit into more than one category.

3. Have students share which examples they connected to which categories and why. Students may have chosen different placements for the examples. Ask students why some have connected different items to different values. *Everyone has different values.* Are there examples that were placed in more than one category? Ask students which ones have more than one placement. Why can they be placed in more than one category? *Values can be interpreted in different ways by different people.*

Conclusion

To wrap up this lesson, review with your students the seven value categories. They have just introduced themselves to the fact that individuals have different values, and can interpret values differently. How do the students think that having different values can impact forests? What kinds of problems or challenges could arise as a result of these differing values? Have students imagine that a plot of forested land can be used for 3 different purposes – recreation, timber, and as a wildlife habitat. Can they imagine any conflicts that would come up because of the values people place on these different purposes? *Hikers may not want to hike through land that had been logged, the wildlife in the area may not be tolerant of people using the forest or of logging operations.* Tell students that in the next several lessons, they will take a look at who manages forests, how they are managed for different values, and the conflicts that arise.

Log Book

Have students write a paragraph about how a forest is most valuable to them. Do they value forests for economic, aesthetic, recreational, educational, egocentric, ecological, and/or cultural reasons? Make sure students understand that they can cite several different values if they choose.

Web Links

Large clearinghouse for other forestry websites— www.envirolink.org

Wisconsin Forest Resource Education Alliance— http://www.wfrea.org

Food and Agriculture Organization— www.fao.org/forestry

References

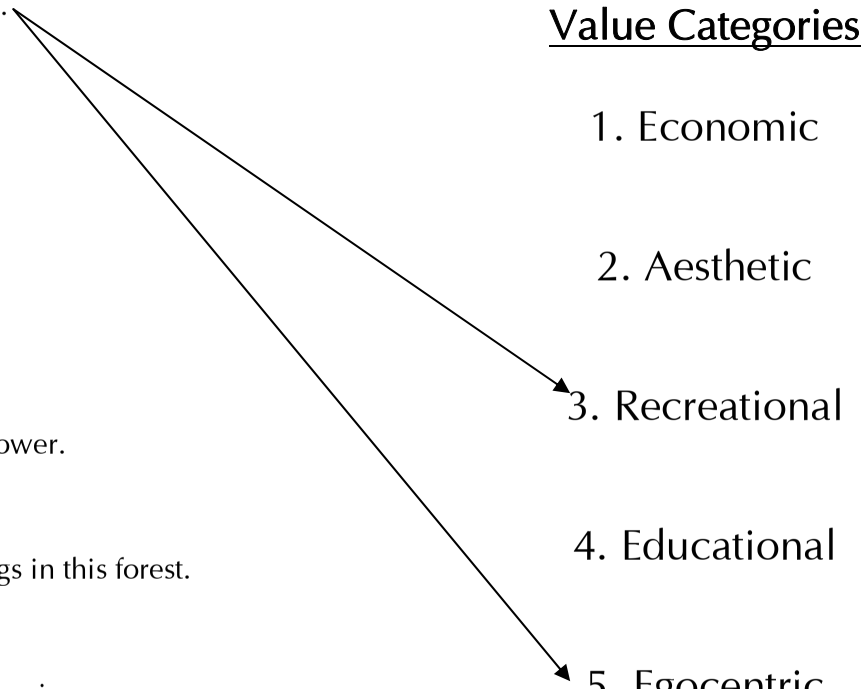
Strathe, Sterling. 1994. Wetland Understanding Leading to Protection. Outdoor Skills Center, Inc.

Hungerford, et al. 1973. Investigating and Evaluating Environmental Issues and Actions: Skill Development Module. Stipes Publishing Co. Champaign IL.

FOREST VALUE CATEGORY WORKSHEET

Instructions: Read each of the statements on the left-hand side of the worksheet. Draw a line from each statement to the value that you place on it. The statements may be connected to more than one value.

- This forest is my favorite place to hike and camp.
- Timber for house construction.
- I believe that we should respect all of nature.
- Listening to the rain patter on the leaves.
- Mountain biking.
- Harvesting pulpwood for paper production.
- Ensures clean water in a nearby stream.
- Habitat for the endangered Snow Trillium wildflower.
- Clearing forest for housing development.
- I have a spiritual connection to many of the things in this forest.
- Making a leaf collection.
- I am a logger partly because my family owns a logging company
- Controls soil erosion.
- Clearcutting for farmland.
- I own this forest; I can do whatever I want with it.
- Classroom visit to a forest.
- Deer hunting
- Bird watching.

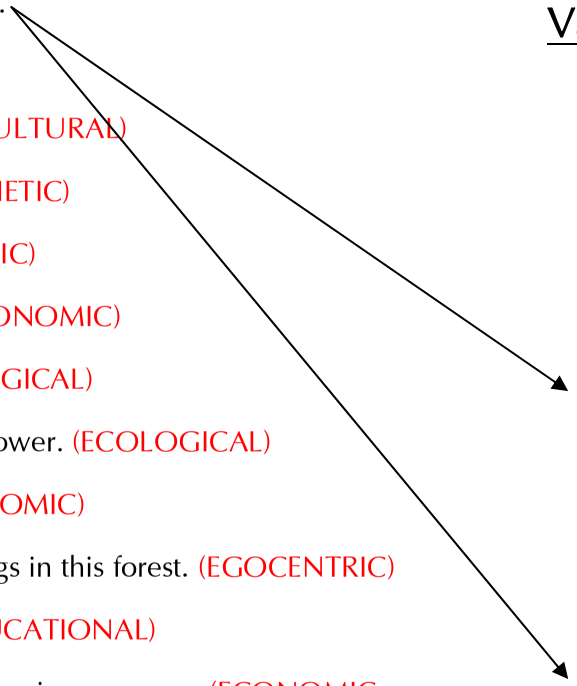


FOREST VALUE CATEGORY WORKSHEET

(Answer key. These answers are suggestions. Individuals may have varying opinions.)

Instructions: Read each of the statements on the left-hand side of the worksheet. Draw a line from each statement to the value that you place on it. The statements may be connected to more than one value.

- This forest is my favorite place to hike and camp.
- Timber for house construction. (ECONOMIC)
- I believe that we should respect all of nature. (CULTURAL)
- Listening to the rain patter on the leaves. (AESTHETIC)
- Mountain biking. (RECREATIONAL, EGOCENTRIC)
- Harvesting pulpwood for paper production. (ECONOMIC)
- Ensures clean water in a nearby stream. (ECOLOGICAL)
- Habitat for the endangered Snow Trillium wildflower. (ECOLOGICAL)
- Clearing forest for housing development. (ECONOMIC)
- I have a spiritual connection to many of the things in this forest. (EGOCENTRIC)
- Making a leaf collection. (RECREATIONAL, EDUCATIONAL)
- I am a logger partly because my family owns a logging company (ECONOMIC, EGOCENTRIC)
- Controls soil erosion. (ECOLOGICAL)
- Clearcutting for farmland. (ECONOMIC)
- I own this forest; I can do whatever I want with it. (EGOCENTRIC)
- Classroom visit to a forest. (EDUCATIONAL)
- Deer hunting (RECREATIONAL, EGOCENTRIC, ECONOMIC, CULTURAL)
- Bird watching. (RECREATIONAL, EGOCENTRIC, EDUCATIONAL)



Value Categories

1. Economic
2. Aesthetic
3. Recreational
4. Educational
5. Egocentric
6. Ecological
7. Cultural

Lesson Seven

Natural Resource Careers – A Game of Life

Concepts

1. There are many career opportunities available in managing our natural resources.
2. Managing natural resources involves managing the environment and working with people. A scientific background along with people skills are important in natural resources careers.
3. Persons who are seeking jobs compete with others seeking the same position. Natural resources career fields are no exception.
4. Employers most often look at a combination of the job seeker's education, work and volunteer experiences, and personal attributes to help make hiring decisions.
5. Resumes are tools to help highlight qualifications and ensure that there is the "right fit" between the employee, the position, and the organization.
6. Students can start building knowledge, skills, and experiences in their middle school and high school years to help prepare for future career opportunities.

Objectives

Students will be able to:

1. List at least eight career opportunities related to managing natural resources.
2. Explain why those entering natural resource management-related career fields must have "people skills" in addition to scientific knowledge and skills.
3. Develop a resume for a specific natural resource career field when given a resume template and sample qualifications.
4. Work cooperatively on a team to evaluate resumes against selection criteria and recommend candidates for interviews.

Teaching Site

Indoor classroom for group activity and discussion.

Materials

One large piece of paper and pencil/marker for each student group, chalkboard and chalk, overhead projector (optional) with transparency of resume template (optional), sample or real job announcement bulletins, copies of real sample resume (optional), a copy of **Some Key Job Titles** and the **Game of Life Cards** hand-out for each student group,, and a **Search and Screen Committee Evaluation Checklist**.

Time Period

One 50-minute class period.

Nutshell

In this lesson, students will step into the shoes of people who make a career of helping to manage our natural resources. Students will explore the qualifications needed to be competitive in the job market for natural resource careers, build a fictitious resume, apply for a job, and evaluate each others resumes against selection criteria.

Teacher Preparation

Become familiar with general career fields associated with natural resources management. The background information provided with this lesson offers some basics. You might also find ideas about the types of jobs and specific qualifications by reviewing current job bulletins such as *The Job Seeker* (see references) that detail numerous career opportunities in natural resources.

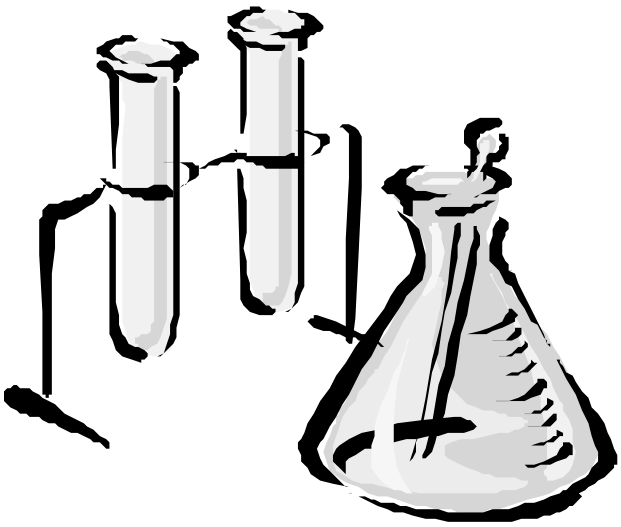
Familiarize yourself with recommended resume formats or plan to use the resume template provided. Duplicate a **Resume Template** for each student. Duplicate the **Screening Committee Checklist** for each student group. Prepare the **Game of Life Cards** for each small student group in your class. Copy each set of cards on a different color of paper to make it easy to sort them out later if you would like to use them again in the future. If you feel comfortable in doing so, be ready to share a personal experience in seeking employment, being interviewed, and so on. This will help the students gain insights into how the process *really* works, and the things they can do in their own lives to positively influence their future career opportunities.

Watch your time during his lesson. Save at least 15 minutes at the end of the period for the student resume evaluation and wrap-up. While the students don't know it today, they'll all be hired in their respective career fields and this will set them up for the forest management simulation in lesson eight.

Background Information

For the purposes of this lesson, we will focus on just four general career fields in natural resources: *Soil Science/Water Science, Parks and Recreation, Forestry,* and *Wildlife*. Make sure that your students understand that there are many other wonderful career opportunities in other natural resource career fields available such as fisheries, environmental education, and international resource management. These four areas have been chosen because they help bring in key environmental aspects as well as human dimensions. Both soil science and water science have been grouped together for the sake of this activity, but people may specialize in either one or the other field in the real world. We are simply attempting to simplify things for the sake of this exercise. In the background information, we have not included details about salary ranges because of the wide range of pay depending on qualifications. If students are interested in these kinds of details, please refer to current job announcements or employment guides such as *The Complete Guide to Environmental Careers in the 21st Century* (see references).

In general, a career in **soil science** is one that generally employs people in helping to manage soil resources. This is a field with a variety of job possibilities in the public and private sectors. People with soil science degrees (majors or minors at the undergraduate level) may be employed in such areas as solid waste management, recycling, agriculture, pollution prevention, hazardous waste management, municipal wastewater treatment plants, forestry, construction, etc. They may be employed as consultants at the county level to help assist landowners and businesses in managing soil resources and they may even be the people who do the perk tests to help determine the placement of private septic systems and new buildings.



Because the soils field (connoting "dirt" or "dirty" as in trash/waste) is viewed by some as less glamorous than other natural resource fields such as wildlife (warm, fuzzy animals), there is generally less competition in the soils job market. In-field placement rates of college graduates with majors or minors in soil science are outstanding—there are simply not enough soil scientists to go around.

Because water is the lifeblood of our planet, there are many opportunities in **water science** career fields. Water-related careers include general areas of specialty such as: limnology (study of lakes), fisheries, watershed management, drinking water supply and treatment, aquatic toxicology, water chemistry, hydrology, wastewater treatment, groundwater protection, oceanography, and wetland restoration. A master's degree may be required in order to be competitive for certain water science positions because of the complex nature of the resource and due to the broad interest in fields such as fisheries. There are many job opportunities in both the public and private sectors with the fastest growing demand being in the private sector.

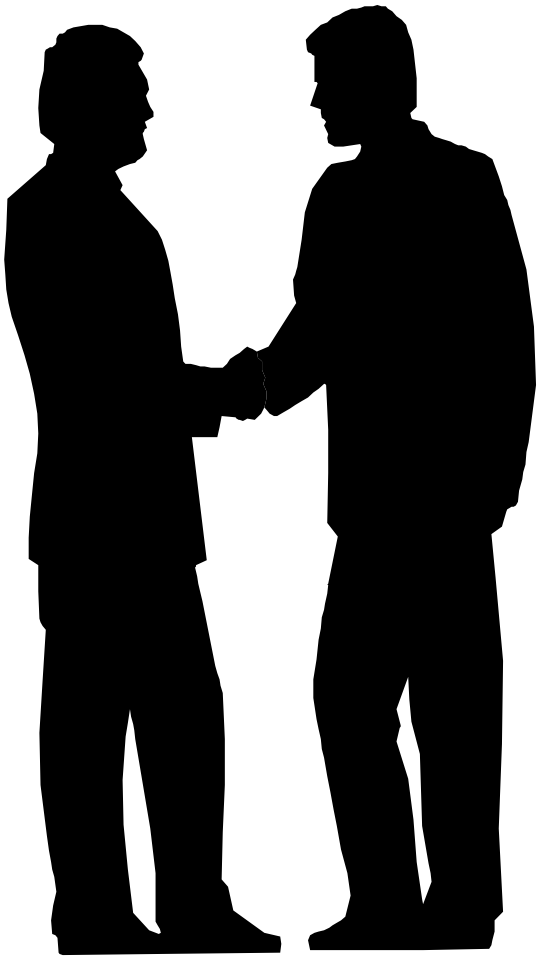
Since many people have positive childhood experiences related to parks and/or camping, they may often look to **parks and recreation** career fields first when investigating career opportunities in natural resources. People working in this field are often those involved in enhancing the experience of visitors who come to natural areas to relax and enjoy their surroundings. This role in helping others get the most pleasure out of their leisure time has great appeal to many who are also seeking a job they will personally enjoy. The parks and recreation career field is one in which most of the employment opportunities are found in the public sector. Some general areas of work within the parks and recreation field include: environmental interpretation, outdoor education/recreation, administration, environmental education, and site operations/maintenance. Bachelor's degrees are usually required for careers in this field with master's degrees preferred for administrative positions and higher level opportunities for long-lasting careers (as opposed to seasonal work) in environmental interpretation and education. This career field is a relatively fast-growing one as there are more and more people seeking to enjoy parks and other natural areas during their leisure time.

There are a wide variety of career opportunities in **forestry** with the fastest growing specialty in urban forestry, where people are involved in caring for trees in urban or suburban areas. Some other areas of emphasis or specialty in forestry include: forest products/wood products, forest ecology, research, fire crew, arboriculture, urban planning, entomology and forest pathology, forest economics, forest hydrology, forest recreation, and education. Foresters are involved in helping to manage tens of thousands of acres of publicly and industry owned timberlands. In addition, they are often key in helping to advise private landowners in managing their own woodlands. A bachelor's degree is required.

Among young people, there is generally great interest in the field of **wildlife** because of the immense appeal of working with animals. There are many different opportunities in the related to wildlife. A partial list of opportunities for specialties in wildlife-related careers includes the following: wildlife biology, research, zookeeping, animal rehabilitation, urban wildlife, fisheries, habitat restoration, environmental law enforcement, endangered species management, education, non-game species management, migratory birds, aquariums, aquaculture, ichthyology, marine biology, and wildlife refuge management. Because of the appeal of this career field, a master's degree is usually required in order to support long-lasting

opportunities in this profession (as opposed to seasonal work). Most of the job opportunities in the field of wildlife are in the public sector.

In general, people desiring to succeed in natural resource careers today must not only have a solid foundation in the sciences, but they must also have well developed "people skills." An understanding of general business principles is also helpful because it emphasizes the ways that economics driven by human dimensions enter the natural resource management picture. This was not so much the case in the past when natural resource professionals were often specialists in their respective fields and they could go about the business of just managing "their" natural resource. Today's natural resource management professionals must also have a broad understanding of how to integrate their activities with those of other natural resource professionals who may be trying to manage the same resource from a different perspective. For example, a forester should have a general understanding of what it is that those in the fields of soils, waters, wildlife, etc. are striving to accomplish so that there can be an integrated approach to holistically managing the forest resources. This is the reason why communications skills, the ability to work cooperatively on a team, and an understanding of and respect for diverse perspectives are also near the top of the list of key qualifications of tomorrow's natural resource professionals.



Activities

Divide the class in eight small groups so that by step #2 below, there will be two groups focusing on soils/waters, two groups assigned wildlife, two groups assigned forestry, and two groups assigned parks and recreation career fields. This will work nicely in helping to play the "Game of Life" later in this lesson period.

1. Begin by asking the students if anyone has ever asked them what they want to be when they grow up. Most young people at the middle school level are not yet sure, so it may be helpful to investigate possible career fields to help get them thinking about some of the possibilities. This activity will help them become familiar with some opportunities in four natural resource career fields in particular. Of course, there are <u>many</u> other career fields that may be of interest to the students, but through this lesson, they will learn some basics about how the job application process works and what they might be able to do to improve their chances of landing the job they want someday—no matter what career field they may choose from the world of options available to them. This exercise will also help students understand that there are many choices for jobs within general career fields too.

2. Distribute one large piece of paper and a marker/pen to each group. Have them divide their paper into quarters. In each one of the quarters, have a student scribe write the headings: "Soils/Waters," "Forestry," "Parks and Recreation," and "Wildlife." Then, have them brainstorm a small list jobs/careers in each of those areas. Compile a master list of the student's career ideas on the board. Share copies of the job list enclosed with this lesson. It details even more job opportunities within each of the four career fields that are the focus of this lesson. Now, randomly assign each student group one of the four natural resource career fields: soils/water, forestry, wildlife, and parks and recreation. This will now become their career field throughout the rest of this lesson.

3. Prepare the student groups to brainstorm the qualifications that they believe someone needs in order to be successful in their assigned career field. Define qualifications as a combination of education, experiences, and personal attributes that contribute toward that individual's ability to perform the tasks necessary on the job or to work on a specific team associated with the job. Some qualifications relate to knowledge. Some relate to skills acquired. Others relate to the personal qualities of the prospective employee. For example, if students are in the forestry group: What are some qualifications that may be important in contributing to the success of someone in the forestry field? Have each student group spend a few minutes discussing the qualifications needed and have them record their ideas.

4. Bring the student groups back together and see if there are some similarities among the groups about the qualifications that they feel would be important for their respective career field. Summarize the short discussion with the point that there are some common qualifications that will apply no matter which natural resource career field is selected. Good communications skills is one example of a common qualification. Point out that there are other qualifications which are unique to specific career fields, too. One example is the ability to operate wildlife telemetry equipment. Wildlife researchers may need to have this qualification if they are to be hired for a specific research study involving radio-collared animals. On the other hand, a water scientist may not need to know how to operate that equipment. Instead, the water scientist should know *that radio collars exist and how they are generally used by wildlife researchers in acquiring information to help in making wise natural resource management decisions.* The water scientist will likely consult with the wildlife researcher when radio telemetry information is needed.

   Basic scientific/ecological knowledge, business skills/knowledge, and people skills are three important common qualifications no matter which career field in natural resources someone enters today. Emphasize the fact that managing natural resources today is as much about managing people as it is about managing the environment itself.

5. Set the stage for the rest of this lesson by telling the students that there is a job opening available at the Central Wisconsin Environmental Station (or some other local organization) in their assigned career field. Tell them that you know that each student really wants that exciting, well-paying, and rewarding job (have fun with it!). Each student will compete for the job with other students who share the same assigned career field by submitting a resume for the position. Tell the students that a Search and

Screen Committee (panel of teachers, for example) will review the resumes submitted and make hiring decisions to see who will land the job. Challenge them to do their best to sell themselves as the best candidate for the position.

6. Since most students at this point in their lives haven't had a wealth of work experience (and of course, they haven't yet had the opportunity to get a college degree if that is their goal), explain that they are now going to be involved in a simple card game called the "Game of Life." This game will set each individual student up with the background in their respective career field so that they can go on to develop a resume and apply for a job in that field. Distribute one **Game of Life Instruction Sheet** to each group and/or give verbal instructions. Then, distribute the **Game of Life Cards**. Have the students play the game. After the students have received their "Experience, Education, and Other" qualifications through the "Game of Life," they are ready to build their own practice resume.

7. Distribute a **Resume Template** to each student. Review the basic parts of a resume and give a brief explanation of the following terms that may be found on their **Game of Life Cards**: Bachelor's degree, master's degree, a college major and a college minor. In addition, explain that sometimes people have an emphasis of study within college, too. This is an area in which someone has taken a lot of coursework or otherwise focused their learning experiences.

8. Have each student now build a personal resume based on the **Game of Life Cards** dealt to him/her. If they were dealt an "Education" card that said they had a bachelor's degree in Soil Science, for example, then they would write that qualification under the "Education" heading on their resume. If they had an "Other" card state that they had volunteered at a farm, then they could note that under the "Other" category on their resume if they thought it might be helpful in getting the job. Have them also suggest a possible career goal for their career field—a reason why someone might want to work in that career field. For example: If the student is assigned the soils/water field, a career goal might be "to help restore wetlands." Most of the qualifications dealt to them through the "Game of Life" should be included on their resume, but they may add other qualifications or experiences that they feel might also be important to compete for and be selected for the position. Allow the students about 10 minutes to create their resume. (You can assign the resume development project as a take-home assignment if you prefer.) Remind them that the resume appearance counts when reviewed by those making decisions about who will get a job interview!

9. Have the students submit their resumes in application for the position. Collect the resumes and distribute them to the neighboring student group assigned the same career field. For example, if you collected forestry resumes, then see that the other students who wrote forestry resumes receive the set you've just collected. This will ensure that the student groups will be better prepared during the review process which follows because they had experience thinking about the qualifications foresters might need to be successful and preparing a resume for that same career field.

10. Explain that each student group will now become the Search and Screen Committee for their assigned career field. This committee will evaluate the resumes they have received and decide who should get an interview. Emphasize that their group must

work together and try to reach a consensus. Distribute a copy of the **Search and Screen Committee Evaluation Checklist** that details the specific criteria that the committee will use in making their decision. Explain that in the real world, we often don't have an opportunity to know exactly what the selection criteria will be, but by doing some research about the hiring organization and the position available, we can get some clues that may help us better match our resume to their interests and better help us market ourselves. We can also do our best to prepare for the position by building a solid education and experience base over the years so that we can become qualified to enable us to beat the competition. Our resumes are really marketing tools that can open doors to the next level of competition: The interview.

11. Call the student groups back together after they have spent a few minutes evaluating the resumes they had been given. What do they think about the process?

Conclusion (<5 minutes)

Summarize this lesson by asking the students to offer ideas about how this resume writing and resume evaluation experience might be helpful in preparing them for their own future. Congratulate them on the accomplishment of writing their first practice resume—something that most young people their own age have never before done. Already, they are ahead of the competition!

Student Log Book

Have your students write a paragraph that discusses the importance of experience in landing a job and have them list ways that they can gain valuable experience.

Seeds to Grow

1. Following the Search and Screen Committee exercise, pass back each student's resume. Have them evaluate their own resume based on the criteria by completing the evaluation form. What would they change on their resume if they could? Why? Discuss the fact that they can't go back to change their life experiences in time to reapply for the position and improve their chances for getting the job today. But, *what does this say about their choices and preparations during middle and high school? What can they do starting today to help increase their chances of landing a job—no matter what their future field might be?*

2. Consider offering students the opportunity to revise their own resumes based on what they now know as the selection criteria. Then invite them to resubmit their resumes to the Search and Screen Committee. Did they succeed in improving their scores on the evaluation checklist?

3. Have the students research a natural resource career and design a brochure to attract others to choose that career. Have them include the following in their brochure: Job duties, salary, work conditions and hours, education and experience required, and at least one picture.

4. After students have had the opportunity to role-play the Search and Screen Committee, have them evaluate the process of trying to reach consensus about who to interview for the job. What were the challenges? What lessons can be learned about the process of

reaching consensus? In what other areas of their own lives or in our own communities is consensus seeking important?

5. Consider offering students sample standard interview questions and having them practice being the interviewer and the interviewee. Then, have them evaluate the experience of being the asker and the person being asked the questions. How does it feel? What could you do to improve your confidence and why is that important?

Resources

Environmental Careers Organization. 1999. The Complete Guide to Environmental Careers in the 21st Century. Island Press. Washington D.C.

Wisconsin Department of Natural Resources. 1993. Environmental Quality: A Career with Rewards. Publication #PE-021 93. 16 pp.

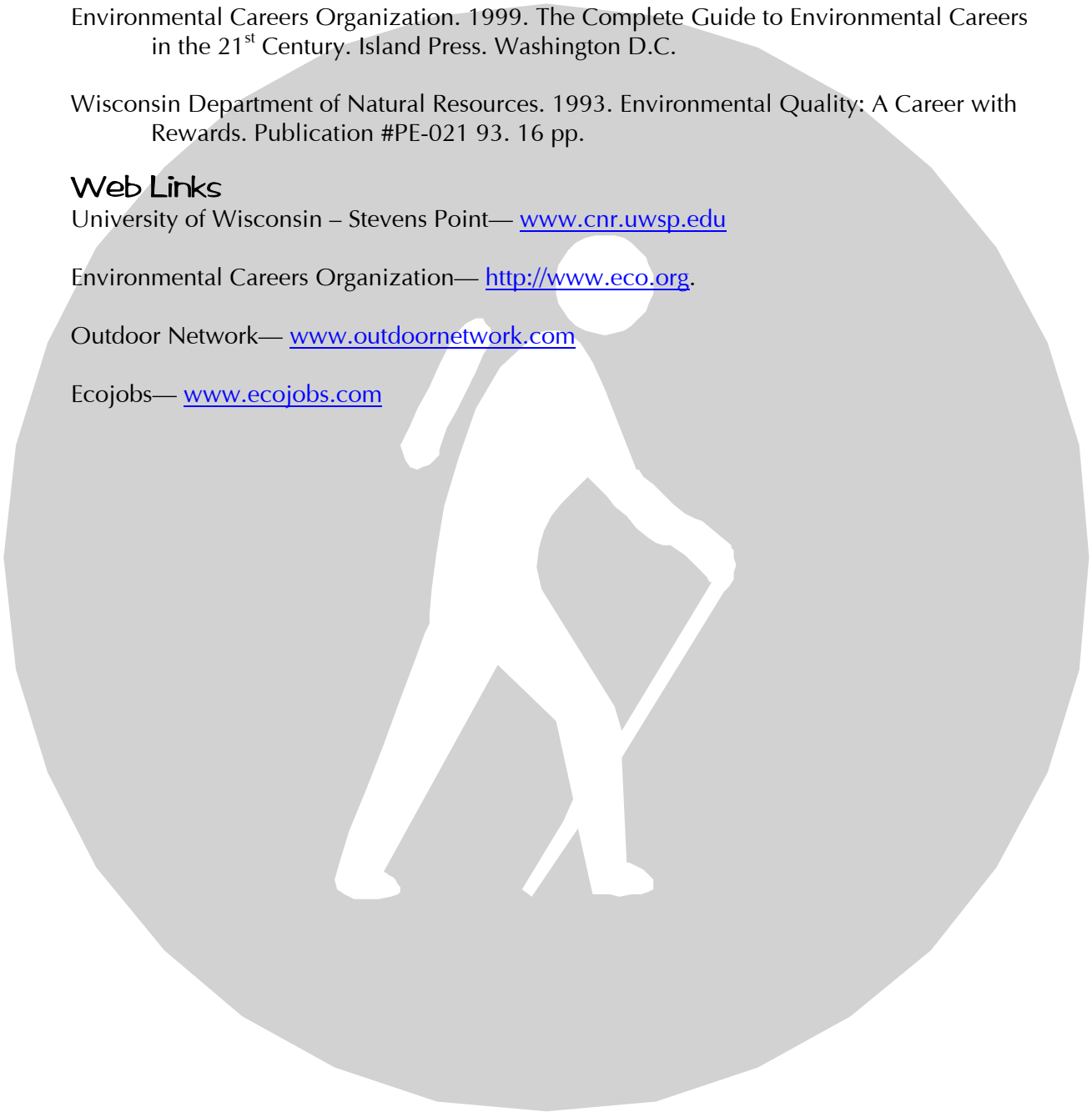
Web Links

University of Wisconsin – Stevens Point— www.cnr.uwsp.edu

Environmental Careers Organization— http://www.eco.org.

Outdoor Network— www.outdoornetwork.com

Ecojobs— www.ecojobs.com



Some Key Job Titles

Soils/Water:
Geologist
Hazardous Waste/Solid Waste Specialist
Hydrogeologist
Soil Scientist
Soil Chemist
Farmer
Archaeologist
Agricultural Economist
Decontamination Specialist
Environmental Planner
Agronomist
Groundwater Specialist
Marine Scientist
Soil Conservation Specialist
River and Lake Ecologist
Wetland Scientist
Consultant
Landscape Architect
Oceanographer
Irrigation Specialist
Agriculture Engineer
Recycling Coordinator
Erosion Control Specialist
Landfill Manager
Wastewater Treatment Specialist
Aquatic Toxicologist
Water Chemist
Drinking Water Quality Control Specialist
Wastewater Engineer
Environmental Engineer
Watershed Planner
Limnologist
Fisheries Scientist
Researcher
Pollution Prevention Coordinator
Lake Association Leader
Educator

Parks and Recreation:
Environmental Interpreter
Park Administrator
Naturalist
Recreation Specialist
Outfitter
Site Manager
Environmental Educator
Buildings and Grounds/Maintenance Staff
Nature Center Director
Visitor Center Director
Park Commissioner
Planner
Campground Director
Outdoor Educator
Ecosystem Restoration Specialist
Historian
Living History Program Coordinator
Education Program Coordinator
Landscape Architect
Museum Director
Ranger
Ecotourism Specialist
Research Scientist
Youth Program Coordinator

Wildlife:
Wildlife Biologist
Fisheries Specialist
Conservation Educator
Endangered Species Biologist
Wildlife Refuge Manager
Fish Hatchery Manager
Field Researcher
Game Warden
Wildlife Rehabilitator
Marine Biologist
Aquarium Director
Zoo Director
Wetlands Ecologist
Animal Control Officer
Educator

Forestry:
Urban Forester
Arboriculture Specialist
Consultant
Forest Hydrologist
Forest Pathologist
Forest Entomologist
Forest Manager
Horticulturalist
Landscape Designer
Recreation Manager
Ranger
Forest Economist
Educator
Logger
Researcher
Botanist
Wood Products Industry Worker
Civil Engineer
Planner

Possible Interview Questions

Why are you interested in this position?

Why should we select you for this position?

Tell me about yourself.

What are your strengths?

What could you bring to this job?

Describe an experience when you were a team player.

Describe an experience when others looked to you for leadership.

What qualifications do you have to prepare you for this job? (knowledge, skills, experiences?)

The Game of Life

Here's how to play:

You're applying for a job in soils/water, forestry, wildlife, or parks and recreation. (Your teacher has assigned you one of these career fields.) You will participate in a "Game of Life" (a card game) to determine what your educational background and other experiences/qualifications are for that career field. Using the results of the "Game of Life," you'll then be able to apply for the job available.

Your teacher will distribute your career group's set of "Game of Life" cards. Don't turn them over to look at them. There will be three sets of cards for each career field: **Education**, **Experience**, and **Other**. Be sure not to mix the three sets of cards together because each is used for a separate round of the game.

Round #1: Deal out the cards in the "Education" pile to your small group of students. Keep passing the cards out around the circle of students until there are no more cards remaining. There may not be an equal number of cards to go around and this is okay! Don't look at your cards yet!

Round #2: *Starting with the next person in line when you finished dealing out the "Education" cards in Round #1,* deal out all of the "Experience" cards. Don't look at your cards yet!

Round #3: *Starting where you left off when dealing out the "Experience" cards,* deal out the "Other" cards until there are no more left.

Everyone may now look at his or her cards. These qualifications and experiences now are "yours." For the purpose of this exercise, they now represent "your life." These are **some** of the qualifications and experiences that you'll now use for applying for a job in your career field. Your group work is temporarily finished. Now, you're on your own to compete with fellow students in the same career field for THE BIG JOB. In order to apply for that job, you'll need a resume.

Your teacher will give the next instructions. *Good luck!!*

Wildlife Education	Wildlife Education	Wildlife Education
Master of Science in Wildlife Management, 2000	Bachelor of Science in Wildlife Management with a Minor in Environmental Law Enforcement, 1999	Bachelor of Science degree in Natural Resource Management, 2000.
Wildlife Education	**Wildlife Education**	**Wildlife Education**
Bachelor of Science degree in Biology/Zoology with a minor in Wildlife Management, 1999.	Bachelor of Science degree in Fisheries Biology, 2000	Bachelor of Science degree in Wildlife Biology, 1999; currently enrolled as graduate student studying for Master's degree in Fisheries. Will graduate with Master's degree in three months.
Wildlife Education	**Wildlife Education**	**Wildlife Experience**
Master of Science in Wildlife with an Emphasis in Habitat Restoration.	Master of Science in Wildlife Management, 1999	Field Biologist Intern with the Institute for Wildlife Management. Six month position. Involved in conducting population studies of white-tailed deer in urban areas.

Wildlife Experience	Wildlife Experience	Wildlife Experience
Environmental Education Internship, Free Environmental Center. Taught environmental lessons to school children visiting a local nature center. Nine months.	Game Warden's Intern. Three months internship assisting game wardens with environmental law enforcement efforts.	Wildlife Environmental Science Internship, Podunck Wildlife Sanctuary. Cared for injured animals at a wildlife rehabilitation center. One year position.
Wildlife Experience	**Wildlife Experience**	**Wildlife Experience**
Wildlife Technician, Harry Bellafonte Farms. One year experience caring for all phases of pheasant production with an emphasis on brooding young pheasants.	Zoo-Keeper's Assistant, San Fran Zoo. Two summers of experience in cleaning the elephant's cage, answering questions from visitors to the Elephant's Exhibit, and assisting the Head Zoo-Keeper in caring for the African Elephants.	Black Bear Research Intern, Northern Ridges. Three month internship helping aid lead research scientists in studying black bear habitat requirements.
Wildlife Experience	**Wildlife Experience**	**Wildlife Experience**
Wildlife Researcher, University of Life. Two years working on a grant-funded project with the National Institute for Endangered Species to determine the range of the California Condor.	Gas Station Attendant. Two years, part-time checking out customers. Opening and closing facilities.	Animal Shelter Volunteer. Cared for cats and dogs at local shelter. Also cleaned cages. One year during high school. .

Wildlife Experience	Wildlife Experience	Wildlife Experience
Veterinarian's Volunteer. Helped out at vet's office with care of animals in kennel. Job shadowed veterinarian. Two years during high school.	Research Assistant. Participated in plant study to determine which species of plants were most affected by deer browsing in an urban area. One year.	Deer Population Study Assistant. Helped UP University professor in conducting radio telemetry studies on deer populations in Sweet County. One year.
Wildlife Experience	**Wildlife Experience**	**Wildlife Experience**
Gas Station Attendant. Sold gas and other items at the One-Stop Store. Part-time for one year.	BurgerMagic Staff. Flipped burgers and made fries. Checked out customers. 6 months.	Environmental Health Staff. Cleaned hospital bathrooms and hospital cafeteria. Evening shift. Six months
Wildlife Other	**Wildlife Other**	**Wildlife Other**
Hobby Bee-Keeper for 4 years. (Maintain beehives and collect honey. Sell honey for own business.)	Enjoy fishing and hunting.	Member of local conservation club, ConservoClub. Helped plan fisheree fund-raising event.

Wildlife Other	Wildlife Other	Wildlife Other
Achieved highest award in Scouting.	Volunteer at local fish bait shop. Cared for minnows and other bait in tanks. Sold bait to customers.	Avid bird-watcher.
Wildlife Other	**Wildlife Other**	**Wildlife Other**
Enjoy hiking.	Writer with two published articles in Natural Animals Magazine.	Rock climber.
Wildlife Other	**Wildlife Other**	**Wildlife Other**
Participated in Sandhill Crane Count in marshes in early spring.	Park Naturalist. Greeted visitors at local park to answer questions about the natural features of the area. Sold park admission stickers. One summer.	Student Organization Leader for Wildlife Tomorrow Club at UP University. Organized community service projects. One year.

Wildlife Other	Wildlife Other	Wildlife Other
Recycling Center Staff. Sorted recyclables.	High School Debate Team. Won County contest debating issue of whether or not bow hunting should be allowed to keep urban deer populations in check.	National Honor Club of High School Students. Two years. Recognizes academic excellence and student leadership.
Wildlife Other	**Wildlife Other**	**Wildlife Other**
Babysitter. Watched kids of neighbors.	Had own business mowing lawns for neighbors on a regular basis over a three-year period.	Participated in planning for, planting, and maintaining a 2-acre butterfly garden on our high school grounds.
Wildlife Other	**Wildlife Other**	**Wildlife Other**
Musician. Drummer.	Environmental Center Volunteer. During summer, volunteered to help with nature activities for elementary-aged children at day camp. Developed and taught animal tracking lesson.	As the child of a military officer, lived all over the United States and the world including such places as Korea, Germany, Belgium, Turkey, Alaska, Virginia, and Washington State.

Wildlife Other	Wildlife Other	Wildlife Other
Grocery Store Bagger. Bagged groceries for customers and helped load their cars.	Stocker for Warehouse of Auto Store. Stocked shelves and bins with tools and parts.	Volunteer Library Aide. Helped return books to shelves in library. Checked in/out books and helped customers learn how to use computerized "book-find" system.

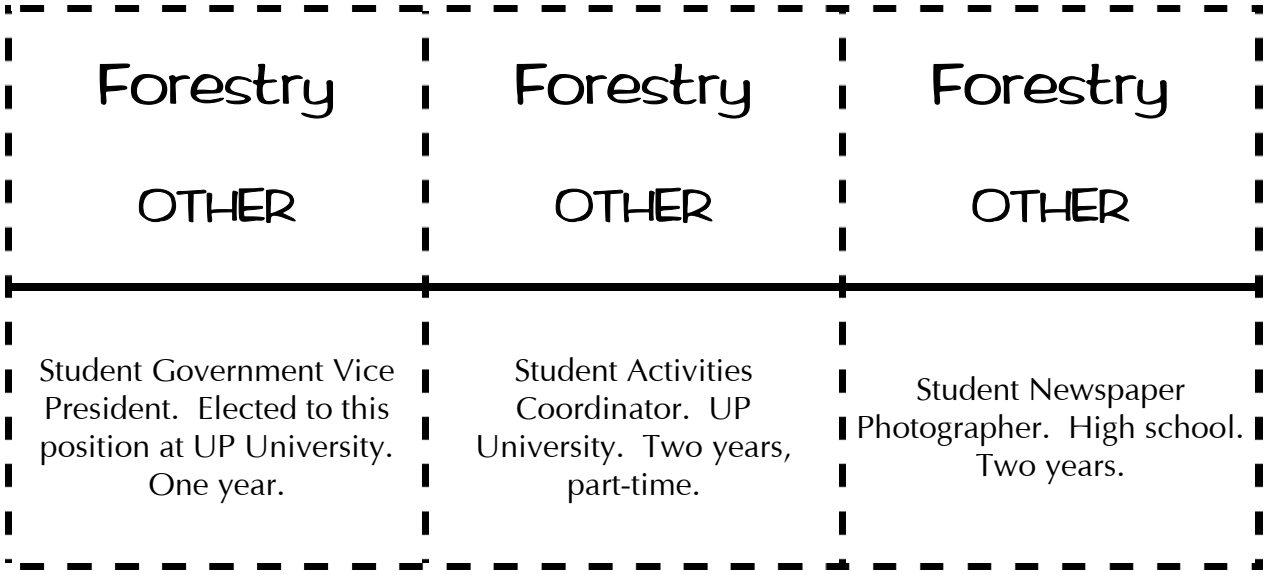
Forestry EDUCATION	Forestry EDUCATION	Forestry EDUCATION
Bachelor of Science, Forestry, 1999.	Bachelor of Science, Forestry with Minor in Soil Science, 2000.	Master of Science in Forestry with Emphasis in Urban Forestry, 1999.
Forestry EDUCATION	**Forestry EDUCATION**	**Forestry EDUCATION**
Bachelor of Science, Forestry with a Minor in Business.	Bachelor of Science in Forest Ecology, 1999.	Masters of Science in Business Administration, 2000.
Forestry EDUCATION	**Forestry EDUCATION**	**Forestry EXPERIENCE**
Bachelor of Science, Forestry, 1999.	Bachelor of Science, Forestry with Minor in Soil Science, 2000.	Lumberjack and Logging History Museum Staff. Led visitors on guided tours of local museum that featured lumberjack and logging history of the region. Summer position.

Forestry Experience	Forestry Experience	Forestry Experience
Natural Resources Forestry Program Coordinator. Two years experience coordinating forestry programs for to help educate private landowners about how to more effectively manage their own lands. Organized training workshops.	Intern in Public Affairs Department of Smith's Paper Mill. Two years experience assisting with news services, writing for company newsletter, and helping on special projects.	ArborCare Tree Service. Two summers of experience as a crew member. Trimmed trees and assisted with timber harvest practices for private landowners.
Forestry Experience	**Forestry Experience**	**Forestry Experience**
WauWau Tree Care Crew Member. One year tree trimming and timber harvest experience.	Environmental Affairs Assistant for Champ Company. Helped the Lead Coordinator of Environmental Affairs build partnerships with legislators, media, trade association, and public interest groups. One year.	Laboratory Assistant. Assisted in conducting laboratory tests on wood products made by LifeLong Wood Company. Conducted an independent research study and presented at State Wood-Products Conference. Two years.
Forestry Experience	**Forestry Experience**	**Forestry Experience**
Garden Center Employee. Assisted customers in selecting and purchasing trees in the bare root room of SunTown Garden Center. Six months.	Teaching Assistant. Assisted well-known professor at UP University in teaching undergraduate students about the basics of forestry.	Fire Warden Intern. Assisted local fire warden in enforcing fire laws such as burning bans. Educated landowners. Part-time, two years.

Forestry EXPERIENCE	Forestry EXPERIENCE	Forestry EXPERIENCE
Summer Camp Counselor. Led teens on wilderness trips. One summer.	Farm Aide. Two years of part-time experience helping milk cows at neighborhood dairy farm.	Canning Factory Staff. Worked part-time through bean and corn canning seasons.
Forestry EXPERIENCE	**Forestry EXPERIENCE**	**Forestry EXPERIENCE**
Student Delegate to National Convention for ForestryNet Organization. Voted by fellow university students to be their representative at national assembly.	Legislative Research Intern. One year experience researching environmental issues for local legislative official.	Just Trees 'n Shrubs Company Staff. Worked in the tree care division of a large tree nursery part-time for one year.
Forestry OTHER	**Forestry OTHER**	**Forestry OTHER**
Chainsaw Safety Trainer, Rural Land Society. Led five workshops for the general public on how to properly use and care for chainsaws.	Certified Wildfire Fighter. Certified through university course in wildfire suppression techniques. Participated on burn crew on two major prairie wildfires.	Member on Landscaping Crew for GoGreen Landscaping Company. Implemented natural landscape plans. Had contact with landowners to clarify landscape concepts and verify landscape plans met their needs.

Forestry OTHER	Forestry OTHER	Forestry OTHER
Board Member, Student Society of Forestry Forever Chapter, UP University. Helped to organize student chapter of over 35 so that they could gain more first-hand experience in the forestry field.	Qualified in Safe Tree Climbing. Trained with 40 hours of experience in maneuvering ropes, harnesses, and other tree-climbing equipment.	Food Center Service Desk Staff. Two years, part-time. Assisted customers through a variety of services including check cashing, film development, mail services. Upheld quality assurance policies. Liaison between customers and store management.
Forestry OTHER	Forestry OTHER	Forestry OTHER
Highway Crew. Two summers. Participated on County Road Crew to repair potholes in county roads. Helped to redirect traffic.	Retirement Home Volunteer. Two years part-time experience. Assisted in delivering dinners to elderly folks. Also worked in recreation room helping to lead a variety of games and activities.	Equestrian Instructor. Taught horsemanship lessons for girls at a summer camp. One Summer.
Forestry OTHER	Forestry OTHER	Forestry OTHER
Chair of Local Earth Day Special Event. Organized planning teams to host a one-day environmental event for the general public. Coordinated news services.	Recycling Center Staff. Sorted recyclables. Six months, part-time.	Farmhand. Helped parents run all aspects of family dairy farm.

Forestry OTHER	Forestry OTHER	Forestry OTHER
Trail Maintenance Volunteer. Helped local hiking club maintain 24 mile trail segment. Two years.	Certified scuba diver.	Updated certification in First Aid and CPR.
Forestry OTHER	Forestry OTHER	Forestry OTHER
Assistant at Small Engine Repair Shop. Learned how to repair a variety of small engines such as chainsaws and lawn mowers. One year. Part-time.	Motorcycle Shop Clerk. Helped customers learn about motorcycle brands and make buying decisions. Part-time, six months.	Bakery Assistant, Donuts Division. Baked donuts every Saturday morning as part of family-owned business.
Forestry OTHER	Forestry OTHER	Forestry OTHER
Computer skills well developed. Internet "literate."	Designed and continue to maintain own web page. (Since 1999.)	Excellent written communication skills.


Forestry
OTHER
Student Government Vice President. Elected to this position at UP University. One year.
Forestry
OTHER
Student Activities Coordinator. UP University. Two years, part-time.
Forestry
OTHER
Student Newspaper Photographer. High school. Two years.

Soils/Water Resource EDUCATION	Soils/Water Resource EDUCATION	Soils/Water Resource EDUCATION
Bachelor of Science in Soils, 2000.	Bachelor of Science in Water Resources with a Minor in Soils, 2000	Master of Science in Water Resources with an Emphasis on Watershed Management, 2000
Soils/Water Resource EDUCATION	**Soils/Water Resource EDUCATION**	**Soils/Water Resource EDUCATION**
Bachelor of Science in Soils, 1999.	Master of Science in Water Resources with an Emphasis on Water Policy, 2000.	Bachelor of Science in Soils, 1999.
Soils/Water Resource EDUCATION	**Soils/Water Resource EDUCATION**	**Soils/Water Resource EXPERIENCE**
Bachelor of Science in Water Resources with a Minor in Soils, 2000.	Bachelor of Science in Forestry with a minor in Soils, 1999.	Farmhand. Helped parents run all aspects of family dairy farm.

Soils/Water Resource EXPERIENCE	Soils/Water Resource EXPERIENCE	Soils/Water Resource EXPERIENCE
County Conservation Technician. Two years experience providing technical assistance concerning agricultural soil and water projects.	Assistant to Water Resource Specialist. One year assisting the Water Resource Specialist in promoting and coordinating a variety of research and monitoring projects.	Trail Maintenance Volunteer. Helped local hiking club maintain 10 mile trail segment. One year.
Soils/Water Resource EXPERIENCE	**Soils/Water Resource EXPERIENCE**	**Soils/Water Resource EXPERIENCE**
Visitor Center Naturalist. Led public programs on a variety of environmental topics. Two summers.	Organizer for Inner City Beautification Effort. Helped to organize teams for a special event to improve the quality of the environment and the quality of life in my hometown's inner city area. 120 people involved.	Watershed Center Assistant. Helped Center Staff develop exhibits on watershed basins. Summer.
Soils/Water Resource EXPERIENCE	**Soils/Water Resource EXPERIENCE**	**Soils/Water Resource EXPERIENCE**
Conservation Corps Staff. One year experience on work crew doing a variety of conservation and building projects to improve local parks and trails. Part-time	Greenhouse Staff. Under direction of horticultural specialists, participated in all aspects of greenhouse operations. Part-time, 9 months.	General Manager, Recreation Services, UP University. Student manager of the operation which involved maintaining an inventory of skis, camping gear, canoes, and other outdoor equipment for student check-out. Managed other student staff. One year.

Soils/Water Resource EXPERIENCE	Soils/Water Resource EXPERIENCE	Soils/Water Resource EXPERIENCE
Greenhouse Assistant. Worked for local company that specialized in aquatic vegetation and pond-making. Advised customers about how to build and maintain ponds. One summer.	River Rafting Guide. Two summers of experience safely leading groups of people on river rafting trips. Maintained rafting equipment.	Save Our Habitat Volunteer. Participated in a wide variety of habitat restoration efforts in the Pierson County area including trout stream improvement, prairie restoration, and wetland management projects. Two years.
Soils/Water Resource EXPERIENCE	**Soils/Water Resource EXPERIENCE**	**Soils/Water Resource EXPERIENCE**
Fish "Farm" Research Assistant. Participated in a one-year research study on fish "farming" to determine the feasibility of starting an aquaculture business in our local community on the Mesh River.	Natural Resource Assistant I. Sold admission stickers for entrance into the park. Gave visitors information about points of interest in the park.	Fishing Boat Food Processor. One summer on fishing vessel in Alaskan waters sorting and processing fish.
Soils/Water Resource OTHER	**Soils/Water Resource OTHER**	**Soils/Water Resource OTHER**
Trout Future Volunteer. Participated on local conservation project to improve trout stream habitat. Was the publicity chair for the annual Christmas Tree Round-Up so that there were enough trees to finish the project of tying them to shoreline.	Ice Cream Server. Made shakes, ice cream cones, and other frozen treats for customers at a local ice cream shop. One summer, full-time.	Computer skills well developed. Internet "literate."

Soils/Water Resource Other	Soils/Water Resource Other	Soils/Water Resource Other
Designed and maintain a web page for my environmental club at Second to None University.	Excellent written communication skills.	Gave 10 guest presentations for local civic organizations on the subject of trout stream habitat improvement.
Soils/Water Resource Other	Soils/Water Resource Other	Soils/Water Resource Other
Bank teller. One year (full time) as a bank teller helping customers with a variety of financial transactions.	Student Government Secretary. Elected to this position at Second to None University. One year.	Recreation Coordinator. University liaison to students. Helped plan exciting trips for students over spring break. Two years, part-time.
Soils/Water Resource Other	Soils/Water Resource Other	Soils/Water Resource Other
Student Newspaper Photographer. Second to None University. Two years meeting publication deadlines.	Cashier. Checked out customers at local grocery store.	Debate Team Leader on High School Forensics Team. Our team took second place in the debate competition at the State Level.

Soils/Water Resource OTHER	Soils/Water Resource OTHER	Soils/Water Resource OTHER
Hobby gardener.	Treasurer, Student Society for Soils. One year elected position at UP University as officer for student organization that focuses on issues related to soil conservation.	Have up-to-date boat safety certification and lifeguard qualifications.
Soils/Water Resource OTHER	**Soils/Water Resource OTHER**	**Soils/Water Resource OTHER**
Certified in first aid and CPR.	Volunteer at County Conservationist's Office.	Desktop publishing experience. Have developed publicity flyers.
Soils/Water Resource OTHER	**Soils/Water Resource OTHER**	**Soils/Water Resource OTHER**
Taught fly-tying workshops for kids so that they could learn how to make their own fishing lures.	Tutor for Biology Students. One year, part-time during college. Helped biology students in UP University master zoology coursework.	Summer Camp Trip Leader for Local Youth Organization. Led teens on summer adventures including canoe trips and water rafting trips.

Soils/Water Resource Other	Soils/Water Resource Other	Soils/Water Resource Other
Received the Mesh River Artist's Award in a local painting contest. (All contestants were to paint the River.)	Experience showing calves at local County Fair. Won blue ribbon.	Worked at Soil Testing Lab at UP University. Part-time after classes for one year.

Parks and Recreation Education	Parks and Recreation Education	Parks and Recreation Education
Bachelor of Science in Forest Recreation, 1999.	Bachelor of Science in Forest Recreation with a Minor in Environmental Education, 2000.	Master of Science in Forestry with an Emphasis in Forest Recreation, 2000.
Parks and Recreation Education	**Parks and Recreation Education**	**Parks and Recreation Education**
Bachelor of Science in Natural Resources with a Minor in Environmental Education/ Interpretation, 1999.	Master of Science in Natural Resources with an Emphasis on Environmental Education, 1999.	Master of Science in Natural Resources with an Emphasis on Park Interpretation, 2000.
Parks and Recreation Education	**Parks and Recreation Education**	**Parks and Recreation Experience**
Bachelor of Science in Forest Recreation with a Minor in Adventure Education, 2000.	Master of Science in Education with an Emphasis in Recreation, 2000.	Parks Commission Staff. Six months on special project to gather public input about a new hiking/biking trail network proposed for a suburban area. Analyzed statistics.

Parks and Recreation Experience	Parks and Recreation Experience	Parks and Recreation Experience
State Park Naturalist. Two summers developing, promoting, and delivering public programs to site visitors.	Assistant Site Director. Two years experience assisting Camp Director in overseeing the general operations of the year-round youth camp.	Naturalist. Developed, delivered, and evaluated nature programs for youth ages 7-9 in a summer camp.
Parks and Recreation Experience	**Parks and Recreation Experience**	**Parks and Recreation Experience**
Summer Camp Counselor. Around-the-clock care and programming for summer campers ages 7-16. Programs included archery, waterfront activities, the arts, and nature education activities.	Challenge Course Trainer. Volunteer trainer at local high school to certify others on the proper use of the challenge course equipment. One year.	Intern, County Parks Department. Six months experience helping out with a variety of parks jobs including maintenance, custodial services, trail projects, and safety checks in local campgrounds.
Parks and Recreation Experience	**Parks and Recreation Experience**	**Parks and Recreation Experience**
Member on Landscaping Crew for GoGreen Landscaping Company. Worked on landscape crew creating natural landscapes in an urban area. Nine months.	Park Naturalist. Greeted visitors at local park to answer questions about the natural features of the area. Sold park admission stickers. One summer.	River Rafting Guide. Two summers of experience safely leading groups of people on river rafting trips. Maintained rafting equipment.

Parks and Recreation Experience	Parks and Recreation Experience	Parks and Recreation Experience
Park Naturalist. Led public programs on a variety of environmental topics. Two summers.	Organizer for Inner City Beautification Effort. Helped to organize teams for a special event to improve the quality of the environment and the quality of life in my hometown's inner city area. Promoted green spaces.	Assistant Forestry Technician. One year experience assisting on a study of the impacts of clear-cutting on soil erosion in western Podunck County.
Parks and Recreation Experience	**Parks and Recreation Experience**	**Parks and Recreation Experience**
Burgers R Us Cashier. Checked out customers. Trained others to operate new cash registers. Six months.	Gas Station Attendant. Sold gas and other items at the Fun-Stop Store. Part-time for one year.	Member, Student Society of Forestry Forever Chapter, UP University. Participated in a variety of forestry-related student activities such as Forestry Awareness Day and arboriculture demonstrations for the general public. Two years.
Parks and Recreation Other	**Parks and Recreation Other**	**Parks and Recreation Other**
Equestrian. Raised horses since I was a youngster. Trained them. Participated in horsemanship competitions.	Avid bird-watcher.	Participated on college Swim Team. (Four years in competition.)

Parks and Recreation Other	Parks and Recreation Other	Parks and Recreation Other
Lifeguard certification.	Desktop publishing experience. Have developed publicity flyers.	Taught birdhouse building workshops for kids ages 9-11. (Special event at local fair.)
Parks and Recreation Other	**Parks and Recreation Other**	**Parks and Recreation Other**
Summer Camp Trip Leader for Local Elderhostel Organization. Led able seniors on summer adventures including canoe trips and hikes. (Part-time.)	Tutor for Forestry Students. One year, part-time during college.	Intern at Planning and Zoning Commission. Assisted Senior Planners as they worked through new policy issues to manage urban sprawl.
Parks and Recreation Other	**Parks and Recreation Other**	**Parks and Recreation Other**
Enjoy hiking.	Writer with three published articles in Naturalist Magazine.	Scuba diver.

Parks and Recreation Other	Parks and Recreation Other	Parks and Recreation Other
Participated in Frog Count in marshes in early spring. (Two springs.)	Student Organization Leader for the Forest Recreation Club at UP University. Organized community service projects. One year.	Recycling Center Tour Guide. Volunteer position leading people on tours of facilities.
Parks and Recreation Other	**Parks and Recreation Other**	**Parks and Recreation Other**
High School Forensics Team Member.	Special Event Organizer. Organized planning teams to host a one-day environmental event for the general public. Coordinated news services.	Participant in Hike-A-Thon fund-raiser to support local trail network development. Raised $350.
Parks and Recreation Other	**Parks and Recreation Other**	**Parks and Recreation Other**
Recreation Coordinator. Helped plan exciting weekend field trips for students. One year.	Enjoy biking.	Photographer. Have one award-winning photograph.

Parks and Recreation Other	Parks and Recreation Other	Parks and Recreation Other
Amateur Astronomer. Since I was young and had my own telescope, I have been studying astronomy in my own backyard.	Telemarketing experience for local non-profit organization. (Three months, part-time.)	Love to backpack. My goal is to someday hike the entire 1000 mile Ice Age Trail network in the State!

Wildlife

	Education			Experience			Other		
	Master's degree in Wildlife desired.			At least two years' experience in wildlife or related field desired. Research experience balanced with real world dealings with human dimensions in wildlife management.			Demonstrated ability to tolerate a wide variety of work conditions and people. Would prefer candidates with experience resolving issues. Must be an independent worker—someone we can count on to meet deadlines without someone watching over his/her shoulder.		
Applicant Name	Plus	Ok	Minus	Plus	Ok	Minus	Plus	Ok	Minus

Forestry

	Education			Experience			Other		
	Bachelor's degree in Forestry required.			Business/economics background desired. At least two years' experience in forestry or related field. Emphasis on forest products industry preferred.			Ability to balance business "sense" with natural resource "sense." Also requires ability to work as part of a team.		
Applicant Name	Plus	Ok	Minus	Plus	Ok	Minus	Plus	Ok	Minus

Soil/Water Resources

	Education			Experience			Other		
	Bachelor's degree in Soils or Water Science required.			Proven ability to work well with others in a professional setting. Field experience doing research or working with public on resolution of soils- or water-related issues preferred.			Ability to work independently. Must be dependable and trustworthy. Proven ability to manage many projects simultaneously.		
Applicant Name	Plus	Ok	Minus	Plus	Ok	Minus	Plus	Ok	Minus

Parks and Recreation

	Education			Experience			Other		
	Bachelor's degree in Parks or Recreation or related field required.			Minimum two years' experience working in a public setting required—must have had a great deal of experience working with people from a variety of backgrounds. Experience planning programs desired.			Candidates with exceptional oral and written communications skills only. Volunteer experience desirable because it indicates a willingness to "pitch in and help." Demonstrated ability to work well with people of all ages. Love of outdoors.		
Applicant Name	Plus	Ok	Minus	Plus	Ok	Minus	Plus	Ok	Minus

Resume

Name_____

Address_____
_____

Career Goal

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Education

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Experience

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REFERENCES AVAILABLE UPON REQUEST

Resume

Name Jo B. Less

Address 101 Wild Ln.
Lifeton, CO 23324

Career Goal
To become a wildlife rehabilitator.

Education
- Bachelor of Science degree in Natural Resource Management, 2000
-

Experience
- Wildlife Environmental Science Internship, Podunck Wildlife Sanctuary. Cared for injured animals at a wildlife rehabilitation center. One year position.
- Black Bear Research Intern, Northern Ridges. Three month internship helping lead scientists in studying black bear habitat requirements.
-

Other
- Avid bird-watcher
- Writer with two published articles in Natural Animal Magazine.
- Had own business mowing lawns for neighbors on a regular basis over a three-year period.
-
-

REFERENCES AVAILABLE UPON REQUEST

Lesson Eight

Forest Management

Concepts

1. Sustainable harvesting is a logging method used by foresters to ensure a continuous and constant supply of lumber throughout time.
2. The type of management used on a forested land depends on the goals of the landowner, the investors, the local community, and the public.
3. Forest resources can be managed for multiple uses.
4. Conflicts may arise when managing a forest for multiple uses.
5. Compromise and cooperation are important when management plans encounter conflict.

Objectives

Students will be able to:

1. Identify and compare the uses of clearcutting, shelterwood cutting, and selection cutting in forest management.
2. Define sustainable harvest.
3. Use the dot-grid method to calculate the areas of different forest types on a map.
4. Design a forest management plan using management guidelines to meet objectives.
5. Compromise with other students to create a management plan.
6. Describe several sources of conflict in forest management.

Teaching Site

Indoor classroom with large desk/table space.

Materials

Day 1 - Forest Area - calculators, rulers, transparent dot grids for students, **Forest Area Worksheets** for students. Harvesting Methods – all 5 **Harvesting Methods Overheads**. Sustainable Harvest – **Sustainable Harvest Worksheet 1 and 2** as worksheets for students and as overhead transparencies.

Day 2 - Forest Management Simulation – calculators, rulers, red/green/blue/brown colored pencils, transparent dot grid handouts, **Shady River State Forest Map handout**, **Worksheets 1-2** as handouts and teacher copy for reference, **Management Objectives for wildlife and recreation and forestry** as handouts, **Best Management Practices and Rules for Map Drawing** as handout.

Day 3 - Decision and Discussion – calculators, **Worksheet 3**, **Who owns Wisconsin's Forests Pie Chart** as an overhead transparency.

Lesson Time

3 50-minute class periods

Nutshell

In this lesson students will learn forest management concepts and practices and use these techniques to create forest management plans that satisfy certain objectives. While creating the management plan the students will see how conflict can arise when trying to meet differing management goals. The completion of these management plans, along with a guided discussion, will introduce the concepts of multiple-use management and sustainable forestry.

Teacher Preparation

Read background information before each day of class and prepare materials. Familiarize yourself with the worksheets and overheads. It may be helpful to use the dot grid, work through the worksheets, and answer all of the questions that appear in the activities before beginning the lesson.

Vocabulary

- **Acre** – the most common unit of measurement used by foresters in Wisconsin. A football field is about 1.2 acres in size.
- **Cutting rate** – the rate of timber harvesting that produces a sustainable harvest.
- **Cutting (Harvesting) method** – timber harvesting method used to encourage the re-growth of specific trees (clearcutting, shelterwood cutting, and selection cutting).
- **Dot grid** – a grid composed of squares and dots that foresters use to measure area on a map.
- **Ecosystem management** – use of ecological concepts to predict the effects of management actions on the ecosystem and to guide management planning and actions over large areas of land and through long periods of time.
- **Multiple-use management** – the practice of managing forest resources for a variety of benefits including water quality, timber yield, wildlife habitat, recreation, and wilderness.

- **Sustainable harvest** – forest management practices that ensure the constant and continuous production of forest resources through time.

- **Sustainable forestry** - the practice of managing forest ecosystems to provide ecological, economic, and cultural benefits for present and future generations

See previous lesson for additional terms used in this activity.

Background Information

Sustainable Harvesting

Sustainable harvest is a method of cutting and planting trees which forest managers use to maintain continuous and lasting timber production. Sustainable harvesting also distributes a forester's work, time, and expenses evenly. It may be best to visualize sustainable harvest by example.

Assume that you are harvesting red pine and that red pine must be 60 years of age before it is big enough to harvest. Also assume that you have 120 acres of red pine and all of the red pine that you have is 60 years of age. What is your harvest plan? If you cut all 120 acres right away then you will have to wait 60 years to cut again. You would overwork yourself and your employees and then have an extended 60 year vacation. If you plan on managing the land in perpetuity it would make more sense to evenly distribute the cutting.

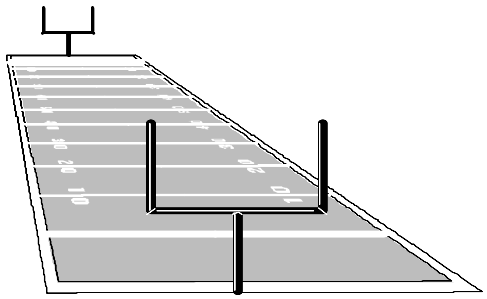
If you take the total amount of acres you have and divide it by the number of years that it takes the trees to mature you will come up with the **cutting rate** (120 acres / 60 years = 2 acres per year).

Now visualize the result. If you begin cutting 2 acres per year and planting directly afterwards, by the time you reach the end, the first acres that you cut will once again be 60 years old. You can then continue to harvest. This trend will continue indefinitely, assuming that the land will continue to produce mature red pine trees in 60 years. The final outcome can be visualized as a continuous cycle of harvesting and planting.

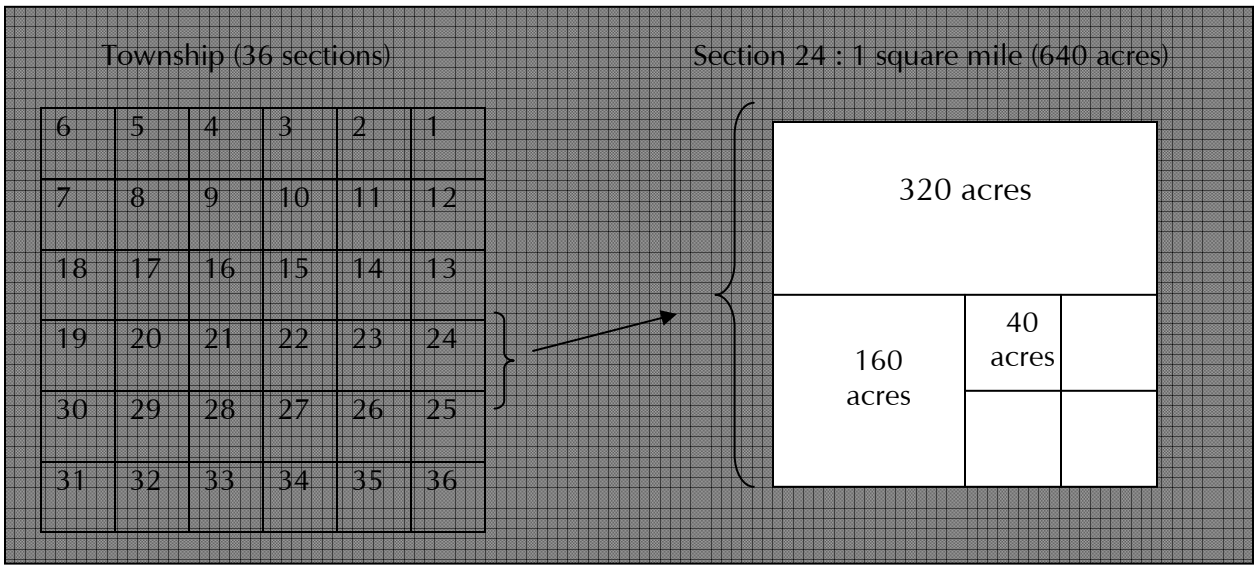
It is important to note though that real forest management is unlikely to ever be this mathematically perfect. Most likely the trees will differ in growth rates throughout a forest and the ages of trees will not be evenly distributed. Disturbances such as insect infestations and wildfires, along with invasive plants, soil erosion, acid rain, and many other factors, continuously disrupt natural forest systems. These disruptions also affect the amount of timber and rates of growth throughout a forest.

Forest Area

Acres are the most common unit of land area used by foresters when mapping forested land in the Wisconsin. One acre is equal to 43,560 square feet. Why such a strange number? When land was first mapped in the United States during our westward expansion, a grid method was used that divided land into townships. These townships were made up of 36 sections. Each section was 1 square mile. The sections (square miles) were then further divided. One square mile equals 640 acres, thus half of a section would be 320 acres. One half of a half section would be 160 acres and so on. As more people acquired land, the land was divided into smaller and smaller parcels.



Today it is common for an individual to own a quarter of a quarter section which is 40 acres. The term "the back 40" refers to this system of land distribution. For comparison, **a standard outdoor football field is about 1.2 acres.**

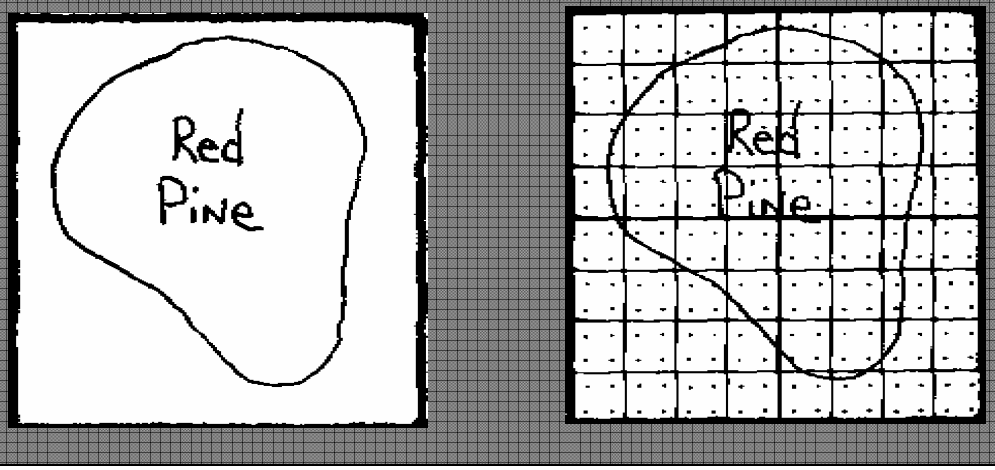


When resource managers need to measure land area on maps, it is common to use a dot grid to do so. The dot grid is a relatively quick and easy way to get estimations of land areas. Many types of dot grids are used, each having its own specific scale. The dot grid that we will be using has a scale of 1 dot = 40 acres.

To use the dot grid place the transparent grid over the top of the map. Line up the grid so that the solid lines run vertically and horizontally. Count all of the dots that are inside of the land area in question. Some dots may be right on the line. If this is so, count every other one as in. Take the total number of dots and multiply it by the number of acres the dot represents (40). The answer is the number of acres of land.

For example: The map below on the left represents the forested area in question. If you needed to find the forested area occupied by red pine trees, you would 1) lay the grid over the picture as shown in the picture below on the right 2) count the number of dots inside of the area marked as red pine (if they are on the line count every other one), and 3) multiply the number of dots times 40. Your answer will be the acreage of red pine in the forested area.

(111 dots) x (40 acres per dot) = 4440 acres of red pine



Forest Management

Managing forested areas requires foresight, planning, and the involvement of many people who represent various goals and interests. It is necessary to seek the input of more professionals than just foresters. Wildlife biologists, soil scientists, hydrologists, recreation specialists, and many other professionals work with foresters to create management plans. The local community's needs and public opinion must also be kept in mind as they may be the landowners, users, or funding sources. Their combined efforts in creating a management plan is crucial to quality forest management.

The purpose of a management plan is to identify the goals and objectives of the landowner, determine how these goals will be achieved, achieve the goals in accordance with the best management strategies available, and monitor the effectiveness of the management plan. The management goals and objectives are determined by the landowner's values. When the landowner is a public agency, such as state government, the values considered are those of the community as interpreted by government officials. There are two major forest management theories that dictate current and future forestry practices: sustainable forestry and ecosystem management.

Sustainable forestry involves the sustainable production of timber (as discussed earlier) along with the continuous production of many other benefits from a forest. According to Wisconsin State Legislature, sustainable forestry is "the practice of managing constantly changing forest ecosystems to provide ecological, economic, social, and cultural benefits for present and future generations."

Ecosystem management is a new concept in forestry and its applied definition remains broad and unspecified. Ecosystem management encourages foresters to move away from thinking of forests as just tree components and towards treating them as integrated and complex systems of water, air, soil, plant, and animal interactions. Much data and understanding is still required to properly manage ecosystems, but the understanding that many ecosystem characteristics are related is well established. For example, Mike Dombeck, the chief of the U.S. Forest Service, strongly emphasizes the importance of healthy forests and good forest management as a key in maintaining healthy watersheds. Healthy watersheds provide us with clean water, wildlife habitat, land security, and many other benefits.

The development of management plans that use ecosystem management principles is very difficult and requires the coordination of many different citizen and state groups. According to the Wisconsin DNR, the understanding of scientific facts together with open-minded discussion among citizens with differing perspectives will be required to develop policies that consider ecological principles, economics and human values.

Activities Overview

Students will participate in a simulation activity which will demonstrate the complexities of forest management. On day one, the entire class (the new group of employees for the DNR Forestry Division) will participate in a DNR training session. In this session, the students will learn how to use a dot grid to measure land area from a map, the methods of tree harvesting, and the science of sustainable harvest.

On day 2, the class will be divided into groups of 2-4 students. Each group will receive the forest cover map of the Shady River State Forest and be introduced to the maps details and the history of the land. They will use this map along with a data table to determine the value of standing timber within the state forest. The students will then be given the compiled list of management objectives (forestry, parks and recreation, and wildlife) and a list of Best Management Practices

that they must follow. Students will work within their group to form a management plan that meets or exceeds their objectives and the Best Management Practices assigned to them. After the maps are completed, students will determine how much money they make each year from forestry in the State Forest and how much standing timber is available to be harvested.

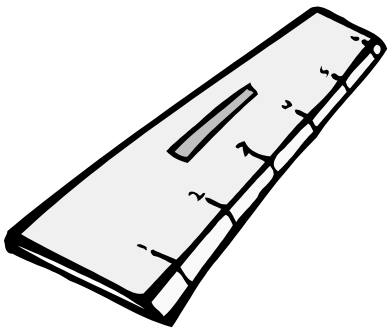
On the third and final day, the groups will present the maps to the rest of the class. These final maps will be overviewed by the teacher (State Forester) and the class (DNR staff) in order to determine if the Best Management Practices and objectives were met. The final maps will then be voted on by the class to select the best management plan. Students will then be introduced to the concept of sustainable forestry and begin to analyze how forests are managed throughout Wisconsin. They will assess the economic cost of multiple-use management and the ways this cost can be measured. Finally, the students will take a peek at who owns and manages Wisconsin's forested lands.

Activity 1- The Training Session

At the beginning of class let the students know that each and every one of their applications for employment has been accepted by the Wisconsin Department of Natural Resources Bureau of Forestry. Let them know that a very large piece of land has just been donated to the state of Wisconsin as a State Forest and that their involvement is necessary in its management. Congratulate them and tell them that today is the first day of training for this project. After training is finished today, the following two days will be spent working on the project at hand. Let the class know that they will need the skills learned today in order to complete the project successfully.

1. Forest Area (15 minutes)

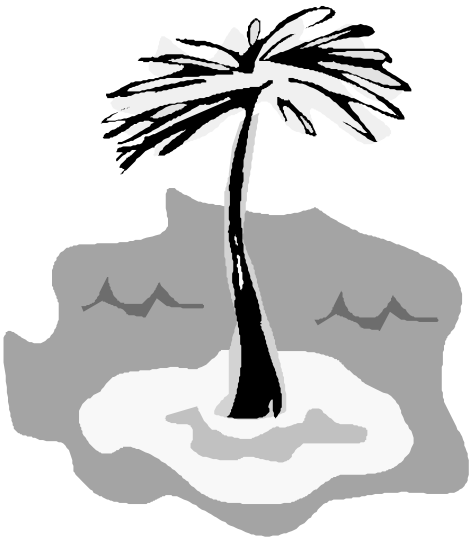
Distribute the **Forest Area Worksheet** to the class. Have the class turn the worksheet over face down. Ask them what shape the paper is. *A rectangle.* Ask them to use a ruler to figure out how long and how wide the paper is in inches. *11 inches x 8.5 inches.* Tell them that if they multiply the length of the paper times the width of the paper, the answer will be the area, or the amount of space on top of their desk that the paper covers (write all of the answers on the board as you go through the questions). Have them do the math. *11 inches x 8.5 inches = 93.5 square inches.* Ask them what units follow the number 93.5. *Square inches.* Tell them that when doing math with units like inches or centimeters they must keep track of the numbers and the units. For example, (11 x 8.5) = 93.5 and (inches x inches) = square inches, the complete answer = 93.5 square inches or inches squared. Have them measure the same piece of paper using centimeters and get the answer. *If your students are still having trouble, have them divide the paper into 8.5 equal columns and 11 equal rows. Have them count the boxes, adding the ½ boxes together (93.5) and measure the height and width of a box (1 inch by 1 inch). Tell them these boxes are all 1 square inch of area or 1 inch x 1 inch.*



Ask the class how many inches are in a foot. *12.* Ask them how many square inches are in a square foot. *12 inches x 12 inches = 144 square inches.* Ask them how many square inches are in a football field. *Who knows!!* Tell them that the number would be huge. Ask them if they can think of a way of making the number smaller. *Use bigger units.* Tell the class that foresters often map very large areas of land. Ask the class if anyone know what units of area foresters use to map land. *Acres.* Tell the class that there are 43,560 square feet of area in just 1 acre. That's pretty big. Tell them that an NFL football field is just about 1.2 acres in size.

Have the students flip over the worksheet. Ask them to figure out the area of shape #1. *It isn't as easy as measuring the length and width and multiplying it.* Tell them that forests, lakes, and other features on the land take many different shapes and are difficult to measure with a ruler. Tell them that foresters and many other professionals use a dot grid to measure shapes like these. Hand out the **Transparent Dot Grids** to the students.

The dot grids should be cut into strips 12 boxes long x 8 boxes wide and one should be given to each student (this size will be big enough to use easily and small enough to save on the number of transparencies used – 1 transparency makes 2 strips). You may also save additional transparencies by grouping or pairing students for this activity.



Ask the students to pretend that the shapes are features on the land (lakes, buildings, islands, swimming pools etc.) and that they are looking at a map. Ask them how they might figure out the area of the shape on the land? *They can find the area of the shape with the dot grid.* Tell the students to place the transparent dot grid on shape #1. Tell them to line the dot grid so that it is laying long-ways up and down over the shape and is parallel to the edges of the paper. Have the students count the number of dots that are inside of the shape. If a dot is right on the edge of the shape, count every other one.

Once they have the number of dots inside the shape, have them write that number down. Tell the class that each dot is equal to 40 acres of land. Have them multiply the number of dots times 40 acres. The answer is the area of the shape in acres. Write the calculation on the board: (# of dots) x (40) = acres of land area. Have students complete the worksheet in this manner. After completion, either collect the dot grids or tell students to save them because they will be using them for their project tomorrow.

Ask the students why foresters would need to know the area of forested land. Brainstorm the reasons. Ask them to think back on what they have learned about forests. Ask them if all forests have the same structure and tree composition. Tell the class that a forested area can differ greatly from place to place. One forested area may have swamps, lakes, valleys, hilltops, cliffs, rivers, etc. and the forest cover will differ from place to place. Foresters map the areas of different forest types across the landscape. These different cover types have different trees, different structures, different disturbances, and require different management methods.

2. Harvesting Methods (10 minutes)

Harvesting methods are forest management practices used when cutting down trees to sell as products. The purpose of harvesting methods is to take economically valuable trees from the forest in a way that ensures that the forest will grow more of the same economically valuable trees in the future. Ask the class if they can think of any trees that have been or currently are economically valuable in Wisconsin. *White pine – ship masts, homes, etc.; aspen – paper products; oak – furniture; fir and spruce – Christmas trees.* Use the **Forest Harvest Overheads 1-4** to illustrate the 3 major types of harvesting methods used in Wisconsin: selection cutting, shelterwoood cutting, and clearcutting.

During **selection cutting**, single trees are selected and removed from the tree stand leaving small, widely spaced holes in the upper canopy. This allows small patches of light to reach the forest floor. **Shelterwood cutting** removes large groups of trees from the forest but leaves some shade and shelter for young trees. This method allows large amounts of light to reach the forest floor. **Clearcutting** removes all of the trees from the forest. This method leaves little to no shelter for young trees and brings sunlight to the entire forest floor.

Have the class think back to the competition and the different trees in the competition. Ask the class if they can remember which tree species they were and if they were tolerant to shade, fire, wind, etc. Ask the class to remember how the forest changed through time because of disturbances and how their trees reacted to the disturbances. Tell the class that harvesting methods are very similar to natural disturbances within the forest. They remove certain trees from the forest and make it easier for some trees to grow and harder for other trees to grow. The difference is that harvesting methods take the economically valuable trees and encourage the same trees to re-establish themselves in the forest. Ask students how they think that harvesting methods might differ for different tree species (you may use the competition trees as examples). *Trees that need shade must be grown under a canopy, and trees that need sunlight must be grown in the open. Many trees grow more slowly than others and take longer to mature. Different trees are used for different products and these products require the trees to be a certain size. For example: red pine trees and utility poles for power lines ,and historically, white pine trees for ship masts.*

Put the **Harvesting Methods Sheet** on the overhead and use it to illustrate the harvesting methods required for certain trees found in Wisconsin. Tell the class to write the trees and the management practices used for each in their log books because they will be using them for the next class.

Tell the class that the characteristics of the trees also determine the products that we can make from them. *Long straight trees can be used for utility poles, log cabins, etc., while fast growing trees with soft, clean wood can be used for paper production. Trees with strong, flexible wood are used for many building purposes. One example is the use of white cedar wood for the construction of canoes (cedar-strip canoes). Many trees also produce resins used in paints and finishes, while other trees produces syrups used for candy, soft drinks, and other foods. Trees can also provide habitat for commercially valuable animals and plants like honey bees and shiitake mushrooms*.

Ask the class if they think that the demand for products from all of the different tree species in the forest is the same. *No, different trees are used for different products and each of these products have different costs. The wood of many trees is very valuable for expensive furniture, stocks for guns, and carvings. The wood from trees such as black walnut, black cherry, and sugar maple are worth more money than white birch or jack pine wood.* Ask the class if they think that the amount of money that a tree is worth can influence the type of harvesting method that landowners use. *Yes it does.* Finally, introduce the class to the 4 factors that influence the harvesting methods that

are used within forests. Write these on the board and have the students copy them into their logbooks.

Four Factors that Influence Harvesting Methods

1) The forest type (structure and composition)
2) The characteristics of the trees within the forest type
3) The quality and quantity of different trees within the forest type
4) The products that the landowner wishes to produce and continue to produce

3. Sustainable Harvest (25 minutes)

Ask the class if they know what the word "sustainable" means. Discuss the answers. Ask for a volunteer to help you illustrate the definition. Have the student run in place as fast as they can. Ask the class how long they think the student can continue to run that fast. *Not long*. Explain to the class that the rate or speed that the student was running was very fast and it requires a lot of energy to run that fast. Tell them that the human body could not continue to supply enough energy to keep up that pace for a very long time.

Now ask the student to walk slowly in place. Ask the class how long they think the student could keep that up. *A long time*. Could the student keep up the pace all day long? *No -- hunger, exhaustion, boredom*. Tell the students that a sustainable pace would be a pace that could be kept up for the entire time the student was awake. Relate the idea of pace to the class by discussing marathon runners, swimmers, etc.

Tell the class that when harvesting trees from the forest, foresters try to cut down trees at a pace that will allow them to cut trees from the same piece of land throughout the future. Ask the class how this is possible. *By planting trees after cutting them down and only cutting trees down as fast, or slower, than the trees can grow.* Write the following problem on the board.

Suppose you have 4 hickory trees in your backyard. You use the wood from these trees to smoke, cure, and grill meat. The first of the trees is 10 years old, the second is 20 years old, the third is 30 years old and the fourth is 40 years old. To produce good fire logs the trees must be 40 years old. A 40 year old tree will produce 200 fire logs when you cut it down. You plant a new tree every time you cut one down.

Have students copy the problem into their log books. Draw the trees in proportional sizes on the board, put the ages underneath them, and ask the following questions:

Will the trees remain this age forever? *No*. Why? *Because trees grow and age just like people do*. How old does a tree have to be before you can cut it down for firewood? *40 years old*. After you cut the 40 year old tree down, how long will it be until you can cut firewood again? *10 years.* Why? *Because, by that time, the 30 year old tree will be old enough to cut down.* How many fire logs will you have for those 10 years? *200*. Why? *Because each 40 year old tree produces 200 fire logs and it will be ten years before you cut down another tree*. If you have 200 logs and they have to last you 10 years, how many can you use each year? *200 logs / 10 years = 20 logs per year*. If you plant a new tree every time you cut one down for firewood, how long can you continue to use 20 fire logs a year? *forever*. Why? Use the tree pictures you have drawn on the board to show that if you continue to plant trees after you cut them, you will always have a 40 year old tree every ten years.

Once the class can do the calculations (# of logs from each tree harvest / # of years between harvests = log use per year) and they are introduced to the 'forever' in sustainable harvesting, ask them the following questions:

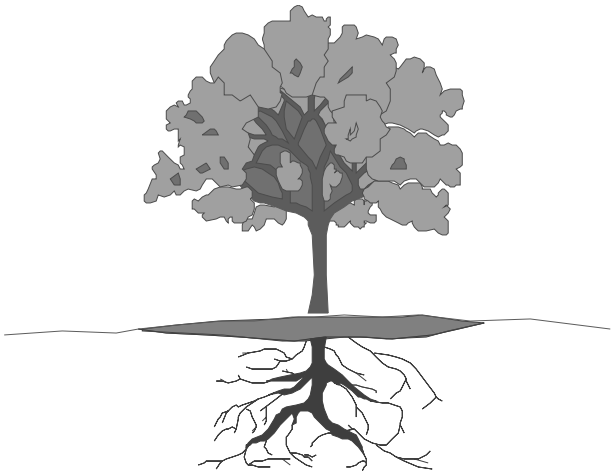
What would happen if you didn't plant trees after you cut them down? *You would run out of wood in 40 years*. What happens if you use more than 20 logs a year for firewood? *You wouldn't have enough firewood, you would have to cut your trees down too early, you would have to buy firewood from somewhere else*. If you use more than 20 logs per year or neglect to replant your trees after cutting them down, would it be sustainable? *No*.

Tell the class that it is time to apply what they have just learned. Put the **Sustainable Harvest Worksheet 1** on the overhead projector, but only let the very top of the sheet show and cover everything below the row of trees and ages labeled 'Original Tree Stand'. Cover the cutting rate with a pen. Tell the class that the stand consists of 6 acres of red pine trees and that all of the trees are 60 years of age. Tell them that these red pine trees are ready for harvesting at 60 years of age and that they can be harvested at any time beyond that age. Tell them that the landowner plans to use these trees for lumber and to heat his home. Have them brainstorm the best ways of harvesting the trees. Possible answers may be*: Cut them all down because they are all old enough. Let them grow bigger because then you'll have more firewood and construction wood. Don't cut them down at all. Cut 0.1 acres every year or 1 acre every ten years*.

Tell the class that the best way to manage this stand would be to 1) evenly distribute your work and expenses, 2) maintain a constant supply of wood each year, and 3) maintain the same supply of wood throughout the future. Assess the answers from the brainstorm with these criteria.

If no student answers correctly, then ask the class if they have enough information to figure out the pace or rate that they should cut the trees down. *They do have enough information*. The **cutting rate** = (the # of acres of red pine trees) / (# of years it takes for red pine trees to be ready for harvest) or (6 acres / 60 years = 0.1 acres per year). Hand out **Sustainable Harvest worksheets 1 and 2** and reveal the overhead worksheet. This worksheet will illustrate the result of cutting 1 acre every ten years. Go through both worksheets with the class and write the answer to each question (1-7) directly onto the overhead as the class answers them. Have the students write the answers on their worksheets. Correct answers are: 1) 1 acre, 2) 80 years old, 3) 10 years old, 4) 2 acres, 5) 110 years old, 6) 50 years old, 7) yes and forever.

After the students fully grasp the concept of sustainable harvesting, ask if they think that red pine trees grow at the same rate in all types of forests. *No, forests differ in the amounts of nutrients that are in the soil, the degree of competition from other trees, weather patterns, moisture, etc. All of these factors affect the rate at which trees grow.* Ask the class what they think would happen if the red pine trees in the last exercise only took 50 years to mature? *You could cut the tree down faster (6 acres / 50 years = .12 acres per year).* What if they took 70 years? *You would cut at a slower rate (6 acres / 70 years = .0857 acres per year).*



Ask the class what other things might cause trees to grow faster or slower? A*dding fertilizer (faster), soil erosion (slower).* What could happen if harvesting trees was causing soil erosion? *The more trees you harvest, the more soil you would lose. As the soil is lost so are the nutrients that trees need to grow. The trees would grow at slower and slower rates. Ultimately, you would have to cut at slower and slower rates to keep a sustainable pace.* What other natural events might cause problems with future harvests? *Disturbances (fire, insect infestation, floods, acid rain, etc.).* What other events might increase the speed that you cut down trees? *The demand for wood from consumers. Increases and decreases in wood prices. Financial needs of the landowner.* Brainstorm how the demand for wood and the speed at which you cut down trees are related. How is this influenced by all of the other natural factors that affect the way trees grow?

Activity 2 – Forest Management Simulation

Day 1 – The Management Plan (50 minutes)

1. Briefly review the subjects that the students learned in the training session. Ask students if they remember how to measure forest area and if they remember the harvesting methods commonly used in Wisconsin. Once students are comfortable with the information, divide the class into groups of 2-4. Explain to the class that each of the groups will each work on the project separately. Explain the project to the class.

"In the early 1800s a lumber baron named Folsom bought a very large piece of land in the Northwoods and began his logging operation. The huge pines and dense hardwoods made him a fortune. He soon realized that the forests of the North were almost gone. He stopped his logging and saved what he had left. Many people thought that he was quite foolish for leaving the land unlogged, but he was rich and had many friends and didn't much care. The land has been passed through two generations of Folsoms. Just last month the last Folsom passed away. Within his will was the deed to the land signed over to the state of Wisconsin to be used as a State Forest. You are here today to form a management plan for this land, the Shady River State Forest."

2. Hand out the **Shady River State Forest Map** to each group. Have the groups identify all of the major features on the map: legend, roads, rivers, lakes, forest types, and property boundaries. Explain the different forest types to the class.

1) **Old Growth White Pine** – a mixed coniferous and deciduous stand dominated by very large and very old white pine trees.
2) **Bottomland Hardwoods** - found on lower ground that stays moist throughout the growing season. These stands are made up of mostly deciduous trees like maple, birch, aspen, and ash. These forests are usually not very productive and trees do not grow to great heights or in great numbers, but some trees have a very high quality wood such as black ash.
3) **Northern Hardwoods** – deciduous and mixed forests found in great abundance throughout northern Wisconsin. Maple, oak, elm, hickory, and birch grow in great quantities. Mature northern hardwood stands are usually dominated by large and valuable sugar maple trees.
4) **White Cedar Swamps** – lowland, wet, coniferous forest dominated by slow growing, but valuable white cedar trees.
5) **Aspen Lowland** – young, early-successional forest made up of dense stands of aspen trees. These forests are sometimes called 'dog-hair stands' because they are as thick as the hair on a dog's back.
6) **Red Pine Plantation** – a replanted forest made up of straight rows of even-aged red pine trees. Plantations contain large amounts of tall, straight, valuable trees.

3. After you have reviewed the map, hand out **Worksheet 1**. Have students calculate the total timber value of the State Forest as shown on the worksheet. Explain to the class that this the economic value of the trees today. Ask them what would happen to this value as the forest (trees) grows older. *Trees would get bigger, more wood, more money.* Brainstorm the possible ways that the trees could be harvested referring to the sustainable harvest activity. After discussing the economic value of the forest, ask the class if they think that a state forest should be managed for more than just wood products. Try to form a list of things that happen today in Wisconsin's State Forests. *Hiking, biking, camping, hunting, fishing, skiing, etc.*

4. Tell the groups that they must manage the forest for more than just timber and hand each group the **List of Management Objectives** (forestry, wildlife, and recreation). Browse through each objective set starting with wildlife and ending with forestry. Point out the objectives from each set and explain them. Tell the groups that by following all of the objectives, they will create a management plan that fulfills all of the DNR requirements.

5. Remind the class that many management practices can be harmful to the environment. Ask the groups if they can remember anything from our logging history that caused environmental damage. *Slash from logging caused devastating fires, logging caused soil erosion, many forests were permanently changed, many animals and plants became extinct or endangered, etc.* Ask the groups what might happen if they were to drive logging trucks across the swamp on their map. *Soil and trees would be damaged and they might lose a few trucks.* Tell the students that foresters must also follow Best Management Practices in order to protect the quality of water and the future potential of the forest to grow trees. Hand out the **Best Management Practices for Shady River State Forest**. Review all of the practices that must be followed.

6. Make sure that each group has at least 1 red pencil , 1 green pencil, 1 brown pencil, and 1 blue pencil along with at least 1 dot grid, 1 ruler, and 1 calculator. Tell the groups that they

must cooperate to complete the map. Tell them that all of the restricted areas should be marked in blue, wildlife habitats should be outlined on the map with red pencil, all of the recreations requirements should be marked in brown, and all of the land being logged for forestry should be outlined in green. The areas used for forestry and the wildlife habitats they choose must be calculated using the dot grid (1 dot : 40 acres). The length of trails and other lines can be determined with their rulers (1 mile : 3 cm or 1 cm : 1/3 mile). **All of this information is listed on the* ***Rules for Drawing the Management Map Handout*** *that you have given the groups*.

! Be sure to have extra copies of the maps and of the calculation worksheet in case students make mistakes.

Day 2 – Decision and Discussion (40 minutes)

1. After all plans are finished hand the groups **Worksheet 2**. Have them use the areas that they have left for forestry to find the answers to the worksheet. After completing **Worksheet 2**, students will have calculated the amount of money made form forestry each year in the State Forest. This dollar amount is calculated by using the areas left for forestry, a sustainable cutting rate, and the appropriate harvest method. This yearly income will be used as one way that students can judge the value of the management plan.

2. After the map and worksheet are finished, post them for the entire class to see. It is possible that some groups will not finish the maps. Tell the class that managing forests for many uses is not easy and sometimes impossible. Have an elected student from each group present their plan to the class including the dollar value from **Worksheet 2**. After the presentations, ask the students which plan they think is best. Lead a discussion on the strengths and weaknesses of each plan using the Best Management Practices, management objectives, and the annual profit made from the forestry practices as your guidelines. Have the students think about what arguments surfaced and what tough decisions were made in their groups. Ask the class to help you identify the sources of conflict. Have the students use a ranking system to vote on the best plan.

Here is an example of how the ranking system works for choosing a plan (next page). Of the six plans, each student ranks their choices from 1 to 6, with 6 being their top choice. The plan that receives the highest score is the best: in this case #6.

	Ellen	Nick	Sterling	Rachel	Anne	Totals
Plan #1	3	6	1	5	2	17
Plan #2	2	5	3	1	4	15
Plan #3	1	3	5	2	6	17
Plan #4	4	4	2	6	3	19
Plan #5	6	1	6	3	1	17
Plan #6	**5**	**2**	**4**	**4**	**5**	**20**

3. After the best plan is chosen, congratulate all of the groups for their work. Ask the class what they think the difference between sustainable harvesting and sustainable forestry is. Tell them to think about all of the things that they have managed for in the Shady River State Forest. After their ideas are exhausted tell them that sustainable forestry not only provides a continuous supply of lumber throughout the future but also supplies the many other qualities of a forest such as recreation, education, wildlife habitat, and environmental protection.

4. Have the students look at **Worksheet 1.** Ask the class how much the timber was worth then, before we managed the forest. *About 2 billion dollars*. Ask the class if the wildlife and recreation requirements along with the Best Management Practices have changed the amount of timber available for harvesting. *It has, many areas are now protected and reserved.* Brainstorm the ways that they can determine the new market value of standing timber after the management plan. Hand out **Worksheet 3**. Have students use the areas left for forestry in their management maps to complete the table (these can be taken directly from **Worksheet 2**). Use this total value and the value calculated before management to find the economic cost of the management plan.

Value of timber before management (Worksheet 1) – Value of timber after management (Worksheet 3)
= Economic Cost of Management

! Tell the class that this is one of the ways that the economic cost of managing for purposes other than forestry can be calculated.

Conclusion (10 minutes)

Lead a discussion on the weaknesses of this method for determining the cost of managing for multiple uses. Explain that no other values are taken in to account (recreational, educational, ecological, egocentric, and aesthetic). The park will also continue to make money from its recreational facilities. Ask the students to brainstorm all of the other values that their management plan has provided. Ask the class if they think that managing forests in this way is beneficial to people in the state. Ask the groups if they think that all forest management is done in this way. *No.* Why? *Because many different people own the land and these people have different objectives.* Who else owns land besides the state? *Industries, counties, the national government, private landowners, Native American tribes.* Put the **Who Owns Wisconsin's Forest Pie Chart** on the overhead. Explain the chart to the students.

With the chart on the overhead, explain to the class that State Forests, National Forests, and much of the county-owned land is managed much the same as the project they have just completed. These lands are managed for multiple uses and for the use of the general public. These managed lands also use Best Management Practices. The other landowners manage land with their specific goals and interests in mind. These specific goals differ between landowners and can include many different land uses. Have the class figure out the percent of forested land that is managed in this fashion. *71%.* Have the students brainstorm ways that individuals, industries, and corporations might manage their forests differently than the way that they have managed their forest.

Student Log Book

Have students write a summary of the sources of conflict that arose when forming their management plan. Have the students relate some of these conflicts to conflicts that exist in their hometown or somewhere in Wisconsin. Encourage students to ask their parents, relatives, friends, etc. about these real-life conflicts.

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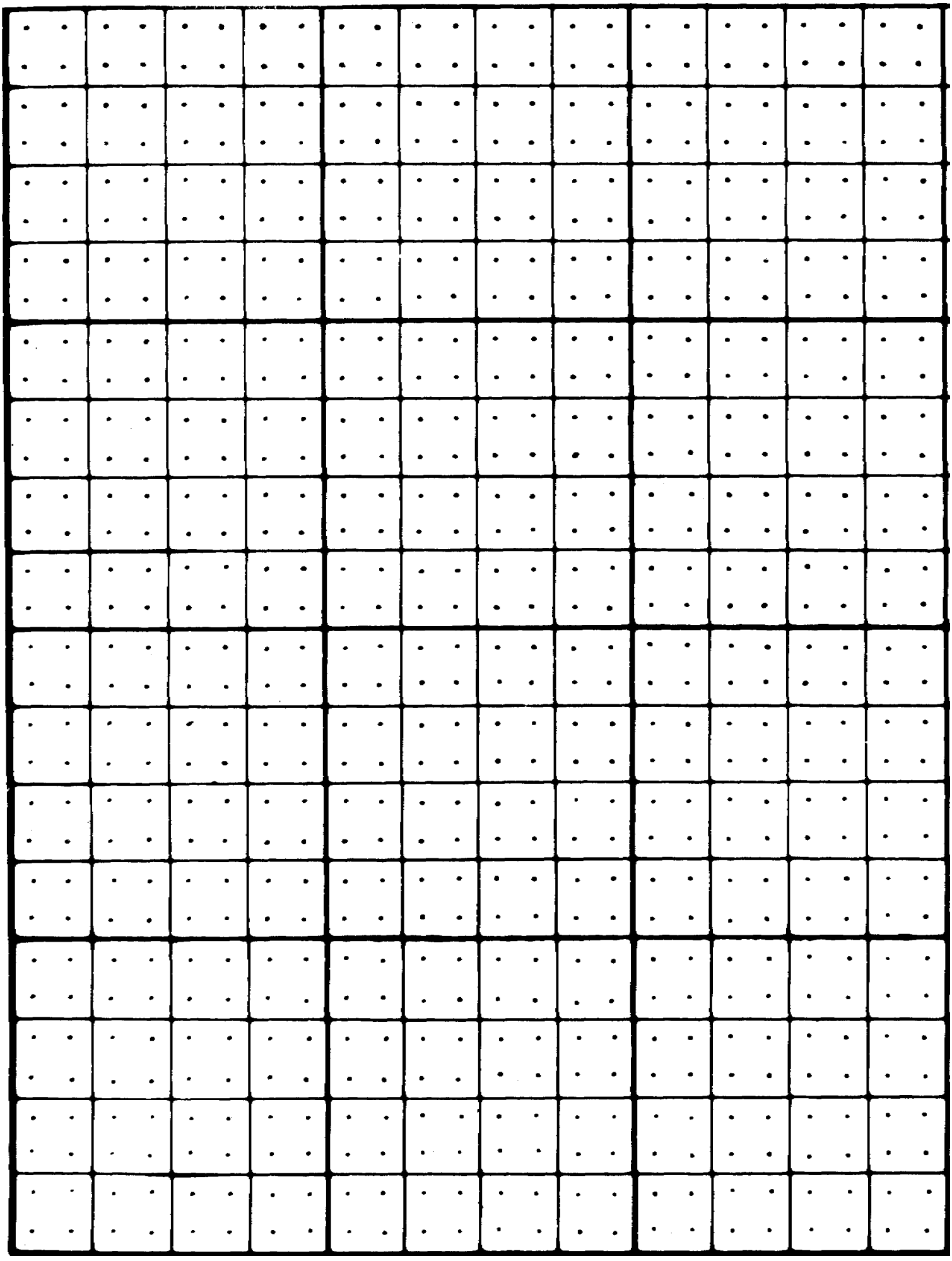
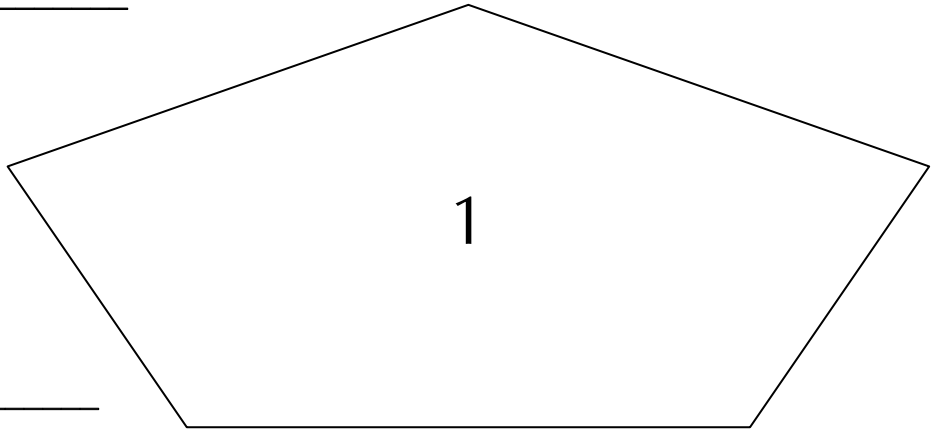


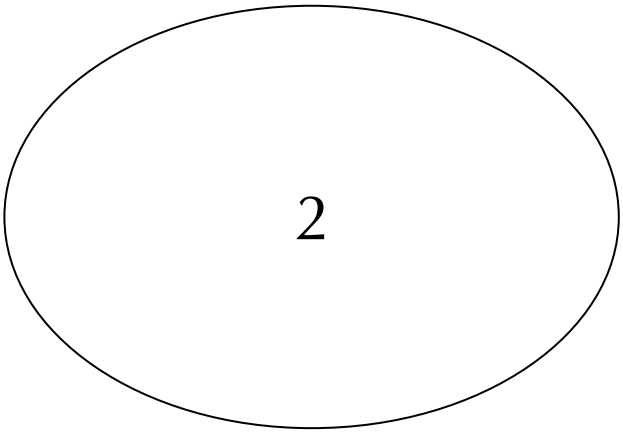
Forest Area Worksheet

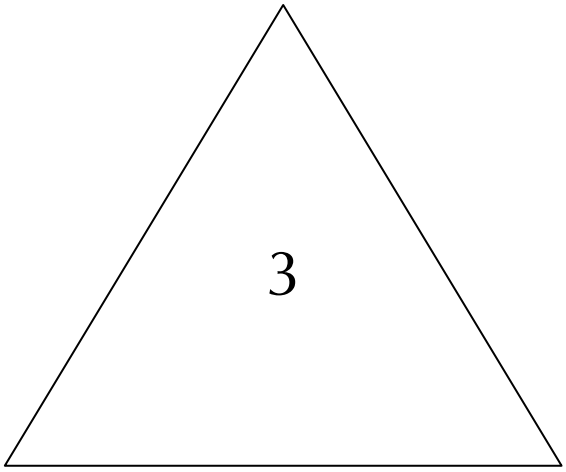
(Use your dot grid to determine the area inside of the shapes below)
1 dot : 40 acres

Area 1 _____

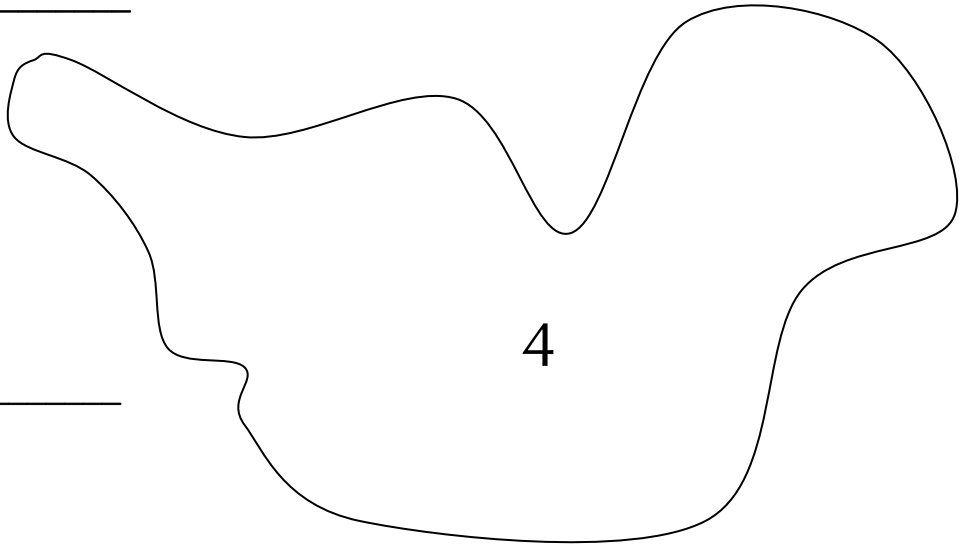


Area 2 _____





Area 3 _____



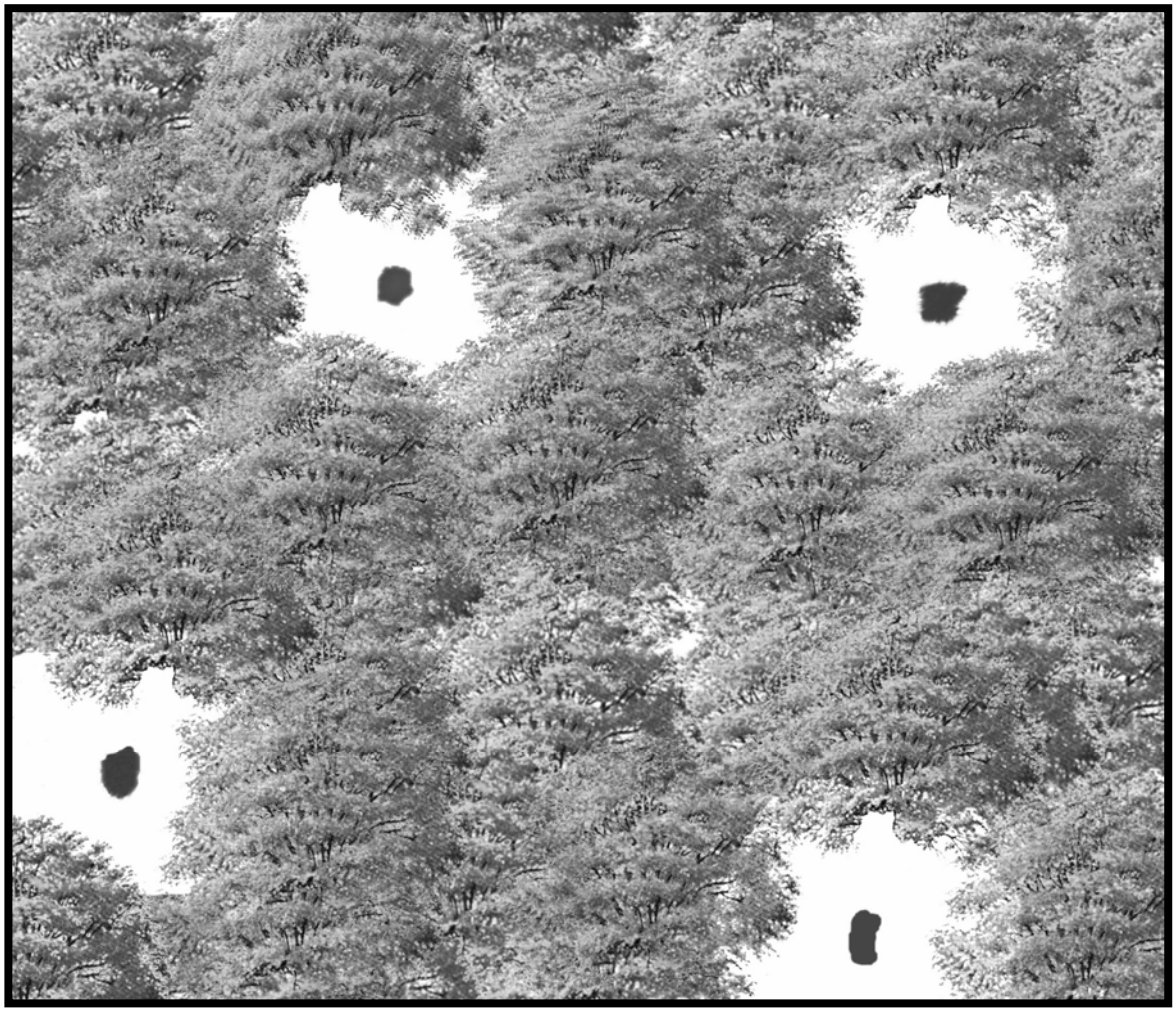
Area 4 _____

Forested Land Before Harvesting

(Harvesting Methods Overhead #1)

Selection Cut

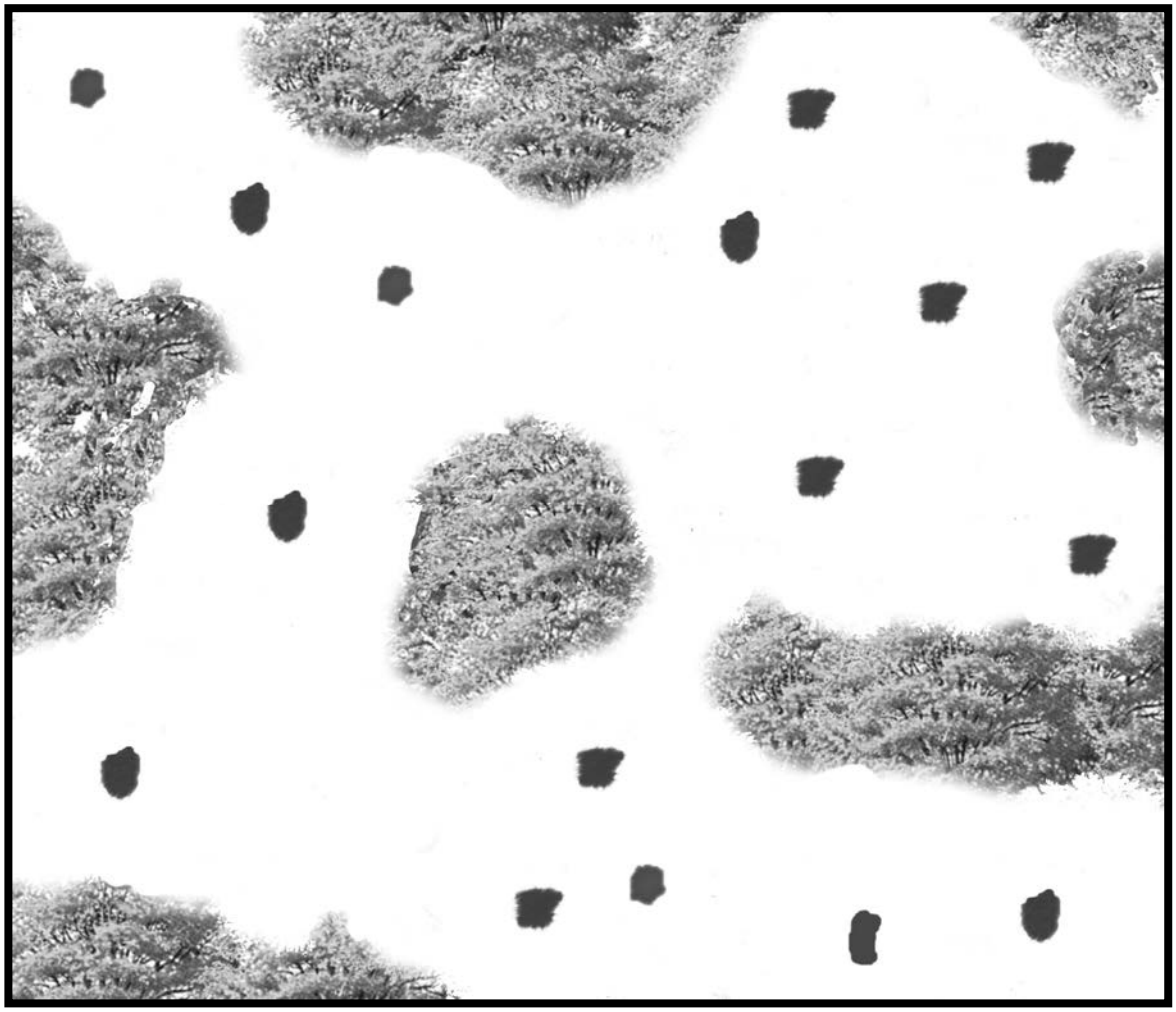
(Harvesting Methods Overhead #2)



- Removes select trees
- Creates small, scattered gaps in the canopy
- Brings patches of light to forest floor
- Used to encourage the establishment and growth of shade tolerant trees

Shelterwood Cut

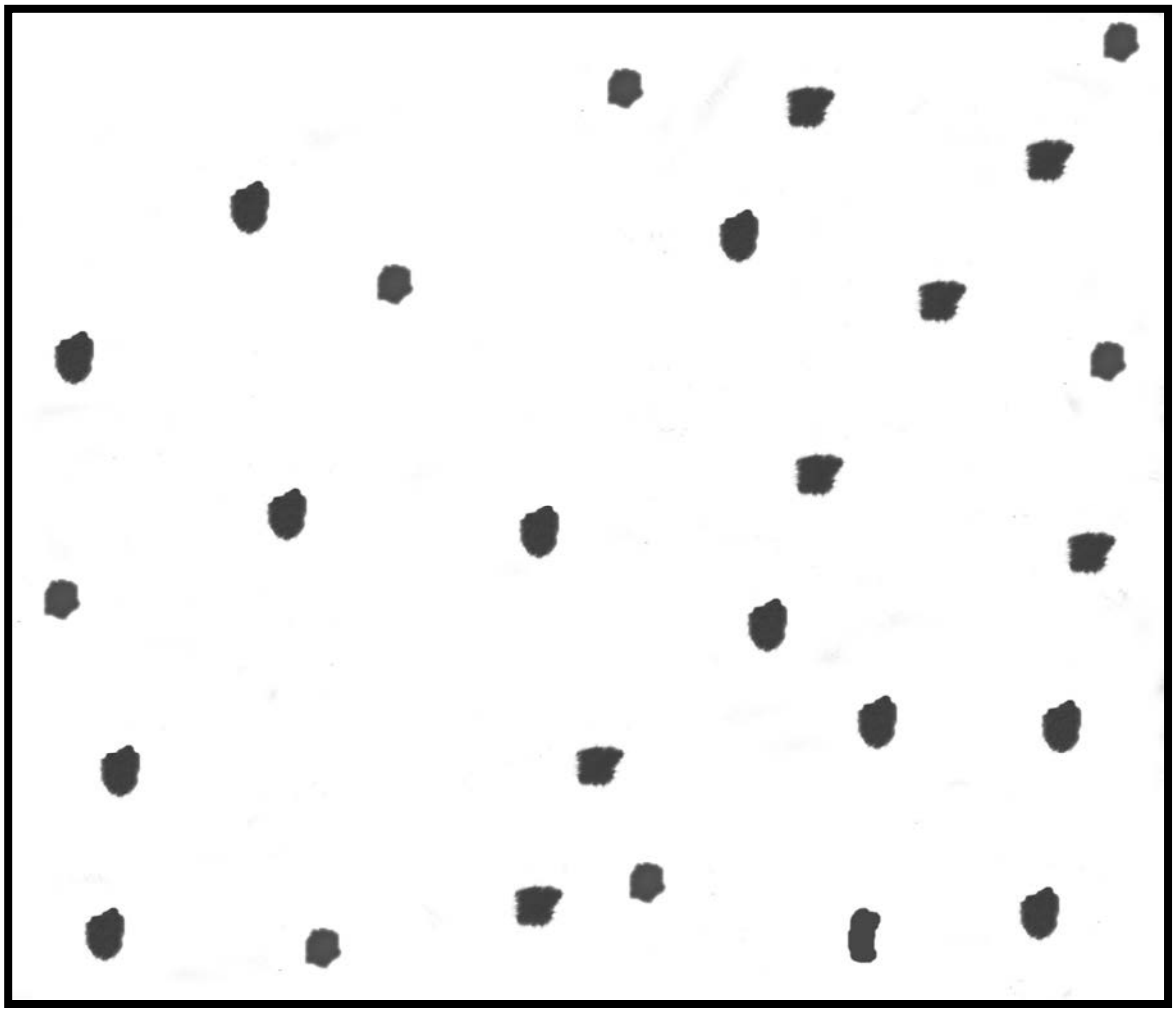
(Harvesting Methods Overhead #3)



- Removes larger groups of trees
- Creates large gaps in the canopy
- Leaves only small portions of shade on the forest floor
- Used to cause growth in suppressed trees and provide shade for the re-growth of shade tolerant trees

Clearcut

(Harvesting Methods Overhead #4)



- Removes all trees in one cut
- Brings sunlight to the entire forest floor
- Used to promote the growth of trees intolerant of shade

Timber Management Practices

(Harvesting Methods Overhead #5)

CLEARCUT

Shade Intolerant Trees

Aspen
Birch
Tamarack
Jack Pine
Red Pine
Black Spruce

SHELTERWOOD

Partially Shade Tolerant Trees

Oak
White Cedar
White Spruce
Hickory

SELECTION

Shade Tolerant Trees

Black Ash
Basswood
Hemlock
Sugar Maple
Balsam Fir

Sustainable Harvest Worksheet I

Each tree = 1 acre of red pine plantation
Total acres of red pine plantation = 6
Cutting rate = 0.1 acres per year *or* 1 acre every ten years

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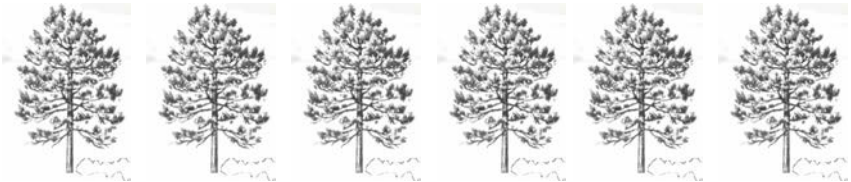
Original Tree Stand.



Age 60 60 60 60 60 60

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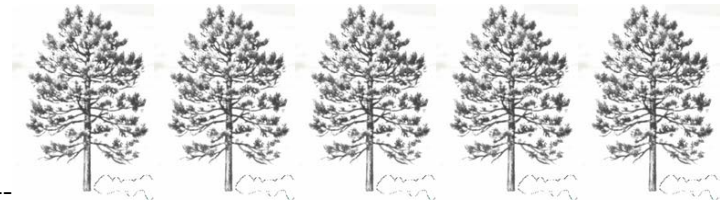
1) You have been cutting for 10 years. How many acres have you cut?



Age 0 70 70 70 70 70

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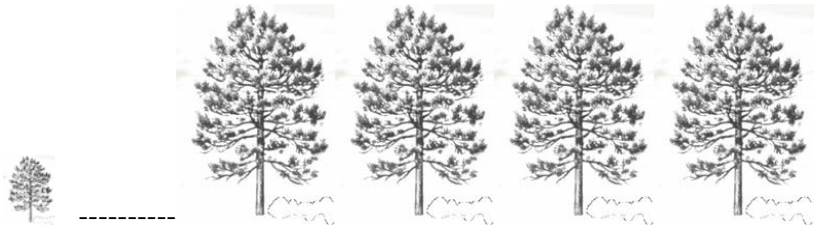
2) You have been cutting for 20 years. How old are your oldest trees?



Age 10 0 ? ? ? ?

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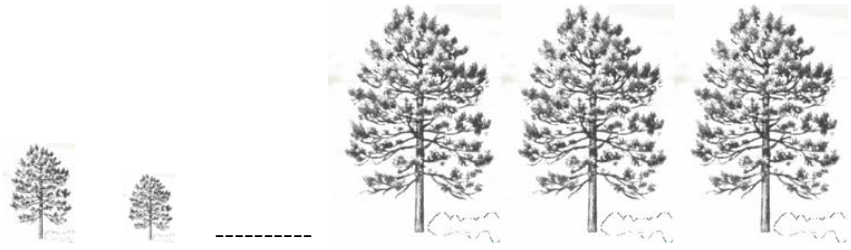
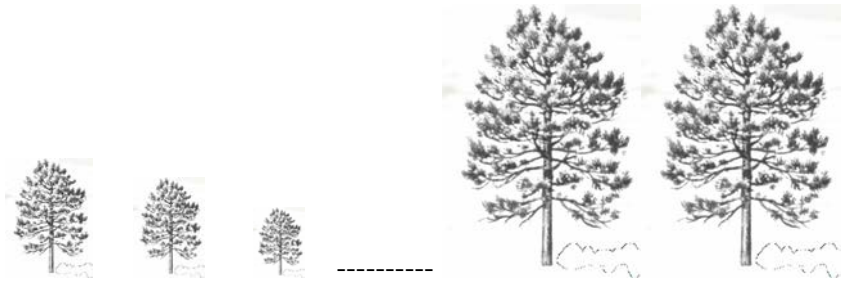
3) You have been cutting for 30 years. How old are your youngest trees?



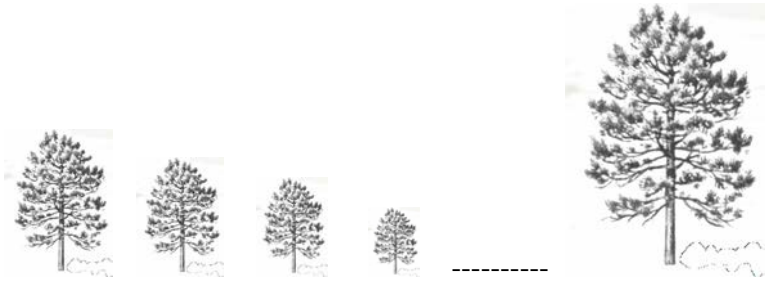
Age 20 ? 0 90 90 90

Sustainable Harvest Worksheet 2

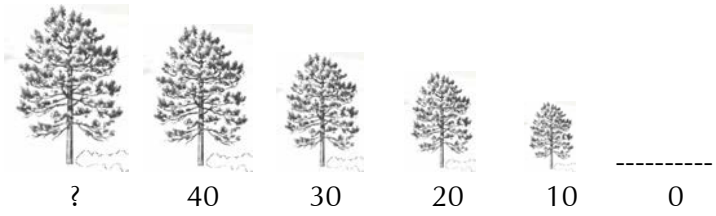
4) You have been cutting for 40 years. How many acres of 100 year old trees are there?



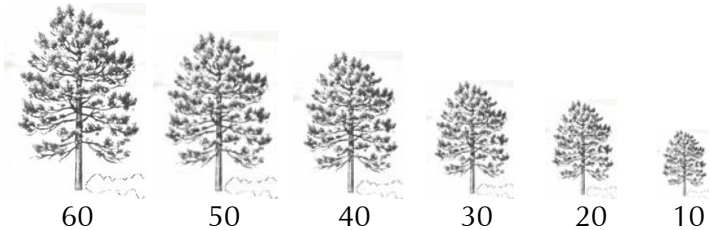
5) You have been cutting for 50 years. What is the oldest that any of the trees will be?



6) You have been cutting for 60 years. How old are your oldest trees?



7) Your Forested Land After 70 Years of Ownership. Can you continue to cut 1 acre of trees every 10 years? How long can you do this?



Dollar Value of Timber in Shady River State Forest Before Management

(TEACHER COPY)

Forest Type	Number of logs per acre (hundreds)	(x)	Price per log (hundreds of $)	(x)	Acres	(=)	Total for each forest type
Old Growth (White Pine)	5	(x)	$4	(x)	7,360	(=)	$1,472,000,000
Northern Hardwoods (Mature Sugar Maple)	3	(x)	$2.50	(x)	8,240	(=)	$618,000,000
Mature Red Pine Plantation	5.5	(x)	$1	(x)	3,040	(=)	$167,200,000
Bottomland Hardwoods (Black Ash)	1	(x)	$1.50	(x)	8,360	(=)	$125,400,000
Forest Type	**Number of poles per acre (hundreds)**	**(x)**	**Price per pole (hundreds of $)**	**(x)**	**Acres**	**(=)**	**Total for each forest type**
White Cedar Swamp (White Cedar)	3	(x)	$1	(x)	2,920	(=)	$87,600,000
Aspen Lowland (Aspen)	6	(x)	$0.30	(x)	4,000	(=)	$72,000,000

Total Dollar Value (add all totals together) = $2,542,200,000

Dollar Value of Timber in Shady River State Forest Before Management

(Worksheet 1)

Forest Type	Number of logs per acre (hundreds)	(x)	Price per log (hundreds of $)	(x)	Acres	(=)	Total for each forest type
Old Growth (White Pine)	5	(x)	$4	(x)	7,360	(=)	0,000
Northern Hardwoods (Mature Sugar Maple)	3	(x)	$2.50	(x)	8,240	(=)	0,000
Mature Red Pine Plantation	5.5	(x)	$1	(x)	use the dot grid to find the answer	(=)	0,000
Bottomland Hardwoods (Black Ash)	1	(x)	$1.50	(x)	8,360	(=)	0,000

Forest Type	Number of poles per acre (hundreds)	(x)	Price per pole (hundreds of $)	(x)	Acres	(=)	Total for each forest type
White Cedar Swamp (White Cedar)	3	(x)	$1	(x)	2,920	(=)	0,000
Aspen Lowland (Aspen)	6	(x)	$0.30	(x)	4,000	(=)	0,000

Total Dollar Value (add all totals together) = 0,000

Money Made Each Year from Forestry in the Shady River State Forest
(Worksheet 2)

Forest Type	Cutting Method	Cutting Rate (logs per year)	(x)	Price per log	(x)	Acres of land for forestry	(=)	Money made each year from forestry
Old Growth (White Pine)	Selection Cut	30	(x)	$500	(x)		(=)	
Northern Hardwoods (Mature Sugar Maple)	Selection Cut	20	(x)	$300	(x)		(=)	
Mature Red Pine Plantation	Clearcut	45	(x)	$150	(x)		(=)	
Bottomland Hardwoods (Black Ash)	Selection Cut	12	(x)	$200	(x)		(=)	

Forest Type	Cutting Method	Cutting Rate (poles per year)	(x)	Price per pole	(x)	Acres of land for forestry	(=)	Money made each year from forestry
White Cedar Swamp (White Cedar)	Shelterwood Cut	50	(x)	$150	(x)		(=)	
Aspen Lowland (Aspen)	Clearcut	100	(x)	$30	(x)		(=)	

Total Dollars Made Each Year From Forestry (add all totals together) **=** ____

Dollar Value of Timber in Shady River State Forest After Management

(Worksheet 3)

Forest Type	Number of logs per acre (hundreds)	(x)	Price per log (hundreds of $)	(x)	Acres used for forestry	(=)	Total for each forest type
Old Growth (White Pine)	5	(x)	$4	(x)		(=)	0,000
Northern Hardwoods (Mature Sugar Maple)	3	(x)	$2.50	(x)		(=)	0,000
Mature Red Pine Plantation	5.5	(x)	$1	(x)		(=)	0,000
Bottomland Hardwoods (Black Ash)	1	(x)	$1.50	(x)		(=)	0,000

Forest Type	Number of poles per acre (hundreds)	(x)	Price per pole (hundreds of $)	(x)	Acres used for forestry	(=)	Total for each forest type
White Cedar Swamp (White Cedar)	3	(x)	$1	(x)		(=)	0,000
Aspen Lowland (Aspen)	6	(x)	$0.30	(x)		(=)	0,000

Total Dollars Made Each Year From Forestry (add all totals together) = 0,000

Best Management Practices for Shady River State Forest

1) Temporary logging roads must be constructed to all logging sites from highways, county roads, or other logging roads.

2) Logging roads cannot be constructed through white cedar swamps.

3) No logging practices are allowed within 1/3 mile of any water (mark these restricted areas on your map with blue).

4) Logging operations, including logging roads, may not occur within 1/3 mile of park trails, campgrounds, or public facilities.

5) Forests are to be actively managed to maintain timber wolf, fisher, and neotropical bird habitat.

6) The entire state forest is to be managed to fulfill the recreation requirements supplied.

Rules for Drawing the Management Map

1) Use red to mark wildlife requirements, brown to mark recreation requirements, green to mark lands to be logged, and blue to mark restricted areas near water.

2) 3 centimeters : 1mile

3) 1 dot on the dot grid : 40 acres

4) To make the management easier: Mark the restricted areas in blue first. Mark the habitats for wildlife in red second. Mark the recreation facilities in brown third. Mark the areas for logging and the roads to those areas in green last.

GOOD LUCK!!!!!

Wildlife Requirements

The Department of Natural Resources has chosen three major wildlife habitats to manage for in the Shady River State Forest. These habitats are those of the fisher, eastern timber wolf, and neo-tropical birds. The minimum habitat requirements are listed below. These minimum requirements must be met within the State Forest. Any additional habitat that you can provide will greater benefit the populations of these animals and birds.

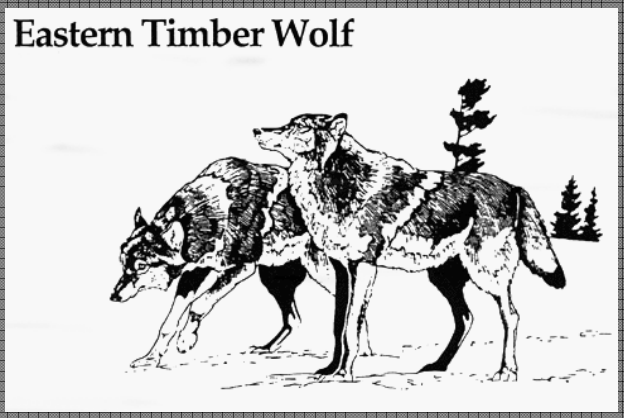
Fisher Habitat Requirements

The fisher is one of the largest members of the weasel family ranging from 30 to 40 inches in length. They are dark brown to black in color and have a grizzly appearance. The last native Wisconsin fisher was seen in 1921. Fishers have been reintroduced into Wisconsin forests and are viewed as an important part of many forest ecosystems. They feed on porcupines, squirrels, snowshoe hares, deer carcasses, and other small animals along with select plants, berries, and tree seedlings.

Fishers require large areas of undeveloped, mature hardwood forest for habitat. They also depend heavily on snowshoe hares that live primarily in white cedar swamps. The minimum requirements that must be met within the Shady River State Forest are as follows:

1) Fisher habitat must be in Northern Hardwood (Mature Sugar Maple) forest.
2) You must provide 2 areas of at least 1500 acres with no logging operations or logging roads within this forest type.
3) Each of these areas must border White Cedar Swamp.

Eastern Timber Wolf Requirements



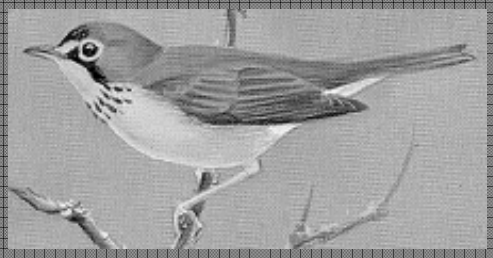
The eastern timber wolf or gray wolf has ranged everywhere in North America except deserts. Wolves were gone from Wisconsin lands after the logging of the 1800s but returned in 1970 after large forested areas were once again in place. They were classified as an endangered species in 1975. In 1999, there were estimated to be 197 wolves in Wisconsin and they have been reclassified from endangered to threatened. The Wisconsin Department of Natural Resources has recently developed a Wolf Management Plan that is now in place throughout Wisconsin.

Wolves require extremely large tracts of land to support them. This habitat is estimated at nearly 200 square miles (128,000 acres). Habitat is provided for wolves by creating corridors in the forest. Corridors are strips of un-logged land that connect different forests. These corridors connect larger areas of wolf habitat. The corridors that connect wolf habitats are very similar to interstate highways. The highways make a path for cars and people that connect from city to city. The corridors make paths for wolves to move from habitat to habitat.

The white-tailed deer is the main prey species for wolves in Wisconsin. Young deciduous forests (aspen lowlands and bottomland hardwoods) supply habitat for the deer and for the wolf itself. The Shady River State Forest is located within a Wolf Management Zone and must meet the minimum habitat requirements for land located within the zone. The following management guidelines apply:

1) A corridor (pathway) must be made for wolves in the State Forest.
2) The corridor must connect any two of the property borders.
3) The corridor must be at least ½ mile wide.
4) The corridor can be made through aspen lowlands, red pine plantations, bottomland hardwoods and white cedar swamps.
5) Logging operations may occur inside of the corridor BUT no logging roads can be made across the corridor.

Neo-tropical Bird Requirements



Neotropical birds are birds that live much of their life in South America, Central America, Mexico, or the West Indies. Many of these birds migrate to Wisconsin in the warmer months to raise their young. These birds require only small amounts of land to nest. Usually their nesting range only amounts to around 2 acres. However, neotropical birds will only select to nest in large tracts of undeveloped, old forests . The larger the tract of undeveloped land is, the more likely it is that the birds will choose to nest there.

Much of the neotropical bird habitat in Wisconsin has been developed or is currently under development. It has recently been observed that many areas that used to contain high numbers of neotropical birds now have few of these birds. Many birds still live within the areas, but the species are local species such as the robin, blackbird and starling and are not neotropical species.

The Wisconsin Department of Natural Resources has chosen the Shady River State Forest as management zone for neotropical birds. The minimum requirements are as follows:

1) You must provide at least 2000 acres of old growth white pine forest for neotropical bird habitat.
2) No logging practices or logging roads are allowed in the area.
3) The area selected for neotropical bird habitat must border a water source such as a river or lake.

Recreation Management Objectives

Since this land belongs to the state it must be accessible to and usable by the general public. As recreation managers, you must build adequate facilities for all of the visitors, including those with special needs, such as wheelchair accessibility. You are also required to supply a variety of outdoor activity options for both summer and winter visitors.

The following facilities must be built:

1) A visitor's center and educational exhibits covering at least 80 acres.
   - The area must border a lake and be located in mature or old growth forest. A permanent road must be built to the center and no logging practices or logging roads can happen within 1/3 mile of the area.

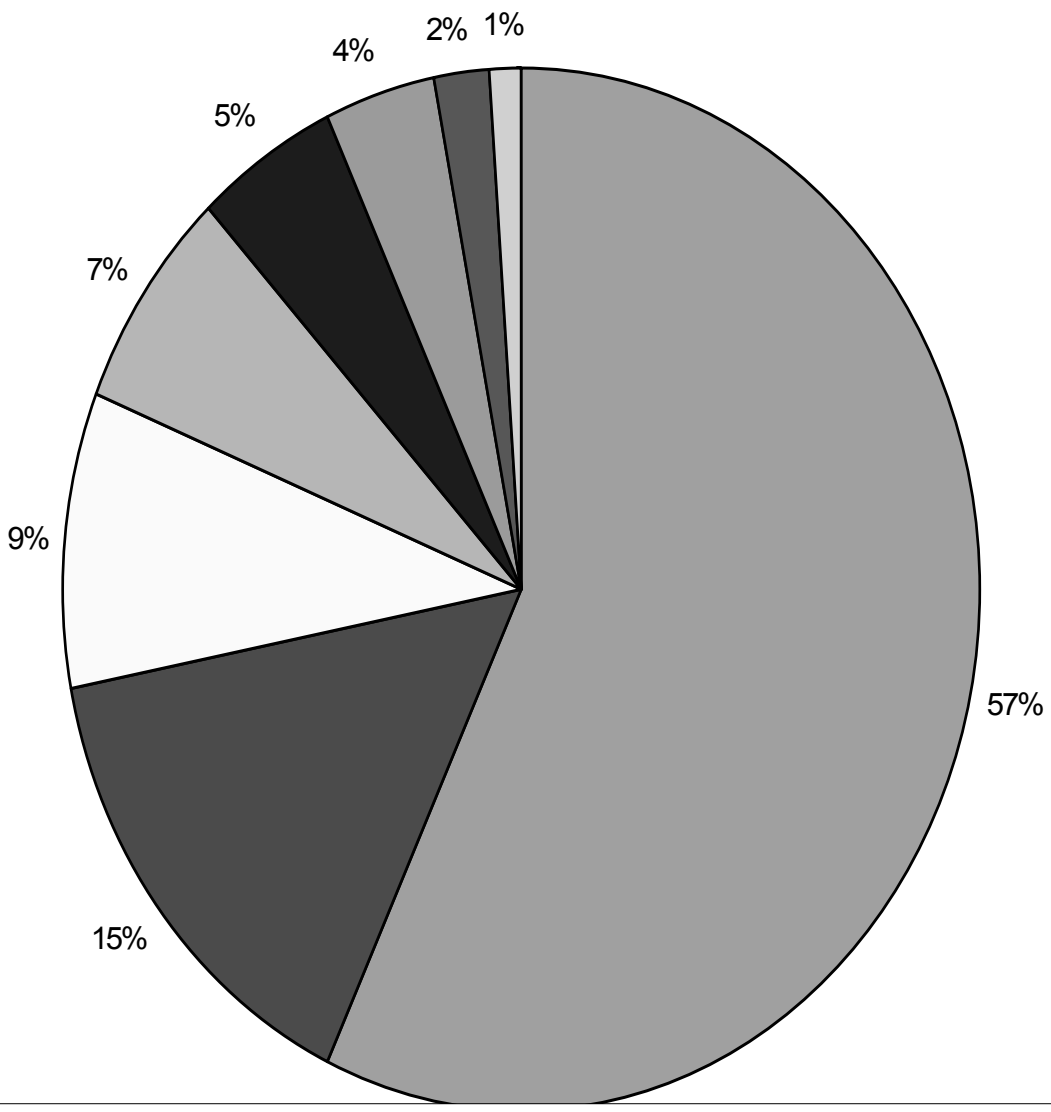
2) Fifteen miles of trails for hiking only, and 15 miles of trails only for mountain biking and cross-country skiing must be made into the forest.
   - The trails should go through as many forest types as possible. They can be made side by side. No logging practices can occur within 1/3 mile of these trails. No logging roads may cross these trails.

3) A family campground covering at least 40 acres.
   - The campground must be connected by a permanent road. No logging operation can happen with 1/3 mile of the campground. No logging roads may cross the campground or the campground road.

Forestry Objectives

- After you have marked all of the wildlife requirements and recreation requirements on your map, follow the Best Management Practices and draw roads to any area that can be forested. These roads must start from a road on the property boundary of the map and end in the forest that is to be logged.
- Once the area is connected by a logging road, mark the total area that can be forested in green. Once the areas are marked, use the dot grid to figure out the area of land that can be used for timber production in each forest type.
- Once you have the areas of each forest type, write them in the correct space in the area column of Worksheet 2.
- Use Worksheet 2 to determine how much money you will make from forestry each year. The cutting methods were selected for each forest type to make sure that the valuable trees will continue to grow. The cutting rate was determined to make sure that you cut trees only as fast as they can grow (sustainable harvest). The price was determined by the amount that consumers are willing to pay for the timber.
- The amount of money that you make each year from forestry will be used to judge the quality of your management plan. The more money that you make from forestry, the better you have used the land for the wildlife requirements, recreation requirements, and Best Management Practices.

Who owns Wisconsin's forested land?



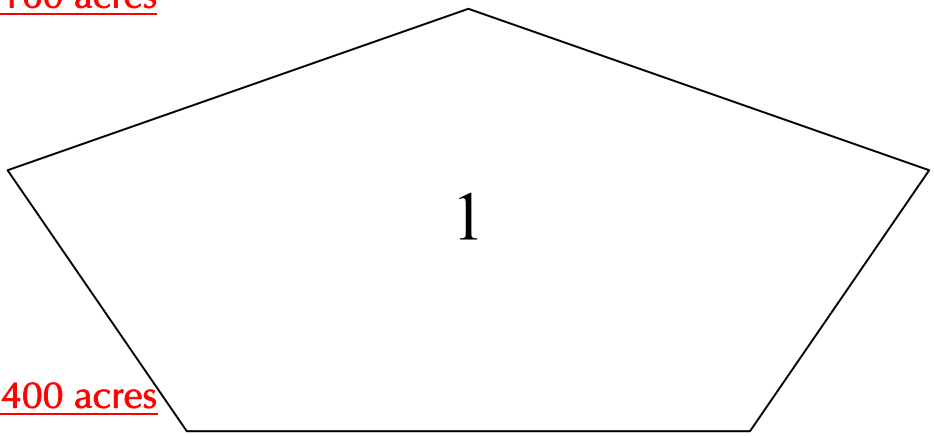
- Private Individual = 57%
- County Owned = 15%
- National Forest = 9%
- Forest Industry = 7%
- State Forest = 5%
- Private Corporation = 4%
- Tribal Lands = 2%
- Other = 1%

Forest Area Worksheet

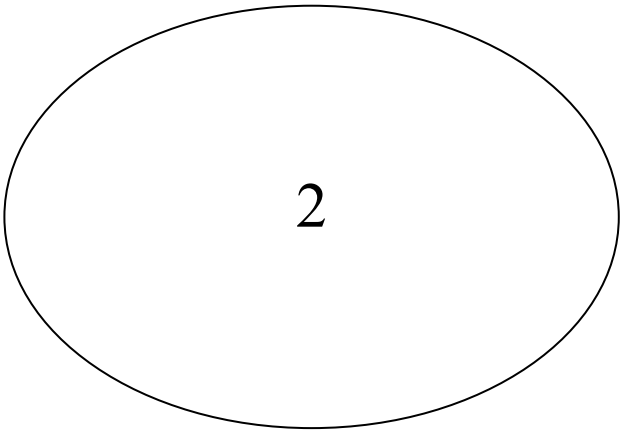
(Use your dot grid to determine the area inside of the shapes below)
1 dot : 40 acres

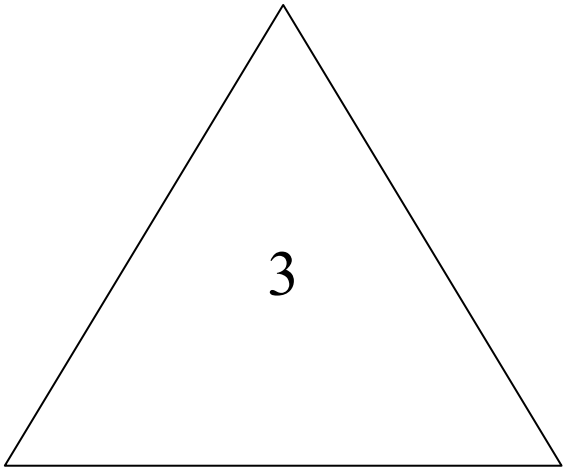
***These answers were determined with the dot grid reduced to 93%.

Area 1 approx. 3160 acres

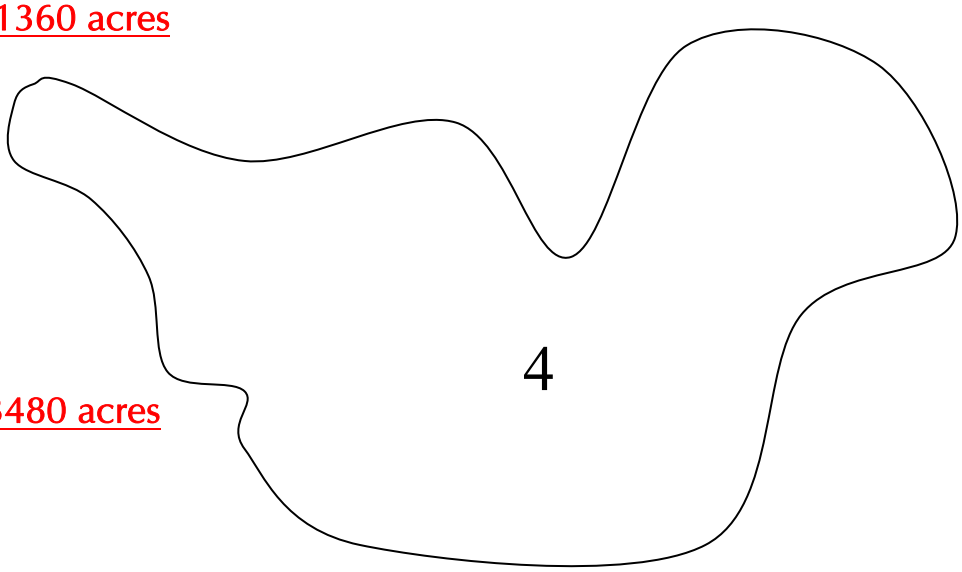


Area 2 approx. 2400 acres





Area 3 approx. 1360 acres



Area 4 approx. 3480 acres

Lesson 8

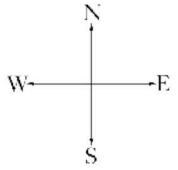
Tip:

For best results on the worksheets and mapping activity, reduce the size of the grid to 93% on a photocopy machine before making additional copies.

Duplicating Instructions

Print this map on 8.5 X 11 inch paper.
Photocopy map onto 11 X 17 inch paper, enlarge by 136%.
This will ensure the figures for land area match those on the worksheets in the lesson.

Shady River State Forest
Map of Forest Types



Forest Type Descriptions

1) Old Growth White Pine - a mixed coniferous and deciduous forest dominated by large, old White Pine trees.

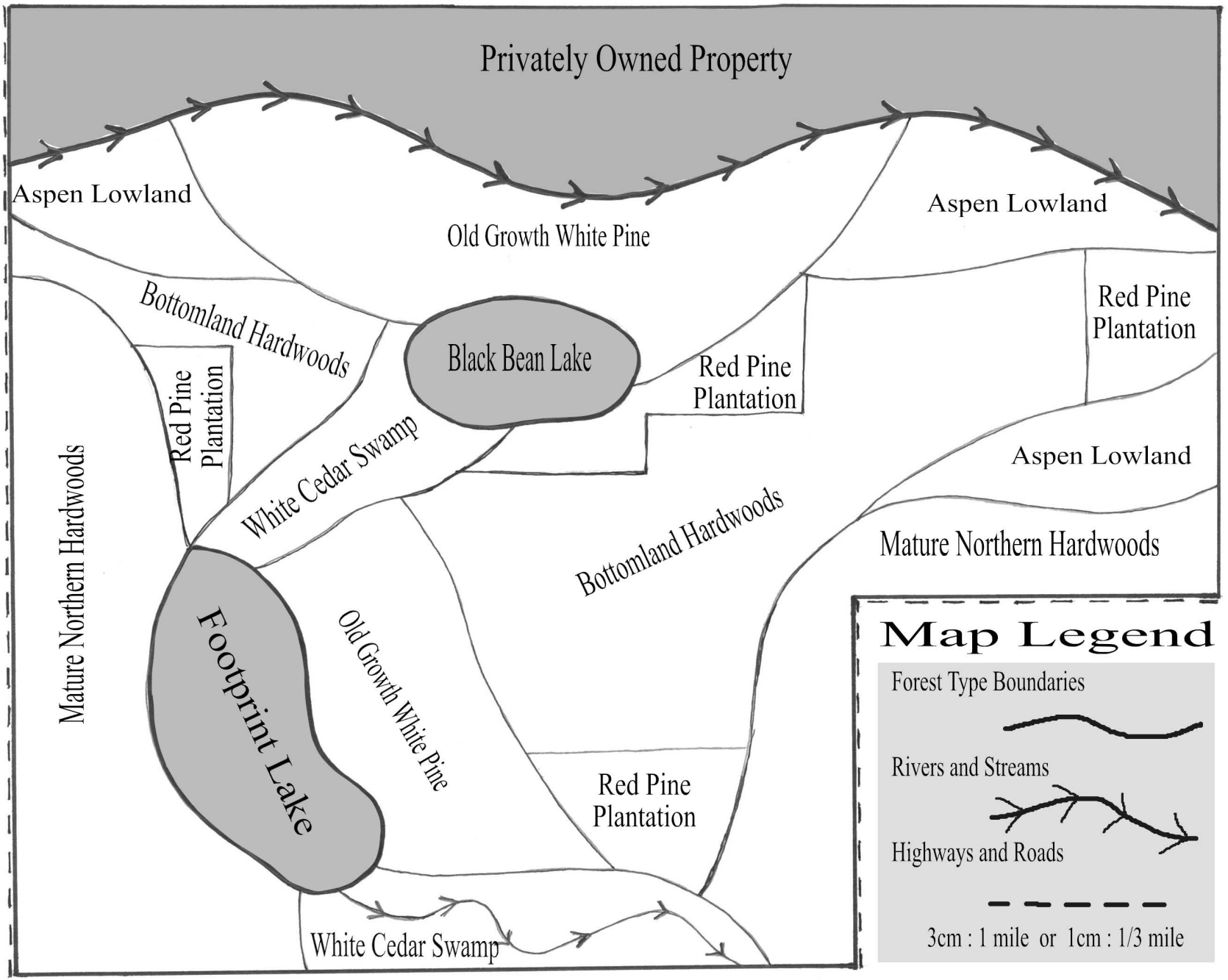
2) Bottomland Hardwoods - found on low gound that stays moist throughout the growing season. Made up of deciduous trees like maple, birch, aspen, and ash. Trees do not grow to great sizes or in great numbers, but many trees such as Black Ash are very valuable.

3) Northern Hardwoods - deciduous and mixed forest found in great abundance throughout northern Wisconsin. Maple, oak, elm, hickory, and birch may grow in large quantities. Mature forests are usually dominated by large, valuable Sugar Maples.

4) White Cedar Swamps - lowland, wet, coniferous forest dominated by slow growing, but valuable White Cedar trees.

5) Aspen Lowland - young forest made up of dense stands of Big-tooth and Trempling Aspen trees that are highly valued for paper and pulp production.

6) Red Pine Plantation - a replanted forest made up of straight rows of even-aged red pine trees. Plantations contain large amounts of tall, straight, valuable trees.



Lesson Nine

Forestry Issues Investigation

Concepts

1. Environmental issues arise when at least two parties have different viewpoints associated with an environmental problem.
2. Environmental issues in forestry are complex.
3. Issues can be dissected into individual parts to help understand and resolve them.

Objectives

Students will be able to:

1. Identify the components of an environmental issue.
2. Extract the factual and relevant information from the article pertaining to a current forestry issue by applying the skills necessary to investigate issues.
3. Propose alternative solutions to an issue and outline consequences associated with each solution.

Teaching site

Indoor classroom with chalkboard and/or overhead projector

Materials

Chalkboard and chalk
Copies of the article for every two students
Copies of the Forestry Issues Investigation worksheet for every two students
Paper and pencils

Lesson Time

One 50 minute class period

Nutshell

In this lesson, students will acquire the skills necessary to investigate issues related to forestry. They will read an article concerning current issues in forestry and extract relevant information from the article. Students will discuss, in a small and a large group setting, the reasons why conflicts arise when managing forests.

Teacher Preparation

Make copies of the article and **Forestry Issues Investigation Worksheet** for students. Prepare overheads of the **6 Steps for Investigating Environmental Issues** and **Forestry Issues Investigation Worksheet.**

Vocabulary

- **Problem** – is a situation or experience that is difficult to deal with.
- **Issue** – occurs when there are at least two different viewpoints based on a problem.
- **Belief –** is something that a person thinks is true about an issue.
- **Persuasion –** involves verbally motivating people to take action.
- **Consumerism –** involves putting economic pressures on a business or industry, to force a change in how they do business.
- **Political action –** involves trying to persuade an elected official or government agency to conform to your same values.
- **Legal action –** is taking legal or judiciary action, such as a lawsuit, or taking out a legal restraint, such as an injunction, to prevent a person or organization from carrying out an undesirable environmental behavior.
- **Ecomanagement –** involves physically maintaining or improving the existing ecosystem.

Background Information

This lesson deals with the investigation of environmental issues related to forestry. Issue investigation is an important part of environmental education. It leads students to become environmentally knowledgeable and responsible citizens – citizens that are ready to take action. It is important that students understand the processes involved in issue investigation in order to act responsibly. Numerous methods for investigating issues have been developed. This activity introduces a 6-step process that will enable students to break down an issue into several different components (issue, players, beliefs, values, etc.). Using this information, students will identify the actions proposed to resolve the issue and evaluate them in regard to possible consequences.

Throughout the Forestree Unit, we have introduced students to the human components of the environment. One commonly accepted framework for developing environmentally literate citizens involves ecological knowledge, issue investigation, and citizen action. The overall objective of that framework states that, "The environmentally literate citizen is able and willing to make environmental decisions which are consistent with both a substantial quality of human life and an equally substantial quality of the environment. Furthermore, this individual is motivated to act on these decisions either individually or collectively." In other words, environmental knowledge leads to stewardship or action.

Hungerford, et al., have laid out four subcomponents of developing environmentally literate citizens. These components, like the components of an ecosystem, are interdependent, and must be taught together. They develop in conjunction with one another, through increased knowledge and experience.

The first subcomponent is **ecological foundations**. The concepts include: individuals, populations, interactions, interdependence, limiting factors, energy transfer, biogeochemical cycling, community, ecosystem, succession, and man as an ecological factor. Having a sound background in science prepares a person for being environmentally literate. Students have covered forestry-related scientific knowledge in the first lessons of this unit.

The second component is **personal awareness of environmental issues and human values**. This awareness includes understanding the way in which human cultural activities and individual behaviors impact the environment. It is essential that individuals understand the need for thorough investigation of an issue, the roles of differing human values, and the need for clarifying personal values. An environmentally literate citizen will be aware of the importance of responsible citizen action. Understanding the role humans and their values play in environmental issues is paramount to creating the attitudes necessary to lead someone to environmental action. Students have explored the role of values in the previous lesson, and will be exploring an environmental issue in this lesson.

The third factor in creating environmentally literate citizens is **the investigation and evaluation of environmental issues and their solutions**. This factor deals with the skills necessary to investigate issues. The skills Hungerford, et al, suggest are the abilities to:

1. identify and investigate an environmental issue using primary and secondary sources of information
2. analyze issues to determine the perspectives associated with the issue
3. identify the cultural and ecological implications of those positions
4. identify alternative solutions to the issue and evaluate those alternatives
5. identify and clarify personal values in regards to the issue in question

The Forestry Issues Investigation lesson is most concerned with the third factor. By the end of the lesson, students will have the skills necessary to thoroughly investigate any environmental issue.

The fourth factor is **taking appropriate citizen environmental action**. This involves taking individual or group action to resolve an issue and evaluating the actions taken in regard to the quality of life and the environment. This lesson focuses on identifying action that is already proposed in dealing with an issue, and evaluating with regard to possible consequences of those actions. It is important for students to understand that there are many different kinds of action that can be taken to resolve an issue: persuasion, political action, consumerism, legal action, and ecomanagement.

Persuasion involves verbally motivating people to take action. It can include debating and letter writing.

Consumerism involves putting economic pressures on a business or industry, to force a change in how they do business. Boycotting a company is a type of consumerism.

Political action means that you are trying to persuade an elected official or government agency to conform to the same values you hold. Lobbying, voting, and supporting particular candidates over others are forms of political action.

Taking legal or judiciary action, such as a lawsuit, against a person or organization qualifies as **legal action**. Taking out a legal restraint, such as an injunction, to prevent a person or organization from carrying out an undesirable environmental behavior is also legal action.

Ecomanagement involves physically maintaining or improving the existing ecosystem. Examples of ecomanagement include reforestation, landscaping, restoring stream habitats, and installing bird boxes.

If students find that they feel strongly about an issue, they are encouraged to find a way to take action on that issue. They should, however, realize that there is a method to deciding what action to take. This method will be briefly explained towards the end of this lesson. Teachers can have students decide on an action to take regarding either a forestry-related issue or other issues and implement the action as an extension activity.

Note to Teachers

Many teachers shy away from teaching issue investigation because the issues can be controversial and the teacher may think it is not his or her place to introduce those topics in the classroom. However, it is issue investigation that teaches students to make informed decisions about environmental issues. As the teacher, you will not be sharing your values and opinions, but guiding the students to explore issues and identify the values of the people involved. In doing this, the students should begin to develop their own values and opinions of the issues being studied. This is an important lesson in the Forestree Unit and we encourage you to spend as much time as the students need to cover the concepts of issue investigation.

Activities

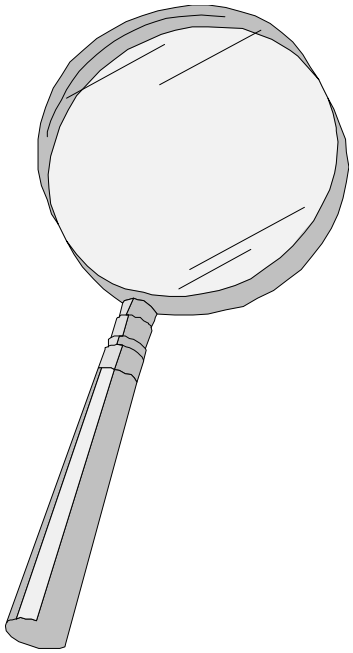
Developing Investigation Skills (20 minutes)

In order for your students to effectively investigate and evaluate environmental issues in forestry, they need to have certain skills. This lesson will provide students an opportunity to practice those skills on an issue affecting the field of forestry today. Tell your students that they are going to learn how to investigate issues in forestry.

Tell students they will soon be reading an article relating to forestry issues. They will need to be able to extract information from this article to investigate the issue thoroughly. As you discuss the steps they will be taking, show the **6 Steps for Investigating Environmental Issues** overhead. Students should copy the steps in their log book, so they can look back on them, if necessary.

Ask students, "What do we mean by an environmental problem?" *Something that is wrong with the environment. It could be pollution, deforestation, etc.* Ask students to tell you what an issue is. *An issue occurs when there are at least two different viewpoints based on a problem. The issue may be about the best way to solve the problem, but it also could be about whether or not*

the problem exists. Ask your students what they think the first step in investigating an issue should be. *Identifying what issue is at stake.* Identifying the issue in the article basically means picking out the main topic of the article.



The next step is identifying *who* is involved in the issue. Ask yourself, "Who are the key players?" There are at least two sides to every issue, sometimes even more. Once you have done this, you need to know the key beliefs for each side, and what their key values are pertaining to the issue. Beliefs and values are two separate things, not to be confused with one another. Review with your students what a value is (covered in Lesson 6). *A value is the worth something has to a person. There are different types of values.* Ask them what a belief is and how it is different from a value. *A belief is something that a person thinks is true about the issue. They believe it to the best of their knowledge to be a fact, even though it may not be a fact. It is not the same as what they desire or want (a value).*

Ask students, "Once you know what the issue is, the players involved, and what they believe and value, what do you think you need to do?" *Figure out what each player's position is on the issue.* Ask yourself, "What action does the player recommend to solve the issue?" "What do they want to do?" You should also try to identify the type of action proposed by each player. There are five different types of action. Ask your students, "What do you think these types are? ***Persuasion*** *(e.g. letter writing),* ***consumerism*** *(e.g. boycotting a business),* ***legal action*** *(e.g. lawsuit, injunction),* ***political action*** *(e.g. lobbying a legislator, voting),* ***ecomanagement*** *(e.g. re-forestation, landscaping).* Some types of action may be better suited to an issue than others.

The last step in this process is evaluating the proposed actions. Ask students, "Why would we want to evaluate an action?" *You must identify the consequences of these actions – what will happen if a particular action is implemented?* Ask your students what kinds of consequences they think actions can have. *Social, environmental, economical, legal, political, etc.* The consequences of actions could bring about the results desired, but could also make things worse. It is essential to think about all consequences, good or bad. By knowing the consequences, people can make better decisions about whether or not a particular action will bring about the results that they want.

Analyzing the Issue (20 minutes)

Have students find a partner. Pass out the **Forestry Issue Investigation** worksheet. The worksheet reflects the steps that you have just discussed with the class. Explain to your students that they will use this sheet to analyze an issue. Take a few minutes to read through the sheet with them, allowing them to discuss any questions about it.

Pass out the provided article to the pairs of students. Tell students that as they read through the article with their partner, they need to look for the answers to the questions on the worksheet. By answering these questions, students will begin to break the issue down into its components.

After the students have had time to read the article and fill out the worksheet, have the class come together and discuss their findings. You should go through the worksheet, one component at a time. Ask students what their answers were. Write students' answers on the chalkboard or overhead. If there are different opinions on certain components, take time to discuss why students have different answers.

**Note: The purpose of this lesson is to help students learn the skills necessary to dissect environmental issues. The article provided was chosen to address these skills. If you feel that a different issue would benefit your students, please use the following guidelines when choosing an appropriate article. The article should 1) focus on an environmental issue related to forestry, 2) include 3-5 different perspectives and, 3) provide enough background information so that students can define the problem at the root of the issue.*

CONCLUSION (10 minutes)

Tell students there are many different issues facing forestry and the environment. With the skills they used today, they will be able to effectively analyze these issues. As they move through life, they can use these steps to investigate issues in newspapers and magazines, issues on the television and movies, and issues that arise in conversations with other individuals.

Ask if any of your students feel strongly about the issue that was just discussed. Tell your students that taking action is the last step in investigating environmental issues. *(This is something that they can do on their own, or as an extension activity. You are just going to let them know the appropriate steps to take when deciding to take action.)* The students have already looked at all sides of the issue. The next step is identifying possible alternative solutions to the issue. Brainstorming is an excellent tool to use for this step. Ask students what types of action they could take on an issue. *Review: persuasion, consumerism, political action, legal action, and ecomanagement.* Students should try to include all types of action when brainstorming alternatives.

What do they think should happen next? *Evaluate the alternative actions.* Students should think about the good and bad consequences (social, environmental, economic) of the different alternatives. They should also think about their available resources (time, skills, people) – will they truly be able to carry out the action effectively? They must make sure that the action is consistent with their values related to this issue.

Finally, based on their evaluation, they would pick the best feasible option. Once chosen, they would implement the action, and then evaluate the success of their action based on their desired results.

These steps can be taken regarding any environmental issue. Encourage your students to take action on an issue that they feel strongly about, but remind them to thoroughly investigate the issue before deciding what type of action to take.

Student Log Book

Have students discuss the last part of the Issue Investigation in their log books. Ask them to analyze the actions presented for each player in the story and the positive and negative consequences involved. These consequences may be a result of the action or a result of achieving their overall goal.

Seeds to Grow

As an extension activity, pick out local issues related to forestry and/or the environment. Have students go through the issue investigation process. Continue the process into action, following the steps outlined in the conclusion. Students should find alternative solutions to the issue, evaluate those alternatives, and decide on the best action to take. They should then implement their chosen action, and evaluate its success once implemented.

Web Links

About.com— http://forestry.about.com/education/scilife/forestry/library/blartdex

National Forest Roadless Policy— http://roadless.fs.fed.us

Environmental News Service— Http://ens.lycos.com

E magazine— www.emagazine.com

Ecolonomics— www.ecolonomics.org

Topic index for forestry issues— www.metla.fi/info/vlib/Forestry/Topic/

Society of American Foresters Journal of Forestry— www.safnet.org/pubs/jof

SciCentral articles, reports, databases, and directories for renewable resource issues— http://www.scicentral.com/B-forest.html#articles

U.S. Forest Service roadless policy— http://www.cnie.org/nle/for-24.html

References

American Forest Foundation. 1996. Exploring Environmental Issues: Focus on Forests. Project Learning Tree. Washington D.C.

Durbin, Kathie. 1996. Tree Huggers: Victory, Defeat, and Renewal. The Mountaineers. Seattle, Washington.

Hungerford, et al. 1973. Investigating and Evaluating Environmental Issues and Actions: Skill Development Module. Stipes Publishing Co. Champaign, IL.

6 Steps for Investigating Environmental Issues

1. Identify the issue
2. Identify the key players
3. Identify the key beliefs
4. Identify the key values
5. Identify actions proposed by the players
6. Evaluate consequences of the actions – social, environmental, economic, etc.

This article is a composite of three different stories that appeared in the Milwaukee Journal Sentinel on November 17th and 18th, and December 3, 1999.

Forest Service plan sparks controversy in Wisconsin

On Oct. 19, 1999, the national government published its plan to preserve some of our National Forests as 'roadless' areas. These areas would be restricted from logging operations and forest road building. The plan intends to target forested areas that are already without roads or that have poor quality roads. The plan also targets the critical areas for protecting animal habitat and water supplies.

Paul Strong, a spokesman for the Forest Service in Rhinelander, Wisconsin, said that their local forest service agency was directed in October to add "protections" to all of the areas in the Nicolet and Chequamegon National Forests that did not currently have roads. Of the 1.6 million acres that comprise the two Wisconsin forests, about 74,000 acres are in that category. 2.75% of the National Forest in Wisconsin is currently protected as wilderness areas that have no roads or buildings. The Forest Service plan protects about 4.5% more of the National Forest land in Wisconsin from motorized vehicle access and operations such as logging.

"There are already 11,000 miles of roads through the National Forests in Wisconsin," Strong said. This plan would restrict the building of any new roads only in the protected areas, not in the rest of the forest. Across the country, national forests have about 40 million acres designated as 'roadless' areas. "These lands for the most part had few developed areas or roads but had no restrictions on the use of them either," said Strong. "In Wisconsin, some may have been logged before and had low maintenance roads built on them, that is an analysis we have to do. I suspect there will be strong opinions voiced from a variety of standpoints on the Forest Service Plan,"

A Forest County official says he is fighting the U.S. Forest Service plan that could ban logging and road-building on about 74,000 acres in two national forests in Wisconsin. Forest County Board Chairman Erhard Huettl joined a standing-room-only crowd at the first of two public hearings on this proposal Monday in Crandon. The second meeting was on Tuesday in Park Falls.

"I want to let the Forest County residents know what I intend to do as Forest County Board chairman to stop this plan from being rammed down our throats, I also want to say that this is not a threat; it is a promise", said Huettl on Monday. He has also appointed a three-member County Board committee to respond to the Forest Service plan. At least a half-dozen semi rigs filled with logs sat in a high school parking lot where Monday's meeting was held. The crowd sent a clear message that access to National Forests should be kept for recreation and logging since these are two major sources of employment and revenue for the counties in northern Wisconsin.

The Forest Service said a plan was needed because of strong public sentiment for protecting our current 'roadless' areas. Supporters say those tracts of land offer "clean water, biological diversity [and] wildlife habitat." They also promote "forest health, dispersed recreational opportunities, and other public benefits."

The federal government feels that it can no longer afford expensive road-building and road maintenance in the forests. "The public has questioned the logic of building new roads into

'roadless' areas when the Forest Service doesn't even have the funding to maintain its existing road system. Indeed, the Forest Service has a growing $8.4 billion maintenance and reconstruction bill and receives only 20% of the annual funding it needs to maintain its existing 380,000-mile road system," said a representative for the Forest Service. There are more miles of U.S. Forest Service roads than there are highways throughout the entire country.

The Forest Service issues contracts to log about 110 million board feet of lumber annually from the forests, he said. "The logging contracts are generally worth up to $8 million," he said. Opponents of the proposal say banning activities on the lands could harm some rural communities in Wisconsin that depend on access to the forest for the timber products industry and for recreational uses.

"If Washington D.C. takes away local control of our national forests, it will have tremendous effects on the future of the entire industry," said Nadine Bailey, president of the Timber Producers Association of Michigan and Wisconsin. "This could mark the beginning of the destruction of logging in Wisconsin. I consider this to be the precursor to the type of forest closure that ruined the industry in the northwest region of the United States." Bailey is urging all 1,300 members of her organization to write letters to the U.S. Forest Service voicing opposition to the plan, which has strong support among state environmental groups.

Environmentalists have said more needs to be done to protect forest lands from destructive logging. According to a midwest representative for the Sierra Club (a national environmental group), the federal government will not take away the power local citizens exercise in deciding the future of the forests. Rather, the government "wants to return the forests to the people" while regaining control from "the industry, which has pretty much destroyed the national forests," said Carl Zichella, regional spokesman for the group. "This is the kind of hysteria we're going to hear from the industry," he said, adding that the Clinton plan "will have a minimal, if any, effect on the industry. Timber harvests from national forests account for no more than 10% to 11% of logs cut in the state."

Carl Johnson, a sophomore at the University of Wisconsin-Madison, said he witnessed the negative impact of logging when he worked in Vilas County at a camp run by the state Department of Natural Resources. Campers using the facilities at nearby Big Lake were angry to see the timber being harvested so close to a campground. "What they liked about (their vacations) was the musky fishing and stuff like that," Johnson said. "National forests give people the same feelings. In a place where there are no vehicles, no roads - it's nothing you can describe on paper.

Forestry Issues Investigation

What is the Issue?

	Who are the Players?	What are their Key Beliefs?	What are their key values?	What action would the players like to take?	What Type of Action is This?
Player 1					
Player 2					
Player 3					
Player 4					
Player 5					
Player 6					
Player 7					

Forestry Issues Investigation

What is the Issue?

	Who are the Players?	What are their Key Beliefs?	What are their key values?	What action would the players like to take?	What Type of Action is This?
Player 1	National Government/ Forest Service	Protecting wilderness areas is necessary for animals, clean water, etc. Roads are expensive to maintain.	Biodiversity Economics	Preserve roadless areas through creation of legislation.	Legal
Player 2	Forest County Board	New restrictions threaten logging industry. Residents should have a say so on the issue.	Jobs Freedom Recreation	Formed committee Have public hearings	Persuasion Political
Player 3	County Residents	Extra protection threatens logging, which is a major source of jobs and revenue.	Jobs Revenue	Attend hearings, voice opinions	Persuasion Political
Player 4	Timber Producers Association (opponents)	Extra protection threatens local economy and the logging industry.	Jobs Economics Local control	Letter writing	Persuasion
Player 5	Environmentalists	More should be done to protect forests.	Local control Freedom Biodiversity	Speak out to protect wilderness areas.	Persuasion
Player 6	Recreationalists (campers)	Timber harvest negatively affects recreation.	Recreation Aesthetics	Voice opinions and/or find a new camping area.	Persuasion Consumerism
Player 7					

High Tension Over Proposed Power Line

Compilation of articles-Milwaukee Journal Sentinel Apr. 16, 1999; Duluth News Tribune May 23, 2000; AP Nov. 29, 2000; The Bee Feb. 28, 2001

A high-voltage power line between Duluth, MN and Wausau, Wis., would help Wisconsin meet its growing need for electricity, according to the draft environmental impact statement on the proposed project.

The existing 345-kilovolt line, from Minneapolis to Appleton, has frequently been pushed to capacity, forcing utilities in Wisconsin to scramble for alternative power supplies to feed demand on summer days. In the summer of 1997, unexpected heavy flows of electricity over the line caused a "near disaster" that nearly set off blackouts across parts of the Midwest, the utilities said in calling for the new transmission line.

That event, and electric shortages the last two summers, prompted Gov. Tommy G. Thompson and the state Public Service Commission to push utilities to beef up their infrastructure by adding new power plants and building a new transmission line.

"This transmission line, as proposed by Wisconsin Public Service and Minnesota Power, will go a long way to assuring Wisconsin residents will have affordable energy while at the same time helping to improve electric reliability," Thompson said in a prepared statement.

Wisconsin Electric Power Co. of Milwaukee also expressed its support for the project.

"The utilities are pulling together for what is best for Wisconsin in the long term," said spokeswoman Maripat Blankenheim.

David Benforado, executive director of the Municipal Electric Utilities of Wisconsin, which represents 82 communities that own and operate their own electricity systems, also backed the proposal.

"We want it built tomorrow. We hope that there are no obstacles that will pop up," he said.

But it could come at a cost to the environment. The proposed 250-mile-long, 345-kilovolt Arrowhead-Weston line that Minnesota Power and Wisconsin Public Service Corporation want to build has a greater potential to harm the environment than three possible alternative lines elsewhere in Wisconsin, the draft EIS found.

The Arrowhead-Weston line, however, is the only one that utility companies have asked to build.

``Part of our legal requirements is to look at alternatives," Public Service Commission of Wisconsin spokeswoman Annemarie Newman said.

The draft EIS also examined the possible environmental impacts of using different routes for the Arrowhead-Weston line and considered the need for the project.

One thing it did not do was make a recommendation for or against the project.

The PSC began mailing copies of the 500-plus page statement Friday.

``It's too early to comment on the draft," said Ed Garvey, Madison attorney for the group Save Our Unique Lands, which opposes the line. ``We haven't even had our experts take a look at it."

Garvey said his office is sending the draft EIS to SOUL's experts today.

``Then it's just question of continuing to marshal public opinion, which doesn't need much marshaling, because just about everyone we know is opposed to it," he said.

A number of people in Northwestern Wisconsin oppose the proposed line because of fears over its potential impact on property values, health and the environment. Project supporters say the line is needed to increase the reliability of the region's electrical system.

"I am concerned for all of the farmers and other landowners who make a living off of this area," said Margaret Buchberger of Marathon City. "Since this land represents their livelihood, this proposal means life or death for them." She said her family uses the land for logging and plans to grow ginseng, but a power line would cut across the farmland and prevent the use of large machinery needed for logging.

"The Public Service Commission will ultimately decide whether the line should be built, whether some modification of this project should be built, or if this project should not be built at all," said Jeffrey L. Butson, public affairs director for the PSC.

He said there was a clear division on the proposal by Minnesota Power and Wisconsin Public Service Corp. for the 345,000-volt line, as expressed at various public information sessions held by the commission.

"Primarily we are hearing (from the public) that this project ruins their land," he said. "It basically cuts across their land which will, they believe, affect their property value should they choose to sell. They did not intend to use the land for that purpose. A lot of these people retired on their land and use it for recreation," Butson said. "There are also growing concerns about some of the health issues associated with a power line."

But business representatives view the line as a plus for economic development.

"Reliable power is very important to encourage new businesses into town, and some businesses rely on it for other reasons," Butson said.

Minnesota Power manager of public affairs John Heino hadn't seen the draft EIS by mid-afternoon Monday. But he was pleased that it's been released.

``It's an important document that begins the process of considering the potential impacts on the environment," he said. ``We are anxious to consider ways that we can build this badly needed line and do it in a way that minimizes the impacts on the environment."

Picking a route for the line, provided it is built, is one way to minimize environmental impacts. The draft EIS broke the proposed line into three segments, each containing three possible routes. Each route has its own pros and cons.

The three routes in the Oliver-Exeland, Wis., segment illustrates that. One route maximizes the opportunities to put the transmission line on existing rights of way. Another route would minimize the contact people would have with the line but cuts across at least eight forests greater than 1,000 acres in size. Such forest fragmentation can affect species such as timber wolves. The third possible route would combine advantages of the first two, but may need tribal approval to use an existing transmission line right of way through the Lac Courte Oreilles Reservation, the draft EIS said.

From Exeland there are two possible corridors to Weston: a northern one running near Tripoli and one running near Owen. ``Forest fragmentation is a very serious concern on all of the Tripoli routes," the draft EIS said. ``Limited access to construct the new line across many wetlands and streams is also a significant environmental concern in the Tripoli sector." The northern segment, by comparison, has a lower potential of breaking up

forests. The tradeoff is that this segment's routes ``are primarily in an agricultural landscape... impacts on farm operations could be an important concern."

If the proposed line is built along one of the Tripoli routes, more than 10,000 acres of county forests would be impacted, according to SOUL intervenor Linda Ceylor. She quoted testimony presented by Price County Forester Pete Bartelt at a public hearing in Tomahawk explaining the negative effects of siting the transmission line though the county forests.

Egtvedt acknowledged that there would be a loss of overall income to the county if the line was located through county forests, but said the county would gain some income because the trees which would be cut down along the route and the right-of-way could be sold and the county would receive payment for the use of the land.

He said the damage to the forest ecosystem would have an adverse impact only in areas with small blocks of forested land, but stated he did not know the overall effects of a transmission line on forest fragmentation.

Pat Berg, Athens, asked Egtevedt what WPS could do about their stand of maple trees in the Ogema area. She said the route would bisect the entire stand and make it impossible for the family to continue to operate their maple syrup business. She was told some type of settlement would be made for the trees that had to be cut down but the family would not be reimbursed for the loss of possible income.

In response to questions from David Ludwig, an attorney for the Public Service Commission, Egtvedt said the transmission lines should use as much of the existing corridors, like highways and railroad rights- of-way as possible. He said the potential impacts of the proposed transmission line won't be known for years.

The Arrowhead-Weston route has the highest number of acres of county forest, the most miles of state trails, the most rivers listed in the Nationwide Rivers Inventory, and the most river and shoreline miles of Outstanding and Exceptional Resource Waters, the draft EIS said.

``These factors indicate an area largely dominated by natural landscape features that could be seriously harmed by the construction of a major high-voltage transmission line," the draft EIS says.

But the proposed Arrowhead-Weston line would also cross the area with the lowest density of roads and humans. That could translate to fewer landowners concerned over property values, health and safety.

The public has until July 5 to comment on the draft EIS. The state will use those comments as it prepares the final EIS, which could be completed by mid- to late-August. The PSC has to wait at least 30 days after the final EIS is released before it can begin public hearings on the project.

Ski Area to Add 50 Runs and Seeks Park Land for Condos

By Amy Kimmes | Wausau Daily Herald | Compilation from July 6 & 10, 2001

Downhill skiers will find 30 new runs when Granite Peak Ski Area opens this season and can expect about 20 more runs the following winter, the owner said Monday.

Charles Skinner Jr. said the expansion is progressing quickly, which he said is good news for skiers and for nearby businesses that benefit from the tourism.

But environmentalists say it's destroying the hill's ecosystem, and many came to a four-hour public meeting Monday in Wausau to voice their concerns. Granite Peak already clear-cut 29 acres for the 30 new runs on the east side of Rib Mountain, and it plans to clear another 29 acres for the west-side expansion.

Critics also questioned the state Department of Natural Resources' unprecedented plan to sell or swap state park land to Skinner so that he can build rental lodging near the ski runs. The development would include one central building of 60 to 70 upscale rooms and about 15 double-unit cabins for families and larger groups.

Dawn Narron, 75, wants all the expansion to stop.

"I want them to get the heck out of there," Narron, a town of Texas resident, said in a telephone interview before the DNR held the public meeting at the University of Wisconsin Marathon County. "They shouldn't be tearing the mountain up. The mountain belongs to the people. The (DNR) is putting money into the pockets of investors and the guy (Skinner) putting it up."

Skinner, a Duluth resident who also operates Lutsen Mountain north of Duluth, signed a 30-year lease with the state to operate the Rib Mountain ski hill owned by the DNR. Skinner secured $7 million last summer from several sources, including a team of nine local banks.

Without the expansion, downhill skiing would have no future in Rib Mountain, he said. Granite Peak must also offer lodging to survive long-term, Skinner said.

"I wouldn't do it if it weren't necessary for the ski area," he said. "But it's necessary for the park's survival in the decades to come."

Dave Daniels, northern region parks and recreation specialist for the DNR, said Skinner has come up with funding that previous owners could not generate.

"It has been fallow for a long time," Daniels said.

DNR officials said they probably would swap land with Skinner, instead of selling property, because they want to keep the park at its current 412 acres. The state already has helped Skinner by buying 40 acres for about $140,000 to allow for the ski hill's west-side addition.

Skinner wants 20 acres at the base of the hill on which to build the rental units, Daniels said. The state would want 20 acres of equal value in return.

The deal requires federal approval, said Tom Watkins, a DNR official in Madison.

"Whenever you change the park boundaries, (the federal government) gets involved in the review and approval," Watkins said.

The public will be kept involved in the process, DNR officials said.

“But the important thing is that at this point there is no decision at hand regarding the land trade or sale,” Watkins said.

The current lease places land value at about $5,000 an acre at Rib Mountain State Park. The land will be reassessed and appraised to determine its current value.

Dennis Holzem, 53, town of Weston, supports Skinner’s expansion plans and said he understands the need for rental lodging.

“It’s high time that we make something out of Rib Mountain State Park,” said Holzem, who skied there about 80 times last season.

“I sometimes wonder if (rental units) are really necessary, but I have to trust the business end of it,” he said. “Seeing how poorly used the ski hill is during the week, rental units could solve that problem.”

“That ski area is probably the single biggest tourist draw for the whole Wausau area,” said Roger Jolly, 52. “I’m totally in favor of utilizing whatever space (Skinner) needs to make the hill even more attractive to skiers and snowboarders.”

Tony Schultz, 21, of Athens opposes Skinner’s upgrades.

“I’m concerned about the environmental devastation and the declining water quality and the fact that they can pump water from the river (to make snow),” Schultz said. “This is a public land being manipulated by a guy with money. I’m just amazed that so many people are willing to defend this guy’s profits.”

“The DNR has been entrusted to protect our public properties and have done us a disservice by even thinking of selling or trading lands for private development,” said Al Opall, a Rib Mountain resident and member of Save Our Mountain Environment.

Opall said he’s not against skiing or improvements on the hill, but he is against additional development that would eat up state park land.

Skinner can make improvements within the existing property to make a living on the ski hill, Opall said.

Wisconsin Green Party member Donna Krause of Wausau agrees.

“We’re letting a private business make a profit off state lands,” Krause said. “It’s putting money into Skinner’s pockets, not the community’s.”

Billboards, Trees at Odds

By Raegan Isham | Wausau Daily Herald | July 10, 2001

A proposed state budget amendment would allow businesses and billboard owners to cut down trees and shrubs along any road, street or highway, but critics hope to block its passage.

If the amendment is approved, the state won't have to issue permits.

The "result is going to be an excessive cutting to expose signage," said Chuck Mitchell, president of Citizens for a Scenic Wisconsin. Large billboards are a nuisance, he said.

The amendment to the state's budget, which was added by the Senate caucus, would allow businesses and billboard owners to remove or trim vegetation along public rights-of-way if certain criteria apply. That includes if the vegetation interrupts the view of the business or sign for more than six seconds if a driver is traveling at the posted speed limit, the owner pays for the trimming or removal of vegetation and the cost for cleanup and disposal and state funds won't be used to pay for the trimming, removal or replacement vegetation.

The budget needs to be approved by the Senate and Assembly and Gov. Scott McCallum before owners can remove vegetation.

The Department of Transportation is in a difficult position, said David Vieth, director of the DOT's Bureau of Highway Operations. The department is asked to protect vegetation and provide a pleasant experience for travelers along highways, but the visibility of signs and businesses also is important for tourism.

"Certainly we know there's a high value to businesses being seen by traffic," Vieth said.

When signs along highways become hidden by trees or other vegetation, it diminishes the value of the sign for the advertiser and sign owner, Vieth said.

The amendment was co-authored by Rep. David Ward, R-Fort Atkinson, and Sen. Roger Breske, D-Eland. Ward said he was contacted by outdoor advertising representatives in his district who said it was difficult to get permits from the DOT to remove vegetation in front of billboards. Most of the vegetation was naturally grown, Ward said.

If the billboard can't be seen by drivers, it is useless, Ward said. He wants to make sure the investment of the business or billboard owner is protected and that removed trees or shrubs are replaced with similar vegetation at the owner's expense.

Bill Mitchell, general manager of Lamar Advertising of Central Wisconsin in Marshfield, said if the amendment passes, it will help make billboards that are blocked by vegetation more visible.

"Basically all we're trying to do is cut vegetation in most cases that's grown up since the billboards have been erected," he said.

The vegetation that is removed is replaced with something smaller such as a shrub that won't block the billboard.

Right now, businesses or billboard owners can apply for a permit from the DOT to remove the trees or ask the department to remove it. The DOT will remove vegetation only if the sign or business was there first and then became blocked.

If the DOT has a crew remove the vegetation, the removal costs are charged to the person requesting the removal, Vieth said.

Cornel Hausler, a Merrill resident and a member of Citizens for a Scenic Wisconsin, said the possibility of allowing businesses and billboard owners to cut down vegetation at their choosing is “mind-boggling.”

“This is going to be devastating to the environment. ... They’ll have a right to cut down anything,” Hausler said.

Not only do trees and other vegetation give Wisconsin a scenic appeal, they prevent erosion, produce clean air and provide habitat for animals, Hausler said.

If the amendment is approved, the DOT won’t have to issue permits.

“We don’t want to see any more billboards than we have to,” Chuck Mitchell said.

The state DOT owns and manages 150,000 acres of land along highways. This helps erosion and noise control as well as scenic appeal, Chuck Mitchell said.

“We would like to see the status quo,” Chuck Mitchell said. “We think the DOT does a nice job, we think it’s their jurisdiction.

“We think it’s a travesty to see private citizens operating on public lands to suit their private purposes. Those are public lands for the use and for the aesthetic values of the public,” Chuck Mitchell said.

Lesson Ten

The Wisconsin Forestry Summit

Concepts

1. Many topics in forestry throughout Wisconsin, the U.S., and the world are controversial.
2. Many people have different opinions about these topics.
3. To better understand controversial topics involving people and the environment, it is important to use the knowledge that you have and look at the topic from all of the differing viewpoints.

Objectives

Students will be able to:

1. Use the information they have acquired to analyze and discuss selected controversial topics in forestry.
2. Redefine and expand on their original conceptual image and definition of 'forest'.

Teaching Site

Indoor classroom where desks or chairs can be arranged in a circle

Materials

List of summit questions; overheads of supporting pictures/quotes; chalkboard/chalk or large easel pad and pen

Lesson Time

One 50-minute class period

Nutshell

Students will participate in a culminating summit regarding Wisconsin forestry. They will synthesize their knowledge of forestry in order to discuss topics affecting Wisconsin forests and forests throughout the country and the world.

Teacher Preparation

Read through summit questions. Make overheads of the pictures/quotes/statistics included for each question. Arrange desks/chairs in a circle to facilitate discussion.

Activities

Wisconsin Forestry Summit (30-35 minutes)

Welcome students to the Wisconsin Forestry Summit. Tell the students that many state, national, and global summits happen each year on topics such as climate change, agriculture, pollution, biodiversity, and forestry. A summit is a meeting organized by professional scientists, teachers, historians, political leaders, and many others in order to discuss and come to decisions on controversial topics that affect all of us.

Tell the class that today they will be discussing a few controversial issues in forestry. Tell the class that this will be their final day of forestry research. Ask them to think back to all of the lessons that they have done involving forestry. Have the students go through their log books and briefly review the subjects that they have covered. Tell the class that they will be discussing a variety of questions during the summit that will require them to reflect on the knowledge that they have developed during this unit.

Start by encouraging students to ask any and all questions that they have from the material that you have covered. After the questions are exhausted, inform the students that on this final day they will attempt to discuss and understand a few of the most important topics in forestry today. Explain the summit rules to your students *(these are merely suggestions; add or subtract to this list to fit your situation)*:

- One person speaks at a time
- Give the speaker your respect and attention
- All students are expected to participate during the summit
- Raise your hand to speak

Once students are fully aware of the rules and ready to begin, introduce the first topic. As you read through and discuss the questions, make sure that the picture or quote associated with that question is on the overhead. Give students time to discuss each topic thoroughly. Play devil's advocate with your students - they should be able to defend their thoughts on a topic. Try to get through as many questions as possible, choosing from the four options below. Be sure to leave enough time at the end of class for the last two activities.

Subjects and Questions for the Wisconsin Forestry Summit

1) **Population and Sustainable Forestry – Population Growth Overhead**
   Put the **Population Growth Overhead** on the projector. Ask the class to read the overhead. Help them to understand that many places in the world are growing much faster than Wisconsin or even the United States. Ask the class if they think that there are more people in Wisconsin now then when the settlers came, during the Depression, or when they were younger. Have them think back to sustainable harvesting in forestry. Review the subject explaining that the sustainable cutting rate will supply a constant supply of timber from a forest into the future. Ask the class if they can remember what happens to the supply of timber if the cutting rate is too fast. *It will eventually run out.* Ask the class how the overhead and sustainable harvesting are related. *The more people we are, the more resources we will require. A constant and lasting supply of timber can only support a constant population.*

   Have the students analyze the scenario to determine if population growth affects our forests. What about the land required to grow our food? For people to build houses on? Ask the class what solutions they can think of. *Use less resources, land, etc. per person. Grow our forests at a faster rate and cut at a faster rate. Reduce population growth rates. Import wood from other countries (is this sustainable?)* Discuss the topic in any amount of detail until ideas are exhausted.

2) **All cut or no cut and the plantation debate – Plantation/Natural Forest Overhead and the Who owns Wisconsin's Forest Pie Chart from the Management Lesson**
   Use the last discussion to lead into a debate on zero-cut or all-cut forestry. Ask students if logging all of our state and/or national forests is an adequate way to increase the supply of lumber and people employed and economic output. Can logging more forests support the needs of a growing population? What would we lose by logging all of our forests? *All of our other values (aesthetic, recreational, cultural, egocentric, ecological, etc.)* Where would we go to hike and mountain bike? What would happen to our wildlife (fishers, neotropical birds, timber wolves, black bears)? What about diversity and climate and soil erosion?

   Now ask the class what might happen if we were to preserve all of our nation's forests. What about the products the forest produces? The jobs involved in forestry? The income the state makes from forestry practices? Use the **Who Owns Wisconsin's Forest Pie Chart** to show the percentages of state, federal, and county land that would

become unmanaged for forestry. Use statistics from the utility lesson to show the amount of jobs and money that the state would lose. Ask the class to discuss the results of each extreme.

Put the Plantation/Natural Forest Transparency on the overhead. Ask the class what the differences between these two forests are. *Structure, composition, diversity, uses, animal habitat, aesthetics.* Ask the class which pictures they think is more beautiful. Which forest provides the most animal habitat? *Natural.* Which forest is better for soil and water quality? *Natural.* Ask them which one produces more wood for timber. *Plantation.* Have the class brainstorm and discuss the relationships between plantations and natural forests. *Plantations are used to produce large amounts of timber from small amounts of land.* If we can supply our timber needs with plantations, is logging in the remaining natural forests necessary? *The more wood we produce from plantations, the less that natural forests must be logged. The more wood we produce, the less we will have to import from other countries.* Are other countries using forestry practices that are destroying the environment (tie-in to tropical rain forests)? When are there enough forest plantations? When are there too many?

3) Time and Place of Forest Disturbance – Quotes from Dr. Patrick Moore and Greg Closter and the Clearcut photo as overheads

Place the Clearcut Photo on the overhead and have the students discuss the picture. Is it pretty? What kind of animals would live there? Would you want to go hiking there? Does it make you angry? Where did all of that wood go? Who made money from that wood? Use the quotes to convey the opinions regarding logging and clearcutting. Discuss each quote using the information that students have learned about cutting methods and our logging history. Have them talk about what happens to forests after a clearcut. Is it permanent? Ask them if all clearcutting is harmful to the environment. Is clearcutting misused? What might the differences be between clearcutting aspen in Wisconsin and clearcutting Old Growth Forests on the mountain sides of Oregon and Washington? What about the clearcutting of the tropical rain forests?

4) Wisconsin Logging History and Rainforest Logging Today – Wisconsin Loggers/Tropical Loggers Photos Overhead, Tropical Forests Overhead, and Unlogged Forests Overhead

Ask students if they have ever heard of the tropical rain forests. What have they heard? Have students discuss the logging of the rainforests and all they have heard about it. Use the overhead of the Unlogging Forests in the U.S. to show the amount of forests that we have logged over time. Point out Wisconsin and show the unlogged forest that are left. *None.* Ask students to discuss the consequences and benefits of that logging and the way that we view and use our forests.

Put up the Tropical Forests Overhead and point out the rain forests on each of the continent. *The gray areas confined around the equator.* Read the statistics on the bottom of the sheet. Ask students why they think people are logging the rainforests and what impacts it is having.

Put the Wisconsin Loggers/Tropical Loggers Photo on the overhead. Ask the class to compare and contrast the two photographs. Ask them what would have happened if

we had been stopped before we logged our forests. Would our economics, forests, homes, jobs, be different? Why did we log our forests? How did it help us today? Why are the people in the tropics logging their forests? *To clear land for agriculture, to use wood for heat and energy, to build homes, to sell the logs to other countries, to try to support a growing human population.* Are they selling products to the U.S.? Are we using wood products from the rain forests? What consequences and benefits resulted from the logging of our forests? How can we help the people in the tropics and help the forests at the same time?

Summit Wrap-Up

Tell the class that many questions are still not answered about forestry and that new questions are always being asked. The most important thing is that they judge the issues in forestry today and the future with the knowledge that they have gained while using all of the values that they have learned. A knowledgeable decision is the most correct decision.

Concept Mapping (10 minutes)

After the summit discussion has concluded, tell students that they are going to do an activity with which they are familiar. This is a way for students to see how much they have learned during the course of the Forestree Unit. Ask them "What do you think of when you hear the word forest?" This is the same question they were asked at the beginning of the unit. Once again, as they brainstorm answers, write them on the chalkboard or on an easel pad. As you add each idea or word, try to group words based on concepts as you did in Lesson One. Make sure all words lead back to the word ***forest*** in the middle. Encourage students to think back over the last 10 lessons as they brainstorm. Once all ideas have been exhausted, pull out the first concept map they made. Compare the two (the last concept map should be much larger)– how much have students learned during this unit?

Conclusion – Redefining the Forest (5-10 minutes)

Tell students that, as evidenced by their summit discussions and concept mapping, they have learned a lot about Wisconsin forestry. Some of their perceptions of a forest and its uses may have changed over the last 10 lessons. Ask students to get out their log books. Tell them that their last assignment for the Wisconsin Forestree Unit is to rewrite their definition of a forest. They are not allowed to look at the definitions written at the beginning of the unit. Give students a few minutes to write a definition of a forest. Once everyone is finished, have them go back and read their first definition of a forest. Ask students how their definitions compared. Were the definitions the same or different? What did they learn about forestry over the course of the Forestree Unit?

Log Book

Have students write a short paragraph answering the question "How can you use the knowledge and skills you developed during the Wisconsin Forestree Unit throughout your life?"

Seeds to Grow

As an extension, students can pick a topic discussed in the summit. They can investigate this topic using library and Internet resources to answer the questions covered in the summit in more detail. Students can prepare a report on this topic or make a presentation to the class.

Web Links

World Forest Institute— http://www.vpm.com/wfi/

Temperate Forest Foundation— http://www.forestinfo.org/CoolFacts/fromtree.htm

Wisconsin Forest Resource Education Alliance— http://www.wfrea.org

The Food and Agriculture Organization— www.fao.org/forestry

The State of the World's Forests— http://www.fao.org/forestry/fo/sofo/sofo99/sofo99-e.stm

Environmental News Service— Http://ens.lycos.com

References

Berger, John J. 1998, Understanding Forests. Sierra Club Publication.

Durning, Alan Thein. 1993. Saving the Forests: What Will it Take? World Watch Paper 117.

Edwards, Margaret et al. 1997. Global Environmental Change: Deforestation. National Science Teachers Association. Arlington, Virginia.

Patent, Dorothy Hinshaw. 1996. Biodiversity. Clarion Books. New York.

Population Growth

In the seconds it takes you to read this sentence, 24 people will be added to the Earth's population.

Before you finish reading these paragraphs, that number will reach about 430. Within an hour ... 11,000. In one day ... 260,000.

Two nights from now, the growth in human numbers will be enough to fill a city the size of San Francisco.

At the beginning of the year 2000, our population was estimated to be 6 billion people. We are increasing by 95 million people every year.

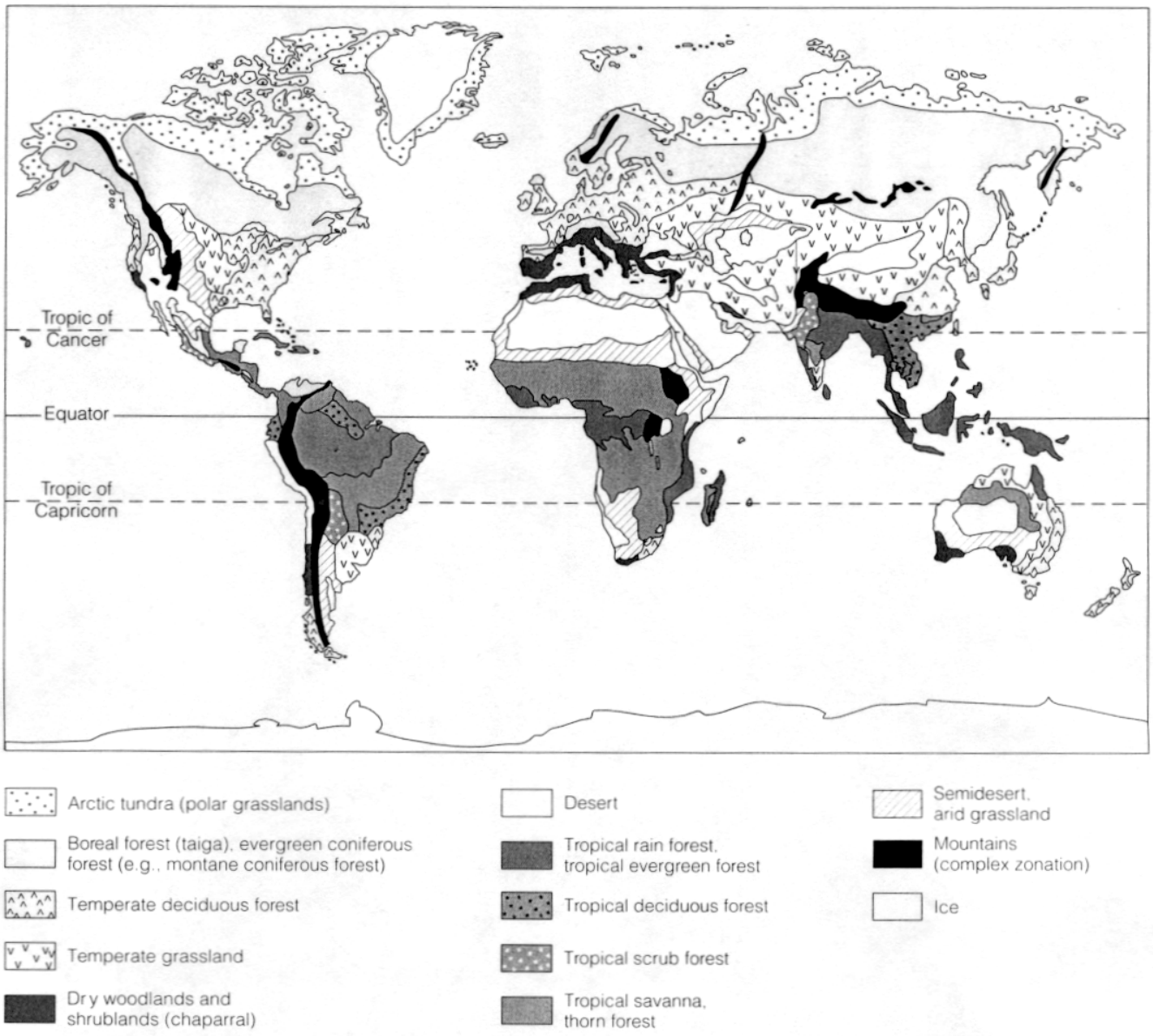
"The Sierra Club says, 'You don't need a professional forester to tell you if a forest is mismanaged – if a forest appears to be mismanaged, it is mismanaged.' They want you to believe that the ugly appearance of a recently harvested forest means permanent destruction of the environment. And yet, the unsightly sea of stumps is not nuclear waste or toxic chemicals. It is 100% organic and will soon grow back to a beautiful new forest again."

- Dr. Patrick Moore, 1999
- a founder of Greenpeace

"Foremost, I'd like to state that no matter what anyone says, the one, and only benefit of clear cutting is economics - bringing in machinery and tearing up everything in your way is the fastest, most efficient, cheapest way to harvest timber, period. Anyone who believes otherwise probably believes that ‘peace keeping mission’ and ‘war’ are the same. So, let's not argue about clear cutting being beneficial to the environment in any way, shape, or form - it just doesn't wash."

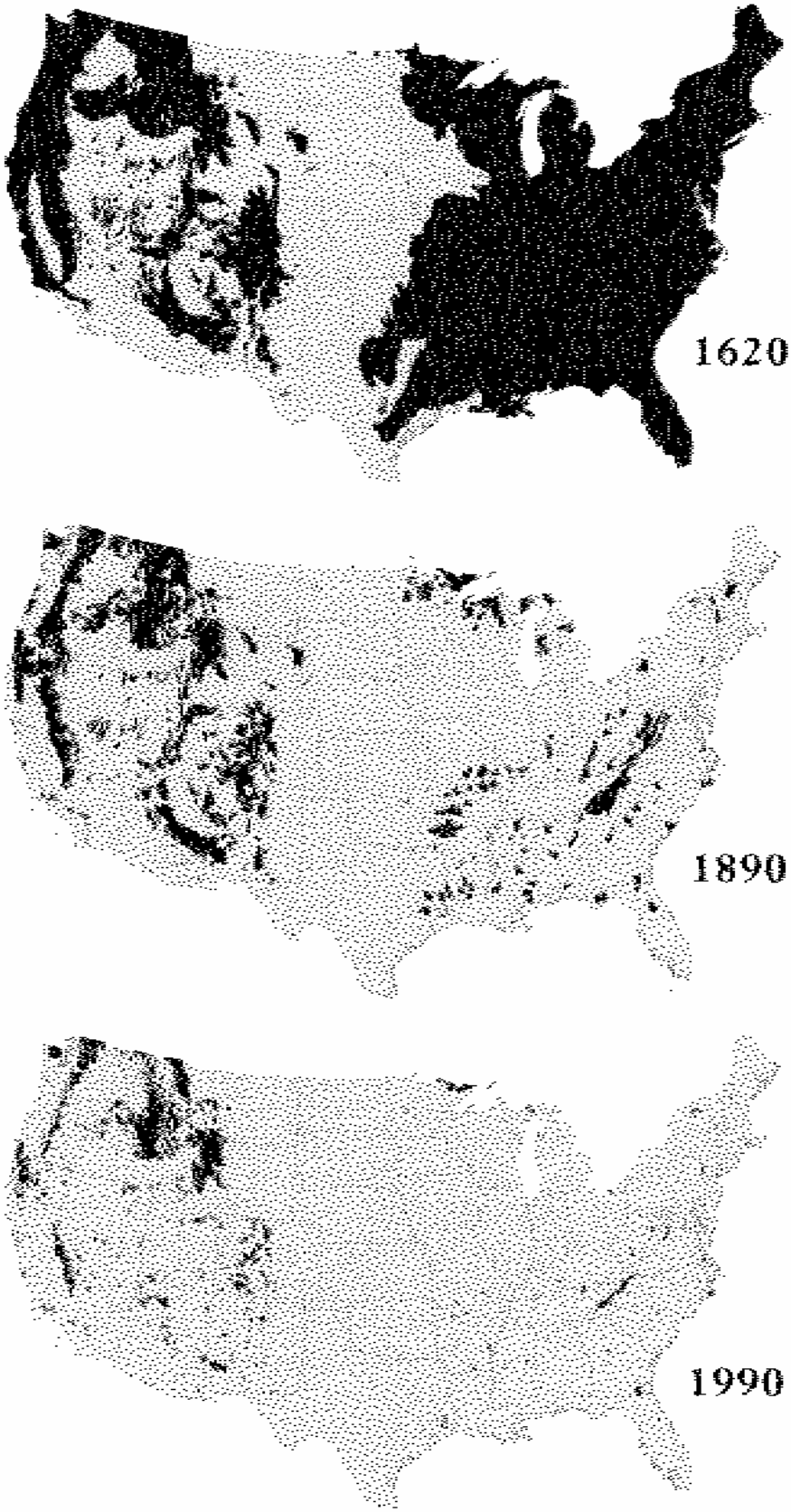
Greg Closter
‘The Battle for the Northwoods’

Tropical Forests



Area of the World's Tropical Rainforest Before Logging
= 6.2 million square miles

Area of the World's Tropical Rainforest in 1999
= 2.1 million square miles


1620
1890
1990
Unlogged Forests

Rainforest Loggers and Wisconsion Loggers

K. Amman

Clearcuts

Plantations and Natural Forests

Resources and References

Lesson 1 - The Science of Forests and Trees

Addis, James et al. 1995. Wisconsin's Biodiversity as a Management Issue. Wisconsin Department of Natural Resources.

Bates, John. 1995. Trailside Botany: 101 favorite tree, shrubs, and wildflowers of the Upper Midwest. Pfiefer-Hamilton Publishers. Duluth, MN.

Kimmins, Hamish. 1997. Balancing Act: Environmental Issues in Forestry. UBC Press, Vancouver.

Perry, David A. 1994. Forest Ecosystems. John Hopkins University Press. London.

Petrides, George A. 1958. Peterson Field Guide: Trees and Shrubs of Eastern North America. Houghton Mifflin Co., Boston.

Platt, Rutherford. 1987. 1001 Questions Answered About Trees. Dover Publications Inc. New York.

Wisconsin Department of Natural Resources Bureau of Forestry. 1990. Forest Trees of Wisconsin and How to Know Them.

Lesson 2 - A Competitive Edge

American Forest Foundation. 1996. The Changing Forest: Forest Ecology. Project Learning Tree. Washington, D.C.

Kotar, John. 1984. Habitat Types of Northern Wisconsin. Dept. of Forestry Pub. Madison, Wisconsin.

Kotar, John. 1996. A Guide to Forest Communities and Habitat Types of Southern Wisconsin. Dept of Forestry Pub. Madison, Wisconsin.

USDA Forest Service. 1990. Silvics of North American Trees. Vol. 1-2.

Walker, Laurence C. 1996. Forests: A Naturalist's Guide to Woodland Trees. University of Texas Press. Austin, Texas.

Whelan, Robert J. 1995. The Ecology of Fire. Cambridge University Press.

Lesson 3 - Forests of Wisconsin

Hole, Francis D. 1980. Soil Guide for Wisconsin Land Lookers. Geological and Natural History Survey and University of Wisconsin Extension. Bulletin 88. Soil Series 63.

Hole, Francis D. and Germain, Clifford E. 1994. Natural Divisions of Wisconsin. WDNR Publication. Madison, Wisconsin.

Lesson 4 - Wisconsin Forest History

Botkin, Daniel B. 1990. Discordant Harmonies. Oxford University Press, New York.

Cronon, William. 1983. Changes in the Land. Hill and Wang. New York.

Leopold, Aldo. 1949. A Sand County Almanac and Sketches Here and There. Oxford University Press. New York.

Mead, Howard and Dean, Jill and Smith, Susan. 1971. Portrait of the Past: A photographic journey through Wisconsin. Wisconsin Tales and Trails Inc. Madison, Wisconsin.

Ostergren, Robert C. and Thomas R. Vale. 1997. Wisconsin Land and Life. The University of Wisconsin Press. Madison, Wisconsin.

Peattie, Donald Culross. 1948. A Natural History of Trees or Eastern and Central North America. Houghton Mifflin Co., Boston.

Rosholt, Malcolm. 1980. The Wisconsin Logging Book. Palmer Publications Inc. Amherst, Wisconsin.

Rosholt, Malcolm. 1982. Lumberman on the Chippewa. Palmer Publications Inc. Amherst, Wisconsin.

Rosholt, Malcolm. 1986. Photos from Wisconsin's Past. Palmer Publications Inc. Amherst, Wisconsin.

Wessels, Tom. 1997. Reading the Forested Landscape: A Natural History of New England. The Countryman Press. Woodstock, Vermont.

Lesson 5 - Forest Utility

Smith, W. Brad and Hahn, Jerold T. 1989. Wisconsin's Forest Statistics, 1987: An inventory update.. General Technical Report, NC-130. St. Paul, MN. US Dpartment of Agriculture Forest Service. North Cantral Forest Experiment Station.

Lindbeis, Richard and Hovind, James H. 1985. Wisconsin's Forest: An assessment. DNR Bureau of Forestry.

Vander Zouwen, William J. 1998. Preserving Wisconsin's Outdoor Legacy.

Wisconsin Blue Book 1997-98 and 1999-2000

Wisconsin Department of Natural Resources. 1998. A Look at Wisconsin's Forests. PUB-FR-122

Lesson 6 - Forest Value

Strathe, Sterling. 1994. Wetland Understanding Leading to Protection. Outdoor Skills Center, Inc.

Hungerford, et al. 1973. Investigating and Evaluating Environmental Issues and Actions: Skill Development Module. Stipes Publishing Co. Champaign IL.

Lesson 7 - Careers in Forestry

Environmental Careers Organization. 1999. The Complete Guide to Environmental Careers in the 21st Century. Island Press. Washington D.C.

Wisconsin Department of Natural Resources. 1993. Environmental Quality: A Career with Rewards. Publication #PE-021 93. 16 pp.

Lesson 8 - Forest Management

Addis, James et al. 1995. Wisconsin's Biodiversity as a Management Issue. Wisconsin Department of Natural Resources, Madison.

Benzie, John W. 1977. Manager's handbook for red pine in the north central States. USDA For. Serv. Ben. Tech. Rep. NC-33, 22p. North Cent. For. Exp. Stn., St. Paul, MN.

Botkin, Daniel B. 1990. Discordant Harmonies. Oxford University Press, New York.

Dombeck, Michael. Dec. 2, 1999. Presentation at University of Wisconsin – Stevens Point.

Erdmann, Gayne G. and Crow, Thomas R. and Peterson, Ralph M. and Wilson, Curtis D. 1988. Managing Black Ash in the Lake States. USDA For. Serv. Gen. Tech. Rep. NC-115, 9p. North Cent. For. Exp. Stn., St. Paul MN.

Erdmann, Gayne G. and Crow, Thomas R. and Oberg, Robert R. 1989. Volume tables for second growth northern hardwood forests in northeastern Wisconsin. USDA For. Serv. Gen. Tech. Rep. NC-223. 5p. North Cent. For. Exp. Stn., St. Paul, MN.

Johnston, William F. 1977. Manager's handbook for northern white cedar in the north central States. USDA For. Serv. Gen. Tech. Rep. NC-35, 18p. North Cent. For. Exp. Stn., St. Paul, MN.

Lee, Robert G. et al. 1990. Community and Forestry: Continuities in the Sociology of Natural Resources. Westview Press.

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Wisconsin Department of Natural Resources Bureau of Forestry. Wisconsin Woodland Management Reference Book.

Lesson 9 - Forestry Issues Investigation

American Forest Foundation. 1996. Exploring Environmental Issues: Focus on Forests. Project Learning Tree. Washington D.C.

Durbin, Kathie. 1996. Tree Huggers: Victory, Defeat, and Renewal. The Mountaineers. Seattle, Washington.

Hungerford, et al. 1973. Investigating and Evaluating Environmental Issues and Actions: Skill Development Module. Stipes Publishing Co. Champaign, IL.

Lesson 10 - Wisconsin Forestry Summit

Berger, John J. 1998, Understanding Forests. Sierra Club Publication.

Durning, Alan Thein. 1993. Saving the Forests: What Will it Take?. World Watch Paper 117.

Edwards, Margaret et al. 1997. Global Environmental Change: Deforestation. National Science Teachers Association. Arlington, Virginia.

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** Many lessons also utilize resources and references that are listed under previous lesson headings.

Web Links for Forestree

www.blm.gov/education/ecosystem/ecosystem.html
The Bureau of Land Management is part of the US Department of the Interior. They manage 264 million acres of land, mostly in the western part of the country. Under the education section, their Ecosystem Management information and lesson is reprinted from *Science and Children* magazine, Nov/Dec 94. From the BLM Home Page, go to Kid's Page, then to family history and from here students can type in their family name and see if their family was one of the firsts to receive land from the federal government.

www.envirolink.org
This is a large clearinghouse for other websites. Click on Education to get a list of organization, material, and other resource websites specific to education.

www.freenetwork.org
The Forest Resource Environmental Education website is devoted to sharing information about forests and the forestry industry. This site has a kid's section and a teacher section. In the kid's section there are a few interesting games, like choosing which items on a list came from trees and matches pictures of leaves to the correct tree name. It's a MN based organization.

http://forestry.about.com/education/scilife/forestry
About.com is a large clearing house for information through which you can access forestry information. The address given here is a direct path to the forestry section. Use above address and add /library/blartdex to get a list of forestry related articles. Add /library/tree/bltypdex to get forest type maps for U.S.

http://www.stateforesters.org
Website for the National Association of State Foresters, who provide management assistance and forest protection services to National Forests in the U.S. It is also a clearing house for other forestry and related links.

http://www.vpm.com/wfi/
This website for the World Forest Institute is mostly for professionals, but it does have a link to the World Forestry Center in Oregon.

http://lcweb2.loc.gov/ammem/collections/finder.html
This is the website of the Library of Congress and it contains a few historical photographs from the University of Chicago, some of which are related to forestry.

http://www.dnr.state.wi.us
This is the website of the Wisconsin Department of Natural Resources. If you add /org/land/forestry/, you'll get directly to the forestry page.

http://www.forestinfo.org/CoolFacts/fromtree.htm
This is the website for the Temperate Forest Foundation. They have a good glossary of terms related to forestry. They also have a kid's section, which includes Cool Facts. In the Cool Facts section there is a huge list of tree products, as well as interesting facts and statistics on wood and paper use. The Issues and options section is worth taking a look at.

http://www.wfrea.org
This is the website of the Wisconsin Forest Resource Education Alliance and has links to lots of other sites regarding education, resources and organizations.

http://www.ncfes.umn.edu
This is the website for the U.S. Forest Service, North Central Forest Experiment Station, which serves the Lake States. This is a good place to find current information on the activities of the Forest Service.

www.fpl.fs.fed.us/
This is the website for the Forest Product Laboratory in Madison WI. The FPL is part of the US Forest Service. This site offers more technical information, but may be interesting for students to see what professionals in the field are doing.

www.forestnet.com/forest_management.htm
Forest management company in British Columbia has developed a computer model to show a forest after logging.

http://forestry.msu.edu/uptreeid
Tree identification key for Michigan's Upper Peninsula, written by Bill Cook

http://www.consolidatedpapers.com
This is the website for Consolidated Paper Co. They offer guest speakers and the website helps you contact the right person. They also have a children's section, but it is geared towards younger students.

http://www.wipapercouncil.org
This is the website for Wisconsin Paper Council. Their kid's section is designed for younger students.

http://www.fs.fed.us
Home page for the US Forest Service.

http://roadless.fs.fed.us
This is a website devoted to information about the proposed plan to halt the building of roads through 40 million acres of National Forests in the U.S. The website is easy to read and provides clear background information on the proposed plan. This is a very controversial issue and worth exploring with your students.

www.woodweb.com/~treetalk/wowarchieves.htm
This website offers lots of good information on tree species and their characteristics and what they are used for. It would be a good place for students to go for researching a particular tree for the utility lesson.

www.hardwoodhandbook.org
This website also list common uses of hardwood tree species.

Http://ens.lycos.com
This website is for the Environmental News Service. They post articles and information on current environmental issues.

http://www.ets.uidaho.edu/winr/articles.htm
This is the website for Women in Natural Resources and has links to articles related to forestry and written by women.

www.emagazine.com
This is the website for the magazine E. It contains articles in an easy to read and understand format.

www.ecolonomics.org
This is the website for a new foundation called Ecolonomics, created by the actor Dennis Weaver. Its purpose is to demonstrate and highlight businesses that are environmentally sustainable as well as economically profitable.

www.metla.fi/info/vlib/Forestry/Topic/
This is a virtual library site that gives a topic index for forestry issues and research.

www.safnet.org/pubs/jof
This is the publications section of the Society of American Foresters, who publish the *Journal of Forestry*. This is a good way to find articles on current forestry issues and research.

www.fao.org/forestry
This is the website for the Food and Agriculture Organization, which is international. The subject navigator section is a good place to find articles on international forestry issues. One of their journals is called *Unasylva*.

http://www.endangeredspecie.com/states/wi.htm
This endangered species website categorizes and explains the state of endangered species throughout Wisconsin. This page is part of a network that does the same for endangered species throughout the world.

http://www.wisc.edu/botit/links.html
The Department of Botany at the University of Wisconsin-Madison has developed five sets of digital images for use with our courses. As part of their obligations as a public institution, they have made these sets available for general educational use. The digital images include plants, trees and forests and are divided into Wisconsin major forest types. They will prove very useful in illustrating different tree species, forest types, and many ecological concepts.

http://www.legis.state.wi.us/lrb/bb/index.html
This website allows free access to all the information in the newest Wisconsin Blue Book. The *1999-2000 Wisconsin Blue Book* is comprised of 13 sections and almost 1,000 pages. It presents the economic statistics for all of Wisconsin's industries, including the forest industry.

http://www.fao.org/forestry/fo/sofo/sofo99/sofo99-e.stm
The State of the World's Forests is published every two years to give the most comprehensive and up-to-date picture available of the status of forests worldwide. The *State of the World's Forests 1999* reports on the latest figures on global forest cover; current efforts to assess forest resources; the forest fires of 1997 and 1998; recent trends in forest management; the significance to forestry of the Kyoto Protocol of the Framework Convention on Climate Change; current and projected forest products production, consumption and trade; recent trends in forest policy, legislation and institutions; and the international dialogue and initiatives on forests, among other topics.

http://badger155.hypermart.net/nature.html
Supplies information on much of Wisconsin's wildlife.

http://www.scicentral.com/B-forest.html#articles
Provides articles, reports, databases, and directories for renewable resource issues in the United States. This SciCentral website is a great cache for resources and information.

http://www.cnie.org/nle/for-24.html
This website overviews the roadless policy recently adopted by the U.S. Forest Service.