

ED5630 - Forest Sampling Teaching Unit (Summer 2004)

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Submitted: August 31st, 2005

I. Target Grade/Subject: Grade 8

This unit will be taught in 8th grade science classes at Hart Middle School. Approximately 175 student will participate in this unit. This is a five-day mini-unit that will be inserted into an already existing unit dealing with the hydrosphere and geosphere. In other words, it is a mini-unit sandwiched between two units. The reason for this is to have students survey our existing test site that is used for our water quality monitoring. The test site is 100 acres and is located at Stoney Creek Metro Park.

II. Unit Overview:

This unit will be an introduction unit to forestry and forestry resources. The goal of the unit is to have students realize and understand the importance of our forestry resources. Second, to expose students to simple survey methods and tree identification. Lastly, is to stress the importance of managing and being stewards of our forests. The primary activity that will be taught is from Dr. Andy Burton's tree identification and measurement techniques.

III. Resources:

- A. www.forestryimages.org
- B. www.mfra.org
- C. www.dsisd.k12.us/mff
- D. A Guide to Forest Communities and Habitat Types of Central & Southern Michigan. 2004. John Keter and Timothy Burger, The Department of Forestry, University of Wisconsin.
- E. Woodland Stewardship: A Practical Guide for Landowners. 1993. Baugham et al. University of Minnesota
- F. Michigan Trees (revised and updates) A Guide to the Trees of the Great Lakes Region. 2004. Burton V. Barnes & Warren H. Wagner, Jr., University of Michigan Press
- G. "Michigan Forests Forever Teacher Guide"
- H. Project Learning Tree: Environmental Education Activity Guide, American Forest Foundation, Washington D.C. 2003

IV. Objectives:

- Obtain information on basic Michigan forest characteristics and descriptors
- Identify products that the forest provides.
- Identify the importance of forest ecosystems

- Be able to use a Biltmore stick.
- Plot out 1/10 of an acre (plot sampling).
- Identify the four types of trees in our plot sampling, using leaf structure.
- Identify the four types of trees in our plot sampling using other indicators, ie: bark and twig formation.

V. Michigan Content Standards:

Science:

Standard III.5 Ecosystems

- Describe how materials cycle through an ecosystem and get reused in the environments; and analyze how humans and the environment interact.

Standard V.3 The Atmosphere & Weather

- All students will investigate and describe what makes up weather and how it changes from day to day, from season to season and over long periods of time. Explain what causes different kinds of weather and analyze the relationships between human activities and the atmosphere. Be able to use tree growth to look at past weather patterns. This will tie into the geosphere unit.

Math:

Standard 1:

- Students collect and explore data, organize data into a useful form, and develop skills in representing data.

VI. Activities/Lessons Format/Field Activities:

Activity	Type
1. Pre-test (Day 1)	Individual/Class Discussion
2. Forest Resources & Facts (Day 2)	Group/Class Discussion/Presentation
3. Wood Products	Group/Class Activity
4. Measuring Site Quality and Tree Identification	Group Activity
5. Survey Site	Group Activity at Stoney Creek Metro Park
6. Lesson Quest	Assessment

VII. Lessons:

Day I – Pre-test and class discussion

Lesson Objective:

1. Students will be exposed to the term Silviculture – “What is Forestry”
2. To raise awareness and exposure to Michigan Forests.

Activity:

-Have students take a “Wooden You Know” pre-test. Each question will launch a - classroom discussion about our great forest and generate many inquires and explorations. Once students have finished the pre-test, review the answers with students.

Time:

50 minutes

Name _____ Date _____

A “Wooden You Know” Pre-Test

1. How much of Michigan is covered with forest?
 - a. about half
 - b. about $\frac{3}{4}$
 - c. about 90 percent
 - d. I don't know

2. Forests are always changing. We call that process:
 - a. biodiversity
 - b. harvest
 - c. habitat
 - d. succession

3. Shade from trees can cool the surrounding area by how much?
 - a. 2.5 degrees
 - b. 10 degrees
 - c. 16 degrees
 - d. I don't know

4. Who has the most state-owned forest?
 - a. Wisconsin
 - b. Michigan
 - c. California
 - d. Alaska

5. What percentage of Michigan was forested 10,000 years ago?
 - a. Almost all of Michigan
 - b. About the same as now
 - c. There were no forests
 - d. I don't know

6. How many different products in the USA contain wood?
 - a. 150
 - b. About 2,500
 - c. Over 5,000
 - d. I don't know

7. Well-managed forests provide...
 - a. soil protection and high water quality
 - b. wildlife habitat and recreation
 - c. sawlogs and pulpwood
 - d. all of the above

8. What is the primary job of a forester?
 - a. cut trees from the forest
 - b. fight wildfires and save forest trees
 - c. balance the various benefits and products from the forest
 - d. I don't know

9. The most common tree in Michigan is...
 - a. white pine
 - b. sugar maple
 - c. paper birch
 - d. I don't know

10. How many vertebrate wildlife species live in Michigan?
 - a. about 400
 - b. about 200
 - c. under 100
 - d. over 600

Pre-Test Key

1. a. about half of Michigan is forested

Fifty-three percent of Michigan, or 19.3 million acres, is covered with forest. Most of Michigan was covered with forests when European and early American settlers began moving into the Northwest Territory. Non-forest land included vegetation types such as prairie, open wetlands (marshes), "barrens", rock outcrops, dunes and burned over areas. Burned forest originated both from lightning strikes and from American Indian activity.

Agriculture and cities are the two main causes of deforestation in Michigan. Most of Michigan's best agriculture areas are in the south, which is why forests did not grow back after initial logging, like they did in the north. Most of Michigan's human population is also in the southern Lower Peninsula because of the proximity to farmland, milder climate, and its location to major emigration routes from the eastern states.

2. d. succession is the ecological process that results in constant change in vegetation

Succession is a key concept in understanding forest ecology. It is also fundamental to nearly all of our forest management systems. Succession is the orderly, often predictable, change in vegetation over time. Forests are dynamic systems. When we think of forests, we should always keep in mind the impact of succession on a particular piece of forest. An appreciation of this temporal element will provide a clear understanding for forest systems, including wildlife habitat, water quality, soil conditions, and visual quality.

3. b. 10 degrees

Ten degrees may not always sound like a lot, but just the effect on reducing summer cooling costs is "tree-mendous." Trees in urban and residential areas and parks provide welcome shade on those hot summer days.

4. d. Alaska

At about 3.5 million acres, Michigan has the second largest amount of state-owned timberland in the USA, behind only Alaska.

5. c. There were no forests.

Forest coverage has varied over the millennia. How much of present day Michigan was forested 10,000 years ago? NONE! There wasn't a single tree in all of Michigan. Why? Because the land was under the glaciers at the time. Since glaciation, Michigan has undergone various periods of warm, dry conditions and cool, wet conditions. At one time, a great deal of Michigan was covered with prairie vegetation. Forest composition of tree and other plant species has changed many times with climate changes.

The important lesson in this question is that forests are constantly changing from both natural cycles, succession and human impact.

6. c 5,000 different products.

Over 5,000 products are made from trees. See list at <http://www.forestinfo.org>. Some products are easy to associate with wood, such as lumber and paper. Other items, such as toothpaste, cosmetics, clothing and food additives are less obvious. The biggest advantage of using wood in products is the fact that wood is renewable, the only major raw material that can make that claim.

7. d. all of the above are results of well-managed forests

Naturally, all the items listed above, and other outputs as well, are part of forest management. Forest management addresses more than just timber, although timber is a major component of most forest management systems.

8. c. Balance the various benefits and products from the forest are the primary focus of a forester.

This is an extension of question #7. Foresters may not be the only natural resource professionals involved with forestry. Often wildlife biologists, hydrologists, soil scientists, botanists and others work with foresters to manage forests. The forestry profession focuses primarily on trees and forest ecology, but also addresses disciplines associated with forests because a forest is more than trees.

9. b. sugar maple

The sugar maple is the most common. The sugar maple is a shade-tolerant species that can reproduce in the shade of most forest canopies. The increasing abundance of sugar maples suggests that our forests are growing older and moving towards the later end of forest succession.

10. a. about 400 vertebrate (excluding fish)

Actually there about 575 species of vertebrate wildlife can be found in Michigan! These include birds, fish, mammals, amphibians, and reptiles. Most of these species are dependent upon forests for good habitat conditions, even the fish because forest is critical to the maintenance of high water quality. It is probably impossible to identify and catalog all species of wildlife if other taxa are included.

Day 2 & 3 -Forest Resources & Facts

Lesson Objective:

1. Explain the biological, economic and social factors of a forest.

Activities:

Understanding forest begins with knowing a few basic facts. Students will be put into groups of four or five. Each group will be given a topic:

- National Forest
- Michigan Forest
- Wood uses
- Economic Benefits
- Environmental Benefits
- Wildlife Benefits

It is the responsibility of each group to research their topic. Resources will be available, laptop computers, resources books and fact sheets to get the groups started. Students will be given one class period to put together a small five minutes presentation. Presentations should include information about the assigned topic. Each group should have at least two visual aides. Visual aides may include graphs, pie charts, diagrams, and charts.

Time:

50 minutes

Day 4: Wood Products

Lesson Objective:

1. Students will be able to recognize how we depend on tree in our daily lives.
2. Students will identify and categorize products derived from trees.

Activity:

Start with a brainstorming session. Ask students to list as many tree products as they can think of and list them on the chalkboard. Look over the list with the students.

- Which products do students use everyday?
- Which is made totally from trees?
- Which is made partially from trees?

Then discuss the categories that products fall into.

Category Examples:

- Newspaper is a paper product.
- Furniture is a wood product.
- Apple is a food product.

- Carpeting is a cellulose product.
- Cork is a bark product.
- Crayons is a sap product.

Once you have discussed the categories for products next tape a magazine picture of a forest product on each of the students back. It is helpful to have students help. Once every student has a mystery product taped to his or her back you are ready to begin. Instruct the students that they must figure out the identity of the product on their back by asking each other questions. They can ask each person only two questions, and the questions must require a “yes” or “no” answer. For example, Is this product used in our school?

Give students time to mingle and ask questions. When they think they’ve identified their product they then must categorize the product. Have poster signs for each category around the room. Students must then post the mystery product under the correct category sign.

After every student has posted their mystery product, It is time to revisit the list of the tree products that the group brainstormed on the chalkboard. Have the class identify categories that those products would belong too. See if students can name the other products that come from trees. Talk about unusual tree products such as chewing gum, turpentine, species, medicine and others. You may also want to bring in samples of some unusual tree products. Also you could share a list of wood products from Michigan Forester web-site. (list attached)

Time: 50 minutes

Day 5: Tree Identification

Lesson Objective:

1. Students will be able to identify the methods to identify a tree.
2. Students will be able to identify the five basic tree types at our river testing site (Stoney Creek Metro Park) (Choke Cherry, Sugar Maple, Paper Birch, White Oak, Hickory).

Activity:

Using Dr. Andy Burton’s CD-ROM power point presentation the teacher will discuss the three basic methods to identify trees.

1. Bark: Foresters need to know bark for the ID because it is there throughout the year.
2. Leaves: Very useful in the summer or all year for conifers. Can’t always see the leaves on very tall trees. Important characteristics include, shape, edges and simple vs. compound leaves for identifying trees.
3. Twigs: Visible throughout the year. Ex. color, leaf scars, opposite vs. alternate.

After discussing the three methods and viewing the PowerPoint presentation it is time to identify tree leaves. Using the Golden Guide Identification books each group of two will receive 12 common leaves to the Rochester area to identify.

Assessment:

Using the PowerPoint slide show students will review the correct identification of the twelve given leaves.

Time:

50 minutes

Day 6: Survey Site @ Stoney Creek Metro Park

Lesson Objectives:

1. Students will be able to plot 1/10 of an acre.
2. Students will identify trees within the 1/10-acre plot.
3. Students will count the number of types of trees within a 100-acre estimate.

Activity:

The instructor will demonstrate how to measure 1/10 of an acre plot. Students will then be given plots within the West Branch Creek area (Stoney Creek Metro Park) to measure and to identify trees. Students will work in-groups of three to accomplish this task.

*Note: Students are using the plot layout sheets but will not do any of the tree measurements. The tree measurement activity will be done in the spring when we return to conduct our stream monitoring.

Assessment:

The purpose of the pretest is to get students to think about forest resources and how these resources are important to Michigan.

The Forestry Unit Quest is the final assessment. The Quest is attached with a key. In addition, each student will turn in a journal entry at the end of each lesson activity. Journal entry will be done in their Science logs.

National Forest Facts

-About one third of the United States-737 million acres-is forested. About 490 million acres are classified as timberlands-forests capable of growing commercial wood, and forests cover about 67% as much as they did in 1600, which is about 1/3 the area of the country.

-Foresters have done a magnificent job in restoring America's forests. Our forests now grow nearly four times more wood each year than in 1920.

-Neither Michigan nor the USA is running out of trees or forests. In fact, indicators show just the opposite.

-There is enough standing timber in the USA to build a cord pile that would circle the earth over 100 times.

-In 1992, our nation's timberlands had a net annual growth of more than 21 billion cubic feet of timber (a cord pile about 200,000 miles long). When compared to an annual timber harvest of 16 billion cubic feet (a pile 150,000 miles long), net growth is surpassing harvest by 33%.

-More than 270 million acres of federal land is set aside for use as wildlife refuges, parks and wilderness areas.

-Approximately 59% (9.9 million acres) of the timberland in the United States is owned by 7 million private owners. Altogether, federal, state and local governments own 27% (132 million acres) of timberland in the United States. The forest products industry owns about 14% (69 million acres) of commercial timberland in the United States.

-The implications of changing ownership patterns are significant. The yearly transition to many New Forest owners makes the communication of information difficult. Not to mention the amount of lands being subdivided to build homes and loss of productive forest land. Nationwide 32% of owners expect to harvest some trees in the next ten years.

-The US Government plants 16% of new trees every year in the United States

Michigan Forest Facts

-There are 11.5 billion trees in Michigan.

-The largest tree in Michigan is a black willow in Grand Traverse County. The tallest tree is a 201-foot white pine in Marquette County. The tallest tree in the world is a California redwood at 368 feet.

-Michigan has the fifth largest area of timberland in the USA, exceeded only by Georgia, Oregon, Alabama and North Carolina. And, yes, we have more timberland than Alaska.

-Michigan has about 19.3 million acres of forest, covering about 53% of the State. This is an increase over a million acres since 1980

-Michigan was about 95% forested prior to Euro-American settlement. The two main causes of deforestation have been agriculture and construction of towns & cities. Logging, fires and pollution do not result in deforestation.

-Most common tree species in Michigan are sugar maple, red maple quaking aspen.

-Although 30 million trees are planted in Michigan each year, many millions more are regenerated through forest management working in concert with natural processes.

-Michigan forests support 150,000 jobs and annually add nine billion dollars to the state economy. Another 50,000 jobs and three billion dollars are gained from forest-based recreation.

-The Upper Peninsula holds 45% of Michigan's forest, with 39% in the northern Lower Peninsula, and 16% in the southern Lower Peninsula.

_On the average, Michigan's trees have been getting older and larger for over 50 years. While this true overall, there are important differences among tree species and forest types.

The two most serious threats to Michigan forests are probably intensive browsing by deer and forest ownership parcelization.

Wood Use Facts

-Wood is 16 times more efficient as an insulator than concrete, 415 times as efficient as steel and 2000 times as efficient as aluminum. It is also cheaper to produce, has much less negative environmental impact, and is renewable.

-Each person uses wood and paper products equivalent to what can be produced from one 18" in diameter 100-foot tree every year. On daily basis, that's 4 to 4.5 pounds of wood, or the equivalent of roughly half a two-by-four.

-Each day, Americans recycle enough used paper to fill 15 miles of boxcars. In 1995, that totaled more than 43 million tons of paper and paperboard, an average of 329 pounds per person.

-We read over 350 million magazines, 2 billion books and 24 billion newspapers a year. Corrugated boxes are used to ship 95% of all manufactured goods in the United States.

-We use more wood by weight than all other raw materials combined. Wood products make up 47% of all industrial raw materials manufactured in the U.S. yet uses only 4% of the energy needed to manufacture these industrial materials.

Economic Facts

-The forest industry ranks among the top 10 employers in 40 of the 50 states.

-About 45 percent of the paper consumed in the United States is recovered for recycling. Recycled paper, however, is not "pure" so it must contain some new wood fiber for strength.

-1993 was the first year in history in which more paper was recycled than buried in landfills. Paper can be recycled only 5 to 8 times before the fibers in the paper become too short and weak to be reused. Old newspapers are commonly used to make tissue and cardboard, while magazines are often recycled into newsprint.

-Fire protection, at the turn of the century, wildfires annually burned across 20 to 50 million acres of the country, with devastating loss of life and property. Through education, prevention, and control, that amount has been reduced to about 2 to 5 million acres a year, a reduction of 90%.

-Today, advanced technology allows us to use every part of the tree for products useful to society. In addition to lumber and paper coming from the trunk of the tree, bark, resins, cellulose, scraps and even sawdust are turned into products that range from camera cases to medicines to rugs.

Environmental Benefit Facts

-A large tree in full leaf can lift well over a ton of water a day from the soil and carry it along an elaborate system of pipelines to every leaf. Most of this water is returned to the air through a process called transpiration. On that same day, the same tree may transpire several hundred gallons of water into the air, cooling as much air as would six window air conditioners.

-Wind is estimated to cause about 30% of annual soil erosion, on agricultural cropland. Wind erosion is primarily due to tilled fields lying exposed for long periods between growing seasons. Forest crops are rotated over decades rather than annually, so wind is not a major erosive factor for forests.

A typical tree uses nearly a pound and a half of carbon dioxide and gives off more than a pound of oxygen to grow one pound of wood. An acre of trees might grow 4,000 pounds of wood a year, use 5,800 pounds of carbon dioxide and give off 4,280 pounds of oxygen in the process. One mature tree absorbs approximately 13 pounds of carbon dioxide a year. For every ton of wood a forest grows, it removes 1.47 tons of carbon dioxide and replaces it with 1.07 ton of oxygen.

-An average, large healthy tree could have about 2,000 leaves. During 60 years of its life, such a tree could grow and shed approximately 3,600 pounds of leaves. Those leaves return about 70 percent of the nutrients to the soil.

-Three well-placed mature trees around a house can cut air-conditioning costs by 10-50 percent, while trees and other landscaping can increase property value by 5-10 percent.

-Clearcutting is the only effective means to regenerate forest types adapted to catastrophic disturbance and intolerant of shade.

Wildlife Facts

Species such as white-tailed deer, wild turkeys and wood ducks were almost extinct at the turn of the century. Wildlife conservation and habitat enhancement has resulted in flourishing population of these and other species we now take almost for granted. Now foresters are working with other professionals to improve habitats and ensure survival of other wildlife species.

Over the past decade, forest products companies have spent more than 100 million on wildlife and environmental research. They employ more than 90 wildlife biologists. Hundreds more biologists are employed by public agencies, conservation groups and others.

-Wildlife habitat is best manipulated through forest management. Not only can most habitat objectives be met, but they can be met without taxpayer or forest owner expenses