

FINDING OUT ABOUT THE FOREST

In fulfillment of requirements for Michigan Technological University's
ED 5630 Forest Resources & Environmental Sciences Teacher Institute.
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General Science - Middle School (Gr. 6-8)

Timeframe: 3 to 4 weeks

Background

Forests are an integral part of our daily lives in Michigan. Historically, about 70 percent of our land was covered in hardwood or coniferous forests. Every child in this state lives within 10 miles of a forest, and for most students, a forest or woodlot of some type lies just outside their door.

Forestry is a huge industry in our state as well. Much of our economic stability results from some type of forest use, direct consumption, such as timbering for wood or pulp, or indirect usage, for example, hunting, camping, hiking, snowmobiling, or bird and wildlife watching.

Despite the importance of our forest resources, most students have little if any formal instruction dealing with the ecosystem of the forest. Fewer and fewer children have formal knowledge of the woods, as they spend less and less free time roaming the local woodlot, building forts, watching wildlife and climbing trees. Adults assume that children know about the forest, yet even those adults could benefit from the information gained from current research and scientific study of this unique ecosystem. If Michigan is to sustain our incredible forest resource, it's citizens must understand and value this complex environment. This understanding can begin from developing a familiarity with the basic function of the forest and the elements of sustainable forest management.

Middle school age students need to practice educational objectives in a real world context. Involvement in an actual project where academic ideas must be synthesized, applied, and communicated, leads to an organic understanding of concepts taught which does not fade over time, but remains in long term memory. Lessons must be connected to the student's real world. The Middle School curriculum teaches ecological concepts of both living and non-living resources. Students study energy flow, relationships between organisms, and change within an ecosystem over time, as well as concepts involving energy, soil, weather, water, nutrient cycling and man's impact upon the natural environment. What better, more natural context for these lessons, than an exploration of the forest outside their door?

Through an exploration of an adjoining school forest or woodlot, middle school students will practice Michigan benchmarks for science, math, social studies and language arts. In addition, they will achieve district goals through authentic, hands-on instruction. By involving students in a real project affecting their own environment, they will become more knowledgeable of that ecosystem, there-by gaining an appreciation of that resource. Understanding, using and appreciating their school forest will lead to the desire to both appropriately use and sustain our Michigan forests and forest resources throughout the world.

Unit Overview

The students will demonstrate knowledge of basic objectives and benchmarks through an exploration of their school forest or woodlot. At the completion of this unit of study teams of students will create and present a creative lesson for other students and guests teaching about one or more aspects of their school forest ecosystem.

Through this activity they will practice local district goals by demonstrating cooperative learning, effective communication, participation in a fit and healthy lifestyle and by showing care for their community and world.

The goals of this unit are:

The student will

- Observe the local forest ecosystem, defining the biotic and abiotic parts of the forest whole.
- Trace the flow of energy through the forest ecosystem.
- Practice the water, nitrogen and carbon cycles as relate to the flow of nutrients through the forest ecosystem.
- Observe and identify the groundcover, understory and canopy layers of the forest.
- Collect leaves, observe bark, buds and tree shape to identify correctly major hard and softwoods in their local forest.
- Keep a journal of their observations in a forested area of their choosing.
- Use nets and traps to capture insects in their forest area and use insect keys to identify their captives.
- Discuss the role of exotic species in forest ecosystem change.
- Use an auger to collect soil samples draw a soil profile and conduct chemical and percolation tests and identify the soil horizons in three different parts of their local forest.
- Examine a soil survey and classify the soils collected in the three sample locations.
- Examine any surface water present in their forest, and discuss as a group, how forest ecosystems impact and are impacted by water quality.
- Calculate the diameter at breast height (dbh) of all trees in a 10 meter section of the forest and calculate the height and number of board feet of timber using a diameter tape, Biltmore stick and board feet tables. The student will report their findings in dollar values.
- Examine the role of hunting and sportsmen and women in the use and preservation of the forests and other wild lands in Michigan.
- Cooperatively teach one or more aspects of their new knowledge, in a creative and entertaining manner, to other students and guests, demonstrating confidence with new information and skills learned.

Unit Outline

Lesson /Time Frame	Key Objective	Activity	Michigan Benchmark(s)	Assessment	Materials
Week One					
Day 1 (50-60 minute period, daily)	TSW observe the forest ecosystem, identifying the biotic and abiotic parts.	Brainstorm what is a forest? Trip to school forest. Locate journaling 'spot'. Record all observations.	SCII.1.MS1 Generate scientific questions about the world based on observation. ELA I.2.MS.1 Express ideas clearly, connect with specific audience, move readers through a variety of text.	Journals read by instructor, and responses written. No formal evaluation. Voc. Biotic/abiotic	Journals Pencils Clipboards
Day Two	TSW collect soil samples. Draw a soil profile, chemically test and determine permeability on forest soils.	Discuss glacial history of area. View topo map, aerial photos and soils maps. Review 4 parts of soil, particle size and plant's use of soil.	SCI.V.1.MS.1 Describe and identify surface features using maps. SCI V.1. MS.3 Explain how rocks are broken down, how soil is formed and how surface features change. SCI.V.1.MS.4 Explain how rocks and fossils are used to understand the age and geological history of the Earth.	Quality of discussion, notes, student interest. Voc. Soil horizon, soil profile, permeability Sand, silt clay, loam.	Topographic map of area Soils map of area Aerial photo of area Dry and damp samples of sand, silt, and clay
Day Three	TSW collect soil samples. Draw a soil profile, chemically test and determine permeability on forest soils. TSW use a soil survey and classify forest soils.	Visit forest and collect samples from 3 different areas. Run perc and chemical tests. Return and classify soils using a soil survey	SCII.1.MS.2 Design and conduct scientific investigations.	Soil profile drawing and description, use of soil survey. Voc. Soil Survey, perc test, acid, alkaline, buffer Journal entry - soils	Perc Can 3 gallon water Stopwatch Soil auger Soil probe (optional) SCS Soil Survey Plastic bags (3 small) newspapers Clipboards, notebooks, colored pencils Journals
Day Four	TSW recognize that forests are impacted by and do impact water quality.	Water in the forest. Discuss role of water in the forest ecosystem. How does it get there? Where does it go? How does the forest change it?	SCI.V.2.MS.2 Describe how water reaches the ocean and returns. SCI.V.2.MS.3 Explain how water can exist below the Earth's surface and how it's replenished.	Hydrologic cycle review sheet. (including transpiration and groundwater) Journal on water in the forest	Large Whiteboard Colored Whiteboard markers Student notebooks Journals
Day Five	TSW trace the flow of energy through the forest ecosystem.	Using DNR forest laminated posters, students trace at least 6 intersecting food chains through the forest.	SCI.III.5.MS2 Describe how all organisms acquire energy directly or indirectly from the sunlight.	Poster results. Food chains should be logical and correctly drawn and include producers through decomposers. Journal entry on food webs.	Laminated MI Forest posters (DNR) Sets of 6 colored whiteboard markers Journals

Lesson /Time Frame	Key Objective	Activity	Michigan Benchmark(s)	Assessment	Materials
Week Two					
Day Six	TSW identify the tree layers of the forest, canopy, understory, and groundcover.	In class, draw all the producers in a forest ecosystem. Discuss results emphasizing three layers of typical forest.		Forest producers drawing and discussion. Voc. Canopy, understory, groundcover	
Day Seven	TSW use leaves, tree shape, bark and buds to identify common Michigan trees.	Discuss what is a tree? Teach use of tree guides, emphasizing use of shape, bark and buds as well as leaves. Discuss role of abiotic factors on plant populations. (Carbon, nitrogen, energy, water)	SCI.III.2MS1 Compare and classify organisms into major groups on basis of their structure.	Classroom participation in discussion. Voc. Opposite , alternate, simple, compound (as relates to leaves).	Sets 6 common forest tree leaves Tree Identification guides
Day Eight	TSW use leaves, tree shape, bark and buds to identify common Michigan trees.	Trip to forest. Working in pairs, identify at least 6 common trees. As a group, identify common forbes and understory plants.	SCI.III.2MS1 Compare and classify organisms into major groups on basis of their structure.	Journal entry on trees and producers in the forest. Review of carbon and nitrogen cycles.	5 meter strings 25 small flags Circular plot maps Pencils/clipboards Tree identification books Journals
Day Nine	TSW will use nets and traps to capture insects in the forestland use insect keys to identify their catch.	Brainstorm animals that might live in the forest. Discuss their 'value'. Focus on insects how they help and hurt the forest. Introduce traps.	SCI. III.5.MS.3 Predict the effect of changes in one population in a food web on other populations.	Classroom discussion on forest animals. Quality of brainstormed ideas.	Insect traps 6 styrofoam plates 6 deli dishes Spray glue 18 Four inch nails Insect id books
Day Ten	TSW discuss the role of exotic species in forest ecosystem change.	Trip to forest. Examine foliage for insect damage and other signs of animals. Set traps. Look for worms. Teach about impact of exotic species (worms).	SCI III.2.MS3 Describe evidence that plants make and store food. SCI. III.4.MS.2 Explain how new traits might become established in a population and how species become extinct.	Results of exploration. Journal entry on impact of worms. Voc. Exotic Species	Insect traps 6 styrofoam plates 6 deli dishes Spray glue 18 Four inch nails Insect id books Journals

Lesson /Time Frame	Key Objective	Activity	Michigan Benchmark(s)	Assessment	Materials
Week Three					
Day Eleven	TSW use keys to identify insects.	Collect traps. Examine and identify insects caught. Draw and write about what was found, and how it could change the forest.	SCI. III.2.MS 1 Compare and classify organisms into major groups on the basis of their structure.	Insect drawings and research findings.	Blank paper Colored pencils Insect id books Hand-lenses
Day Twelve	The student will calculate the diameter at breast height of all trees in a 10 meter section of the forest and calculate the height and number of board feet of timber using a diameter tape, Biltmore stick and board feet tables. The student will report their findings in dollar values.	Trip to forest. In teams measure 10 meter plot. Use dbh tape, Biltmore stick to measure all canopy and understory trees. Return and use values in math class to calculate value of timber resource.	SCI.1.1 MS 3 Use tools & equipment appropriate to scientific investigations. SCI 1.1 MS4 Use metric measurement devices to provide consistency in an investigation SCI.IV.1.MS2 Explain when length mass, weight...are appropriate to describe the size of an object. MA.III 3 MS.4 Make predictions & decisions based on data. MA III.1.MS.1 Collect & explore data through observation, measurement, surveys, sampling techniques and simulations.	Completion of worksheet on timber resource data and calculations. Voc. Radius, diameter, Biltmore stick, board feet	Biltmore Sticks Diameter Tapes Data Table Forest Plot Maps Clipboards
Day Thirteen	The student will review the role of hunting and sportsman in the use and preservation of the forests and other wild lands in Michigan	Forests are fundamental! Brainstorm mammals and birds that live in and use Michigan forests. Discuss value of the recreational usage of Michigan forests. Include economic data.	SCI.III.5.MS.1 Describe common patterns of relationships among populations.	Journal entry What are forests good for? Brainstormed list of questions for tomorrow's guest. Voc. Sportsman	Journals
Day Fourteen	The student will review the role of hunting and sportsman in the use and preservation of the forests and other wild lands in Michigan	Visit from local Safari Club member- discussion of the role of the sportsman in wildlife habitat preservation and usage.	SCI.III.5.MS.5 Explain how humans use and benefit from plant and animal materials.	Letter of thanks to today's guest. Must include three things learned about sportsmen, wildlife and wildlands preservation.	Letter Writing Materials
Day Fifteen and Sixteen	TSW review the major events in the history of forest management in the US.	Show selected sections of <u>The Greatest Good</u> . Read selections from <u>Walden</u> , <u>A Sand County Almanac</u> etc.	SCI II 1. MS 6 Recognize the contributions made in science by cultures and individuals of diverse backgrounds. SCI.III.5.MS.6 Describe ways in which humans alter the environment.	Journal Entry What can one person do? Reflection on what student has learned and what they perceive as their role in the future of Michigan's forests. Voc. Sustainability	<u>The Greatest Good</u> Monitor DVD player

Lesson /Time Frame	Key Objective	Activity	Michigan Benchmark(s)	Assessment	Materials
Week Four					
Day Sixteen (cont'd.)	TSW review the major events in the history of forest management in the US.	Show selected sections of <u>The Greatest Good</u> . Read selections from <u>Walden, A Sand County Almanac</u> etc.	SCI II 1. MS 6 Recognize the contributions made in science by cultures and individuals of diverse backgrounds. SCI.III.5.MS.6 Describe ways in which humans alter the environment.	Journal Entry What can one person do? Reflection on what student has learned and what they perceive as their role in the future of Michigan's forests. Voc. Sustainability	The Greatest Good Monitor DVD player
Day Seventeen and as needed to complete.	Working in small groups, the student will, in a creative and entertaining manner, teach one or more aspects of their new knowledge to other students and guests, demonstrating confidence with new information and skills learned.	Choose groups and begin working on presentation of one aspect of forests. Goal is to demonstrate knowledge through teaching others. Creativity and detail are to be valued.	SCI II 1.1 MS2 Describe limitations in personal knowledge. ELA I.III.MS.1 Integrate listening, speaking, viewing, reading and writing skills for multiple purposes and in varied contexts. ELA I. III. MS.8 Express their responses and make connections between oral, visual, written, and electronic texts and their own lives.	Rubric for Presentation Final Journal Grade	Journals Materials for presentations

Day One:

Objective: TSW observe the forest ecosystem, identifying the biotic and abiotic parts.

Benchmark(s): SC.I.1.MS1 Generate scientific questions about the world based on observation.
ELA I.2.MS.1 Express ideas clearly, connect with specific audience; move readers through a variety of texts.

Materials:

Journal for each student (can be spiral notebook, stapled journal made of colored and lined paper, or Duotang notebook filled with about 12 sheets of lined paper.)

Pencils

Clipboards (optional)

Hook: Mental Field trip. Close your eyes and imagine.... Take students on a trip deep into the shade of the forest. Have them look around inside their memory. Note large, medium and small plants. Look for signs of life. What animals do they see? What plants? What are the animals doing? What does the soil look like? Is there any evidence of water? Wind? What is the temperature? Now use their imaginary ears. What do they hear?...

Activity: Have the students open their eyes and share some of the things their memories sensed. Take a minute to discuss their favorite forest spot. Explain that we are going to take a trip into a nearby forest, and record on paper what they really do see. This new spot will be different in many ways from what their memories recalled. Their job is to record what really can be sensed and experienced and be true to what they see.

Rules for journal entries:

1. Record date, time and place for each entry
2. Record weather—approximate temperature, wind, precipitation, cloud cover.
3. Focus on one aspect of the forest each time you write.
4. Pretend that your journal is a friend you are talking with. Feel free to discuss ideas and ask questions in your writing.
5. Use drawings to illustrate your thoughts. You do not have to do this, but you may draw if you would like to. Drawing illustrates your writing, but does not replace it. You are still expected to write.
6. Entries should be at least a half page. If you double-space, that means a full page. This does not include drawings. They are extra.

Remind students of travelling ‘rules’, take them to the forest or woodlot, and gather to redefine the words ‘biotic’ and ‘abiotic.’ Let them find their spots, spread out from each other, where they can still see you, and give them about 20-30 minutes of journaling time. (Teacher should also journal during this time, to model for students. Children will enjoy having the opportunity to read and comment on the instructor’s daily journal entries. Keep your journals available in the classroom.) Students should remain in their ‘spots’ until everyone is finished. Return to class. Collect journals.

Assessment: Students should receive full credit for thoughtful journal entries that show careful observation. Be certain to make some type of positive open-ended comment on each journal, as the first entries will set the model for the entire project.

Day Two

Objective: TSW collect soil samples. Draw a soil profile, chemically test and determine permeability on forest soils.

Benchmark(s): SCI.V.1.MS.1 Describe and identify surface features using maps. SCI V.1. MS.3 Explain how rocks are broken down, how soil is formed and how surface features change. SCI.V.1.MS.4 Explain how rocks and fossils are used to understand the age and geological history of the Earth.

Materials:

Topographic map of area and/or aerial photo of area (optional)
Soils map of area (from Natural Resources Conservation Service or county conservation district)
Dry and damp samples of sand, silt, and clay

Hook: (Drawing on prior knowledge) Have a rounded waterwashed rock on demonstration desk. Also have a sharp-sided rock. Ask the students what they can see that is different about the two. Take all observations. Now ask—what is different about the *history* of these two rocks if you knew they came from Michigan? Begin discussion of Michigan’s glacial history.

Activity: Using a topographical map of the area, aerial photos, and/or a soils maps, lead a discussion of the history of Michigan’s soils. Important points to delineate:

- Glaciers last passed through Michigan about 10,000 years ago.
- Glaciers scraped away all ancient soils, and mixed, moved, and redeposited them
- All Michigan soils have been redeposited by and developed since the glaciers.
- Soils in Michigan are vary and support a wide variety of ecosystems.
- In Michigan, it takes about 100 years (if undisturbed) to form one inch of soil.

Teach the four parts of any soil. The parts are: minerals, air, water, and organic matter (living and previously alive). Soils can have different amounts of these materials, and that is part of how they are classified. Soil can have different sized particles of minerals. The size of the particles gives the soil part of its name. Sand has the largest sized particles and feels gritty, or like rubbing salt. Silt feels smoother, more like flour. Clay is smoother yet. When wet it will feel slippery. Dry, it feels like talcum powder. The size of the particles changes how the soil works.

Sand has big air spaces that let water through it more quickly. It dries out fast, doesn’t compact (clump together) and has spaces that allow living things like animals and plants to move through it with less effort. The speed at which water moves through soil is called its’ *permeability*, or percolation rate. But because the particles in sand are large, they have less area for minerals to be given up to the plants. Producers have a harder time getting the nutrients that they need from sandy soil, so it can’t grow as many plants. (Be certain to have some sandy soil on hand for student to touch and feel as you teach these ideas.)

Silt has smaller spaces, so water moves through it more slowly, but can still pass through. So can plant roots and small animals, but it takes more effort. When pressure is applied, it clumps together in bigger lumps, and usually more minerals (nutrients) are available to plants because the particles are smaller and have more surface area. It is usually the best growing soil. (Touch silty soil, both dry and damp.)

Clay is made of the smallest particles. They pack together tightly- like bingo chips. Water makes clay particles cling together, and water has a hard time getting down through clay particles because

the spaces are so small. For the same reason, clay soils don't dry out for along time. If you squeeze damp clay it packs together very tightly, sometimes forever. That is how bricks are made. Clay soils are full of nutrients because the particles are so small, but it is very hard for plants and animals to begin life in clay soils because they can't get down through them. (Touch and observe clay, both dry and damp.)

Loam: The easiest soil for most plants to grow on is called loam. Loam is a mixture of particle sizes, and has lots of organic material mixed into it. It looks and feels a lot like chocolate cake. Some people call loam 'black dirt' and it can be very valuable if you want to farm or grow a garden, flowers or lawn. Black dirt is full of nutrients that plants need to grow. In nature, loam develops from any sized particle over time, when the conditions are right. It takes about 100 years on average for an inch of black dirt or *topsoil* to develop in Michigan. Topsoil can easily be damaged by people when we drive over it, and compact it, or uncover it and allow it to blow away, or cover it up with concrete, asphalt, or buildings. Once it is damaged, it takes long periods of time to redevelop.

Different types of forests develop on different types of soils. When you dig a hole you can see what type of soil is there, and whether it has recently formed, or has been undisturbed, and developed over a long period. The layers of the soil are called the *soil horizons*. The combination of soils in the horizons in any one location is called the *soil profile*. The soil profile is used to name and identify the soil. Special scientists called Soil Scientists work with identifying soils, drawing soils maps, and figuring out the best use of any type of soil.

Assessment: Quality of discussion, notes and interest of students.

Day Three

Objective: TSW use a soil survey and classify forest soils according to soil texture, permeability, and amount of organic matter.

Benchmark(s): SCII.1MS.2 Design and conduct scientific investigations.

Materials:

Large tin can with top and bottom removed, marked at 2 and 12 centimeters (inside)

3 one gallon milk jugs full of water

Stopwatch or watch with a second hand

Soil auger

Soil probe (optional)

SCS Soil Survey for your county

Plastic bags (3 small) & permanent markers to label bags

Large piece of white paper or several newspapers to lay soils out on

Clipboards, notebooks, colored pencils or crayons for each student

Optional: soil chemistry tests (nitrogen, pH, etc.) and soil thermometer

Diagram or overhead illustrating the different soil horizons

Hook: Have soils auger and soil probe at front of room. Ask students to hypothesize what these tools are for in their notebooks. Have them share their ideas. Explain the use of these tools, and introduce briefly, the soil survey for your county.

Activity: Take students, with their notebooks, clipboards, regular and colored pencils out to the first typical forest soils site. You will want to also bring a percolation test can, and a stopwatch or watch

with a second hand. (An acid solution test bottle, nitrogen test kit, soil temperature probe, soils color chart are optional and chemical tests are better used in the classroom upon return.) A good way to choose the sites is to watch for vegetation changes. You can test sample spots ahead of time, or just core three spots in different places in the local forest. Good choices are, oak grove, maple hardwood area, and area with pines. Forest edge, center of woodlot, and playground area will also give you enough variation to teach the lesson.

With adult supervision drill the first test hole. Lay out soils removed as the auger cuts down through the soils. A flat-nosed shovel will work also if you don't have an auger, but it is more difficult physically. Have students observe and draw the A horizon (topsoil) and the B horizon (subsoil). Discuss the colors and depth of each as the soil change. Why is the topsoil darker (more organic material- things have lived and died there.) Decide by feel the particle size. Put a few tablespoons full of each color of soil into a separate small plastic bag to test when you return to the classroom. (optional) Direct students to draw a sketch of the soil profile in notebooks. Use the soil survey to try to locate your site and name the soil. Does the description match? Why or why not? Now look at the common vegetation for that soil, the glacial history, the climate or the proposed use of the land. There are many, many pieces of information in the soil survey. The objective is to expose the students to this document as a reference.

Carefully clear the forest debris off the top of a small area of soil. Press the perc. can about two centimeters into the soil. Fill to about 10 centimeters and time how long it takes the soil to accept the water. (Be sure it doesn't drain out around the edges- you may need to apply a little pressure to keep a tight fit.) Note the 'perc time.'

Repeat this procedure in two other spots. Return to the classroom.

Optional: in classroom, run acid and nitrogen tests on soil samples, if desired. (If your classes study nutrient cycling, or chemistry, they can build on that understanding to make this real-world connection. It is optional.) Examine soil samples under stereoscope if available. Note particle size and shape. Discuss. Relate perc time to sample size.

Assessment: Assign a journal entry discussing forest soils and their impact on the forest community.

Day Four

Objective: TSW recognize that forests are impacted by and do impact water quality.

Benchmark(s):

SCI.V.2.MS.2 Describe how water reaches the ocean and returns.

SCI.V.2.MS.3 Explain how water can exist below the Earth's' surface and how it's replenished.

Materials:

Large whiteboard for drawing

Colored whiteboard markers

Student notebooks or blank drawing paper

Hook: Have a bicycle, tricycle, a bike wheel, or pictures of various bikes at room's front. Write in notebooks? What are these objects? How did they get their names? How are they alike? How are they different? After students are finished with their thoughts, share ideas together, and begin to define the word 'cycle.' Ask, "what kind of a cycle did you learn about earlier in school?"

Activity: Teach a review lesson on the hydrologic cycle. Be sure the students understand the parts of the word. Hydro – water, logic – step by step, cycle – circle. Review the parts they know. They should have evaporation, condensation and precipitation in prior memory. Add to that absorption, run-off, surface water, groundwater, aquifer, impermeable layer, saturated, unsaturated, and transpiration.

Simple definitions that work are:

- Absorption- water that soaks into the ground. It moves between the spaces of the soil and earth materials.
- Run-off- water that travels downhill along the surface of the land. This is the water that can't get into the soil fast enough. It has power and can cause erosion.
- Groundwater- water stored beneath the surface of the earth between the particles of the earth materials. This is the water we drink when we get our water from wells.
- Impermeable layer or bedrock – a layer of earth material, rock or sometimes clay, that does not allow water to pass through. This layer causes groundwater to collect above it in layers of broken rock, gravel or sand.
- Aquifer—the layer of earth material that groundwater is collected in.

Transpiration - the water that plants lose through evaporation from openings in their leaves where the plant takes in CO₂ and gives off O₂ (during photosynthesis); and takes in O₂ during respiration and cellular respiration This water evaporates into the air from the surface of the leaves. Think transpire (T for tree –although it can be any producer- breath). Transpiration is the passage of water vapor through openings in any membrane or pore.

Transpiration is a new concept for most middle school students. You may need to work through old misconceptions that plants live by photosynthesis alone and only animals respire. Producers photosynthesize by capturing light energy and CO₂ to make sugars. Plants breakdown these sugars in a process called cellular respiration, in order to live. This is similar to the way animals have to use food energy to stay alive. As producers/plants respire they give off water. This process has been given the special name transpiration. The amount of transpiration by a forest is considerable.

You can demonstrate transpiration in the classroom by covering a leaf of a healthy, well-watered plant with a baggie, then putting the plant in a warm dark cupboard or closet for a short time (a night). Observe the interior of the baggie. It will be full of mist. This is water given off by the plant through transpiration.

Complete a careful drawing of the entire hydrologic cycle including all the new terms and their definitions. Do not forget to emphasize the role of light energy in powering this entire process. Brainstorm what the water cycle does for the planet. Common answers should include:

- Water is purified (if the atmosphere is not polluted).
- Water is moved from the surface water to higher land. It recharges lakes, rivers, wetlands and groundwater.
- All plants and animals are 'watered' by the hydrologic cycle-no hoses to drag!

Assign a journal entry on water in the forest. Focus on these questions: What is the role of water in the forest? Where does it come from? How does it effect the organisms there? How does the forest change the water?

Assessment: Steps of the water cycle and journal entry.

Day Five

Objective: TSW trace the flow of energy through the forest ecosystem.

Benchmark(s): SCI.III.5.MS2 Describe how all organisms acquire energy directly or indirectly from the sunlight.

Materials:

Laminated posters from Michigan DNR, *Michigan Forests* or *Michigan Jackpine Forests*, enough for each team of two students (available free from Michigan DNR).

Water erase markers, 6 light colors for each team.

Michigan or Great Lakes Wildlife ID books (optional)

Hook: Choose several students to read their journals from yesterday's lesson on water. Discuss water's role in the ecosystem. Remind the students to think about what they know about food chains. Does water have a part of a food chain? Why or why not? (Water is a nutrient, so it isn't part of the food chain, which shows the flow of energy through an 'ecosystem,' but water is essential!)

Activity: Review a simple food chain including the sun, producer, primary, secondary and tertiary consumers. Review the roles of scavengers and decomposers in a food chain. Draw one chain on the board and model how energy arrows are added to show the flow of energy through an ecosystem.

Sun ► producer ► primary consumer ► secondary consumer ► tertiary consumers ► decomposer

Using DNR laminated posters of any Michigan forest ecosystem and water soluble markers, give teams of two students the task of drawing 6 separate food chains in that forest ecosystem. Have them draw each chain in a different color, if possible. Discuss where the chains intersect with each other. Have students share their ideas of who eats whom, and where the energy flows. Check drawings for correct energy arrows. Ask where each chain begins, and where each ends. What is left when the decomposers are finished? Explain how decomposers release nutrients back to the ecosystem. Ask, "Is the food web a cycle?" (No—it has a beginning—the sun—and an end—decomposers.)

Clean posters. Discuss how energy might flow through the school forest ecosystem.

Assessment: Accuracy of drawings and discussion of food chains.

Day Six

Objective: TSW identify the tree layers of the forest: canopy, understory, and groundcover and stages of tree growth: seedling, sapling, pole-size, mature tree/harvestable timber, snag.

Benchmark(s): none

Materials: none

Hook: In students' notes, have them draw from memory all the different plants they have seen on the school forest floor. Then have them add the middle layer of vegetation, if they remember any. Next have them add in the trees. Have them draw on their visual memory.

Activity: Go out to the forest and have students redraw into their journals the forest as they see it now. Help them to see the tree layers of the forest, the groundcover, the mid, or sapling layer, and the canopy. Discuss the energy available at each layer. Help them to see that, depending on the type of forest, the plants in the three layers may or may not be the same. Help them to see the different shapes of plants, their bark and leaves in the different layers. Have them write about the layers and what they mean to the future of the forest.

Assessment: Quality of drawings, participation in discussion, and journal entry.

Day Seven

Objective: TSW use leaves, tree shape, bark and buds to identify common Michigan trees.

Benchmark(s): SCI.III.2MS1 Compare and classify organisms into major groups on basis of their structure.

Materials:

6 each of five common forest tree leaves
Tree identification guides for Michigan trees

Hook: Place leaves of several common tree types on each desk for students to examine as they come in. Ask students about the tree types they have been collected from. Some will know a few, many will only guess. How can they find out what kinds of trees are in their forest spot?

Activity: Introduce tree keys or guides to each pair of students. Teach tree shape, bark, and buds as well as leaves for identification purposes. Explain why it is useful to know the types of trees growing in a forest by explaining that walking through the woods is a lot like attending a football game or concert. If you don't know anyone, you can still enjoy it, but if you are there with all your friends, it can be more fun! Knowing the plants that are in the forest makes it feel like you are among friends. The trees also can tell you about the climate, soils, and what kinds of animals live there, but those are lessons for another day.

Explain that the soil, weather, available water and other nutrients determine what types of plants are 'comfortable' in the forest ecosystem. Different types of plants are adapted to different abiotic factors.

Teach about different leaf shapes, simple and compound, and venation patterns, pinnate palmate. Discuss the difference between angiosperms and gymnosperms, hardwoods and softwoods. Have students add important ideas to their notebooks. Exchange leaves among the groups, and using the keys find and read about several common forest trees.

Assessment: Assign a journal entry about one tree that the student has read about. Have them give three or more facts they remembered about that tree from their reading.

Day Eight

Objective: TSW use leaves, tree shape, bark and buds to identify common Michigan trees.

Benchmark(s): SCI.III.2MS1 Compare and classify organisms into major groups on basis of their structure.

Materials:

5 meter strings, tape measures, or meter sticks for measuring plots
25 small flags 20 of one color and 5 of another for marking plots.
Circular plot maps (draw around a pie plate on blank paper and duplicate)
Pencils/clipboards (one each per team)
Tree identification books or handouts

Hook: Use a short visual (on the board) quiz to review the names of the basic leaf shapes, venation and branching patterns. Remind students to look first at bark, and tree branching patterns, then at leaf and bud shape to identify their trees. Pass out Michigan tree keys.

Activity:

Take students to forest area. Working in teams of four, students will mark a 10 meter circle. (To save time, you can have these premarked using surveyor's tape or flags.) Students will be using this circle for several lessons, so leave the markers in place after today's lesson. Students mark the center of the plot, then using a precut 5 meter string, they walk a radius and mark the edge of their circle.

Using a circular blank 'map' mark center of plot, then draw in each canopy tree. Use meter strings or tape measures to estimate distance from center, and four cardinal points. (You can rough these in, or be exact with compasses depending on the experience and maturity of the students.) Drawing the map itself can be a good exercise in estimating and visualization. It is not critical to be accurate, but each tree should be included. With younger children, you can make the plots and maps ahead of time.

Students should then use their tree identification books, and their powers of observation to identify each tree species and label it on their map. Most children, working in teams, can complete a 10 meter map in about 30 minutes, if they are comfortable with the tools. You can take longer, or use a smaller plot to adjust this to their ability level.

If time allows, gather class and look together at understory plants and saplings in mid-story. If you need a second day for this lesson, you can expand this part of the lesson to help students identify common understory forbes. Use *A Guide to Forest Communities and Habitat Types of Michigan* to assist you. A discussion of habitat type identification by common plant community is a natural end from this activity.

Assessment: Student cooperation, completion of suitable map, correct use of tree identification books. Teacher should collect the maps.

Day Nine

Objective: TSW will use nets and traps to capture insects in the forest and use insect keys to identify their catch.

Benchmark(s): SCI. III.5.MS.3 Predict the effect of changes in one population in a food web on other populations.

Materials:

Commercial insect traps	6 deli or cottage cheese containers, fairly deep
(Available from Forestry Suppliers)	Spray glue
6 styrofoam plates	18 Four inch or longer nails
	Insect identification books or handouts

Hook: In student notes, take 2 minutes to generate (silently) the longest list of all the animals they could find in their forest 'spot'. Share a few ideas together. Now ask them to circle all the animals with fur (mammals). The list will be long, take a few minutes to do the same with birds, reptiles, amphibians. The lists will get shorter and shorter. Now focus on insects. Students will rarely have more than one listed, and that will probably be ants.

Activity: Tell students that probably the most common animals in the forest are insects, but we rarely pay much attention to them. They are very important to the forest community. We need to focus on them a little because of the many ways they help and hurt the forest. Demonstrate and explain the use of several types of trapping devices. You can use commercial traps available from Forest Suppliers Company or other commercial outlets, use nets, purchased or homemade, and create pit traps using steep sided containers such as cottage cheese or deli containers, nails, and styrofoam plates as lids. Using a small trowel, set the deli dish level with the forest floor, poke three or four long nails (4 in) through the edge of the plate and elevate it about 2 cm above the deli dish. Crawling insects will fall into the dish and not be able to escape. A little spray glue on the sides of the container will insure their capture, or you can pour a little isopropyl alcohol in the bottom. The plate is to protect the pit trap from weather. Discuss insects' role in the forest, how they fit into the food web. Students should understand that insects eat producers, and other insects, but they also provide food for many birds, reptiles amphibians, and other animals. Even bears eat insects! They also play an important role in pollination of flowering plants, and seed dispersal. If the posters used in the food chain activity included insects, you can show that poster again and discuss how the food web would develop 'holes' without the insects present. If time allows, distribute insect identification books and allow time to peruse them. Point out the vast variety and diversity of insect forms and colors.

Assessment: Assign a journal entry discussing three ways insects could impact a forest ecosystem.

Day Ten

Objective: TSW discuss the role of exotic species in forest ecosystem change.

Benchmark(s): SCI III.2.MS3 Describe evidence that plants make and store food.
SCI. III.4.MS.2 Explain how new traits might become established in a population and how species become extinct.

Materials:

Insect Traps (pit traps and others)

Sweep Nets

Ziplock Bags

Hook: Remind students of how to set traps, demonstrate use of sweep nets and assign tasks to different groups, (this will vary, depending on what types of traps are being set).

Activity: : Take the students to the forest, set a variety of traps in at least 3 of the forest plots, and move to another area to sweep with the nets. Ziplock bags work well to empty nets and traps into, are cheap and unbreakable. Bags should be full of air, so insects do not get crushed. Leave traps set over the weekend.

Have students collect a few bits of evidence of insect damage. Discuss.

If an oak tree is available in your forest area, discuss gypsy moth damage. You might want to show and/or set gypsy moth traps if available, or demonstrate the use of *Tanglefoot* or sticky trunk wraps. Define exotic species- *an organism introduced into a habitat where it is not native, and has few or no population controls.* (Is not part of the natural food chain.) Discuss how introduced species can create heavy competition for habitat niches, sometimes taking over native species' niches, and forcing them out of the habitat, and even causing them to become extinct. Emphasize that new types of organisms create changes, forcing established organisms to adapt or die. People impact the rate at which new species move into ecosystems.

Now introduce worms. All earthworms are exotic species in Michigan and other glaciated areas. When Europeans entered the Michigan ecosystem they brought worms with them, both inadvertently, in ballast, plantings, and earth materials, and deliberately, for use in their gardens and as fish bait.

While worms are excellent scavengers, and help with the movement of nutrients through the soil, they really can change the groundcover in a forest area. Many producers and consumers have evolved without earthworms in their habitat. When worms are introduced, they so change the ecosystem, those organisms that cannot adapt to the changes, will die out.

Pull back the leaf cover and look for signs of worms on the soil surface. You may see castings, (little piles) holes, and leaf curls, where earthworms pull bunches of partially decomposed leaves below ground. You will also see mineralized earth at the surface. None of those things would be in an area without worms. You might mention that some research scientists keep track of exactly where worms are already, and where have not yet appeared. Forests without worms look very different, the leaf layer is much thicker, and there is a much greater variety of small plants and fungi.

Mention to students that worms themselves are thought to only be able to travel about 10 meters per year, and that worm front maps travel right up watercourses. They should be able to synthesis that

the worms are carried up streams and rivers by fishermen, and are discarded in the forest when fishermen are finished. Most people don't know that has any effect. Now they do.

Assessment: Results of exploration. Journal entry on impact of worms.

Day Eleven

Objective: TSW use keys to identify insects.

Benchmark(s): SCI. III.2.MS 1 Compare and classify organisms into major groups on the basis of their structure.

Materials:

Blank paper

Colored pencils

Insect identification books or handouts

Hand-lenses

Hook: Go out to forest to carefully collect traps. Return to classroom.

Activity: Examine trapped insects and insects collected from day ten 'sweeps.' Carefully remove and examine. Students should sketch at least three insects they trapped, using colored pencils and magnifying lenses, or stereoscopes. Using the insect identification keys, students should name their found insects and write a little about the lifestyle of each, its habitat, diet, lifecycle. Information will vary depending on the keys used and success of the student's trapping. Students should hypothesize on how each type of insect could contribute to forest change.

The teacher could watch for signs of any know exotics, pointing them out if found. A discussion of the economic impact of exotics would be a natural extension, if time allows.

Assessment: Insect drawings and research findings, and journal entries.

Day Twelve

Objective: TSW calculate the diameter at breast height of all trees in a 10 meter section of the forest and calculate the height and number of board feet of timber using a diameter tape, Biltmore stick and board feet tables. TSW report their findings in dollar values.

Benchmark(s): SC11.1 MS 3 Use tools & equipment appropriate to scientific investigations. SCI 1.1 MS4 Use metric measurement devices to provide consistency in an investigation SCI.IV.1.MS2 Explain when length mass, weight...are appropriate to describe the size of an object. MA.III 3 MS.4 Make predictions & decisions based on data. MA III.1.MS.1 Collect & explore data through observation, measurement, surveys, sampling techniques and simulations.

Materials:

Biltmore Sticks

Diameter Tapes

Data Table

Students Forest Plot Maps

Clipboards

Hook: Have Biltmore sticks and diameter tapes out where students can see them when they enter. Hold the Biltmore stick up and explain. We have been looking at the forest as an ecologist, trying to see how it all works together, today we will look at it more as a forester, who is interested in using the forest for the wood products it provides.

Direct the students to brainstorm all the things that they can think of in one minute that are made of wood. Share the answers.

Activity: Teach the students how to use the Biltmore stick and diameter tapes to measure the trees in their plot.

Redistribute the maps of the plot circles made on day eight. Students should go to their assigned plot, and using their new technologies (tools), record the height and dbh (diameter at breast height) for each canopy tree in their plot. You may wish to have them number their trees on the map, and then record their findings in a simple data table that can be carried to the math class where they will complete their calculations of number of board feet and approximate value using current market values. (optional)

Remember the value of this lesson is to look at the forest in a different way. The accuracy of the measurements is not as important as experimenting with the tools, working cooperatively, estimating, and evaluating the trees as lumber.

Record all values, then carry data tables to math to work with values. If you are self-contained, or wish to do this yourself, tree volume tables are available in MSU Extension Bulletin 461, and current market values by species can be found through a web search.

Assessment: Willingness of students to try new tools, cooperative teamwork, completion of appropriate data.

How to use a Biltmore Stick: (For more information, consult Michigan Extension Bulletin 461.)

Stand 66 feet from the base of trunk. Hold the stick vertically at a distance of 25 inches from your eye. (Smaller students may need a partner to help hold the stick at an appropriate distance).

Adjust the stick so that the zero end is in line with the upper limit of usable height. This is the highest spot that the trunk is at least 8 inches in diameter (Tell the students, the diameter of a smallish paper plate.) The trunk should be clear to that point, with no major branching. If large branches occur lower, then measure to the bottom of the major branching.

Without moving your head, or the stick, shift your line of sight from the top of the trunk to the stump height at the base of the tree. (Usually 12 inches above ground) From the scale, read the number of logs, or fractions of logs in the tree. (Logs are 16 feet each for all deciduous trees, they are sold in 8 foot *bolts* for pines.) Biltmore sticks can also be used for diameters.

How to use Diameter Tapes: Tapes are placed around tree at a height of 4.5 feet. Students will have to decide what part of their body is at 4.5 feet before they leave the classroom. Large splits, bulges, and leaning trees should all be rounded high (measured above), since those things will interfere with market value of the lumber. Read the tape where the lines cross, and record the diameter at breast height.

Day Thirteen

Objective: TSW review the role of hunting and outdoor sports enthusiasts in the use and preservation of the forests and other wild lands in Michigan.

Benchmark(s): SCI.III.5.MS.1 Describe common patterns of relationships among populations.

Materials: none

Hook: In notes, have students respond to the question “What are forests good for?” Allow time to share ideas. Brainstorm a list of all the ways that humans use the forests. Possible ideas will be, timber, hunting, camping, hiking, bird watching, firewood cutting, and others.

Activity: Discuss the many and varied ways that people use their forests. Discuss yesterday’s work with timber values. Ask if assigning a value to the wood seemed easy or difficult. (They will think of it as very difficult, because of the measurement, new tools, and math involved.) Explain that assessing the timber value of a forest is really quite easy compared to the value of the forest for other things, because timber can be measured. The value of the forest for water or air quality is much more difficult to measure, and we are just beginning to understand and value that service. One way that we can value the forest is to look at how humans use the animals that live there, by looking at what we spend on enjoying them each year.

Talk about camping with the students, how much time they spend each year, what equipment they use, how far they travel. Make some dollar estimates.

Talk about hunting. Do their parents or friends hunt? Are they interested in hunting? Have they taken Hunter’s Safety class yet? How much time and money do they think their families spend? Leave things open-ended, and encourage kids to wrestle with the idea of forest economics.

Explain that tomorrow we are inviting an expert from a local Safari Club, or MUCC or Sportsmen’s organization to come and talk about using the forests to hunt and play in. Assign students (in class, collect them) to write five or six questions for tomorrow’s guest.

Assessment: Have students write five or six questions for tomorrow’s guest. What can they tell us about how we use and value the forests as sportsmen or recreational users?

Day Fourteen

Objective: TSW review the role of hunting and sports enthusiasts in the use and preservation of the forests and other wild lands in Michigan

Benchmark(s): SCI.III.5.MS.5 Explain how humans use and benefit from plant and animal materials.

Materials: none

Hook: Before class, write up a simple introduction for today’s guest. Meet with a well-spoken student, and allow them to introduce the guest speaker. Be certain to include the purpose of their visit.

Activity: Presentation from a local representative of Safari Club, MUCC, or a local sportsman's club or a person from the Michigan Parks Department. Be certain to provide a few of yesterday's questions from students to them ahead of time, and be certain that the students have their questions from yesterday to ask, if time allows.

Assessment: Assign a written letter of thanks to today's guest. Letter should include at least three interest things the student learned from the presentation. Letters should be in proper friendly letter format, and suitable for mailing to the guest speaker.

Day Fifteen & Sixteen

Objective: TSW review the major events in the history of forest management in the United States. TSW give examples of how Americans care for their forest ecosystems and give examples of ecosystem services provided for forest ecosystems.

Benchmark(s): SCI II 1. MS 6 Recognize the contributions made in science by cultures and individuals of diverse backgrounds. SCI.III.5.MS.6 Describe ways in which humans alter the environment.

Materials Needed:

For the Greatest Good; A History of Forest Management and the USFS in the U.S. (video)
Video player and monitor
Notebooks

Hook: Read selection such as *February –The Good Oak* from *A Sand County Almanac* by Aldo Leopold if the students are mature enough. For younger students, you might have them respond to a journal question such as; what can one person do for a forest?

Activity: Show selected parts from *The Greatest Good*, a history of the Forest Service published by the USDA. As students watch this documentary, stop every 10 minutes or so, and have them write their reactions and thoughts into their journals. Ask them, "What is happening? What does it make them think about in their own lives? What is interesting to them?" Have them exchange journals with a friend and read their responses and reply. Do this 3 or 4 times throughout the viewing of the film (two days).

Create questions as you view the film with the students. Be sure they understand the changes the management of our forests have gone through during the last 100 years. Help them to understand that many of the issues we as Americans in have dealing with the wise use of our forest resources, other countries never have to think about, because their natural forests lands are all gone. Remind them that all state and national forests belong to *them*. The government manages them in our best interest, but it is the people who own and can ultimately decide what happens to them and how they are sustained or destroyed.

Assessment: After viewing the film, have students reflect again on what one person can do for and with their forests. Have them write a final journal entry reflecting on what they have learned about the forests and what they perceive as their role in the future of Michigan's and the United States' forests.

Lesson Extension

What Have Michigan Ecosystems Done For You Lately?

(From MDEQ's new Michigan Environmental Education Curriculum Support (MEEECs) unit *Ecosystems & Biodiversity* by Pamela Schmidt).

Below is a summary of some of the services provided by ecosystems:

Water Purification – Plants, especially in wetlands, work together with microorganisms in the soil to filter out sediments and toxins from water. Some organisms, such as aquatic snails and clams pump water through their bodies to filter out food, and end up helping to clean the water at the same time.

Air Purification- In a delicate balance of nature, the earth's plants, animals, and microorganisms work together to exchange gases needed for their survival. During photosynthesis, plants purify our air by taking in carbon dioxide and releasing oxygen. Animals then use oxygen from the air, and release carbon dioxide. This process also helps to remove other pollutants from the air. For example, in cities, trees can help to improve the air by removing some of the toxins from car exhaust.

Pollination – One third of all human food comes from plants that are pollinated by animals such as bees or hummingbirds. Pollination is essential to both wild plants as well as crops grown on farms. Agriculture is Michigan's second most important industry, contributing approximately \$35 billion to our economy every year. Some of the major crops produced in Michigan include: soybeans, dry beans, blueberries, and tart cherries, all of which depend on wild pollinators.

Seed Dispersal – Plants make seeds in order to reproduce. In order to grow, the seeds need sunlight, water, nutrients, and space, usually found away from the parent plant. Plants depend on wind, water, and other animals to help disperse or spread around their seeds. Many kinds of plants depend on animals for their dispersal. Some seeds are packaged in tasty fruits, which are eaten by animals (especially birds) and are passed through their digestive tracts and often transported to a new location. Other seeds are stored away or buried by animals such as blue jays, squirrels, and chipmunks. Seeds that are forgotten by the animal have a chance to grow. Other seeds stick to animal fur and travel with the animal until they fall off in a new location. Still other plants depend on the wind or water for seed dispersal.

The Decomposition of Wastes and Recycling of Nutrients – Dead things (and the waste of living things) are recycled back into the soil through the work of scavengers and microscopic decomposers. Some examples of scavengers include centipedes, pillbugs, and vultures. Examples of decomposers include fungus, bacteria, and other microorganisms.

Natural Pest & Disease Control – An estimated 99% of all agricultural pests are controlled by natural enemies, such as birds, spiders, wasps, ladybugs, fungi, viral diseases, and flies. These natural predators and diseases save farmers billions of dollars annually, reducing the need for chemical pesticides. Diseases that effect humans, wildlife, and plants, are also controlled by their natural enemies. For example, ticks which cause Lyme disease are controlled by predators, such as birds.

Drought and Flood Control – Enough rain falls onto the Earth's land surface every year to cover the land to an average depth of 1 meter. Much of this water is soaked up by plants, which hold the soil in place, reducing the likelihood of erosion and mudslides. In places where forests have been cleared, the land is unable to hold the water, increasing likelihood of both floods and drought.

Climate Control – Have you ever visited a forest on a hot day and been surprised to find it was much cooler than in town or especially a parking lot? Forests help control climate by providing shade that is beneficial to all kinds of animals, including people. In the summer, a single tree may transpire as much as several hundred gallons of water into the air every day, providing a cooling effect similar to six window-unit air conditioners. Trees and other plants also help to counteract global warming by taking in and storing carbon dioxide, the gas that is most responsible for global warming.

Recreation & Nature Appreciation –People value natural ecosystems as places to visit for recreation and vacations. For example, millions of people visit Michigan's 96 state parks and other public areas every year to participate in activities such as hiking, cross-country skiing, camping, wildlife watching, photography, boating, fishing, and hunting. Forest-based tourism brings in around \$3 billion to Michigan every year.

Production of Ecosystem Goods -- including wild plants, fish, and wild game used for food; plants used for medicine; and resources such as fuel, timber, and fiber (more info at <http://www.dsisd.k12.mi.us/mff>)

Wood produced by our forests provides material for building houses and furniture, making paper products, and using for firewood. Trees and other plants also provide other materials such as essential oils and flavorings, resins, dyes, vegetable fats, waxes, gums, insecticides, and fibers. In Michigan, approximately 322 million cubic feet of timber are harvested every year to manufacture products such as paper, lumber, and furniture. Michigan also produces about 1/5 of all of the Christmas trees in the U.S. Michigan's forestry industry generates around \$9 billion for the state's economy.

Did you know that all of these things are made right here in Michigan?

- The "leather" (really made of paper), tag on Levi's (Kimberly Clark in Munising, MI)
- Paper for the National Geographic magazine (International Paper in Quinnesec, MI)
- Basketball court floors for the Pistons, Bulls, Bucks, Timber Wolves, and more (Rossi American Hardwoods in South Range, MI)
- Bowling Pins and Alleys (Brunswick in Muskegon, MI)
- Telephone poles (Hydrolake in McBain, MI)

Day Seventeen (and as needed to complete)

Objective: TSW, working in small groups, in a creative and entertaining manner, teach one or more aspects of their new knowledge to other students and guests, demonstrating confidence with new information and skills learned.

Benchmark(s): SCI II 1.1 MS2 Describe limitations in personal knowledge. ELA I.III.MS.1 Integrate listening, speaking, viewing, reading and writing skills for multiple purposes and in varied contexts. ELA I. III. MS.8 Express their responses and make connections between oral, visual, written, and electronic texts and their own lives.

Materials Needed:

Room for presentations

Refreshments (optional)

Material requested by students for their presentations

Hook: Brainstorm 5 things you learned that you didn't know before you studied the forests. Now tell me three people who are not in the classroom that do not know those things. Share. Now tell the students, their job is to teach them.

Activity: Divide students into groups of two or three. From a long list of main topics studied, such as tree identification, exotic species, water quality, or soil, have each team choose one topic about forests that they think they would like to teach to other students and invited guests.

Share rubric and discuss as a class what a quality presentation would consist of. Give students a time frame of not less than 5 minutes for their presentations, and not more than 10 minutes. Students will need several days to create their presentations, practice them, create props, activities, posters or manipulative to make their presentations more interesting, invite guests by handwritten notes and PRACTICE their presentations.

You may wish to invite other classes, parents, other school adults, seniors, or community members to attend. Organize your celebration, and enjoy the results!

Assessment: Presentation rubrics and final journal grade.

Finding Out About Forests - Presentation Rubric

	Minimal 0-5	Average 6-10	Exceptional 11-15
<i>Students show fluency and present clearly</i>			
<i>Students demonstrate knowledge of material</i>			
<i>Students are creative and confident</i>			
<i>Totals- Final Score-</i>			

References for Teachers

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Materials Used with Students

National Audubon Society. 1980. *Field Guide to North American Insects & Spiders*_Alfred A. Knopf, New York.

Harrington, Steve and Illick, Joseph. 1998. *Trees of the Great Lakes Region*. Maritime Press, St. Ignace.

Websites

National Zoo Excellent interactive website the students can use to practice leaf and tree identification. Also an interactive lesson on forest layers including insects. Lots of other good links from this site. www.nationalzoo.sciedu/education/conservationcentral/walk.

Globe The Globe project is an international cooperative program that involves students in real research. This site will give you lots of background information, and techniques for working with soils. It is only one of the topics students investigate. <http://ltpwww.gsfc.nasa.gov/globe>.

Michigan Forests Forever Lots of interesting and helpful background materials including readings for children, and many hands-on activities aligned with Michigan Benchmarks. <http://www.dsisd.k12.mi.us/mff>.

USDA Forest Service Excellent materials and activities for use with elementary and middle school age students, including simple worksheets for calculating board feet found in standing timber, and soils studies. www.na.fs.fed.us/spfo/ce.

Upper Peninsula Tree Identification Key A user-friendly, free, on line reference for identifying trees. Lots of additional teacher and student materials available on this site. <http://forestry.msu.edu/uptreeid/>.

Systematic Entomology Laboratory ARS USDA Some good photos of common bugs on line, the Good, the Bad, and the Ugly and the Young Dipterists sections. www.sel.barc.usda/selhome.