Optimal Regeneration Conditions for Selected Tree Species*

This chart lists the conditions under which the seeds of certain tree species will most readily germinate and grow.

Tree species	Light Level	Soil Moisture Level
White pine	Partial Shade	Dry to moist
Red pine	Partial shade to full light	Dry to moist
Pitch pine	Full light	Dry to wet
Hemlock	Partial to full shade	Moist to wet
Balsam fir	Partial shade	Moist
Red spruce	Partial shade	Moist
White spruce	Partial shade	Moist
Atlantic white cedar	Partial shade	Moist
Northern white cedar	Partial to full shade	Moist to wet
Eastern red cedar	Full light to light shade	Dry to moist
Larch	Full light	Moist to wet
Red maple	Not critical	Dry to wet
Sugar maple	Partial shade	Moist
Silver maple	Full light	Moist to wet
Paper birch	Full light	Moist
Black birch	Partial shade	Moist
Yellow birch	Partial shade	Moist
Beech	Partial to full shade	Moist
Ash	Full light to light shade	Moist to moderately wet
Basswood	Partial shade	Moist
Black cherry	Partial shade	Moist
Butternut	Full light to light shade	Moist
Red oak	Partial shade to full light	Moist
Black oak	Partial shade to full light	Dry to moist
Scarlet oak	Partial shade to full light	Dry to moist
Chestnut oak	Partial shade to full light	Dry to moist
White oak	Partial shade to full light	Dry to moist
Shagbark hickory	Partial shade	Moderately moist
Other hickories	Full light	Dry to moist
Yellow poplar	Light shade	Moist
Aspen; poplars	Full light	Moist
Elm	Partial shade	Moist

*Adapted from Table 14, “Optimal Conditions for Regeneration of Major Tree Species.” *Working With Your Woodland*, by Mollie Beattie, Charles Thompson, and Lynn Levine. University Press of New England: 1983. pp. 142-3.

My Nature Journal

Today's date is _____

The weather today _____ is (example: sunny, cloudy, rainy, snowing)

The temperature is _____

The season is _____

A special thing I noticed outside today is: (Write as much as you can about it, using words that show how it looked, smelled, and/or felt)

_____

_____

_____

_____

_____

_____

Here's a sketch of it:

What's My Habitat?

Sketch a picture of your habitat below, showing the forest layers present. Be sure to note snags (standing dead trees) and down logs if you see them—they're an important part of forest community habitat.

Overstory

Mid-story

Understory

Shrubs

Ferns & grasses

Humus & Soil

1. How did resource managers create this habitat?

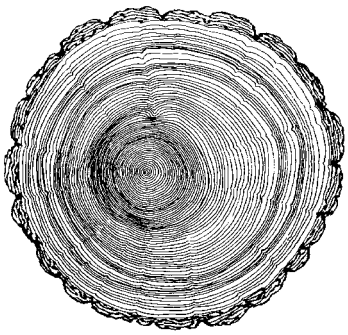
2. Why do you think they created this habitat?

3. What kind of natural disturbance might make this kind of habitat?

4. What animals might live in this habitat?

5. What do you think this habitat will look like in 10 years?

6. In 50 years?



Time and Cycles Lesson

"Logs of Straw: Dendrochronology"

Activity (Allow 45-60 minutes)

In this activity straws will be used to simulate tree-ring core samples. Using the straws, students will work in groups to reconstruct a 50-year climatic history. Students will record this chronology on a 3-meter time line designed to highlight significant social, personal, and scientific events covering the same period.

Dendrochronologists seldom cut down a tree to analyze its rings. Instead, core samples are extracted using a borer that is screwed into the tree and pulled out, bringing with it a straw size sample of wood about 4 millimeters in diameter. The hole in the tree is then sealed to prevent disease.

Materials

For each group of four students:
One set of white straws marked with ring patterns (see illustration below). Markings can be produced with permanent black marker on paper or plastic straws.

- One 3-meter strip of adding machine tape for each group
- Colored pencils for each group
- Colored markers for each group
- A notebook for recording results (optional)
- Reference material such as almanacs that provide students with the dates of social and scientific events over the last 4 decades.

Prior to the activity the teacher should construct sets of straws similar to the set shown in the illustrations.
Group students in teams of four. The following information on the straw samples can be recorded on the blackboard or copied and handed out. Review with the students some of the tips on reading tree rings found in the boxed section.

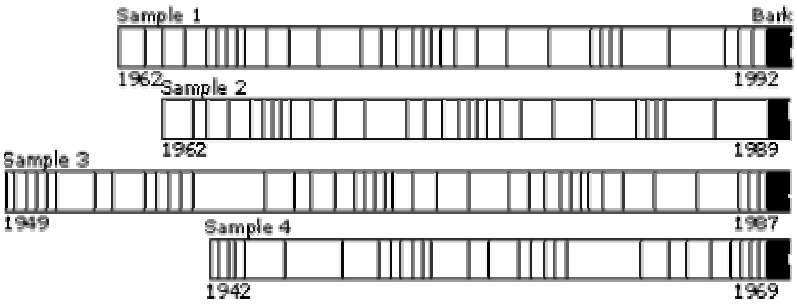
Reading Tree Rings

Core sample 1 is to be used as a standard against which to compare the others, because a bore date of 1992 has been established. Notice the varying patterns of ring widths in sample 1; look for similar patterns in other samples.

Core sample patterns are alternating dark and light lines. The darker lines of a core sample represent the end of a growing season The light-toned space between the two darker lines represents one growing season.

Tree rings are formed from the center of the tree outward. The ring closest to the bark is the youngest and final growth ring. The ring closest to the center of the tree is the oldest growth ring. Neither the outer layer of bark nor the central pith layer of a sample is counted when determining the age of a sample.

Similar ring patterns are found between trees growing under the same conditions. The most obvious feature of these patterns is varying widths. Widening of a ring indicates good growing conditions, while narrowing indicates poor ones. Conditions can include climatic factors such as temperature and moisture as well as factors such as erosion, fire, landslides, etc.



Procedure

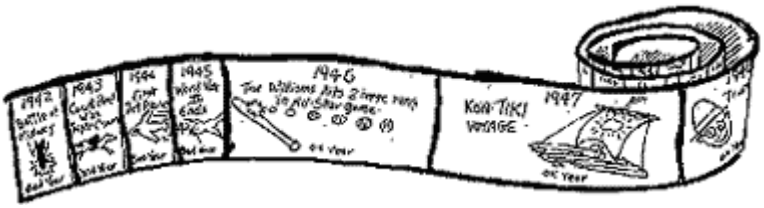
Imagine you have core samples from four trees:

- Sample 1. From a living tree, July 1992, Pinetown Forest.
- Sample 2. From a tree from the Pinetown Christmas Tree Farm.
- Sample 3. From a log found near the main trail in Pinetown Forest.
- Sample 4. From a barn beam removed from Pinetown Hollow.

1. Determine the age of each tree (how many years it had been growing) by counting the rings. Record your answers in your notebook or in the first column on the chart below:

	Age of tree	Year tree was cut	Year growth began
Sample 1			
Sample 2			
Sample 3			
Sample 4			

2. Look for patterns in the rings. Patterns in this exercise match well, but actual ring patterns will vary among different species of trees. Once a ring pattern has been discovered, line up all the samples. Because you know that Sample 1 was cut in 1992, you can match the patterns of all the other samples and determine when all the other trees were cut or cored and also when they began to grow. Record this information in your notebook or fill in the chart above.
3. Make a time line. Spread out the adding machine tape. Beginning at the left end of the tape, record each year from the earliest year identified on the tree-ring samples through 1992. After the years are recorded on the strip, identify years that were good growing years for the trees in Pinetown, and years that were poor. Think of other events that might have happened during this time period such as your birthday, Presidential elections, important scientific discoveries, or record-setting sports achievements. Fill them in on the time line. You can color the time line and illustrate it with drawings, photographs, or newspaper clippings.



Questions

- Which ring on each tree represents your birth year?

- What kind of growing season existed that year in Pinetown?
- In which years did droughts occur in Pinetown?
- Is there a pattern to the droughts?
- What buildings in your areas were built during the lifetime of these trees?

Extensions

Find and map the locations of some of the oldest known trees in your neighborhood. Sketch what you think a core from one of these trees might look like.

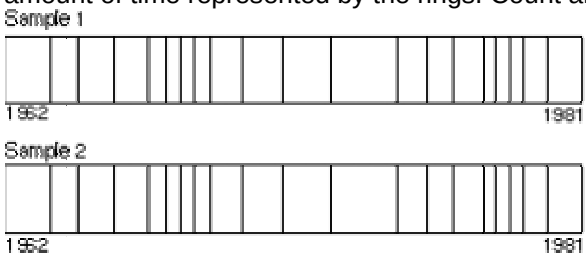
Contact your local forestry service or science museum and obtain some actual cross sections of trees that have been cut in your area. Use the techniques applied during this activity to "read the tree." If a tree has been cut in your neighborhood recently, look at the tree rings on the stump or ask if you can keep a small piece of the trunk.

Create some simulated core straws of your own for another group to analyze and report about.

For the Teacher

Aligning the Samples in the Lesson

The following illustration shows how samples 1 and 2 can be aligned. Have the students align all four samples so that the patterns match, and determine the years when each tree was cut and when it began to grow. Have them count all the rings from the oldest samples as they are aligned with the younger samples to determine the total amount of time represented by the rings. Count aligned rings that appear on several samples only once.



Charts

The charts should be completed as follows:

	Age of tree	Year tree was cut	Year growth began
Sample 1	31	1992	1962
Sample 2	28	1989	1962
Sample 3	39	1987	1949
Sample 4	28	1969	1942

The total time covered by the tree rings is 50 years, from 1942 to 1992.

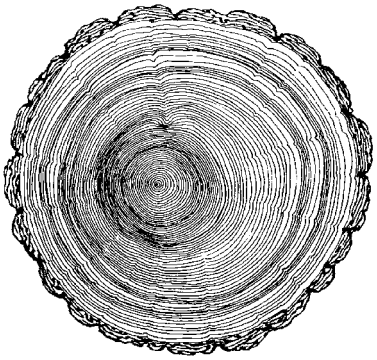
Answers to Questions

The answers to some of the questions in the activities will depend on the individual class-for example, when they were born or when buildings in their area were built. In looking at the climate record as revealed in the tree rings, notice that there is a significant period of poor growing conditions in each of the four decades covered by the tree samples. This pattern, which can be graphed, is the type of pattern scientists might look for when studying climate change.

Classroom Resources

Angier, Natalie, Warming?-Tree rings say not yet: New York Times, Tuesday, December 1, 1992, p. C-1, C-4.
U.S. Geological Survey, 1991, Tree rings-timekeepers of the past: Reston, Virginia, USGS, 15 p.

Trees of Many Sizes



Choose a tree to measure. How big is it around? (What is its **circumference**?). Measure the circumference at your eye level. (Resource managers measure tree diameter at 4.5’ above the ground).

The circumference of a circle is roughly 3 times bigger than the diameter (the distance straight through the middle of the circle, from one side to another). So, what is the approximate diameter of this tree?

How old do you think this tree is? How might you figure that out?

What is the smallest tree you can see? What is its circumference? Is it taller than you, or smaller? How tall?

How old do you think this tree is? How might you figure that out?

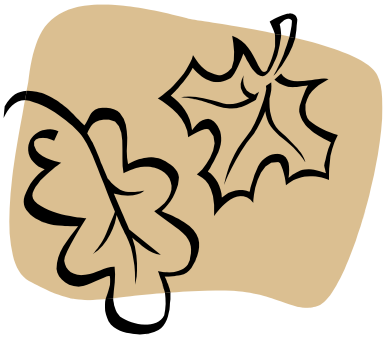
Which size trees would be best for lumber?

Which would be best for deer and rabbits to browse?

Can you find a tree that is the same height as you are? What is its **circumference**? How old might it be?

American Museum of Natural History

Online Field Journal - Field Journals



Leaves

Your Name:

Today's Date:

What's the Weather Like?

Draw the leaves you see in the space below.

http://www.amnh.org/nationalcenter/online_field_journal/index.html

American Museum of Natural History

Online Field Journal - Field Journals

Insects

Your Name:

Today's Date:

What's the Weather Like?

Draw the insects you see in the space below.

http://www.amnh.org/nationalcenter/online_field_journal/index.html

American Museum of Natural History

Online Field Journal - Field Journals

Birds

Your Name:

Today's Date:

What's the Weather Like?

Draw the birds you see in the space below.

http://www.amnh.org/nationalcenter/online_field_journal/index.html

Habits and Habitat: Forest Animal Survey

My forest animal is a _____.

My animal looks like this:

My animal likes to eat

_____

_____.

My animal finds food in this part of the forest (openings, mature forest, ground, shrub layer, canopy, etc.):

_____

_____.

My animal makes its home in this part of the forest (openings, mature forest, ground, shrub layer, canopy, etc.):

_____

_____.

Other animals that prey on (hunt and eat) my animal include:

_____

_____.

In winter, my animal (migrates, remains active in the northern forest, hibernates, etc.):

_____

_____.

When you're walking in the forest, you might see signs of my animal, including (nest, tracks, nibblings, resting spots, and so on). Describe these animal signs:

_____

_____.

Apple as Earth

Length of Lesson: One hour (15 minutes for activity, discussion time flexible)
Grades: Elementary/Middle School
Subjects: Earth Sciences/Resources

Lesson Objective:

The learner will demonstrate an understanding of the earth's water system, and how land and water are connected on the planet.

Introduction:

Evaluate student readiness to determine which is more appropriate: a teacher led demonstration or hands-on student participation. Collect materials accordingly. Using the globe, familiarize the students with global geography including continents and oceans. If necessary, give students a brief review of fractions.

Materials:

- A globe (optional)
- One apple for every two students (or if you choose, just one apple for you to use in front of your students)
- Plastic knives (or one knife for your solo demonstration)
- Blank labels (approximately 25 so they can write labels for their apple earth)

Instruction:

Introduce the idea that the apple(s) represents the Earth, as we know it, covered by water and land.
The Land:

- Cut the apple in half (from top to bottom)
- Cut each of the 2 pieces of apple in half (top to bottom)
- Set aside 3 pieces of apple and label them "ocean"
- Set one piece aside and label it "land"

***Discussion*:** The apple has just been divided into 4 parts. Each part represents 1/4th of the earth. How many quarters of the earth is ocean? How many are land? This "land" quarter also represents areas of the earth not covered by oceans, lakes, rivers, and ice.

- Write labels for "lakes", "rivers", and "ice" and place beside the word "land"
- Take the 1/4th piece that represents the "land" and cut it in half.
- Label one piece "uninhabitable"

Discussion: This piece is 1/8th of the earth's surface and represents all the land that is too dry, too wet, too cold, or too hot for people to live.

- Write labels that describe uninhabitable land and place next to the "uninhabitable" label, e.g. "mountain", "flood plain", "desert", "swamp", and "ice".

- Write labels that describe the conditions of “uninhabitable” land, e.g. “too hot”, “too wet”, “too cold”, and “too dry”.
- Take the other 1/8th piece and cut into 4 pieces. Set the 3 pieces back below the “land” label and set the 1/32nd piece aside. Label this 1/32nd piece “land that grows food”.

Discussion: This represents the amount of land that grows food for the whole world’s population.

- Take this 1/32nd piece and cut off a thin slice. Label this “drinkable water”.

Discussion: This tiny slice represents 3/100th of 1% of the earth’s surface and it represents ALL of the drinkable water for the whole world’s population. We must take care of our drinkable water supply because we are dependent upon it for survival.

Closure:

Discussion Questions:

- What resources do you use in a given day? Week? Year?
- How do those lists compare to the resources you need?
- Where do your resources come from?
- Which resources are renewable? Non-renewable?
- How does human population size affect resource consumption?
- Are resources consumed equally among the Earth's people? Is that fair?
- What problems will or are already arising due to population increase?
- What are possible solutions to these problems?
- On a global level, what issues exist regarding land use?
- What issues exist regarding land use in your community?

Background Information:

Land use is an issue that spans time and place, popping up on both a local and global level on a daily basis. As inhabitants of the planet Earth, we all utilize the resources provided by the land, from food, to clothing, and in many cases, much, much more! Many of us are not aware of what little space we have to produce these resources, essential to human survival. Any activity, debate or discussion involving land use can be followed up with this "Earth as an Apple" activity to both increase understanding and act as a springboard for further dialogues.

Lesson Provided by Yosemite National Institute, Teacher Resources:

http://www.yni.org/yi/yi_fieldscience/teacher_resources/lessonplans/geology/appleasearth.html

Air Quality Terms and Definitions

Purpose and Objective: To improve students' vocabulary and knowledge of air pollution.

Grade Level: 3rd through 4th grades

Background: Air pollution is a problem in many areas of the United States. It can damage trees, lakes, and make people and animals sick. It can also damage buildings and other structures. Air pollution also can cause haze, reducing visibility in national parks and sometimes interfering with aviation. The federal government regulates air pollution in order to protect human health and the environment. There are several words that are used when discussing the subject of air pollution.

Procedure: Print out the words and let the students use it to increase their vocabulary of air pollution and air quality terms. Students may want to make flash cards for the study of these terms.

Word Search Provided by the Texas Natural Resource Conservation Commission
http://www.tnrcc.state.tx.us/air/monops/lessons/airsearch.html

Air Pollution Word Search

There are 15 words that are often used in connection with air pollution listed in the word search below. Can you find them?

I	X	I	H	A	V	L	C	F	H	N	F	X	B	O	J	D	D	V	L
K	U	S	Y	T	U	A	F	B	O	G	P	L	G	K	U	A	Q	K	C
Q	C	O	P	K	K	H	A	I	M	I	P	R	S	B	P	H	F	W	Y
T	F	G	O	P	C	I	T	C	E	L	Z	F	S	I	C	K	Q	D	I
H	T	Q	X	W	Y	Y	N	G	Q	K	X	M	L	T	R	P	I	U	N
J	X	V	H	V	Q	R	N	M	V	W	L	U	A	Q	K	O	H	S	T
U	I	S	O	N	Q	P	Q	R	Y	X	S	H	S	M	O	G	S	T	O
Z	M	F	R	E	S	H	M	C	O	P	O	L	L	U	T	I	O	N	X
M	X	B	W	R	V	G	D	O	Y	P	R	G	S	J	Z	N	J	I	Y
Q	X	Z	J	I	E	B	U	S	H	M	P	L	L	V	F	J	T	W	G
E	J	Q	U	S	T	N	E	O	A	E	B	C	U	W	X	P	R	B	E
Z	F	Y	T	V	W	E	U	S	C	M	I	V	N	K	G	D	U	H	N
H	F	G	Q	M	B	I	A	T	L	S	M	J	G	L	T	T	C	X	Y
T	F	R	T	W	O	C	I	G	O	I	A	B	S	U	Q	I	K	C	P
L	V	S	N	B	C	L	Y	U	U	E	R	V	T	B	S	I	R	A	X
W	O	X	Y	C	K	E	R	C	D	E	Z	E	N	J	S	E	K	R	X
H	S	O	X	Z	I	E	Y	E	S	P	M	Z	F	D	Z	Q	R	Z	I
P	N	C	L	G	W	D	N	T	X	N	S	N	D	L	E	Z	D	X	J
B	O	L	R	B	I	Z	A	F	L	A	F	U	M	F	N	O	S	E	Q
M	W	M	A	B	R	E	A	T	H	E	J	S	W	M	C	A	I	R	F

Here are the words to look for:

Air	Breathe	Bus
Car	Clouds	Dust
Eyes	Fresh	Lungs
Nose	Oxygen	Pollution
Sick	Smog	Truck