Teaching Activity: Logs of Straws (Dendrochronology)

Introduction:

Trees are some of nature's most accurate time keepers. Their growth layers, appearing as rings in the cross sections of the tree trunk, record evidence of floods, droughts, insect activities, lightning strikes, and even earthquakes. The growth of a tree depends on local conditions, which include the availability of water. Because the water cycle, or hydrologic cycle, is uneven, that is the amount of water in the environment varies from year to year, scientists use tree ring patterns to reconstruct regional patterns of drought and climatic change.

This field of study, known as dendrochronology, was begun in the early 1900's by an American astronomer, Andrew Elliot Douglass. Douglass was working at an observatory in Arizona collecting tree trunk cross sections to study their annual growth rings. He theorized that there might be a connection between sunspot activity and drought. In addition to correlating the narrow rings to periods of drought, and in turn to sunspots, Douglass had to establish the actual year each tree ring represented. Because absolute ages can be determined through dendrochronology, the science has proven useful far beyond the narrow study to which Douglass applied it.

Scientists attempt to discover the history of climatic changes, both locally and globally as revealed by tree rings, ice cores, pollen samples and the fossil record. Computers are used to detect possible patterns and cycles from these sources. In dendrochronology, large data bases allow scientists to compare the tree ring records of many trees with nearby weather stations. If the tree growth patterns statistically match rainfall records, then tree growth can be used to construct maps of past regional climates for hundreds of years. Scientists study tree growth by taking narrow cores similar to the straws students will be working with. In this way trees do not have to be cut down for study. The evidence so far suggests that climate change is simply a part of life on Earth.

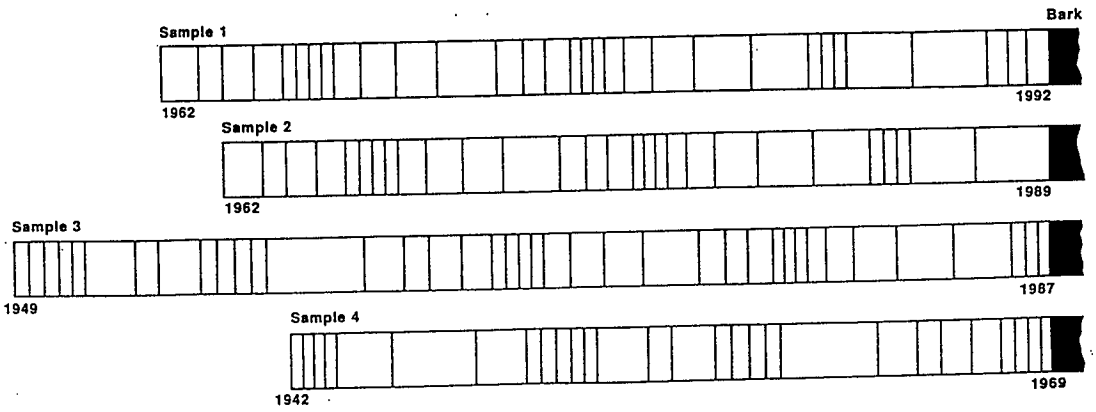
Objectives:

- Students will simulate investigations using tree ring core samples
- Students will construct a 50 year climate history.
- Students will record the chronology of the tree rings on a time line to highlight significant social, personal and scientific events;

Materials: (For each set of 4 students): 1 3m strip of adding maching tape, colored pencils/markers, notebook (optional), pencil/pen, Lab Sheet, reference materials (Almanacs, etc.,)

Procedure:

1. Prepare straws in sets of 4 as shown below:



2. Group students in teams of 4.
3. Pass out or read to class, copies of the following information on the straw samples: "Reading Tree Rings." Review with students before beginning the activity.

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.

4. Read and discuss each part of the student Lab Sheet.

Important Terms: Tree ring core, pattern, growing season, pith layer, bark;

Charts: Charts should be completed as follows:

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

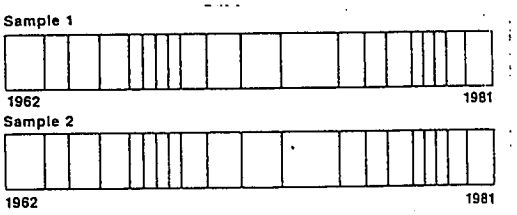
The total time covered by the tree rings is 50 years, from 1942 to 1992.

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 4 decades covered by the tree samples. This pattern, which can be graphed, is the type of pattern that scientists might look for when studying climate change.

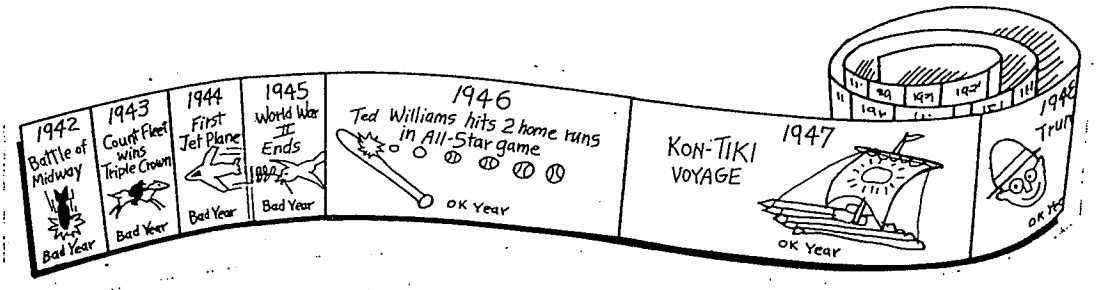
Aligning the Samples:

The following illustration shows how samples 1 and 2 can be aligned:



- Have the students align all 4 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.***

Time Line: Below is a sample of what a student completed time line may look like:



Extensions:

- Measure the rings in the photograph included with this packet.. Assume the tree was cut ion 1992. How old is the tree? Can you determine good and bad years for growth?
- 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 cur in your area. Use the techniques applied during this activity to "read" the tree. If a tree has been cut in your neighborhood lately, look at the tree rings on the stump or ask if you can keep a small piece of the trunk for analysis.
- Create some simulated core straws of your own for another group to analyze and report about.

Student Activity Sheet: Logs of Straws

Introduction: Tree growth depends on environmental factors including location, surrounding foliage, water and temperature. The yearly variance of these factors may be reflected in a tree's annual growth rings. Counting these growth rings gives a fairly accurate account of a tree's age. The wider the rings the more growth. The narrow rings will indicate less growth due to drought or cold cycles. Growth occurs only in one small microscopic layer of the tree called the *cambium.* It lies next to the *sapwood.* As it produces cells, the tree grows. The other parts of the tree trunk are basically dead.

Objectives:

- To investigate tree ring core sample using simulations;
- To construct a 50 year climate history;
- To record the chronology of the tree rings on a time line;
- To analyze and draw conclusions from your investigation;

Materials: Set of 4 straws, Activity Sheet/ Data Table, Pencil / Pen, notebook (optional), markers/crayons, reference materials;

Procedure:

1. Imagine that you have core samples from 4 trees:

    - From a living tree, July 1992, Pinetown Forest;
    - From a tree from the Pinetown Christmas Tree Farm;
    - From a log found near the main trail in the Pinetown Forest;
    - From a beam removed from Pinetown Hollow;

2. With the other members of your group, determine the age of each of the trees by counting the rings.
    - Record your answers in the first column of the **Data Table.**

#	*Age of tree*	*Year tree was cut*	*Year growth began*

3. Look for patterns in the rings. Patterns in this exercise match well; actual patterns will vary among species.

4. Once a pattern is 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 the other trees were cut or cored.
    - Record this information on the **Data Table**.

5. Make a time line.
    - Spread out the adding machine tape.
    - Record each year from the earliest year identified on the 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 bad.
    - Think of or research events that might have happened during this time period. (i.e. Your birthday, Presidential elections, etc.).
    - Fill in the events in the time line.
    - Color in the time line and illustrate it with drawings, clippings, or photographs.
6. Answer the questions below.
    - Which ring on the tree represents your birthday?
    - What kind of growing season existed in that year in Pinetown?
    - In which years did droughts occur?
    - Is there a pattern to the droughts?
    - What buildings in your area were built during the lifetime of the trees?