## Time \& Cycles - Dendrochronology

Trees contain some of nature's most accurate evidence of the past. Their growth layers, appearing as rings in the cross section of the tree trunk, record evidence of floods, droughts, insect attacks, lightning strikes, and even earthquakes.

Each year, a tree grows. The new growth is called a tree ring. How much the tree grows depends on such things as how much water was available. Because the amount of water available to the tree varies from year to year, scientists can 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 1900s by an American astronomer named Andrew Ellicott Douglass.

By counting the rings of a tree, we can pretty accurately determine the age and health of the tree and the growing season of each year.

Modern dendrochronologists seldom cut down a tree to analyze its rings. Instead, core samples are extracted using a borer that's 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.

In this activity, you will be given samples that simulate tree-ring cores.
Your group will be given four simulated tree-ring cores. The samples came from the following sources:

- Sample 1: From a living tree from the Pinetown Forest, July 1993
- 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


## Procedure

1. Your group should determine the ages of each of the trees.

- Count the rings carefully, remembering that each ring represents one year of growth.
- The pith (central layer) and bark are not counted in determining the age of a sample.
- The youngest ring is closest to the bark and the oldest ring is closest to the pith.

2. Record the tree ages in the data table below.

| Sample | Age of Tree | Year Cut or <br> Cored | Year Growth <br> Began |
| :---: | :---: | :---: | :---: |
| $\mathbf{1}$ |  | 1993 |  |
| $\mathbf{2}$ |  |  |  |
| $\mathbf{3}$ |  |  | $\square$ |
| $\mathbf{4}$ |  |  |  |

3. Sample 1 was cored in 1993, meaning that the outer ring grew that year. How can you tell what year Sample 1 started growing? Figure that out and record the year in the data table for Sample 1.
4. Samples 2,3 , and 4 were cut down before the tree ring core was taken - but we don't know exactly when. How can we figure out both the year they were cut and the year they started growing from the tree ring cores? To do this, look at all four cores. You should see that there are patterns in the rings - some are wide and some are narrow.

- Wide rings indicate that the tree was growing fast that year, probably because the weather was good
- Narrow rings indicate slow growth, probably linked to regional drought or cold temperatures


All of these trees were growing in the same general area, so if they were alive at the same time, they should show the same ring patterns. Can you match any ring patterns between cores? Once you have found some pattern matches, line up the cores so that the patterns overlap.

Figure 1: Example of pattern matching in the tree cores.
(Note that your patterns won't look like this.)
5. Once the cores are lined up, here's how you can determine their ages. You know that 1992 is the last ring on Sample 1. Count backward until you get to the ring that matches on another core. That ring was produced in the same year on both cores. Now you can count backward on this core until you reach the first matching ring on the next core. Those rings were produced in the same year as well. Repeat for the last core. Now simply count backward to the end of the cores and you have the year the trees began to grow. Record the data in the data table.

## Observations and Questions

1. Which tree ring represents your birth year?
2. What kind of growing season (good or bad) existed that year in Pinetown? How can you tell?
3. If poor tree growth around Pinetown was mainly caused by drought, which years were probably drought years? How can you tell?
4. Did Pinetown have more years of drought or plentiful rainfall?

## Tree Growth Study

## Introduction

Forest trees grow in both height and diameter. The growth of a tree is influenced by it environment. By working with the cross section of a tree, a view of a tree round can reveal how outside influences have affected the tree's quality of life. The Xsection (cross section) can also provide information about the tree's age.

## What makes those rings?

The appearance of rings in a x-section is due to the growth pattern of the tree. During regions that have seasons, trees will grow very rapidly in the spring and then not as rapidly in the late summer. The faster growth of early spring makes large cells that are light in color, the lighter colored area is called earlywood or springwood. Summer growth, which is slower, produces cells that are smaller and darker in color, these dark regions are called latewood, or summerwood. The circles created by the alternating summer and springwood are called annual rings. The oldest layer of growth is in the center, and the newest growth rings are closest to the bark. Counting the rings can give you an estimate of how old the tree is. This method is not foolproof though. Some environmental conditions can cause the tree grow more than once during a growing season, and thus produce false rings; ring counts do not always indicate the tree's true age.

## What other things can a cross-section tell you?

The width of the rings gives you clues about how favorable the growth season was. If environment conditions were good (plenty of water \& sunlight) the growth rings will be wide. If conditions were not as favorable during the year, the growth rings will be narrower.


The shape of the concentric circles (annual rings) can also tell you what kind of conditions the tree lived in. In normal conditions, the rings will be in near perfect circles. Sometimes, trees don't grow in a regular pattern, which causes the rings to be irregular. Imagine if a tree was growing next to a boulder, and it had to grow around the obstacle: the resulting rings would be a little lopsided.


Also, if a tree is damaged on the outside, as it grows that damage will become a scar on the inside. Damage could come from being cut, or fire, or disease.

## Questions:

1. Name 3 things that the cross section of a tree can tell you about the tree.
2. What is a false ring?
3. The dark rings on the tree are called [earlywood / latewood].
4. The cells produced during the summer are [ larger / smaller ] than spring cells.
5. The oldest layer of growth is near the [ center / outside ] .
6. If a tree had to grow around an obstacle, the rings would be [ lopsided / scarred ].
7. Ring scars are caused by [ damage / earlywood]

Examine the rounds: tree rounds have three distinct regions. The outer region, or bark, is separate from the area of wood on the inside. The center, or core, of the tree is the pith, which is small in comparison to the larger area of wood. Less noticeable region is the thin cambium, which lies between the bark and wood. Wood rays appear as lines radiating from the pith to the outside of the wood like spokes of a wheel. The wood area is further divided into two regions. The outer area of the new growth is usually light in color and represents the live tissue called sapwood. The inner area is darker, and is dead tissue called heartwood. Sometimes this area is filled with gums and resins which gives it a very dark color.

Locate all the underlined structures on your tree rounds (if possible). Make a sketch of one of them below and label each region (or structure) that is underlined above. Use shading to help distinguish the areas of sapwood and heartwood.



