You Are a Dendrochronologist

You and your team have been given a set of "cores" that have been removed from several different species and different individual living trees, at different times over the last 100 years or so, and have come from different locations around the country. By carefully studying the patterns of growth rings displayed in each set of cores from a given location, and aligning them by common patterns found in these cores, we can construct a tree ring "time-line" that runs from the present day to as much as 115 years ago. Each core tells a part of the story of the growth conditions that the various living trees were subjected to during their lifetime. When all the cores are properly aligned, the entire record of growth and environmental conditions becomes much more apparent.

2 Days Needed To Complete

In this activity, you will align the different tree cores, record the age of each core when taken, and then by measuring and recording the width of each unique ring (mm) and graphing that data (either into a spreadsheet or by making a pencil and paper graph), observe and identify what relationship there is between precipitation amounts and tree ring growth.

Procedure

1. Your teacher will provide you with a need a set of simulated tree cores pre-marked with ring patterns.

2. Student teams should cut out the individual tree cores **(MAKE SURE TO KEEP THE LABELS ATTACHED IF YOU ARE CUTTING THEM OUT YOURSELVES!!)** and lay them out on your workspace.
    a. Record the core's name and # in Table 1.0
    b. Count and record the number of rings in each core.
    c. Based on number of growth rings, record the age of the tree when the core was taken.
    d. Measure the width in millimeters (mm) of each ring in each core, and using pencil (in case of mistakes!) record the value in the center of each ring on the samples. This serves two purposes:
        i. Allows you to have a numerical pattern to look for, as well as the visual pattern of the rings themselves
        ii. Once the cores are properly aligned, you will then have, in chronological order, a composite, long-term set of data that can then be graphed.
    e. Now look for patterns or groups of patterns in the growth rings that are common to two or more core samples, and **align the cores into chronological order from left to right (oldest to most recent).** These common patterns represent years when both trees were actively growing. **REMEMBER early growth is represented by lighter wood and later growth by darker wood**. Take your time, double check each other, and be as accurate as you can.

3. When your team group has the cores correctly aligned, you should carefully tape tem together to form one continuous composite core that represents over 100 years of tree growth within a specific region. Your team will then have over 100 years of tree ring data representing a time line of climatic (and ecological) events that can be used to relate tree growth to historical precipitation levels.

4. **Accurately and carefully record this data in an Excel spreadsheet** or your journals. Your team should choose 1 person to act as the recorder of data, and have them checked for accuracy by another member of the team.

5. Using your aligned core samples, your team should work to complete Table 1.0. **All references to years are hydrologic years (October 1st-September 30th).** This means that "Year Cut" would not be, for example 1972, but rather 1972-1973.

6. Once your team has successfully completed this part of the activity, you should rank the samples from oldest to most recent, record that data in Table 1.0. and complete the two questions at the bottom of the table. The taped cores should be carefully folded and stored. Your teacher will collect them for use later.

Day 2

1. Go to the website http://cdiac.ornl.gov/epubs/ndp/ushcn/ushcn.html This is the United States Historical Climatology Network and was developed over the years by a joint effort between NOAA and NASA, and offers detailed, user friendly access to climatological data from reporting stations throughout the United States. You will use it to acquire historical HY precipitation data in the form of Excel spreadsheets. Once at the site:

   A. Click **DATA ACCESS**>Click **WEB INTERFACE**

   B. This takes you to a Google style map of the United States. On the Pull-Down menu, students should select the state that their core sample came from and then

      Click **MAP SITES**

   C. A group of push pins will appear; you should select the reporting station that your core sample came from, and when you do, a bubble will appear.

   D. Click **GET MONTHLY DATA**
   Click **Create a download file of data summarized by hydrological year (Oct 1 - Sep 30)**
   Select **TOTAL PRECIPITATION**

   E. You can give your file a unique name of your choosing, or simply go with the default name. The year range should be the default selection.

      Click **SUBMIT**

   F. This generates a link to an Excel file that you can download to your computer or flash drive. This file will contain hydrologic year (HY) precipitation amounts in inches, sorted by year.

2. Now enter your ring width data into the Excel spreadsheet, and generate line graphs comparing growth rates in their tree sample to historical HY precipitation levels. Your team should save their files, so they can be displayed electronically for class discussion, and print copies of your graphs for class display when you are finished.

Lesson 14: Assignment 3-You Are a Dendrochronologist

Name_____ **Date**_____**Class** _____

Table 1.0 You are a dendrochronologist data collection table.

Sample Name_____

Species_____

Core Number	# of Rings in Core	Age of Tree When Core Was Taken	Year Tree Started to Grow	Year Tree Was Cut	Age Rank 1-7 (Oldest-Youngest)

Name_____ **Date**_____ **Class**_____

You Are a Dendrochronologist…

Analysis questions:

1. How many unique rings are represented by your composite sample core? _____

2. Determine the mean (average) ring width for your composite sample core. You can do this manually by adding up all the values and dividing by the number of values you have, or your teacher can show you how Excel will do it for you easily and quickly. Record the mean: _____ mm.

3. Looking at your graph, in general terms, describe the relationship between precipitation levels and tree growth.

4. Thinking about your answer to Q3, is there an exact one-to-one relationship between precipitation and tree growth. Why or why not? Explain your answer and give reasons based in your data.

5. Based on your data and graphs, and what you now know about tree rings and their development in relationship to precipitation amounts, how do you think temperature would affect the growth of tree rings? Give reasons for your answer based in your data and develop a hypothesis for the affect of temperature on tree growth.

6. Search the USHCN website for temperature data for the last 10 years for your sample area. Compare those values to your tree ring data. Describe the relationship that you notice. How does this compare to the relationship between precipitation and ring growth?

7. Based on what you now know about precipitation, temperature and tree growth, how could you use your tree ring data to determine what the average temperature was 80 or 100 years ago at your sample site? Explain your answer in as much detail as possible.