

Teacher Background Information

How Old Is Your Tree? (SC070109)

Background

The outside of a woody stem is composed of bark. Just inside is the *phloem*, which is the tissue that conducts food down to the roots. (That is why a tree that has had a ring of bark cut all around it or “girdled” can live through the year, but will store no food and die the following year.) The cambium, or growing tissue, is just inside the phloem. Next comes the xylem, the tissue that carries water up the tree. Xylem grows in proportion to the amount of water available to the tree.

Water is one of the main ingredients in the process of photosynthesis. Since carbon dioxide is usually in constant supply (more than the plant could use) water is usually the limiting factor in the growth of plants. Students may be surprised to learn this, since their preconception (often produced by elementary teachers) is that sunshine is the main driving force. It is, but even in the coldest weather sunshine is normally available more readily than water. (To explain limiting factors to students, it is often good to compare photosynthesis to a collation job. You have three pages to staple together, in three piles. You keep stapling until you run out of one page. The page you run out of is the one that determines how many copies you get.)

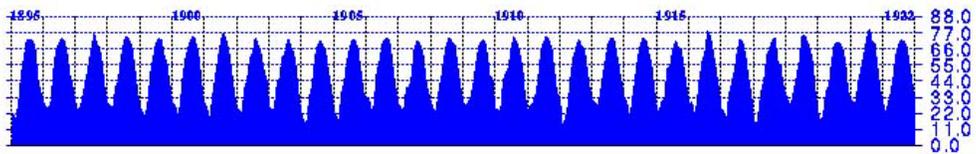
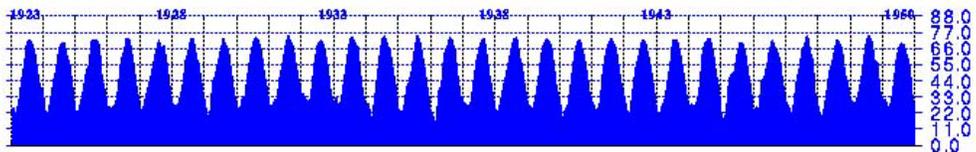
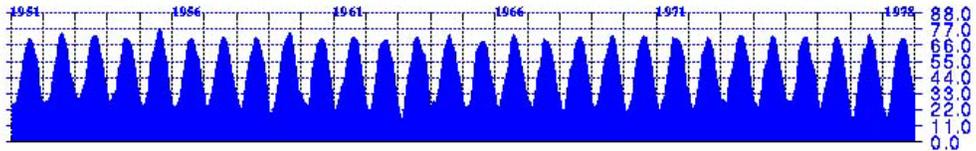
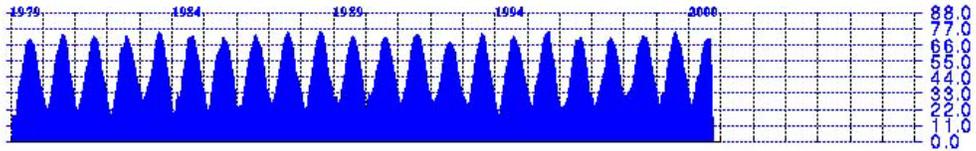
Because xylem is produced proportionally to the rate of photosynthesis, it grows quickly in the summer and slowly in the winter. Winter rings are darker because the cells are more dense. A tropical rain forest tree would not have distinct rings, nor would a coniferous tree.

Climate Data

In order to make comparisons between tree rings, water, and temperature, students will have to first total the monthly precipitation and make a histogram of yearly precipitation. They may be amazed at the differences year-to-year and the periodic cycles. To make the pictures larger, you can expand them using the “handles” on the JPEG images and print them at the maximum size of your printer. Printing on a transparency sheet allows the images to be displayed for the entire class.

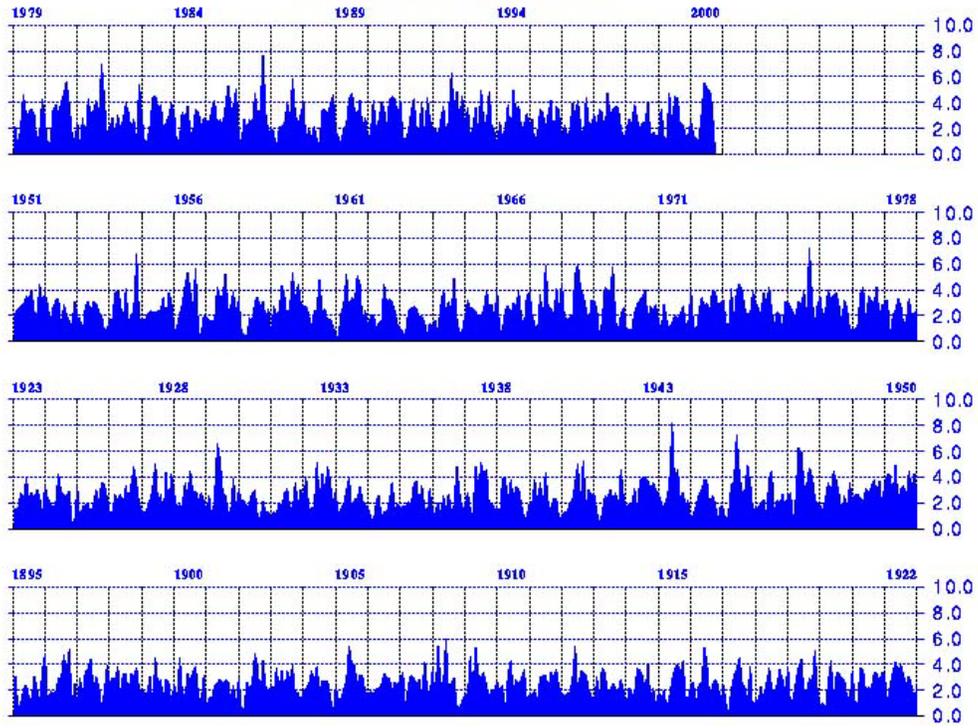
Data for two areas of Michigan are provided here.

Temperature (degrees Farenheit)



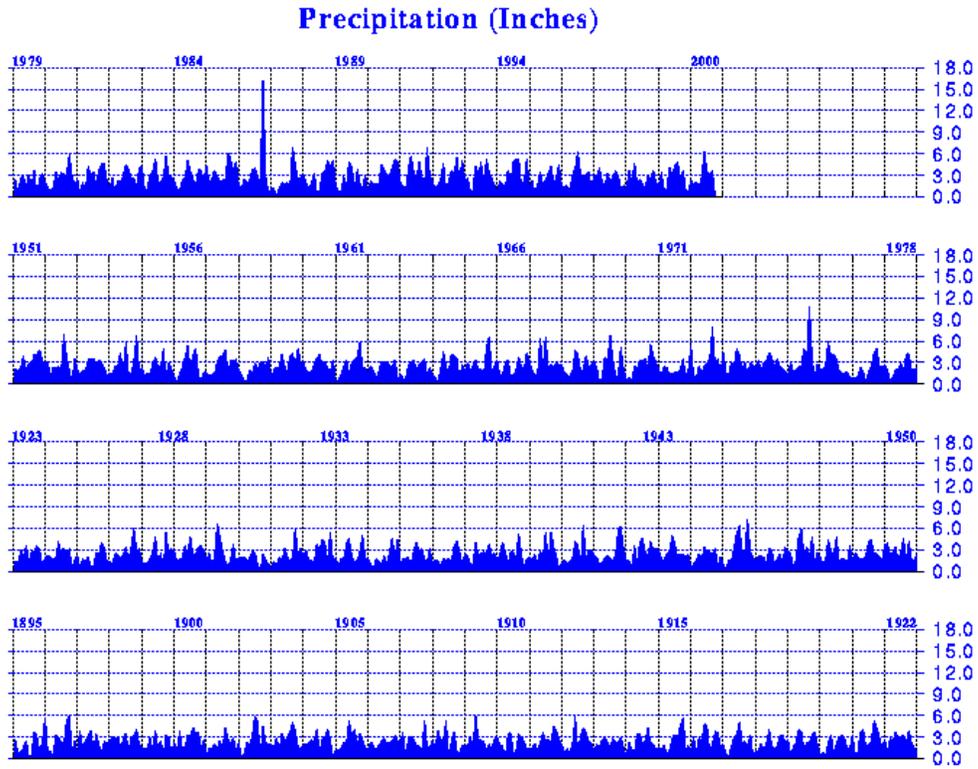
Michigan - Division 10: 1895-2000 (Monthly Averages)

Precipitation (Inches)



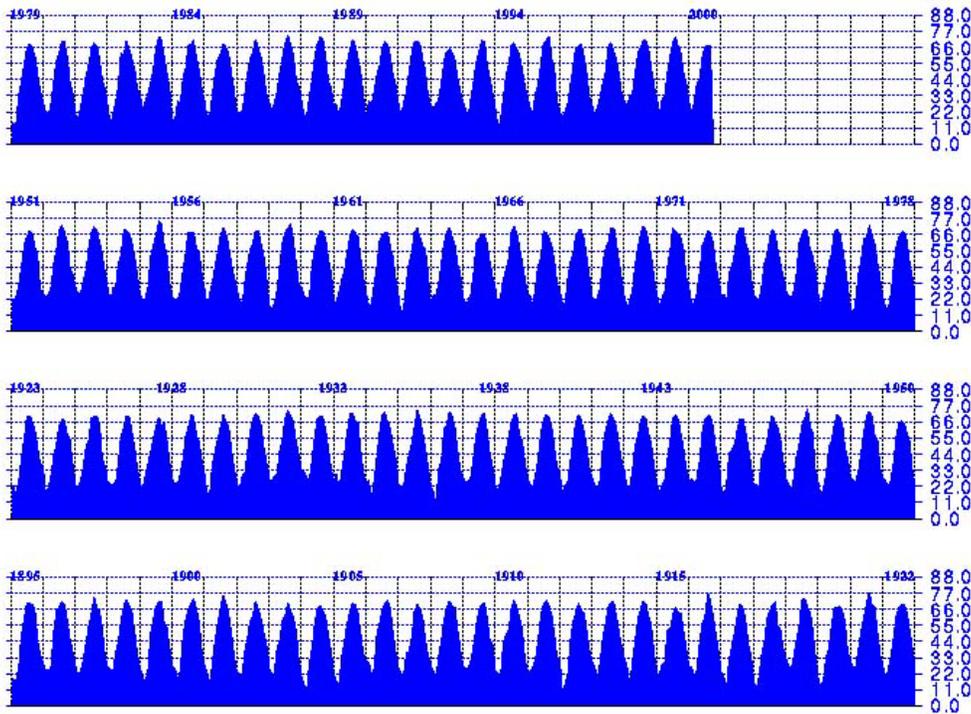
Michigan - Division 10: 1895-2000 (Monthly Averages)

Lansing:



Michigan - Division 06: 1895-2000 (Monthly Averages)

Temperature (degrees Farenheit)



Michigan - Division 06: 1895-2000 (Monthly Averages)

Students may ask about using English units. In fact, they are looking at the relationship between the highs and lows, not the total. So units are not important.

When students make the temperature graph, they have been asked to exaggerate the y-axis scale by numbering it beginning at 55. This allows them to better see differences. The graph provides an interesting jump-off to a discussion of global warming.

The correlation process may seem difficult at first, but is much easier than it seems. To help students work through it, ask them to find several dry years in a row. Then find several thin tree rings in a row. Are the dry years followed by one, two, or perhaps three wet years? There should be a similar pattern in the tree rings.

Remember that each of the lessons in the second half of unit SC0701 builds a case for one part of the photosynthesis equation. Each lesson is important to build the entire equation. Put the equation in a prominent position on the board and work through “how do we know” for each part of the expression.

Three possible extensions for this lesson are:

- 1) Using a scientific calculator the values could be analyzed for a Correlation Coefficient between the width of the growth ring and either the temperature or the precipitation data. The closer the r-value comes to 1, the better the match.
- 2) Does Michigan temperature data provide any evidence for global warming? If so, could you prove it to a friend?
- 3) Last year lake levels were at record lows. Was that due to temperature or rainfall? [In fact it was high temperature—more lake evaporation.]