

How Nature Records Climate Change: How Can We Learn About Past Climates from the World Around Us?

Trees contain some of nature's most accurate records of the past. They have alternating layers of light springwood and darker summerwood called annual rings. You can count the number of annual rings to find the age of the tree. It is possible, in some years, that more than one ring is made. These false rings occur due to disease, frost damage, or injury. Under these conditions, ring counts are not always 100%. Tree growth in a specific year depends on a complex set of local growing conditions. The amount of rainfall and water availability is one key variable affecting the growth rate each year.

In temperate regions, seasonal growth in the diameter of a tree usually continues longer in conifer or softwood trees than in deciduous or hardwood tree. Softwood trees continue to produce growth late into the fall. The growth rings in softwood trees are therefore larger than those in hardwood trees. Some hardwood trees have distinct rings. Other hardwoods produce cells (vessels) of similar size through the growth rings, which makes it more difficult to identify the springwood from the summerwood.

Watch Video 1

Observe

Record your observations from **Video 1** in the table. Were there any signs of abnormal growth, such as rings being different sizes on different sides of the tree sample? Were the tree rings condensed or spread out? What does this tell you about the climate it grew in?

Data Table			
Tree Sample	Distance from Center to Last Ring	Number of Annual Rings	Age of Tree's Best Growth
Mulberry	6 cm	10	9
	Observations		
Red Oak	Rings are small and there is a dark region that takes up most of the tree round. The rings seem fairly regular in size. Hard to count.		
Walnut	Rings are not as condensed as the red oak. The central portion is darker. The rings seem fairly consistent.		
Pine	The rings are very easy to see in this sample. They are spread out in the beginning but condense as they reach the bark. The newest growth is a very wide band.		



Identify an Experimental Design Flaw

The effects of climate change vary by region. What are the limitations from studying tree rings to determine climate history?

Not all regions have conditions to produce trees, such as the arctic or the desert. These regions cannot use tree rings to assess the climate. This is where ice cores and rock formations can help.

Refine/Expand the Experiment

How could you expand this experiment to determine what factors may be responsible for any differences in the widths of the growth rings or the reason for abnormal growth?

It would be helpful to have the geographical location where the tree rings originated and what date they were harvested. Then weather data could be obtained for that region during that time period. This would help determine if there was a lot of rain or a drought and any other environmental indicators. Abnormal growth would be harder because there are a lot of random factors such as access to sunlight and whether the tree had to grow around obstacles.

Practice Scientific Reasoning

Compare and contrast the ages of the trees. If the tree round samples are of similar size, how do their ages differ? What does this tell you about the growth rate of different tree species?

The red oak sample was the smallest but it appeared to have the most rings. They were heavily condensed. The pine was the biggest and the rings were much more spread out. But the walnut slice seems to be the youngest. Hardwood trees seem to be slower growing and produce more condensed rings. Softwood trees appear to grow faster and as a result the rings are more spread out.

Connect to Your World

With the need to preserve our natural resources, scientist do not usually go around cutting trees down to measure their growth and analyze past climate. Instead, they use a boring device known as an increment borer to extract a small core sample from the tree. The hole is then sealed to prevent disease. How can taking samples from National Parks help bring insight into the effect human activity has on climate change?

National parks are protected areas. Some are so remote that they get less visitors. This allows trees to grow and age past what is seen in unprotected areas where development occurs. The redwood trees in California have been around for thousands of years. This can give a lot of information of how human activity has changed the climate over the course of millennia. Very useful information.



Learn More by Exploring This Link

<https://www.environmentalscience.org/dendrochronology-tree-rings-tell-us>

At-Home Extension

The tree rounds used in this activity were obtained from limbs of trees that had already been cut for some purpose. Scrap limbs are usually burned for waste, so these tree limbs are, in effect, being recycled. See if you can obtain tree rounds from your area. What does the information in those tree rounds say about past climate in your region?

Watch Video 2

Video 2 explains the Paris Climate agreement which exists to reduce human impact on climate change.

In School

If you would like to combine this activity with an in-school experience, try the following kit:
<https://www.flinnsci.com/360-science-how-nature-records-changes-in-climate/>