Counting Birthdays

LESSON

GRADE LEVEL K-5

CATEGORY Plants, Animals and Habitats

TOPIC Trees, Age and Growth Rates

LENGTH
30-60 minutes

MATERIALS
- Copy Pages
- Tree cookies
- Meter sticks or tape measures if using cookies; rulers if using copy page

SETTING
Indoors

GROUP SIZE
Any size

SUBJECT AREAS
Science, Math

KEYWORDS
Growth rate, tree cookies, dendrochronology, sapwood, heartwood

HCTF Education

Overview

By examining growth rings on tree cookies, student detectives determine the ages and growth rates of individual trees. From this study, students will speculate about how weather and other factors affect the history and future of the forest.

Objectives

Students will be able to:

- age a tree by counting its growth rings
- calculate growth rate of a tree
- interpret how the spacing of the rings indicate seasonal and long-term growth conditions

Making Connections

Forests are iconic, dominant features of British Columbia, essential to our climate, wildlife, water supply, and economy. Understanding how trees grow, and the factors affecting their growth, helps us understand the history or our landscape, and its possible future.

Background

Forest researchers learn tree life histories by studying the growth rings of trees. Cross-sections sliced from stumps or logs yield **tree "cookies"** which allow convenient assessment of age and growth rate. To age a live tree, a tool called an increment borer extracts a cylindrical sample known as an increment core, which provides the same information. Cookies and increment cores are taken from the oldest part of the three, near its base. By reading the stories that the tree rings tell, researchers obtain clues about the history of a tree and its forest. This study is called **dendrochronology.**

Trees grow new wood mostly during spring and summer, always outwards from the older wood, towards the bark. In BC, trees grow fastest in late spring and early summer, producing a relatively wide ring of light early wood. Growth slows later in summer, as moisture and nutrients become less available, and yields a narrower, darker, ring of late wood. This pattern of light and dark together indicates a year's growth: an annual ring. Most people count the darker ring, since it is narrower and more distinct, to determine a tree's age.

New wood growth forms layers under the bark, creating the hollow wood cells known as **sapwood**. These cells transport water and nutrients (not sap) to the leaves. Sap flows in the cells immediately under the bark: carrying nourishing sugar down from the leaves to the roots during the growing season, and up from the roots to boost the growth of leaves in the spring. As time passes, the older cells in the center of the tree fill with resins and turn dark, becoming **heartwood.** Heartwood gives the tree strength and helps resist decay.

Growth rings vary in size, influenced by the tree's environment. Growth factors include the amount of moisture and sunlight, space, competition with other plants, soil conditions, insect attacks, disease, and fire. Because of this variability in growth rate, annual rings and dendrochronology help us to understand the history of the forest environment.

Procedure

The Warm-up

1. Begin with a discussion of the concept of age.
   - How do we measure the age of people?
   - Why do we measure human age in this way?
   - If you don't know a person's age, how do you tell how old they are?
   - What conditions allow a human to grow in a healthy way?
   - How do we know how old a plant is?
2. List some plants that live only a few months. List some plants that live for many years.
   - What conditions allow a plant to grow in a healthy way?
   - Discuss the age of trees. Here are some questions:
   - How can you tell the age of a tree?
   - What would a young forest look like?
   - What would an old forest look like?
   - What determines how long a tree lives?

The Activity

Distribute tree cookies or the activity sheets. Have the students count the number of dark rings (late growth) on the tree disc, from the center to the bark (one side only!). Double check! How old was the tree?

Determine the average yearly growth rate of your tree. Measure the diameter of the tree disc. Divide the diameter of the tree disc by its age to find the average growth in girth each year.

Growth rate = diameter of tree ÷ age (number of rings)

3. Examine the tree discs to see if they indicate variable growing conditions through the life span. Rings tightly spaced may indicate a dry growing season; more widely spaced rings indicate more favourable growing conditions. Soil fertility, shade, competition, weather, etc., all affect annual ring width; i.e., how well the tree grows.
   - In which years did the tree grow above the average rate? Below? What might have caused the differences?
   - Do you notice any unusual shapes, patterns or markings on your tree disc?
   - What might cause these?
   - What events happened to the tree during its lifetime?
   - How did the tree die?
   - In what ways could a tree become unhealthy or die?

Wrap-up

1. Compare the findings:
   - age determinations
   - growth rate determinations
   - life histories of the trees.
2. Discuss how changes in climate and other environmental factors might affect tree growth in the future.

Assessment

1. Share the findings of the dendrochronology research with an essay or presentation.
2. Present or sketch a cookie and ask students to assess the tree's age and growth rate.
   - How would you know if a tree had a poor growing year?
   - What about a good year?
   - What are some of the reasons that might cause a good growing year?
   - A bad growing year?

3. How does dendrochronology inform us about the history of the forest?

4. Ask students to draw a tree cookie, and describe the history of their tree's life.

5. Use any form of written expression to tell the story of a tree from one of the tree discs.

Extensions

1. Ask the students to take an "increment core" of their life. Draw a tree disc of their life with a ring for every year that they have lived. Between the rings, mark the events of their life (e.g. if they moved or when they began to walk. They may need to ask their parents or guardians for some help).

2. Create a play based on the life of one tree, including how that tree interacted with its forest surroundings.

3. Conduct a discussion predicting what the forest in your area might look like in the future.
   - What changes could happen to the forest in your community?
   - How might any one of these changes affect the forest?
   - What might happen if there were major climatic changes?

4. Visit a local forest and estimate the ages of the trees. Conifers put out a "whorl" of branches each year, all at the same level, so age and growth rate can be approximated.

5. Hike up a mountain and compare the age of trees at altitude. Discuss conditions that lead to slower growth in the subalpine.

6. Investigate how growth rings inform archeology.

7. Find out how trees are used for radio-carbon dating.