POLAR TREC
Learning Resources

Details

Completion Time: About a week

Permission: Download, Share, and Remix

Tree Cookies

Overview
Students will measure and analyze features of two different species of trees by using their cross-sections (cookies). Further analyses will allow students to graph their results and apply the knowledge gained to an understanding of tree growth, health and diversity.

Objectives
• Students will use and understand the following terms: radius, diameter, circumference and area of a circle.
• Students will calculate area and circumference (to check their circumference measurements).
• Students will make quality graphs, make predictions based on their data, and practice critical thinking skills.
• Students will communicate their findings and reasoning to a small group of students.

Lesson Preparation
Background Information:
Dendrochronology is the dating and study of annual tree rings. Dendrochronologists are scientists who use tree rings to answer questions about the natural world and the place of humans in this world. Tree rings can tell us many things, such as past and current environmental processes and conditions as well as help us understand possible future issues.

Two of the main kinds of trees are found in Interior Alaska: Alaska paper birch and white spruce. One way to study the health of trees is to look at tree cookies, cross sections of trees that can give a lot of information about the tree's growth history and health, such as age and growth conditions (water availability, temperature, pest populations, fire).

Procedure
Activity 1
Hand out 4 birch tree rings to each group of students.

Materials

- One set of 15 birch tree cross-sections (cookies)
- One set of 15 white spruce tree cookies
- Graph paper
- Pencil
- Sewing tape measure
- Activity 2 handouts
- Large graph paper
- Very large sheets of light colored paper for graphs to be glued on

Learning Resources

Tell students not to count the rings just yet. Ask students what tree rings can tell us and have them jot a list down on a piece of paper. Do a Continuous All Write Round Robin: Students share ideas around the group and everyone writes down the ideas if they have not already listed them on the paper. Share as a class and the teacher makes a list so that class can view. It is likely students will know that they can count the rings to find the age. Have students estimate the rings on each tree cookie in their group…do they all come up with similar estimations? Now students count the rings. Do the all come up with exact same answers? Do another All Write Round Robin answering, "Why do you think you came up with different answers?" Discuss as a class.

Activity 2

Show PowerPoint or have guest speak introducing tree rings, what they can tell us and maybe look at a couple of different methods to count them (I'm currently trying to see if I can get a guest speaker from the Laboratory of Tree Ring Research located at the University of Arizona to do this!).

Activity 3

Bring out the rest of the tree rings—these should be the White Spruce rings. Ask students to look and, doing an All Write Round Robin, list the differences between the two different kinds of tree cookies. Share as a class. Give students the handout and instruct students that they will be doing a small investigation to discover if it is possible to tell the age of a tree by its circumference. Students will be doing numerous measurements, then calculating circumference. Once all measurements are taken, students will use them to make graphs. Groups may work together, but each individual makes their own graphs.

Activity 4

Each student in the group needs to have their graphs completed. Have each student present and explain one of their graphs to the group. Then students decide on the best way to graph the final version as a team. Hand each group 2 large pieces of graph paper. The final version of their graphs goes on this paper, which is to be glued on a large piece of butcher paper. A table and one calculation should accompany each graph on the paper to show the data that is graphed. Have students hang graphs up at the time limit. Then do a gallery walk, where students go to each graph as a team and discuss. Possible questions to pose to the teams:

- What makes a good graph? A great graph?
- Do all teams have the same answer?
- Are example calculations accurate, thorough and easy to read?
- What could you do to make your calculations/proof more effective?
- Are all graphs the same? If not, what are the differences in the graphs?
- After looking at other graphs, what could you do to make your graph even better?
- Did other groups come up with the same conclusions?

Learning Resources

Activity 5 (optional)
Have students repeat Activities 2-4, except using the other set of tree rings they didn't originally work with and investigating relationships via the area of the tree cookie's surface.

Extension
Writing Connections: Compare and contrast the two sets of tree rings. What may cause the differences you notice?
Science: What are the parts of a tree ring? Explain the purpose of each part of the tree ring. What do you think the tree cookies of Alder would look like? Why?
Art: Make sketches of the bark of different trees. Give short descriptions of each bark. Predict why each bark is the way it is…is it thick, thin? Why? Then research your question to check your answer. Were you correct? If not, what is the actual reason for the type of bark?

Resources
http://www.idahoforests.org/cookie1.htm
http://www.treetures.com/RingALing/RingTeacher.html
http://ltrr.arizona.edu/

Assessment
n/a

Credits
Sunny Castleberry

Learning Resources

National Science Education Standards (NSES)

Content Standards, Grades 5-8

Content Standard A: Science As Inquiry
a. Abilities necessary to do scientific inquiry

Content Standard C: Life Science
a. Structure and function in living systems
d. Populations and ecosystems
e. Diversity and adaptations of organisms

Content Standard F: Science In Personal and Social Perspectives
b. Populations, resources, and environments

Content Standards, Grades 9-12

Content Standard A: Science As Inquiry
a. Abilities necessary to do scientific inquiry

Content Standard F: Science In Personal and Social Perspectives
c. Natural resources

Other Standards

Alaska State Standards
Mathematics Connections: [GLE M3.4.1, M6.4.1, M6.4.2, M7.4.2, M7.4.3]

Name _____ Date _____ Per _____

Activity 2: Tree Cookies & Circumference!

TREE COOKIES & CIRCUMFERENCE!

Question: Can you determine how old a tree is just by the tree's circumference? If so, what kind of a relationship do you expect to find?

Hypothesis: _____

Go through this activity to discover the answer to the question above! Along the way, you will also discover radius and diameter as well! Vocabulary words have an * in front of them ☺.

***Circumference** is the distance around the edge of a circle.

1. Find out how old each tree is by counting the tree rings. Record your data in the table provided.

2. Take your tape measure and measure the circumference of each tree ring for your specific series of tree cookies (either Birch or Spruce). Measure to the nearest tenth of a centimeter. Record your data in the table provided.

***Diameter** is the distance across the center of the circle (or tree cookie!) from one side to the other.

3. Measure the diameter of each tree cookie to the nearest tenth of a centimeter. Record your data in the table provided.

***Radius** is half the distance across the circle OR half the diameter.

4. Calculate the radius for each tree cookie. Show your evidence and record your data in the table provided.

Another way to get circumference is to calculate it using a formula. The formula for the circumference of a circle is $C = 2\pi r$ OR $C = \pi d$ where *r* is radius and *d* is diameter. You should know that $\pi \approx 3.14$. For example, if we measured the diameter as 11.5 cm and use the second equation, $C = \pi d$, we get $C = (3.14)(11.5) = 36.11\ cm$.

5. Calculate the circumference for each tree cookie. Show your evidence and then record in the table provided. Then answer the following questions in full sentences.

a. Did your calculated circumferences come out to be the exact same as OR close to your measured circumferences? Explain.

b. Are any of your measurements/calculations way off? What do you think happened?

c. Why do you think your teacher would want you to measure AND calculate the circumference when it would have been much easier to just measure the circumference of the tree cookies and be done with it?

6. Graph tree age vs. measured circumference on a graph. Get graph paper from your teacher. Remember to include a title, even intervals along the x and y-axis, and labels. Graph accurately and neatly.

7. Use your graph to explain your results.

ENRICHMENT: Is counting rings an accurate way of counting tree rings? Read the literature at the following website http://ltrr.arizona.edu/ . If you do not have access to a computer, go to the activity table in the back and look at some of the online handouts.

Name _____ Date _____ Per _____

Activity 5: Tree Cookies & Area!

TREE COOKIES & AREA!

Question: Is there a relationship between the age of a tree and the area of the surface of a tree cookie?

Hypothesis: _____

Go through this activity to discovery the answer to the question above! Along the way, you will also rediscover radius and diameter as well! Vocabulary words have an * in front of them and are in **Bold** ☺.

***Area is the extent of a two-dimensional surface or shape; i.e. it can be thought of as the amount of material needed to cover a surface.**

1. Find out how old each tree is by counting the tree rings. If you worked with birch tree rings the other day, you should be working with white spruce tree rings today. Record your data in the table provided.

2. Take your tape measure and measure the circumference of each tree ring for your specific series of tree cookies (either birch or spruce, whichever set you are working with). Measure to the nearest tenth of a centimeter. Record your data in the table provided.

***Diameter** is the <u>distance across the center of the circle</u> (or tree cookie!) <u>from one side to the other.</u>

3. Measure the diameter of each tree cookie to the nearest tenth of a centimeter. Record your data in the table provided.

***Radius** is <u>half the distance across the circle</u> OR <u>half the diameter.</u>

4. Calculate the radius for each tree cookie. Show your evidence and record your data in the table provided.

We will use radius to calculate the area of the tree rings. Unlike circumference, you MUST use radius (NOT diameter) to calculate area. The formula for the area of a circle is $A = \pi \cdot r^2$ where r^2 is radius times radius and $\pi \approx 3.14$.

5. Calculate the area for each tree cookie. Show your evidence and then record in the table provided. Check answers with another team member. Answer the questions below.

    a. Were ALL your answers the exact same or similar to those of another team member?

    b. If not, why? What did you both do in order to explain and fix the differences in your calculations?

6. Graph tree age vs. measured area on a graph. Get graph paper from your teacher. Remember to include a title, even intervals along the x and y-axis, and labels. Graph accurately and neatly.

7. Use your graph to explain your results. Was your hypothesis correct? Why or why not?

ENRICHMENT: Is counting rings an accurate way of counting tree rings? Read the literature at the following website http://ltrr.arizona.edu/ . If you do not have access to a computer, go to the activity table in the back and look at some of the online handouts.