Temperature Activity 3

Temperature Through Time

Objectives and Standards
- To learn about methods of recording climate in the past using proxies like tree rings.

NSTA Standards Addressed
Content Standards
A, B, C, D, E, F, G

4-H SET Abilities Addressed
Evaluate
Measure
Observe
Communicate
Summarize/Relate
Model/Graph/Use numbers
Compare

Supplies Needed

- History of Temperature handout
- The Stump worksheet with drawn 'tree cookie'
- a real tree cookie, if available

Background

Tree rings can record aspects of climate as they grow. Each year a tree grows a new ring as it gets thicker and grows taller. The thickness of the ring is dependent upon the climate conditions during the summer; a better growing climate for the tree results in thicker rings, while a poor growing climate for the tree results in thin rings. Tree cookies are thin slices of a tree trunk. They expose the growth rings produced by the tree during its life. This activity provides information on how scientists use 'proxy' information, like that from tree rings, to learn about ancient climates.

CoCoRaHS Extension

Because CoCoRaHS volunteers and the data collected by them records weather, and because not all areas have had CoCoRaHS volunteers long enough to estimate a climate trend for your region, compare data that has been collected by CoCoRaHS volunteers in your area to a Farmer's Almanac of your area. Farmer's Almanacs can be found in your local library and record daily weather for years. Observe similarities and differences. In what ways would a Farmer's Almanac be useful?

Activity

1. Hand out the History of Temperature handout to youth and ask them to read it alone or in groups.
2. Bring the group together and discuss what they learned from the hand out. Did they find out anything new or exciting?
3. Hand out the Stump worksheet to the youth. If you have your own tree cookie, you can use it in place of the one on The Stump worksheet.

Discussion

While tree rings alone cannot tell the entire story, knowing about what types of environments different trees lived in help to put the rest of the story together. Specifically, when trees live near the edge of their habitat range, they are more susceptible to changes in temperature and precipitation. When multiple tress from multiple habitats across the globe are studied, climate reconstructions from trees tell an amazing story of the history of Earth's climate. In addition to data from other forms of proxy evidence, climate scientists have been able to reconstruct Earth's climate for over 800,000 years!

The History of Temperature

We take our knowledge of temperature for granted today. As we get up in the morning to start our days, newspapers and television sets tell us about the expected temperature highs and lows, so we are prepared when we leave the house. Many of us also look outside our window to see a thermometer displaying temperature at our house at that moment. Our instruments for predicting and recording temperature have gotten much better through time, and we can certainly be thankful. Since around 1850, our thermometers have been accurately calibrated and our recordings have been frequent enough throughout the day for us to have a very accurate record of temperature each day in regions around the Earth.

We can also approximate (make an intelligent guess about) the temperature without turning on our T.V. or looking out the window. Based on the area where you live, you may know that winter will be chilly and summer will be warm. Farmers do this, too. Farmers and gardeners want to know when the last frost will be in their area so that they can plant their crops and flowers without fear of losing them to cold weather. To do this, they look up the temperature in their area for many many past years for each day to determine a good time to plant in their area that year, so that their plants will have plenty of time to grow without perishing in the cold weather.

Weather patterns that are consistent in an area for a long period of time constitute the climate. Having a warm or cold climate does not mean that every day will be warm or cold; certainly a cool climate can have some hot days, and a place with a warm climate, like Florida, can have some very chilly days, even snowy days! But, on average, a warm climate will have mostly warm days and a cool climate will have mostly cool days.

Humans are not the only creatures on Earth that are affected by changing temperatures; birds migrate south for the winter, deciduous trees shed their leavs and slow their growth until spring, bears hibernate until there is more food for them to feed on. All over the planet, organisms react to changing temperatures. And where you live as an organism dictates what type of climate, what consistent temperatures and precipitation, you can tolerate. We certainly don't find palm trees in Canada, nor do we see many pine trees in Florida. Organisms adapt to a particular climate over long periods of time so that they are able to handle the consistent temperatures and precipitation in their environment.

With that knowledge, we can learn things about temperature long before we had accurate thermometers all over the globe. We can use nature's thermometers, the organisms themselves, to help figure out the temperatures of regions all over the planet for hundreds, and even thousands, of years!

This data is called proxy information, because it is recorded with second-hand knowledge. Think about a conversation you had recently with your parents, where you recount what you and your friends did at school one day, or at the beach. They don't get a full account of how you spent every minute of your day, but by the end of your story they understand what you did, who was there, if you had fun, if you have homework, and other important information. They experienced your trip or schoolday 'by proxy,' with second-hand information.

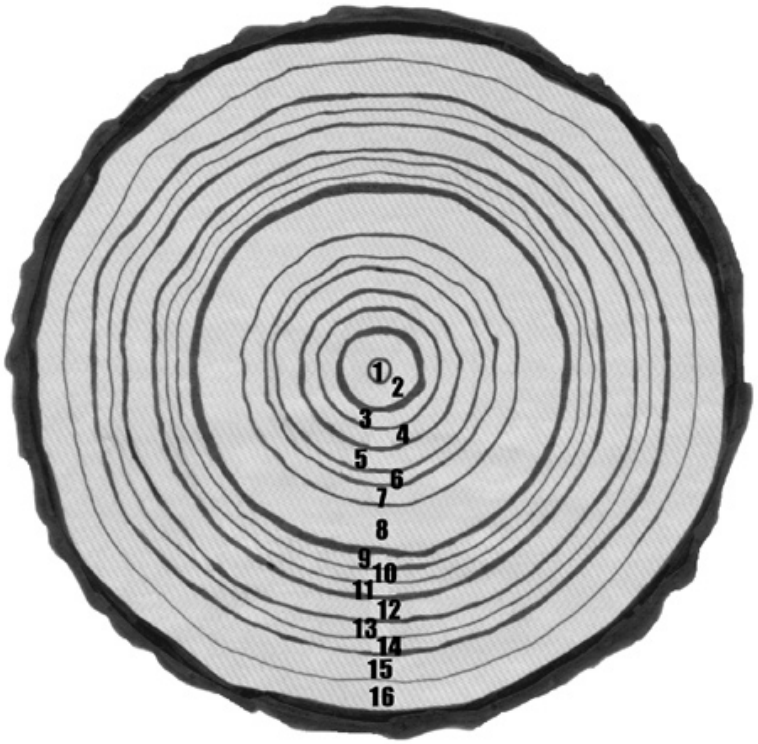
We're going to focus in on using trees as a proxy today. Trees can live a long time. There are some redwood trees in the US that are nearly 2000 years old! When trees die, they often (geologically speaking) fall into the swamp in which they are growing, or into a nearby lake, and preserve until geologists find them. And how do we calculate the age of the tree? Tree rings! Each year, a tree grows a new ring of wood under their bark. The width of the ring tells us about climate that year because the growth rate of the trees depends largely on temperature and precipitation during the growing season. Trees grow more during warm, wet years, making wider rings, and less during cold, dry years, making narrow rings. They can also tell stories about extraordinary events that happened during the tree's life, like fires, that were big enough to have affected the tree's growth. Scientists who study tree rings are called Dendrochronologists (dendro = trees, chronology = timeline).

When you look at the rings of trees alive since 1850, the width of the ring can be calibrated to the accurately recorded temperature and precipitation conditions of that year. Then, older rings of live trees and those of dead trees can be used as proxies of temperature and precipitation for those years before we had accurate temperature records. In the case of redwoods, we could get a temperature and precipitation record of the northwestern US for thousands of years!

Paleontological Research Institution
TRACKING CLIMATE IN YOUR BACKYARD

The Stump Worksheet

Use your own tree cookie, or the picture supplied below, to answer the questions!



This tree was cut 3 years ago. Write that year. _____

How old was the tree? _____

What year did the tree start growing? _____

Find the ring that grew the year you were born. Was it a a cool, dry year or a warm, wet year? How do you know? _____

_____

_____

In what year of growth was it the coolest and dryest? _____
Warmest and wettest? _____

Make a Tree Ring Timeline!

1. Take the image above and fold it in half and place it on another sheet of paper, or cover half of your tree cookie with paper.
2. With a pencil, place a small tick mark on the paper where each tree ring stops.
3. Remove the folded tree cookie paper or tree cookie.
5. You now have a series of vertical lines.
6. Extend these lines so they are about 1/4 inch long. With a ruler, draw a horizontal line connecting each tick mark. It should look similar to the image on the right.
7. Label each year. You have now made a timeline! If you do this with many tree cookies, you can line up the timelines together to make an even longer timeline!

Please send us your feedback!

As a 4-H Educator, you know what has worked well, what has not, and how we can improve the *Tracking Climate in Your Backyard* curriculum. Please share your feedback about the curriculum. We'd love to receive copies of any reports or newspaper coverage about completed *Tracking Climate in Your Backyard* projects.

Fax or mail your completed feedback to Trisha Smrecak, Museum of the Earth, 1259 Trumansburg Rd., Ithaca, NY, 14850 or fax to: 607-273-6620.

Check the activity completed	Suggestions for improving the activity
Rainfall Activities ☐ Make It Rain ☐ Where Does the Rain Come From? ☐ Stormy Weather	
Snowfall Activities ☐ Confetti Snow Maps ☐ How Much Water? ☐ Edible Education ☐ The Snowflake Game ☐ Snow Journaling	
Temperature Activities ☐ Energetic Weather ☐ Shade of the Old Oak Tree ☐ Temperature Through Time	
Wind Activities ☐ Why Does the Wind Blow? ☐ Make Your Own Wind Dial	
Hydrologic Cycle Activities ☐ The Incredible Journey ☐ Understanding Evapotranspiration ☐ Pinecones: Mother Nature's Weather Forecasters ☐ What is a Watershed?	
Climate Activities ☐ Where is My Backyard? ☐ Soak up the CO_2 ☐ Buckets O' CO_2 : How Your Backyard Can Change the Ocean ☐ Raise the Waters	
CoCoRaHS Participation ☐ Precipitation measurements and other activities	

Please share your suggestions for improving the Tracking Climate in Your Backyard curriculum.

How have you used Tracking Climate in Your Backyard in your community?

Thank you for completing the Tracking Climate in Your Backyard curriculum feedback. We appreciate learning about how you are using the curriculum and receiving your suggestions for improving it.

Organization _____ **Contact Person** _____

Email _____ **Date** _____