Temperature Through Time

Name: _____

Date: _____

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 the 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 to provide a very accurate record of daily temperatures 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 leaves and slow their growth until spring, and 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 recounted 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 school day 'by proxy,' with second-hand information.

We're going to focus on using trees as a proxy today. Trees can live a long time. Some redwood trees in the US 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 remain 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 its bark. The width of the ring tells us about the 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!