

Fossil Journal

Nature in the Classroom

Slater Museum of Natural History
University of Puget Sound
Tacoma, Washington

Name:

School: _____ Grade:

Start date: _____ End date:

Where I found my leaf: _____

When I found my leaf: _____

Place your leaf here to create a leaf rubbing on page 4.

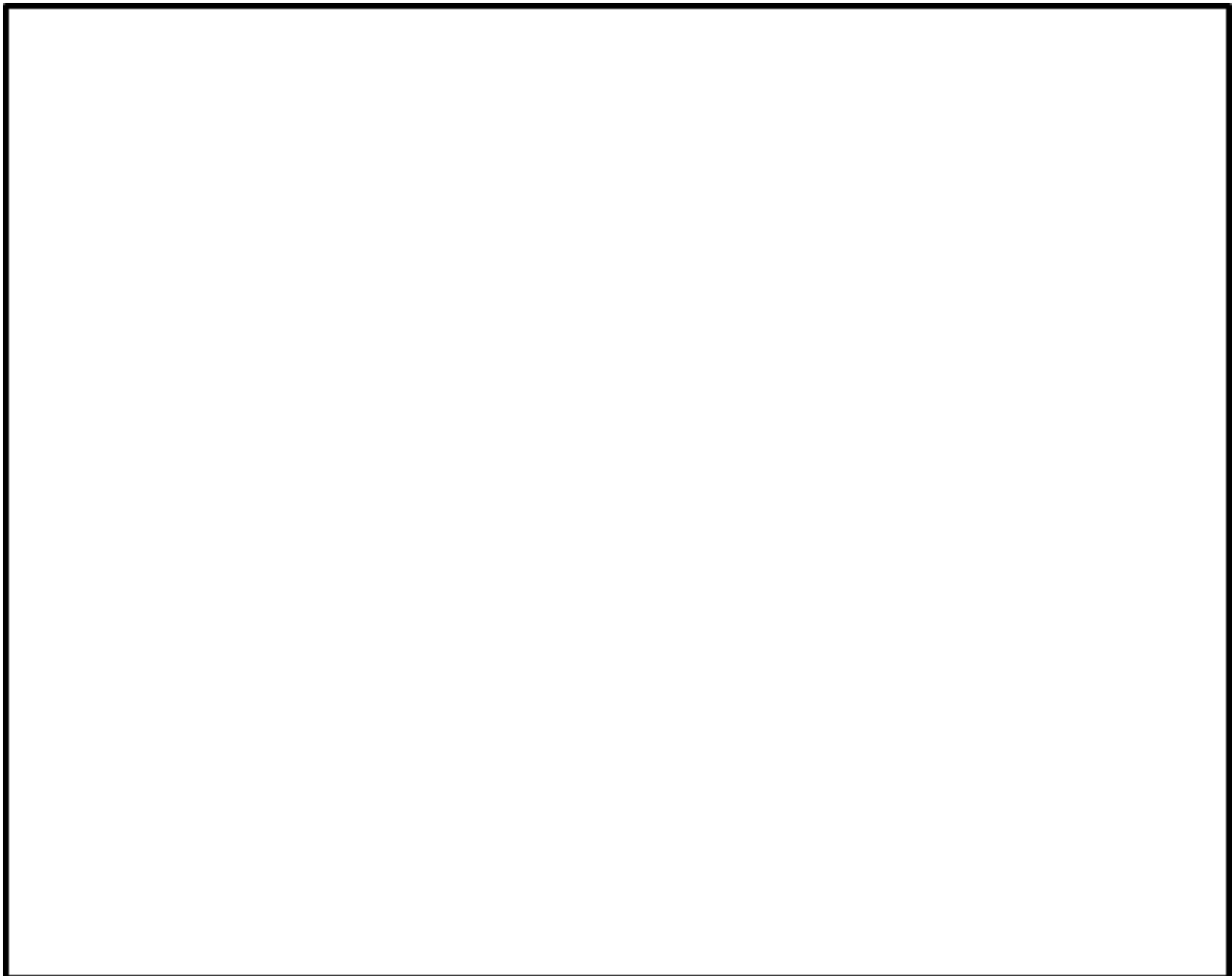


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This curriculum and journal were authored by Robert Niese, Sal Greenberger, Mary Krauzer, and Slater Museum of Natural History staff. The Slater Museum of Natural History's goals are to preserve and provide a collection of specimens to be used for research, education and inspiration. The museum houses one of the largest collections of Pacific Northwest bird, mammal, reptile, amphibian and plant specimens. We appreciate the support of the Institute of Museum and Library Services, Mortensen Family Foundation, and Wells Fargo Foundation in the development of these materials.

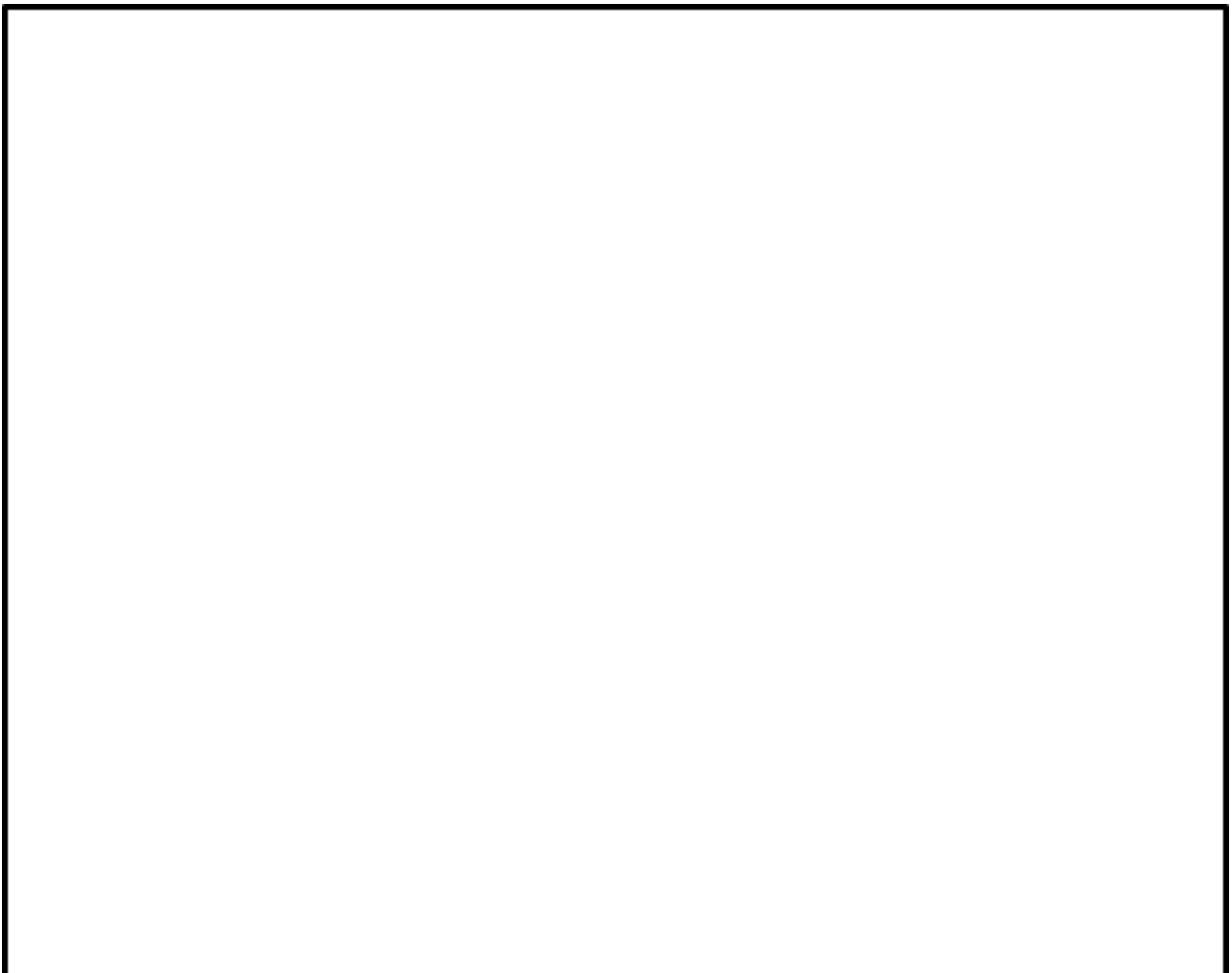
Lesson 4:

Leaves of Change – Reading the Fossil Record

Goal

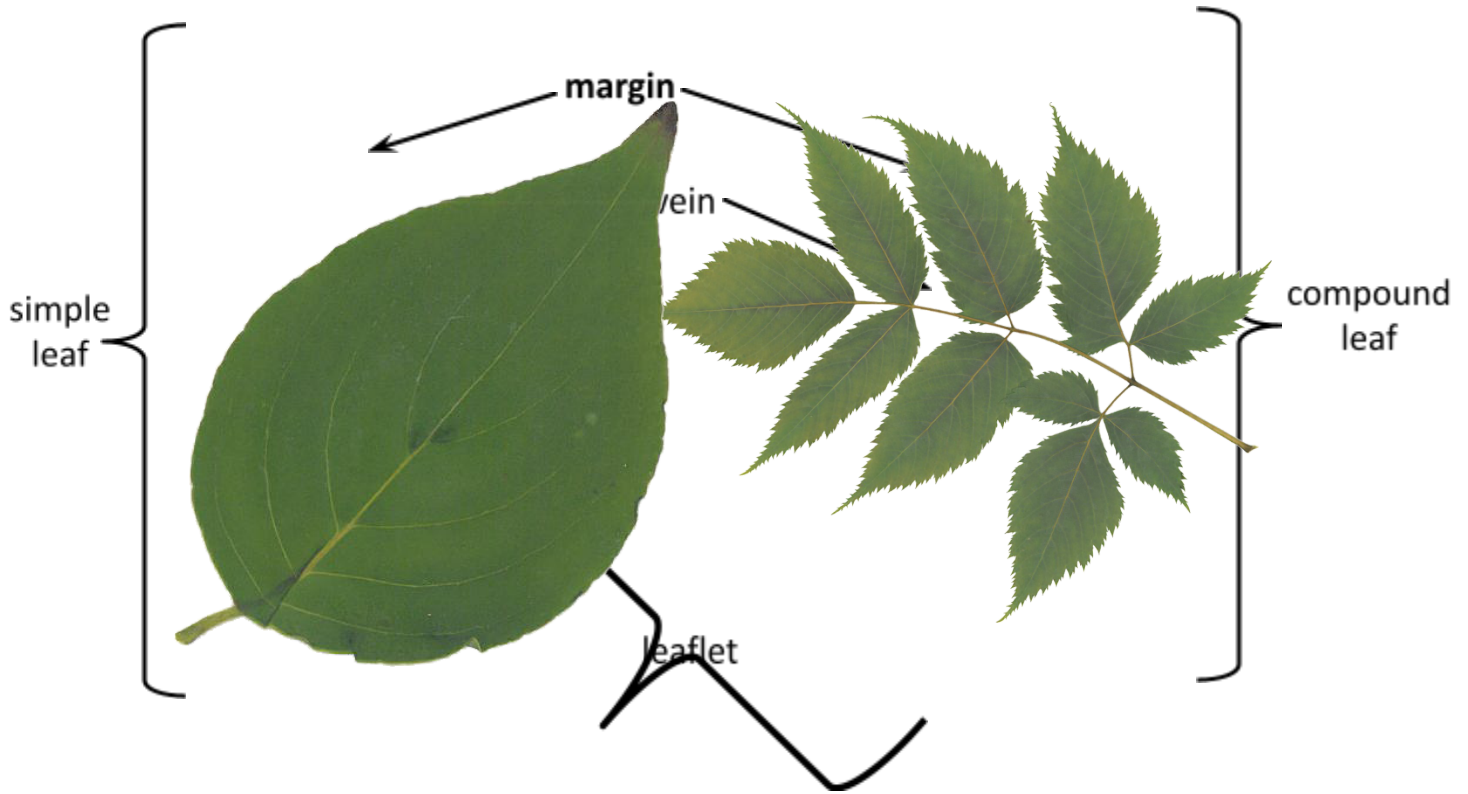
Students will learn how paleontologists can use observations about present-day Earth to better understand the past.

Leaf Rubbing: Place your leaf on page 1 to create a rubbing here.

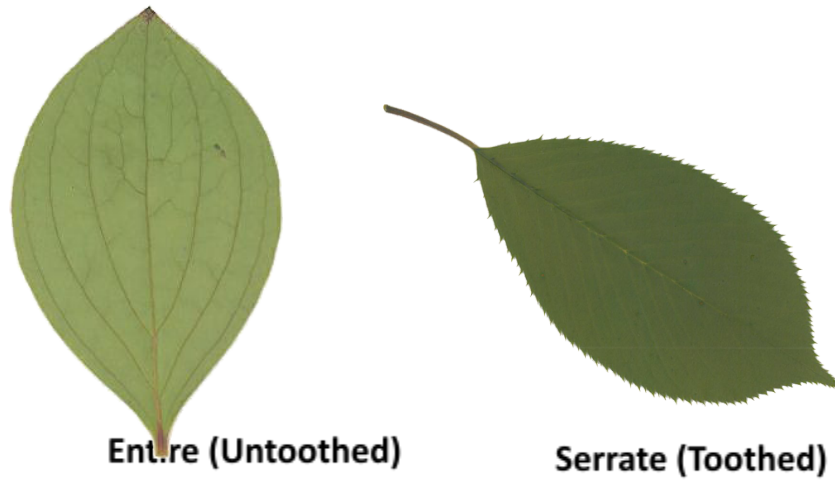


Lesson 4: Leaves of Change—Reading the fossil record
Leaf Margins Diagram

Leaf Anatomy



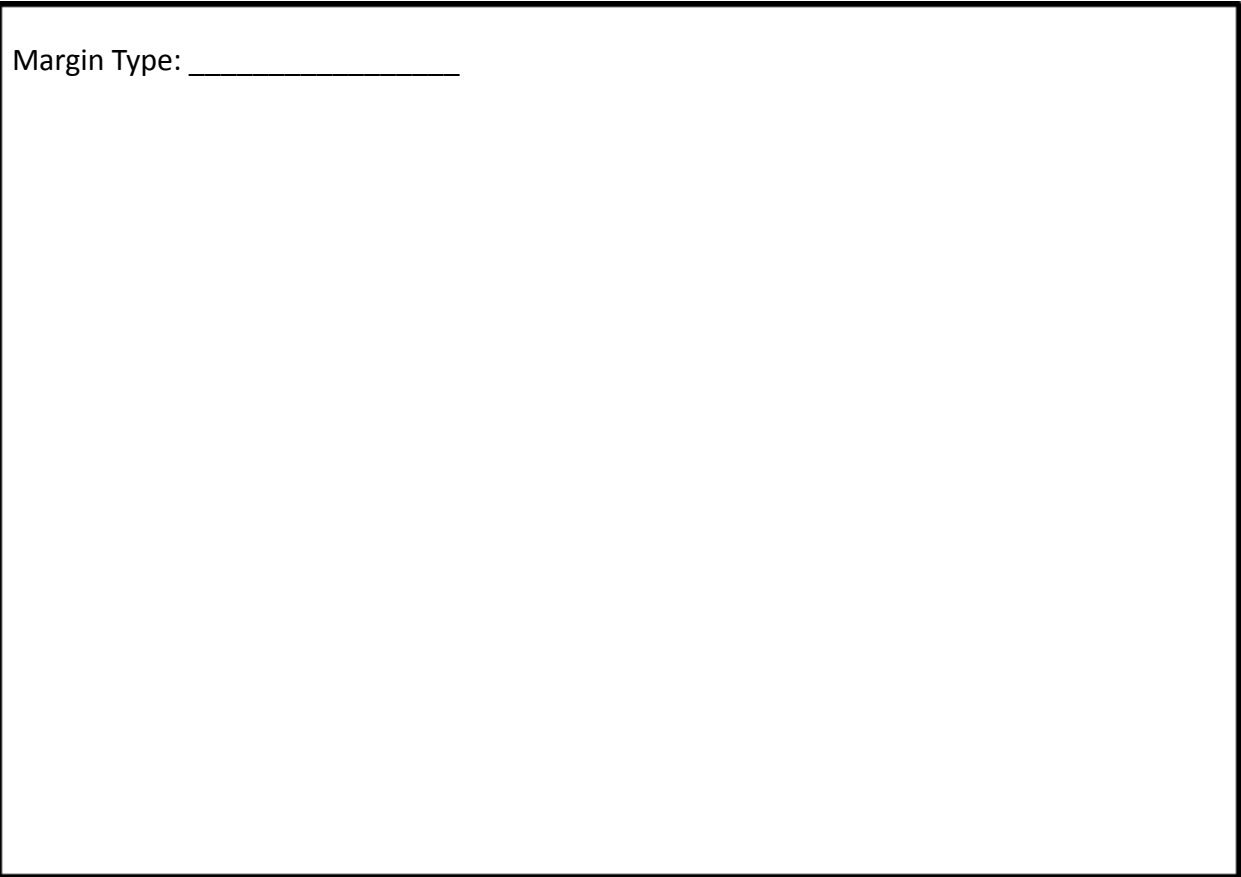
Leaf Margins



Lesson 4: Leaves of Change—Reading the fossil record
Practice Worksheet: Introduction to Leaf Margins

Sketch the leaf you brought in to class in the space provided. Make sure to draw accurate margins, vein patterns, and shape. The Margin Type is the group your teacher put your leaf in—Toothed or Untoothed.

Margin Type: _____



Lesson 4: Leaves of Change—Reading the fossil record
Extant Leaves: Data Collection Worksheet

Plant Communities around the World

Note the location of your Plant Community in the world. Look at each plant in your community and, using what you have learned about leaf morphology, place each plant into the correct category based on its leaf margins (toothed or untoothed). Count the types of plants and record them below.

Collecting data from your Plant Community –

My Plant Community is from _____.

Plants with Untoothed Margins: _____

Plants with Toothed Margins: _____

Total Plants: _____

Calculating the Fraction of Untoothed Leaves –

$$\frac{\begin{array}{l} \# \text{ Plants with} \\ \text{Untoothed Margins} \end{array} \boxed{}}{\begin{array}{l} \# \text{ Total Plants} \end{array} \boxed{}} = \text{Fraction of} \\ \text{Untoothed leaves}$$

What is the relationship between the number of untoothed leaves and the Fraction of Untoothed Leaves?

Finding the Mean Annual Temperature of your Plant Community –

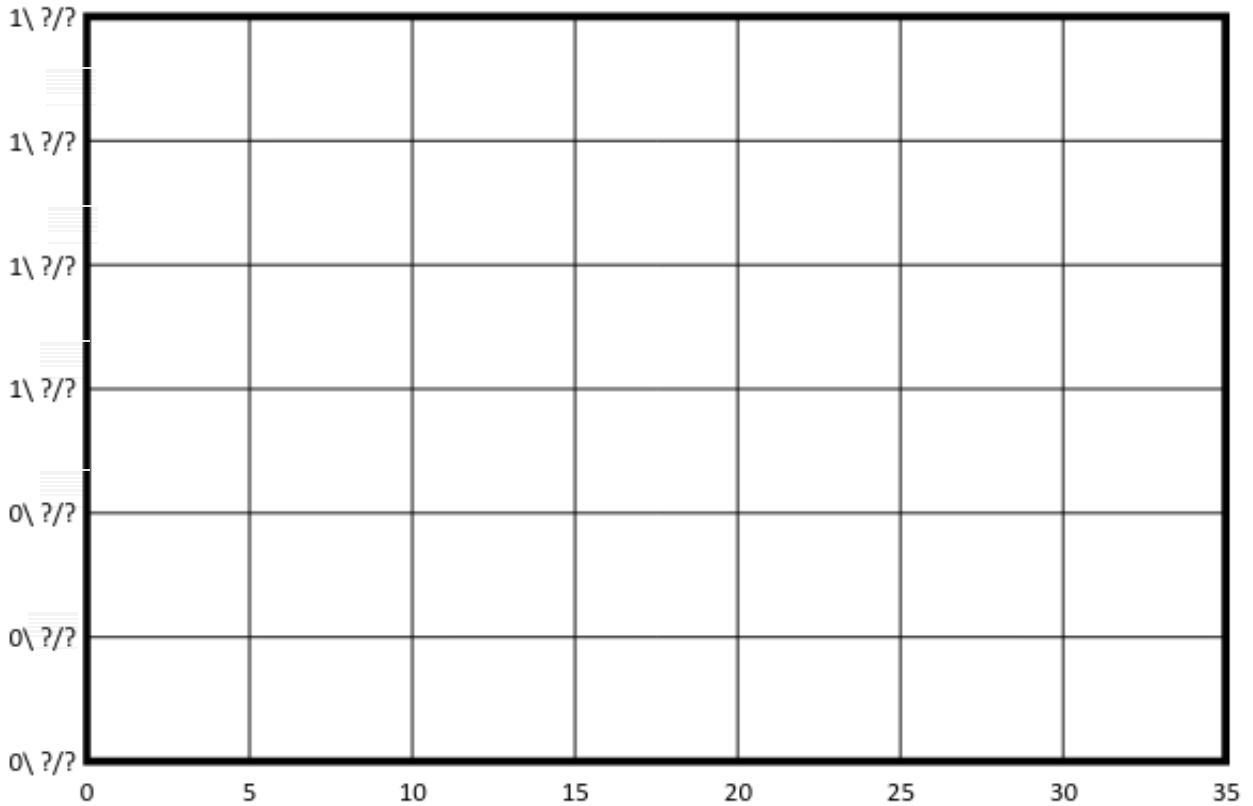
Look at the map on the other side of your laminate to find the M.A.T. at the location of your Plant Community.

The Mean Annual Temperature in my Plant Community is _____.

Lesson 4: Leaves of Change—Reading the fossil record

What the Fraction of Untoothed Leaves and M.A.T. Tell Us

Find the point where your Mean Annual Temperature (x-axis) and P-value (y-axis) line up on the graph, and make a dot. We will share all the data from Plant Communities around the world to add many dots and eventually make a line.



What is the trend you see on the graph? What does this show about the relationship between MAT and the Fraction of Untoothed Leaves?

For example, in a place with a high MAT would you see many or few Untoothed leaves?

Lesson 4: Leaves of Change—Reading the fossil record
Extant Leaves: Data Collection Worksheet

Making a Prediction about the Past –

I think Washington was (circle one): warmer or colder 110 million years ago.

According to your prediction, what would leaf margins in Washington be like 110 million years ago? Why?

Extant Washington Leaf Community –

Note what color box your group has. Using what you have learned about leaf morphology, place each leaf into the correct category based on its margins (Toothed or Untoothed). **Check the box that describes the margin of each leaf.**

My Group Color: _____

Leaf ID #	Toothed Margin?	Untoothed Margin?

Lesson 4: Leaves of Change—Reading the fossil record
Extinct Leaves: Data Collection Worksheet

Pick one extinct leaf fossil and sketch it in the space below. Make sure to add as much detail as possible regarding its margins, vein patterns, and shape.

Leaf # _____	Margin Type: _____

Note what color box your group has. Using what you have learned about leaf morphology, place each leaf into the correct category based on its margins (Toothed or Untoothed). Use the table below to record your data.

My Group Color: _____

Leaf #	Toothed Margins?	Untoothed Margins?

Lesson 4: Leaves of Change—Reading the fossil record
Class Totals: Data Collection Worksheet

Fill-in the spaces below for your group color only. Then as a class, fill in the remaining spaces.

Extant Washington Plant Community –

	# Untoothed Plants	# Plants in Community
Red Group		
Blue Group		
Green Group		
Totals		

$$\frac{\text{Total Untoothed Plants}}{\text{Total Plants in Community}} = \text{Fraction of Untoothed leaves}$$

Fossil Washington Plant Community –

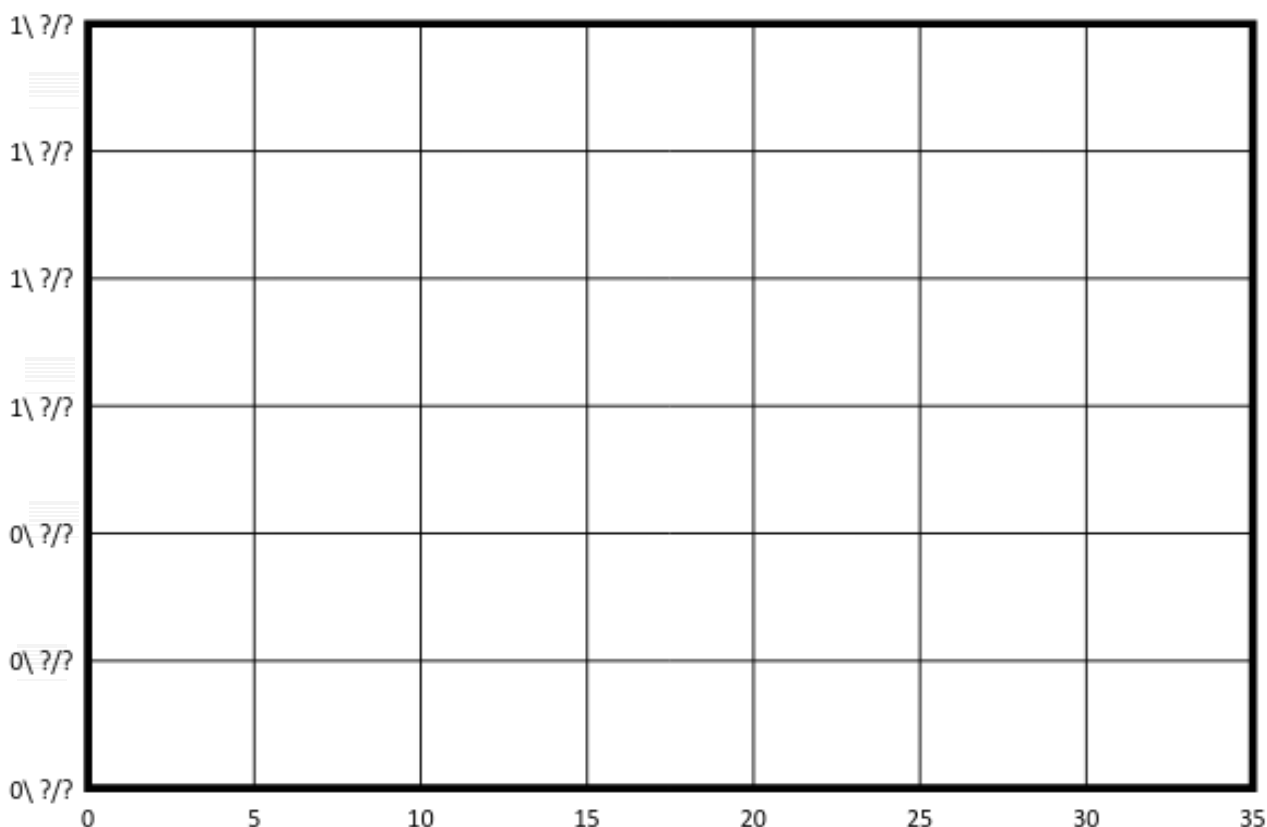
	# Untoothed Plants	# Plants in Community
Red Group		

$$\frac{\text{Total Untoothed Plants}}{\text{Total Plants in Community}} = \text{Fraction of Untoothed leaves}$$

Blue Group		
Green Group		
Totals:		

Lesson 4: Leaves of Change—Reading the fossil record
Graphing and MAT

Graph your Fraction of Untoothed Leaves (on the y-axis) to find the Mean Annual Temperature (x-axis). Do this twice – once for your fossil leaves and once for your extant leaves.



Fraction of Untoothed leaves for extant plant communities: _____

MAT of Washington today: _____ °C

Fraction of Untoothed leaves for extinct plant communities: _____

MAT of Washington 110 million years ago: _____ °C

**Lesson 4: Leaves of Change—Reading the fossil record
Conclusion Worksheet**

Now that you have found the MAT for present-day Washington (extant leaves) and Cretaceous Washington (extinct leaves), was our state warmer or colder 110 million years ago? Explain how you figured this out- make sure to include a summary of the trend you found between the Fraction of Untoothed Leaves and the MAT .

Glossary:

- adaptation
a trait, or characteristic of a trait, which improves an organism's ability to survive and reproduce in its environment
- climate
the typical weather conditions of a region; includes temperature, air pressure, humidity, rainfall, sunshine, cloudiness, and winds, throughout the year, averaged over many years
- community
(in biology) a group of many species of organisms that interact in an area
- ecosystem
a community of organisms and their physical habitats
- entire
(in reference to margins) smooth edged, without teeth
- extant
still in existence
- extinct
no longer in existence
- fossil
the remains or impression of a prehistoric organism preserved in rock
- leaf margin
the edges of a leaf
- MAT
acronym for "mean annual temperature"; the average of all temperatures for a given region in a year
- mean
(in math) the average; the sum of all quantities divided by the number of quantities
- paleontology
the study of ancient existence
- serrate
(in reference to margins) toothed, jagged