Exploring Factors that Affect Tree Growth

Author: Debbie French, PhD

Frenchd14@yahoo.com

**Description of Activity**

* Students will work through a simulation to discover how environmental factors such as temperature and rainfall amount effect tree growth. Students will then watch a video of Bob Taylor on his World Forestry Tour to learn about sustainable forestry methods across the globe. Students will then research average temperature and rainfall amounts for the location they have selected. Students will then reflect on why knowing about environmental factors and sustainable forestry are important to the guitar industry.
* This activity is targeted towards grades 7-10, but can be scaled up or down to accommodate students’ needs. This could be used in a life science, earth science, wood shop, or guitar-making class.

**Learning Objectives:**

1. Students will be able to **explain** how environmental factors such as rainfall and temperature affect tree growth.
2. Students will be able to **create** and **analyze** graphs of temperature and rainfall amounts.
3. Students will be able to **explain** why knowing about environmental factors that affect tree growth is important to the guitar manufacturing industry.

**Standards:**

**Next Generation Science Standards:**

|  |  |  |
| --- | --- | --- |
| Student Performance Expectation: | | |
| **MS-LS1-5:** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. | | |
| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-5) | Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5) | Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4),(MSLS1-5) |

CCSS ELA/Literacy:

**WHST.6-8.2:** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant

content. (MS-LS1-5)

**WHST.6-8.90SL.8.5:** Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5)

CCSS Math:

**6.SP.A.2:** Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

**Materials Required:**

* Computers with internet access
* Paper/Pencil

**Safety:**

**safetys:**

* There are no safety concerns for this activity.

**References:**

* Students will need access to the following site to use the simulation:

https://scied.ucar.edu/tree-ring-interactive

**Activity:**

* Students will use the UCAR tree ring simulation to learn how environmental properties affect tree growth. See attached sheets for a more complete description.

**Reviewing Faculty Cohort Members:**

* Doug Hunt, Southern Wells High School

Exploring Factors that Affect Tree Growth—Student Handout

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Directions: Your task is to complete Levels 1-5 plus the, “Sandbox” level for the, “Decoding Past Climate with Tree Rings” Simulation available at the link below:

<https://scied.ucar.edu/tree-ring-interactive>

**Before you begin:**

Define *dendrochronology*:

**Level 1: Moisture**

For this part of the simulation, your task is to replicate the right side of the tree by adding rings that have grown under dry, normal, or wet conditions. To add a new tree ring, select on the level of moisture (dry, normal, or wet) and then click on the, “Grow New Ring” icon. Your tree ring should match the size of the tree ring on the right. If you guessed incorrectly, click on the, “Remove Last Ring” icon and try again.

Before you begin, predict which moisture conditions will allow the tree the most during the year: [circle your answer]

Dry Normal Wet

Now, complete the simulation & record your score below:

Score for this simulation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Which moisture conditions created tree rings with the largest growth?
2. Which moisture conditions created tree rings with the least growth?
3. How do the results match your prediction?
4. In your own words, describe two limitations with this model:
5. A

**Graph for Level 1:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  | Temperature | | |  | Moisture | | |  |
| Moisture |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Wet |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Normal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Dry |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

When finished, click on the, “home” icon to return to the main page.

**Level 2: Temperature**

In this simulation, you will look at how temperature affects tree growth rings. Keep in mind, this is a generalization. Some trees do prefer colder temperatures; others prefer to grow in warmer temperatures. To add a new tree ring, select on the temperature level (cold, normal, warm) and then click on the, “Grow New Ring” icon. If you guessed incorrectly, click on the, “Remove Last Ring” icon and try again until the new ring on the left matches the tree ring on the right.

Before you begin, predict which temperatures will allow the tree a lot during the year: [circle your answer]

Cool Normal Warm

Now, complete the simulation & record your score below:

Score for this simulation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Which temperature (cool, normal, or warm) created tree rings with the largest growth?
2. Which temperature created tree rings with the least growth?
3. How do the results match your prediction?

**Graph for Level 2:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  | Temperature | | |  | Moisture | | |  |
| Temperature |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Warm |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Normal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Dry |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |

When finished, click on the, “home” icon to return to the main page.

**Level 3:** In the real world, trees are subjected to a variety of temperature conditions and rainfall amounts. Your task is to adjust both the moisture levels *and* the temperatures to get the same tree ring pattern as on the right.

Before you begin, which combination of factors do you think will help the tree grow the most in a year? Circle one *moisture* level and one *temperature* level:

Moisture: Dry Normal Wet

Temperature: Cool Normal Warm

Now, complete the simulation & record your score below:

Score for this simulation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Graph for Level 3:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | |  | |  | |  | |  | |  |  | Temperature | | | | | |  | | | Moisture | | | | | | | |  | |  | |  | |
| Temperature | Moisture |  | |  | |  | |  | |  | |  |  |  | |  | |  | |  | | |  | |  | |  | | | |  | |  | |  | |
| Warm | Wet |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | |  | |  | |  | |  | |
| Normal | Normal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | |  | |  | |  | |  | |
|  | Dry |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | |  | |  | |  | |  | |
|  | Year | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | | 12 | | 13 | | 14 | | | | 15 | | | |

1. The tree ring formed during year #4 had the largest growth. What were the temperature and moisture levels that year? [Hint: you may have to look at the graph]
2. The skinniest tree ring was formed in year #12. What were the temperature and moisture levels that year? [Hint: you may have to look at the graph]
3. How do the results match your prediction?

When finished, click on the, “home” icon to return to the main page.

**Level 4: The Long Spell.** This task will be similar to Level 3. You will be adjusting the moisture and temperature levels to match the tree rings on the sample to the right.

Now, complete the simulation & record your score below:

Score for this simulation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What were the moisture levels from years 5-13? How did this effect tree growth?
2. The skinniest tree ring is from year #10. Describe what the moisture and temperature levels were during that year:
3. The largest tree ring is from #14. Describe what the moisture and temperature levels were during that year:

**Graph for Level 4:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | |  | |  | |  | |  | |  |  | Temperature | | | | | |  | | | Moisture | | | | | | | |  | |  | |  | |
| Temperature | Moisture |  | |  | |  | |  | |  | |  |  |  | |  | |  | |  | | |  | |  | |  | | | |  | |  | |  | |
| Warm | Wet |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | |  | |  | |  | |  | |
| Normal | Normal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | |  | |  | |  | |  | |
|  | Dry |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | |  | |  | |  | |  | |
|  | Year | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | | 12 | | 13 | | 14 | | | | 15 | | | |

When finished, click on the, “home” icon to return to the main page.

**Level 5: A Gradual Trend**. This task is also similar to Levels 3 and 4. You will be adjusting the moisture and temperature levels to match the tree rings on the sample to the right.

Now, complete the simulation & record your score below:

Score for this simulation: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. The skinniest tree ring is from year #6. Describe what the moisture and temperature levels were during that year:
2. The largest tree ring is from years #8 and #13. Describe what the moisture and temperature levels were during that year:

**Graph for Level 5:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | |  | |  | |  | |  | |  |  | Temperature | | | | | |  | | | Moisture | | | | | | | |  | |  | |  | |
| Temperature | Moisture |  | |  | |  | |  | |  | |  |  |  | |  | |  | |  | | |  | |  | |  | | | |  | |  | |  | |
| Warm | Wet |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | |  | |  | |  | |  | |
| Normal | Normal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | |  | |  | |  | |  | |
|  | Dry |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | |  | |  | |  | |  | |
|  | Year | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | | 12 | | 13 | | 14 | | | | 15 | | | |

**Level 6: Sandbox.** Not all trees like the same temperature and moisture level. In the upper right-hand corner of the simulation, click on the dropdown menu for, “Choose a Tree to Match.” Circle which tree you have chosen in the space below. Your task is to identify which combination of moisture level and temperature preferred by the tree species you chose.

Ash Aspen Beach Birch Elm

Maple Oak Redwood Willow

1. Temperature and moisture levels that promotes the most growth:
2. Temperature and moisture levels that prohibits growth:

**Conclusion:**

1. You may have heard of the famous violin maker, Antonius Stradivarius. His violins are regarded as being the best in the world. For years, researchers have tried to identify the secret to his violins. One possible hypothesis is that the density of the wood may be a factor—the denser the wood, the better the violin sounds. What combination of temperature and moisture levels would create a very dense tree—a tree with lots of small, compact rings, showing little growth? Use data from this simulation to support your answer.
2. What other scientific questions do you have about factors that influence tree growth?

1. As a luthier (guitar maker), why is it important to understand factors that influence tree growth?

Exploring Factors that Affect Tree Growth—Extension Activity

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_

For an extension activity, you can follow Bob Taylor [Taylor Guitars] around on his World Forestry Tour.

|  |  |
| --- | --- |
| Location | YouTube Link |
| Ireland | https://www.youtube.com/watch?v=Bmv2RIIOrpc |
| Guatemala | https://www.youtube.com/watch?v=3Y3ItVCjmSc |
| Cameroon | https://www.taylorguitars.com/videos/sustainability/bob-taylor-s-world-forestry-tour-in-the-village-cameroon-april-28-2017/85726817-90451888/ |
| Fiji | https://www.youtube.com/watch?v=rgY8\_vAmH-Q |
| Vietnam | https://www.youtube.com/watch?v=Sj27NzqLPMw |
| Malaysia | https://www.youtube.com/watch?v=Z8NgAW-iG9Y |
| Hawaii | <https://www.youtube.com/watch?v=cgy6mEV5yNA> |

First, select a location and watch the accompanying video to answer these questions:

Part 1:

1. Location:
2. Type of tree(s)
3. How are these trees being grown and harvested in a sustainable way?
4. How is this type of wood used in a guitar?

Part 2: For this section, you will have to do some outside research on your own.

1. What biome is the location you selected in?
2. What are the following temperatures (or ranges) for your location?
   1. High temperature:
   2. Average temperature:
   3. Low temperature:
3. Average yearly rainfall:
4. Is there a rainy season? If so, when is the rainy season?
5. Graph the average temperature for each month and the average rainfall for each month on the graph below:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Rainfall | Jan | Feb | Mar | April | May | June | July | Aug | Sept | Oct | Nov | Dec | Temp. |

Tree Rings—Answer Key

Name: Answer Key Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Directions: Your task is to complete Levels 1-5 plus the, “Sandbox” mode for the, “Decoding Past Climate with Tree Rings” Simulation available at the link below:

<https://scied.ucar.edu/tree-ring-interactive>

**Level 1: Moisture**

For this part of the simulation, your task is to replicate the right side of the tree by adding rings that have grown under dry, normal, or wet conditions. To add a new tree ring, select on the level of moisture (dry, normal, or wet) and then click on the, “Grow New Ring” icon. If you guessed incorrectly, click on the, “Remove Last Ring” icon and try again.

Before you begin, predict which moisture conditions will allow the tree a lot during the year: [circle your answer]

Dry Normal Wet

Answers will vary

Now, complete the simulation & record your score below:

Score for this simulation: Answers will vary. The higher the student’s score 🡪 the more correct guesses the student provided.

1. Which moisture conditions created tree rings with the largest growth?

Wet conditions created tree rings with the largest growth.

1. Which moisture conditions created tree rings with the least growth?

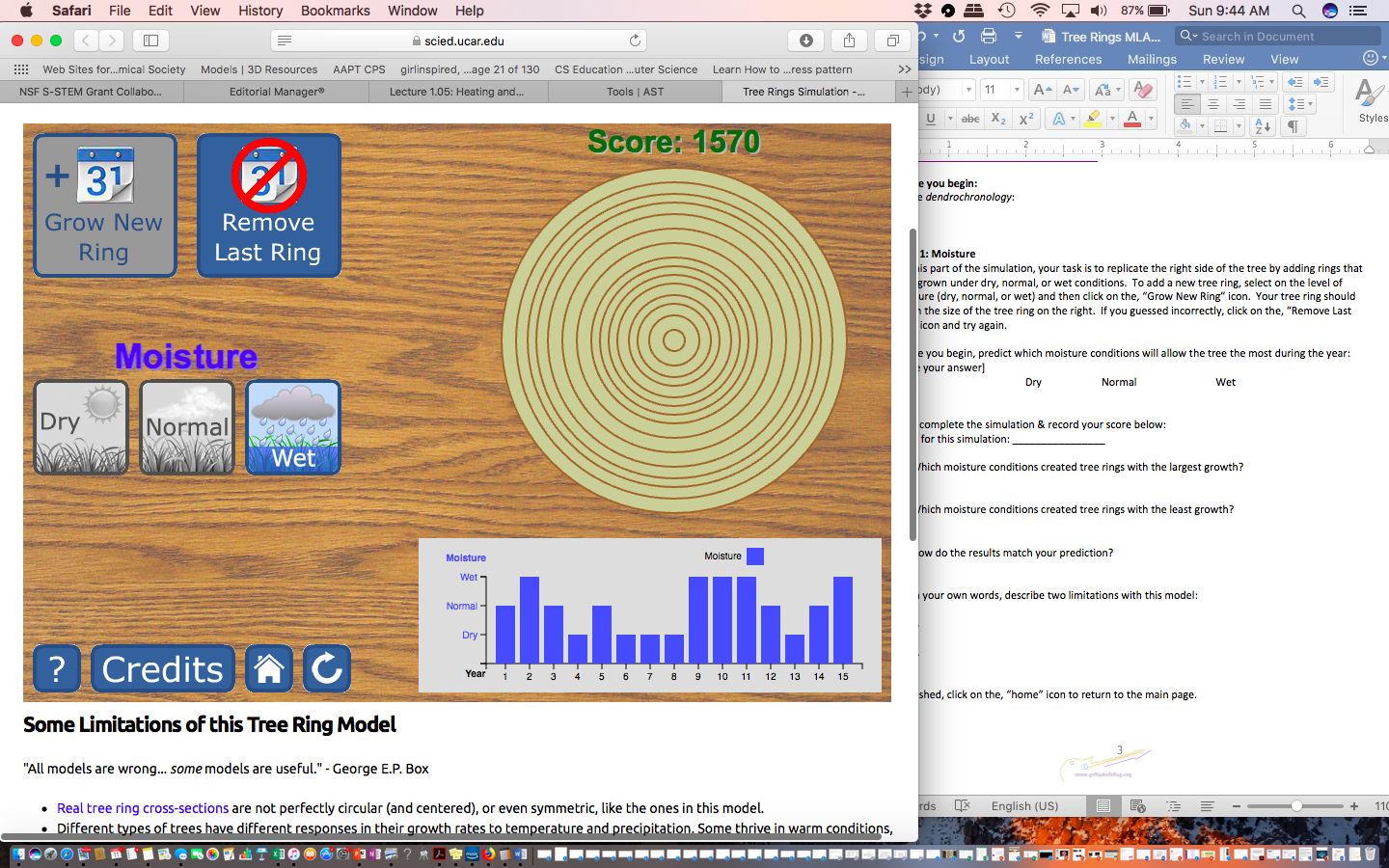
Dry conditions created tree rings with the least amount of growth.

1. How do the results match your prediction?

Answers will vary

1. In your own words, describe two limitations with this model:
2. Different species of trees respond differently to temperature and moisture levels.
3. There are other factors that effect tree growth that are not represented in these models. a

Graph:



When finished, click on the, “home” icon to return to the main page.

**Level 2: Temperature**

In this simulation, you will look at how temperature affects tree growth rings. Keep in mind, this is a generalization. Some trees do prefer colder temperatures; others prefer to grow in warmer temperatures. To add a new tree ring, select on the temperature level (cold, normal, warm) and then click on the, “Grow New Ring” icon. If you guessed incorrectly, click on the, “Remove Last Ring” icon and try again until the new ring on the left matches the tree ring on the right.

Before you begin, predict which temperatures will allow the tree a lot during the year: [circle your answer]

Cool Normal Warm

Answers will vary

Now, complete the simulation & record your score below:

Score for this simulation: Answers will vary

1. Which temperature (cool, normal, or warm) created tree rings with the largest growth?

Normal conditions created tree rings with the largest growth.

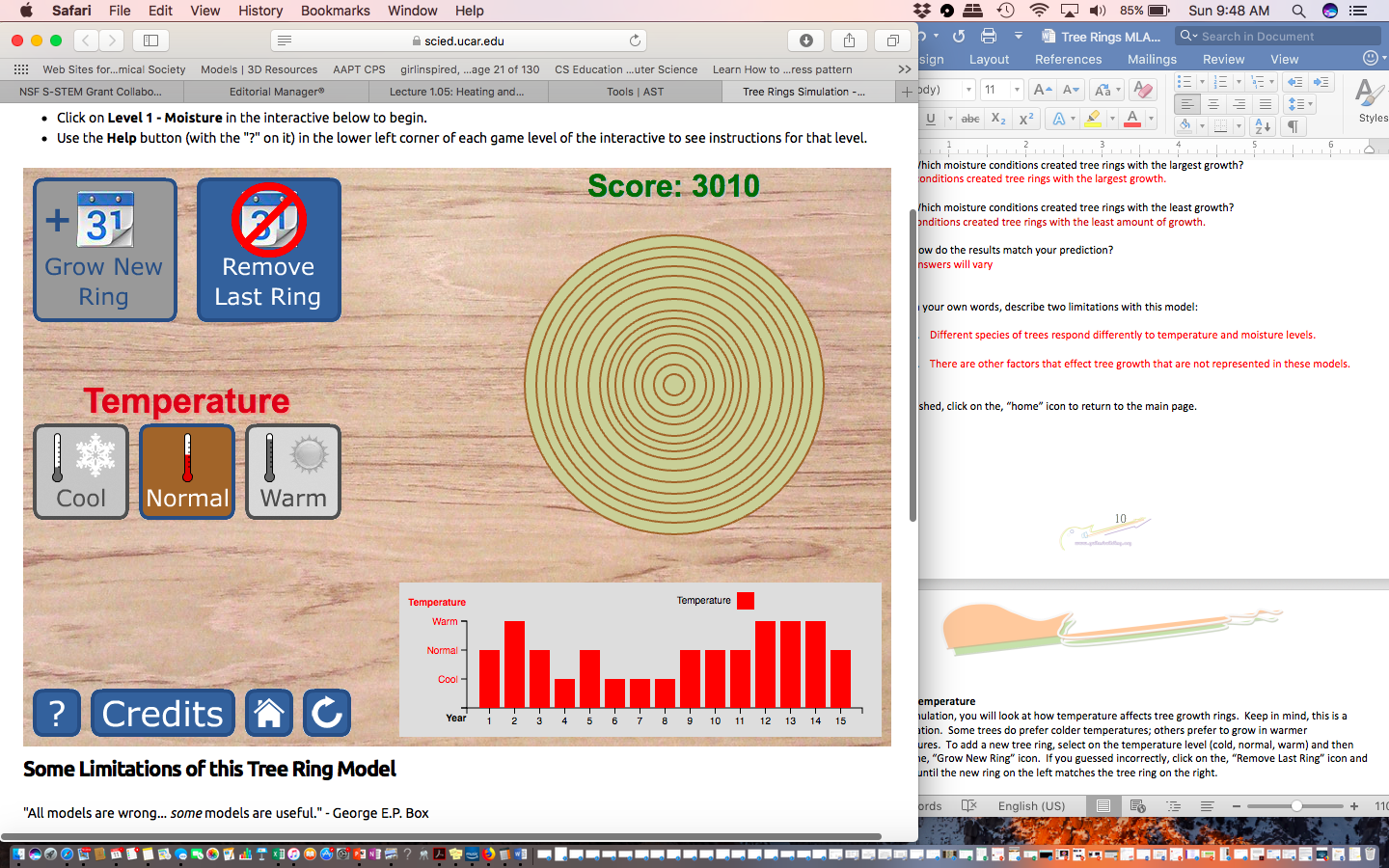
1. Which temperature created tree rings with the least growth?

Cool temperatures created tree rings with the least growth.

1. How do the results match your prediction?

Answers will vary

Graph:



When finished, click on the, “home” icon to return to the main page.

**Level 3:** In the real world, trees are subjected to a variety of temperature conditions and rainfall amounts. Your task is to adjust both the moisture levels *and* the temperatures to get the same tree ring pattern as on the right.

Before you begin, which combination of factors do you think will help the tree grow the most in a year? Circle one *moisture* level and one *temperature* level:

Moisture: Dry Normal Wet

Temperature: Cool Normal Warm

Answers will vary

Now, complete the simulation & record your score below:

Score for this simulation: Answers will vary

1. The tree ring formed during year #4 had the largest growth. What were the temperature and moisture levels that year? [Hint: you may have to look at the graph]

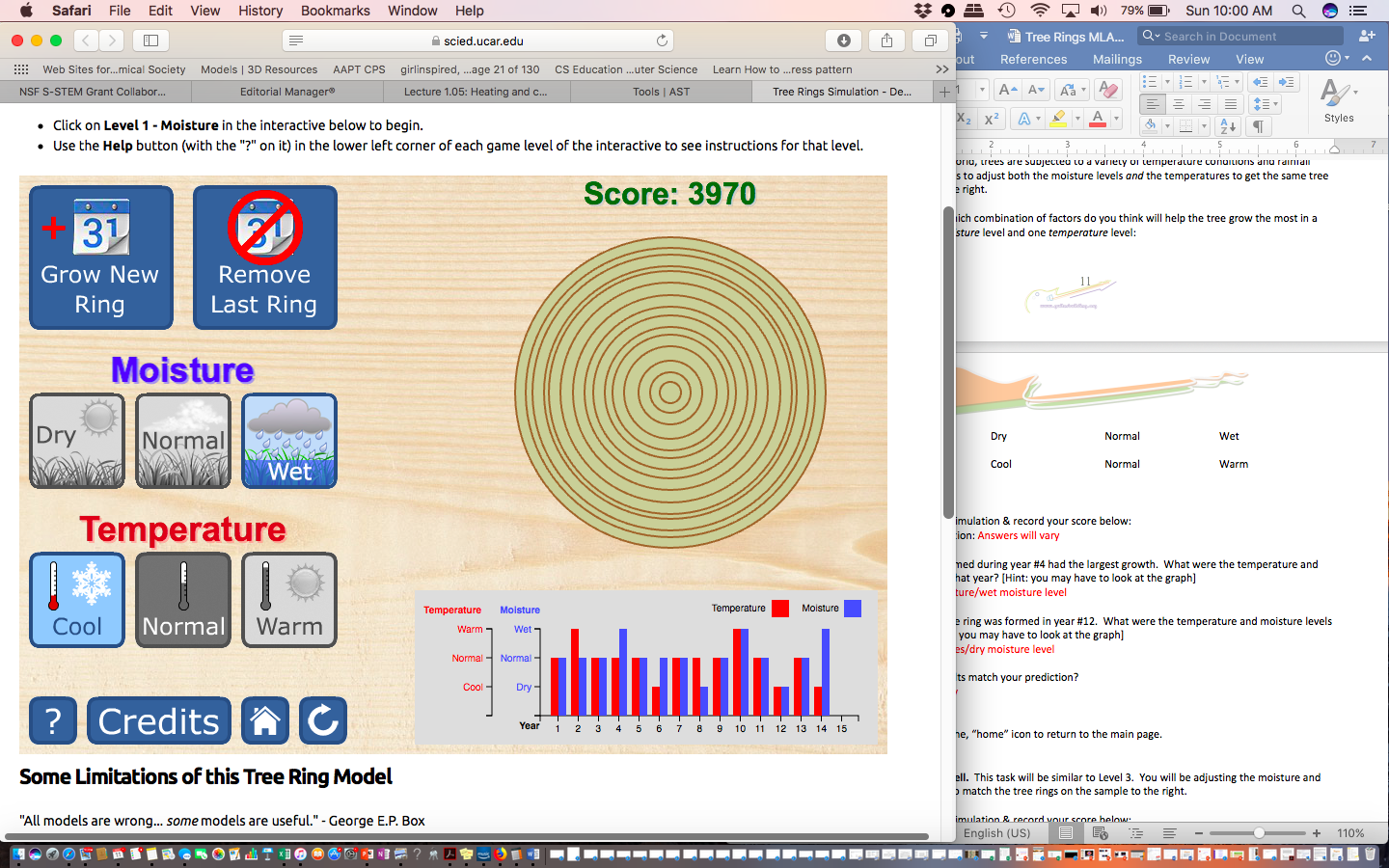
Normal temperature/wet moisture level

1. The skinniest tree ring was formed in year #12. What were the temperature and moisture levels that year? [Hint: you may have to look at the graph]

Cool temperatures/dry moisture level

1. How do the results match your prediction?

Answers will vary



When finished, click on the, “home” icon to return to the main page.

**Level 4: The Long Spell.** This task will be similar to Level 3. You will be adjusting the moisture and temperature levels to match the tree rings on the sample to the right.

Now, complete the simulation & record your score below:

Score for this simulation: Answers will vary

1. What were the moisture levels from years 5-13? How did this effect tree growth?

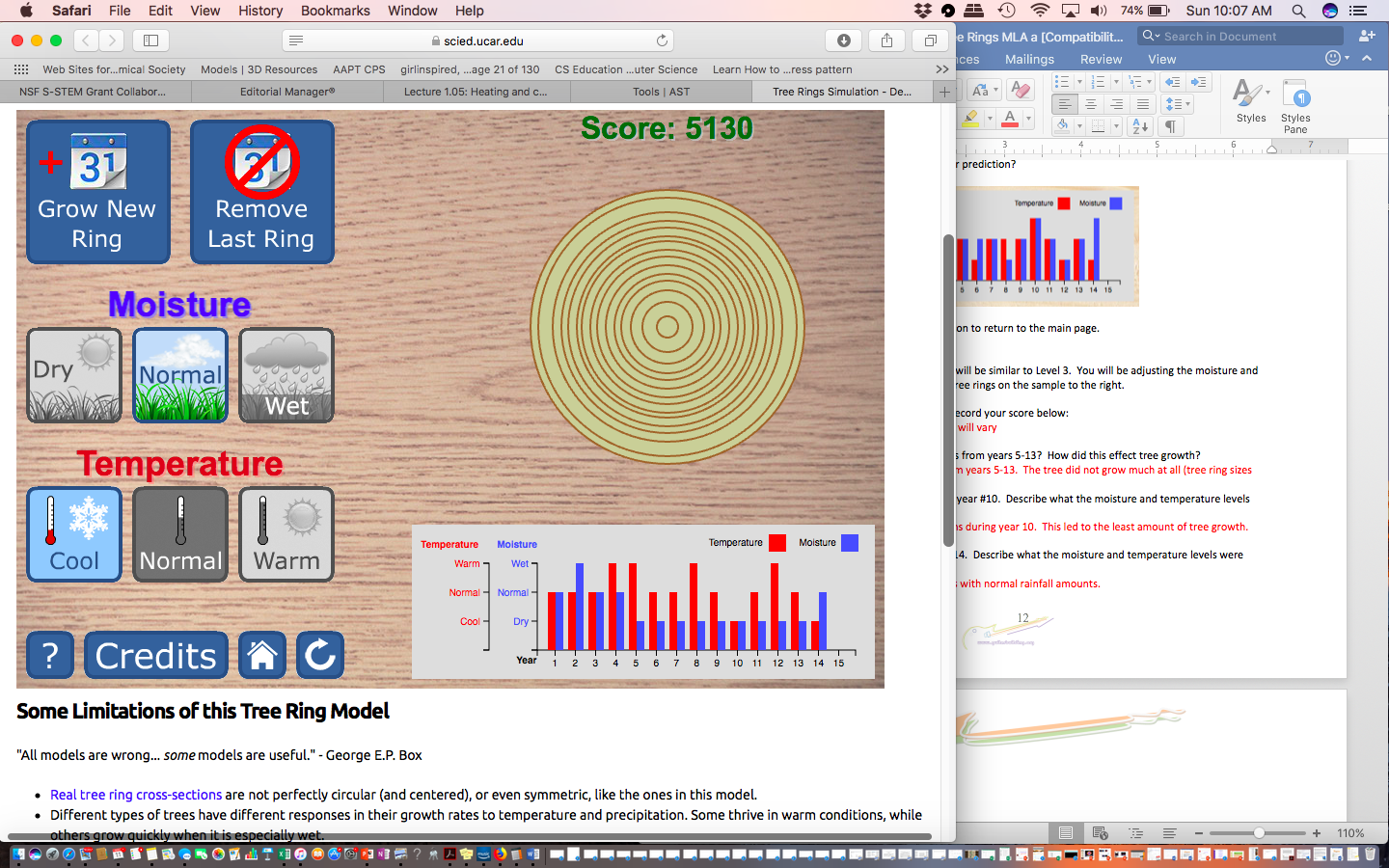
There were dry conditions from years 5-13. The tree did not grow much at all (tree ring sizes were small).

1. The skinniest tree ring is from year #10. Describe what the moisture and temperature levels were during that year:

There were cool, dry conditions during year 10. This led to the least amount of tree growth.

1. The largest tree ring is from #14. Describe what the moisture and temperature levels were during that year:

There were cool temperatures with normal rainfall amounts.



When finished, click on the, “home” icon to return to the main page.

**Level 5: A Gradual Trend**. This task is also similar to Levels 3 and 4. You will be adjusting the moisture and temperature levels to match the tree rings on the sample to the right.

Now, complete the simulation & record your score below:

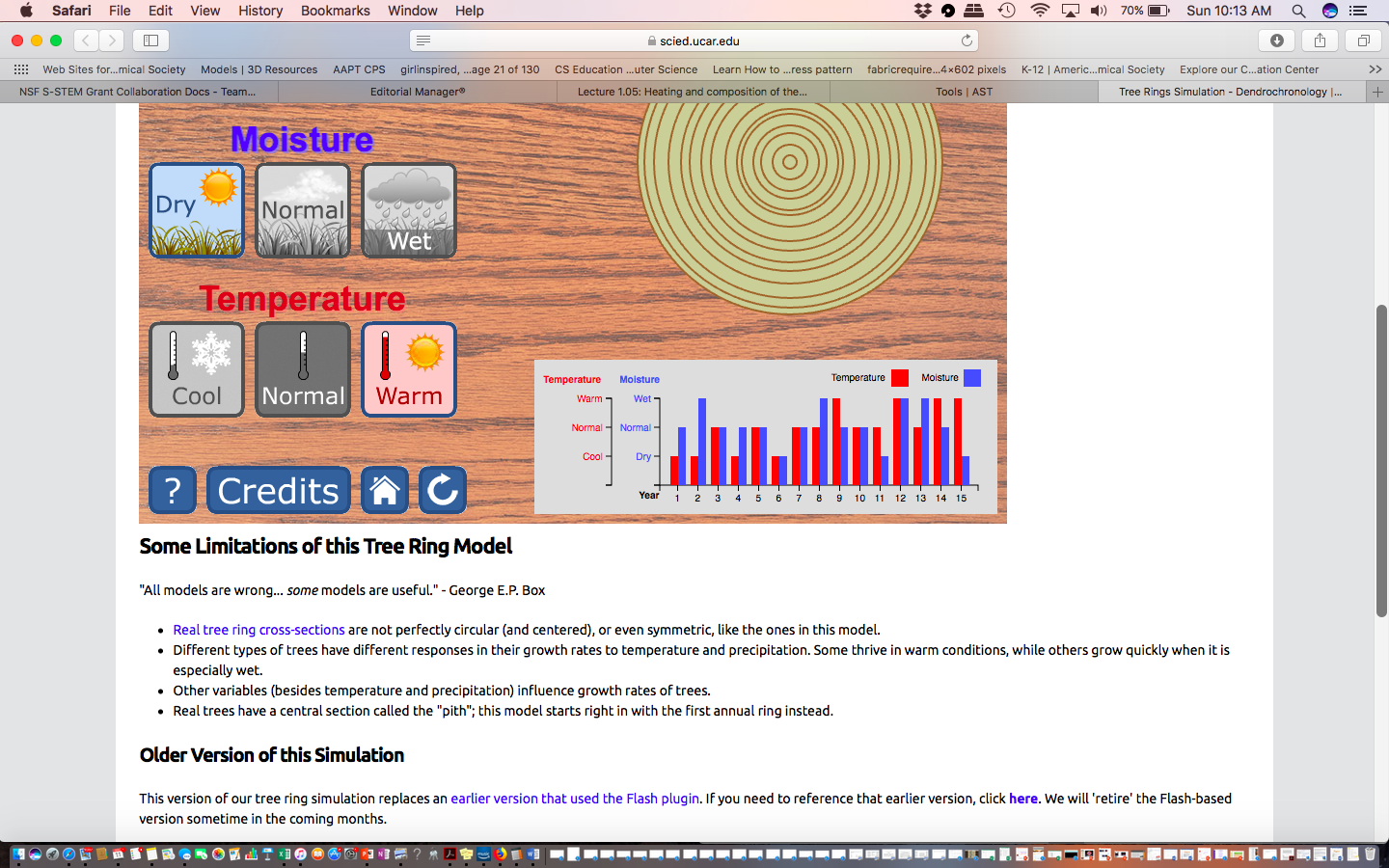
Score for this simulation: Answers will vary

1. The skinniest tree ring is from year #6. Describe what the moisture and temperature levels were during that year:

Cool and Dry

1. The largest tree ring is from years #8 and #13. Describe what the moisture and temperature levels were during that year:

Normal temperatures and wet moisture levels.



**Level 6: Sandbox.** Not all trees like the same temperature and moisture level. In the upper right-hand corner of the simulation, click on the dropdown menu for, “Choose a Tree to Match.” Circle which tree you have chosen in the space below. Your task is to identify which combination of moisture level and temperature preferred by the tree species you chose.

Ash Aspen Beach Birch Elm

Maple Oak Redwood Willow

Answers will vary

1. Temperature and moisture levels that promotes the most growth:

Answers will vary

1. Temperature and moisture levels that prohibits growth:

Answers will vary

1. You may have heard of the famous violin maker, Antonius Stradivarius. His violins are regarded as being the best in the world. For years, researchers have tried to identify the secret to his violins. One possible hypothesis is that the density of the wood may be a factor—the denser the wood, the better the violin sounds. What combination of temperature and moisture levels would create a very dense tree—a tree with lots of small, compact rings, showing little growth? Use data from this simulation to support your answer.

Cold temperatures with little rainfall lead to stunted tree growth. For more information on the topic, please visit:

<https://en.wikipedia.org/wiki/Stradivarius>

1. What other scientific questions do you have about factors that influence tree growth?

Answers will vary

1. As a luthier (guitar maker), why is it important to understand factors that influence tree growth?

The guitar industry is currently facing shortages of different types of woods such as mahogany, rosewood, and ebony. Some of these woods are controlled and are not allowed to be exported into the United States. Woods are selected for desired characteristics such as color or tone. If these woods are not available, other replacement woods will have to be sourced. Having a reliable supply of woods ensures the guitar manufacture can maintain the same quality of product.

Extension Activity

Name: Answer Key Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_

For an extension activity, you can follow Bob Taylor [Taylor Guitars] around on his World Forestry Tour.

|  |  |
| --- | --- |
| Location | YouTube Link |
| Ireland | https://www.youtube.com/watch?v=Bmv2RIIOrpc |
| Guatemala | https://www.youtube.com/watch?v=3Y3ItVCjmSc |
| Cameroon | https://www.taylorguitars.com/videos/sustainability/bob-taylor-s-world-forestry-tour-in-the-village-cameroon-april-28-2017/85726817-90451888/ |
| Fiji | https://www.youtube.com/watch?v=rgY8\_vAmH-Q |
| Vietnam | https://www.youtube.com/watch?v=Sj27NzqLPMw |
| Malaysia | https://www.youtube.com/watch?v=Z8NgAW-iG9Y |
| Hawaii | <https://www.youtube.com/watch?v=cgy6mEV5yNA> |

First, select a location and watch the accompanying video to answer these questions:

Answers will vary

Part 1:

1. Location:
2. Type of tree(s)
3. How are these trees being grown and harvested in a sustainable way?
4. How is this type of wood used in a guitar?

Part 2: For this section, you will have to do some outside research on your own.

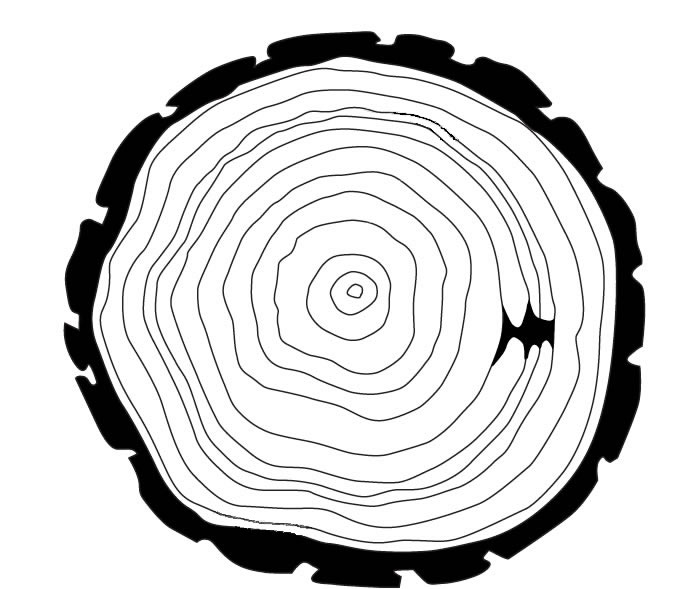
1. What biome is the location you selected in?
2. What are the following temperatures (or ranges) for your location?
   1. High temperature:
   2. Average temperature:
   3. Low temperature:
3. Average yearly rainfall:
4. Is there a rainy season? If so, when is the rainy season?
5. Graph the average temperature for each month and the average rainfall for each month on the graph below:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Rainfall | Jan | Feb | Mar | April | May | June | July | Aug | Sept | Oct | Nov | Dec | Temp. |

Assessment Questions

The following questions can be used as a pre/post assessment to determine student learning gains:

1. Define *dendrochronology*:
2. Define *dendroclimatology:*
3. List two (2) factors that could affect tree growth:
4. If you know when a tree was cut down, describe how you could determine the age of the tree:
5. How you were given a tree cookie (a cross-cutting of a tree trunk), how could you identify what the growing conditions were like that year? Be sure to list and describe specific examples:



Assessment Questions—Answer Key

The following questions can be used as a pre/post assessment to determine student learning gains:

1. Define *dendrochronology*:

Dendrochronology is the process of determining the age of a tree by counting the number of tree rings, and subtracting that number from the date the tree was cut down. This assumes the tree produced one ring/year. Some tree species may skip a year; others may produce two rings per year.

1. Define *dendroclimatology:*

Dendroclimatology is the process of determining what the growing conditions were like each year the tree grew.

1. List two (2) factors that could affect tree growth:

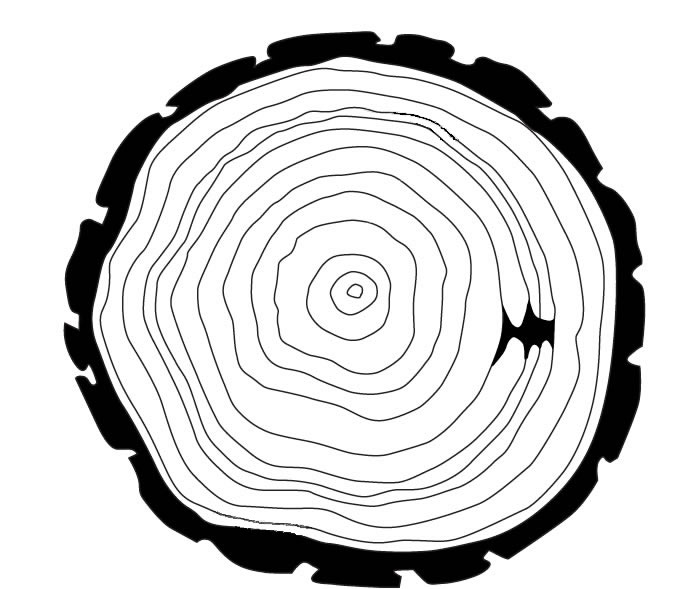
-Temperature

-Rainfall amounts

1. If you know when a tree was cut down, describe how you could determine the age of the tree:

You count the number of tree rings, that will give you the age of the tree.

1. How you were given a tree cookie (a cross-cutting of a tree trunk), how could you identify what the growing conditions were like that year? Be sure to list and describe specific examples:



The narrow tree rings represent poor growing conditions.

The broad rings represent good growing conditions.