



Reading the Trees: Dendrochronology at Jamestown

Grade: 3rd-5th

Subjects: History, Virginia Studies, Science, Math

Time: 1 hour

Class Size: Adaptable

Skills: Measuring, analyzing, interpretation

Strategies: Have students read and interpret primary sources to gain understanding of historical events. Compare and contrast primary sources with archaeological evidence.

Student will:	SOLs
<p>VS.1 Students will demonstrate skills for historical thinking and geographic analysis by:</p> <p>a) analyzing and interpreting artifacts and primary and secondary sources to understand events in Virginia history</p> <p>VS.2 Demonstrate an understanding of the relationship between physical geography and the lives of native peoples of Virginia by:</p> <p>c) locating and identifying water features important to the early history of Virginia</p> <p>e) describing how American Indians related to the climate and their environment to secure food, clothing, and shelter</p> <p>f) describing how archaeologists have recovered new material evidence at sites including Jamestown</p> <p>VS.3 Demonstrate an understanding of the first permanent English settlement in America by:</p> <p>f) describing the hardships faced by settlers at Jamestown and the changes that took place to ensure survival</p> <p>g) describing the interactions between the English settlers and native peoples, including the role of the Powhatan in the survival of the settlers</p> <p>VS.4 Demonstrate an understanding of life in the Virginia colony by describing everyday life in colonial Virginia</p>	<p>VS.1, VS.2, VS.3, VS.4</p>
<p>3.1, 4.1, 5.1 Students will plan and conduct investigations in which: data are collected, recorded, and reported using the appropriate graphical representation (graphs, charts, diagrams); predictions are made using patterns, and simple graphical data are extrapolated; manipulated and responding variables are identified; and an understanding of the nature of science is developed and reinforced.</p> <p>3.6, 4.5 Investigate and understand how plants and animals in an ecosystem interact with one another and nonliving components</p> <p>3.10 Investigate and understand that natural events and human influences can affect the survival of a species</p> <p>4.9 Investigate and understand important Virginia natural resources</p>	<p>Science 3.1, 3.6, 3.10, 4.1, 4.5, 4.9, 5.1</p>



3.3, 4.4, 5.4 Solve single-step and multistep practical problems involving sums or differences of two whole numbers 3.7, 4.8 Estimate and measure length using US customary and metric units 3.16, 4.15, 5.18 Identify and describe patterns found in objects, pictures, numbers, and tables	Math 3.3, 3.7, 3.16, 4.4, 4.8, 4.15, 5.4, 5.18
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Background

Dendrochronological studies, better known as “tree-ring dating,” illustrate the environmental and societal changes that occurred within the first few years of the Jamestown settlement.

Tree rings grow at a rate of one ring per year. Each ring is composed of one light and one dark ring. Light rings indicate growth during spring and summer while dark rings indicate the slower growth season during fall and winter. The wider their width, the more growth occurred that year. Wide rings demonstrate warmer and wetter seasons. Thin rings indicate periods of colder temperatures and little rainfall or drought.

The end of the sequence shows the exact year and season that a tree died or was cut down. This information helps archaeologists date the artifacts or buildings that the tree was used to create. Scientists can also use growth ring width patterns to understand how climate changed over time. By overlapping tree ring samples, scientists can create sequences that trace climate patterns back thousands of years.

Tree-ring analyses show that the English settlers arrived in the Chesapeake Bay during one of the worst droughts in almost 800 years. During this time, the settlers and the neighboring Virginia Indians struggled to survive. Without excess food, Virginia Indians were unable to continue to provide the settlers with provisions. The groups began competing for resources, adding to already-increased tensions. In 1609, Chief Powhatan posted a guard around James Fort and the settlers were unable to leave to hunt or gather food. The drought also significantly reduced the Jamestown Island tides, resulting in brackish and unsafe water. So many individuals died from starvation and disease that the winter of 1609-1610 was referred to as the “starving time.”

This lesson first explains the concept of dendrochronology and then draws a connection between the scientific data and events at Jamestown. It asks students to consider the impact environmental change can have upon historical events.

Resources and Materials: Lesson includes a rain-fall spinner and a student worksheet. Teachers will need to print and construct the spinner using heavy stock paper before the lesson. Students will also need construction paper, scissors, rulers, and colored pencils.

Procedure

- 1) Have students work either individually or in small groups. Provide each student or small group with a blank piece of construction paper. Have students measure and draw a circle that is 1”, 2”, 3”, or 4” in diameter. (Students may choose their starting diameters.) Have students use their colored pencils to shade the inside of their trunks a light color and the very edge a dark color. Explain that this circle represents their tree trunk after its first year.
- 2) Have one group spin the attached rain fall spinner. Have all students add and color the indicated amount to their tree trunk circles. (Spin again if spinner lands on “CUT YOUR TREE” on the first spin.)



- 3) Pass the spinner to the next group and repeat. If a group lands on "CUT YOUR TREE" they must stop adding to their tree. Have that group start another tree on a separate piece of paper.
- 4) Repeat until all groups have cut their first tree or until there is a reasonable representation of tree ring samples. Have the students complete Part I of the attached worksheet. Remind them that thinner rings represent drought years and thicker rings years with higher rainfall. Discuss their answers.
- 5) Have each student/group cut a 1" wide sample through the center of their tree rings. Collect all the "samples," mix them up, and redistribute them randomly between the groups. Have students work together to arrange the samples in chronological order based on the patterns of the tree rings. (Note: The trees cut first will be in the beginning of the sequence while those started or cut mid-activity will be near the end.)
- 6) Have each group complete Part II of the worksheet. Review their answers using the additional discussion questions below.
- 7) If time allows or as homework have students use their samples to create a rainfall graph. Use the scale: 1" ring = 10" of rain. Students may also use the link to the *Jamestown Rediscovery* project below to research whether archaeologists have used the methods they listed in Question 5 Part II and how.

Discussion Questions

- How might a lack of fresh water and food have affected the relationships and trade between the Powhatan Indians and the English settlers? Why were these relationships so important? *The settlers had previously relied on the food the Virginia Indians brought them to supplement their own supplies. During the drought, the Powhatan were no longer able to bring them surplus food. The groups began competing for limited resources, which in turn heightened tensions.*
- Why is it necessary to use many sources (historical documents, scientific data, etc...) together when studying the past? Address the concept of bias within historical accounts based on who was writing and when. *Historical documents are written from a certain point of view of the past and often contain limited information. Scientific data such as tree ring studies help archaeologists fill in these gaps. When personal accounts and scientific studies are used together, they give archaeologists a fuller picture of events in the past.*
- Were students surprised that archaeologists use tree rings to know more about events in the past? Why or why not? *Answers will vary.*

To learn more and view additional lesson plans visit *Jamestown Rediscovery* at <https://historicjamestowne.org>

Additional Resources

College of William and Mary. 1998. "Extreme Droughts Played Major Role In Tragedies At Jamestown, 'Lost Colony.'" *Science Daily* 28 April. <http://www.sciencedaily.com/releases/1998/04/980428075409.htm>.

Detwiler, Darin. 2010 Dendrochronology at Jamestown. https://www.youtube.com/watch?v=dHYdTAd_qgU.

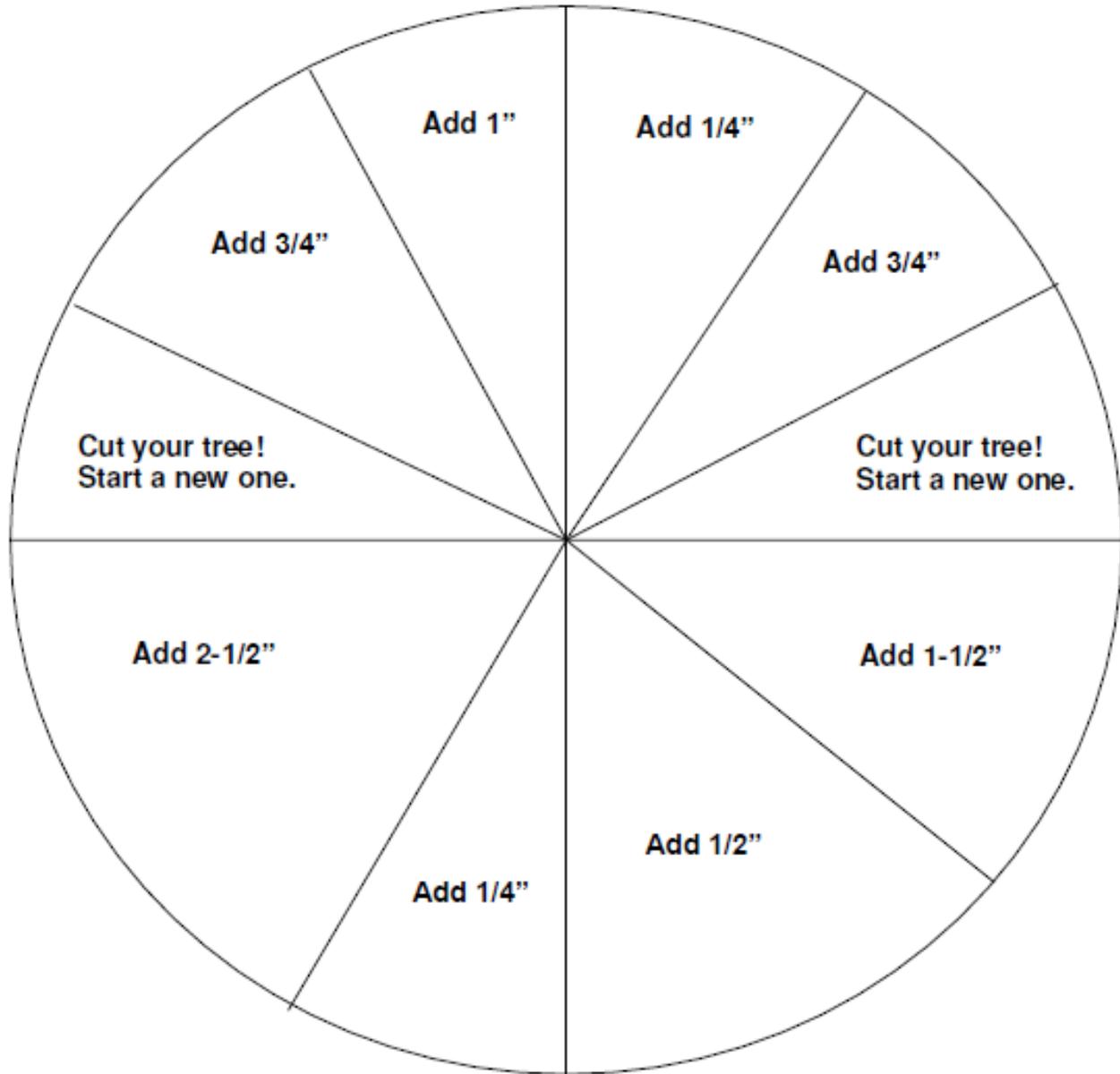
Percy, George. 1606. Observations gathered out of a discourse of the plantation of the southern colony in Virginia by the English. <http://www.virtualjamestown.org/exist/cocoon/jamestown/fha/J1002>



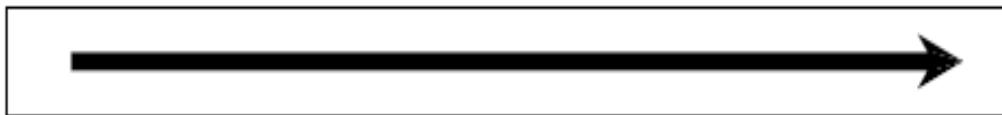
Smith, John. *The Complete Works of Captain John Smith 1580-1631, Volume 1*. Reprinted 1986 by the University of North Carolina Press Chapel Hill. Edited by Philip L. Barbour. University of North Carolina Press, Chapel Hill, NC. <http://www.virtualjamestown.org/exist/cocoon/jamestown/fha-js/SmiWorks1>

Stahle, David W., Malcolm K. Cleaveland, Dennis B. Blanton, Matthew D. Therrell, and David A. Gray. 1998. The Lost Colony and Jamestown Droughts. *Science* 280(5363): 564-567.

RAIN FALL SPINNER



Cut out the arrow below and attach as a spinner to the circle using a brad.





Name: _____

Reading the Trees: Dendrochronology at Jamestown

Vocabulary

Archaeologist: a scientist who studies how people lived within the past

Artifact: an object made or used by a person in the past

Excavation: the scientific removal of soil and artifacts from an archaeological site

Feature: a non-moveable part of an archaeological site, such as pits or building walls

Site: a place used by people in the past containing artifacts and features

Background

Archaeologists often use both historical documents and scientific data together to understand events in the past. Dendrochronology, the scientific study of tree rings, is one method they use.

Tree rings show how the climate has changed through time. Each year as a tree grows, it adds a ring to its trunk. Each ring is made of one light-colored and one dark-colored band. Light bands show how much a tree grew during spring and summer. The smaller dark bands are its slower growth during fall and winter. The wider a band is, the warmer and wetter the season was. Thin bands show colder temperatures and little rain or drought. The last growth ring shows the season and year that a tree died or was cut down. By matching up ring patterns in tree trunk samples, archaeologists can build sequences (timelines) that go back thousands of years.

Tree ring sequences are very important in understanding events at Jamestown. In 1607, English settlers arrived in Virginia and began building James Fort. Historical documents recorded that most of them died from lack of food and disease soon after. The nearby Virginia Indian tribes also lost many people during this time. Tree rings studies help explain why this was. These studies show that the colonists arrived at Jamestown during the worst drought in almost 800 years.

Directions

Part I

The colonists wrote about their experiences at Jamestown. Read the two accounts below and use them to answer the following questions.

Being thus left to our fortunes, it fortuned that within ten days scarce ten amongst us could either go, or well stand, such extreme weakness and sickness oppressed us... whilst the ships stayed, our allowance was somewhat bettered, by a daily proportion of biscuit...but when they departed, there remained neither tavern, beer-house nor place of relief...our continual labor in the extremity of the heat had so weakened us, as were cause sufficient to have made us as miserable in our native country, or any other place in the world. From May, to September, those that escaped lived upon sturgeon (fish), and sea-



crabs...but now was all our provision spent, the sturgeon gone, all helps abandoned... --Colonist Captain John Smith, 1606-1612

Our men were destroyed with cruel diseases as swellings, fluxes, burning fevers...but for the most part they died of [miserable] famine. There were never Englishmen left in a foreign country in such misery as we were in this new discovered Virginia...our food was but a small can of barley sod in water to five men a day, our drink cold water taken out of the river, which was at a flood very salt[y], at a low tide full of slime and filth, which was the destruction of many of our men. Thus, we lived for the space of five months in this miserable distress... --Colonist George Percy, 1606

1. What problems did the colonists face in the early years of Jamestown?
2. How do you think tree ring studies can help archaeologists learn more about that time?

Part II

1. Follow your teacher's directions to draw a tree trunk on your construction paper. How many inches across is your first ring?
2. Your teacher will show you how to use the spinner to grow your tree. When your class has finished, use your ruler to measure your final tree trunk diameter. How many inches across is it? (If you have two trees, count your first one.)
3. Count the number of rings in your tree trunk. How old was your tree when it was cut? (Remember that one year has one dark and one light ring.)



4. Which year was the wettest? The driest? How do you know?
5. Describe any patterns you see. For example, was every year dry and cold or did the climate change many times between dry and wet?

Part III

Your teacher will show you how to build a tree ring sequence. Use your sequence to answer the questions below.

1. How many tree samples do you have?
2. How many years are in your sequence? (For a challenge, use your answer to count backwards from today's date. What year did the first tree start growing?)
3. Imagine you are an archaeologist and found this sequence at Jamestown. Describe any patterns you see. What could it tell you about the climate that the settlers and Virginia Indians lived in? (Remember that many dry seasons in a row may show that there was a drought, while many wet seasons may show bad storms and flood.)
4. Would you want to live in a place with this climate? Why or why not?
5. You learned that archaeologists can use historical documents and tree ring studies together. If you were an archaeologist at Jamestown, what other pieces of information could you use to know more about how the settlers and Virginia Indians lived?