The Laboratory of Tree-Ring Research
The University of Arizona
1215 E. Lowell Street
Tucson, AZ 85721
http://ltrr.arizona.edu/

Lesson 1 Title: Seeds to Giants: An Introduction to Dendrochronology (the study of tree-rings)

Area: *This section related to ADE standards is to be completed by the K-12 educator. The study of tree-rings fits in to every strand/concept and can be connected to any subject area from Art History to Zoology! Need materials? Contact us at outreach@ltrr.arizona.edu

	ACADEMIC STANDARDS:		
Unit (ADE Standard):	**R__**	**M__**	**SC__**
	INDICATORS:		
Lesson Title (ADE Measurement Strand/Concept Criteria):	**S_C_**	**S_C_**	**S_C_**

Objectives:	**PO:**	**PO:**	**PO:**
1. **Identify** the parts of the tree 2. **List** the nutrients and processes necessary for tree-growth 3. **Label** structural components of annual tree-rings in conifer species 4. **Define** the term Dendrochronology			

Need: Students will review the basic parts of the tree, tree growth, processes related to tree growth, and annual ring formation. Students will also be introduced the study of tree-rings - also known as dendrochronology, and learn the structure of annual rings. Students will make observations about ring patterns using real tree cross sections or copies of samples.

Time: 50 minutes

Online resources:
Realia (Tools, Equipment, and Supplies):

- Seeds to Giants Lesson Presentation
- Branching Out Cards
- Bellwork Option 1 or 2 (You can also use the branching out activity as bellwork)
- "Related" and "Unrelated" cards

- Cross-Sections or copies of laminated Douglas Fir and Gambel Oak images for making observations
- Magnifying glasses or macrolenses (for use with cell phone cameras)
- Ring Structure image

Key Terms: **(This is a comprehensive list of the vocabulary that may be helpful to review or introduce for this lesson and you may choose the terms that make sense for your grade level and classroom needs from this list for this lesson.)** annual ring, bark, branches, cambium, canopy, carbon cycle, climate, dendrochronology, disturbance, earlywood/latewood, evapotranspiration, geography, geology, hardwood/sapwood, leaves, natural/anthropogenic, nutrients, observations, perturbation, photosynthesis, pith, precipitation, proxy, roots, soil, sunlight, temperature, topography, tree cookie, tree cross-section, trunk, water

Bellwork Option 1: Ask students to draw a tree AND label the parts of the tree (Note: A bellwork handout has been made for you and is included with this lesson plan in your Lesson 1 folder on your memory drive).

Bellwork Option 2: Ask students to list what trees need to grow. (Note: A bellwork handout has been made for you and is included with this lesson and is in your Lesson 1 folder on your memory drive).

 **Interest Approach:** **You-Me-Us Moment: This moment enhances interpersonal, intrapersonal, and linguistic intelligences.** The "Branching Out" Activity: Ask students to work with a partner to read each card and then divide their set of "branching out" cards in two distinct piles. One pile is designated as fields of study that are "related" to tree-rings, the other pile is designated for fields of study that are "unrelated" to tree-rings. Remind students to be ready to share why and how they made these decisions when called upon. To assess, ask students to share which disciplines they felt were unrelated to tree-ring science and why they made this decision. Help students connect each unrelated discipline to tree-rings in some way to emphasize how so many fields of study are connected to tree products and tree-rings and how closely or distantly related each of the fileds of study they examined are related to trees and tree-rings.

Summary of Content and Methodology

 Earth Friendly Tips: Ask students to bring in realia for you to save on gas and carbon emissions, print double sided handouts without color, have students view handouts on computers, or laminate handouts to reuse with other classes and give students dry erase markers which can be wiped off after each use, reuse old magazines for images and scratch paper for recording observations for this lesson.

 **Activity:** **Dickens Moment: This moment helps learners act out or create scenes to reinforce concepts.** Ask students to stand up and use their bodies to demonstrate the parts of the tree: canopy, branches, leaves, trunk, and roots.

Ask: What do trees need to grow? Water, nutrients and sunlight that the tree uses through processes such as photosynthesis, evapotranspiration and the carbon cycle.

Ask: Has anyone ever observed the rings of a tree? What did you notice? What did you wonder?

State: Patterns, size, shape, scars, and differences in ring width and color are great observations!
State: Now let's take a look at two samples!

Have the Gambel Oak and Douglas Fir images ready to view.

Ask students to make observations and then share what they noticed.

Ask: now that we have observed two samples, let us review the structure of the annual rings!

Demonstrate the pith, annual ring, early and late wood, hard and sap wood, cambium and bark. Then have the students label a paper image of the ring structure.

Here is an animation of ring growth at the cellular level:

- http://dendro.cnre.vt.edu/forestbiology/cambium2_no_scene_1.swf

Now that we have made observations and discovered the patterns and structure of tree-rings, we should think about the events that a tree may experience.

Ask: What natural and human events might a tree experience?

- Natural: fire, drought, insects, stress from competition or lack of resources
- Anthropogenic (human): development, logging industry, root damage due to being transplanted in a new region
- Other events?

Ask: Would you agree or disagree with this statement: Tree growth is also related to factors such as geography, geology, topography, climate and ecosystem perturbation/disturbances?

Great answers! You are correct in thinking that these factors influence tree growth, and these factors are recorded in the tree-rings! We call these records of events proxies. Coral samples, soil samples and ice cores are also considered proxies as they also record events related to these factors.

Ask: Does anyone know what you might call a scientist that studies tree-rings? That is correct! A person who studies tree-rings is also known as a Dendrochronologist. Dendrochronology is the study of tree rings and events over time!

Summary (Teacher): The teacher will ask questions to help the students summarize the lesson. You can also have students review the Bear Essential News DendroIntro Article in your Lesson 1 folder on your memory drive from the workshop.

Conclusion (Student): Ticket Out Option 1: The students will turn in a summary statement and underline key terms and concepts as their ticket out. (Note: A ticket out handout has been made for you and is included with this lesson plan in your Lesson 1 folder on your memory drive).

 **Ticket Out Option 2: Picasso Moment: This moment helps learners interpret concepts and create a learning gallery from their individual learning style and gives them a chance to share visual representations or artwork of a scientific concept.** (Note: A ticket out handout has been made for you and is included with this lesson plan in your Lesson 1 folder on your memory drive). The students will turn in a synthesis drawing in the form of a colorful drawing or art

piece of a tree cross section that reflects the same number of rings as their age (9 years old = 9 rings) as their ticket out.

Application: Extended Classroom Activity: Have the students make a list of careers that may be connected to the study of tree-rings. This may also be used as a topic for research, a presentation or a paper to be done by the students.

Evaluation: Students will be evaluated by short activities, periodic quizzes or exams based on grade level and classroom needs.