



TREE STUDY INDOOR LAB TEACHER'S GUIDE

Learning Goal: Students will learn the interrelationship and value of shoreline trees/plants. Establish the contribution of trees and other vegetation to a healthy shoreline.

Objectives:

- Establish the contribution of trees and other vegetation to a healthy shoreline.
- Recognize characteristics of trees for identification.
- Determine the age of a tree using a bore sample.
- Determine the height of a tree using a clinometer.

Note: Prior to the start of the lab, collect samples (leaves, cones, needles, etc.) from local trees and label them with numbers. Make an associated key so that you can match the numbers to the species. Also include a slab that students can age by counting rings (if available), or place samples from tree boring out for students to practice aging.

1. Introduce the guests in the room.
2. Briefly list tasks for today's lab:
 - Discuss the value of vegetation on the shoreline, water, and aquatic life forms.
 - Learn to identify several varieties of trees.
 - Examine tree rings to determine age.
3. Demonstrate the use of equipment that students will use on the field trip (borer and clinometer, if time permits). Explain that they will be able to use these tools later. Due to short class periods, we typically have the instructor practice the use of the clinometer on a separate day before coming to the field trip.
4. Hand out the lab manuals. Start a discussion with students on the benefits that trees provide to aquatic ecosystems. Have students give answers and list them on the board. Point out that this list is one of the questions in the lab manual, so they should be filling it in.
 - **Shade** – trees provide cover which creates cooler water temperatures (water with lower temperatures can hold more oxygen).
 - **Nutrient absorption:** roots take up nutrients and keep fertilizer from entering water. Excess nutrients spark aquatic plant growth, which can lead to imbalances in oxygen use and can deplete oxygen through plant respiration (at night) and increased decomposition.
 - **Shelter** – when trees are standing and when they fall into the water, they provide habitat for aquatic and terrestrial life.
 - **Shoreline retention** – trees and other vegetation help slow runoff, resulting in reduced erosion and stabilizing the soil.

- **Aesthetics** – trees also help to reduce the visual and environmental impacts of human activity.
 - **Diversity** – trees also help to increase native plant diversity, which leads to environmental stability.
5. Now start a conversation on the biology of trees and how that plays into the benefits described earlier. What are some of the common parts of a tree? List roots, bark, trunk, leaf, branch, buds, etc. Explain that students will be using these different parts to identify tree species.
- **Needles** – Show examples: white pine has clusters of 5 needles (remember “white” has 5 letters), whereas red pine has 2-3 needles in each cluster. Jack pine clusters are short and twisted. Spruce looks like a bottle brush, whereas balsam fir has flat needles and smell like Christmas.
 - **Leaves** – look for the lobes, teeth, shape to help ID trees, structure and whether the branching is alternate, opposite, compound.
 - **Bark** – red pine has reddish scales, whereas white pine has dark bark and is furrowed; paper birch unwraps, is white and papery, whereas aspen is white but does not peel off in the same way.
 - **Flowers** – can also be used to ID trees when they are available
 - **Cones/nuts/seeds** – oak produces acorns, maple produces helicopters (samaras), jack pine releases seeds in a fire so they are very closed off and have a covering on them, aspen has catkins. If you have time, you could discuss how conditions, such as fires, could help different species survive. Jack pine trees need the heat to open up the cones, disperse the seeds, and create conditions for the seeds to grow.
6. How do trees grow? Ask students how trees get their energy. That way you can gauge if students have learned about photosynthesis already, you can review how trees use the sun’s energy, CO₂, and water to produce mass (glucose) to grow.
- While a tree is growing, it uses the cambial layer for transporting nutrients, water, and waste up and down the tree. The cambial layer produces xylem and phloem.
 - Demonstrate how xylem sucks the nutrients and water up from the roots/ground and phloem releases/flushes the tree out.
 - This cambial layer is within the wood of the tree. Trees lay down rings in a systematic way every year. Tree’s growth pattern helps us age trees. If you take the bark off of the trunk, you will find the wood of the tree.
 - Each year the cambial layer becomes an “annual ring”. If you look closely, there is a light ring and a dark ring that make up one annual ring. The light ring is the springwood and the dark ring is the summerwood.
 - The width of the annual ring indicates how much growth there was in one year and can be used to assume the growing conditions for the year, indicating rainfall and potential drought years.
 - Students may think that the center of the tree is alive, but the outside is where active growth and cellular transportation are happening. As the tree continues to grow, it

expands outwards and adds rings every year. This is why you see trees that are hollowed out and have very little wood left in the middle but are still able to survive.

- By counting the annual rings, you can see how old a tree is. Remember to only count the dark OR light rings. If you start in the middle of a tree slab, you are starting at the point where the tree germinated and started growing.
7. Tell the students that they will get a chance to count the rings both in a picture in the lab manual and with a tree slab (show slab to students). Tell students to remember to only count light or dark rings when aging, as this represents one annual ring. At this point, have the students open their lab manuals. Point to where they can find each task (aging, species identification) around the room. As you are doing so, spread the tree samples out for the students to access.
 8. With the lab manuals open, show students the first thing in the lab is the tree ID. Explain how they will match the numbers on the tree samples to the pictures and guides in their lab manual to ID the tree species. You can direct students to take a sample to their lab space and ID which tree it is, returning it when they are done.
 9. While students are independently working through the lab, guide them through the various tasks:
 - Be sure to go around the room and help them with the math calculations in the lab manual. They are asked to think about growth per year and to use the circumference of a tree to figure out the thickness (diameter). The equations are provided for students, but some will need additional support.
 - At this point, also be reminding students that for the second set of questions, they should refer to the slab. Students might forget there is a tree slab and will try to use the picture in the lab manual for these questions.
 - Make sure the students are using the pictures and guides in their lab manual to ID the species.

Additional Resources: Use Vermont Tech Dendrology Fact Sheet to help identify species:
<https://dendro.cnre.vt.edu/dendrology/factsheets.cfm>