

FACTivity

Materials needed for each student pair:

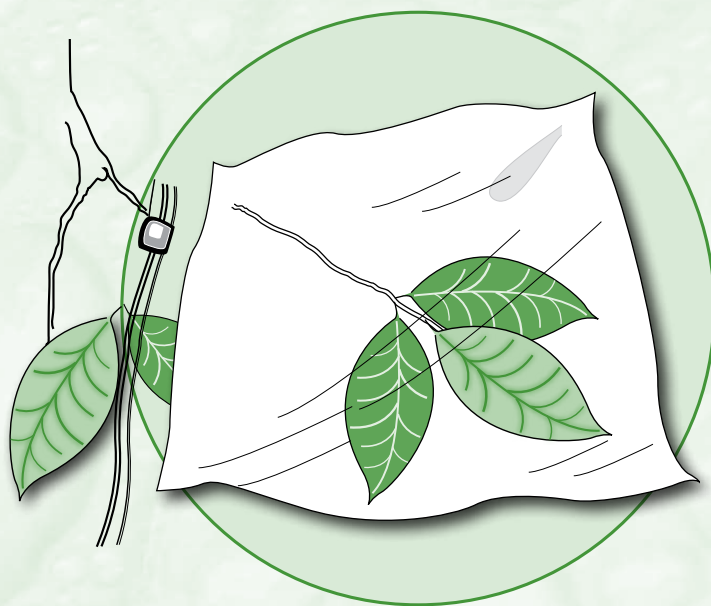
- 1 pint ziplock plastic bag
- Permanent marker or small piece of paper, tape, and a pencil
- Graduated cylinder (1 to 5 ml)
- 1 piece of blank or lined paper and a pencil

In this **FACTivity**, you will answer the question: **How much water is transpired by a tree during daylight hours? The method you will use to answer this question is:**

Day 1: 10 minutes

Your teacher will divide the class into pairs of students, and will give each pair a plastic bag with a ziplock closure. Write your names on the plastic bag (or use paper and tape to identify the bag as yours). Go outside and select a tree that has leaves or needles that can be easily reached when you stand on the ground. You may select the same tree as another pair of students, but you must be able to use a separate branch and leaves.

Place the plastic bag on a branch and seal the bag as tight as possible around two to three of the leaves. The leaves should be inside the plastic bag. **The bag must be placed on a tree branch the following morning (on Day 2), before school starts for the day.**



Day 2:

If possible, allow the plastic bag to stay on the branch for at least 2 hours. Regardless, be sure to note the amount of time each bag is on the tree and, if possible, keep as close to an hourly schedule as possible.

Before removing the bag from the tree, estimate the percentage of the tree's total leaf area contained in the plastic bag. To do this, estimate the total number of leaves on the tree. Count the number of leaves on your branch (including the leaves inside and outside of the bag). Then, estimate the number of branches on the tree and multiply the two numbers. Record the total number of leaves. The estimation of the total number of leaves can be difficult, and will always be an estimate. Make the best estimate you can.

Count the number of leaves in your bag and divide this number into the estimated total number of leaves. Record this number. Before removing the bag, gently shake it to dislodge water from the leaves'

surface. Carefully remove the plastic bag from the branch and leaves, keeping the water in the plastic bag and sealing the bag after removing it from the tree. Gently wave the bag to move the water into one corner of the bag.

Inside the classroom, measure the amount of water in each bag by pouring contents into the graduated cylinder. Calculate how much water was transpired in 1 hour. For example, if the bag was on the tree for 2 hours, divide the amount in half. Then, multiply that amount by 10, assuming there are 10 hours of daylight during which the tree transpires. Finally, calculate how much water would be transpired by all of the leaves on the tree during the 10 hour period.

For example, say there are 3 leaves in the bag and an estimated 27,000 leaves on the tree. Divide 27,000 by 3 to get 9,000. If the three leaves transpired 1 milliliters in 1 hour, students would estimate the leaves would transpire 10 milliliters in 10 hours. To estimate how many milliliters the entire tree transpired in 10 hours, multiply $9,000 \times 10 = 90,000$ milliliters. Multiply $.001$ by $90,000 = 90$ liters. To convert this to gallons, multiply $90 \times .264 = 23.76$ gallons. In this example, the tree transpired an estimated 90 liters or 23.76 gallons of water in 10 hours of daylight.

Compare your findings with other students' findings. Larger trees should be found to transpire much more water than



smaller trees. Is anyone surprised at how much water is transpired by a tree during daylight hours? Now, reread the second and third paragraphs under “Findings.” Would the loss of schoolyard trees cause any changes to the water cycle of the schoolyard? If so, how?

(**Note:** This FACTivity was adapted from the USDA Natural Resources Conservation Service <http://members.tripod.com/~crossg/edaid1.htm>), which had adapted it from Project Learning Tree.

Article adapted from: Ford, Chelcy R. and Vose, James M. 2007. *Tsuga canadensis* (L.) Carr. mortality will impact hydrologic processes in southern Appalachian forest ecosystems. *Ecological Applications*, 17(4), pp. 1156-1167. http://www.srs.fs.usda.gov/pubs/ja/ja_ford006.pdf.



If you are a trained PLT educator, you may use Activity #5: “Poet-Tree,” Activity #63: “Tree Factory,” Activity # 77: “Trees in Trouble.”