FACTivity

Time: 1 class period

Needed: Cloth tape measure, ruler, paper and pencils, copies of forms from page 24.

Note: In advance, your teacher may want to examine the trees in the schoolyard to identify potential trees for this activity.

The questions you will answer with this activity are:

1) What is the estimated leaf area of two similar trees in your school yard?

2) How healthy do those trees appear to be?

3) Based on what you learned through reading this research, how might the trees' root systems compare?

(Note: This activity must be done when leaves are on the trees.)

The method you will use to answer the questions is:

Before you begin, write one or two hypotheses (hi **poth** uh ses) stating what you would expect to find out in this inquiry. Each student may write their own, or you may develop the hypotheses as a class.

Note: A **hypothesis** is a written **"if-then"** statement that follows this form: "If X (a variable that you define) is related to Y (another variable that you define), then changing or observing a difference in X in this way (a change or difference that you define) will result in a change to or a difference in Y in this way (a change or difference that you define)."

1. Select two small trees of similar trunk size. You must be able to reach into the tree's canopy. If possible, select trees of the same species but growing in different areas of the schoolyard. Scientists measure tree trunks at the same height every time. This height, called diameter at breast height or d.b.h., is 1.37 meters or 4.5 feet from the ground. You should measure your trees at d.b.h. using a cloth measure. You will measure the circumference (not the diameter) of the tree's trunk. The important thing is to find two small trees about the same size, and hopefully of the same species.

Divide the class into six groups. Three groups will work with one tree the other three will work with the second tree.

2. Select a *random* sample of leaves from each of the trees. Have a group of four students (two students from one tree, two from the other) quickly determine the best way to make a *random* selection of leaves. You must be able to reach the leaves without using a ladder or other prop.

One group from each tree will select 20 leaves from their tree, using the selection process determined by the group of four students. If possible, do not pick the leaves but measure them while they are on the tree. Using a ruler, measure each leaf's length and width.

Multiply the length by the width to calculate an estimate of the leaf's area. Measure at the widest point in the leaf. Do this for each leaf in your sample. Note that your measurement for each leaf's area will be too large, because leaves are not rectangular. However, if you measure the leaves on both trees in the same way, you can still compare the leaf area of the two trees. This is because the measurements will be equally too large. Accurately record the measurements for each tree, keeping the two trees' samples separate. Then, each group will calculate the average leaf area of their tree's leaves.

(Note: Do not climb into the tree or use a ladder or other prop to reach the leaves. Only measure the leaves you can reach while standing on the ground.)

Tree Site Conditions

Question	Answer and point value	Number of points
Does the tree have mulch around its base?	Yes=1 No=0	
Is the soil around the tree *eroded*?	Yes=0 No=1	
Is the tree shaded?	All day=0 More than half of the day=1 Less than half of the day=2 No=3	
Are insects eating the leaves?	Many leaves affected=0 Some leaves affected=1 Few leaves affected=2	
Is there damage to the tree's bark?	A lot of damage=0 Some damage=1 No=2	
Are the leaves green and healthy?	Most=1 Most are not=0	
Does the tree get adequate water? (Leave this question out if you do not know)	Yes=1 No=0	
TOTAL POINTS		

NOTE: See page 24 for copyable template.

3. Meanwhile, the second group from each tree will record the tree's site conditions. Use the chart on page 16 to observe and record the tree's site conditions.

4. Meanwhile, the third group for each tree will estimate the number of leaves on their tree. One idea is to count the number of leaves on one branch, then count or estimate the number of branches on the tree. By multiplying the two amounts, you will have an estimate of the number of leaves on the tree.

5. Inside the classroom, calculate the total leaf area of each tree. Do this by multiplying the estimated number of leaves on the tree by the average leaf area. For each tree, complete the table below. If possible, reproduce this table on the white board so that the entire class can see it.

Tree 1	Tree 2
Species:_____	Species:_____
Circumference:_____	Circumference:_____
Estimated # leaves: _____	Estimated # leaves:_____
Estimated average leaf area:_____	Estimated average leaf area:_____
Total estimated leaf area:_____	Total estimated leaf area:_____
Site condition score:_____	Site condition score:_____

NOTE: See page 24 for copyable template.

Hold a discussion to compare the two trees. Is one tree healthier than the other? How do you know? Based on your reading of this research, how do you think the root systems of the two trees compare? Which root system, if any, may be receiving a greater amount of carbon? Give a reason or reasons for your claim.

As a class, make a list of at least three weaknesses of the inquiry process you just completed. Further discuss what you would do differently to improve the inquiry process. ***(Hint: For example, if you could have sampled leaves from the entire tree, your sample would better represent the entire tree.)***

Extension: After completing the **FACTivity**, have students reread "Thinking About Science." In small groups or as a class, have students discuss their experience of working in groups while doing this **FACTivity**. Students should be reminded to be sensitive and courteous in their discussion.

If you are a Project Learning Tree-trained educator, you may use Activity #28, Air Plants, as an alternative activity or an extension.

From: Palmroth, S., Oren, R, McCarthy, H. R., Johnsen, K. H., Finzi, A. C., Butnor, J. R., Ryan, M. G., Schlesinger, W. H. (2006). Aboveground sink strength in forests controls the allocation of carbon below ground and its [CO_2]-induced enhancement. Proceedings of the National Academy of Sciences, Vol. 103(51): 19362-19367. http://www.treesearch.fs.fed.us/pubs/27136