Measuring the Forest

In this activity, students will learn about how we measure forests.

Set up

In this activity, students will learn why forests are important to monitor and how forest scientists (e.g. dendrologists) measure forests. Activity 1 introduces some information about US forests, activity 2 teaches students to measure a single tree using DBH, and activity 3 teaches students to calculate stand density. All activities can be done indoors, though going outside to measure real trees is a fun way to get kids outside! (See Extensions). For activity 2, it is best done with “tree cookies”: slices of tree trunks of different diameters. These can be easily made, borrowed (try a university or local forest service) or purchased. But if you don’t have tree cookies, you can use the students themselves (they can measure their own or a partner’s diameter at ankle, waist or chest height.)

Introducing the Activity

Ask your students: Why are forests important?
Possible answers: Timber, pulp, wildlife habitat, air quality, CO₂ consumption
Discuss the possible answers and explain how a forest works to provide these important services.

Activity 1: Where are the forests?

1. What percentage of the United States’ land area is covered in forest?
Provide your students with the following numbers:
• In 2010, there were 304,022,000 ha of forest in the United States
• The United States is 982,667,500 ha
Ask them to calculate the percent of forested land. Answer:
\[
\text{Part } \div \text{ Whole } \times 100\% = \frac{304,022,000}{982,667,500} \times 100\% = 30.9\%
\]

2. On the map, have your students shade the area you think are forest.
Once students have finished, provide them with the map on the following page showing where the forests are. Explain that darker colors indicate higher biomass. Explain that biomass = biological material from living or recently living organisms (mass per unit area).

Activity 2: Measuring Trees

Have you students look at some different trees (show the picture in the handout or take them outside to some trees). Point out that they come in all shapes and sizes.

Ask your students: How can we measure how they are different?
Let them brainstorm and share their ideas with the group. As they bring up ideas, ask them if these measurements would be easy or difficult to make.

1. Explain that trees can be seen as a crown (the ellipsoid where the leaves are) and a trunk (a cylinder). Ask them to draw a circle around the crown and a rectangle for the trunk in their handout.

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Activity 2 Continued.

2. Explain that dendrologists (tree scientists) can measure crown height and width, total height, or height of trunk to crown to compare trees. But the most common measurement is **DBH = Diameter at Breast Height**. Explain that this is the diameter of the tree 4.5 feet above the forest floor on the uphill side. This avoids the swell at the base.

3. Explain circumference and diameter. Have the students do the practice problems: Answers:
   - 1. \( D = 2, \ C = \pi \times 2 \approx 6.28 \)
   - 2. \( D = 6, \ C = \pi \times 6 \approx 18.84 \)
   - 3. \( D=1, \ C = \pi \times 1 \approx 3.14 \)
   - 4. \( C = 3.14, \ D = \frac{1.314}{\pi} \approx 1 \)
   - 5. Radius (R) = 3, \( D = 2R = 2 \times 3 = 6 \)
   - 6. For every 1 inch increase in diameter, the circumference increases \( 3.14 \) inches.

4. Have your students make and test their own DBH tape.
   - 1. Give each student a 3 foot length of flagging tape, a ruler, and a sharpie
   - 2. Using a ruler, mark off every \( \pi \) (3.14 inches). 0.14 of an inch is between 1/8” and 3/16”.
   - 3. Have your students test it out on tree cookies and their heads.
   - 4. Optional: Take your students outside, and have them measure some real trees!

Activity 3: Measuring Forests

Have your students look at different forests (pictures or take them outside). Ask how they think we can describe differences with numbers.

1. Explain that forest scientists calculate stand density = number of trees per area
2. Calculate the stand density of the plot. Show them an example calculation for **Plot A**: Count the number of trees (10)
   - Find the area (L*W) of the stand (15 ft * 25 ft = 375 ft^2)
   - Divide the numerator by the denominator (10/375 = \( 0.03 \) trees/ft^2)
   
   **Answer: Plot B**: Number of trees = 16 trees; Area of Stand: 5 ft*8 ft = 40 ft^2
   - Stand Density = 16 trees/ 40 ft^2 = \( 0.4 \) trees/ft^2

Extension and Variations:
- Take this activity outside! Have students practice with their DBH tapes and stand calculations in a real forest.
- Determine how much carbon dioxide a particular tree is taking up: Use the USDA Forest Service Tree Carbon Calculator at http://www.fs.fed.us/ccrc/tools/ctcc.shtml. This is a small downloadable (free) program. You input your climate zone, tree species and tree size (DBH), and the program will calculate CO2 stored in the tree, above ground biomass, and other things.

Resources
NIMBioS Education Module “Measuring a Forest” www.nimbios.org/education/
Project Learning Tree www.plt.org

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