Tree Circumference- Non-Standard

Purpose

To measure circumference at breast height (CBH) of all trees greater than 15cm circumference on the Carbon Cycle Site.

Overview

After completion of Carbon Cycle Site Set-Up and Tree Mapping students will use scientific field methods to measure CBH. Ultimately CBH will allow students to calculate aboveground biomass and carbon storage.*This can be done at the same time as shrub/sapling and herbaceous measurement (if applicable).*

Student Outcomes

Students will be able to:

- Work as a team to delegate and complete field tasks.
- Use accuracy and precision to measure CBH on all trees greater than 15cm in the Carbon Cycle Site.
- Discuss differences between measurements taken during the previous year and their own measurements.

Questions

Content

- How is tree circumference used to calculate carbon storage?

Science Concepts

Grades 9-12

Scientific Inquiry

- Design and conduct a scientific investigation
- Use appropriate tools and techniques to gather, analyze, and interpret data
- Use mathematics in all aspects of scientific inquiry

Nature of Science Standards

- Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models

NGSS (Black-covered directly, gray-addressed, but not directly covered)

- *Disciplinary Core Ideas*
  - Gr.6-8: LS4.A
- *Science and Engineering Practices*
  - Planning and carrying out investigations
  - Using mathematics and computational thinking
- *Crosscutting Concepts:*
  - Patterns

Time/Frequency

60 minutes (travel time not included)

Should be completed eveyr year

Level

Secondary (Middle & High School)

Materials and Tools

- Per quadrant (North, South, East, West).
- Clipboard (2)
- Pencil (2)
- *Tree Data Sheet (azimuth, distance, species and notes filled out)* (2)
- Measuring tape (150-300cm) (2)
- *Tree Circumference Field Guide* (2)
- Paint Stick/Tree Crayon (2)
- *Tree Data Collection Challenge - Team Scoring Rubric* (optional)

Additional materials will be necessary if any trees are now greater than 15cm CBH and need to be added to the data sheet (year 2+).

- Compass (1)
- Measuring tape (30-50m) (1)
- Height indicator for 1.35m (2)
- Tree ID guide/local species keys (1)
- Tree Mapping Guide (2)

Prerequisites

- *Carbon Cycle Site Set-Up*
- Learning activities (*Biomass Units, How to Measure Trees, Allometry*)
- *Develop an Investigation Plan* (optional)
- *Tree Mapping*
- If these students did not perform the sample site set up and tree mapping themselves, follow *Discussion Points for Site Visit* (found in *Tree Mapping*)

Preparation

- Divide your class into groups of 2-3 students per area.
- Review and make copies of the *Tree Data Entry Sheet* for each circumference group.
  - *If this is year 2+ of measurement at your GLOBE Carbon Cycle Site, the *Tree Data Entry Sheets* should include all Tree Mapping information (azimuth, distance, species and notes) and the previous year's Tree CBH data.
- Review, make copies (1 for each group), and laminate the *Tree Circumference Field Guide* (students do not need to write on the protocol guides, so laminating them ensures saved time, money, and resources)
- Bring at least 1 copy of the *Tree Mapping Student Field Guide* in case new trees need to be mapped.

What To Do and How To Do It

PREPARE TO GO OUTSIDE **Grouping:** Small Groups **Time:** 15 Minutes

- Review expected student behavior while in the field.
- Divide into Teams.
- Students gather field materials and tools.
- Students review the *Tree Circumference Field Guide* and *Tree Data Sheet* and ask questions.

PERFORM CIRCUMFERENCE **Grouping:** Small Groups **Time:** 90 Minutes

- Students should follow the procedures for each task in their *Field Guide*.

NOTES:

- Students may need help with Tree Mapping procedures for any "new" trees (those that have grown greater than 15cm CBH since the site was last measured).

Assessment

Tree Data Collection Challenge – (Rubric)

If you did not use this assessment for Tree Mapping or you are having students complete *Tree Mapping* and *Tree Circumference* protocols at the same time you should consider the *Tree Data Collection Challenge – Team Scoring Rubric* as a way of ensuring high quality student data. Rubric can be found at the end of the *Tree Mapping Student Field Guide*

Teams compete against each other to complete their field tasks. To win the challenge, students will be graded on a number of factors – see rubric.

NOTES:

- To assess precision, accuracy, and completeness of collected data:
  - Either you or a student pair from another team can randomly select 2-4 trees and check all of its CBH measurements.
  - How quickly all tasks are completed may be different for quadrants if there are significantly more trees in one area of the site.

Resources

- Carbon Cycle eTraining: www.globe.gov/get-trained/protocol-etraining/etraining-modules/16867717/3099387

Tree Circumference - Student Field Guide

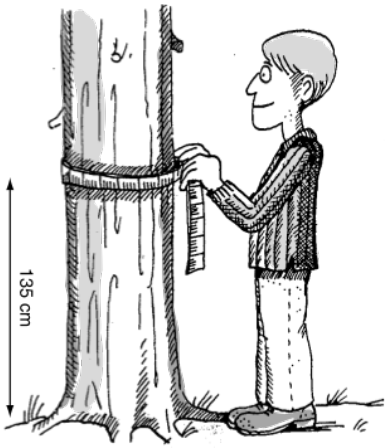
Tree Circumference Team - 2-4 people per group

Task

Make measurements of circumference at breast height (CBH) (1.35m) for all mapped trees (living) greater than 15 cm circumference on your Carbon Cycle Site.

Materials (1 per group)

- ❑ Clipboard
- ❑ Pencil
- ❑ *Tree Data Sheet*
- ❑ Height indicator for 1.35m (optional)
- ❑ Flexible measuring tape (150-300cm)
- ❑ Tree crayon/paintstick (optional, but recommended)



Procedure

1. Review *Tree Circumference Guide: Badly Behaving Trees.*
2. Using your Non-Standard Site Tree Map (either a Google Earth image or a hand-drawn sketch, where each tree has been given a number) divide the trees between Circumference Teams; paying attention to the way trees are positioned, devise a way to ensure each tree is only measured once.
3. When you arrive at the first tree, begin by checking if the tree is alive. If it has died, put a "d" in the circumference column and record DEAD with the date in the "notes" section of the *Tree Data Sheet*.
4. Measure from the highest point of ground at the base of the tree to a height of 1.35m. Use a tree crayon to draw a horizontal line at 1.35m. If the tree is "badly behaving" draw a line at the place where you will measure and then record this height in the "notes" section of the *Data Sheet.*
5. Using the marked height, measure CBH to the **nearest tenth centimeter,** e.g. 16.6.
6. Report this value to the data recorder. The recorder should repeat the value out loud as they write on the *Tree Data Sheet*. (This ensures accurate CBH values.)
7. Repeat this process for all trees in your designated section.
8. NOTE: If you discover **a tree that is not mapped**, i.e. not included on your data sheet, check to see if it has grown larger than 15cm circumference. If so, you will need to measure CBH and record "added" to the data sheet in the notes section. See your teacher for additional instructions about Tree Mapping.

Tree Circumference Guide: Badly Behaving Trees