



Tree Height Comparisons

Hand-Held Clinometer vs. the NASA GLOBE Observer: Trees Tool

Background

Tree height is the most widely used indicator of an ecosystem's ability to grow trees, so tracking tree height can help us to assess the ecological health of a given area. Tracking tree height can also help to measure biomass and so to calculate carbon amounts, key parameters in understanding climate change. (For more background, see "Trees in Trouble: What affect [sic] does tree mortality have on climate change?" GLOBE Scientists' Blog, 1/23/2013; <https://go.usa.gov/xd9hU>)

Using the NASA GLOBE Observer: Trees tool, students and citizen scientists can measure tree height for as many trees as they want. It's possible to track the growth of trees over time and even take observations at the same time as the NASA Ice, Cloud, and land Elevation Satellite-2 (ICESat-2) (<https://icesat-2.gsfc.nasa.gov/>) and the Global Ecosystem Dynamics Investigation (GEDI) (<https://gedi.umd.edu/>) instrument on board the International Space Station, both of which are taking measurements of tree height from space.

Taking great measurements and observations of tree height is vital to the accuracy of the science, to the comparison of the data to that of ICESat-2 and GEDI, and to the understanding of local to global impacts of trees on the environment.

Task

To do a comparison of tree height measurements using a hand-held paper clinometer versus the GLOBE Observer: Trees tool (<https://observer.globe.gov/do-globe-observer/trees/making-tree-observations>) for citizen science and to explain any differences between the two measurement methods.

Time

45-60 minutes

Safety

When taking tree height measurements and observations, please adhere to private property and all other laws pertaining to the area where the measurements are made.

Materials

- [Paper clinometer](#) with string, tape, paper drinking straw, a washer or paperclip, and clipboard (Note: If you have access to a laminator, we recommend laminating the paper clinometer.)
- Smart device with [NASA GLOBE Observer app](#) installed
- Trees to observe and measure



Paper clinometer



Smartphone with NASA GLOBE Observer: Trees tool



Example tree for observation

What to Do

For the Hand-Held Paper Clinometer

1. Print and build your paper clinometer and following the instructions at <https://go.usa.gov/xd9ht>.
2. Find a tree that is at least 5 m (15 ft) tall and on level ground.
3. Stand where you can clearly see the base and the top of the tree.
4. Look at the top of the tree through the drinking straw.
5. Use the clinometer to measure the angle at which you are looking at the tree. It helps to have a friend tell you where the string crosses the arc.
6. Walk to the base of the tree, counting your steps.
7. Calculate the tree height using the simple equations on the back of the paper clinometer.
8. Write down the tree height in column labeled “Paper Clinometer Tree Height (m or ft).”

For the NASA GLOBE Observer: Trees tool

1. Open the NASA GLOBE Observer app and enter the Trees tool by pressing on the rectangular button labeled “Trees.”
2. Follow the step-by-step instructions in the app
3. When you reached the “Location” screen, enter the latitude and longitude at the base of the tree, into the table below.
4. When you reach the “Review” screen, enter the tree height information into the table below.

Tree Height Difference

1. Calculate the tree height difference by comparing the tree heights from the paper clinometer and the NASA GLOBE Observer: Trees tool and add that information into the “Difference (m or ft)” column.

Tree Height: Paper Clinometer vs. NASA GLOBE Observer: Trees Tool	Paper Clinometer Tree Height (m or ft)	NASA GLOBE Observer: Trees Tool Tree Height (m or ft)	Difference (m or ft)	Latitude at base of tree	Longitude at base of tree
Tree 1					
Tree 2					
Tree 3					
Tree 4					
Tree 5					
Tree 6					
Tree 7					
Tree 8					
Tree 9					
Tree 10					

Table 1: Data Input Table for Tree Height Observation Comparisons

Questions for Review

- Did you notice any difference in the tree height observed using the paper clinometer versus the tree height observed using the NASA GLOBE Observer: Trees Tool?
- What could be the reason one would see tree height differences between the two observation methods?
- What NASA satellites and instruments are making tree height observations from space, and how might one be able to compare one's ground-based data to those observations?
- Why is measuring and observing tree height important?

Glossary

Biomass - the total mass of organisms in a given area or volume

Clinometer - an instrument used for measuring the angle or elevation of slopes

GEDI – Global Ecosystem Dynamics Investigation

ICESat-2 – Ice, Cloud, and land Elevation Satellite-2

Latitude - the angular distance of a place north or south of the earth's equator, or of a celestial object north or south of the celestial equator, usually expressed in degrees and minutes

Longitude - the angular distance of a place east or west of the meridian at Greenwich, England, or west of the standard meridian of a celestial object, usually expressed in degrees and minutes