

Title: Field-Based Learning Activity: Biometry and cycles in nature

Authors:

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Level: 11- 12 years old

Time: 60 minutes (in the field), 60 minutes in the classroom

Purpose

The extended purpose of this activity is to help students understand a tree as a living system by measurements (height, trunk, crown). The students learn biological processes and environmental conditions. The activity promotes inquiry, collaboration, and critical thinking. This is an example of a lesson in which an interdisciplinary approach is applied, as students perform measurements on biological objects and learn about cycles in nature, while applying mathematical knowledge and skills. Students develop scientific, mathematical and digital competencies, and are also taught the scientific approach.

Overview

Students investigate one or more trees through observation and measurement. Students estimate the height of trees, measure the height of trees (by pencil, GLOBE Observer app), measure the circumference of the tree and crown width. Students calculate the age of tree and connect the measurements taken with cycles in nature. They compare results across groups and synthesize findings into a visual poster.

Learning Outcomes

- Perform biometric measurements on trees
- Relate cycles in nature to measurements taken
- Analyze the results of biometric measurements
- Present scientific data visually and clearly using digital tools

Materials and tools

- Measuring tape
- Mobile phone with GLOBE Observer app and **Pl@ntNet** app
- Worksheets and writing tools (Appendix)
- Computer (Canva)

Introduction

Before going to the field, the teacher introduces the students to the objectives of the fieldwork, the tasks they will be working on in the field, instructs them on how to use the equipment and the methods of working in the field. The students will be divided into groups. Students with difficulties can also work in a group with students who attend regular classes because the tasks are based on practical examples from life and the students easily adopt them. The teacher prepares worksheets for the students to work on in the field and instructs them that after the fieldwork, they will create a poster in Canva in the classroom where they will be able to insert pictures of the trees, they measured with all the data. In the classroom, a comparison of the measurement results by group can also be made (if the group is younger and is only measuring one tree) or the group carries out measurements on several different trees and then analyses the results of the tree measurements they measured. After students create their posters in Canva, they will present their work on the poster.

Description of student work on field

- Students working in groups (4 – 5 students)
- Identify the tree species
- Measure and estimate the height of trees
- Measure tree circumference and calculate the age of tree
- Measure tree crown width and calculate an average
- Record and compare data
- Relate changes in tree size to the number of tree cycles
- Discuss the differences in the three height results obtained
- Creating a digital poster

Assessment of Rubric for Students
Students clearly explain the ways of conducting biometric measurements and connect them with cycles in nature. They explain different methods of measuring tree height and analyze the differences. They make digital posters independently.
Meet Standards: Students explain how to conduct biometric measurements and connect them to cycles in nature. They describe different methods of measuring tree height and, with the help of their teacher, analyze the causes of different tree height measurement results. They mostly create digital posters independently.
Needs Improvement: Students describe ways of conducting biometric measurements, with the support of the teacher they connect them to cycles in nature. Partially independently They describe different methods of measuring tree height and with the help of the teacher they analyze the causes of different results of tree height measurements. They need support to create a digital poster.

Appendix: worksheet for students

Name and surname: _____ Class: _____

The picture shows the life cycle of a tree. We will find out:

- a) How old is our tree, and how many cycles of leaf changes have passed?
- b) How many years has the tree been producing oxygen?
- c) How tall is our tree, and what living conditions were necessary for it to grow?
- d) How does the tree grow in width?

1. First, we will determine the type of tree using the Pl@nt Net app.

What type of tree is selected? _____

2. Let's estimate the height of the tree. Look at the picture to see how we estimate the height of the tree.

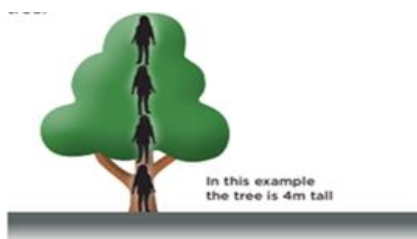


Figure 1 Estimation of tree height, Source: Natural Resources Wales

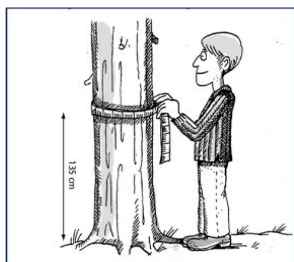
One student from the group should stand next to the tree. Another student should walk 20 steps away from the tree and then stop and use their fingers to measure the height of the student standing by the tree. Once they estimate the height of the student next to the tree, without moving their fingers, they will "stack" that distance using their fingers along the height of the tree.

How many times can we stack the student next to the tree? _____

The height of the student next to the tree is: _____

height of the tree = height of the student · number of students stacked next to the tree = ____

3. Let's measure the circumference of our tree with a measuring tape at the height of our chests. With the help of the circumference, we will calculate how old our tree is. Look at the picture to see how we measure the circumference of the tree.



Take the measuring tape and measure the circumference of the tree.

Circumference of the tree: _____

We will calculate the age of our tree dividing the circumference by 2.5

age of tree = circumference: 2.5 = _____

Figure 2 Measuring the circumference of a tree, Source: GLOBE program

How many years has our tree been producing oxygen? _____

The tree grows in width because substances produced during photosynthesis are stored in it. This means that the more years of photosynthesis, the more substances are stored in the tree.

Which gas in the air is reduced by the process of photosynthesis? _____

4. Let's determine the height of the tree using a pencil. Look at the picture to see how.

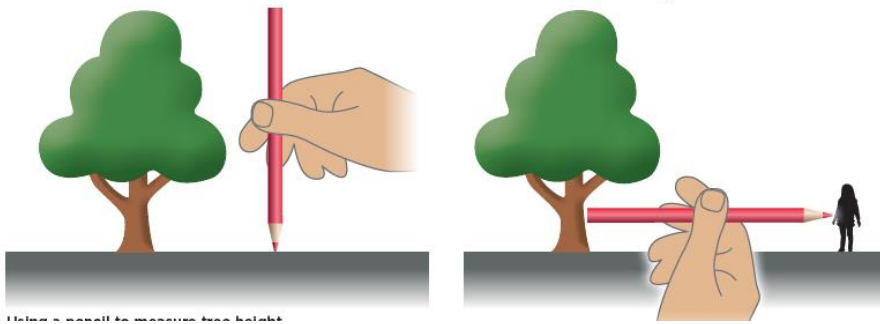


Figure 3 measuring tree height, Source: Natural Resources Wales

Procedure: The student moves away from the tree so that the pencil he holds vertically in front of his eyes overlaps the height of the tree. The other student standing at the base of the tree walks to the side as far as the student holding the pencil told him to when he turned the tip of the pencil to the side (the base of the pencil must match the base of the tree). The distance the student walked from the base of the tree to the point where he stood is the height of the tree. The method is based on the similarity of triangles.

The measured length from the base of the tree to the student standing at the designated point is also the height of the tree.

height of the tree: _____ m

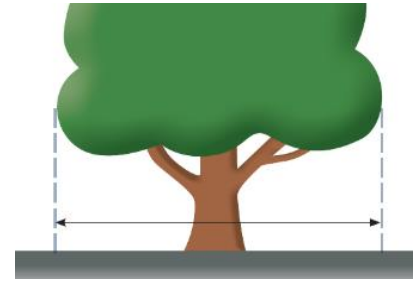
5. Let's determine the height of the tree using the GLOBE Observer app.

height of the tree: _____ m

Write four living conditions necessary for a tree to grow: _____

6. Let's measure the width of the tree's crown.

The width of the tree's crown is the distance at which the branches spread from the trunk. The spread of the branches provides a good indicator of how far the roots have spreads underground.



Procedure:

Find the branch that extends the farthest from the trunk of the tree and have one student stand directly under the tip of that branch. The other student should go to the opposite side of the tree and find the branch that extends the farthest on that side, then stand under its tip.

While both are looking at the tree, each student should take a step away from the trunk so that the distance between them can be measured without the trunk in the way (e.g., one student takes a step to the right, and the other to the left so that they are both on the same side of the tree).



Figure 4 Measuring tree's crown,
Source: Natural Resources Wales

The distance d_1 between the students: _____

Now find the branches that are the shortest or closest to the trunk of the tree and repeat the measurement procedure.

The distance d_2 between the students: _____

The average width of the crown is calculated by adding the two measured distances and dividing that sum by 2:

$(d_1 + d_2) : 2 =$ _____

7. Answer the questions:

Are the tree heights measured in three different ways the same? _____

What is the reason for this? _____

8. Compare the results of measurements from different groups

Tree Number	Plant Species	Height / m (app)	Height (using pencil) / m	Estimate the height of tree / m	Circumference / cm	Tree crown/m	Age (Circumference: 2.5)

9. Create a poster in Canva with pictures of all the trees, under which you will write all the measured sizes.

Literature:

1. *The GLOBE teachers guide*. The GLOBE program
<https://www.globe.gov/do-globe/globe-teachers-guide>
2. *Carbon storage calculator: worksheet*. Natural resources Wales
Available from: <https://cdn.naturalresources.wales/media/687190/eng-worksheet-carbon-storage-calculator.pdf>
3. *Natural Resources Wales. Tree measuring connecting trees with the curriculum for Wales* [Internet]. Cardiff: Natural Resources Wales; n.d. [cited 2026 Jan 7].