

EduTrend Contents

W4C · ENVIRONMENTAL SCIENCE · HIGH SCHOOL

Carbon in the Trees

How much carbon do our trees store?

Ages 15–18 | Level: Advanced | 75 minutes | Groups of 3 · up to 24 | Activity 05

Inside: activity at a glance · step-by-step session plan · facilitator notes · 3 student worksheets · assessment checklist

ACTIVITY 05 · AT A GLANCE

Carbon in the Trees

Students investigate trees as carbon stores. They measure the circumference and estimate the height of trees on the school site or in a park, use published allometric relationships to estimate biomass and stored carbon, and compare with typical carbon emissions. They then evaluate tree planting as a climate strategy.

Learning outcomes

By the end of the session students can:

- measure tree diameter at breast height and estimate height with trigonometry;
- use an allometric equation to estimate biomass;
- convert biomass to stored carbon and carbon dioxide;
- evaluate the uncertainty and the role of trees in climate mitigation.

KEY WORDS

carbon sink · biomass · allometric equation · diameter at breast height · sequestration · uncertainty

CURRICULUM LINKS

Biology: photosynthesis and the carbon cycle. Maths: trigonometry, logarithms. Geography: climate change mitigation.

1	2	3	4	5	6
QUESTION	**INVESTIGATE**	**MEASURE**	**ANALYSE**	**ACT**	**REVIEW**
What is the issue?	Collect evidence	Count and record	Find patterns	Plan a solution	Did it work?

Materials (per group)

- Tape measure (at least 3 m)
- Clinometer (or protractor, straw and weight) and metre rule
- Tree identification guide
- Calculator or spreadsheet
- Worksheets 1, 2 and 3

Before the session

- Choose 5–10 accessible trees; check for hazards.
- Prepare an allometric equation sheet from published forestry literature for the species present.
- Practise height measurement with the clinometer.
- Check weather and permissions.

SAFETY

Stay on paths, away from roads; do not climb trees. Watch for uneven ground and roots. Wash hands after fieldwork.

ACTIVITY 05 · SESSION PLAN

Step by step

Timings are for 75 minutes: 40 minutes fieldwork, 35 minutes analysis. Treat allometric estimates as approximate and state the source of the equation.

Time	What happens	Say or ask
0–10 min Hook	A mature tree weighs several tonnes. Where did all that mass come from?	*"Did it come from the soil?"*
10–20 min Methods	Demonstrate measuring circumference at 1.3 m and estimating height with a clinometer.	*"Why measure at a standard height?"*
20–50 min Fieldwork	Groups measure and identify 5 trees, recording circumference, distance and angle.	*"How accurate is your height estimate?"*
50–60 min Calculate biomass	Convert circumference to diameter and use the allometric equation.	*"What does this equation assume?"*
60–70 min Carbon	Carbon is about 50% of dry biomass; CO2 = carbon × 44/12.	*"How does this compare with a car's annual emissions?"*
70–75 min Evaluate	Discuss uncertainty and whether planting trees is enough.	

CHALLENGE CARD (print or copy onto the board)

Estimate the total carbon dioxide stored in the trees you measured. How many years of an average car's emissions does this equal? State your main sources of uncertainty.

ACTIVITY 05 · FACILITATOR NOTES

The science in brief

Trees take carbon dioxide from the air during photosynthesis and store carbon in wood, roots and leaves. About half of the dry mass of wood is carbon. Because trees cannot be weighed directly, scientists use allometric equations: statistical relationships between easily measured quantities, such as trunk diameter, and total biomass.

Stored carbon can be converted to carbon dioxide by multiplying by 44/12, the ratio of the molar masses of CO2 and carbon. Estimates carry large uncertainty from measurement error, species differences and root mass. Trees are valuable carbon sinks, but growth is slow, and protecting existing forests and cutting emissions are also essential.

Common ideas to listen for

- “Tree mass comes from the soil.” Most comes from carbon dioxide in the air.
- “Planting trees alone can solve climate change.” Emission reductions are still needed.
- “The equation gives an exact answer.” Allometric estimates are approximate.

Adapting the activity

Support

Measure circumference only and use a lookup table of biomass by diameter.

Stretch

Estimate annual sequestration using typical growth rates and compare species.

WORKSHEET 1

Field data

Name: _____ Class: _____ Date: _____

Measure circumference at 1.3 m. Estimate height: distance × tan(angle) + eye height.

Trees

Tree	Species	Circumference (cm)	Distance (m)	Angle (°)	Height (m)
1					
2					
3					
4					
5					

WORKSHEET 2

Carbon calculations

Diameter = circumference ÷ pi. Carbon = 0.5 × dry biomass. CO2 = carbon × 44/12.

Calculations

Tree	Diameter (cm)	Biomass (kg)	Carbon (kg)	CO2 (kg)
1				
2				
3				
4				
5				
Total				

WORKSHEET 3

Evaluation

Answer with reference to your data.

Sources of uncertainty and their effect

Are trees enough? Evaluate using evidence

FOR THE TEACHER

Assessment checklist

Use during the session. One sheet covers up to eight students; copy as needed.

Student	Measures accurately	Calculates carbon correctly	Evaluates uncertainty and strategy

Suggested codes: W = working towards · E = expected · G = greater depth

ABOUT THIS ACTIVITY

Carbon in the Trees is a sample activity from the EduTrend Contents W4C Environmental Science programme (high school, level: advanced). Every activity in the programme follows the same format: a practical challenge, a clear session plan, facilitator notes and ready-to-print worksheets, so that teachers, club leaders and parents can run it without extra preparation.

Full 15-, 20- and 32-week programmes are available from EduStore at edutrend.org.

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