Outdoor & Woodland Learning SCOTLAND

Teachers Learning Pack

Carbon storage calculator

Activity plans

Worksheets

Resource Cards

www.owlscotland.org

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Carbon storage calculator

Curriculum for Excellence Level	**Third, Fourth**
Time needed for activity	**45 – 60 minutes**
Location	**Outdoor environment with access to a range of trees**

Context

This activity plan highlights the importance of sustainably managing our natural resources, focusing on the important role trees have as a carbon store; absorbing carbon dioxide from the atmosphere through photosynthesis.

Curriculum links

Sciences:
Planet Earth: Biodiversity and interdependence; Processes of the planet

- **SCN 3-02a**
- **SCN 3-05b**
- **SCN 4-01a**
- **SCN 4-04b**
- **SCN 4-05b**

Social studies: People, place and environment

- **SOC 4-10a**

Objectives

By the end of this activity learners will be able to:

- measure how much carbon is stored in trees
- wage and identify different types of trees
- describe how trees combat climate change by storing carbon

Equipment and resources

- Information note - Carbon
- Resource cards - Carbon equivalent
- Worksheet - Carbon calculator
- Clipboards
- Pencils
- Tape measures
- Calculators
- Tree ID sheets, books or apps

What to do

Trees take in carbon dioxide from the atmosphere and store it as carbon in their trunk, roots and leaves. Approximately half of the dry weight of a tree is carbon. This means that trees are a carbon store and can help us to reduce the effects of climate change.

During this activity learners will identify tree species, work out approximate ages, calculate the dry weight and the amount of carbon stored in a tree.

Follow the steps on the Worksheet - Carbon calculator for up to three different trees as follows:

1 Tree species

Use identification sheets, books or apps to identify the species of tree.

2 Measure the circumferences

Use a tape measure to measure the circumference of the tree at chest height (1.3 metres up the trunk from the ground).

3 Age of tree

Calculate the age of the tree based on the given growth rates.

4 Dry weight

Use the conversion table to convert the circumference of the tree into the dry weight.

5 Carbon stored

Use the dry weight to calculate how much carbon is stored in the tree.

6 How do we produce this amount of carbon?

Use the Resource cards - Carbon equivalent, to find real life examples of how we create the amount of carbon which is stored in the tree.

Plenary

Relate findings for everyday examples of how we produce carbon.

Discuss what can we do to reduce the amount of carbon we produce?

Key questions

- How do we produce carbon?
- How are trees connected to our carbon emissions?
- What is a carbon store?
- How much carbon is stored in your tree?
- What can you personally do to reduce the amount of carbon released into the atmosphere?

Adapting for different needs/abilities

Less able

- Leader to complete the worksheet with whole group for one tree only.
- Break down each stage of the worksheet and check results and understanding before moving on to the next stage.

More able

- Learners complete each step independently.
- Learners can compare broadleaf and conifer carbon storage capabilities.

Follow up activity/extension

- Learners calculate the carbon footprint of their household, whole school etc.
- Create an action plan to reduce the carbon footprint calculated.

Try our other tree and woodland learning resource:

- Activity plan - Seed dispersal
- Activity plan - Tree planting
- Activity plan - Carbon footprint

Additional information

See Information note - Carbon

Additional resources

Looking for more learning resources, information and data? Please visit:
https://www.owlscotland.org and **www.outdoorlearningdirectory.com**
Alternative format, large print or another language, please contact:
Scottish.Forestry@forestry.gov.scot

Thank you to Natural Resources Wales for sharing this resource with Outdoor & Woodland Learning Scotland

Carbon storage calculator

As trees grow they take in carbon dioxide from the atmosphere and store it as carbon in their trunk, roots and leaves. Approximately half of the dry weight of a tree is carbon. This means that trees are a carbon store and can help us to reduce the effects of climate change.

Follow the instructions to complete the table and calculate the amount of carbon that has been stored in up to 3 different size trees.

Instructions

1 Species

Use identification sheets, books or apps to identify the species of tree.

2 Circumference

Use a tape measure to measure the distance all the way around the trunk of the tree at a height of 1.3 metres (approximately chest height) up from the ground.

3 Age

Divide the circumference of the tree by the growth rate to calculate the age. Trees grow at different speeds with the circumference increasing at an average of 2.5cm per year.

Growth rates

- Holly and yew – 1.25cm per year
- Oak – 1.88cm per year
- Ash, beech, elm and hazel – 2.5cm per year
- Sycamore – 2.75cm per year
- Pine and spruce – 3.13cm per year

NB If the species of your tree is not listed use the average growth rate of 2.5cm per year.

4 Dry weight

Use the conversion table on next page to convert the circumference of the tree into the dry weight.

Dry weight conversion table

Circumference (cm)	Dry weight (kg)
1.5	0.009
2.5	0.04
5	0.23
10	1.4
20	9
30	27
40	82
50	106
75	310
100	668
125	1208
150	1964
175	3253
200	4221

5 Carbon stored

Half of the dry weight of the tree is carbon, therefore you need to divide the answer for the dry weight by two. This tells you how much carbon is stored in the tree.

Example
The circumference of a tree is 150cm. Looking at the table this means that its dry weight is about 1964kg. Dividing this by two tells us that the tree is storing 982kg of carbon.

Circumference converted into dry weight ÷ 2 = carbon stored

6 How do we produce this amount of carbon?

Use the carbon equivalent resource cards to find out how we create the amount of carbon which is stored in the tree.

		Tree A	Tree B	Tree C
1	**Species**			
2	**Circumference** (cm)			
3	**Age** (circumference ÷ growth rate)			
4	**Dry weight (kg)** (see conversion table)			
5	**Carbon stored** (kg)			
6	**How do we produce this amount of carbon?** (see Resource cards: Carbon equivalents)			

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4.5kg Carbon = Playing x-box 360 for 1 hour every day for 6 months

0.005kg Carbon = Boiling a kettle for 1 hot drink

155kg Carbon = Running 2 refrigerators for 1 year

0.16kg Carbon = Using an electric oven for 1 hour

604kg Carbon = A family of 4 flying to Europe for a holiday twice a year

41kg Carbon = Running 1 dishwasher for 1 year

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Resource cards

1,626kg Carbon
=
3 people on a return flight from the UK to North America

0.018kg Carbon
=
Watching television for 1 hour

0.5kg Carbon
=
Drying 1 load of clothes in a tumble drier

15kg Carbon
=
Washing clothes for a family for 1 year

334kg Carbon
=
Using electricity to cook for a household for 1 year

53kg Carbon
=
Driving an articulated lorry from Cardiff to London

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Resource cards

982kg Carbon
=
1 average petrol car being driven 11,000 miles

1,980kg Carbon
=
2 average petrol cars being driven 11,000 miles

Additional resources

Forests for the future:
www.forestsforthefuture.co.uk

Forests for the Future is designed for upper primary learners to explore the local and global issues surrounding climate change and sustainable development. There is a focus on the role that trees, forests, and people can play in reducing and/or mitigating any negative impacts.

The Forests for the Future resource seeks to encourage teachers and their learners outdoors – using local trees, parks and woodland areas (private and public) to help understand climate change issues, the value of trees in the carbon cycle, and what individuals and schools can do to make a difference.

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