

Trees

What do trees do for me?



Terrific Scientific Campaign

Investigation: Trees

Hello! Welcome to the Trees Investigation from the Terrific Scientific campaign!

Please complete this investigation when the trees are in leaf so that your children can identify them.

At BBC Terrific Scientific, we think it is vital to develop science learning in primary schools across the UK. By taking part in this activity, you will be developing your class's scientific thinking and investigative skills.

At Key Stage 2 (Second Level), children need to:

- **Develop** investigative skills.
- **Understand** when it is important to control variables.
- **Predict, observe and record** results.
- **Draw conclusions** (which may generate new questions).
- **Understand** the need to repeat activities.
- **Record** what they see and not what they want to see.

We have incorporated these principles into this exciting activity. We've made it suitable for primary classrooms by using readily available equipment and suggesting opportunities for support and differentiation.

The BBC deems this activity safe if following some basic precautions. It is your responsibility as a school to carry out your own risk assessment and

we recommend you consider the risks and mitigations we have described in this activity pack, as well as any risks which may be relevant to your specific class environment.

As well as these key working scientifically principles, we have made sure there are links to the science curriculum for each nation, as well as cross curricular opportunities for further learning. We think these are just as important, as they help to explain the relevance of science and how it links to the world around us.

On our website you will find a supporting 'How to' film which shows teachers and teaching assistants how to set up and carry out the experiment. You will also find additional resources including a step-by-step lesson presentation, including an introductory film, which sets the investigation into context for your students.

Related links:

Find out more about
Terrific Scientific and our
other investigations:
bbc.co.uk/terrificscientific

In 2017 we partnered with the University of Leeds for this investigation. Schools around the UK submitted their results from this investigation to help further scientific learning and give input to professional scientific research; understanding the impact of the carbon value of trees in the UK's primary schools. An overview of the results from the University of Leeds' research can be found on our website.

Although the you can no longer submit your results to the university of Leeds or the Terrific Scientific map you can still try this investigation in your classroom.

We hope this inspires you and your students to get scientific!

The Terrific Scientific Team.

Supported by: University of Leeds, United Bank of Carbon, Royal Society of Biology, Woodland Trust and Primary Science Quality Mark.

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What will the children learn?

Learning intention

- Children will **understand and justify** why carbon storage is important, through the context of trees in their school's grounds.
- Children will **compare evidence** they collect to identify trees in the school grounds **and learn how to estimate** the size of trees on their site.
- Children will understand **how to use the data** they have gathered to estimate the carbon value of the trees on their site.

The investigation allows you to add a range of further activities (see 'Additional Activities'). These will determine further learning objectives.

This activity will:

- Enthuse children about science, underlining the principle that science is accessible to all.
- Demonstrate that science helps us to understand the world around us.
- Gather evidence through practical activities, observations and controlled investigations.
- Allow children to see that their results can directly contribute to further scientific study.
- Develop students' investigative skills, as well as building conceptual understanding.

Curriculum points – England, Scotland, Northern Ireland and Wales

England

Year 5; living things and their habitats. Describe the life process of reproduction in some plants.

Forces. Explore the effects of air resistance by observing how different objects such as sycamore seeds fall.

Year 6; living things and their habitats. Classifying plants using keys



Notes:

The average carbon footprint of someone in the UK is over 2000 kg (2 tonnes) of carbon⁴, which is equivalent to making 716849 cups of tea!



Scotland

Sciences; principles and practice.

This activity gives opportunities for developing inquiry and investigative skills.

Planet earth; biodiversity and interdependence.

Links; E, F, S; SCN 0-01a, 1-02a, 2-02a 2-02b. Looking at living things over time.

Biological systems; body systems and cells.

Links; S; SCN 2-13a. Composting leaves.

Biological systems; inheritance.

Links; S; SCN 2-14a. Life cycles.

Topical science; topical science.

Links; E, F, S; SCN 0-20a, 1-20a, 2-20b. Using the C Calculator.

Northern Ireland

The world about us; interdependence.

Questions from Geography and Science & Technology can be addressed through investigating plants and local habitats, acting on a global issue, life cycles and plant growth.

The world about us; change over time.

Questions from Geography and Science & Technology can be addressed through observing seasonal changes, investigating global issues, decay of materials and shadow work.

Wales

Science; Opportunities for Key Stage 2.

Skills; Enquiry: exploring and taking measurements.

Developing; appropriate equipment use, making careful observations and measurements, repeating data collection for accuracy.

Reflecting; children think about what they have done in order to consolidate learning and transfer skills.

Range; Interdependence of organisms; through fieldwork the plants in a local environment can be assessed, investigate how humans affect the environment.

The sustainable earth; a consideration of waste.



Trees

Watch the film:

You might find it useful to watch the Trees introduction film before you read through the resources.

bbc.co.uk/programmes/p04xw7xb

Introduction

Trees have many roles in nature and help us in many ways too. They provide us with foods like apples and pears, are a home for a variety of creatures and their roots help hold soil together and prevent flooding. But one of the most important roles they have is removing carbon dioxide (CO₂) from the air and using it to produce the oxygen (O₂) we need to breathe. They do this through a process called **photosynthesis**.

All animals, including us, release carbon into the atmosphere as a gas in the form of CO₂ when breathing and when we decay. Plant leaves take in CO₂ from the air and with a little bit of water and sunlight, convert it to O₂ and carbohydrates they use to grow.

Plants with many leaves, such as trees, are able to remove lots of CO₂ from the air and so, are incredibly useful to us. **Carbon value** is a measure of the amount of carbon absorbed and then stored in this way whilst producing O₂.

However, since the industrial revolution, we have been releasing more CO₂ than ever before, and the rising level of carbon dioxide in the world's atmosphere is too much for trees to tackle on their own. This is contributing to **climate change**.



Notes:

To give your class some context around why the storage of carbon in trees is important for all life on Earth, or to stretch eager children, you might want to explain the Carbon Cycle using the separate resource sheet on our website.

What is carbon?

Carbon (C) is an element which is sometimes described as the building block of life, as all living things on Earth contain it. It is special in that its atoms are able to bond with other carbon atoms in different shapes, so you can find different forms including diamond, graphite and charcoal. It can also bond to other elements such as oxygen (O_2) to form carbon dioxide (CO_2).

All the forests in the world are thought to absorb around 4 billion tonnes of CO_2 each year¹. Even though this sounds like a lot, we are releasing around 3 billion tonnes by cutting down trees each year alone, and even more through burning coal, gas and petrol. It is estimated that only around one quarter of the total CO_2 emissions from burning fossil fuels is taken in by plants². On top of this, CO_2 is constantly being released from natural and long-term processes, making trees even more vital in keeping our planet balanced and healthy.

What do trees do for us?

An average tree can store several hundred kilograms of carbon, really big trees may even store one tonne (1000 kg)! Most of these trees are found in tropical forests, but we also find them in our parks and playgrounds. This means there are around 400 trees for every human on Earth.

We aren't really sure how many trees are cut down each year, but estimates are between 6 and 15 billion trees per year... that's equal to an area of forest 100 times the size of Wales each year. A lot of people around the world are concerned by this, especially as in a single year, a big leafy tree can produce enough oxygen for ten people to breathe. If we keep getting rid of trees at this rate, we will lose a very important carbon store and a major source of the world's oxygen supply, which we and other animals need to breathe and survive.

The science of observing trees

For centuries, scientists have observed and recorded what is around them. These records of observations are called data. Having accurate data about our surroundings is important in science as it means scientists can look for patterns. Scientists look for patterns they expect to see and sometimes they spot new patterns they had not anticipated. In this scientific work, children will be recording observations (data) about the trees in their area through a survey. They will also have to think creatively about ways to make their observations more accurate and useful.

In 2017 the BBC teamed up with The University of Leeds to perform a large scale survey to help gather information on trees. Scientists at the University of Leeds do research on trees and forests all around the world. There are too many trees for the scientists to measure them all individually, so, to carry out their research, they needed the help of students all around the UK! The information collected helped the scientists work out how much the trees in schools across the UK are helping to fight climate change and provided evidence to help protect them. You can read more about their work and how the data from this investigation was useful to them here: <http://leaf.leeds.ac.uk/>.

Although the University are no longer collecting data, at the end of this investigation, your school will know how much carbon the trees on your grounds are storing, and how this helps combat climate change.

In the 2017 mass participation investigation every school that submitted data became part of Terrific Tropical Trees and adopted a tree that was planted in Africa. This helped create new habitats for local wildlife, new jobs for local people and also helped combat climate change. More information on this, and similar schemes can be found at the bottom of this resource.

Even if your school has no trees you can still take part in this investigation, trees in a local park can be used to complete the tasks (following school guidelines for an off-site visit). You can use our 'Decision Tree' in 'Teacher Preparation' to decide the best course of action for your class.

While gathering the information for this investigation, there are other curriculum linked tree activities which your children may enjoy (see 'Additional Activities'). Alongside this pack, on the website, you will find a 'Student Recording Sheet' which will allow you to collect all the information you need as you survey your trees..



Notes:

If you are interested in planting more trees on your school site, visit the Woodland Trust website and search for "Trees for Schools"



Starter Activity

This activity is designed start your class thinking about trees, and the many ways in which they are beneficial to us.

You will need (per child):

- Envelopes
 - Paper
 - Pencil/Pen
 - Copies of worksheet 'What I know about trees' (in 'Student Resource Pack')
 - Copies of resource 'Carbon comparisons' (in 'Student Resource Pack')
1. Using the sheet provided, give your children 5 mins to list the things they know about trees on side one of the worksheet.
 2. Ask them to fold up their paper and seal it in their envelope, and write their name on the front.
 3. Collect the envelopes and keep them safe. At the end of the investigation, you will ask your children to repeat this exercise, this time completing side two of the worksheet, so that they can compare and reflect on their learning.
 4. Discussion: Ask your class how trees are helpful to us. Collect a list of their ideas which might include:
 - a. Providing food including fruit and nuts.
 - b. Providing shade.
 - c. Home for many animals and insects, squirrels, birds etc.
 - d. Holding soil together, preventing flooding.
 - e. Fire wood – fuel for heating and cooking.
 - f. Building houses, boats etc.
 - g. Amenity value – they look beautiful.
 - h. Climbing.
 - i. Producing oxygen for us to breathe.
 - j. Removing carbon dioxide (which we breathe out) from the air and storing it.

Notes:

Trees are alive, treat them with care and be careful not to damage them when doing your surveys.

Make sure you tease the last point out of your class if they don't come up with it.



5. Explain that it is storing of carbon.
6. Play your class the Trees introduction film available on our website:
bbc.co.uk/programmes/p04xw7xb
7. Play your class the Trees How to film available on our website:
bbc.co.uk/programmes/p04xw7xv



At the end of the main investigation

Revisit the worksheet as part of the plenary activity:

1. Give the children back their "What I know about trees" worksheet and ask them to re-read what they wrote.
2. **Class discussion: has what they know changed?**
3. Ask them to complete the questions on the second side of the worksheet, which consolidates their learning from the investigation.
4. Next, use the 'Carbon comparisons' worksheet to let the children compare the total amount of carbon stored in the trees at school with the use of everyday appliances. To complete this exercise, they will need to convert the carbon total into a CO₂ total. This is achieved by a simple multiplication, and gives a figure which can be widely compared. Instructions are on the worksheet.

Once you have a total for amount of carbon stored in the trees in your school, show your children our carbon comparison resource and let them compare how much usage of everyday items this equates to.

Main Activity

Teacher preparation Expected duration

Approximately 2 hours. This will depend on the number of suitable trees on your school grounds. It will take around 15 minutes for a group of 3 to investigate one tree, depending on your children's proficiency.

Equipment needed

To measure trees:

- Marker pens or chalk OR brightly coloured ribbon and a label.
- 100cm measuring tape.
- Some string (3m should be sufficient for most trees).
- 30cm clear plastic ruler.
- Pencil.
- Student Recording Sheet (in 'Student Resource Pack').
- Tree ID Sheet (in 'Student Resource Pack')*.
- Carbon Calculator Sheets (in 'Student Resource Pack').

To collect leaves:

- Several clear plastic bags e.g. sandwich or freezer bags.
- Labels / Paper.
- Pencil / Pen.

***Tree ID sheet:** We have worked with the Woodland Trust to produce a special version of its tree identification resource, designed to help children identify trees commonly found in school grounds in the UK. Alternatively, children could make their own key using leaves from the site they are investigating (see 'Additional activities'). Do make the time to go outside ahead of the lesson and practice identifying trees yourself. A little practise will pay dividends!



How should your class investigate trees?



Before the class:

- Work out how many groups the class will be split in to (we recommend small groups of 3-5 children)
- Decide how long you would like to spend on this activity. We estimate that it should be possible for each group to measure 6 trees per hour.
- Use this information to select a suitable number of trees to observe and measure using the guides below.
- Identify the trees to be measured by numbering each tree with chalk on each trunk. For a large site, trees should be chosen that are representative of the area in terms of species and size.

Organising your Tree Survey

The way you organise your tree survey will differ depending on the number of trees on your site and the number of children involved with the survey.

We recommended assigning trees to groups in one of two ways:

- Each group measures the same set of trees as each other.
- Assign each group a unique set of trees to measure

Each method influences the number of trees you will be hypothetically be able to measure in your allocated time but also the number of trees you have access to may influence which method you select.

For example, in a class of 30 students split in to 10 groups:

1. Using method one, where each group measures the same trees, 6 trees will be measured 10 times in 1 hour.
2. Using method two, where each group has their own unique set of trees, you will be able to measure 60 trees in 1 hour

This should give you an estimate of how many trees you can measure in your allotted time and which method will be best for your school groups and class size.

Notes:



We estimate that a group of three children will be able to measure around 3-4 trees an hour.



When you have finished your survey:

- If some groups do not have a complete survey of the trees (e.g. only 10 out of 12 are surveyed by one group, but 12 out of 12 are surveyed by another group), children can pool results with each other to make sure every group taking part has a full data set of the trees surveyed at the school
- If each group within a class has surveyed all of the available trees, collate the data at the end of the survey to find the average measurements for each of the trees surveyed.

What to do if:

You have no trees on your school grounds

Don't worry if you have no trees at your school, you can still take part!

- You could visit a local park, green space or nature reserve to do the investigation. You could even measure any trees that are on your high street (if it safe to do)
- You can still do some tree survey activities with your class off site (see 'Offsite tree activity').
- You could take in various leaves/branches/buds/fruits from the local area for your class to look at and identify in the classroom.

You haven't got many trees for the number of children at your school

You have trees on site and could count all or most of them in your allotted time.

In this scenario you can use either method to measure your trees.

- Before the investigation starts identify the trees to be measured by numbering each tree with chalk on each trunk
- If you only have a few trees you may prefer to have each group measure every tree.
- If you have enough trees you may wish to assign a unique set of trees to each group
- Make sure children note down the number of each tree they are measuring on their 'Student Recording Sheet' in the 'Tree ID Number' column.

Tree choice

Selecting suitable trees to survey

All plants remove some CO₂ from the atmosphere, but for the purpose of this study we will be focusing on trees of 1.5 metres and taller with a clear trunk (i.e. not bushes or shrubs). Where a tree has become part of a hedge, it will not be suitable as it will be very difficult for children to measure. For example, a free-standing hawthorn tree is fine, whereas one which is part of a hedge will be unsuitable.

Notes:



The teacher notes section will help you select trees to study and deal with any anticipated issues.

Your tree checklist:

- Are the trees safe to study? Ensure you do not do a tree study on a windy day.
- Can the staff/children get close enough to measure the circumference (girth) of the tree? ([See 'Teacher notes'](#) for guidance)
Can the staff/children step far enough back for the height to be calculated?
- Are there any other issues such as thick ivy on the trunk, multiple stems/trunks? ([See 'Teacher notes'](#) for guidance)
- Is the tree free-standing and not forming part of a hedge?
- For a large site, are the chosen trees representative of the area in terms of species and size?

Discuss:



Talk to other teachers taking part in this Terrific Scientific investigation to estimate how many trees each class could hypothetically measure.

Possible issues with the trees

If there are no leaves:

- If you are investigating early in April you may find that the trees have not yet come into leaf. In this case other attributes such as branch shape and bark to help you identify the tree. You could use fallen leaves beneath the tree as long as you are completely confident they came from the tree you are measuring.

If you find a tree you cannot identify:

- Complete the activity using the tree and collect evidence to help you identify the tree later. The carbon calculators supplied by the University of Leeds are general, one for broadleaved trees and one for needle-leaved trees. Plus, you can enter the tree as "unknown" if you can't work out its species.

Main Activity

Instructions

The investigation for each tree is split into four activities which you could print and give to your children.

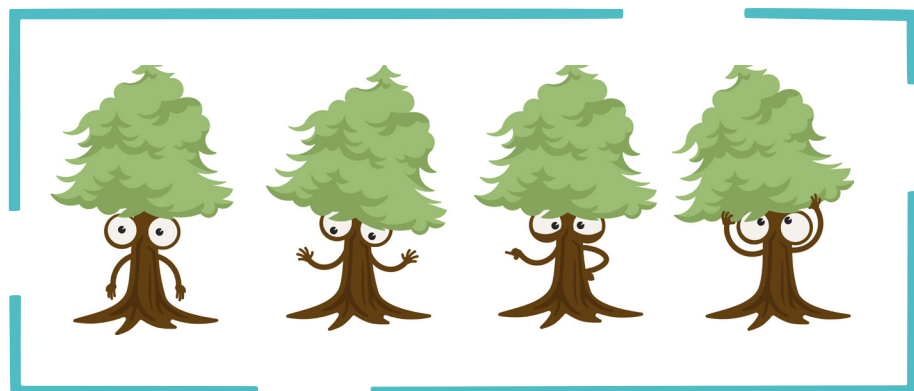
Tip:

Why not practice each step first to help with children understanding and produce more accurate results?

Note: the “how-to” film on our website will really help you to understand the investigation. bbc.co.uk/programmes/p04xw7xv

Make sure you have introduced the investigation and explained how you have decided which trees to survey, referring to the decision tree.

1. Divide the class into small groups (3 – 5 children depending on how many are in your class).
2. Allocate a tree or collection of trees to each group to investigate.
3. Make sure each group has the equipment necessary.



Activity one:

Measure the tree's circumference

Ensure you have safe access to take this measurement on each of your chosen trees.



You need to be able to measure the circumference of the tree 1.3 metres from the ground. Some trees may have large roots at the trunk base forming a buttress. When measuring 1.3m, choose points on the tree where there are few root buttresses to avoid confusion and measure from the bottom of the trunk.

There may be obstacles in the way of the circumference measurement e.g. shrubs, branches, climbing plants (See 'Health & Safety and Control Measures').

Important:



Use a piece of string to measure the girth, then measure the string on the ground.

Tape measures can spring back fiercely, which is why we are recommending this method instead.

1. Make sure your tree has a chalk number or ribbon label on it, and note down the number in your "Tree ID Number" column of your 'Recording Sheet'.
2. On the tree trunk, measure 130cm from the ground at the base of the trunk using your 100cm tape measure and 30cm ruler (together they add up to 130cm) and make a small chalk mark on the tree bark.
3. Repeat this on the other side of the tree so that there are two chalk marks on the tree.
4. One person should hold the end of the string against the tree bark on one of the chalk marks. Another person should then wrap the string around the tree so it is tight and touching the bark. Make sure it is level with both of the chalk marks.
5. Where the string goes all the way around the tree and meets the end of the string, carefully mark the string using a marker pen or hold it carefully at this point.
6. Take the string off the tree, lay it on the ground, pull it tight and using your tape measure, measure the length of the string up to the mark you made.
7. This is the circumference of the tree. Write this information on your Recording Sheet.

Watch the film:

Use the diagram on the next page and the 'How to' film on our website to help you with this task.

Activity two:

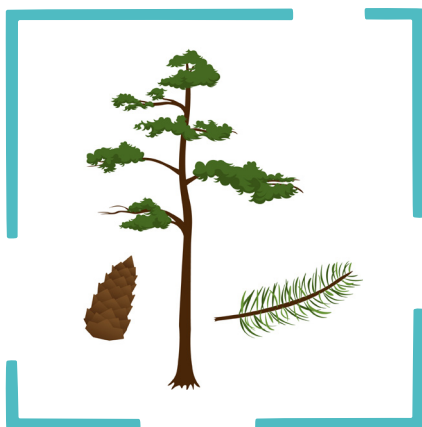
Estimate the height of the tree

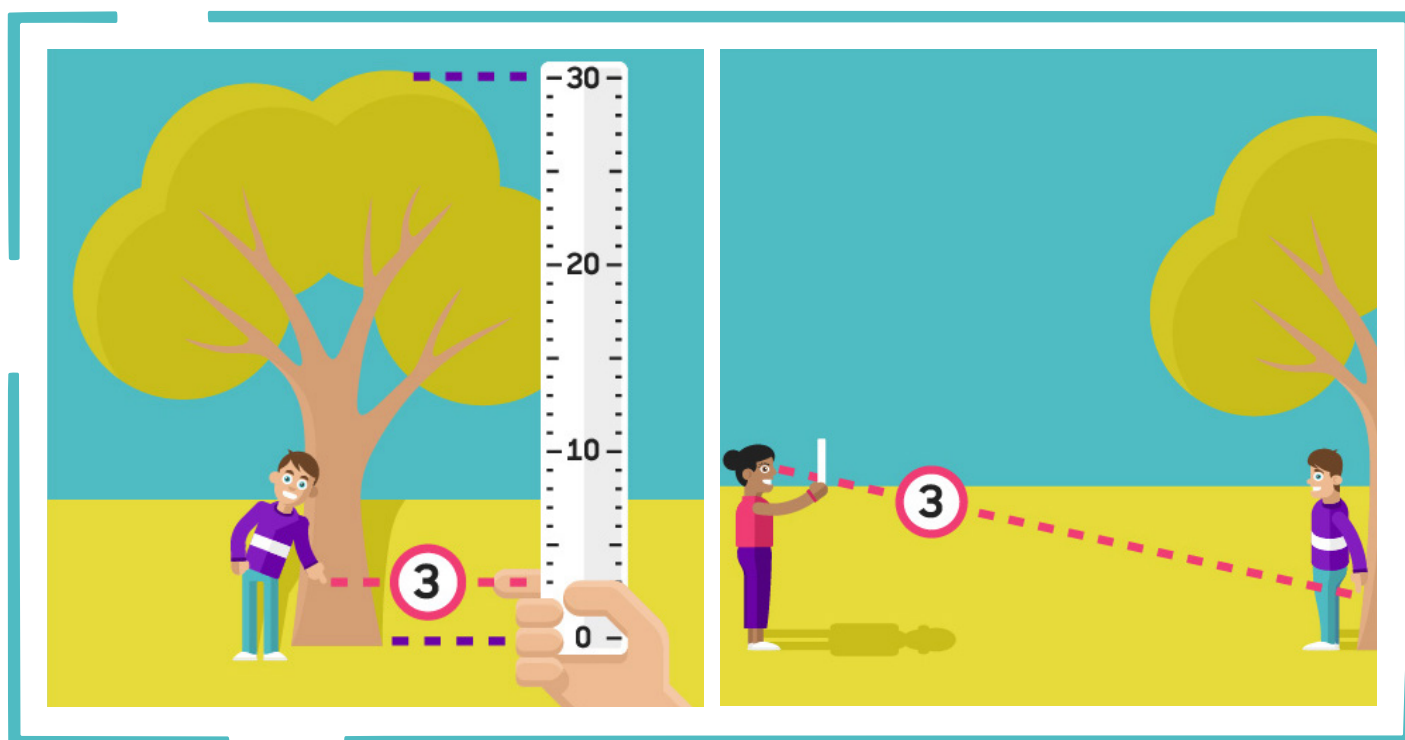
There are several methods commonly used to calculate a tree's height. For the purpose of this investigation we have outlined a simple method for all schools to follow for consistent results. You may be aware of other methods for estimating tree height; however, it is important to use the following method to ensure the final carbon calculations are correct, and to allow you to compare your results with other classes that have taken part.

It may be useful for children to practice this procedure on a known height e.g. a second floor window ledge or netball post, so they are familiar with the methodology. You can also line up trees with something of a known height, or multiples of a known height, to check that your measurement is about right.

Please estimate the height of the tree in metres.

1. Stand facing the tree, a few metres from the trunk. Check there are no obstacles/holes near you or behind you.
2. Hold the 30cm ruler vertically at arm's length with the 30cm mark at the top. Look through the ruler at the tree.
3. Walk carefully backwards away from the tree with someone walking alongside you to guide and prevent you from tripping on anything. Whilst doing so, look through the ruler until the top of the tree lines up with the 30cm mark on the ruler and the bottom of the tree trunk is in line with the 0cm mark.
4. If you walk too far, move closer until the tree seems to be the same height as your ruler. Check the ruler is still vertical and stand still to keep the ruler in this position.
5. Someone else from your group should now stand next to the tree. Ask them to point their hand to the side of the tree trunk near the ground and ask them to slowly lift their hand up the trunk. It should start at the 0cm mark on your ruler, come up to the 1cm mark and then the 2cm mark. When their hand is in line with the 3cm mark on your ruler shout "STOP!".





6. Ask them to keep their hand that is pointing at the tree very still. Your group could mark this height on the tree with a bit of chalk to make this easier.
7. Another member of your group should then measure the distance from the bottom of the trunk to the 3cm mark on the tree.
8. Record this measurement on the 'Student Recording Sheet'.
9. Now work out the height of the tree by multiplying this measurement by 10. Remember to take care to change your measurement from centimetres to metres (1 metre = 100 centimetres).
10. Record the height you have calculated on the 'Student Recording Sheet'.

Tip:



Why not practice each step first to help produce more accurate results.

Activity three:

Identify the tree

Children will need to gather a leaf from the tree they are collecting data from. This can be done by picking leaves from the ground or from lower branches. Make the children look up to be sure the leaves are from the tree they are recording. If there are no low branches arrange for some lower twigs to be cut off to give the children access to the leaves. If you are working between autumn and early in April, some trees may not yet have their leaves, in this case try to use leaves on the ground and bark to help you to identify the tree.

To make identification easier, we have provided a 'Tree ID Sheet' produced in collaboration with the Woodland Trust. Trees can be identified whilst they are being measured or material can be collected from each tree to use in identification back in the classroom.



1. Gather evidence from the tree you are measuring. This could be leaves, fruits, seeds, flowers, or even a photograph. If you pick up a leaf or seed, look up at the branches above and check it is the same shape.
2. Sometimes other plants grow up the tree trunk, such as ivy. If there are lots of leaves on the trunk, look up at the branches to see if they are the same leaf shape as the ones on the trunk.
3. You can identify the tree now or later using the 'Tree ID Sheet' provided.
4. If you will be identifying the tree in the classroom, put your evidence in a clear plastic bag. Use one bag per tree when collecting evidence and make sure you write the tree's ID number along with your group's name on a label and stick them onto the bag/inside the bag.
5. Do not damage the tree; be careful, only take the minimum leaves/fruit/seeds.
6. Once identified, write down the name of the tree species on your 'Student Recording Sheet'. If you can't identify the tree, write "unknown" but note if it is needle-leaf or broad-leaf.



Activity four:

Calculate the carbon value of the trees

Once you have observed, measured and identified all of the trees in the survey area, you will need to work out the carbon value for each one using the chart provided and then estimate the total carbon value of all the trees surveyed.

The University of Leeds have produced two Carbon Calculator Sheets, one for broad-leaf and one for needle-leaf trees.



1. For each tree, decide if they are a broad-leaf or needle-leaf tree, you could look back at your Tree ID sheet to work this out. Use the relevant 'Carbon Calculator Sheet'.
2. You will have measured the height (in metres) and circumference (in cm) of each tree. Along the top of the chart, find the height category that your tree fits into (e.g. 7-9 m). You might need to round your measurement to the nearest whole number. Then move down the table to find the circumference category that your tree fits into. (e.g. 95-125cm).
3. The number in this box is the carbon value (in kilograms). Add this value to your 'Student Recording Sheet'.

Different species of tree store different amounts of carbon and this is mainly due to whether it is one type of tree or the other.

Results and Review

Notes:

As an extension activity, each group could investigate the same trees and compare their results to check their accuracy in collecting data.

Students should be encouraged to create bar charts to help them answer these questions.

- What is the most common species of tree?
- What is the least common species of tree?
- What is the average height of each species?
- On average, which species is the tallest?
- On average, which species is the shortest?
- What is the average circumference of each species?
- On average, which species has the biggest circumference?
- On average, which species has the smallest circumference?
- Which species stored the most carbon – why do you think this is?

You may also wish to try to investigation the relationship between **height and circumference using a scatter graph**. Once the graph has been plotted the students can look for a pattern in the data.

- Is there a pattern between circumference increase as height increases?
- Can they explain the pattern they see (if they see one)?

Note –

This is a pattern seeking activity and, as students are using biological data, there will be many other factors influencing height and circumference. The students will only be able to say there is a casual relationship between these two attributes and may wish to discuss what could influence it, such as species, age, location of the tree etc.



Discussion of results

As part of this discussion, please ask your children to refer to the “The things I know about trees” worksheet which they completed at the start of the investigation, and complete side 2.

- How many trees are growing on your site?
- Can you estimate their age? How does this affect their carbon value?
- What could you do to increase the carbon value of your school?
- Do any trees on your site show signs of pests or diseases? How do you think this would affect the tree?
- Discuss the other ways you could lower your carbon footprint.
- Which species of tree on your school grounds have the highest carbon value? Why do you think this is?
- Which sites close to your school would you expect to have a high carbon value?
- Where in the world would you expect trees to have the highest carbon value?

Additional activities

There are plenty of fun learning opportunities around trees across the whole year, and we have gathered some ideas in our Additional Activities Pack which is available on the website.

We have also produced the two additional resources below:

The carbon cycle

In order to understand more about how carbon moves in the environment, we have designed this stand-alone activity. Please refer to the Carbon Cycle Worksheet on our website: guides.files.bbci.co.uk/terrific-scientific/Carbon_Cycle_Activity.pdf

WANTED: Invasive species!

Lots of our trees are at risk of disease and pests and we need your help to look for them, so we have designed this stand-alone activity. The scientists at the University of Leeds are particularly interested in any additional information you can give them about your trees. Please refer to the 'Spot the problem' PDF on our website.

Note:



Find out more about your tree and how to reduce your school's footprint at: unitedbankofcarbon.com/terrifictropicaltrees

Watch the film:



The different layers of a deciduous forest: bbc.co.uk/education/clips/zygdrdm

Tropical rainforest: bbc.co.uk/education/clips/z2ngsg8

Terrific tropical trees

We need to plant more trees to compensate for those that have been cut down and help remove the excess CO₂ we have released into the atmosphere.

As part of the 2017 mass participation event for this investigation the BBC worked with the United Bank of Carbon on a project to help each school involved to plant trees in Africa – Terrific Tropical Trees, which was also sponsored by Samuel Grant Packaging, The Bettys & Taylors Group, and UBoC!

Over 40,000 new trees were planted as part of this initiative.

Trees growing in tropical parts of the world like South America, Africa and Asia not only help to fight against climate change but also provide a vital habitat for animals and help create jobs for local people. The United Bank of Carbon (UBoC) arranged for new forests to be planted in Africa, with at least one tree being planted and protected for every school taking part. At the end of the project they had planting an amazing 44,640 trees!

Things to think about:

- How could your school improve its carbon storage?
- How could your school community reduce its carbon output?
- If there is no room at your school where else could you plant some trees?
- What other plants/shrubs could you plant in your school grounds?

If you are interested in planting more trees on your school site, please visit the Woodland Trust 'Trees for Schools' page:

www.woodlandtrust.org.uk/get-involved/schools/trees-for-schools/

Glossary

Broad-leaved	Trees whose leaves are generally large, and two sided.
Carbon calculator	Sheet used as a means of calculating the amount of carbon taken out of the air by a tree.
Carbon cycle	The series of movements by which carbon is stored and transferred through different processes in the environment. Please refer to the Carbon Cycle Worksheet available on our website.
Carbon dioxide (CO₂)	A gas made of one carbon atom and two oxygen atoms.
Carbon value	In the case of this activity, the amount of carbon stored in all living tree material, both above and below the ground.
Carbohydrates	Sugars which are produced by plants.
Circumference	The length of a circle's perimeter, in this case the measurement around a tree trunk.
Climate change	The large-scale, long-term change in the planet's weather patterns or average temperatures due to human actions such as burning fossil fuels.
Deciduous tree	A tree that sheds all its leaves annually in autumn.
Diameter	The length of a line from one side of a circle to the other, passing through the circle's centre.
Erosion	When material is worn away by something.
Evergreen tree	A tree that has leaves all year round.
Fossil Fuel	A natural fuel such as coal, oil or gas, formed in the geological past from the remains of living organisms.
Girth	See 'Circumference'.
Global warming	The process by which the world's global atmospheric and surface temperature is increasing due to human actions, such as burning fossil fuels.
Greenhouse gas	A gas that contributes to the greenhouse effect in the atmosphere by absorbing infrared radiation, such as CO ₂ . They are necessary to keep us warm enough to survive, but are damaging in the amounts we are currently releasing and contributing to global warming.
Habitat	The natural home or environment of an animal, plant, or other organism.

Horizontal	A straight line, left and right.
Identification key	A tool used to find the name of an organism through closed questions about it.
Needle-leaved	A tree that has small leaves often resembling needles.
Pollard	A tree where the branches are removed regularly at the same height to encourage growth.
Photosynthesis	The process by which green plants make food and O ₂ from CO ₂ , water and sunlight.
Sucker shoots	Shoots growing from the base of the plant upwards, near ground level.
Symmetrical	A shape where each side of an imaginary line is the same.
Vertical	A straight line, up and down.

References

1. Pan et al. (2011) 'A Large and Persistent Carbon Sink in the World's Forests.' Science. 333. 988-993
2. Reich. (2011) 'Biogeochemistry: Taking stock of forest carbon.' Nature: Climate Change. 1. 346–347
3. Crowther et al. (2015) 'Mapping tree density at a global scale.' Nature. 525. 201–205
4. Carbon footprint per person (for 2013) from: <http://data.worldbank.org/indicator/EN.ATM.CO2E.PC>



Health & safety and control measures

Notes:



The teacher notes section will help you select trees to study and deal with any anticipated issues.

Notes:

If you have no trees and are investigating trees away from your school site, please do not submit data on these trees to the BBC or the University of Leeds, simply state that your school grounds do not have trees.

- Trees on site should be safe, with any potential problems identified and dealt with according to your school's H&S policy in advance.
- Avoid trees with thorns (e.g. blackthorn, acacia etc.)
- Avoid trees where stinging nettles, giant hogweed and parsnip plants grow nearby. Ivy can irritate sensitive skin. Children with sensitive skin must avoid trees covered with ivy.
- If your children require medication e.g. epipens, inhalers etc. please ensure that you take it with you.
- Have a first aid kit with you when working outside.
- Avoid doing the data collection in windy weather.
- If working after windy/stormy weather, check the area to be surveyed prior to data collection for possible hazards (e.g. loose branches on the trees).
- Ensure children never put their hands in their mouths during the activity and never put anything they find during the activity in their mouths (e.g. berries, nuts). Children must wash their hands thoroughly after the activity.
- The data collection involves someone standing close to the tree's trunk, so check for any shrubbery/walls/thorny plants/trip hazards that may be in their way.
- Ensure children wear suitable footwear to avoid slips, trips and falls.
- Be careful of any animals and insects you might encounter, and remember you are working within their living environment so try not to disturb them. Most are harmless, but occasionally trees can be home to wasp nests, which should definitely not be disturbed.
- If working off-site, follow your school guidelines for an off-site visit.
- The oak processionary moth has part of its life-cycle that can be dangerous – cause rashes etc. – if you touch it. Please advise your children not to touch any kind of “hairy” caterpillar just in case it is related.