



Forestry England

Activity sheet

Calculating tree growth



Forest Research

There are many different factors that can affect the rate that trees grow. These include environmental factors such as changes in temperature and soil moisture, but also different management techniques including thinning regimes and planting different tree species alongside each other. Scientists at Forest Research monitor tree girths (circumference) to record and understand the impact of these factors to help grow resilient forests for the future.

In the short term, girth measurements can pick up water related changes in the diameter of the stem (trunk). During summer it is common to observe a daily pattern of stem shrinkage when the tree is photosynthesising, followed by expansion later in the afternoon, when water stores are recharged. However, over longer time periods, regular measurements can show growth as more woody material is added.

1. Make your own girth band

Make your own girth band to track the growth of a tree in your school grounds and compare results with others in your class. You will be able to regularly measure changes and the band could stay on the tree for several years.

If you don't have any suitable trees in your school grounds then you can use a local park or woodland but make sure you have permission from the landowner.

You will need:

- High density packing tape or webbing strapping
- Ribbon
- Digital callipers
- Pin
- 4.5cm tension spring (4.5mm diameter)
- Marker pen
- Scissors
- Tape measure
- Gloves and safety goggles
- Pen and paper for recording



Fig 1



- Select a tree, preferably one that is over 3m tall and has a girth (circumference) of 60cm – 1m. You need to make sure that you will be able to find your tree in the future so you can take more measurements. Depending on the location/surroundings of your tree you might need to mark the tree by tying some ribbon around it or on one of the lower branches.
- Measure from the ground up the trunk to a height of 1.3m. (*fig 1*)

- At 1.3m, wrap the tape or strapping around the tree and cut the length so that there is about 10cm overlap. (*fig 2*)
- Take the band off the tree and put a pinprick in the tail end.
- Thread the hook on the end of the spring through the pinprick hole.
- Write an identity number on your girth band and also 'Do not touch'.

Fig 2

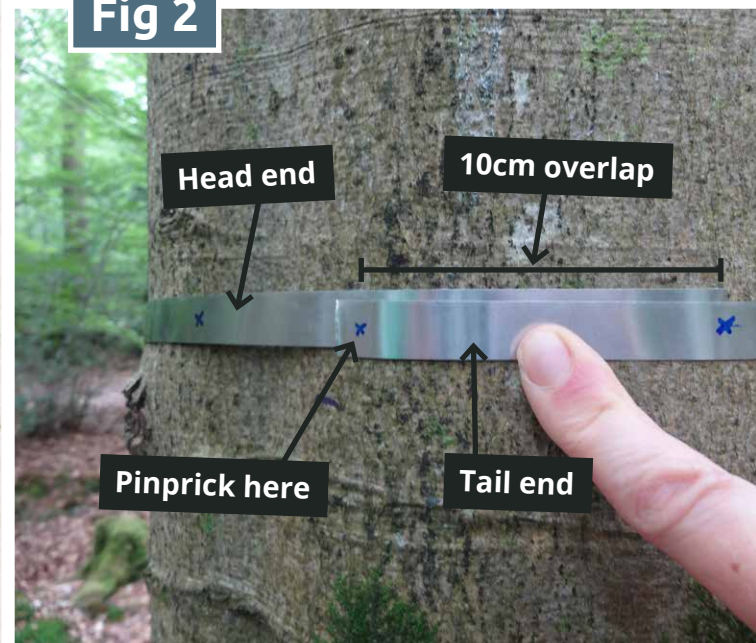


Fig 3



- Wrap the girth band back around the tree at 1.3m from the ground. Put another pinprick on the head end of the tape where the free end of the spring reaches the tape. Make sure the tape is overlapped and the spring is under tension. If necessary, mark the point with a pen and release the tape to pinprick it. (*fig 3*)
- Thread the hook on the other end of the spring through the new pin hole.

Fig 4



- Mark an 8cm window on the tail end of the tape with 6cm of it on the overlap and 2cm beyond it. (*fig 4*)
- Cut out the window going down about halfway from the top edge of the tape. You might need to take the band off the tree to do this.

- Measure the size of the window using your callipers and record. (*fig 5*)
- Use the tape measure to measure the circumference of the tree just above your girth band so you know the current tree girth.

Fig 5



Every month go back and measure the size of the window with the callipers.



Create a spreadsheet to record the difference between the new and previous reading - this is the change in tree girth.



Make a prediction on how you would expect the tree girth to change over the year.

Analysing the data

1. Is the change in girth over the year as you would expect?
2. Can you see any patterns in your data?
3. How does your data compare with others in the class? Is there any notable difference between the growth rate of different tree species?

2. Tree girth data exercise

Our scientists at Forest Research use automatic dendrometers (also known as an auto girth band), to continuously measure the girth of the tree.

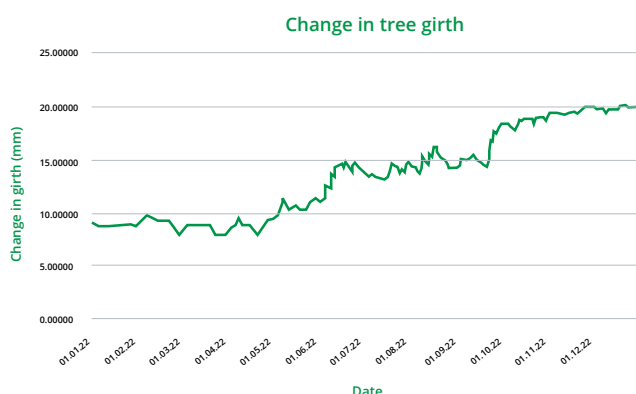
Remember that a daily pattern of shrinkage is normal in the summer during photosynthesis, but in periods of drought there may be prolonged continuous shrinkage.

There are different styles of automatic dendrometer. The one pictured records the circumference of the stem (trunk) every 30 minutes at a resolution of 0.001mm and sends the data wirelessly.

The spreadsheet holds data from 2019 from three trees which Forest Research are monitoring.

Open and save the spreadsheet and complete the tasks below.

1 Predict how you would expect the girth of a tree to change over a year. When would you expect there to be more of a change?



2a

Create a graph to show the change in girth of one of the trees over the year.

2b

Are the results as you expected? Can you describe and explain what your graph shows?

3

Calculate your chosen tree's change in growth over the whole year by finding the minimum value and taking this away from the maximum value.

4a

Add your selected tree's temperature data to your graph using a second vertical axis, or create a separate graph so you can easily compare the change in the girth with the temperature.

4b

Is there any correlation between temperature and change in girth? Explain.

5

How do you think this method can be used to help build resilient forests for the future?

You will need:

- [Automatic dendrometer data](#)



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