How to calculate tree carbon content

The carbon content of trees is based on a number of measurements both directly recorded from the field and calculated from data thereafter. To find the carbon content precisely is extremely difficult and it is not advisable for students to attempt to gain that level of precision. Instead, a good estimation of carbon content can be had by roughly calculating the volume of the tree and apply to this a known index value to account for organic density (known as the **specific gravity**).

Start by finding the height of the tree (see Guide 36) and the circumference of the tree trunk using a tape measure, taken roughly at chest height. Ensure that both measurements are recorded in metres.

Find the radius (r) of the tree trunk using the following equation:

$$r = \frac{\text{circumference}}{2\pi}$$

To find the volume of the tree, one uses the calculation that finds the volume of a cone. This is because it is assumed that the tree is unlikely to be cuboid in shape, and instead the cone accounts for the trunk being wider at the base of the tree and thinner with more foliage at its crown.

The volume (V) of the tree (in m^3) is therefore:

$$V = \pi r^2 \times \left(\frac{\text{height}}{3}\right)$$

Next calculate the biomass of the tree using the specific gravity value for the type of tree in question or for its species. If the species of tree is not known, it may be easier to simplify the calculation and use the specific gravity values for deciduous or coniferous trees. Some of the known specific gravity values for common tree species in the UK are listed below.

Biomass (B), in dry tonnes, is then calculated:

$$B = V \times \text{specific gravity}$$

Species	Specific gravity
Alder	0.44
Ash	0.56
Beech	0.59
Cherry	0.47
Dogwood	0.68
Elder	0.57
Elm	0.44
Hazel	0.51
Holly	0.50
Hornbeam	0.69
Horse chestnut	0.5
Larch	0.47
Lime	0.42
Maple	0.53
Oak	0.56

Species	Specific gravity
Plane	0.48
Poplar	0.35
Scots pine	0.42
Silver birch	0.53
Spindle	0.60
Spruce	0.37
Walnut	0.55
Wayfarer	0.72
Sweet chestnut	0.50
Weeping willow	0.42
Yew	0.55

Type	Specific gravity
Coniferous	0.39
Deciduous	0.53

Biomass in itself is a useful measurement to have for different trees, but if one wishes to estimate the rough carbon content of a tree, we assume that 50% of any tree's biomass is its carbon (also in dry tonnes).

It is worth remembering that these calculations make a number of assumptions about the tree being measured; most obviously that the tree has a cone-like shape. Many factors can affect the shape of the tree, not least its age and its health so these factors may also have to be considered before one compares different trees in different locations.