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Is there a maximum tree width?

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If the height of a tree is limited by capillary action, why can't trees grow to an unlimited width?

Guy Cox, St Albans, New South Wales, Australia

This takes me back to my plant science degree. First of all, capillary action doesn't limit the height of trees. If it did, they would be nothing like the magnificent specimens we see all around us.

Water transport in trees depends partially on water molecules sticking together to form a column in hollow cells within the bulk of the trunk. This is distinct from capillary action and therefore no fundamental limit exists on the height of a tree.

It isn't clear that anything limits the girth of trees either, but the trunk functions to support the crown. In a forest, the primary consideration is to get the crown high enough to catch the sun.

Ancient, slow-growing trees can have very broad trunks – this is seen in the redwoods of the Sierra Nevada mountain range in the US, which can be more than 3000 years old and have trunks about 10 metres in diameter. In Australia, we have the largest broadleaved trees in the world, reaching heights in excess of 100 metres, but they are relatively fast growing and short lived.

Trees in isolation can spread very widely. Two oaks in England – the Newland Oak, Gloucestershire, and the Cowthorpe Oak, North Yorkshire – reportedly had trunks more than 5 metres in diameter. Both were relics of ancient forests, but once freed from vertical competition, they spread horizontally. Though they are now both dead, the Newland Oak was about 1000 years old and the Cowthorpe Oak lived for up to 1800 years.

In the case of the Newland Oak, its large horizontal spread was probably encouraged by pollarding – the practice of harvesting branches for timber.

Mike Follows, Sutton Coldfield, West Midlands, UK

The function of a tree trunk is to provide support for the branches, which carry leaves for photosynthesis, as well as being a conduit for water. The trunk won't grow wider than it needs to be as building that extra tissue would be a waste of energy.

It also won't be too narrow, however. If a tree were too thin for its height, it would buckle. The minimum diameter required to prevent a cylindrical column buckling under its own weight is proportional to its height to the power of 1.5. Trees largely obey this relationship, but with some variation between species and among individual trees within each species.

Trees can also develop wider trunks if exposed to the wind. This should mean that trees on the edge of a forest have thicker trunks. Indeed, it is often the spindlier trees away from the edge of a forest that are toppled during severe storms. This is probably because these trees aren't adapted to the strong wind that can penetrate further into a forest on such occasions.

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