

Trees might be 'aware' of their size

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Trees are known for their great, but not unlimited, trunk height and diameter. They have evolved to develop a heavy above-ground biomass, but this integral feature poses a challenge to the trunk's stability.

Despite its evident importance, the principle by which plant stems

respond to their increasing [weight](#) remains unknown. To address this question, a theory of "vertical proprioception," a mechanism that balances the radial growth of the stem with the weight increase, has been developed.

To study the theory, researchers at the University of Helsinki, University of Cambridge and Natural Resources Institute Finland manipulated the aerial weight of downy [birch](#) (*Betula pubescens*).

The researchers observed that the tree was indeed able to adjust its stem radial growth in [response](#) to the added weight, and the strength of this response varied along the length of the stem. Furthermore, a degree of lateral stem movement was required for this response: static [trees](#) did not grow as thick as free-moving ones.

"Even though the idea of [plants](#) sensing their own weight and thickening their stem accordingly sounds intuitive, our study is the first one to address this question in trees," says Juan Alonso-Serra from the Faculty of Biological and Environmental Sciences, University of Helsinki.

One approach to understand how this weight-sensing mechanism works is by comparing normal plants with plants lacking this ability. The researchers took advantage of a naturally occurring birch mutant named elimäki. This exceptional tree grows upright for three months, after which its stem suddenly bends at the very base, and the whole tree collapses.

The researchers showed that, unlike normal trees, elimäki trees fail to properly adjust their width to their increasing weight, which makes them less stable mechanically. The lack of a proper response in elimäki trees is linked to a single position (locus) in the birch genome, enabling the future identification of the mutated gene.

The use of mutant trees was a key part of the project. In most plant models, such as Arabidopsis, [genetic studies](#) are feasible because a new generation can be produced within months, whereas the same typically takes decades with trees.

However, birches are exceptional as they are the among the few tree species where flowering can be induced already at six months' age. This provides a unique opportunity to address basic and applied questions concerning the life and development of trees.

More information: Alonso Serra, J. A et al. (Accepted/In press). ELIMÄKI locus is required for vertical proprioceptive response in birch trees. *Current Biology*.

Provided by University of Helsinki

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