**Earthquakes boost tree growth**

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Earthquakes boost tree growth
Short-term fertilizing effect leaves signatures in wood cells
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Rings seen in the cross section of a tree
By measuring changes to individual cells in tree rings, researchers dated an earthquake in Chile to within 1 month of when it struck.MEHMET GÖKHAN BAYHAN/ISTOCK
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Earthquakes can tear down buildings, but they can also build up forests—at least for a little while. New research shows strong quakes can help trees grow by driving extra water into the soil surrounding their roots. These fleeting growth spurts leave signatures in wood cells that could also be used to better detect and date ancient earthquakes.

“This is really, really a new frontier in [timing earthquakes] on a more precise scale than a year,” says Irina Panyushkina, a tree ring expert at the University of Arizona who was not involved in the study.

University of Potsdam hydrologist Christian Mohr didn’t set out to find a link between seismicity and tree growth. But his research took a turn after the magnitude 8.8 Maule earthquake in Chile in 2010. It shook the river valleys where he was studying sediment transport—and it shook him. “I was there during the earthquake, which was pretty scary,” says Mohr, who sheltered in a doorframe as the waves rocked his wooden cabin in the middle of the night. The earthquake and ensuing tsunami devastated parts of coastal Chile, killed hundreds, and directly affected more than 2 million people.

When Mohr and his colleagues returned to one of the river valleys after the earthquake, they found that streams there were flowing faster. Mohr suspected the Maule quake had shaken up soils and made them more permeable, allowing groundwater to more easily flow down from the ridges into the valleys. It seemed natural that earthquakes might also help valley trees grow at the expense of those on the hillslopes.

To see whether this was happening, Mohr and colleagues drilled two dozen plugs of wood from the trunks of six Monterey pines growing along the valley floors and ridgelines of two plantations in the Chilean coast range. Each plug was thinner than a pencil and twice as long as one. Back in a laboratory in Germany, they put thin sections of the cores under a microscope and tracked how the size and shape of cells within the tree rings changed as more water became available.

The researchers also measured how the ratio of heavy to light carbon isotopes changed in these cells. Trees take up more carbon-12 than carbon-13 during photosynthesis, so a change in the ratio can signal a photosynthetic growth spurt.

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Trees on the valley floor, they found, experienced a small but discernable growth spurt lasting for weeks to months following the Maule quake—a boost about as strong as those caused by heavy rainstorms. And as predicted, trees on the ridges grew more slowly after the quake, they reported last month in the Journal of Geophysical Research Biogeosciences.

Panyushkina says the technique could be used to identify earthquakes and other events that cause short-term growth effects, which might be missed when considering tree ring width alone. Because tree rings reflect average growth over each year, studies using them to identify earthquakes, volcanic eruptions, and tsunamis can only date events to the nearest year, at best. By combining the cell-level measurements with carbon isotope data, Mohr and colleagues were able to pin down the Maule earthquake to within 1 month of when it hit.

A logical next step would be to repeat the study in different locations, to see whether the technique applies to different tree species and climates, says Andres Iroumé, a hydrologist and forester at the Universidad Austral de Chile, Valdivia, who was not involved in the study. In Chile, foresters often plant quick-growing Monterey pines in arid soils that limit the trees’ growth. Mohr expects the new method will work best in comparably arid regions where extra water leads to bigger growth spurts. He plans to repeat the study with tree cores from Napa Valley in California.

The method could also help scientists peer into the past, Panyushkina says. She anticipates the method might one day help researchers identify short-term disturbances like earthquakes that occurred thousands of years ago. Reconstructing a more accurate record of ancient earthquakes and other events impacting groundwater would be “important for geological purposes, important for hydrology … [and] important for society,” she says. “What [these researchers] provided is the technique, the tool.”
* **How does an earthquake affect the flow of water through valleys, soil and rivers?**
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* **Explain how an earthquake can help trees in the valleys grow while trees high on the ridgelines do not grow as a result of an earthquake?**
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* **Explain how this discovery could be used?**
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* **How could you benefit from this discovery?**
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* **What other positive benefit could you imagine from an earthquake? Do you think it has been researched?**
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