



## **Long-term trends in C, O, and N isotopes in tree rings from pristine tropical forests**

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Various drivers of global change can affect tree growth and forest dynamics, but these effects are poorly known for tropical forests. By analysing trees of different ages and wood of different cambial age from trees in pristine tropical forests in Brazil and Thailand, we distinguish between long-term changes (decadal) related to the environment and changes related to the trees' ontogeny (cambial age). Cellulose  $^{13}\text{C}$  trends were independent of tree age, reflecting the rise in  $\text{CO}_2$  concentration that result in increases in tree water use efficiency. By contrast, cellulose  $^{18}\text{O}$  showed no long-term trend, but increased with tree age in some species, which may be caused if larger trees access water from different soil layers or the crown grows to higher canopy strata.  $^{15}\text{N}$  significantly declined with cambial age, which may reflect different nitrogen sources or internal recycling in larger trees, or soil development in microsites where trees regenerate. However, independent of tree age, there were also long-term changes in  $^{15}\text{N}$  that point to changes in the N cycle even in tropical forests that are rather remote from N emissions. Whether these are related to increased N input or indirect effects of  $\text{CO}_2$  on the N cycle, remains unknown.