

# Turgor pressure limits red cedar growth in tropical forests

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Tropical forests are experiencing increasing vapor pressure deficits ( $D$ ), with possible negative effects on tree growth. However, the mechanisms by which climatic variability drives tree growth are poorly understood.

The role of turgor limitation in driving tropical tree growth has also remained largely unexplored.

In a study published in *Plant, Cell & Environment*, researchers from the Xishuangbanna Tropical Botanical Garden (XTBG) of the Chinese Academy of Sciences and their collaborators have investigated how environmental conditions can induce turgor limitation in stem growth, and in turn, explain diel and [seasonal patterns](#) in stem diameter growth in the widespread tropical tree species *Toona ciliata* (red cedar).

The researchers conducted continuous monitoring for one year in a [tropical rainforest](#) near XTBG, Yunnan Province in southwest China. They applied a turgor-driven mechanistic model to quantify the [environmental conditions](#) that cause turgor to limit intra-annual stem diameter growth rates in *Toona ciliata*.

To simulate turgor-driven growth during the growing season, the researchers collected hourly sap flow and dendrometer measurements. They found that the simulated seasonal patterns of radial growth agreed well with growth observations. Growth primarily occurred at night, and pre-dawn accumulation appeared to be limited under higher vapor pressure deficits.

The team also found that the nighttime turgor pressure required for growth was negatively related to the previous midday vapor pressure deficit in all seasons. "This may be due to the relatively high canopy conductance at high vapor pressure deficit, relative to stem rehydration," said FAN Zexin of XTBG.

The study shows that the mechanistic modeling of turgor dynamics in the cambium is an effective tool for simulating and understanding the diel and seasonal growth dynamics of a tropical tree species. In red cedar, turgor limitation is highly sensitive to changes in atmospheric drought,

probably driven by poor stomatal control.

"Our results provide the first evidence that tropical trees grow at night and that turgor [pressure](#) limits [tree growth](#)," said Fan Zexin of XTBG.

**More information:** Richard L. Peters et al, High vapour pressure deficit enhances turgor limitation of stem growth in an Asian tropical rainforest tree, *Plant, Cell & Environment* (2023). [DOI: 10.1111/pce.14661](#)

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