

Tracking the movement of the tropics 800 years into the past

October 15 2018



By studying the annual rings of black pines (*Pinus nigra*) such as these, scientists figured out that the northern boundary of the tropics moved back and forth in the last 800 years. The people at the top of the ridge are dendrochronologists from Istanbul University in Turkey. Credit: Ünal Akkemik

For the first time, scientists have traced the north-south shifts of the northern-most edge of the tropics back 800 years, reports a University of Arizona-led international team.

The movement of the [tropical](#) boundary affects the locations of Northern Hemisphere deserts including the Sonoran, Mohave and Saharan. Those deserts sit just north of the tropical belt, which includes the subtropics.

Before now, scientists had information about the location of the tropical belt going back to around 1930, when reliable instrumental record-keeping began.

On a standard map, the tropical belt spans roughly 30 degrees north latitude to 30 degrees south latitude.

However, the new research reveals that from the year 1203 to the year 2003, the northern edge of the tropics fluctuated up to 4 degrees north and south of the northern 30th parallel.

"Movement of the limit of the tropics is associated with changes in precipitation regimes," said Raquel Alfaro Sánchez, who led the research team while a postdoctoral researcher at the UA Laboratory of Tree-Ring Research.

From 1568 to 1634, the tropics expanded to the north, the team found. That time period coincides with severe droughts and other disruptions of human societies, including the collapse of the Ottoman empire in Turkey, the end of the Ming Dynasty in China and near abandonment of the Jamestown Colony in Virginia, said Alfaro Sánchez, currently a postdoctoral researcher at the Centre de Recerca Ecològica i Aplicacions Forestals in Barcelona, Spain

Co-author Valerie Trouet said, "Our results suggest that [climate](#) change

was one of the contributing factors to those societal disruptions."

To track the northern boundary of the Earth's tropical belt from 1203 to 2003, the team used the annual rings of trees from five different locations throughout the Northern Hemisphere. Researchers can figure out annual precipitation years into the past because each annual growth ring of a tree reflects the climate that year.

Having an 800-year history also allowed the researchers to connect rare events such as huge volcanic eruptions with subsequent changes in climate, said Trouet, a UA associate professor of dendrochronology.

Massive volcanic eruptions cool the Earth because of all the fine particles and aerosols thrown into the atmosphere. The 1815 Tambora eruption in present-day Indonesia caused such cooling worldwide that 1816 was known in Europe as "the year without summer," the team writes.

"We can see the contraction of the tropics after [volcanic eruptions](#) such as Tambora," Trouet said.



By studying the annual rings of centuries-old black pines (*Pinus nigra*) such as this, scientists figured out that the northern boundary of the tropics moved back and forth in the last 800 years. Credit: Ünal Akkemik

Trouet said learning how aerosols affect climate is important because some researchers have proposed sending such particles into the atmosphere as a geoengineering solution to global warming.

The team's research paper, "Climatic and volcanic forcing of tropical belt northern boundary over the past 800 years," is scheduled for online publication in *Nature Geoscience* on October 15. Names of the additional co-authors are at the bottom of this release.

Other researchers have documented that the tropics have been expanding northward since the 1970s, Alfaro Sánchez said.

Because computer models of current and future climate models also show expansion of the tropical belt, but not as much as is actually occurring, the researchers wanted to develop a longer history of the movement of the tropical zone, Trouet said.

Researchers use tree rings to reconstruct past climate and climate changes for many locations around the globe. Those climate reconstructions extend hundreds of years into the past. To track past tropical belt movements, Alfaro Sánchez and her colleagues used existing tree-ring chronologies from five locations: Arkansas, the American West, the Tibetan Plateau, Turkey and northern Pakistan.

To discern how the tree-ring records reflect changes in the tropical belt, the team looked at tree rings from 1930 to 2003 and compared the trees' natural archive of climate to instrumental records of changes in the

tropical belt.

The researchers focused on recorded changes in Hadley cells, the huge atmospheric convective cells that circumnavigate the globe in the tropics. Trouet said Hadley cells are an important driver of atmospheric circulation.

Knowing how changes in Hadley cells correlated with changes in [tree rings](#), the team then used multiple tree-ring chronologies to see how the tropics expanded and contracted as much as 800 years ago.

"This is the first reconstruction that went back to pre-industrial times," Trouet said. "To know what the natural climate variability is, we need to go farther back in time than the last 150 years."

Alfaro Sánchez and her colleagues found the tropical belt has expanded and contracted on its own long before industrial times.

Internal variability in the Earth's climate system affects the movement of the tropics, Trouet said.

The current recorded expansion of the tropical belt since the 1970s is in part due to the increase in greenhouse gases in the atmosphere, other researchers report.

The current expansion of the tropics may have important societal impacts, because the team found that past severe droughts were associated with persistent periods of tropical expansion, Alfaro Sánchez said.

More information: R. Alfaro-Sánchez et al, Climatic and volcanic forcing of tropical belt northern boundary over the past 800 years, *Nature Geoscience* (2018). [DOI: 10.1038/s41561-018-0242-1](https://doi.org/10.1038/s41561-018-0242-1)

Provided by University of Arizona

Citation: Tracking the movement of the tropics 800 years into the past (2018, October 15)
retrieved 24 April 2024 from

<https://phys.org/news/2018-10-tracking-movement-tropics-years.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.