Yucatan climate past informs the global climate present

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New research shows changes in tides and hurricane activity played a part in upending the Maya civilization centuries ago.

Changes to the water table throughout the Yucatan Peninsula impacted the Maya and now offer lessons on the effects of present-day climate change, researchers say.

"Big parts of the Yucatan Peninsula sit on rock formations made of limestone, with fissures and caves throughout," said Aaron Coutino, a recent PhD graduate in applied mathematics at the University of Waterloo. "Rainwater and runoff accumulate in the cave formations and underground rivers, and that's where much of the freshwater is on the Yucatan."

"If you have changes in sea level or tidal activity, then what happens in those fissure zones is a mixing between the fresh water on the surface and the salty water that intrudes from the ocean underneath."

The researchers show that fluctuations in Maya population and settlement patterns were impacted by access to fresh water. Long before the arrival of Europeans and the eventual destruction of the Maya civilization, the archeological record shows cycles of internal disruption.

"Sometimes things in Maya cities were good, and sometimes people seem to disperse out into the countryside," said Marek Stastna, a professor of applied mathematics at the University of Waterloo and a co-author on the study.

"There's a variety of theories in the archeological community as to why. This research suggests it was to do with regular access to freshwater. The water stops being good for drinking and even stops being useful for irrigation. When you can't irrigate your crops, you can't have a city of 40,000, like some of the Maya cities were."

The researchers placed sensors in bodies of water throughout the Yucatan to gather data. They found daily fluctuations of water levels and

salination that show ocean tides impact even far-inland lakes. Their work offers new insights for archeologists and climate historians, but also for present-day climatologists.

The researchers say the study informs how the contemporary world can think about the different ways climate change expresses itself. The Yucatan, with its unique water table, is vulnerable in particular ways. Other regions will have their specific vulnerabilities.

"Right now, you see how climate change expresses itself in places like British Columbia, with these huge forest fires. And in the Yucatan, climate change expresses itself through the underground water table. If you're in Acadia, maybe the bigger concern is coastal erosion, but in the Yucatan change can manifest inland" Stastna said.

"People shouldn't be thinking about whether climate change is happening, but how it expresses itself in different places."

The study was published in the journal *Geophysical Research Letters*.

More information: Aaron Coutino et al, Inland Tidal Oscillations Within the Yucatan Peninsula, *Geophysical Research Letters* (2021). DOI: 10.1029/2020GL092091

Provided by University of Waterloo

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