

# Green Sahara's ancient rainfall regime revealed

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The multicorer device being lowered into the ocean takes eight one-foot cores from the seafloor. Scientists analyze such cores for clues to the climate of the past several thousand years. Credit: Peter deMenocal

Rainfall patterns in the Sahara during the 6,000-year "Green Sahara" period have been pinpointed by analyzing marine sediments, according

to new research.

What is now the Sahara Desert was the home to hunter-gatherers who made their living off the animals and plants that lived in the region's savannahs and wooded grasslands 5,000 to 11,000 years ago.

"It was 10 times as wet as today," said lead author Jessica Tierney of the University of Arizona. Annual [rainfall](#) in the Sahara now ranges from about 4 inches to less than 1 inch (100 to 35 mm).

Although other research had already identified the existence of the Green Sahara period, Tierney and her colleagues are the first to compile a continuous record of the region's rainfall going 25,000 years into the past.

The team's paper "Rainfall regimes of the Green Sahara," is scheduled for publication in the journal *Science Advances* on Jan. 18.

Archaeological evidence shows humans occupied much of the Sahara during the wet period, but left for about a thousand years around 8,000 years ago—the middle of the Green Sahara period.

Other investigators have suggested the Sahara became drier at the time people left, but the evidence was not conclusive, said Tierney, a UA associate professor of geosciences.

Her team's continuous rainfall record shows a thousand-year period about 8,000 years ago when the Sahara became drier. That drier period coincides with when people left, she said.

"It looks like this thousand-year [dry period](#) caused people to leave," Tierney said.

"What's interesting is the people who came back after the dry period were different—most raised cattle. That dry period separates two different cultures. Our record provides a climate context for this change in occupation and lifestyle in the western Sahara."





A crane will lift the 20-foot-long coring device over the side of the R/V Oceanus and lower the corer to a depth of greater than two miles. The resulting sediment core represents about 40,000 years of time. Credit: Peter deMenocal

Tierney and her colleagues also used their rainfall record to suggest ways current climate models can better replicate the Sahara's ancient climate and therefore improve projections of future climate.

Tierney's co-authors are Francesco Pausata of Stockholm University in Sweden and Peter deMenocal of Columbia University's Lamont-Doherty Earth Observatory in Palisades, New York. The David and Lucile Packard Foundation, the National Science Foundation and the Swedish Research Council funded the research.

Researchers had long known the Sahara was much greener in the past, but how much of the Sahara was wetter and how much wetter was not well understood, Tierney said. Although scientists can learn about past climate by examining ancient lake sediments, in the Sahara the lakes dried up long ago and their sediments have blown away.

Instead of lake sediments, Tierney and her colleagues used cores of marine sediments taken off the coast of West Africa at four different sites. Because the cores were taken over a north-south distance of about 800 miles (1,300 km)—from offshore Cape Ghir, Morocco, to the northwest corner of Mauritania—the cores revealed both the ancient rainfall patterns and the areal extent of the Green Sahara.

In terrestrial plants, the chemical composition of a leaf's wax changes depending on how dry or wet the climate was when the plant was

growing. Leaf wax also washes into the ocean and can be preserved in the marine sediments that are laid down year after year.

"The waxes record the climate conditions on land," Tierney said.

By analyzing the leaf wax from ancient [marine sediments](#), the team determined the region's past [rainfall patterns](#) and also gathered clues about what types of plants were growing.

The team also wanted to know whether the conditions on land interacted with the atmosphere to affect climate, because most of the current [climate](#) models don't simulate the Green Sahara period well, she said.

The amount of solar radiation the Earth receives during the Northern Hemisphere summer depends on where the Earth's "wobble," known as precession, is in its 23,000-year cycle.

At the beginning of the Green Sahara, the Northern Hemisphere was closer to the sun during summer. Warmer summers strengthened the West African monsoon and delivered more rain. Toward the end of the Green Sahara, the Northern Hemisphere was farther from the sun and the West African monsoon was weaker.

There's a feedback between vegetation, dust and rainfall, Tierney said. Right now the Sahara Desert is the planet's biggest source of dust—but a vegetated Sahara would produce much less dust.

**More information:** "Rainfall regimes of the Green Sahara," *Science Advances*, [advances.sciencemag.org/content/3/1/e1601503](https://advances.sciencemag.org/content/3/1/e1601503)

Provided by University of Arizona

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