

# THE *Current*

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## **Lessons in sustainability, evolution and human adaptation — courtesy of the Holocene**

The El Gigante rockshelter in western Honduras is among only a handful of archaeological sites in the Americas that contain well-preserved botanical remains spanning the last 11,000 years. Considered one of the most important archaeological sites discovered in Central America in the last 40 years, El Gigante was recently nominated as a UNESCO World Heritage site.

“No other location shows, as clearly as El Gigante,” state UNESCO materials about the site’s universal value, “the dynamic character of hunter-gatherer societies, and their adaptive way of life in the Central American highlands, and in Mesoamerica broadly during the early and middle Holocene.”

Now, anthropologists [Douglas Kennett](#) and [Amber VanDerwarker](#) of UC Santa Barbara, UCSB postdoc Richard George and colleagues from multiple institutions have excavated and analyzed botanical macrofossils — such as maize cobs, avocado seeds or rinds — from El Gigante using modern technologies. Their results are [published](#) in the journal PLOS ONE.

“Our work at El Gigante demonstrates that the early use and management of tree crops like wild avocado and plums by at least 11,000 years ago,” Kennett said, “set

the stage for the development of later systems of arboriculture that, when combined with field cropping of maize, beans and squash, fueled human population growth, the development of settled agricultural villages and the first urban centers in Mesoamerica after 3,000 years ago.”

The study provides a major update to the chronology of tree and field crop use evident in the El Gigante with 375 radiocarbon dates, finding that tree fruits and squash appeared early, around 11,000 years ago, with most other field crops appearing later in time — maize around 4,500 years, beans around 2,200 years ago. The initial focus on tree fruits and squash, Kennett noted, is consistent with early coevolutionary partnering with humans as seed dispersers in the wake of megafaunal extinction in Central America. Tree crops predominated through much of the Holocene, and there was an overall shift to field crops after 4,000 years ago that was largely driven by increased reliance on maize farming.

“The transition to agriculture is one of the most significant transformations of our Earth’s environmental and cultural history,” Kennett said. “The domestication of plants and animals in multiple independent centers worldwide resulted in a major demographic transition in human populations that fueled the transition to more intensive forms of agriculture during the last 10,000 years. Agriculture also provided the economic foundation for urbanism and the development of state institutions after 5,000 years ago in many of these same regions.”

The botanical materials at El Gigante, remarkably well preserved, reflect the transition from foraging to farming, providing a rare glimpse of early foraging strategies and changes in subsistence. Unique in its location along the southern periphery of Mesoamerica, and for its lower elevation than the dry caves of central Mexico, the authors note, El Gigante serves as a macrobotanical archive for interactions and the flow of domesticated plants between Mesoamerica, Central America and South America. Broader still, it enables researchers to examine the long term evolutionary and demographic processes involved in the domestication of multiple tree and field crops.

“The quality of the plant preservation at El Gigante is simply unmatched, giving us a deeper understanding of how ancient Hondurans managed their forests, domesticated a variety of plant species and intensified their cultivation of key resources over millennia,” said VanDerwarker. “What seems clear is that practices of

forest management and field cultivation were closely linked and evolved in tandem.”

And therein, Kennett added, some lessons for modern society can be inferred.

“Our work shows that different types of agricultural systems supported human populations in Central America and that some were more sustainable than others,” he said. “Forest management and arboriculture persisted for thousands of years before it was eclipsed in importance by the expansion of maize farming after 4,000 years ago. The archaeological record provides an archive of human adaptation that should be considered in the context of anthropogenic alteration of our Earth’s climate today. These ancient archives could help rural farmers in Central America adapt to changing conditions moving into the future.”

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