For ancient farmers facing climate change, more grazing meant more resilience

March 23 2021

Archaeobotanists like Professor Alexia Smith, pictured here, look for ancient plant remains. All the plant remains collected from the field are identified in the lab. Credit: University of Connecticut

Humans are remarkably adaptable, and our ancestors have survived challenges like the changing climate in the past. Now, research is

providing insight into how people who lived over 5,000 years ago managed to adapt.

Madelynn von Baeyer Ph.D., now at the Max Planck Institute for the Science of Human History, UConn Associate Professor of Anthropology Alexia Smith, and Professor Sharon Steadman from The State University of New York College at Cortland recently published a paper in the *Journal of Archaeological Science: Reports* looking at how people living in what is now Turkey adapted agricultural practices to survive as conditions became more arid.

The work was conducted as von Baeyer's doctoral research at Çadır Höyük, a site located in Turkey that is unique because it has been continuously occupied for thousands of years.

"I was interested in studying how plant use was impacted by changing cultural patterns. This fit Steadman's research goals for Çadır Höyük really well," says von Baeyer.

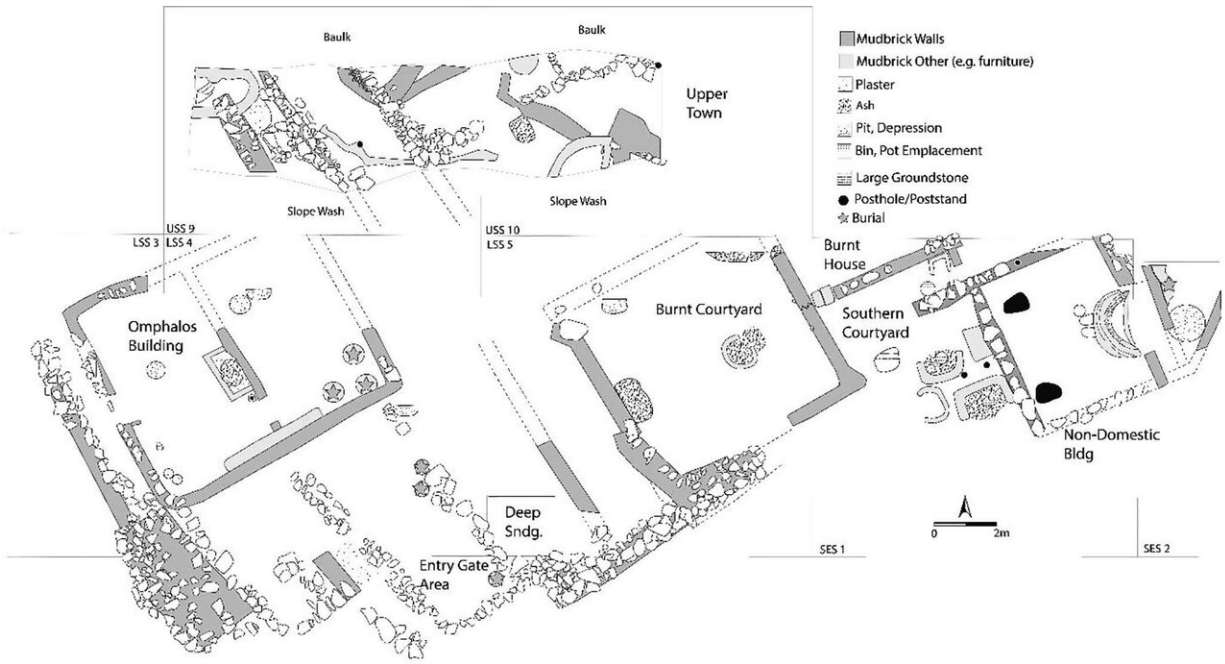
Smith explains the site is situated in an area with rich agricultural and pasture land that sustained generations through time.

"People would build a mud brick structure, and over the years the structure is either abandoned or collapses and the people just build on top of it," Smith says. "Eventually these villages look like they have been built on hills, but they're really just occupations going up and up."

Just as the occupants built new layers up, the archaeologists excavate down to get a glimpse of history and how lives changed over the millennia. Within the layers, archaeobotanists like von Baeyer and Smith look for ancient plant remains; for instance, intentionally or unintentionally charred plant matter. Though wood was often used, much can be learned by looking at the remains of fires fueled by livestock

dung, says Smith: "The dung contains seeds that give clues about what the animals were eating."

Von Baeyer explains the research process: "Archaeobotanical research has three, vastly different, main stages: data collection, identification, and data analysis. Data collection is in the field, on an archaeological dig, getting soil samples and extracting the seeds from the dirt; identification is in the lab, identifying all the plant remains you collected from the field; and data analysis to tell a full story. I love every step."



Plan of the full Late Chalcolithic excavated areas at Çadır Höyük featuring (from west to east) the Omphalos Building, the Burnt House and Courtyard, and the Southern Courtyard. Credit: *Journal of Archaeological Science: Reports* (2021). DOI: 10.1016/j.jasrep.2021.102806

The focus was on a time period called the Late Chalcolithic, roughly

3700-3200 years before the common era (BCE). By referencing paleo-climatic data and Steadman's very detailed phasing at Çadır Höyük, the researchers were able to discern how lifestyles changed as the climate rapidly shifted in what is called the 5.2 kya event, an extended period of aridity and drought at the end of the fourth millennium BCE.

With climate change, there are lots of strategies that can be used to adapt says Smith, "They could have intensified, diversified, extensified, or abandoned the region entirely. In this case they extensified the area of land used and diversified the herds of animals they relied upon."

Zooarchaeologists on the site examined the bones to further demonstrate the shift in the types of animals herded, while the seeds from the dung-fueled fires at the dig site gave clues to what the animals were eating.

Smith says, "We know they were herding cattle, sheep, goats, and pigs, and we saw a shift to animals that are grazers. They all have a different diet, and by diversifying you are maximizing the range of potential calories that can eventually be consumed by humans."

By employing this mixed strategy, the people of Çadır Höyük were ensuring their survival as the climate became increasingly dry. Smith says that at the same time they continued to grow wheat, barley, chickpeas, and lentils, among other crops for humans, while the animals grazed on crops not suitable for human consumption—a strategy to maximize resources and resilience.

Von Baeyer says she was not expecting to make an argument about climate and the environment at the outset of the study.

"What this study does is pretty rare in archaeobotany by tracing a shift due to climate change over a relatively short time period," she says. "Often when archaeobotanical studies talk about shifts in plant use over

time, it's over large cultural changes. This study looks at a shift that only spans 500 years."

Though the circumstances are not exactly the same as they were nearly 6000 years ago, there are lessons we can apply today, says von Baeyer.

"We can take this idea of shifting animal management and feeding practices and make it work in a current context," she says. "I think that this case study, and other studies that use archaeological data to examine climate change, expands the range of possibilities for solutions to shifting environmental conditions. I think archaeological case studies invite more out of the box thinking than just current case studies. Right now, we need to think as creatively as possible to come up with sustainable and efficient responses to climate change."

More information: Madelynn von Baeyer et al. Expanding the plain: Using archaeobotany to examine adaptation to the 5.2 kya climate change event during the Anatolian Late Chalcolithic at Çadır Höyük, *Journal of Archaeological Science: Reports* (2021). DOI: 10.1016/j.jasrep.2021.102806

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