

# How climate change goaded the transition from nomadic hunter-gatherers to settlement and farming societies

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The prehistoric archaeological site Jordan River Dureijat ("Jordan River Stairs") on the shores of the Paleo Lake Hula. The prehistoric archaeological site Jordan River Dureijat ("Jordan River Stairs") on the shores of the Paleo Lake Hula.  
Credit: Prof. Gonen Sharon, Tel-Hai College

Based on the identification of plant remains, Tel Aviv University and Tel-Hai College researchers provide the first detailed reconstruction of the climate in the Land of Israel at the end of the last ice age (20,000-10,000 years before present). The researchers claim that significant climate changes characterizing the period, manifested by sharp differences in temperature and precipitation not only seasonally but throughout the year, were a significant influence in the transition from a nomadic hunter-gatherer society to permanent settlement and an agricultural way of life. The study also provides the first information pertaining to the history of the region's flora and its response to past climate change. Against the backdrop of the Glasgow climate conference, the researchers believe that understanding the response of the region's flora to the dramatic past climate changes can help in preserving the regional variety of plant species and in planning for current and future climate challenges.

The research was conducted by Dr. Dafna Langgut of the Department of Archaeology and The Steinhardt Museum of Natural History at Tel Aviv University; Prof. Gonen Sharon, Head of the MA Program in Galilee Studies at Tel-Hai College, and Dr. Rachid Cheddadi, expert in evolution and palaeoecology of University of Montpellier, Institute of Evolutionary Sciences (ISEM) Montpellier, France. The groundbreaking study was recently published in the leading scientific journal *Quaternary Science Reviews*.

The study was conducted at the prehistoric archaeological site Jordan River Dureijat ("Jordan River Stairs") on the shores of the Paleo Lake Hula. The site is unique for its exceptional preservation conditions yielding finds that enabled discovery of the primary activity of its early local residents—fishing. Botanic remains preserved also enabled researchers to identify the plants that grew 10,000—20,000 years ago in the Hula Valley and its surroundings.



Dr. Dafna Langgut. Credit: Sasha Flit/Tel Aviv University

Two major processes in world history took place during this [period](#): the transition from a nomadic to a settled lifestyle that occurs during a period of dramatic [climate](#) change. Prof. Sharon, supervisor of the Madregot Hayarden excavation, explains that "in the study of prehistory, this period is called the Epipalaeolithic period. At its outset, people were organized in small groups of hunter-gatherers who roamed the area. Then, about 15,000 years ago, we are witness to a significant change in lifestyle: the appearance of settled life in villages, and additional dramatic processes that reach their apex during the Neolithic period that followed. This is the time when the most dramatic change of human



history occurred—the transition to the agricultural way of life that shaped the world as we know it today."



Dr. Dafna Langgut collecting sediment samples for fossil pollen investigation. Credit: Prof. Gonen Sharon, Tel-Hai College.

Dr. Langgut, an archaeobotanist specializing in identification of plant remains, elaborates on the second dramatic process of this period, the climatic changes that occurred in the region. "Although at the peak of the last ice age, about 20,000 years ago, the Mediterranean Levant was not covered with an ice sheet as in other parts of the world, the climatic conditions that existed nevertheless differed from those of today. Their exact characteristics were unclear until this study. The climatic model

that we built is based on reconstruction of the fluctuation of the spread of plant species indicating that the main climatic change in our area is expressed by a drop in temperature (up to five degrees Celsius less than today), whereas the precipitation amounts were close to those of today (only about 50 mm less than today's annual average).

However, Dr. Langgut explains that about 5,000 years later, in the Epipalaeolithic period (about 15,000 years ago) a significant improvement in climate conditions can be seen in the model. An increased prevalence of heat-tolerant tree species, such as olive, common oak, and Pistacia, indicate an increase in temperature and precipitation. During this period, the first sites of the Natufian culture appear in our region. It could very well be that the temperate climate assisted in the development and flourishing of this culture, in which permanent settlement, stone structures, food storage facilities, and more first appear on the global stage.

The next stage of the study deals with the end of the Epipalaeolithic period, about 11,000-12,000 years ago, known globally as the Younger Dryas period. This period is characterized by a return to a cold, dry climate like that of the ice age, causing somewhat of a climate crisis around the world. The researchers claim that until this study, it was unclear whether and to what extent there was any expression of this period in the Levantine region.

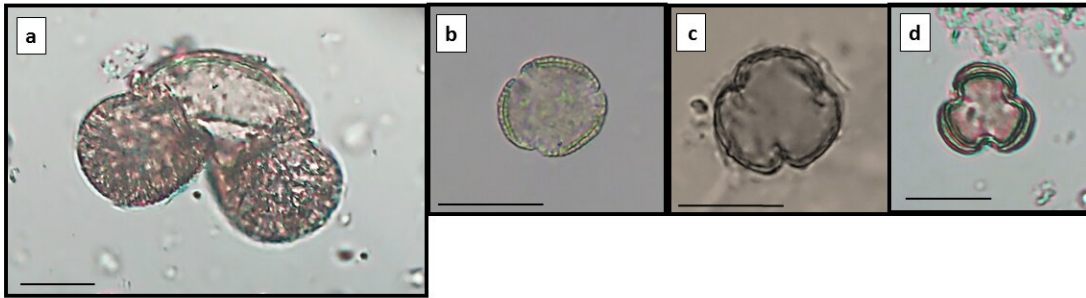


Chart of fossil pollen grains. **a)** *Pinus* (pine). **b)** *Olea europaea* (olive). **c)** *Quercus calliprinos* (evergreen oak). **d)** *Artemisia* (sagebrush). The bar represents 20µm.

Chart of Fossil pollen grains. Credit: Dr. Dafna Langgut

According to the researchers "the findings that arise from the climate model presented in the article show that the period was characterized by climatic instability, intense fluctuations, and a considerable drop in temperatures. Nevertheless, while reconstructing the precipitation, a surprising phenomenon was discovered: the average quantities of rainfall reconstructed were only slightly less than those of today; however, the precipitation was distributed over the entire year, including summer rains."

The researchers claim that such distribution assisted in the expansion and thriving of annual and leafy plant species. The gatherers who lived in this period now had a wide, readily available variety of gatherable plants throughout the entire year. This variety enabled their familiarity just before domestication. The researchers are of the opinion that these

findings contribute to a new understanding of the environmental changes that took place on the eve of the transition to agriculture and domestication of animals.

Dr. Langgut concludes that "this study contributes not only to understanding the environmental background for momentous processes in human history such as the first permanent settlement and the transition to agriculture, but also provides information on the history of the region's flora and its response to past [climatic changes](#). There is no doubt that this knowledge can assist in preserving species variety and in meeting current and future climate challenges."

**More information:** Dafna Langgut et al, Climate and environmental reconstruction of the Epipaleolithic Mediterranean Levant (22.0–11.9 ka cal. BP), *Quaternary Science Reviews* (2021). [DOI: 10.1016/j.quascirev.2021.107170](#)

Provided by Tel-Aviv University

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