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Clues to climate's future may lay in past

By Alison Pollard
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(CNN) -- Climate change could have drastic consequences.

Just ask the ancient Egyptians.

Harvey Weiss, professor of archaeology at Yale University, says climate change was a fact of life for earlier civilizations. From pharaohs to the medieval Vikings, swift and sometimes violent changes in weather patterns sparked mass migrations and technological innovations like irrigation.

"Those episodes proved to be the single most important stimulus for the major transformations in human history," said Weiss, who digs through the traces of vanished empires for evidence of these climatic events.

Climate change was first proposed as a consequence of human activity in 1895. A Swedish chemist theorized that burning fossil fuels like coal might emit enough carbon dioxide to warm the planet. But natural climate variation, caused by fluctuations in the Earth's orbit and other natural cycles, wasn't thought to occur on a time scale perceptible to humans -- until recently. (The science debate)

Climate scientists now say warming and cooling events during the past 10,000 years brought about significant swings in rainfall and temperature in remarkably short periods. The climate record -- stretching back more than 750,000 years -- can be read in the sediments and ice layers from Asia to Greenland. These records, carefully analyzed by scientists, reveal a mercurial climate.

Periodic ice ages going back 10,000 years show extreme temperature swings, exceeding 6 degrees Celsius within 50 years in some cases, said Richard Sommerville, meteorologist at the Scripps Institution of Oceanography.

Studying the impact of climate change on past people such as the Anasazi may help shed light on the future.

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By contrast, human-induced climate change is thought to have raised global temperatures just 0.6 degrees Celsius during the past 150 years. The United Nations predicts the next century could bring temperature increases as high as 5.8 degrees Celsius (10.4 F).

As high-resolution data about prehistoric climates accumulates, archeologists are looking for connections between climate change and human development.

The collapse of early Bronze Age civilizations in modern-day Greece, India and Greece have been theoretically linked to abrupt climate changes about 4,200 years ago.

According to research published in the journal Science, the Anasazi -- the ancestors of modern Pueblo Indians, who built elaborate stone and adobe structures in the American Southwest -- also may have succumbed to decades of intense drought and cooler temperatures during the 13th century, in addition to factors like warfare and religious turmoil. Today, only the sand-swept ruins of their pueblos and cliff dwellings remain.

Ultimately, not all climate change may have been destructive.

Weiss is dusting off evidence in the region known as the Fertile Crescent, including much of modern-day Iraq and Syria, indicating that a human revolution in irrigated agriculture occurred after an extended drought and cold spell.

A 200-year cooling period about 8,000 years ago slashed precipitation levels in the region by thirty percent, according to marine and geological records. Weiss believes this climate change initiated a mass migration away from dry-land farming to the creation of irrigated fields along the Tigris and Euphrates rivers, allowing the people to build some of the earliest institutions of civilization.

Weiss says he has found evidence that the drought drove farmers in ancient Mesopotamia to build irrigation

channels. Eventually, this allowed farmers to grow enough surplus food to feed the writers, priests, artists, politicians and architects who lived in cities.

More modern examples

The ancients are not the only ones to be influenced by weather, though. More modern -- and far colder -- examples exist.

Scientists from the University of Colorado used ocean sediment cores collected off the coast of Iceland to produce an almost weekly record of temperature changes in the region during the past 2,000 years.

Their findings -- announced in March -- show that in Iceland during what is known as the Little Ice Age (from about 1350 A.D. to 1850 A.D.) there was an increase in cooler winters, colder summers and increased temperature variability. According to the research, these changes influenced the population greatly, as a 1-degree drop in average summer temperatures may have meant a 15 percent drop in crop yields.

Not all scientists regard climate change as the predominant force in the rise and fall of early civilizations, but some researchers believe it may teach the present world about the possibilities of the future.

"The historical lesson ... is that those societies had no knowledge of what was happening to them and certainly no historic knowledge of what could happen to them, where we have both," Weiss said.

Today, scientists are improving predictions and narrowing down some parameters of climate change with new technology.

But no one can say with certainty what the future will bring. The inherent complexity of the climate system means computer models will likely give scientist a broad range of temperature possibilities only.

"The problem is that we don't understand how the climate system works well enough to understand where the thresholds might be," said Woody Hickcox, senior lecturer in environmental studies at Emory University in Atlanta, Georgia. "But we're racing towards them, if they're there."

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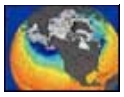

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