

# Scientists studying how large-scale environmental disruptions affected ancient societies

June 18 2019

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John Day, Distinguished Professor Emeritus in LSU's College of the Coast & Environment, has collaborated on a new analysis of societal development with Joel Gunn of the University of North Carolina at Greensboro, William Folan of the Universidad Autonoma de Campeche in Mexico, and Matthew Moerschbaecher of the Louisiana Oil Spill Coordinators Office. Gunn and Folan are Mayan archaeologists and Moerschbaecher is a graduate of LSU's oceanography program. They report that over the past 10,000 years humanity has experienced a number of foundational transitions, or "bottlenecks." During these periods of transition, the advance or decline of societies was related to energy availability in the form of a benign climate and other factors.

"Studying the factors that led to the advancement and contraction of past societies provides insight into how our globalized [society](#) might become more or less sustainable," Day said.

With [human population](#) having exceeded the capacity of Earth's resources, their analysis suggests that a transition toward sustainability for the current energy-dense, globalized industrial society will be very difficult if not impossible without dramatic changes.

The authors say that these past transitions were caused by a combination of social, astronomical and biogeophysical events such as [volcanic eruptions](#), changes in solar emissions, [sea-level rise](#) and ice volume,

biogeochemical and ecological changes, and major social and technological innovations. One example is the worldwide crisis of 536 AD, caused by three major volcanic eruptions in a decade. This event led to the destruction of half the population of Europe via the Black Death plague, starvation, and wars. In China and the Mayan region, it led to crop failures, famine, and plagues. And, the population of Rome fell to 12,000 from one million people 500 years earlier.

They found that while energy was abundant, societies expanded and prospered. Conversely, when [energy sources](#) declined, there was societal contraction and collapse. The previous example implies that changes are more likely to transpire due to planetary-scale disturbances and constraints, whether societal or environmental, and will likely lead to strong societal disruptions. However, in the past, major changes sometimes moved toward a more sustainable social organization. For example, after one disruption, The Mayans switched to a more efficient use of energy and marine transportation and, at the time of European contact, were leading a very sustainable lifestyle.

**More information:** Joel D. Gunn et al, Geo-cultural Time: Advancing Human Societal Complexity Within Worldwide Constraint Bottlenecks—A Chronological/Helical Approach to Understanding Human–Planetary Interactions, *BioPhysical Economics and Resource Quality* (2019). [DOI: 10.1007/s41247-019-0058-7](https://doi.org/10.1007/s41247-019-0058-7)

Provided by Louisiana State University

Citation: Scientists studying how large-scale environmental disruptions affected ancient societies (2019, June 18) retrieved 23 April 2024 from <https://phys.org/news/2019-06-scientists-large-scale-environmental-disruptions-affected.html>

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