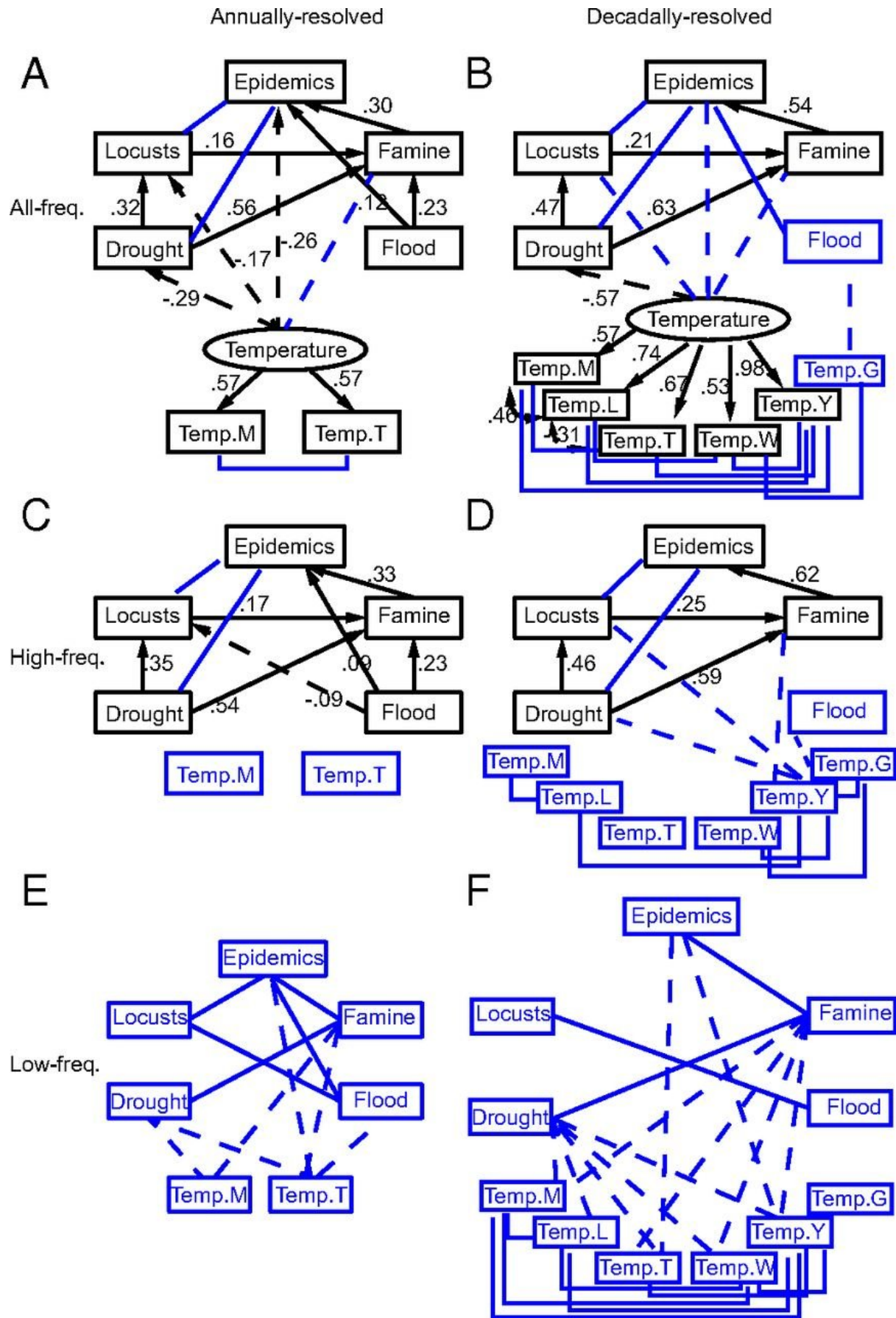


# **Biological consequences of climate change on epidemics may be scale-dependent**

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Frequency-dependent effects of biological and climatic factors on prevalence of human epidemics in ancient China. Credit: IOZ

Conventional thinking holds that current climate warming will increase the prevalence and transmission of disease. However, a recent study led by Prof. ZHANG Zhibin of the Chinese Academy of Sciences and Prof. Nils Christian Stenseth of the University of Oslo in Norway show that the impact of climate change on the prevalence of epidemics may be scale dependent.

The study was conducted using two millennia of historical data from ancient China extracted from "A Compendium of Chinese Meteorological Records of the Last 3,000 Years."

When data covering a large time scale were analyzed, the researchers found that [climate](#) cooling caused more epidemics. However, when data covering a small time scale were analyzed, the association between epidemics and temperature was not consistent; in other words, both positive and negative associations were observed. Further analysis revealed that a long-term cool and dry climate trends contributed to more epidemics mainly via an increase in locusts and famines. Both long-term and short-term trends in epidemics were closely and positively associated with drought, flood, locust and famine events.

Conventional theory suggests that climate warming should cause more [disease](#) by increasing the rates of development, reproduction and/or survival of hosts and/or vectors directly. Evidence supporting this theory is mainly derived from analyses of short-term data. On a large time scale, however, temperature not only affects hosts and vectors directly,

but also indirectly by influencing precipitation, and then agricultural production, famine, and finally, disease.

The researchers found that long-term climate cooling trends caused more droughts in China, probably due to the weakening monsoon. Droughts caused more locusts and the collapse of agriculture, producing more famines. Hungry people were more susceptible to disease and infections due to weakened immunity.

The long-term effects of climate change were not easily captured by using short-term data. China has a long history of recording significant biological, climatic and social events, which provides a unique opportunity to study the biological consequences of long-term climate change.

This study highlights the scale-dependent effects of climate change on biological as well as natural disasters. In contrast with the conventional view, the researchers found that the biological consequences of climate could be nonmonotonic, i.e., the effects could be either positive or negative.

The study's findings may have implications for human disease prevention. In the short term, more droughts, floods or a [warm climate](#) would increase the risk of disease prevalence. However, over the long term, climate cooling would cause more epidemics as well as other disasters. The researchers expressed an urgent need to study the scale-dependent effects of [climate change](#) on human epidemics.

**More information:** Huidong Tian et al, Scale-dependent climatic drivers of human epidemics in ancient China, *Proceedings of the National Academy of Sciences* (2017). [DOI: 10.1073/pnas.1706470114](https://doi.org/10.1073/pnas.1706470114)

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