

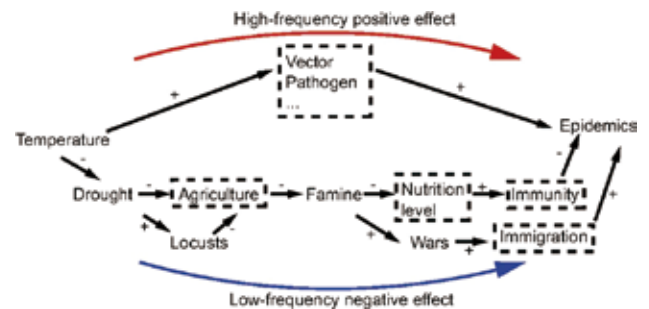
Biological Consequences of Climate Change on Epidemics May Be Scale-dependent

Many people believe the current climate warming has increased disease occurrences or transmissions across the world. However, a recent study led by ZHANG Zhibin from the Chinese Academy of Science and Nils Chr. Stenseth from the University of Oslo has discovered that the impacts of climate change on the prevalence of epidemics were scale-dependent.

Using historical data of two millennia in ancient China, which were extracted from *A Compendium of Chinese Meteorological Records of the Last 3,000 Years*, the researchers found when the data were analyzed at a large time scale, climate cooling would cause more epidemics. However, when data were analyzed at smaller time scales, the association between epidemics and temperature was not consistent. Both positive and negative associations were observed. Further analysis revealed that long-term trend of cool and dry climate had led to more epidemics by increasing locusts and famines. Both long-term and short-term trends of epidemics were closely and positively associated with drought, flood, locust and famine events.

Climate warming was believed to have caused more diseases by helping the survival and reproduction of hosts or vectors. Evidences for such a theory were mainly from analyses of short-term data. However, at a larger time scale, temperature not only directly affects hosts and vectors, but also indirectly influences precipitation, agricultural production, famine and eventually diseases. The current study revealed that long-term trends of climate cooling caused more droughts in China, probably due to the weakening monsoon. Droughts in turn had led to more locusts, and the collapses of agriculture and more famines. Hungry people became more susceptible to disease infections due to reduced immunity.

The long-term trend effects of climate change



The hypothesized scale-dependent mechanisms for the temperature-induced prevalence of human epidemic events in our study. +, positive effect; -, negative effect; and dashed rectangle, variables that are not available in this study.

cannot be easily captured by using short-term data. China has a long history of recording significant biological, climatic and social events, which provided a unique opportunity of studying the biological consequences of long-term climate change.

This study highlights the significance of scale-dependent effects of climate change on biological disasters as well as natural disasters. Different from the conventional view, they found that the biological consequence of climate is non-monotonic, as a context-dependent transformation between positive and negative effect. Their findings may also have some implications in disease prevention. For a short-term period or trend, more droughts or floods or warm climate would increase the risk of disease prevalence. However, for the long-term period or trend, climate cooling would cause more epidemics as well as the other disasters.

Their paper was published in the *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, with the title “Scale-dependent climatic drivers of human epidemics in ancient China”.