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Climate strongly affects violence worldwide

Climate change has been linked to human violence and conflict around the world, a study shows.

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Shifts in climate are strongly linked to human violence around the world, with even relatively minor departures from normal temperature or rainfall substantially increasing the risk of conflict in ancient times or today, according to a new study by researchers at the University of California, Berkeley, and Princeton University.

The results, which cover all major regions of the world and show similar patterns whether looking at data from Brazil, China, Germany, Somalia or the United States, were published in the journal *Science*.

By amassing more data than any prior study, the authors were able to show that the Earth's climate plays a more influential role in human affairs than previously thought.

What the research showed

The study data covers all major regions of the world and show similar patterns of conflict linked to climatic changes, such as increased drought or higher than average annual temperature. Examples include spikes in domestic violence in India and Australia; increased assaults and murders in the United States and Tanzania; ethnic violence in Europe and South Asia; land invasions in Brazil; police using force in Holland; civil conflicts throughout the tropics; and even the collapse of Mayan and Chinese empires.

The new study could have critical implications for understanding the impact of future climate change on human societies, as many global climate models project global temperature increases of at least 2 degrees Celsius over the next half century.

Although there has been a virtual explosion in the number of scientific studies looking at how climatic impacts shape human conflict and violence, especially in recent years, the research stems from disparate research fields ranging from climatology, archaeology and economics to political science and psychology.

"What was lacking was a clear picture of what this body of research as a whole was telling us," said Solomon Hsiang, the study's lead author, who was a postdoctoral fellow in Science, Technology, and Environmental Policy at Princeton during the research project and is now an assistant professor of public policy at UC Berkeley's Goldman School of Public Policy.

"We collected 60 existing studies containing 45 different data sets and we re-analysed their data

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and findings using a common statistical framework. The results were striking."

Personal violence included

The latest study adopted a broad definition of conflict and used the latest research methods to re-evaluate what they found to be the most rigorous quantitative studies released since 1986 to examine aspects of climate such as rainfall, drought or temperature, and their associations with various forms of violence.

To determine if a link between climate and conflict existed at multiple levels of social organization, the UC Berkeley-Princeton researchers looked at whether evidence of a linkage was consistent within each of three broad categories of conflict:

- Personal violence and crime such as murder, assault, rape, and domestic violence;
- Intergroup violence and political instability, like civil wars, riots, ethnic violence, and land invasions;
- Institutional breakdowns, such as abrupt and major changes in governing institutions or the collapse of entire civilizations.

They found that all three types of conflict exhibit systematic and large responses to changes in climate, with the effect on intergroup conflict being the most pronounced in percentage terms. The authors found that conflict responded most consistently to temperature, with all 27 out of 27 studies of modern societies finding a positive relationship between high temperatures and greater violence.

New approach to climate studies

A central contribution of the study was to develop a method for comparing results around the world, because the nature of climatic events differs across locations. The authors' new approach was to convert climate changes into location specific units known to statisticians as standard deviations.

"We found that a 1 standard deviation shift towards hotter conditions causes the likelihood of personal violence to rise 4% and intergroup conflict to rise 14%," said Marshall Burke, the study's co-lead author and a doctoral candidate at Berkeley's Department of Agricultural and Resource Economics.

"For a sense of scale, this kind of temperature change is roughly equal to warming an African country by 0.4°C (0.6°F) for an entire year or warming a United States county by 3°C (5°F) for a given month. These are moderate changes, but they have a sizable impact on societies."

"We often think of modern society as largely independent of the environment, due to technological advances, but our findings challenge that notion," said study coauthor Edward Miguel, the Oxfam Professor of Environmental and Resource Economics and director of the Center for Effective Global Action (CEGA) based at UC Berkeley.

Just the beginning



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The researchers said that exactly why climate affects conflict and violence is the most pressing question for future related research.

"We're in the same position that medical researchers were in during the 1930s: they could find clear statistical evidence that smoking tobacco was a proximate cause of lung cancer, but they couldn't explain why until many years later. In the same way, we can show that climatic events cause conflict, but we can't yet exactly say why," said Hsiang.

"Currently, there are several hypotheses explaining why the climate might influence conflict. For example, we know that changes in climate shape prevailing economic conditions, particularly in agrarian economies, and studies suggest that people are more likely to take up arms when the economy deteriorates, perhaps in part to maintain their livelihoods."

No single answer

Burke said there are very likely multiple mechanisms at play, since no single theory explains all of the evidence.

"The studies showing that high temperature increases violence crime in the U.S. and other wealthy societies seems to suggest that physiological responses are important, too, with very short-run exposure to heat contributing to more aggressive and violent behavior," he said. Nonetheless, in all cases, Burke noted "the collected evidence shows that humans across the globe have proven poorly equipped to deal with exposure to hotter temperatures."

While the study finds strong evidence that climatic events may be a cause of conflict, the researchers stressed that they are not claiming that climate is the only or primary cause of conflict, cautioning that conflict dynamics are complex and remain poorly understood.

"Say you look at data on car accidents," offered Hsiang, "and you see that they become more likely on rainy days. Does that mean that rain is the only factors responsible for accidents? Of course not. Driver error ultimately causes accidents but rain can make it much more likely. Similarly, violent conflicts might occur for a variety of reasons that simply become more likely when climatic conditions deteriorate."

Facing a hotter future

"Our results shed new light on how the future climate will shape human societies," said Burke. The findings of the study suggest that a global temperature rise of 2 degrees Celsius could increase the rate of intergroup conflicts, such as civil wars, by over 50% in many parts of the world.

"It's possible that future societies might figure out better ways to cope with hot temperatures and variable rainfall, and indeed we hope that they will," said Miguel. Nevertheless, the authors argue that it is dangerous to assume that people will cope well to extreme climate when they have not done so historically.

"We need to understand why climate changes cause conflict so we can help societies adapt to these events and avoid the violence. At the same time, we should carefully consider whether our actions today are making our children's world a more dangerous one," said Hsiang.

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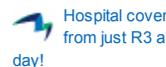
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