

Quantifying the Influence of Climate on Human Conflict

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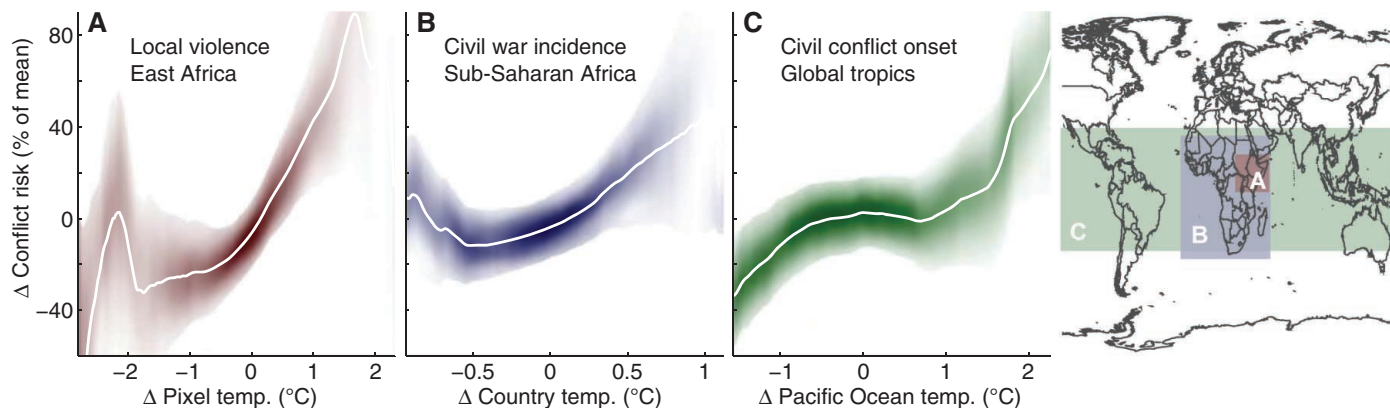
Introduction: Despite the existence of institutions designed to promote peace, interactions between individuals and groups sometimes lead to conflict. Understanding the causes of such conflict is a major project in the social sciences, and researchers in anthropology, economics, geography, history, political science, psychology, and sociology have long debated the extent to which climatic changes are responsible. Recent advances and interest have prompted an explosion of quantitative studies on this question.

Methods: We carried out a comprehensive synthesis of the rapidly growing literature on climate and human conflict. We examined many types of human conflict, ranging from interpersonal violence and crime to intergroup violence and political instability and further to institutional breakdown and the collapse of civilizations. We focused on quantitative studies that can reliably infer causal associations between climate variables and conflict outcomes. The studies we examined are experiments or “natural experiments”; the latter exploit variations in climate over time that are plausibly independent of other variables that also affect conflict. In many cases, we obtained original data from studies that did not meet this criterion and used a common statistical method to reanalyze these data. In total, we evaluated 60 primary studies that have examined 45 different conflict data sets. We collected findings across time periods spanning 10,000 BCE to the present and across all major world regions.

Results: Deviations from normal precipitation and mild temperatures systematically increase the risk of conflict, often substantially. This relationship is apparent across spatial scales ranging from a single building to the globe and at temporal scales ranging from an anomalous hour to an anomalous millennium. Our meta-analysis of studies that examine populations in the post-1950 era suggests that the magnitude of climate’s influence on modern conflict is both substantial and highly statistically significant ($P < 0.001$). Each 1-SD change in climate toward warmer temperatures or more extreme rainfall increases the frequency of interpersonal violence by 4% and intergroup conflict by 14% (median estimates).

Discussion: We conclude that there is more agreement across studies regarding the influence of climate on human conflict than has been recognized previously. Given the large potential changes in precipitation and temperature regimes projected for the coming decades—with locations throughout the inhabited world expected to warm by 2 to 4 SDs by 2050—amplified rates of human conflict could represent a large and critical social impact of anthropogenic climate change in both low- and high-income countries.

Climate and conflict across spatial scales. Evidence that temperature influences the risk of modern human conflict: (A) local violence in 1° grid cells, (B) civil war in countries, and (C) civil conflict risk in the tropics. The map depicts regions of analysis corresponding to nonparametric watercolor regressions in (A) to (C). The color intensity in (A) to (C) indicates the level of certainty in the regression line.



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FIGURES AND TABLE IN THE FULL ARTICLE

Fig. 1. Samples and spatiotemporal resolutions of 60 studies examining intertemporal associations between climatic variables and human conflict.

Fig. 2. Empirical studies indicate that climatological variables have a large effect on the risk of violence or instability in the modern world.

Fig. 3. Examples of paleoclimate reconstructions that find associations between climatic changes and human conflict.

Fig. 4. Modern empirical estimates for the effect of climatic events on the risk of interpersonal violence.

Fig. 5. Modern empirical estimates for the effect of climatic events on the risk of intergroup conflict.

Fig. 6. Projected temperature change by 2050 as a multiple of the local historical SD (σ) of temperature.

Table 1. Primary quantitative studies testing for a relationship between climate and conflict, violence, or political instability.

SUPPLEMENTARY MATERIALS

Supplementary Text

Figs. S1 to S4

Tables S1 to S4

References (140, 141)