Study ties conflict risk in sub-Saharan Africa to climate change, economics, geography

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A massive new University of Colorado Boulder study indicates there is a statistical link between hotter temperatures generated by climate change and the risk of armed conflicts in sub-Saharan Africa.

CU-Boulder Professor John O'Loughlin led a research team that assessed more than 78,000 armed conflicts between 1980 and 2012 in the Sahel region of Africa - a semi-arid belt just south of the Saharan Desert that spans about 3,000 miles and more than a dozen countries from the Atlantic to the Indian oceans.

The team was looking for links between armed conflicts and temperature and rainfall anomalies, as well as assessing other causes of violence in the Sahel. "We found a clear signal that higher temperatures in the Sahel over time does increase the risk of conflict," O'Loughlin said.

While there are growing academic and public policy debates on the effect global climate change may be having on armed conflict in Africa, the link between climate and conflict in the Sahel does not hold true for the entire continent, said O'Loughlin, a professor of distinction in CU-Boulder's geography department. Even in the Sahel, political, economic and geographic factors were more of an influence on conflict than climate.

A paper on the subject appears this week in the *Proceedings of the National Academy of Sciences* (*PNAS*). The study was co-authored by CU-Boulder postdoctoral researcher Andrew Linke and University of

Alaska Anchorage Assistant Professor Frank Witmer, a former CU-Boulder graduate student who received his doctorate under O'Loughlin. The National Science Foundation (NSF) funded the study.

The study also showed areas in the Sahel that were wetter or dryer than long-term averages were neither more nor less likely to experience violent conflict, he said. "This is an important finding because global climate change often results in environmental changes outside the realm of temperature increases," O'Loughlin said.

"Increasing frequency or greater severity of warmer temperatures could be problematic for the security of populations in regions where the link is statistically significant," said Linke. "But it's important to remember that our study shows that a number of other social forces have strong influences on political violence and conflict."

The new research follows a 2012 *PNAS* study led by O'Loughlin that indicated the risk of human conflict in East Africa from 1990 to 2009 increased somewhat with hotter temperatures and dropped a bit with higher precipitation. That study, which charted about 26,000 instances of conflict, also showed socioeconomic, political and geographic factors played a larger role in armed conflicts than climate change.

For the new study the research team divided the African continent into thousands of geographic grid cells, each about 6,214 square miles (10,000 square kilometers), examining them individually for both conflict and climate data, said O'Loughlin, also a faculty research associate at CU-Boulder's Institute of Behavioral Sciences.

O'Loughlin said the link between climate and violent conflict is strongest for "communal incidents" - violence between groups of civilians, rather than large-scale civil wars where rebel groups battle government armies.

The exhaustive database of violent events in the Sahel from 1980 to 2012 was assembled in part by CU-Boulder undergraduates, who combed online information sources like LexisNexis, a corporation that pioneered the electronic accessibility of legal and newspaper documents. The work by the students—who put thousands of hours into the project—was funded by the NSF's Research Experience for Undergraduates (REU) and has generated several undergraduate honors theses, O'Loughlin said.

The CU-Boulder students coded each conflict event with very specific data, including geographic location coordinates, dates, people and descriptive classifications. The event information was then aggregated into months and into the grid cells that served as the units of analysis for quantitative modeling.

Each conflict grid also was coded by socioeconomic and political characteristics like distance to an international border, capital city, local population size, well-being as measured by infant mortality, the extent of political rights, presidential election activity, road network density, vegetation condition and ethnic community inclusion into the national government. The National Center for Atmospheric Research in Boulder and the University of East Anglia in Norwich, England, provided climate data for the study.

Data also came from the Armed Conflict Location and Event Dataset (ACLED), directed by Clionadh Raleigh of Trinity College in Dublin. That database covers individual conflicts from 1997 to 2009 in Africa and parts of Asia and Haiti. There are more than 60,000 violent incidents in the database to date. Raleigh started the data collection while earning her doctorate at CU in 2007 under O'Loughlin.

As a next step, O'Loughlin has undertaken a new NSF-funded study with CU-Boulder anthropology Professor Terrence McCabe and political

science Professor Jaroslav Tir to look at the mechanisms of conflict in Kenya. Researchers are interviewing Kenyans about their experiences regarding both violence and climate change, including the severity and frequency of drought. The study will include data on human migrations as well as the welfare of pastoralists and farmers as a result of climate change, he said.

More information: Effects of temperature and precipitation variability on the risk of violence in sub-Saharan Africa, 1980–2012, www.pnas.org/cgi/doi/10.1073/pnas.1411899111

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