

Climate Change and Violence: Nigeria as a Case Study

Introduction

Will a changing climate lead to violence? This question, stepping beyond the question of anthropogenic climate change, is attracting an increasing amount of attention in circles from the intelligence community to the Department of Defense to massive reinsurance companies such as MunichRe. With this project, we hope to examine one country that has been experiencing violence and instability, Nigeria, and determine if it is suffering from what scientists call climate stress, and if so are the areas impacted also those experiencing violent events?

The drought facing California is already placing great stress on what could be considered the 7th largest economy in the world, which itself is already integrated into the largest economy and one of the most stable systems of government. Yet experts have already cast doubt on America's ability to manage the disruptions without social and economic pain—how will developing countries fare? Will they manage to adapt and provide for their citizens, or will instability and violence blossom in the areas subjected to rising sea levels, hotter summers, and drier rainy seasons? Will the subsequent unrest take hold and spread, drawing in regional and world powers? To answer that question, we must first determine if climate stress can be linked to violence and instability.

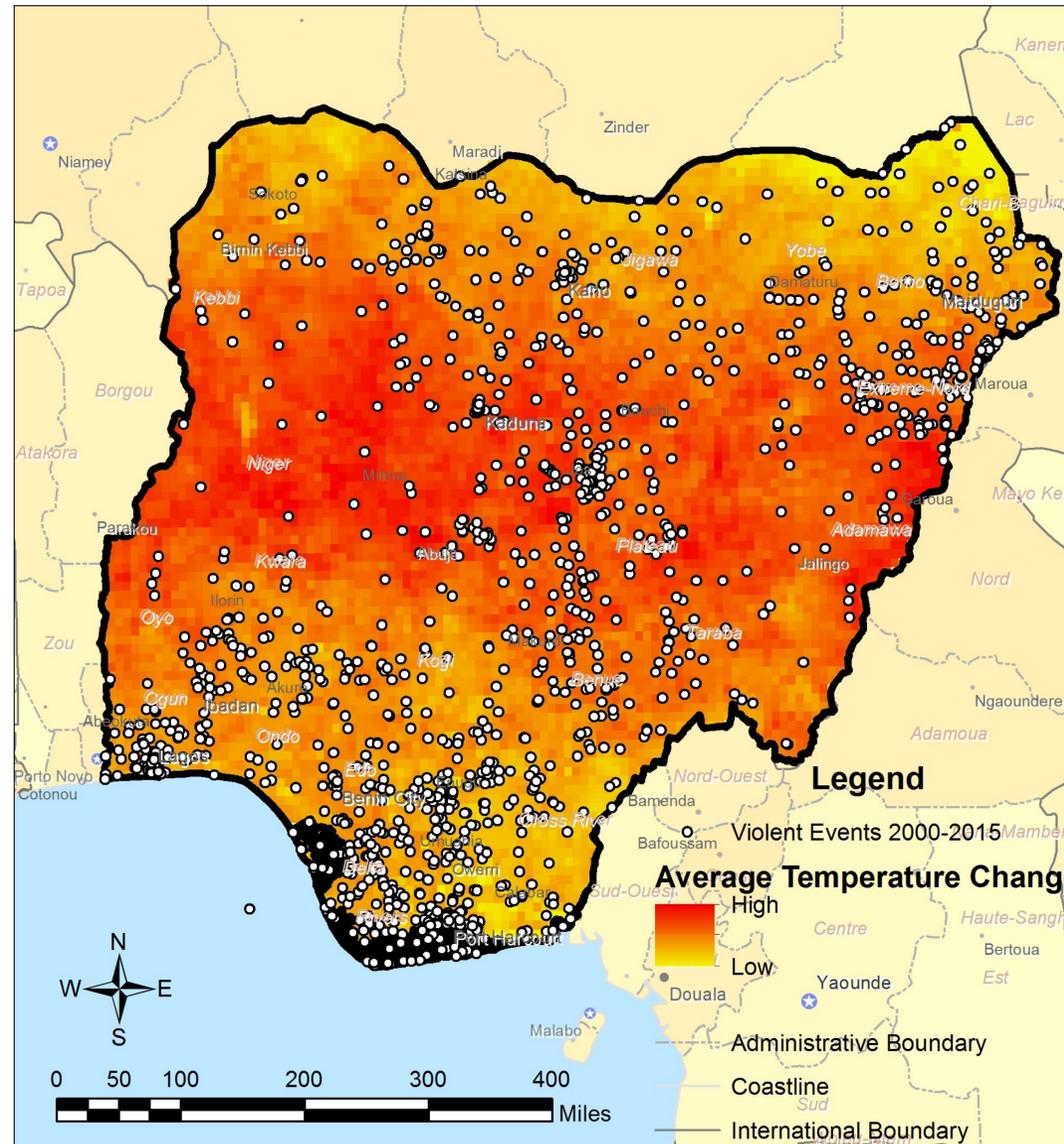
Methods

This project will take surface temperature, a proxy for measuring air temperature, as collected by NASA's MODIS Terra mission, which provides raster data containing the information in 0.1 degree blocks, the highest resolution available publicly. It will use the raster calculator to create, from a monthly data point, a yearly average surface temperature for each 0.1 degree area, covering from February 2000 up to April 2015. Once done, we compared change in temperature over time on a year to year basis, as well as over the entire 15-year period of time, to assign a value to the increase or decrease in average temperature.

Once this data is entered, conflict data obtained from the ACLED database for Nigeria running from January of 2000 to April 2015 was analyzed and sorted by location. Each discreet event was catalogued in ACLED's database according to both time and location. When taken with administrative data, we were able to categorize each administrative district by number of violent events over the timeframe selected.

After this was completed, we joined the data with that of the change in surface temperature (also aggregated by district) using Zonal Statistics as Table. This enabled a comparison of those districts experiencing violent events with their changing temperatures over time, allowing us to see those that had experienced temperature increases with those that had experienced temperature decreases, or no net change in the observed timeframe. To more clearly see the differences, those districts that experienced no increase (or a decrease) in surface temperature were assigned the value of "0", while those districts that experienced an increase in surface temperature were assigned the value of "1". These were then examined to more clearly see which areas experienced both violence and an increase in temperature (the map in the bottom right).

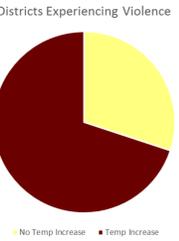
Nigerian Surface Temperature Change 2000-2015



Results

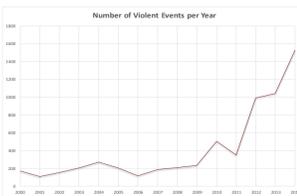
We found that between 2000-2015, Nigeria suffered 6,260 acts of violence as categorized by ACLED. 2001 had the lowest number, with 105 recorded, while 2014 saw the highest with 1,528. The numbers rise sharply after 2009, which can be attributed in part to the rise of Boko Haram after the death of their leader and subsequent radicalization. 2009-2014 saw 4,647 violent events, of which Boko Haram is responsible for 819.

During the 15 year period examined, every district saw at least one act of violence resulting in a fatality, while 70% of them also saw an increase in average surface temperature. To look at those numbers more closely, of the 775 administrative districts examined in this analysis, 542 of them saw an increase in average surface temperature between 2000-2015 as well as incidents of violence. Incidents of violence increased sharply from 2008 to 2012, and also began to spread from traditionally restive areas such as the Niger River Delta into the interior of the country.



Limitations

Access to good data—both of violence and climate—remains a stumbling block to more fully analyzing these events. Though excellent data was obtained from NASA's MODIS satellite, that mission is relatively recent in human history, having launched in 18 December 1999. Prior to this time high-resolution climate data was not available, instead each data point covered enormous areas of territory (up to 1.4 degrees). In addition, separating the signal from the noise remains difficult: Nigeria has suffered from unrest for many years, and while its origins may lie in environmental factors, it typically breaks out along ethnic and religious lines. Therefore, we cannot say there is a causal relationship between climate stress and violence.

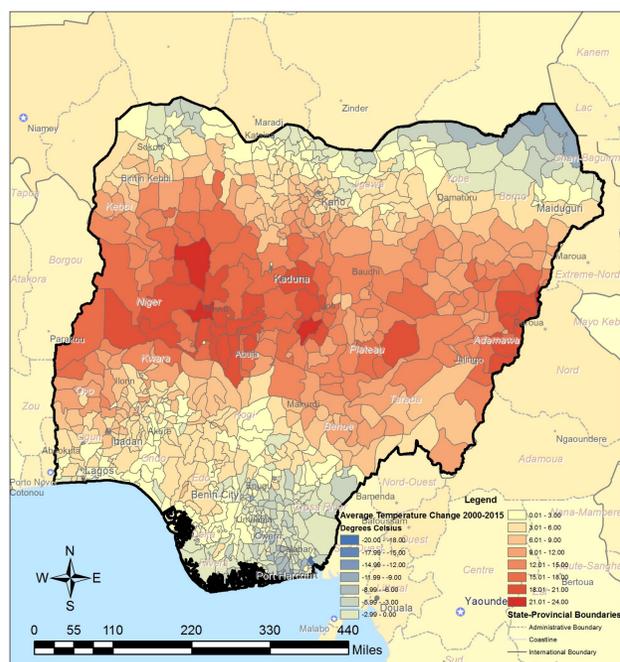


Conclusions

Though as noted above there are limitations in the conclusions one can draw from this analysis, the fact that a rising surface temperature tracks so well with an increase in violence events in number, frequency, and location affected warrant this as an area for further study. Three improvements are suggested for any further study: First, to secure better historical climate data, which will allow for greater accuracy in tracking changes over time. Second, to gather more in-depth data about each violent event. ACLED's database has great detail as well, but it is limited by its purpose. To examine those involved, their stated intentions, and other mitigating factors (drought, pollution, etc.) would allow a clearer picture of those actions that were impacted by environmental changes. Third, a rigorous statistical analysis should be done to control for other variables. As stated earlier, conflict and violence driven by climate stress may act out along ethnic and religious lines, to cite two possibilities. It is important to separate those who take up arms because of crop failure and government inability (or unwillingness) to help from those who are true extremists.

With this in mind, further study of this phenomenon is recommended, along with expansion to include other countries and regions, to determine if there is simply a coincidence or a true spatial correlation.

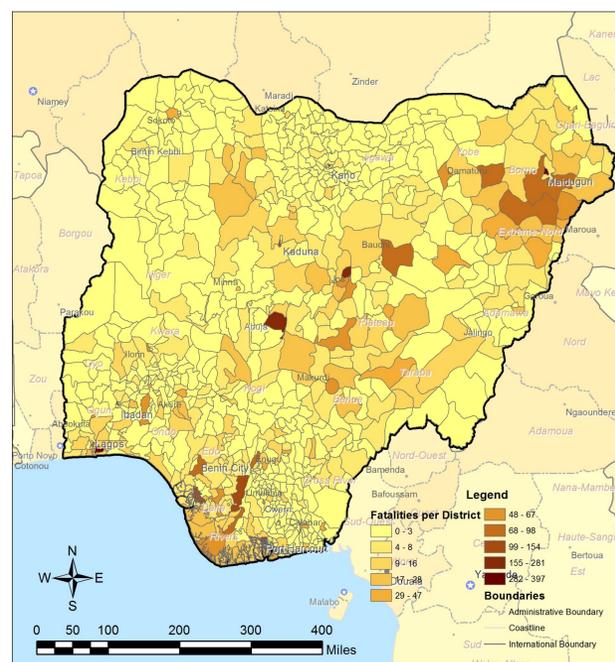
Temperature Change by District



Cartographer: Geoffrey Carr
 Date: 5 May 2015
 Course: GIS for International Applications
 Coordinate System: D_WGS_1984
 Projection: Africa Albers Equal Area Conic
 Sources: NASA Earth Observation (NEO) MODIS Terra Mission; ACLED Version 5 Nigeria Totals 2014, Realtime All Africa Totals 2015; GADM; ESRI World Map; Tufts M\ Drive
 Professors Florance and Talmadge



Violent Events by District



Violence in Rising Temperature Districts

