Spatial Risk of Boko Haram Violence in Nigeria

Introduction

The militant organization known as Boko Haram has its roots in the complex socio-historical, cultural and economic divisions present between the primarily Islamic north and largely Christian southern portions of Nigeria. Founded in 2002 after a series of clashes and increasing tension with state security forces, Boko Haram launched a series of coordinated attacks in 2009 that garnered international attention. Since then, the organization’s attacks have increased in virulence and sophistication. To date, according to the World Bank and other sources, Boko Haram has killed over 20,000, displaced 2.8 million from their home and caused more than $5.0 billion USD in damage — making it the world’s deadliest terrorist organization.

Nigeria and other Lake Chad basin countries live under the continued specter of threat from Boko Haram violence. Since 2013, Boko Haram has launched attacks in neighboring Cameroon, Chad, and Niger with varying levels of success. According to UN estimates, close to 2.8 million people have been displaced by the organization in the Lake Chad Basin region which has a total population of 100 million. At present, approximately 5.6 million are in need of emergency food aid.

Located in western Africa on the Gulf of Guinea, Nigeria is the world’s 32nd-largest country, roughly twice the size of California. It is the most populous country in Africa, as of 2013, with an estimated 173.6 million people. Many of these people live under threat from Boko Haram which has demonstrated its ability to strike throughout the country. The aim of this project is to utilize previous occurrences of Boko Haram violence to predict which communities will be at risk for future violence and where the organization is likely to spread its influence.

Methodology

This project utilizes publically available data to assess areas which have a high likelihood for future Boko Haram terrorist attacks. It builds upon efforts focused on evidence-based, GIS-driven analyses used by law enforcement, urban planners, healthcare professionals and others developing surveillance systems to most appropriately target resources.

Two methodologies were principally used in this project: clustering and suitability analysis. The clustering analysis intended to measure the predictive power of each variable, the results of which were applied to a suitability analysis. The suitability analysis was used to determine areas at risk of attack. Thus, the weighting of the suitability analysis was informed by the statistical outputs of the spatial analyses. While not inclusive of all the potential variables available to predict attacks, four variables from publically available data sources were utilized: incidence of previous Boko Haram attacks, healthcare facilities, local and domestic airports, and local and international roads.

Spatial autocorrelation based on the selected variables was initially measured using Global Univariate Moran’s I in GeoDa. Following this, the data was analyzed using Local Univariate Moran’s I. The local results helped to inform where clustering of each variable was occurring and their significance. Global and Local Bivariate Moran’s I analyses were conducted for fatality data versus the other predictors. The results of these analyses were visual aids, while a regression was performed to quantify the predictive capability of each variable. These coefficients were then used to determine the weighting for the suitability analysis.

The standard deviation maps per variable illustrated how their data was distributed:

The incidence data was the only to show a visible trend, being higher in the North-east. The number of health clinics and roads per locality were fairly dispersed, unlike airports which were focal. The results of the univariate global Moran’s I’s results quantified these observations:

The fatality data shows the highest clustering, followed by health clinics and roads. Airports show dispersion as was expected from the visual observation. The use of univariate global Moran’s I can help to inform which variables are worth keeping.

Results

The results of the univariate local Moran’s I allowed one to see where clustering or dispersion might be taking place and their statistical significance:

There is overlap between the significant fatality clusters and the other variables. This observation used to predict the results of a bivariate global/local Moran’s I.

Unfortunately, the results of the regression had an R² and adjusted R² of < 1%. Thus, it was deemed that the coefficients of this regression would not be accurate to be used as a base for weighting of the risk analysis. Rather than make unfounded decisions, an unweighted raster was ultimately applied. Note: the results from the Moran’s I analyses revealed a protective effect from greater number of health clinics, so it was reclassified accordingly.

Ultimately, the results indicate a relatively expected outcome: Nigeria’s north-east is likely to remain the site of extreme Boko Haram violence in the short- and intermediate-term. While there are widespread pockets of risk throughout the country — domestic, regional and international efforts must focus on addressing the drivers of instability in this region, abject poverty and environmental degradation.

Recommendations

This project illustrated how one might theoretically conduct a risk analysis grounded upon statistical results. Experimentally, this work was limited by the variables selected, as the model was unable to account for most of the variance in the data as shown in the regression. It is recommended that additional research be conducted in order to guide the selection of more powerful predictors, that could then be used to increase the accuracy of variable weightings.

REFERENCES


For a complete list of references, please see the actual document.