Shedding Light on Conflict: Can Night Lights Data Be Used to Understand the Economic Impacts of Violence?

Introduction
Conflict impedes development. Countries that have experienced conflict lag behind others in development indicators. The effects of conflict on development are often measured using GDP, but GDP may not be an accurate measure of economic activity in developing countries, and only allows for country level analysis. Increasingly, violence is concentrated in specific provinces, rather than entire countries (Fig. 2) necessitating subnational measures of economic impact. Research has shown that night lights are a good proxy for GDP growth, particularly in data poor countries, and unlike GDP, nightlights can show sub-national growth. This project examines whether the effects of conflict are reflected in night lights.

Data
The night lights data are drawn from lights observed by satellites every night, and averaged over each calendar year. Each pixel represents .86 square kilometers, and is assigned a Digital Light Number between 0—63 based on brightness of light in that area (Fig 1). The Armed Conflict Location Dataset (ACLED), draws on media and agency reports, to produce a census of conflict type and locations between 1997-2010. In this analysis I only consider battles and violence against civilians.

Methodology
To calculate the change in light I subtracted the lights 1995 from the 2010 lights. Next, I conducted a Kernel Density Analysis for all of the incidence of violent conflict between 1997 and 2010 (Fig. 4). I used a search radius of 20 miles, predicting that incidence of violence impact the growth in the nearest trading center. Finally, I calculated a Pearson’s r correlation for the two.

Results
There was no statistically significant correlation between change in light and conflict density.

Discussion & Limitations
Limitations in my analysis may be the cause of the insignificant result. I did not control for intervening variables such as population growth and examined a very large area.

Hypothesis
According to economic and political science literature, conflict stunts economic development and therefore, conflict density should be inversely related to growth in lights.

It is possible that my results are correct and there is no relationship between lights and conflict, which implies no relationship between conflict and development. Since this finding contradicts economic and political sensibilities, a much more rigorous analysis is needed before reaching that conclusion.

Explanations and Future Work
Regional Correlation and Post-Conflict Growth
Perhaps a correlation exists at the regional level. I conducted the same analysis in West Africa, a region characterized by an economic and political variation (Figs. 5 & 6). Here conflict Density and Light have a positive correlation of .1231. Which is statistically significant (90%). This positive correlation may reflect rapid development in the years since the end of the Liberian and Sierra Leonean Civil Wars.

Population Driving Both?
Both may be driven by population density, rather than any correlation to each other. Visually comparing Fig. 7 to Figs. 4 & 3 supports this hypothesis and provides a strong intuition for further research.

Future Work
These results indicate a time series regression that controls for year and country effects, population, and other variables is needed to reach a definitive conclusion. Lights may also also be able to show rapid growth in post conflict countries.

Figure 1
Night Lights from Space 1995

Figure 2
Conflict Incidents by Province 1997—2010

Figure 3
Change in Light 1995 - 2010

Figure 4
Density of Conflict 1997—2010

Figure 5
Density of Conflict In Western Africa 1997—2010

Figure 6
Change in Light 1995 - 2010

Figure 7
Population Density 2010