GUATEMALA: VULNERABILITY TO CLIMATE CHANGE

OVERVIEW

Climate change is one of the most important, urgent and complex challenges facing our world today. According to the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report: Climate Change 2007, vulnerability is the "degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, the sensitivity and adaptive capacity of that system". Even though Central America accounts for a very small percentage of the global greenhouse gas emissions, it is one of the most affected regions by climate change.

Guatemala is a country particularly vulnerable to climate change and extreme events because of two reasons: its geographical position in an earthquake and hurricane zone and its lack of capacity to adapt and cope with climate change. The impacts of climate change are already compromising the development of the country. In this sense, GIS technology can be used to analyze the vulnerability of a country to climate change and be used as a tool for improving mitigation and adaptation measures as well as better aid distribution.

METHODOLOGY

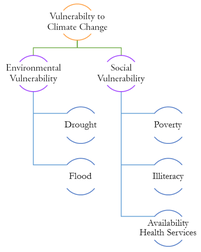
In order to determine Guatemala's vulnerability to climate change, an overall index per municipality was constructed with 2 sub-indices: environmental vulnerability and social vulnerability. Both indices were composed by variables representing important factors that determine vulnerability.

The *environmental vulnerability* index comprises drought risk and flooding risk. Flood risk was created using annual average precipitation and drought risk was created using data on annual average precipitation and average annual temperature. These averages were created with the raster calculator tool and data of monthly average temperature and precipitation. The raster data was reclassified and given a rank by level of risk.

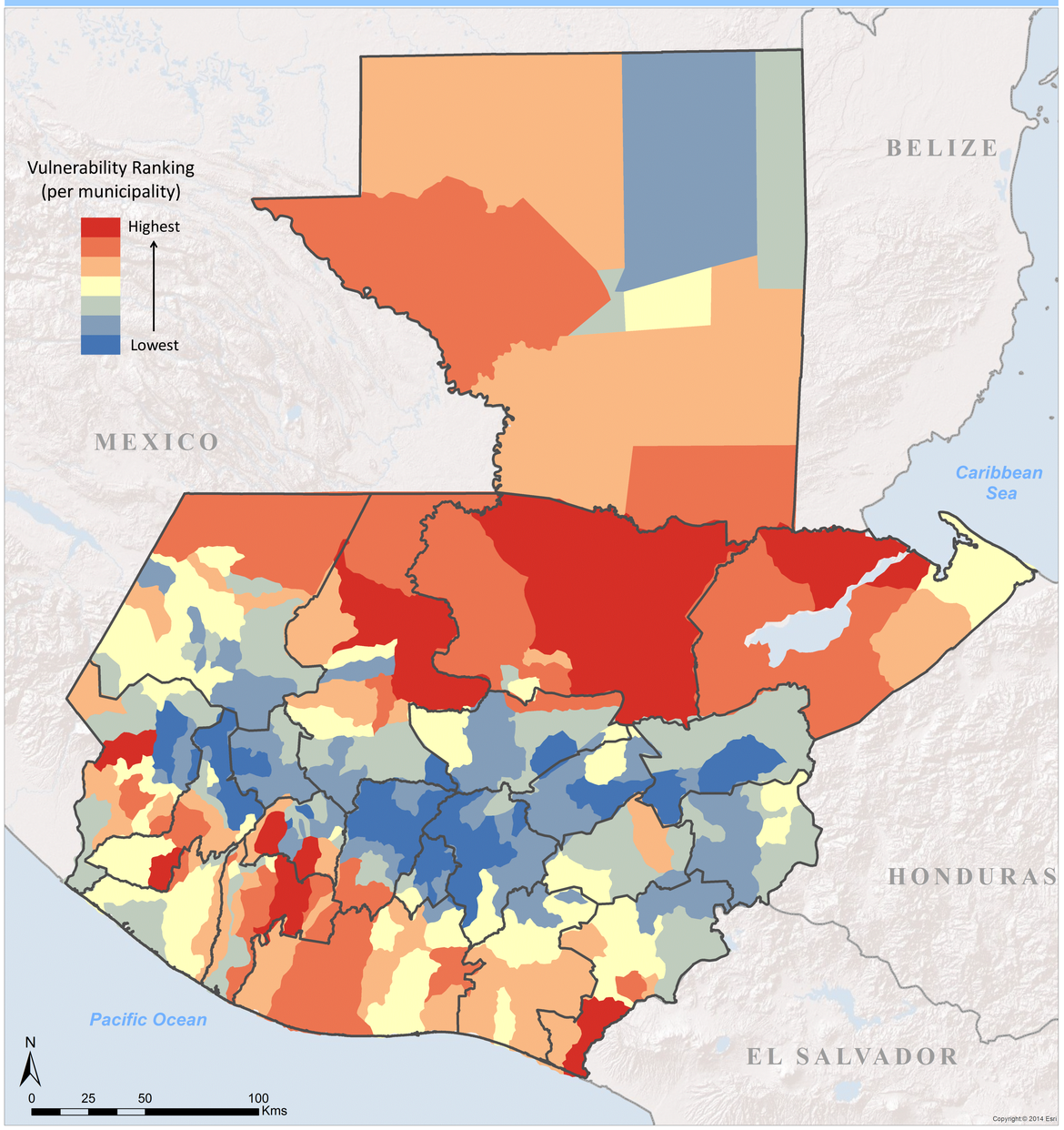
The *social vulnerability index* comprises illiteracy rate, poverty rate and number of health centers available per square kilometer in each municipality. After ranking each variable, the three variables were added to create an overall social vulnerability score.

The environmental and social vulnerability sub-indices were added together to obtain an overall index of vulnerability.

Risk	Rank Value
Lowest	1
	2
Medium	3
	4
Highest	5



Overall Vulnerability to Climate Change



Sources: WorldClim, United Nations Statistics Division, Instituto Nacional de Estadística (INE), Secretaría de Planificación y Programación de la Presidencia (SEGEPLAN), ESRI, Sistema Nacional de Información Territorial(SINIT), Instituto de Agricultura Recursos Naturales y Ambiente (IARNA).

RESULTS

Many of the municipalities with the highest levels of vulnerability are located in Las Verapaces region (two departments located in the Northern part of the country). Within this region, the five most vulnerable municipalities are in the same department: Alta Verapaz. Additionally, the most vulnerable populations are clustered within rural areas with high levels of poverty.

The five least vulnerable municipalities are located within the Metropolitan region and its surroundings. Although indigenous populations were not factored in this study, the results correspond to areas with high percentages of indigenous populations.

Most Vulnerable		
Municipality	Department	Population
Panzós	Alta Verapaz	60,843
Lanquín	Alta Verapaz	25,381
Chisec	Alta Verapaz	69,414
Senahú	Alta Verapaz	68,242
Cahabón	Alta Verapaz	61,445

Least Vulnerable		
Municipality	Department	Population
Chinautla	Guatemala	129,454
Mixco	Guatemala	487,830
Villa Nueva	Guatemala	539,909
Petapa	Guatemala	175,331
Pastores	Sacatepéquez	15,338

The final map provides an alternative framework for understanding the most vulnerable areas in the country. It provides a synthesis of the complex interaction between environmental and social vulnerabilities.

LIMITATIONS

One of the main limitations to this study was the lack of access to data. Additionally, the data used in creating the variables was drawn different years (2010, 2012 and 2013). This study only used a limited number of socio-economic and environmental variables to conduct the analysis of vulnerability to climate change. Moreover, adaptive capacity was not considered in this study although it would have yielded a richer analysis. It is commonly used as a third sub-index when determining overall vulnerability to climate change. Additional variables should be considered in order to obtain more accurate and significant results.

THE FLETCHER SCHOOL
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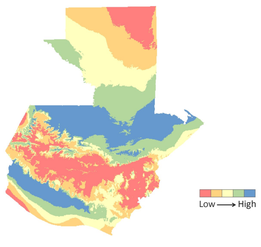
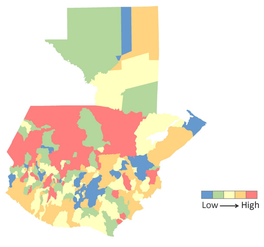
Cartographer: Alejandra Mazariegos
Coordinate System: WGS 1984, UTM Zone 15N
Projection: Transverse Mercator
GIS for International Applications
May 10, 2016.

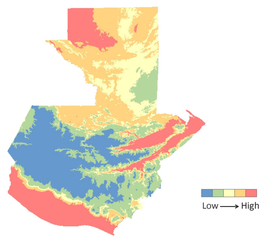
Precipitation



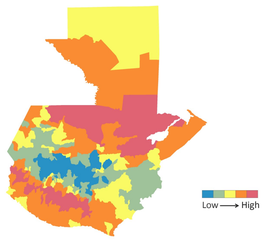
Drought



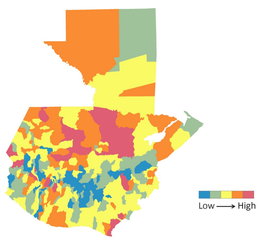
Temperature



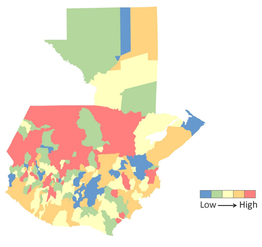
Environmental Vulnerability



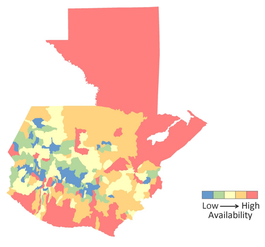
Social Vulnerability



Poverty



Health Services



Illiteracy