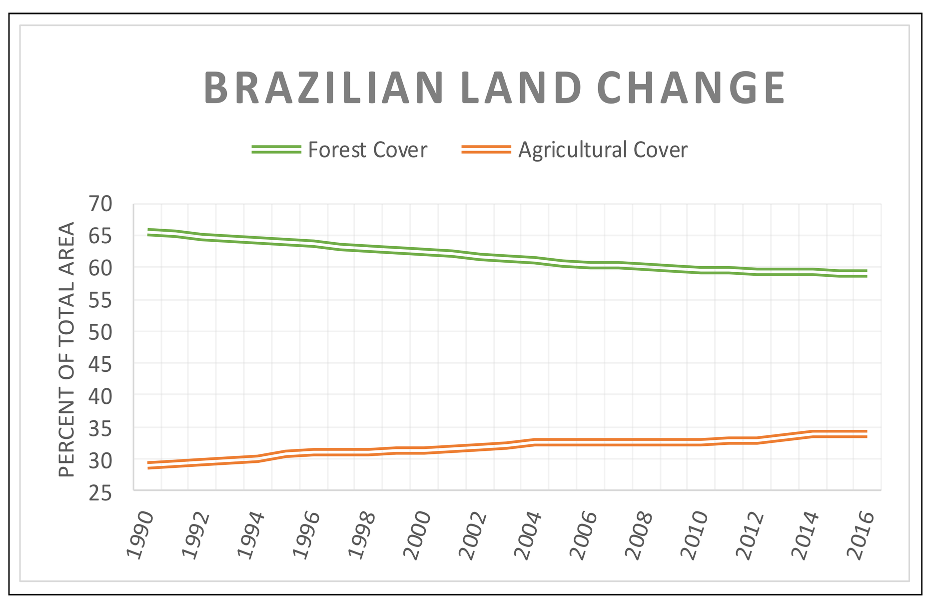
SAPPING OUR STRENGTH

Deforestation and human vulnerability

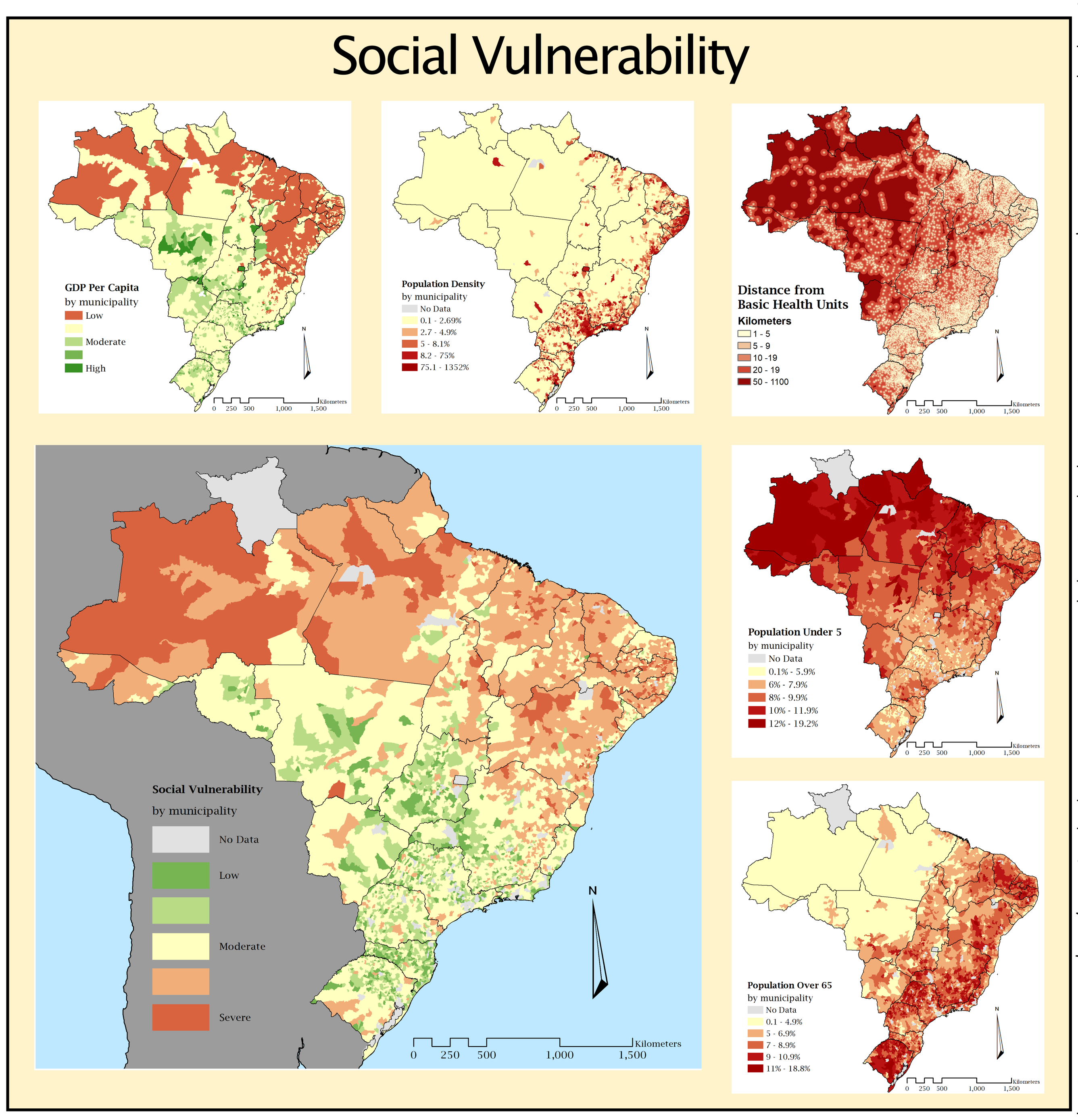
Introduction

Traditional analyses of community vulnerability to zoonoses focus primarily on social indicators, such as access to health care, socioeconomic status, population density, and age. However, following recent scholarship exposing the complicated link between human and environmental health, analyses that integrate environmental health indicators for land change would likely achieve a more accurate estimate of vulnerability.



On the Brazilian landscape, foreign and domestic investment have resulted in steady rates of deforestation and agricultural growth since the early 1990s (World Bank). This trend will likely continue or worsen due to climate change, unless major amendments to policies are made.

The negative ramifications that result from deforestation extend well beyond the effects on biodiversity and habitat loss; researchers have shown that deforestation can be highly detrimental to local economies (Global Forest Watch, 2018); others are concerned that deforestation in the rainforest may harm rain cycles and diminish the stock of freshwater in the Amazon (Pearce, 2018); and finally, deforestation can create ideal conditions for a heightened spread of new and existing infectious disease such as malaria and dengue (Robbins, 2016).



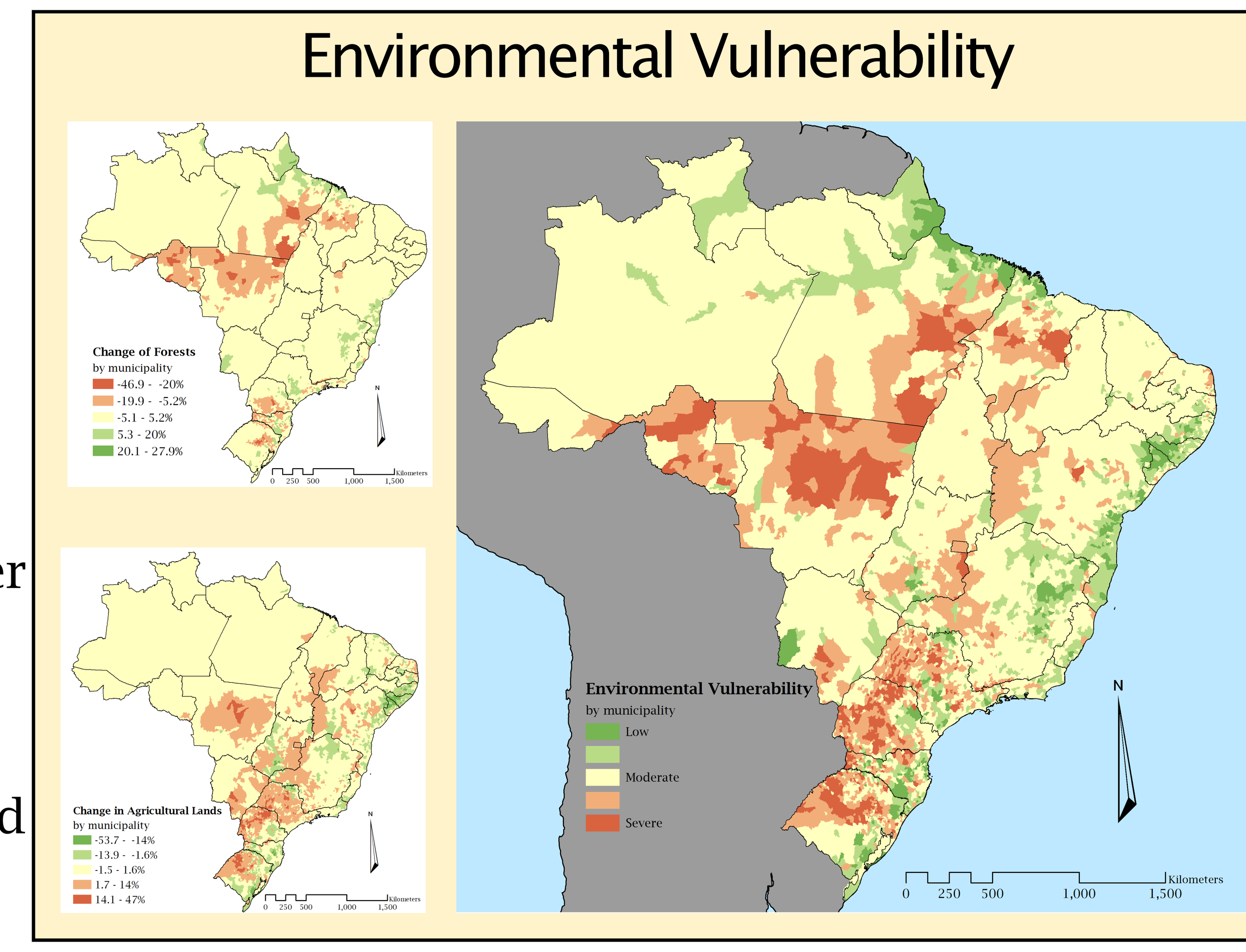
Drastic changes to the environment wipe out ecological balance and often support the spread of the zoonoses' host species, such as mosquitos and slugs. The low-lying vegetation on the newly converted agricultural land, provide hosts with ideal habitats. Increased sunshine can warm land and waters and increase breeding rates. New forest boundaries may force other host species like bats and primates to converge within remaining forest lands and support the spread of disease amongst their population. Finally, alterations to landscapes have also been proven to shift the behavior of mosquito populations leaving them more aggressive than members of the same species found in intact environments (Robbins, 2016).

Methods

Over the course of this project, three vulnerability analyses were performed for Brazilian communities on a municipal level using different combination of indicators. First, vulnerability was assessed using social variables from the Brazilian census. Age, socioeconomic status, population density, and distance from the nearest "Basic Health Unit" were classified at natural breaking points and symbolized at a municipality level to show the distribution of data within the larger population. Each of these classifications received a vulnerability "rank" from 1-5, with 1 being the least vulnerable and 5 being the most vulnerable. This individual vulnerability was then aggregated to develop a "social vulnerability composite."

Methods cont.

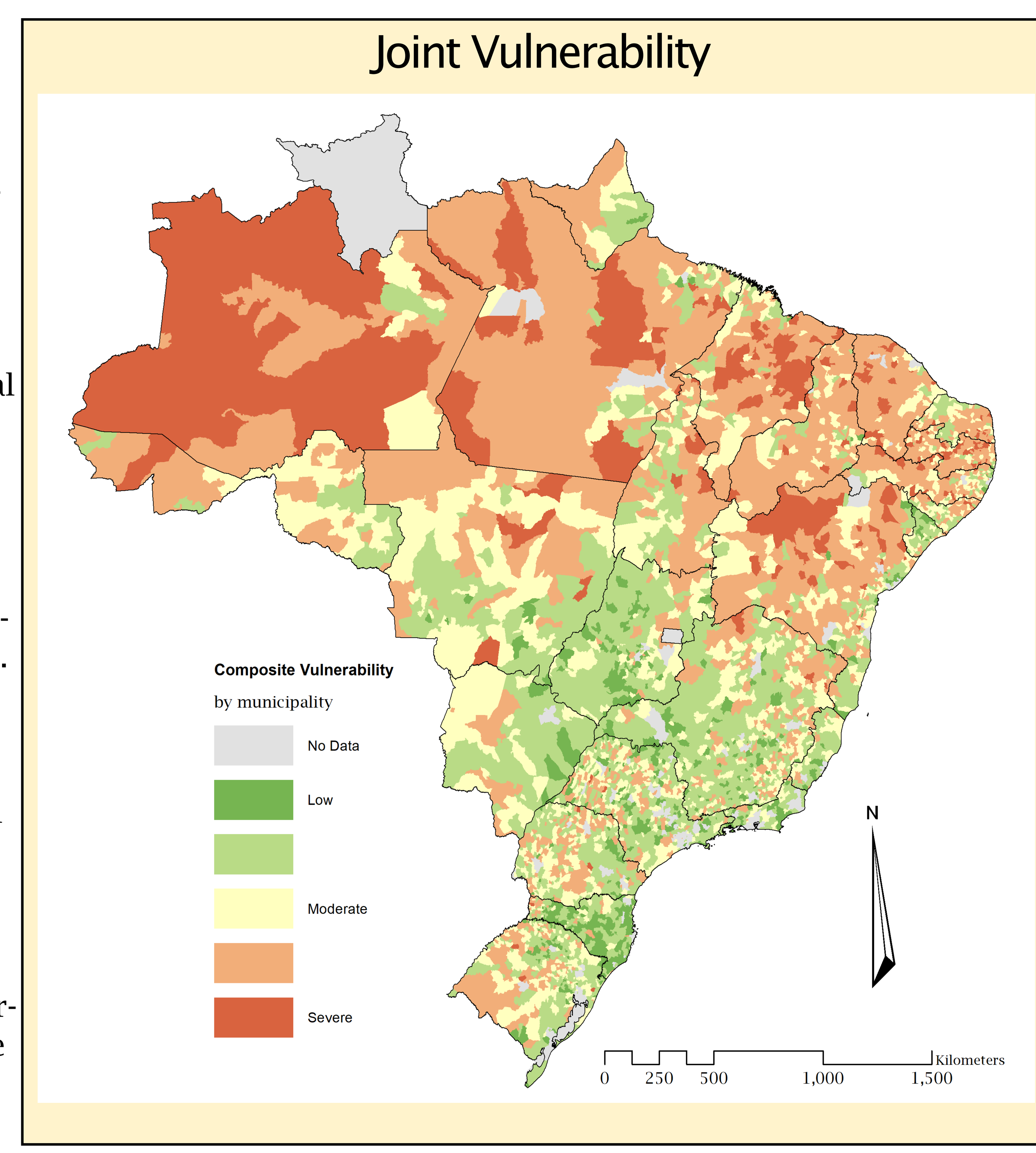
A similar process was utilized to calculate an "environmental vulnerability composite." The environmental indicators utilized Modis land cover. The raster data sets queried total land cover for both forests and agriculture from 2002 and 2012. The difference between the two showed total land cover change over ten years. Similar to above, individual environmental vulnerability variables were aggregated to produce a composite score and symbolized to show variation across municipalities.



The social and environmental composites were then added together to form a vulnerability analysis complete with both social and environmental variables.

Results & Discussion

Including both social and environmental variables in the vulnerability assessment suggested that far fewer individuals were at high risk (~17.5 million) than in the purely social analysis. This is likely because municipalities with high social vulnerability and environmental vulnerability became significantly worse off than the communities only burdened with social vulnerability.



There are a couple of limitations to this analysis. First of all, data utilized in this analysis was largely from 2007, and therefore social vulnerability scores could fail to represent the current reality of the social landscape in Brazil. Furthermore, environmental variables were limited to land cover change along the lines of forest and agriculture. Many other variables could be included: temperature and aspect, to determine ideal breeding grounds for mosquitos, water bodies, and the range of habitat for different host species. These variables should be included in future analysis. Finally, it was assumed that each variable held equal weight in determining the vulnerability to zoonoses, however, in reality it is probable that the weight of each of these variables depends on where the individuals live.

	Vulnerability Level	Number of Municipalities	Total Population
Social Composite	Low	92	1,165,336
	High	930	18,870,542
Environmental Composite	Low	1,107	96,723
	High	30	29,251
Joint Composite	Low	461	9,206,470
	High	57	1,324,891

Cartographer: Ana Nichols Orians
Created for: DHP 207: GIS for International Applications

Data Sources: Instituto Brasileiro de Geografia e Estatstica; Infraestrutura Nacional de Dados Abertos; NASA; ESRI; WorldBank.
Projection: South America Albers Equal Area Conic

The Fletcher School of Law and Diplomacy
Tufts University