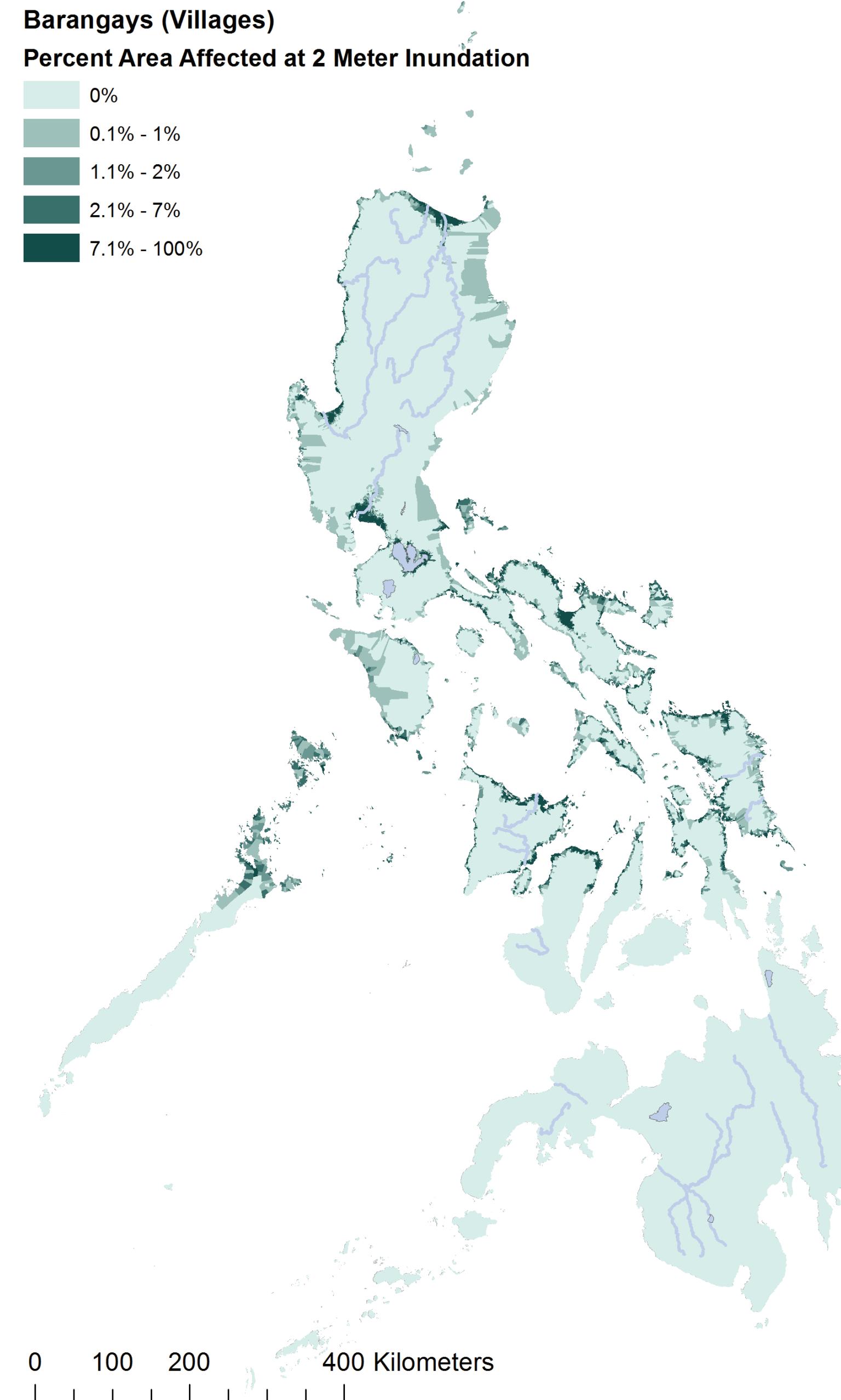


# THE IMPACT OF SEA LEVEL RISE IN THE PHILIPPINES

## Charting Climate Change in Metropolitan Manila



### Overview

In recent years, increasing attention has been paid to climate change and its potential impacts. Ranging from droughts to sea level rise, climate change impacts will affect agriculture, security, livelihoods, human health, and migration patterns.

Sea level rise occurs as a result of thermal expansion in the oceans and from melting glaciers, ice caps, and the Antarctic and Greenland ice sheets. While sea level rise is difficult to predict, current estimates vary from as little as 50 centimeters to as much as three meters. Approximately 634 million people live in low-elevation coastal zones, many clustered in urban areas. People who live in exposed urban areas are particularly vulnerable to the impacts of sea level rise, including flooding from high tides and storm surges, especially since rapid urban development has increased runoff and reduced natural wetland barriers to flooding.

The urban poor are particularly vulnerable because many are forced to live in marginal, hazard-prone areas, like flood plains, and may live in substandard housing lacking adequate infrastructure, such as sanitation, water, and solid waste disposal. Not only are the urban poor exposed to flooding hazards, but they often have limited resources and capacity to take measures to protect themselves.

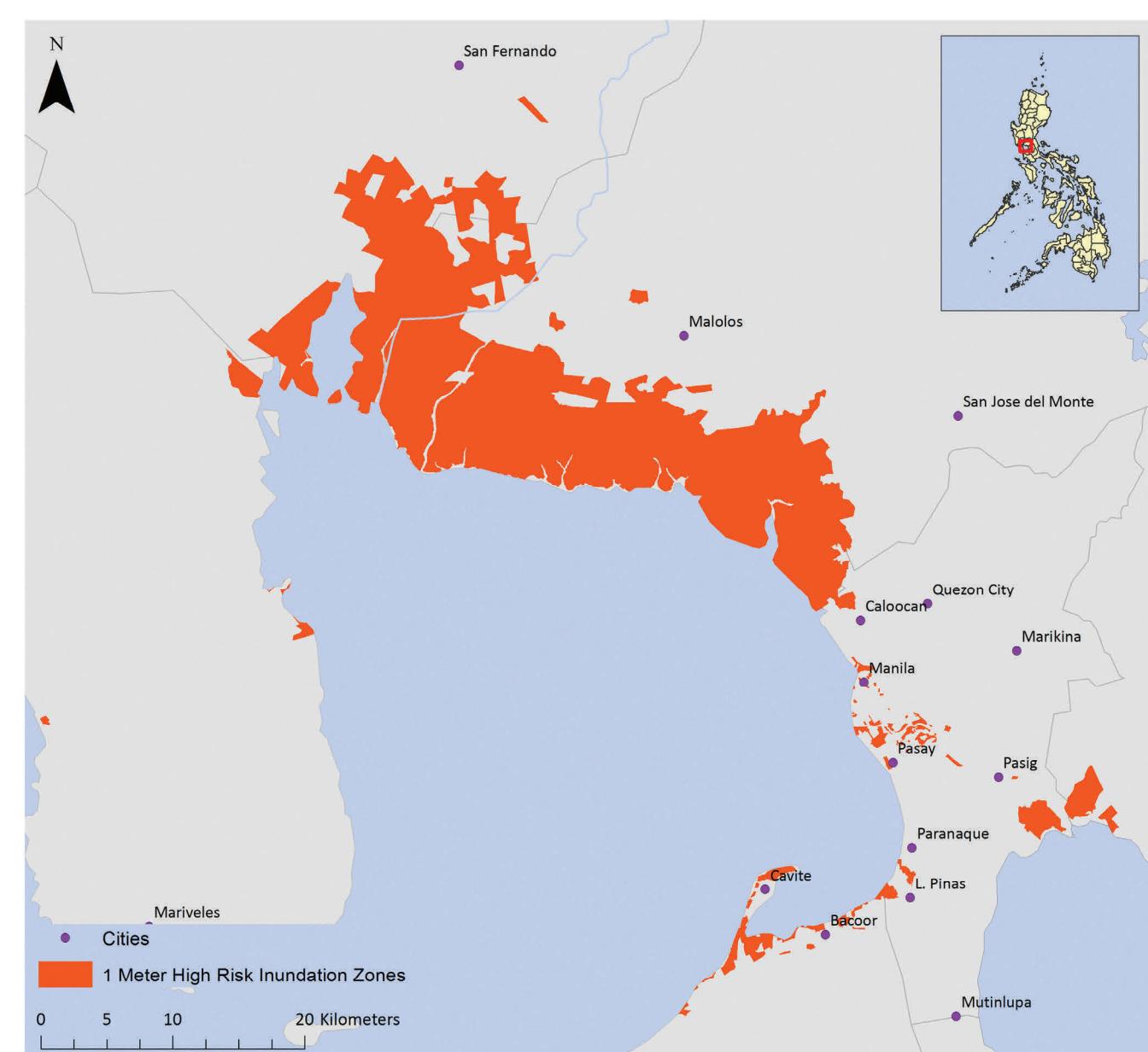
The Philippines is expected to experience more frequent and severe flooding as a result of sea level rise and more frequent cyclones. According to the World Bank, its urban population is expected to account for 75% of the national population by 2035. Many of these emerging urbanites live in informal settlements that are especially vulnerable to sea level rise.

### Urban Slum in Tondo District, Manila

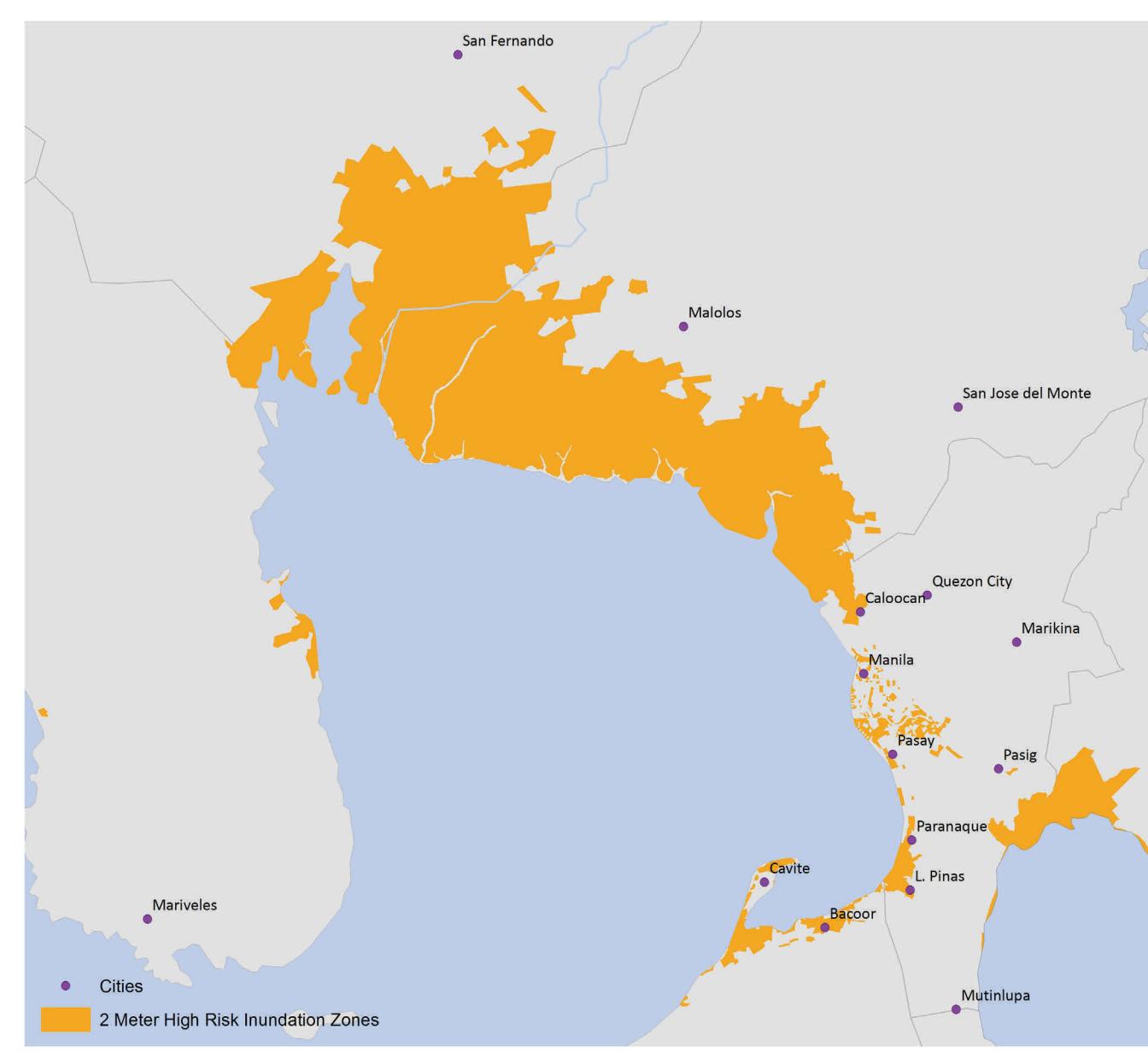


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### High Risk Barangays: One Meter



### High Risk Barangays: Two Meters



### High Risk Barangays: Three Meters



### Methodology

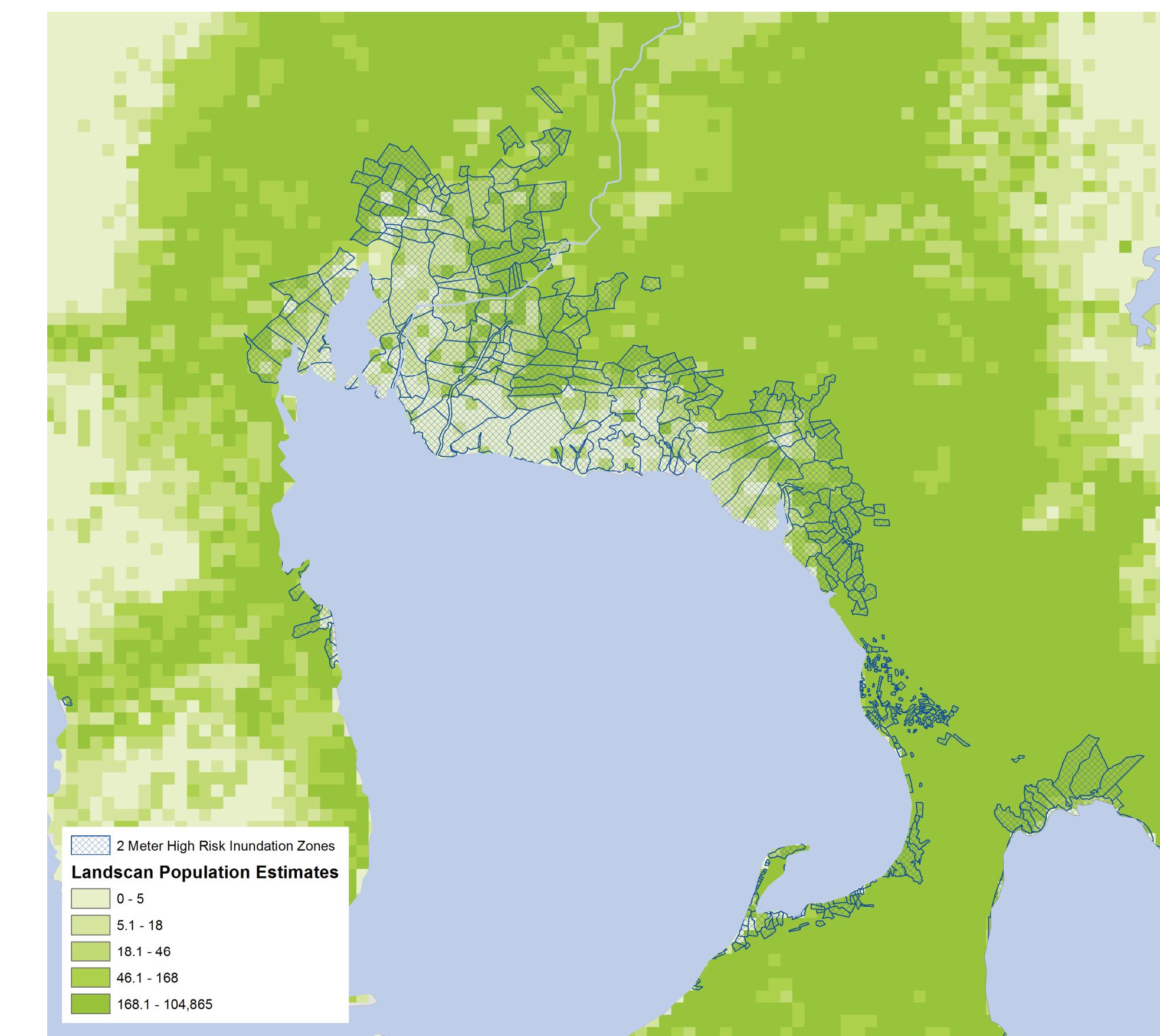
To determine what areas of the Philippines are vulnerable to climate change, this project reclassified elevation data to determine what would areas be inundated with sea level rise at one, two, and three meters, representing a low, high, and catastrophic estimate.

To determine which barangays (villages) are the most vulnerable, this project used zonal statistics and the field calculator to determine the percentage of each barangay that would be inundated at each level. Then, a threshold was set of inundation of more than 7 percent of each barangay's area to determine high-risk barangays. A layer was created from these selected barangays to create high risk inundation areas at the two meter level to examine underlying population and land use.

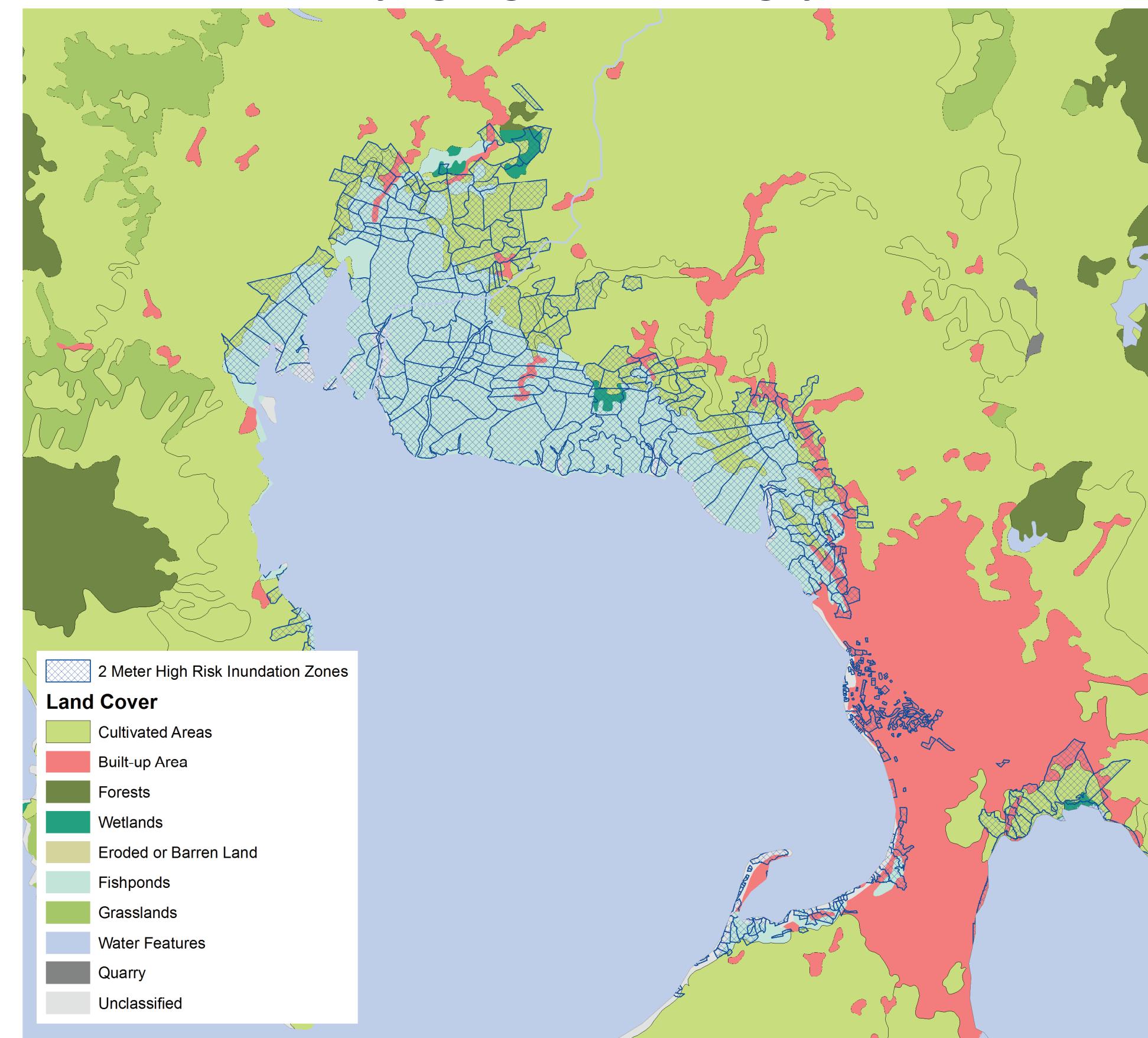
**Data Sources:** Data from this project came from Tufts GIS, National Oceanic and Atmospheric Administration, GADM, and the PhilGIS portal.

**Projection:** WGS 1984: UTM Zone 51M

### Population Underlying High Risk Barangays at Two Meters



### Land Cover Underlying High Risk Barangays at Two Meters



### Analysis and Conclusions

Inundation from sea level rise would have significant consequences for the Philippines. The low estimate for sea level rise, one meter, would affect 7,000 square kilometers in 2,490 barangays (villages), impacting an estimated 1.8 million people. The high estimate for sea level rise, two meters, would affect nearly 8,000 square kilometers in 2,730 barangays, impacting an estimated 2.3 million people. Catastrophic three meter sea level rise would affect over 15,000 square kilometers in 5,387 barangays, and impact an estimated 3.4 million people.

The population map shows that while many of the high risk barangays in the metropolitan Manila area have relatively low population, the fringes of the high risk inundation zone are some of the most densely populated areas in the country.

An examination of land cover underlying high-risk barangays in the metropolitan Manila area reveals that coastal fishponds are the primary land use. This is interesting, because fishponds have not only been associated with increased flooding from levee construction, but also with land subsidence, which would magnify the consequences of sea level rise.

This analysis demonstrates that urgent action needs to be taken to mitigate and adapt to sea level rise, particularly in urban areas. If it goes unaddressed, the lives, livelihoods, and property of millions of people will be directly impacted.