

Population Impact Analysis: Sea Level Rise in San Francisco and Western Alameda County

Abstract

Climate scientists predict that the **ice sheets** on top of **Greenland** will **melt** if global temperatures rise by another 3 degrees Celsius, a possible outcome of current global warming trends within the next 150 years. Experts predict that such an event would **raise global sea level by approximately 20 feet**, through the combined effects of the addition of water to and thermal expansion of the oceans.

In this GIS project, I analyze the impact such a sea level rise will have on the populations of the San Francisco and western Alameda Counties in Northern California.



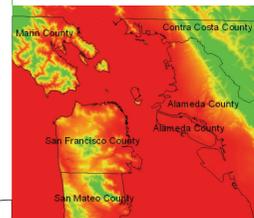
Data Sources

- Topographic (digital elevation map) and Orthographic data is displayed courtesy of the USGS.
- All demographic data is taken from the US Census Bureau's 2000 Census, and is displayed courtesy of ESRI.
- Road data is displayed courtesy of the Federal Geographic Data Committee.

Notes

- Most Census Blocks span a range of elevations, especially in hilly San Francisco County. I decided that all parts of a Census Block that will be partially flooded by the rising sea level should be considered "affected," and therefore the entire Census Block should be counted as being flooded by the rising sea level.
- Household Income data is only available at the Census Block Group level of detail. Because Block Groups are composed of several Blocks, my method of determining which areas will be affected produced less accurate results for my analysis of Wealth and Poverty in Flooded Areas than the analysis of Racial Density and Total Flooded Area.

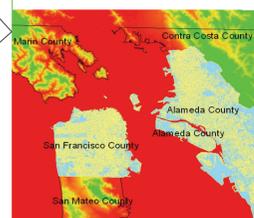
Methodology



I started with a digital elevation map (DEM) raster of the area of analysis (accuracy: 1/3 arc length). I re-projected the DEM so that its vertical (z-value) data was in the same units (feet) as the rest of the map, and added County polygons for reference.



I then georeferenced a cropped orthographic image of the area of analysis to the County polygons. I included the orthographic image only to add visual context to the images, I did not use it in the analysis process.



I added Census Block polygons and SF1 Census data for San Francisco and Alameda Counties to the map. I then clipped them to the County polygons, and assigned each Block the elevation of the lowest DEM raster value occupying the same geographic space.



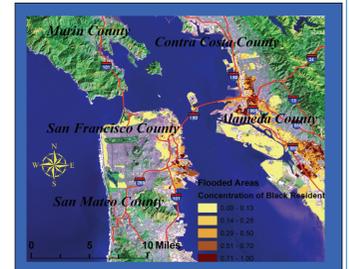
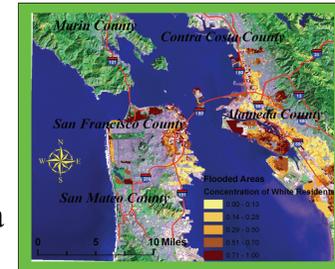
Using the elevation data attached to each Census Block, I selected the Blocks that were less than 20 feet above current sea level¹. I used selection tools to analyze and display demographics of the areas that will be flooded should sea level rise 20 feet.



This map shows the Census Blocks of San Francisco and near Alameda Counties that will be flooded should sea level rise 20 feet.

Racial Density in Flooded Areas

The Bay Area is known for its racial diversity, a trend reflected in these maps. Still, there are several flood areas that are dominated



by a single racial group (high percentage of Census Block residents who describe themselves as a given race). Examples are **Whites in Western Alameda and Northern San Francisco**, **Blacks in Central Alameda**, and **Hispanics in Southern Alameda** Counties. **Asian populations** are not highly concentrated in flood areas.

Wealth and Poverty in Flooded Areas²



California households with a total income of less than \$25,000 per year are considered to be below the poverty line. I define a wealthy household as one with a total income of greater than \$125,000 per year. This analysis shows, with the exception of some **wealthy coastal communities in San Francisco County**, most of the areas that will be flooded hold **high concentrations of the Bay Area's impoverished population**. Given the attractive views real estate in the hills offers, this class division is intuitive.