

Sea Level Rise

Cape Cod Major Water Sources and Critical Facilities

Background

Cape Cod is located on Atlantic Ocean from the southeastern corner of mainland Massachusetts, in the northeastern United States. Cape Cod is a sand and gravel remnant of the last continental deglaciation that occurred from 15,000 to 20,000 years ago. The coarse sands -extremely permeable, making for a high-yielding groundwater system. (Walter et al., 2016). Cape Cod is comprised of 15 towns that encompass 400 square miles. The Cape's population doubled between 1970-2010. (James et al). Cape Code economy is driven mostly by the tourism especially during summer time. Fishing industry is also contributing to the economy of the Cape Cod mostly on oysters. Cape code is surrounded mostly by the sea. The cap code is among the most vulnerable places toward sea level rise. Due to its natural flat topography with a highest elevation of 95 m, it's more prone to impacts of sea level rise. During the recent year's Cape Cod is struggling with sea level rise which include the ground water table rise, intrusion of salt sea water into the fresh water reservoirs. The failure of septic system due to the intrusion of water into is commonly observed in many places across the Cape Cod. And according to the recent IPCC report the sea level rise will continue and under business as usual scenarios it is obvious to have more drastic impacts. In this study, we will try to map the water resources which are more likely to be impacted under different seas level rise scenarios (1foot and 5feet) and its possible impacts on the critical facilities as well.

Research Questions

What's the impact of sea level rise on critical facilities in Cape Cod?

What's the impact of sea level rise on ground water resources in Cape Cod?

What's the impact of sea level rise on surface water sources in Cape Cod?

Sources and References

M drive (SRTM data for cape cod was acquired from the M drive <https://www.fema.gov/national-flood-hazard-layer-nfhl>

<https://www.census.gov/>

<http://giscccommission.opendata.arcgis.com/>

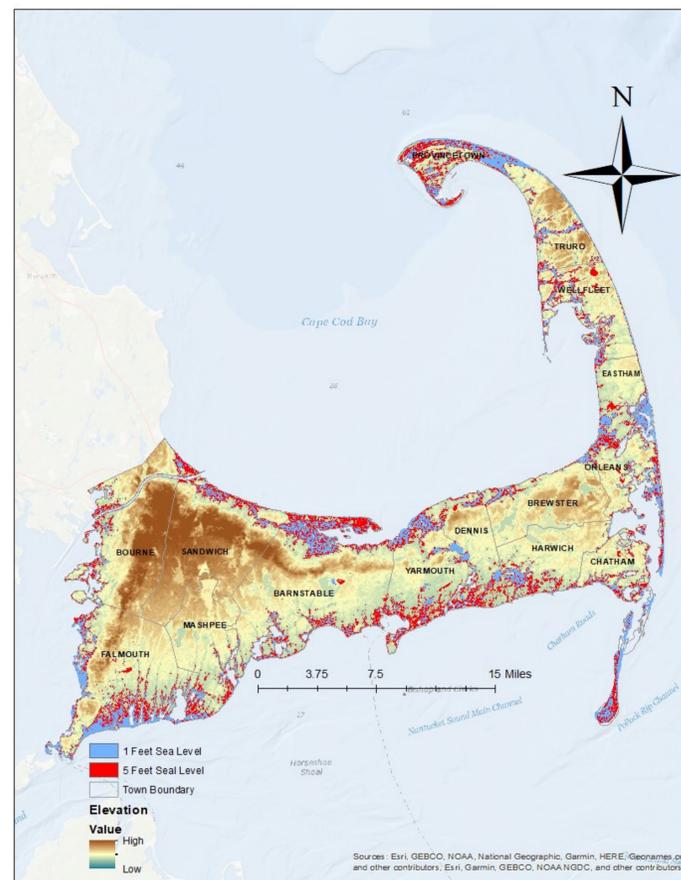
Walter, D.A., McCobb, T.D., Masterson, J.P., and Fienen, M.N., 2016, Potential effects of sealevel rise on the depth to saturated sediments of the Sagamore and Monomoy flow lenses on Cape Cod, Massachusetts



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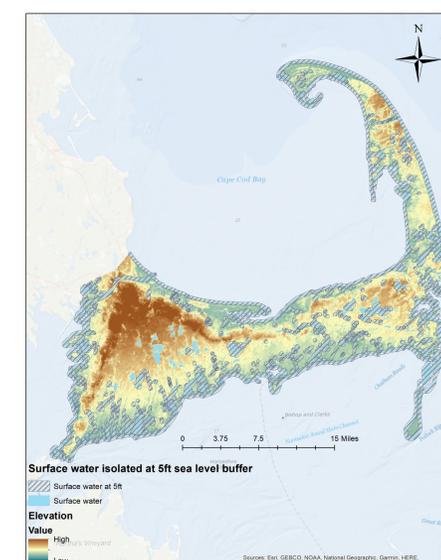
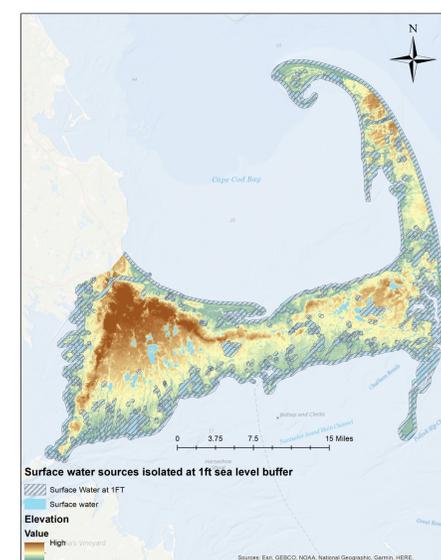
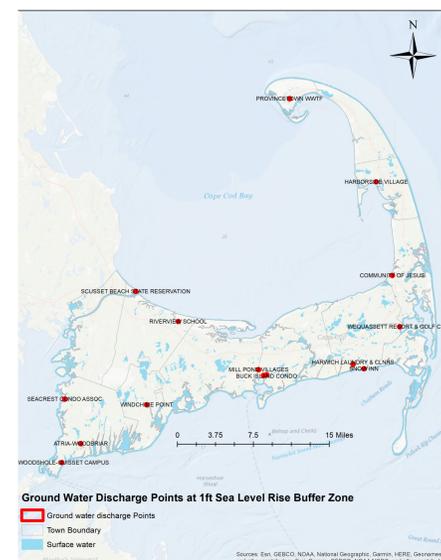
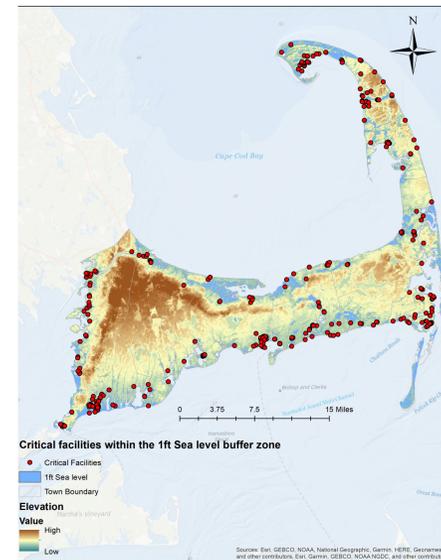
Methodology

The elevation models data derived from the SRTM (Shuttle Radar Topography Mission) was acquired from M drive at data Lab Tufts University. Than using the reclassify tool it the layer was reclassified into different categories representing high to low vulnerable areas, according the elevation difference. In the next step raster calculator was used to add 1 foot scenario to the elevation layer, than the same method was applied to see the 5 foot sea level. The raster is converted to vector to do use the buffer and select by location tool. A buffer zone of 100 meter was created around the major water resources. The select by location tool is than used to see which water resources are in the sea level rise buffer zone.



Impact	1 Foot Sea level	5 Feet Sea level
Land Area Inundated	9%	21%
Ground Water Discharge points	24%	40%
Surface Water Sources	51%	68%
Critical facilities	32%	49%

NAD83 Massachusetts Mainland, Projection : Lambert Conformal Conic



Results and Discussions

The result showed that the Cape Cod major water resources along with important critical facilities are at high risk to sea level rise flooding. The surface water sources like river, lakes and ponds showed high vulnerability to both 1 foot and 5 foot sea level rise. More than 50% of the surface water showed to be lie within the flood prone region. The critical facilities also have higher risk for sea level inundation, in worst case scenario showed 49% of the facilities lie in the sea level rise prone area. The Sewer systems and other water treatment plants lie in this category. The major ground water discharge points were also studied under both scenarios. The intrusion of salt water into the ground water is likely possible because 21-40% of the ground water points lie in the sea level rise prone zone. Many studies reported that under business as usual conditions the sea level is expected to rise by 1 foot till the mid of this century and 5 foot in worst case scenarios till 2100. From this study it was observed that the Cape cod region is among the most vulnerable region for sea level rise.. The major policies should have to be formulated while considering these vulnerability scenarios in mind. The land use change has to be controlled where no construction in the coastal flooding prone areas. The major infrastructure has to be shifted to high elevation and safe zone. The sewer and other water treatment facilities also need to be reorganize. The tourism and recreational activities serve as backbone to the local economy of the region, which is also very likely to be impacted by the sea level rise. The policies should be made to preserve the recreational sites by using different flood barriers. The community based awareness and early warning systems along with other adaptation measures must be introduced timely to cop with the future sea level rise scenarios.