Under the Flood Line:

The Potential for Coastal Flooding in Danvers, MA Under Combined Sea Level Rise, Storm Surge, and High Tide Scenarios

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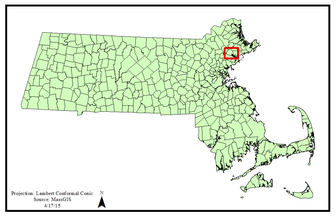
Abstract

Since reliable record keeping began in 1880, the global sea level has risen roughly 8 inches and is projected to rise an additional 1 to 4 feet by 2100 (National Climate Association). With this alarming trend, it is essential to adequately prepare coastal communities for potential changes. This research provides statistical analysis of coastal flooding predictions for the town of Danvers, Massachusetts. Flooding scenarios were based off of the National Oceanic and Atmospheric Association's (NOAA) coastal flooding scenarios. The scenarios include low, moderate, and high emission predictions and are based off of NOAA's latest national climate assessment. The scenarios do not reflect solely sea level rise, but how rising sea levels could combine with storm surges and high tides to create the worst case possible of flooding. Calculations refer to these combined scenarios and state that coastal flooding could rise raise water levels by 9, 12, or 16 ft. depending on emission rates. This poster demonstrates the effects of this worst case scenario flooding on infrastructure and populations within Danvers and were conducted with the use of ArcMap 10.2 and MassGIS data to determine what percentage of the town would be inundated based off of the three emission scenarios. Analysis concludes that the town is facing millions of dollars worth of damage and actions should be taken to mitigate this destruction.



Source: http://bid.soobahkdo.org/auctions/region-1-destination-2015/

Source: http://themorrisseyteam.com/boston-north-shore/danvers-homes/

Methodology

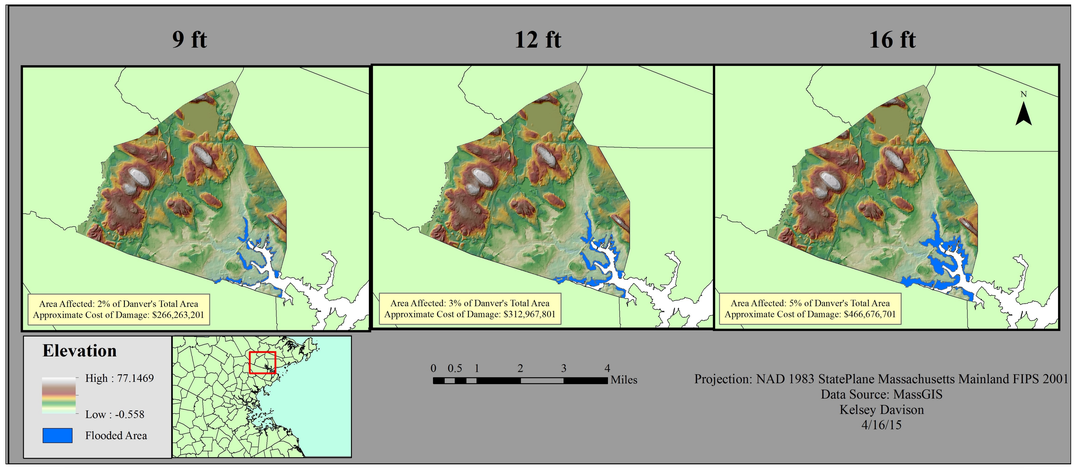
1)Data was acquired from MassGIS and imported into ArcMap 10.2 for analysis.

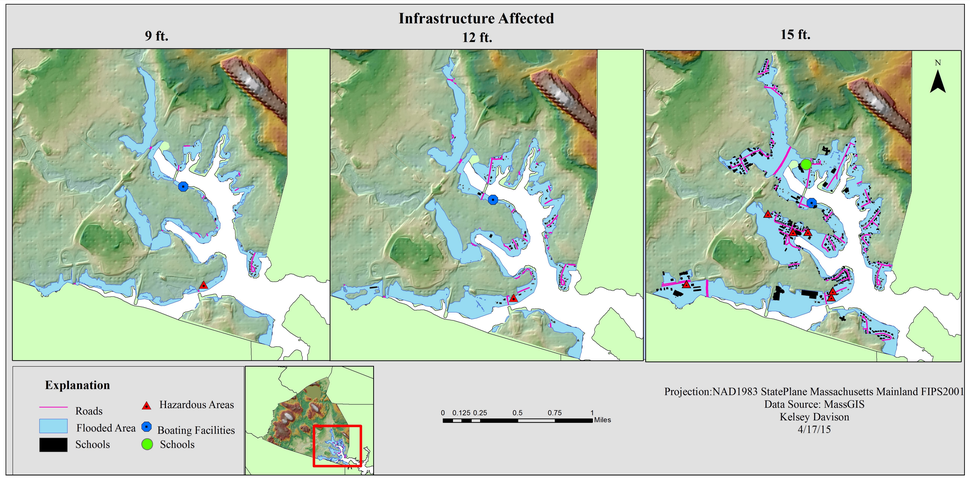
2) Digital Terrain Models (DTM) downloaded from MassGIS were interpolated to create a raster elevation layer for the entire town.

3)Areas prone to flooding were determined based off of the raster elevation layer by isolating coastal areas that fall below 9, 12, and 16 ft.

4)Infrastructure, land, and population affected were determined by downloading parcel data for buildings in flooded areas and Census Block Groups for populations affected. Google Earth was used to identify businesses residing in flooded areas.

Results

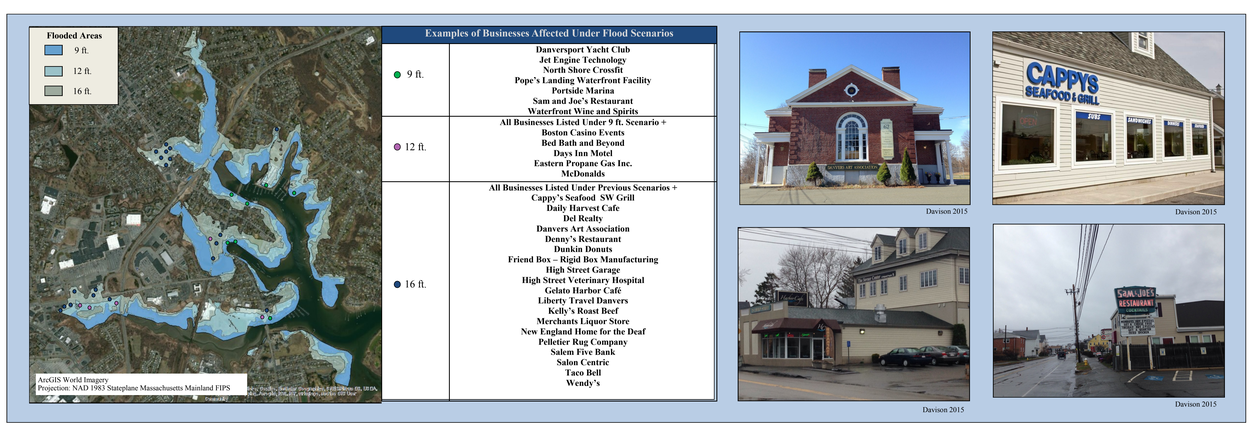




Scenario	Structures Affected
9 ft.	57
12 ft.	145
16 ft.	537

- Under all scenarios one of the North Shore's most important highways, route 128 would be affected.
- Only one school would be affected, the Riverside Elementary school, and only in the 16 ft. scenario.
- Analysis was unable to determine what hazardous area facilities actually were, but a dramatic increase from 1 hazardous area in the 9 ft. and 12 ft. scenario to the 6 total hazardous areas under the 16 ft. scenario was identified.

Scenario	Miles of Road Affected
9 ft.	.5
12 ft.	1.74
16 ft.	6.2



The total population of Danvers is 26,493. To gain a greater understanding of flood impacts statistics were calculated to determine what percentage of the population would be affected under each scenario. Analysis also calculated the total number of elderly and youth that would be affected, since these groups of individuals would have greater difficulty relocating in a storm surge scenario. Youthful populations were determined as individuals aged 10 and under while elderly populations were calculated as individuals 70 years and above. It is important to note that data used was collected in 2010 by the Census Bureau so estimates are out of date.

Populations Affected		
	# of People Affected	% of Total Population
9 ft.	430	2%
12 ft.	799	3%
16 ft.	1,593	5%

Vulnerable Populations Affected			
	Youth	Elderly	Total
9 ft.	43	97	140
12 ft.	79	160	239
16 ft.	169	293	456

Conclusion

- These scenarios demonstrate that we do have the power to thwart sea level rise if we control our emissions.
- The high emission scenario would affect over double the low emission scenario, with an additional area of 1,076,075 m^2 falling subject to flooding.
- Damage to route 128 could seriously handicap the entire north shore.
- The Board of Selectman for the town reported that for the 2015 fiscal year the total town revenue will amount to around $107,000,000 which breaks even with the town's expenditures, leaving little room for additional costs.
- Considering this project's findings and the town's current budget, sea level rise will be a serious financial burden for the town.
- The costs of these change are inestimable if we imagine the entire U.S. coast line coping with rising sea levels.
- It is up to us to act now and prevent the degree of damage rather than have to react to the worst case scenario.

References & Contact

Parris A et al (2012. Global sea level rise model. Global Sea Level Rise Scenarios for the U.S. National Climate Assessment. NOAA. Tech Memo OAR CPO– 1:37 pp.

"National Climate Assessment." *National Climate Assessment*. N.p., n.d. Web. 27 Mar. 2015. Access at::http://nca2014.globalchange.gov/report/our-changing-climate/sea-level-rise.

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