Assessing Coastal Vulnerability and Beach Stability: A Connecticut Case Study

Michelle Ritchie
mritchi2@binghamton.edu
Graduate Student, Department of Geography, Binghamton University

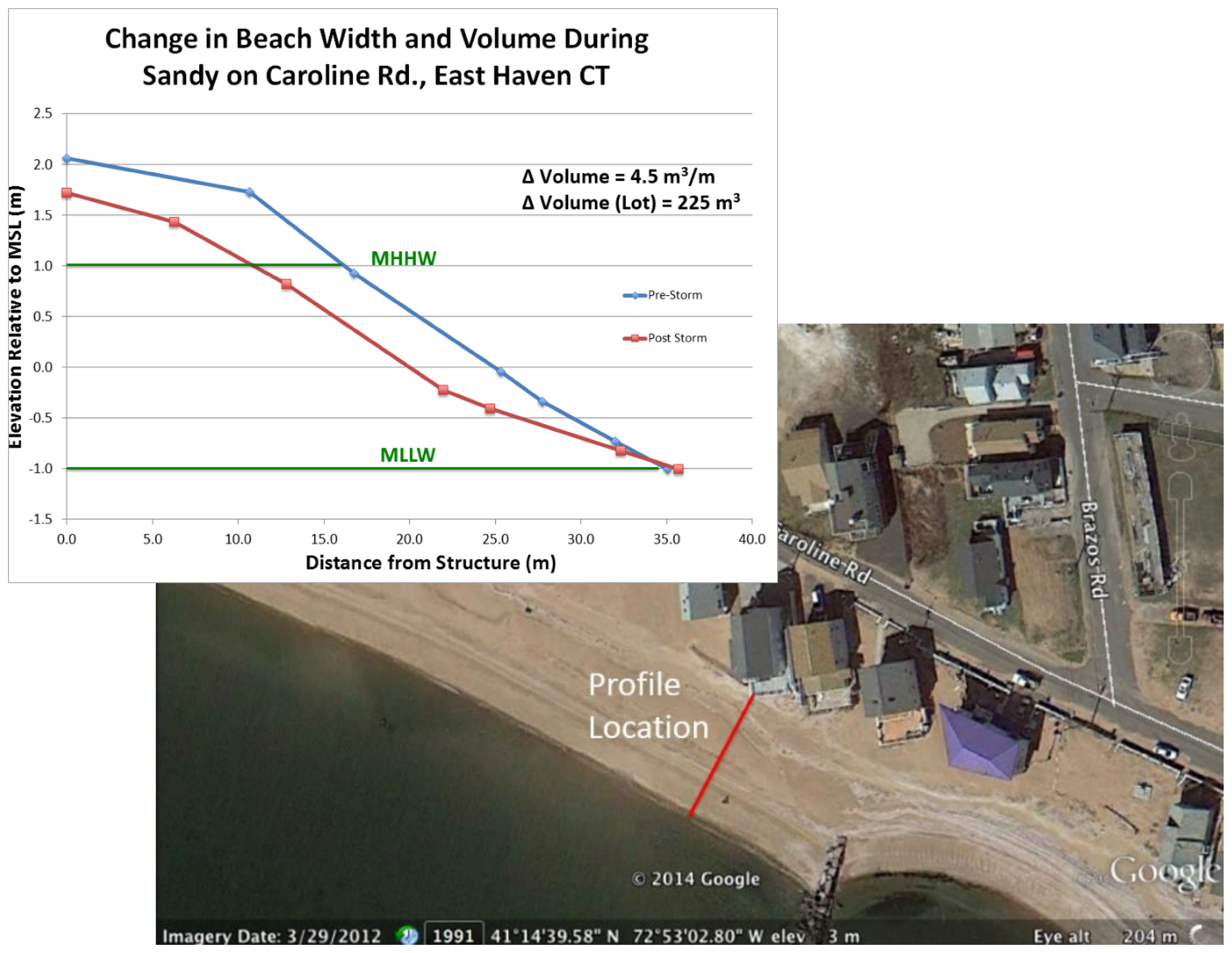
Introduction

Hurricanes Irene and Sandy have caused unprecedented damages to the Connecticut shoreline in recent years, particularly in East Haven. The fact that these storms occurred successively has raised concerns about rising sea levels and storm intensification, likely attributable to climate change.

In response to this, student researchers responded by going out into the community to document storm damage and gather data. The analysis of such information proved useful for policy and decision making in the area. This environmental research also benefited a variety of community partners such as coastal town managers, environmental regulatory agencies, and informal environmental education centers.

Coastal Vulnerability

Topographic elevation, presence of seawalls, and raised structures all influence the severity of wave damage during storms. Data analysis, however, indicated that beach width and height were the primary determinants of the degree of wave damage to coastal structures. Elevation was another notable factor. The data collected has been used to support proposed policy changes that would make it easier to maintain the buffering capacity of local beaches in the face of large storm waves through updated beach nourishment projects and policy.



This graph represents the volume of beach width lost due to Superstorm Sandy at a specific profile location.

Constructing Flood Maps

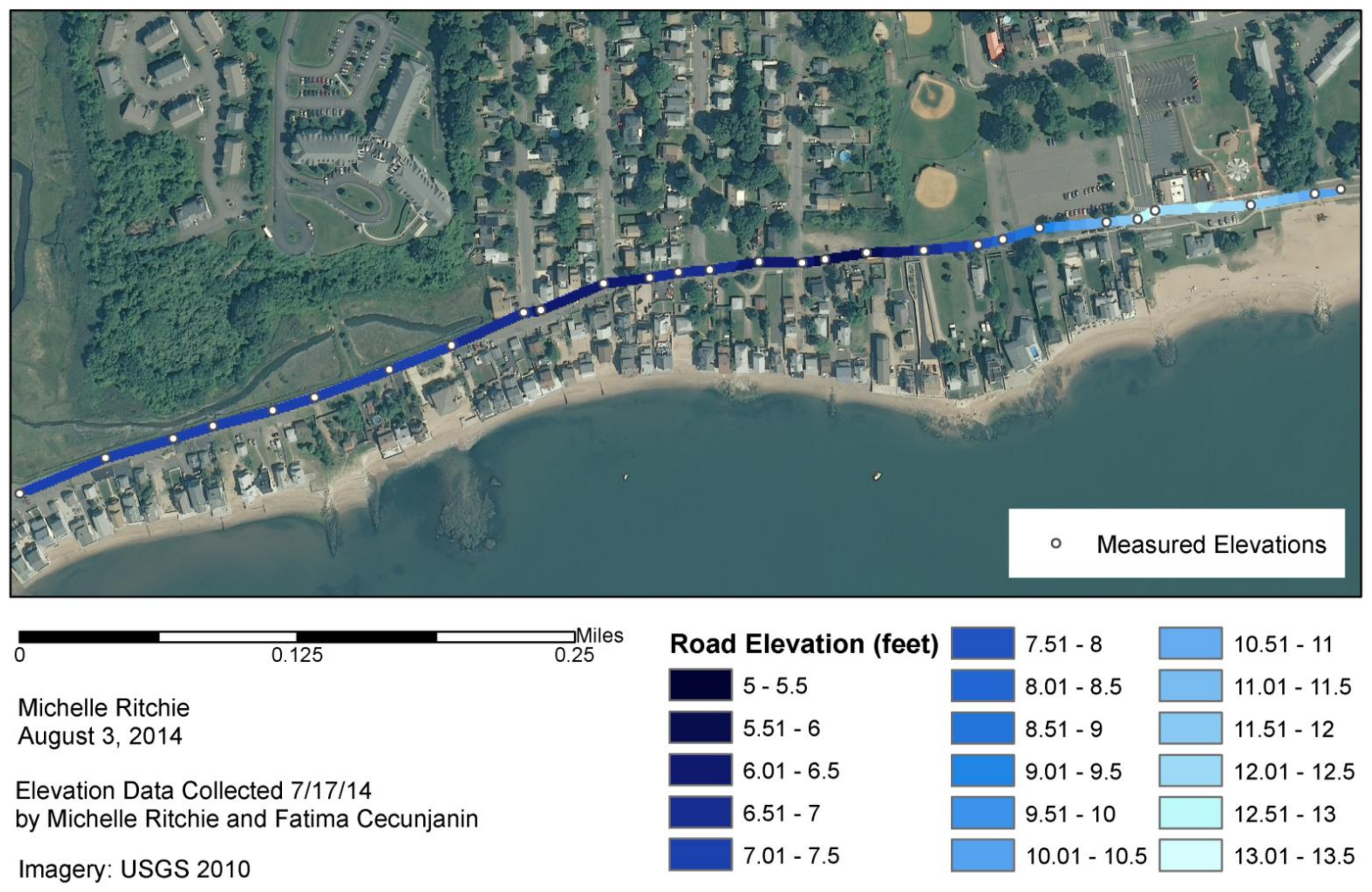
Following the flooding that accompanied the peak storm surge of Hurricane Sandy, debris lines associated with the flood were located, photographed, and addresses were noted. Successively, blue dots were painted on the spots that represented the debris upper boundaries. Later, these locations were recorded using geographic positioning technology (GPS) and the elevations were measured using laser based surveying technology (total station).

Flood line locations were then processed using Google Earth and Geographic Information Systems (GIS). An average elevation for flood line locations was calculated along with a measure of variability (standard deviation). The average elevation for the flood debris (8.93 feet) was then compared with the peak storm surge water elevation measured at the New Haven tide gauge. The difference between the tide gauge elevation and the elevation determined by averaging debris elevations was just 0.6 inches.

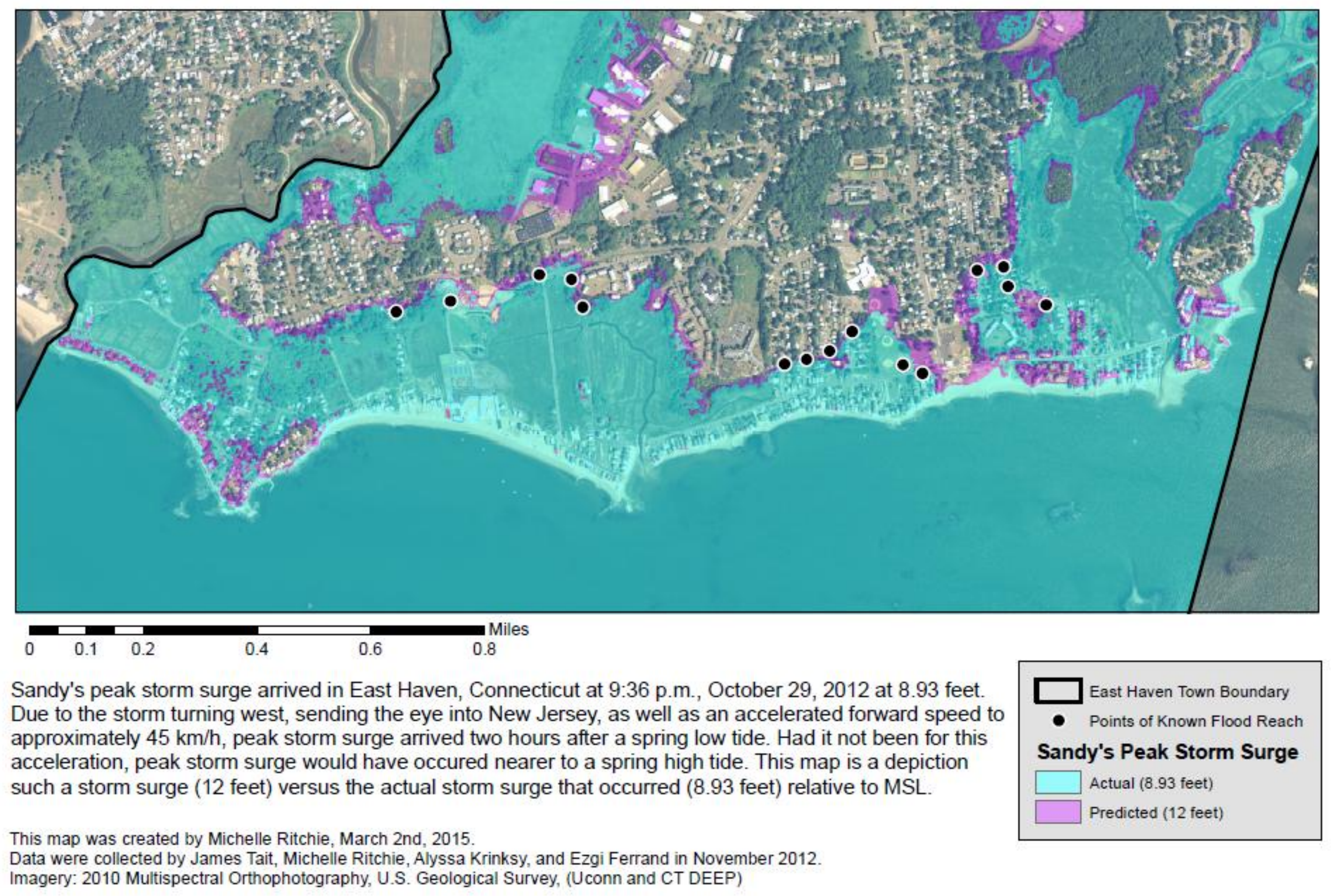
After analyzing wave damage during Sandy, a series of maps were constructed using ESRI's ArcGIS showcasing coastal road elevations, Sandy's peak storm surge, and a series of flood predictions based on the IPCC's sea level rise projections. These maps were then shared with the East Haven town engineers office to aid in updating their emergency response plans. This research also become a part of the town of East Haven's official report to FEMA.

Fatima Cecunjanin and Michelle Ritchie surveying in East Haven, Connecticut.

Cozy Beach Avenue, East Haven
Road Elevation Relative to MSL



Superstorm Sandy's Peak Storm Surge in East Haven, Connecticut:
What if it occurred after high tide instead of low tide?



This map illustrates the damages to homes along the East Haven shoreline during Sandy based on interviews conducted by Stephanie Cherry in conjunction with data from town records.

Conclusion

Since Connecticut's coastline is intensely urbanized and therefore, increasingly vulnerable to coastal disasters as we have seen first hand from hurricanes Irene and Sandy, it is time for societal perceptions of the coast to change in a way that incorporates scientific research being done in the area. More importantly, research results should influence policy and future decisions made about the coastline.

The research conducted in East Haven not only helps with disaster management and early warning protocols, but it clearly shows the risks of developing at the coastline. In the near future, managed retreat from the coastline in highly vulnerable areas should to be explored, and further development in these regions should be strongly discouraged.

Through the work done with the Werth Center, it is our hope to educate people, particularly present and potential community members, about the implications of these storms and how we can learn from them to be well equipped in the face of future coastal disturbances.

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