

Coastal Vulnerability Index (CVI) Assessment Suffolk County, New York

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Introduction

Coastal zones are dynamic regions that can be particularly vulnerable to local and regional characteristics, as well as small scale and global threats. The communities established within coastal zones, which define coastal zone social characteristics, are equally susceptible to these threats. To successfully mitigate threats to the coastal zone and associated communities, it is imperative that policy makers have a clear understanding of which areas will be most affected. CVIs analyze stressors affecting the coastal zone, zone sensitivity to stressors, and zonal adaptive capacity. The coastal vulnerability index (CVI) generated by this analysis identifies areas within Suffolk County, New York that are most vulnerable to coastal threats. Indices were generated depicting an equal weighting of all index parameters, weighting that prioritized physical parameters, and weighting that prioritized social parameters.

The CVI is a valuable resource for government officials, coastal zone managers, and policy makers within the study area as it allows stakeholders to identify which areas and communities are most at risk and facilitates threat mitigation and preventative planning. The CVI is also a resource for other GIS professionals as it provides an example of a countywide vulnerability assessment.

Suffolk County was chosen as the study area as it has an expansive coastline, low elevation, and high population.



Figure 1. Study Area: Suffolk County, New York State. The study area encompasses the county boundary defined by the 2010 U.S. Census.

Methods

- Physical CVIs can be combined with social indices to include socioeconomic parameters providing a more inclusive view of the coastal zone and coastal communities (Thatcher et. al., 2013).
- Parameters were selected to provide a generalized view of vulnerability based on known coastal sensitivity, elevation, and proximity of social and economic resources to the coastal zone.
- Physical parameter attribute values were ranked on a 1 – 4 scale of increasing risk. Rank values were based on ranks proposed by (Gorokhovich et. al., 2013).
- Social parameter manipulations were based on methods used by (Thatcher et. al., 2013). Social rankings were assigned based on numerical scaling of data.

Manipulated datasets as needed:
project, clip, mosaic, mask, etc.

Reclassified data based on
desired vulnerability rank

Calculated a new raster to
produce an index

Figure 2. Workflow for index creation.

Raster Name	Equation Identifier	Description
Reclassified_DEM	a	Elevation
Reclassified_ESIP	b	Environmental Sensitivity
Reclassified_Landuse	c	Land use and cover
Reclassified_Parcels	d	Property Category
Reclassified_POP	e	Population

Table 1. Raster identification and use in index

Coastal Vulnerability Index	Equation
Equally Weighted	$a+b+c+d+e$
Physically Weighted	$(0.3^*a) + (0.2^*b) + (0.4^*c) + (0.05^*d) + (0.05^*e)$
Socially Weighted	$(0.05^*a) + (0.05^*b) + (0.1^*c) + (0.3^*d) + (0.5^*e)$

Table 2. Coastal vulnerability index equations

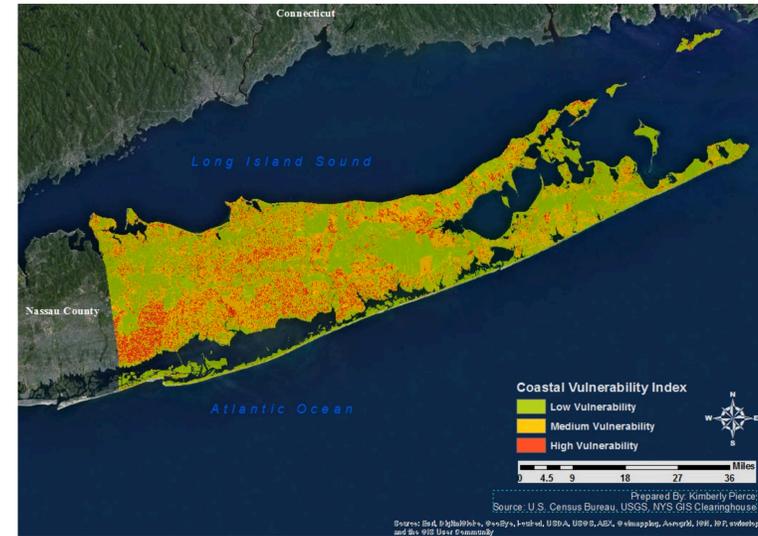


Figure 3. Suffolk County Coastal Vulnerability Index. This figure shows the threat distribution throughout Suffolk County when all parameters are equally weighted. This indexing method is useful in determining generalized vulnerability within the study area.

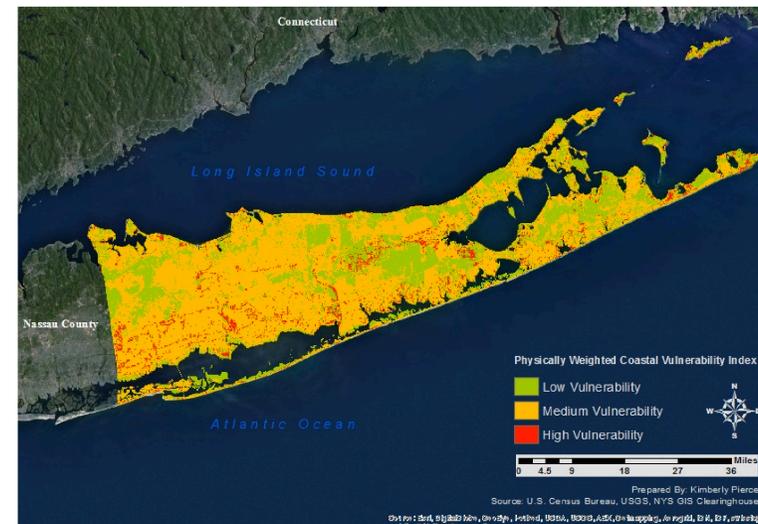


Figure 4. Suffolk County Physically Weighted Coastal Vulnerability Index. This figure shows the threat distribution throughout Suffolk County when physical parameters are given priority. This indexing method is useful in determining which physical characteristics make an area most vulnerable.

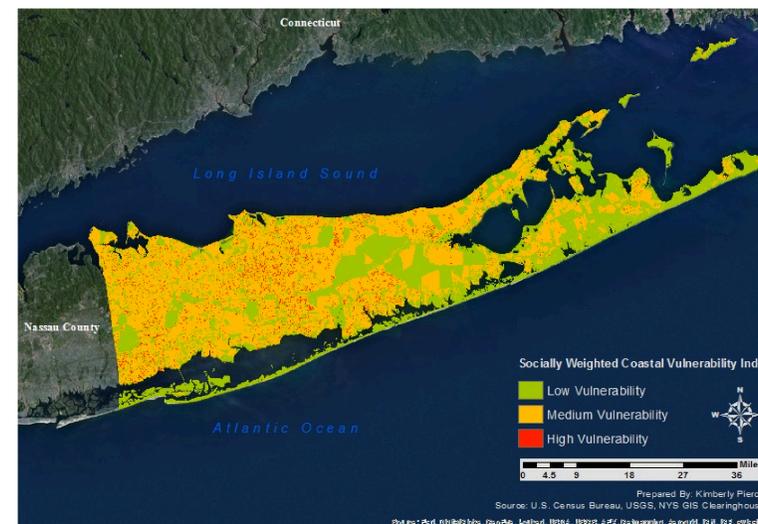


Figure 5. Suffolk County Socially Weighted Coastal Vulnerability Index. This figure shows the threat distribution throughout Suffolk County when social parameters are given priority. This indexing method is useful in determining which communities are most vulnerable.

Results Summary

- Suffolk County's south shore and western areas are the most vulnerable areas in each analysis. These regions experience the highest coastal vulnerability when all index parameters have the same weight.
- Equally weighting all parameters provides the best outlook for Suffolk County. This weighting system, though it exhibits the highest polarization of vulnerability ranks, has the largest expanse of low vulnerability areas out of the three analyses.
- When physical parameters are given priority weighting, the majority of the County receives an index ranking of "Medium Vulnerability". This is likely due to the overall low elevation within Suffolk County. The highest elevation within Suffolk County is only 401 feet (122 m) above sea level (Suffolk County Government, 2013).
- When social parameters are given priority weighting, the western portion of the County receives a higher vulnerability ranking than the eastern end of the County. This is due to higher population densities within the western expanse of Suffolk County.

Conclusions

- CVI analysis is highly customizable and has a wide range of use for coastal zone planning and threat mitigation. Methodology should be matched to selected parameters.
- The methodology used in this analysis produced results consistent with anticipated outcomes and reflect known patterns of coastal damage from previous coastal storm events.
- Further analysis of the coastal vulnerability of Suffolk County, NY is needed to ensure a comprehensive understanding of the county's coastal zone.

Recommendations

- To ensure that the vulnerability of the county's coastal zone is adequately understood future studies should incorporate additional physical, socioeconomic and demographic parameters.
- Up-to-date datasets, which include recent changes due to coastal storms, need to be created and made available to stakeholders.
- It is necessary to consider availability of data for the selected analysis area. Lack of data may necessitate expansion of the study area to ensure accuracy given dataset resolution.

References

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- Santos et. al., M. (2013). GIS-based approach to the assessment of coastal vulnerability to storms. Case study in the Bay of Cadiz (Andalusia, Spain). *Proceedings 12th International Coastal Symposium. Special Issue No. 65*, pp. 826-831. Plymouth, England: Journal of Coastal Research.
- Suffolk County Government. (2013). *Our Community*. Retrieved November 24, 2013, from Suffolk County Government, Long Island, NY: <http://www.suffolkcountyny.gov/Community.aspx>
- Thatcher et. al., C. (2013). Economic Vulnerability to Sea-Level Rise along the Northern U.S. Gulf Coast. *Journal of Coastal Research*, *SI (63)*, 234-243.
- U.S. Census Bureau. (2013, June 27). *State & County QuickFacts: Suffolk County, NY*. Retrieved November 24, 2013, from U.S. Department of Commerce: <http://quickfacts.census.gov/qfd/states/36/36103.html>