

Coastal Vulnerability Assessment: Methodology for Connecticut Sea Level Rise

A prioritization tool for decision makers that explains the region's sensitivity to sea level rise

Why defining the coastal vulnerability is important?

- The implementation of hazard mitigation and climate change adaptation can be improved with a clear understanding of the underlying factors causing the vulnerability of the region to climate stressors. Identifying and assessing highly vulnerable areas, as well as the contributing factors to vulnerability, is necessary groundwork in developing a strategy for addressing coastal risks.
- The coastal vulnerability assessment includes a GIS-based coastal vulnerability index model. Using this model we are examining the relative influence of selected indicators to identify a range of more to less sensitive locations.
- The assessment is aimed to identify the socio-economic and biophysical parameters that are affecting Connecticut's coastline to sea level rise. The assessment points to critical factors and their interactions and how these factors contribute to coastal vulnerability.
- The vulnerability assessment is an informational source for planners, designers, engineers, and decision makers to inform adaptation.

Coastal vulnerability index model

- The coastal vulnerability index (CVI) model is developed to assess vulnerability and resiliency of Connecticut coastal towns. A GIS-based modeling approach uses a 1-acre grid to identify locations in the state facing a range of risks and provide relative comparisons.
- The CVI model demonstrates the resiliency and sensitivity of the coastal grid to selected climate stressors. The grids are ranked against each other to develop a comparative sea-level rise vulnerability across the coast.
- The CVI supplements the coastal vulnerability assessment to provide a broader picture of the underlying factors affecting coastal communities in terms of sea level rise vulnerability and flood risk potential. The CVI spatial data set is informational for planners. The assessment requires detailed analysis for site-specific analysis.

Vulnerability Assessment Flow

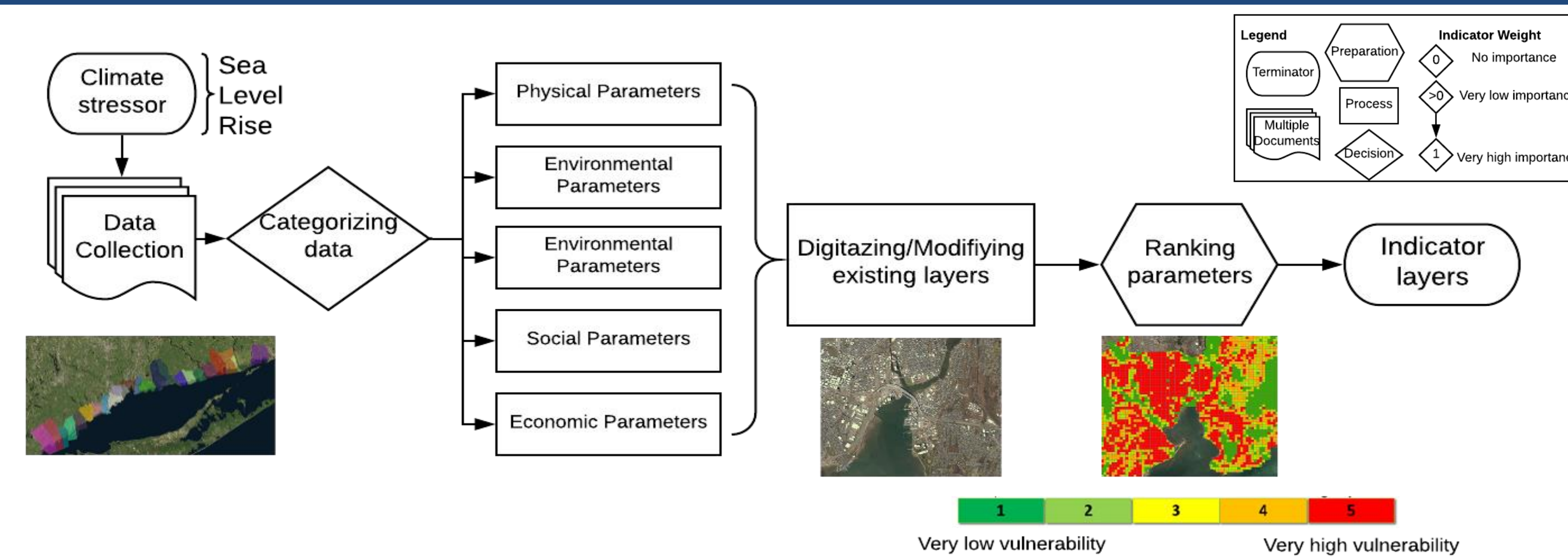


Figure 1: Indicator Layer Generation

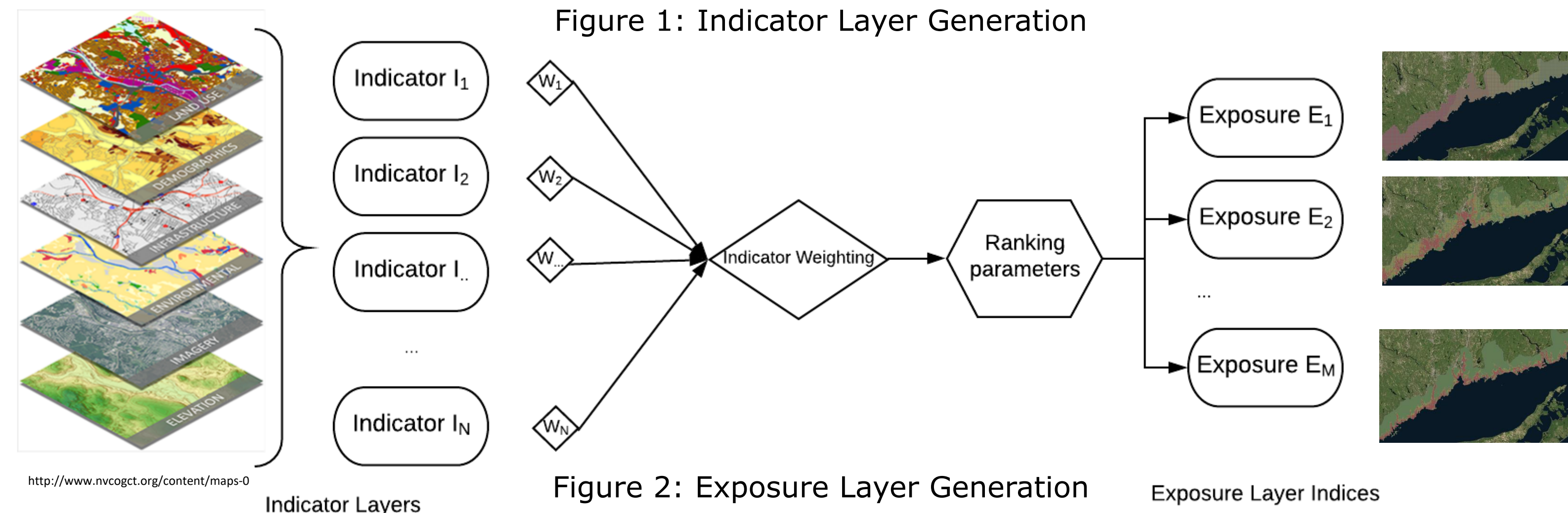


Figure 2: Exposure Layer Generation

Indicator and Exposure Layers

The raw datasets are combined and ranked to generate the indicator layers. The exposure layers are the weighted combination outputs of the indicator layers.

The results depend on the intensity relevance, completeness of the set of indicators, data availability, classification scores and issues of uncertainty.

The indicator layers are:

Sea level rise	Airport	Geology
Wave height and power	Foreshore slope	Engineering frontage
Wind speed and direction	Soil subsidence	Aquifer type
Storm surge	Soil drainage	Marsh habitat
Tidal range	Coastal elevation	Critical habitat
Rainfall	Shoreline change rate	Coastal Forests
Hydraulic connectivity	Erosion susceptibility	Roads
Railways and stations	Geomorphology	Critical Infrastructure
Elderly and young persons	Population Density	Buildings
Median household income	Land use	Health insurance
	Disabled persons	Employed population

The exposure layers are:

Coastal Exposure	Sea Level Rise
Wave Exposure	Salt water intrusion impact with sea level rise
Wind Exposure	Erosion impact with sea level rise
Surge Potential	Natural Habitat impact on sea level rise

Limitations

- CVI is a one-dimensional estimate of the vulnerability of the coast to future sea level rise. The representation of grids along the coastline does not incorporate a number of dynamic processes affecting the land-ocean interactions. Therefore, it can inaccurately represent the maximum landward extent of coastal flooding. These are common concerns where GIS is utilized given that it is a linearly representative tool.
- Vulnerability assessment results should be combined with dynamic modeling approaches and detailed analysis in order to define the probability of risks associated with predicted flooding under selected sea level rise scenarios.
- Changes in the prioritization criteria will change the weighting system for output exposure layers.
- Indicator layers should be updated periodically with new and more comprehensive information as it becomes available.

Expected Results

- The coastal vulnerability assessment is aimed to build public awareness, efficiently allocate limited resources, identify impacts to the community assets, and support prioritization strategies.
- The model presents detailed information via histograms and probability distributions using curve-fitting methods for both input indicator layers and output exposure layers. The statistical significance of the different grids and the local distribution of the indicator and exposure layer distribution will be presented via descriptive statistics and statistical significance tests.
- Collaborative interdisciplinary expertise will be used to improve the vulnerability assessment. The analysis and results of the exposure layers can be customized to the needs of specific users preferences.
- The datasets, technical report, peer-reviewed article and the data viewer will be available online.