Using WebGIS tools To Support Resiliency Planning in New Jersey

Richard Lathrop
Coastal Community Resiliency Progression

Assess
Evaluate Your Municipal Risks and Vulnerabilities

Plan
Utilize Getting to Resilience to Plan for the Future

Implement
Take Actions to Increase Municipal Preparedness
Information and tools to support place-based decision-making

Assess Risk and Vulnerability
Using the NJFloodMapper to Understand your Current and Future Risk

In order to answer the evaluation questions on current and future risk and help visualize different inundation routes, FEMA flood maps (regional Flood Height and Flood Elevation Maps) and the Super Storm Sandy. The site also creates on-the-ground photo visualizations at iconic Jersey Shore locations.

Additional data layers to explore economic vulnerability, the potential of future floods and percentage of confidence.

The NJFloodMapper uses a Google Maps-based tool to help communities understand flood risk and manage it. You can print your maps or share them using the "share" button.

Explore the website at: NJFloodMapper.org

To access go to NJFloodMapper.org
Use the slider bar above to see how various levels of sea level rise will impact this area.

Levels represent inundation at high tide. Areas that are hydrologically connected are shown in shades of blue (darker blue = greater depth).

Low-lying areas, displayed in green, are hydrologically "unconnected" areas that may flood. They are determined solely by how well the elevation data captures the area’s hydraulics. A more detailed analysis of these areas is required to determine the susceptibility to flooding.

Use the slider to view a simulation of sea level rise at this location.
FEMA Preliminary Flood Insurance Rate Maps (PFIRMS)

This map shows high-risk (1% chance in a given year) and moderate-risk (0.2% chance in a given year) flood zones designated by the Federal Emergency Management Agency (FEMA).

Some parts of the flood zone may experience frequent flooding while other areas are only affected by severe storms. Areas outside of mapped zones may also be at risk since land use changes could have occurred after the maps were created, changing the flooding potential.

To designate the zones and determine insurance premiums, FEMA conducts flood insurance studies. Incorporated in the studies are statistical data for river flow and storm tides, hydrologic and hydraulic analyses, rainfall and topographic surveys, and storm frequency and intensity models.

This data is showing the Preliminary Flood Insurance Rate Maps (PFIRMS). These maps have not been finalized and are not available for all counties.

Zooming in to a smaller area will display the Base Flood Elevation (BFE) in feet for a particular zone.
NJFloodMapper: Sandy Surge extent

Data shown on this map were derived from storm surge inundation data created by the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model. SLOSH is used to calculate storm surge heights and the extents of inundation for hurricane evacuation studies. Hurricane storm surge heights are influenced by many factors, including hurricane intensity (categorized by the Saffir-Simpson hurricane wind scale, ranging from 1 to 5), size (radius of the eye), and ocean conditions.
Maintaining Green Infrastructure: Coastal Salt Marshes

Tidal Marsh Retreat

Marsh builds up vertically through accretion

Marsh migrates horizontally

(1.1 m*) Upper limit of High Marsh

(0.53 m*) Upper limit of Low Marsh

(0.0 m) MTL (1995)

(-1.0 m*) Lower limit of SAV

*Note: In the model, "elevations" are determined by mean tide level (MTL) and spring tide range of each cell.

High Salt Marsh
Low Salt Marsh
Intertidal flats/Subtidal pools
SAV Beds

Tidal Marsh Retreat

Summative Evaluation

How useful are these tools? How can they be improved?

The level of usefulness for the following website enhancement ideas.

- The addition of a storm surge layer
- Maps illustrating special flood hazard areas...
- Inland flooding maps
- FEMA Sandy Payout Map
- FEMA Sandy Damage Map
- Healthcare/Long Term Care Facilities
- Nursing Homes
- Mobile Home Communities
- Emergency Operations center
- Storm/Severe weather shelter
- Pet Shelters
- Municipal garages (machinery for waste disposal...)
- Emergency Bus Pick-up locations

Very Useful vs. Useful
This online self assessment process is a tool to assist communities to reduce vulnerability and increase preparedness by linking planning, mitigation, and adaptation. Through this assessment you will find out how your preparedness can be worth valuable points through FEMA's Community Rating System and Sustainable Jersey.

**Plan for your community's future in the face of climate change**
Visualization & Information capture through map/graphics

Flood Exposure Profile
Help jump-start your community discussions about hazard impacts with maps of your area that show people, places, and assets exposed to coastal flooding. The map data and the discussions spurred from these maps are valuable and applicable to a variety of community planning processes—from comprehensive land-use to hazards mitigation and conservation planning.

NJ FloodMapper
The NJ FloodMapper is a user-friendly visualization tool for local communities who need to make decisions concerning flooding hazards and sea level rise. This website should be used to promote enhanced preparedness and land use planning decisions with considerations for possible future conditions.

Preparedness Assessment
Getting To Resilience
This online self-assessment process is a tool to assist communities to reduce vulnerability and increase preparedness. Through this assessment you will find out how your preparedness can be worth valuable points through FEMA's Community Rating System and Sustainable Jersey. Also the outputs provided at the completion of the questionnaire can strengthen local/county all-hazards and emergency operations plans.
NJAdapt Coastal Flood Exposure Profiler
Municipal Profiles

“map-packs”

Coastal County Snapshots

Coastal County Snapshots turn complex data into easy-to-understand stories, complete with charts and graphs. Users select a coastal county of interest and the website does the rest, providing information that can help communities become more resilient to coastal hazards.

Local officials can use the snapshots as a planning tool to assess their county's resilience to flooding and understand the benefits provided by natural resources. The handouts generated by the snapshots can be a helpful educational tool when working with governing bodies and citizen groups.

Features

- Assesses a county's exposure and resilience to flooding
- Analyzes a county's dependence on the ocean or Great Lakes for a healthy economy
- Examines the benefits a county receives from its wetlands
- Compares
Climate Stories on njadapt.org

http://nebula.wsimg.com/371031cafb163d05b7f380c712c8ed54?AccessKeyId=ACB457C88AE224CE0A00&disposition=0&alloworigin=1
Assessing New Jersey’s Exposure and Vulnerability to Coastal Flooding

An integrated statewide assessment was needed to address questions such as are most exposed to coastal hazards now or might be in the future under sea level rise.

1st step: Model hazards

→ 2nd step: Map resulting exposure

→ 3rd step: Assess Sensitivity

$$CFE = a + b + c$$

Where $CFE =$

(a) Flood Prone Areas
(b) Storm Surge (SLOSH)
(c) Nuisance Coastal Flooding
NJ Coastal Flooding Exposure (NJCFE)

• The logic was such that areas exposed to flooding on a more frequent basis were given a higher ranking. Thus the ranking incorporates the probability or likelihood of the area being flooded.
  – For example, even though a Category 3 storm surge has higher flooding elevations, the likelihood of occurrence is lower than a Category 1 storm surge and therefore the Category 3 flood area was given a lower exposure ranking.

• Extreme exposure areas are those that are exposed to relatively frequent flooding. In addition, the Extreme exposure areas also include those areas subject to the most powerful wave impacts.
NJ Coastal Flooding Exposure: projecting into the future

<table>
<thead>
<tr>
<th>Flooding Hazard</th>
<th>Present</th>
<th>2050</th>
<th>2100</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMA Special Flood Hazard Areas (SFHA)</td>
<td>Extreme: V zone High: 1% A zone Moderate: 0.2% (X) zone</td>
<td>Extreme: V zone High: 1% A zone + 2’ Moderate: 0.2% (X) zone + 2’</td>
<td>Extreme: V zone High: 1% A zone + 5’ Moderate: 0.2% (X) zone + 5’</td>
</tr>
<tr>
<td>SLOSH Storm Surge</td>
<td>Extreme: N/A High: SLOSH Cat 1 Moderate: SLOSH Cat 3</td>
<td>Extreme: N/A High: SLOSH Cat 1 + 2’ Moderate: SLOSH Cat 3 + 2’</td>
<td>Extreme: N/A High: SLOSH Cat 1 + 5’ Moderate: SLOSH Cat 3 + 5’</td>
</tr>
<tr>
<td>NOAA/NWS Shallow coastal flooding (SCF)</td>
<td>Extreme: SCF High: N/A Moderate: N/A</td>
<td>Extreme: SCF + 1’ High: SCF + 2’ Moderate: SCF + 2.5’</td>
<td>Extreme: SCF + 2.5’ High: SCF + 5’ Moderate: SCF + 7’</td>
</tr>
</tbody>
</table>
NJ Coastal Flooding Exposure - Present

New Jersey Coastal Flooding Exposure

<table>
<thead>
<tr>
<th>Category</th>
<th>2000</th>
<th>2050</th>
<th>% change</th>
<th>2100</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (ac)</td>
<td>Area (ac)</td>
<td>% change</td>
<td>Area (ac)</td>
<td>% Change</td>
</tr>
<tr>
<td>Moderate</td>
<td>197,433</td>
<td>183,329</td>
<td>-7.1</td>
<td>165,833</td>
<td>-16.0</td>
</tr>
<tr>
<td>High</td>
<td>148,060</td>
<td>165,272</td>
<td>+11.6</td>
<td>185,489</td>
<td>+25.3</td>
</tr>
<tr>
<td>Extreme</td>
<td>234,224</td>
<td>271,784</td>
<td>+16.6</td>
<td>310,608</td>
<td>+32.6</td>
</tr>
<tr>
<td>Total</td>
<td>579,717</td>
<td>620,385</td>
<td>+7.0</td>
<td>661,930</td>
<td>+14.2</td>
</tr>
</tbody>
</table>
NJ Coastal Flooding Exposure

### Exposure Levels
- Water
- Moderate
- High
- Extreme

Data sourced from FEMA, NOAA, and NWS
Map created by Eden Basinaventura under the direction of Dr. Richard G. Lathrop, Jr.

### Infrastructure

<table>
<thead>
<tr>
<th></th>
<th>Moderate (M)</th>
<th>High (H)</th>
<th>Extreme (E)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Miles of road affected</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Roads (miles)</td>
<td>382</td>
<td>270</td>
<td>45</td>
<td>697</td>
</tr>
<tr>
<td>Evacuation Routes (miles)</td>
<td>297</td>
<td>249</td>
<td>58</td>
<td>604</td>
</tr>
<tr>
<td><strong># of facilities affected</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>10</td>
<td>17</td>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td>Coastal Energy Facilities</td>
<td>12</td>
<td>15</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>Schools</td>
<td>180</td>
<td>119</td>
<td>2</td>
<td>301</td>
</tr>
<tr>
<td>Fire Stations</td>
<td>99</td>
<td>90</td>
<td>6</td>
<td>195</td>
</tr>
<tr>
<td>Law Enforcement</td>
<td>46</td>
<td>44</td>
<td>3</td>
<td>93</td>
</tr>
<tr>
<td>Long Term Care / Assisted Living Facilities</td>
<td>20</td>
<td>11</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>Hospitals</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>13</td>
</tr>
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</table>

### Socially vulnerable populations

|                        |              |          |             |       |
| Total Population (in persons using 2010 Census) | 428,769      | 333,923  | 150,959     | 913,651 |
| Zero Vehicle Households (persons 2010 Census)   | 26,642       | 29,549   | 6,007       | 62,198 |
| Limited English Proficiency (persons 2010 Census) | 69,262      | 50,513   | 10,192      | 129,967 |
| Over 65 years in age (persons 2010 Census)      | 52,121       | 39,420   | 22,606      | 114,147 |

### Known Contaminated Sites (NJDEP)

|                        |              |          |             |       |
| Active Sites with Confirmed Contamination | 197 | 269 | 24 | 490 |
| Total (including pending sites) | 1261 | 1501 | 193 | 2955 |

### Property parcels affected

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<thead>
<tr>
<th></th>
<th># affected</th>
<th>$ Land value (in 2013 $)</th>
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</thead>
<tbody>
<tr>
<td>Commercial Properties</td>
<td>20,154</td>
<td>$26,555,293,664</td>
</tr>
<tr>
<td>Industrial Properties</td>
<td>3,934</td>
<td>$8,960,318,156</td>
</tr>
<tr>
<td>Residential Properties (includes Apartments)</td>
<td>335,873</td>
<td>$129,057,872,992</td>
</tr>
<tr>
<td>Total Combined</td>
<td>359,961</td>
<td>$164,573,484,812</td>
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</table>

### Area Exposure

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