RESILIENT TRANSPORTATION AND COMMUNITIES - THEMES

• Intergovernmental Coordination
  • Challenges
  • Partnerships among fragmentation
  • Opportunities
  • Incentives
  • Resources
  • Shared goals/ value added
  • Communications
COASTAL FLOOD MAPPING TOOLS FOR PROTECTING TRANSPORTATION INFRASTRUCTURE IN SOUTH FLORIDA

KEREN PRIZE BOLTER, PHD
CLIMATE, POLICY AND GEOSPATIAL ANALYST

South Florida Regional Planning Council
S. FL LEADS THE US IN RENTER COST BURDEN

Most Cost-Burdened Counties in the U.S.

Top 5 by Renter Cost-Burden

- Miami-Dade, FL: 63%
- Broward, FL: 62%
- Atlantic, NJ: 50%
- L.A., CA: 59%
- Cook, IL: 56%

49% of all Miami-Dade County households are cost-burdened (spending more than 30% of income on housing costs)
COASTAL RESILIENCY PROJECTS

• SFRPC Work
  • Monroe CHHA
  • Train the Trainers
  • Infrastructure Resilience
  • Adaptation Action Areas
  • SLR Impacts on Public Health
  • DataCommon

• PARTNERSHIPS!
  • Compact Initiatives
  • County/municipal Work
  • Community organizations
  • Academic

DATA DRIVEN FLORIDA
SOUTHEAST FLORIDA DataCommon
THEMES

Overview of initiatives/partnerships

The Infrastructure Protection Resources Project

Trainers and Tools: Coastal Flood Hazard Resiliency

DATA to communicate risk & inform policy
Sandy Cove condo on Lower Matecumbe in Islamorada

POST IRMA

https://storms.ngs.noaa.gov/storms/irma/index.html
WAS A 3 STORY CONDO

WHAT ABOUT THAT HOUSE?
WHY?
Year
Built?
1973
1989
How many more housing units are not up to code?

Andrew 1992

Code ch. 2002

Florida 9,094,999 Housing Units

Broward County, FL 814,454 Housing Units

Miami-Dade County, FL 988,833 Housing Units

Monroe County, FL 52,913 Housing Units

Sources: US Census 2011-2015 ACS
ANOTHER BIG FACTOR:

COASTAL HIGH HAZARD AREA

sfregionalcouncil.org/chha/  arcg.is/1bOq0e

1 ft SLR 2040
NEW SUPERBASIN FOR SLOSH CATEGORY 1 HURRICANE (NHC, 2017)

73,217 Grid Cells in view; Wave Height 1.0 - 11.8 ft NAVD88
WHY HURRICANE IRMA WASN’T FAR WORSE, AND HOW CLOSE IT CAME TO CATASTROPHE

1. Cuba Landfall lowered from hurricane category 5 to 3
2. Southwest FL and the Keys’ far less developed zones caught the brunt
3. Shift West prevented strengthening

no-win situation for forecasters?

COMMUNICATING RISK

- Different for each vulnerability – both are “new normal”
- Sea Level Rise (chronic) vs Storm Surge (acute)
NEED TO ADDRESS CURRENT & FUTURE IMPACTS

- Tidal Flooding
- Saltwater Intrusion
- Failing Drainage
- Malfunctioning Canals
- Beach Erosion
- Habitat loss
- Reduced Groundwater Storage
FUTURE PROJECTIONS

Source: Southeast Florida Regional Climate Compact

Relative Sea Level Rise near Key West, FL
(inches relative to mean sea level)

- USACE Intermediate / NOAA Intermediate Low
- 81” in 2100
- 61” in 2050
- 31” in 2100
- 34” in 2060
- 26” in 2070
- 14” in 2080
- 12” in 2090
IMPROVING THE PLANNING PROCESS TO PROTECT INFRASTRUCTURE EMERGING FROM COASTAL FLOOD HAZARDS

http://sfregionalcouncil.org/portfolio-item/infrastructure-resilience
WHAT DON’T THE MODELS TELL US?

Identifying and Ground-Truthing Tidal Flooding Hotspots in 6 Pilot Communities
Hollywood
King Tide 2016
September vs October
Infrastructure Resilience Survey

Investigators: Keren Bolter, PhD, Christina Miskis, and Vince Edwards. Thank you for your interest in taking this brief survey. It may take about 5-10 minutes. Your participation in this survey is completely voluntary and your responses will remain confidential. We appreciate your input!

The purpose of the survey is to measure infrastructure resilience in communities within South Florida. Please help us identify the extent of existing and emerging tidal flooding conditions and any planned mitigation in your community. A potential benefit that you may receive from participation is knowing that you made a personal contribution to a regional scorecard which supports infrastructure resilience. The results will give local governments insight on innovative practices used by your City/County. We will use these practices to compare with modeled results.

include a “redevelopment component which outlines the principles which shall be used to eliminate inappropriate and unsafe development in the coastal areas when opportunities arise.” and now includes “sea-level rise” as one of the causes of flood risk that must be addressed in the “redevelopment principles, strategies, and engineering solutions” to reduce flood risk.

Encourages local governments to take direct action in mitigating flood damage and requires local coastal management plans to take flood risk into consideration.
North Bay Village Coastal High Hazard Area
Created using South Florida SLOSH (hSF1) basin
Category 1 Hurricane surge height at mean tide (2016)
compared to 2015 LIDAR elevation and adding the
Southeast Florida Climate Compact high projections

CHHA increases from 2015 sea level
- Dry
- Current CHHA
- CHHA in 2030 - 5.6 in
- CHHA in 2060 - 21.7 in
PROJECT BACKGROUND

Train the Trainers

Trainers and Tools:
Building Coastal Flood Hazard Resiliency in Florida’s Regional Planning Council Communities

http://sfregionalcouncil.org/trainers/
PROJECT GOALS AND OBJECTIVES

- For Florida’s coastal communities to be better prepared for the potential impacts of sea level rise.

- Introduce community planners, local officials and other interested parties to resiliency tools which help project potential impacts and identify vulnerable community assets.
<table>
<thead>
<tr>
<th>CANVIS</th>
<th>SEA LEVEL RISE (SLR) VIEWER</th>
<th>COASTAL FLOOD EXPOSURE MAPPER</th>
<th>SKETCH PLANNING TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOAA</td>
<td>NOAA</td>
<td>NOAA</td>
<td>UF GEOPLAN CENTER</td>
</tr>
</tbody>
</table>

**Intended to elicit higher levels of stakeholder engagement,** CanVis utilizes no data and modifies imagery to show potential inundation scenarios.

**Can facilitate stakeholder engagement, scoping and inventory, and assessment and analysis; online interactive platform in map format to display SLR scenarios.**

**Helps start community discussions about hazard impacts with maps of your area that show people, places, and natural resources exposed to coastal flooding.**

www.coast.noaa.gov/digitalcoast/tools/flood-exposure

**Offers a variety of sea-level rise analyses related to transportation; intended to promote stakeholder engagement, scoping/inventory, assessment/analysis, and planning.**

sls.geoplan.ufl.edu
MAPPING SLR: DATA INPUTS & METHODS

Local trend data and water levels

Future scenarios of SLR. How fast will SLR and when? Use local data for projections

High resolution LIDAR
Sea Level Rise Viewer

NOAA Office for Coastal Management

Overview

Confidence

Marsh Impacts/Migration

Flood Frequency

Social Vulnerability

Related Resources

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stories</td>
<td>25</td>
</tr>
<tr>
<td>Data</td>
<td>7</td>
</tr>
<tr>
<td>Publications</td>
<td>5</td>
</tr>
<tr>
<td>Tools</td>
<td>4</td>
</tr>
<tr>
<td>Videos and Webinars</td>
<td>3</td>
</tr>
<tr>
<td>Self-Guided Resources</td>
<td>2</td>
</tr>
<tr>
<td>Classroom, Instructor-Led</td>
<td>2</td>
</tr>
<tr>
<td>Contributing Partners</td>
<td>1</td>
</tr>
</tbody>
</table>

- National Oceanic and Atmospheric Administration Office for Coastal Management
COASTAL FLOOD EXPOSURE MAPPER

Developed by NOAA Office for Coastal Management

The information in this product is based on the Roadmap for Adapting to Coastal Risk

www.coast.noaa.gov/digitalcoast/tools/flood-exposure
Select the Flood Hazards Map or One of the Community Exposure Maps

Select a section below to view maps showing flood hazards or different aspects of community exposure to those flood hazards.

Flood Hazard Layers
- Coastal Flood Hazard Composite
- Shallow Coastal Flooding
- FEMA Flood Zones
- Storm Surge Scenarios
- Sea Level Rise Scenarios

Societal Exposure Maps
- Population Density
- Percent in Poverty
- Percent Elderly (>65)
- Employees
- Projected Population Growth

Infrastructure Exposure
- Development
- Critical Facilities
- Development Patterns

Ecosystem Exposure
- Natural Areas and Open Space
- Potential Pollution Sources
- Natural Protection
COASTAL FLOOD EXPOSURE MAPPER

Hazard Zones:

- FEMA Zones (% annual chance): A zone (1%) & 0.2%
- Shallow Coastal Flooding (NWS flood thresholds)
- Sea Level Rise (Above MHHW): 1 ft & 2 ft & 3 ft
- Storm Surge (by Hurricane Category): 1 & 2 & 3

Number of Hazards: 9

NOAA, 2017
SKETCH PLANNING TOOL
Developed by the University of Florida GeoPlan Center
sls.geoplan.ufl.edu
Use the map to the right or click on one of the links below to view interactive maps of Sea Level Scenarios.

The maps show potential inundation and affected transportation infrastructure due to sea level change. Inundation maps were developed using sea level change projections from the U.S. Army Corp of Engineers and tide gauge and sea level trend data from NOAA (see About Page for more information on methods).

User Guide for Map Viewer (PDF)

FDOT DISTRICT 1 MAP VIEWER
Major cities: Bradenton, Fort Myers, Lakeland, Naples, Sarasota
Counties: Charlotte, Collier, De Soto, Glades, Hardee, Hendry, Highlands, Lee, Manatee, Okeechobee, Polk, and Sarasota

FDOT DISTRICT 2 EAST MAP VIEWER
Major cities: Jacksonville, Palatka, St. Augustine
Counties: Baker, Clay, Duval, Nassau, Putnam, St. Johns

FDOT DISTRICT 2 WEST MAP VIEWER
Major cities: Gainesville and Lake City
West Counties: Alachua, Bradford, Columbia, Dixie, Gilchrist, Hamilton, Lafayette, Levy, Madison, Suwannee, Taylor, Union

FDOT DISTRICT 3 MAP VIEWER
Major cities: Tallahassee, Panama City, Pensacola
Counties: Bay, Jefferson, Okaloosa, Walton, Wakulla, and Franklin

FDOT DISTRICT 4 EAST MAP VIEWER
Major cities: Orlando, Kissimmee, Sanford, Leesburg
Counties: Brevard, Orange, Osceola, and Lake

FDOT DISTRICT 4 WEST MAP VIEWER
Major cities: Tampa, St. Petersburg, Clearwater
Counties: Hillsborough, Pinellas, Pasco, and Hernando

FDOT DISTRICT 5 MAP VIEWER
Major cities: Jacksonville, Tallahassee, Gainesville
Counties: Alachua, Baker, Bradford, Clay, Duval, Escambia, Flagler, and Gadsden

FDOT DISTRICT 6 EAST MAP VIEWER
Major cities: Tallahassee, Panama City, Pensacola
Counties: Bay, Escambia, Franklin, Santa Rosa, and Walton

FDOT DISTRICT 6 WEST MAP VIEWER
Major cities: Miami, Fort Lauderdale, West Palm Beach
Counties: Broward, Miami-Dade, and Palm Beach
Tampa Bay, 2080, High Projection

View transportation facilities potentially exposed to inundation various SLR scenarios.

Available transportation layers by scenario
COMMUNICATING ABOUT SEA LEVEL RISE

- Health Impacts
- Financial Impacts
- Habitat Loss
- Environmental Justice
- Sustainability for future generations
- Catastrophic impacts of creeping changes

THANK YOU!
KEREN BOLTER
KBOLTER@SFRPC.COM
GULF STREAM...BIG UNKNOWN

Regional-Local Relative Sea Level Rise
Thermal Expansion and Oceanographic Effects in Intermediate (1 m) Scenario

meters in 2100

0 0.1 0.2 0.3 0.4 0.5 >0.6
WHO IS GREATER MIAMI AND THE BEACHES? • GREATER MIAMI AND THE BEACHES RESILIENCE STRATEGY
PRIORITIZED SHOCKS AND STRESSES

Shocks
- Hurricanes/Tornado (22%)
- Economic Crash (11%)
- Infrastructure Failure - Cyber Security/Communications (9%)
- Infrastructure Failure - Transport/Access (9%)

Stresses
- Inadequate Transportation System (15.5%)
- Sea Level Rise (15.5%)
- Aging Infrastructure (15.5%)
- Lack of Affordable Housing (14%)
- Access to Quality Education (7%)

STRENGTHS AND WEAKNESSES

Strengths
- Ensures continuity of critical services (21%)
- Meets basic needs (14.5%)
- Fosters long-term and integrated planning (10%)

Weaknesses
- Provides reliable communications and mobility (31%)
- Empowers a broad range of stakeholders (12.5%)
- Supports livelihoods and employment (8%)
- Ensures social stability, security and justice (8%)
- Provides and enhances natural and manmade assets (8%)
EFFECTIVE ADAPTATION STRATEGIES

1) land-use regulations & building codes
2) limits on insurance subsidies
3) redesign and retrofitting of structures
4) updates for drainage, flood control, and water supply infrastructure
5) increased coastal protection

• CO-BENEFITS!
IMPACTS OF SLR ON PUBLIC HEALTH

- Mapped zones most prone to environmental sea level rise impacts
- Described associated public health risks and
- Identified the region's socially, economically and medically vulnerable communities most susceptible to sea-level rise health effects.
<table>
<thead>
<tr>
<th>Location</th>
<th>Population</th>
<th>Percent of Income Spent on Transportation - Median Income Families</th>
<th>Percent of Income Spent on Transportation - Low Income Individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida</td>
<td>19,645,772</td>
<td>Florida 26.21%</td>
<td>Florida 54.7%</td>
</tr>
<tr>
<td>Broward County, FL</td>
<td>1,843,152</td>
<td>Broward County, FL 23.49%</td>
<td>Broward County, FL 47.97%</td>
</tr>
<tr>
<td>Miami-Dade County, FL</td>
<td>2,639,042</td>
<td>Miami-Dade County, FL 22.21%</td>
<td>Miami-Dade County, FL 44.12%</td>
</tr>
<tr>
<td>Monroe County, FL</td>
<td>75,901</td>
<td>Monroe County, FL 24.68%</td>
<td>Monroe County, FL 61.06%</td>
</tr>
</tbody>
</table>

www.locationaffordability.info/About_Data.aspx
What's the need? Data driven decision-making - CPOK

What is being done? Overview of initiatives

The Infrastructure Protection Resources Project

Trainers and Tools: Coastal Flood Hazard Resiliency

Next Steps Moving Forward
NOAA’s Coastal Flood Exposure Mapper is particularly useful for Floodplain Management Planning (Activity 510), Element 512.a

- credit for mapping areas of future flooding due to sea level rise
- credit for notifying property buyers of sea level rise
- credit for regulatory map based on future conditions
- Class 4 rating or higher requires minimized increases in future flooding
- Class 1 rating requires flood elevations that reflect future conditions

Source: W. Thomas Hawkins, UF College of Law, 2016
MODELLING SURGE
MOMS VS STORM SPECIFIC

Hurricanes
Florida has been hit more times by hurricanes than any other state. When we look to the future, the effects of climate change may be uncertain but our history with hurricanes is not.
Between 1851 and 2005, there were 35 major hurricanes that struck Florida. Because the state is near the tropics and westerly winds blow off the African coast along the equator, the state will always be especially vulnerable. Florida must retrofit through building codes and infrastructure upgrades, reinforce low-lying areas of high investment and, in some cases, retreat from areas that cannot be safely or cost-efficiently defended.
King Tide 2016
Sep - Nov
Under the Flood Insurance Reform Act of 2012, you could save more than $90,000 over 10 years if you build 3 feet above base flood elevation*

<table>
<thead>
<tr>
<th>Premium at 4 Feet Below Base Flood Elevation</th>
<th>Premium at Base Flood Elevation</th>
<th>Premium at 3 Feet Above Base Flood Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9,500/year</td>
<td>$1,410/year</td>
<td>$427/year</td>
</tr>
<tr>
<td>$95,000/10 years</td>
<td>$14,100/10 years</td>
<td>$4,270/10 years</td>
</tr>
</tbody>
</table>

* $250,000 building coverage only (does not include contents), AE (high to moderate risk) zone, single-family, one-story structure without a basement at: 4 feet below base flood elevation (BFE); at BFE; and at 3 feet above BFE. (Rating per FEMA flood insurance manual, October 1, 2012). The illustration above is based on a standard National Flood Insurance Program (NFIP) deductible.