



BUILDING COASTAL FLOOD HAZARD RESILIENCY WITH A REGIONAL TOOLS BUFFET

NOVEMBER 14, 2016

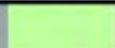



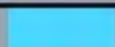

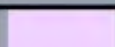

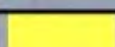

KEREN PRIZE BOLTER, PHD
SOUTH FLORIDA REGIONAL COUNCIL

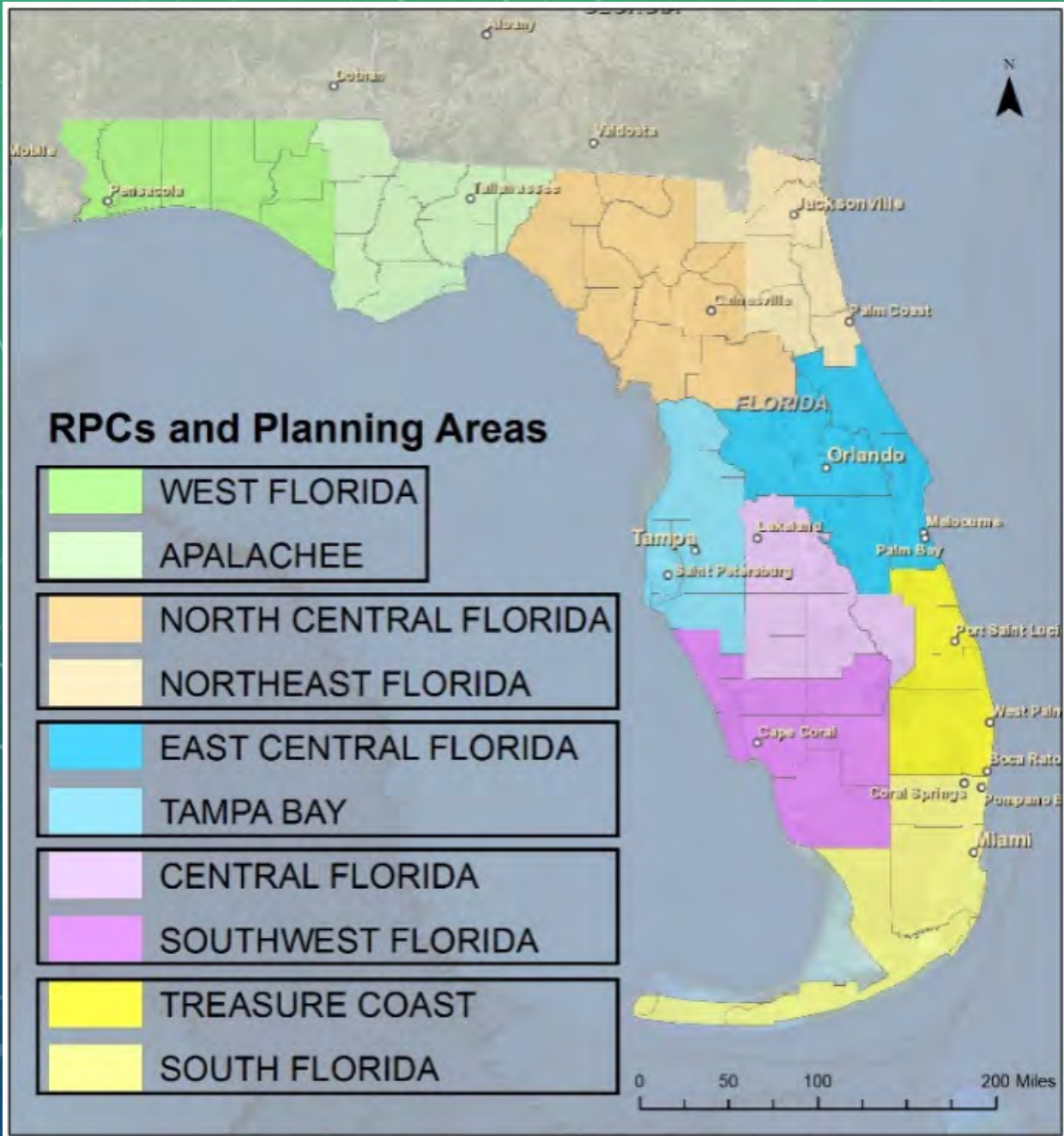
PROJECT BACKGROUND

TRAINERS AND TOOLS:

BUILDING COASTAL FLOOD HAZARD
RESILIENCY IN FLORIDA'S REGIONAL
PLANNING COUNCIL COMMUNITIES

RPCs and Planning Areas

	WEST FLORIDA
	APALACHEE
	NORTH CENTRAL FLORIDA
	NORTHEAST FLORIDA
	EAST CENTRAL FLORIDA
	TAMPA BAY
	CENTRAL FLORIDA
	SOUTHWEST FLORIDA
	TREASURE COAST
	SOUTH FLORIDA



TRANSLATION OF SCIENCE TO
POLICY AND RISK PREPAREDNESS

PROJECT GOALS AND OBJECTIVES

Building Capacity through Technical Assistance Coupled with Outreach

- 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.





COASTAL RESILIENCY TOOLS BUFFET



TOOLS AND POLICY FOR RESILIENCY PLANNING

- **Intention of this training is to**
 - Present guidance about tools and other data resources available
 - Provide information about new requirements & emerging practices for addressing resiliency planning
 - MOVING FROM PLANNING TO IMPLEMENTATION



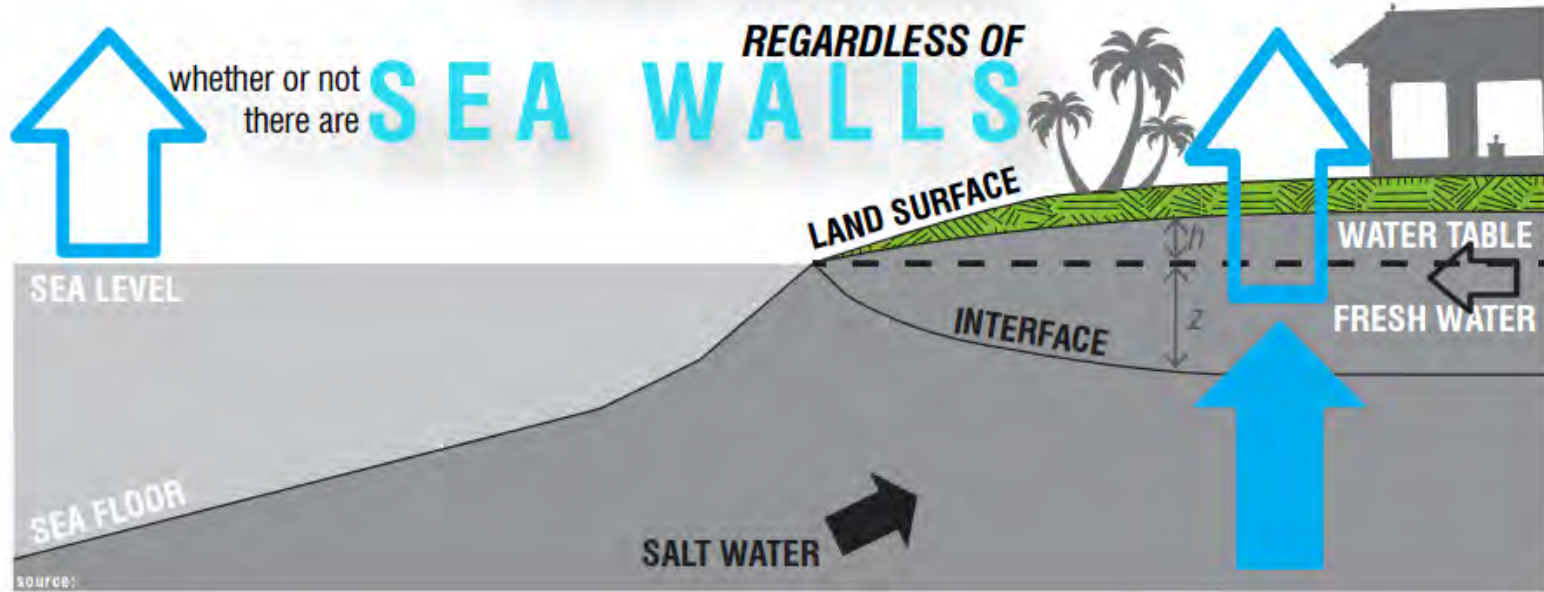


CURRENT & FUTURE IMPACTS

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

SALT WATER

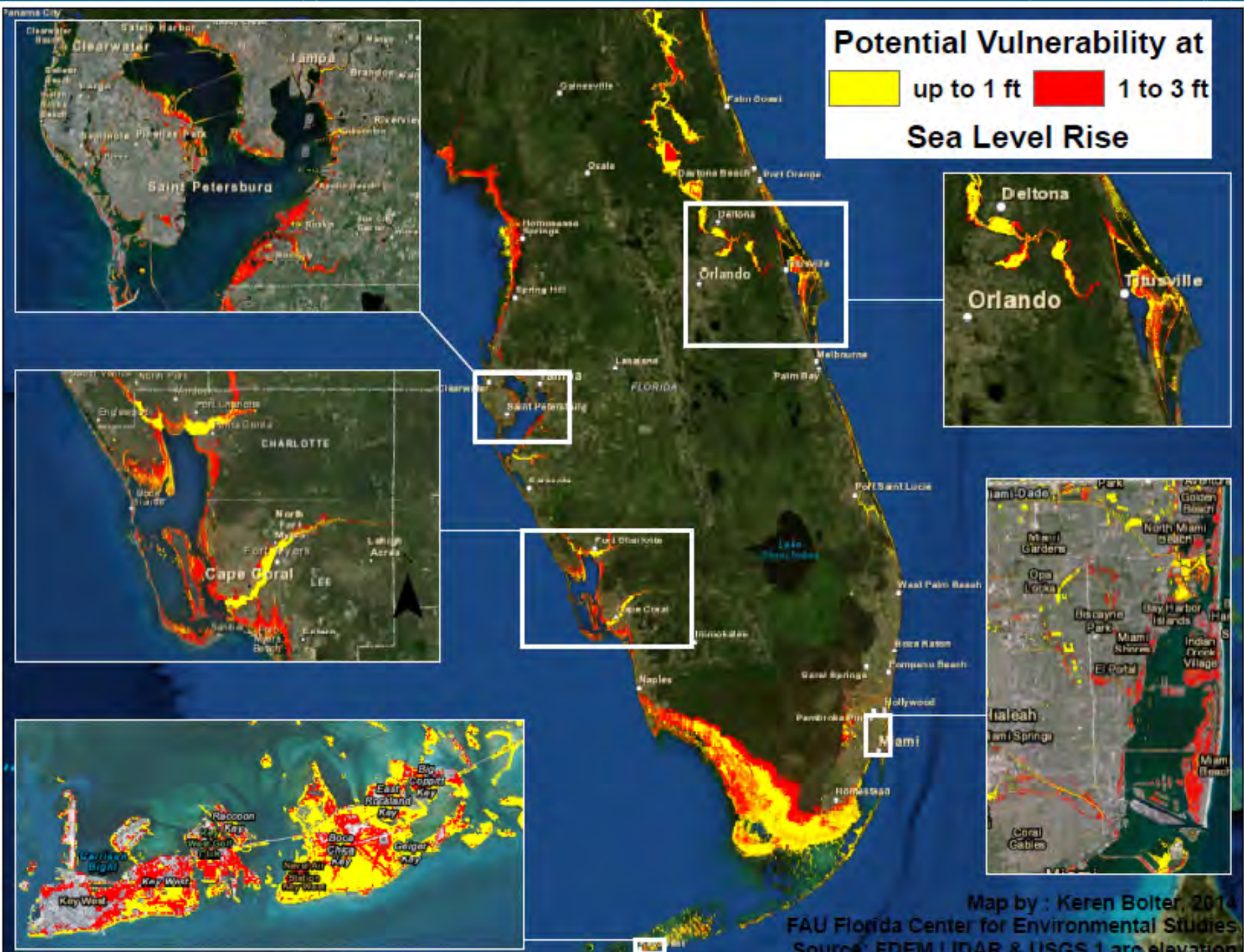
from the ocean
is moving
UPWARD, UNDERGROUND,



Potential Vulnerability at

 up to 1 ft  1 to 3 ft

Sea Level Rise



Map by : Keren Bolter, 2014
FAU Florida Center for Environmental Studies
Source: FDEM LIDAR & USGS 1 arc elevation

Types of Inundation – All inundation is not the same!

Short Term (Episodic):

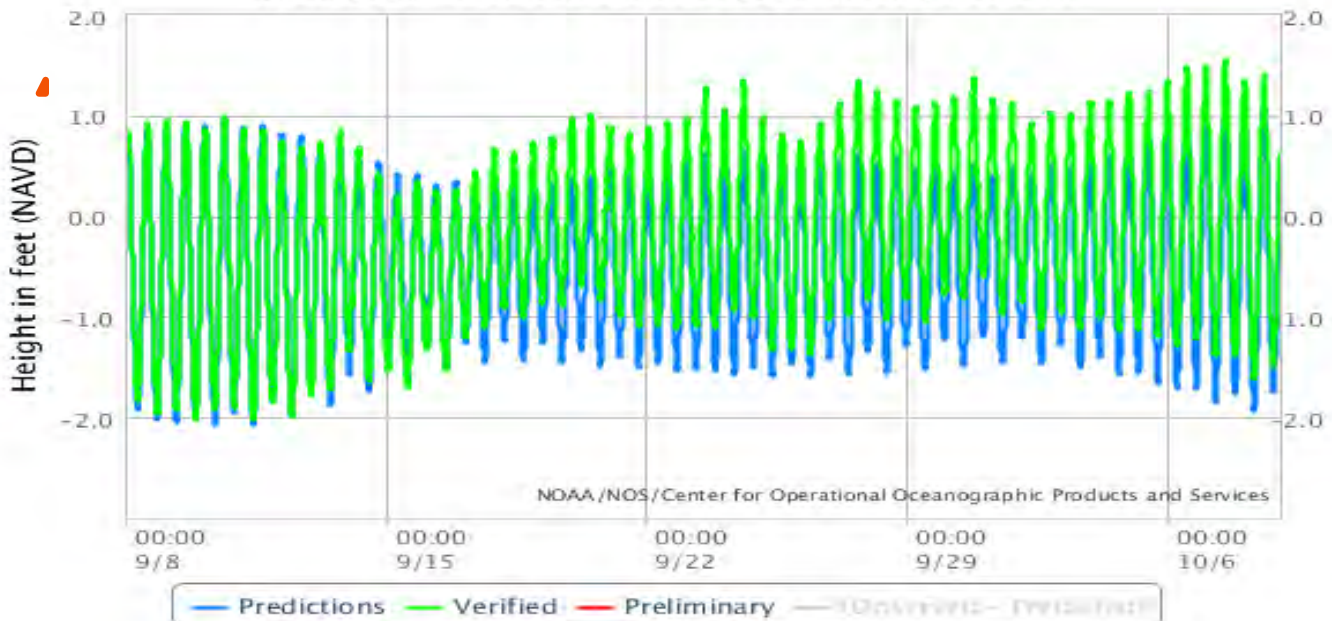
- Storm Surge
- Tsunami
- Inland Flooding
- Shallow Coastal Flooding

Long Term (Chronic):

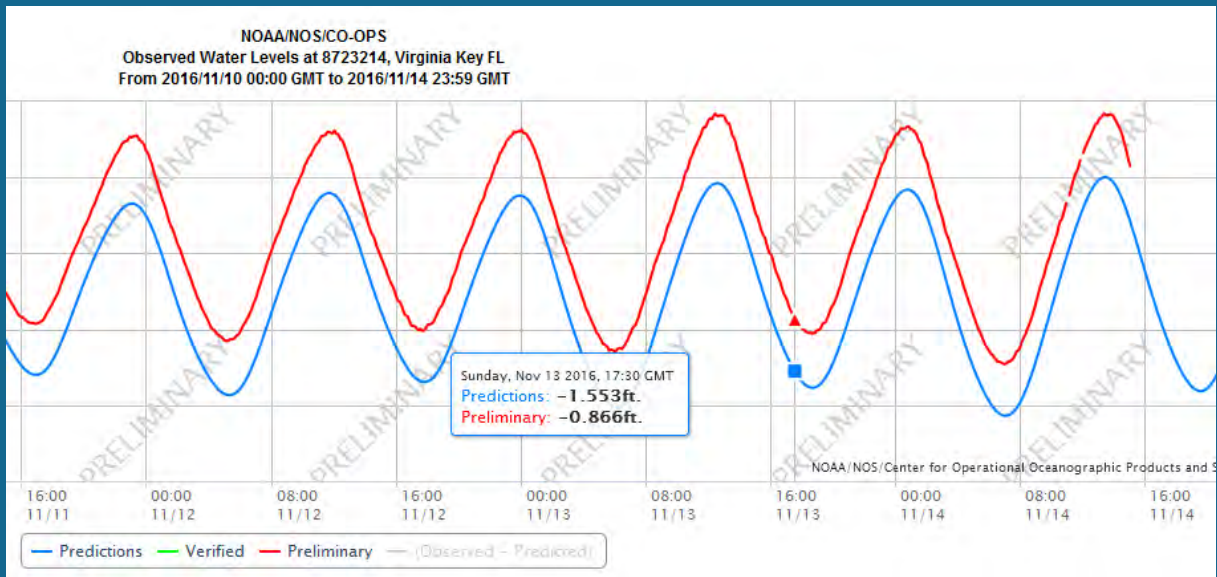
- Relative Sea Level Change



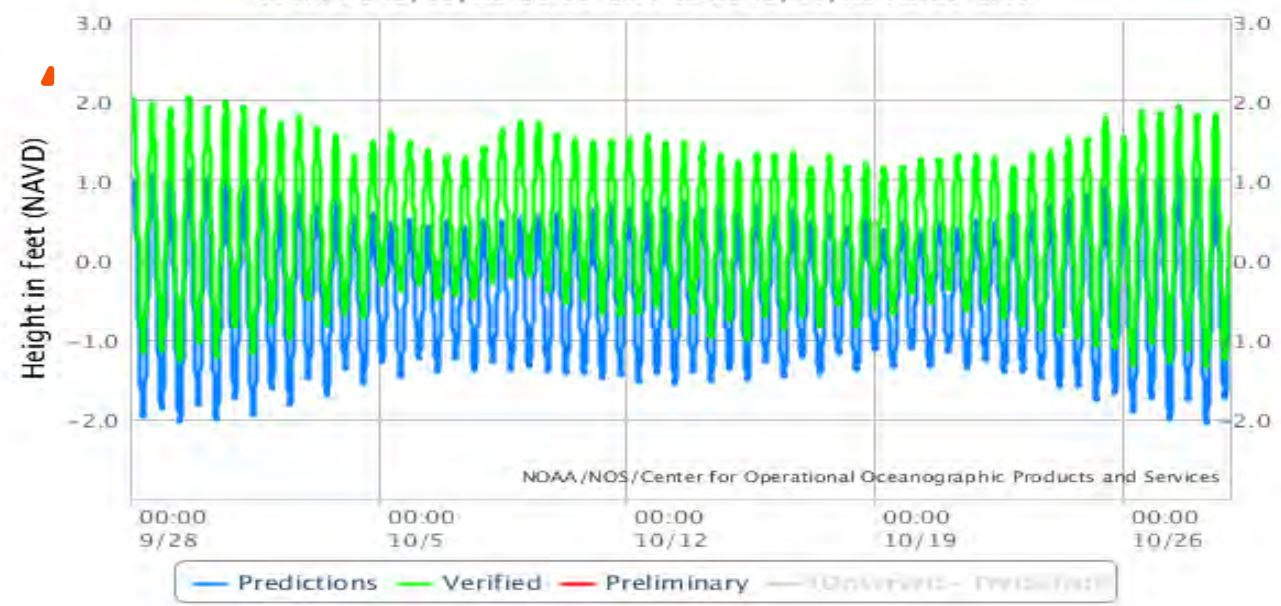
NOAA/NOS/CO-OPS
 Observed Water Levels at 8723214, Virginia Key FL
 From 2014/09/08 00:00 GMT to 2014/10/08 23:59 GMT



King Tide 2016



NOAA/NOS/CO-OPS
 Observed Water Levels at 8723214, Virginia Key FL
 From 2015/09/28 00:00 GMT to 2015/10/28 23:59 GMT





Hollywood King Tide 2016 September vs October

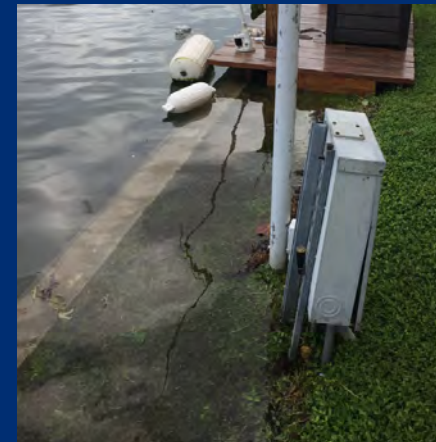
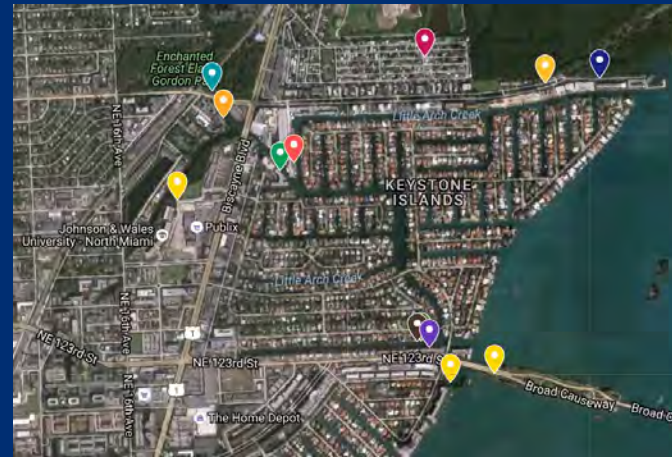




The extreme tidal flooding is to many extents predictable, compared to other flooding events

GROUND-TRUTHING IN NORTH MIAMI

Varied impacts of predicted flooding





DigitalCoast

OFFICE FOR COASTAL MANAGEMENT

/digitalcoast/tools/



C-CAP Land Cover Atlas

View and explore coastal land cover and change data

Contributing Partners

NOAA OCM

Reporting, Visualization



CMECS Crosswalk Tool

Translates existing benthic habitat data sets to the Coastal and Marine Ecological Classification Standard (CMECS)

Contributing Partners

NOAA OCM

Analysis



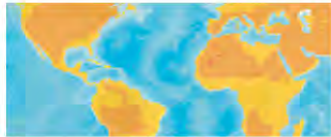
CanVis

Visualize future scenarios using your photographs and this tool's object icons

Contributing Partners

NOAA OCM, USDA National Agroforestry Center

Visualization



Climate Wizard

Use state-of-the-art climate models and statistical analysis to view, generate, and download climate change maps and tables

Contributing Partners

The Nature Conservancy

Analysis, Reporting, Visualization



Coastal Change Hazards Portal

Create a map of potential ecological, social, and economic impacts from rising seas and changing climate

Contributing Partners

USGS

Analysis, Reporting, Visualization



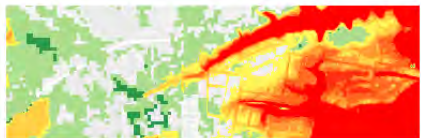
Coastal County Snapshots

Turn complex data into easy-to-understand stories, complete with charts and graphs

Contributing Partners

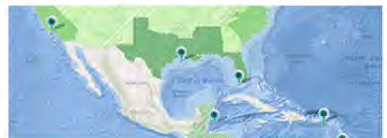
NOAA OCM

Reporting



Coastal Flood Exposure Mapper

Maps people, places, and natural resources that are potentially exposed to coastal flooding



Coastal Resilience Mapping Portal

Create a map of potential ecological, social, and economic impacts from rising seas and changing climate



Data Access Viewer

Find and download data hosted on the NOAA Office for Coastal Management website

<https://coast.noaa.gov/digitalcoast/tools/>

58 Tools

HAZARD ASSESSMENT TOOLS

CANVIS NOAA



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

SEA LEVEL RISE (SLR) VIEWER NOAA



Can facilitate stakeholder engagement, scoping and inventory, and assessment and analysis, SLR Viewer offers an online interactive platform in map format to display a variety of sea level rise scenarios.

COASTAL FLOOD EXPOSURE MAPPER NOAA



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



SKETCH PLANNING TOOL UF GEOPLAN CENTER

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

CanVis

NOAA Office for Coastal Management, USDA National Agroforestry Center



DOWNLOAD

TAKE THE TRAINING

Overview

This easy-to-use, downloadable visualization tool allows users to “see” potential changes, from coastal development (including a new building or marina) to sea level rise. Controls are similar to Photoshop, but with less of a learning curve. Users can quickly develop realistic visualizations for their stakeholders. Hundreds of coast-based icons (coastal object libraries) are provided.

Features

- Simulate potential on-the-ground impacts of various actions
- Compare outcomes of multiple scenarios
- Create a possible vision of the future

Additional Information

- + Coastal Object Libraries
- + IAN Symbol Libraries
- + Guidance Documents
- + Instructional Videos

Related Resources

Stories	10
Classroom, Instructor-Led	3
Quick Reference	2
Tools	1
Videos and Webinars	1
Publications	1
Self-Guided Resources	1
Contributing Partners	2

- [National Oceanic and Atmospheric Administration Office for Coastal Management](#)
- [USDA National Agroforestry Center](#)

coast.noaa.gov/digitalcoast/tools/canvis

Before

After



Before

After



CANVIS

Developed by NOAA Office for Coastal Management

coast.noaa.gov/digitalcoast/tools/canvis



Before

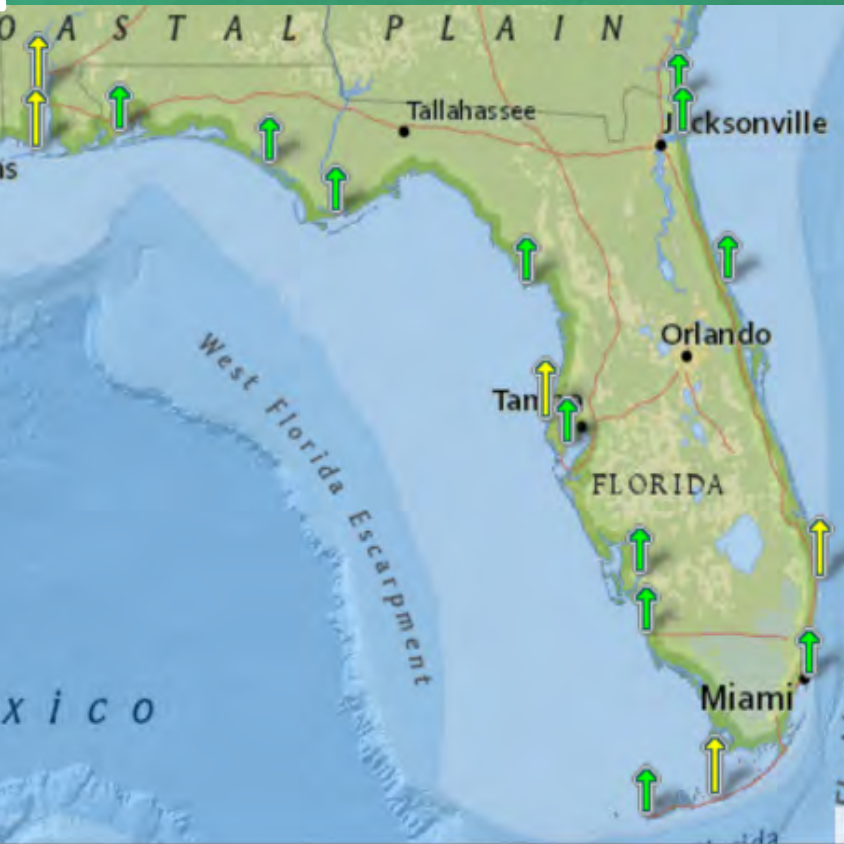
After



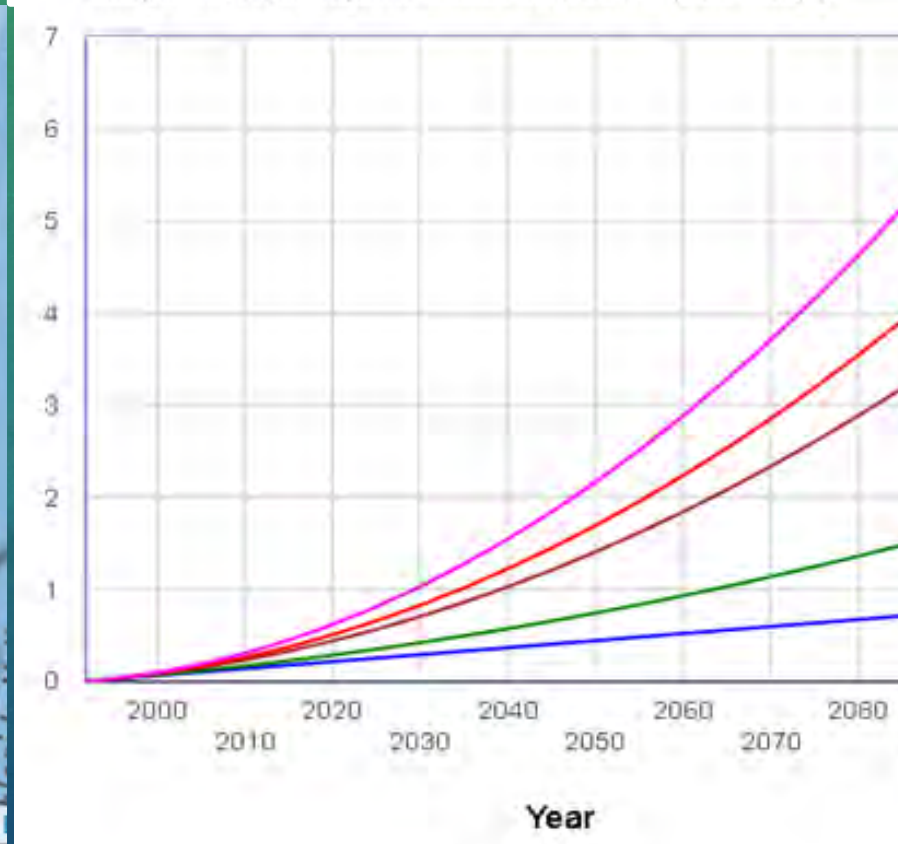
Before

After

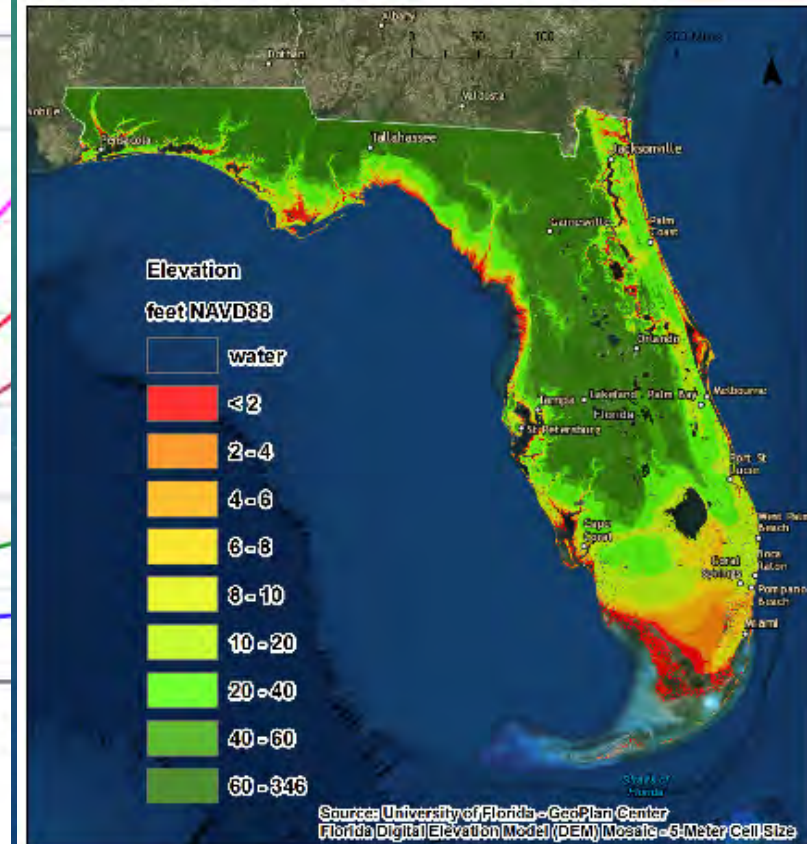
MAPPING SLR: DATA INPUTS & METHODS



Local trend data and water levels



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



High resolution digital elevation model from LIDAR

Sea Level Rise Viewer

NOAA Office for Coastal Management

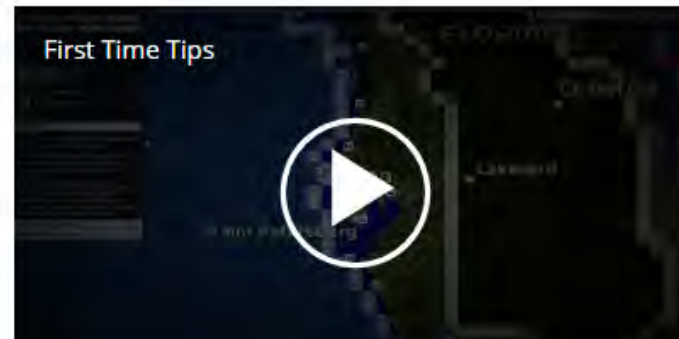
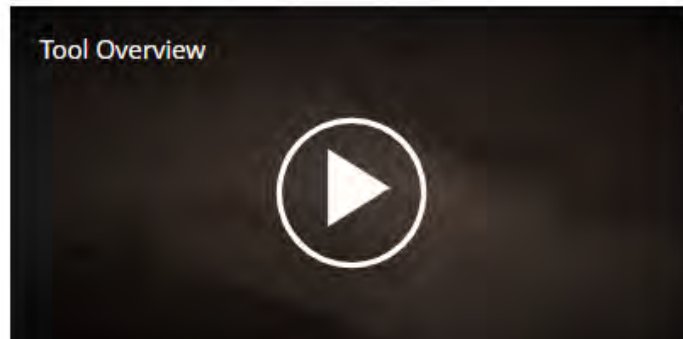
Overview

Use this web mapping tool to visualize community-level impacts from coastal flooding or sea level rise (up to 6 feet above average high tides). Photo simulations of how future flooding might impact local landmarks are also provided, as well as data related to water depth, connectivity, flood frequency, socio-economic vulnerability, wetland loss and migration, and mapping confidence.

Features

- **Visualize** potential impacts from sea level rise through maps and photos
- **Learn** about data and methods through documentation
- **Share** maps and links via email and social media
- **Download** inundation layers and digital elevation models, and access web map services for custom GIS applications

Supporting Videos



Related Resources

Stories	25
Data	7
Publications	5
Tools	4
Videos and Webinars	3
Self-Guided Resources	2
Classroom, Instructor-Led	2
Contributing Partners	1

- National Oceanic and Atmospheric Administration Office for Coastal Management





Sea Level Rise and Coastal Flooding Impacts

Sea Level Rise Confidence Marsh
Vulnerability Flood Frequency

Sea Level Rise ?

3 ft SLR

Legend

- Water Depth
- Low-lying Areas
- Area Not Mapped
- Visualization Location
- Leveed Areas ?

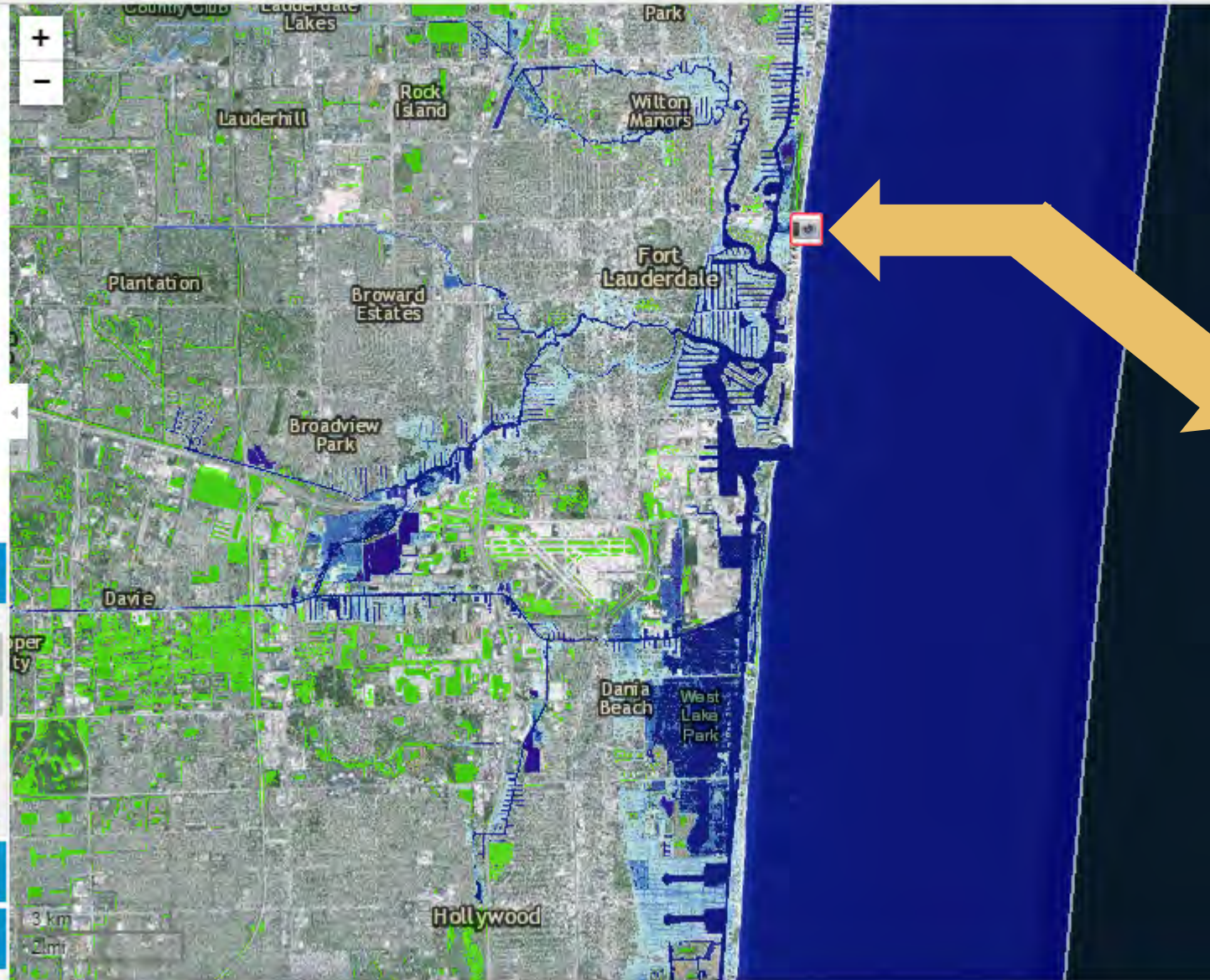
Overview

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).

Understanding The Map

Additional Information

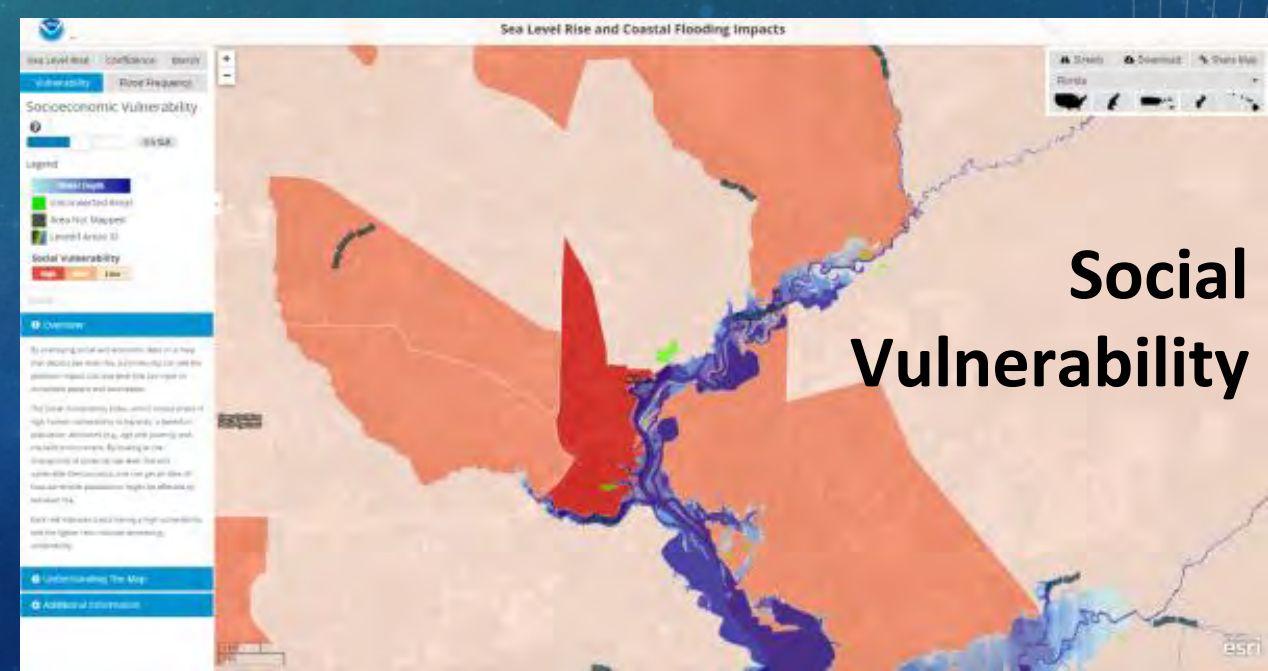
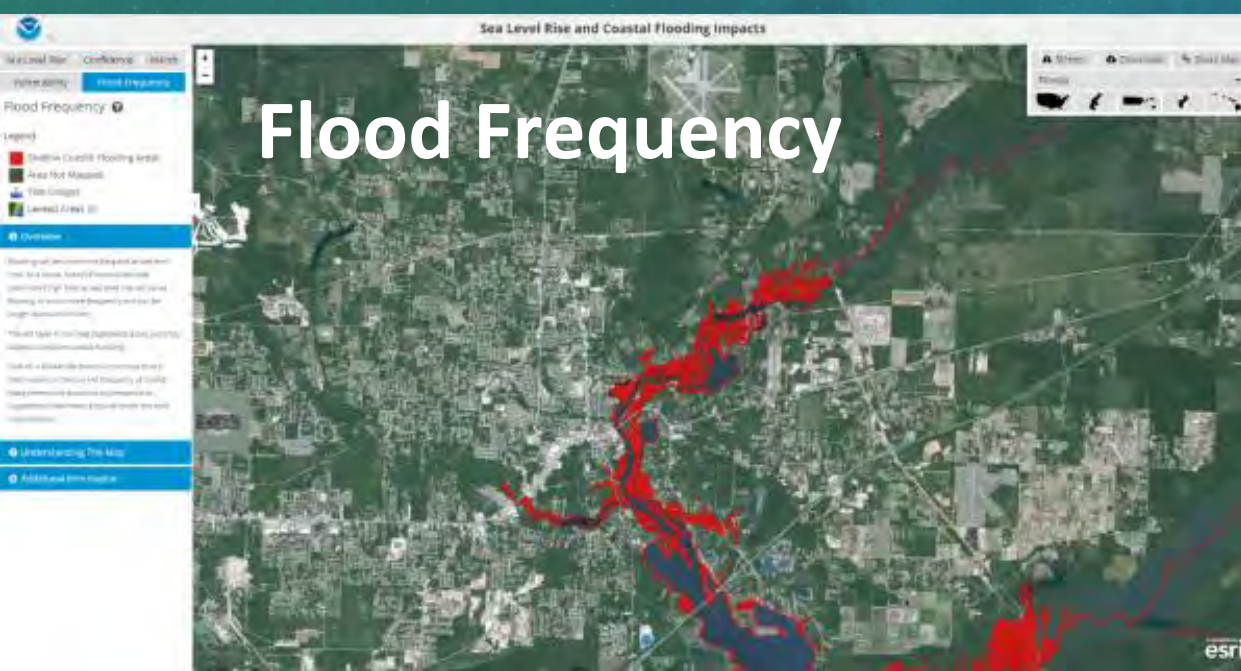
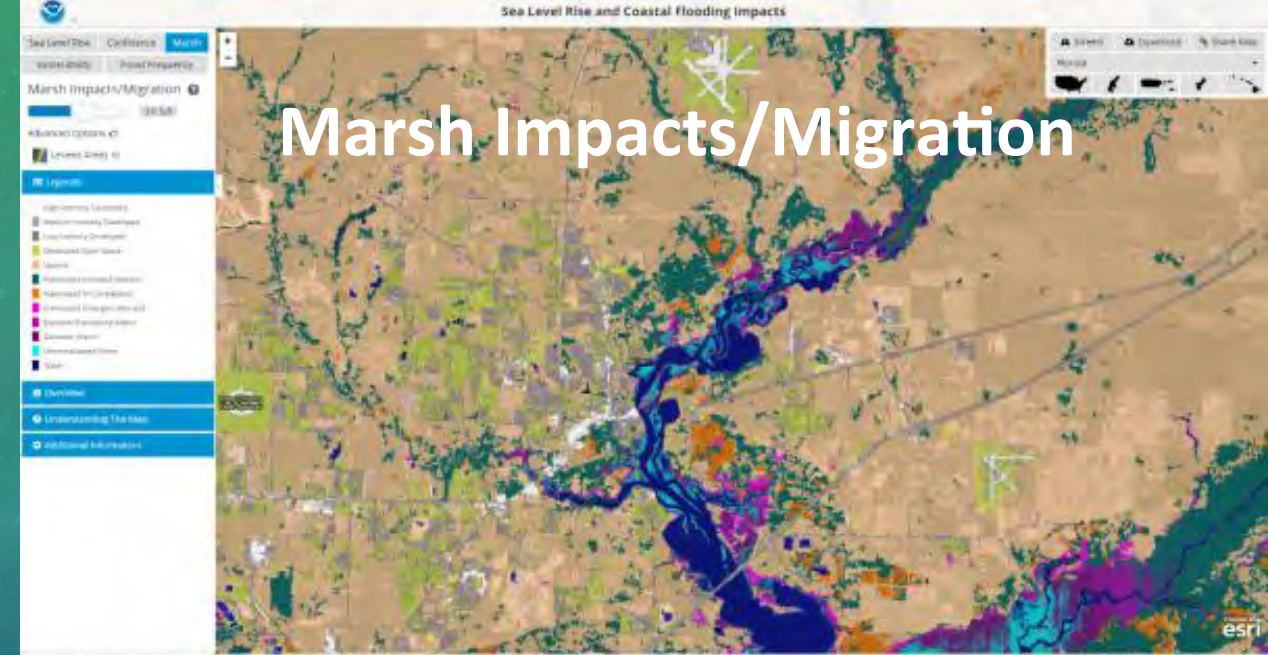
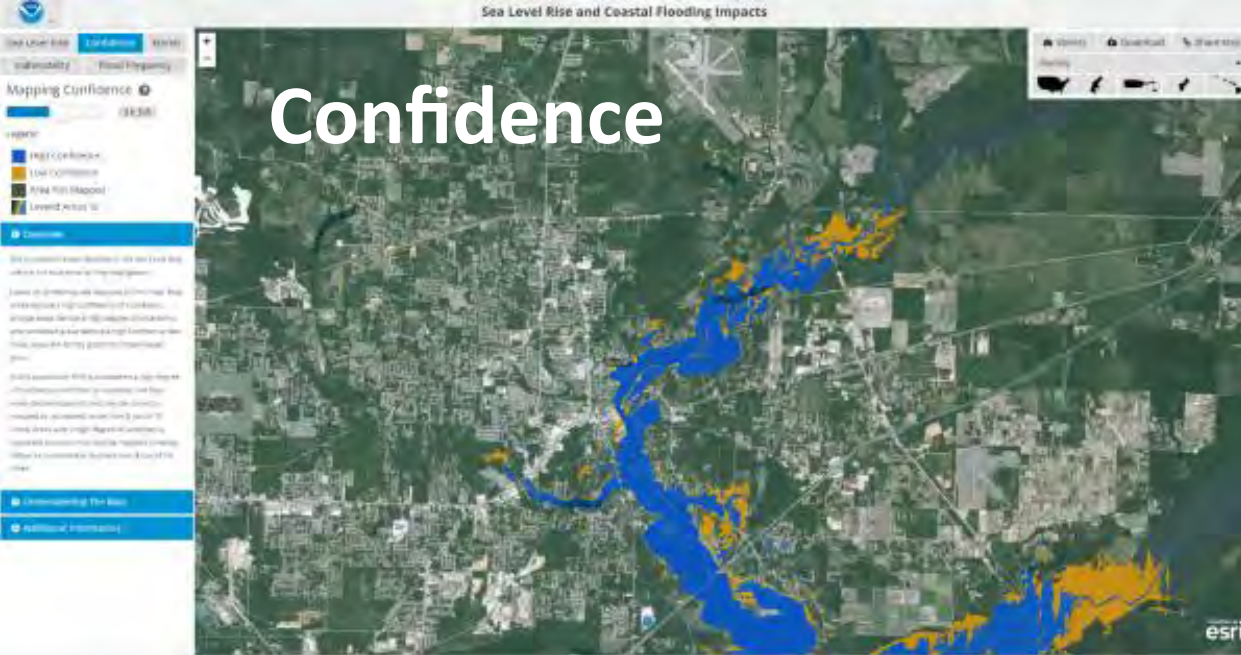


Streets Download
Zoom to: State or Territory

Hugh Taylor Birch State Park



Use the slider to view a simulation of sea level rise at this location.



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

The screenshot shows the homepage of the Coastal Flood Exposure Mapper. At the top center is the NOAA logo. Below it, the title "Coastal Flood Exposure Mapper" is displayed in a large, white, sans-serif font. Underneath the title is a short introductory paragraph: "Help start your community discussions about hazard impacts with maps of your area that show people, places, and natural resources exposed to coastal flooding." A prominent green button with the text "Start Collecting Maps" is centered below the paragraph. At the bottom of the page, there is a smaller line of text: "The information in this product is based on the Roadmap for Adapting to Coastal Risk approach to assessing coastal hazard risks and vulnerabilities." The background of the website is a high-quality photograph of ocean waves breaking on a sandy beach, with a clear blue sky above the horizon.

NOAA

Coastal Flood Exposure Mapper

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

Start Collecting Maps

The information in this product is based on the [Roadmap for Adapting to Coastal Risk](#) approach to assessing coastal hazard risks and vulnerabilities.

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

Coastal Flood Exposure Mapper

NOAA Office for Coastal Management

Overview

This online visualization tool supports communities that are assessing their coastal hazard risks and vulnerabilities. The tool creates a collection of user-defined maps that show the people, places, and natural resources exposed to coastal flooding. The maps can be saved, downloaded, or shared to communicate flood exposure and potential impacts. In addition, the tool provides guidance for using these maps to engage community members and stakeholders. *The current geography includes the East Coast and Gulf of Mexico.*

Features

- Visualize people, places, and natural resources exposed to coastal flood hazards
- Share online maps to communicate with and engage stakeholders

Additional Information

LAUNCH

Related Resources

Publications

Classroom, Instructor-Led

Tools

Videos and Webinars

Stories

Quick Reference

Mixed Delivery

Data

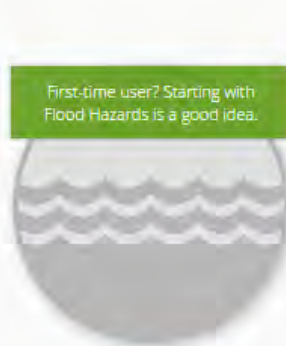
Self-Guided Resources

| [Contributing Partners](#)



Select the Flood Hazards Map or One of the Community Exposure Maps

Select a section below



First-time user? Starting with
Flood Hazards is a good idea.

Flood Hazards

Flooding events are among the most frequent, costly, and deadly hazards that can impact coastal communities. There are two types:

- Short-term (episodic) – Temporary flooding caused by extreme weather conditions, including storm surges, tsunamis, inland flooding, and shallow coastal flooding.
- Long-term (chronic) – Flooding caused by a rise in relative sea level or some other change in conditions.

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

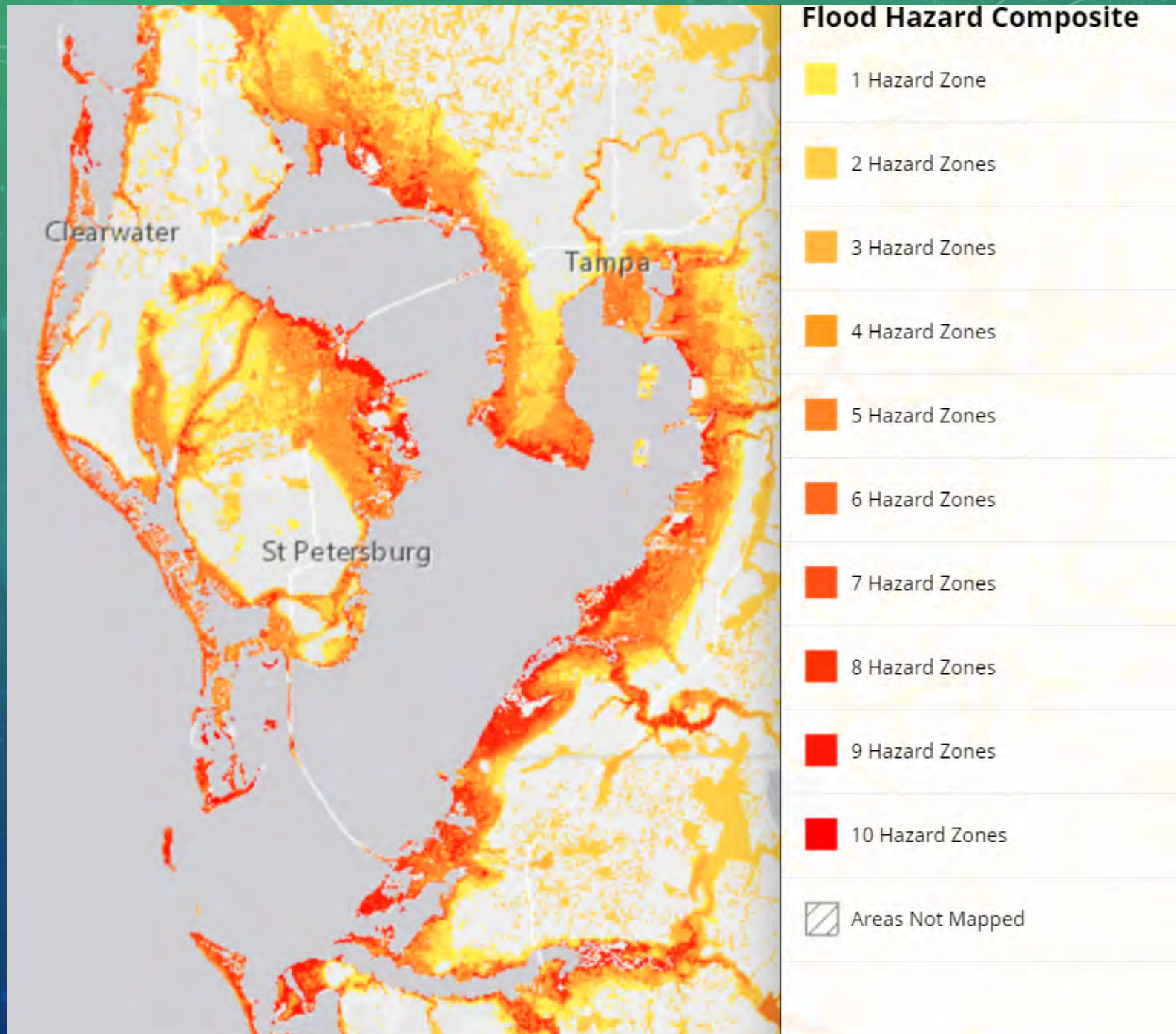
- Natural Areas and Open Space
- Potential Pollution Sources
- Natural Protection

NOAA 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



SKETCH PLANNING TOOL

Developed by the University of Florida GeoPlan Center

sls.geoplan.ufl.edu

SEA LEVEL SCENARIO SKETCH PLANNING TOOL

A planning tool for preliminary assessment of vulnerable transportation infrastructure due to sea level change

[HOME](#)

[ABOUT](#)

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[TOOLS](#)

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SEA LEVEL SCENARIO SKETCH PLANNING TOOL



Map Viewer

- Visualize areas of inundation and affected infrastructure
- *Low technical expertise needed, no GIS software needed*



GIS Data Layers

- SLR Inundation Surfaces & Affected Infrastructure layers
- *GIS Software and intermediate GIS expertise needed*



SLR Inundation Surface Calculator

- Create custom inundation layers
- *Intermediate/Advanced technical/GIS expertise needed*

SKETCH PLANNING TOOL

INTERACTIVE MAPS

[HOME](#) [ABOUT](#) [VIEW MAPS](#) [DOWNLOAD DATA](#) [TOOLS](#) [DOCUMENTS & LINKS](#) [CONTACT](#)

VIEW MAPS

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

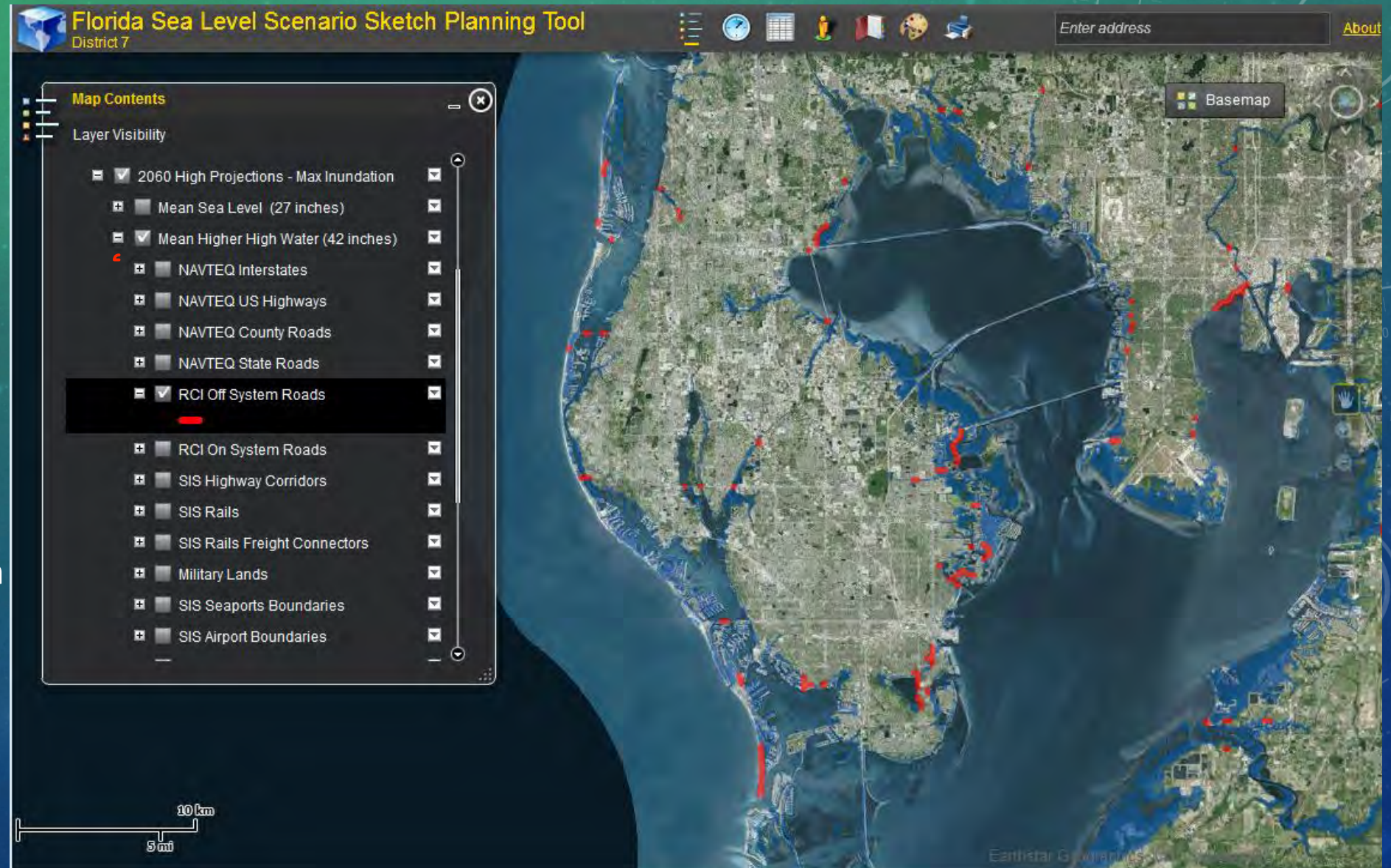


VIEW AFFECTED TRANSPORTATION FACILITIES

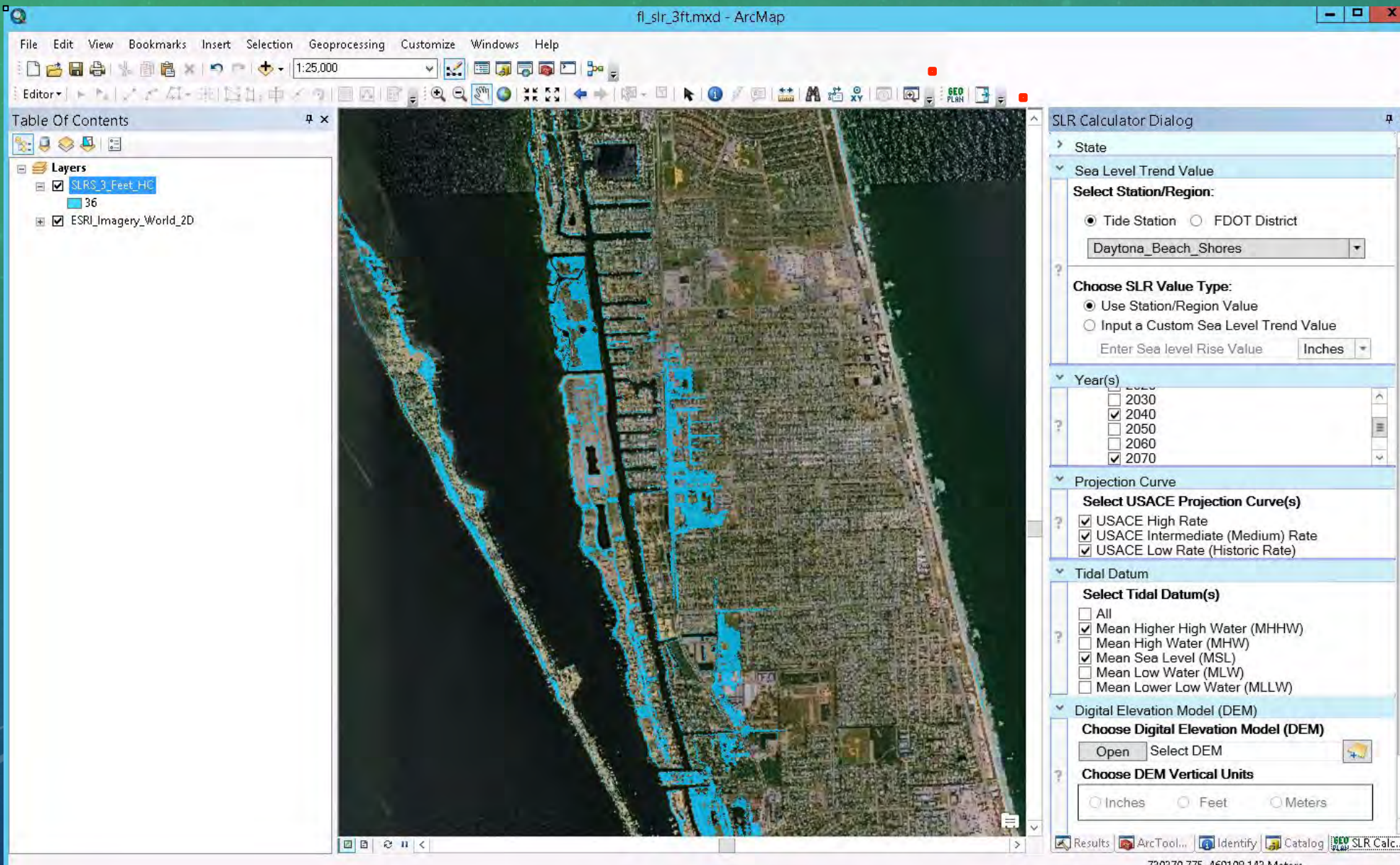
Tampa Bay, 2080,
High Projection

View transportation
facilities potentially
exposed to
inundation various
SLR scenarios.

Available
transportation
layers by
scenario



SLR INUNDATION SURFACE CALCULATOR



ARCMAP ADD-IN

Inputs:

- NOAA tide gauge data
- USACE curve
- Year (by decade 2020-2100)
- Tidal Datum
- DEM

Outputs

- Bathtub model
- Hydro-connectivity filter
- Vector & Raster formats

*Currently supported on
ArcMap 10.1, 10.2.2, 10.3.1
Requires Spatial Analyst*

SOLUTIONS?



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 for storm surge and flood

CO-BENEFITS!





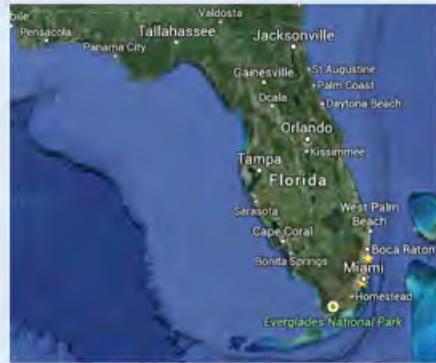
flash floods



high-tide events



storm surge



Adaptation Action Areas



stormwater runoff



related impacts of sea-level rise

Local Planning Tools – Adaptation Action Areas

Strategies for Adaptation Action Areas may include

- Protection
- Accommodation
- Managed retreat
- Avoidance
- Other options

REGULATORY FRAMEWORK – COMMUNITY PLANNING

- On May 21, 2015, Governor Rick Scott signed into law CS/CS/CS **Senate Bill 1094**, available at <http://laws.flrules.org/2015/69>.
- 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.

CHAPTER 2015-69

Committee Substitute for Committee Substitute for Committee Substitute for Senate Bill No. 1094

An act relating to the peril of flood; amending s. 163.3178, F.S.; specifying requirements for the coastal management element required for a local government comprehensive plan; creating s. 472.0366, F.S.; defining terms; requiring a surveyor and mapper to submit a copy of each elevation certificate that he or she completes to the Division of Emergency Management within a specified period beginning on a specified date; authorizing the redaction of certain personal information from the copy; amending s. 627.715, F.S.; authorizing flexible flood insurance; specifying coverage requirements; deleting a provision that prohibits supplemental flood insurance from including excess coverage over any other insurance covering the peril of flood; revising the information that must be

NFIP COMMUNITY RATING SYSTEM (CRS) CREDITS LOWER FLOOD INSURANCE RATES

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

Organizing adaptation options

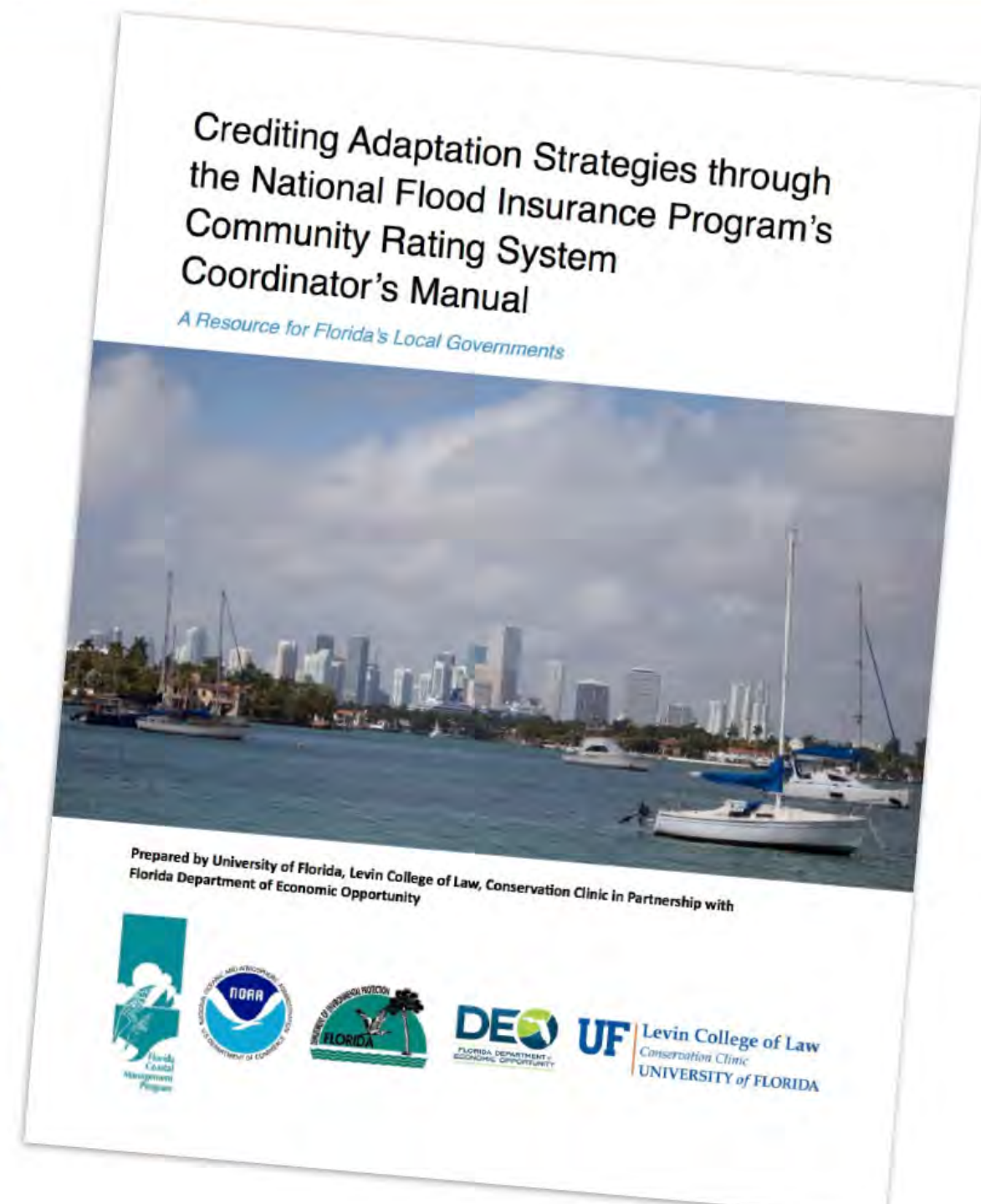
Retreat,
Accommodation
&
Protection

≠

- | | |
|------------|---|
| 300 series | activities related to public information |
| 400 series | activities related to mapping and regulations |
| 500 series | activities related to flood damage reduction |

Source: W. Thomas Hawkins, UF College of Law, 2016
[http://www.tbrpc.org/onebay/obwg/060316/
Hawkins_UF_CRS_ClimateAdapt_06032016.pdf](http://www.tbrpc.org/onebay/obwg/060316/Hawkins_UF_CRS_ClimateAdapt_06032016.pdf)

Crediting Adaptation Strategies through the National Flood Insurance Program's Community Rating System Coordinator's Manual



QUESTIONS?

- Additional Resources can be found at:

<https://coast.noaa.gov/data/digitalcoast/pdf/adaptationguide.pdf>

https://www.epa.gov/sites/production/files/2014-04/documents/cre_synthesis_1-09.pdf

<http://www.climatestrategies.us/library/library/view/908>

Contact Information:

Keren Bolter kbolter@sfrpc.com

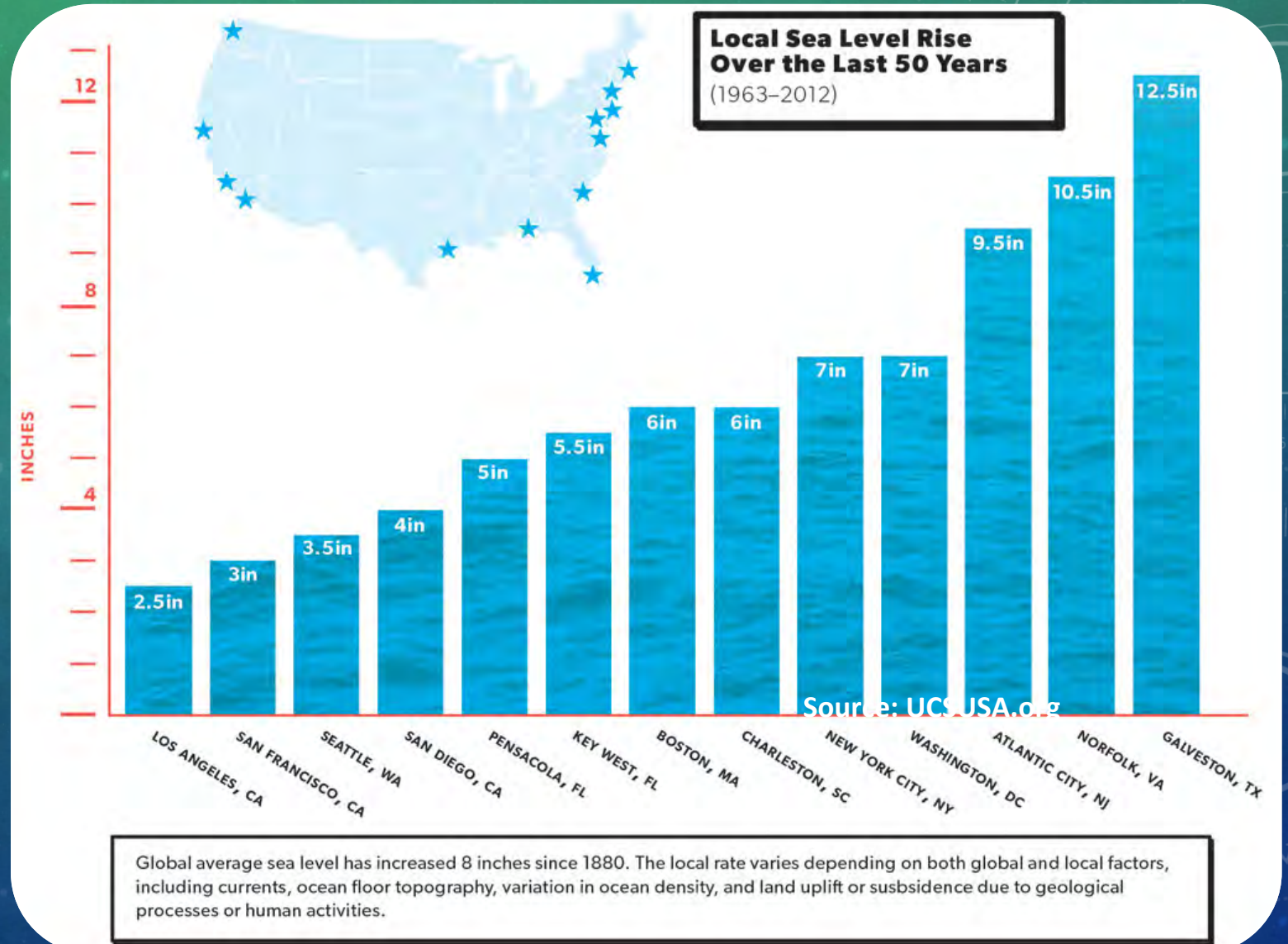
This publication was funded in part, through a grant agreement from the Florida Department of Environmental Protection, Florida Coastal Management Program, by a grant provided by the Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended, National Oceanic and Atmospheric Administration Award No. NA15NOS4190217. The views, statements, findings, conclusions and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida, NOAA or any of their sub-agencies.



WHAT CAUSES CHANGES IN SEA LEVEL?

- LOCAL Sea level rise
- GLOBAL Sea level rise
 - Land ice accounted for about 65% of the total SLR budget from 1993 to 2008.

(Church et al., 2011)



FUTURE PROJECTIONS

