Georgia Coastal Resilience Workshop

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
COASTAL RESOURCES DIVISION

NATIONAL WEATHER SERVICE

Carl Vinson Institute of Government
UNIVERSITY OF GEORGIA

The Nature Conservancy

GEORGIA EMERGENCY MANAGEMENT ★ HOMELAND SECURITY

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

Marine Extension and Georgia Sea Grant
UNIVERSITY OF GEORGIA
Sea Grant

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HOUSEKEEPING RULES

- Please remain muted at all times unless you have a question.
- Use the raised hand function or the chat box to ask questions.
- Hold all questions until the end of each presentation.
- When asking a question, please double check to make sure you are not double muted.
- Enjoy the workshop!

INCREASING COMMUNITY RESILIENCE TO COASTAL STORMS AND SEA LEVEL RISE

Presenters

Kimberly Garvey – U.S. Army Corps of Engineers, Savannah District
Blair Holloway – National Oceanic and Atmospheric Administration, National Weather Service
Jared Lopes – U.S. Army Corps of Engineers, Savannah District
Idris Dobbs – U.S. Army Corps of Engineers, Jacksonville District
John McCombs – National Oceanic and Atmospheric Administration, Office of Coastal Management
Andrew Condon, Ph.D., P.E. – U.S. Army Corps of Engineers, Coastal Hydraulics Lab
Ashby Worley, CFM – The Nature Conservancy
Haydn Blaize – Georgia Department of Natural Resources, Environmental Protection Division
Doug Marcy – National Oceanic and Atmospheric Administration, Office of Coastal Management
Tashya Allen – National Oceanic and Atmospheric Administration, Office of Coastal Management
Jessica Brown, P.E. – University of Georgia Marine Extension and Georgia Sea Grant
Jennifer Kline – Georgia Department of Natural Resources, Coastal Resources Division
Scott Pippin, J.D., CFM – University of Georgia, Carl Vinson Institute of Government
Jack Krolikowski – Georgia Emergency Management Agency, Homeland Security

Georgia Coastal Resilience Workshop

WELCOME !

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Georgia Coastal Flood Trends and Experimental Coastal Flood Extent Maps

Blair Holloway

NOAA/National Weather Service

Blair.Holloway@noaa.gov

OUTLINE

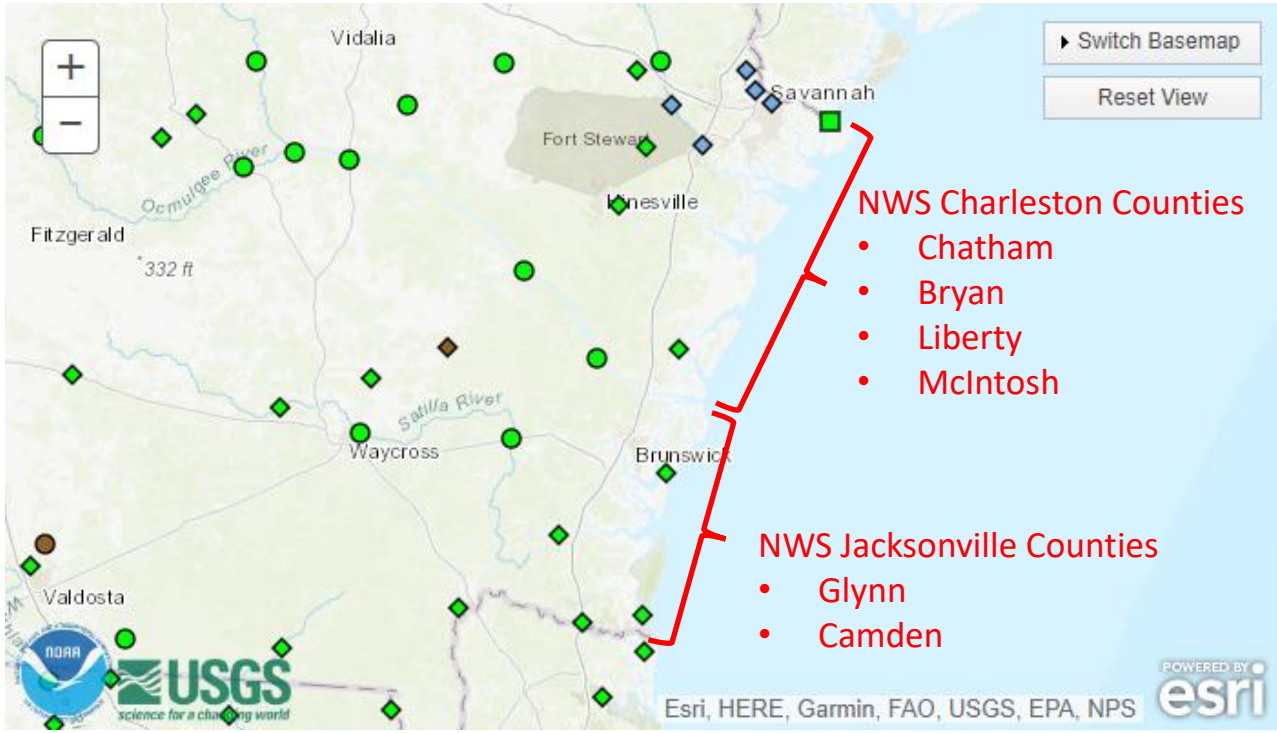
- NWS Charleston coastal flood program
- Coastal flood trends at the Fort Pulaski, GA tide gauge
- Introduce the recently released experimental coastal flood extent maps

HW-80 looking toward Tybee Island – 10/27/2015
Fort Pulaski peak observed tide – 10.43 ft MLLW

NWS Charleston Coastal Flood Program

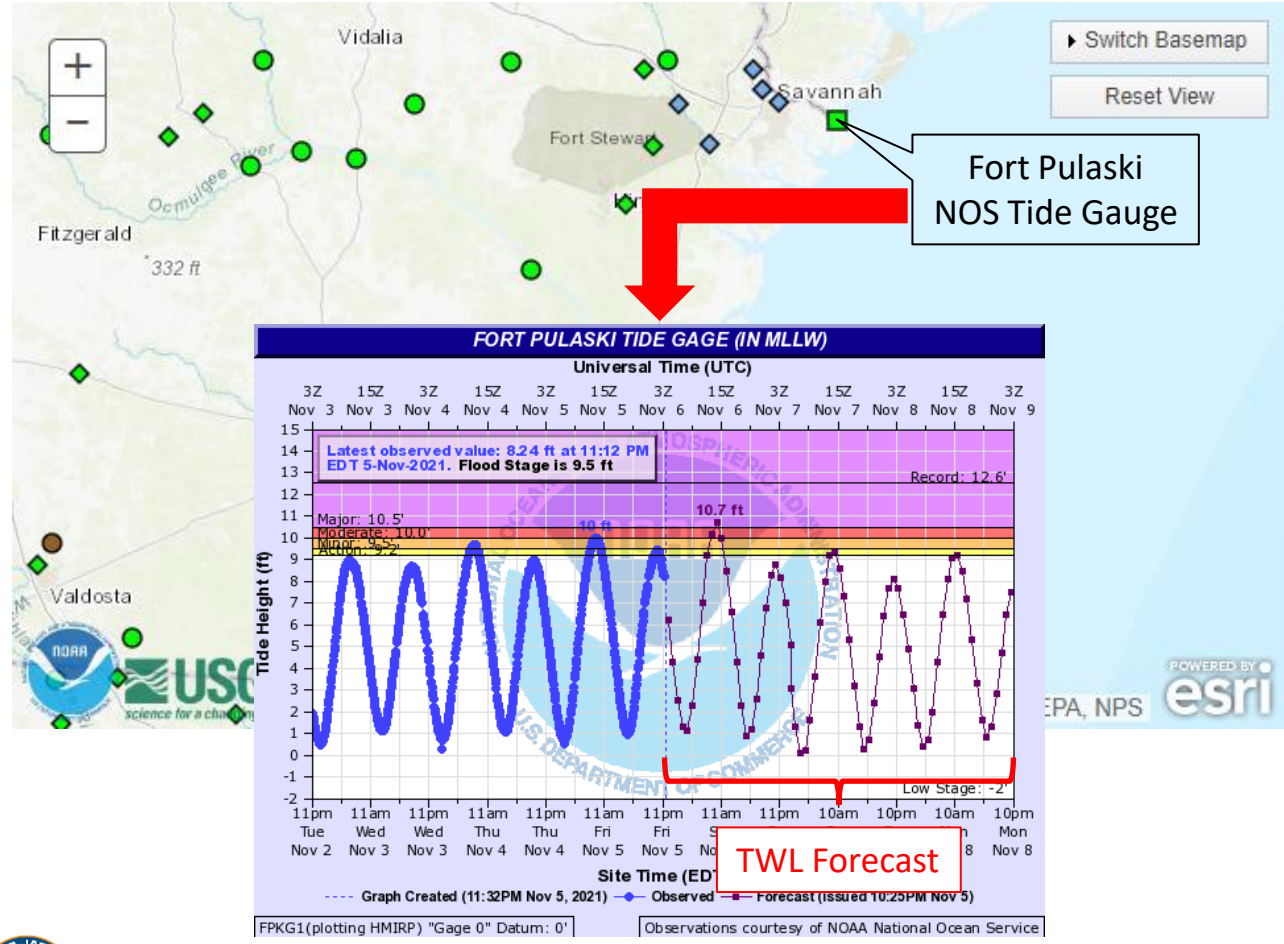
- Limited coastal/tide gauge coverage along the GA coast
  - Fort Pulaski (NOS)
  - Meridian (USGS)
  - St. Simons (USGS)
  - Cumberland Island (USGS)

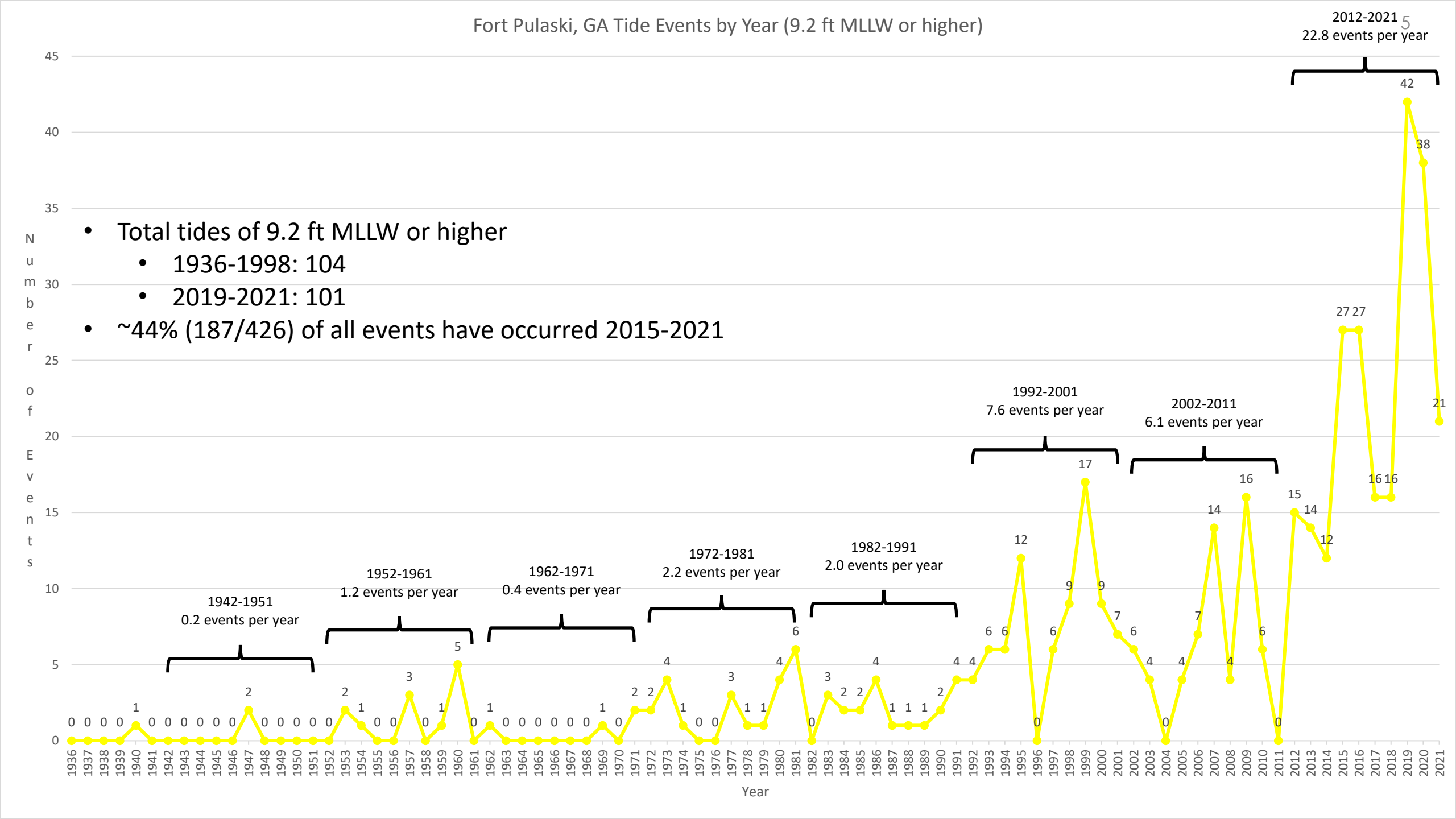
- NWS office coverage
  - NWS Charleston: Savannah River to the Altamaha River
  - NWS Jacksonville: Altamaha River to the FL state line



NWS Charleston Coastal Flood Program

- Coastal flood program for the southeast GA coast is based on the Fort Pulaski (NOS) tide gauge
- A Total Water Level (TWL) forecast is created at least twice each day
- Coastal Flood Watch, Warning, Advisory decisions are made based on the TWL forecast
- Fort Pulaski tide gauge
  - Complete annual data back to 1936
  - Action stage: 9.2 ft MLLW
  - Minor flood stage: 9.5 ft MLLW
  - Moderate flood stage: 10.0 ft MLLW
  - Major flood stage: 10.5 ft MLLW
- Coastal Flood Event Database
  - https://www.weather.gov/chs/coastalflood

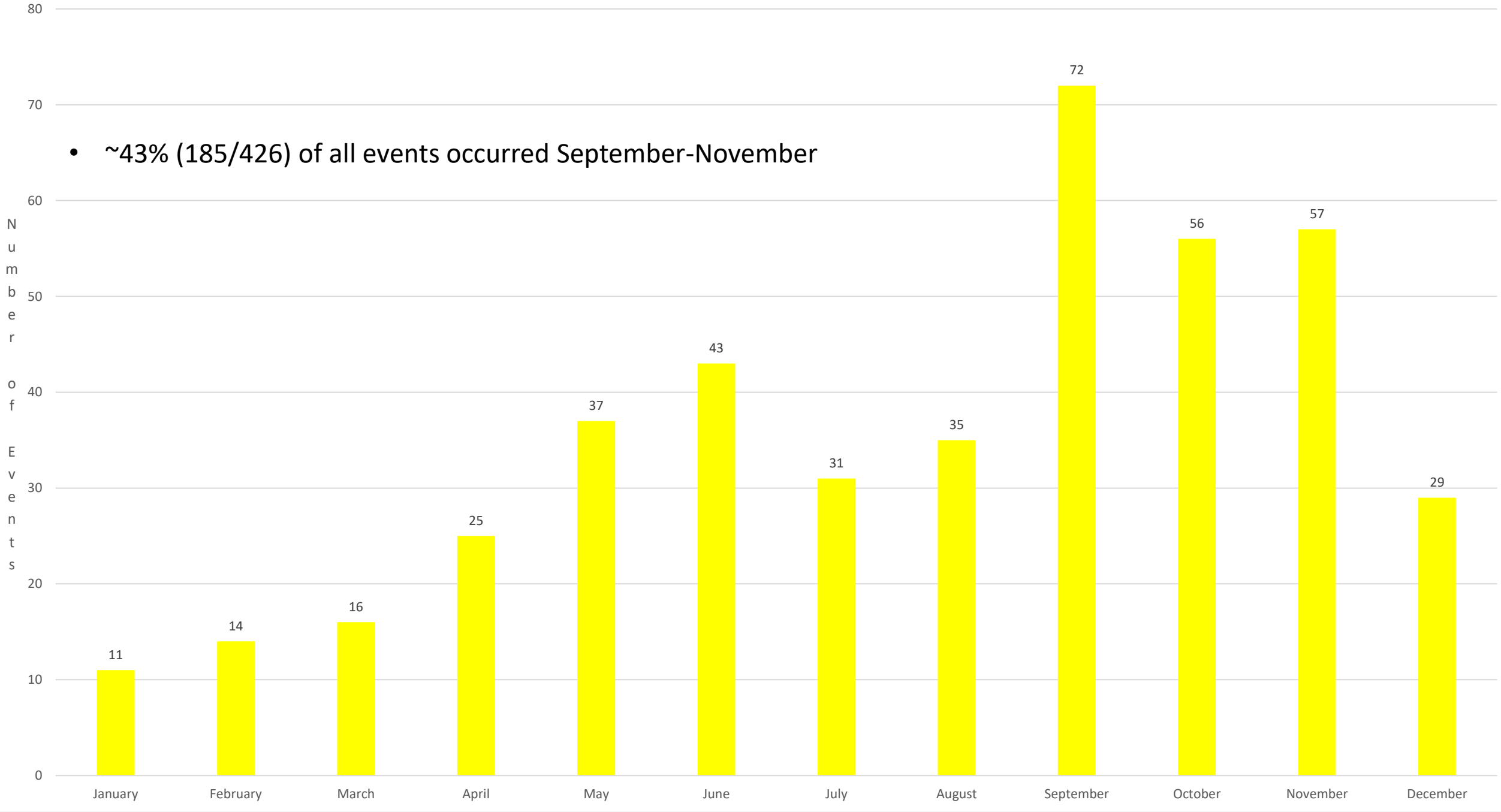


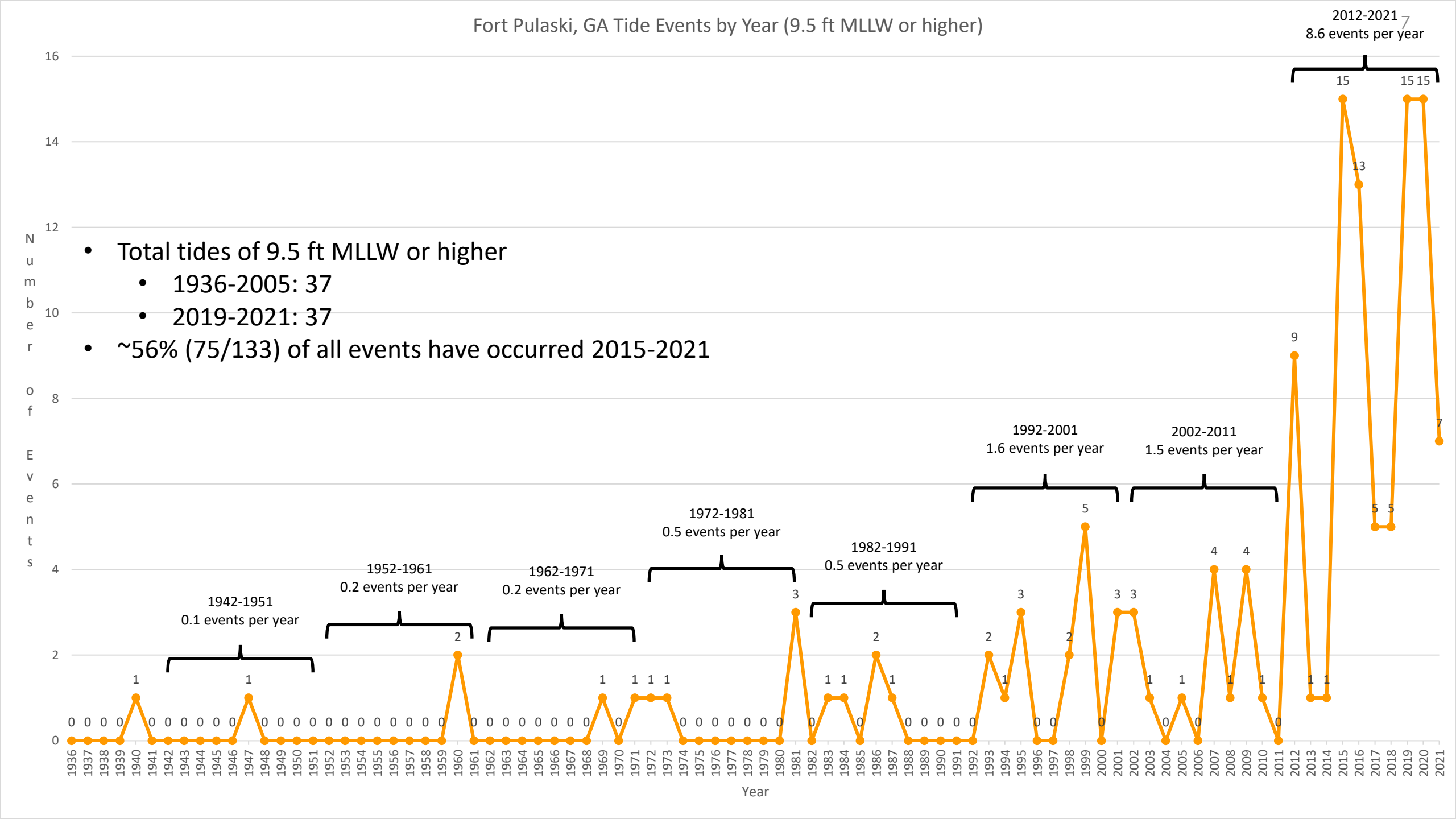


- Total tides of 9.2 ft MLLW or higher
  - 1936-1998: 104
  - 2019-2021: 101
- ~44% (187/426) of all events have occurred 2015-2021

Fort Pulaski, GA 9.2 ft MLLW Tide Events by Month

- ~43% (185/426) of all events occurred September-November

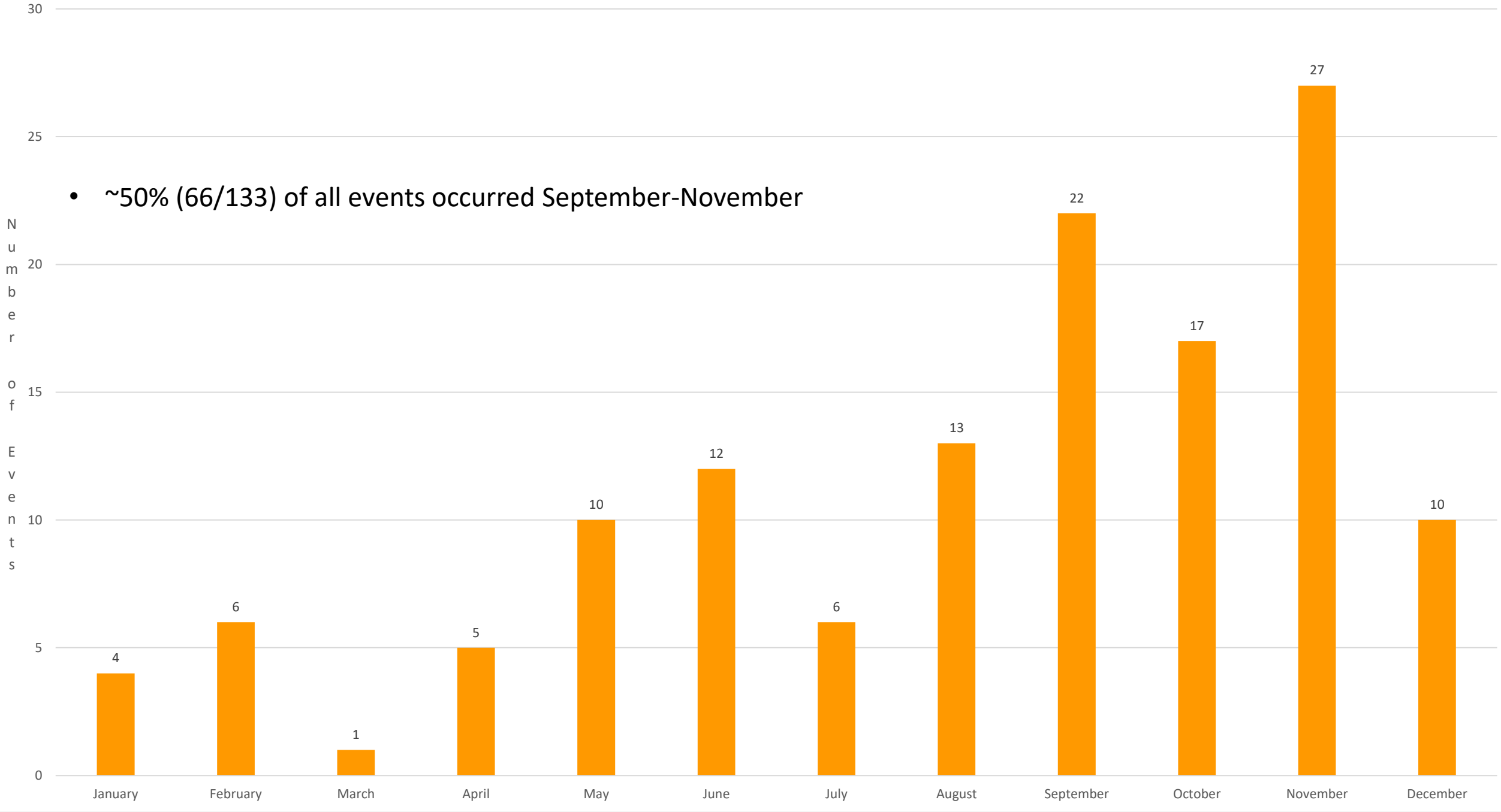




- Total tides of 9.5 ft MLLW or higher
  - 1936-2005: 37
  - 2019-2021: 37
- ~56% (75/133) of all events have occurred 2015-2021

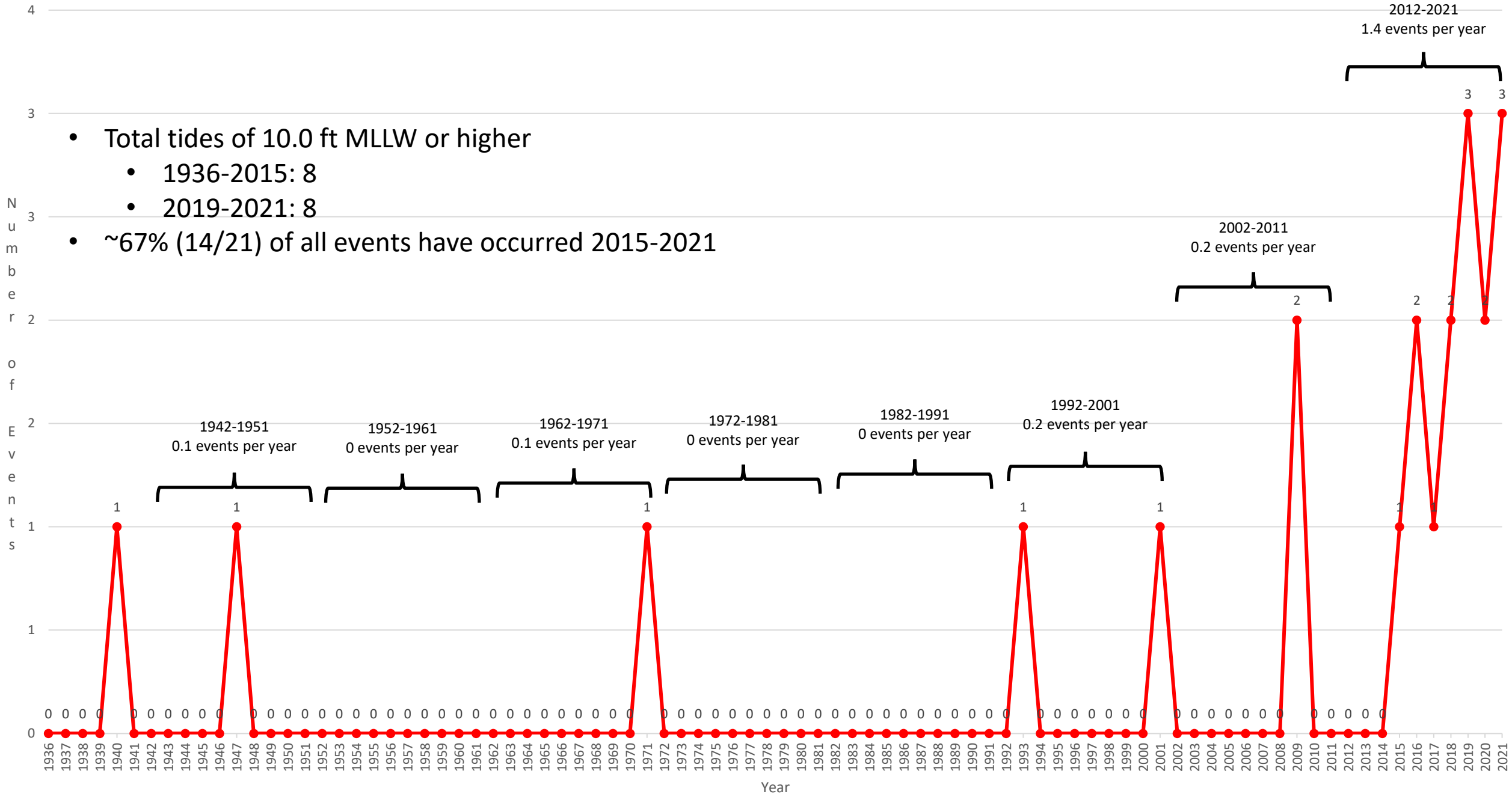
Fort Pulaski, GA 9.5 ft MLLW Tide Events by Month

- ~50% (66/133) of all events occurred September-November



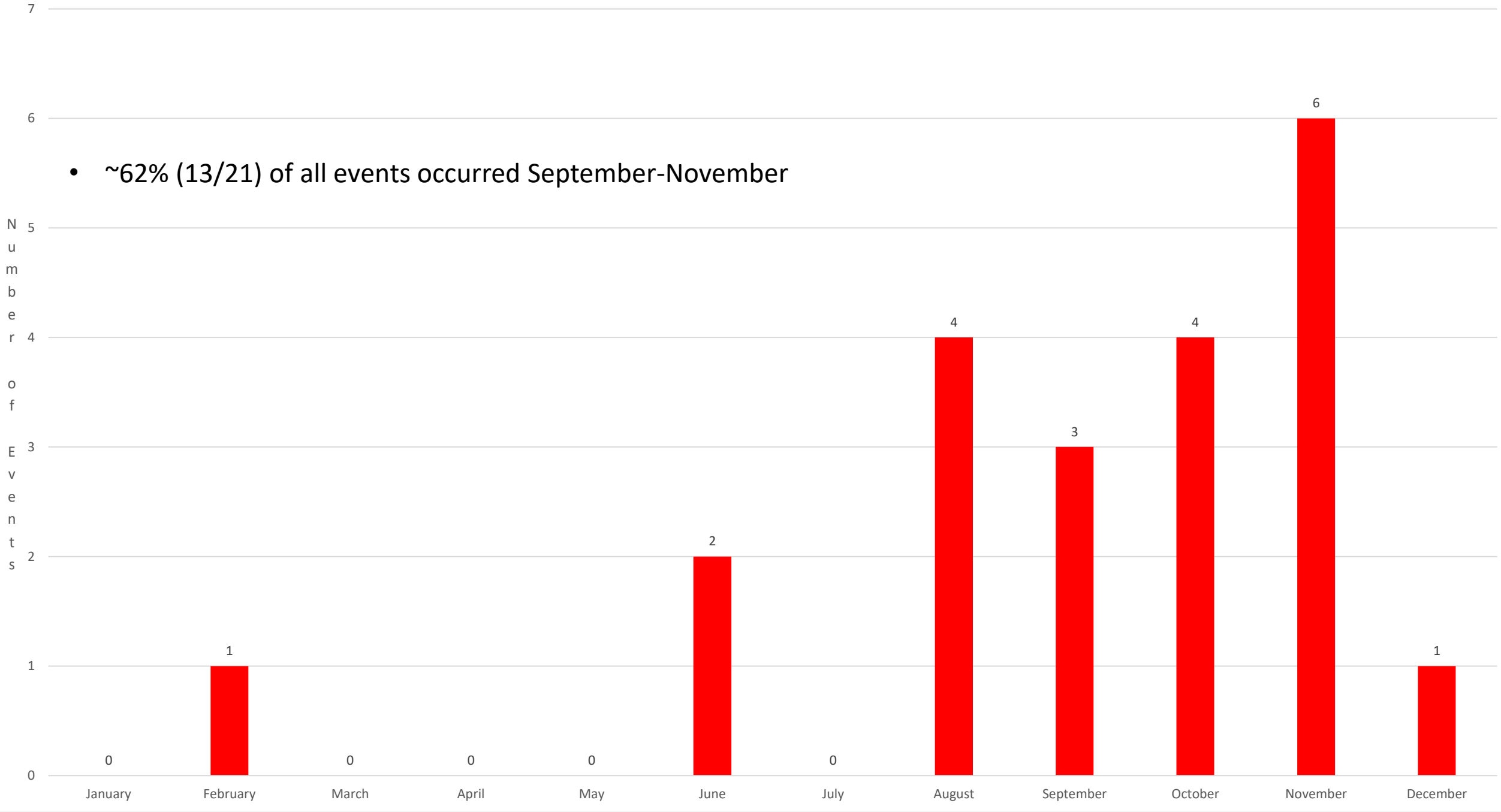
Fort Pulaski, GA Tide Events by Year (10.0 ft MLLW or higher)

- Total tides of 10.0 ft MLLW or higher
  - 1936-2015: 8
  - 2019-2021: 8
- ~67% (14/21) of all events have occurred 2015-2021



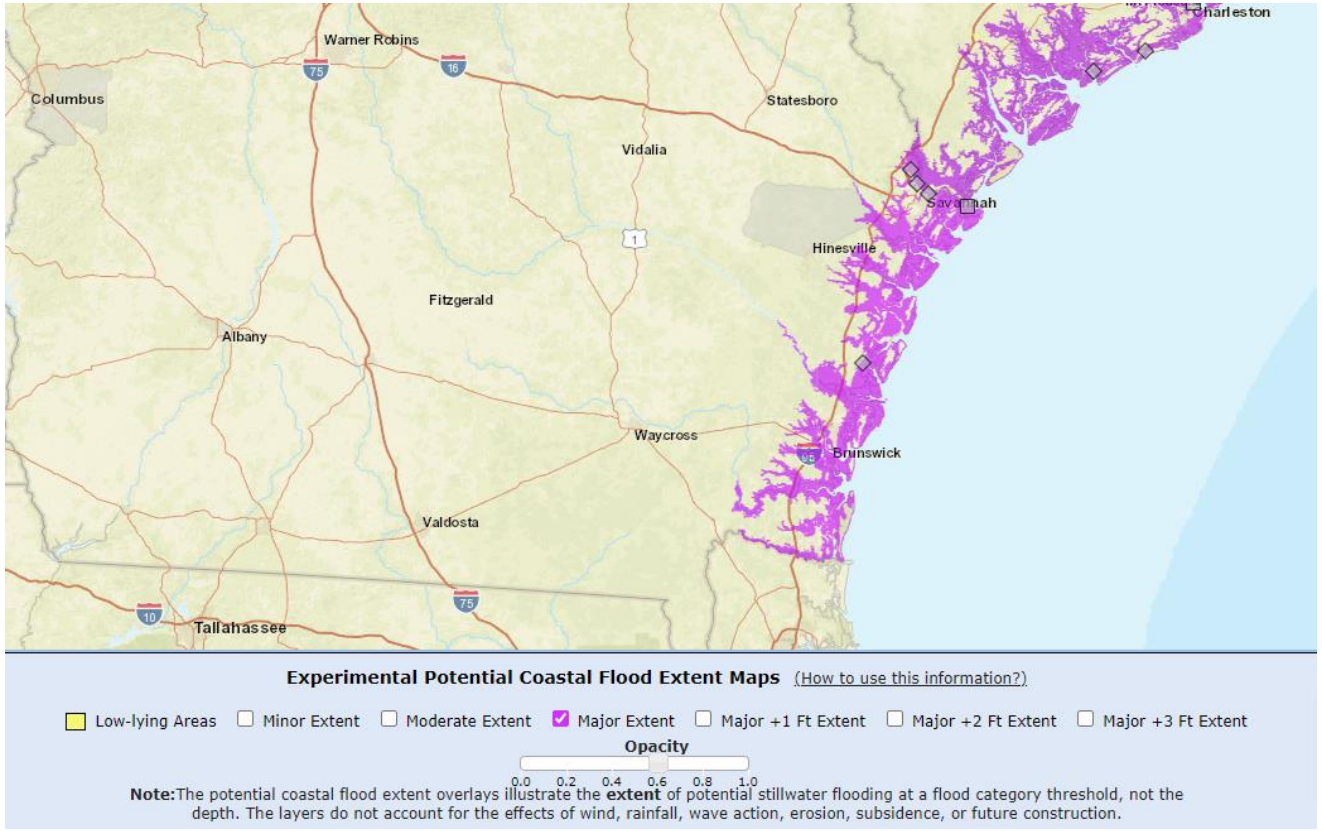
Fort Pulaski, GA 10.0 ft MLLW Tide Events by Month

- ~62% (13/21) of all events occurred September-November



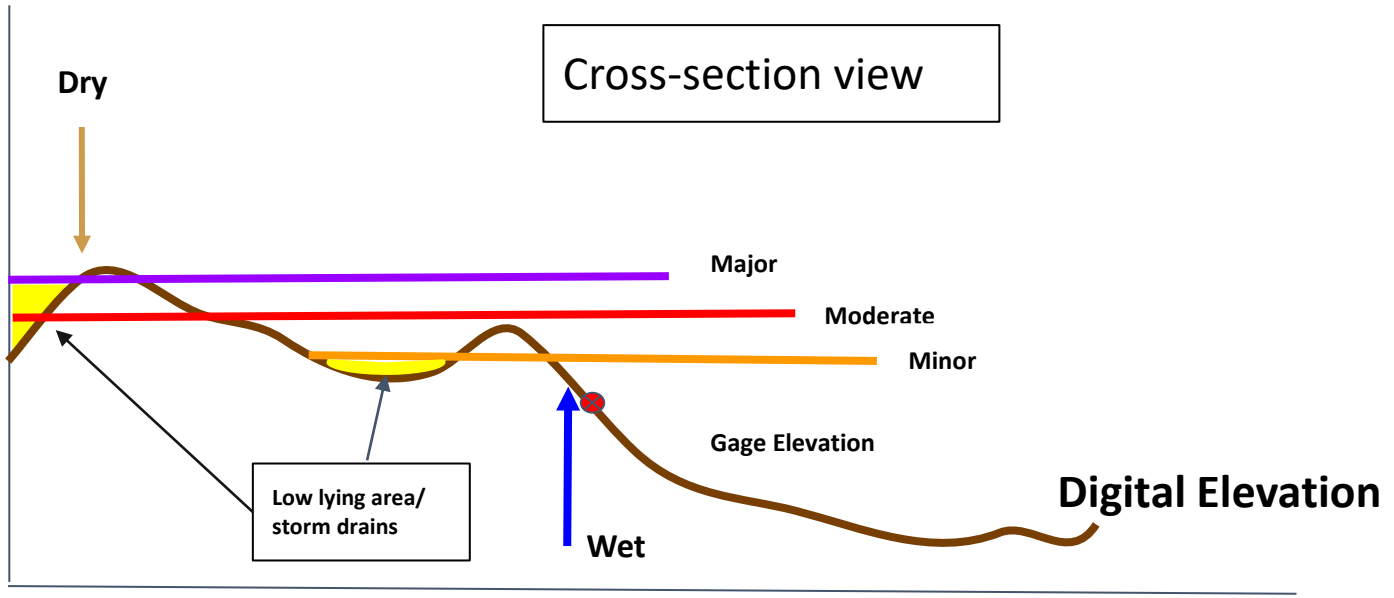
Experimental Coastal Flood Extent Maps

- Purpose is to provide partners with a visualization of potential coastal flood extent
- Created by NOAA Office for Coastal Management
- Based on digital elevation data and NWS defined coastal flood thresholds at coastal gauge locations
- Only highlights wet vs. not wet
- Does not provide depth
- Not a forecast of flood extent



Experimental Coastal Flood Extent Maps

- Minor, Moderate, Major flood stage thresholds determined by NWS offices for each gage location
- Layers indicate wet or dry areas due to the threshold level of flooding
- Yellow areas indicate low lying areas where rain/fresh water can be trapped and salt water can reach through storm drains
- Uses a still water assumption (no waves/wave setup)
- The layers do not account for the effects of wind, rainfall, wave action, erosion, subsidence, or future construction
- https://www.weather.gov/erh/coastalflood



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SOUTH ATLANTIC COASTAL STUDY (SACS)
TIER 1 RISK ASSESSMENT

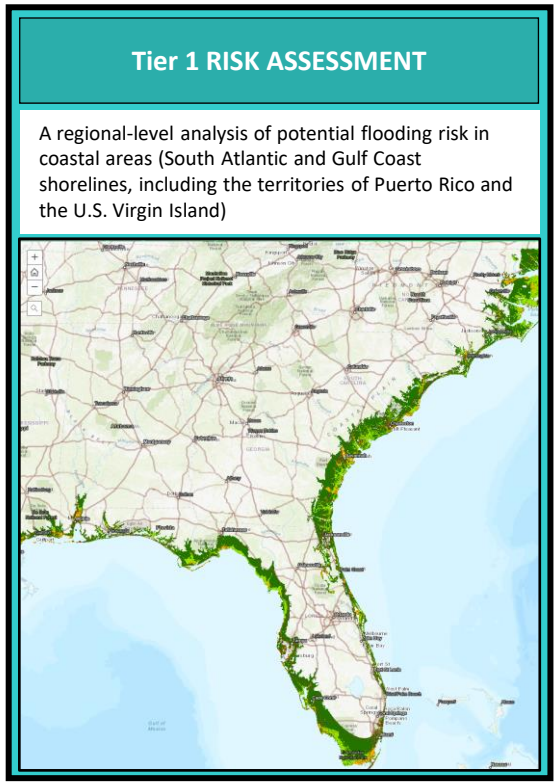
PRESENTED BY JARED M. LOPES, WATER RESOURCES PLANNER

U.S. ARMY CORPS OF ENGINEERS | SAVANNAH DISTRICT

Jared.M.Lopes@usace.army.mil

PRESENTATION OUTLINE

A. Overview of the SACS Tier 1 Risk Assessment
B. Tool Demonstration
C. Learn More / Questions

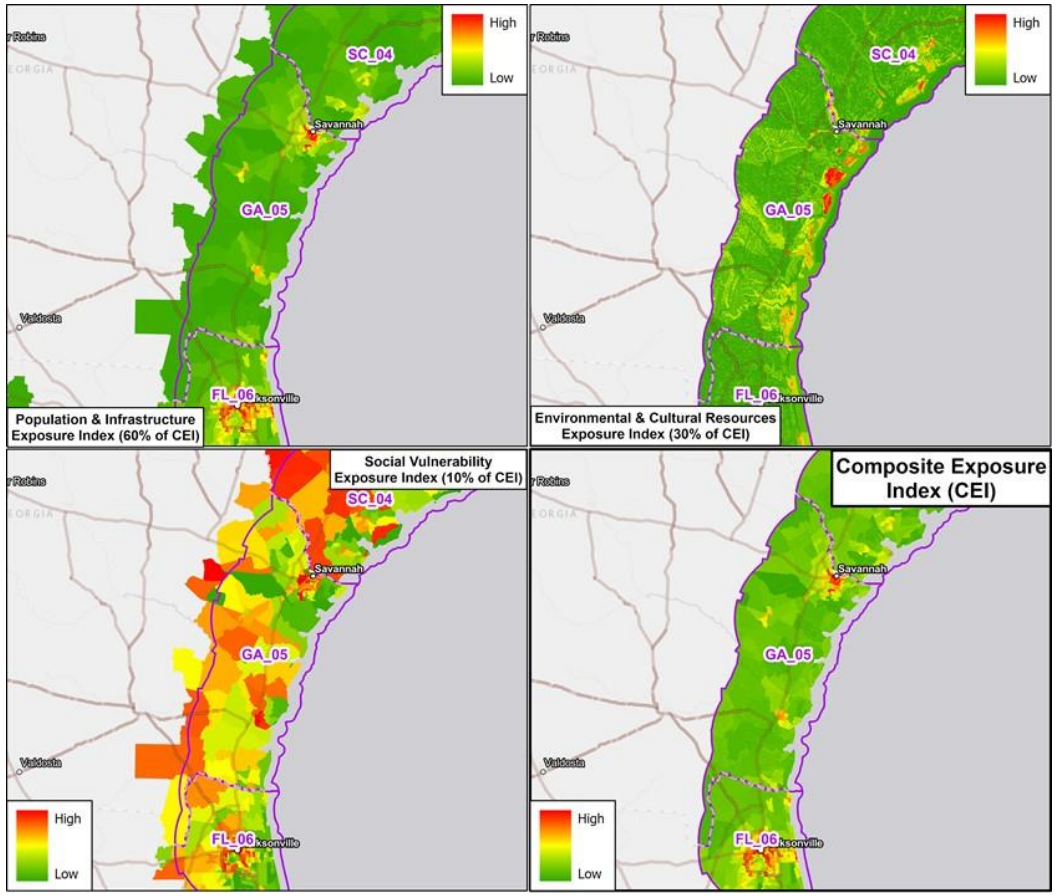


A SACS TIER 1 RISK ASSESSMENT - OVERVIEW

- **Developed by: :** USACE; methodology consistent with analysis and data employed in the North Atlantic Coast Comprehensive Study (NACCS)
- **What it Does:** Provides consistent regional assessment of coastal storm hazards and potential risk caused by storm surge inundation and seal-level rise (SLR) across USACE South Atlantic Division boundaries
- **Access:** https://data-sacs.opendata.arcgis.com/ | https://www.sad.usace.army.mil/SACS/
- **Input:** National-level data sets
- **Output:** Composite Risk Index = Composite Exposure Index x Hazard

  Note: Hazard is defined as annual exceedance probability (AEP) of a flooding hazard
- **Date Published/Update:** 2019
- **Additional Software/Hardware Requirements:** Google Chrome, Microsoft Edge
- **Special Permissions Needed:** None
- **Caveats?** Tier 1 does not consider additional coastal hazards (e.g., erosion, wave attack, compound flooding)

A SACS TIER 1 RISK ASSESSMENT - OVERVIEW



COMPOSITE RISK INDEX = COMPOSITE EXPOSURE INDEX x HAZARD

Exposure Defined: Composite Exposure Index (CEI)

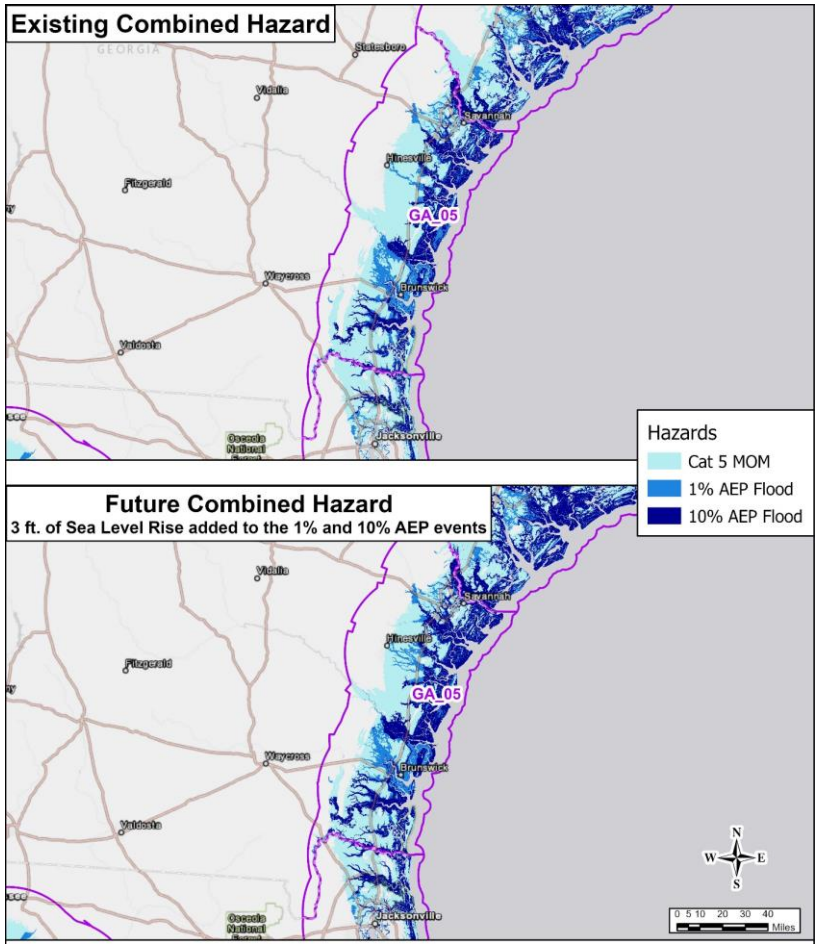
A sum of 3 independent, weighted exposure indices:

Population and Exposure Index (60% weighting):
Population density: number of persons within an aerial extent across the study area
Infrastructure: critical infrastructure that supports the population and communities

Environmental and Cultural Resources Exposure Index (30% weighting):
Important habitat and cultural resources listed in the National Register of Historic Places (NRHP) that would be affected by storm surge

Social Vulnerability Exposure Index (10% weighting):
Characterization includes certain segments of the population that may have more difficulty preparing for and responding to coastal flood events (CDC SVI)

A SACS TIER 1 RISK ASSESSMENT - OVERVIEW



COMPOSITE RISK INDEX = COMPOSITE EXPOSURE INDEX x HAZARD

Existing and Future Flood Hazard

Assessment of coastal hazards caused by storm surge inundation and sea level rise for the following water levels:

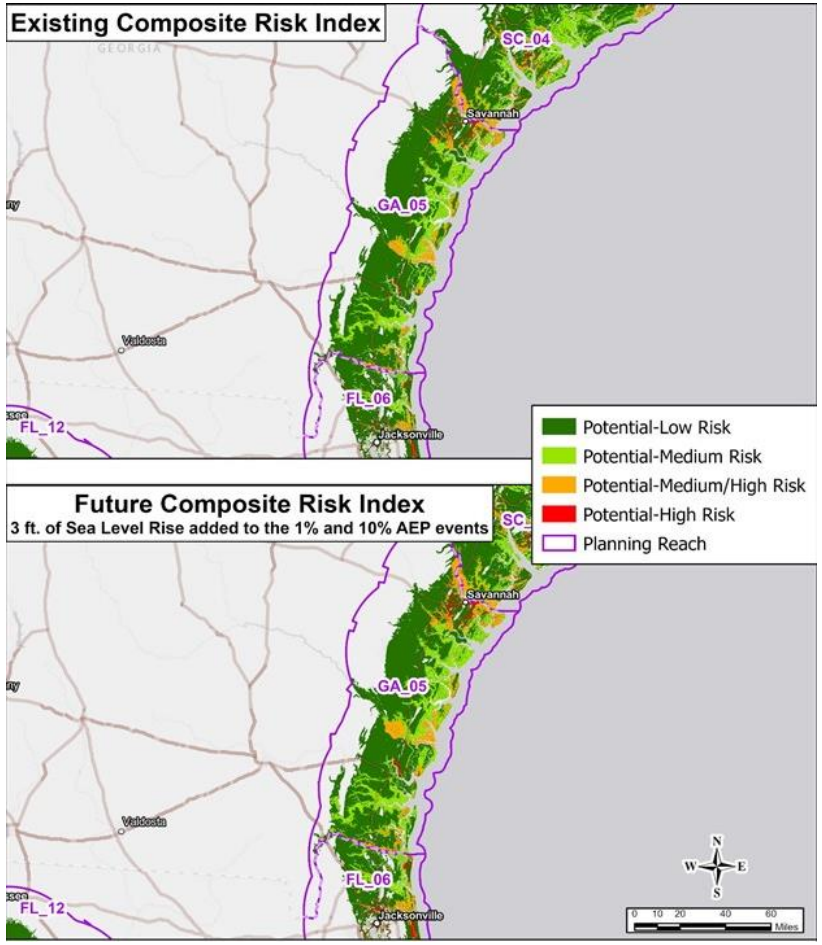
- **10-percent Annual Exceedance Probability (AEP) water levels (10-year storm)** (Source: U.S. Army Engineer Research and Development Center Coastal and Hydraulics Laboratory - ERDC/CHL)

- **1% annual exceedance probability water levels (100-year storm)** (Source: National Flood Hazard Layer - NFHL)

→ 3 feet of sea-level rise was added to the 1% and 10% AEP water levels to simulate future flooding events given relative sea level rise (3 feet of SLR is expected to occur in the next 50-100 years, based on the USACE Medium and High SLR curves)

- **Cat 5 Maximum of Maximum (MOM) hazard (Source: NOAA's Sea, Lake and Overland Surges – SLOSH- model**

A SACS TIER 1 RISK ASSESSMENT - OVERVIEW



COMPOSITE RISK INDEX = COMPOSITE EXPOSURE INDEX x HAZARD

Potential Areas of Risk

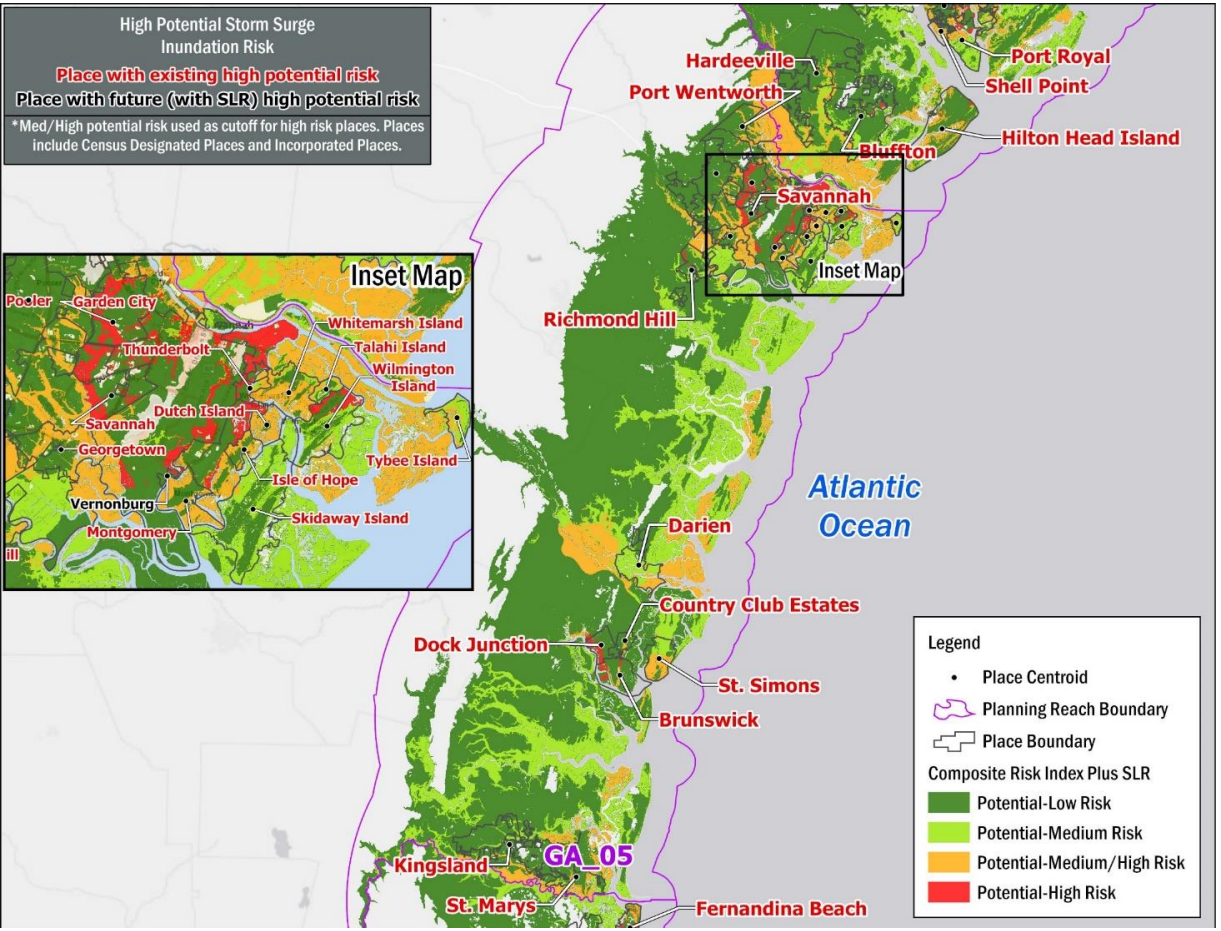
The Composite Risk Index (CEI) and coastal flood inundation hazards were combined to identify potential areas at risk

- Defines risk as function of probability of hazard occurrences (with 3 feet of sea level rise) and exposure (composite exposure index)

- Future condition Composite Risk Index (bottom map) identifies areas that could see a potential increase in risk from coastal storms as a result of 3 feet of sea level rise

INCREASING COMMUNITY RESILIENCE TO COASTAL STORMS AND SEA LEVEL RISE

SACS TIER 1 RISK ASSESSMENT| ASSESS AND COMMUNICATE

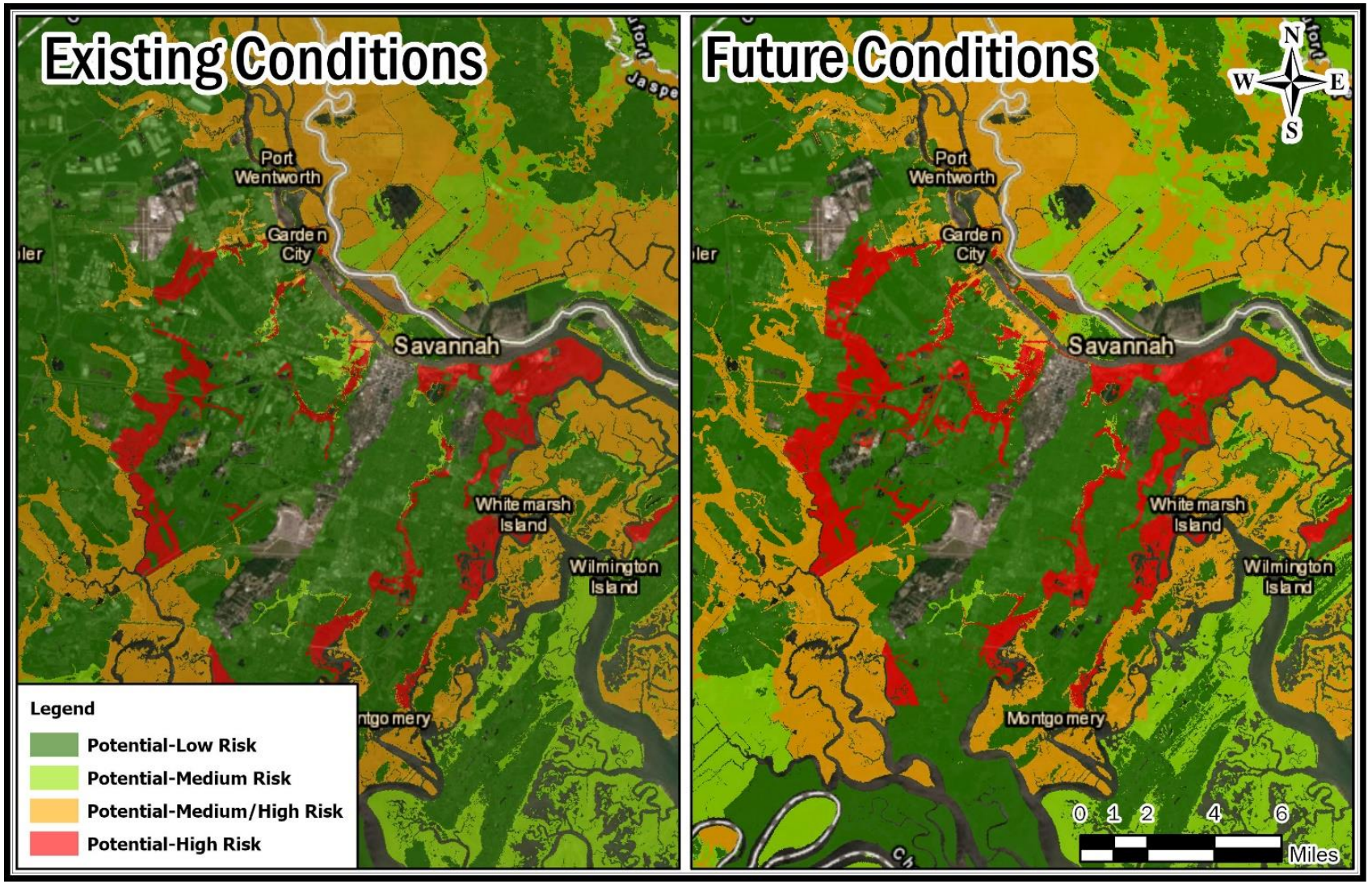


Census Places	Total Acres	No Sea Level Rise (Acres)	With Sea level Rise (Acres)	Change (Acres)	Percent Change
Savannah	69,501	6,568	9,711	3,143	47.85%
St. Simons	11,208	4,036	5,037	1,001	24.80%
St. Marys	15,998	2,727	3,768	1,040	38.17%
Garden City	9,267	2,185	3,593	1,408	64.44%
Darien	15,378	2,789	2,803	14	0.50%
Georgetown	5,658	1,897	2,429	532	28.04%
Port Wentworth	10,520	1,343	2,338	995	74.09%
Whitemarsh Island	4,258	1,842	2,313	471	25.57%
Montgomery	3,894	1,739	1,998	259	14.89%
Brunswick	16,169	1,454	1,968	514	35.35%
Dock Junction	6,766	929	1,606	677	72.87%
Pooler	17,836	561	1,592	1,031	183.78%
Dutch Island	1,960	1,149	1,248	98	8.62%
Richmond Hill	10,460	750	1,120	370	49.33%
Wilmington Island	6,100	855	1,019	164	19.18%
Isle of Hope	1,459	424	669	246	57.78%
Kingsland	28,688	287	599	312	108.71%
Tybee Island	1,951	465	509	44	9.46%
Thunderbolt	1,020	402	489	87	21.64%
Country Club Estates	3,043	195	289	94	48.21%
Talahi Island	939	213	220	7	3.29%
Skidaway Island	11,436	83	87	4	4.82%
Vernonburg	269	0	65	65	∞

*Census places ranked from highest to lowest total area affected. Rows in blue highlight greatest percentage increase in affected area.

INCREASING COMMUNITY RESILIENCE TO COASTAL STORMS AND SEA LEVEL RISE

SACS TIER 1 RISK ASSESSMENT| ASSESS AND COMMUNICATE

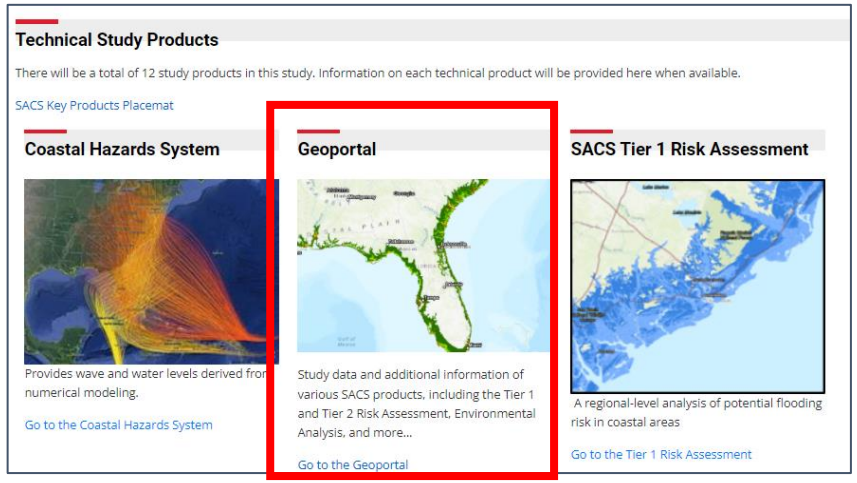


B APPLIED EXERCISES AND ACCESSING THE TOOL

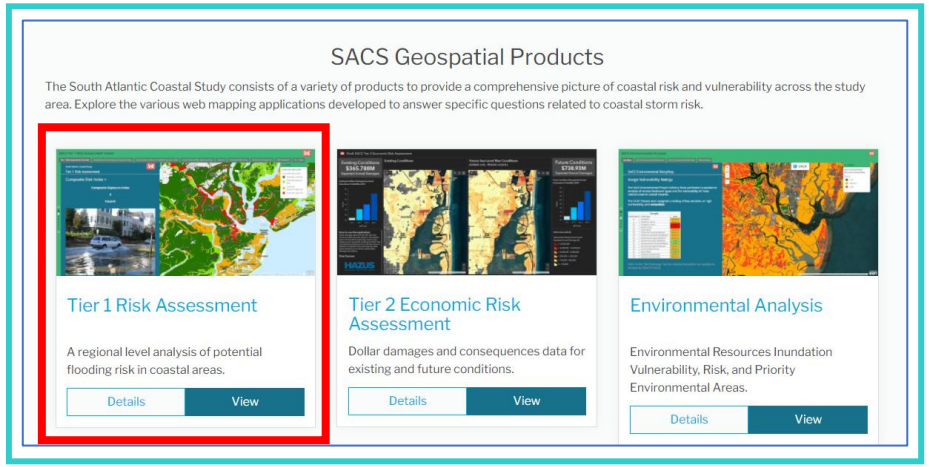
- Problem: Composite Risk Index - Comparison between the existing and future condition (+3' SLR)
- Example location: St Mary's, Georgia

Open the Tier 1 Risk Assessment through the SACS website:

https://www.sad.usace.army.mil/SACS/



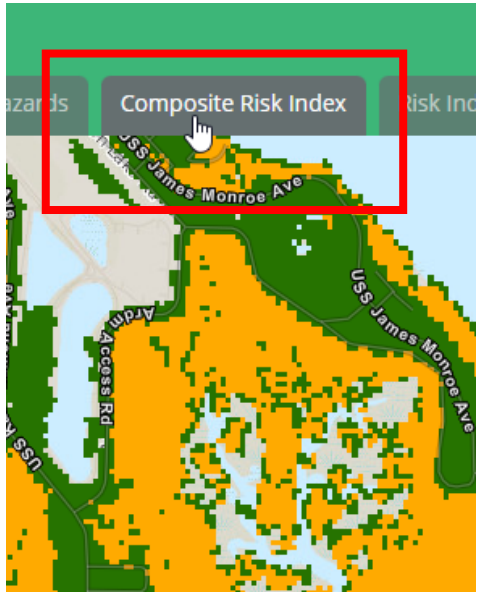
Step 1: Open the SACS Geoportal



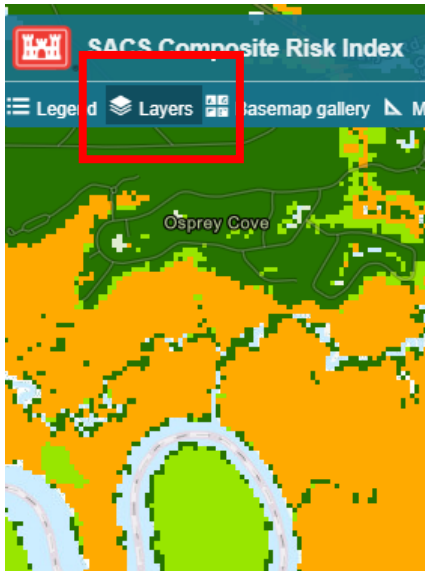
Step 2: Open the SACS Tier 1 Risk Assessment

B APPLIED EXERCISE #1: COMPOSITE RISK INDEX

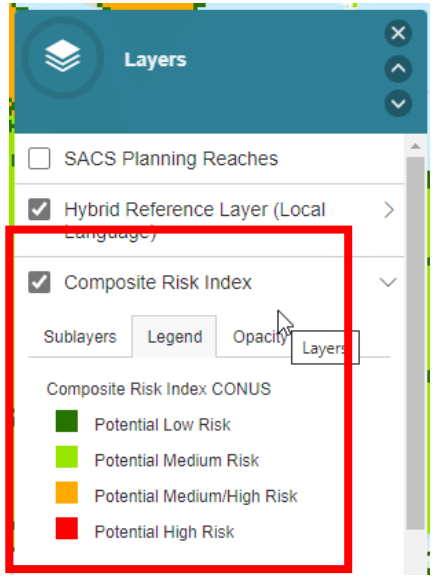
- **Use the "Composite Risk Index" tab to assess changes in projected flood risks between the existing and future condition with SLR.**



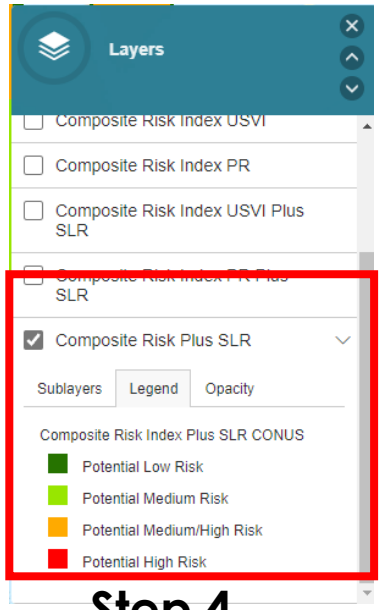
Step 1
Select "Risk Index Comparison" tab from top toolbar (Note: User can use dropdown menu in upper right-hand corner if screen isn't wide enough to display)



Step 2
Once in the tab, click on "layers" under the map heading



Step 3
Select the "Composite Risk Index" layer from the menu

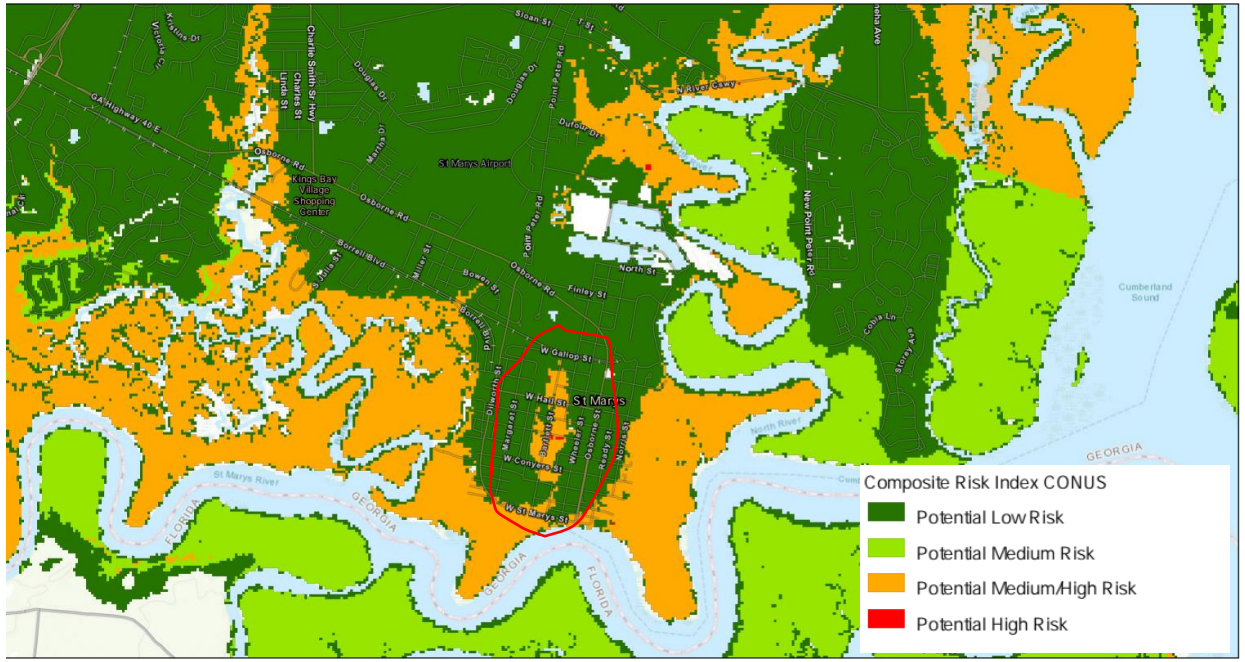


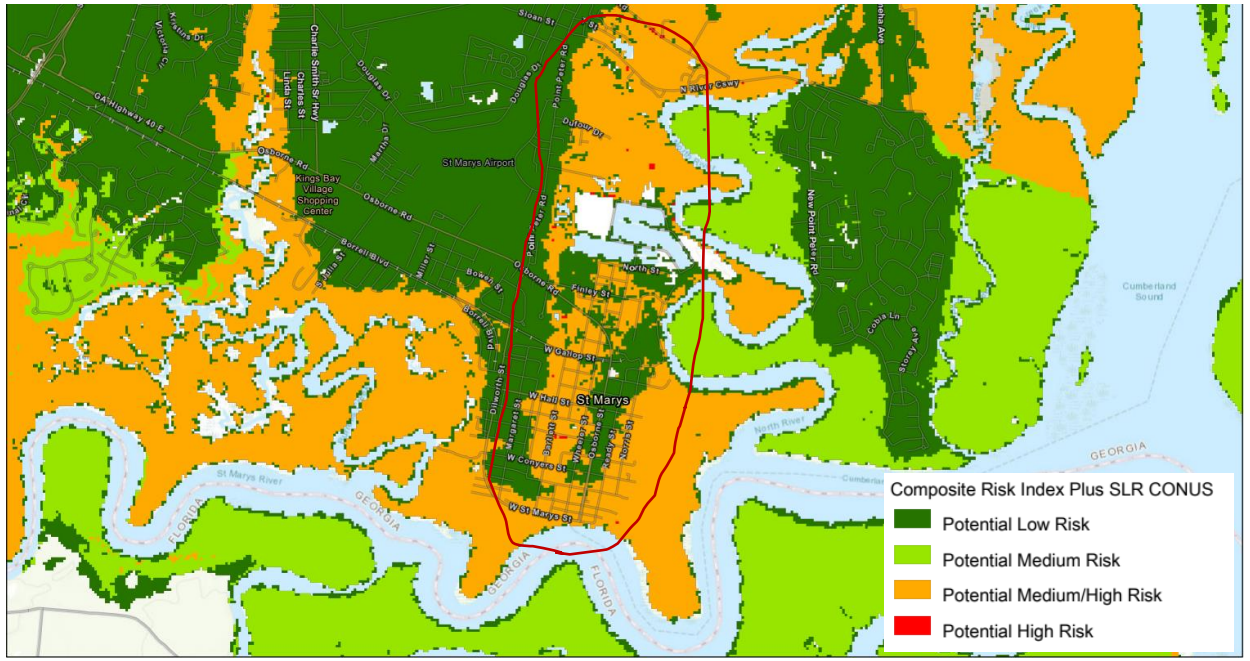
Step 4
Deselect the "Composite Risk Index" layer and select the "Composite Risk Index Plus SLR"" from the menu

SACS TIER 1 RISK ASSESSMENT| ASSESS AND COMMUNICATE

B APPLIED EXERCISE #1: COMPOSITE RISK INDEX

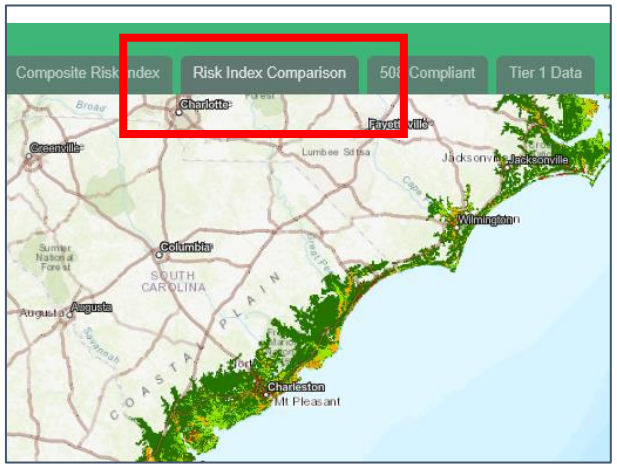
- Assess coastal flooding risk projections between the existing and future condition





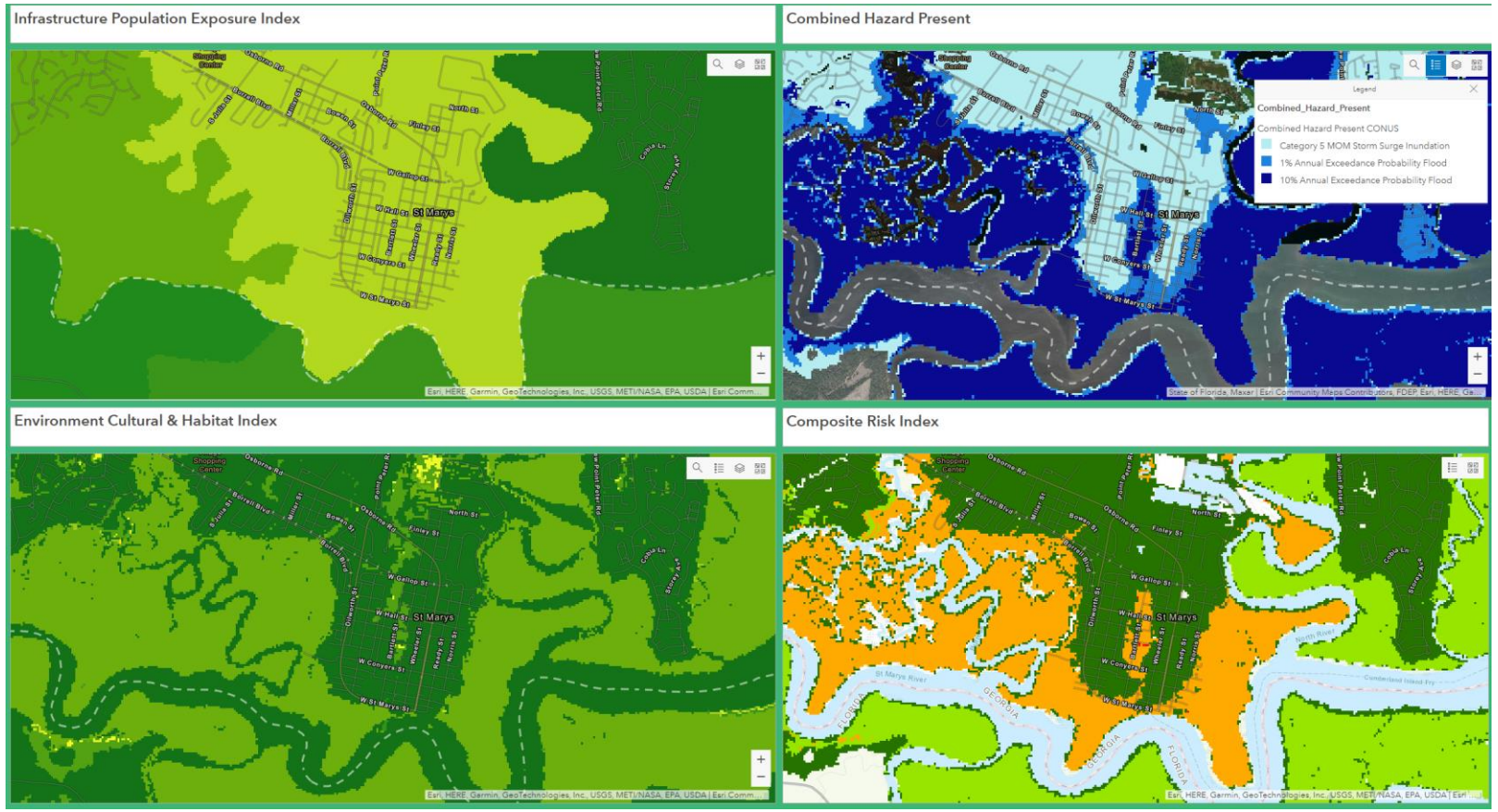
B APPLIED EXERCISE #2: RISK INDEX COMPARISON

Use the "Risk Index Comparison" tab to identify the primary drivers of risk



Select "Risk Index Comparison" tab.

Analyze which AEP hazard or exposure indices are contributing towards the CRI. Note: Population and Exposure Index is weighted at 60%.



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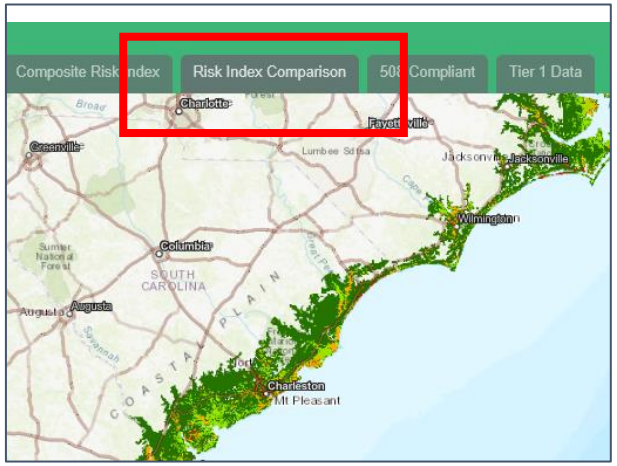

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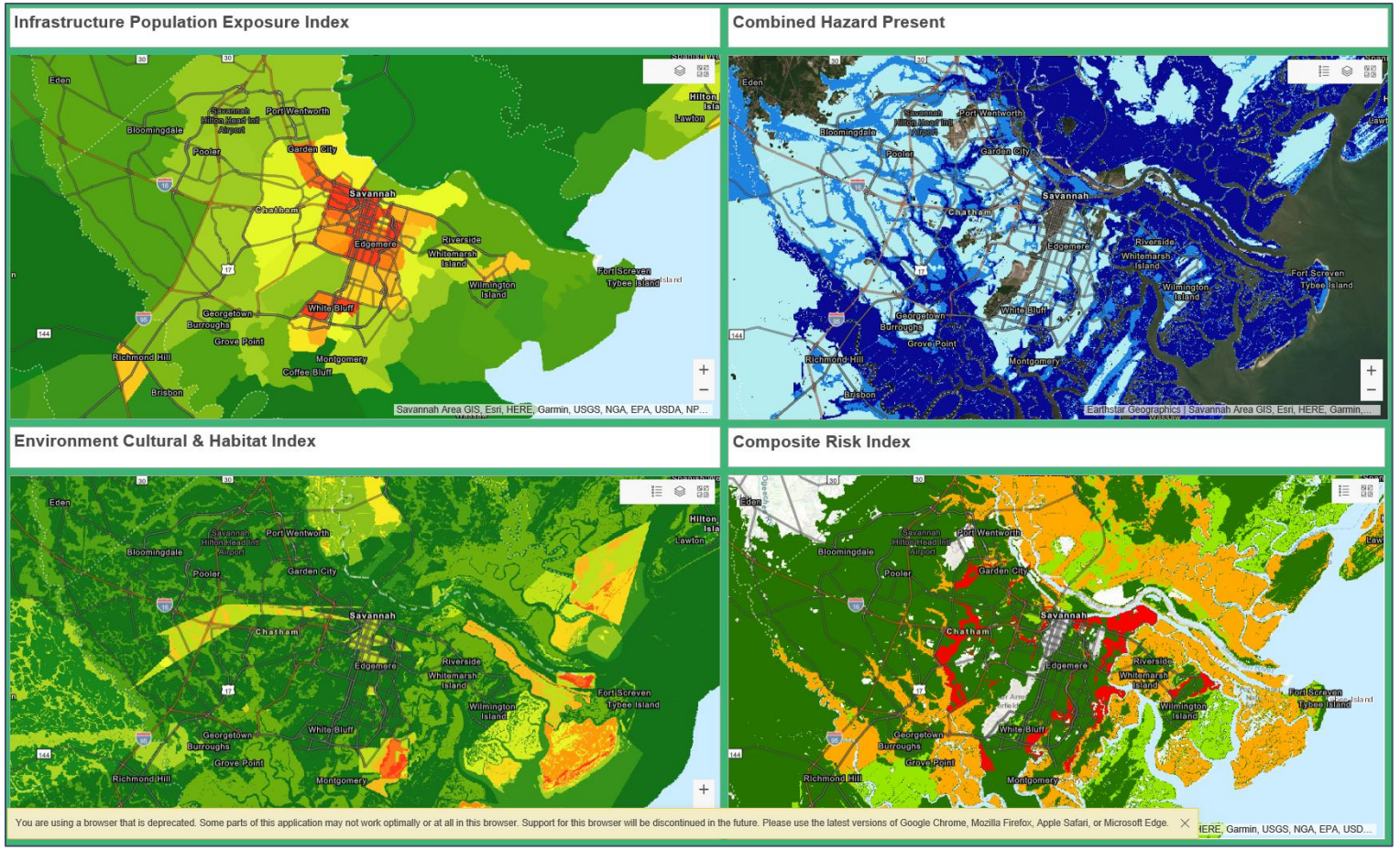

C LEARN MORE

- The South Atlantic Coastal Study (SACS) applies the Tier 1 Risk Assessment to identify potential high-risk locations in the Main Report, Georgia Appendix, and Georgia Focus Area Action Strategies (Chatham County, Glynn County)
- Tier 1 GIS data layers can be downloaded from the geoportal to:
  - Create high resolution maps
  - Conduct additional analyses

Questions?

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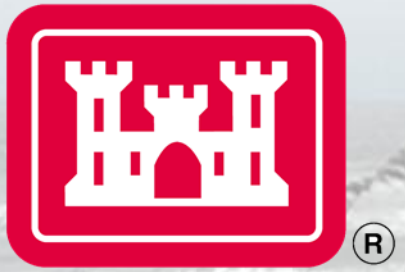
SOUTH ATLANTIC COASTAL STUDY (SACS)
TIER 2 ECONOMIC RISK ASSESSMENT (ERA)

PRESENTED BY IDRIS DOBBS, PLANNER
ECONOMICS BRANCH, JACKSONVILLE DISTRICT

Idris.L.Dobbs@usace.army.mil



A SACS TIER 2 ERA - OVERVIEW

Developed by: USACE and utilizes FEMA's HAZUS model for coastal storm surge inundation

What it does:

- Estimates storm surge inundation risk to public and private property and critical infrastructure
- Helps users to assess/understand the spatial distribution of storm surge risk to economic development in the existing condition and future condition (3 feet of sea level rise added to model)
- Includes all coastal and riverine areas within the zone of tidal influence in GEORGIA and throughout the South Atlantic Division

Caveat? Tier 2 does not consider additional coastal hazards (e.g., erosion, wave attack, compound flooding)

A SACS TIER 2 ERA - OVERVIEW

Input:

- National Structure Inventory (NSI)
- HAZUS (Level-1): North Carolina, South Carolina, Georgia, GEORGIA, Alabama, and Mississippi (CONUS)
- FAST (Flood Assessment Structure Tool): Puerto Rico and U.S. Virgin Islands (OCONUS)

Output:

- Damages aggregated to the Census Place and Census Block Level and expressed in Annual Expected Damages (AED)
- Consequences: $ damage, depreciated losses from 10, 50, 100, and 500-year return periods
- Risk: Expected Annual Damages (EAD) in any given year (if consequence likelihoods and magnitudes are evenly distributed over time)

Incorporating Sea Level Rise

Scenarios presented as a range between low (existing conditions) and high (future)

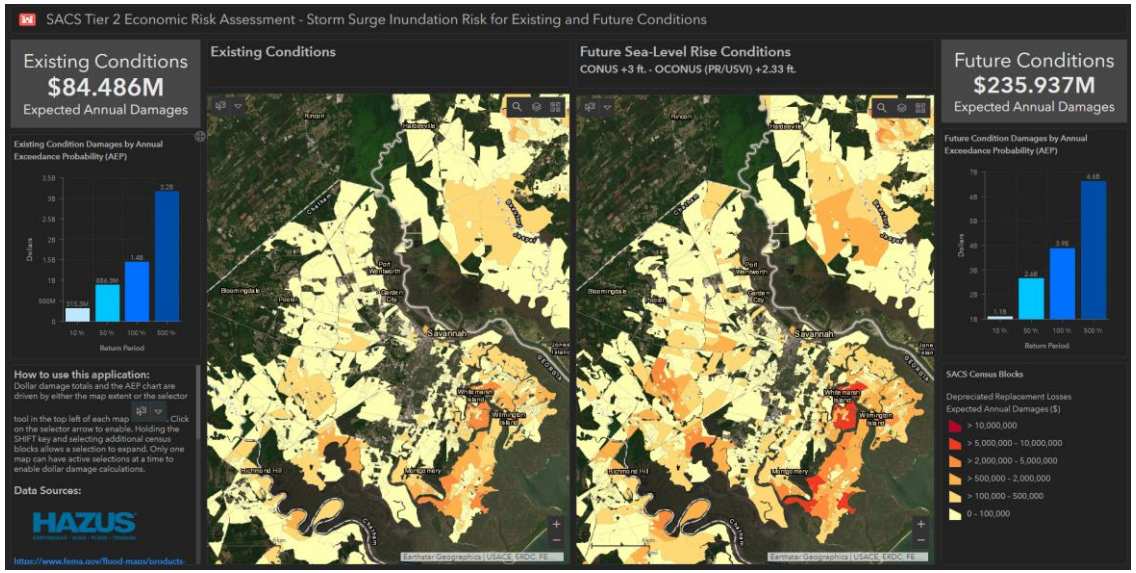
- Existing Conditions (low): no sea level change included
- Future Conditions (high): sea level change included
  - CONUS: 3' of sea level rise
  - OCONUS: 2.33' of sea level rise

A SACS TIER 2 ERA - OVERVIEW

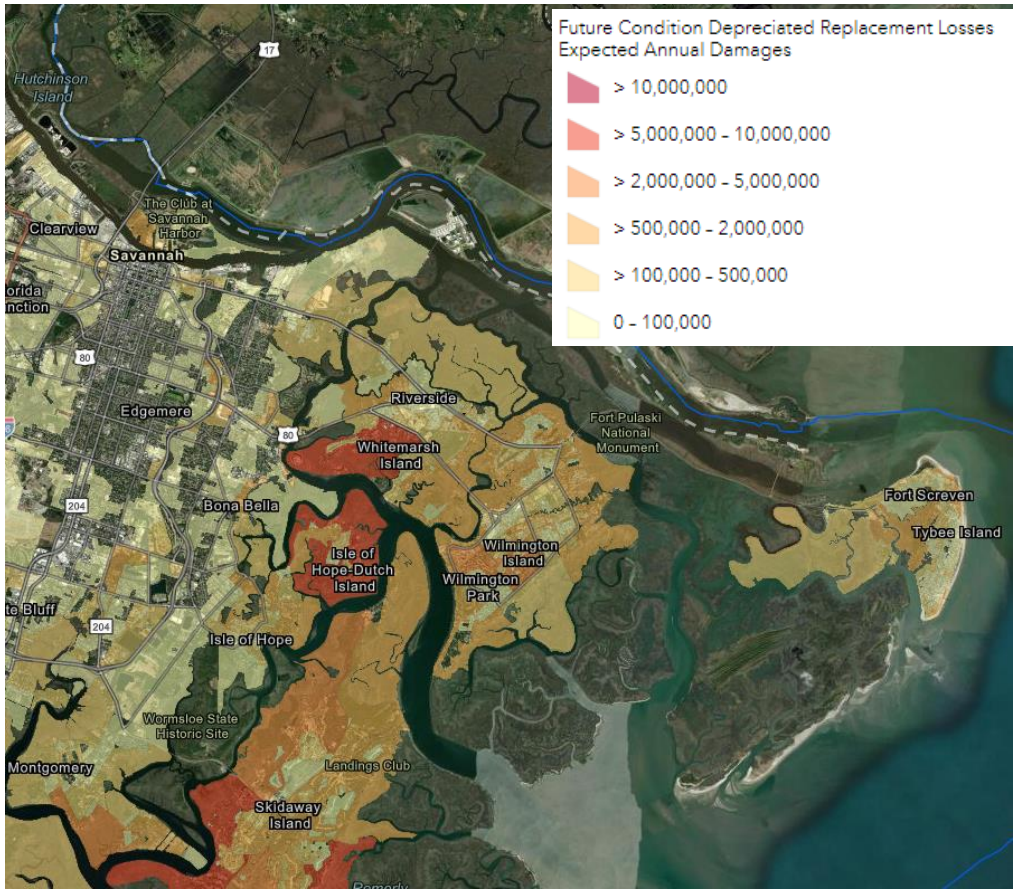
Relationship with Other SACS Products: Pairs with the SACS Measures and Cost Library (MCL) to quantitatively assess the feasibility of coastal risk management solutions/alternative plans to address storm surge inundation risk

Access: Tier 2 ERA report and tools can be accessed through the SACS website and SACS Geoportal (free and publicly accessible)

Date Published: Published in 2020 using FY18 values



ERA Dashboard for Savannah, vicinity

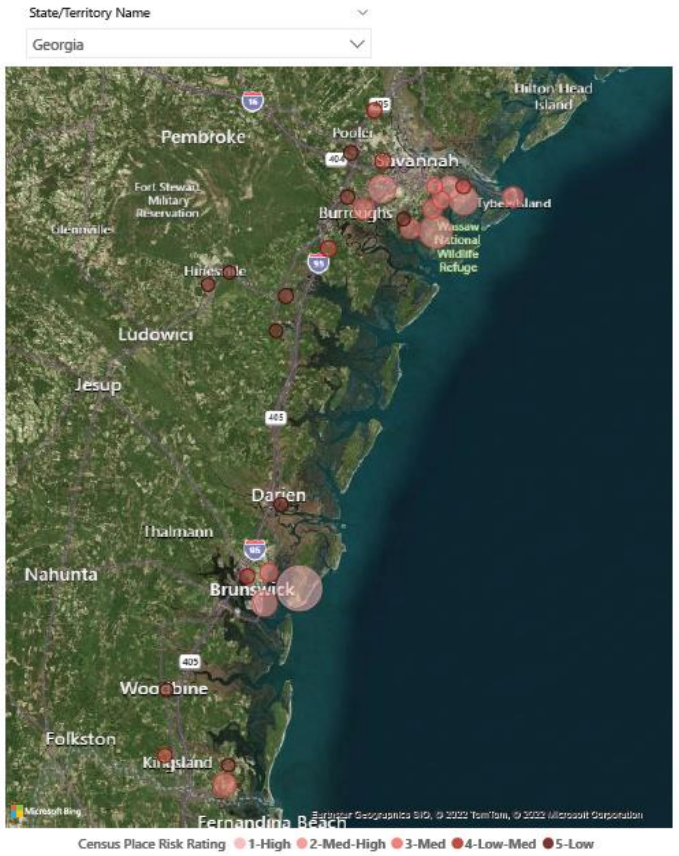


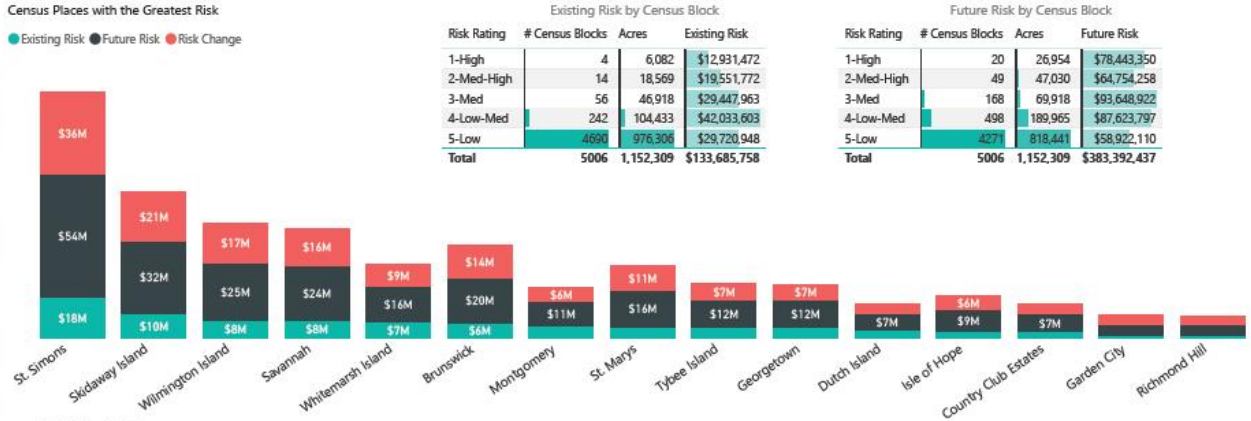
Savannah / Tybee Island area ERA through SACS GIS

A SACS TIER 2 ERA – OVERVIEW/GEORGIA

Georgia:

- **Existing Risk: $134 Million**
- **Future Risk: $383 Million**
- **Comparison of highest risk census places, counties, and planning reaches throughout Georgia**





Existing Risk by Census Block

Risk Rating	# Census Blocks	Acres	Existing Risk
1-High	4	6,082	$12,931,472
2-Med-High	14	18,569	$19,551,772
3-Med	56	46,918	$29,447,963
4-Low-Med	242	104,433	$42,033,603
5-Low	4690	976,306	$29,720,948
Total	5006	1,152,309	$133,685,758

Future Risk by Census Block

Risk Rating	# Census Blocks	Acres	Future Risk
1-High	20	26,954	$78,443,350
2-Med-High	49	47,030	$64,754,258
3-Med	168	69,918	$93,648,922
4-Low-Med	498	189,965	$87,623,797
5-Low	4271	818,441	$58,922,110
Total	5006	1,152,309	$383,392,437

$134M
Existing Risk

$383M
Future Risk

5006
# of Census Blocks

1,152,309
# of Acres Impacted

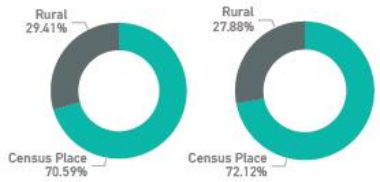
8
# of Counties Impacted

30
Census Places Impacted

1
# of Planning Reaches

Counties with the Greatest Risk

County	% of Existing Risk	% of Future Risk
Chatham	54.32%	51.82%
Glynn	28.95%	30.83%
Camden	6.77%	7.23%
Bryan	3.76%	4.19%
Liberty	3.45%	3.79%
McIntosh	2.74%	2.14%



Existing Return Period Event Consequences by Focus_Area

Focus_Area	EC_DL_10Yr	EC_DL_50Yr	EC_DL_100Yr	EC_DL_500Yr	Existing Risk
Brunswick / Glynn County	$139,988,000	$419,713,784	$628,669,110	$1,425,719,537	$38,698,980
City of Savannah / Chatham County	$307,554,000	$765,949,155	$1,205,214,224	$2,504,602,407	$72,644,411

Future Return Period Event Consequences by Focus_Area

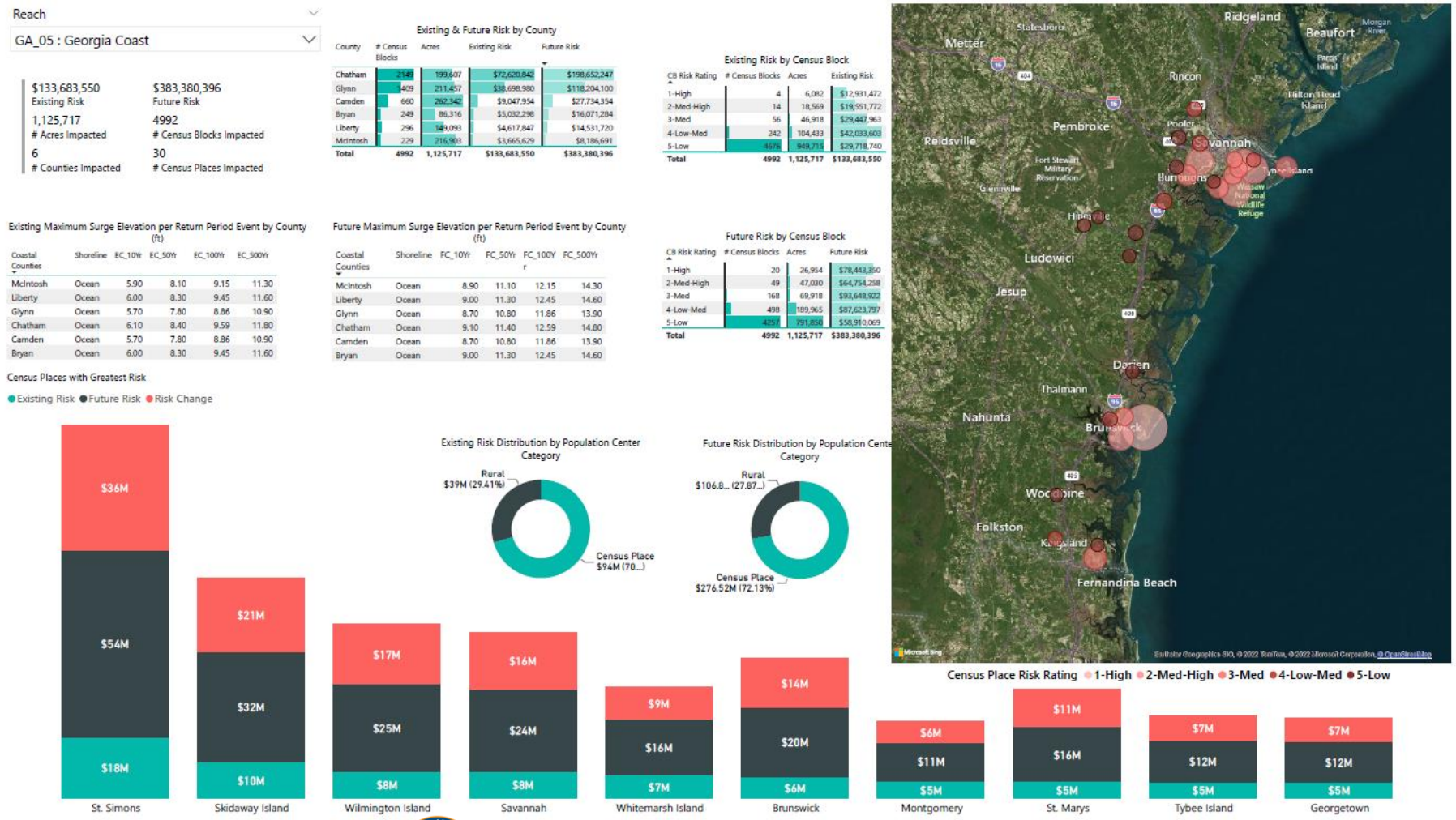
Focus_Area	FC_DL_10Yr	FC_DL_50Yr	FC_DL_100Yr	FC_DL_500Yr	Future Risk
Brunswick / Glynn County	$580,533,828	$1,355,662,402	$1,872,728,886	$2,853,896,517	$118,204,100
City of Savannah / Chatham County	$993,007,688	$2,208,700,782	$3,201,005,648	$5,135,735,593	$198,735,299

A

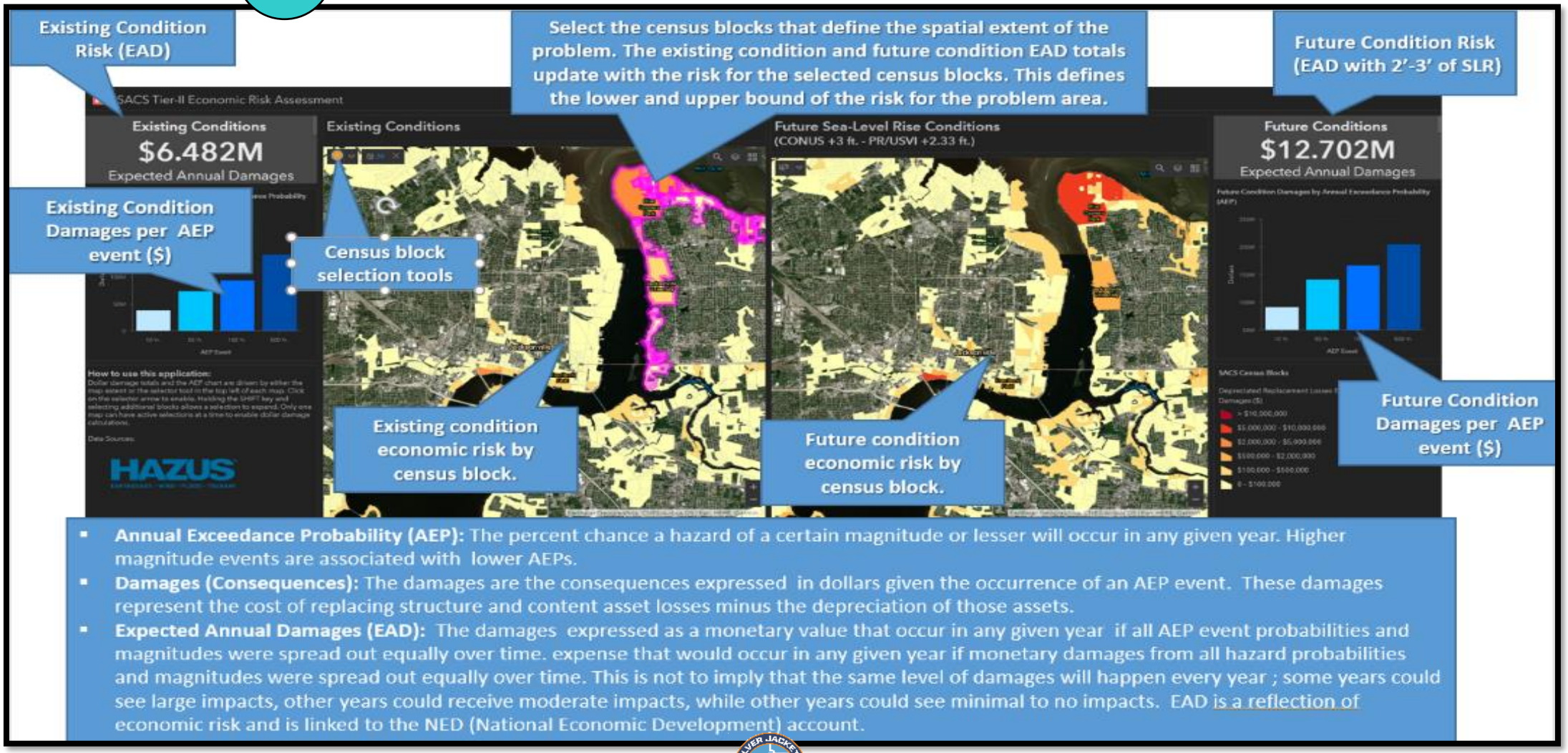
SACS TIER 2 ERA – OVERVIEW/GEORGIA COAST

SACS Planning Reach GA_05 (Georgia Coast):

- Existing Risk: $134 M
- Future Risk: $383 M
- Maximum surge elevation ranges
  - Existing: 5.7ft – 11.8 ft
  - Future: 8.7 ft – 14.8 ft
- Highest risk places include St Simons, Skidway Island, Wilmington Island, Savannah, and Brunswick, etc.



B SACS TIER 2 ERA – HOW TO USE



- **Annual Exceedance Probability (AEP):** The percent chance a hazard of a certain magnitude or lesser will occur in any given year. Higher magnitude events are associated with lower AEPs.
- **Damages (Consequences):** The damages are the consequences expressed in dollars given the occurrence of an AEP event. These damages represent the cost of replacing structure and content asset losses minus the depreciation of those assets.
- **Expected Annual Damages (EAD):** The damages expressed as a monetary value that occur in any given year if all AEP event probabilities and magnitudes were spread out equally over time. expense that would occur in any given year if monetary damages from all hazard probabilities and magnitudes were spread out equally over time. This is not to imply that the same level of damages will happen every year ; some years could see large impacts, other years could receive moderate impacts, while other years could see minimal to no impacts. EAD is a reflection of economic risk and is linked to the NED (National Economic Development) account.

B SACS TIER 2 ERA – HOW TO USE

Step1: Clearly define problem/opportunity in terms of:

- Who, What, Where, Why, and How

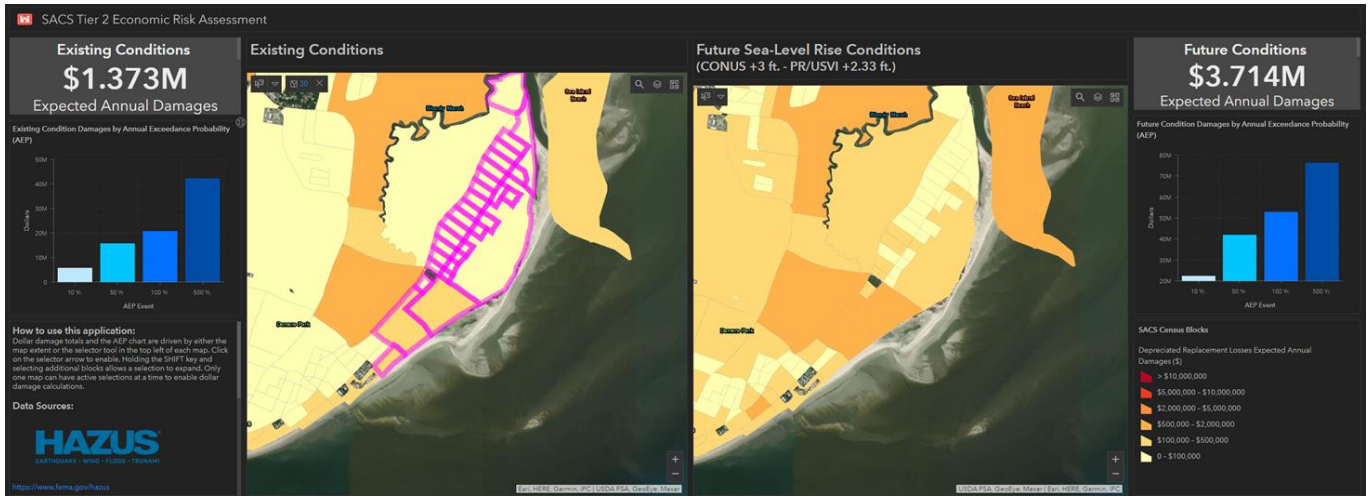
Step 2: Using Tier 2 ERA web app tools, select census blocks that define the extent of the problem

Step 3: Record range of risk

- Risk between $1.4M (existing condition/low range) - $3.7M (future condition/high range)
- Record range of consequences per return period (user discretion)

Steps 4 – 6 : Continued with discussion of the SACS MCL

Problem: Damages to property & infrastructure adjacent to Goulds inlet from storm surge , waves, and erosion

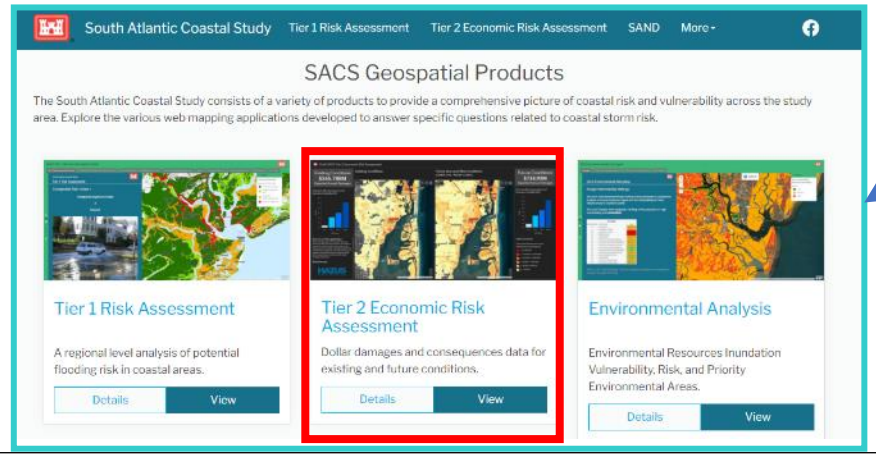


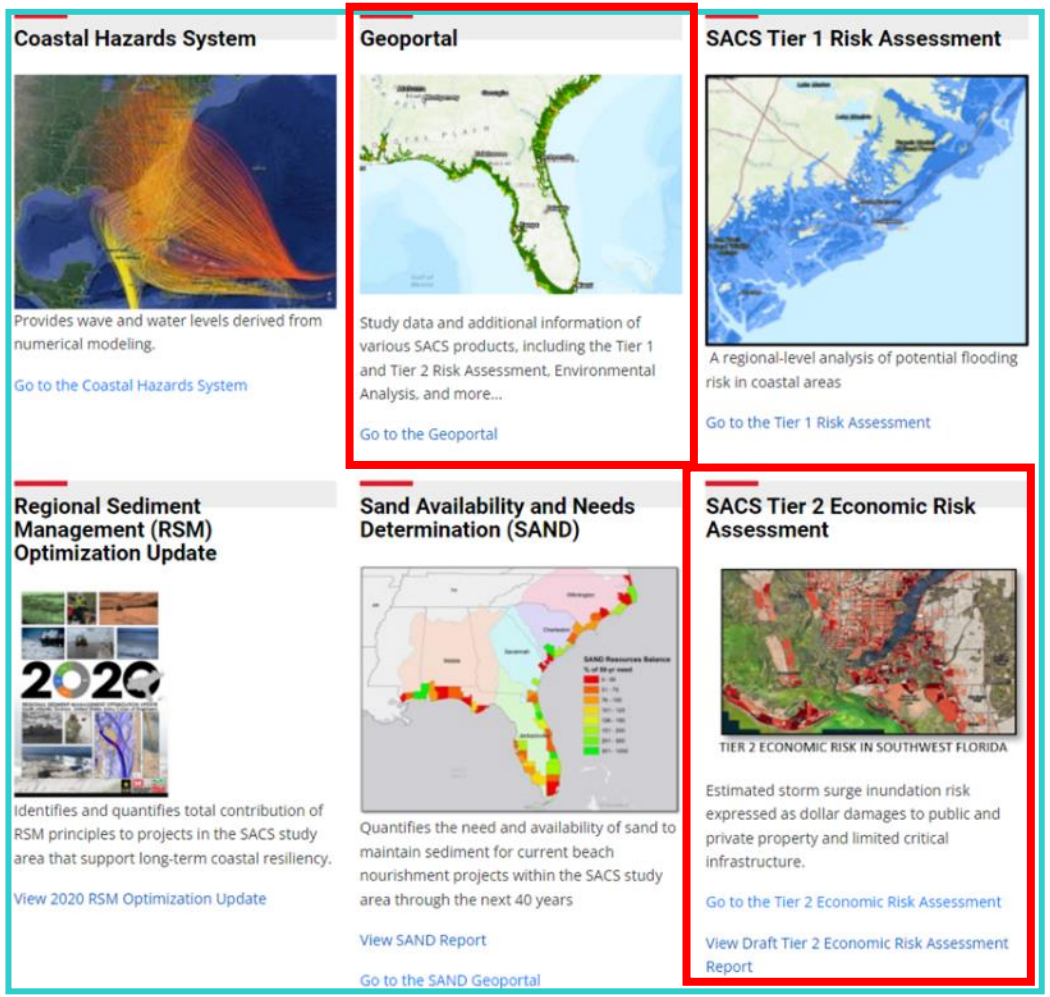
C APPLIED EXERCISES AND ACCESSING THE TOOL

- **Problem:** Damages to property & infrastructure adjacent to Goulds inlet from storm surge , waves, and erosion

Open the Tier 2 Economic Risk Assessment Report and Dashboard through the SACS website and SACS Geoportal:

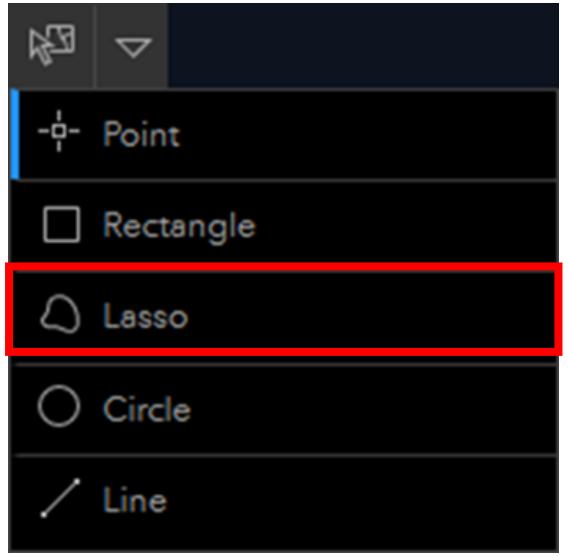
https://www.sad.usace.army.mil/SACS/





C APPLIED EXERCISE #1: SELECTING CENSUS BLOCKS

- Use the Lasso shape selection to determine the potential economic risk range from storm surge inundation for the southern tip of St. Simons Island, Ga.



Step 1

Click on drop-down menu in upper left-hand corner of dashboard and select the lasso shape in order to draw around specific census blocks on interest

Step 2

Draw an eclipse around the southern portion of St Simons Island with the lasso selection and assess the data outputs which provide the existing and future expected annual damages (EAD) (Note: Highlighting census places in one map will also apply to the other map)

Step 3

The economic risk ranges from $11.1M (existing conditions) - $35.7M (future condition with 3 feet of sea level rise) using outputs from the ERA web tool

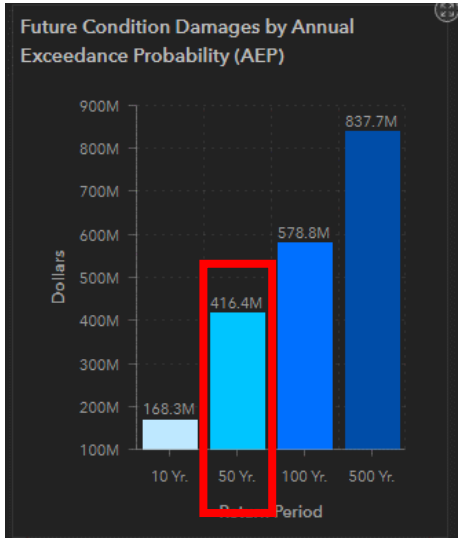
C APPLIED EXERCISE #2: IDENTIFY SPECIFIC AEP DAMAGES

Use the blue bar graphs in the ERA dashboard to determine the amount of economic damages(consequences) associated with the 5% (50-year) AEP to the selected St Simons Island Area with 3 feet of sea level rise

*** AEP: Annual exceedance probability**

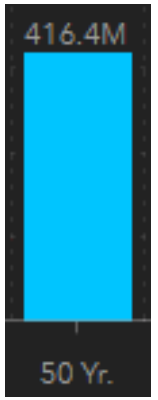
Step 1

Building off the last applied exercise, circle the City of St. Augustine census blocks and zoom into the blue bar graphs associated with the future condition outputs (right-hand map)



Step 2

The bar graphs show the damage from the 10, 50, 100, and 500-year AEP storms with 3-feet of sea level rise (the 50-year is the second bar from the left)



$416,400,000 *Total Damages*

Step 3

The total economic damages associated with a 50-year storm are $416.4 Million

D LEARN MORE

- The SACS Tier 2 Economic Risk Assessment report and dashboard are available through the SACS Website: https://www.sad.usace.army.mil/SACS/
- The South Atlantic Coastal Study (SACS) applies the Tier 2 Economic Risk Assessment to identify potential high-risk locations in the Main Report, GEORGIA Appendix, and Georgia Focus Area Action Strategies
- Tier 2 ERA GIS data layers can be downloaded from the geoportal to:
  - Create high resolution maps
  - Conduct additional analyses

Questions?

Coastal Flood Exposure Mapper

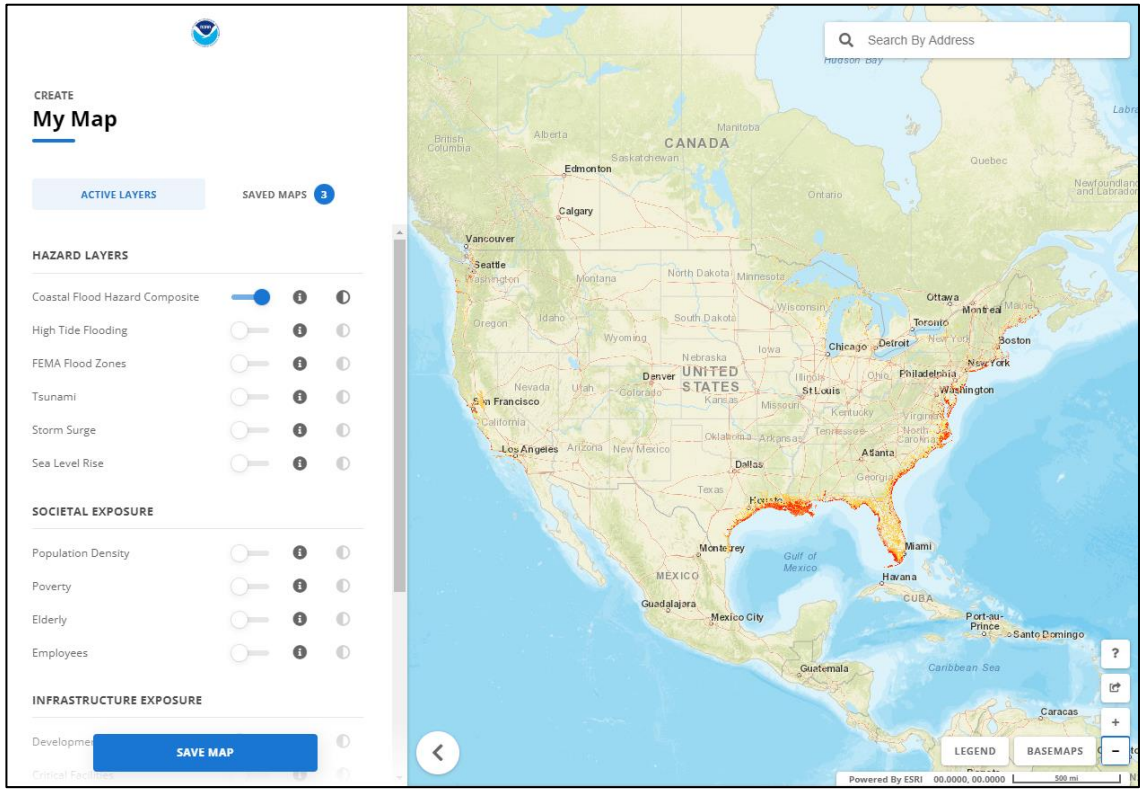
John McCombs

NOAA Office for Coastal Management

John.McCombs@NOAA.gov

Outline

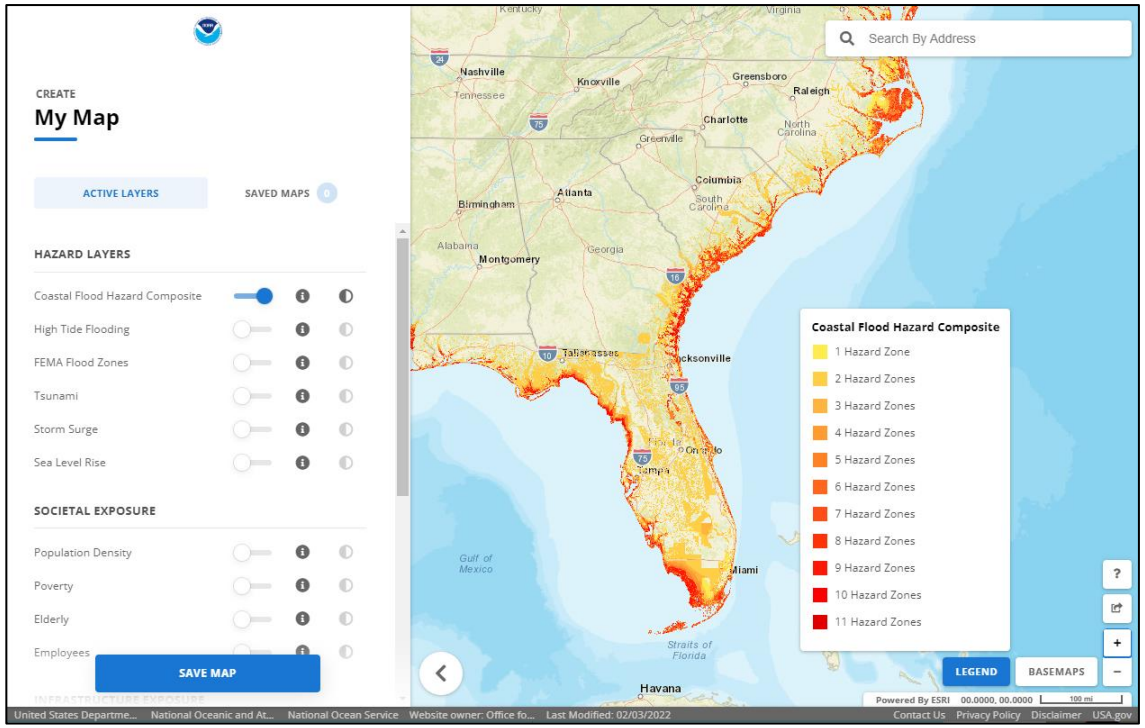
- Overview of Tool
- Description of Layers
- Georgia Focused Examples
- FEMA Community Rating System



[Coastal Flood Exposure Mapper]

Tool Overview

- **Developed by:** NOAA Office for Coastal Management
- **What it Does:** 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.
- **Access:** coast.noaa.gov/floodexposure/
- **Input:** National-level data sets
- **Output:** Customizable maps
- **Date Published/Update:** 2022
- **Additional Software/Hardware Requirements:** None
- **Special Permissions Needed:** None
- **Caveats?** intended to support screening-level analysis



[Coastal Flood Exposure Mapper]

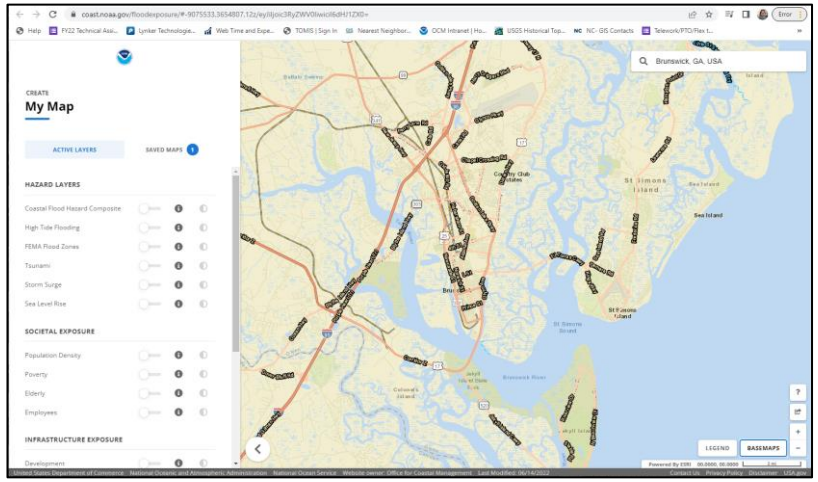
Office for Coastal Management

APPLIED EXERCISE: Infrastructure and Development

- **Your favorite city**
- **Examine Infrastructure features and various Hazards**

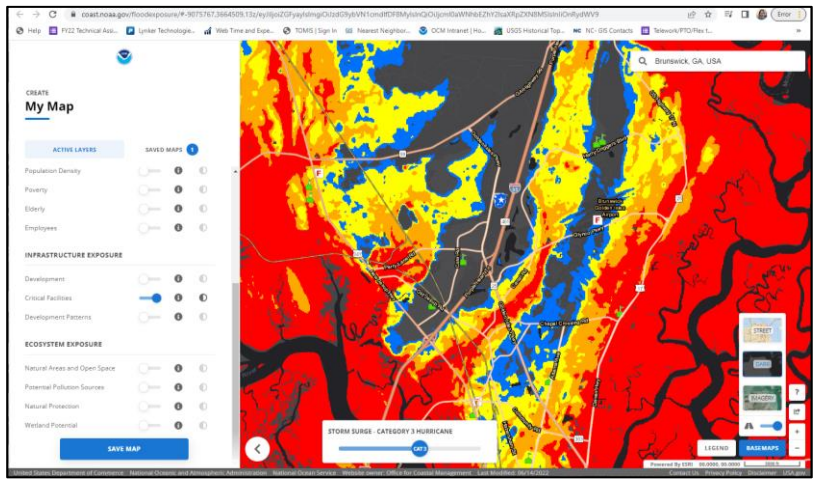
coast.noaa.gov/floodexposure/

APPLIED EXERCISE: Infrastructure and Development



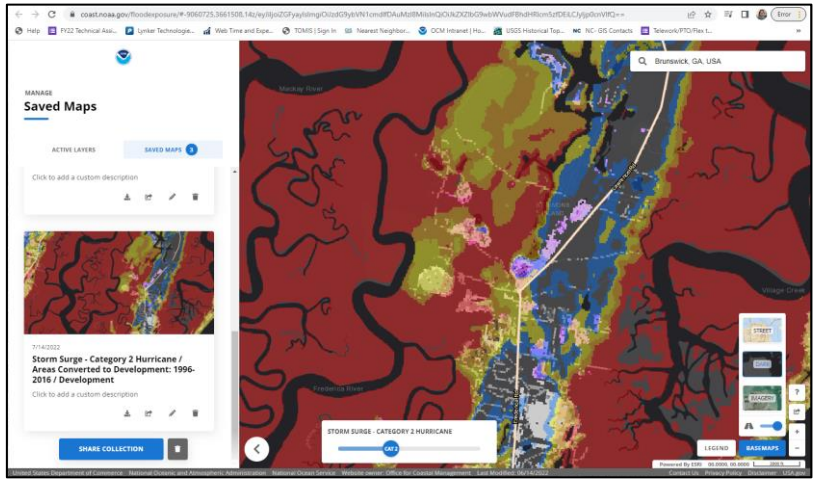
Step 1

Zoom to your area of interest



Step 2

Examine hazards against infrastructure



Step 3

Save maps

Community Rating System

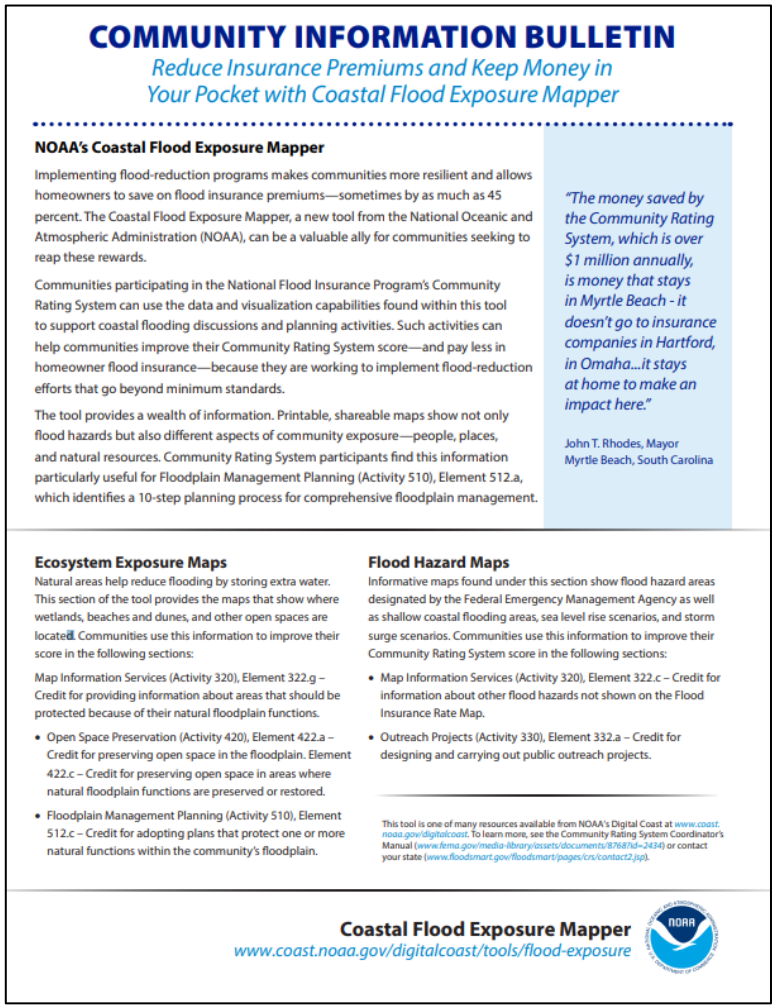
The Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management practices that exceed the minimum requirements of the National Flood Insurance Program (NFIP). Over 1,500 communities participate nationwide.

- 58 communities in Georgia are eligible as of April 2022
- ~14% discount in Special Flood Hazard Areas (SFHA), 6.4% non-SFHA

Community Rating System

The CFEM can be used to support multiple activities with the CRS to help communities receive discounted flood insurance premiums

- Create and provide custom maps of areas at risk
- Perform outreach activities
- Identify open space areas for protection and preservation
- Identify and plan for natural floodplain protection



COMMUNITY INFORMATION BULLETIN

Reduce Insurance Premiums and Keep Money in Your Pocket with Coastal Flood Exposure Mapper

NOAA's Coastal Flood Exposure Mapper

Implementing flood-reduction programs makes communities more resilient and allows homeowners to save on flood insurance premiums—sometimes by as much as 45 percent. The Coastal Flood Exposure Mapper, a new tool from the National Oceanic and Atmospheric Administration (NOAA), can be a valuable ally for communities seeking to reap these rewards.

Communities participating in the National Flood Insurance Program's Community Rating System can use the data and visualization capabilities found within this tool to support coastal flooding discussions and planning activities. Such activities can help communities improve their Community Rating System score—and pay less in homeowner flood insurance—because they are working to implement flood-reduction efforts that go beyond minimum standards.

The tool provides a wealth of information. Printable, shareable maps show not only flood hazards but also different aspects of community exposure—people, places, and natural resources. Community Rating System participants find this information particularly useful for Floodplain Management Planning (Activity 510), Element 512.a, which identifies a 10-step planning process for comprehensive floodplain management.

"The money saved by the Community Rating System, which is over $1 million annually, is money that stays in Myrtle Beach - it doesn't go to insurance companies in Hartford, in Omaha...it stays at home to make an impact here."

John T. Rhodes, Mayor
Myrtle Beach, South Carolina

Ecosystem Exposure Maps

Natural areas help reduce flooding by storing extra water. This section of the tool provides the maps that show where wetlands, beaches and dunes, and other open spaces are located. Communities use this information to improve their score in the following sections:

Map Information Services (Activity 320), Element 322.g – Credit for providing information about areas that should be protected because of their natural floodplain functions.

- Open Space Preservation (Activity 420), Element 422.a – Credit for preserving open space in the floodplain. Element 422.c – Credit for preserving open space in areas where natural floodplain functions are preserved or restored.
- Floodplain Management Planning (Activity 510), Element 512.c – Credit for adopting plans that protect one or more natural functions within the community's floodplain.

Flood Hazard Maps

Informative maps found under this section show flood hazard areas designated by the Federal Emergency Management Agency as well as shallow coastal flooding areas, sea level rise scenarios, and storm surge scenarios. Communities use this information to improve their Community Rating System score in the following sections:

- Map Information Services (Activity 320), Element 322.c – Credit for information about other flood hazards not shown on the Flood Insurance Rate Map.
- Outreach Projects (Activity 330), Element 332.a – Credit for designing and carrying out public outreach projects.

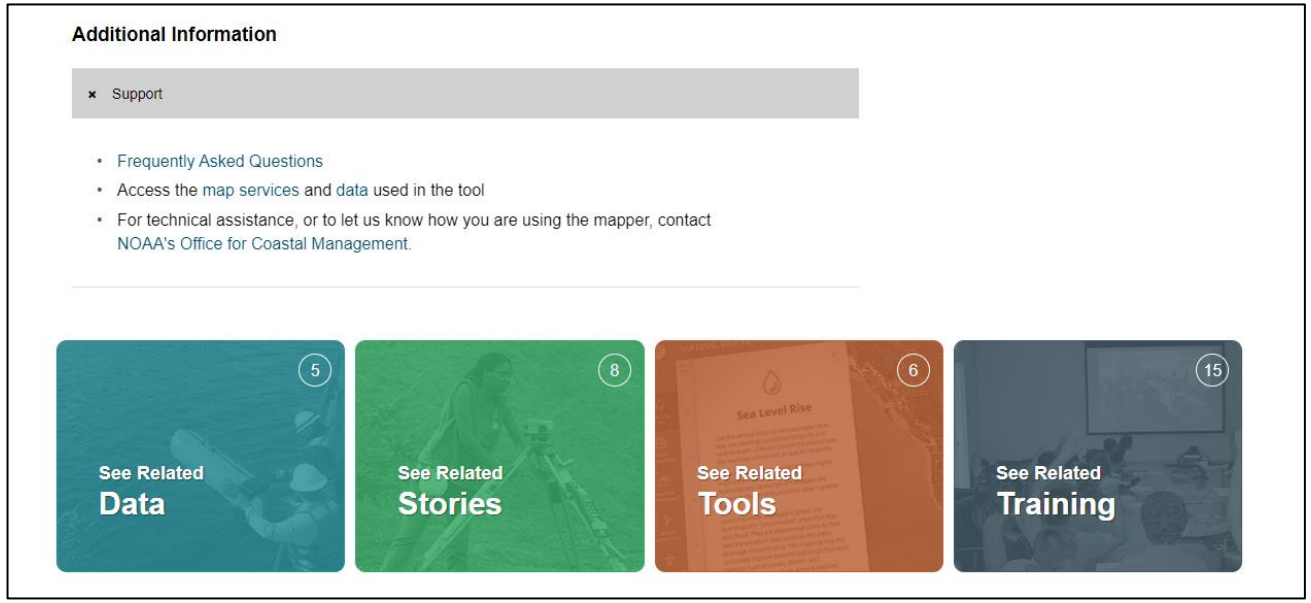
This tool is one of many resources available from NOAA's Digital Coast at www.coast.noaa.gov/digitalcoast. To learn more, see the Community Rating System Coordinator's Manual (www.fema.gov/media-library/assets/documents/87687?id=2434) or contact your state (www.floodsmart.gov/floodsmart/pages/crs/contact2.jsp).

Coastal Flood Exposure Mapper
www.coast.noaa.gov/digitalcoast/tools/flood-exposure

[CFEM for CRS]

LEARN MORE

- https://coast.noaa.gov/digitalcoast/tools/flood-exposure.html
- Data: Links to all the Exposure data and information
- Stories: Identifying Areas Vulnerable to Sea Level Rise in Georgia, Identifying Infrastructure Vulnerable to Shallow Coastal Flooding in South Carolina
- Training: Adaptation Planning for Coastal Communities, How to Map Open Space for Community Rating System



QUESTIONS?

NOAA OFFICE FOR COASTAL MANAGEMENT

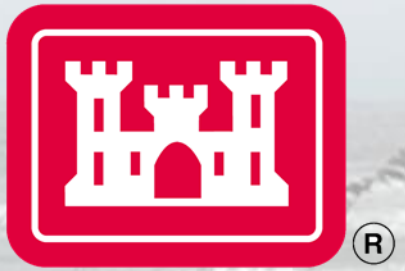
JOHN.MCCOMBS@NOAA.GOV

ASSESS | COMMUNICATE | ADDRESS

Coastal Hazards System

PRESENTED BY Drew Condon, Ph.D., P.E. – Research Civil Engineer
U.S. ARMY CORPS OF ENGINEERS | Coastal Hydraulics Lab

andrew.j.condon@usace.army.mil



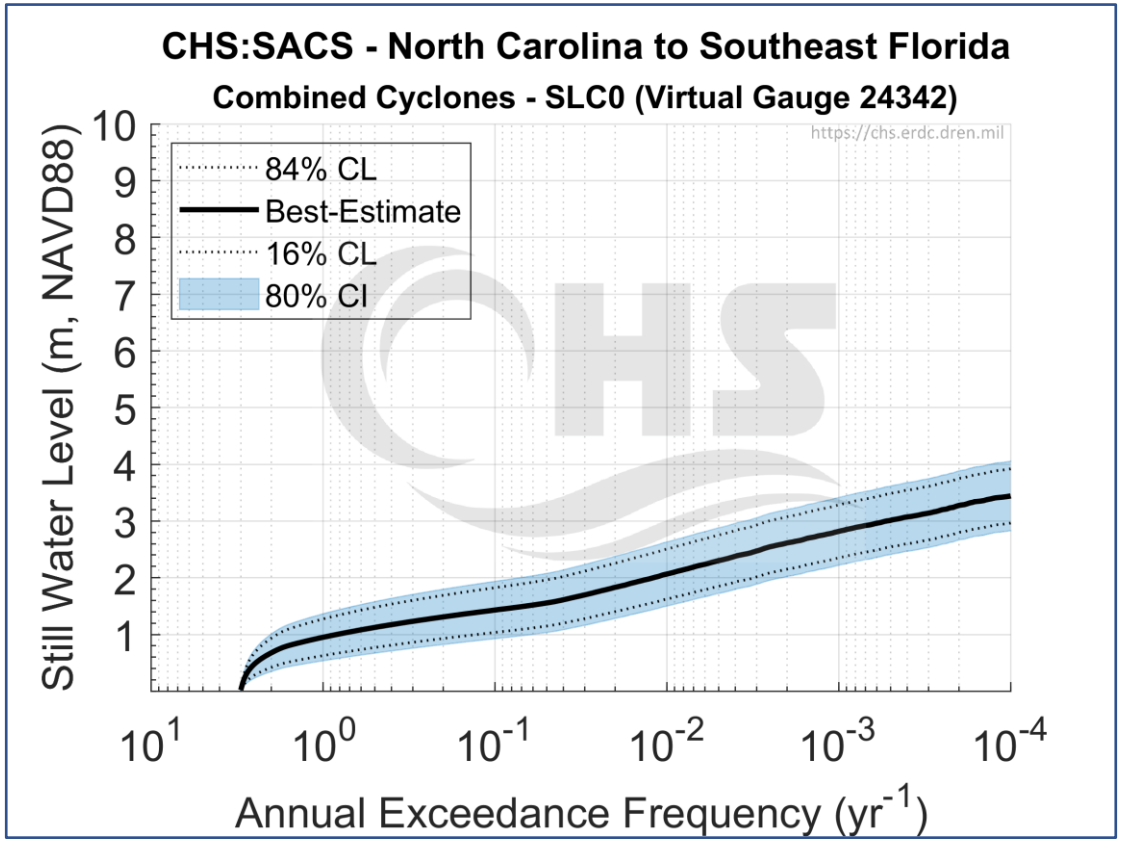
PRESENTATION OUTLINE

A. Overview of Product/Tool
B. Applied Exercise (How to Use)
C. Learn More

Coastal Hazards System Publications and Website

A COASTAL HAZARDS SYSTEM- OVERVIEW

- **Developed by:** USACE – Engineering Research and Development Center Coastal Hazards Group
- **What it Does:** Provides consistent assessment of coastal hazards caused by storm surge and wave attack under current day and future sea levels across USACE South Atlantic Division (NC to FL to MS, including PR and USVI)
- **Access:** https://chs.erdc.dren.mil/
- **Input:** High-fidelity hydrodynamic and wave modeling of probabilistically defined cyclones under current day and future sea level
- **Output:** Time series and peak values of model results; Annual Exceedance Frequencies – 1000's of save points
- **Date Published/Update:** 2021
- **Additional Software/Hardware Requirements:** Chrome, Edge, Firefox, Safari
- **Special Permissions Needed:** None
- **Caveats?** Regional scale – follow-on site-specific assessments may be needed



A COASTAL HAZARDS SYSTEM – OVERVIEW continued

What is the Coastal Hazards System

- CHS is a national-scale effort for the quantification of coastal storm hazards and distribution of Probabilistic Coastal Hazard Analysis (PCHA) results and statistics.
- Provides a centralized location for PCHA data to support feasibility studies, economics analyses, evaluation of nature-based features, stochastic engineering designs, and risk and resilience assessments

CHS Components

- PCHA – framework integrating comprehensive characterization of regional storm climatology, advanced joint probability analysis, high-resolution atmospheric and hydrodynamic numerical modeling, and cutting-edge machine learning techniques and metamodels
- Data repository – numerical model output and hazard curves for storm surge, waves, currents, and wind fields associated with tropical and extratropical cyclones.
- Web-tool / website for easy access to results, documentation, and metadata
- https://chs.erdc.dren.mil/

A COASTAL HAZARDS SYSTEM – OVERVIEW continued

Efficient Storm Sampling

Characterization of Storm Climate (Forcing)

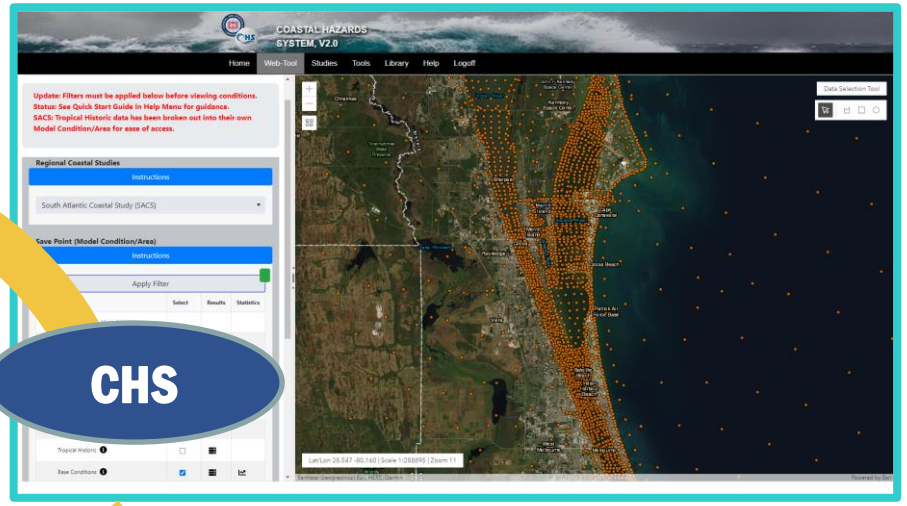
Tropical Cyclones (Synthetic)

Extratropical Cyclones (Historical)

Development of JPM Storm Set

Development of Composite Storm Set

StormSim



CHS

Climate and Hydro Modeling

PBL Cyclone Model (Wind and Pressure Fields)

WW3 (Regional)

ADCIRC

Coupler

STWAVE (Nearshore)

- Water level (storm surge, astronomical tide, SLC)
- Wind speed, direction, currents
- Wave height, period, direction

CSTORM

Response Statistics

Combined Joint Probability

Annual Exceedance Frequency Confidence Levels

StormSim

A COASTAL HAZARDS SYSTEM – OVERVIEW continued

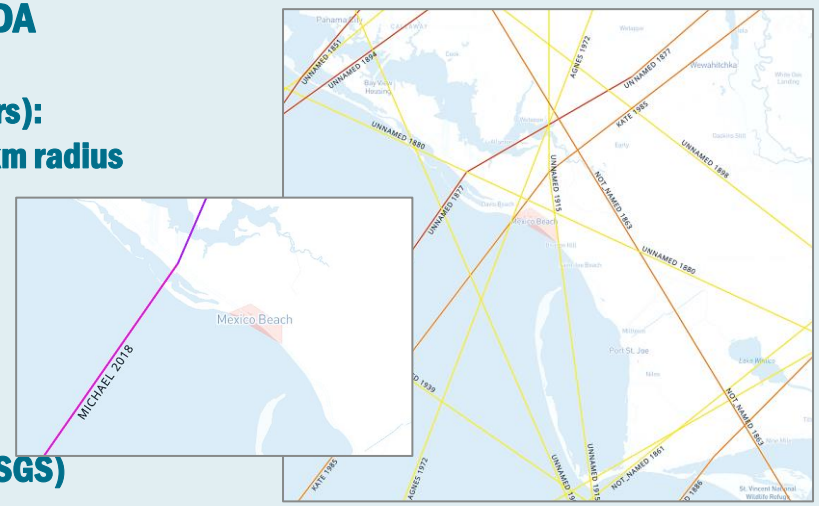
Probabilistic Coastal Hazard Analysis (PCHA)

- **Why use synthetic storms?**
  - Tropical Cyclone (TC) hazard is spatially and temporally underrepresented in historical record.
- **Joint probability method (JPM) is the standard Joint Probability Analysis (JPA) model approach for TCs.**
  - JPM-OS (Resio 2007; Toro 2008)
  - USACE PCHA (Nadal-Caraballo et al. 2014, 2020).
- **Standard TC Forcing Parameters.**
  - Track position (reference location, x_0)
  - Track angle (heading direction, θ)
  - Intensity (central pressure deficit, Δp)
  - Size (radius of maximum winds, R_{max})
  - Translational speed, V_t
- **TCs with Hurricane Michael's characteristics can be represented within JPM probability space.**

MEXICO BEACH, FLORIDA

From 1842-2017 (176 years):
- **19 hurricanes within 50 km radius**
- **Only three category 3**

2018:
Hurricane Michael
- **Category 5 at landfall**
- **Measured storm tide**
  15.5 ft, HWMs ~ 19 ft (USGS)

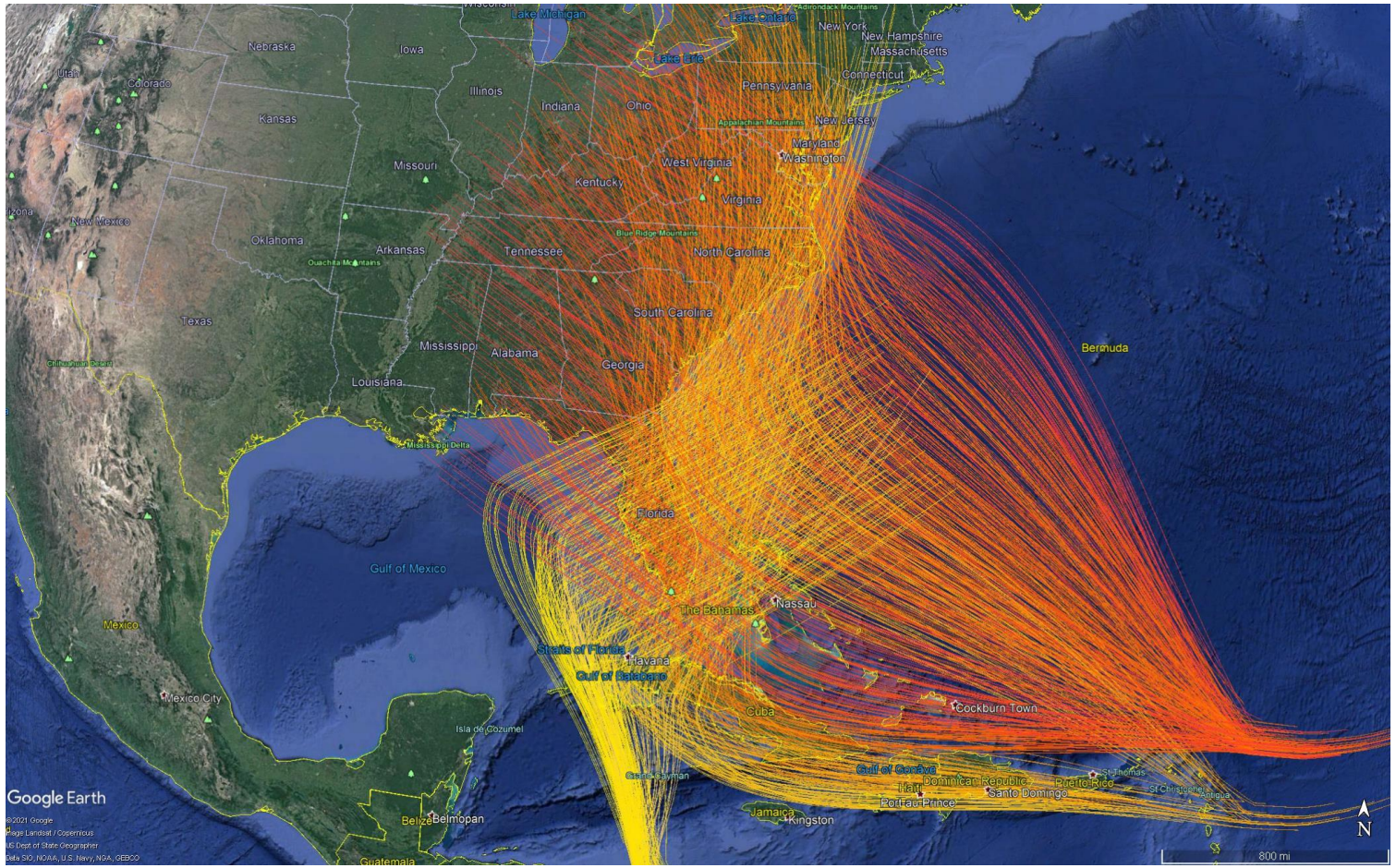


A COASTAL HAZARDS SYSTEM – OVERVIEW continued

SACS CHS Study Domains

- **Puerto Rico / USVI**
  - 300 simulated synthetic tropical cyclones
  - 348,000 augmented suite
- **North Carolina to Southeast Florida**
  - 1,060 simulated synthetic tropical cyclones
  - 1,160,100 augmented suite
- **Southwest Florida to Mississippi**
  - 1,085 simulated synthetic tropical cyclones
  - 1,252,200 augmented suite

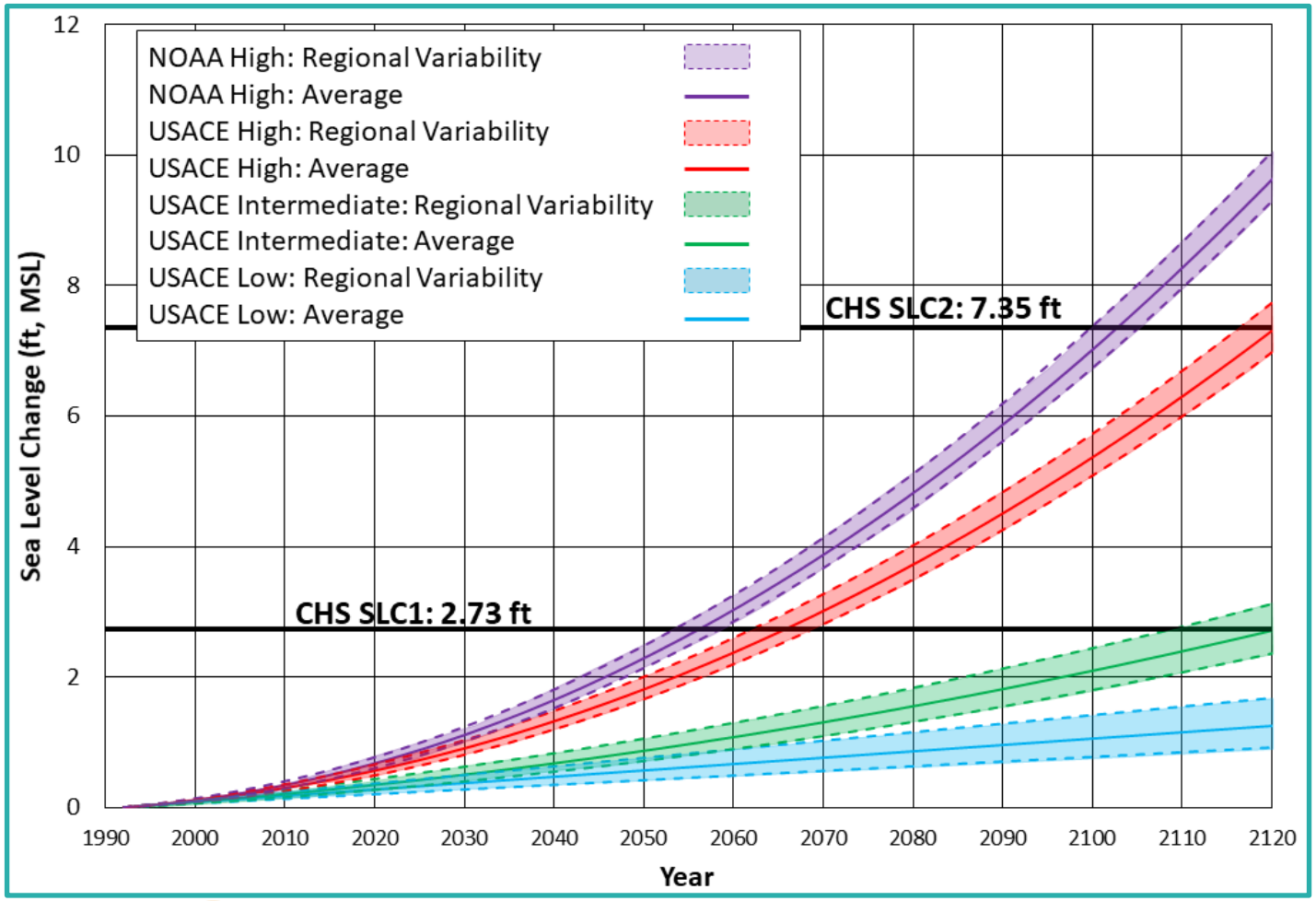
North Carolina to South Florida



A COASTAL HAZARDS SYSTEM – OVERVIEW continued

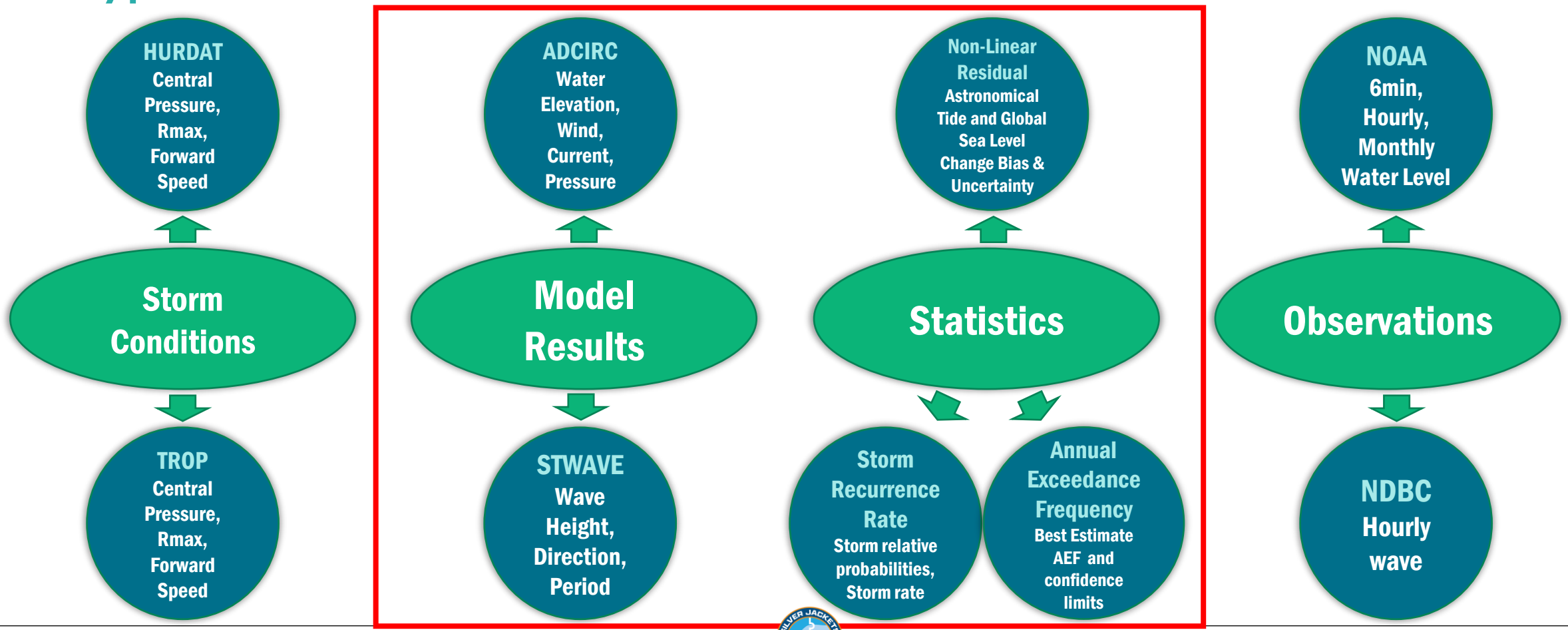
CHS Sea Level Change

- CHS Dynamically Incorporates Sea Level Change
  - Accounts for non-linearities in coupled surge / SLC
- Results available at three initial water levels
  - 0.00 ft of SLC (MSL, 1983 – 2001 tidal epoch)
  - 2.73 ft of SLC
    - ~ 40 – 50 years under USACE High
    - ~ 100 years under USACE Intermediate
  - 7.35 ft SLC
    - ~ 100 years under USACE High



A COASTAL HAZARDS SYSTEM – OVERVIEW continued

CHS Types of Data



B APPLIED EXERCISES AND ACCESSING THE TOOL

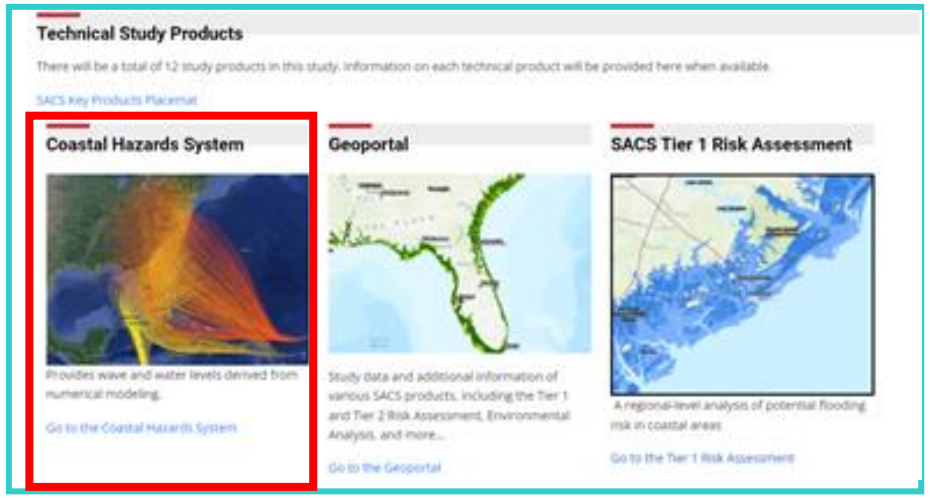
- **Problem: Storm surge inundation annual exceedance frequency (AEF) at Tybee Island for current and future sea level**

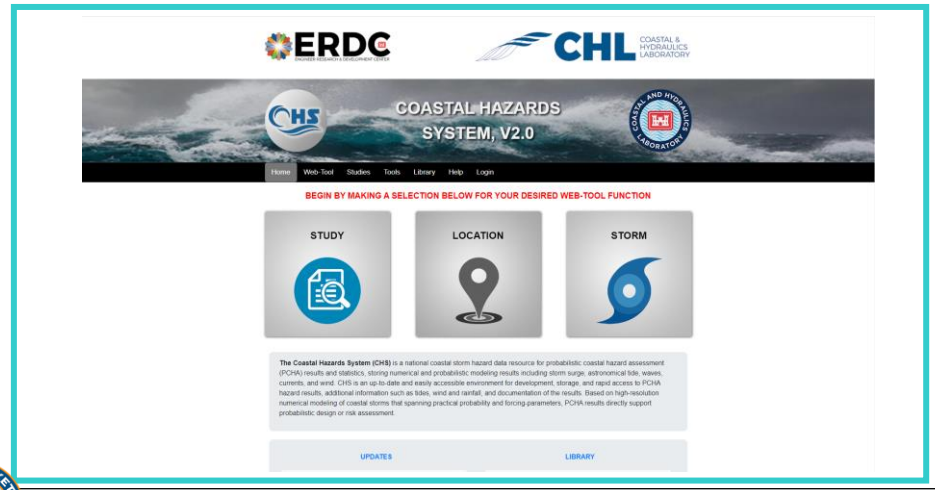
Open the Coastal Hazards System through the SACS website or directly through CHS website:

https://www.sad.usace.army.mil/SACS/

or

https://chs.erdc.dren.mil/

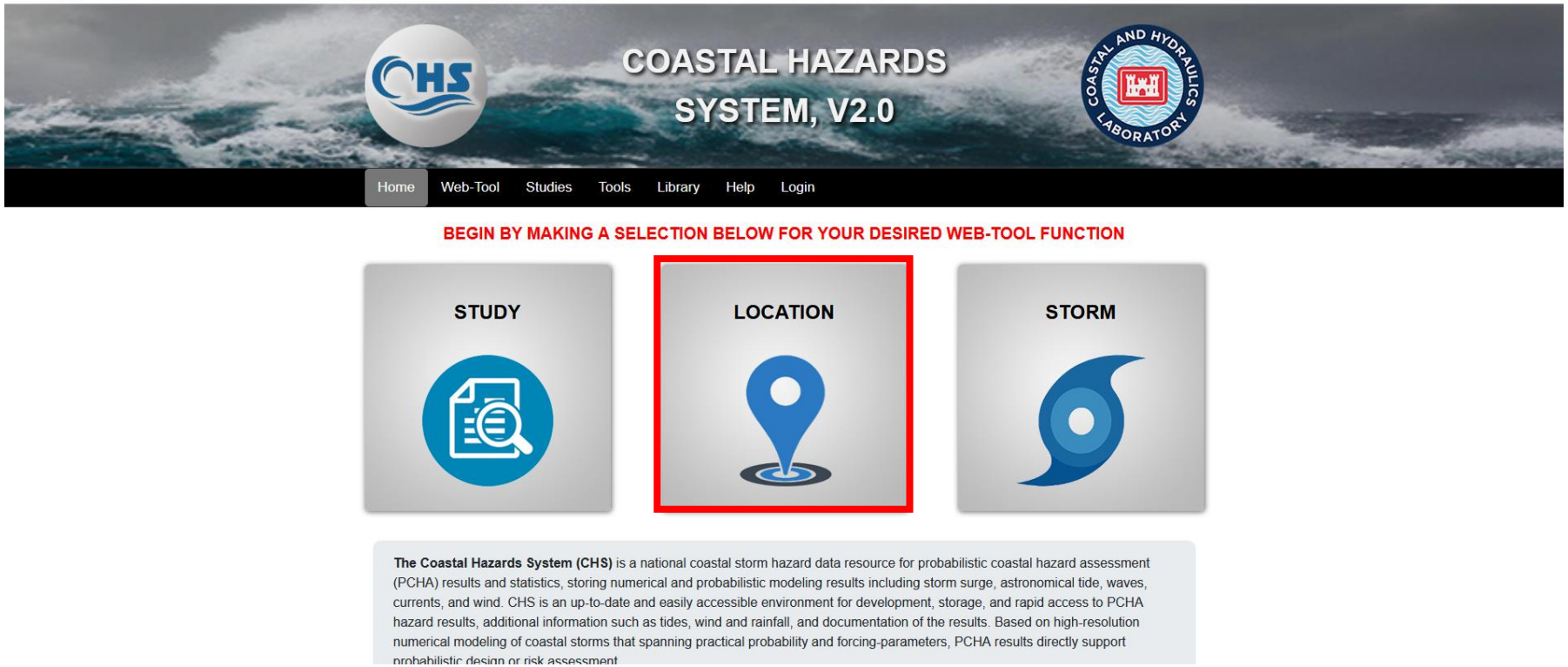




B APPLIED EXERCISE #1: AEFs at Tybee Island

Step 1

- Three options are presented to search for data:
  1) Study
  2) Location
  3) Storm
- Select by Study

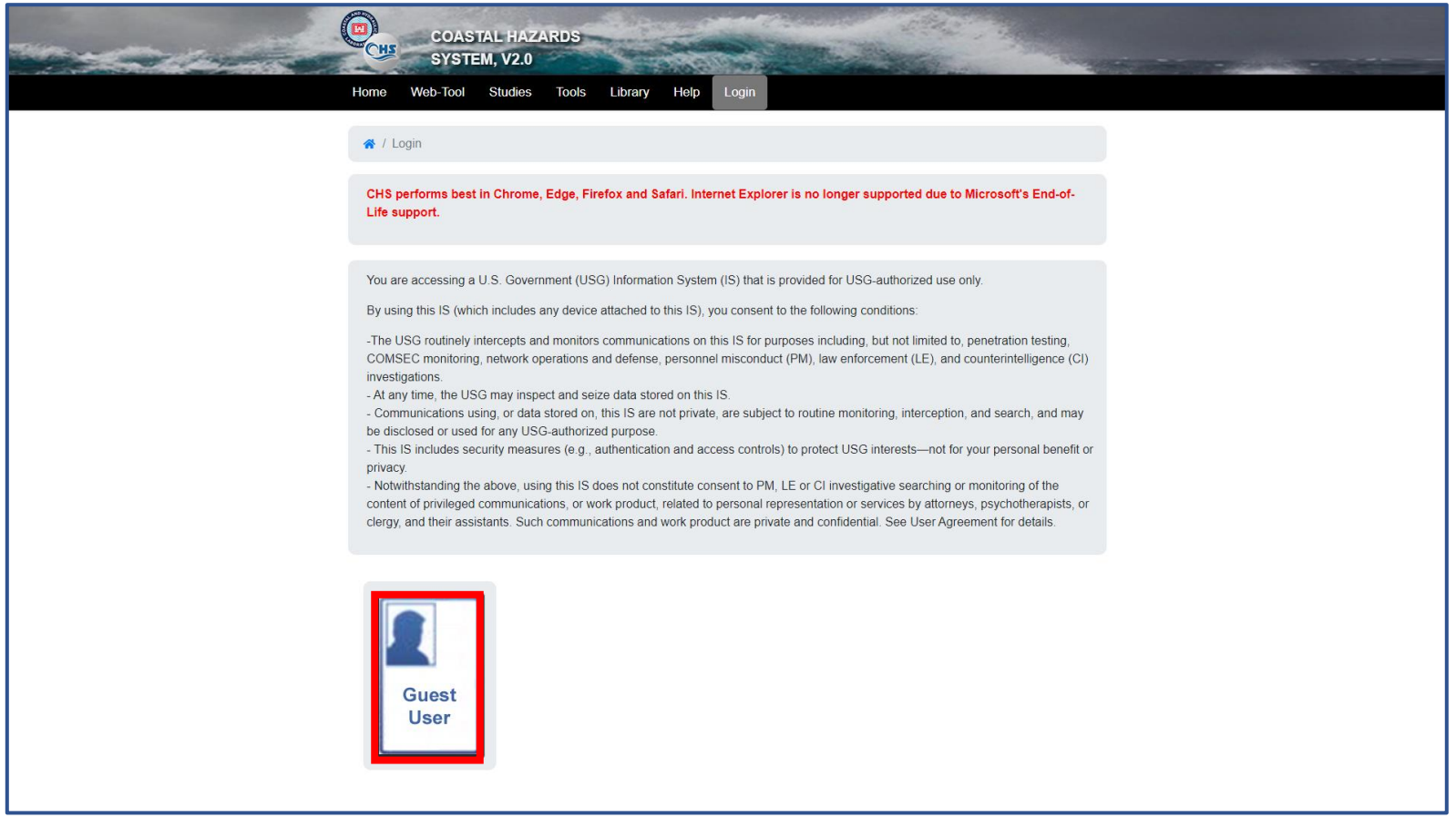


B

APPLIED EXERCISE #1: AEFs at Tybee Island

Step 2

- Select Guest User

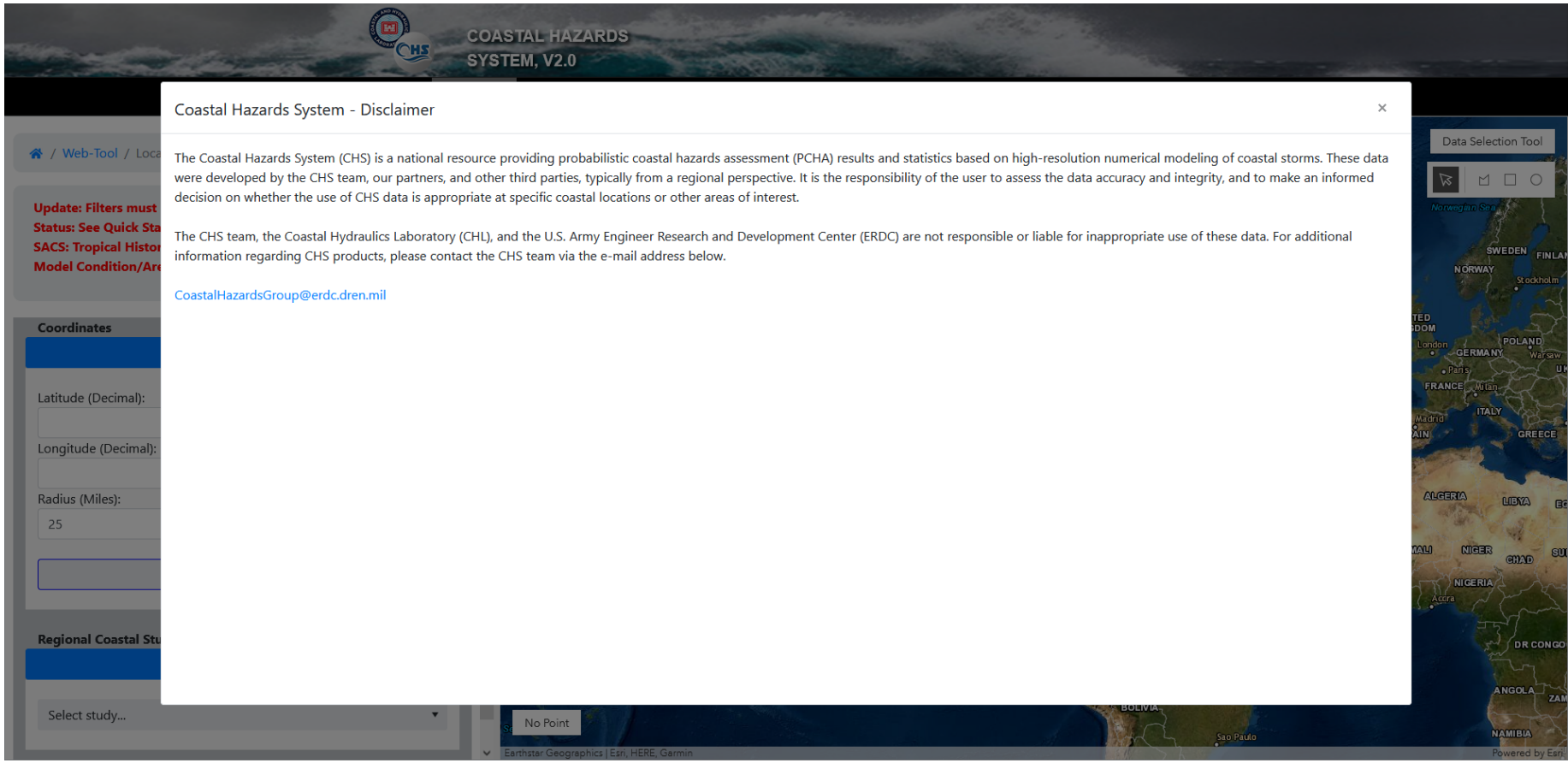


B

APPLIED EXERCISE #1: AEFs at Tybee Island

Step 3

- **Read and close out of the disclaimer**

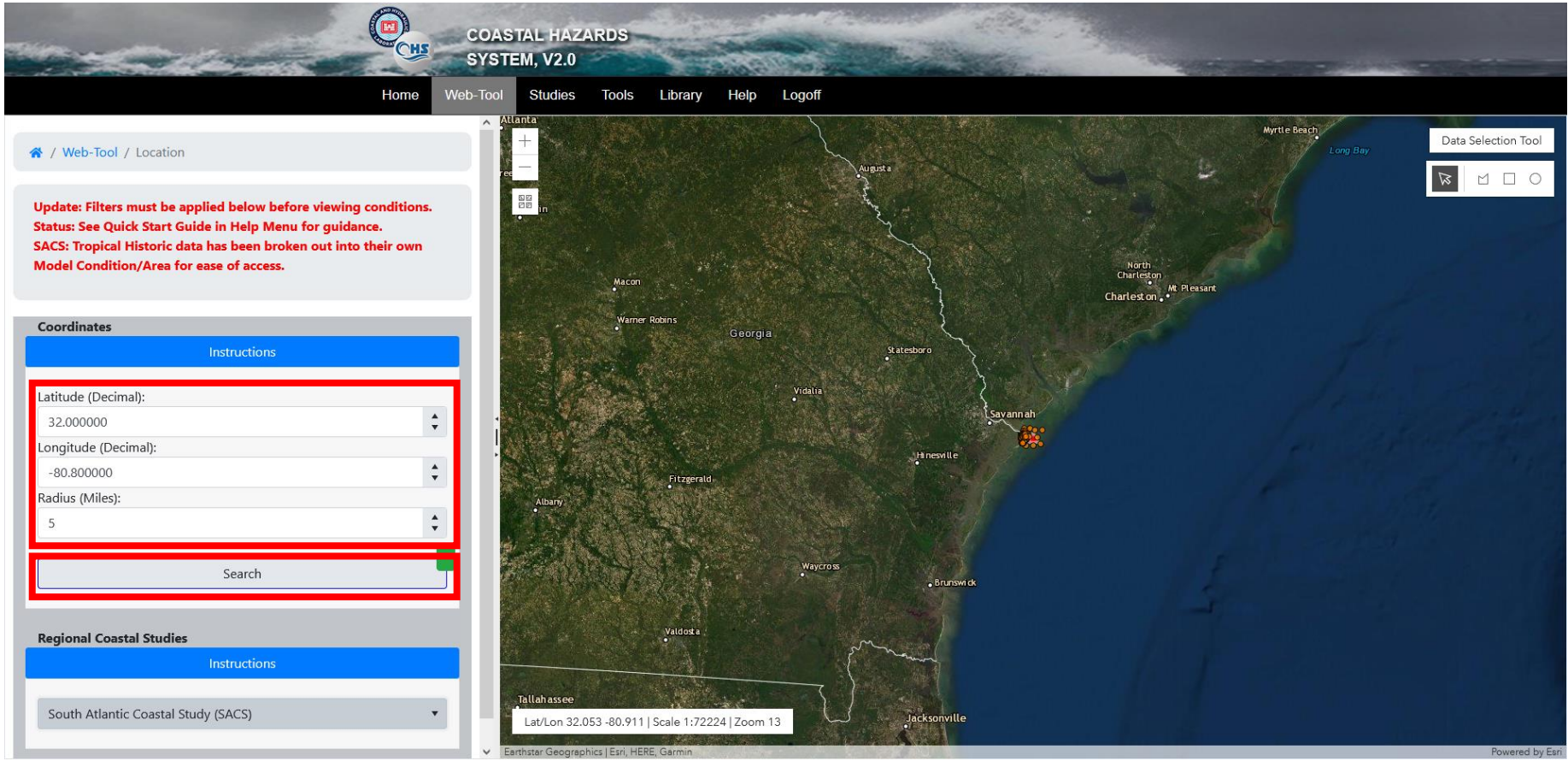


B

APPLIED EXERCISE #1: AEFs at Tybee Island

Step 4

- Enter Latitude and Longitude along with Search Radius for your location of interest
  - Latitude: 32.00°
  - Longitude: -80.80°
  - Radius: 5 Miles
- Select Search

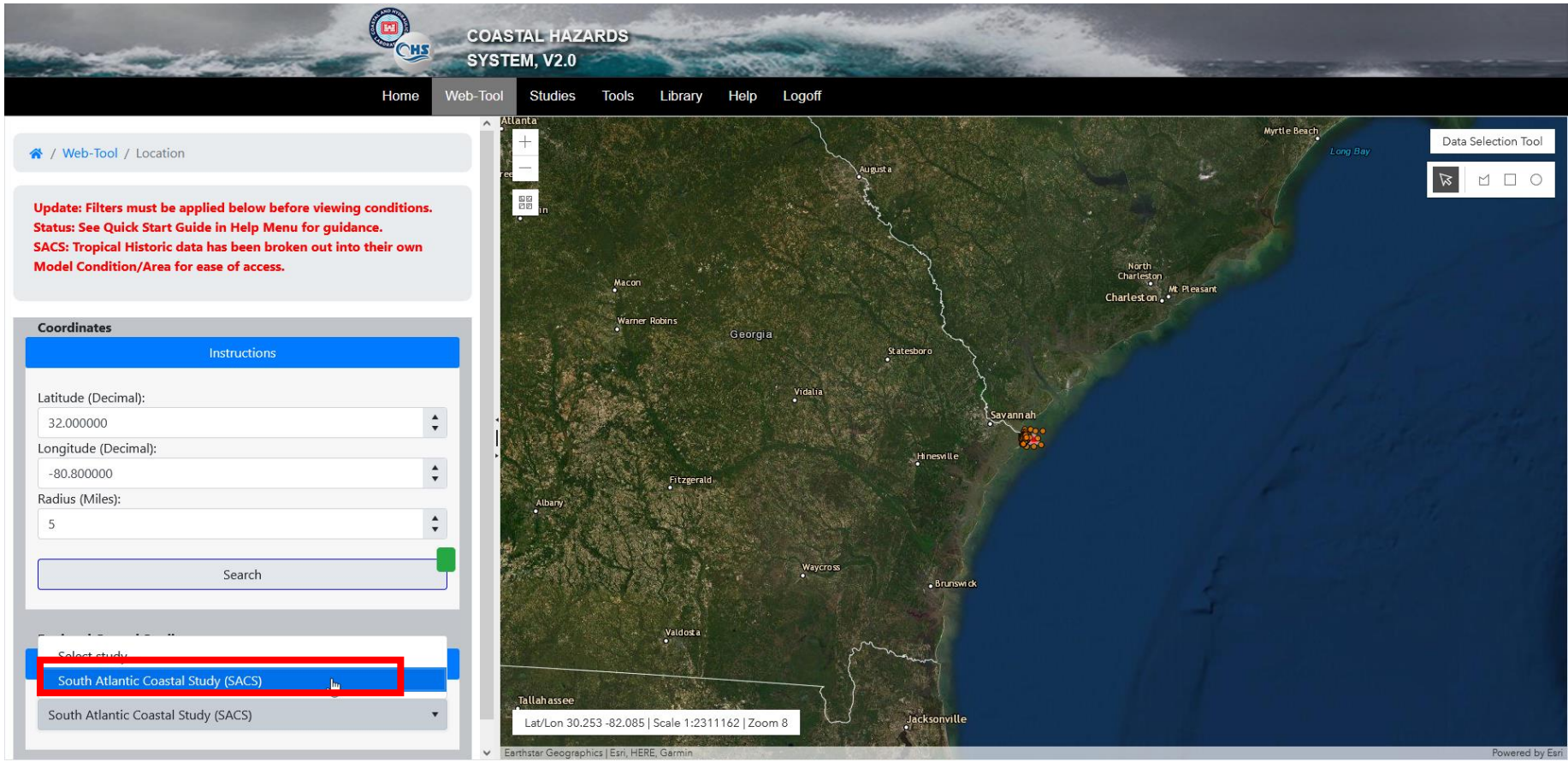


B

APPLIED EXERCISE #1: AEFs at Tybee Island

Step 5

- Bottom Left: Select Regional Study
  - South Atlantic Coastal Study (SACS)

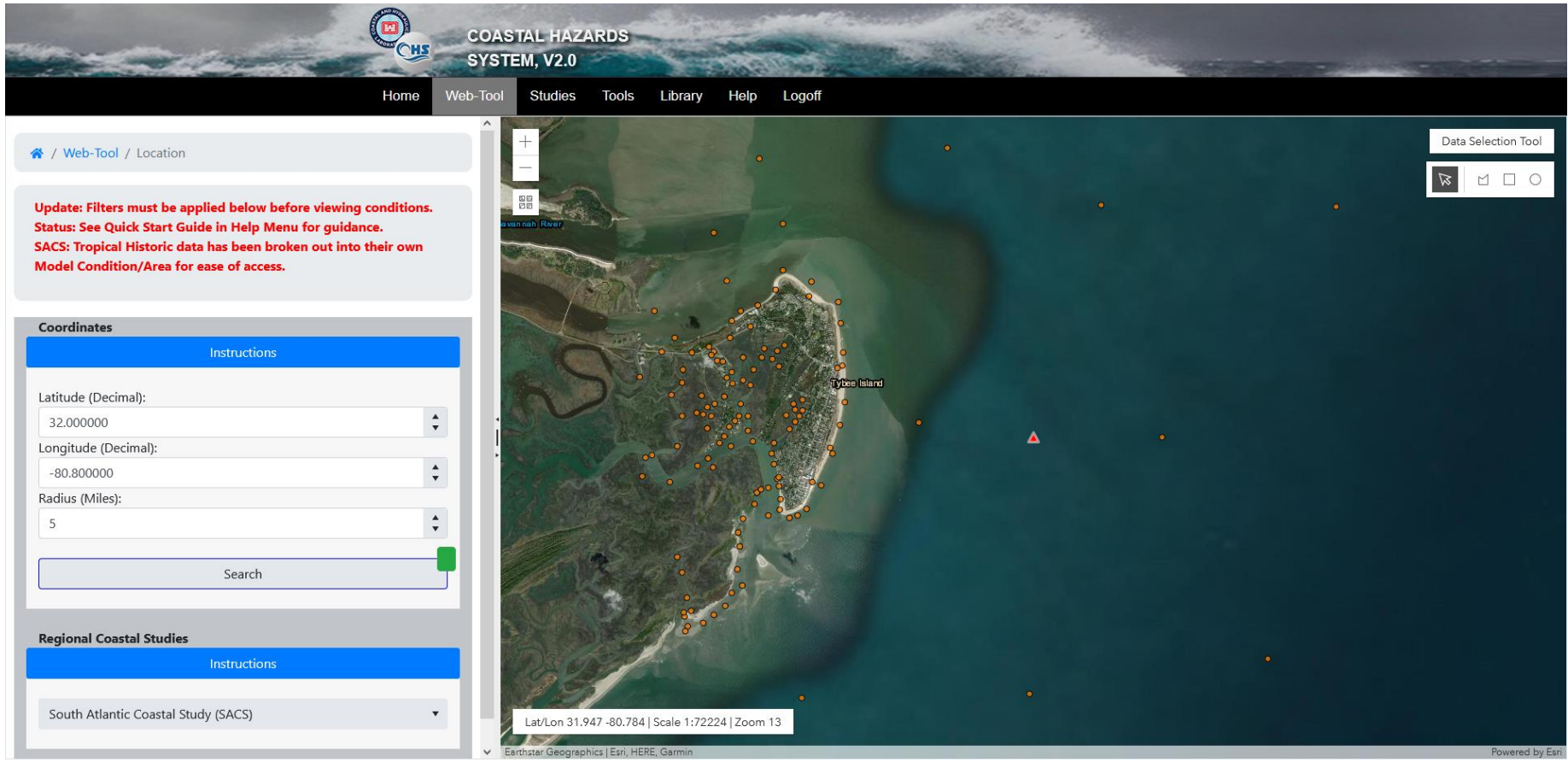


B

APPLIED EXERCISE #1: AEFs at Tybee Island

Step 6

- Zoom into area of interest – Tybee Island

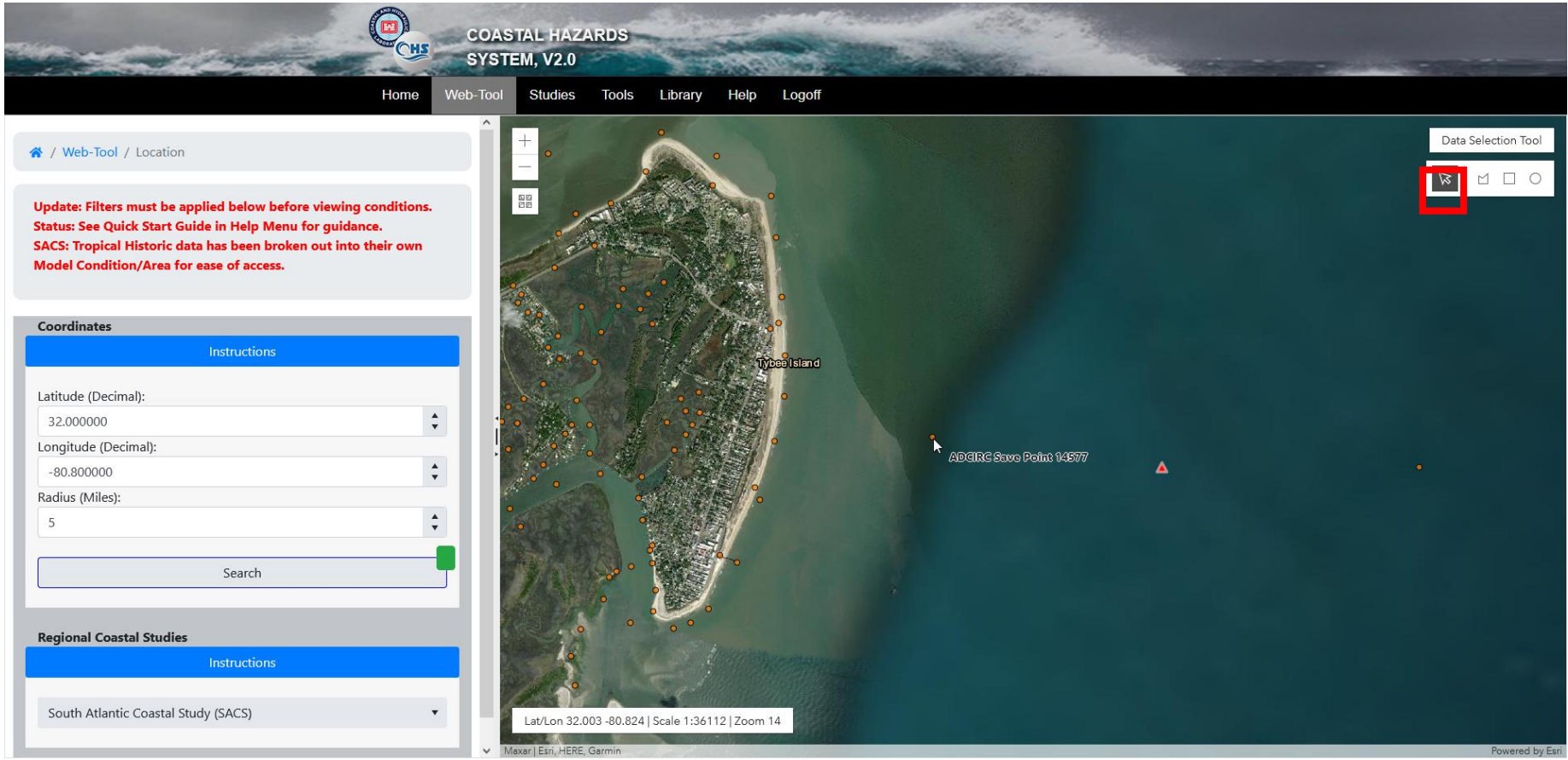


B

APPLIED EXERCISE #1: AEFs at Tybee Island

Step 7

- Use the data selection tool to select point(s) of interest
  - Pointer
  - Polygon
  - Rectangle
  - Circle
- Select
  - ADCIRC Save Point 14977

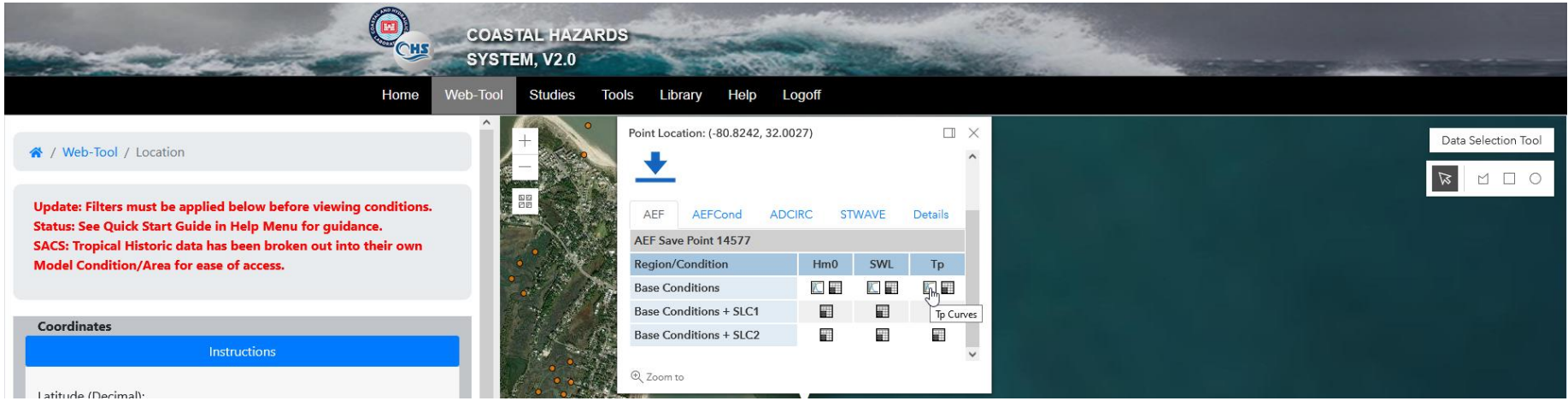


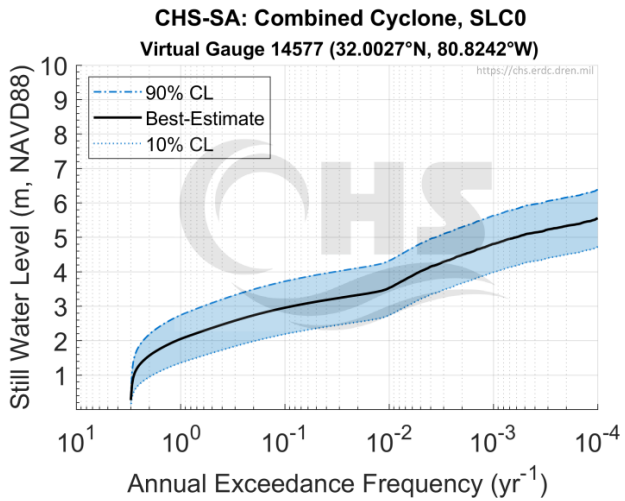
B

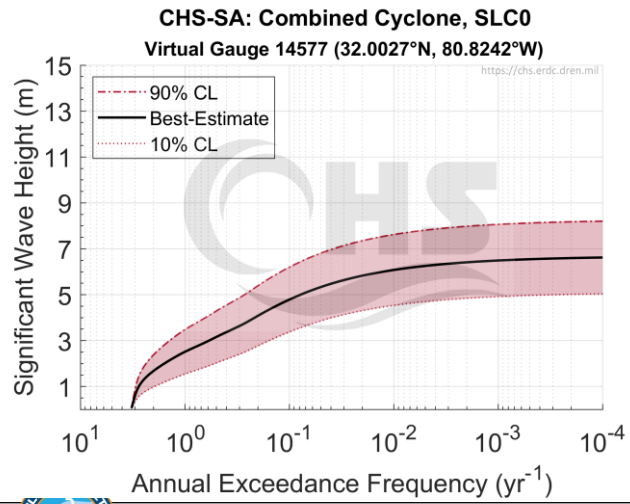
APPLIED EXERCISE #1: AEFs at Tybee Island

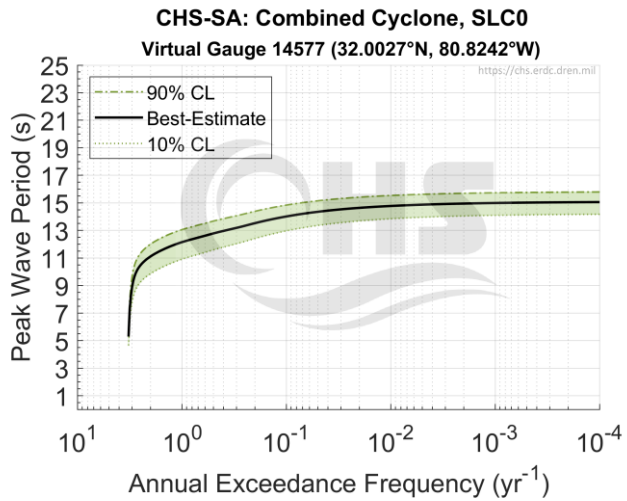
Step 8

- Explore Data Options / Details
  - AEF
  - AEFCond
  - ADCIRC
  - STWAVE
  - Details







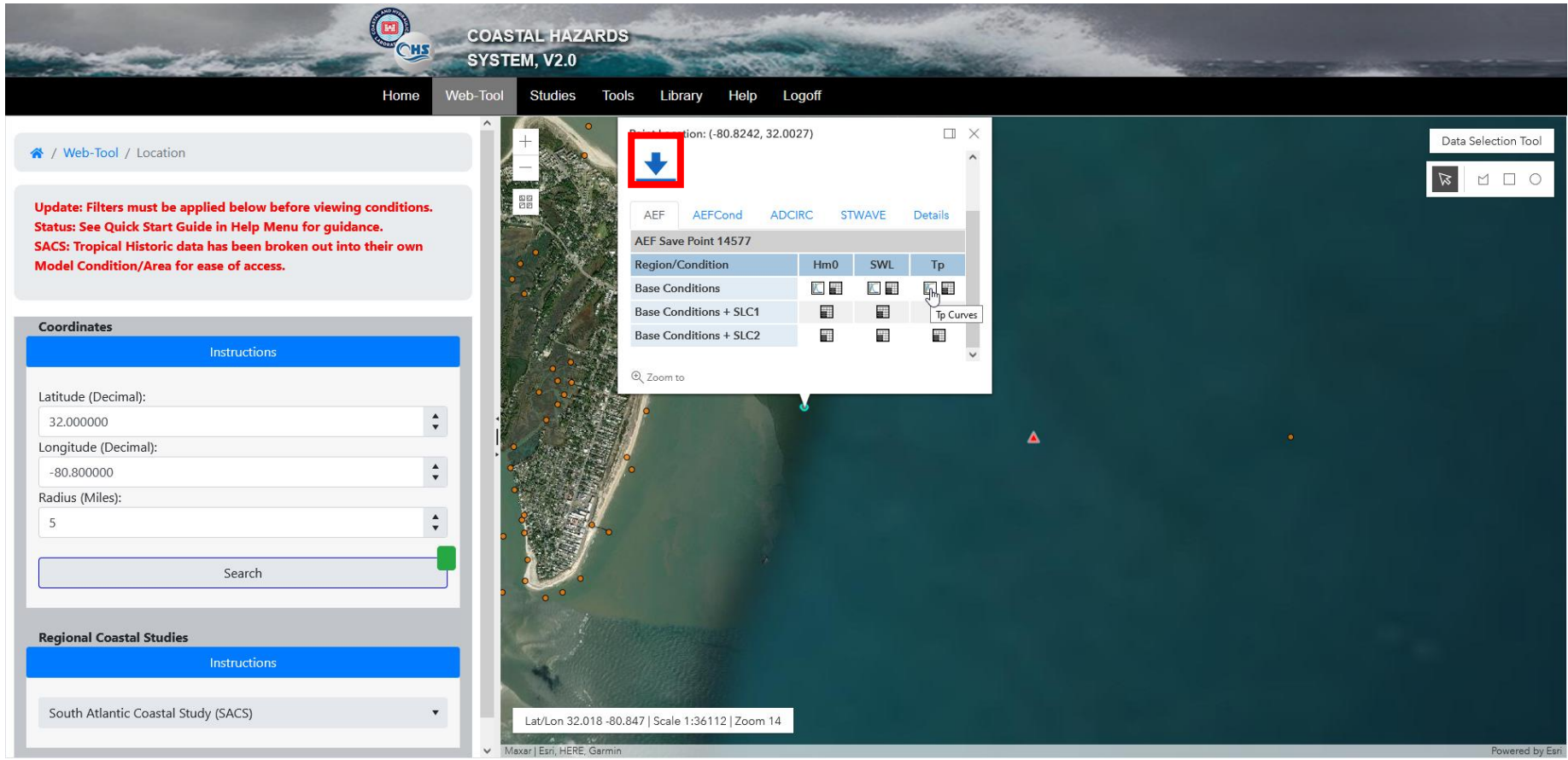


B

APPLIED EXERCISE #1: AEFs at Tybee Island

Step 9

- Download Data
  - Select Arrow

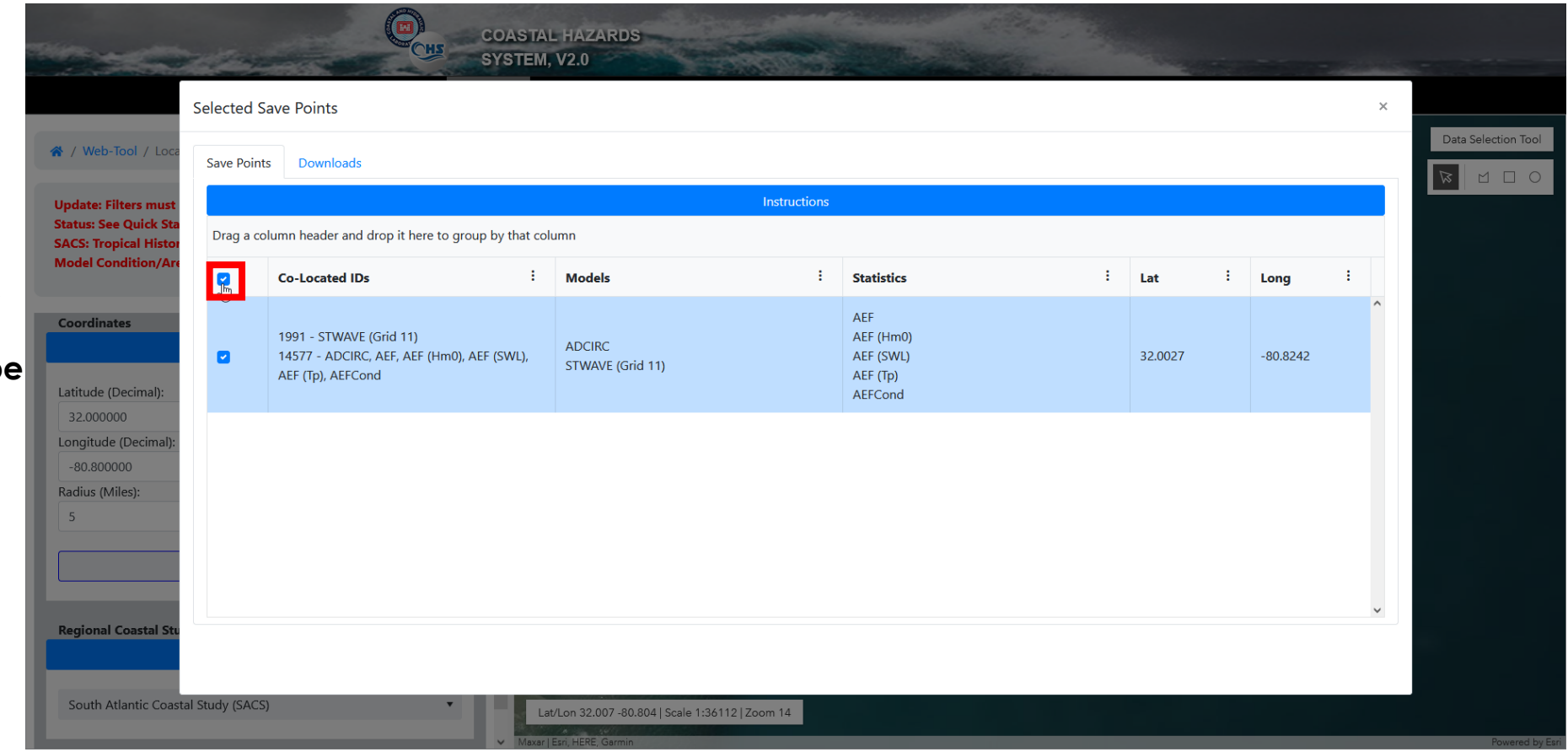


B

APPLIED EXERCISE #1: AEFs at Tybee Island

Step 10

- Select Co-Located ID
  - Only one in our example
  - Could be many if select points by polygon / shape

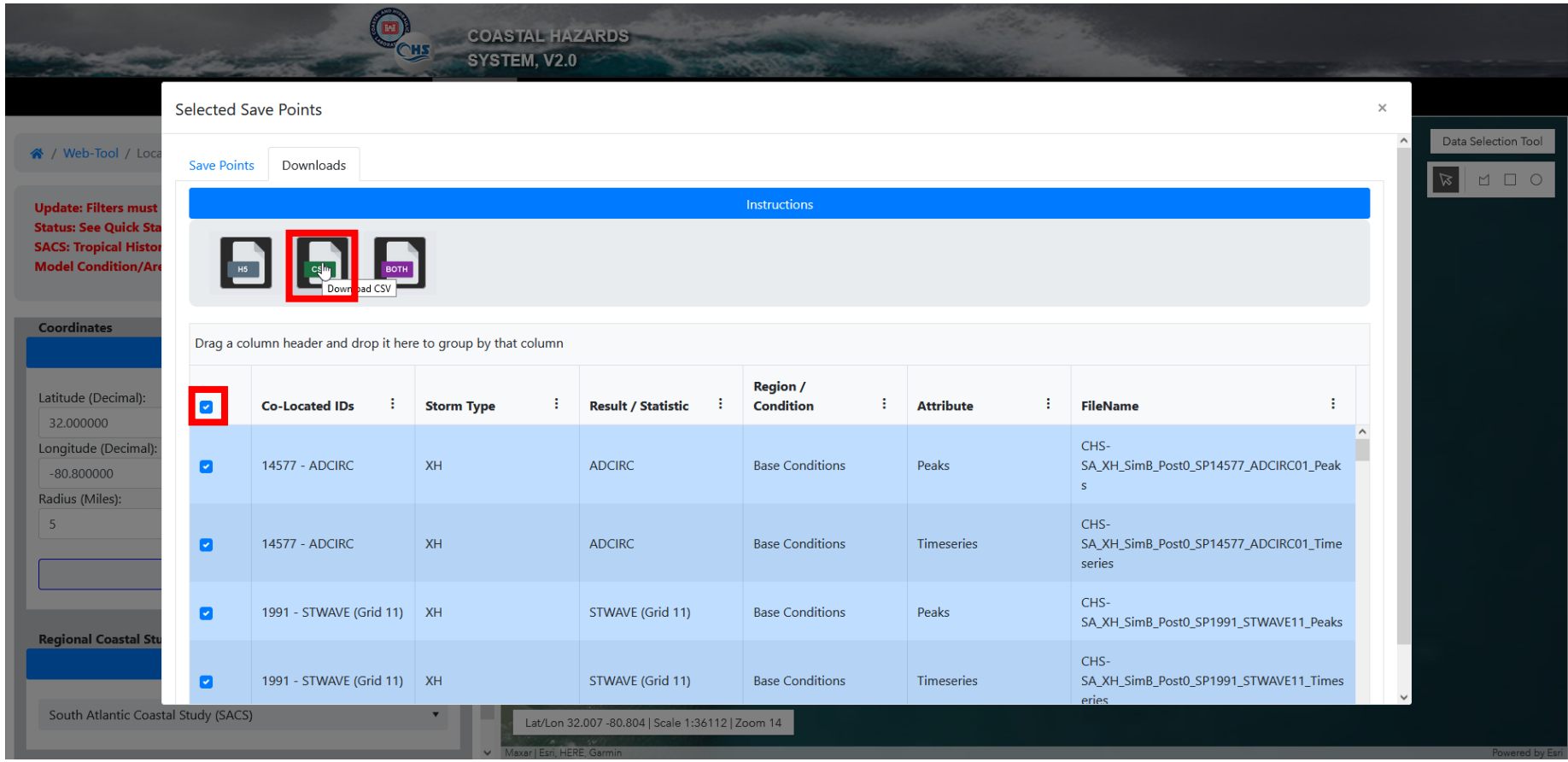


B

APPLIED EXERCISE #1: AEFs at Tybee Island

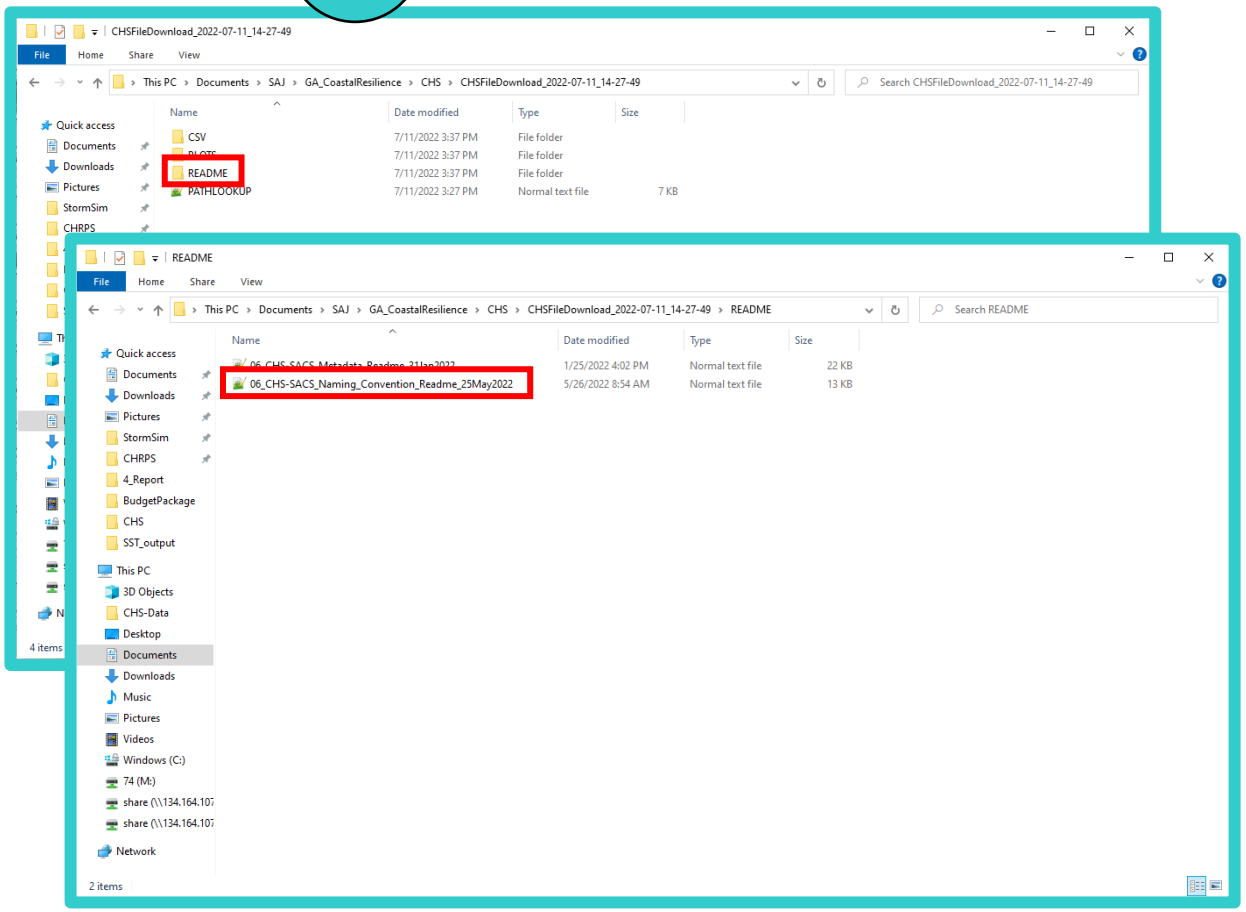
Step 11

- Select All data
- Download as CSV files



B

APPLIED EXERCISE #1: AEFs at Tybee Island



Step 12a

Unzip the file
Explore the data

- **Readme**
- **Naming Convention**

```
INTRODUCTION
============

06_CHS_SACS_Naming_Convention_Readme_25May2022.txt
last updated 25 May 2022

This file contains the Coastal Hazards System (CHS) Filename
Convention for the CHS South Atlantic Coastal Study (CHS-SACS)
dataset which includes the coastal areas from North Carolina down
around Florida to Mississippi as well as Puerto Rico and the US
Virgin Islands.

 *  For detailed information, please see the CHS website
    https://chs.erdc.dren.mil/.
    Contact information is also located at that website.


FILENAMING CONVENTION FORMAT
============================

The CHS filename convention has a standard set of unique
identifiers which make up the filenames for the data files posted
in the system. These identifiers allow each filename to be
self-describing. Detailed information for each identifier for all
CHS-SACS data files is provided below.

All filenames have
 *   7 identifiers separated by underscores
 *   followed by an extension for the filetype
 *   In this format:

Identifier1_Identifier2_Identifier3_Identifier4_Identifier5
                                  _Identifier6_Identifier7.ext


IDENTIFIER DESCRIPTIONS
=======================

Each identifier is described in the following format
* Identifier#
* Data Names separated by ||
* Data Description
* Example
    -   the identifier being demonstrated is indicated by triangle
        brackets, for example <SP001>
* Table of Identifier format code and description



Identifier1
-----------
 *   Identifier1 = Project || Region || Sub-region
 *   Identifier1 consists of a string specifying project name,
     region name or sub-region name, depending on the data
     structure

 *   Example:  <CHS-PR> TS SimB Post0 SP001 STWAVE04 Timeseries.h5
```

B APPLIED EXERCISE #1: AEFs at Tybee Island

Naming Convention

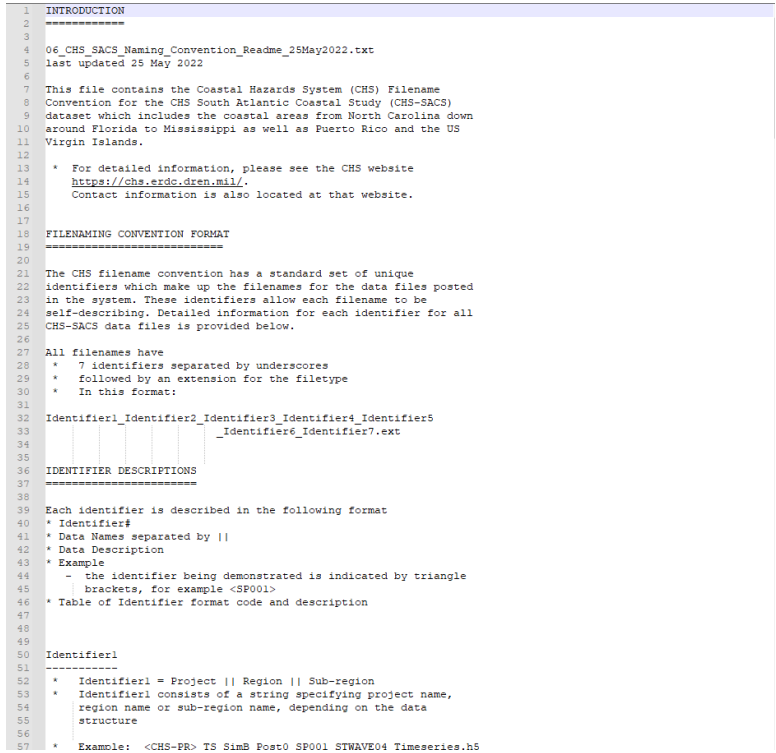
- Identifier1_Identifier2_Identifier3_Identifier4_Identified5_Identifier6_Identifier7.ext Naming Convention
- Identifier1 – Project | Region | Sub-region
  - SACS -SA
- Identifier2 – Storm Type | Data Type
  - TS | XH | TH | CC
- Identifier3 – Simulation
  - Sim0 | SimB | SimB1RT | SimBHT | SimBslc1 | SimBslc2
- Identifier4 – Post-processing
  - Post0
- Identifier5 – Save point | Station | Statistics | Storm
  - SP
- Identifier6 – Model
  - ADCIRC | STWAVE | Stat
- Identifier7 – Result Type | Input Type
  - TimeSeries | Peaks | AEF | AEFCond
- Identifier8 – Filename extension
  - .csv | .h5

Step 12a -Readme

Unzip the file

Explore the data

- Readme
- Naming Convention



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                                    _Identifier6_Identifier7.ext


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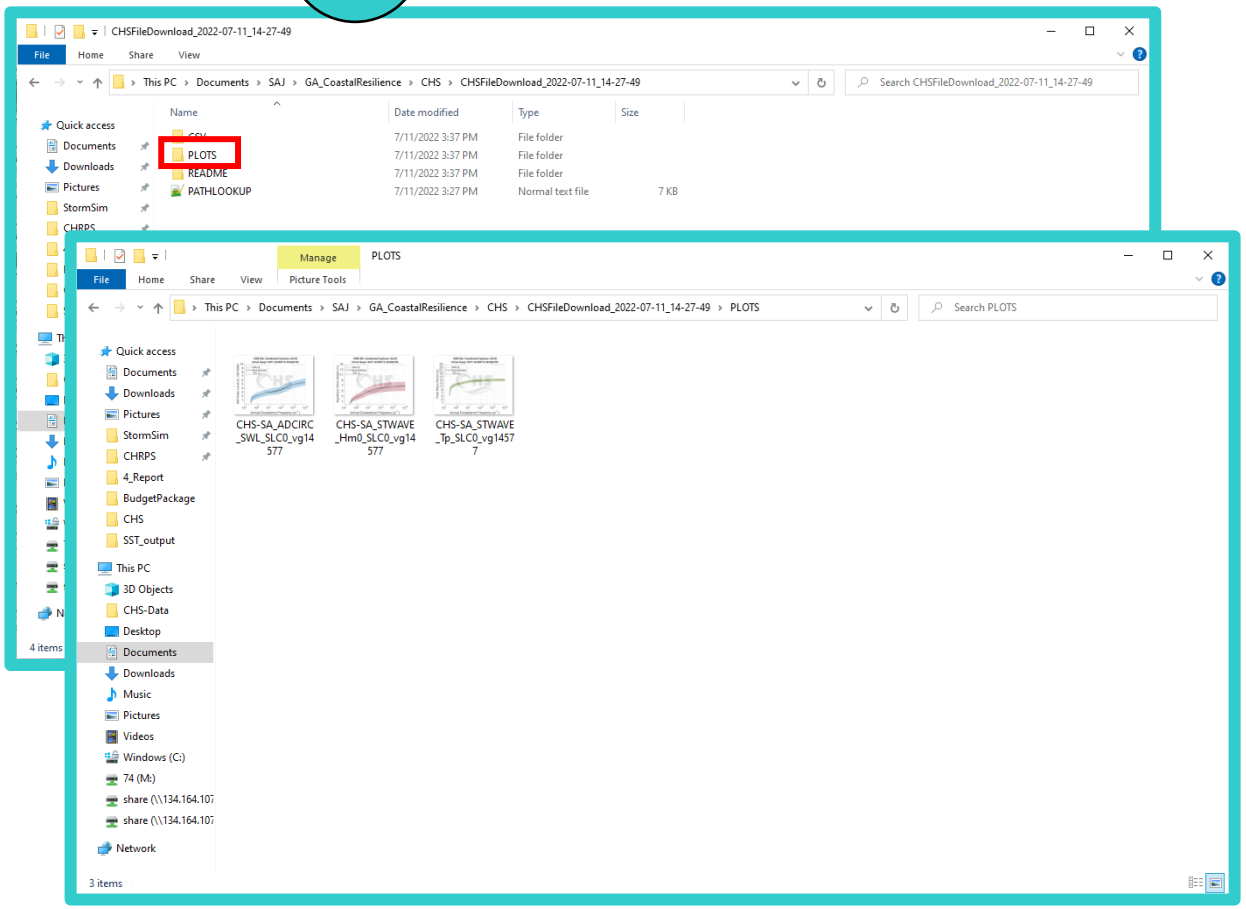
```

B

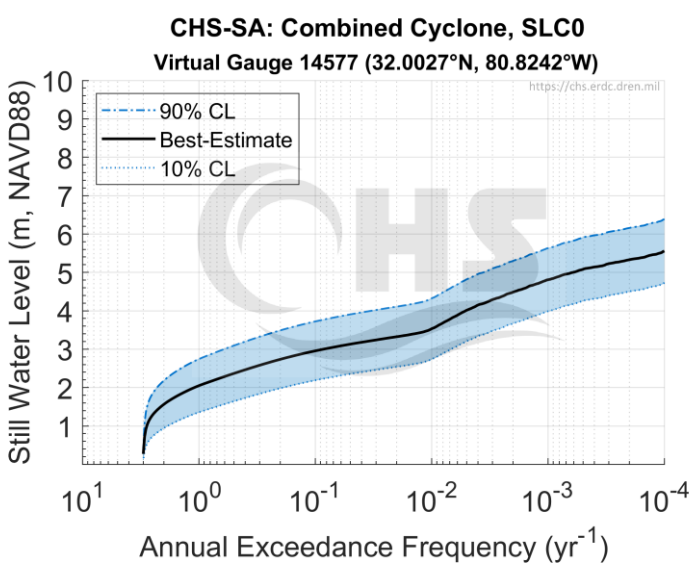
APPLIED EXERCISE #1: AEFs at Tybee Island

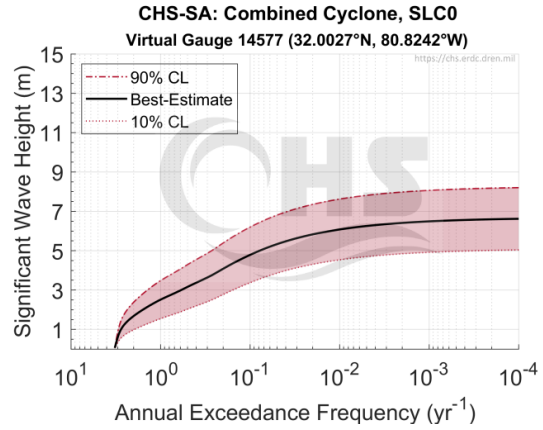


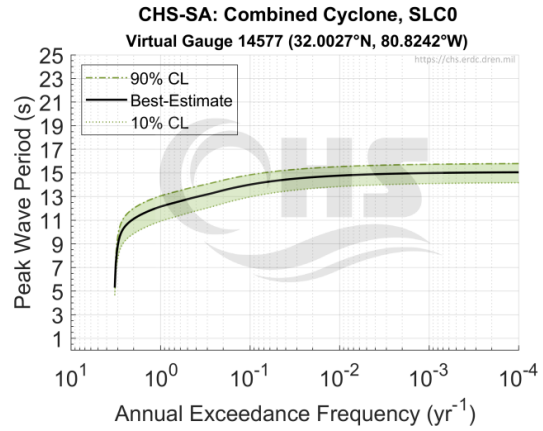
Step 12b - Plots

Explore the data

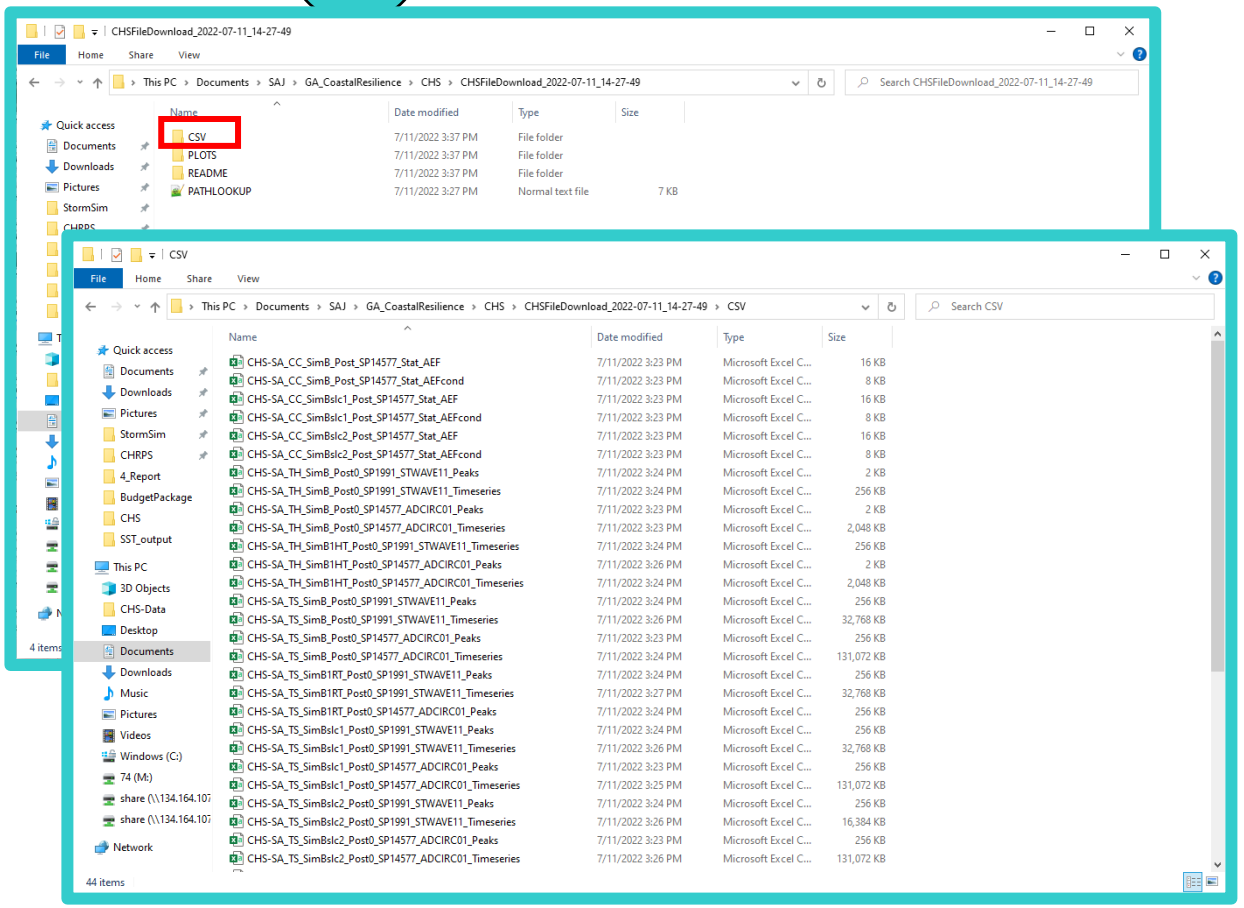
- **AEF Plots**







B APPLIED EXERCISE #1: AEFs at Tybee Island



Step 12c - CSV

Explore the data

- **CSV - Data**

	A	B	C	D	E	F	G	H	I	J	K	L
1	Save Point ID	Save Point Latitude	Save Point Longitud	Vertical Datum	AEF Value:	Parameters	Units	Best Estimate AEF	Confidence Limit 10% for AEF	Confidence Limit 16% for AEF	Confidence Limit 84% for AEI	Confidence Limit 90% for AEF
2		decimal deg	decimal deg		yr^-1							
3	14577	32.002673	-80.824224	NAVD88	10	Hm0	m	NaN	NaN	NaN	NaN	NaN
4	14577	32.002673	-80.824224	NAVD88	5	Hm0	m	NaN	NaN	NaN	NaN	NaN
5	14577	32.002673	-80.824224	NAVD88	2	Hm0	m	1.678708851	0.97970053	1.133269806	2.224147895	2.377717111
6	14577	32.002673	-80.824224	NAVD88	1	Hm0	m	2.51373855	1.547566409	1.753830423	3.267646677	3.47991069
7	14577	32.002673	-80.824224	NAVD88	0.5	Hm0	m	3.160597057	2.030317329	2.278635099	4.042559015	4.290876785
8	14577	32.002673	-80.824224	NAVD88	0.2	Hm0	m	4.081109886	2.772531743	3.060020935	5.102198836	5.389688029
9	14577	32.002673	-80.824224	NAVD88	0.1	Hm0	m	4.786367994	3.375914562	3.685785333	5.886950654	6.196821425
10	14577	32.002673	-80.824224	NAVD88	0.05	Hm0	m	5.333420988	3.859838467	4.183578437	6.483263539	6.80700351
11	14577	32.002673	-80.824224	NAVD88	0.02	Hm0	m	5.8286028	4.307409279	4.641609189	7.015596412	7.349796322
12	14577	32.002673	-80.824224	NAVD88	0.01	Hm0	m	6.078327856	4.536016664	4.874856039	7.281799674	7.620639048
13	14577	32.002673	-80.824224	NAVD88	0.005	Hm0	m	6.254903053	4.698695247	5.04058765	7.469218456	7.811110859
14	14577	32.002673	-80.824224	NAVD88	0.002	Hm0	m	6.411597546	4.843722746	5.188178339	7.635016752	7.979472345
15	14577	32.002673	-80.824224	NAVD88	0.001	Hm0	m	6.490583512	4.917052192	5.262750499	7.718416525	8.064114832
16	14577	32.002673	-80.824224	NAVD88	0.0005	Hm0	m	6.546356646	4.968918428	5.315475064	7.777238227	8.123794863
17	14577	32.002673	-80.824224	NAVD88	0.0002	Hm0	m	6.595852026	5.015005715	5.362311095	7.829392957	8.176698337
18	14577	32.002673	-80.824224	NAVD88	0.0001	Hm0	m	6.620007164	5.037517432	5.385183865	7.854830462	8.202496895
19	14577	32.002673	-80.824224	NAVD88	5.00E-05	Hm0	m	6.620163279	5.037662968	5.385331725	7.854994833	8.20266359
20	14577	32.002673	-80.824224	NAVD88	2.00E-05	Hm0	m	6.620369652	5.037855356	5.385527186	7.855212118	8.202883948
21	14577	32.002673	-80.824224	NAVD88	1.00E-05	Hm0	m	6.620525767	5.038000893	5.385675047	7.855376488	8.203050642
22	14577	32.002673	-80.824224	NAVD88	5.00E-06	Hm0	m	6.620681883	5.03814643	5.385822908	7.855540857	8.203217335
23	14577	32.002673	-80.824224	NAVD88	2.00E-06	Hm0	m	6.620888256	5.038338821	5.386018371	7.855758141	8.20343769
24	14577	32.002673	-80.824224	NAVD88	1.00E-06	Hm0	m	6.621044371	5.03848436	5.386166233	7.855922509	8.203604382
25	14577	32.002673	-80.824224	NAVD88	10	Tp	s	NaN	NaN	NaN	NaN	NaN
26	14577	32.002673	-80.824224	NAVD88	5	Tp	s	NaN	NaN	NaN	NaN	NaN
27	14577	32.002673	-80.824224	NAVD88	2	Tp	s	11.10945749	9.859349038	10.18278647	11.82437841	12.00068335
28	14577	32.002673	-80.824224	NAVD88	1	Tp	s	12.14958671	10.91093881	11.22628528	12.87695068	13.05785789
29	14577	32.002673	-80.824224	NAVD88	0.5	Tp	s	12.78222223	11.58778017	11.88798693	13.49835192	13.67851695
30	14577	32.002673	-80.824224	NAVD88	0.2	Tp	s	13.52738206	12.41637967	12.6909189	14.21382961	14.387596
31	14577	32.002673	-80.824224	NAVD88	0.1	Tp	s	14.01391495	12.97033134	13.22529139	14.6718246	14.8396145
32	14577	32.002673	-80.824224	NAVD88	0.05	Tp	s	14.35416438	13.36125688	13.60194639	14.98900566	15.15178744
33	14577	32.002673	-80.824224	NAVD88	0.02	Tp	s	14.6394647	13.69018204	13.91883708	15.25350528	15.41167218
34	14577	32.002673	-80.824224	NAVD88	0.01	Tp	s	14.77624038	13.84801731	14.07093701	15.37935182	15.53579732
35	14577	32.002673	-80.824224	NAVD88	0.005	Tp	s	14.87033448	13.95660323	14.17560255	15.46683386	15.62104778
36	14577	32.002673	-80.824224	NAVD88	0.002	Tp	s	14.95211847	14.05096714	14.26658007	15.54228993	15.69506536
37	14577	32.002673	-80.824224	NAVD88	0.001	Tp	s	14.99275543	14.09784511	14.31178366	15.57976466	15.73181888
38	14577	32.002673	-80.824224	NAVD88	0.0005	Tp	s	15.02121853	14.13067459	14.34344391	15.60600642	15.75755309
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41	14577	32.002673	-80.824224	NAVD88	5.00E-05	Tp	s	15.05859607	14.17377889	14.38501738	15.64045944	15.79133677
42	14577	32.002673	-80.824224	NAVD88	2.00E-05	Tp	s	15.05870012	14.17388888	14.38513312	15.64055535	15.79143081
43	14577	32.002673	-80.824224	NAVD88	1.00E-05	Tp	s	15.05877884	14.17398964	14.38522066	15.6406279	15.79150194
44	14577	32.002673	-80.824224	NAVD88	5.00E-06	Tp	s	15.05885755	14.1740804	14.38530821	15.64070044	15.79157307
45	14577	32.002673	-80.824224	NAVD88	2.00E-06	Tp	s	15.0589616	14.17420038	14.38542393	15.64079634	15.7916671
46	14577	32.002673	-80.824224	NAVD88	1.00E-06	Tp	s	15.05904031	14.17429114	14.38551148	15.64086888	15.79173823
47	14577	32.002673	-80.824224	NAVD88	10	SWL	m	NaN	NaN	NaN	NaN	NaN
48	14577	32.002673	-80.824224	NAVD88	5	SWL	m	NaN	NaN	NaN	NaN	NaN
49	14577	32.002673	-80.824224	NAVD88	2	SWL	m	1.562117504	0.942819498	1.078876702	2.045358307	2.181415511
50	14577	32.002673	-80.824224	NAVD88	1	SWL	m	2.048480808	1.355319434	1.507604114	2.589357503	2.741642163
51	14577	32.002673	-80.824224	NAVD88	0.5	SWL	m	2.367817858	1.641844545	1.801337872	2.934297845	3.093791172
52	14577	32.002673	-80.824224	NAVD88	0.2	SWL	m	2.734920864	1.981222362	2.146806798	3.323034929	3.488619365

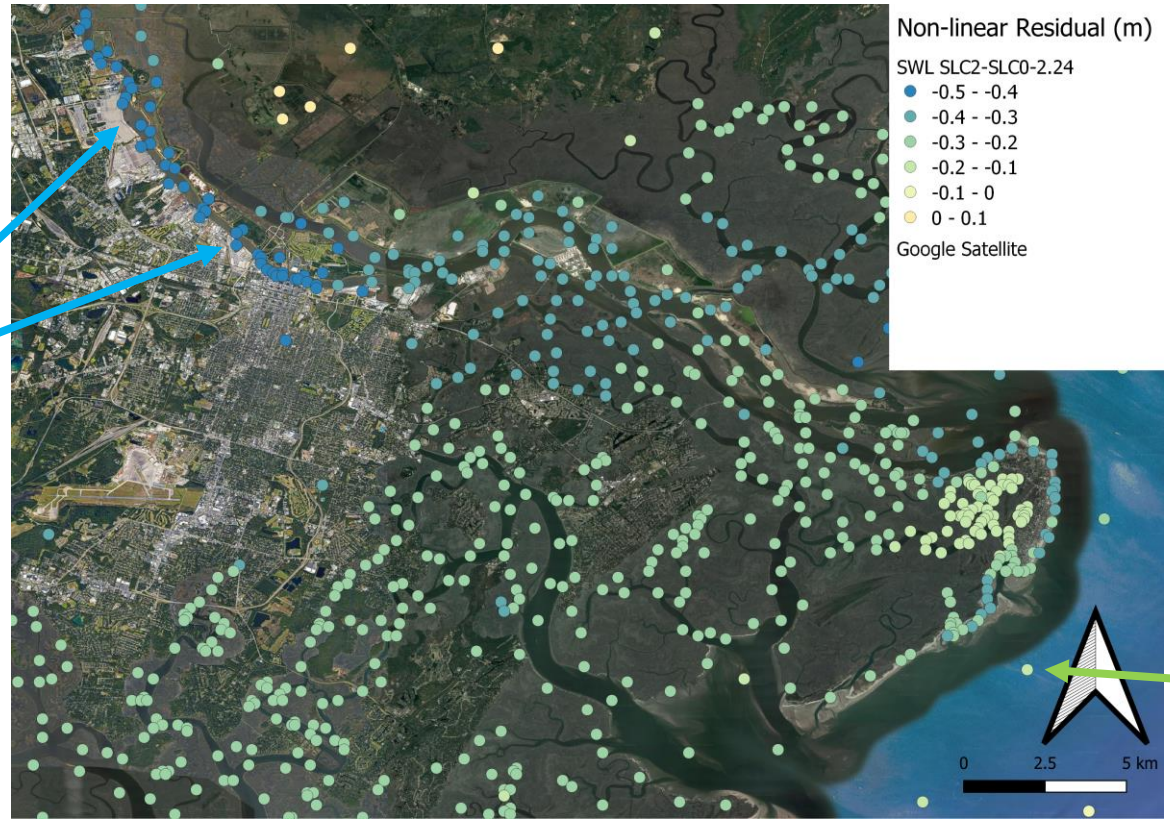
B

APPLIED EXERCISE #1: AEFs at Tybee Island

Reminder

- **CHS Includes SLC: effects can be non-linear**

SLC2 – 2.24 m



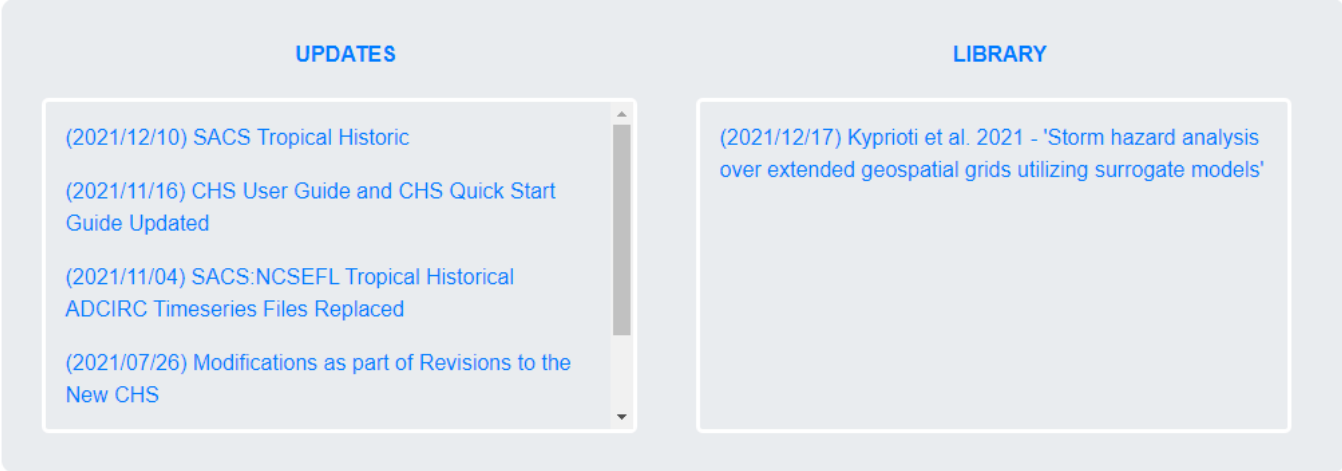
Non-linear decrease in 0.01 AEF with SLC2
~ 0.4 m / 1.3 ft

Non-linear decrease in 0.01 AEF with SLC2
Up to ~0.1 m / 0.3 ft

COASTAL HAZARDS SYSTEM | ASSESS AND COMMUNICATE

C LEARN MORE

- https://chs.erdc.dren.mil/Home/Help
- https://chs.erdc.dren.mil/Home/Library



Questions?

ASSESS | COMMUNICATE | ADDRESS

DECISION SUPPORT TOOLS FOR NATURE-BASED SOLUTIONS

PRESENTED BY ASHBY NIX WORLEY, CFM
COASTAL CLIMATE ADAPTATION DIRECTOR

THE NATURE CONSERVANCY

ASHBY.WORLEY@TNC.ORG

The Nature Conservancy

PRESENTATION OUTLINE

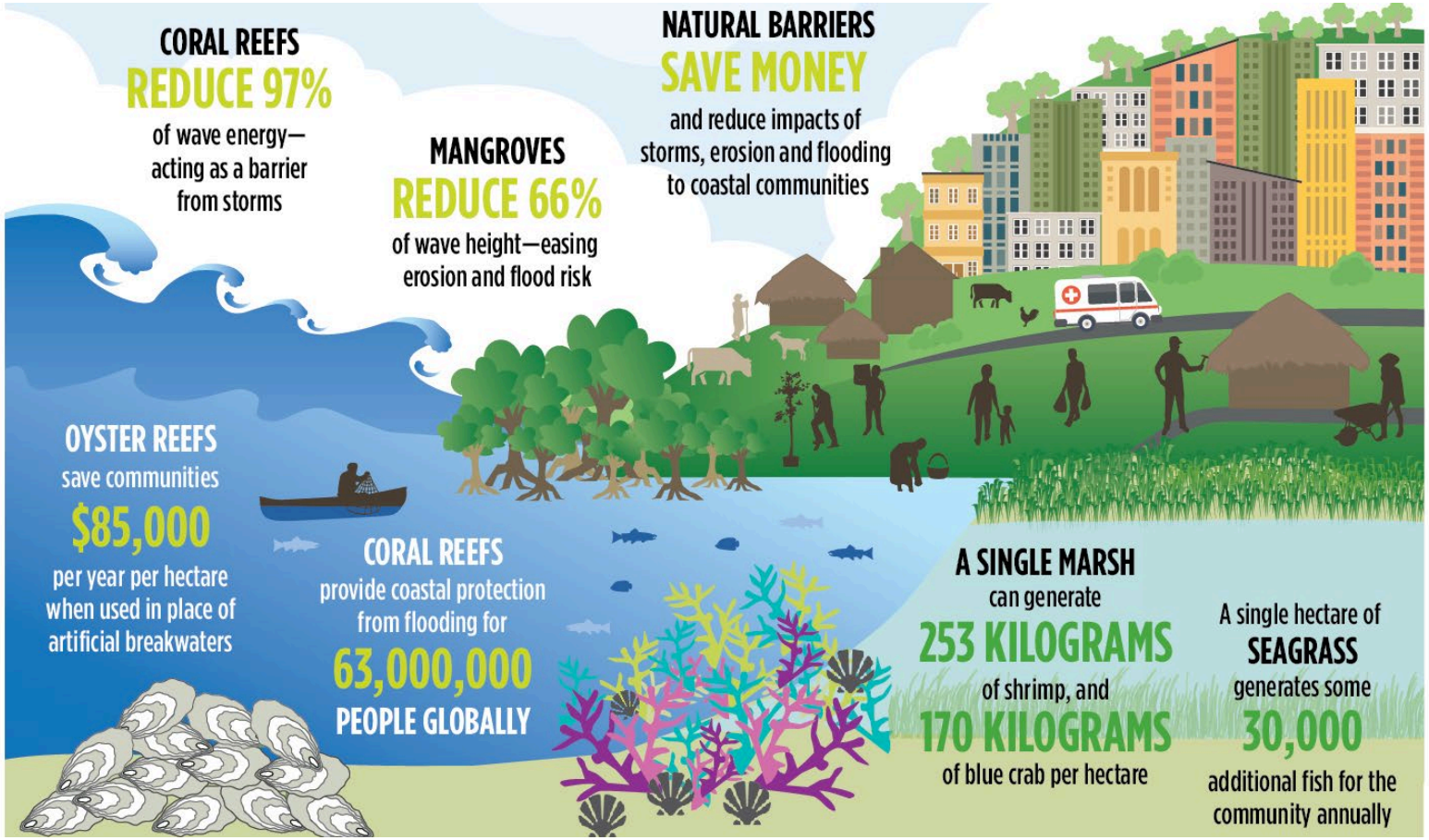
A. Nature Based Solutions (NBS)
B. Resilient Coastal Sites
C. CRS Open Space Explorer
D. Additional Guidance & Resources

Oyster reef

DECISION SUPPORT TOOLS FOR NBS | ASSESS, COMMUNICATE, ADDRESS

A NATURE-BASED SOLUTIONS TO REDUCE COASTAL RISK

Natural Infrastructure
- Barrier islands
- Beaches & dune systems
- Marshes & wetlands
- Oyster reefs
- Preserved floodplains
- Natural open space

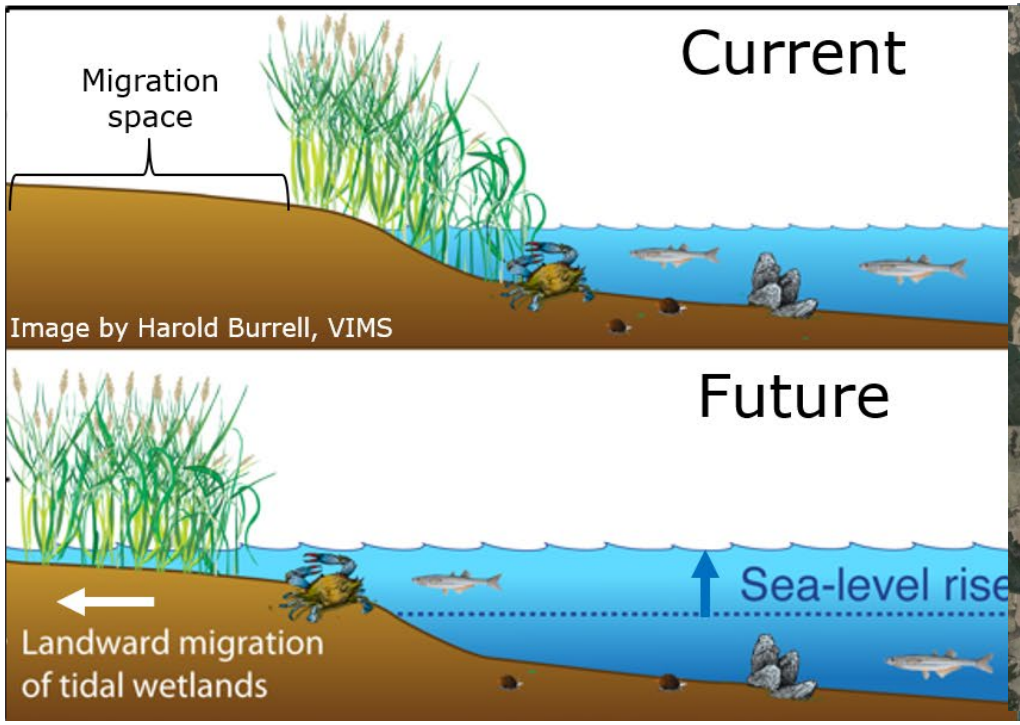


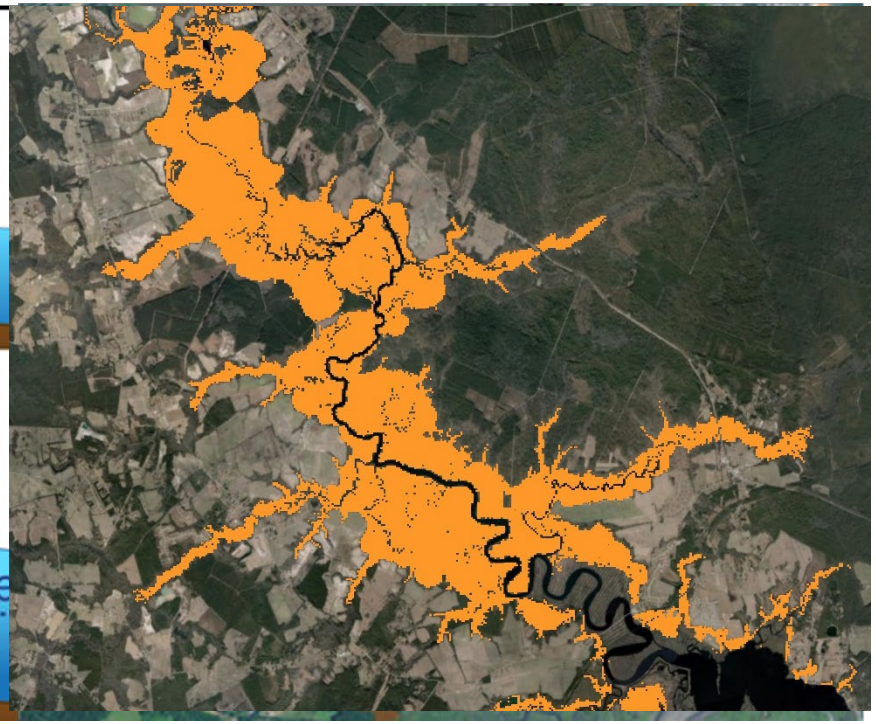
B

RESILIENT COASTAL SITES – OVERVIEW

Marsh Migration

- Adjacent, low-lying land suitable for supporting tidal habitats in the future, and into which current habitats could migrate as sea levels rise.





Coastal Strongholds

People and wildlife depend on coastal habitats for food, water and shelter. But these habitats could disappear forever under rising sea levels. "Coastal strongholds" offer escape routes for threatened habitats to migrate inland and continue to support people and nature.

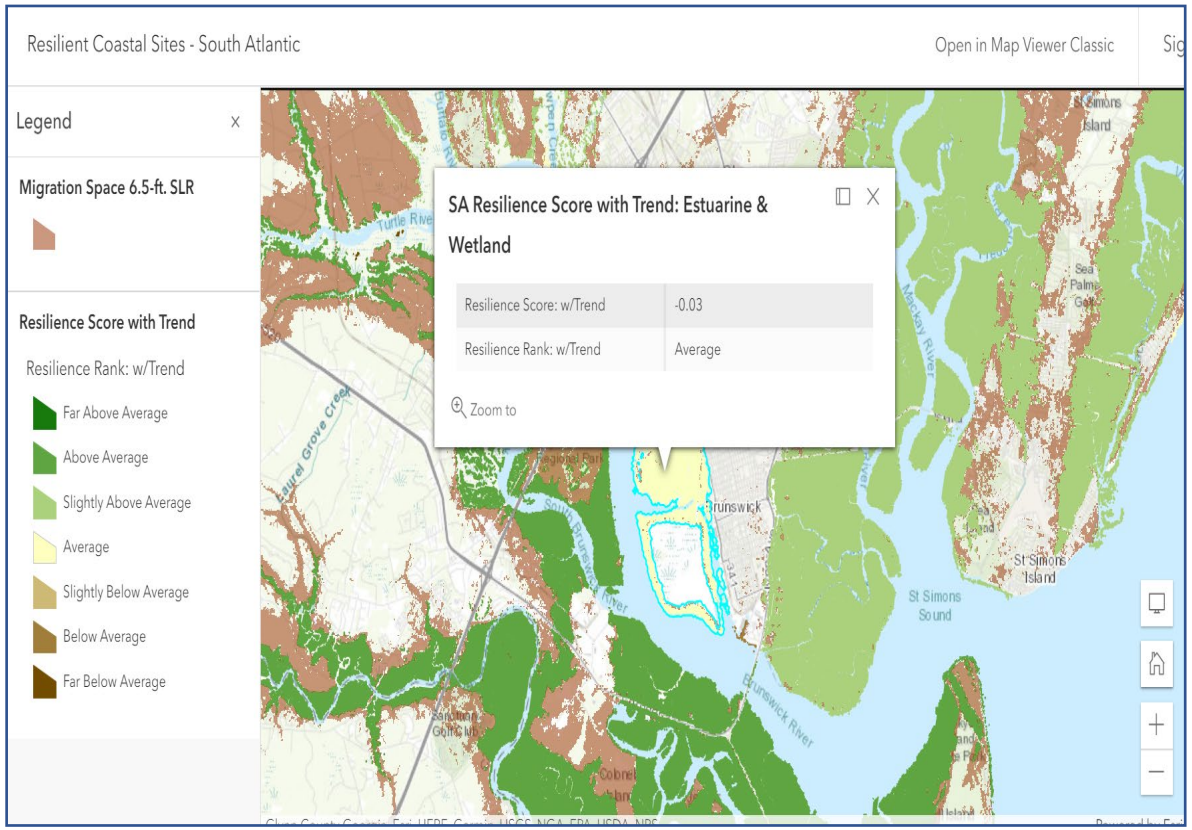
Coastal strongholds give hope that threatened habitats can escape rising sea levels and continue to thrive. But we must act now to keep these areas strong.

The Nature Conservancy
Protecting nature. Preserving life.

DECISION SUPPORT TOOLS FOR NBS | ASSESS, COMMUNICATE, ADDRESS

B RESILIENT COASTAL SITES

- **Developed by:** **The Nature Conservancy**
- **What it Does:** Coastal sites vary widely in their ability to accommodate rising seas, based on inherent natural features and the degree of human influence on key ecological processes. Scientists from The Nature Conservancy evaluated over 1,200 coastal sites in the South Atlantic for their capacity to sustain biodiversity and natural services under increasing inundation from sea level.
- **Access:** **www.nature.org/resilientcoasts**
- **Input:** **National and regional datasets**
- **Output:** Each site received a resilience "score" based on the likelihood that its coastal habitats can and will migrate to adjacent lowlands.
- **Date Published/Update:** **2019**
- **Additional Software/Hardware Requirements:** **None – both online web tool or downloadable datasets available**
- **Special Permissions Needed:** **None**



B

RESILIENT COASTAL SITES – OVERVIEW

What is a Resilient Coastal Site?

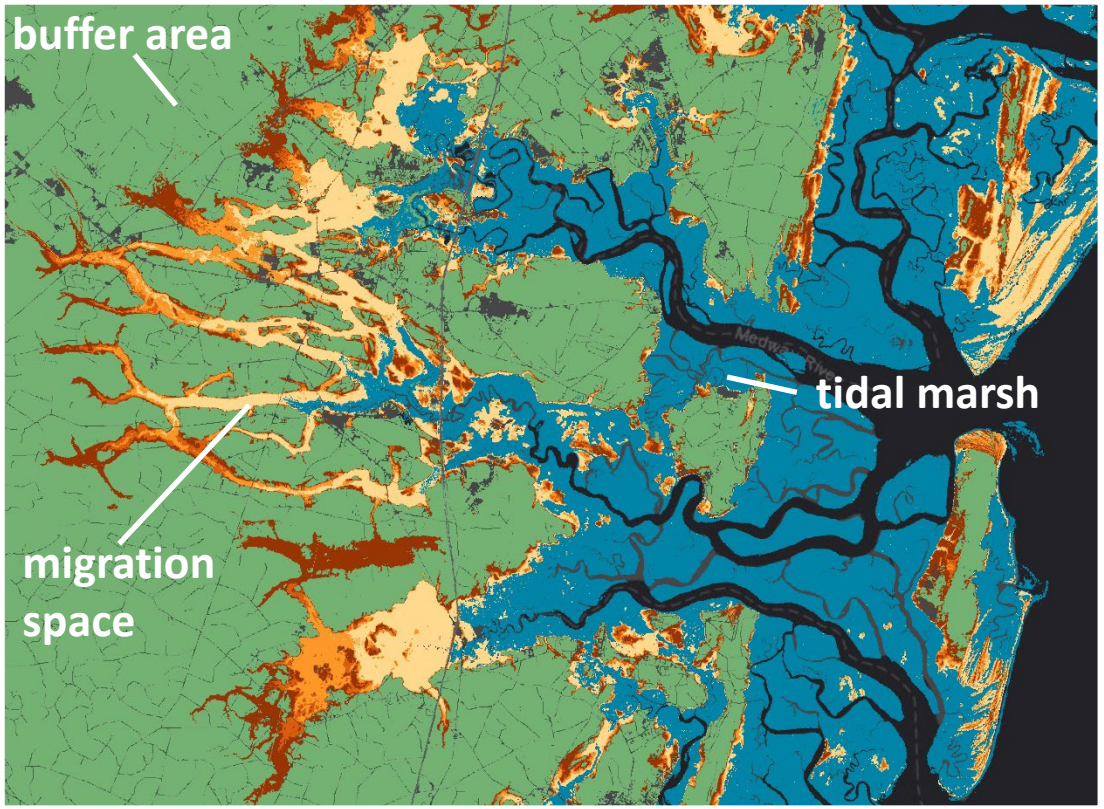
PHYSICAL ATTRIBUTES

- Large migration space
- Many future tidal classes
- Lots of shared upland edge with migration space
- Large tidal complex
- Large buffer area with diverse coastal landforms and maritime highlands

CONDITION ATTRIBUTES

- Few anthropogenic barriers to marsh migration (low development of upland edge)
- Positive sediment balance
- Good water quality index
- Minimal freshwater flow alteration
- Natural buffer area with high wetland connectivity

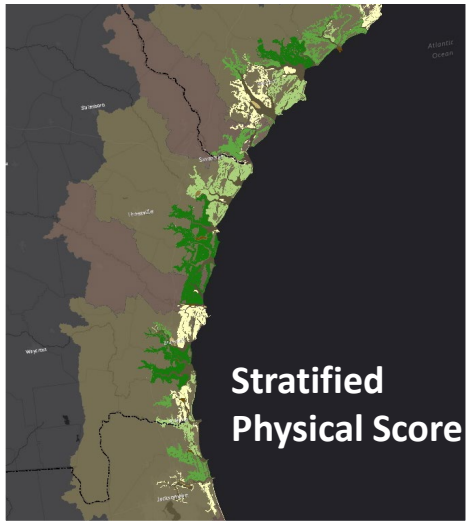
St. Catherine's Sound, Georgia

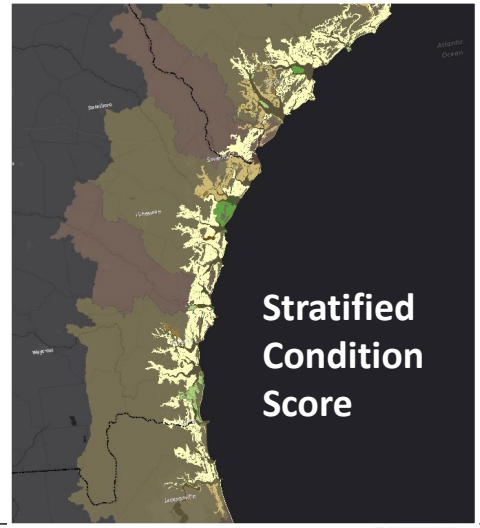


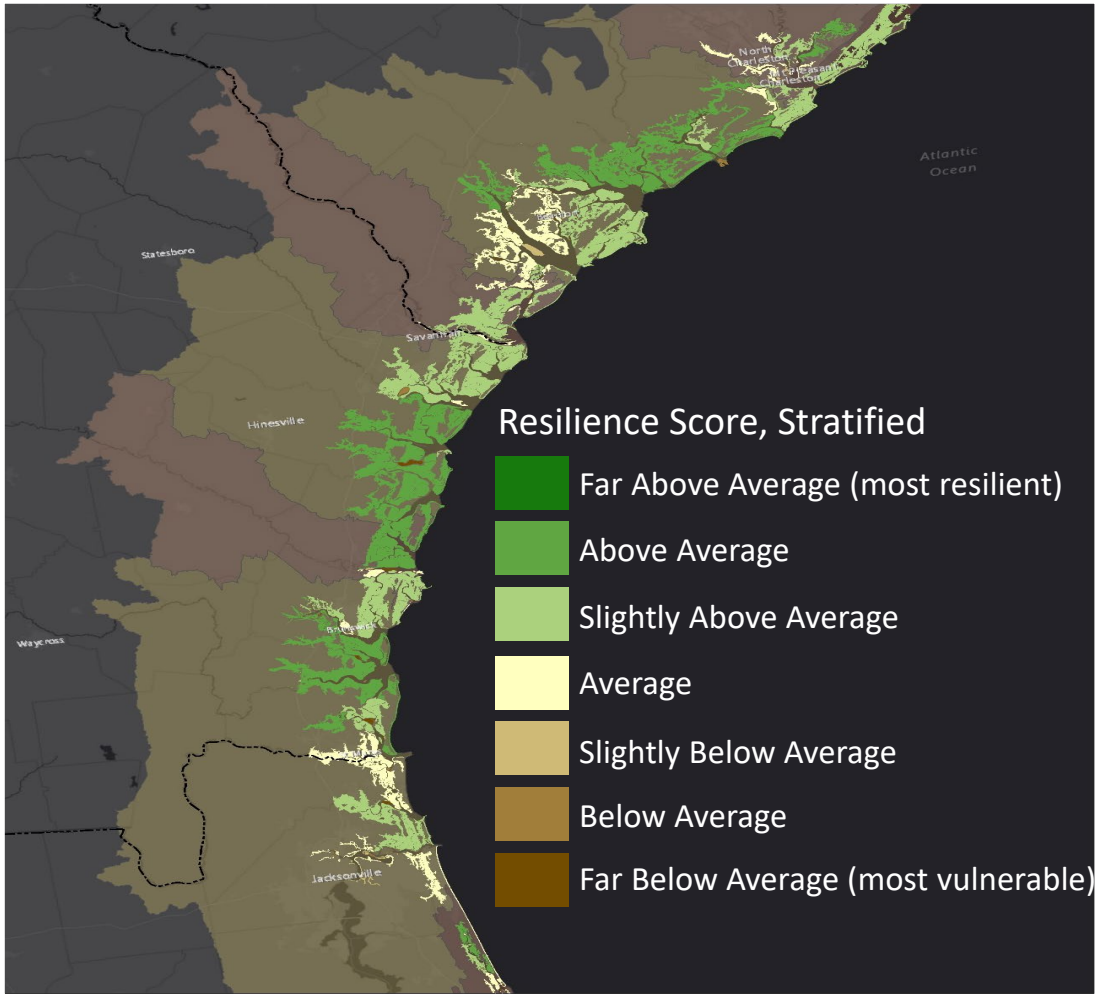
B

RESILIENT COASTAL SITES – OVERVIEW

Resilience Scores (Stratified by Coastal Shoreline Region)



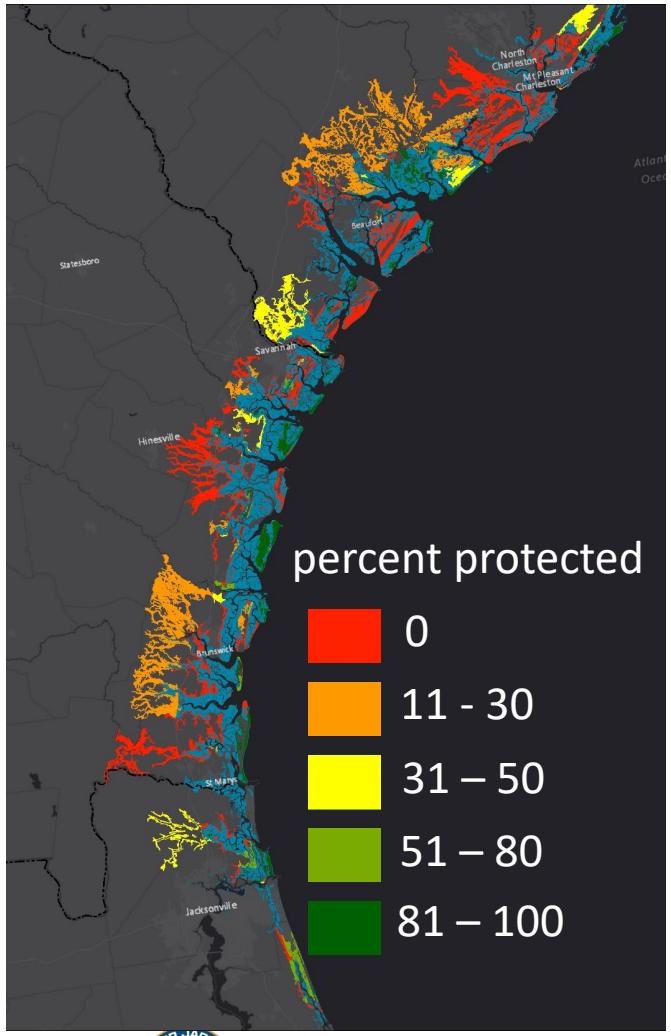


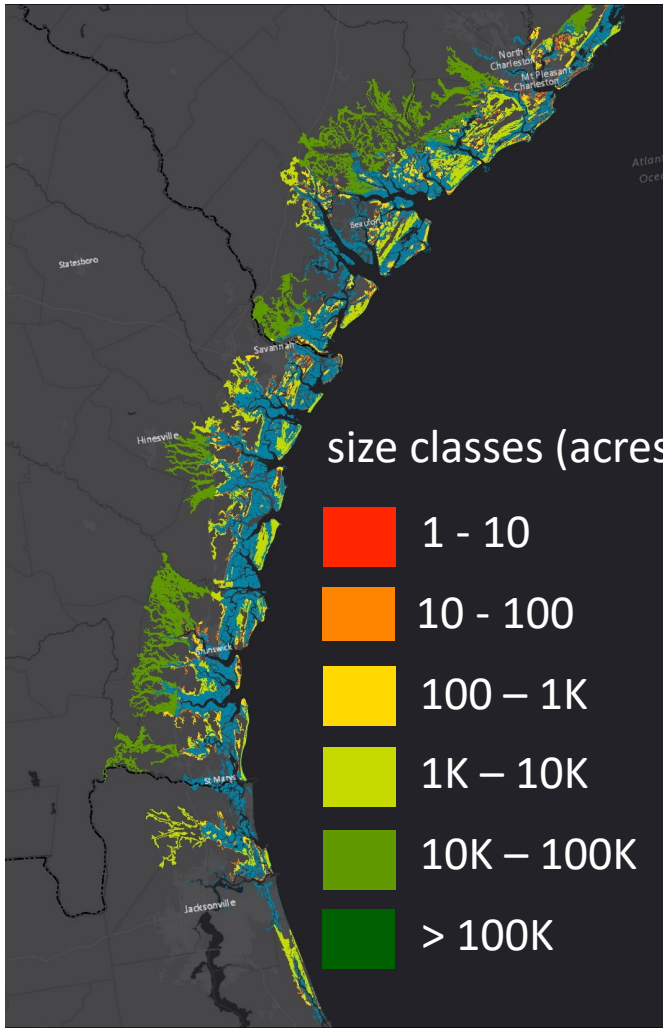


B

RESILIENT COASTAL SITES – OVERVIEW

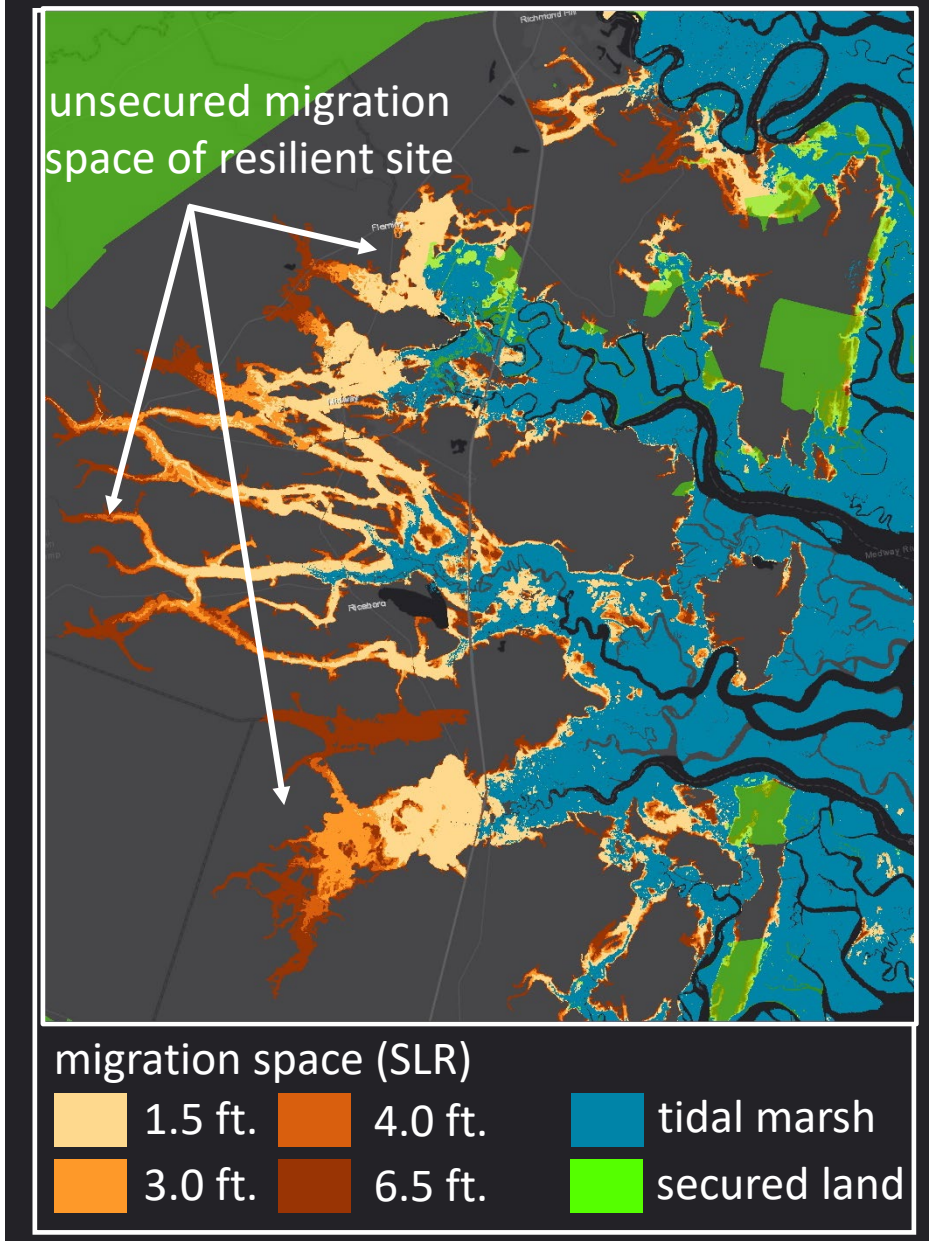
Migration Space of Resilient Coastal Sites at 6.5-ft. SLR





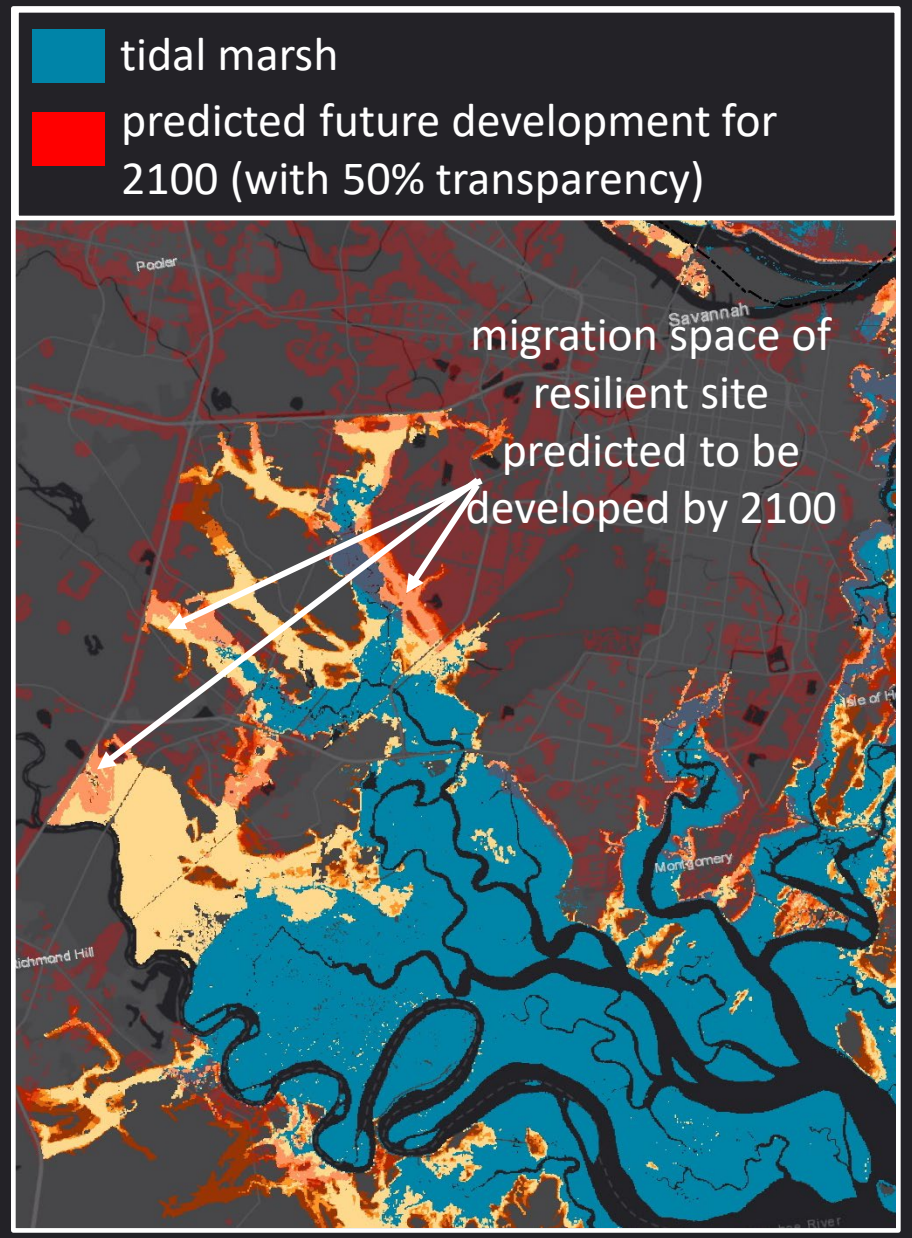
Resilient Coastal Sites - Applied Exercises

Land Protection



west of St. Catherines Sound, Georgia

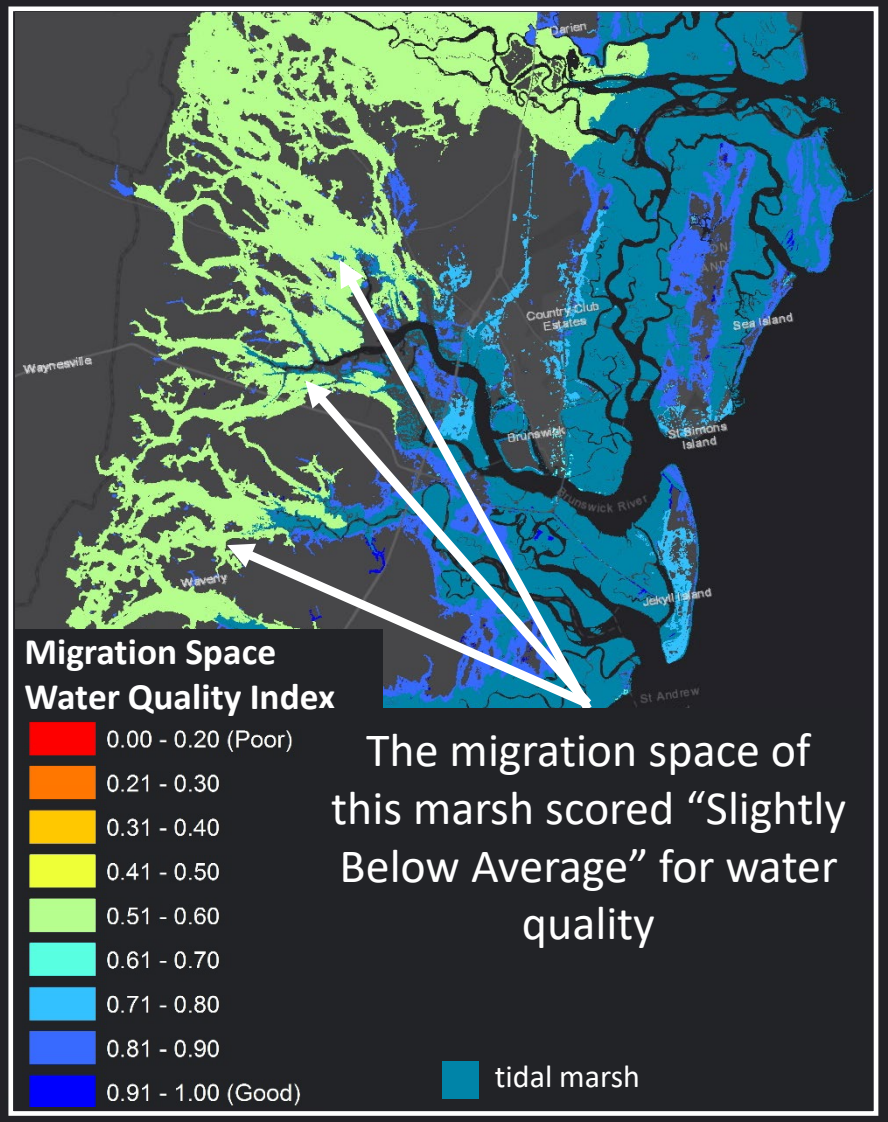
Future Development



Hunter Army Airfield, Georgia

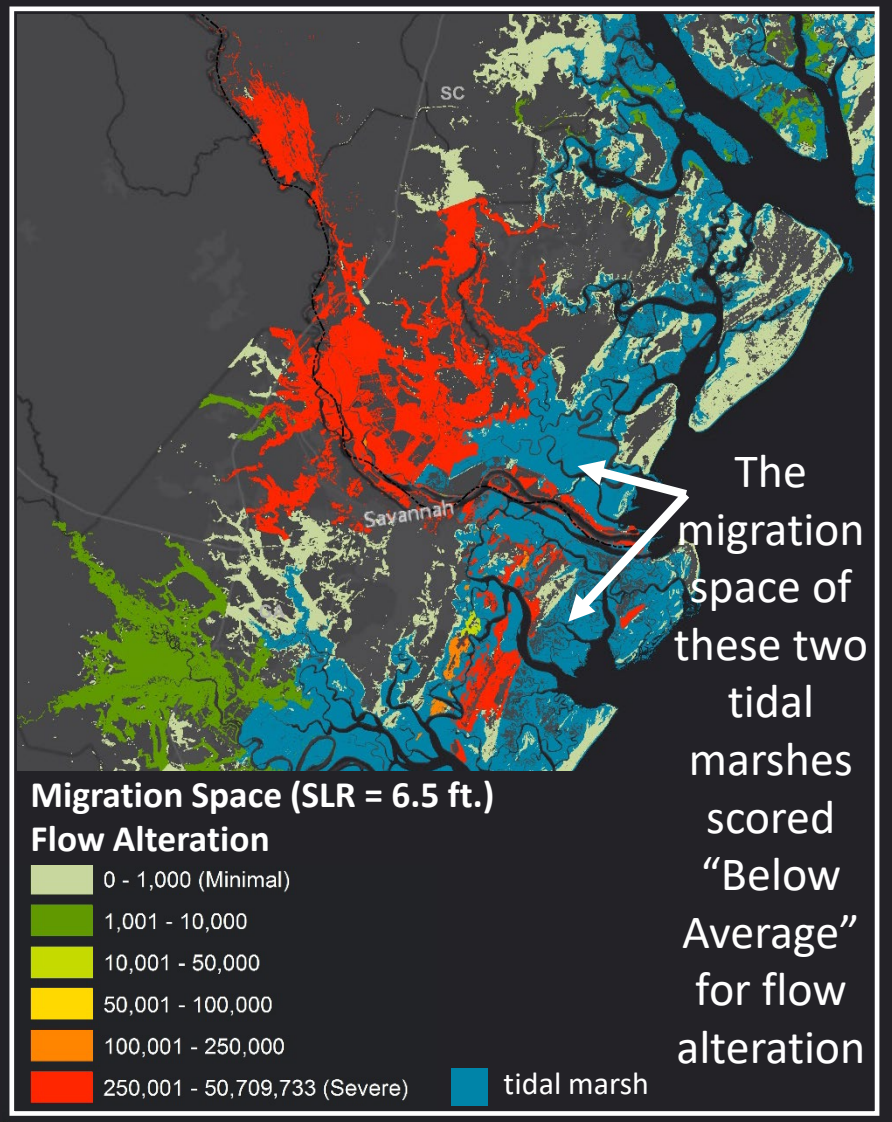
Resilient Coastal Sites - Applied Exercises

Restoration: Water Quality



St. Andrews Sound, Georgia

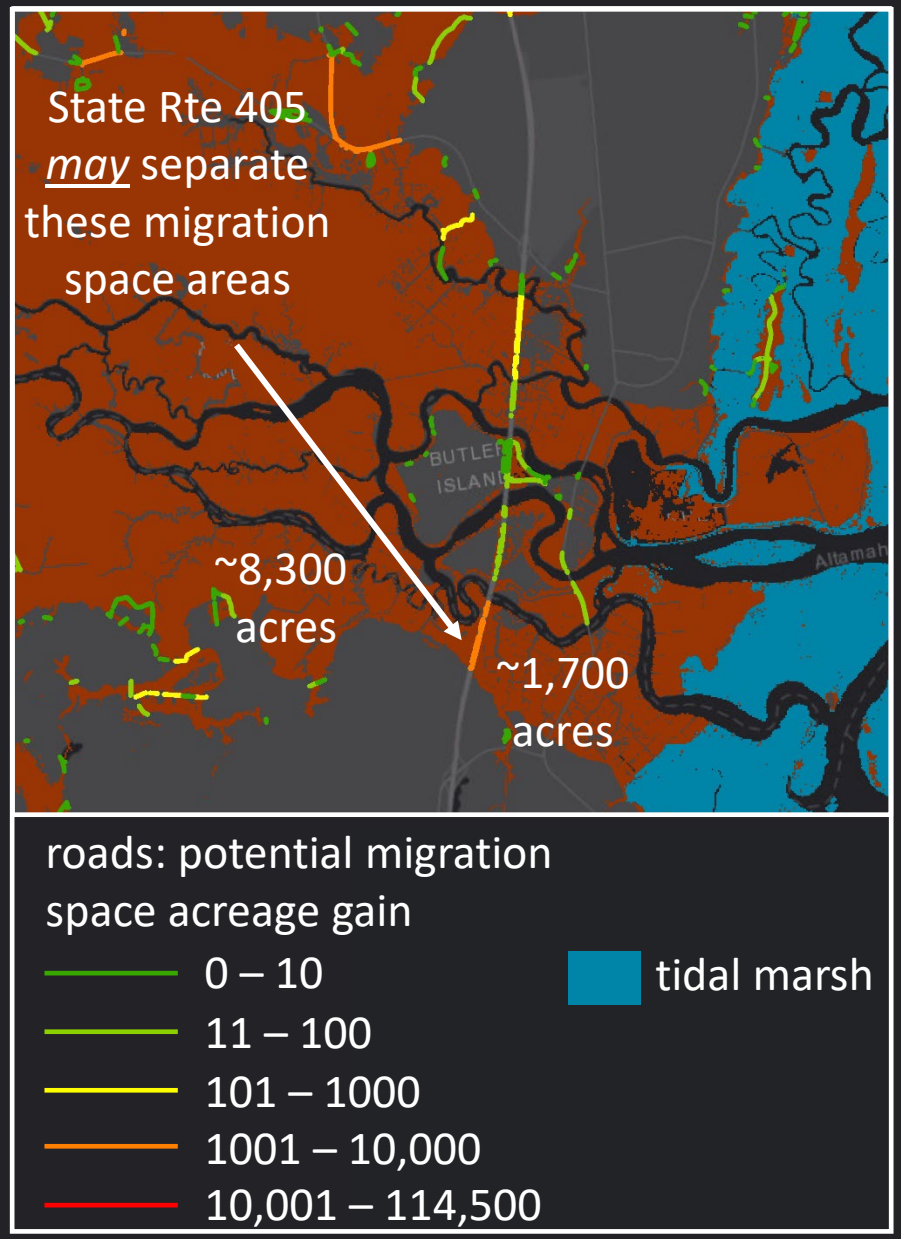
Restoration: Flow Alteration



Savannah River, Georgia/South Carolina

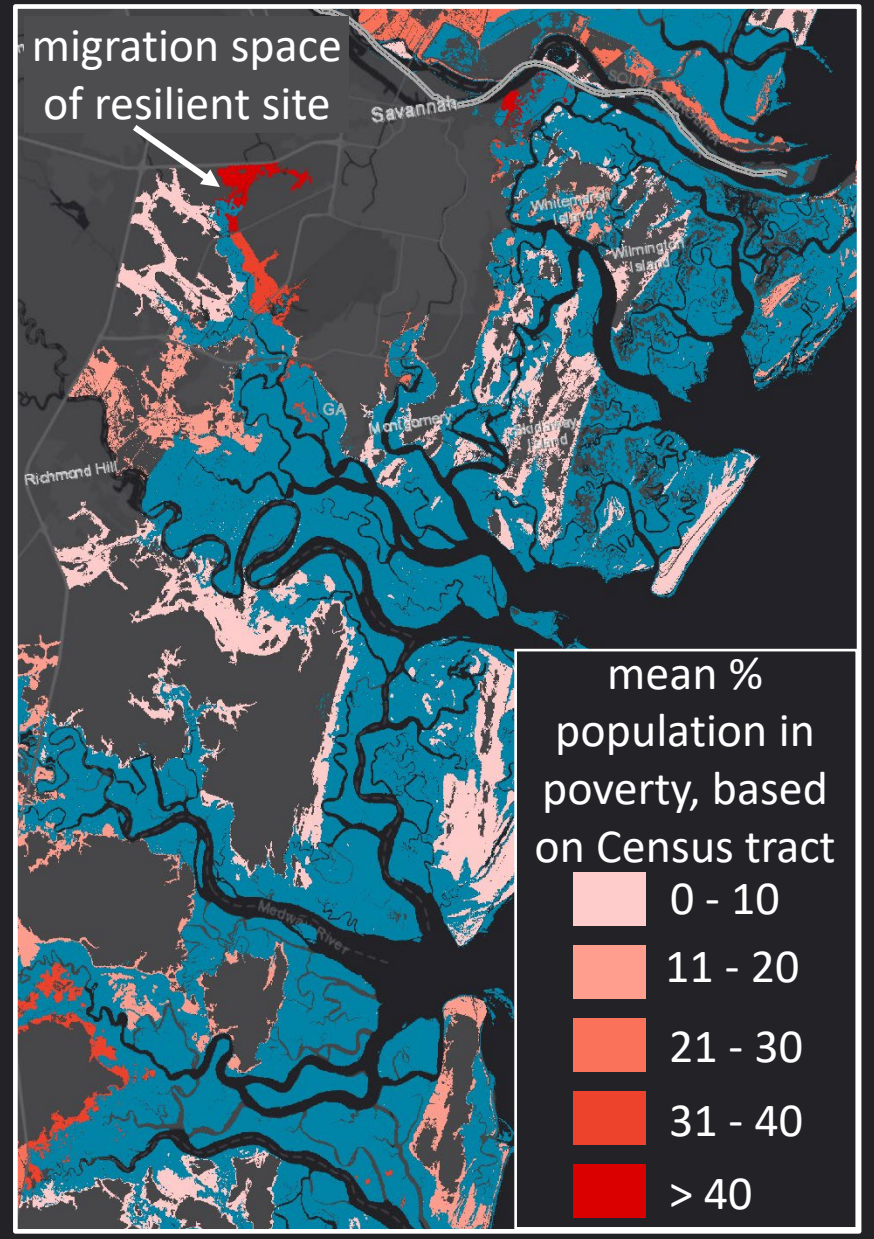
Resilient Coastal Sites - Applied Exercises

Fragmenting Roads



Butler Island, Georgia

Impoverished Areas

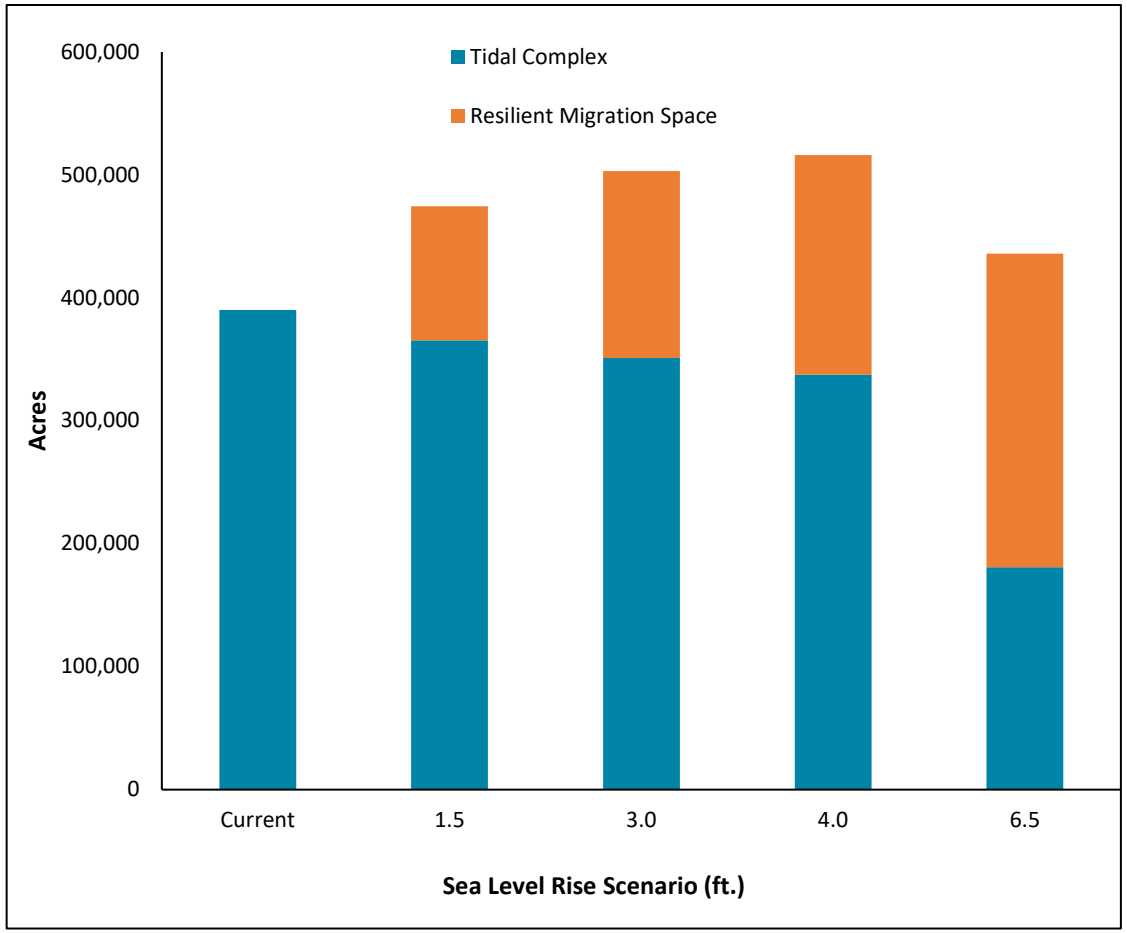


near Savannah, Georgia

B

Sustaining Georgia's Tidal Habitats into the Future

© Mac Stone. As sea levels rise, saltwater creeps up the Sampit River in South Carolina.



C

CRS OPEN SPACE EXPLORER – OVERVIEW

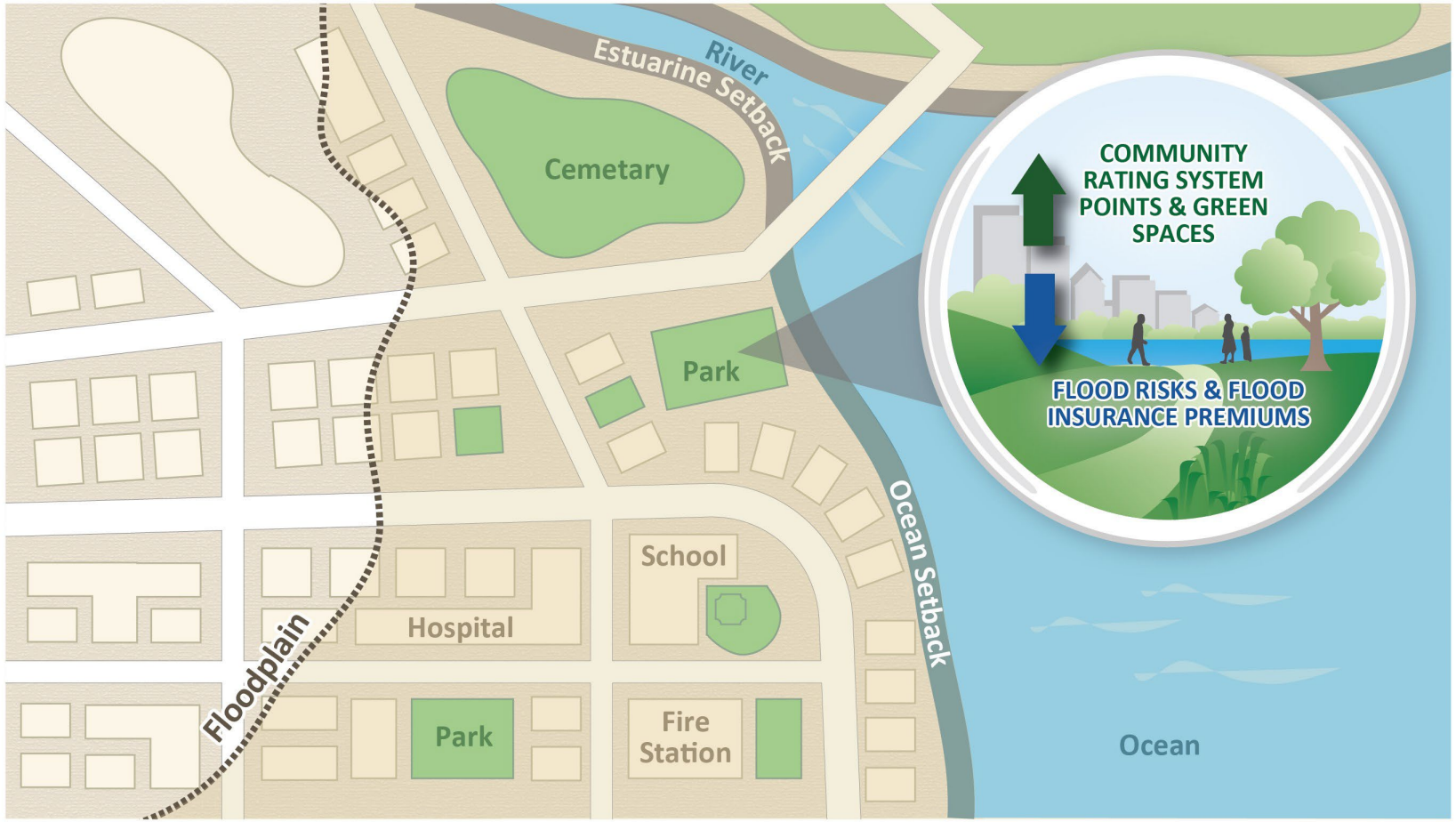
Open Space Preservation

CRS rewards communities that participate in activities that reduce flood risk with reduced flood insurance premiums

Identifying flood risk reduction opportunities an applying for credits can be overwhelming for communities that lack the capacity to take full advantage of the program.

GOALS:

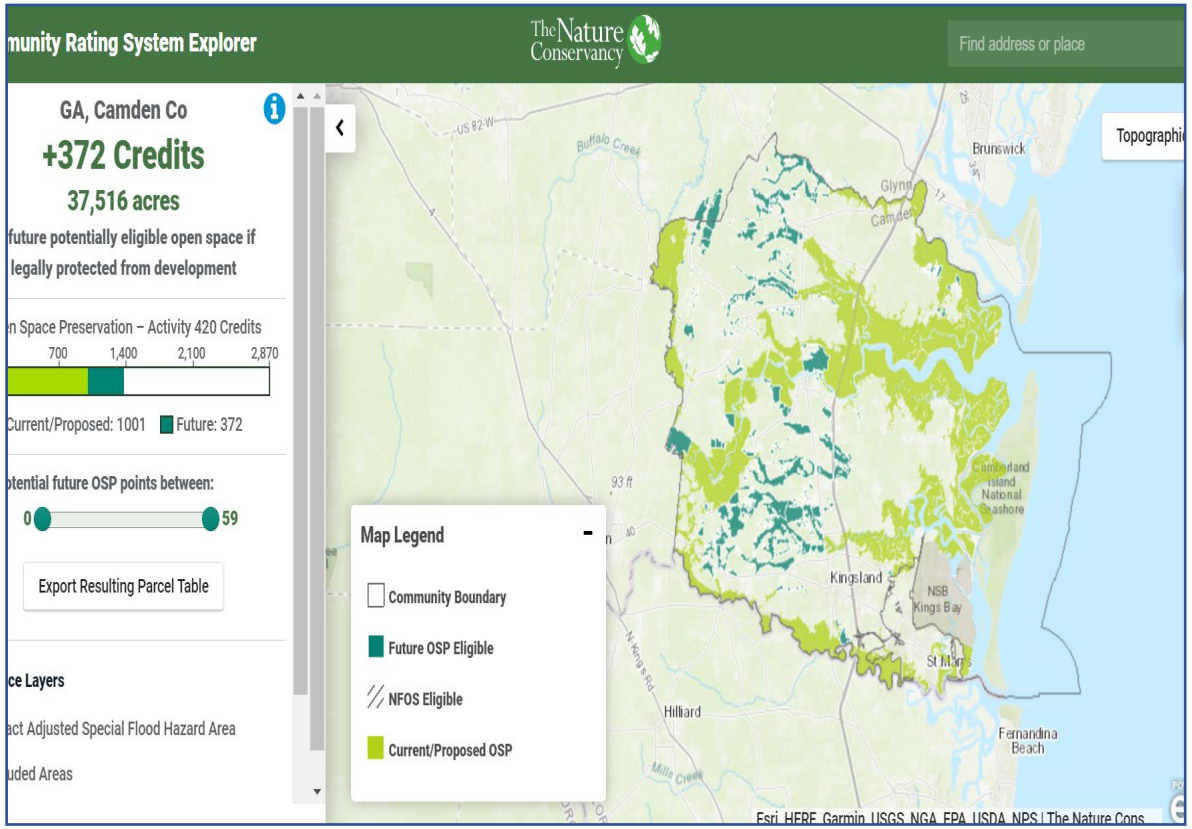
- Help identify areas that count towards "Ope Space Preservation" activities (Including Natural Functioning Open Space, Coastal Erosion Open Space, and Natural Shoreline Protection)
- Provide maps and supporting information necessary for CRS application & review
- Prioritize *future* open space in the floodplain
- Communications and outreach



DECISION SUPPORT TOOLS FOR NBS | ASSESS, COMMUNICATE, ADDRESS

C Community Rating System (CRS) Open Space Explorer

- **Developed by:** **The Nature Conservancy**
- **What it Does:** The CRS Explorer helps planners visualize areas that are eligible for Open Space Preservation (OSP) credits in FEMA's Community Rating System (CRS) to reduce flood risk and premiums.
- **Access:** **https://crs.tnc.org/**
- **Input:** **Local and national datasets**
- **Output:** Identified parcels in the SFHA that have natural land uses but are not currently eligible for OSP because they are not legally protected from development. Additionally, the tool identifies the number of OSP credits that parcel would provide if protected, as well as parcel ownership and value information.
- **Date Published/Update:** **2021-2022**
- **Additional Software/Hardware Requirements:** **None – online web tool and downloadable datasets**
- **Special Permissions Needed:** **None**
- **Caveats?** **This tool is currently only available for Camden & Glynn Counties**

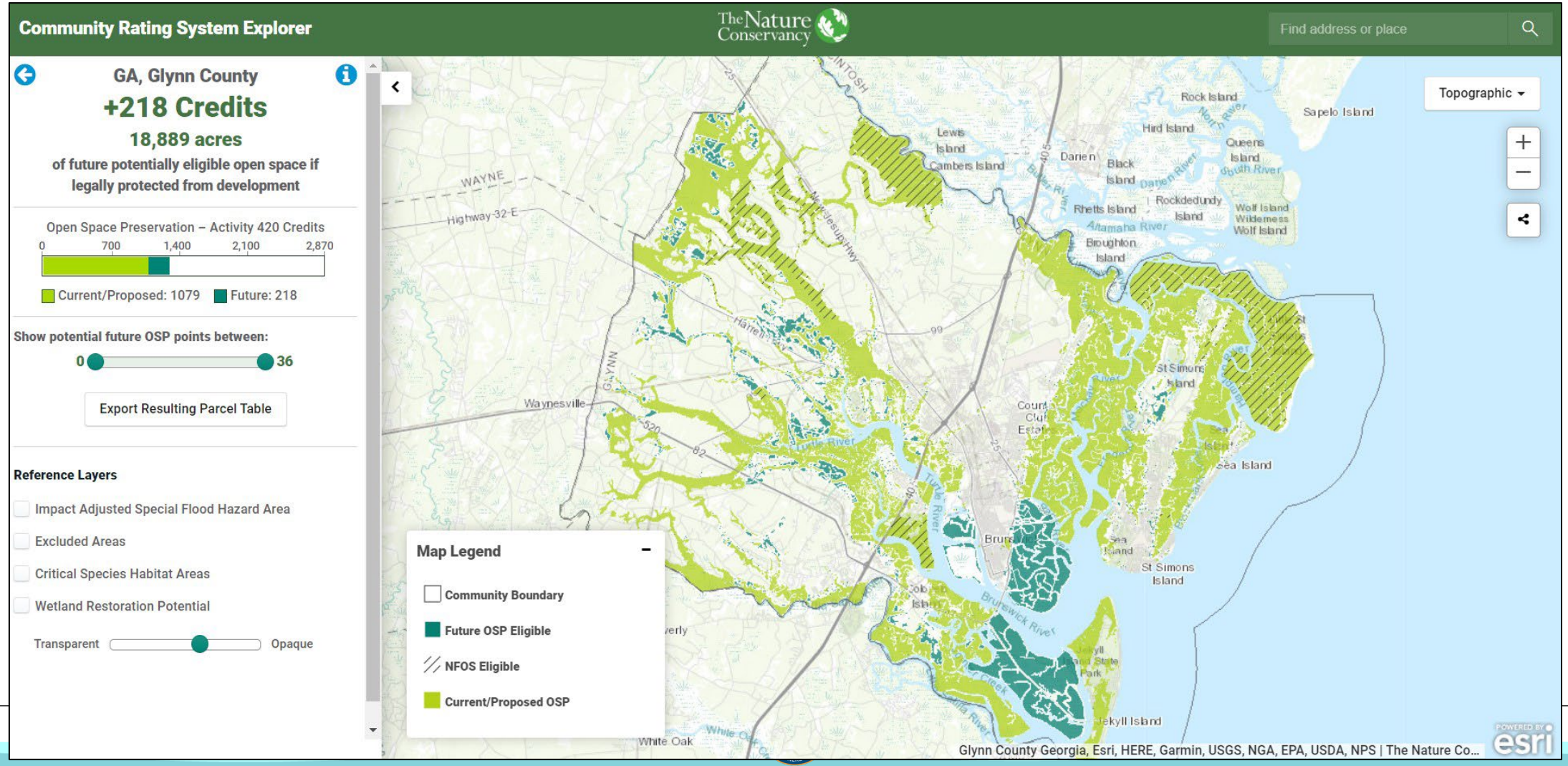


INCREASING COMMUNITY RESILIENCE TO COASTAL STORMS AND SEA LEVEL RISE

DECISION SUPPORT TOOLS FOR NBS | ASSESS, COMMUNICATE, ADDRESS

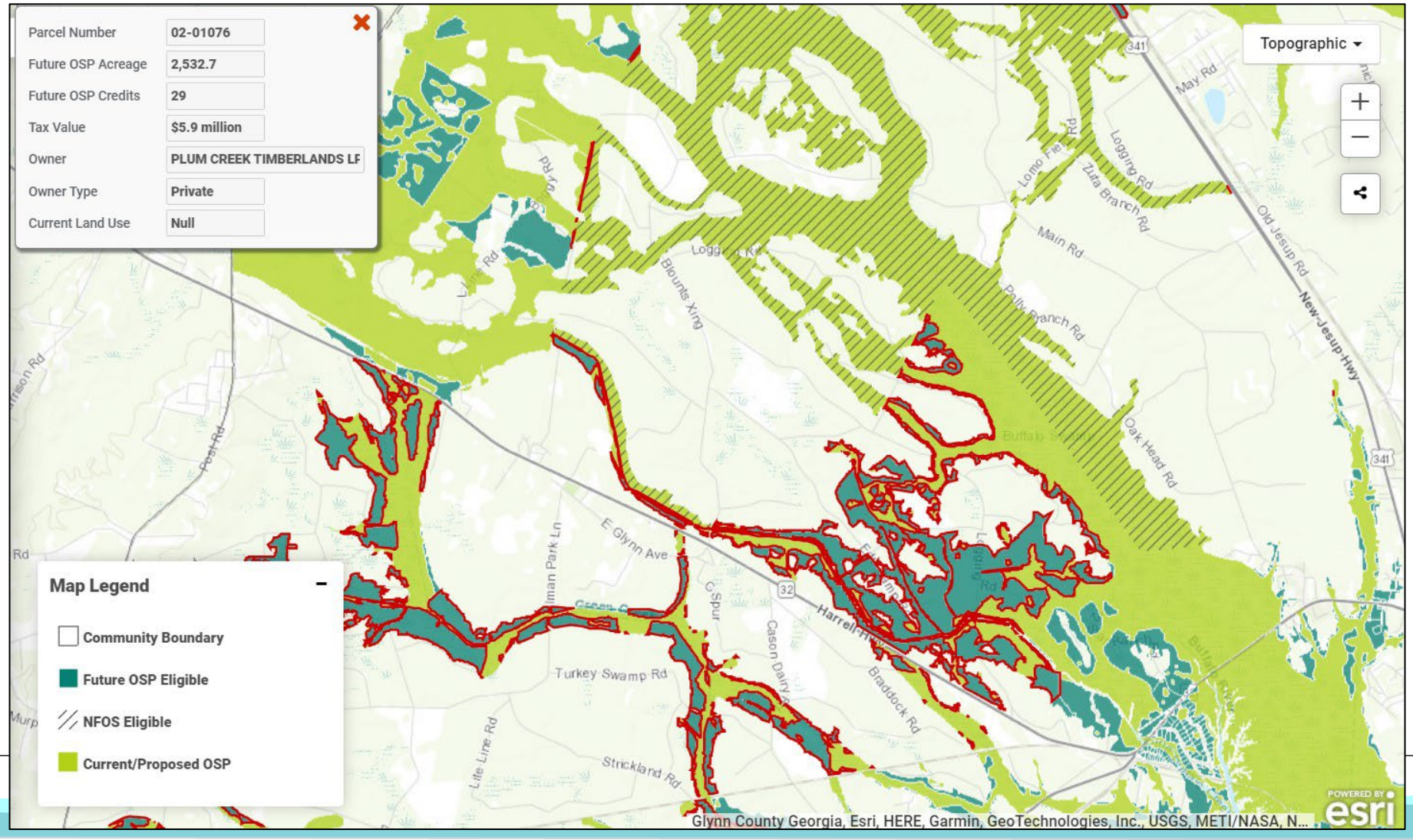
C

CRS OPEN SPACE EXPLORER – OVERVIEW



C

CRS OPEN SPACE EXPLORER – OVERVIEW



C CRS Open Space Explorer – OVERVIEW

How Have Others Used the CRS Explorer?

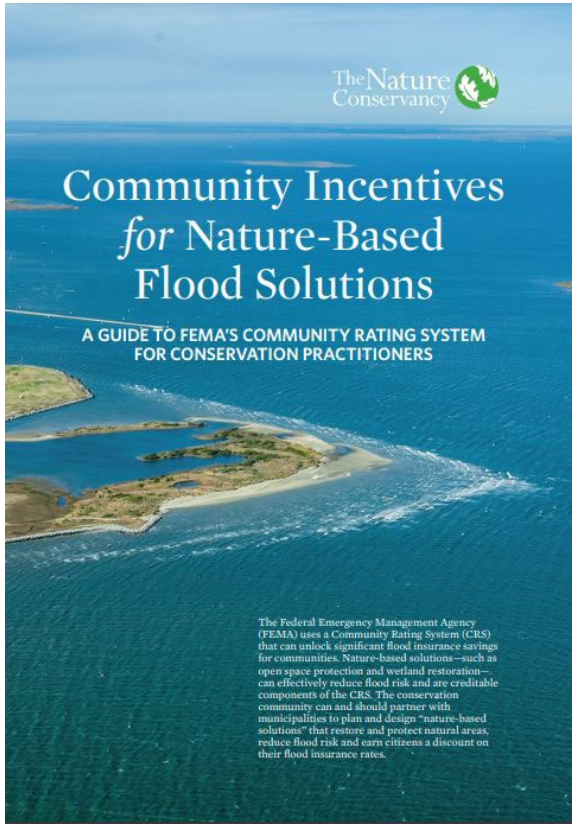
1) In NC, an average of 546 additional OSP credits across 8 communities were identified with 5 communities able to raise a class, increasing their discount.
2) Dare County, NC prioritized 6 large private tracts to protect through long-term easements before their next CRS review.
3) Currituck Co, NC used to guide "conservation subdivisions," a land use zoning approach that allows development density bonuses when environmentally sensitive areas are set aside in conservation
4) St. Marys and Camden County have just completed theirs in 2020 and are using to identify landowners to discuss land protection options
5) Glynn County, City of Brunswick and Jekyll Island maps in progress

How can I use the CRS Explorer?

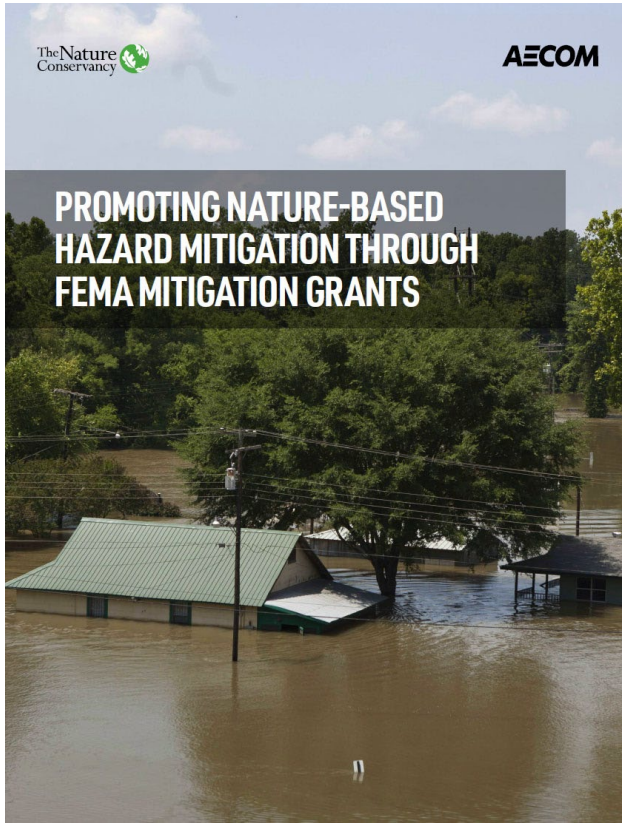
1) Prepare for CRS credit submission
2) To validate already submitted OSP credits
3) Prioritize future OSP
4) Influence zoning/policy
5) Outreach & stakeholder engagement

D Additional Guidance & Resources

Community Incentives for Nature-Based Flood Solutions: A Guide for FEMA's Community Rating System for Conservation Practitioners explains how nature-based solutions are creditable components of FEMA's National Flood Insurance Program Community Rating System (CRS). The guide provides a brief overview of the CRS and discusses how the conservation community can further nature-based solutions through the CRS. Two case studies illustrate how nature-based solutions can be used to improve a community's rating class and obtain more discounts on flood insurance costs



Promoting Nature-Based Hazard Mitigation Through FEMA Mitigation Grants is a guidance document that is intended for stakeholders pursuing FEMA HMA grants for nature-based solutions to mitigate risks associated with flooding (riverine and coastal) and wildfire. Many of the HMA grant programs can fund projects that mitigate other hazards, but this document is limited in discussion to flooding and wildfire. This document is designed to give users a better understanding for how HMA grants are a viable funding source for nature-based solutions to hazard mitigation. This includes an overview of selecting appropriate NBS for a given hazard and location, FEMA HMA requirements, and how to maximize benefits for a given project.



Questions?

Georgia Coastal Resilience Workshop
August 31 & September 1, 2022

Topic: Mapping the 1% Annual Chance Flood in Coastal Areas

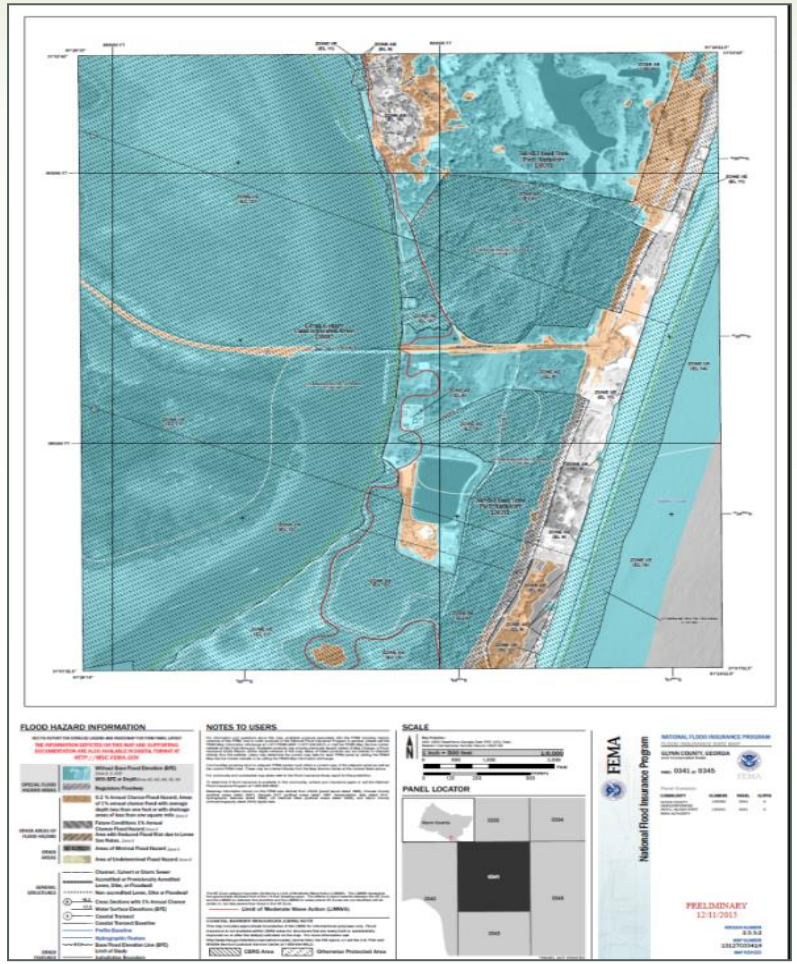
Presented by:
Haydn Blaize
Manager Floodplain Unit
Georgia Department of Natural Resources
Environmental Protection Division

GEORGIA
FLOOD MAP PROGRAM

Role of State

GEORGIA
FLOOD MAP PROGRAM

- The State of Georgia entered into a Cooperating Technical Partner (CTP) agreement with FEMA's Region IV in August 1999.
- State of Georgia now develops and updates the flood hazard maps for communities in all 159 counties



https://msc.fema.gov/portal/home

Role of State Cont'd

The Floodplain Unit also provides community outreach and assistance through a structured Community Assistance Program State Support Services Element (CAP SSSE)

Georgia Flood M.A.P. Program

State Program aligned with FEMA's Risk MAP Program

- Increase focus on risk assessment and planning
- Continue partnerships with Federal, State, & Local Agencies
- Acquire and utilize high accuracy topographic data
- Deliver risk products and datasets

Enhanced Outreach Program

- Outreach Guidebooks
- Increased Community Engagement
- Robust Website (www.georgiadfirm.com)

Role of Community

- State and local governments are required to **enforce** floodplain management ordinances that meet the minimum standards of the NFIP
- Communities can adopt standards higher than the minimum NFIP
- Residents and business owners with buildings in SFHAs that carry a federally backed mortgage are required to purchase flood insurance
- Not in the regulatory floodplain ? – ALL can purchase flood insurance

Role of Community (Cont'd)

GEORGIA FLOOD MAP PROGRAM

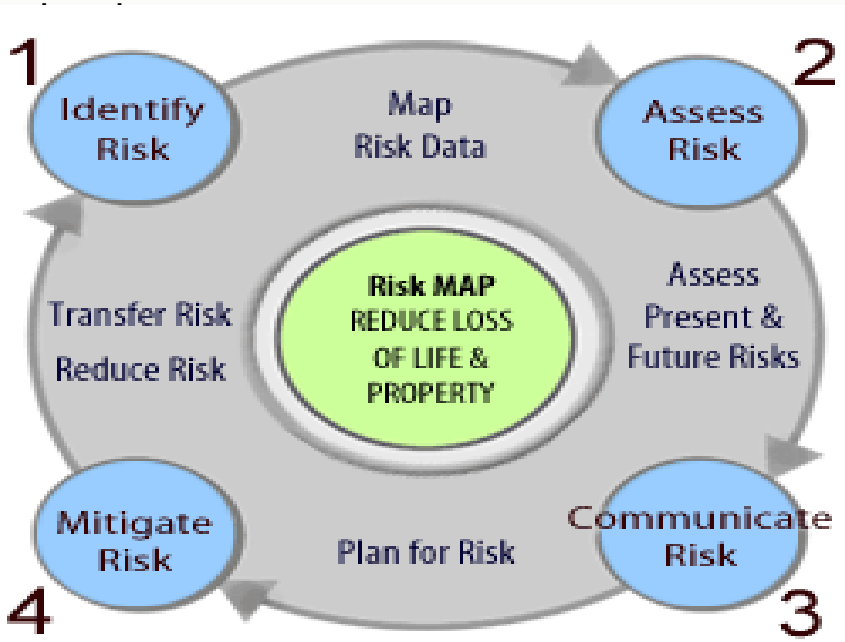
- A community that does not participate in the NFIP faces the following challenges:
  - Flood insurance not available through the NFIP
  - No federal flood related grants or loans available
  - No federal flood related disaster assistance available
  - No federal mortgage insurance or loan guarantees provided

Why Update the Coastal Flood Risk Study?

GEORGIA FLOOD MAP PROGRAM

- **Flood risk changes over time**
  - Effective Surge Analysis was performed in 1989. 25+ years old when new study was funded in FY10!
  - Analyses were dated and did not utilize the current LiDAR data or lates models

- **To gain a complete and current picture of coastal flood risks. This helps community:**
  - Plan for the risk
  - Communicate the risk to your citizens
  - Take action to reduce flood risk to lives and property
  - Build smarter and safer

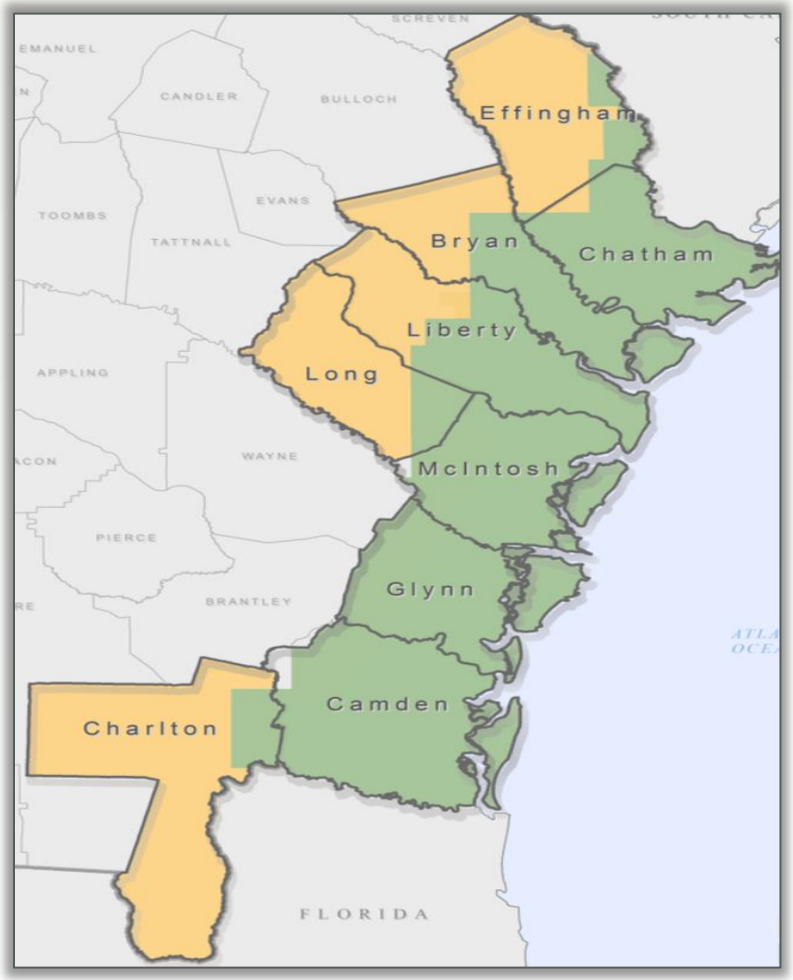


Study Phases

Coastal studies are generally more complex in nature and require more time to process/analyze than Inland (Riverine) studies

In recognition of this, GA DNR split the FY 10 mapping project into two (2) phases:

- **Inland (Riverine): Undertaken by GADNR mapping contractor**
- **Coastal Phase**



Coastal Analyses

GEORGIA
FLOOD MAP PROGRAM

- **The Coastal Phase**: undertaken by two separate mapping partners/contractors.
  - The modeling and engineering of the coastal inundation was performed by the FEMA Region 4 Production and Technical Services (PTS) contractor
  - The mapping by GA DNR's Mapping Study Contractor after receipt of completed engineering data generated FEMA Region 4 PTS contractor.

Field Surveys

Gathered Field Data

- Coordinated with community officials and stakeholders regarding available data
- Conducted thorough data investigation
- Conducted field investigations

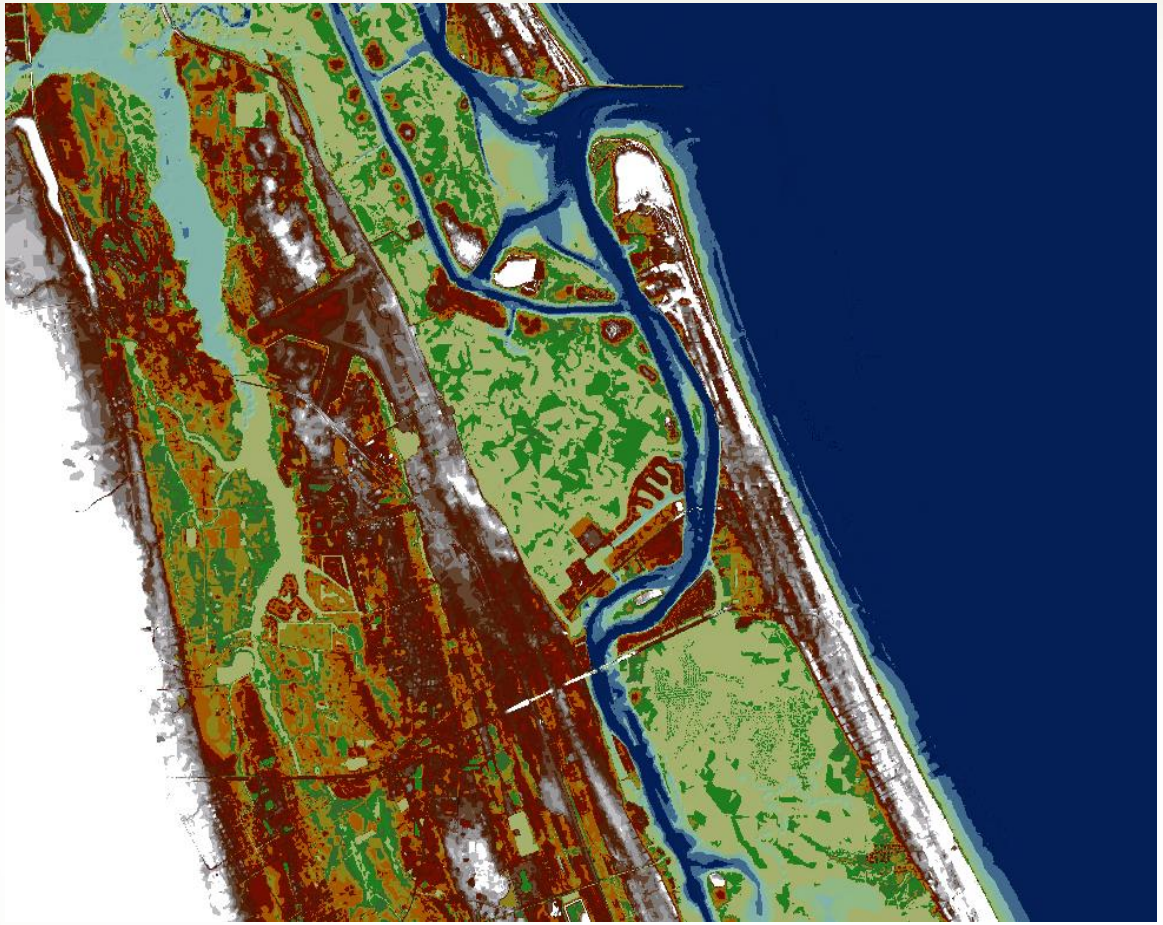
Topography

GEORGIA
FLOOD MAP PROGRAM

Gathered LiDAR, Topographic Data

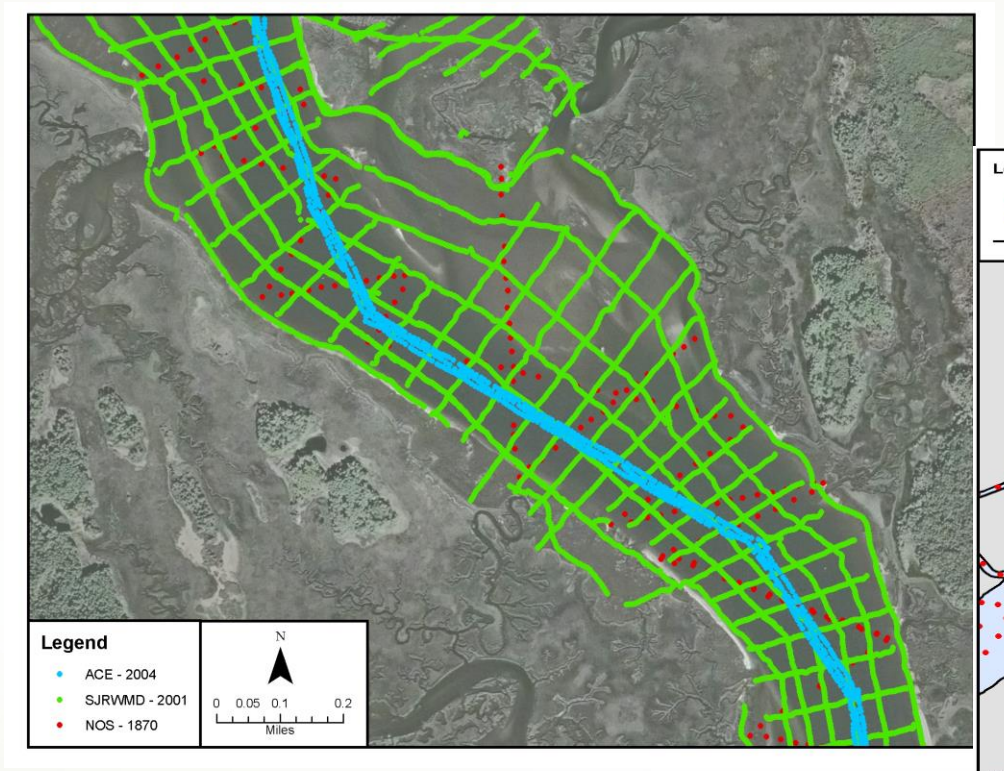
- **Procurement and Processing:** Partnership with NOAA, Coastal RDC, GADNR & FEMA

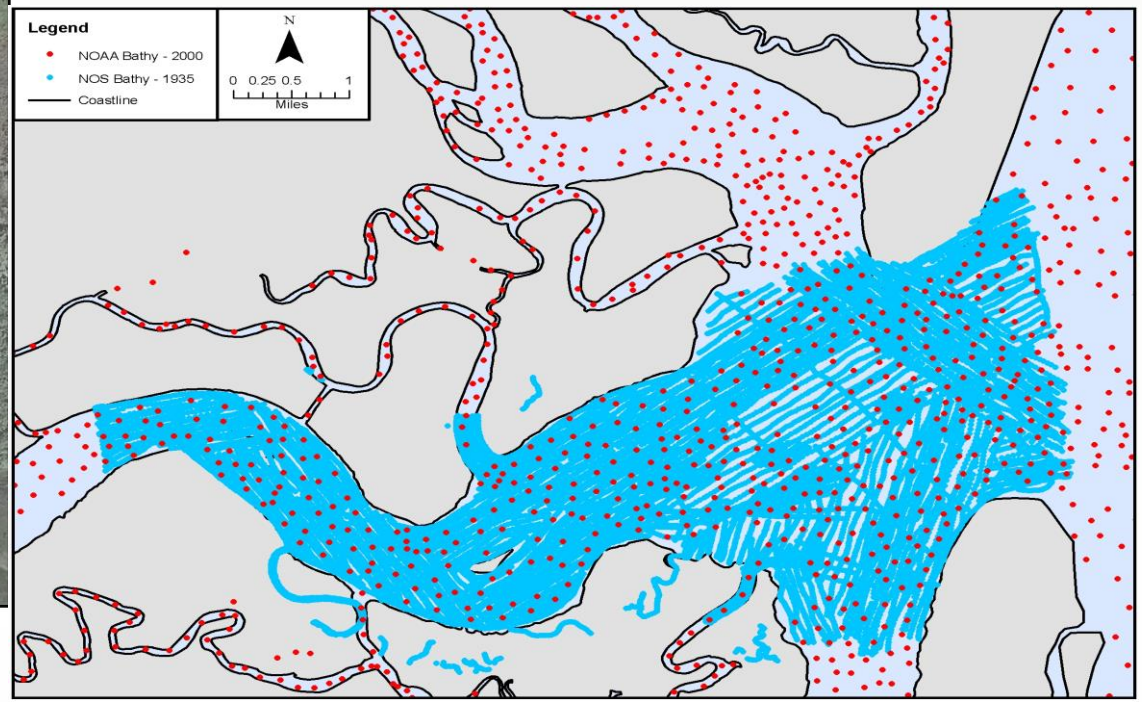
- 2008-2010, 18 cm vertical RMSE (36 cm at 95% confidence interval)



Bathymetric Data

Gathered Bathymetric Data

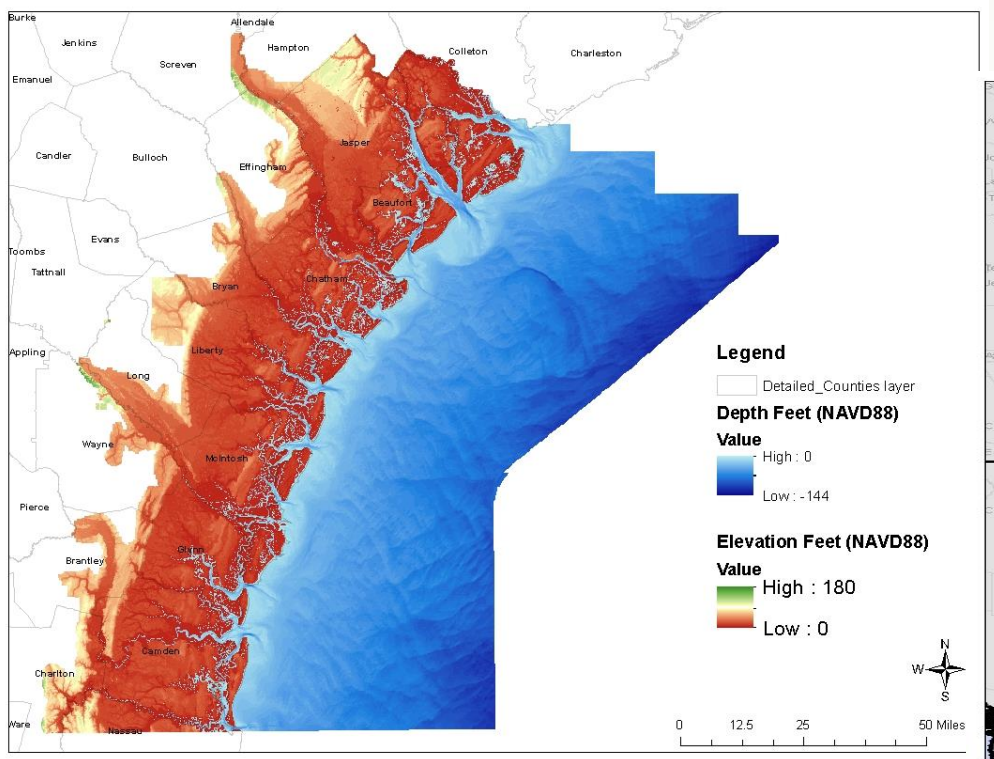


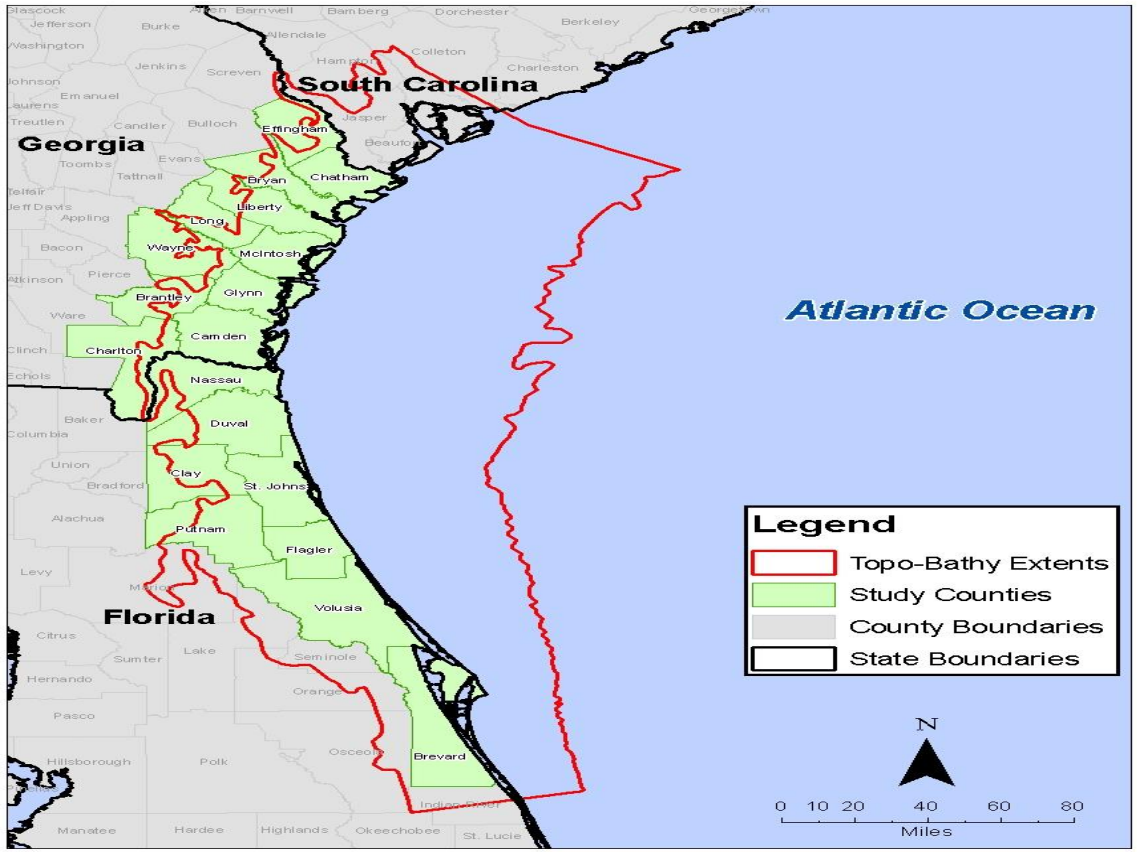


Digital Elevation Model (DEM)

GEORGIA FLOOD MAP PROGRAM

Seamless DEM for GA-North East Florida (NEFL)





Climatology and Storm Analysis

GEORGIA FLOOD MAP PROGRAM

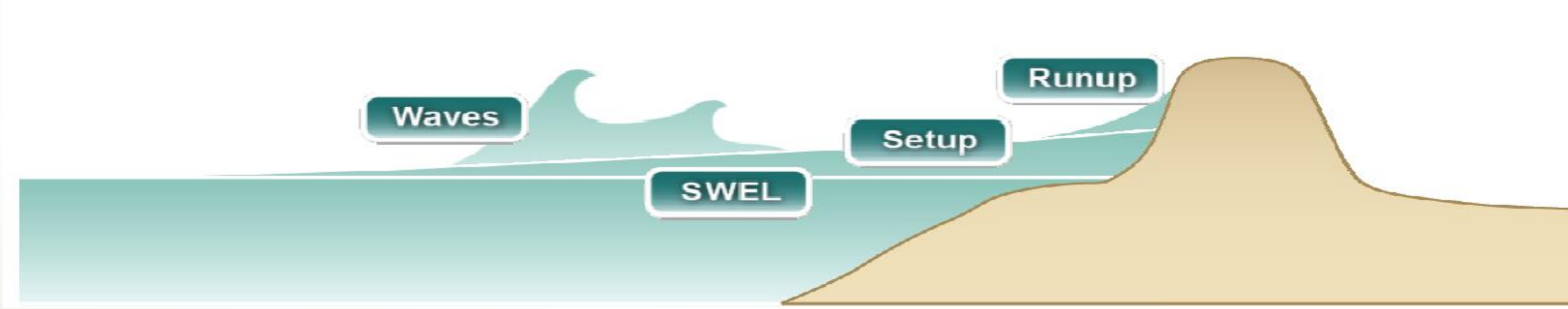
Criteria Sorting of Storms			
1. Local Landfall	2. Significant WL Difference	3. WL Data Availability (> 3 Stations)	4. Wave Data Availability (2 or more stations)
Cleo	Dora (5.91 ft)	Frances (15)	Frances (5)
Dora	David (5.55 ft)	Charley (14)	Ophelia (5)
David	Jeanne (4.22 ft)	Jeanne (14)	Tammy (5)
Chris	Tammy (4.07 ft)	Ophelia (9)	Fay (5)
Edouard	Fay (3.99 ft)	Tammy (9)	Jeanne (4)
Tammy	Frances (3.85 ft)	Dennis 99 (8)	Edouard (3)
Fay	Gabrielle (3.82 ft)	Edouard (8)	Charley (3)
	Floyd (3.8 ft)	Floyd (7)	Chris (2)
	Ophelia (3.04 ft)	Irene (7)	Dennis99 (2)
	Abby (2.93 ft)	Fay (6)	Floyd (2)
	Irene (2.92 ft)	David (5)	Irene (2)
	Bertha (2.62 ft)		
	Bob (2.44 ft)		
	Erin (2.43 ft)		
	Cleo (2.35 ft)		
	Dennis 99 (2.24 ft)		

Base Flood Elevation

GEORGIA FLOOD MAP PROGRAM

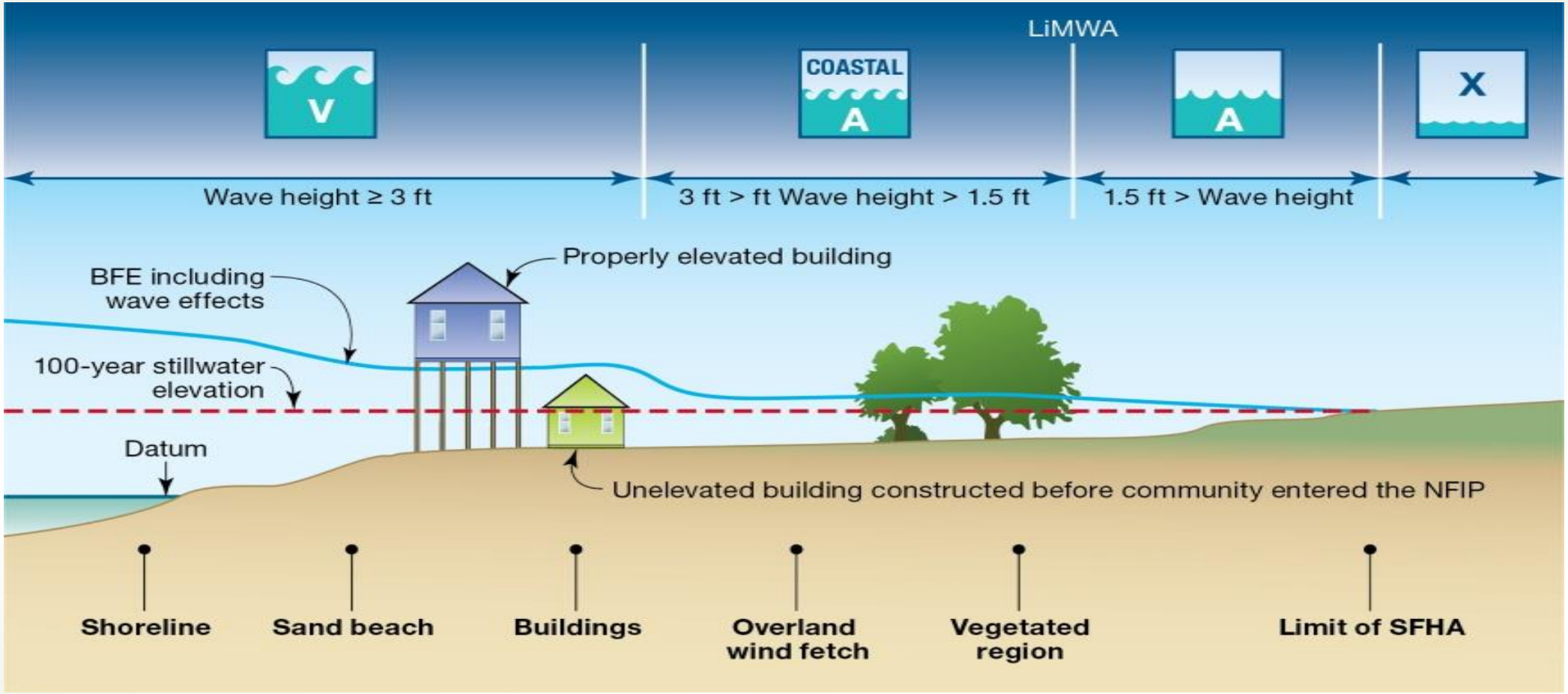
Base Flood Elevation (BFE) on FIRM includes 4 components:

1. Storm surge stillwater elevation (SWEL)
2. Amount of wave setup
3. Wave height above storm surge (SWEL) elevation
4. Wave runup above storm surge elevation (where present)



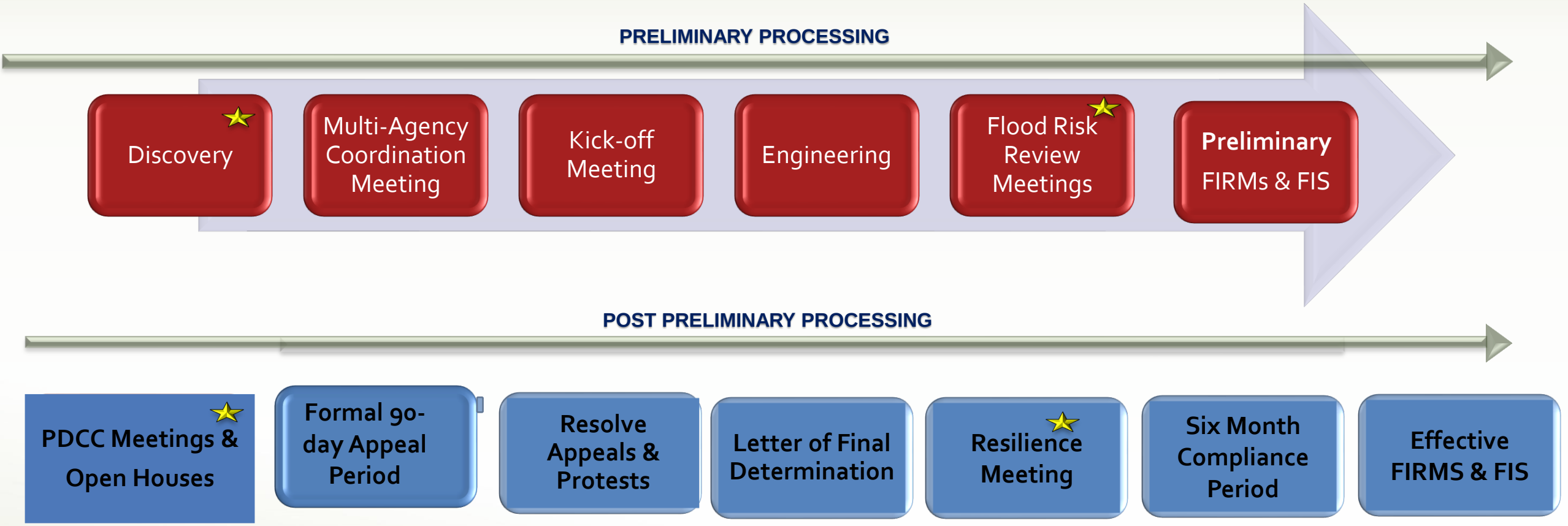
Flood Zones

GEORGIA
FLOOD MAP PROGRAM



Map Update Process
4-6 Years Typical

GEORGIA FLOOD MAP PROGRAM

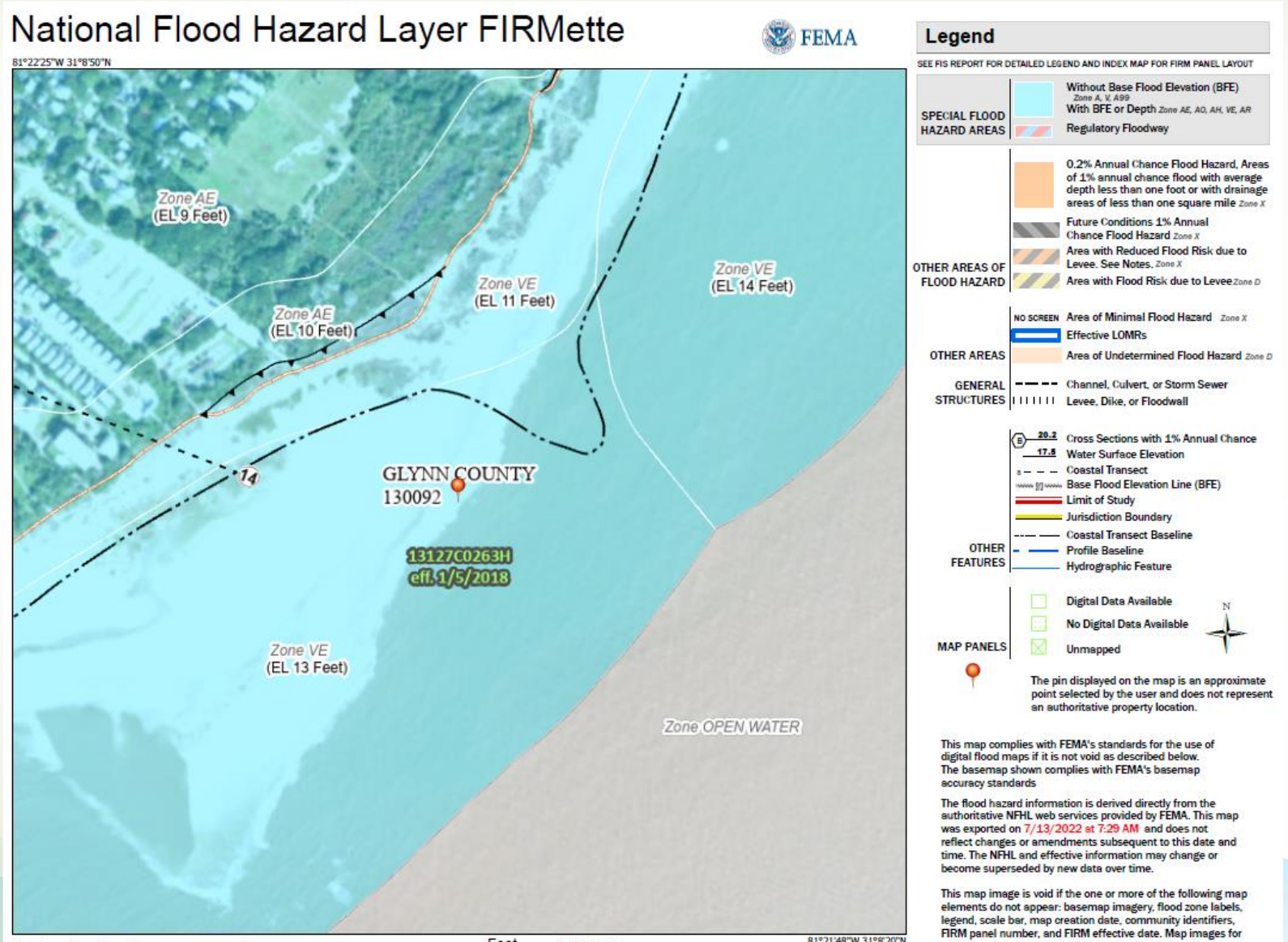


★ = COMMUNITY MEETINGS

GEORGIA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

Flood Insurance Rate Map (FIRM)?

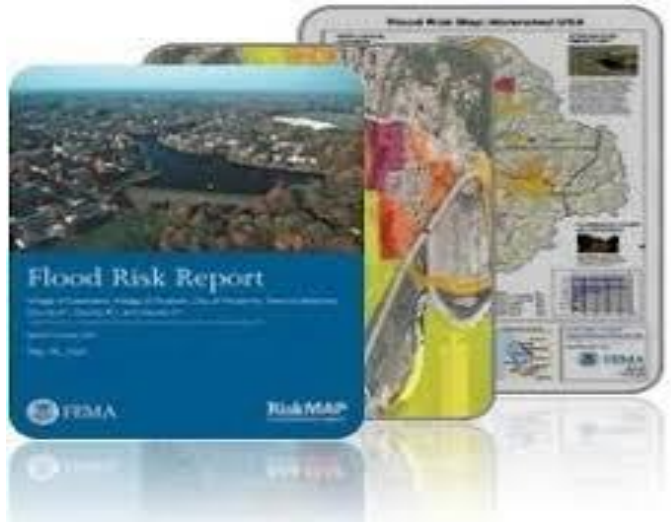
https://msc.fema.gov/portal

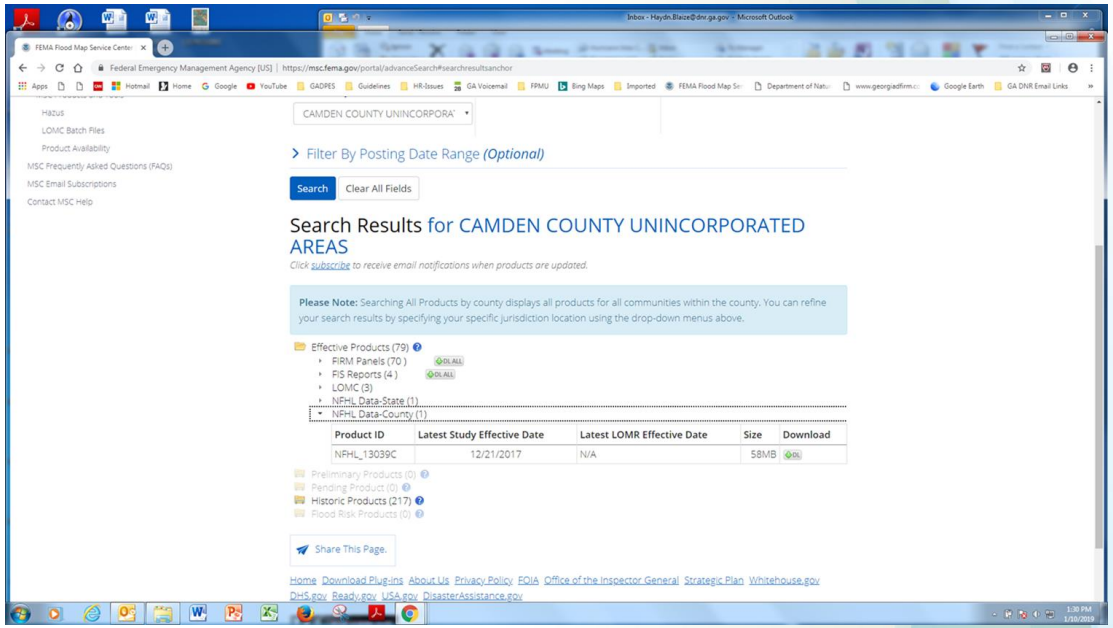


FLOOD INSURANCE **RATE** MAP
OR
FLOOD INSURANCE **REQUIREMENT** MAP?

Coastal Flood Risk Products

- Wave Height Grids
- Erosion Risk Determination Areas
- Depth Plus Grids
- Risk Assessment
- Flood Risk Report





Coastal Communities (Based on Impacts from 1% annual chance flood for Flood Insurance Purposes)

GEORGIA FLOOD MAP PROGRAM

County	Community
Bryan	Bryan UA
	City of Pembroke
	City of Richmond Hill
Camden	Camden UA
	City of Kingsland
	City of St. Marys
	City of Woodbine
Chatham	Chatham UA
	City of Bloomingdale
	City of Garden City
	City of Pooler
	City of Port Wentworth
	City of Savannah
	City of Tybee Island
	City of Vernonburg
	Town of Thunderbolt

County	Community
Glynn	City of Brunswick
	Glynn UA
	Jekyll Island State Park Authority
Liberty	City of Flemington
	City of Gumbranch
	City of Hinesville
	City of Midway
	City of Riceboro
	City of Walthourville
	Liberty UA
	Town of Allenhurst
McIntosh	City of Darien
	McIntosh UA
6	**29**

Role of Community Cont'd

Community Rating System

- Voluntary incentive program
- Encourages community floodplain management activities that exceed the minimum NFIP requirements.
  - based on 19 creditable activities, organized under four categories encompassing Public Information Activities, Mapping and Regulations, Flood Damage Reduction Activities, and Warning & Response
- Will reduce flood insurance premium rates

Coastal Communities Participating in the Community Rating System

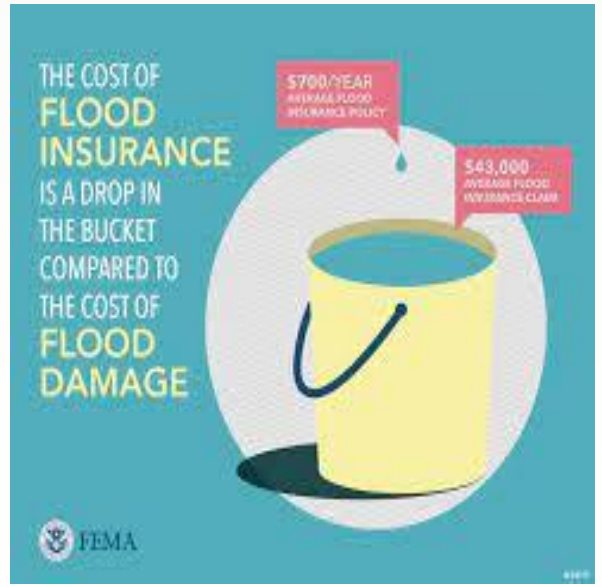
GEORGIA FLOOD MAP PROGRAM

CID	Community Name	County	CRS Rating	Discount
130016#	BRYAN COUNTY *	BRYAN COUNTY	6	20%
130017#	PEMBROKE, CITY OF	BRYAN COUNTY	9	5%
130018#	RICHMOND HILL, CITY OF	BRYAN COUNTY	7	15%
130262#	CAMDEN COUNTY*	CAMDEN COUNTY	6	20%
130027#	ST. MARYS, CITY OF	CAMDEN COUNTY	6	20%
130452#	BLOOMINGDALE, CITY OF	CHATHAM COUNTY	8	10%
130030#	CHATHAM COUNTY*	CHATHAM COUNTY	5	25%
135161#	GARDEN CITY, CITY OF	CHATHAM COUNTY	6	20%
130261#	POOLER, CITY OF	CHATHAM COUNTY	6	20%
135163#	SAVANNAH, CITY OF	CHATHAM COUNTY	5	25%
130460#	THUNDERBOLT, TOWN OF	CHATHAM COUNTY	6	20%
135164#	TYBEE ISLAND, CITY OF	CHATHAM COUNTY	5	25%
130076#	EFFINGHAM COUNTY *	EFFINGHAM COUNTY	7	15%
130093#	BRUNSWICK,CITY OF	GLYNN COUNTY	6	20%
130092#	GLYNN COUNTY *	GLYNN COUNTY	6	20%
130201#	JEKYLL ISLAND, STATE PARK AUTHORITY	GLYNN COUNTY	5	25%
130125#	HINESVILLE,CITY OF	LIBERTY COUNTY	6	20%
17				

NFIP Statistics
Georgia Statewide/Coastal

GEORGIA
FLOOD MAP PROGRAM

Description		Georgia State-wide	Coastal Georgia
Structures in Regulatory Floodplain (Bing Footprints)		88,000	29,160
Flood Insurance Policies in Place	Regulatory Floodplain	29,548	22,590
	Outside Regulatory Floodplain	46,888	24,879
Total Coverage		$21.5 billion	$15.8 billion
Total Annual Premiun		$53 million	$35 million
# of claims since 1978		22,520	7,585
Value of Claims paid since 1978		$455.4 million	129.2 million



Georgia CTP Program at a Glance

GEORGIA FLOOD MAP PROGRAM

$56M
In mapping since FY2008

690 Communities **100%** Modernized

>40,000 mi
Model Back Studies
16 % of Region IV Inventory

26,216 mi NVUE Compliant I **16,430 mi** Unverified I
61.4% NVUE Compliance

201
Communities have active Risk MAP Projects

95 Counties receiving BLE by 2022 = **25,724** miles (2d/1d)

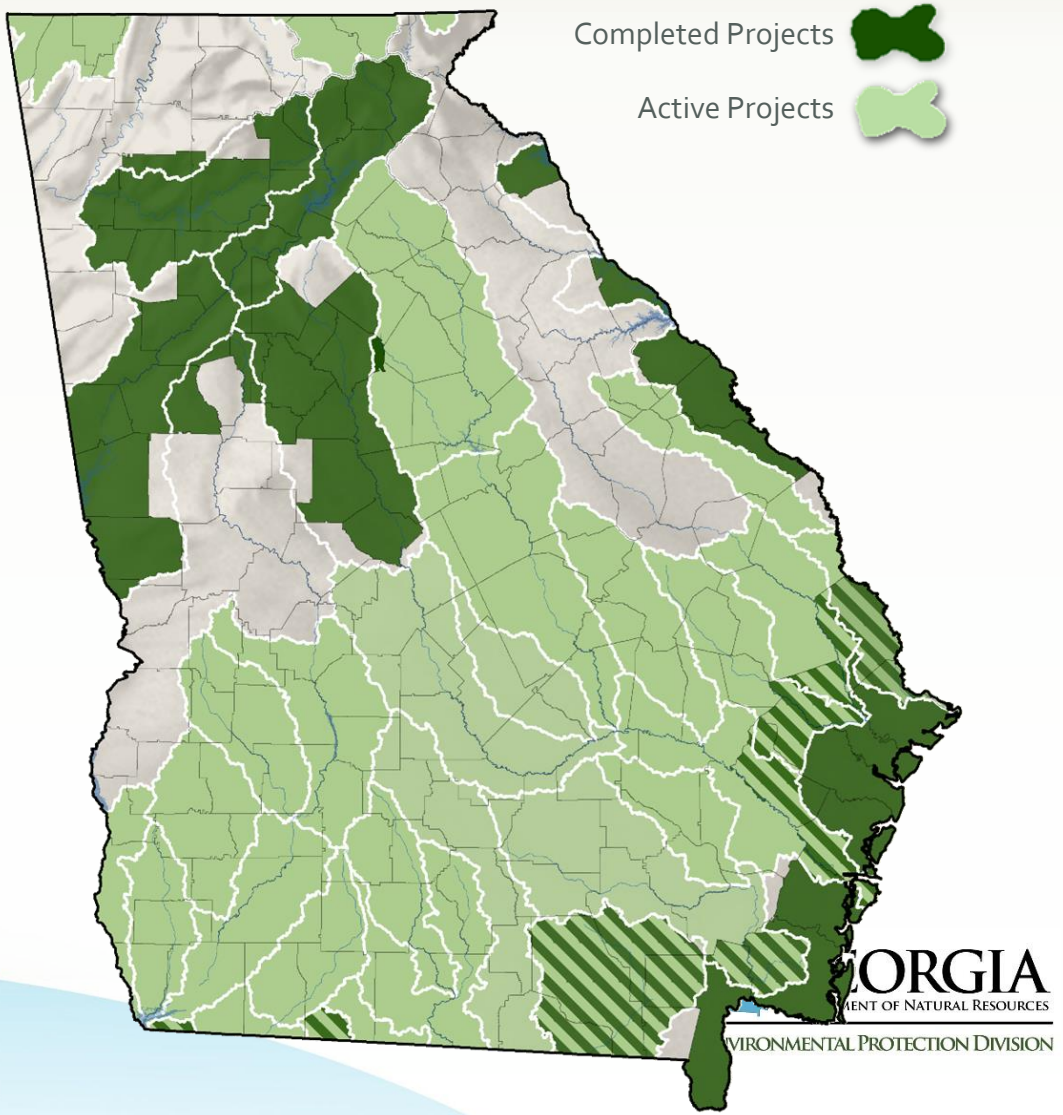
54
Communities Participate in CRS
& **35** are a class **7** or higher

581 Communities participate in NFIP
96.4% higher standards

$6.4M in CRS community savings

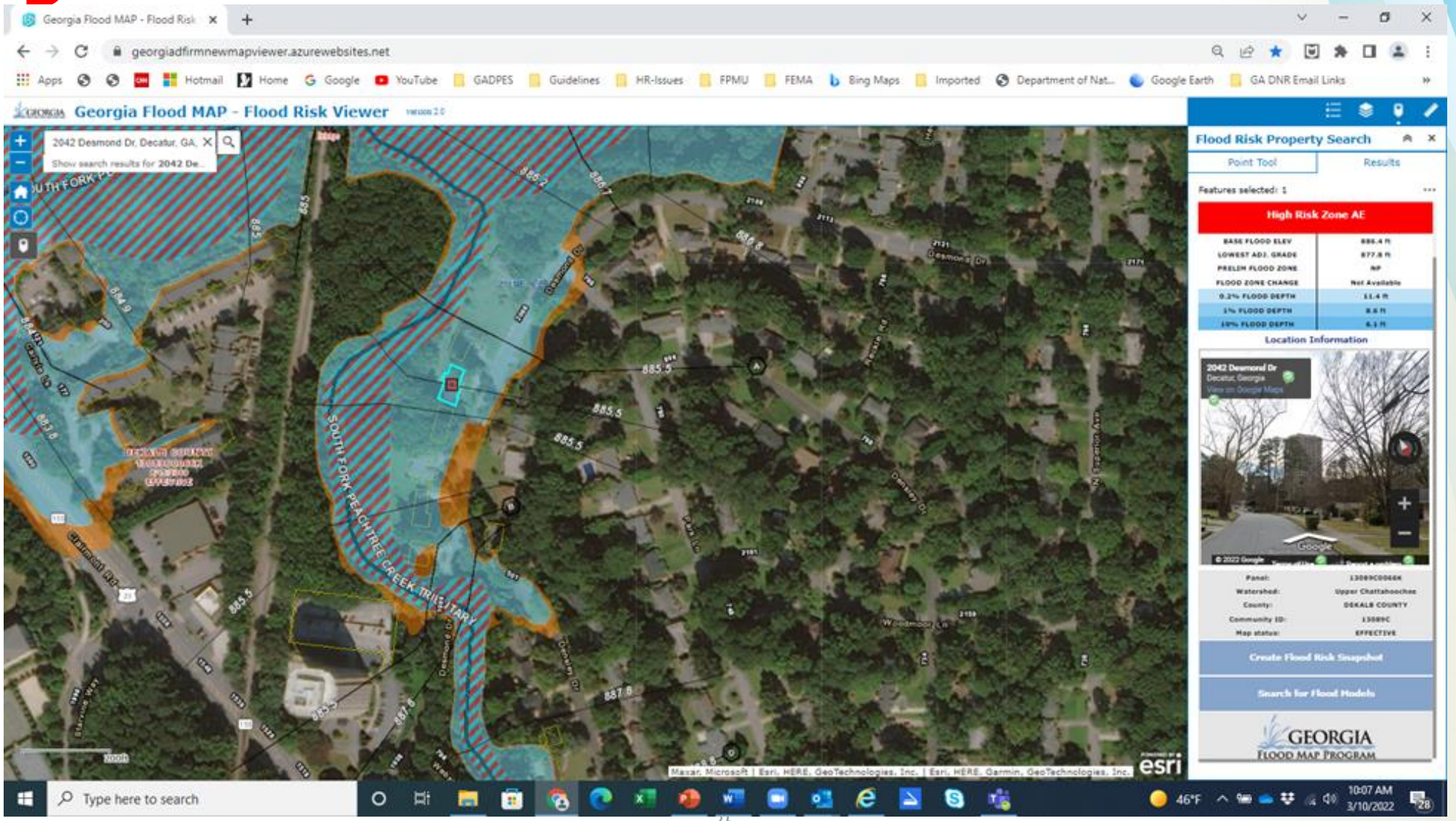
74
Communities with mapped SFHA still do not participate in NFIP
BUT 19 Communities without mapped SFHA do participate

Statewide LiDAR
by 2022



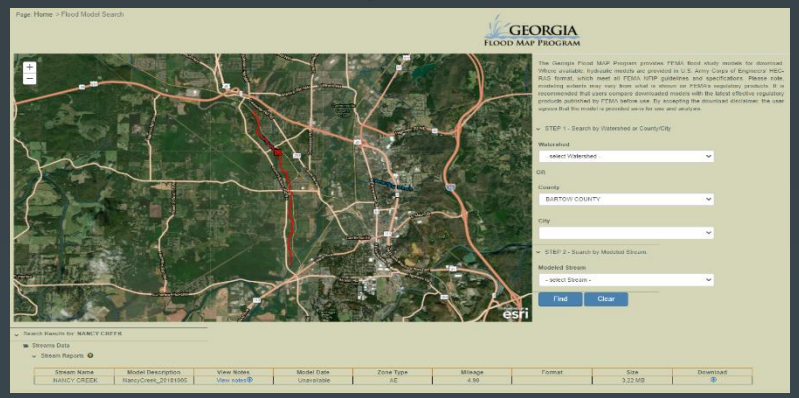
Website

georgiadfirm.com

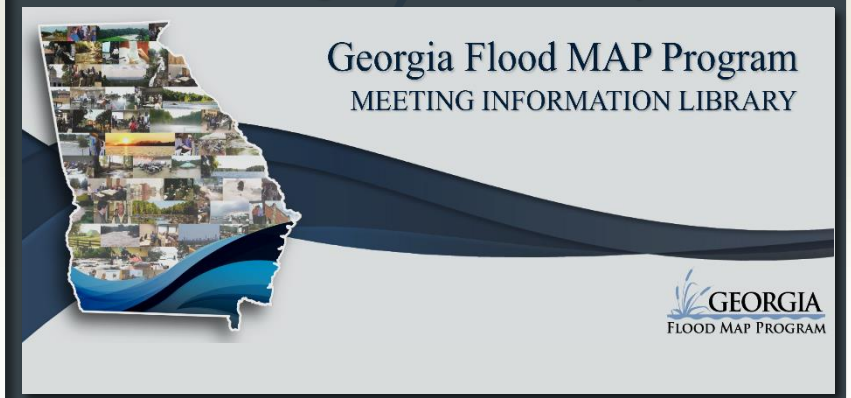


Geospatial Data Viewer Portal

Flood Study Model Search



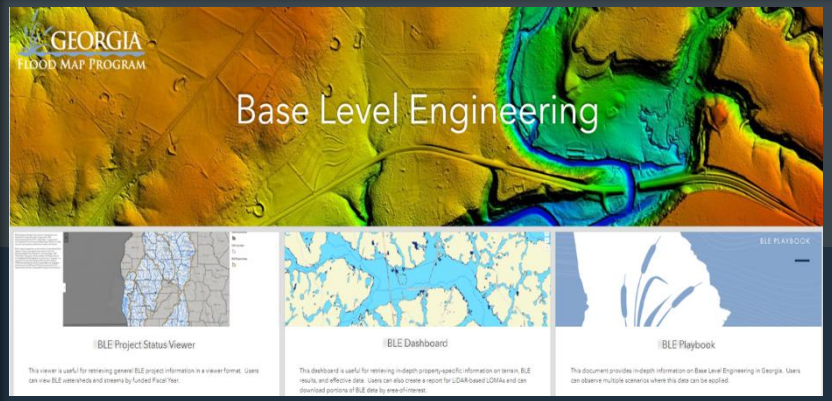
Meeting Information Library



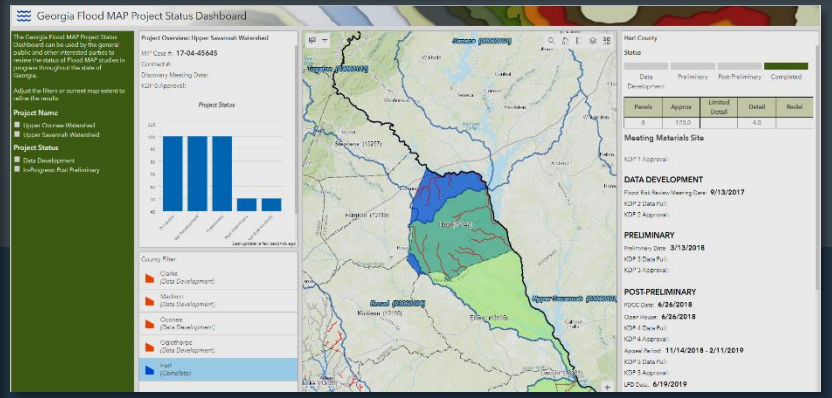
Georgia BLE Playbook

Centralized Program Repository

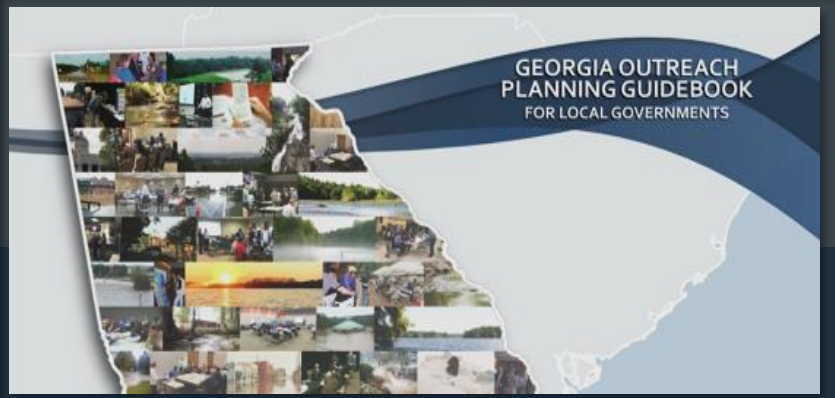
Georgia CRS Activity 420 Statistics



Georgia BLE Viewer



Georgia Project Status Viewer



Outreach Guidebook Interactive Story Map

Thank You

GEORGIA FLOOD MAP PROGRAM

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GEORGIA DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

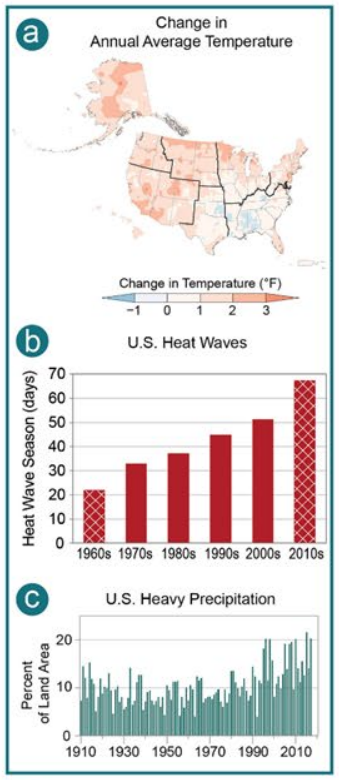
Understanding local sea level rise impacts, including latest science and resources

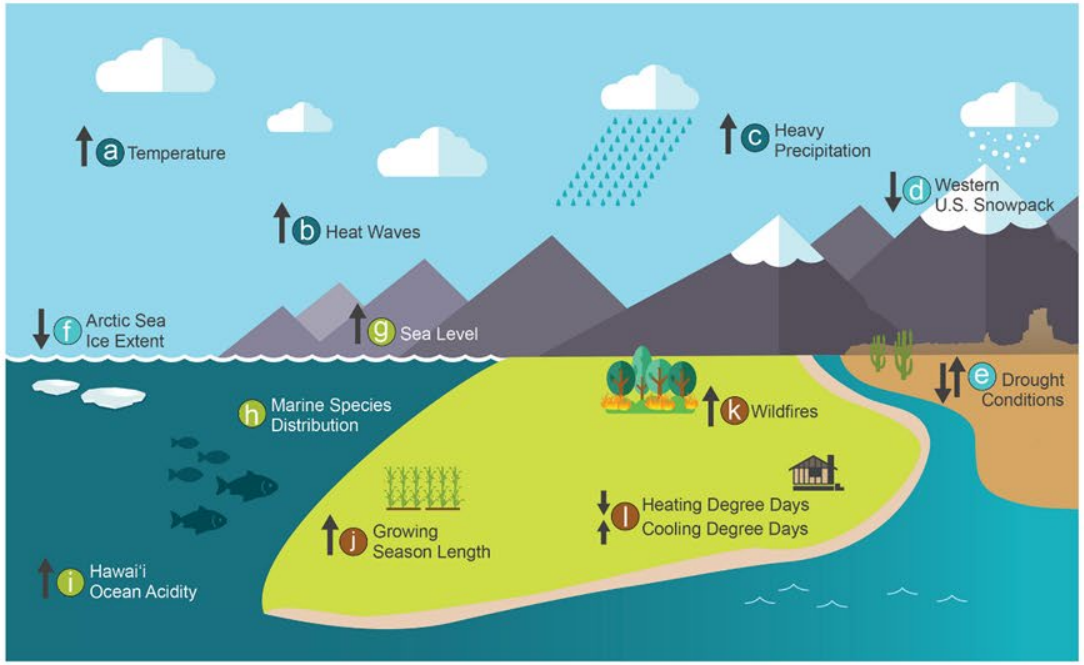
Doug Marcy

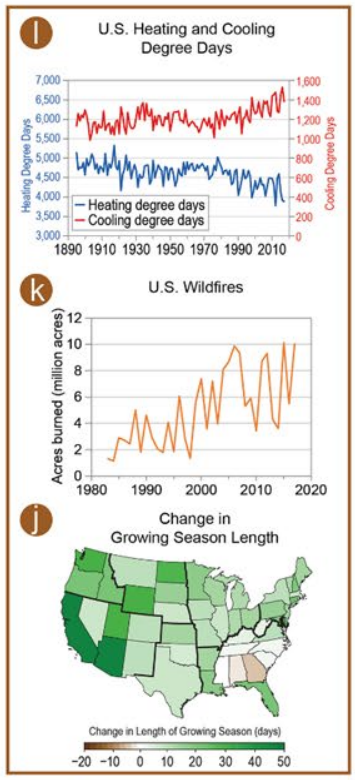
NOAA Office for Coastal Management

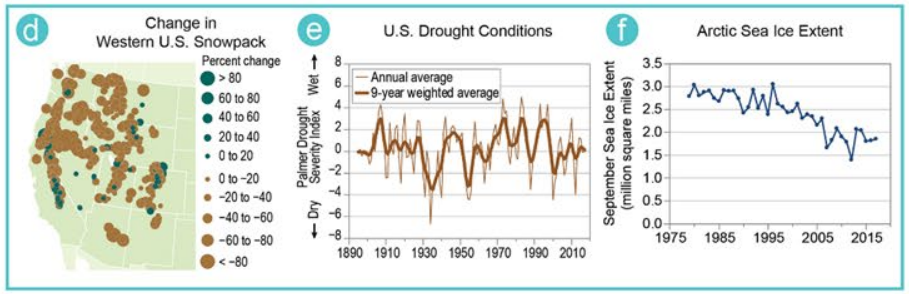
Georgia Coastal Resilience Workshop 2022

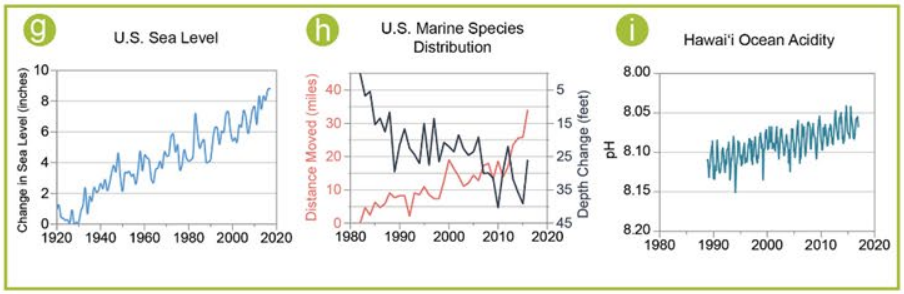
Climate Change Indicators











From USGCRP NCA4

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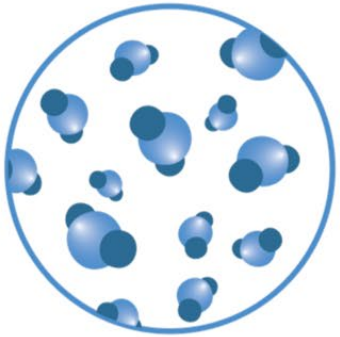
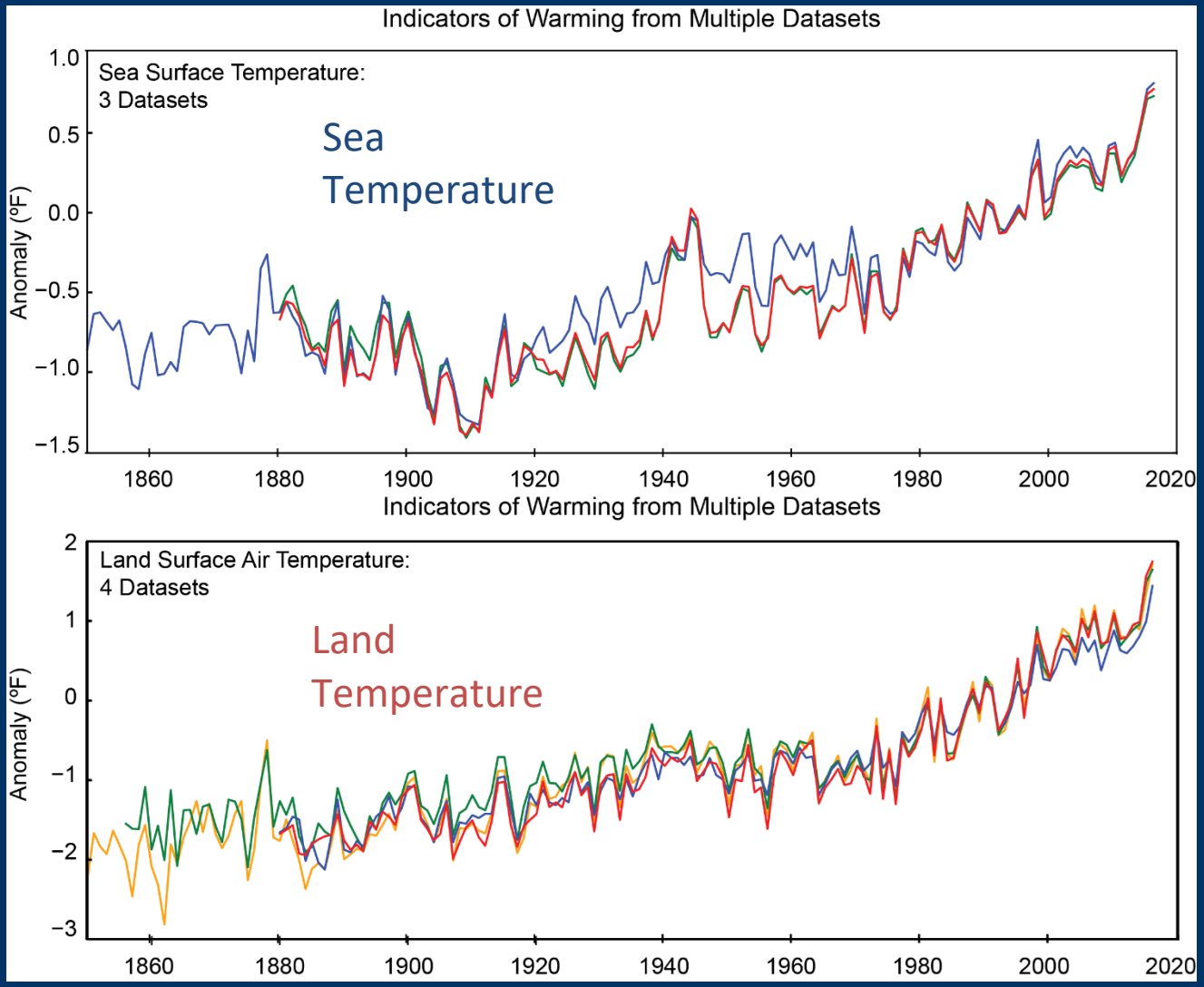
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Intergovernmental Panel on Climate Change Sixth Assessment Report

CO_2 concentration	**Sea level** rise	**Arctic sea ice** area	**Glaciers** retreat
			
Highest	**Fastest rates**	**Lowest level**	**Unprecedented**
in at least	in at least	in at least	in at least
2 million years	**3000 years**	**1000 years**	**2000 years**

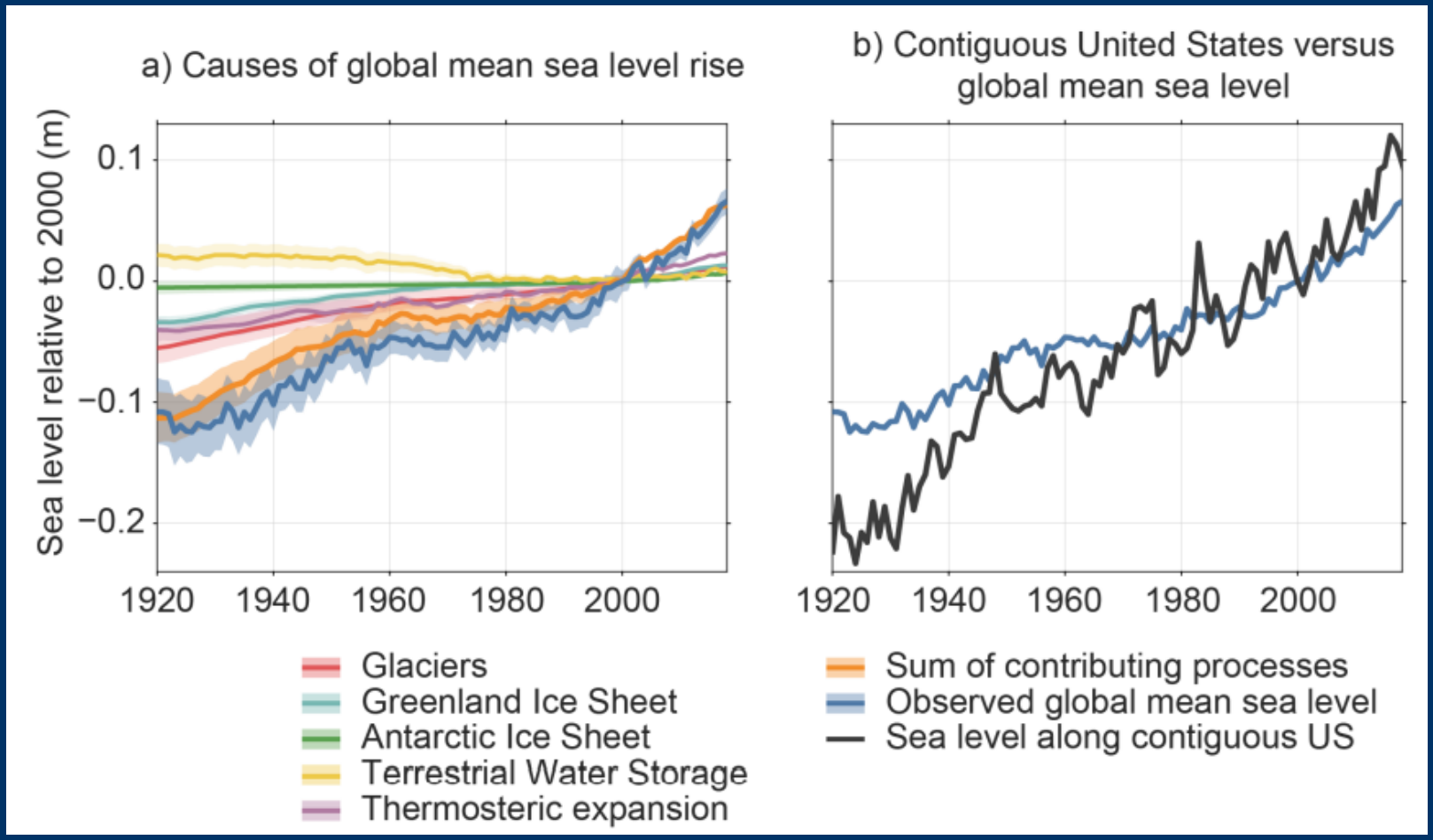
IPCC AR6 Working Group I – Summary for Policy Makers

Historical Land and Sea Temperature



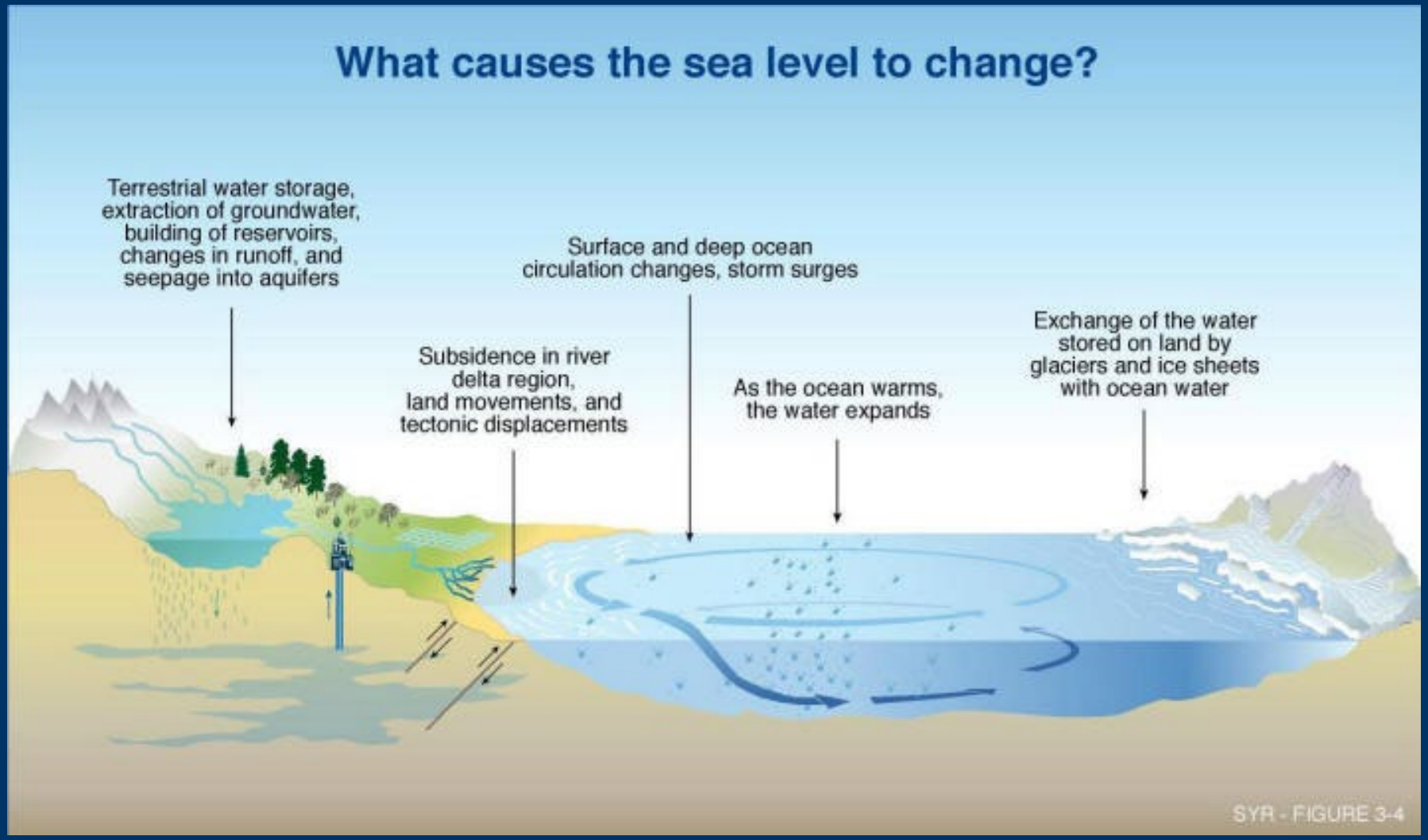
From USGCRP NCA4

Historical Sea Level Rise



Sweet et al, 2022

Sea Level Change



From USGCRP NCA4

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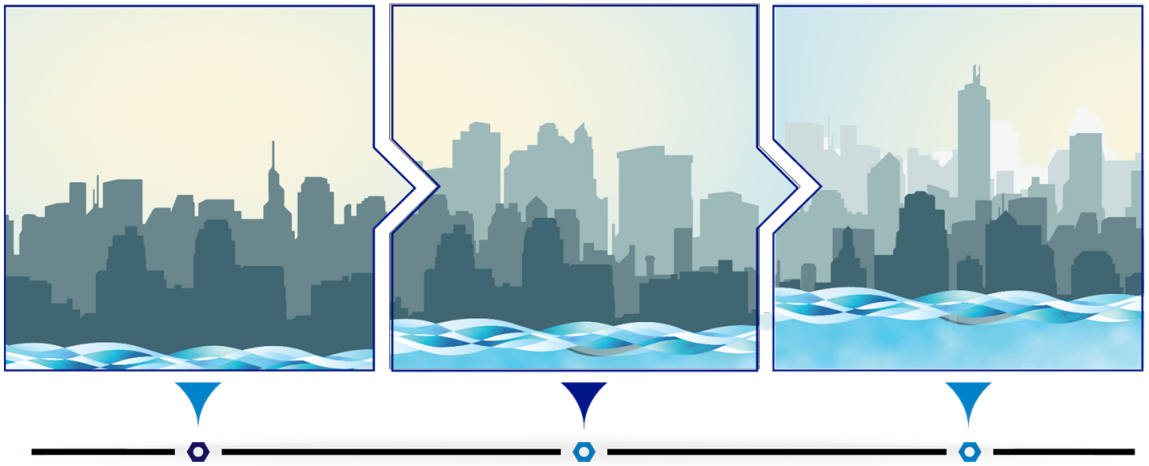
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

National Sea Level Rise



Then	2020 (Now)	2050 (Future)
1920	10-12 inches higher	additional 10-12 inches

- Projections vary by location.
- 10-12 inch rise in last 100 years; same amount of rise projected in next 30 years.
- Results: profound shift in coastal flooding over next 30 years.
- Results: damaging floods projected 10+ times as often.

DETAILS

2022 Sea Level Rise Technical Report

- Federal Interagency Sea Level Rise and Coastal Flood Hazard Scenarios and Tools Task Force
- Most up-to-date sea level rise projections available
- Key input for 5th National Climate Assessment
- Data informs sea level rise adaptation plans at all scales

FEMA USGS science for a changing world US Army Corps of Engineers NASA NOAA

2022 Sea Level Rise Technical Report

CONTENT

- Sea level rise scenarios at global, U.S., regional, and local levels
- Observation trends and extrapolations from 1970-2050
- Extreme water level probabilities for various heights
- Description of scientific data and methods employed

2022 Sea Level Rise Technical Report

KEY TAKEAWAYS

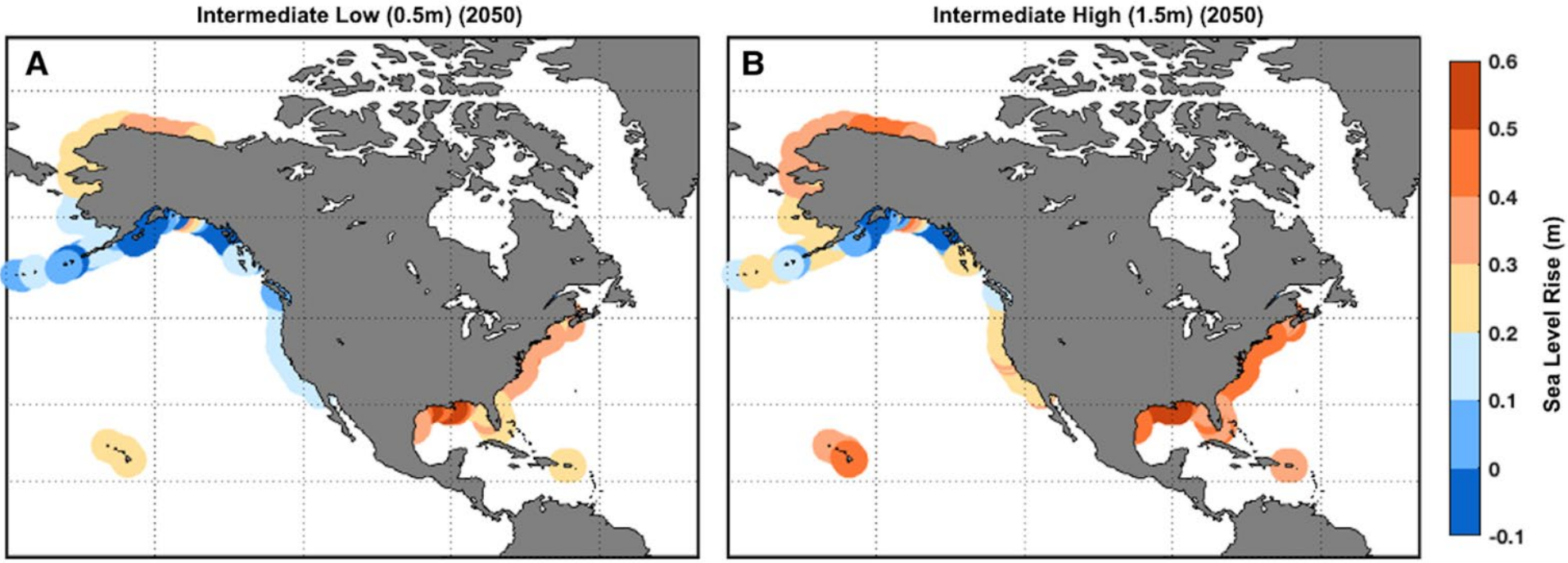
- U.S. Coast: average 10-12 inches sea level rise in next 30 years.
  - Equals change seen over past 100 years.
  - Rates will be lower or higher in different regions.
- Results: More extreme tides and damaging storm surges.
- Results: Profound shift in coastal flooding over next 30 years. By 2050, “moderate” (typically damaging) flooding likely to occur 10+ times more often.

2022 Sea Level Rise Technical Report

KEY TAKEAWAYS

- Emissions Matter: Likely at least two additional feet by 2100 due to current emissions alone. Rising emissions could cause a sea level spike upwards of 7 feet by 2100.
- Greater certainty than previous projections for the next 30 years.
- Uncertainty increases after 2050, and is highly dependent on future emissions.
- Continued observations will enhance future predictions.

Near-Term Sea Level Change (2020-2050)



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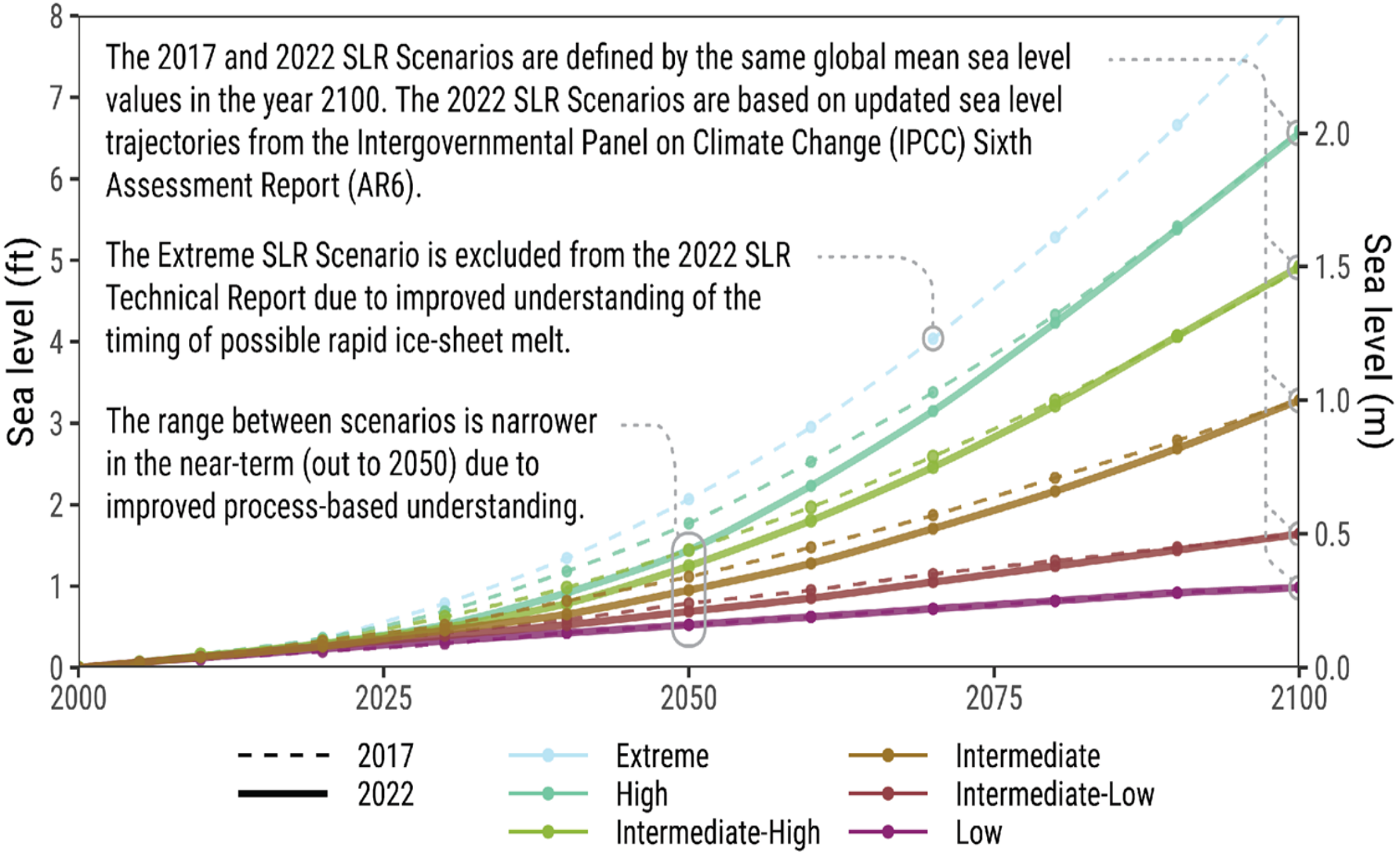
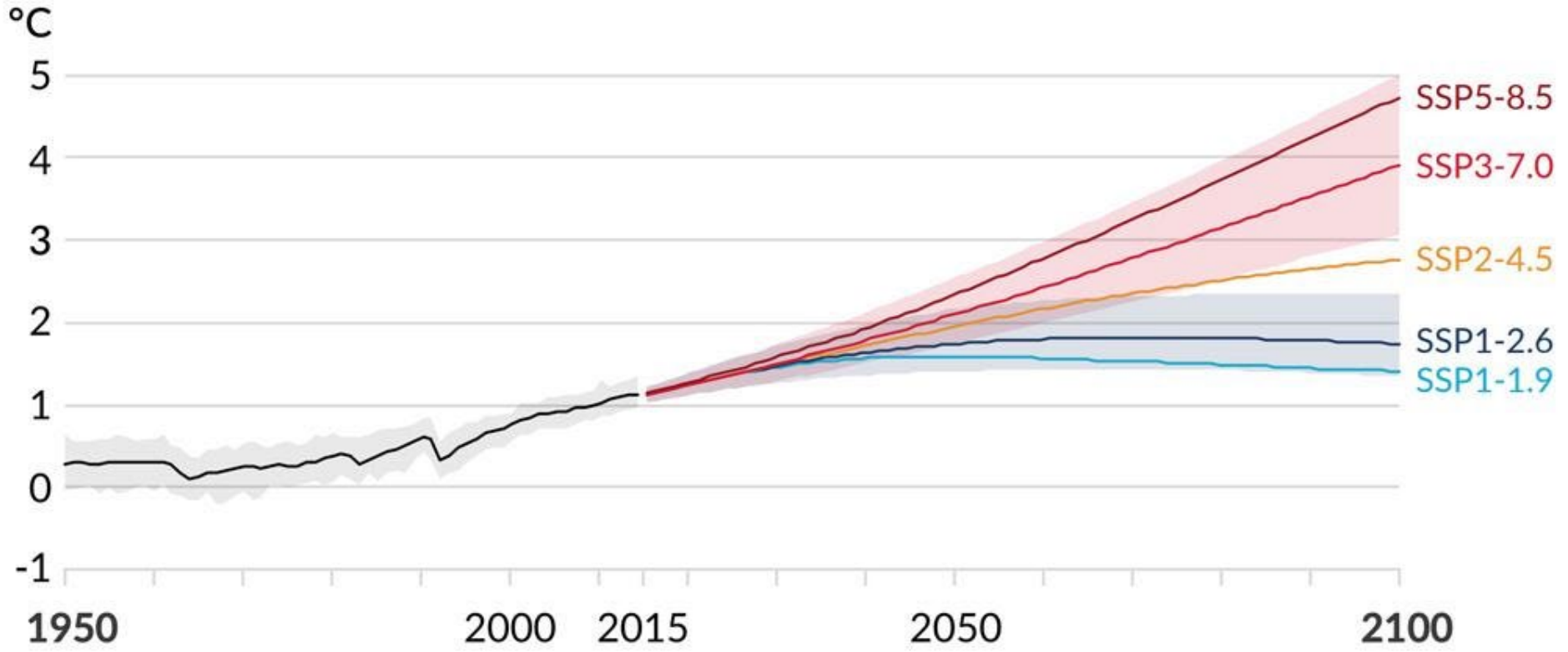
What has changed from 2017?



Southeast

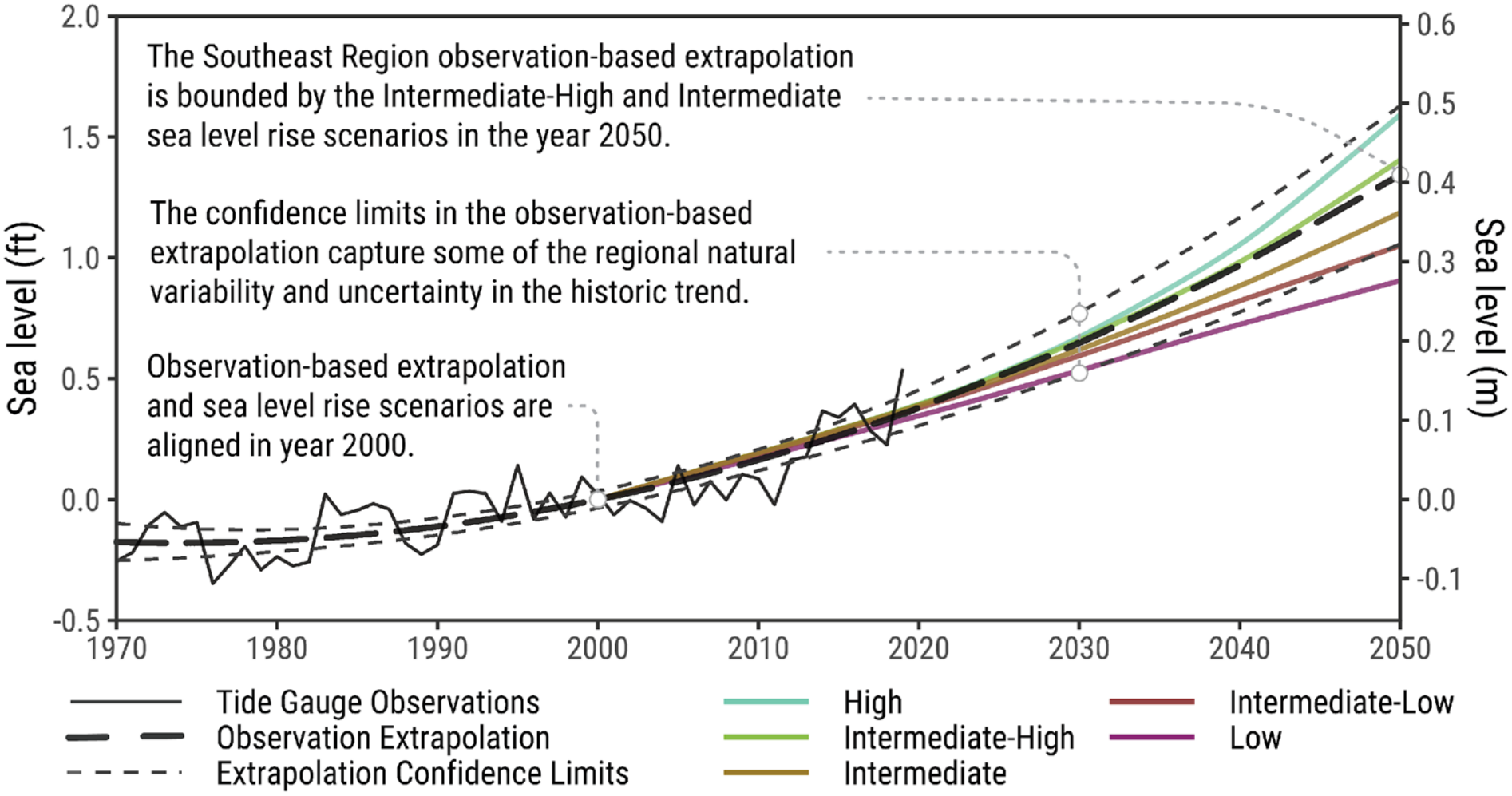
Tide Gauge	2017 Intermed-low 2080	2022 Intermed-low 2080	2017 Intermed-high 2080	2022 Intermed-high 2080
Fort Pulaski, GA	1.64 feet	**1.90 feet**	4.36 feet	**3.51 feet**
Fernandina Beach, FL	1.41 feet	**1.67 feet**	4.10 feet	**3.31 feet**
Mayport, FL	1.44 feet	**1.71 feet**	4.17 feet	**3.35 feet**

Future Temperature

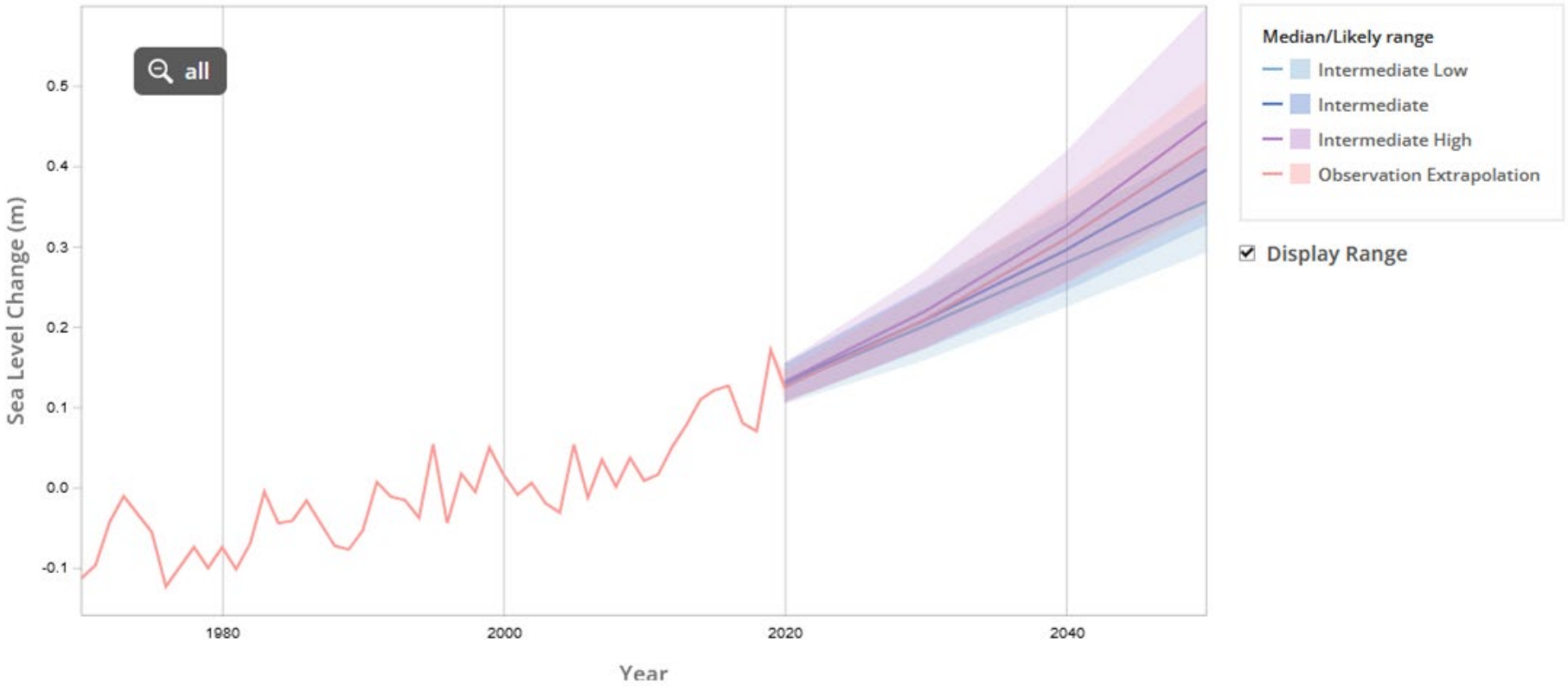


From IPCC AR6

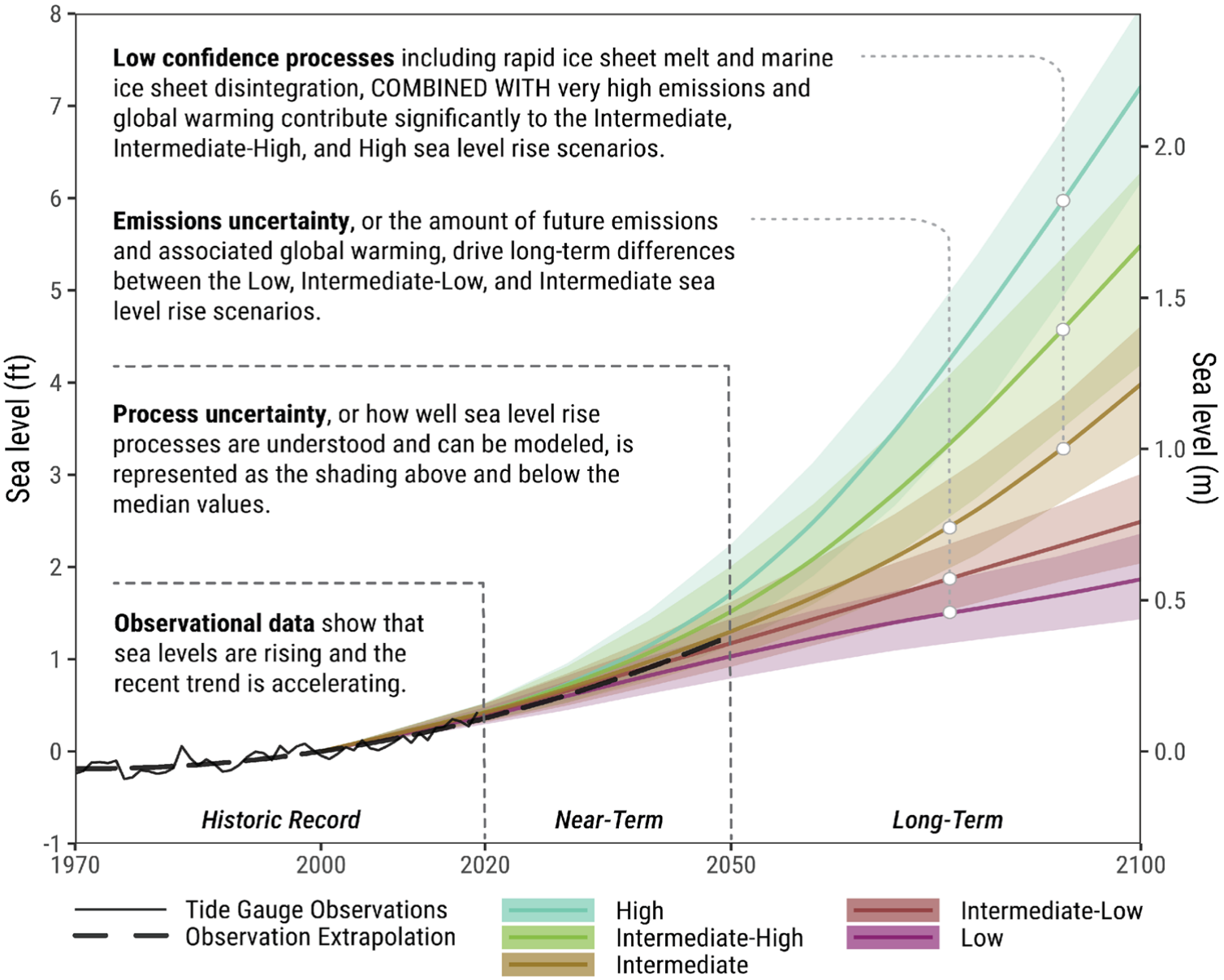
What else is new?



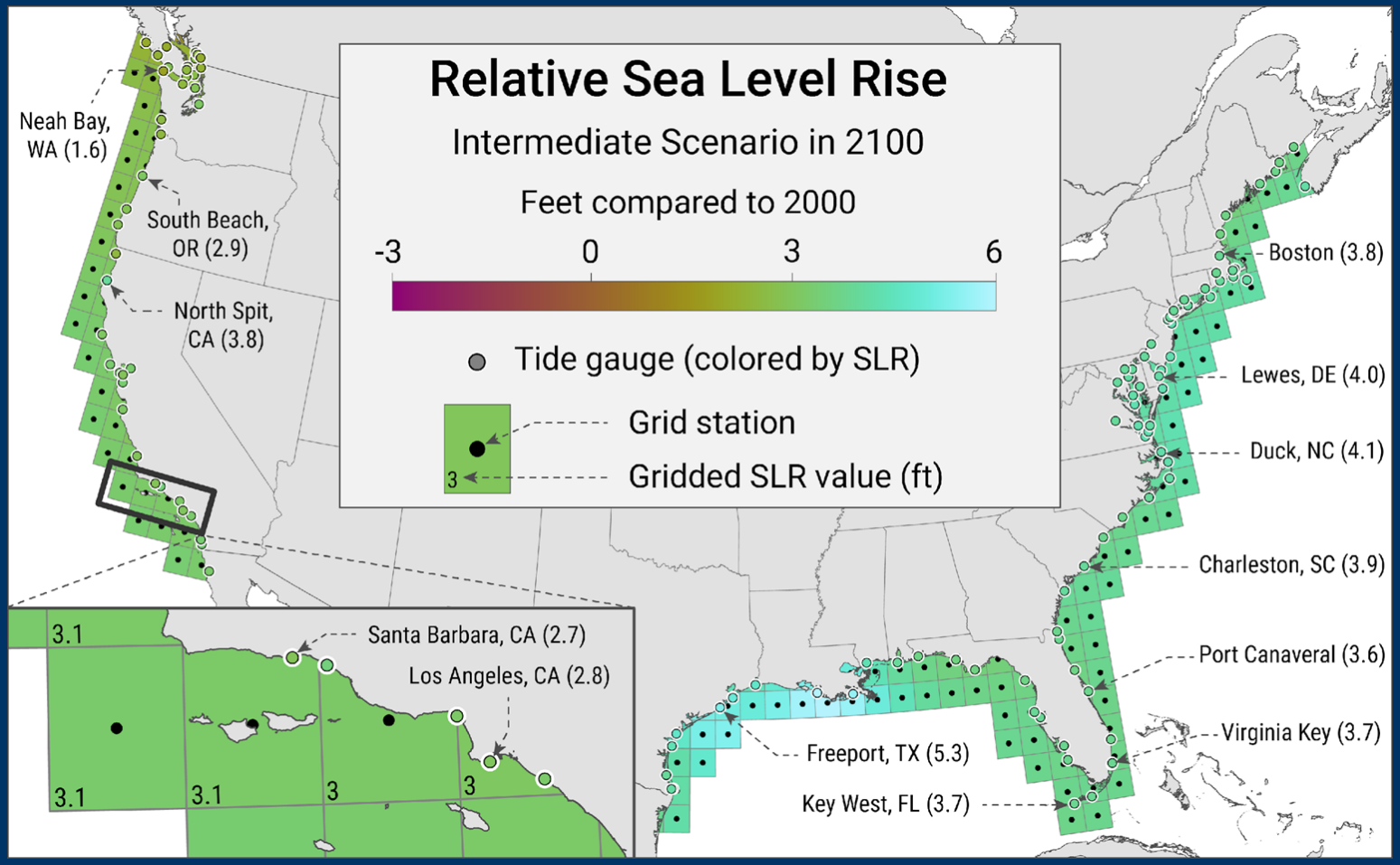
Fort Pulaski, GA: Extrapolated Observation



How confident are we?



Gridded Sea Level Rise Data (with Tide Gauges Overlaid)



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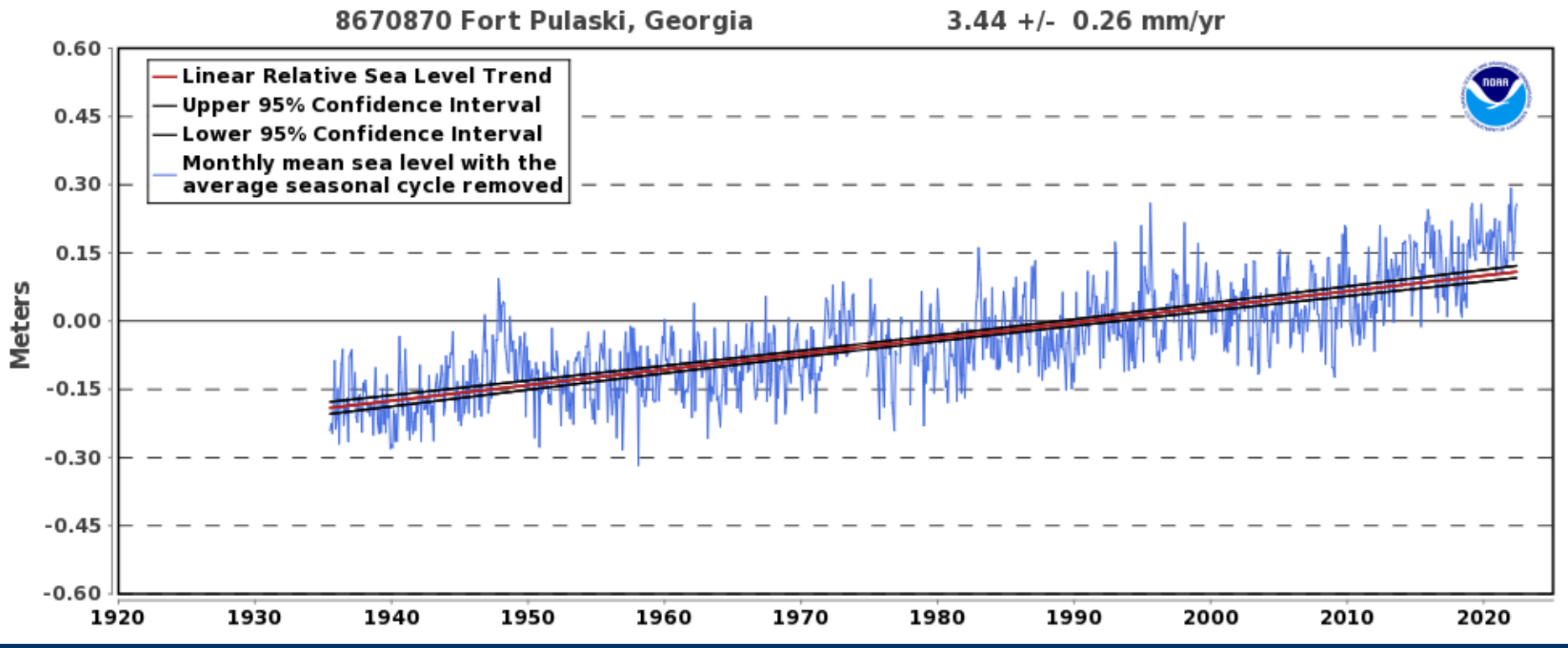
Local Sea Level Rise



1.13 feet in 100 years

tidesandcurrents.noaa.gov

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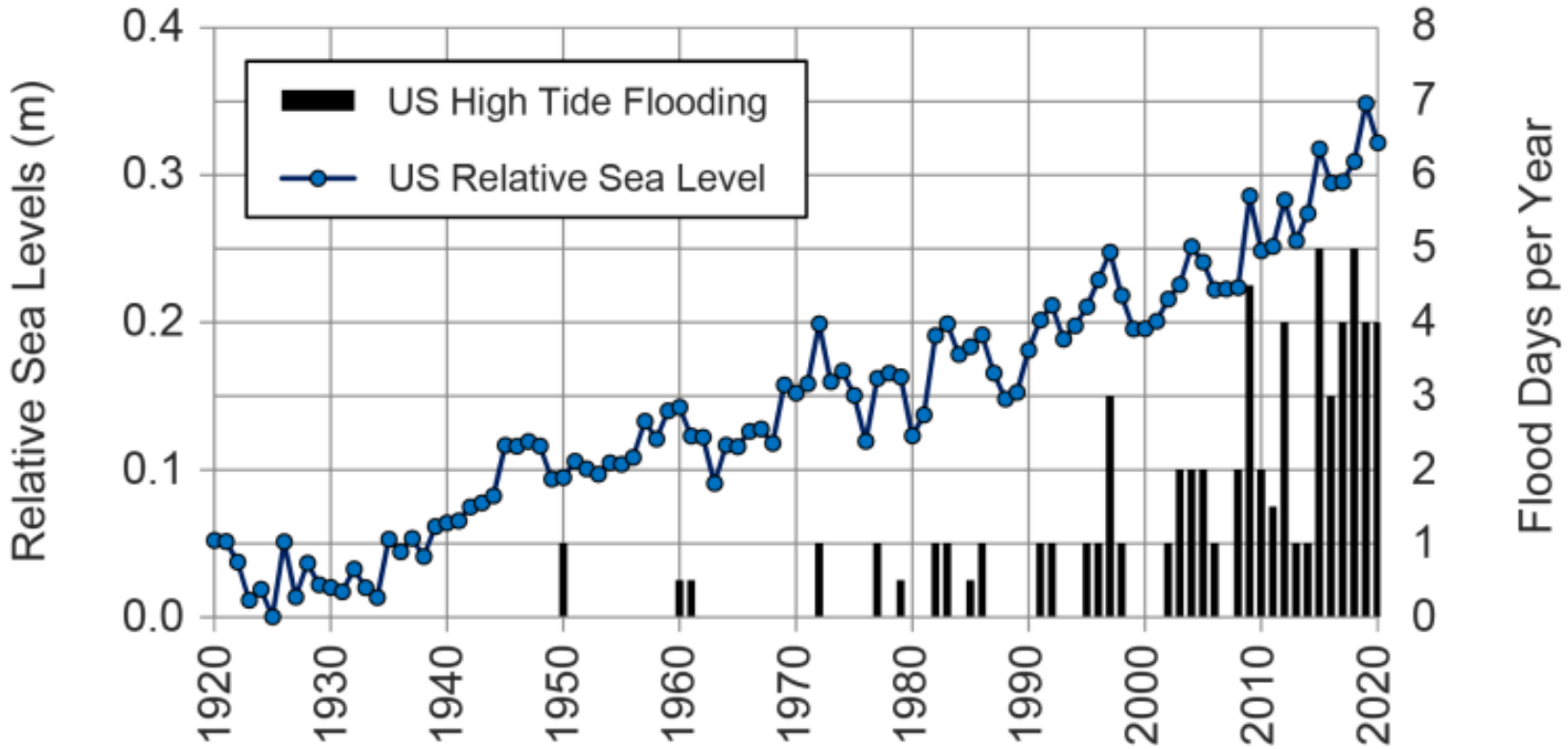
Increase in High Tide Flooding Events



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

High Tide Flooding Averages

Then (2000)

2 days

Now (2020)

4 days – twice as frequent as in 2000

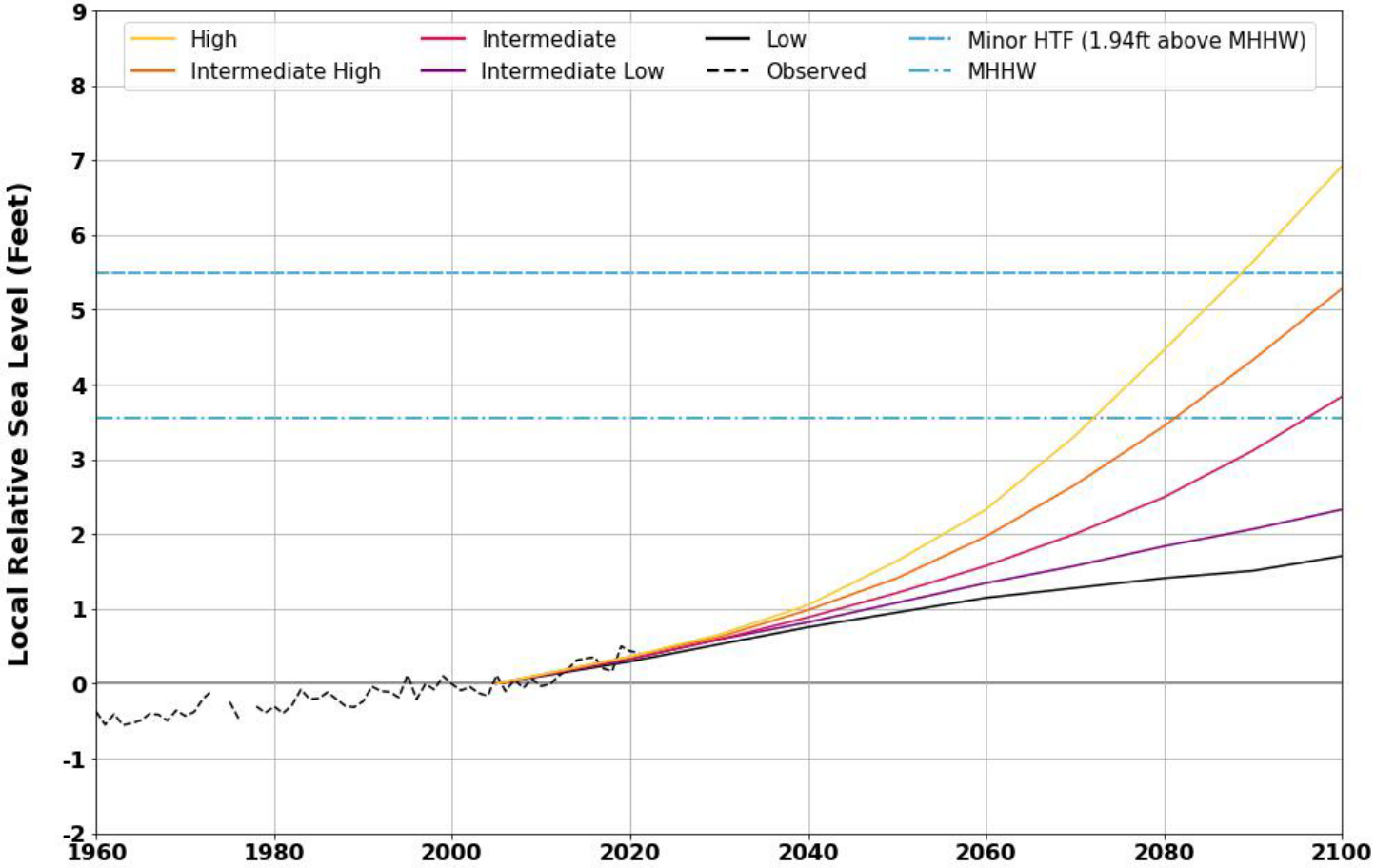
Future (2050)

25 to 75 days – up to 19 times as frequent as in 2020

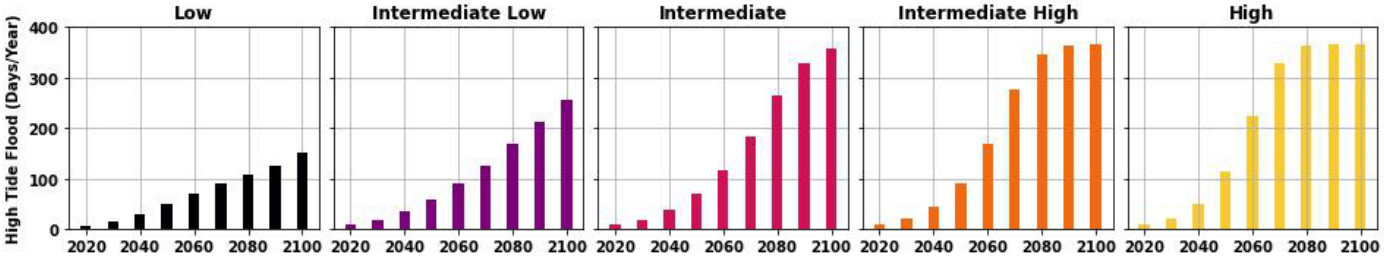
- Some regions have 400 - 1,100% increase in frequency.
- Acceleration is seen at 80% of East and Gulf Coast locations.
- By 2050, minor high tide flooding is normal occurrence at most locations.

Annual Relative Sea Level Since 1960 and Projections to 2100

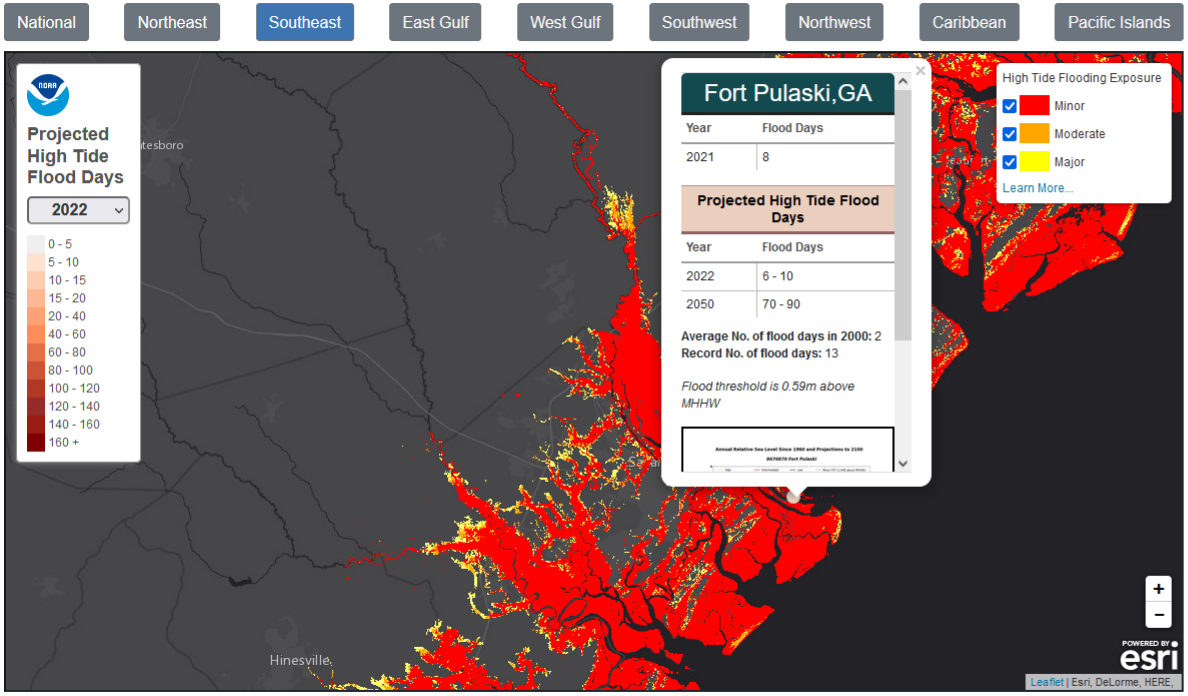
8670870 Fort Pulaski



Projected Annual Average High Tide Flooding by Decade



High Tide Flooding Projections



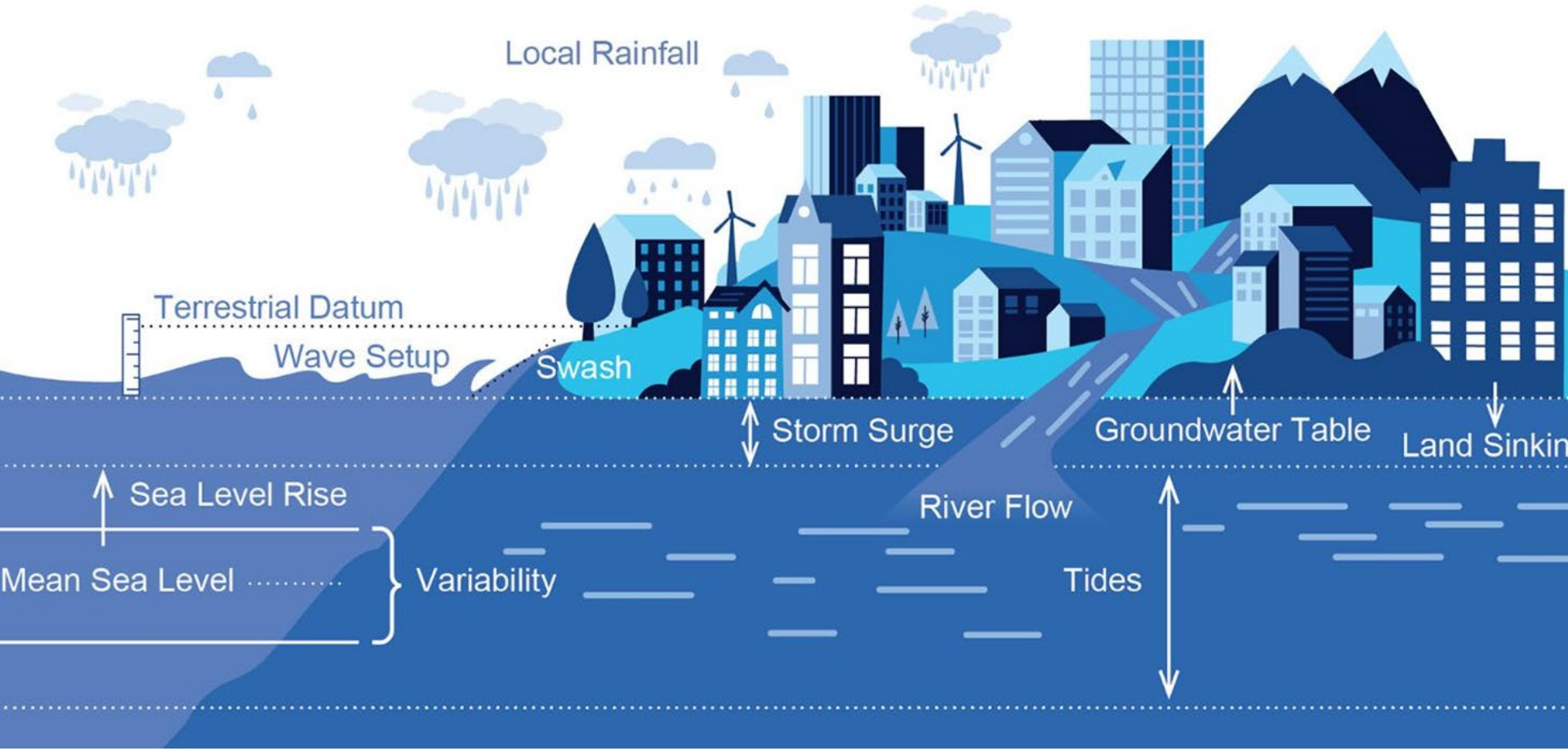
A map showing the projected number of high tide flooding days at National Water Level Observation Network stations at yearly intervals out to 2050. Flooding thresholds supplied by NOAA's Office for Coastal Management.

Southeast State of High Tide Flooding & 2022 Outlook

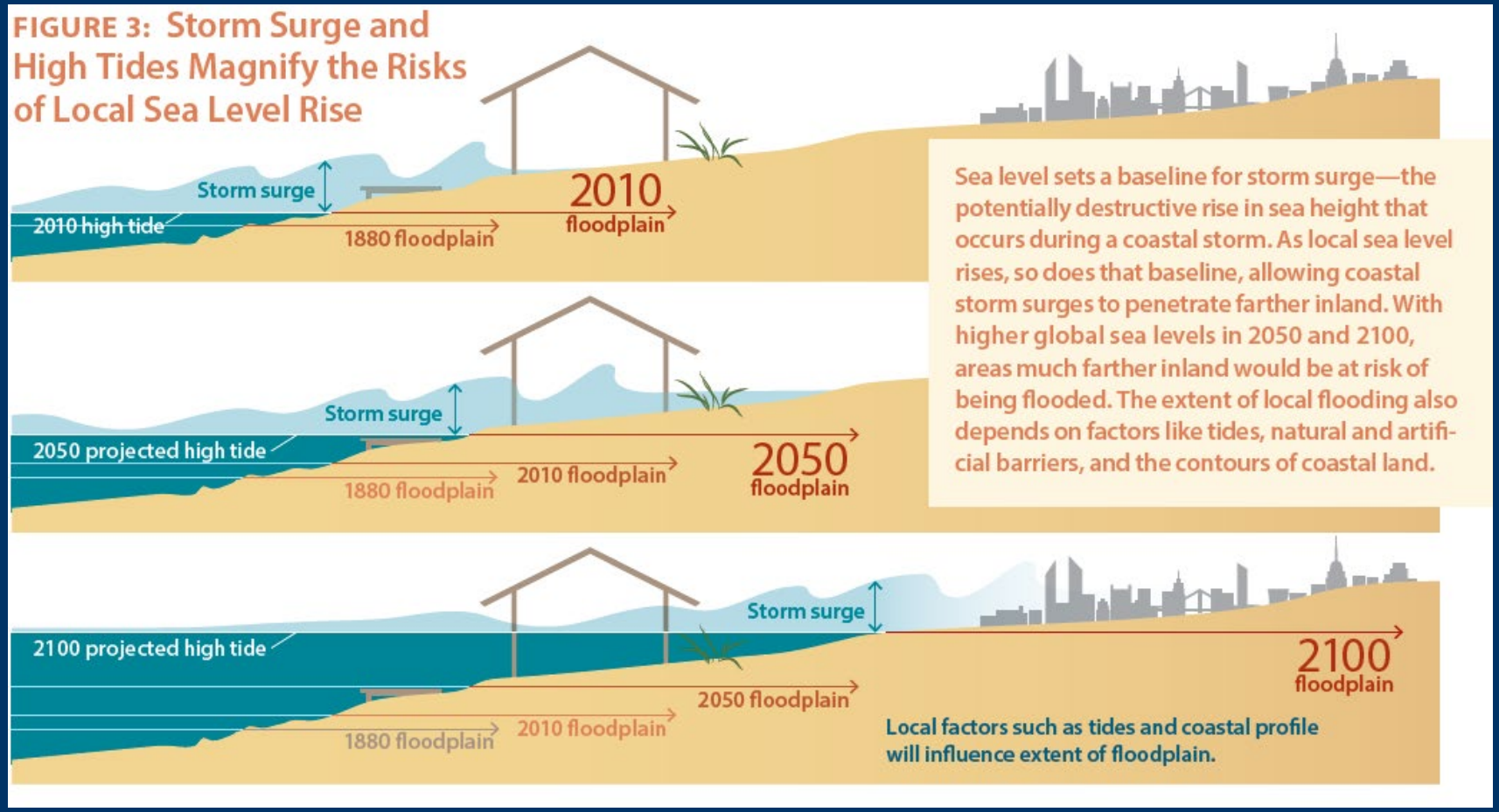
This region of the U.S. is composed of many low-lying areas prone to minor flooding. Coupled with land subsidence and sea level rise, high tide flooding events are becoming more common. Last year, Springmaid Pier (Myrtle Beach, SC) observed 11 flood days, tying its 2021 record. This year's outlook predicts fewer flood events due to Earth's place at the furthest proximity from the moon in a Perigean cycle. Though this year's outlook is moderate, this region has seen an almost 300% increase in high tide flooding events since the year 2000. **3 to 7 high tide flood events are predicted**.

Flooding at high tide.
Photo Credit: *Anonymous, @nc_kingtides on Flickr*
Location: *9th & Bay St, Martha's Mission Cupboard, Morehead City, North Carolina*

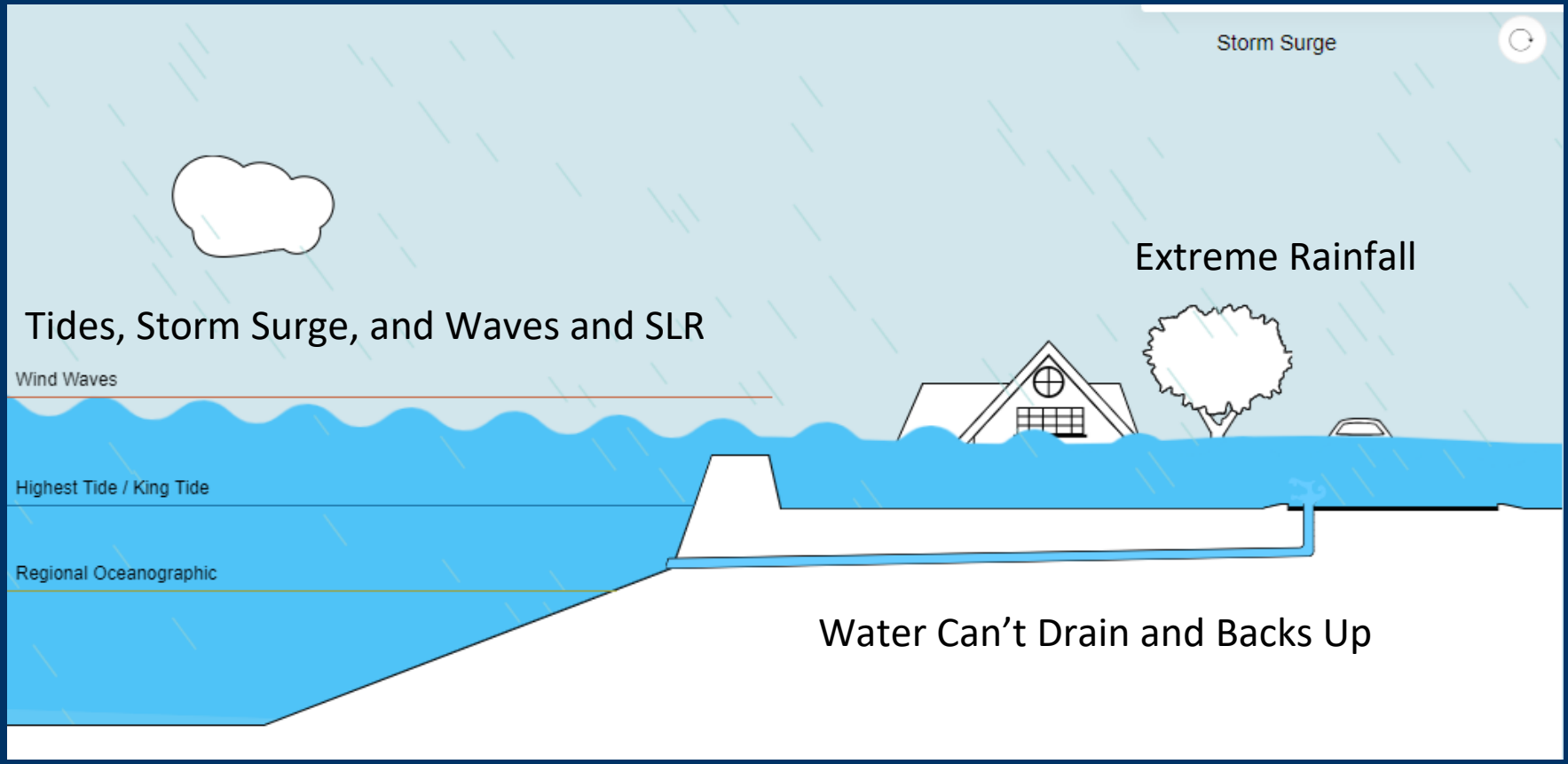
Physical Factors Directly Contributing to Coastal Flood Exposure



SLR Will Make Future Storms Worse



Combined Flooding



https://coast.noaa.gov/stormwater-floods/

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Implications for Local Planning

MIXED NEWS

- Narrower range of possible scenarios until 2050, so more certainty
- Rate of sea level rise has accelerated over the last few decades
- More time to plan for the highest levels than previously projected (though unabated emission levels could change this)
- The tidal flooding regime shift predicted over the next 30 years means planning can’t wait

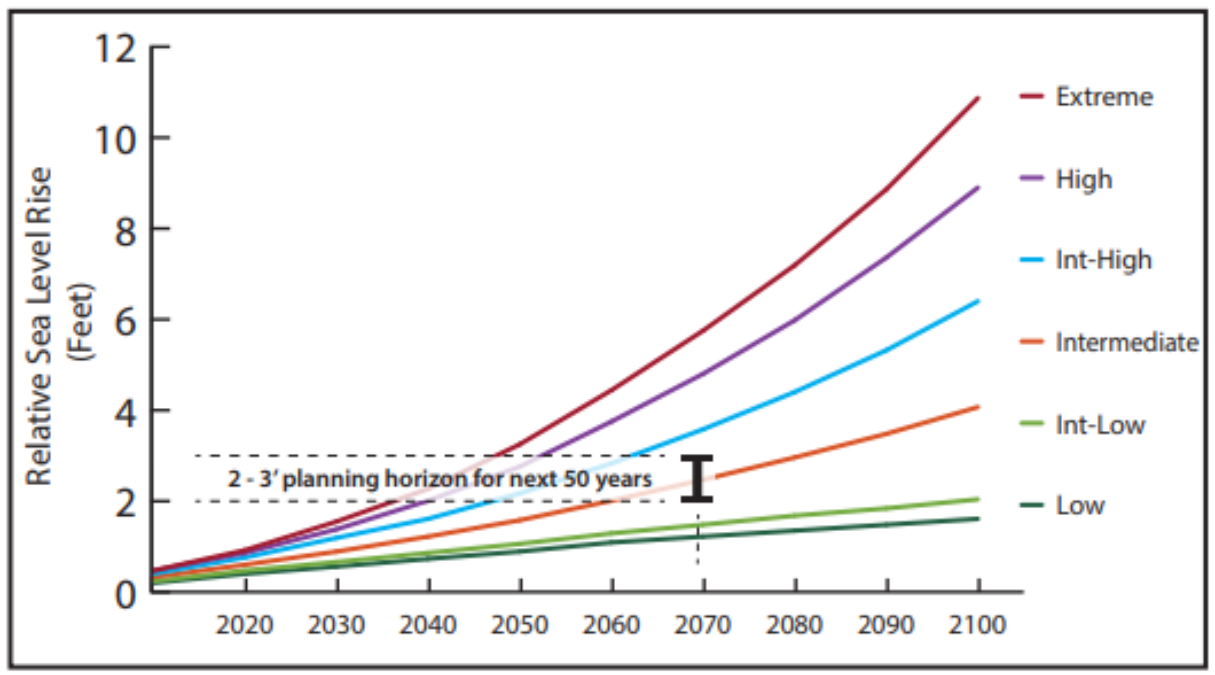
ADVICE FOR COMMUNITIES

Consider Risk Tolerance, Type of Asset

- Some use higher scenarios because they are risk averse and know building a little higher buys extra protection from compound flooding (e.g. storm surge, heavy precipitation events)
- Cost is a factor. Elevating a building an extra foot is different than elevating a major road an extra foot.
- For natural infrastructure, the narrower range of possible scenarios helps avoid the “over building” that impacts ecosystem benefits

Selecting a SLR Scenario (example)

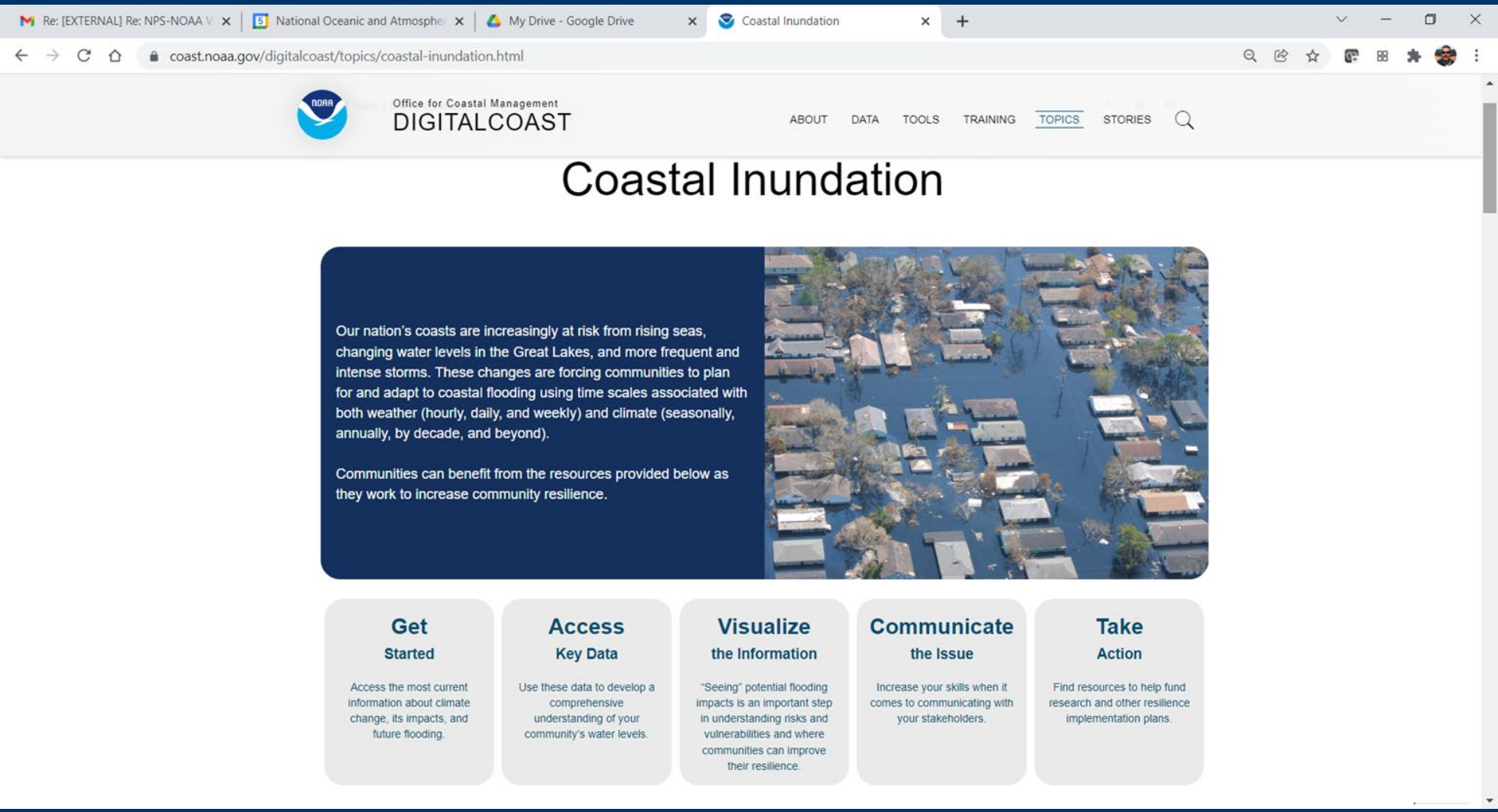
- A 2.0 foot increase will be used for short-term, less vulnerable investment, such as a parking lot.
- A 3.0 foot increase will be used for more critical longer term investments, such as emergency routes and public buildings.



From City of Charleston Sea Level Rise Strategy Document Draft Revision

What Are We Going To Do?

Digital Coast
Coastal Inundation Topics Page



https://coast.noaa.gov/digitalcoast/topics/coastal-inundation.html

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Sea Level Rise Viewer

Visualize scenarios and impacts using local maps and photos

https://coast.noaa.gov/digitalcoast/tools/slr.html

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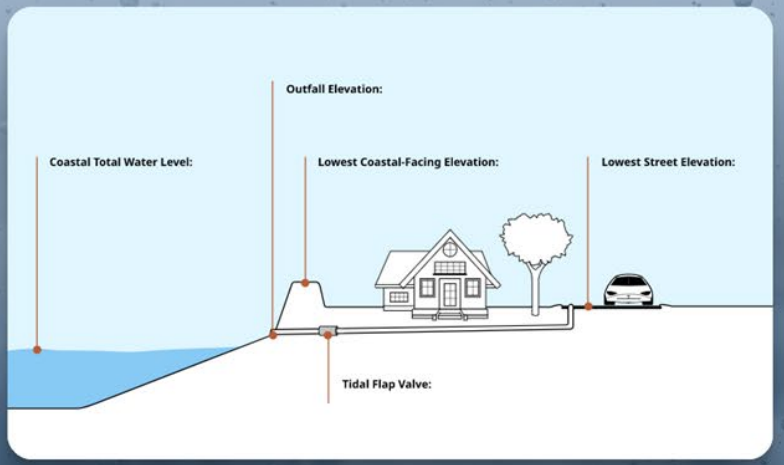
FIGURE 4.2: US HIGHWAY 80 TO TYBEE ISLAND. HIGHLIGHTED RED PORTION SHOWS STRETCH FROM BULL RIVER TO LAZARETTO CREEK BRIDGES.

Tybee Island Sea Level Rise Adaptation Plan DOI:
10.13140/RG.2.1.3825.9604/1

Adapting Stormwater Management for Coastal Floods

Communities can use this website to determine how the flooding of today and tomorrow can affect their stormwater systems, and generate reports that can be used to:

- Display local information about the current and future flooding impacts
- Inform planning efforts



1. Learn more about coastal flooding and sea level rise. — UNDERSTAND
2. Calculate current and future coastal flood frequency and impacts. — ASSESS
3. Determine if, when, and how your stormwater system will be impacted. — ANALYZE
4. Learn different ways to mitigate flooding issues. — TAKE ACTION

Office for Coastal Management

https://coast.noaa.gov/stormwater-floods/

Questions?

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ASSESS | COMMUNICATE | ADDRESS

Nature-Based Solutions for Coastal Hazards

Presented by Tashya Allen

NOAA Office for Coastal Management

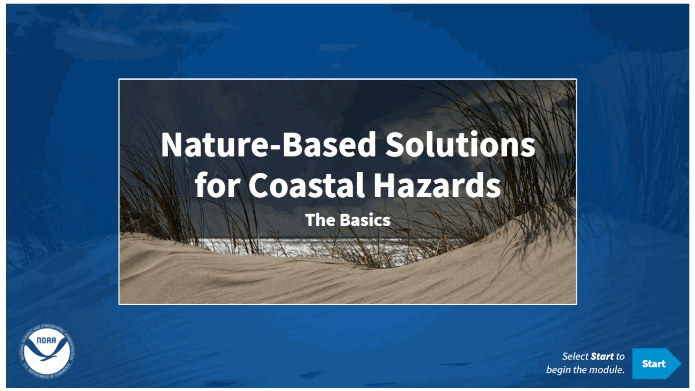
tashya.allen@noaa.gov

PRESENTATION OUTLINE

A. Overview of Products
B. How to Use
C. Learn More

PRODUCT OVERVIEW

- Developed by: NOAA Office for Coastal Management
- What it Does: Learn an approach to identify green infrastructure
- Access: coast.noaa.gov/digitalcoast/training/nbs-basics.html
- Input: Local knowledge
- Output: Part 1 of community green infrastructure plan
- Date Published/Update: 2021
- Additional Software/Hardware Requirements: None
- Bonuses: Available in Spanish, Planners receive one credit hour



Work Through Each Step

Learn an approach to choosing green infrastructure practices

Nature-Based Solutions for Coastal Hazards: The Basics

Addressing Coastal Hazards

Approach | Example 1 | Example 2 | Example 3

The impacts of coastal hazards can be reduced using ecosystem services such as coastal flood control, wave attenuation, and stormwater retention. These ecosystem services are provided by nature-based solutions, which include green or natural infrastructure.

This approach allows communities to *prepare* for events such as hurricanes, coastal storms, and flooding rather than simply reacting to immediate impacts.

Mitigate

HAZARD IMPACTS

using

ECOSYSTEM SERVICES

by

IMPLEMENTING GREEN INFRASTRUCTURE

Menu | Knowledge Check

Nature-Based Solutions for Coastal Hazards: The Basics

Addressing Coastal Hazards

Approach | Example 1 | Example 2 | Example 3

The impacts of coastal hazards can be reduced using ecosystem services such as coastal flood control, wave attenuation, and stormwater retention. These ecosystem services are provided by nature-based solutions, which include green or natural infrastructure.

This approach allows communities to *prepare* for events such as hurricanes, coastal storms, and flooding rather than simply reacting to immediate impacts.

Mitigate

Coastal Flooding

using

Coastal Flood Control

by

Conserving Salt Marsh and Community Parks

Menu | Knowledge Check

Green Infrastructure Plan

Work through the rest of this module to complete this worksheet with information about your community.

The worksheet is the beginning of your community's green infrastructure plan.

To start, print the **Green Infrastructure Plan** (PDF) for your use during this module or open the document (DOC) on your computer.

Green Infrastructure Plan

Use this worksheet to identify green infrastructure practices for your community.

Part 1

For more guidance in completing these steps, check out Nature-Based Solutions for Coastal Hazards: The Basics.

Step 1. Identify a coastal hazard impacting your community.
Step 2. Identify an at-risk location.

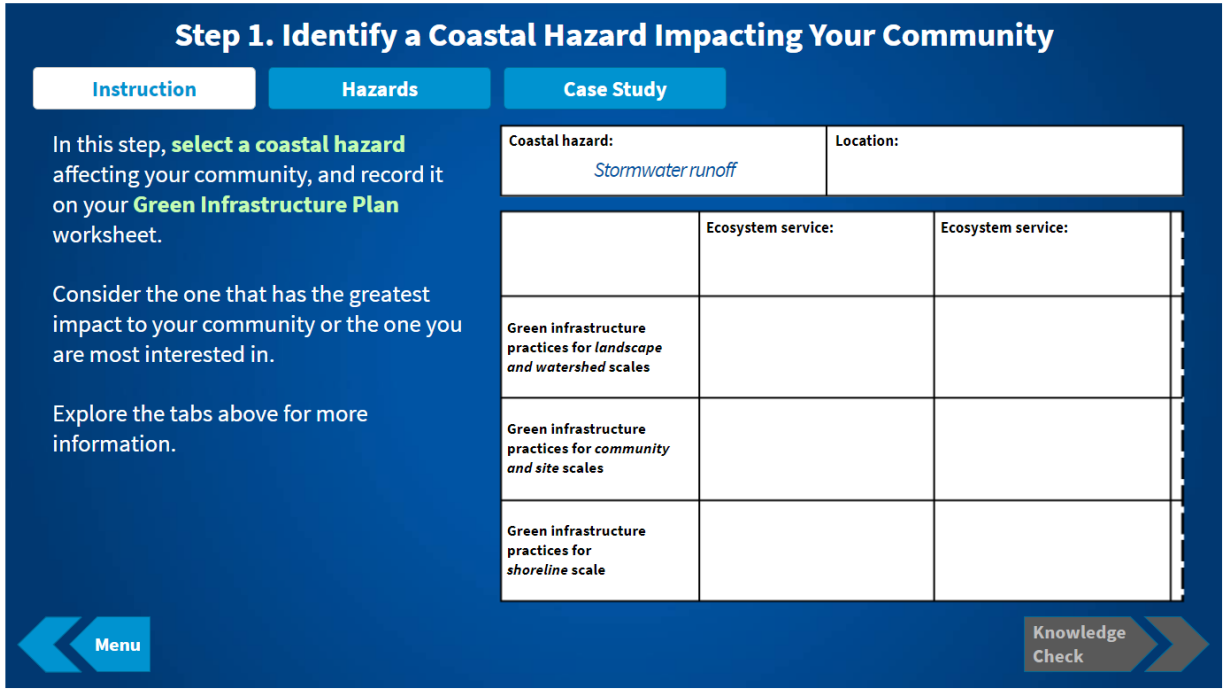
Coastal hazard:	**Location:**

Step 3. Identify ecosystem services that mitigate the impacts of the coastal hazard. List up to three ecosystem services.
Step 4. For each ecosystem service, identify up to three green infrastructure practices that provide that ecosystem service. Consider practices at each scale.
It's okay to use the same practice multiple times, or to leave some boxes or rows empty.

	Ecosystem service:	**Ecosystem service:**	**Ecosystem service:**
Green infrastructure practices for *landscape and watershed* scales			
Green infrastructure practices for *community and site* scales			
Green infrastructure practices for *shoreline* scale			

Menu | Green Infrastructure Plan (PDF) | Green Infrastructure Plan (DOC)

Step 1 – Identify A Coastal Hazard Impacting Your Community



Step 2 – Identify An At-Risk Location

Step 2. Identify an At-Risk Location

Instruction | Mapping Tool

For your selected coastal hazard, **indicate a location** where it is occurring in your community.

Local knowledge is critical when identifying current coastal hazard impacts, as are maps that show community assets located in potential hazard areas.

Select the Mapping Tool tab to explore.

Coastal hazard: *Stormwater runoff*	Location: *Downtown city and environs*	
	Ecosystem service:	**Ecosystem service:**
Green infrastructure practices for *landscape and watershed* scales		
Green infrastructure practices for *community and site* scales		
Green infrastructure practices for *shoreline* scale		

Menu | Knowledge Check

Step 2. Identify an At-Risk Location

Instruction | Mapping Tool

To identify specific problem areas using NOAA's Coastal Flood Exposure Mapper, enter a location in the search box and select the hazard and other map layers as appropriate.

Coastal Flood Exposure Mapper *Link will open in a new browser window.*

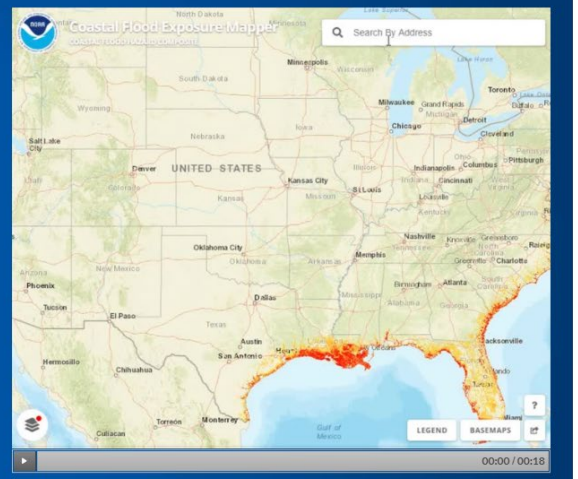
The mapper is available for coastal counties along the East and West Coasts, Gulf of Mexico, and Caribbean and Pacific islands and territories.

If your geography is in the Great Lakes region, visit NOAA's Lake Level Viewer and Coastal County Snapshots to see impacts from changing lake levels and location of flood zones.

Lake Level Viewer

Coastal County Snapshots

Links will open in new browser windows.



Select the play button to begin an animated demo of the mapper. There is no audio in this demo.

Menu | Knowledge Check

Step 3 – Identify Ecosystem Services That Mitigate Impacts

Step 3. Identify Ecosystem Services that Mitigate the Impacts

Instruction | Background | Ecosystem Services | Case Study

So far, you've identified the
- **coastal hazard** and
- **location**.

Now it's time to think about ecosystem services that might mitigate the impacts.

List up to three ecosystem services that could help lessen the impacts of your selected coastal hazard.

Note these on your Green Infrastructure Plan worksheet.

Coastal hazard: *Stormwater runoff*	Location: *Downtown city and environs*

	Ecosystem service: *Stormwater retention*	Ecosystem service: *Water infiltration*
Green infrastructure practices for *landscape and watershed* scales		
Green infrastructure practices for *community and site* scales		
Green infrastructure practices for *shoreline* scale		

Menu | Knowledge Check

Step 3. Identify Ecosystem Services that Mitigate the Impacts

Instruction | Background | Ecosystem Services | Case Study

For hazard resilience, these ecosystem services are particularly important for reducing impacts.

Select each service to learn more.

Menu | Knowledge Check

Step 4 – Identify Green Infrastructure Practices That Provide Ecosystem Services

Step 4. Identify Green Infrastructure Practices that Provide Ecosystem Services

Instruction | Scales | Practices | Case Study

So far, you've identified the
- coastal hazard
- location and
- ecosystem services.

Now it's time to think about green infrastructure practices that preserve, restore, or re-create those ecosystem services.

Choose green infrastructure practices that provide each identified ecosystem service.

It's okay to use the same practice multiple times or leave a box/row empty, but make sure you are considering practices at each scale.

Coastal hazard: *Stormwater runoff*	Location: *Downtown city and environs*

	Ecosystem service: *Stormwater retention*	Ecosystem service: *Water infiltration*
Green infrastructure practices for *landscape and watershed* scales	*Urban forestry*	*Conservation easements*
Green infrastructure practices for *community and site* scales	*Bioswales*	*Permeable pavement*
Green infrastructure practices for *shoreline* scale	*Land acquisition*	*Salt marsh preservation*

Menu | Knowledge Check

Step 4. Identify Green Infrastructure Practices that Provide Ecosystem Services

Instruction | Scales | Practices | Case Study

Types of Green Infrastructure	Scale: Landscape	Watershed	Community	Site	Shoreline
Land Preservation	L	W	C		Sh
Forestry	L	W	C		
Green Streets			C		
Bioretention			C	Si	
Green and Blue Roofs			C	Si	
Permeable Pavements			C	Si	
Dunes and Beaches					Sh
Salt Marsh / Coastal Wetlands					Sh
Oyster and Coral Reefs					Sh
Hybrid Shorelines					Sh

Explore these practices to find ecosystem services that address the hazard at the appropriate scale.

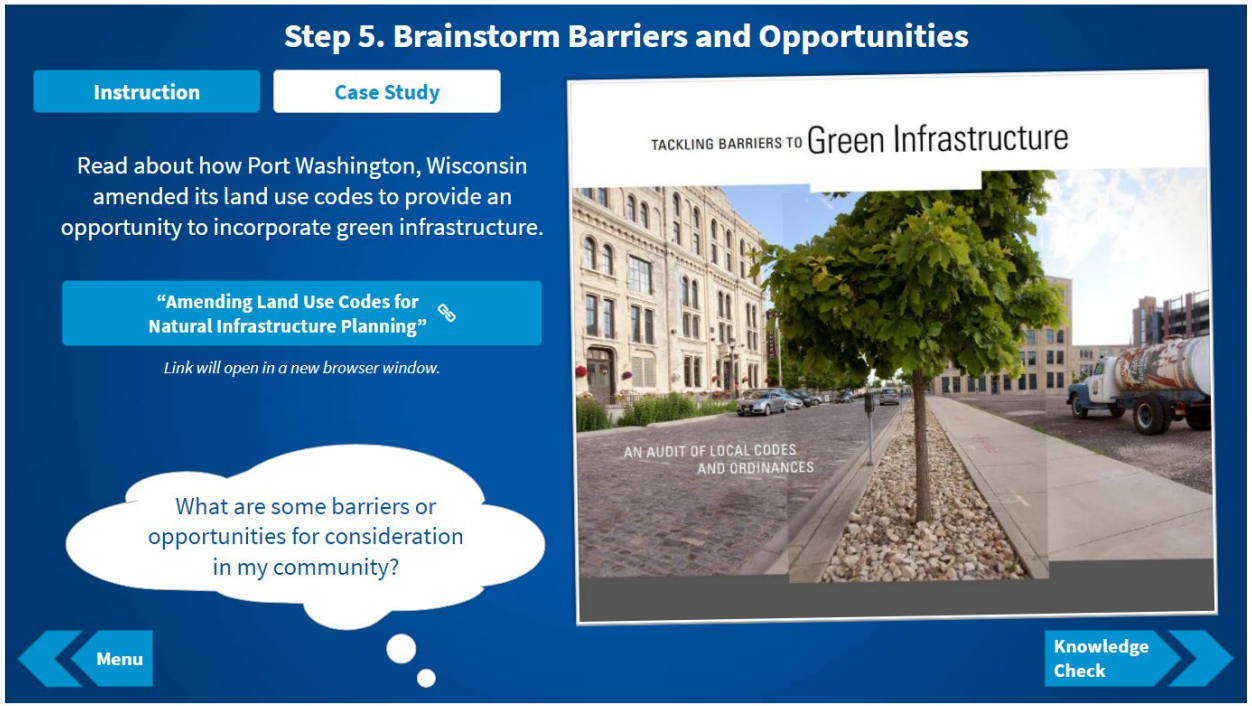
SALT MARSH AND COASTAL WETLANDS

Practices: salt marsh and coastal wetland preservation and restoration, submerged aquatic vegetation preservation

Ecosystem services provided: coastal flood control, sediment transport, erosion control, coastal buffering, wave attenuation, water filtration, groundwater recharge, evapotranspiration, urban heat island reduction

Menu | Knowledge Check

Step 5 – Brainstorm Barriers And Opportunities



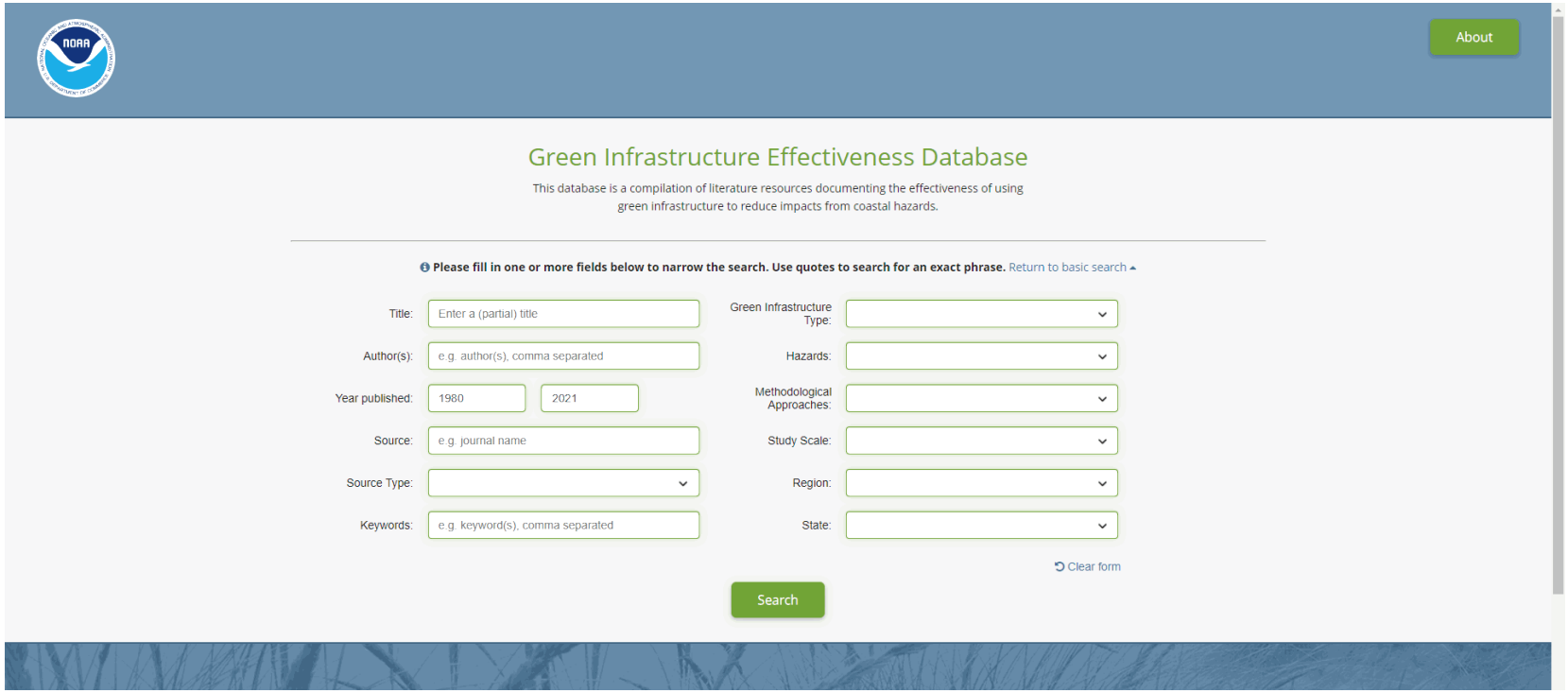
Trainings:

In-Person – learn from local experts and develop a green infrastructure strategy

Virtual – learn from local experts

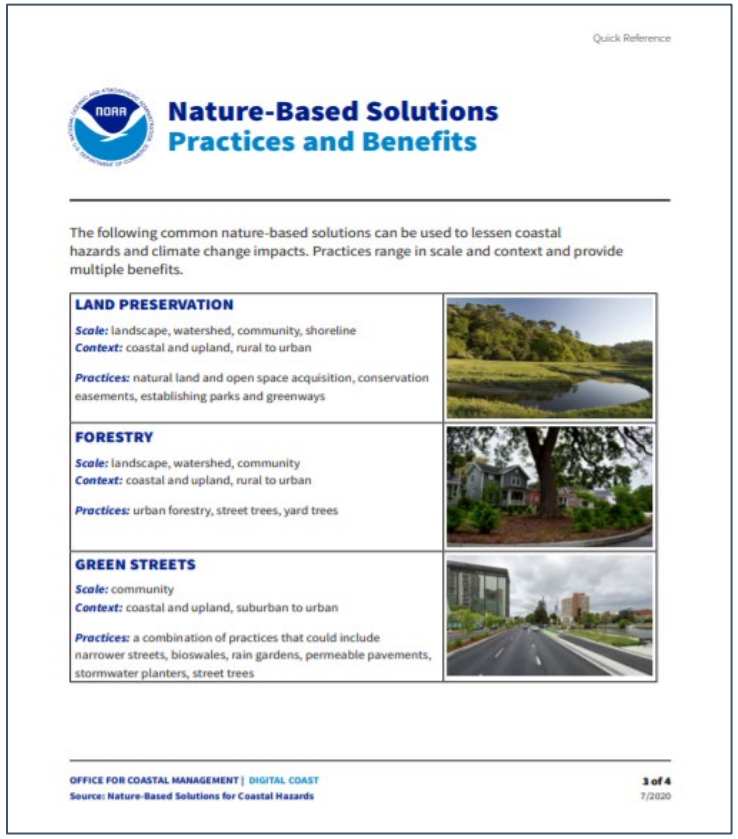
coast.noaa.gov/digitalcoast/training/green.html

Green Infrastructure Effectiveness Database



coast.noaa.gov/digitalcoast/training/gi-database.html

Benefits, Costs, And Economic Assessments



Quick Reference

Nature-Based Solutions
Practices and Benefits

The following common nature-based solutions can be used to lessen coastal hazards and climate change impacts. Practices range in scale and context and provide multiple benefits.

LAND PRESERVATION

Scale: landscape, watershed, community, shoreline
Context: coastal and upland, rural to urban

Practices: natural land and open space acquisition, conservation easements, establishing parks and greenways

FORESTRY

Scale: landscape, watershed, community
Context: coastal and upland, rural to urban

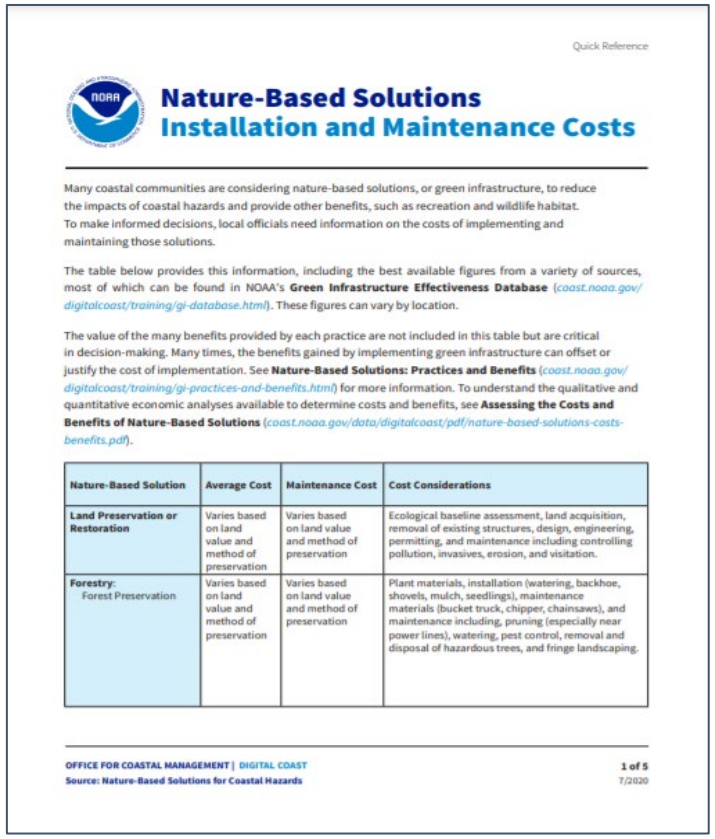
Practices: urban forestry, street trees, yard trees

GREEN STREETS

Scale: community
Context: coastal and upland, suburban to urban

Practices: a combination of practices that could include narrower streets, bioswales, rain gardens, permeable pavements, stormwater planters, street trees

OFFICE FOR COASTAL MANAGEMENT | DIGITAL COAST
Source: Nature-Based Solutions for Coastal Hazards
1 of 4
7/2020



Quick Reference

Nature-Based Solutions
Installation and Maintenance Costs

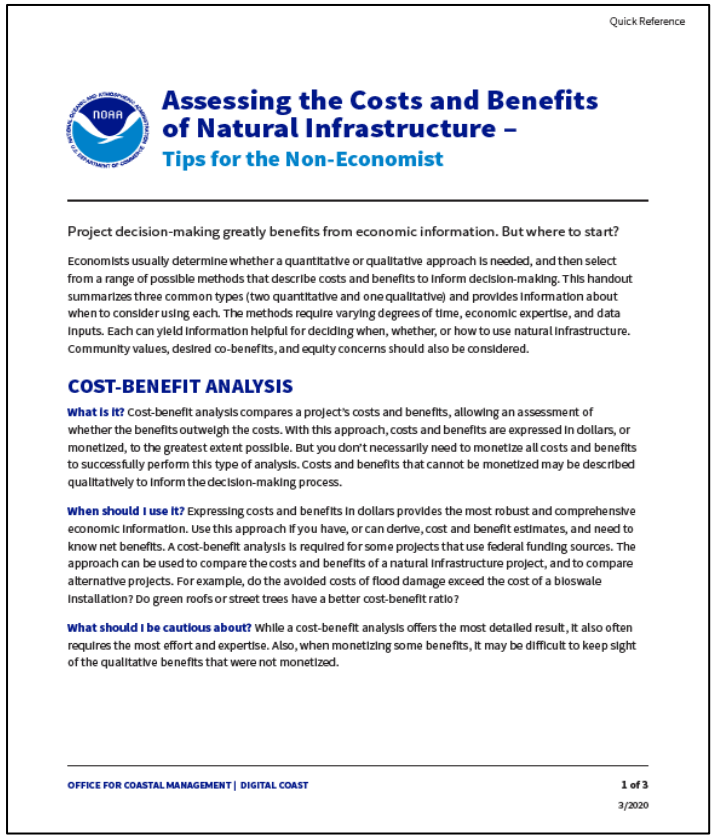
Many coastal communities are considering nature-based solutions, or green infrastructure, to reduce the impacts of coastal hazards and provide other benefits, such as recreation and wildlife habitat. To make informed decisions, local officials need information on the costs of implementing and maintaining those solutions.

The table below provides this information, including the best available figures from a variety of sources, most of which can be found in NOAA's **Green Infrastructure Effectiveness Database** (*coast.noaa.gov/digitalcoast/training/gi-database.html*). These figures can vary by location.

The value of the many benefits provided by each practice are not included in this table but are critical in decision-making. Many times, the benefits gained by implementing green infrastructure can offset or justify the cost of implementation. See **Nature-Based Solutions: Practices and Benefits** (*coast.noaa.gov/digitalcoast/training/gi-practices-and-benefits.html*) for more information. To understand the qualitative and quantitative economic analyses available to determine costs and benefits, see **Assessing the Costs and Benefits of Nature-Based Solutions** (*coast.noaa.gov/data/digitalcoast/pdf/nature-based-solutions-costs-benefits.pdf*).

Nature-Based Solution	Average Cost	Maintenance Cost	Cost Considerations
Land Preservation or Restoration	Varies based on land value and method of preservation	Varies based on land value and method of preservation	Ecological baseline assessment, land acquisition, removal of existing structures, design, engineering, permitting, and maintenance including controlling pollution, invasives, erosion, and visitation.
Forestry: Forest Preservation	Varies based on land value and method of preservation	Varies based on land value and method of preservation	Plant materials, installation (watering, backhoe, shovels, mulch, seedlings), maintenance materials (bucket truck, chipper, chainsaws), and maintenance including, pruning (especially near power lines), watering, pest control, removal and disposal of hazardous trees, and fringe landscaping.

OFFICE FOR COASTAL MANAGEMENT | DIGITAL COAST
Source: Nature-Based Solutions for Coastal Hazards
1 of 5
7/2020



Quick Reference

Assessing the Costs and Benefits of Natural Infrastructure –
Tips for the Non-Economist

Project decision-making greatly benefits from economic information. But where to start?

Economists usually determine whether a quantitative or qualitative approach is needed, and then select from a range of possible methods that describe costs and benefits to inform decision-making. This handout summarizes three common types (two quantitative and one qualitative) and provides information about when to consider using each. The methods require varying degrees of time, economic expertise, and data inputs. Each can yield information helpful for deciding when, whether, or how to use natural infrastructure. Community values, desired co-benefits, and equity concerns should also be considered.

COST-BENEFIT ANALYSIS

What is it? Cost-benefit analysis compares a project's costs and benefits, allowing an assessment of whether the benefits outweigh the costs. With this approach, costs and benefits are expressed in dollars, or monetized, to the greatest extent possible. But you don't necessarily need to monetize all costs and benefits to successfully perform this type of analysis. Costs and benefits that cannot be monetized may be described qualitatively to inform the decision-making process.

When should I use it? Expressing costs and benefits in dollars provides the most robust and comprehensive economic information. Use this approach if you have, or can derive, cost and benefit estimates, and need to know net benefits. A cost-benefit analysis is required for some projects that use federal funding sources. The approach can be used to compare the costs and benefits of a natural infrastructure project, and to compare alternative projects. For example, do the avoided costs of flood damage exceed the cost of a bioswale installation? Do green roofs or street trees have a better cost-benefit ratio?

What should I be cautious about? While a cost-benefit analysis offers the most detailed result, it also often requires the most effort and expertise. Also, when monetizing some benefits, it may be difficult to keep sight of the qualitative benefits that were not monetized.

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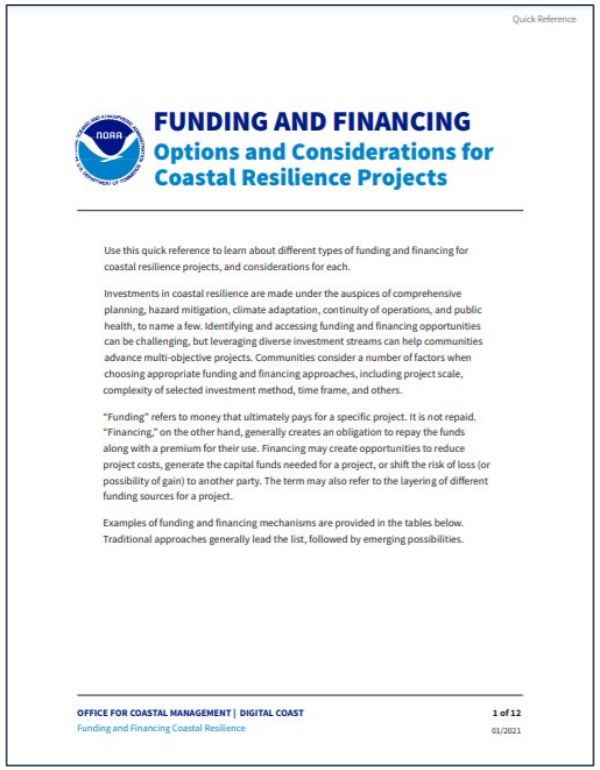
1 of 3
3/2020

coast.noaa.gov/digitalcoast/training/gi-practices-and-benefits.html

Funding And Financing Nature-Based Solutions Quick Reference and Webinar Series



Quick Reference

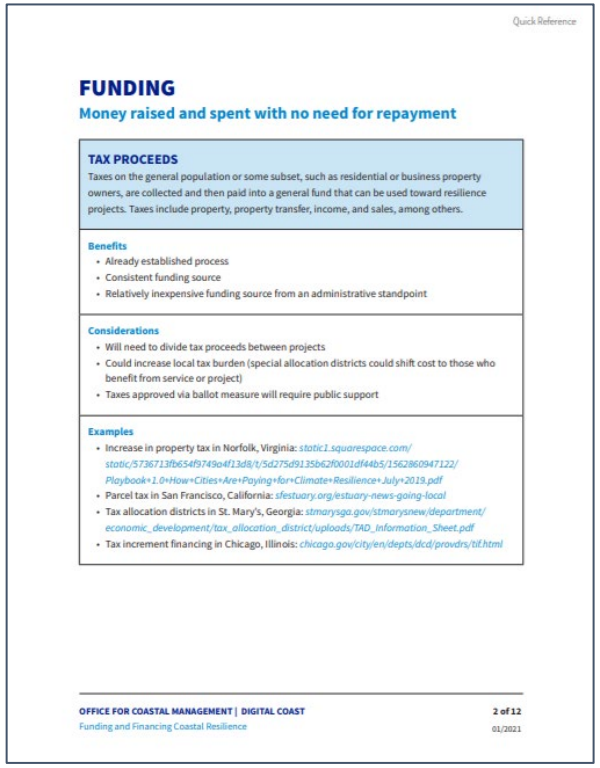
FUNDING AND FINANCING
Options and Considerations for Coastal Resilience Projects

Use this quick reference to learn about different types of funding and financing for coastal resilience projects, and considerations for each.

Investments in coastal resilience are made under the auspices of comprehensive planning, hazard mitigation, climate adaptation, continuity of operations, and public health, to name a few. Identifying and accessing funding and financing opportunities can be challenging, but leveraging diverse investment streams can help communities advance multi-objective projects. Communities consider a number of factors when choosing appropriate funding and financing approaches, including project scale, complexity of selected investment method, time frame, and others.

"Funding" refers to money that ultimately pays for a specific project. It is not repaid. "Financing," on the other hand, generally creates an obligation to repay the funds along with a premium for their use. Financing may create opportunities to reduce project costs, generate the capital funds needed for a project, or shift the risk of loss (or possibility of gain) to another party. The term may also refer to the layering of different funding sources for a project.

Examples of funding and financing mechanisms are provided in the tables below. Traditional approaches generally lead the list, followed by emerging possibilities.



Quick Reference

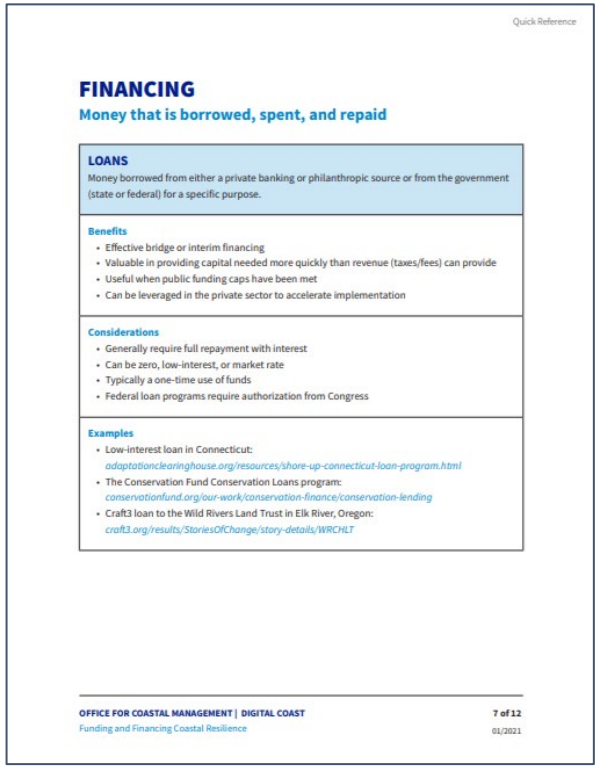
FUNDING
Money raised and spent with no need for repayment

TAX PROCEEDS
Taxes on the general population or some subset, such as residential or business property owners, are collected and then paid into a general fund that can be used toward resilience projects. Taxes include property, property transfer, income, and sales, among others.

Benefits
- Already established process
- Consistent funding source
- Relatively inexpensive funding source from an administrative standpoint

Considerations
- Will need to divide tax proceeds between projects
- Could increase local tax burden (special allocation districts could shift cost to those who benefit from service or project)
- Taxes approved via ballot measure will require public support

Examples
- Increase in property tax in Norfolk, Virginia: *static1.squarespace.com/static/5736713fb654f9749a4f13d8/t/5d275d9135b62f0001df44b5/1562860947122/Playbook+1.0+How+Cities+Are+Paying+for+Climate+Resilience+July+2019.pdf*
- Parcel tax in San Francisco, California: *sfestuary.org/estuary-news-going-local*
- Tax allocation districts in St. Mary's, Georgia: *stmarysga.gov/stmarysnew/department/economic_development/tax_allocation_district/uploads/TAD_Information_Sheet.pdf*
- Tax increment financing in Chicago, Illinois: *chicago.gov/city/en/depts/dcd/provdrs/tif.html*



Quick Reference

FINANCING
Money that is borrowed, spent, and repaid

LOANS
Money borrowed from either a private banking or philanthropic source or from the government (state or federal) for a specific purpose.

Benefits
- Effective bridge or interim financing
- Valuable in providing capital needed more quickly than revenue (taxes/fees) can provide
- Useful when public funding caps have been met
- Can be leveraged in the private sector to accelerate implementation

Considerations
- Generally require full repayment with interest
- Can be zero, low-interest, or market rate
- Typically a one-time use of funds
- Federal loan programs require authorization from Congress

Examples
- Low-interest loan in Connecticut: *adaptationclearinghouse.org/resources/shore-up-connecticut-loan-program.html*
- The Conservation Fund Conservation Loans program: *conservationfund.org/our-work/conservation-finance/conservation-lending*
- Craft3 loan to the Wild Rivers Land Trust in Elk River, Oregon: *craft3.org/results/StoriesOfChange/story-details/WRCHLT*

coast.noaa.gov/digitalcoast/training/financing-resilience.html

Learn More

coast.noaa.gov/digitalcoast/topics/green-infrastructure.html

Questions

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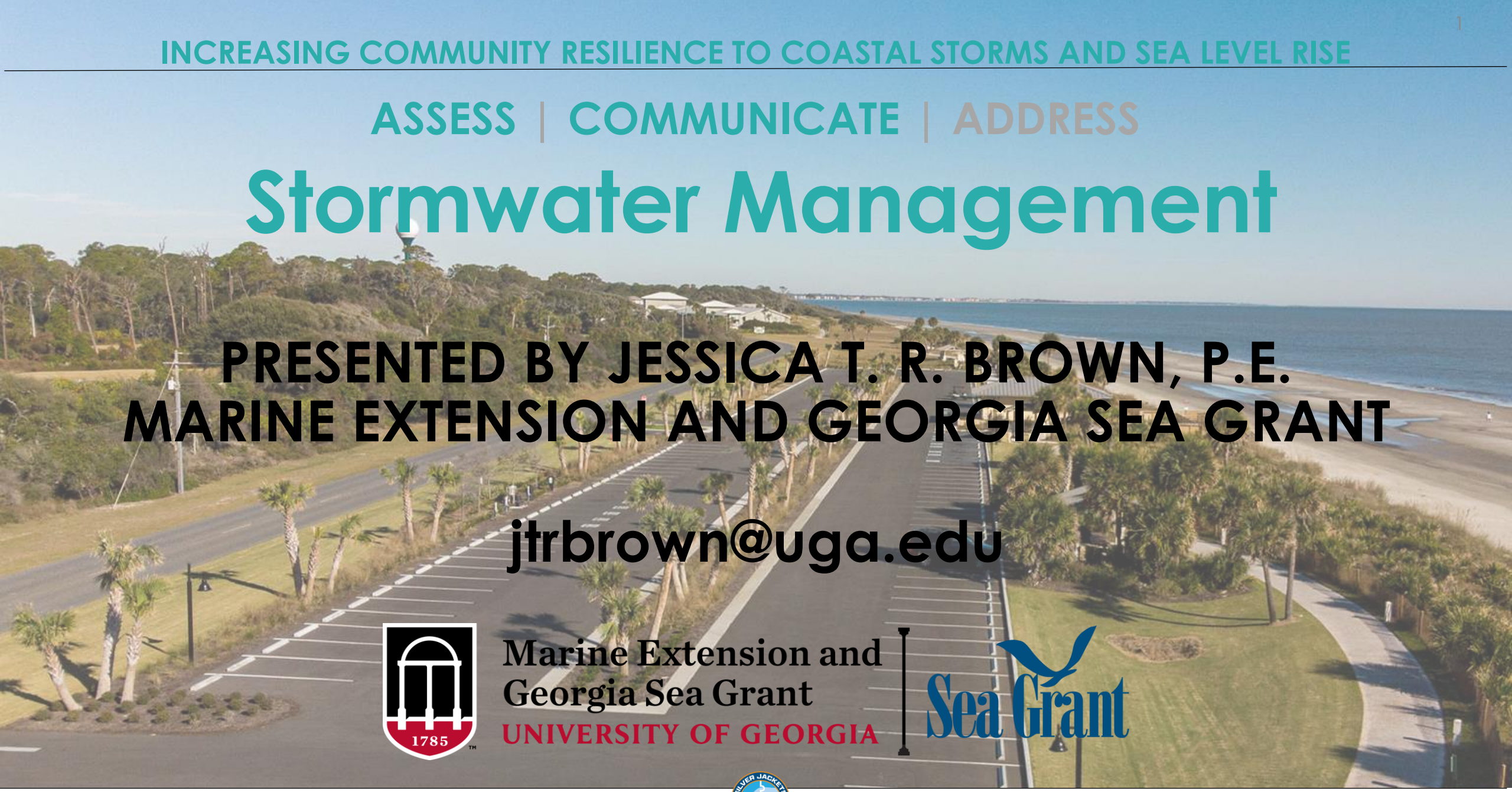
Stormwater Management



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Georgia Sea Grant
UNIVERSITY OF GEORGIA

Sea Grant

PRESENTATION OUTLINE

A. Applicability to State Statutes/Laws

B. Overview of Products/Tools
   - Coastal Low Impact Development Inventory
   - Brunswick's Rethinking Runoff Plan
   - Stormwater Operation, Inspection, and Maintenance Tools

C. Applied Exercises (How to Use)

D. Learn More

Brunswick road closure due to flooding

INCREASING COMMUNITY RESILIENCE TO COASTAL STORMS AND SEA LEVEL RISE

STORMWATER MANAGEMENT | ASSESS AND ADDRESS

Bioretention (Camden County Extension)

Rainwater Harvesting (Brunswick)

Permeable Pavement & Bioretention (St. Marys)

Bioretention (Jekyll Island)

A APPLICABILITY TO STATE STATUTES/LAWS

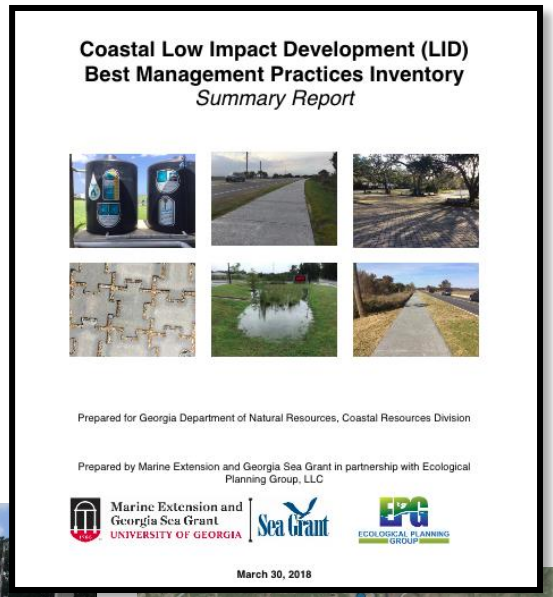
- **National Pollutant Discharge Elimination System Municipal Separate Storm Sewer Systems (MS4) Permit Compliance**
  "The permittee shall update, implement, and enforce a SWMP designed to reduce the discharge of pollutants from MS4 to the maximum extent practicable, in order to protect water quality and to satisfy the appropriate water quality requirements of the State Act and Rules (391-3-6-16). The SWMP must include management practices, control techniques and system design and engineering methods, and other provisions appropriate for the control of such pollutants."

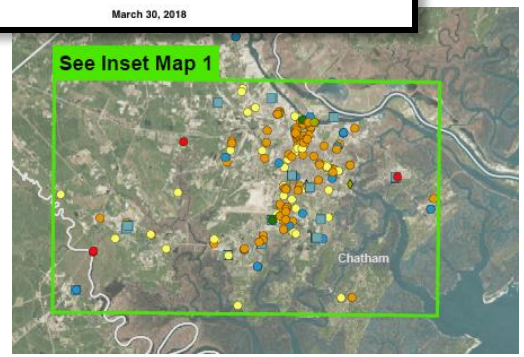
- **Opportunity:** Activity 450 (Stormwater Management) FEMA Community Rating System
  Voluntary incentive program that recognizes and encourages floodplain management practices that exceed the minimum requirements of the National Flood Insurance Program.

STORMWATER MANAGEMENT | ASSESS AND COMMUNICATE

B COASTAL LOW IMPACT DEVELOPMENT (LID) INVENTORY

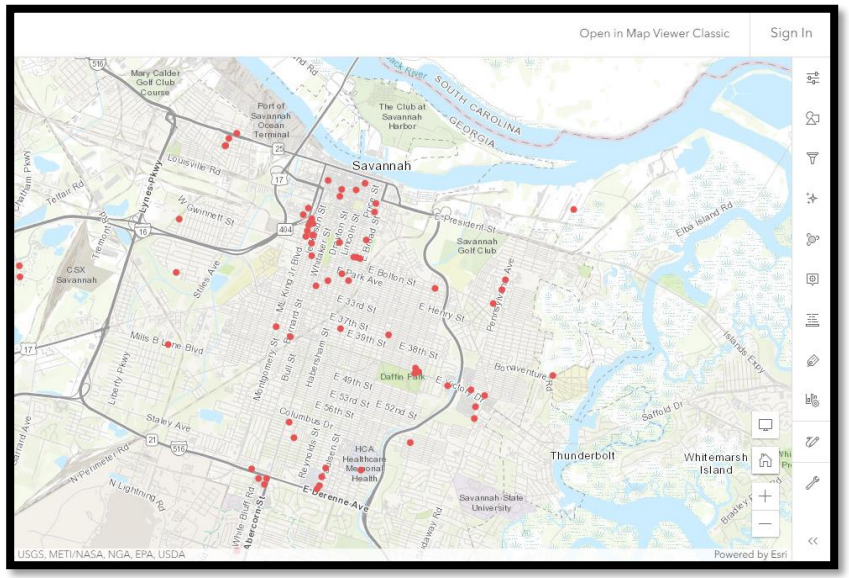
- **Developed by:** UGA Marine Extension and Georgia Sea Grant, Georgia Coastal Management Program, Ecological Planning Group, LLC (2016), Center for Watershed Protection (2016), Goodwyn, Mills, Cawood (2021)
- **What it Does:** Inventory of stormwater green infrastructure practices located on civic, public, commercial and mixed-use properties. Conducted using a combination of data collection and field verification. Includes narrative summary and photographs.
- **Access:** https://www.arcgis.com/home/item.html?id=19e663171d6f4d8fa04500ea0c8e98b9
- **Date Published/Update:** **2017; 2022**





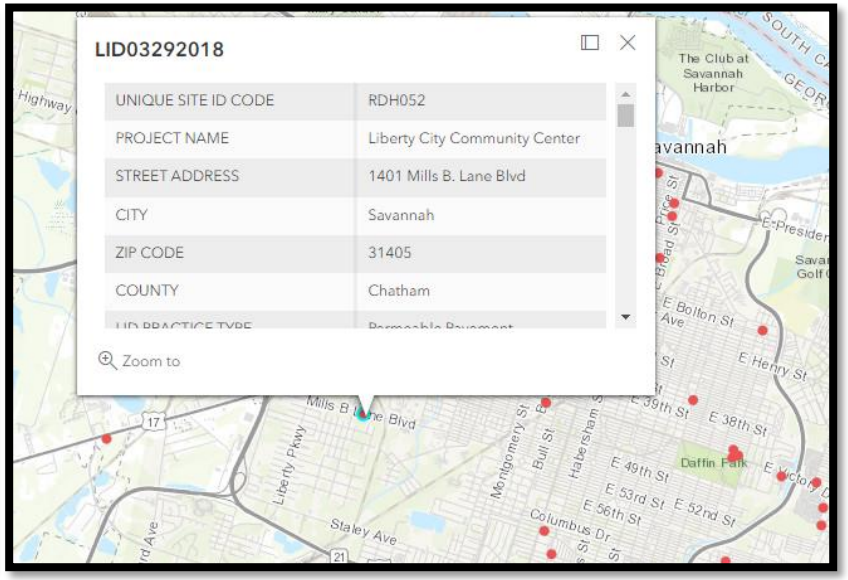
C

USING THE COASTAL LID INVENTORY



Step 1

Search by "location" or "practice"
i.e., "LID Practice type is Permeable Pavement"



Step 2

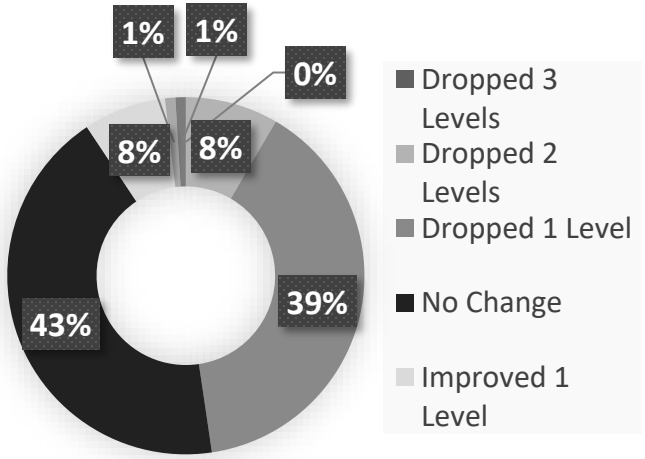
Zoom in and select a site.
"Liberty City Community Center"

Step 3

View photos.

C COASTAL LID INVENTORY COMPARITIVE ANALYSIS

- **91+ new practices,** on-going assessments
- **Reevaluated 146 locations** (Dec 2021) (PP=107, Bio/RG/BS=39)
- About half static visual assessment (PP = 43%, Bio = 56%)

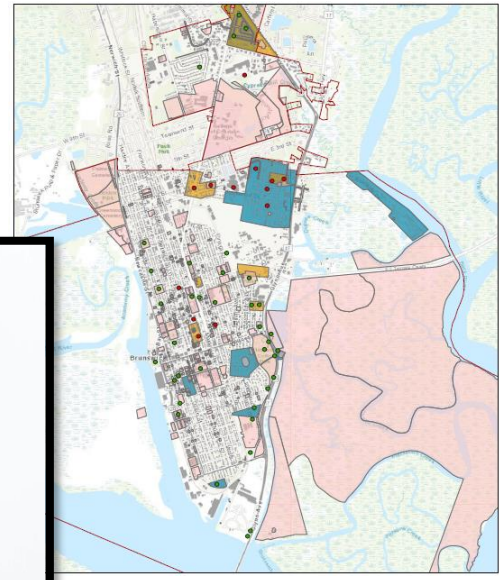


Permeable Pavement Perceived Effectiveness

- Permeable Pavement Infiltration Study
- Cost Pilot Study

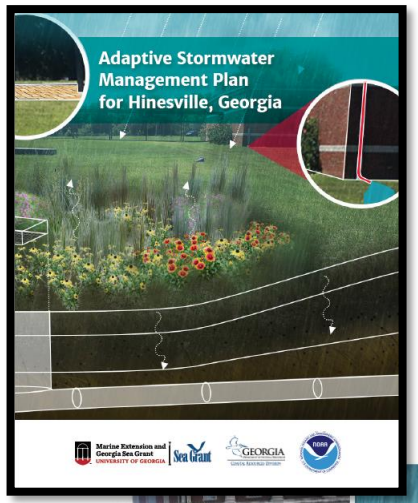
STORMWATER MANAGEMENT | ASSESS AND COMMUNICATE

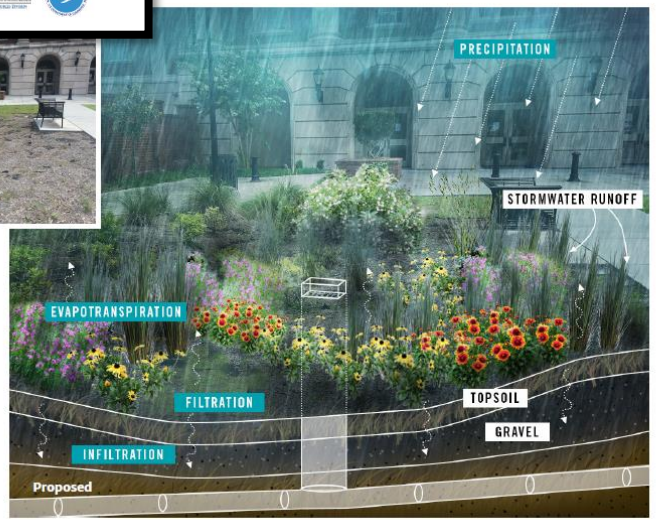
B RETHINKING RUNOFF PLAN



- **Developed by:** City of Brunswick, UGA Marine Extension and Georgia Sea Grant, Goodwyn, Mills, Cawood
- **What it Does:** Identifies priority locations to implement stormwater green infrastructure. Developed as a resource for decision-makers. Locations address water quality or flooding issue, focus on public properties, and educational opportunities.
- **Access:** **Coming soon; ASM Plan - https://gacoast.uga.edu/wp-content/uploads/2021/01/FINAL-ASM-Hinesville_ADA.pdf**
- **Date Published/Update:** **Fall 2022**

B RETHINKING RUNOFF PLAN





SITE EXAMPLE

Liberty County Justice Center

The vegetated quadrant at the main entrance can be retrofitted with four bioretention systems to capture, treat, and infiltrate runoff from the adjacent sidewalk. Runoff from the parking lot on the south side of the site can be treated by a permeable pavement system. Downspouts on the western edge of the building can be disconnected to allow stormwater to infiltrate into the vegetated areas adjacent to the building.

DISCONNECTION AREA		TREATMENT AREA		RUNOFF VOLUME			RUNOFF REDUCTION / RECHARGE		ESTIMATED COST
IMPERVIOUS	COMPACTED	GI / LD TYPE	GI / LID AREA	WATER QUALITY EVENT DEPTH (1.2")	ANNUAL RAINFALL (50")		CREDIT	ESTIMATED VOLUME	CONSTRUCTION
8,500 sq.ft	9,650 sq. ft.	PERMEABLE PAVEMENT	9,650 sq. ft.	1,740 cu. ft.	72,100 cu. ft.	0.54 MGAL	100%	0.54 MGAL / YR	$237,000
15,750 sq.ft	0 sq. ft.	BIORETENTION	1,400 sq. ft.	1,630 cu. ft.	64,900 cu. ft.	0.49 MGAL	100%	0.49 MGAL / YR	$49,500

Goodyear Park

2209 Parkwood Drive

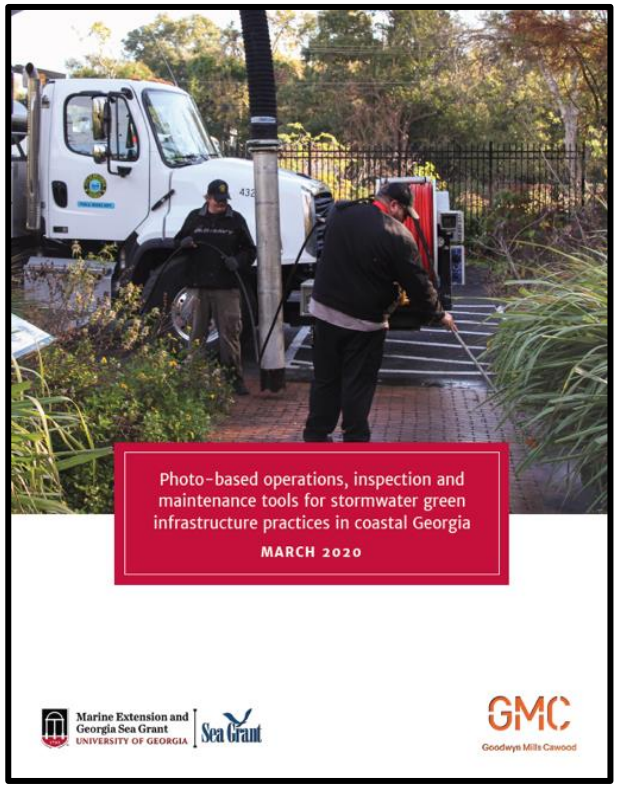
OVERVIEW

Stormwater runoff from various impervious surfaces throughout the park (tennis court, fitness court, and planned pavilion) and stormwater runoff from adjacent streets (Park Ave) can be routed to permeable pavement parking stalls. Parking stalls will be located on the eastern and western edges of the park. The permeable pavement will be used to capture and infiltrate stormwater runoff and reduce erosion along the perimeter of the park. Additionally, the green space at the northwest corner of the park should be prioritized for preservation. Educational signage is proposed for the planned pavilion.

B PHOTO-BASED OPERATION, INSPECTION AND MAINTENANCE TOOLS

- **Developed by:** UGA Marine Extension and Georgia Sea Grant, Georgia Coastal Management Program, Goodwyn, Mills, Cawood
- **What it Is:** A suite of photo-based resources for inspectors and maintenance staff engaged in stormwater management to be used in training and inspections for operation and maintenance of green infrastructure.
- **Access:** https://gacoast.uga.edu/outreach/programs/stormwater-management/, **"Stormwater Operation, Inspection and Maintenance Tools"**
- **Date Published/Update:** **2020**

B PHOTO-BASED OPERATION, INSPECTION AND MAINTENANCE TOOLS



C PHOTO-BASED O&M TOOLS IMPACT

- **2020 Training – 98% agree or strongly agreed** to put something they learned into practice within 12 months.
- **44% of permitted municipalities** have included the tools as recommended resources in GI/LID Plan updates
- **95% of the GI/LID practices** are being assessed by municipalities using the tools

Online training course – Fall 2022

D LEARN MORE

- Rethinking Runoff Lunch Workshop – September 15th
- https://gacoast.uga.edu/outreach/programs/stormwater-management/
- Georgia Stormwater Management Manual updated 2016, Coastal Stormwater Supplement ?

  https://atlantaregional.org/natural-resources/water/georgia-stormwater-management-manual/

Questions?

GEORGIA
DEPARTMENT OF NATURAL RESOURCES

COASTAL RESOURCES DIVISION

Jennifer Kline, Coastal Hazards Specialist
Georgia Coastal Management Program

Resilience at a state level

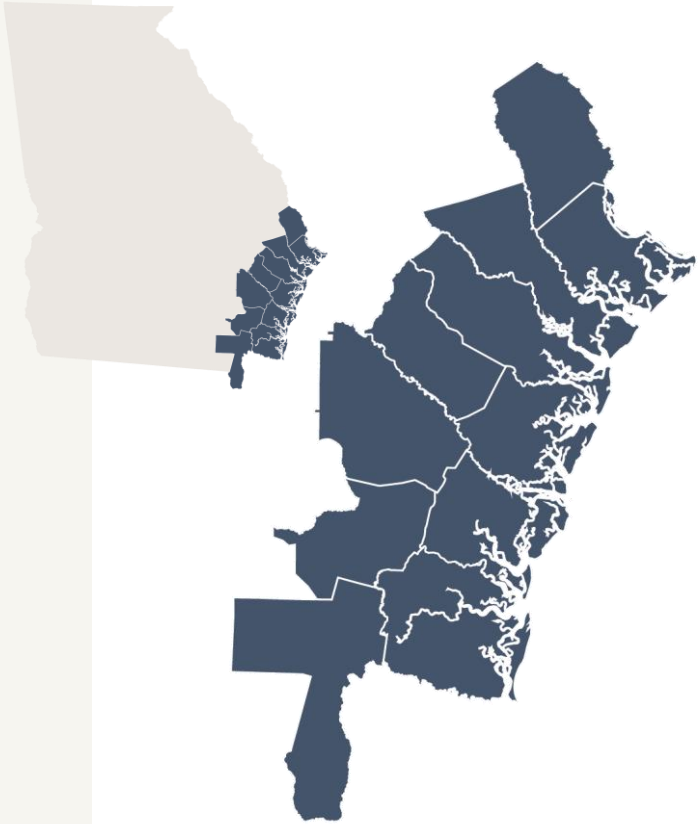
- Department of Agriculture
- Department of Natural Resources
- Department of Community Affairs
- Department of Public Health
- Georgia Emergency Management & Homeland Security
- Georgia Forestry Commission
- Georgia Chamber of Commerce
- University System of Georgia

JURISDICTION

MARSH & SHORE

- Coastal Marshlands Protection Act
- Shore Protection Act
- Revocable Licenses
- Federal Consistancy

COASTAL MANAGEMENT PROGRAM



- 368,000 acres of marshlands
- 300 square miles of Atlantic Ocean
- 3,400 miles of shorelines
- 105 miles of beaches
- 11 counties
- 680,000 people

It is our goal to make Georgia's coast more resilient to hazards by providing training, technical assistance & funding.

COASTAL MANAGEMENT

01 OCEAN & COASTAL MANAGEMENT

02 MARSH & SHORE MANAGEMENT

03 COMPLIANCE & ENFORCEMENT

04 SHELLFISH & WATER QUALITY

01

COASTAL & OCEAN MANAGEMENT

GREEN GROWTH

Building & planning best practices; Low-impact development

COASTAL HAZARDS

Community resiliency; Disaster recovery; Assessing climate change

GIS & PLANNING

Regional LIDAR; Imagery gathering; Web-based mapping

WETLANDS

Assessing health; Monitoring dieback; Promoting restoration

01

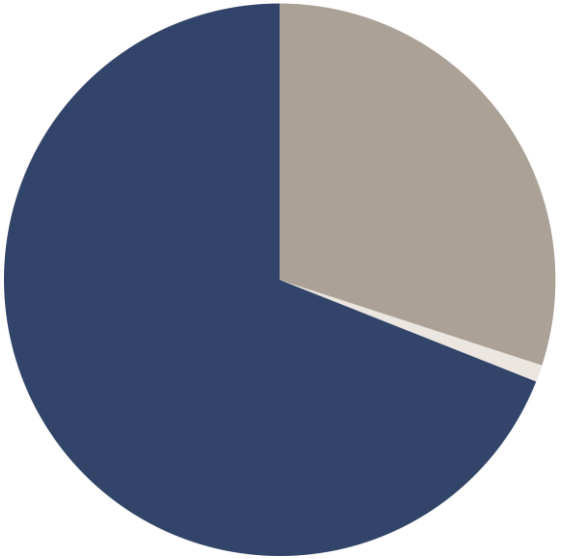
COASTAL & OCEAN MANAGEMENT

Over $3 million to resiliency

COASTAL INCENTIVE GRANTS

Nearly 450 projects funded over 20 years, representing $40 million including matching funds

Over $3 million in resiliency projects

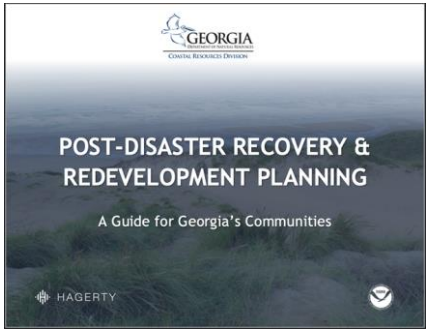


69 percent
Universities

30 percent
Local governments

1 percent
State agencies

DISASTER RECOVERY & REDEVELOPMENT PLANNING



Long-term, holistice, community level planning

- All 11 Coastal Georgia Counties
- Includes Shoreline Change and Sea Level Rise
- All coastal military installations participated

Georgia is the first state in the US to have a completely resilient coast based on FEMA's National Disaster Recovery Framework.

RESPONSE

MARINE DEBRIS

Private docks, marinas and sunken vessels

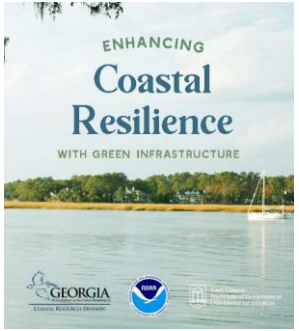
UNMANNED AERIAL VEHICLES

Assistance to state and local governments

ENHANCING COASTAL RESILIENCE WITH GREEN INFRASTRUCTURE

Freshwater

Stormwater/precepitation flooding
Bioswales,raingardens, pervious paving, rainwater harvesting



Saltwater

High-tide flooding
Tide gates, living shorelines, salt-tolerant vegetation, enhanced dunes

PACKAGE IT UP

People

Social Vulnerability
Underserved Communities

Place

Natural Resources
Climate Change
Coast

Protection

NBI & GI
Resources and Tools
Ordinances

BUILDING RESILIENCY WITH NATURE-BASED INFRASTRUCTURE


MINIMIZING GEORGIA'S RISK
MAXIMIZING GEORGIA'S FUTURE
GEORGIA
CLIMATE
CONFERENCE
MINIMIZING GEORGIA'S RISKS.
MAXIMIZING GEORGIA'S FUTURE.

FLOOD LITERACY PROJECT

Terminology is critical

COASTAL LAND CONSERVATION

(formally known as CELCP)

Funding to assist in land conservation.

GEORGIA COASTAL HAZARDS COMMUNITY OF PRACTICE

GOVERNMENT

Dept. of Public Health
Dept. of Community Affairs
U.S. Army Corps
Georgia Emergency Mgmt.
Coastal Regional Comm.

NONPROFIT

Nature Conservancy
Georgia Conservancy

RESEARCH

University of Georgia
Georgia Southern University
Emory University
Savannah State University
Georgia Tech

NATURAL RESOURCES

Coastal Resources Div.
Skidaway Institute
Jekyll Island
Sapelo Island N.E.R.R.


GEORGIA
DEPARTMENT OF NATURAL RESOURCES
COASTAL RESOURCES DIVISION

ASSESS | COMMUNICATE | ADDRESS

Resilient Infrastructure Systems

J. Scott Pippin, JD, CFM

jspippin@uga.edu

Carl Vinson
Institute of Government
UNIVERSITY OF GEORGIA

Carl Vinson Institute of Government
UNIVERSITY OF GEORGIA

Since 1927, the **Carl Vinson Institute of Government** has been an integral part of the University of Georgia. A public service and outreach unit of the university, the Institute of Government is the largest and most comprehensive university based organization serving governments in the United States through research services, customized assistance, training and development, and the application of technology.

Carl Vinson Institute of Government
UNIVERSITY OF GEORGIA

Services & Research

- Economic Development
- Fiscal & Economic Analysis
- Strategic Planning
- Planning & Environmental Services
- Human Resources Management
- Survey Research & Evaluation
- Applied Demography
- State & Local Government Services
- Workforce Development
- Data Analytics and Visualization Services

Carl Vinson Institute of Government
Services & Research

Economic Development

Fiscal & Economic Analysis

Strategic Planning

Planning & Environmental Services

Human Resources Management

Survey Research & Evaluation

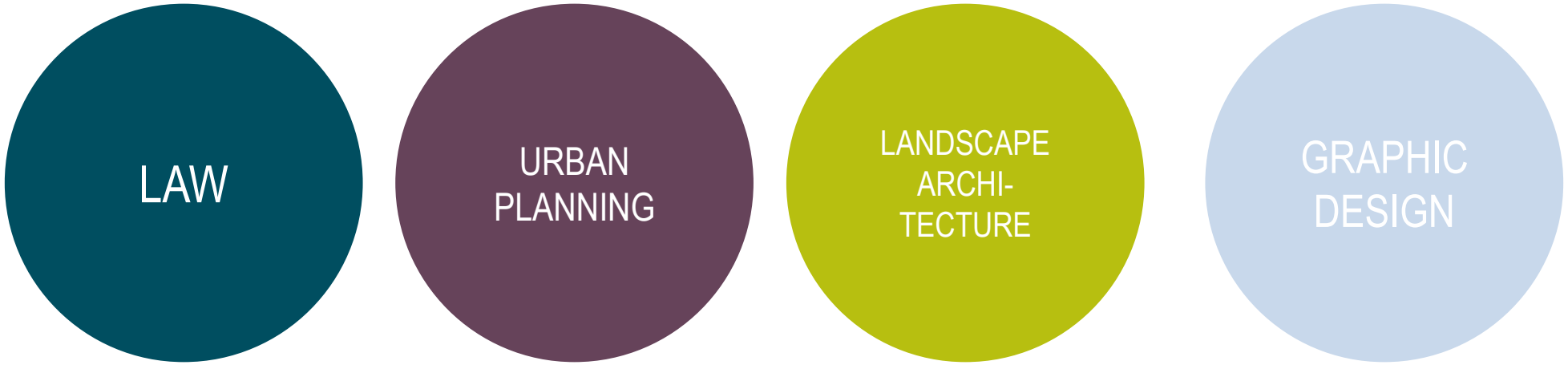
Applied Demography

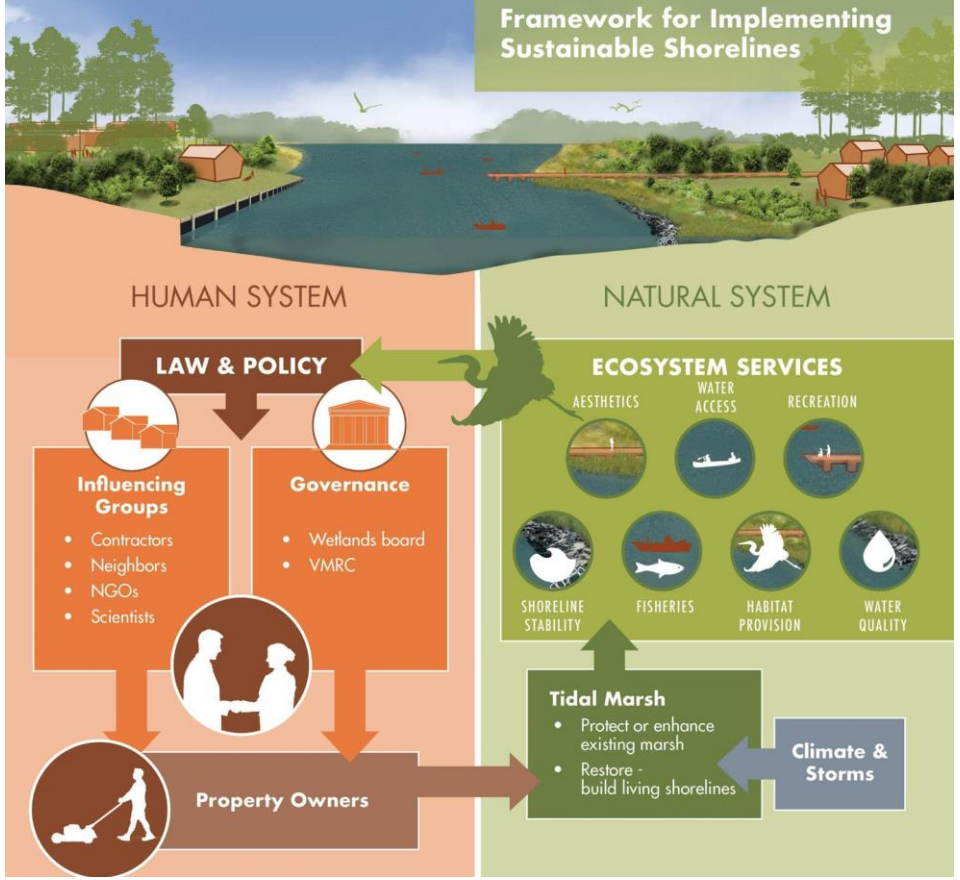
State & Local Government Services

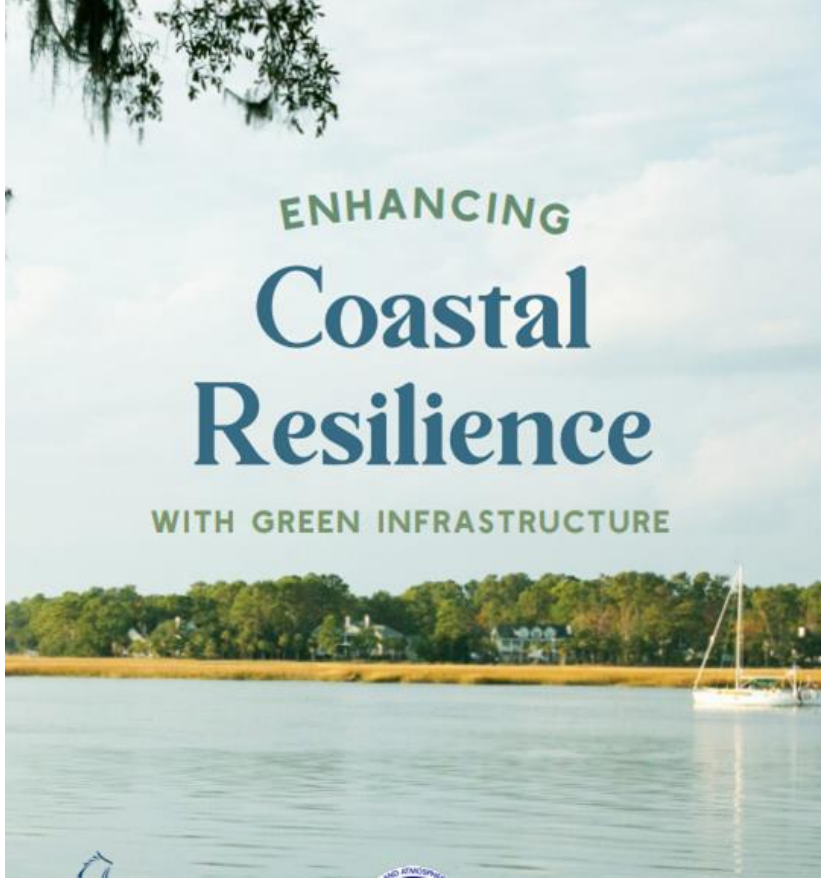
Workforce Development

Data Analytics and Visualization Services

Disciplines Involved







Environmental Law & Policy

ENVIRONMENTAL LAW & POLICY

HAZARDS & RESILIENCE PLANNING

LOCAL, STATE & REGIONAL PLANNING

URBAN DESIGN & PLANNING

GREEN INFRASTRUCTURE & LOW IMPACT DEVELOPMENT

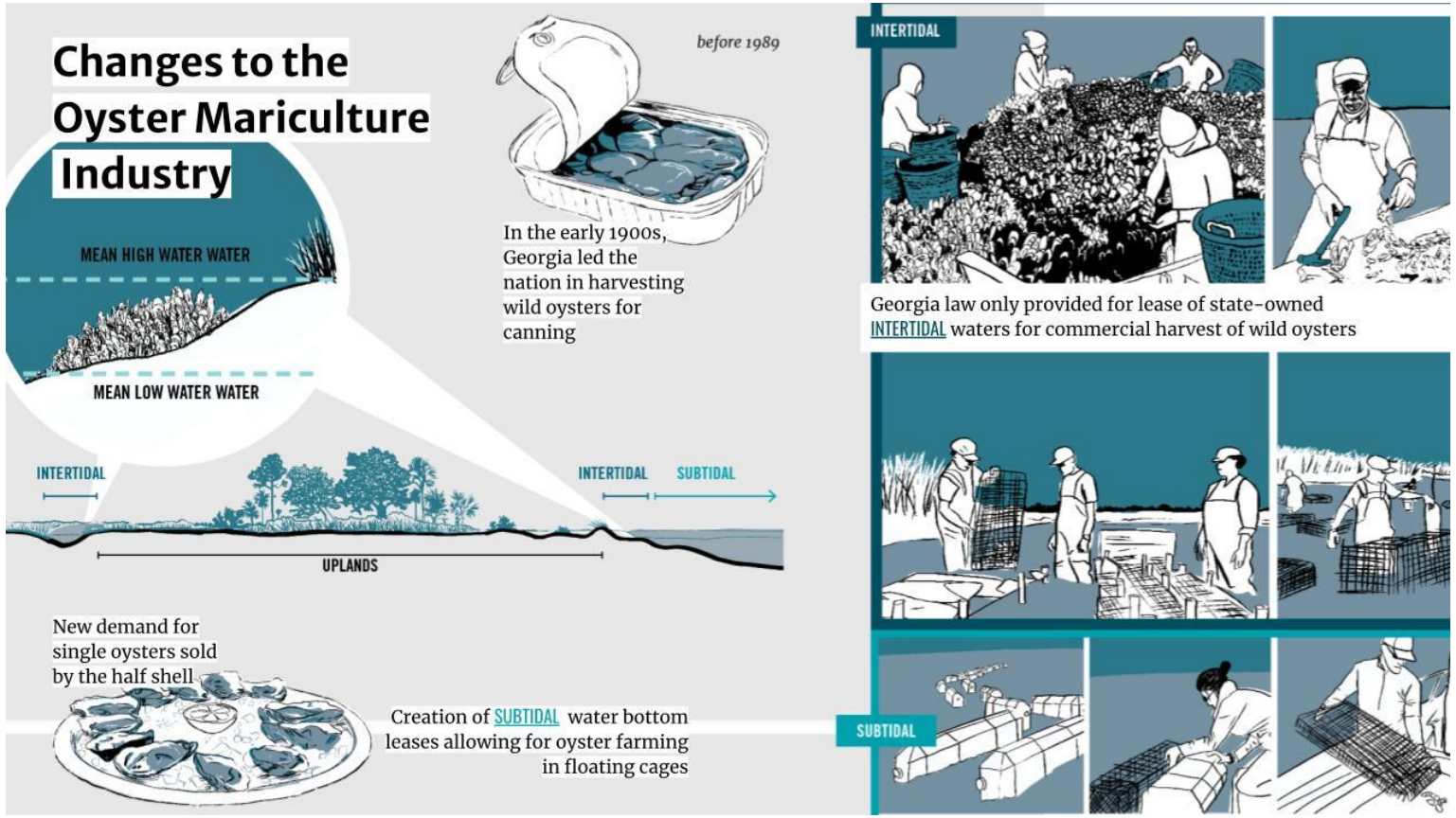
NATURAL & NATURE-BASED INFRASTRUCTURE

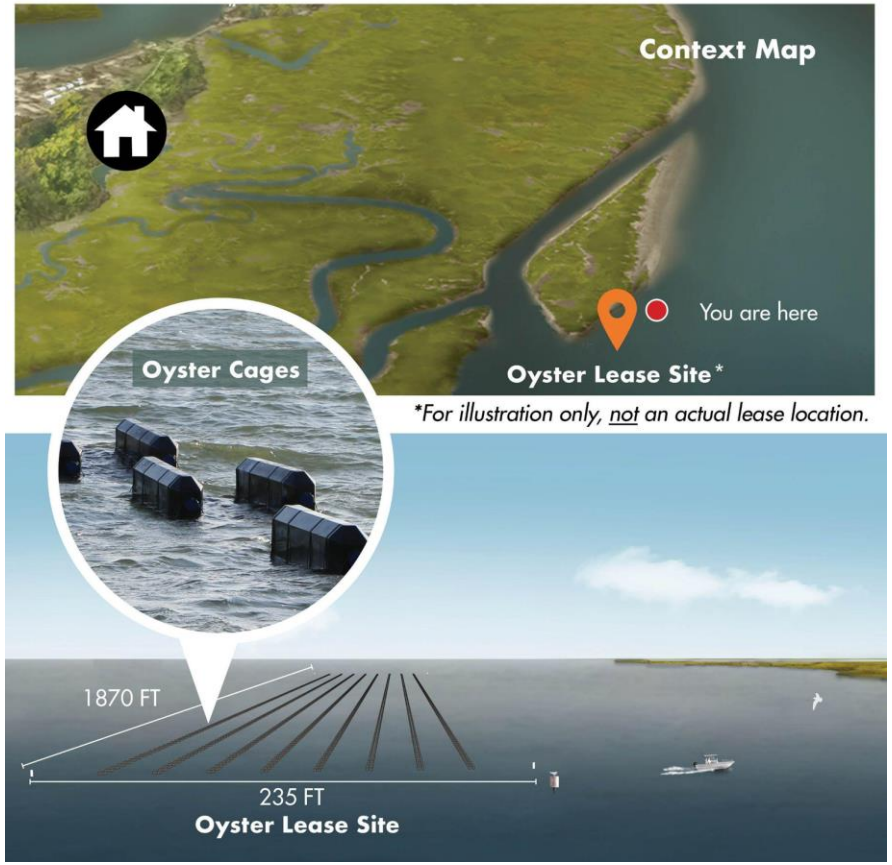
JEKYLL ISLAND 2021
MASTER PLAN UPDATE

Jekyll Island Land Use Update, 2021

Strategic Planning & Natural Resource Planning

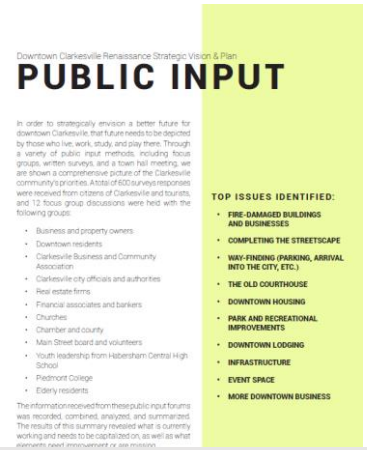
WATER QUALITY REGULATIONS	ASSET-BASED COMMUNITY DEVELOPMENT	LOCAL, STATE & REGIONAL PLANNING	URBAN DESIGN & PLANNING
STRATEGIC PLANNING	LAND CONSERVATION	GREEN INFRASTRUCTURE & LOW IMPACT DEVELOPMENT	LAND USE

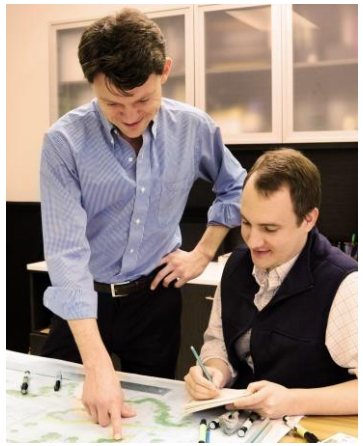


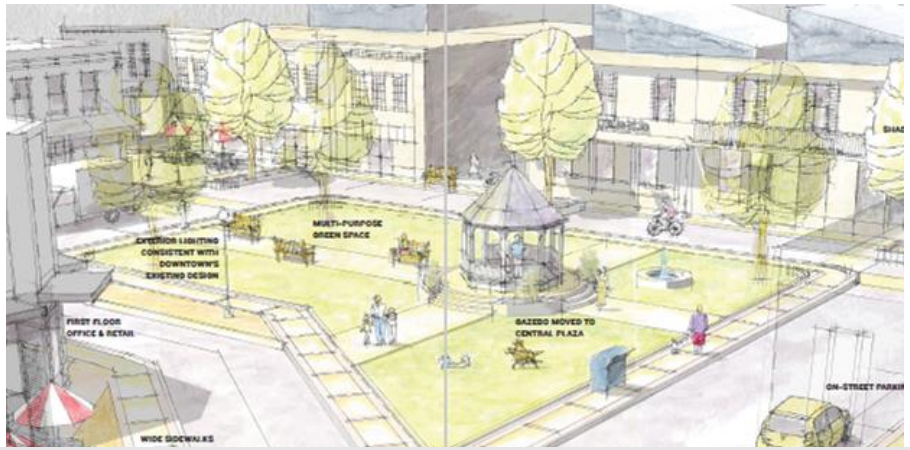


Policy Research and Analysis

ENVIRONMENTAL LAW & POLICY	POLICY ANALYSIS & RESEARCH	COASTAL LAW
PUBLIC ENGAGEMENT	LOCAL, STATE & REGIONAL PLANNING	LAND USE







Downtown Development

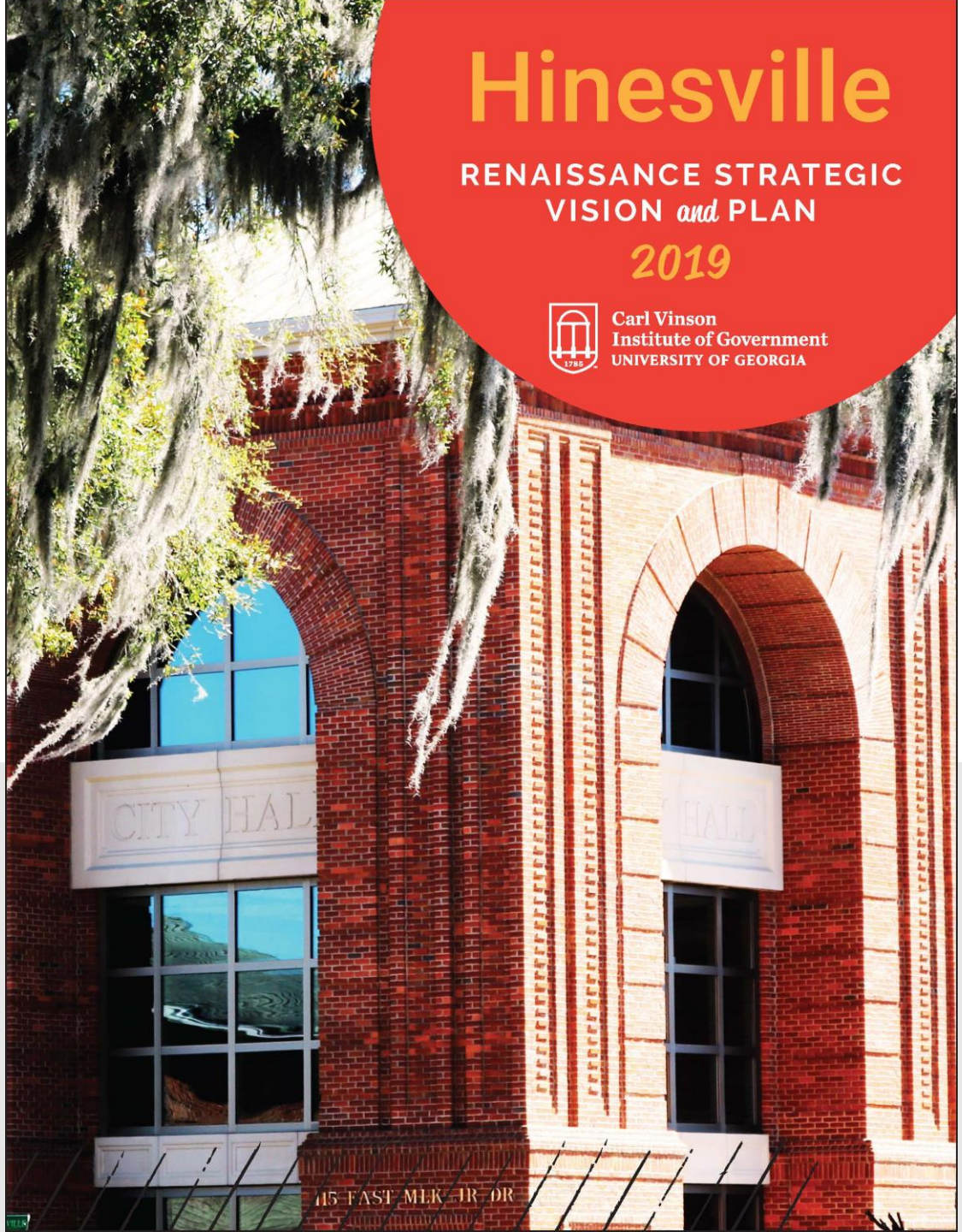
LANDSCAPE DESIGN

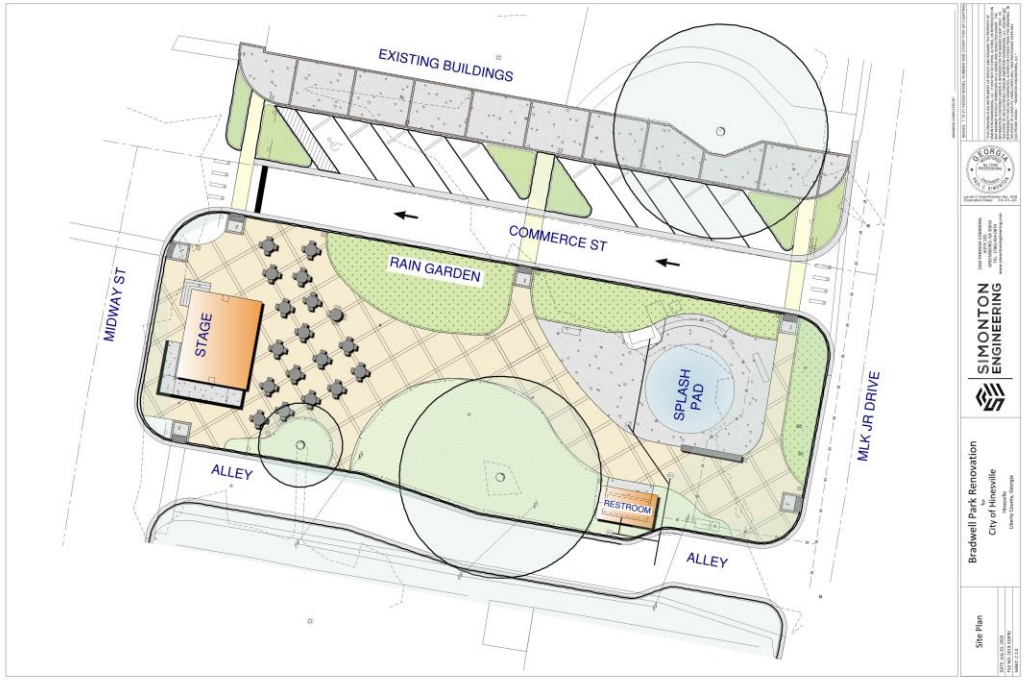
DOWNTOWN DEVELOPMENT

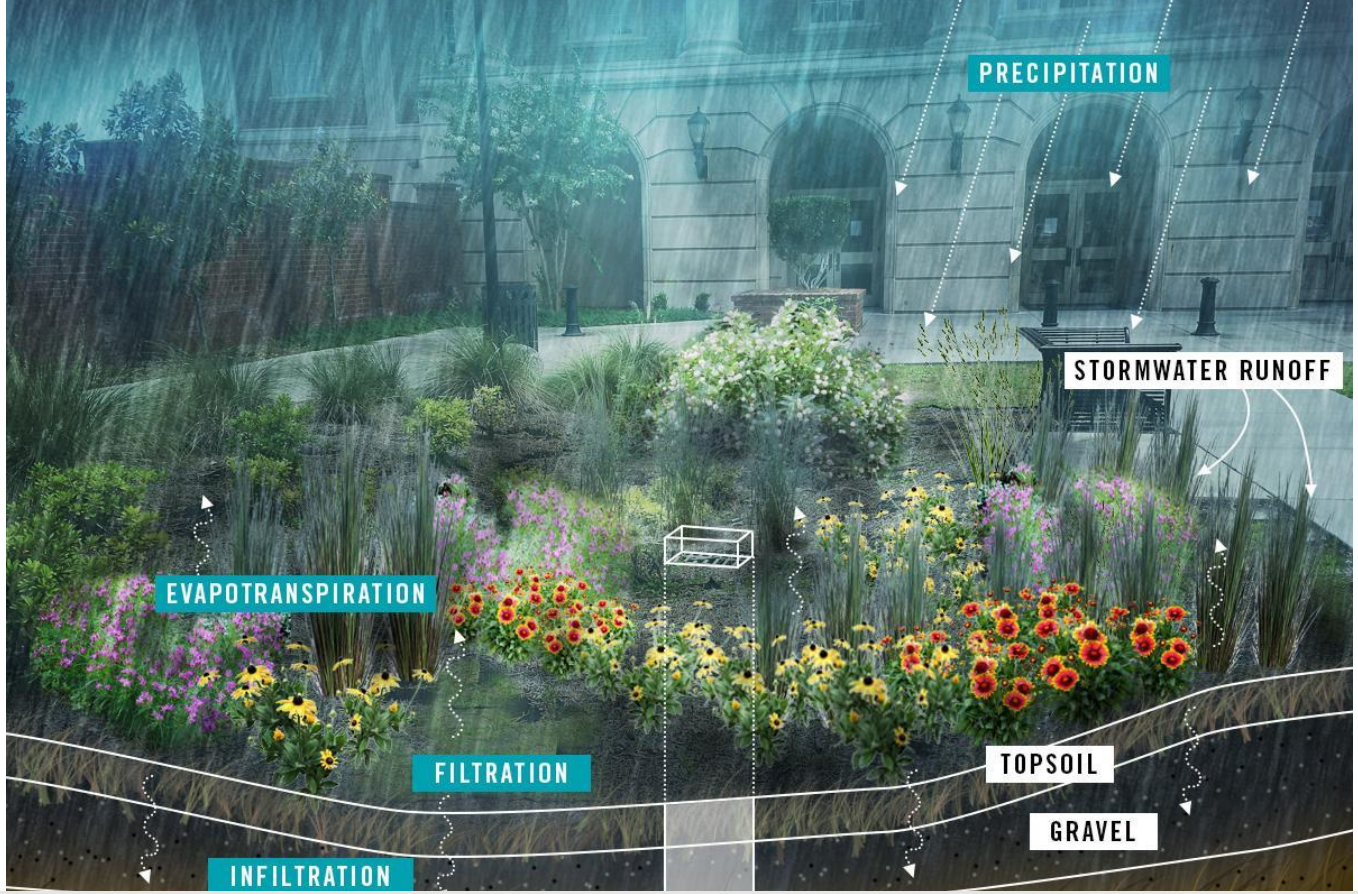
URBAN DESIGN & PLANNING

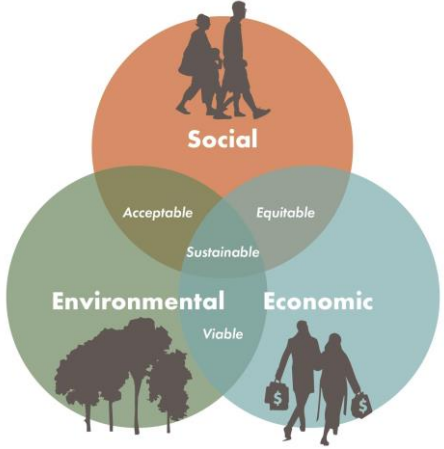
HAND & COMPUTER RENDERING

VISIONING


Hinesville
RENAISSANCE STRATEGIC
VISION and PLAN
2019
Carl Vinson
Institute of Government
UNIVERSITY OF GEORGIA
CITY HAL
115 EAST MLK JR DR


EXISTING BUILDINGS
COMMERCE ST
RAIN GARDEN
MIDWAY ST
STAGE
SPLASH PAD
MLK JR DRIVE
ALLEY
RESTROOM
ALLEY
SIMONTON ENGINEERING
Bradwell Park Renovation
City of Hinesville
Site Plan





Visualization & Graphics

NATURAL & NATURE-BASED INFRASTRUCTURE	GREEN INFRASTRUCTURE & LOW IMPACT DEVELOPMENT	LANDSCAPE DESIGN	ENVIRONMENTAL LAW & POLICY
HAZARDS & RESILIENCE PLANNING	HAND & COMPUTER RENDERING	VISIONING	URBAN DESIGN & PLANNING

Institute for Resilient Infrastructure Systems (IRIS)

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Institute for Resilient Infrastructure Systems
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Institute for Resilient Infrastructure Systems
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Vision

Natural and conventional infrastructure working together for thriving communities, businesses and natural systems.

Mission

- Advance the integration of natural and conventional infrastructure systems to strengthen long term resilience to flooding, sea level rise, drought, and other disruptions.
- Empower communities and businesses to discover wise infrastructure solutions that maximize social, economic, and environmental benefits.
- Support informed decision making through interdisciplinary expertise, advanced tools and techniques, and collaborative partnerships.

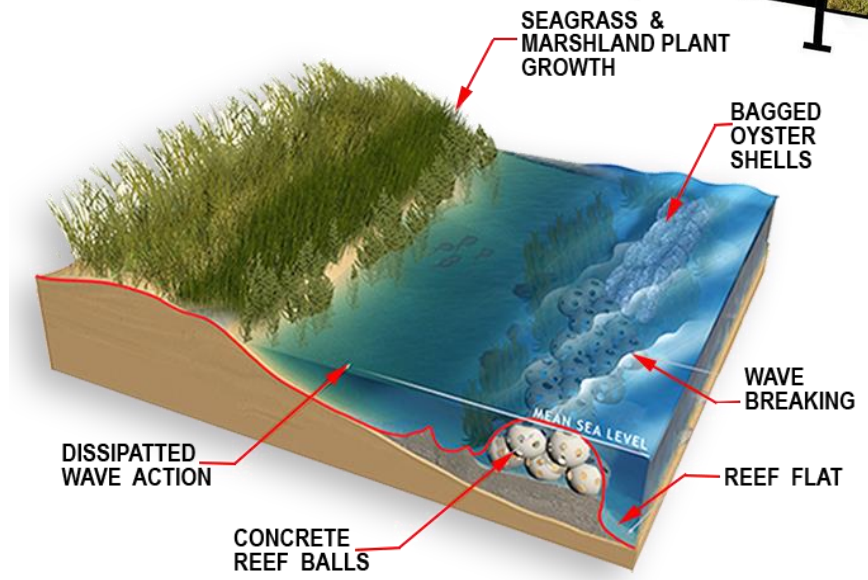
Institute for Resilient Infrastructure Systems
UNIVERSITY OF GEORGIA

- College of Engineering
- College of Agricultural and Environmental Sciences
- Carl Vinson Institute of Government
- College of Environment and Design
- Franklin College of Arts and Sciences (including Anthropology, Geology, Geography, Marine Science, Psychology)
- Marine Extension and Georgia Sea Grant
- College of Public Health
- Odum School of Ecology
- Warnell School of Forestry and Natural Resources
- Skidaway Institute of Oceanography
- School of Social Work

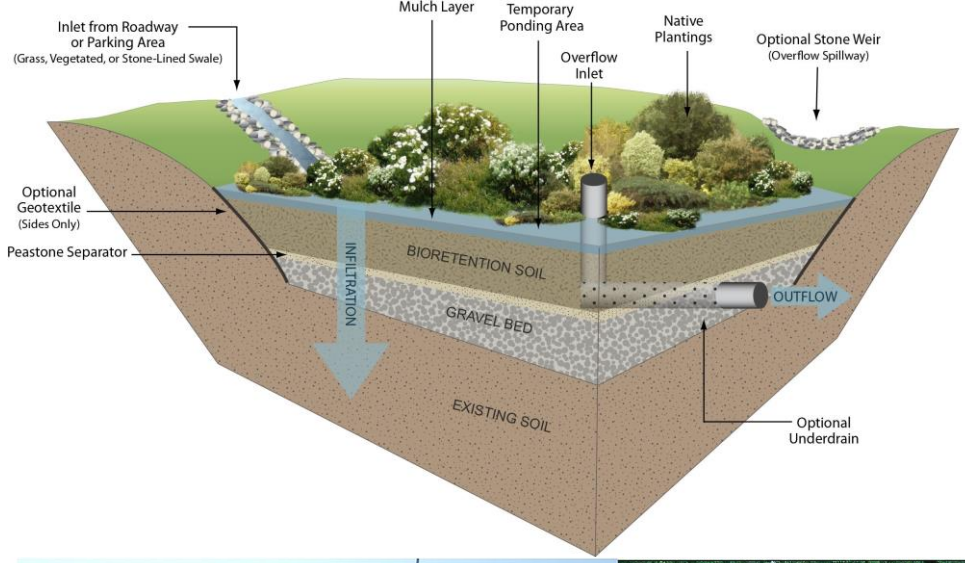
- **Ecologists**
- **Hydrologists**
- **Economists**
- **Landscape architects**
- **Meteorologists**
- **Anthropologists**
- **Social workers**
- **Civil, Mechanical, Environmental, & Computer Engineers**
- **Psychologists**
- **Geologists**
- **Marine Scientists and Oceanographers**
- **Foresters**
- **Lawyers**

US Army Corps of Engineers®

EWN®
Engineering With Nature



Natural Infrastructure



Natural Infrastructure

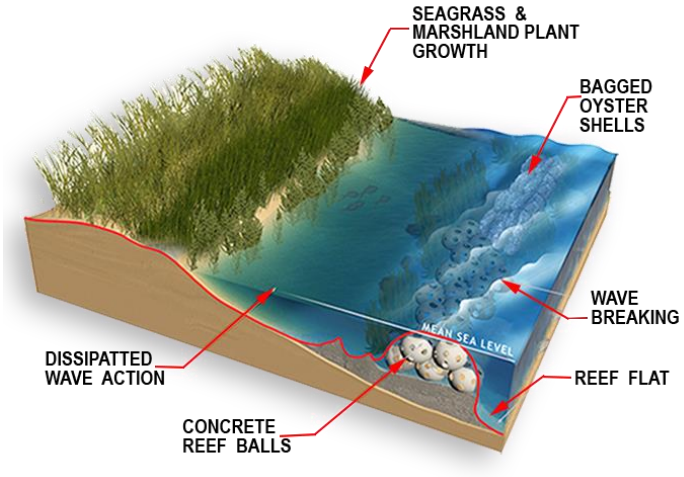
Coastal wetlands (Salt marsh)

Barrier Islands

Levee Setbacks

Beaches and Dunes

Oyster/coral reefs



Engineering With Nature®

US Army Corps of Engineers®

EWN®

- Engineering not “against,” not “for,” but “WITH” nature
- Intentional alignment of engineering and natural processes that requires us to understand:
  - Natural processes
  - NI not as just things in space, but as processes in time
  - System interactions

Network for Engineering with Nature (N-EWN)

METHODS AND STANDARDS

Rigorous methods, standards and tools are needed to effectively plan, design, construct and operate natural infrastructure at different scales.

ASSESSING BENEFITS AND COSTS

Natural infrastructure provides communities with a broad array of economic, environmental and social benefits. Improved approaches are needed to evaluate, quantify and forecast these benefits to support planning and decision making.

MONITORING PERFORMANCE AND OUTCOMES

Technically sound, efficient, and applicable methods are needed to track natural infrastructure performance over time, develop the evidence base for future designs and investments, ensure compliance with policy and inform project operations and adaptive management.

INTEGRATING PEOPLE AND POLICY

Providing infrastructure that supports human wellbeing and equitably meets the needs of diverse communities, requires integration of human values, attitudes, beliefs, and policies with modern communication and collaboration practices.

N-EWN

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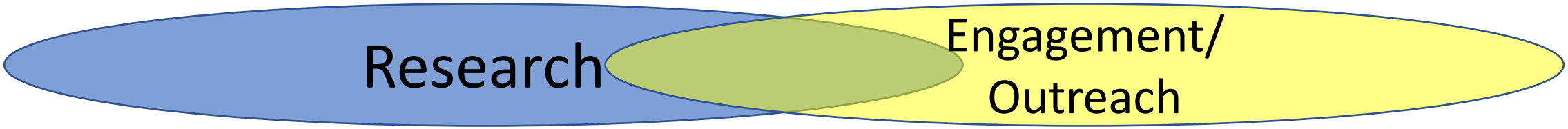
UNIVERSITY OF GEORGIA

N-EWN

MCE Initiative



Responsibilities and Activities:

Conduct basic and applied science.

Develop technical practices and methodologies.

Coordinate academic educational activities.

Outreach and engagement with industry.

Collaborative planning with communities and military installations.

Develop pilot project concepts.

Facilitate the adoption of EWN best practices and concepts.

Conduct/inform legal, policy, and social science research activities.

Military Community Engagement Initiative

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EWN®

Carl Vinson Institute of Government
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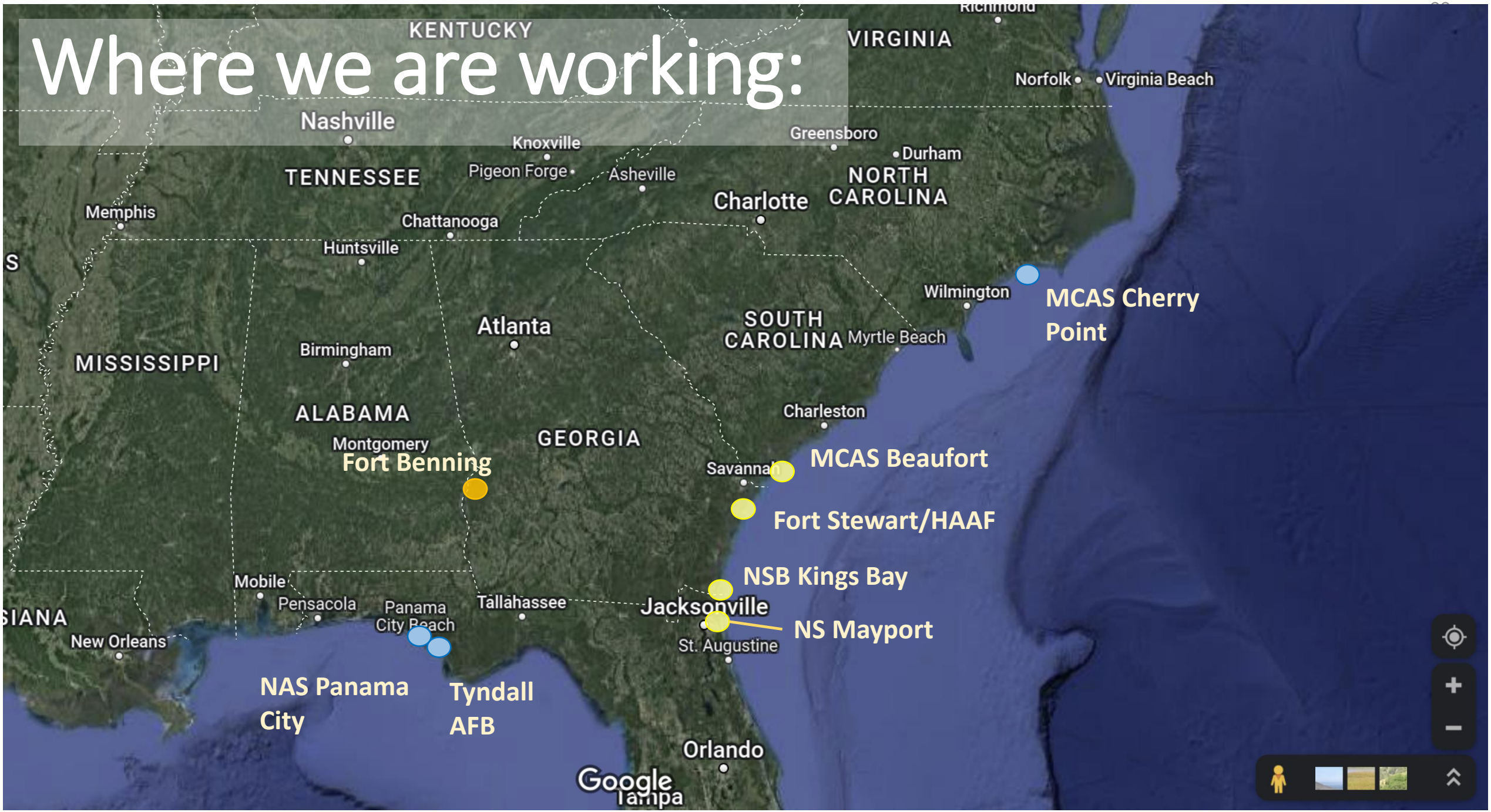
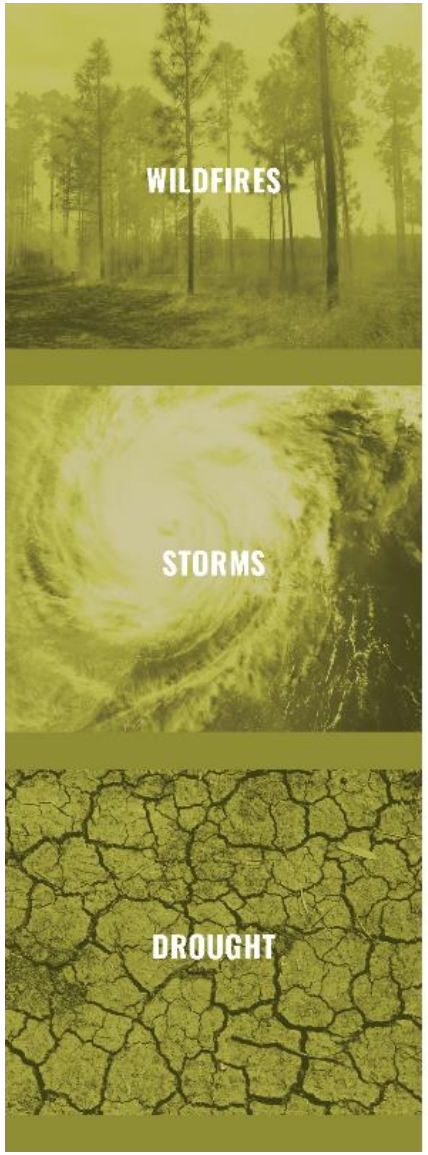
Where we are working:



UGA Military Community Engagement Initiative



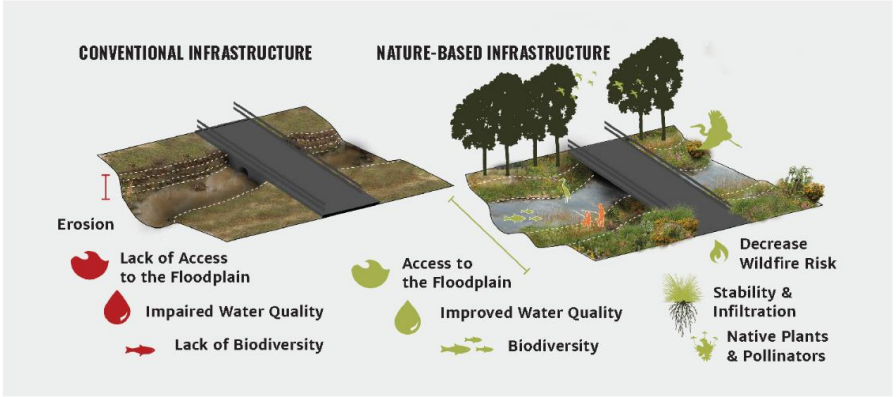
Engineering With Nature® for Climate Resilience on Military Installations

THE UNIVERSITY OF GEORGIA–FORT BENNING PARTNERSHIP

The University of Georgia's (UGA) Institute for Resilient Infrastructure Systems (IRIS) and the Carl Vinson Institute of Government are engaging with Fort Benning to apply Engineering With Nature (EWN) principles and practices to develop plans that addresses the local priorities and vulnerabilities defined by the installation and the surrounding communities.

CURRENT PROJECTS OF THIS PARTNERSHIP INCLUDE:

- Assessing opportunities for EWN projects both inside the installation and across adjacent communities;
- Assessing opportunities to reduce wildfire risk and drought vulnerability;
- Supporting Fort Benning in applying the Army Climate Assessment Tool (ACAT);
- Building improved models of stormwater systems and other infrastructure;
- Evaluating potential operational efficiencies that can improve resilience planning and EWN project implementation; and
- Conducting additional inventories and assessments to understand the root causes of vulnerabilities on the installation and across adjacent communities.



PROBLEM

Climate change poses a variety of threats to military operations based on:

- The nature of the mission of the specific installation
- The geographic and ecological setting in which it operates
- Age and design of local infrastructure systems
- The interconnections the installation has with the surrounding community

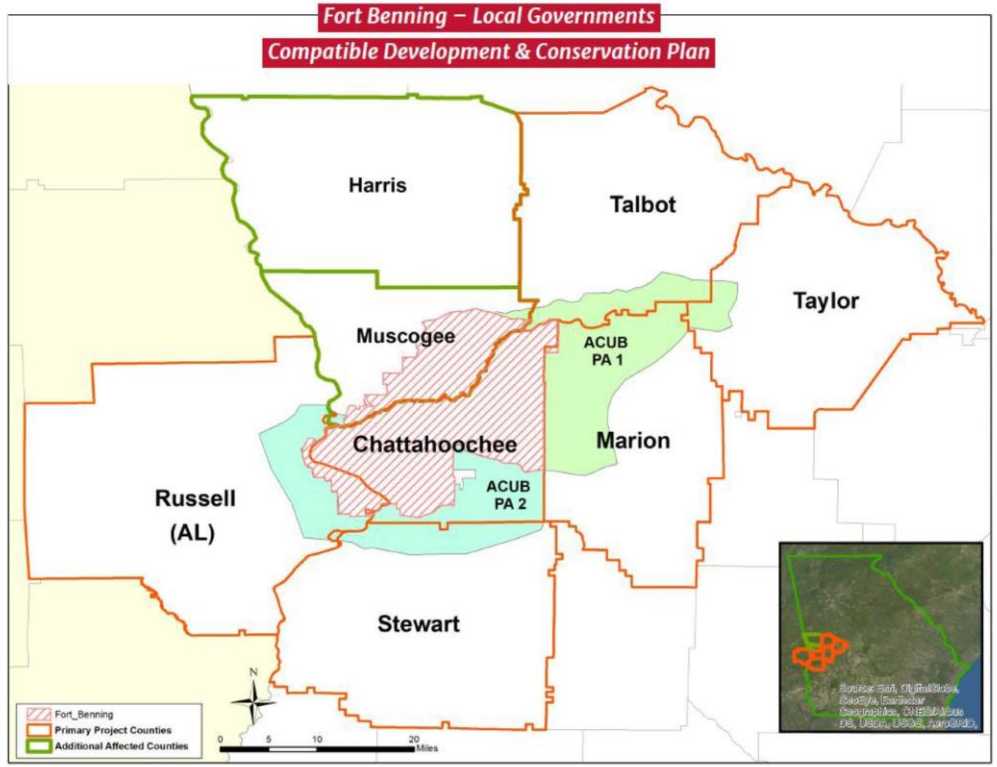
APPROACH

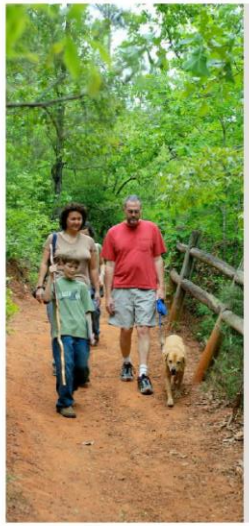
- Climate change is a universally shared challenge, but one where the threats and necessary adaptations are intensely local.
- Through direct engagement with civilian and military personnel and in surrounding communities, this effort will provide practical resources to address local vulnerabilities through application of EWN principles and implementation of natural infrastructure projects to address Army and DOD climate resilience priorities.

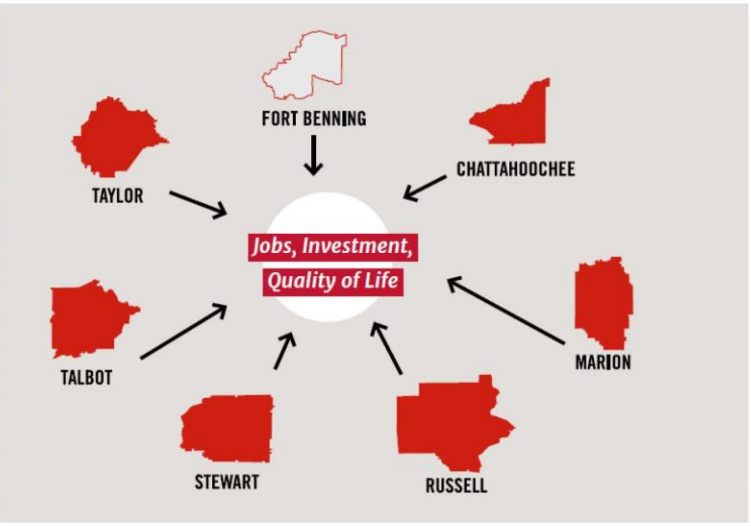
OUTCOME

- This effort will create a network of resilience professionals to share information, drive practical and applied research, and spur innovative projects that can effectively and efficiently address threats to the military mission in all of the widely varied contexts in which the military operates.

EWN Engineering With Nature | NETWORK FOR ENGINEERING WITH NATURE | UNIVERSITY OF GEORGIA 1785 — Carl Vinson Institute of Government, Institute for Resilient Infrastructure Systems







THE PROCESS

- Assess the economic and fiscal impact of existing compatible use programs as well the potental impacts of proposed programs.
- Conduct a feasibility study designed to evaluate potential revenue generating compatible land use activities.
- Conduct robust community engagement in the counties affected by the ACUB priority areas.
- Conduct engagement with Base personnel for input, ideas, needs within the rural region.
- Identify common needs, issues, priorities, and opportunities related to and compatible with mission and ACUB land acquisition efforts.
- Develop a resource and asset inventory describing local opportunities for mission compatible economic development.
- Focus on non-regulatory and incentive-based programs, policies, and activities that can facilitate market driven land use practices that promote compatible long-term development.
- Outline a regional approach with concrete action items to further an economic development strategy.

Develop an Implementation Strategy that identifies funding and resources to support the execution of short-term and long-term action items described in the Plan.

Questions / Discussion

Carl Vinson
Institute of Government
UNIVERSITY OF GEORGIA

Institute for Resilient
Infrastructure Systems
UNIVERSITY OF GEORGIA

ASSESS | COMMUNICATE | ADDRESS

Hazard Mitigation Assistance Grants

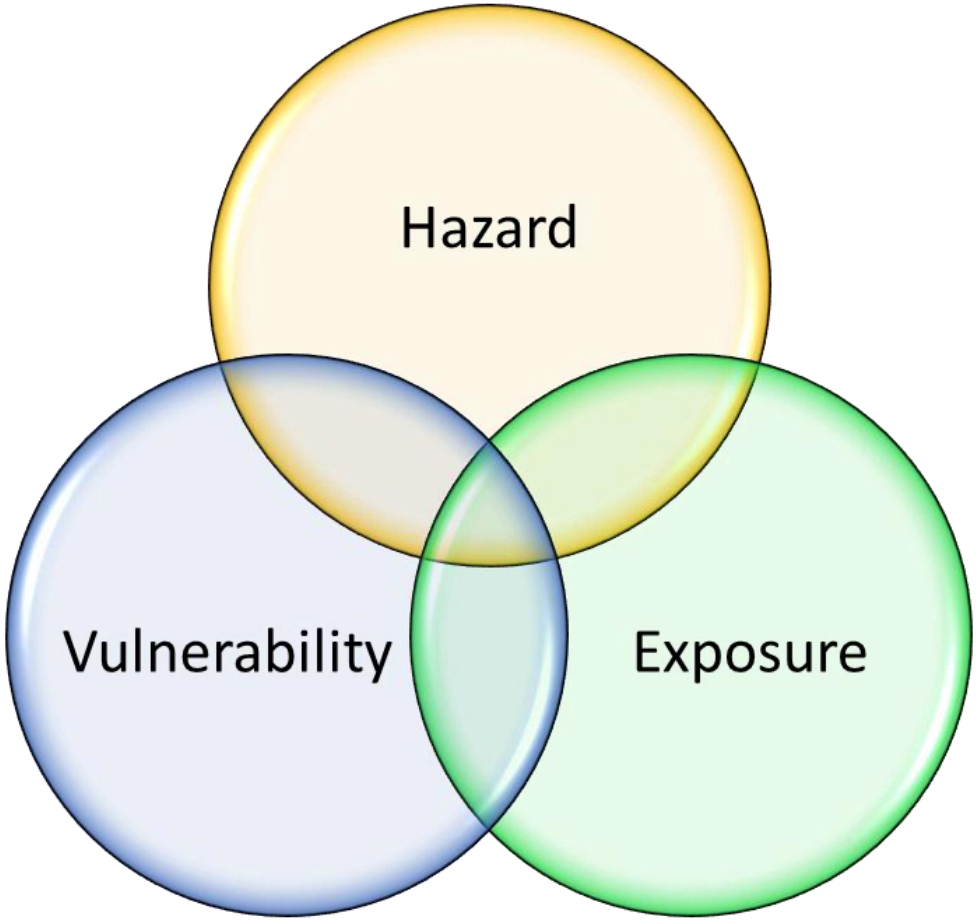
PRESENTED BY: GEMA/HS

gema-hazmitpoc@gema.ga.gov

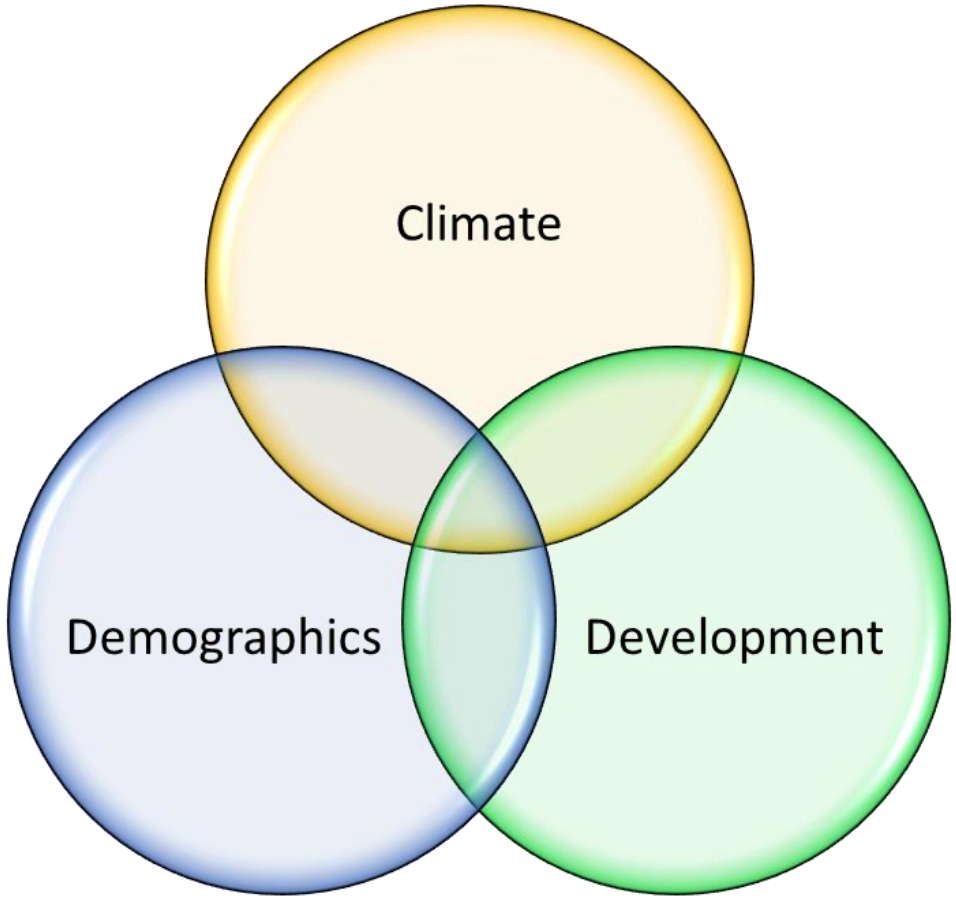
Georgia Emergency Management & Homeland Security Agency (GEMA/HS): "Protection of life and property"

GEMA/HS Hazard Mitigation Department: "Mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazard events."

What is risk, then?



Where are we headed?

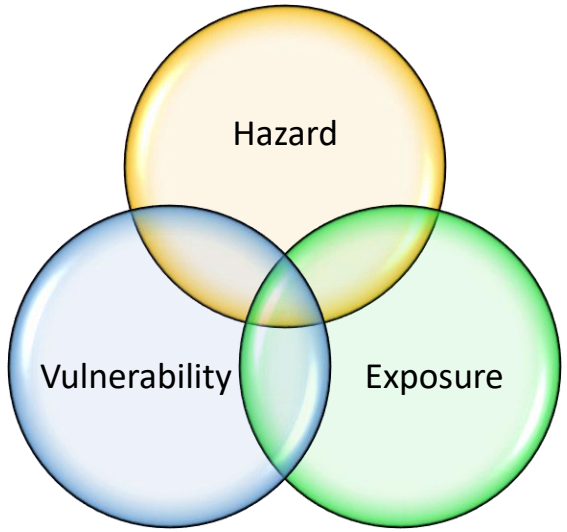


National Institute of Building Sciences

- Natural Hazard Mitigation Saves Report

National Institute of BUILDING SCIENCES™	ADOPT CODE	ABOVE CODE	BUILDING RETROFIT	LIFELINE RETROFIT	FEDERAL GRANTS
Overall Benefit-Cost Ratio	11:1	4:1	4:1	4:1	6:1
Cost ($ billion)	$1/year	$4/year	$520	$0.6	$27
Benefit ($ billion)	$13/year	$16/year	$2200	$2.5	$160
Riverine Flood	6:1	5:1	6:1	8:1	7:1
Hurricane Surge	not applicable	7:1	not applicable	not applicable	not applicable
Wind	10:1	5:1	6:1	7:1	5:1
Earthquake	12:1	4:1	13:1	3:1	3:1
Wildland-Urban Interface Fire	not applicable	4:1	2:1	not applicable	3:1

Cost-effectiveness (Return on Investment)



- "Benefits" are avoided losses or avoided service delivery interruption
- No less than $2.33 in federal dollars for every $1 invested by the local government
  - Up to 9:1 under the current Hazard Mitigation Grant Program

FEMA Community Lifelines Framework

Consideration	Building Resilient Infrastructure & Communities^	Hazard Mitigation Grant Program^	Flood Mitigation Assistance^
Availability	Annually	After Presidentially Declared Disaster	Annually
Current Funding	$1B (minimum $1M to GA)	~$90M (~$80M for Covid-19 Pandemic)	$160M
Competition	Nationwide	Statewide	Nationwide
Eligible (Sub)Applicants	State and Local Governments	State and Local Governments, Qualifying Private Non-Profits	State and Local Governments
Cost Share (Federal %/Non-federal %)	70/30	90/10	75/25
Maximum Award (Federal Share)	$50M	Scales with Disaster	$30M
Grant Deadline	Last week of January	Per Disaster Declaration Date	Last week of January
Application Review	~1 year to 18 months	~18 months to 2 years	~1 year to 18 months
Administration	Reimbursement*	Reimbursement*	Reimbursement*

^All local government subapplicants must participate in the National Flood Insurance Program
*Actual physical work cannot occur prior to award or final approval

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