

# **Building Resilient Communities: Tools for Understanding and Communicating Coastal Risk**

**NOAA in the Carolinas 2012**

**Doug Marcy  
NOAA Coastal Services Center**



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# NOAA Coastal Services Center



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# Priority Issues

- Land-use planning
- Coastal and marine spatial planning
- Hazards and climate change



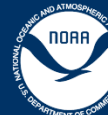
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# Coastal Communities: Vital to U.S. and International Economies

- 57 percent of U.S. gross domestic product is contributed by coastal watershed counties.
- Coastal counties contain 53 percent of the nation's population—but account for only 17 percent of U.S. land area (excludes Alaska).
- Coastal habitats help reduce impacts of floods, storms, and climate change on coastal communities by absorbing water, wave energy, and other stressors.



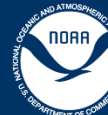
**U.S. population, 2010 census: 308 million, an increase of ~9 percent Census projects 439 million in 2050**



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# Everything has its price, even the weather.

- Economic Cost of Weather May Total \$485 Billion in U.S.
- From wildfires to flight delays to running our AC, "This research shows that a substantial percentage of the U.S. economy is linked to variability in weather."



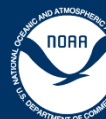
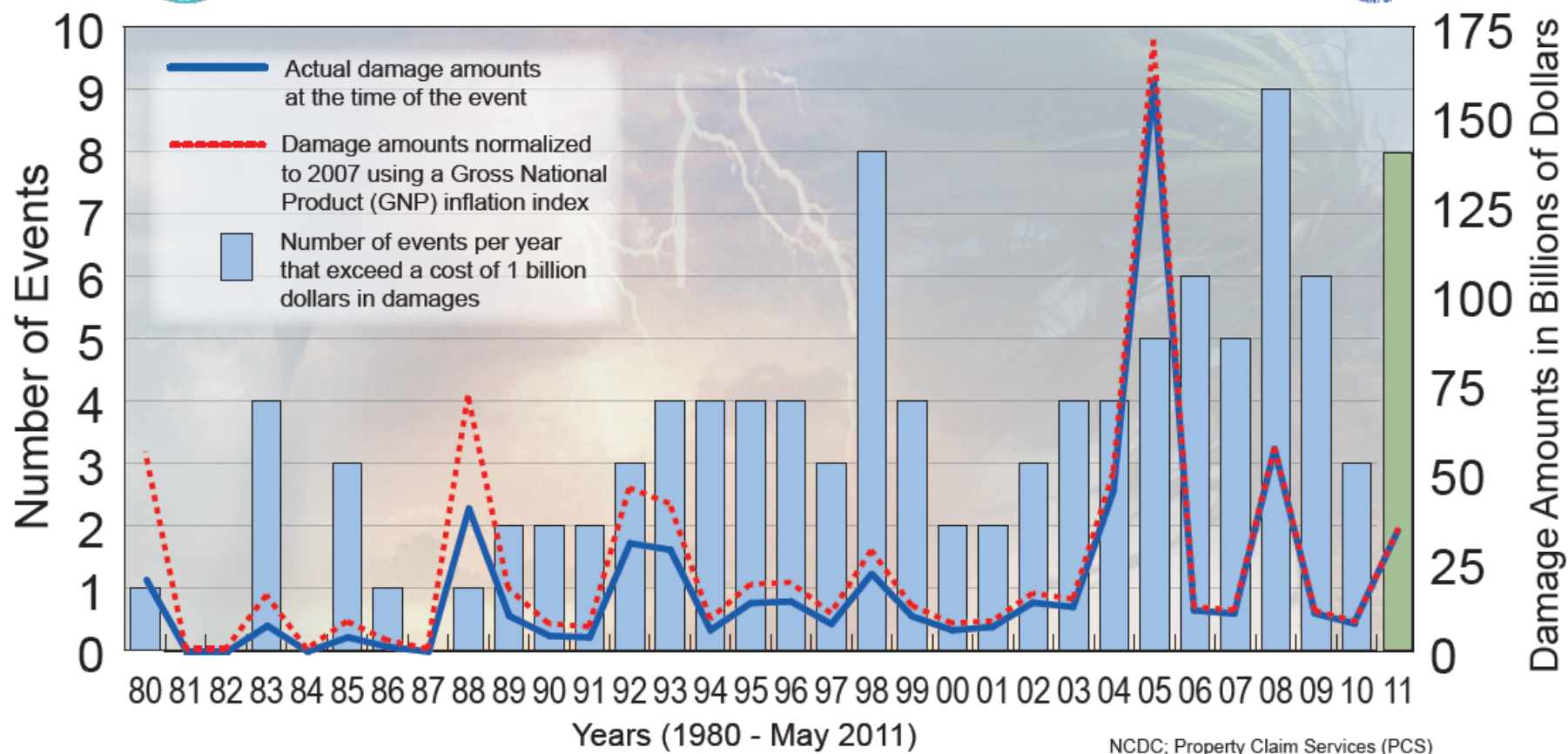
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# A Growth Industry?



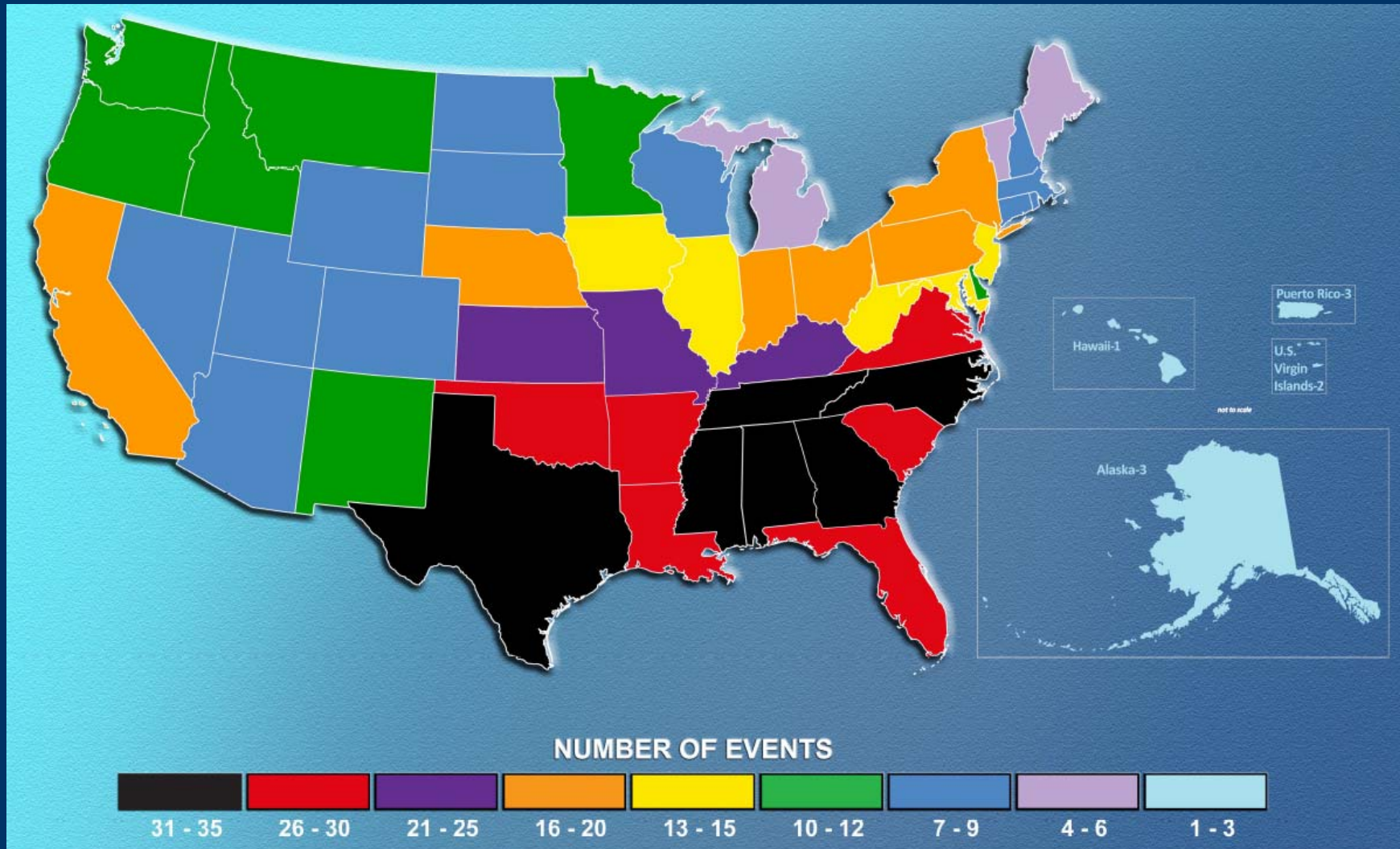
## Billion Dollar U.S. Weather Disasters 1980 - May 2011

NOAA/NESDIS/NCDC



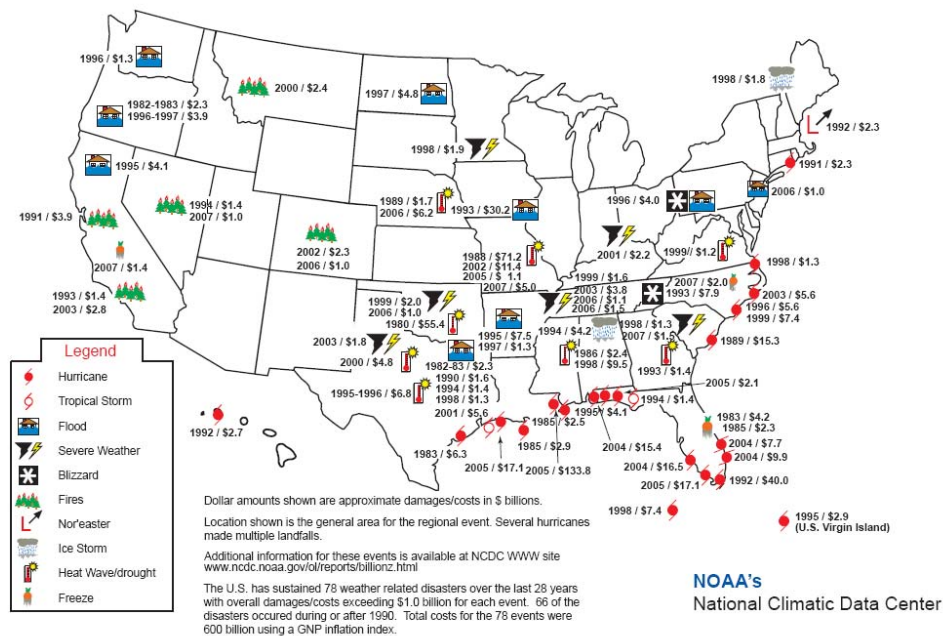
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# Ready to Move?



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## Billion Dollar Weather Disasters 1980 - 2007

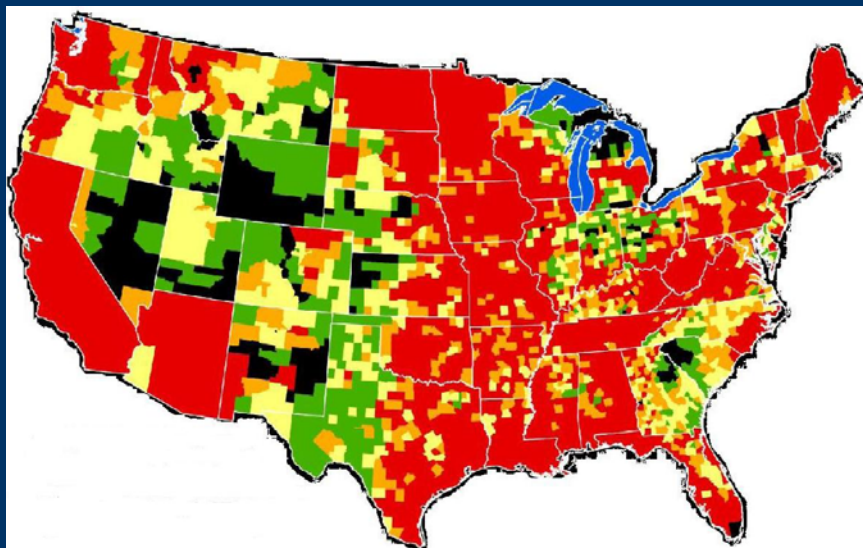


# Ready Or Not, Here It Comes

## Weather and Climate Extremes in a Changing Climate

*Regions of Focus:  
North America, Hawaii,  
Caribbean, and U.S. Pacific Islands*

## Disaster Declarations 1965-2003



**U.S. Climate Change Science Program  
Synthesis and Assessment Product 3.3**

June 2008

# Providing Solutions to Barriers

- Coastal data
- Data accessibility
- Improved intergovernmental coordination
- Techie and non-techie tools
- Training
- Outreach and awareness
- Contracting for geospatial services

*More than just data...*



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# One Solution: Digital Coast



Home About Data Tools Training Approaches ▾ In Action

## *More than just data...*

The Digital Coast also provides the tools, training, and information needed to turn these data into the information most needed by coastal resource management professionals. [Read more...](#)

Welcome to the Digital Coast. If you have questions or comments, please [contact us](#). [Give us your feedback!](#)

### Data

Learn more about the kinds of data available and download data.

### Tools

Use these tools to turn data into the useful information your organization needs.

### Training

Update your skills by participating in one of these training programs.

### In Action

See how data and tools are used to address coastal management issues.

### Approaches

#### Coastal Inundation Toolkit

Understand the basics and get the tools that will help make your community more resilient.

#### Offshore Renewable Energy Planning

Get the data and tools needed to make siting decisions.

#### Conserving Coastal Wetlands for Sea Level Rise Adaptation

Learn spatial techniques and get resources to prioritize wetland conservation.

### Featured Resources

#### Social Coast

Social science data can help address coastal issues. Find highlights of economic and demographic data, and also tools and methods, that can be applied to solve real issues.

#### Sea Level Rise and Coastal Flooding Impacts Viewer

*The Role of Land Use in Adaptation to Increased Precipitation and Flooding*

#### Mississippi Geospatial Clearinghouse

# Digital Coast Partnership



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# Digital Coast Contributors

Mississippi State Coordinating Council  
on Remote Sensing and GIS

NOAA National Geodetic Survey

U.S. Army Corps of Engineers

U.S. Geological Survey

NASA/NOAA/USGS Airborne Lidar Assessment  
of Coastal Erosion (ALACE)

Federal Emergency Management Agency

National Geospatial-Intelligence Agency

U.S. Department of Agriculture

Northwest Florida Water  
Management District

Southwest Florida Water  
Management District

St. Johns River Water Management District

Maryland Department of Natural Resources

Oregon Department of Geology  
and Mineral Resources

Texas Natural Resources Information System

Mississippi Department of  
Environmental Quality

Scripps Institute of Oceanography  
University of Texas

Delaware Department of Natural Resources  
and Environmental Control

South Carolina Department of  
Natural Resources

Florida Division of Emergency Management

Minnesota Department of Natural Resources

Management Association for Private  
Photogrammetric Surveyors (MAPPS)

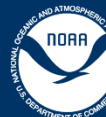


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# Data and Tools

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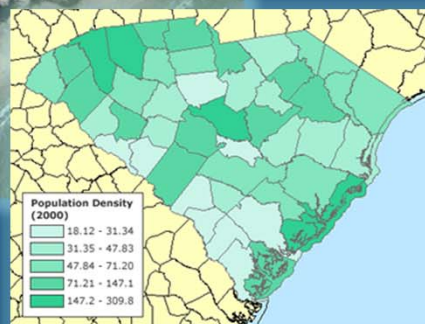
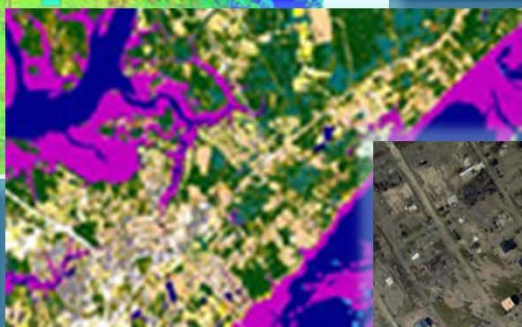
*[www.csc.noaa.gov/digitalcoast](http://www.csc.noaa.gov/digitalcoast)*



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# Digital Coast Data

[www.csc.noaa.gov/digitalcoast/data](http://www.csc.noaa.gov/digitalcoast/data)



- Elevation
- Benthic
- Orthoimagery
- Land cover
- Hydrography
- Marine boundaries
- Socioeconomic



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# Nonpoint-Source Pollution and Erosion Comparison Tool (N-SPECT)

[www.csc.noaa.gov/digitalcoast/tools/nspect](http://www.csc.noaa.gov/digitalcoast/tools/nspect)



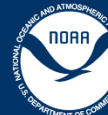
## Features

**Provides** projections and maps of surface water runoff volumes, pollutant loads, pollutant concentrations, and total sediment loads

**Helps** users see areas that might benefit from changes to proposed development strategies

**Processes** digital elevation data quickly and easily

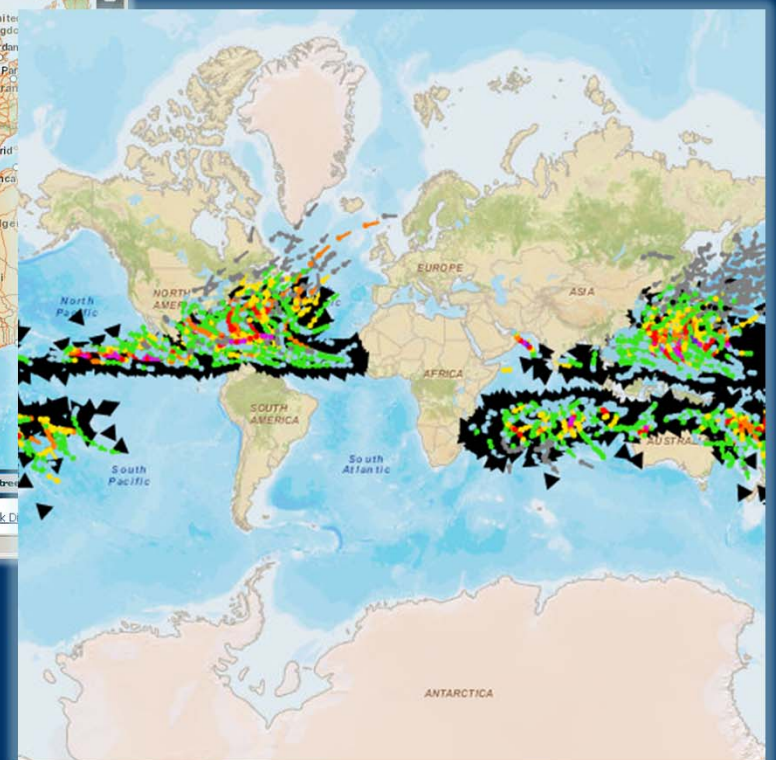
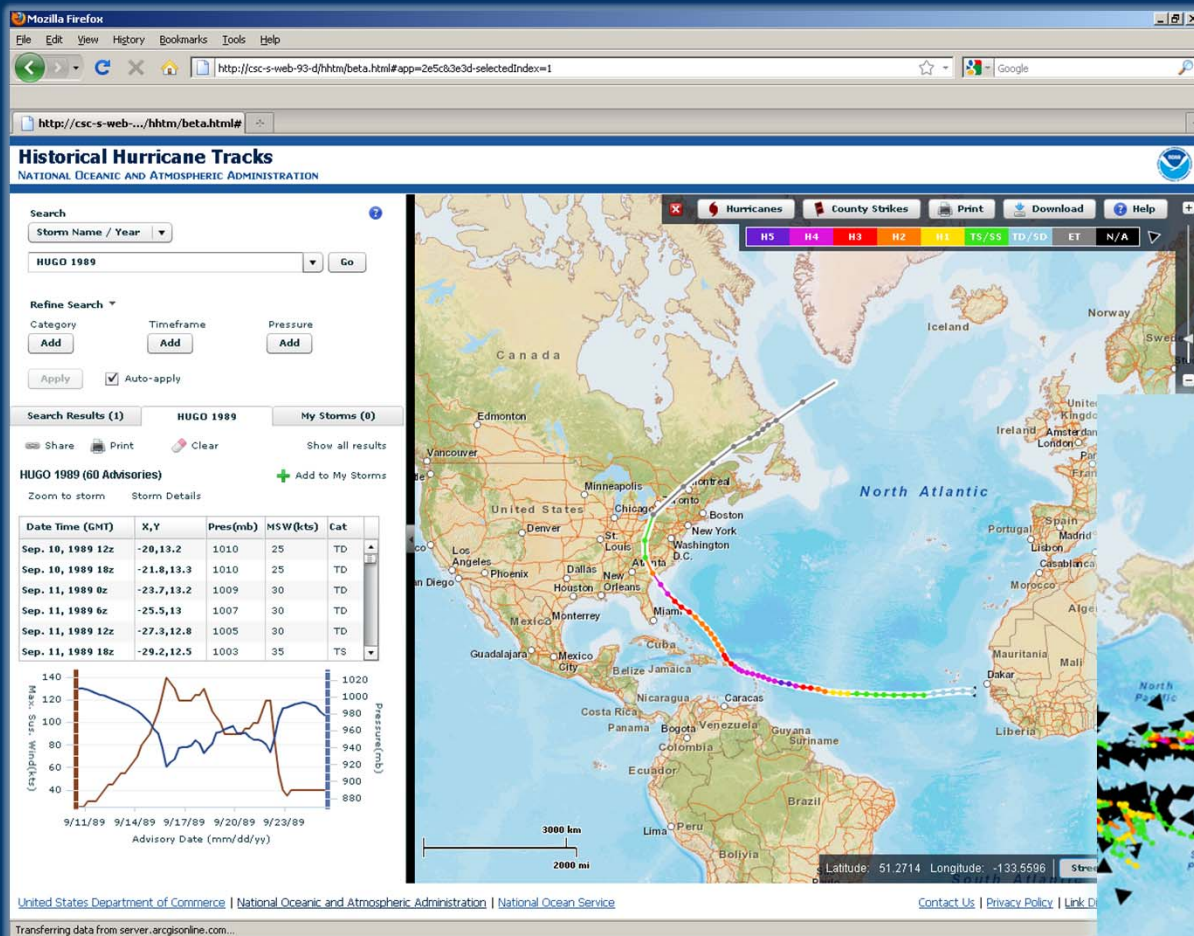
**Provides** a means to analyze "what if" land use change scenarios



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# Historical Hurricane Tracks Tool

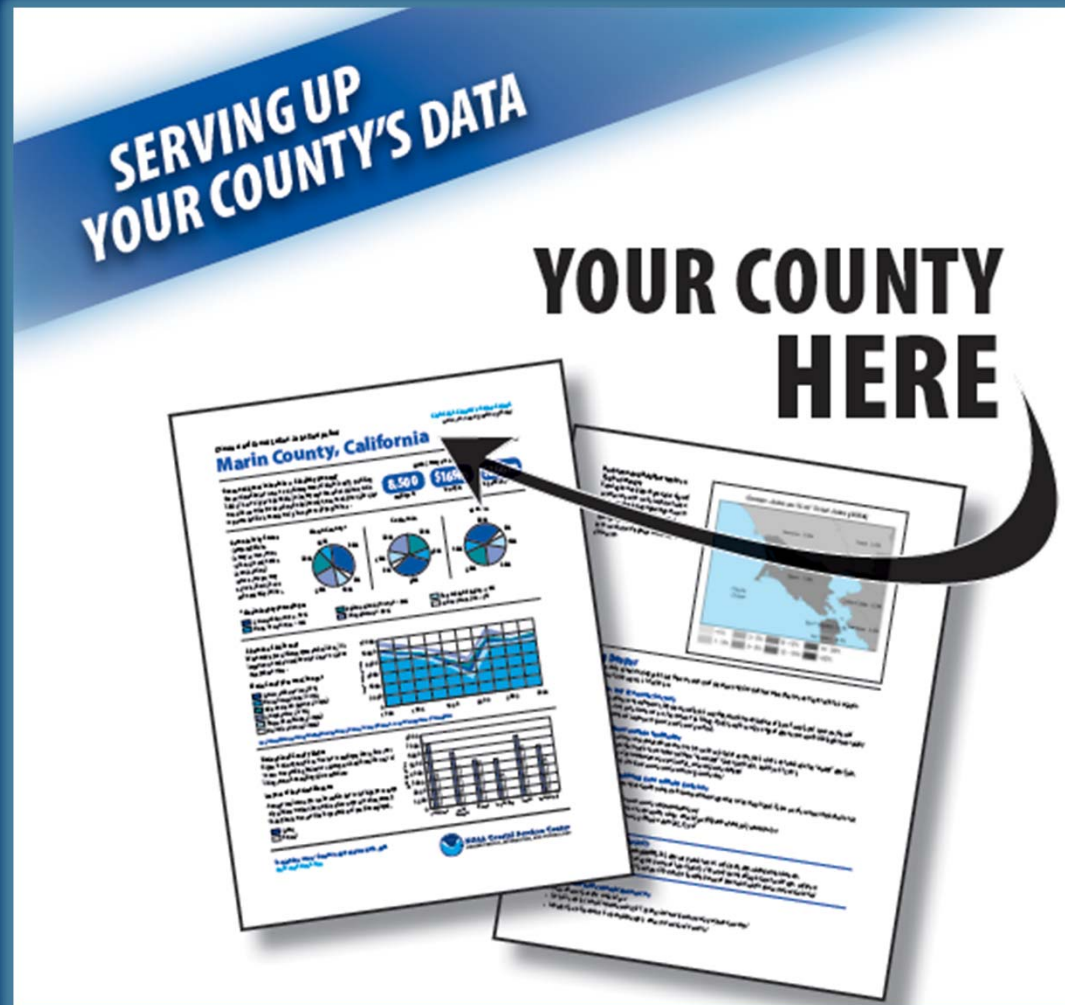
[www.csc.noaa.gov/hurricanes/](http://www.csc.noaa.gov/hurricanes/)



# County Flood Exposure Snapshot

[www.csc.noaa.gov/snapshots/](http://www.csc.noaa.gov/snapshots/)


- Flood exposure
- Ocean jobs
- Wetlands benefits



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# Critical Facilities Tool

[www.csc.noaa.gov/criticalfacilities/](http://www.csc.noaa.gov/criticalfacilities/)

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Search >>

HomeAboutDataToolsTrainingHow-To GuidesPublicationsPartnershipsTechnical Assistance

## Coastal Resilience Index Critical Facilities Tool

[About This Tool](#)

1. Check which elements to view: ☒ Map ☒ Results Table

2. Choose a State Alabama then County/Parish or Municipality Baldwin

**3. Choose Visible Facilities**  
All Facilities: ☒ On ☐ Off  
☒ Airports  
☒ Communication Towers  
☒ Electric Power Facilities  
☒ Emergency Operations Centers  
☒ Fire Stations  
☒ Hazardous Materials Sites  
☒ Medical Care Facilities  
☒ Oil Facilities  
☒ Police Stations  
☒ Potable Water Facilities  
☒ Rail Facilities  
☒ Schools  
☒ Waste Water Facilities  
☒ Flood Zone  
☒ County/Parish

Map data ©2011 Google, INEGI - [Terms of Use](#)



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# National Weather Service Flood Severity Inundation Maps

<http://water.weather.gov/ahps/inundation.php>

**National Weather Service**  
**Advanced Hydrologic Prediction Service**

Home News Organ

Weather Forecast Office Greenville-Spartanburg, SC Lower Mississ

**Lake Wind Advisory**  
View all valid statements/warnings

Data Type  
Inundation Levels  
Flood Categories  
Current/Forecast

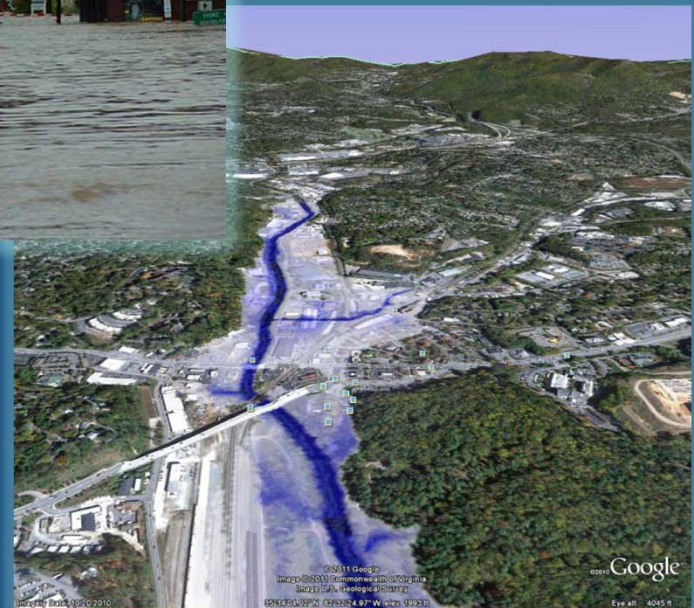
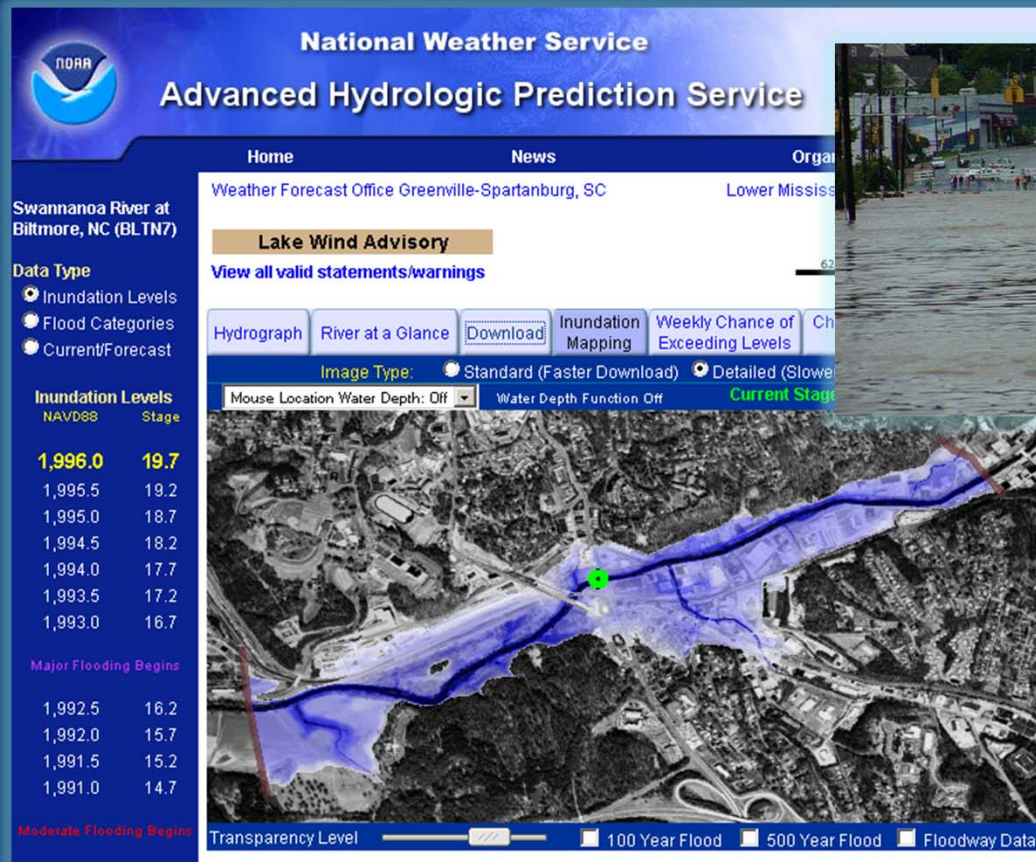
Inundation Levels  
NAVD88 Stage  
1,996.0 19.7  
1,995.5 19.2  
1,995.0 18.7  
1,994.5 18.2  
1,994.0 17.7  
1,993.5 17.2  
1,993.0 16.7  
Major Flooding Begins  
1,992.5 16.2  
1,992.0 15.7  
1,991.5 15.2  
1,991.0 14.7  
Moderate Flooding Begins

Hydrograph River at a Glance Download Inundation Mapping Weekly Chance of Exceeding Levels

Image Type: Standard (Faster Download) Detailed (Slower)

Mouse Location Water Depth: Off Water Depth Function Off Current Stage

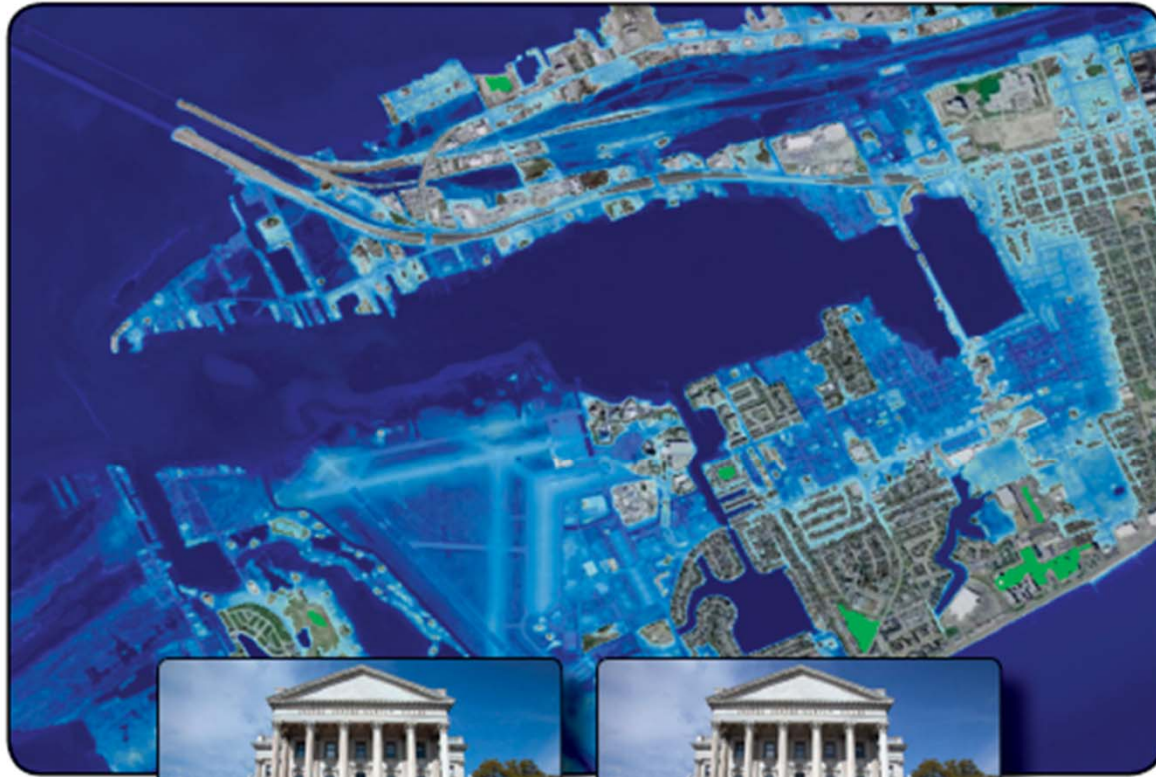
Transparency Level 100 Year Flood 500 Year Flood Floodway Data



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# Sea Level Rise and Coastal Flooding Impacts Viewer

[www.csc.noaa.gov/slr/](http://www.csc.noaa.gov/slr/)



# CanVis

[www.csc.noaa.gov/canvis/](http://www.csc.noaa.gov/canvis/)



Seattle Boardwalk – Sea Level Rise – Before



Seattle Boardwalk – Sea Level Rise – After



Charleston Customs House – 1.5m SLR - Before



Charleston Customs House – 1.5m SLR - After

Visualization

Alternatives

Communication

# Training

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*[www.csc.noaa.gov/training/](http://www.csc.noaa.gov/training/)*



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# Get Out Ahead of Coastal Hazards...

[www.csc.noaa.gov/roadmap/](http://www.csc.noaa.gov/roadmap/)

Approach that helps communities:

- analyze strengths and weaknesses to hazards and climate change
- incorporate risk and vulnerability information and data into existing plans and policies
- highlights products useful in assessing vulnerabilities



## Roadmap for Adapting to Coastal Risk

technical assistance, web-based training, web resources



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# The Social Vulnerability Story

## What to consider...

Factors that contribute to social vulnerability

Factors that contribute to community resilience

The effects of current and projected trends on existing social conditions



# The Infrastructure Vulnerability Story

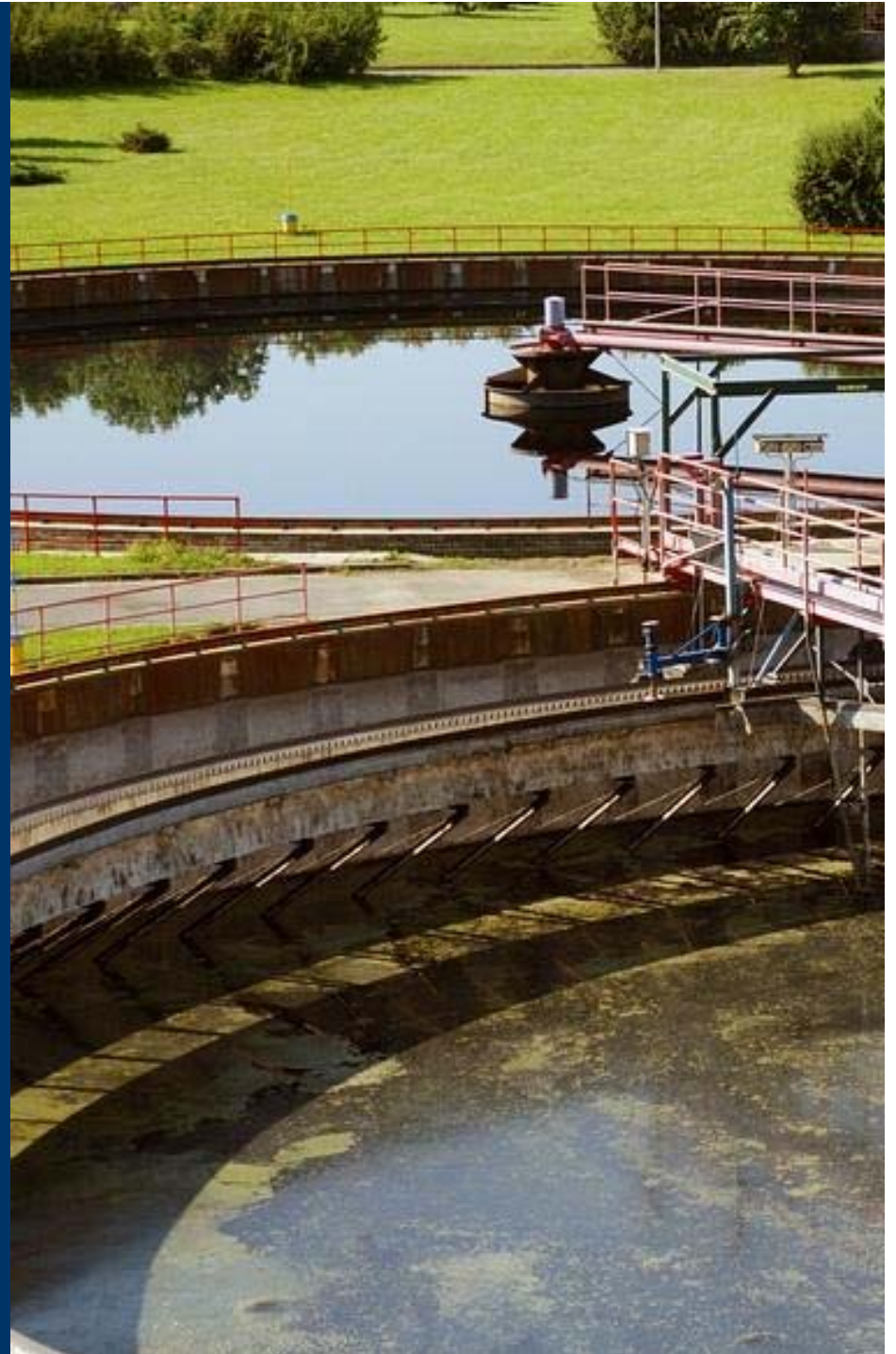
## What to consider...

All types of infrastructure

What's exposed to hazards

Potential factors that contribute  
to infrastructure vulnerability

How existing policies will affect  
future infrastructure vulnerability



# The Ecosystem Vulnerability Story

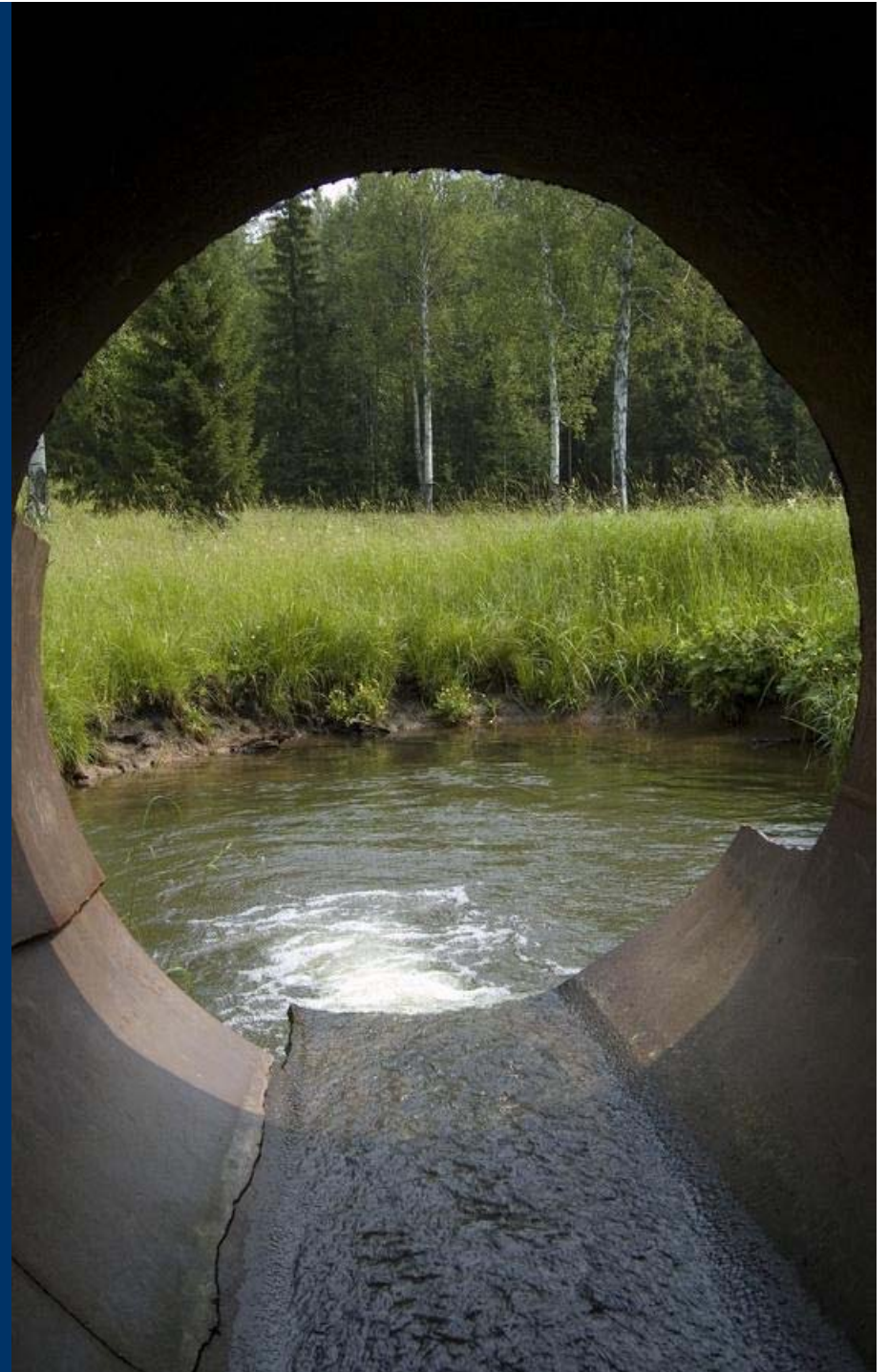
## What to consider...

Protective functions of key natural resources

Additional benefits of key natural resources

Potential stressors to ecosystem

Current policy impacts on the future vulnerability of ecosystem



# CSC Tools & Resources Included



COASTAL INUNDATION MAPPING GUIDEBOOK

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
COASTAL SERVICES CENTER

Chatham County, GA  
Category 3 Storm Surge Inundation

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August 2009



C-CAP Land Cover Atlas  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Florida Miami-Dade

Date Range: 1996 2001 2006

General Developed Forests Wetlands Search

General Statistics Print Full County Report

Miami-Dade County, Florida  
1996 to 2006

What's on the map?  
All changes from 1996 and 2006

Percent of Miami-Dade County that changed  
2.71%

Distribution of land cover by type

1996 2006

Enlarge Chart



GIS Tools for Strategic Conservation Planning

Mossport, MS June 13 - 17, 2011

Instructors: Lindsay Goodwin and Danielle Bamford (The Baldwin Group)

The Conservation Fund NOAA Coastal Services Center

GIS Tools for Strategic Conservation Planning



Coastal CLIMATE Adaptation

CCA Home Resources Forum Calendar Groups Get Started Register

Monthly feature  
Diving Deeper: Preparing for Climate-Related Impacts  
Listen to the interview about climate-related impacts with Stephanie Faurer

RESOURCES  
By Category or State

- Adaptation and Action Plans
- Case Studies and Strategies
- Climate Change Communication
- Climate Change Science and Impacts
- Guidance and Guidebooks
- Outreach Materials
- Policies and Legislation
- Risk and Vulnerability Assessments
- Stakeholder Engagement
- Training and Workshop Materials

Home Data Tools



DIGITAL COAST  
NOAA Coastal Services Center

Home Data Tools

Approaches  
Conserving Coastal Wetlands for Sea Level Rise Adaptation

Home Resources



NATURAL & DEVELOPED AREAS  
Land Cover Data: 2006  
Miami-Dade County, Florida

Coastal Inundation Mapping Training



DIGITAL COAST  
NOAA Coastal Services Center

Home Data Tools

Approaches  
Coastal Inundation Toolkit

Home About Glossary Resources

Understand  
What is coastal inundation, its causes, and impacts?

Identify  
How do I recognize community risk?

Communicate  
What are the best ways to communicate risk and vulnerability information?

Discover  
What are others doing to address coastal inundation?



Hazard Exposure Information for  
Baldwin County, Alabama

Population  
Total 148,100  
Population in Flood Zone 11,872  
Population over 65 4,822  
Population over 65 in Flood Zone 1,744

Amount of Land Connected to Development 2001-2006 (acres)

Amount of Land Connected to Development 2001-2006 (acres)

Amount of Land Connected to Development 2001-2006 (acres)



Sea Level Rise Confidence Marsh

Vulnerability Flood Frequency

Sea Level Rise

Legend

- Water Depth
- Low-Lying Areas
- Visualization Location

Overview

Use the slider bar above to see how various levels of sea level rise will impact this area.

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

Low-lying areas, displayed in green, are hydrologically "unconnected" areas that may flood. They are determined solely by how well the elevation data captures the area's hydraulics. A



Green Infrastructure Short Course



INTRODUCING TO STAKEHOLDER PARTICIPATION

STAKEHOLDER ENGAGEMENT STRATEGIES FOR PARTICIPATORY MAPPING

SOCIAL SCIENCE TOOLS FOR COASTAL PROGRAMS

NOAA Coastal Services Center

# Coastal Inundation Mapping Training

[www.csc.noaa.gov/training](http://www.csc.noaa.gov/training)

Understand inundation

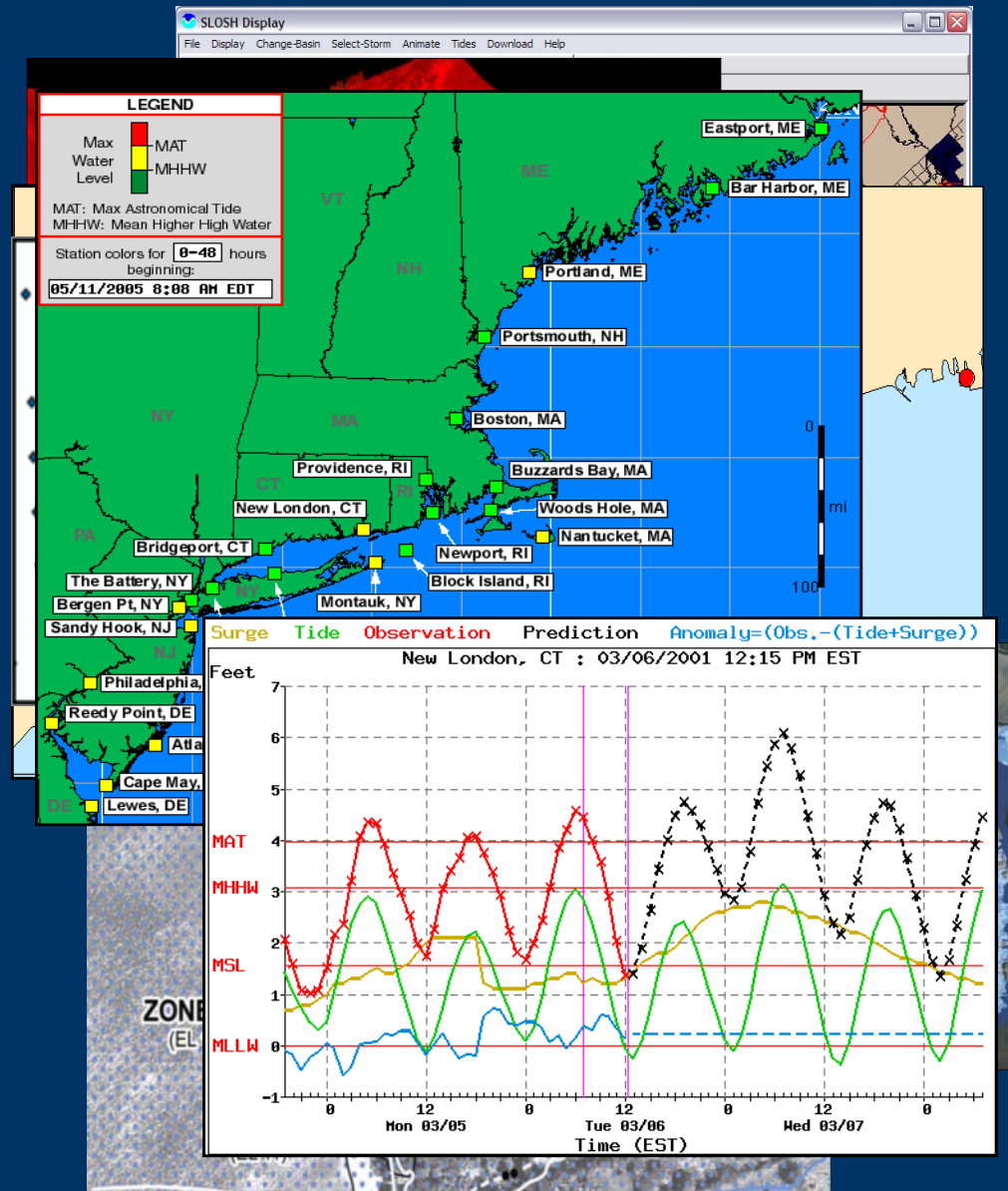
Learn about mapping products

Access data

Perform data conversions

Map inundation using GIS

Identify and use coastal and ocean observation data



# Climate Adaptation Training

**Recognize** the changes and variability in climate and climate's influence on coastal communities

<http://www.csc.noaa.gov/training/>

**Identify** opportunities to leverage a range of governance mechanisms to integrate adaptation strategies into their existing efforts

**Examine** methods for conducting hazard, vulnerability, and risk assessment as it relates to climate change

**Evaluate** the strengths and weaknesses of adaptation strategies

**Apply** climate communication research concepts and findings to enable effective communication with target audiences



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# GIS Tools for Strategic Conservation

<http://www.csc.noaa.gov/digitalcoast/training/gisforscp.html>



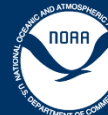
Teaches green infrastructure concepts to help planners communicate and integrate natural resource conservation into planning efforts that support coastal community resilience.



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# Technical Assistance

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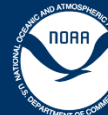
# Coastal Geospatial Services Contract

“Take the headache out of the process.”

<http://www.csc.noaa.gov/idiq/geospatial.html>



- Four prime contractors with over 90 subs
- No overhead charges to states



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# Learn from others...

[www.csc.noaa.gov/roadmap/](http://www.csc.noaa.gov/roadmap/)

- **Miami-Dade County, FL**
  - Sustainability Plan
  - Climate Adaptation
  - Water Supply & Salt Intrusion
- **Delaware County, PA**
  - Hazard Mitigation Planning
  - Redevelopment & Brownfields
  - Watershed Planning
- **Town of Southold, NY**
  - Comprehensive Plan Update
  - Conservation Planning

## Planning for Hazards and Climate Change Impacts: One County's Approach

### Miami-Dade County, Florida

Like most coastal areas, Florida's Miami-Dade County is vulnerable to climate change. With the county's unique topography, computer models predict that sea level rise will increase flooding on both the eastern and southwestern boundaries of the Everglades, causing the county and its infrastructure, people, and natural resources to be "squeezed." The county's major economic sectors, agriculture and tourism, will suffer greatly.

But many Miami-Dade officials believe that the county can implement enhanced mitigation and adaptation measures to create a sustainable, livable community.



## Regional Methods for Mapping Sea Level Rise Inundation Vulnerability in Southeast Florida

### Prepared By:

Diana Umpliere, GISP  
Senior Geographer  
South Florida Water Management District (SFWMD)



### In Coordination With:

Southeast Florida Regional Climate Change Compact  
Inundation Mapping & Vulnerability Assessment  
Work Group



### With Significant Support From:

NOAA's National Ocean Service (NOS), in particular  
Coastal Services Center and CO-OPS



March 2012



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# Publications, How-To Guides, Reports, Websites

[www.csc.noaa.gov/publications](http://www.csc.noaa.gov/publications)

## PUBLICATIONS

Filter by Category:

### PERIODICALS



#### Coastal Services Magazine

This bimonthly trade publication brings new ideas to coastal resource management programs.

**Special Editions** - Local Strategies for Addressing Climate Change: [Volume 1](#) and [Volume 2](#)

#### Fellow News

A quarterly newsletter that provides information about the Coastal Management Fellowship Program.

#### Products and Services Catalog

Describes the products and services offered by the NOAA Coastal Services Center.

### MAILING LISTS

Coastal Connections Newsletter  
Coastal Services Magazine  
Digital Coast Updates  
Coastal GeoTools  
Map Services Notification Group

[▶ Subscribe](#)

### COASTAL RESOURCE MANAGEMENT CUSTOMER SURVEY

Constituents of the NOAA Coastal Services Center are polled regarding their needs and capabilities.

[▶ See the Results](#)



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# Approaches and Resources

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# Climate Adaptation

The screenshot shows the NOAA Coastal CLIMATE Adaptation website. At the top, there's a header with the site name and a search bar. Below the header is a navigation menu with links: CCA Home, Resources, Blog, Calendar, Groups, Get Started, and Register. The main content area features a 'Monthly Feature' section with a photo of a harbor and a link to 'San Diego Bay Sea Level Rise Adaptation Strategy' by ICLEI. Below this is a 'RESOURCES' section with a list of topics and a map of the United States with state abbreviations. At the bottom, there are three sections: 'Blog', 'Calendar', and 'Getting Started?', each with a 'Launch' button.

Coastal  
**CLIMATE** Adaptation

Sign In

CCA Home Resources Blog Calendar Groups Get Started Register

Monthly Feature

San Diego Bay Sea Level Rise Adaptation Strategy

ICLEI

**RESOURCES**  
By Category or State

- » Adaptation and Action Plans
- » Case Studies and Strategies
- » Climate Change Communication
- » Climate Change Science and Impacts
- » Guidance and Guidebooks
- » Outreach Materials
- » Policies and Legislation
- » Risk and Vulnerability Assessments
- » Stakeholder Engagement
- » Training and Workshop Materials

**Blog**  
Read about climate news.  
Launch

**Calendar**  
Don't miss these upcoming events.  
Launch

**Getting Started?**  
This short list will help.  
Launch

Join a Community of Practice.

Contribute to the website by uploading your resources

Share your thoughts on posts in the Blog.

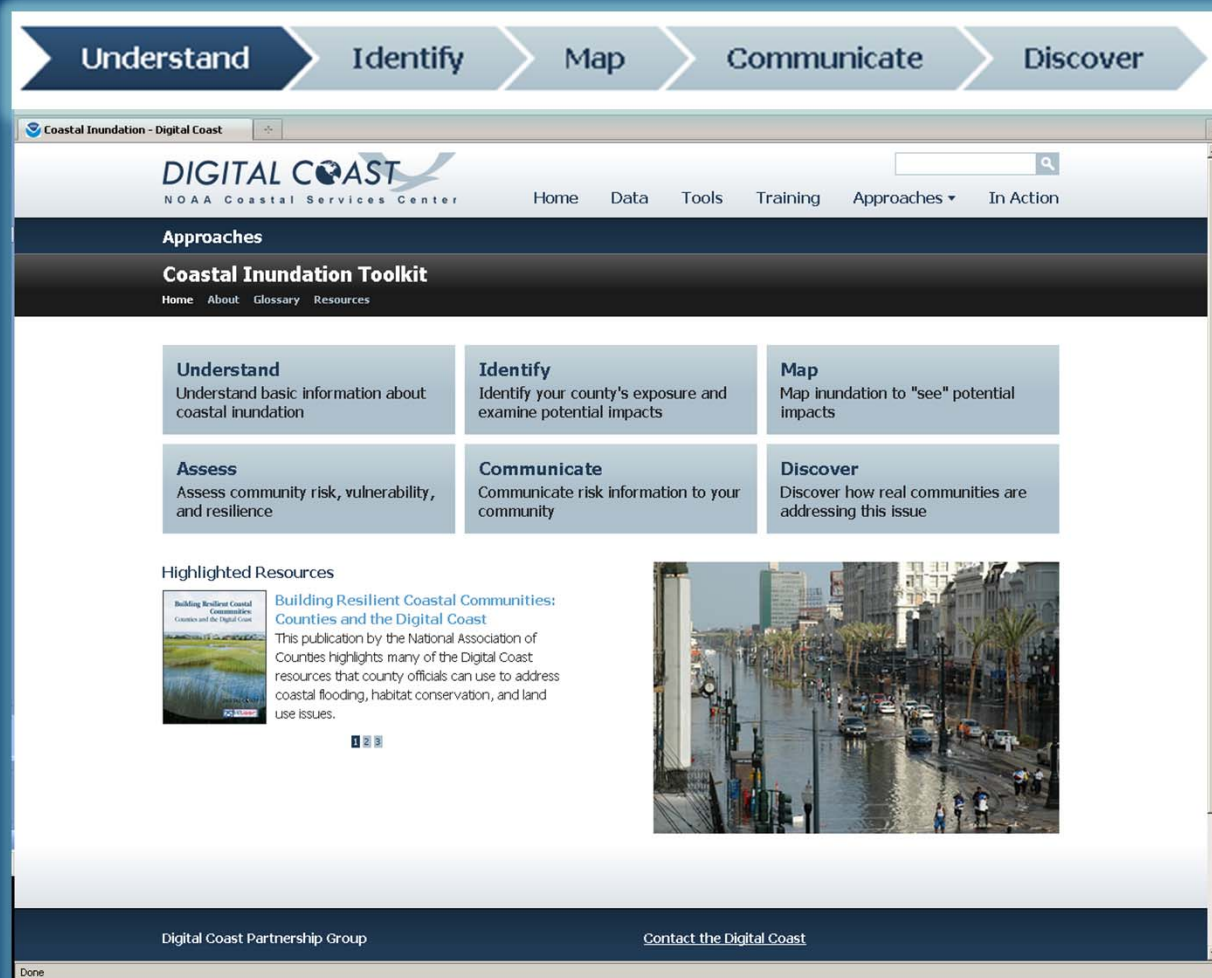
Post upcoming climate-related events



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# Coastal Inundation Toolkit

[www.csc.noaa.gov/inundation/](http://www.csc.noaa.gov/inundation/)



# Conserving Coastal Wetlands

<http://www.csc.noaa.gov/digitalcoast/wetlands/>

**DIGITAL COAST**  
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Home About Data Tools Training Approaches ▾ In Action

**Approaches**

**Conserving Coastal Wetlands for Sea Level Rise Adaptation**

Home Resources


**Understand**  
Why are coastal wetlands valuable and how can they help in coping with sea level rise?

**Identify**  
What spatial data, tools, and techniques can help identify vulnerable wetlands and those that could increase resilience to sea level rise?

**Prioritize**  
What spatial data, tools, and techniques can help prioritize existing or potential future wetland areas for protection?

**Engage**  
How can you build stakeholder support for your strategies?

**Discover**  
How are others incorporating sea level rise information into conservation and other planning efforts?



**About This Site**  
This Digital Coast resource provides spatial techniques, resources, and examples to help communities identify coastal wetland and other vulnerabilities in the face of sea level rise—and to prioritize wetland conservation efforts that incorporate sea level rise considerations.



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# Offshore Renewable Energy Planning

<http://www.csc.noaa.gov/energy/>

**DIGITAL COAST**  
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Home About Data Tools Training Approaches ▾ In Action

**Approaches**

**Offshore Renewable Energy Planning**  
Home


**Understand**  
Understand basic information about renewable energy planning and how a marine spatial planning approach is beneficial

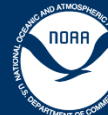
**Identify**  
Identify information about the marine environment from a natural and human-use perspective

**Inventory**  
Inventory data and tools to visualize components of the marine environment

**Analyze**  
Analyze potential locations for renewable energy applications with available tools

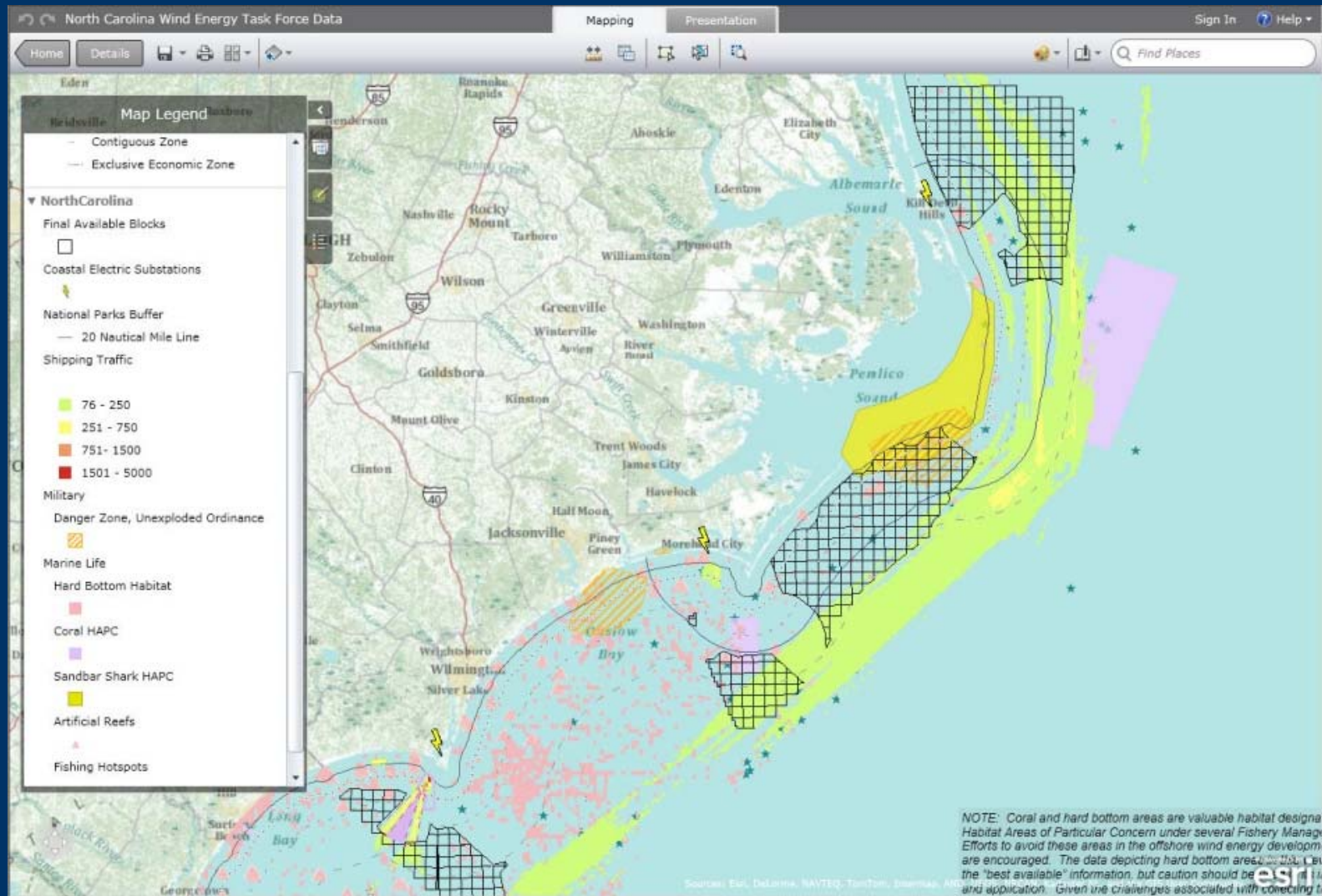
**Discover**  
Discover what other coastal communities are doing to address ocean-siting issues





**NOAA Coastal Services Center**  
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

# North Carolina Renewable Energy Task Force



# True Resilience !!



Source: San Francisco  
Water Management District

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