

Resilience Planning – Preparing for Coastal Storms and Flooding



Photo Credit: Portland Press Herald, Bangor Daily News, Andy Dorr

Resilience Planning for Storm Events

- ◆ What is vulnerability and what is resilience ?
- ◆ How can we help build resilience?
- ◆ Examples of what is happening now in the area
- ◆ What you can do

What Defines Vulnerability: Hazards of Place

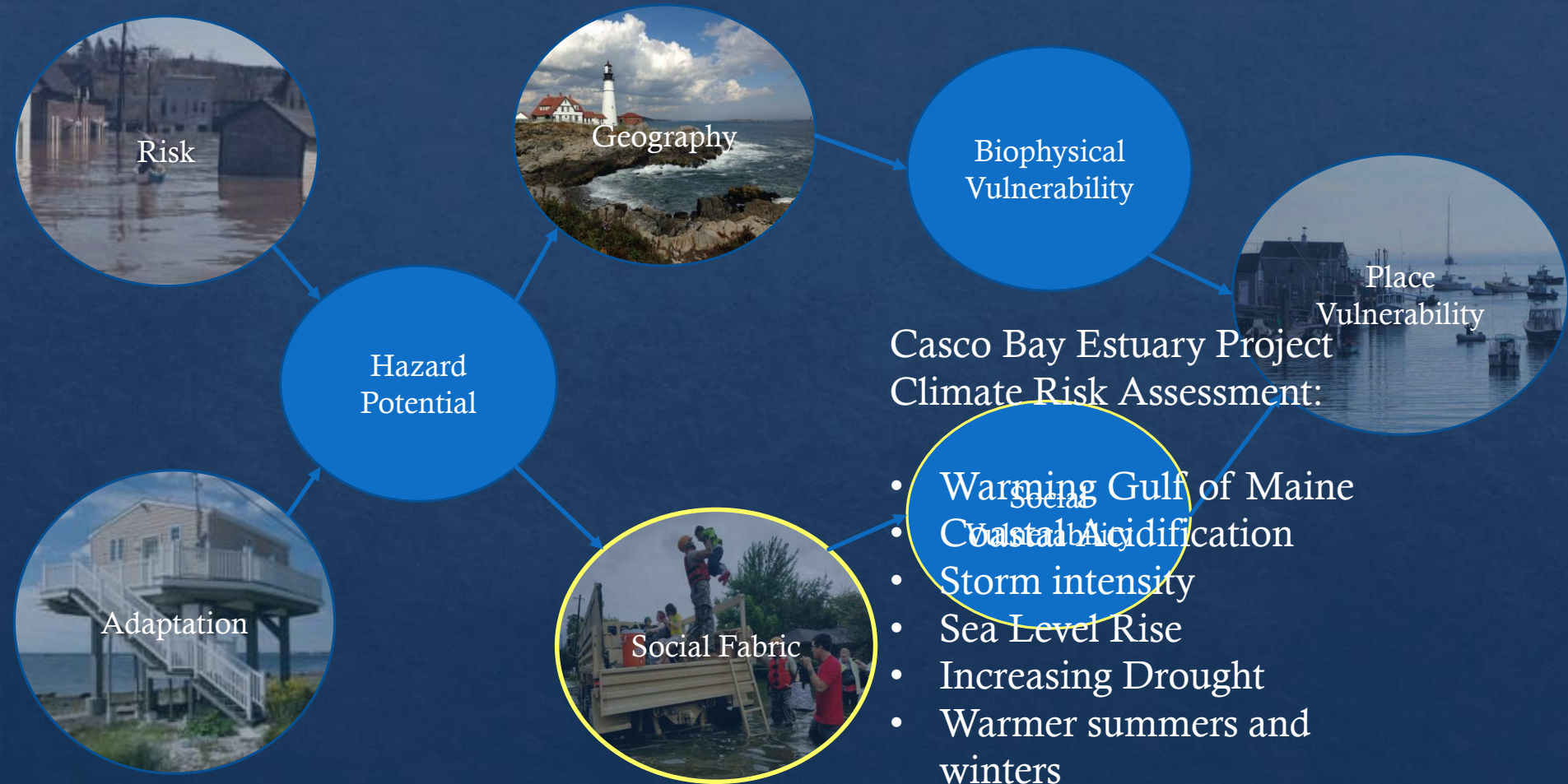


Photo Credits: Maine Emergency Management Agency, Florida Storm Smart Coasts, Fodors, Island Institute, Portland Press Herald, Bangor Daily News

Challenges for Rural Communities

- ❖ Limited options for evacuation and response routes
- ❖ Longer travel times to hospitals
- ❖ Rural emergency response relies large on volunteer responders
- ❖ Limited capacity for addressing infrastructural challenges

Record rainstorm causes 'life threatening' flooding, road closures in southern Maine

Flood waters had receded in Portland by Thursday morning after more than 6 inches of rain fell Wednesday night.

BY DENNIS HOEY STAFF WRITER
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A giant hole appeared after heavy rains Wednesday night at Rufus Deering Lumber on Commercial Street in Portland. Yoon S. Byun/Staff Photographer

1 of 17

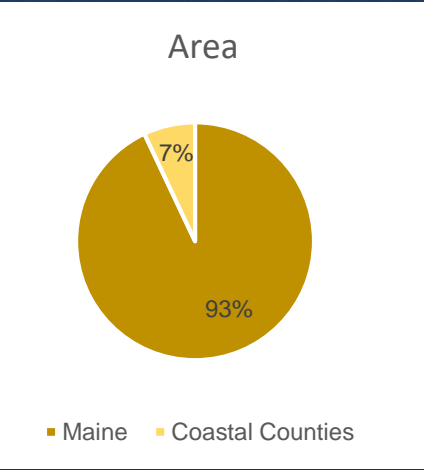
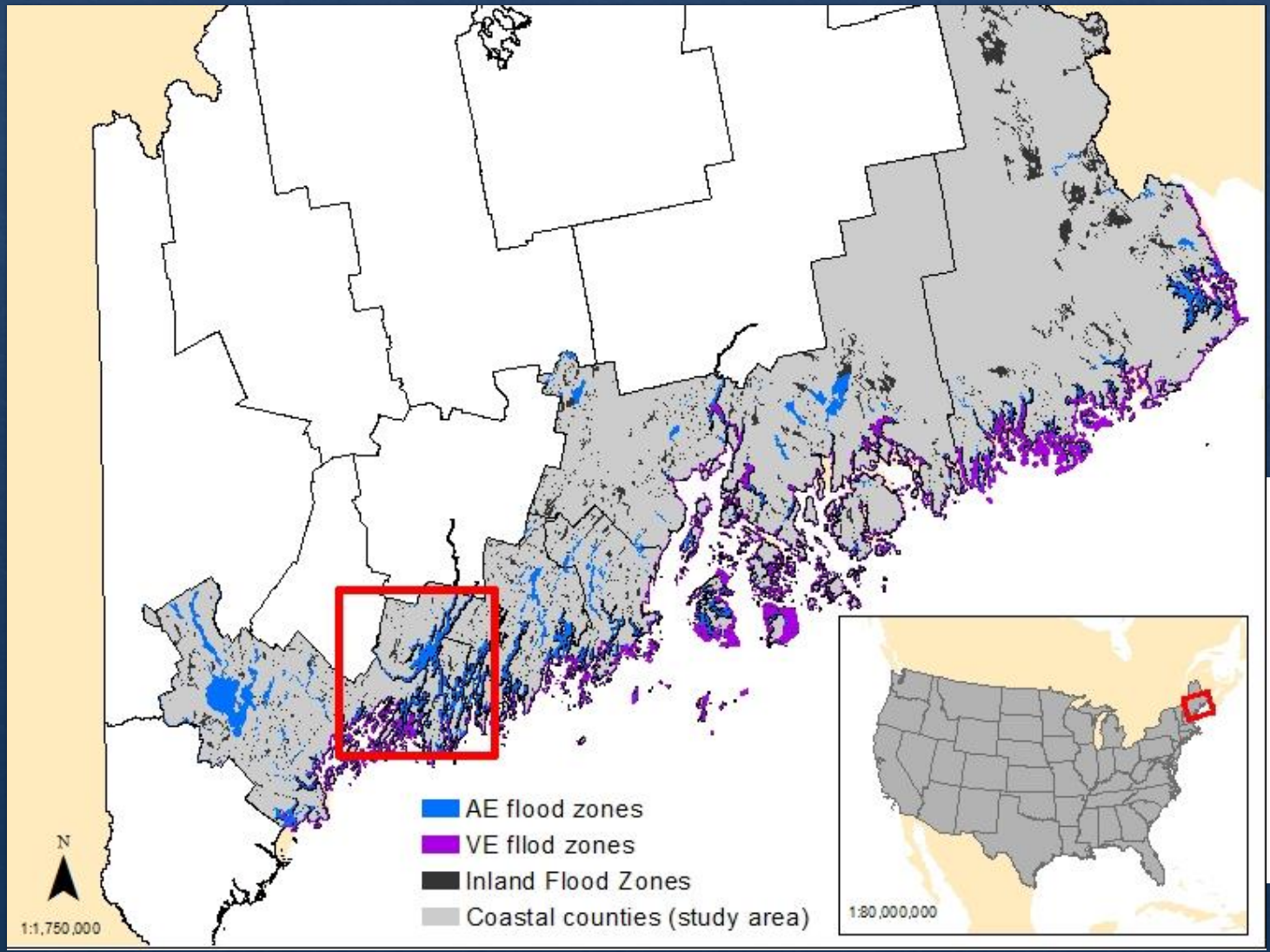
Maine's small-town fire departments struggle to find volunteers, money

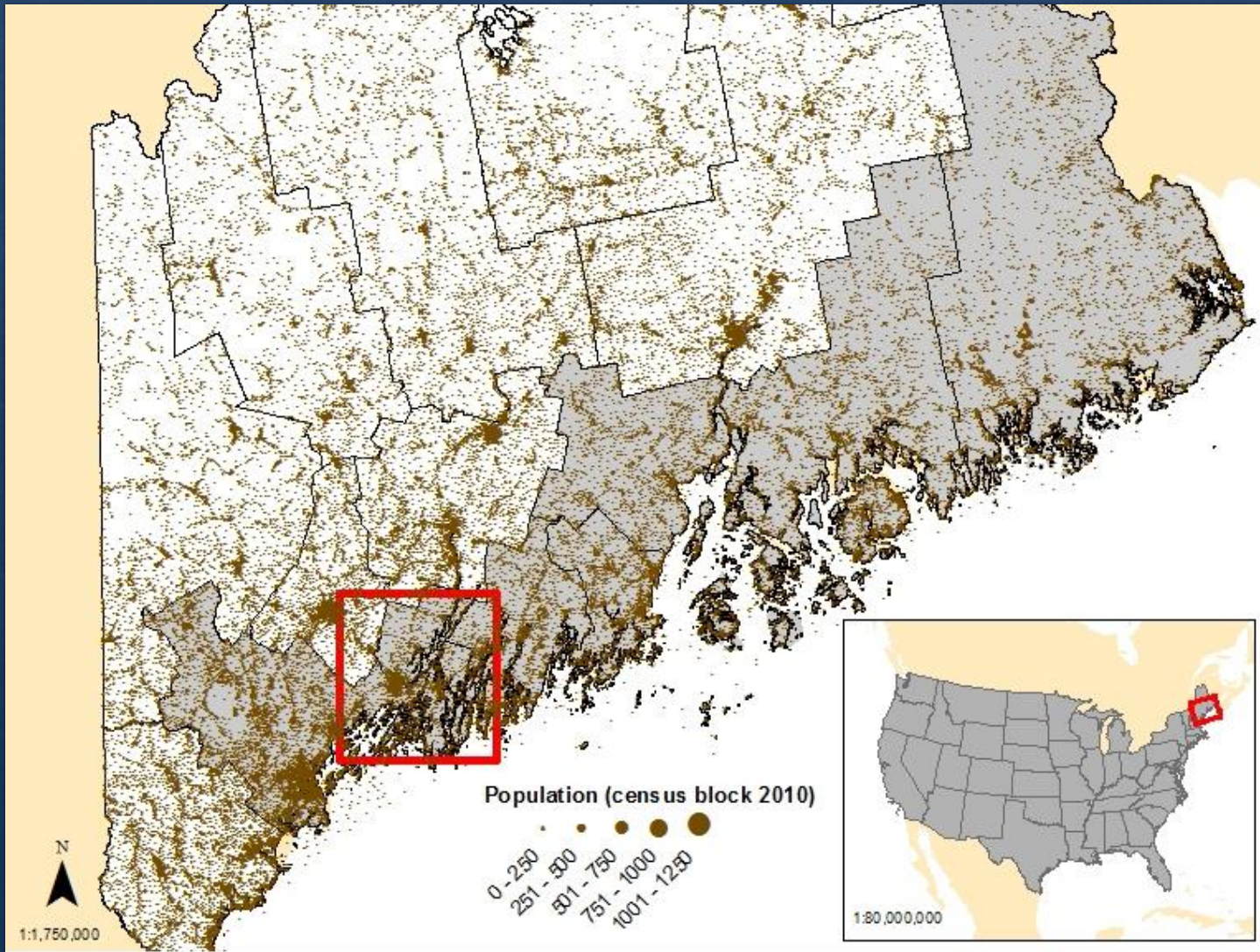


Troy R. Bennett | BDN

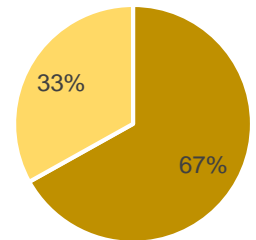


Source: Kennebec Journal, Bangor Daily News



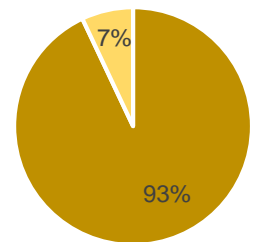


Population

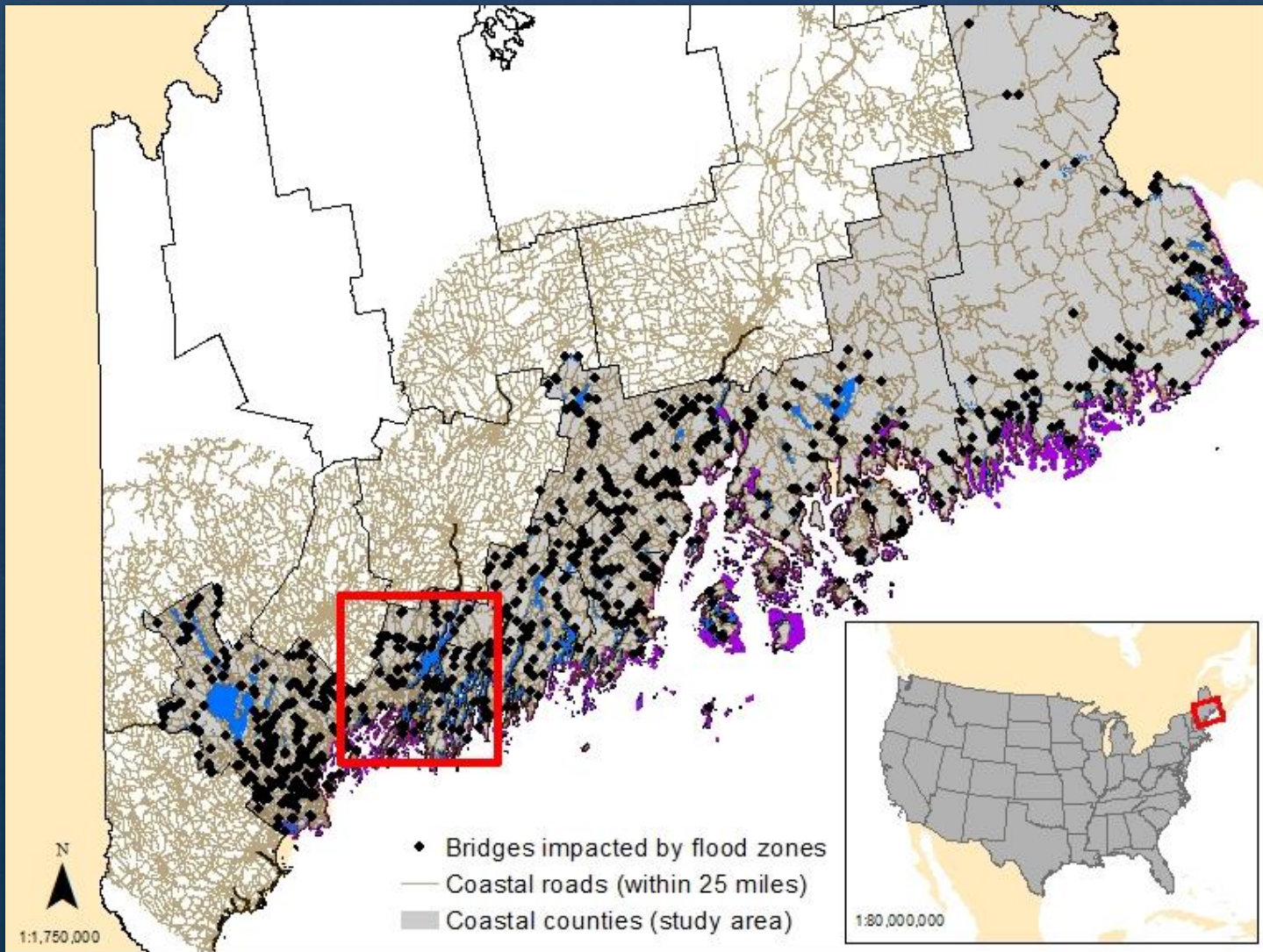


■ Maine ■ Coastal Counties

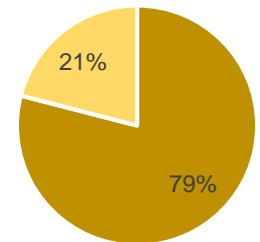
Area



■ Maine ■ Coastal Counties

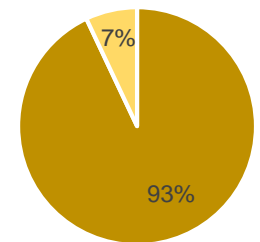


Roads



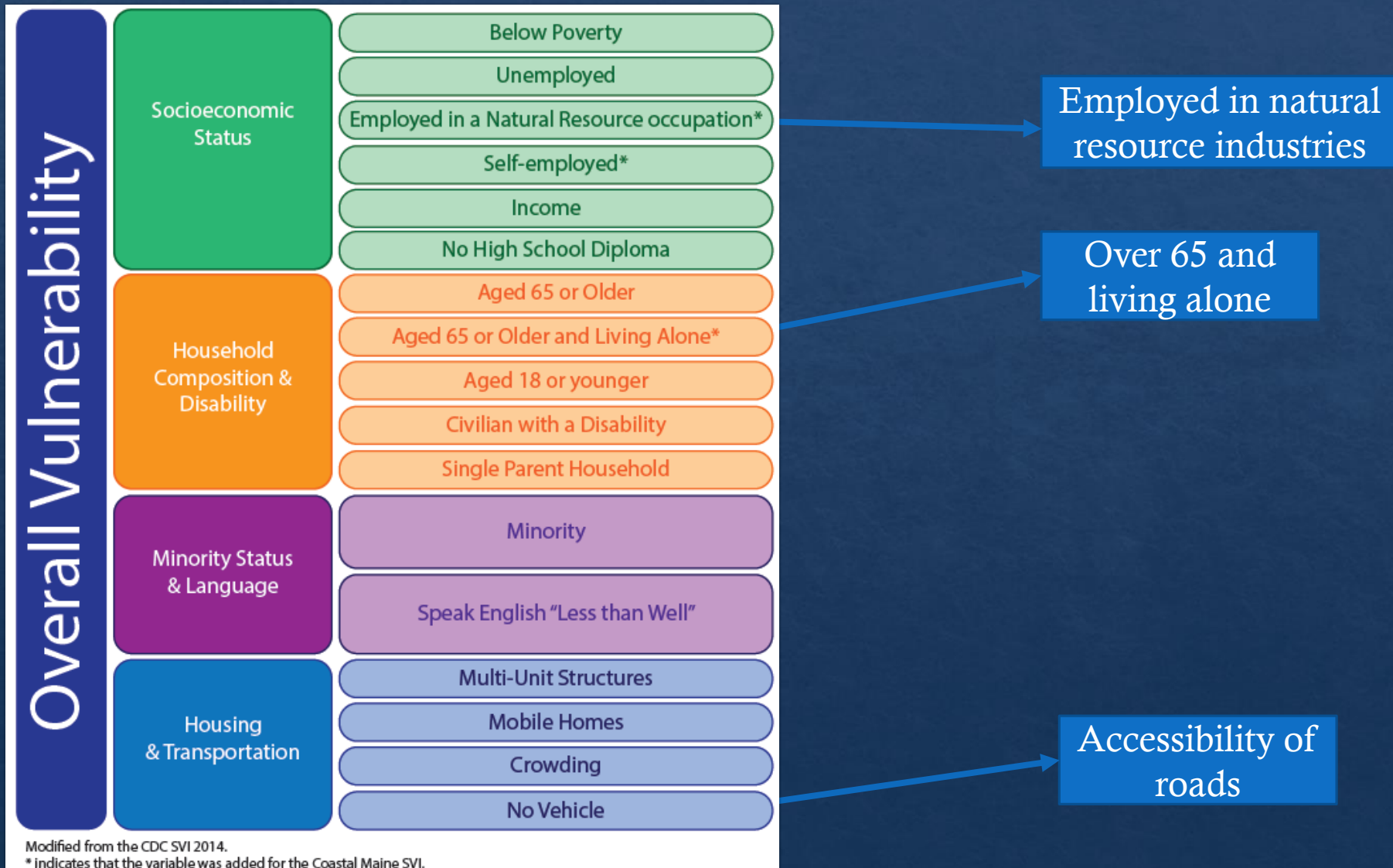
■ Maine ■ Coastal Counties

Area



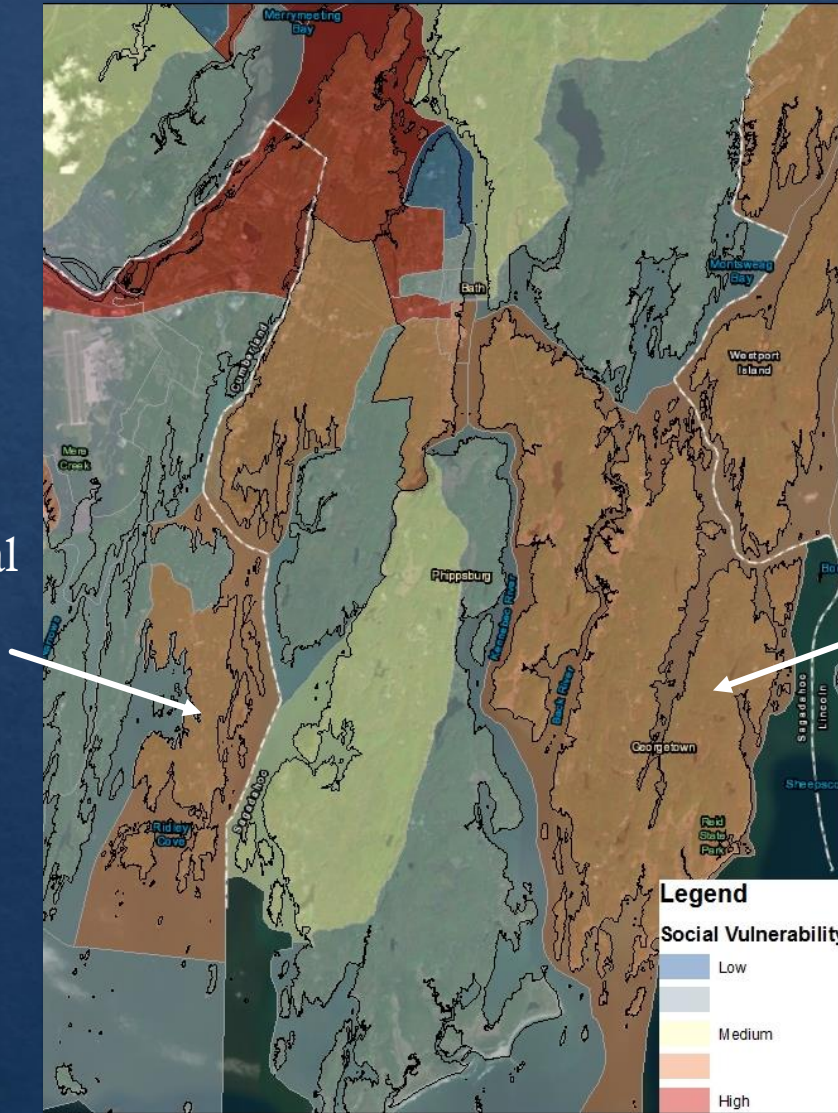
■ Maine ■ Coastal Counties

Maine Social Vulnerability Index



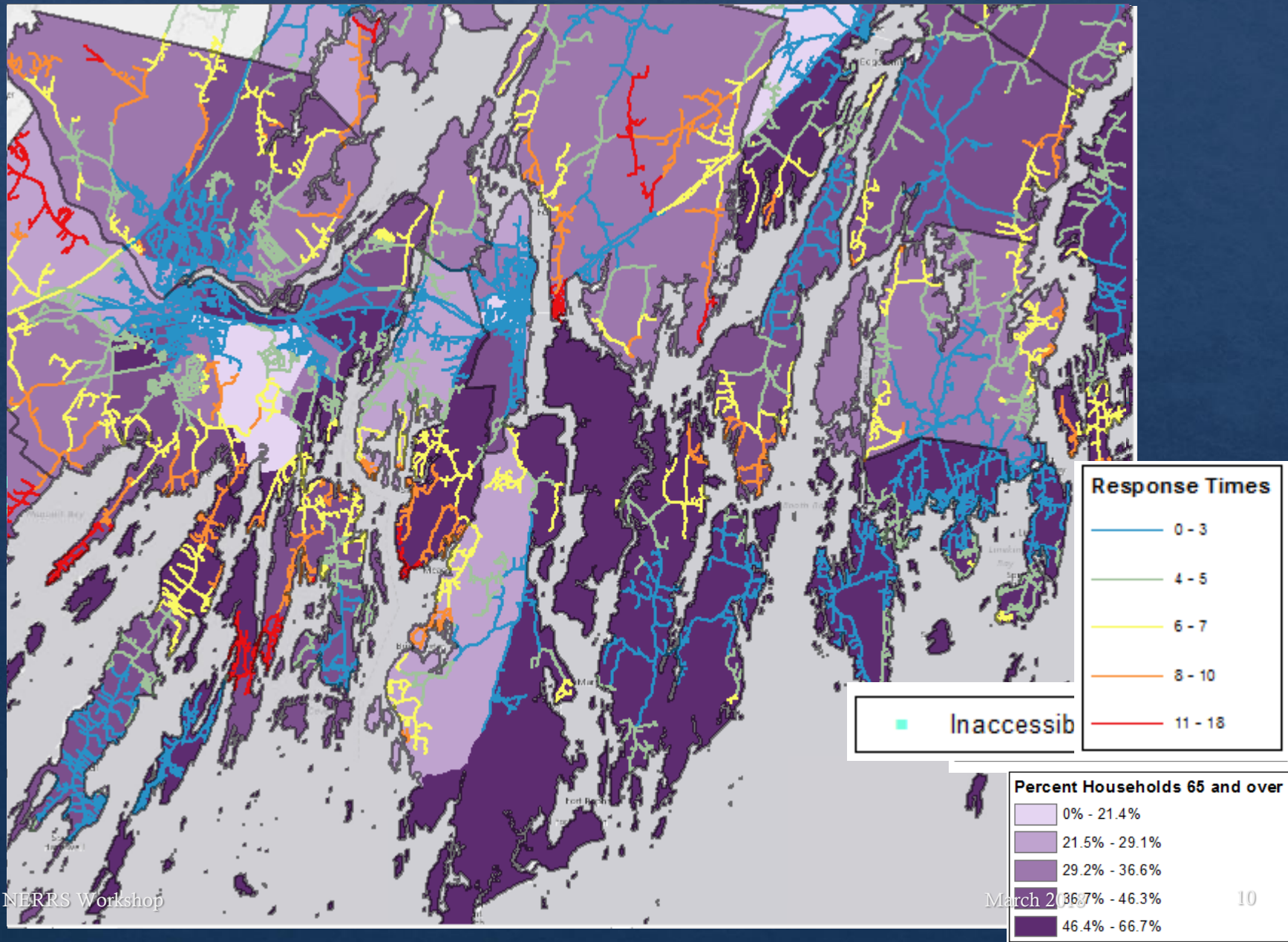
What Makes A Community Vulnerable

Greater percentage self-employed or employed in natural resource industries



Greater percentage of residents over 65 living alone

Combining data sets



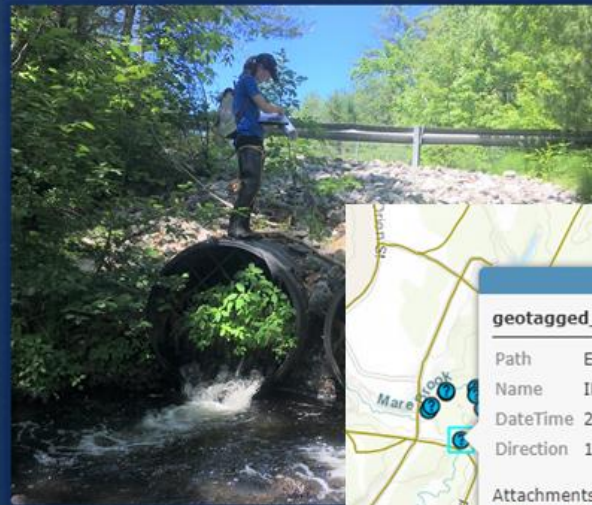
Resilience vs Vulnerability

Community Resilience: “The ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events”

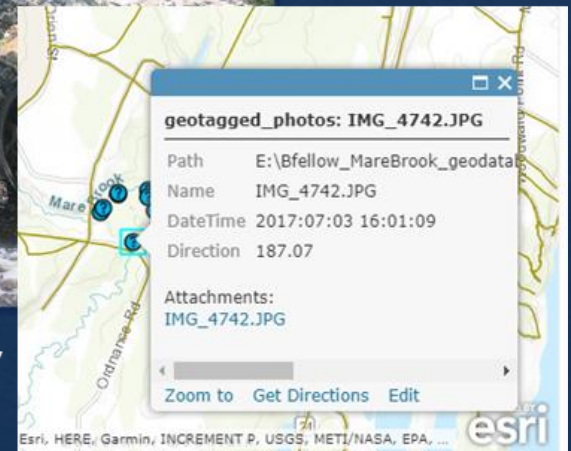
Natural Resource Council 2011



Photo Credit: Casco Bay Estuary Project.



Credit: Lauren Hickey



What contributes to resilience

Social resilience

- ◇ Access to health professionals

Institutional resilience

- ◇ Flood insurance coverage

Economic Resilience

- ◇ Homeownership
- ◇ Economic Diversity

Housing and Infrastructure

- ◇ Number of major roads
- ◇ Evacuation routes *

Community capital*

- ◇ Number civic organizations
- ◇ Citizen disaster preparedness

Environmental resilience*

- ◇ Natural flood buffers
- ◇ Local food supplies

*Drivers for rural resilience

Steps to Resilience

- ◆ **Conduct a vulnerability assessment/resilience inventory**
 - ◆ Infrastructure:
 - ◆ Roads, culverts bridges
 - ◆ Living Shoreline
 - ◆ Conservation and marsh migration
 - ◆ Social Factors

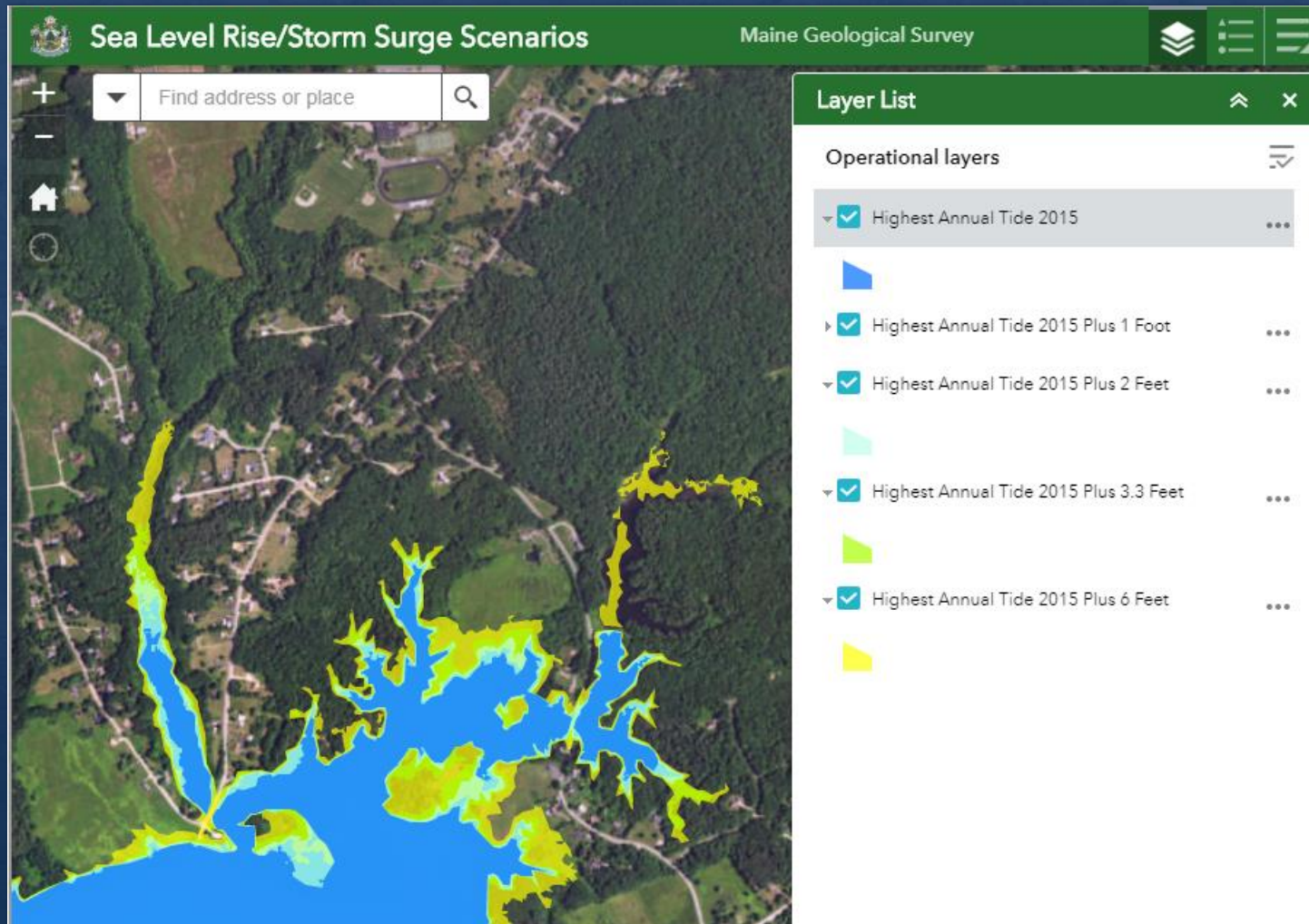
- ◆ **Educate the general public at a local level**

- ◆ **Develop a Climate Adaptation Plan**

- ◆ **Local and Regional Planning Processes** -
 - ◆ Include climate adaptation in planning processes such as Comprehensive Planning Processes, Living Shorelines

Resources to Explore Your Community's Vulnerabilities and Resilience

Investigating Sea Level Rise



http://www.maine.gov/dacf/mgs/hazards/slr_ss/index.shtml

TNC Coastal Application

Coastal Resilience Maine

Get Started

Coastal Resilience is a web mapping tool that allows you to examine nature's role in reducing coastal risks and opportunities for habitat conservation in Maine.

[View Future Habitat Explorer](#)

The Nature Conservancy
Maine DEPARTMENT OF Agriculture Conservation & Forestry
Bowdoin
ISLAND INSTITUTE
Maine Coast Heritage Trust
Blue Sky Planning Solutions
NOAA

Coastal Resilience Maine

Find address or place

Future Habitat

Tidal marshes play a critical role in the aquatic food web and protect cities and towns from coastal flooding. Use this tool to explore tidal marsh changes as sea level rises.

Choose region to explore: Casco Bay
Parcel:

Conservation measures for Casco Bay

Sea Level Rise Prediction

current 1 ft 2 ft 3.3 ft 6 ft

- 1,647 acres Tidal Marsh Area
- 21,801 acres Non-Tidal Wetlands Area
- 258 Road Crossing Barriers Nearby

Additional Layers:

Learn more about your area of interest by selecting from these additional information layers.

- Road-Stream Crossing Barriers
- Non-Tidal Wetlands
- Wildlife and Habitat Concentrations
- Current Conservation Lands
- High-Resolution Topography (LIDAR)

[Data Notes](#) [Print Report](#)




Map Legend

- Conservation Lands
- Wildlife Habitat Concentrations
 - High : 19
 - Low : 0
- Current Tidal Marshes
- Potential Marsh Migration 1ft SLR
- Potential Marsh Migration 2ft SLR

Esri, HERE, Garmin, INCREMENT P, NGA, USGS | Maine Natural A...

Checklists!!!

NOAA Adaptation Planning

	High Value
 <p>Built Infrastructure e.g. bridges, roads, stormwater systems, wastewater treatment plants, buildings...</p>	
 <p>Natural Resources e.g. beaches, rivers, wetlands, wildlife, parks...</p>	
 <p>People, Commerce and Culture e.g. citizens, health services, historical landmarks, economy, recreation and tourism...</p>	

For more information:

<https://coast.noaa.gov/digitalcoast/training/climate-adaptation.html>

Flood Resilience Checklist

Maine Flood Resilience Checklist



A self-assessment tool for Maine's coastal communities to evaluate vulnerability to flood hazards and increase resilience.



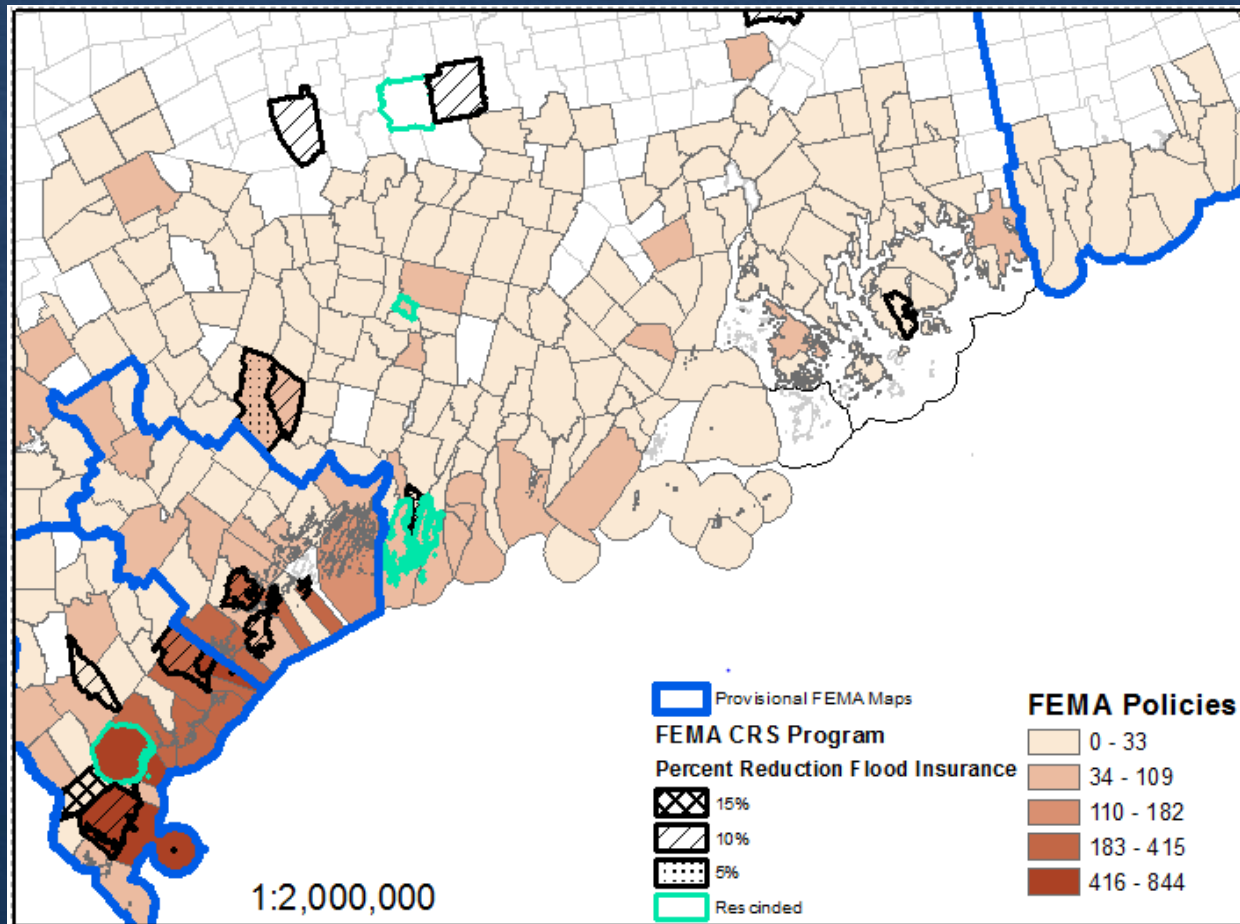
Version 1, July 2017

For more information:

http://digitalmaine.com/mgs_publications/521/

FEMA Community Rating System

- ◆ Provides reductions in insurance rates for meeting criteria.
- ◆ Communities accrue points that are based on a scale of 1-10.
 - ◆ 9 points = 5% reduction in rates, 8 points 10 %, etc...
- ◆ Currently on 22 communities are in the CRS program – however 5 have been rescinded after new maps developed

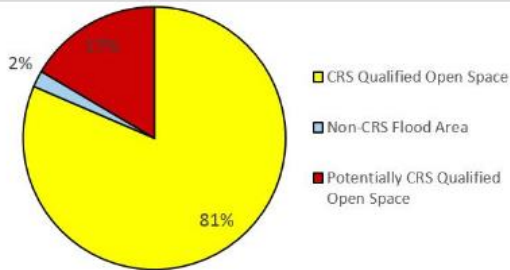


Examining Potential for CRS

A Story Map



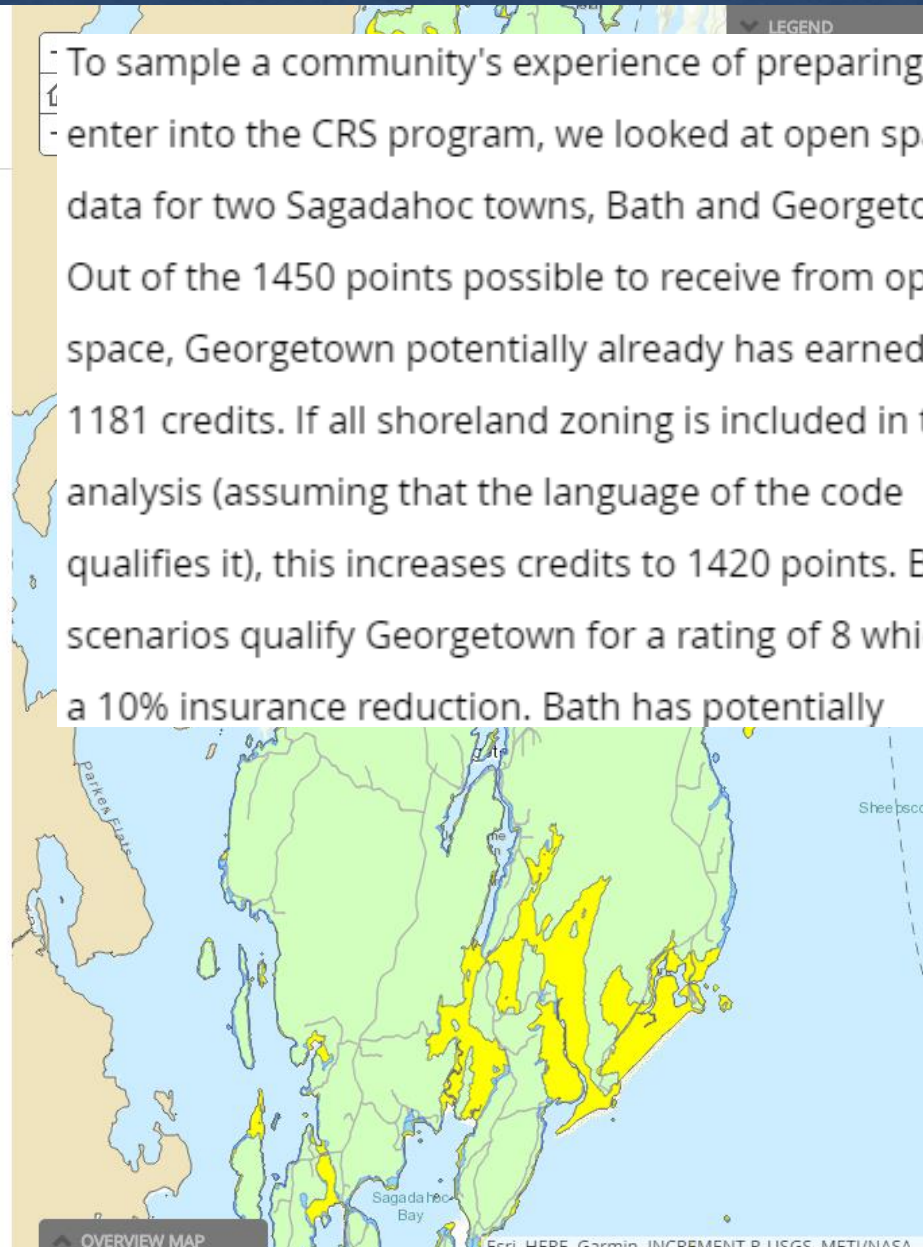
Sagadahoc County, ME CRS Open Space Data Analysis



To sample a community's experience of preparing to enter into the CRS program, we looked at open space data for two Sagadahoc towns, Bath and Georgetown. Out of the 1450 points possible to receive from open space, Georgetown potentially already has earned 1181 credits. If all shoreland zoning is included in the analysis (assuming that the language of the code qualifies it), this increases credits to 1420 points. Both scenarios qualify Georgetown for a rating of 8 which is a 10% insurance reduction. Bath has potentially earned 129 points as is, and if the shoreland zoning code language is deemed acceptable by CRS officials, this amount could increase to around 736 credits. In this second scenario, Bath would have enough credits to receive a rating of 9, entering the CRS program officially and receiving a 5% reduction on insurance premiums.



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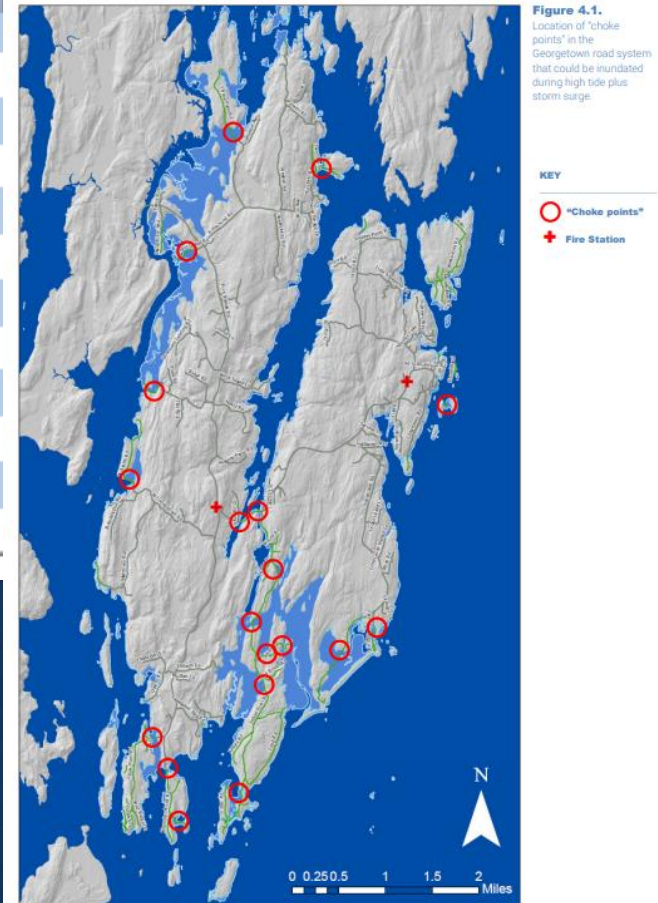


Examples of Resilience Planning

Developing a Climate Adaptation Plan: Georgetown Climate Adaptation Report

Table 3.1. Our framework for understanding the climate change challenge for Georgetown. On the left are major interests of Georgetown residents. On the right are climate factors that might affect these interests. By structuring our thinking this way, the climate change challenge becomes more manageable. It gives us a way to see the whole "landscape" of what we might be dealing with.

Our common interests	Climate factors that affect the things we care about
Roads & Infrastructure	Warming water
Water Supply	Increasing wind
Fisheries Economy	Rising sea-level
Private Property	Coastal storm surge
Public Property	Extreme rainfall
Ecology	Extreme wind events
Recreation	Drought and fire
Emergency Preparedness	Ocean acidification
Cultural and Historical Assets	Invasive species
Human Health	



Educating Community Members: Harpswell Conservation Commission

Changing Weather and You

Reports include Bowdoin College's *Coastal Vulnerability Analysis* through the *Coastal Flooding Risk Assessment*. They provided local data enabling us to begin to think about rising tides, where they will affect local infrastructure and how to begin to plan.

2010 – [Coastal Vulnerability Analysis](#)

2011 - [Harpswell Intertidal, wetlands, watersheds, eelgrass and erosion](#)

2014 – [Sea Level Rise and Casco Bay's Wetlands: Potential Impacts](#)

2015 – [Citizen introductory workshop](#) and [Coastal Flooding Risk Assessment](#)

2015 - [Casco Bay Climate Trends](#)

2015 - [Assessment of Aquifer Vulnerability to Saltwater Intrusion](#)



Why is Harpswell Vulnerable?

- The Gulf of Maine is one of the world's oceans.
- The average number of days with precipitation has increased 300% by mid century
- We are experiencing an increase in the amount of precipitation
- Historical data tells us that sea levels have risen 7 1/2 inches since 1992



What does this mean for Harpswell?

Reports: Harpswell's participatory studies pertaining to changing weather and sea level rise.

Maps: Areas in Harpswell that currently flood when storms at sea combine with high tides. Click here for maps of inundated areas and to enter your location on the interactive map.

Road Maintenance and Stream Crossings: We know over 50% of Harpswell's roads are private and emergency access on private roads are the responsibility of the private owner. Please refer to the Harpswell Helpful Guides to keep in mind when planning future road projects and to maintain them in an effective manner.

Road Associations: The nuts and bolts of road associations. Maine's roads are becoming more expensive than it once was. A legal road association is an important part of managing the infrastructure expenses that will increase as rising tides impact roads.

Highest Annual Tide (HAT) +: 1 FT 2 FT 3 FT 6 FT Roads: State Town Private

Maps are prepared by the Harpswell Conservation Commission for general planning purposes only. The sea level rise and storm surge scenarios were developed by the Maine Geological Survey. The Google earth files (.kmz) of these scenarios will be made available for download. Harpswell data was compiled by the Midcoast Council of Government (MCOG) in June 2015.

Analyzing impacts on particular sectors

A story map



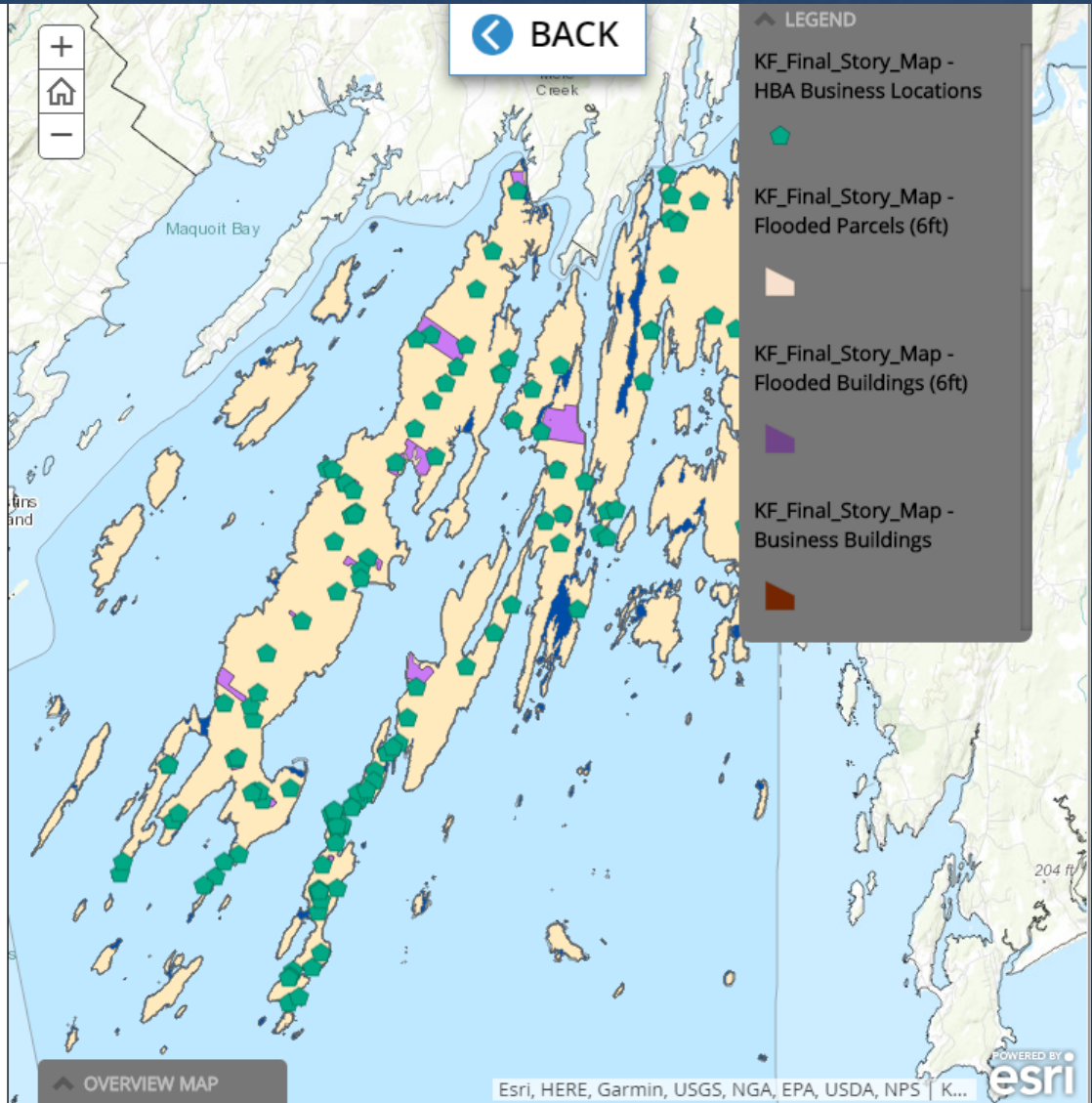
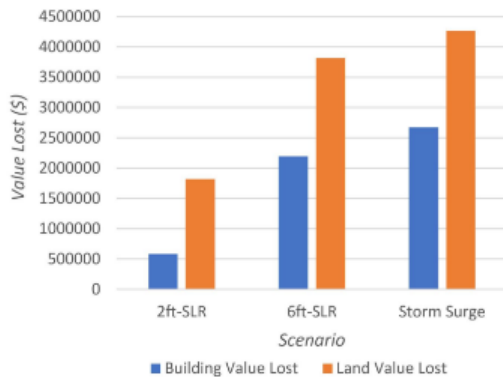
The Economic Impact of Sea Level Rise and Storm Surge on Harpswell, Maine

No issues detected x

6ft SLR would impact 45 business parcels, inundating 11 of them by 25% or more, and would flood 23 businesses (click to see the impacts)

Storm surge would result in 44 flooded business parcels, 15 of which would be inundated by at least 25%, and would flood 27 businesses (click to see the impacts)

Shown below: Total amount of building and land value loss (in \$) in each of the 3 scenarios



Local Policy Making: Bowdoinham Comprehensive Plan

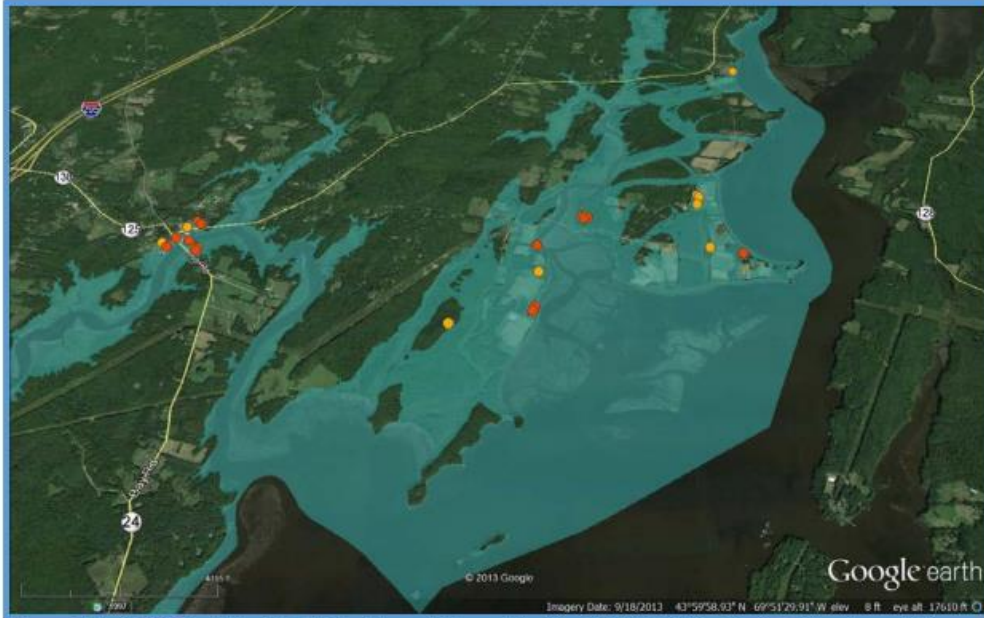


Figure 14: 2100 Predicted Building Inundation with 2 to 3.3 feet (0.6 – 1 m) of Sea Level Rise and Storm Surge from a 1% Storm, illustrating Table 4, rows 3 & 4, column 2. Total Water Elevation = 16.5 feet above MLLW.

Peter Slovinsky, MGS, POSM project, 2013

Legend

Orange Dots - Center Points of Buildings Inundated by 3.3 feet of Sea Level Rise (SLR) with a 1% Storm

Red Dots - Center Points of Buildings Inundated by 2 feet of SLR with a 1% Storm

Blue Shade – Extent of Flooding



Figure 24: East Grand Avenue Area, Old Orchard Beach, Maine. Depiction of Old Shoreland Zone Boundary (purple), and New Shoreland Zone Boundary (red), Now Set 250 feet Horizontally Distant from the Level of the Highest Annual Tide. Highest Annual Tide was set at a contour height of 6.3 feet NAVD 88, using NOAA LiDAR data. From MRPC.

Strategy #7: Maintain a digital Shoreland Zoning Map, and locate the position of the highest annual tide level for Bowdoinham, so that the edges of the shoreland zone are accurate on the map, as sea level rise increases.

Regional Planning: Lincoln County

Modeling future flood zones

Compare with shoreline zoning

Role of floodplain ordinances to increase freeboard of structures within flood zones from 1-3 feet above base flood elevation



Brunswick - Living Shorelines Project

- ◆ NOAA Funded Project “Building Resiliency Along Maine’s Bluff Coast” and “Advancement of Green Infrastructure and Living Shoreline Approaches in the Northeast”
- ◆ Provides an approach for addressing increases requests to permit shoreline stabilization projects
- ◆ Looking for volunteers to monitor



Interested in Getting Involved?

Climate Vulnerability Assessment Tools: A Hands-On Workshop

This session will be an opportunity to test-drive some online climate vulnerability tools. There will be a brief overview by experts, followed by a hands-on training session where you can try out tools that will help your community identify areas that are most at risk from coastal storm events and sea level rise.

- ◇ Gulf of Maine Resources Institute: C-Rise Program
- ◇ SMEDC: Flood Resilience Checklist
- ◇ [The Nature Conservancy: Coastal Resilience App](#)

Tuesday, May 29 at Bowdoin College, Two sessions:
Afternoon 2-4 and Evening 6-8

- ◇ Sign up through Casco Bay Estuary Project



Staying Above Water: Land Protection in a Changing Climate

Supporting a diversity of plants and wildlife

Thursday, May 24, 2018

9:30 am to 4 pm

Maine Maritime Museum

243 Washington Street, Bath, ME

Are you looking to...

- Understand the underlying concepts of coastal resilience.
- Understand where to protect coastal land in the face of rising sea levels and storm surges.
- Learn how other land trusts are integrating coastal resilience into land protection decisions.
- Gain experience with online mapping tools.



Thank You



Photo Credit: Casco Bay Estuary Project.



Photo Credit: Ethan Andrews, Belfast Waterfront



Photo Credit: The Nature Conservancy