CATHERINE CUTLER INSTITUTE

Casco Bay Estuary PARTNERSHIP

UNIVERSITY OF SOUTHERN MAINE

Jerry Monkman, Ecophotography

Building Networks in Casco Bay

CURTIS C. BOHLEN AND MATT CRAIG

CASCO BAY ESTUARY PARTNERSHIP

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Casco Bay Estuary Partnership

One of 28 National Estuary Programs

Hosted by USM's Cutler Institute

A 24-member local advisory board

Implement the "Casco Bay Plan"

Core Funding through EPA's National Estuary Program

Casco Bay Plan

1. Protect and restore habitats for now and for the future
2. Address water quality impacts of human activity
3. Engage communities and support local decisions
4. Mobilize knowledge and resources

Casco Bay

A Complex Bay

- ~ 160 square miles of water
- 575 miles of shoreline
- About 785 islands, islets and ledges
- 13 coastal municipalities

- Strong Tides
- Small Rivers
- Kennebec River Influence

Casco Bay Watershed

985 Square Miles

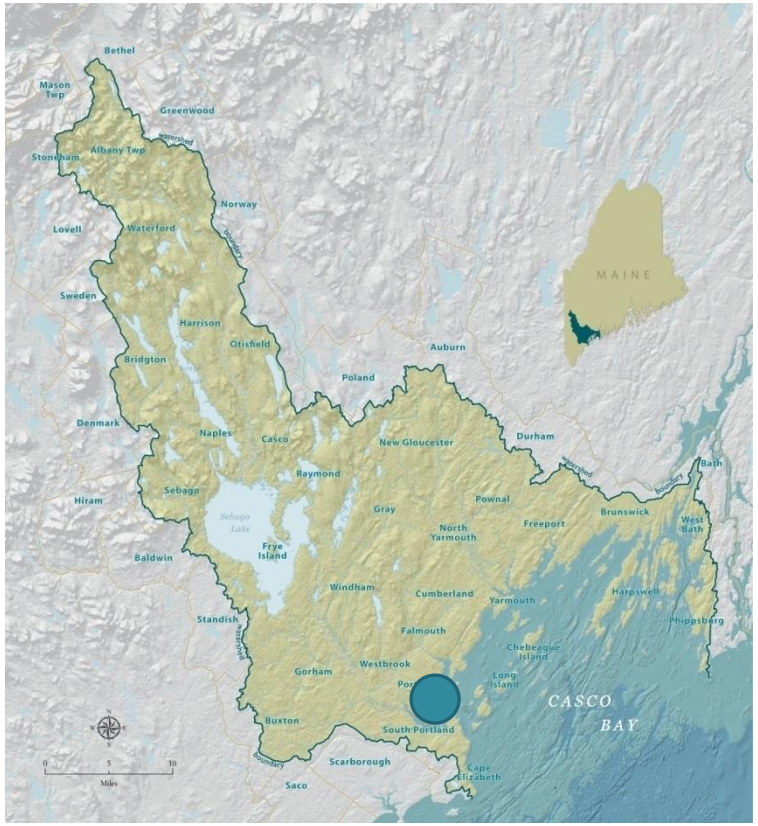
Touches 48 municipalities

60% Forested

Sebago Lake

Compared to all of Maine

- ~ 4.4% of Land Area
- ~ 25% of Population
- ~ 32% of Employment
- ~ 39% of Economic Activity



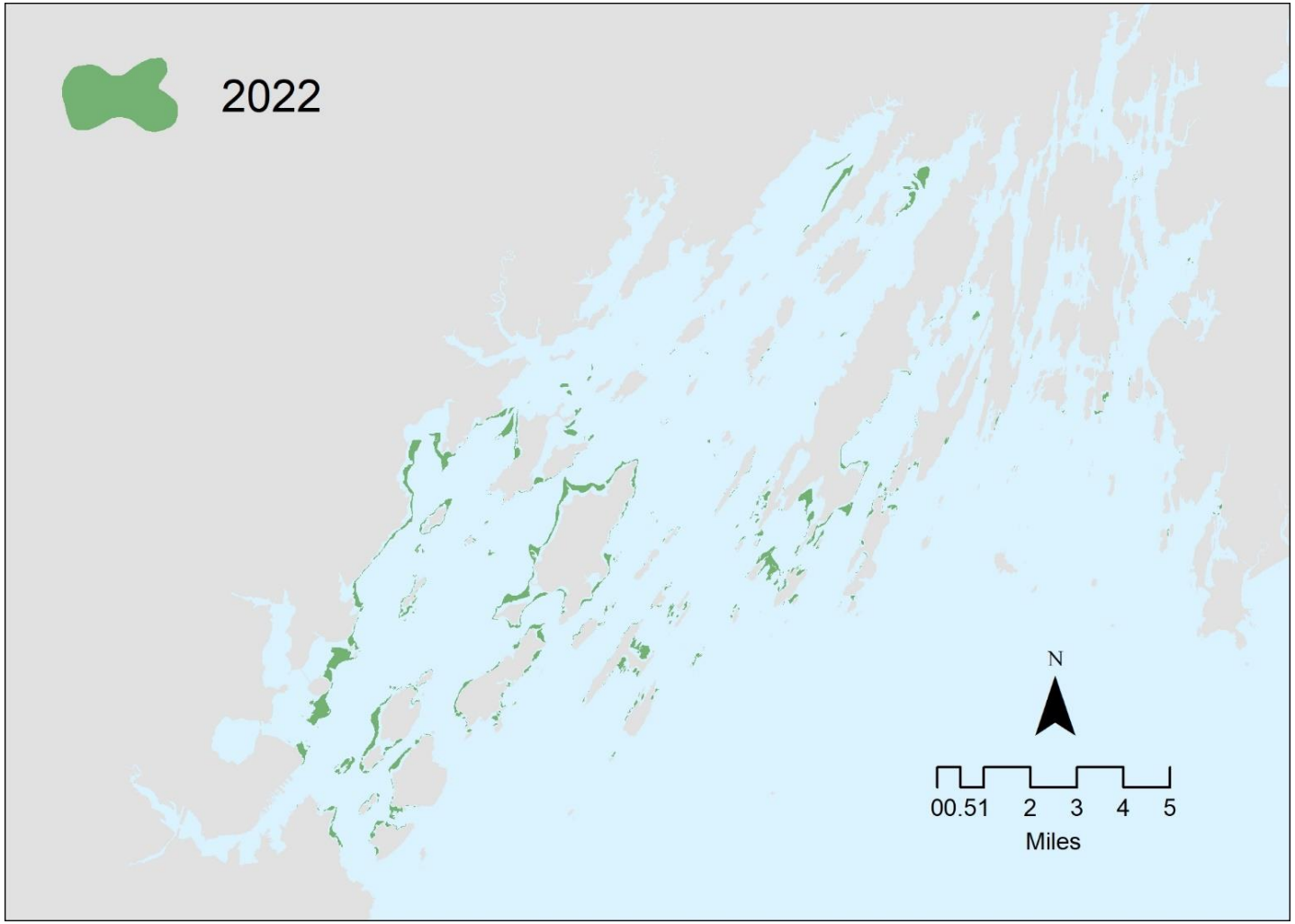
Maquoit Bay Eelgrass

Photos: Hilary Neckles USGS

Eelgrass Changes 1993 to 2022

Eurasian Green Crab

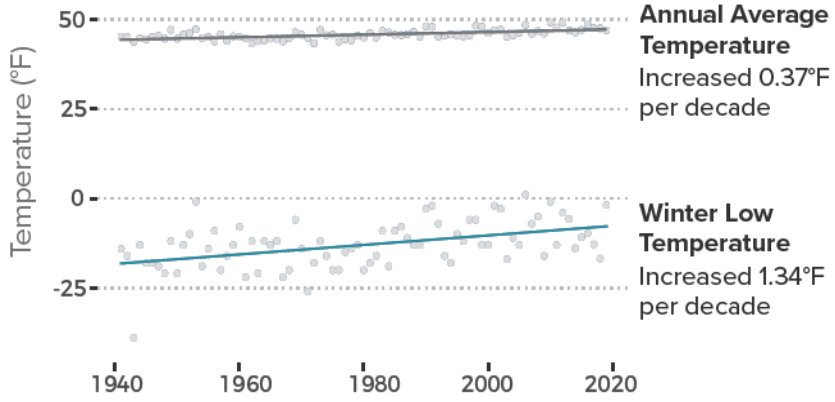
P. Erickson for MIT Sea Grant College Program (from NEANS website)



2,286 Acres

Winters are Warmer and Shorter

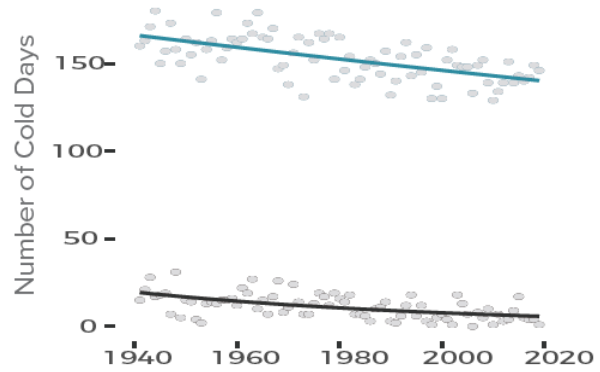
Warmer Years and Winters



Annual Average Temperature
Increased 0.37°F per decade

Winter Low Temperature
Increased 1.34°F per decade

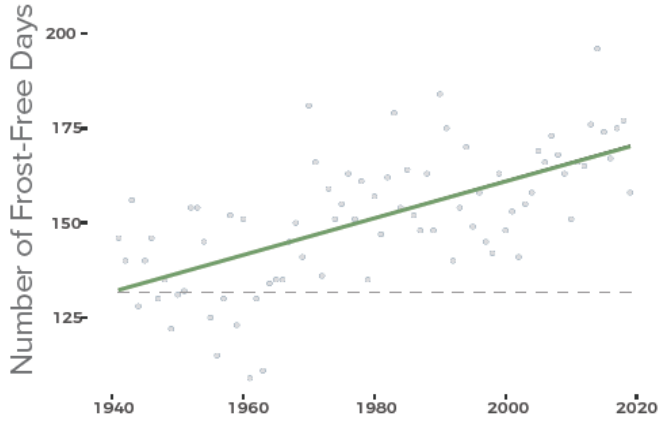
Fewer Cold Days



Days Below Freezing
Decreased from 164± in the 1940s to 141± in the 2010s

Days Below 0°F
Decreased from 18± in the 1940s to 6± in the 2010s

Longer Growing Season



Growing Season
Increased to 168± days in the 2010s

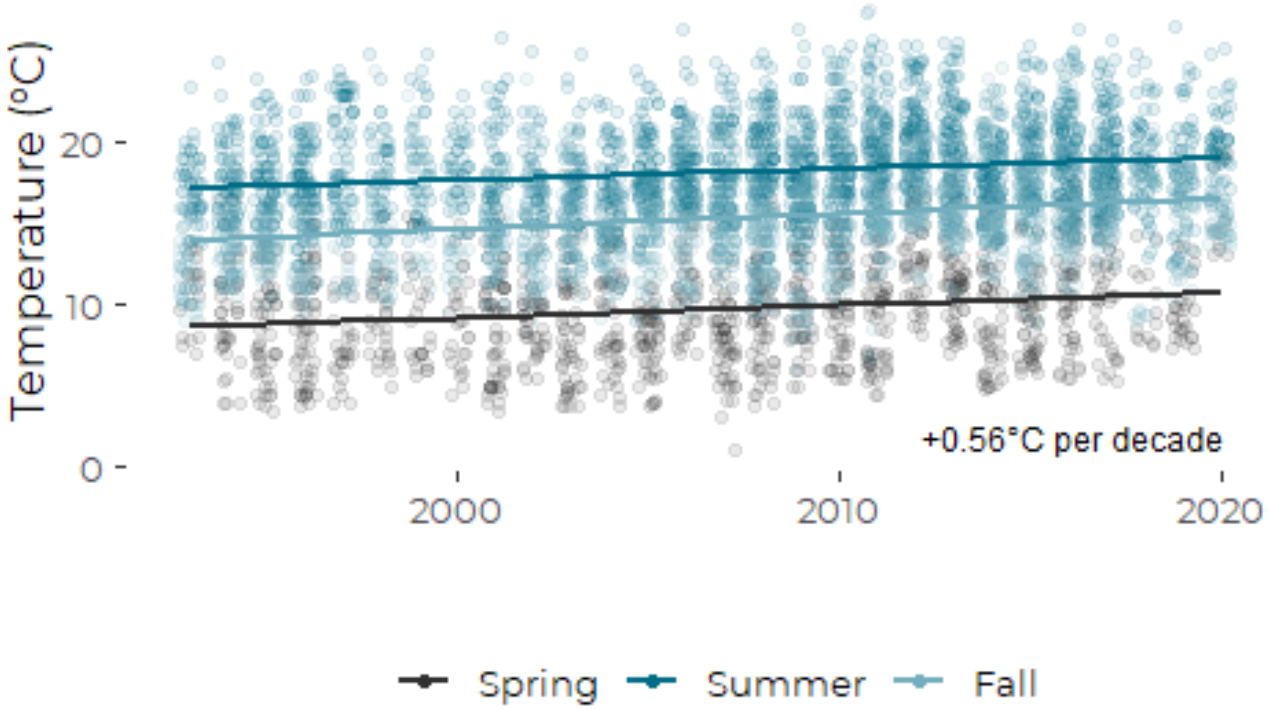
from 134± days in the 1940s

No detectable trends in high temperatures or hot days

Data: Portland Jetport, via NOAA

Bay Water Temperatures

Have increased ~ 1.5 °C since 1993



Spring = April, May
Summer = June, July, August
Fall = September, October

Data: FOCB

Eelgrass

"Team Zostera" (Glenn Page, Sustainametrix)

Field study of timing of flowering

- Peak flowering end of June into July

Testing approaches for collecting seed

- Simple plastic buckets to test ideas
- Looking for facilities to scale up next year

Regional Conversations

Energy around public outreach and community engagement

Portland Harbor Eelgrass

PORTLAND HARBOR COMMISSION, STANTEC

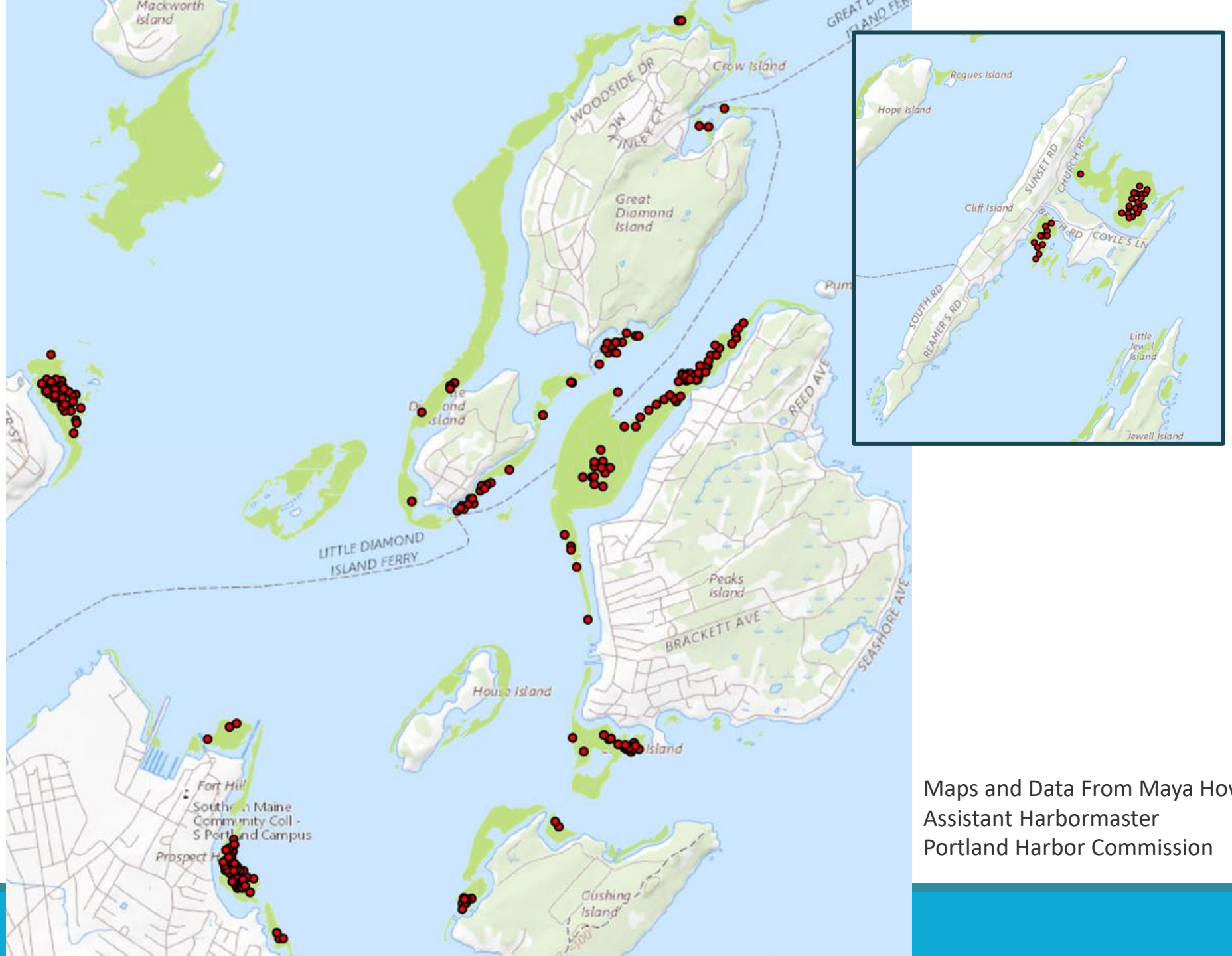
CONSERVATION MOORINGS

MOVED MOST TRADITIONAL MOORINGS OUT OF EELGRASS BEDS

REMAINING MOORINGS IN EELGRASS CANCELED BY HARBOR MASTER

Before

245 charted →
– 9 duplicates
<u>+ 52 found</u>
288 in eelgrass
(31% of 915 moorings)



Maps and Data From Maya Howard
Assistant Harbormaster
Portland Harbor Commission

2022 PROGRESS

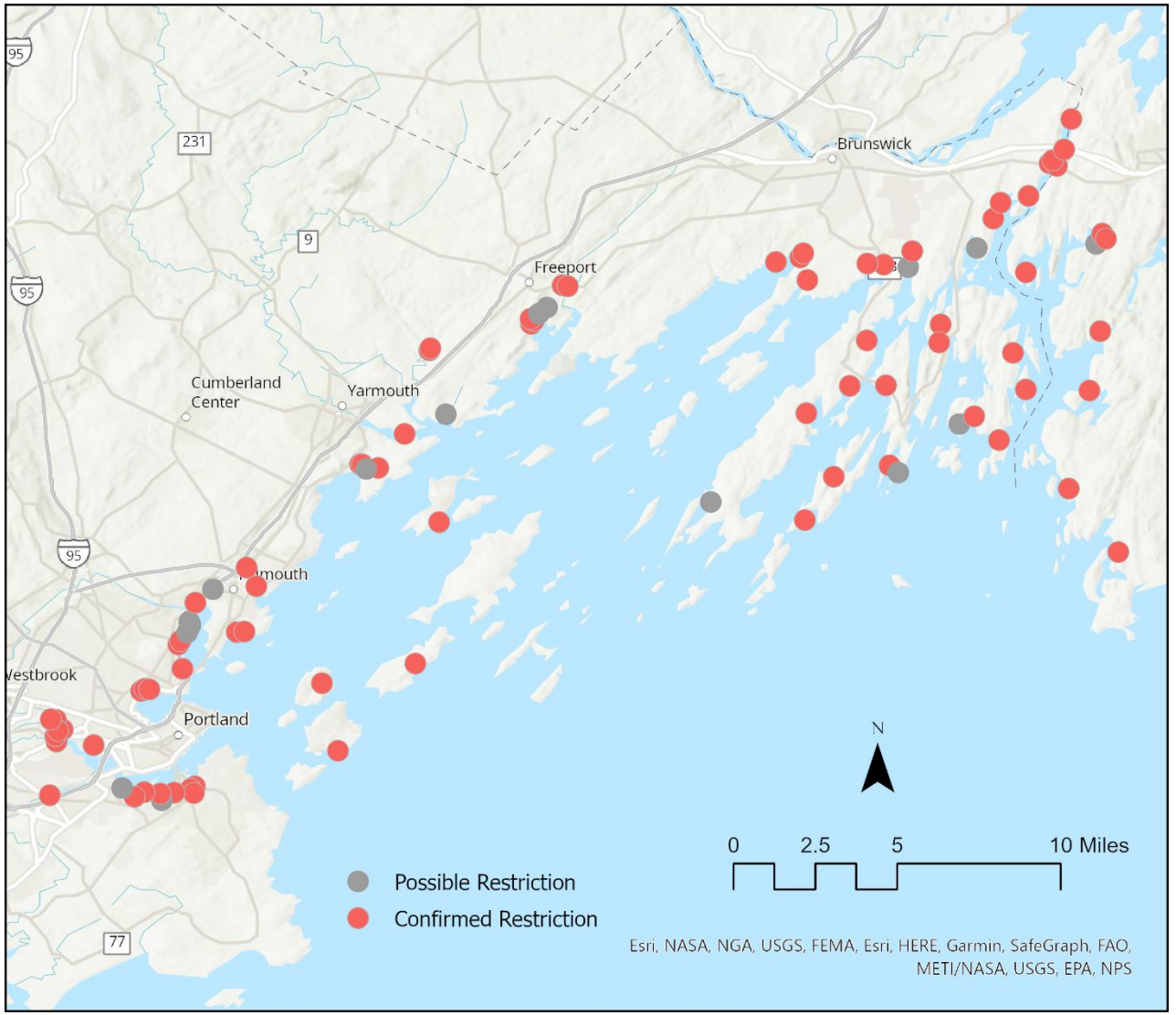
Starting total in eelgrass	288
Installed conservation mooring	52
Moved/canceled	220
Plans for spring 2023	11
No plan, will cancel	5

Maps and Data From Maya Howard
Assistant Harbormaster
Portland Harbor Commission

Tidal Restriction Assessment Based on LIDAR (2012)

Possible Restrictions: 18

Confirmed Restrictions: 76



Bohlen et al. 2012

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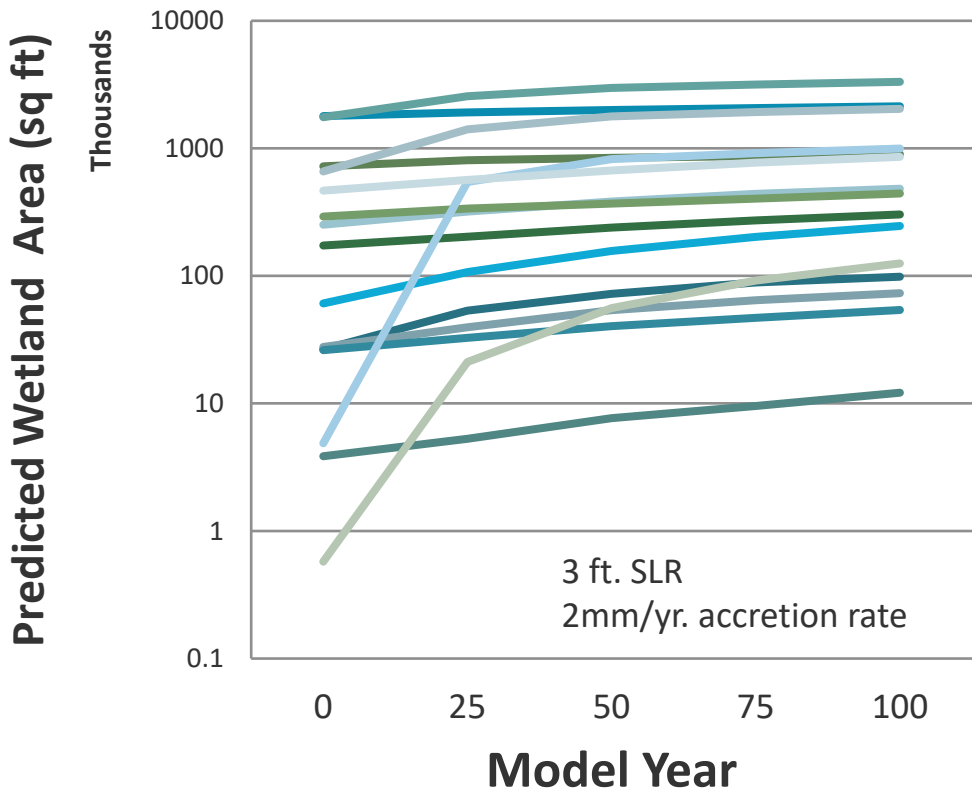
Modeling Fifteen Candidate Restoration Sites



Modeled change in potential tidal area under low to moderate SLR

Significant migration potential: tidal area predicted to increase at all 15 sites

Shift from high marsh to low marsh

Migration of tidal wetland into non-tidal wetland

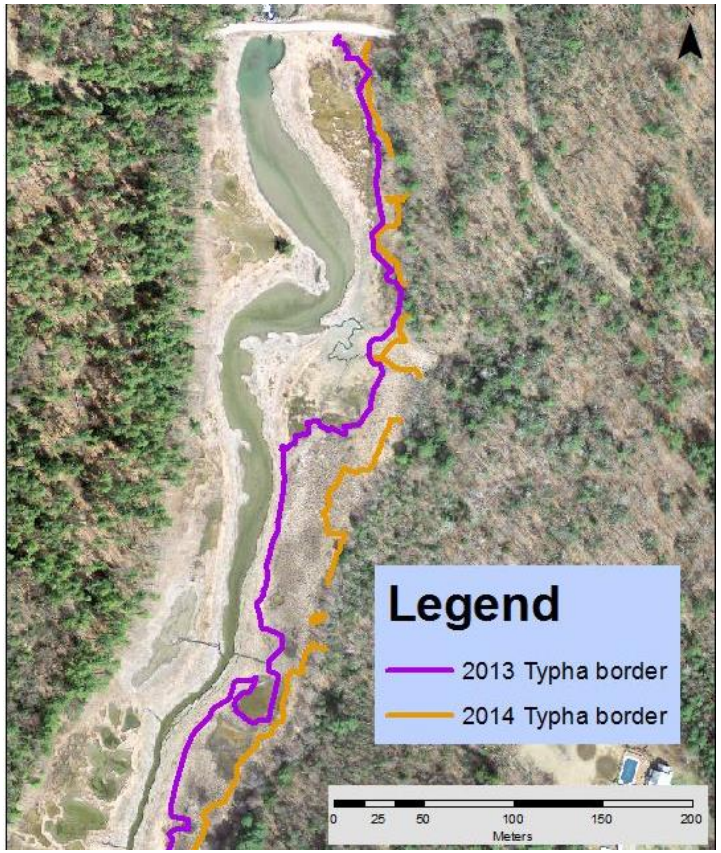
Bohlen et al. 2012

Partners:
Maine DOT,
Baxter State Park Authority
Landowners

Tidal Marsh Restoration

Long Reach Lane, Harpswell

Infrastructure Upgrade



Map courtesy of Shri Verrill

Habitat Restoration
Habitat Resilience

Vegetation Changes

2013

Before, July 2013

2018

After, July 2014
(Yes, this is what we hoped for…)

Long Marsh, Transect 9

Partners:
- CCSWCD
- Town of Harpswell
- Landowners

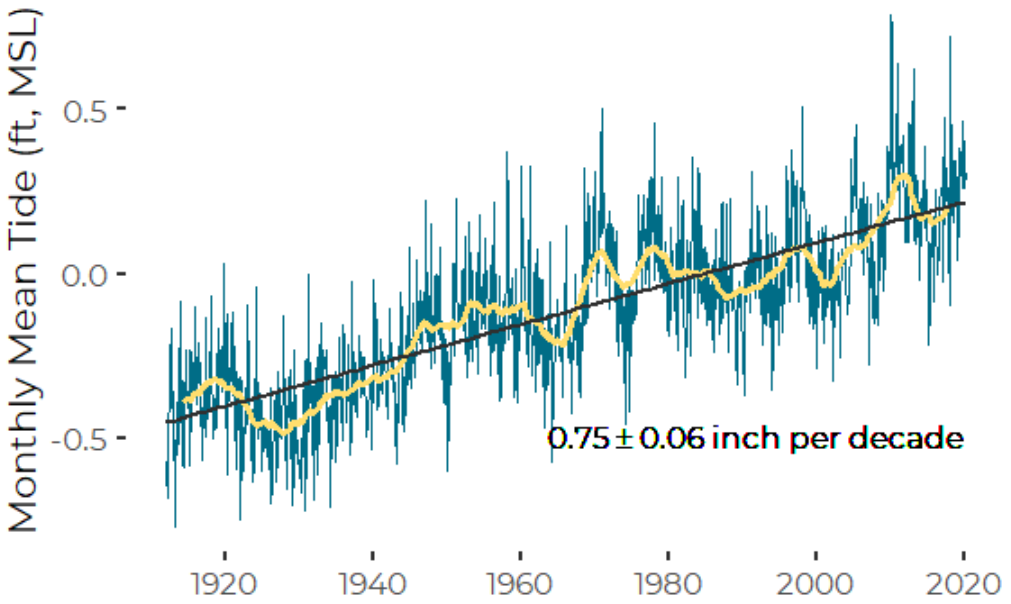
What Were We Missing?

Long Reach Lane

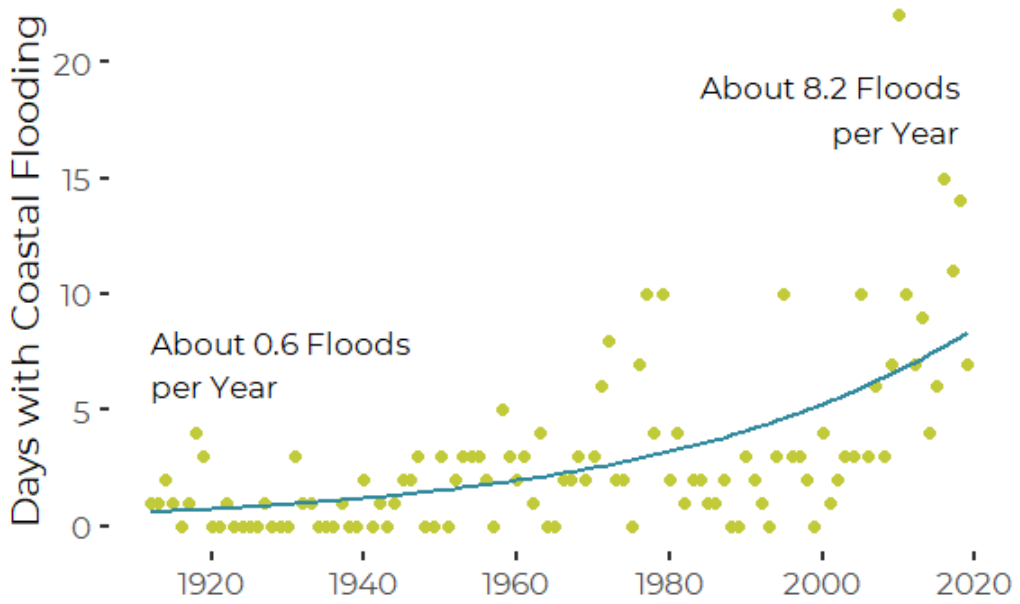
Wallace Shore Road

Rising Seas, More Flooding

Seas have been rising gradually

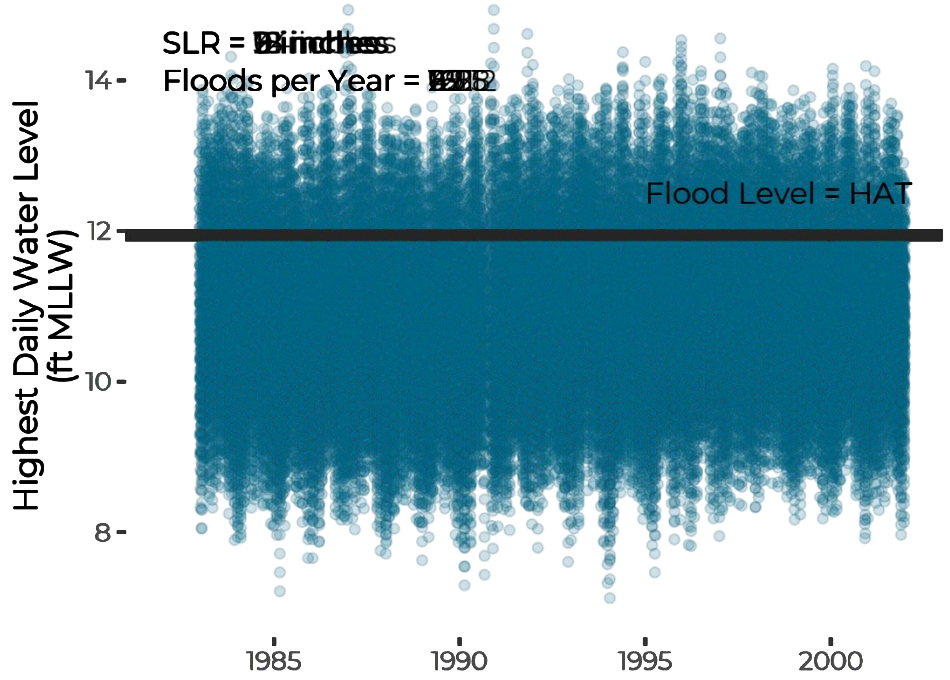


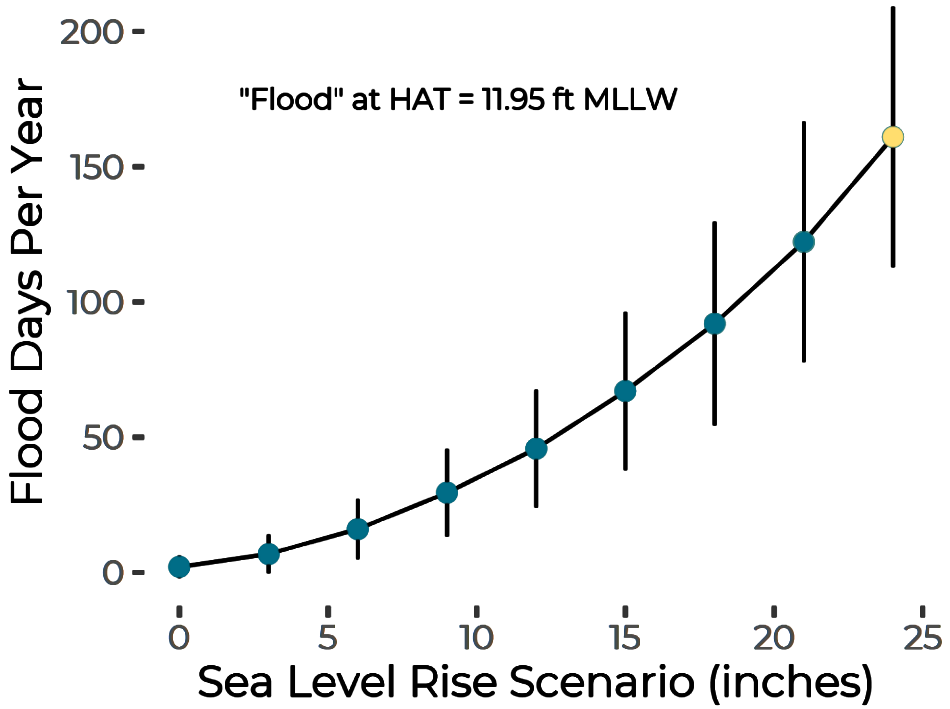
Leading to increasing flood frequency



Data from NOAA Portland Tide Gauge

Estimating Future Flood Frequency





Data from the current “Tidal Epoch”: 1983 through 2001

Working with the town of Harpswell

Dozens of vulnerable crossings

Many on shared private roads

Most lack road associations

Casco Bay Estuary Partnership

From Restoration to Communities

Habitat Restoration

- Looking Backwards

Habitat Resilience

- Looking Forward

Resilient Infrastructure

Community Resilience

Frost Gully, Freeport

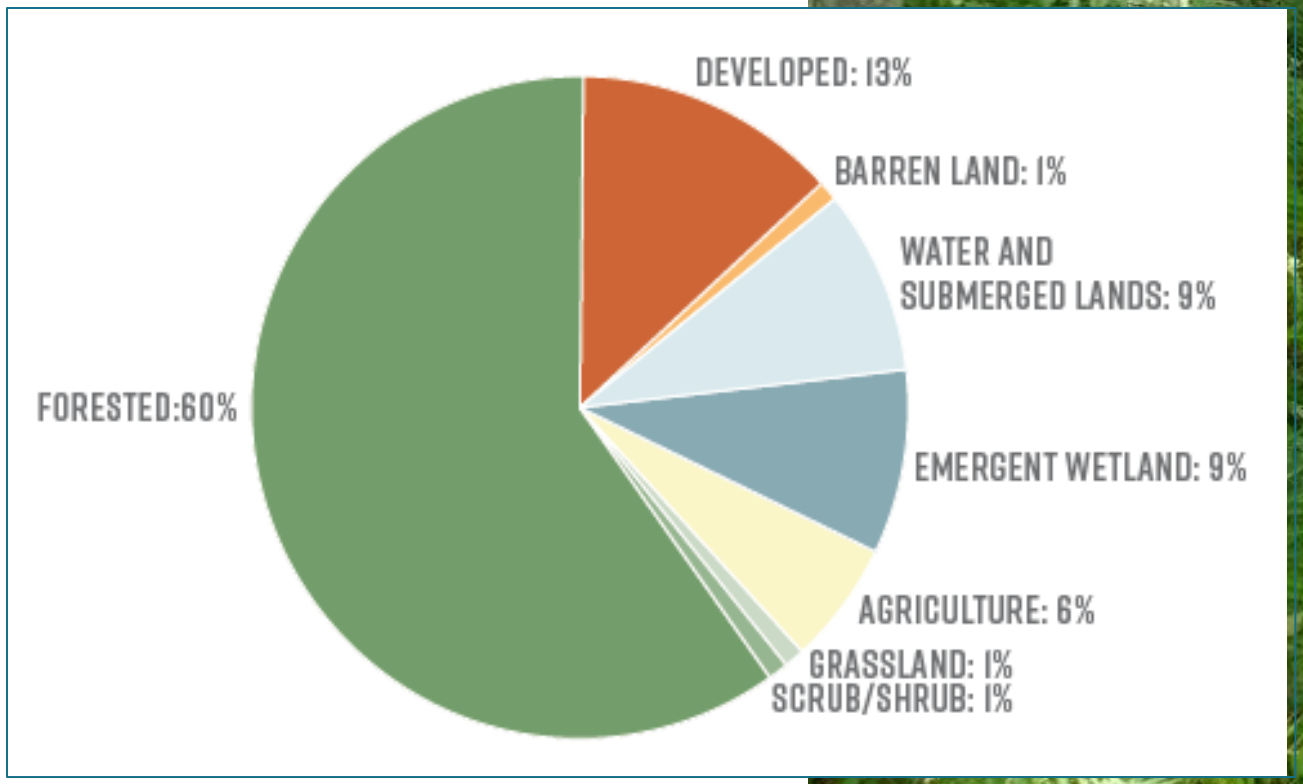
Removal of 3 dams

This project was all but dead…

Teamwork revived it

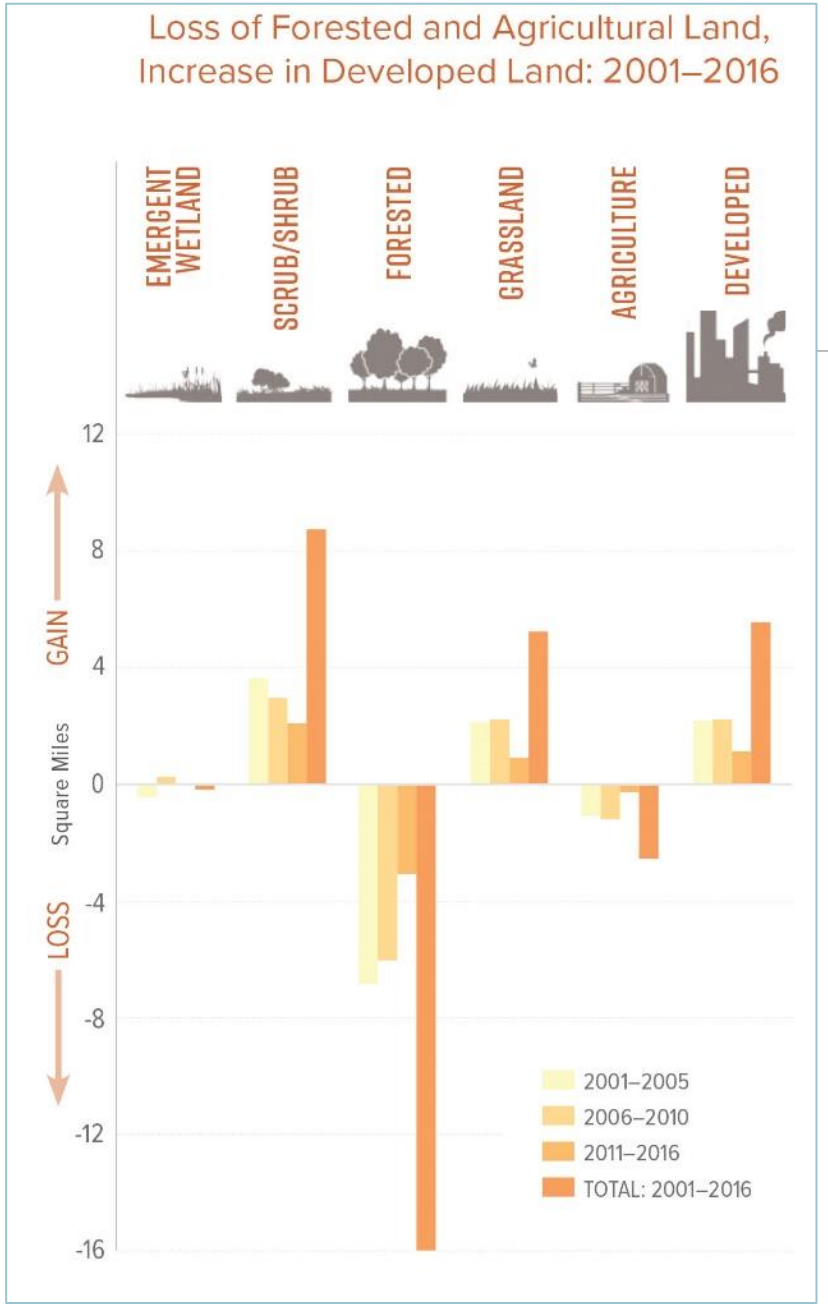
- Carrie Kinne
- Alex Abbott
- Matt Craig

Upstream From Casco Bay



Casco Bay Estuary

Data: National Land Cover Database



Land Use Changes

Population growing ~ 0.5% annually

Exurban communities growing fastest

Loosing forests and agricultural land

- Net loss of about 16 square miles (2 ½ %) of forest in 15 years
- Net loss of about 2 square miles of agricultural land
- Data from before recent construction boom

Data: National Land Cover Database, US Census Bureau

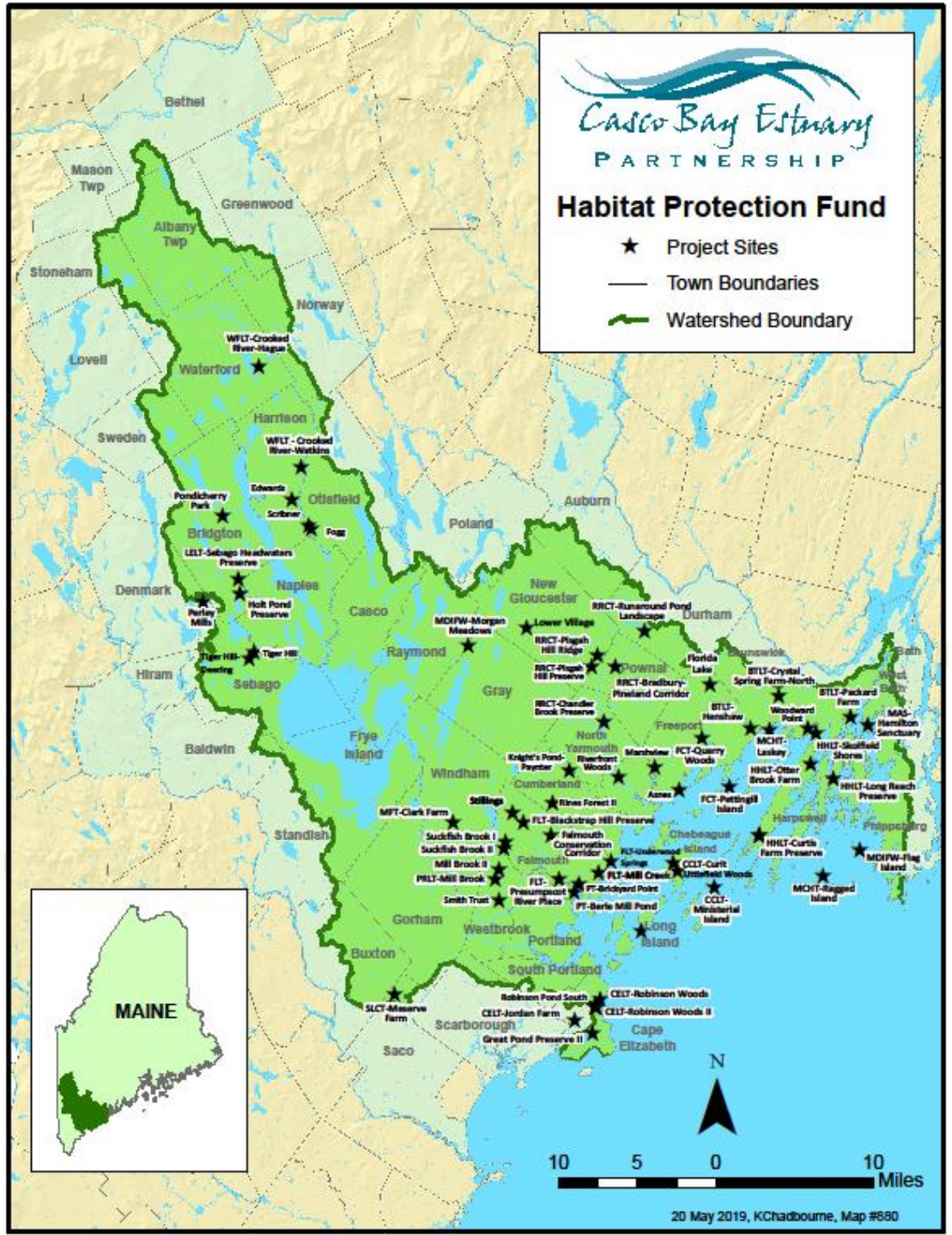
Grants for Habitat Pro And Public Access

CBEP Habitat Protection Fund

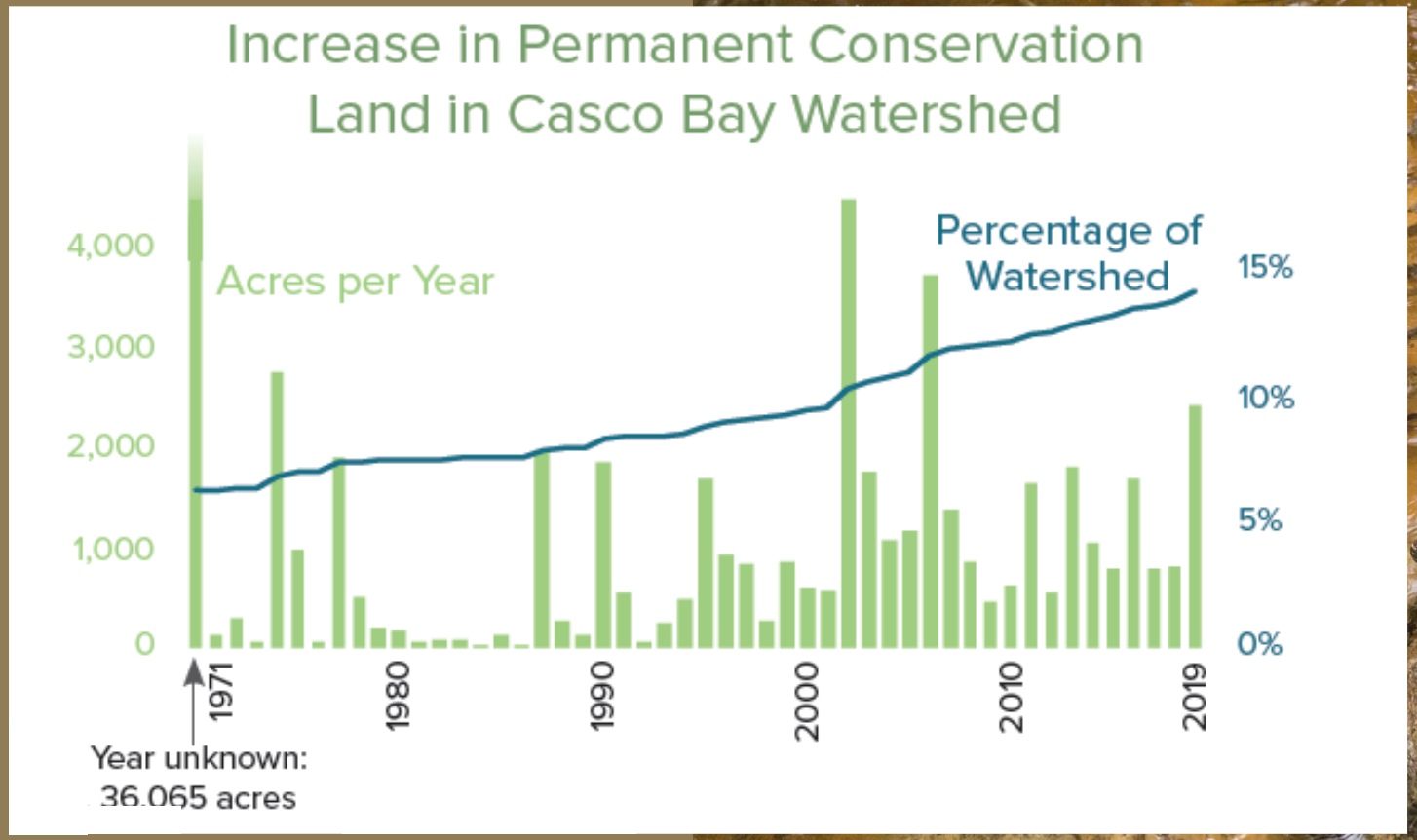
- 20 years and counting
  - 56 Projects
  - 27 Partners
  - 27 Municipalities
- 10,429 acres

Collaborations

- Sebago Clean Waters
- Presumpscot Vision, Values and Priorities



14% of the Watershed Protected



Data: Maine DACF

Jerry Monkman, ecophotography.com

Social Resilience Project

Peninsula, island, and rural coastal towns
- Often physically isolated
- Limited services (hospital, grocery stores, pharmacies)

Vulnerable populations

Storm events

Strengthening coordination
- Municipal Officials
- Emergency Management
- Social Services
- Environmental

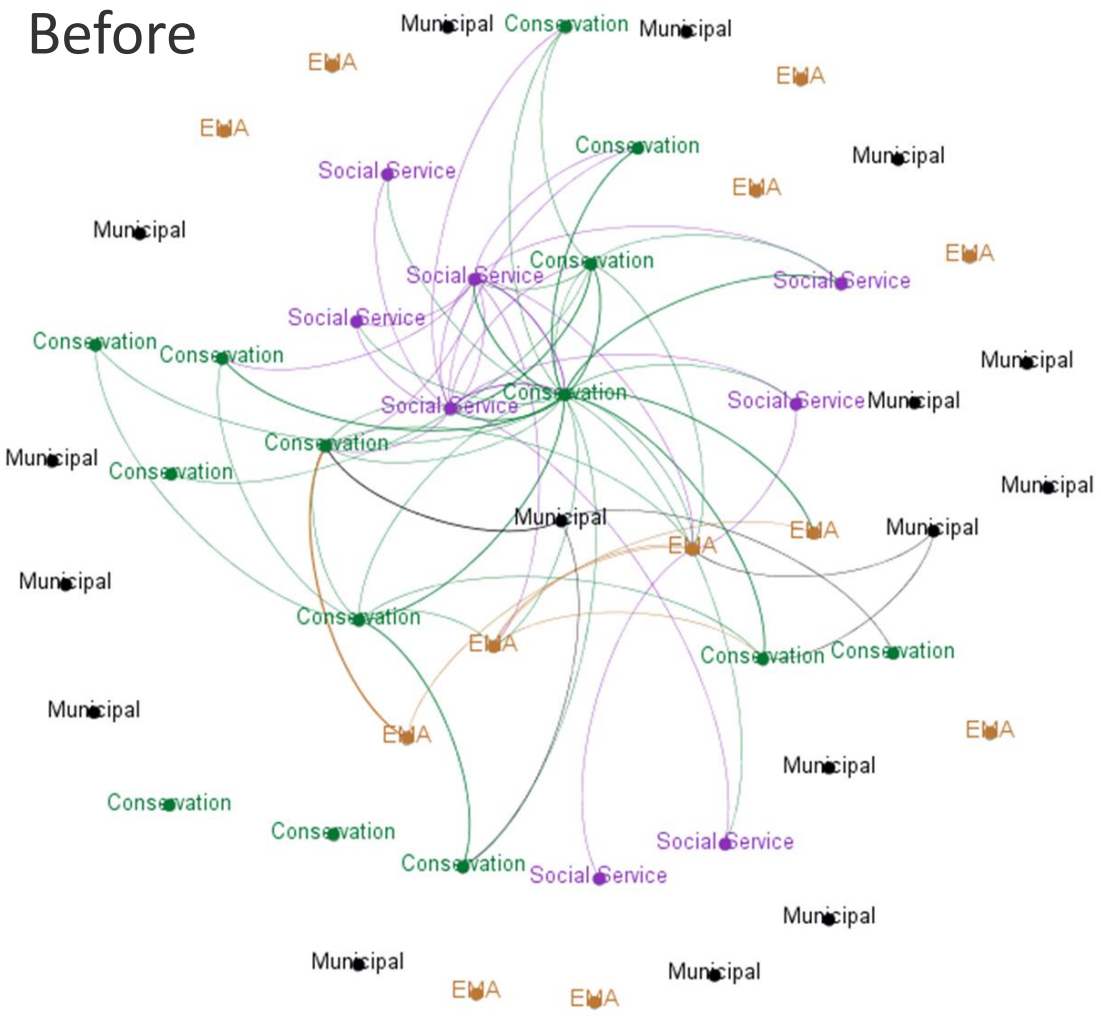
A “tabletop” exercise for an imagined severe storm event…

Partners:
- Maine SeaGrant
- Wells NERR
- The Nature Conservancy
- Kennebec Estuary Land Trust
- Bowdoin College
- Blue Sky Planning Solutions
- Municipalities
- Many others

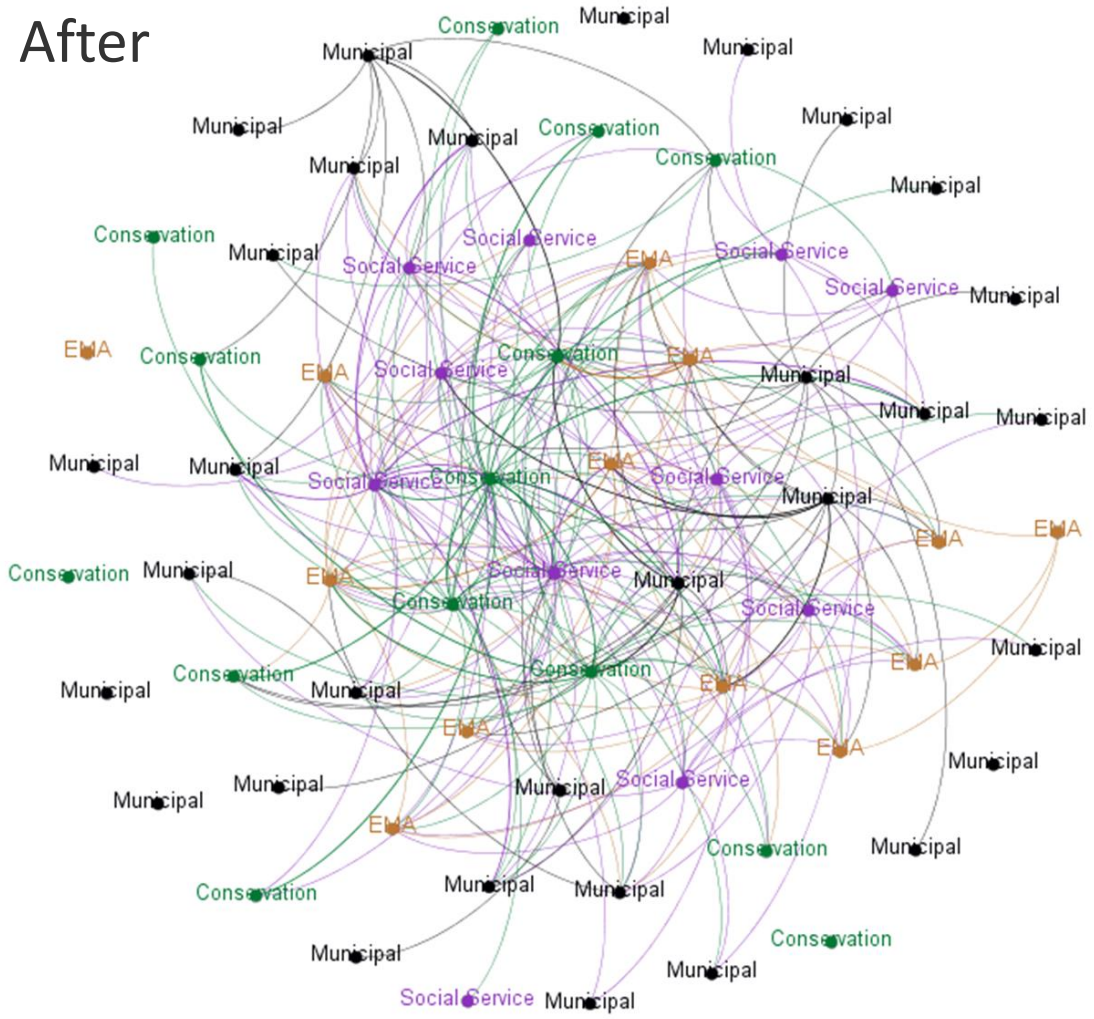
Preparatory focus group

Social Network Analysis

Before



After



Analysis by Eileen Johnson, Bowdoin College

The Casco Bay Regional Ocean Model

High resolution ocean model

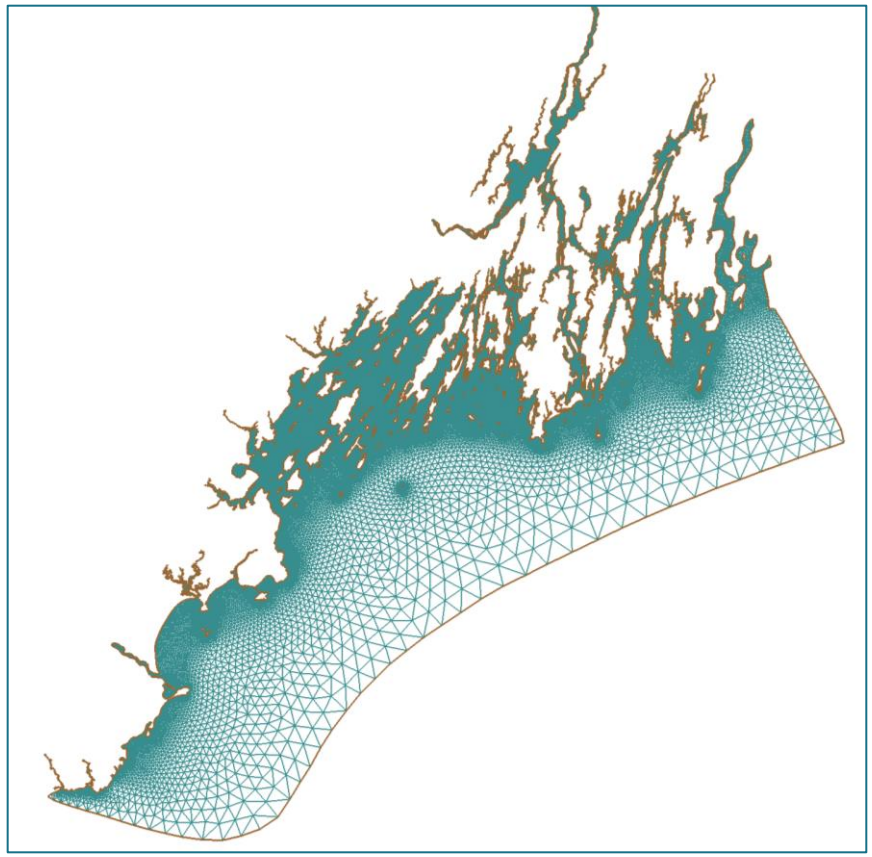
Saco Bay to Boothbay

Predictions about every 10 meters inshore

Daily three-day forecast

- Currents
- Ocean height
- Wave height and period
- Salinity and temperature

Original motivation was for water quality



The “Model Grid” for the Casco Bay Model

What Other Problems Can Models Help Solve?

Three community workshops

Focused on Portland Harbor

- Flooding
- Water Quality
- Port Activities

Follow-up interviews

Jane Ceraso

Flooding at high tide during December 23, 2022 Nor'easter

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Many Possible Uses and Users

Community members want to solve real problems in the Harbor

They want different kinds of information, on different timescales

No single model or model product will address all community interests

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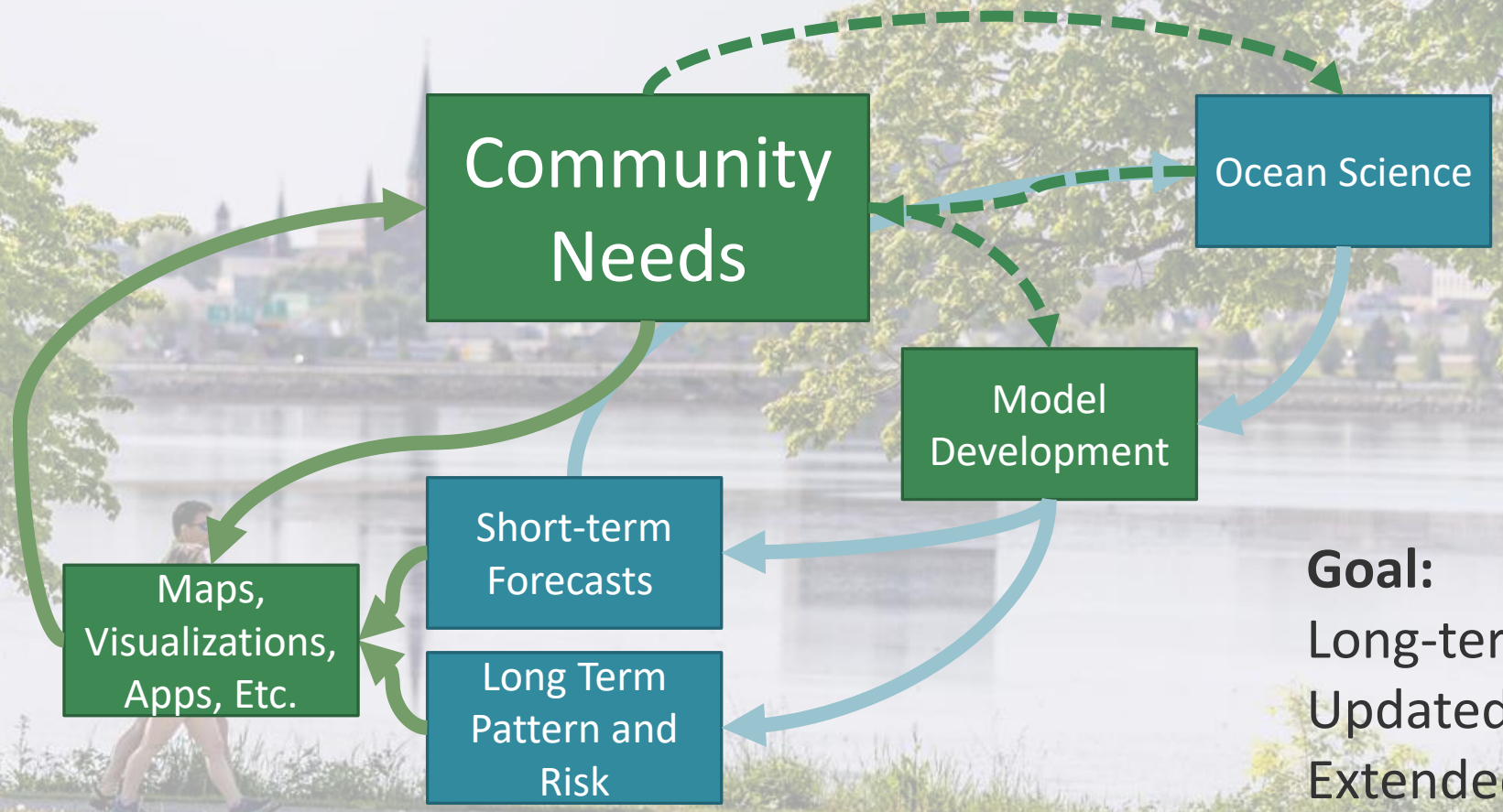
Information Timescale

Forecast	Present or Recent Past	Extreme Events	Pattern, Risk or Tendency

• Tell me what is about to happen
  • Storm warnings
  • Wave forecasts
	• Tell me what just happened
	  • Search and rescue
	  • Accident investigation
		• Tell me what will happen if a big storm hits
		  • Harbor and urban design
		  • Resilience planning
			• Tell me what is likely to happen
			  • Pollutant transport
			  • Shoreline erosion
			  • Tidal statistics

Community Centered Ocean Models



Goal:

Long-term regional tool

Updated as needs change

Extended to address needs

Jerry Monkman, ecophotography.com

Thank You

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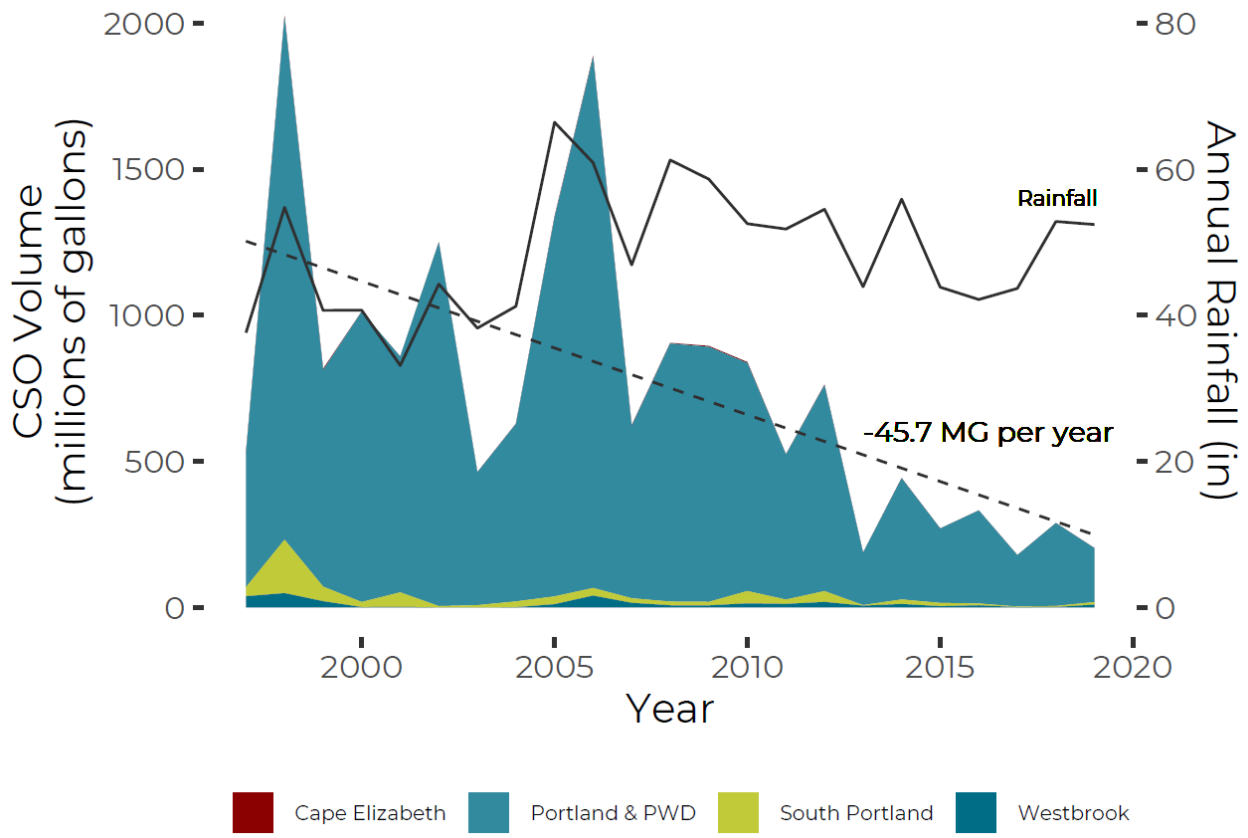
curtis.bohlen@maine.edu

https://www.cascobayestuary.org/

Combined Sewer Overflows



Discharges declined almost 50 million gallons per year annually over the past 20+ years

Data: Maine DEP

Portland Water District Efforts

Updated the aeration system at the East End Wastewater Treatment Facility in 2017

Manage the plant to optimize removal of nitrogen

Summer discharges of nitrogen have dropped by nearly three quarters

Jerry Monkman, ecophotography.com

East End WWTF, Portland, ME

2022-2023 Habitat Accomplishments

2022-2023

5 dams removed

3 culverts replaced

5.3 miles of restored stream connectivity

115 acres preserved

50 acres of wetlands protected

2021-2022

0 dams removed

0 culverts replaced

0 miles of restored stream connectivity

778 total acres preserved

252 acres of wetland protected