



# Coastal Inundation Community of Practice

**Climate Vulnerability Assessments Webinar**

**May 28, 2024**



AMERICAN SOCIETY OF  
ADAPTATION PROFESSIONALS

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**Sea Grant**



# Agenda

- Welcome
- Introduction to Climate Vulnerability Assessments
- Case Studies
- Discussion & Wrap-up



# What is a climate vulnerability assessment?

- Communities looking to address coastal flooding and severe weather can identify the people and places in harm's way
- **Exposure + Sensitivity + Adaptive Capacity**



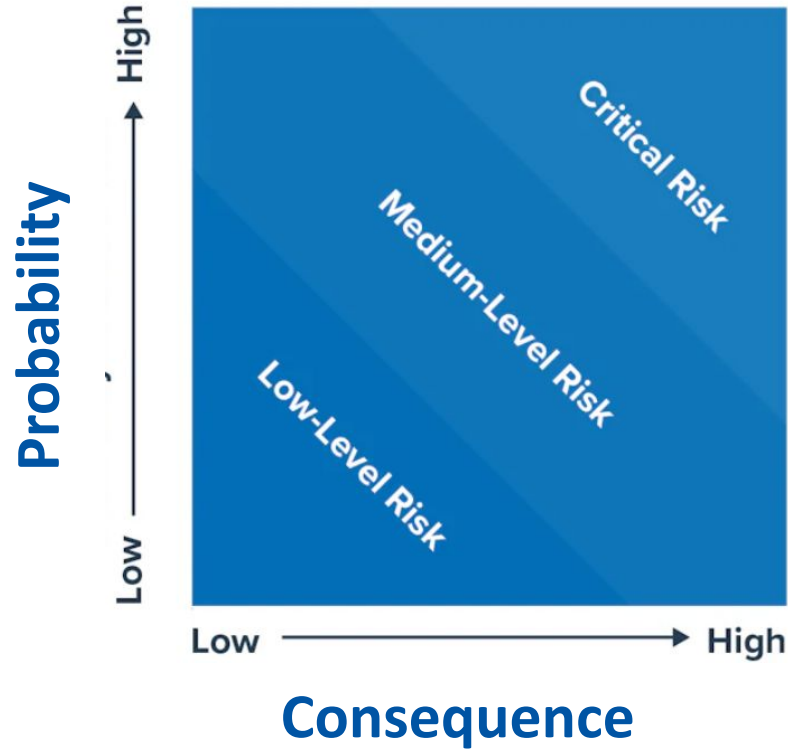
# Terminology

<b>Exposure</b>	People, assets, and ecosystems in places where they could be adversely affected by hazards
<b>Sensitivity</b>	Degree to which a system, population, or resource is or might be affected by hazards
<b>Adaptive Capacity</b>	Ability to adjust to a hazard, take advantage of new opportunities, or cope with change

U.S. Federal Government, 2014: U.S. Climate Resilience Toolkit. [Online] <http://toolkit.climate.gov>.



# Risk



Graphic from mindtools.com



# Regional Case Studies



**Jessica Brunacini**

**Coastal Community Resilience  
Extension Associate  
Main Sea Grant**



**Ruby Pap**

**Coastal Land Use Extension Specialist  
Hawai'i Sea Grant**



**Julia Chase**

**Program Manager, Chief Resilience Officer,  
City of San Diego**



# Case Study 1: Southern Maine



**Jessica Brunacini**

**Coastal Resilience Specialist  
Maine Sea Grant**



## Climate Ready Coast - Southern Maine

A Regional Coastal Resilience Plan for  
Southern Maine

November 2023  
July 18, 2023



# Assessing Vulnerability to Coastal Hazards in Southern Maine

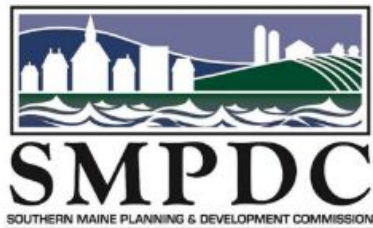


**Coastal Inundation Community of Practice**

Jessica Brunacini, PhD

Coastal Resilience Specialist

# Climate Ready Coast Southern Maine: Project Team



Abbie Sherwin,  
Melanie Nash, &  
Julia Maine



wellsreserve  
at laudholm

Wells National Estuarine  
Research Reserve

Jake Aman,  
Chris Feurt, &  
Annie Cox



Jessica Brunacini &  
Kristen Grant



Dani Boudreau &  
Gwen Shaughnassey



NFWF

Funded by the National Coastal  
Resilience Fund



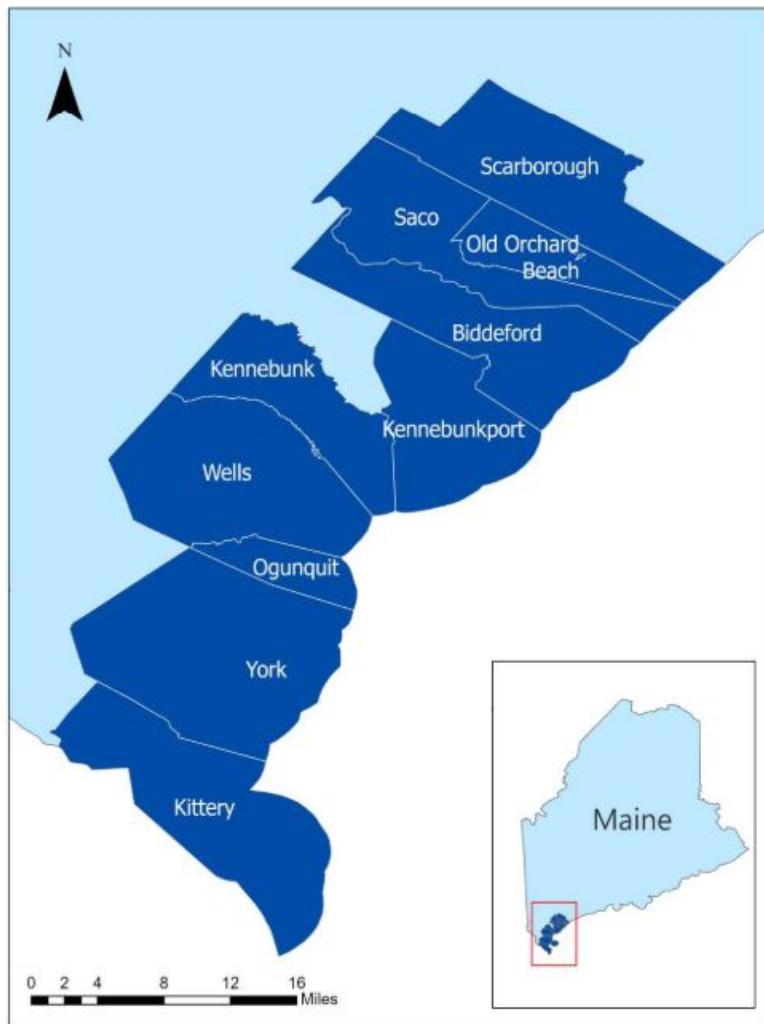
# Project Objectives

## What?

2-year project to develop a regional coastal resilience plan for 10 Southern Maine coastal communities

## Why?

- Fill local and regional capacity gaps
- Continue and advance partnerships
- Coordinate on common priorities
- Leverage existing data, resources, and tools
- Enhance understanding of multi-hazard impacts and vulnerabilities
- Develop strategic priority projects and opportunities for advancing coastal community resilience



## Features of the project region:

- 10 municipalities
- 381 miles of coastline
- 38,259 acres of conserved land
- 6 state ecological focus areas
- Critical habitat including sand dunes, salt marshes, wetlands, open space, and forested areas.



### Assess Coastal Hazard Impacts & Vulnerabilities

- Draft vulnerability assessment mapping tool
- WG & AC review & provide input on draft
- Finalize mapping tool



### Identify & Visualize Adaptation Strategies

- Matrix of locally relevant adaptation strategies, focus on nature-based solutions (NBS)
- Visual renderings of example adaptation strategies for 15 priority sites



### Assess Regional Resilience Planning Needs, Challenges, & Barriers

- Stakeholder survey
- Stakeholder interviews
- Establish Working Group (WG) & Advisory Committee (AC)



### Identify Key Vulnerable Areas

- Project team uses tool to identify 'hot spots' of vulnerability
- Sub-regional WG workshops to refine list of 'hot spots'
- Workshop for WG & AC to identify priority vulnerable areas



### Regional Coastal Resilience Plan

- Outlines local and regional resilience needs
- Identifies priority vulnerable areas for resilience action
- Presents coastal adaptation strategies, focus on NBS
- Foundation for continued regional coordination &

## Working Group & Advisory Committee

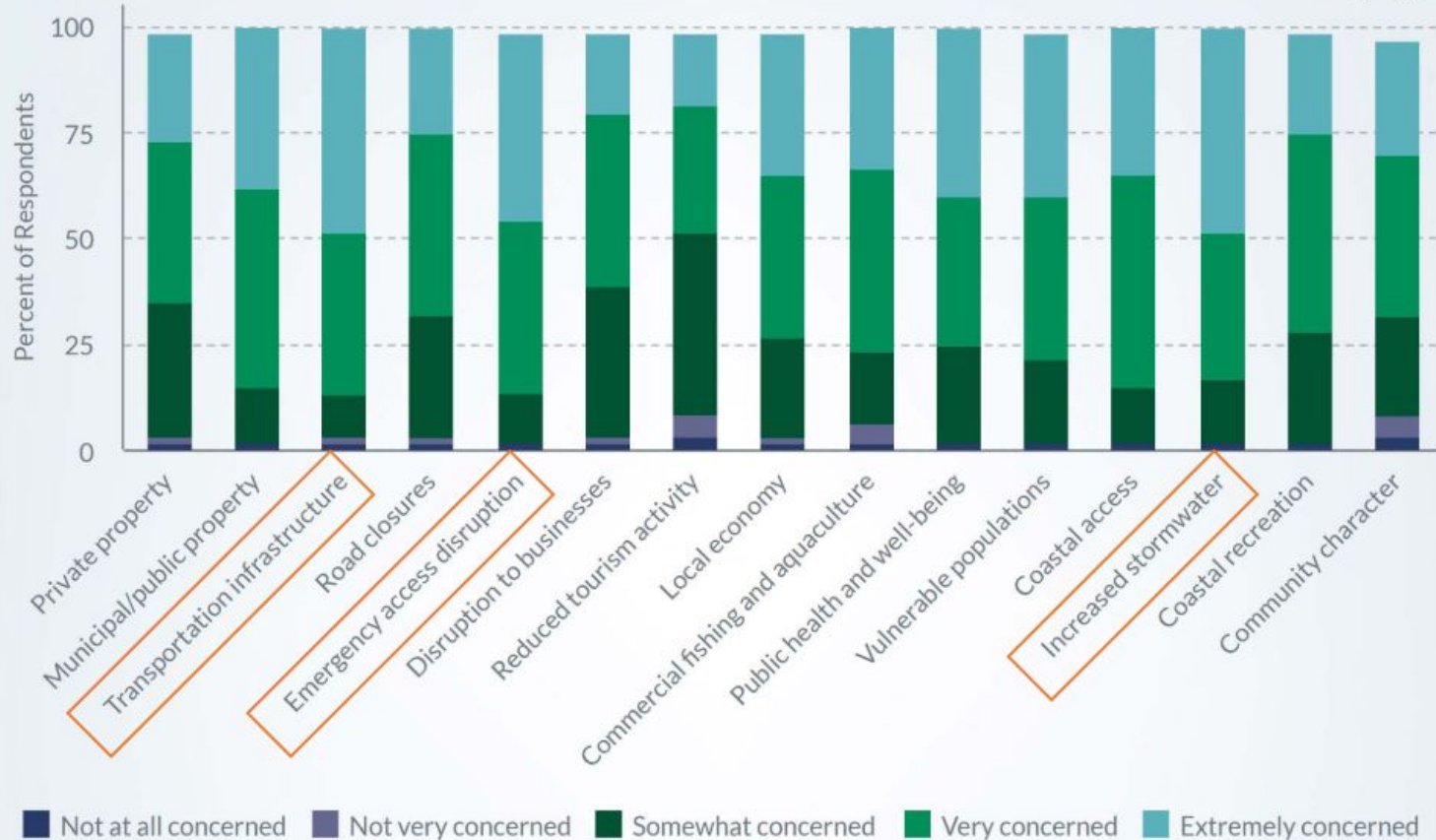
- Municipal staff, including town manager, planners, and public works officials
- Volunteer municipal committee members (e.g., energy, sustainability)
- Local and regional land trusts
- Natural resource management agencies
- Emergency management agencies
- Social services programs
- Scientists and researchers



# **Identifying Planning Concerns, Priorities, & Needs**

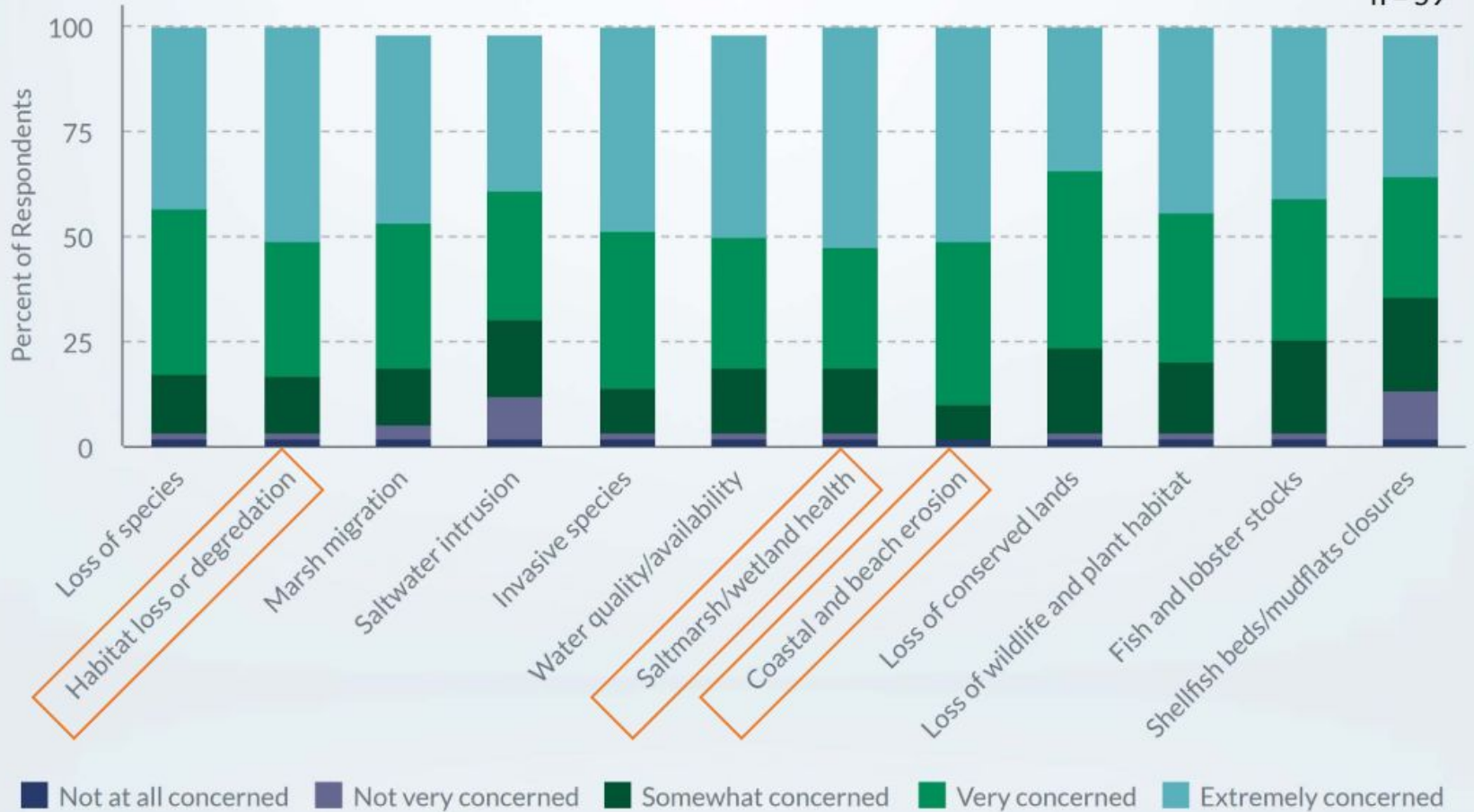
# Level of concern about coastal hazard impacts on the built and social environment

n = 60



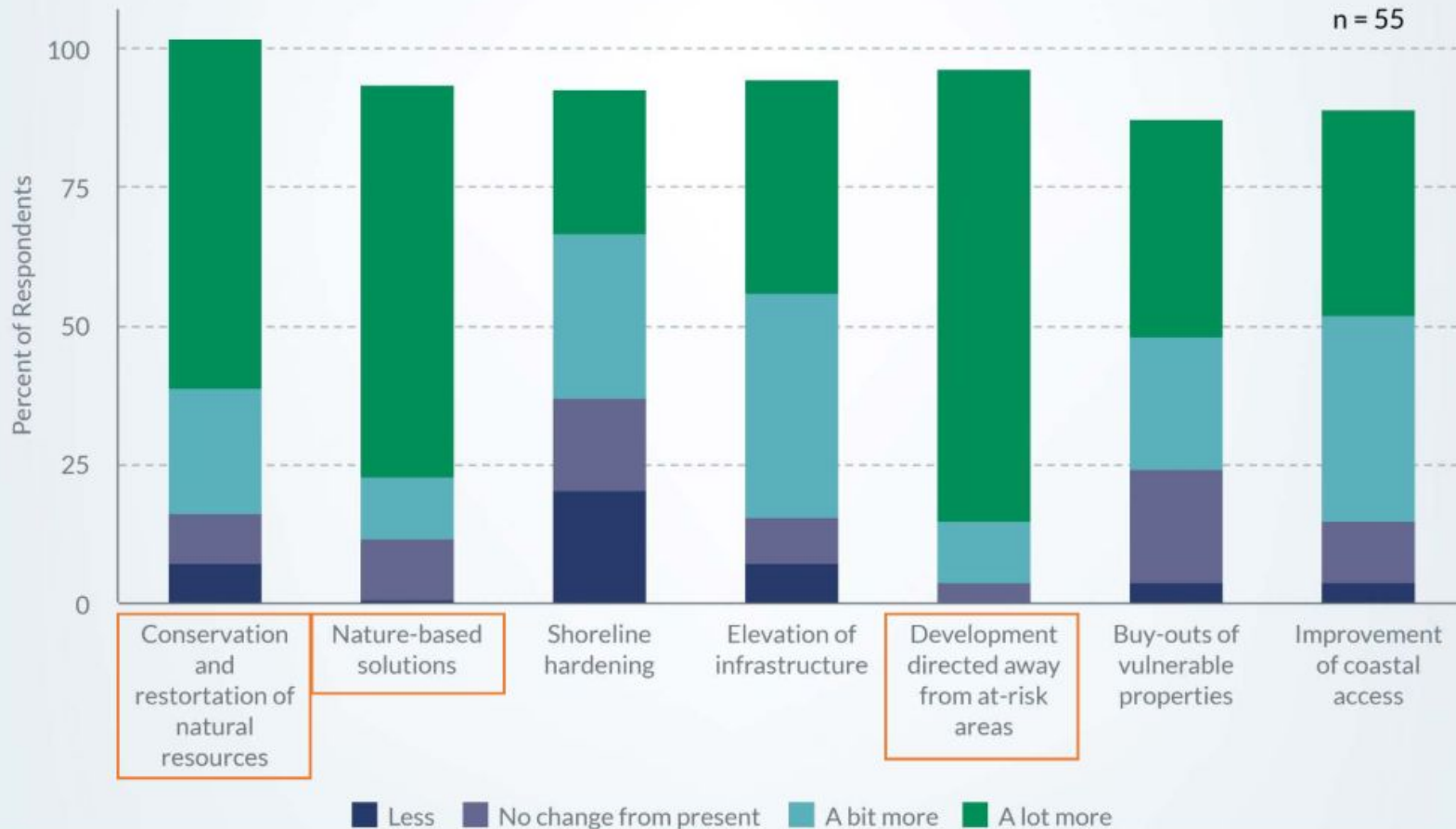
# Level of concern about coastal hazard impacts on the natural environment

n = 59



# Would you like to see more or less of the following in southern Maine over the next 10 to 30 years?

n = 55



# **Assessing Coastal Hazard Vulnerability**

# What ECOLOGICAL information would you like to see included in the vulnerability assessment?

Examples: Beginning with Habitat wildlife data, marsh migration, conserved lands

An assessment of the land status of areas of salt marsh habitat and likely marsh migration lands. Who owns these lands and what condition are they in? Maybe classify in broad categories such as excellent, good, poor, very degraded?

data on Inland land parcels that are vulnerable to flooding due to climate change.

It would be great if the economic analysis part included the value of ecosystem services to coastal economies, even if in a general way

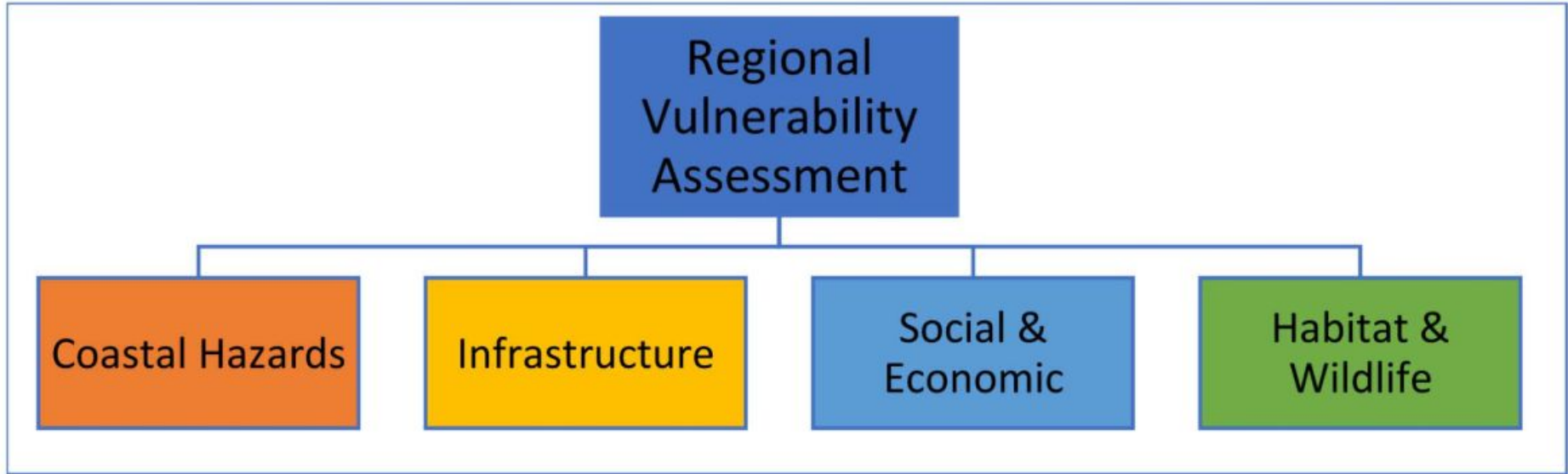
Any municipal survey or research data on intertidal species, including shellfish and their habitat. For example, harvesters in certain areas have said that most soft-shell clams are shifting from the lower intertidal to

Locations of focus areas for rare species as well as identifying areas high in invasive species that could be restored

The occurrence of threatened and endangered species as well as at risk wildlife species in the assessment area. This likely should include the piping plover, least tern, saltmarsh sparrow, roseate tern and red knot.

Approximate the monetary value of these ecological resources.

# Regional Vulnerability Assessment Categories

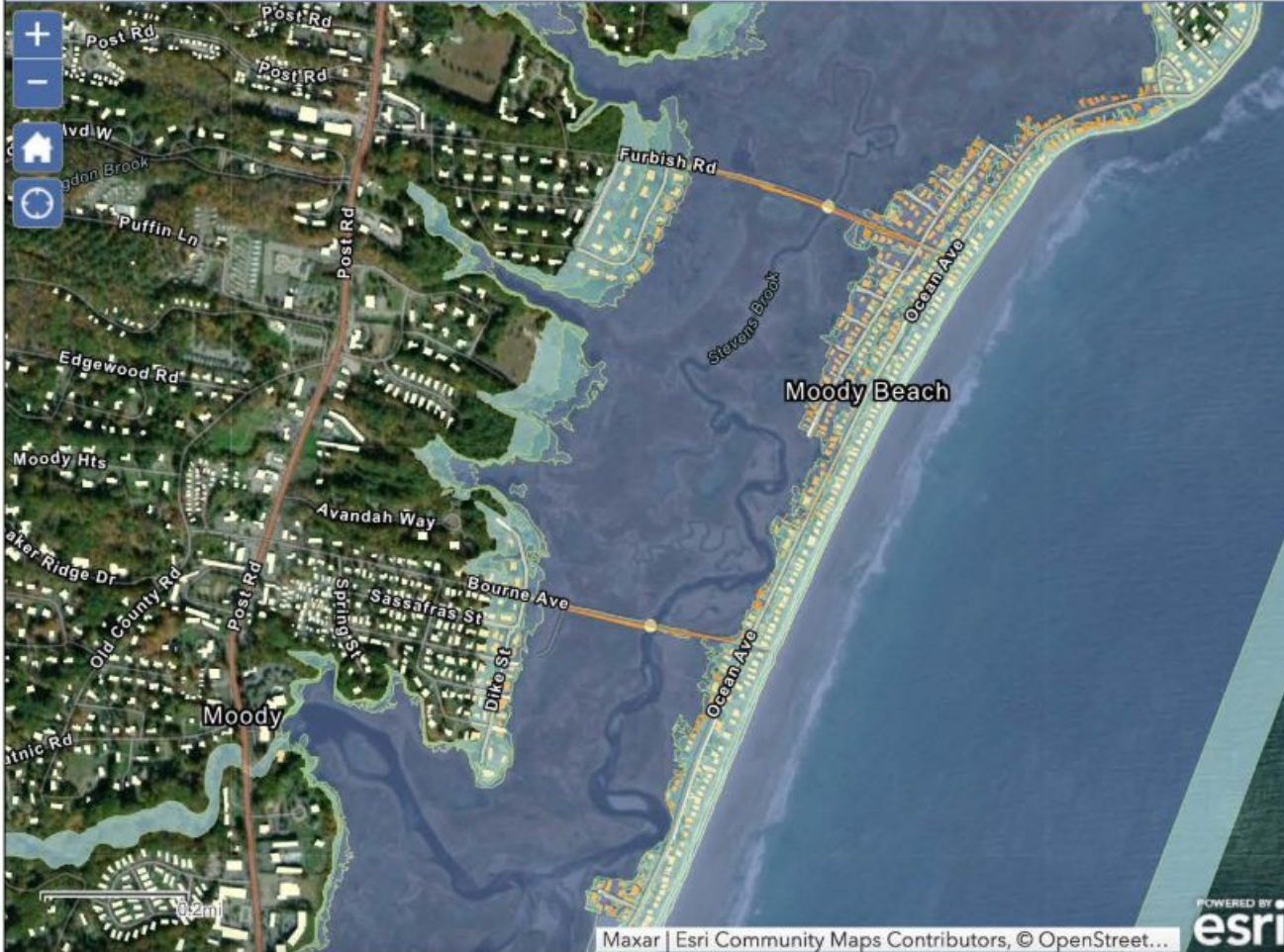


<b>Coastal Hazards</b>		
<b>Topic</b>	<b>Source</b>	<b>Link</b>
Sea level rise ( <i>ME Climate Council 'commit to manage' scenarios: 1.5 ft and 3.9 ft</i> )	ME Geological Survey (MGS)*	<a href="#">Sea level rise/storm surge viewer</a>
Regulatory floodplain (FIRM) ( <i>final data not yet available for OOB</i> )	FEMA	<a href="#">FEMA Map Service Center</a>
Storm surge (supplement FIRM data)	NOAA data – different recurrence interval storms	
Coastal bluff maps	MGS*	<a href="#">Coastal Bluffs</a>
Coastal sand dune maps	MGS*	<a href="#">Sand Dune Boundaries</a>
Areas of existing vulnerability based on local knowledge ( <i>new layer needed</i> )	Climate Ready Coast project* (Google map of survey responses)	<a href="#">Stakeholder survey summary</a>
Water Quality	ME DEP	<a href="#">EGAD Database</a> (Environmental and Geographic Analysis Database)

<b>Infrastructure</b>		
<b>Topic</b>	<b>Source</b>	<b>Link</b>
Roads ( <i>designated based on classification &amp;/or usage?</i> )	ME DOT, municipalities?	<a href="#">ME DOT Public Map Viewer</a>
Evacuation routes	ME Emergency Management Agency (MEMA)	
Tidal road crossings, existing and future	Maine Coastal Program*	<a href="#">Tidal Restriction Atlas</a>
Overtopping potential of coastal engineering structures from 100-year storm BFE	MGS	<a href="#">Coastal Structure and Dune Crest Overtopping Potential Viewer</a>
Critical facilities (hospitals/healthcare facilities, water & wastewater treatment plants, power stations, schools, senior centers, nursing homes)	Maine GeoLibrary, municipalities, York Co. Community Action (YCCAC), County EMA	<a href="#">GeoLibrary Catalog</a>
Emergency centers	Maine GeoLibrary, municipalities	<a href="#">GeoLibrary Catalog</a>
Marine infrastructure (commercial and recreational boating)	DMR (properties with easements); LMF (properties it has funded); other?	<a href="#">DACF Boating Facilities</a>
Utilities (buried and above-ground)	Municipalities	

Social & Economic		
Topic	Source	Link
Demographic data regarding social vulnerability	SMPDC (via Army Corps' <a href="#">Social Vulnerability Index</a> )*	<i>SMPDC developing data</i>
Coastal Risk Explorer ( <i>overlap with infrastructure and coastal hazard</i> )	The Nature Conservancy (TNC)*	<a href="#">Coastal Resilience Tool</a>
Public boating facilities ( <i>related to marine infrastructure in Infrastructure section</i> )	ME Bureau of Parks and Lands ( <i>incomplete dataset, some manual data entry likely required</i> )	<a href="#">ME Boating Facilities</a>
Historic structures & sites	ME Historic Preservation Commission	
Transit routes and stops ( <i>overlap with infrastructure section</i> )	YCCAC, SMPDC, Portland Area Comprehensive Transp. System (PACTS)	
Social service locations ( <i>overlap with critical facilities item of Infrastructure section</i> )	YCCAC, The Opportunity Alliance (TOA – <i>Portland-area Community Action Program</i> )	
Housing - serving vulnerable populations & housing stock condition (Businesses - <i>potential disclosure/privacy issues - instead of GIS layer, maybe <u>have working group</u> apply local knowledge about this.</i> )	YCCAC, ME Housing	
Land use at parcel level ( <i>based on municipal data</i> )	Municipalities	
Municipal growth areas	Municipalities	
Impervious cover (buildings, roads) 5-meter pixel	ME IF&W or Microsoft	<a href="#">Microsoft building footprint layer</a>
Parcels with development potential ( <i>based on GEI build-out analysis</i> )	Municipalities / GEI	

<b>Habitat &amp; Wildlife</b>		
<b>Topic</b>	<b>Source</b>	<b>Link</b>
Current tidal marshes	ME Natural Areas Program (MNAP)*	<a href="#">Current ME tidal marshes</a>
Marsh migration 2.0	MNAP*	<a href="#">Potential marsh migration</a>
Significant wildlife habitat & physical natural resources	ME Dept. of Inland Fisheries & Wildlife	<a href="#">Beginning with Habitat</a>
Diadromous fish habitat	DMR* and USFWS	DMR <a href="#">Nature's Network</a>
Terrestrial and wetland core-connector network	USFWS Nature's Network	<a href="#">Nature's Network</a>
Submerged aquatic vegetation	DEP	<a href="#">DEP Eelgrass</a>
Conserved lands, priority lands	MNAP*; Land Trusts; ME Coast Heritage Trust (MCHT)*	<a href="#">ME conserved lands</a>
Resilience areas ( <i>overlap with hazards, infrastructure, and social/economic data; uses national scale info</i> )	NFWF CREST tool	<a href="#">CREST</a>
Undeveloped habitat blocks & connectors and unfragmented forest	MNAP*	<a href="#">ME coastal undeveloped habitat blocks</a>
Biological resources, sensitive shorelines, and human-use resources (e.g., public beaches and parks (MGS 'overtopping' layer IDs some engineering structures better)	NOAA Environmental Sensitivity Index (ESI)*	<a href="#">ESI</a>
Future coastal habitat ( <i>overlap with marsh migration data</i> )	TNC*	<a href="#">Future Habitat viewer</a>
Shellfish and commercial aquaculture sites	ME DMR	DMR
Urban impaired watersheds	DEP	<a href="#">ME DEP</a>



### Vulnerability Assessment Results

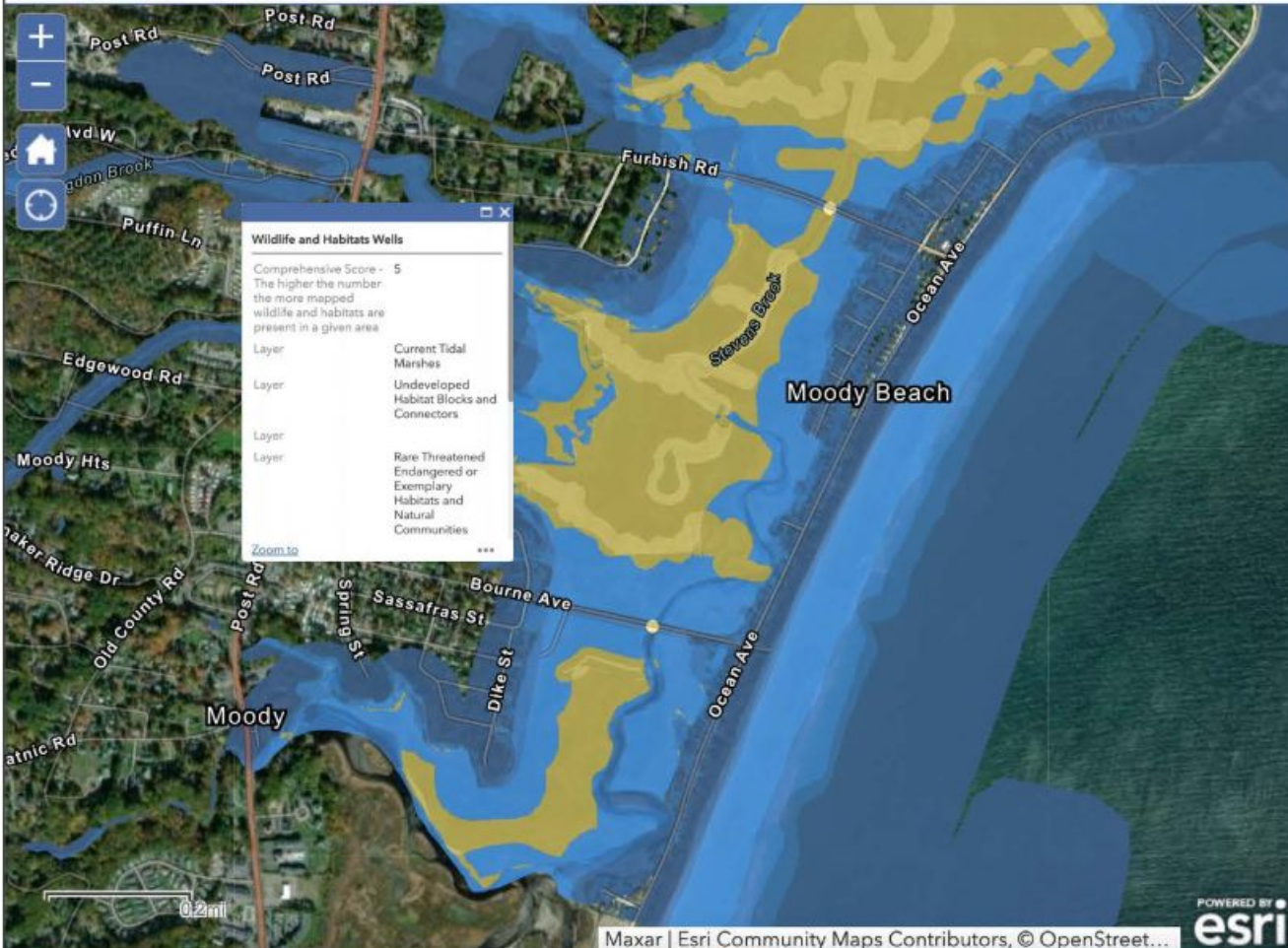
#### Layers

- Social Vulnerability Index - Social Vulnerability Index ...
- Tidal Crossings and Dams Vulnerability Assessment ...
- Building Footprints Vulnerability Assessment ...
- Roads Vulnerability Assessment ...
- Wildlife and Habitats Vulnerability Assessment ...
- FEMA Regulatory Floodplain - 1% Annual Chance Event (no zones) ...
- 1 6 ft only (no HAT) - 1 6 ft only (no HAT) ...
- 3 9 ft only (no HAT or 1 6 ft) - 3 9 ft only (no HAT or 1 6 ft) ...



Wildlife & Habitats

- Current Tidal Marshes ...
- Future Coastal Habitats - Future Coastal Habitats ...
- Undeveloped Habitat Blocks and Connectors ...
- Freshwater Wetlands and Vernal Pools ...
- Aquifers and Source Protection Areas ...
- Rare Threatened Endangered or Exemplary Habitats and Natural Communities ...
- Riparian Habitat and Connectors ...
- Fin Fish Habitats - Fin Fish Habitats ...
- Submerged Aquatic Vegetation and Shellfish Growing Areas ...
- Seabird Nesting and Shorebird Areas ...
- Tidal Waterfowl Wading Bird Habitat ...
- Conserved Lands ...
- Deer Wintering Areas ...
- FEMA Regulatory Floodplain - 1% Annual Chance Event (no zones) ...



Wildlife & Habitats

Layers

- Comprehensive Wildlife and Habitats Scarborough ...
- Comprehensive Wildlife and Habitats Saco ...
- Comprehensive Wildlife and Habitats Old Orchard Beach ...
- Comprehensive Wildlife and Habitats Biddeford ...
- Comprehensive Wildlife and Habitats Kennebunkport ...
- Comprehensive Wildlife and Habitats Kennebunk ...
- Comprehensive Wildlife and Habitats Wells ...
- Comprehensive Wildlife and Habitats Ogunquit ...
- Comprehensive Wildlife and Habitats York ...
- Comprehensive Wildlife and Habitats Kittery ...
- Current Tidal Marshes ...
- Future Coastal Habitats - Future Coastal Habitats ...
- Undeveloped Habitat Blocks and Connectors ...



# Regional Coastal Vulnerability Assessment Presentation – Feedback from WG & AC

	Suggestion	Request Venue	Feasible? / Appropriate?	Change Made?	Notes
1	<p>Make symbology of all layers colorblind-friendly. Red/green color ramps used for comprehensive maps are not colorblind friendly and need to be changed. (Yellow-to-blue or single color ramps tend to be more accessible)</p> <p>Change needed to following layers:</p> <ul style="list-style-type: none"> <li>• Comprehensive coastal hazard</li> <li>• Future tidal road crossings and future other crossings layers</li> <li>• Comp. crossings and dams</li> <li>• Comp. building footprints</li> <li>• Comp. roads</li> <li>• All wildlife and habitat comp. layers</li> </ul>	6/28 webinar	Yes / Yes	Yes	
2	*New layer: Include municipal infrastructure, like water and wastewater infrastructure, in map (include in Infrastructure category)	6/28 webinar	Somewhat / Yes	*Yes	*Municipal infrastructure layers have been made available via SMPDC's online Esri account (the web mapping tool platform) for individual map users to temporarily add the layers to the map. Layers included in map are those provided by municipalities from original data request
3	Include water quality data in map	Email	Yes / No	No	These data won't necessarily support objectives of the project and might increase complexity of tool. Interested users can add this data to their individual 'map session' using map widget.

# Identifying Key Vulnerable Areas

## Working Group member quote

“When moving toward prioritizing projects / action, it would be important to **move beyond maps / coarse social indicators to incorporate data that examine priorities relative to values, emotional, cultural, psychological aspects and other factors that shape sense of community**, etc. that are not well characterized through economic data. This would mean **expanding what might "count" as data, not only quantitative but also qualitative, visual, co-produced data, etc.**”

# Process of ID'ing Priority Vulnerable Areas

Project Team Uses VA Mapping Tool to ID Vulnerability Hot Spots (~50)

```
graph TD; A[Project Team Uses VA Mapping Tool to ID Vulnerability Hot Spots (~50)] --> B[Sub-regional Working Group Sessions: 1st Pass of Vulnerability Hot Spots]; B --> C[Project Team refines Profile Sheets, develops & applies Tier 1 criteria to ID short list of Priority Vulnerable Areas]; C --> D[Workshop: Working Group provides input, engages in dialogue, applies Tier 2 criteria & local knowledge to refine list]; D --> E[Working Group votes on 15 Priority Vulnerable Areas];
```

Sub-regional Working Group Sessions: 1<sup>st</sup> Pass of Vulnerability Hot Spots

Project Team refines Profile Sheets, develops & applies Tier 1 criteria to ID short list of Priority Vulnerable Areas

Workshop: Working Group provides input, engages in dialogue, applies Tier 2 criteria & local knowledge to refine list

Working Group votes on 15 Priority Vulnerable Areas

# **Visualizing Resilience Strategies**

## Mile Road Neighborhood (Wells)

Note: These conceptual visualizations are illustrative examples of possible coastal adaptation strategies; they are not engineered designs and are not conveying strategies that should be used at the site. Strategies shown are only a potential set of possible adaptation measures, other strategies from the Coastal Adaptation Strategy Matrix could be applicable and may be included in visualizations of other priority sites. Please reference the Matrix and other priority site visualizations for further information. Please note that the sea level rise conditions depicted in these visualizations reflect changes that will happen over time.



## Biddeford-Saco Downtown (Biddeford & Saco)

Note: These conceptual visualizations are illustrative examples of possible coastal adaptation strategies; they are not engineered designs and are not conveying strategies that should be used at the site. Strategies shown are only a potential set of possible adaptation measures, other strategies from the Coastal Adaptation Strategy Matrix could be applicable and may be included in visualizations of other priority sites. Please reference the Matrix and other priority site visualizations for further information. Please note that the sea level rise conditions depicted in these visualizations reflect changes that will happen over time.



### Affordable Climate Resilient Housing Development

- Increases available housing
- Integrates strategies to reduce flooding potential



### Greenway Park

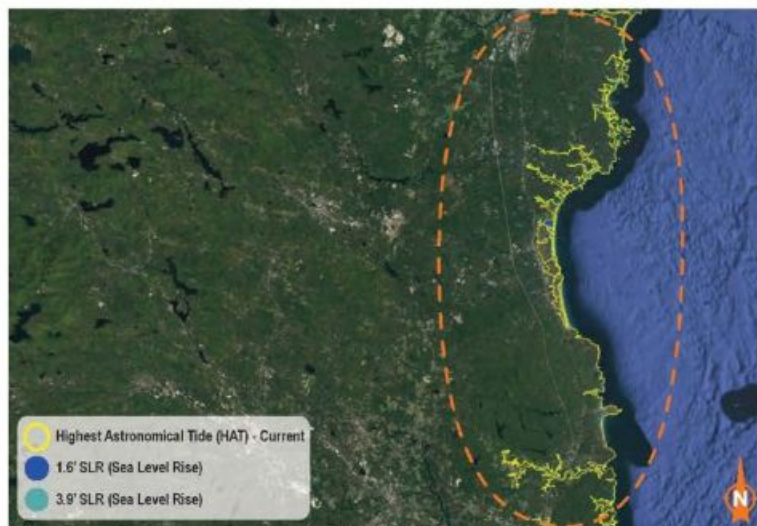
- Integrate bike and pedestrian trails
- Improves aesthetics
- Improves natural function of floodplain
- Protects from flooding
- Improves wildlife habitat
- Improves recreation

### Restored Floodplain

- Improves wildlife habitat
- Protects from flooding and erosion
- Improves aesthetics
- Improves water quality
- Retains stormwater

## Coastal Areas (Southern Maine)

Note: These conceptual visualizations are illustrative examples of possible coastal adaptation strategies; they are not engineered designs and are not conveying strategies that should be used at the site. Strategies shown are only a potential set of possible adaptation measures, other strategies from the Coastal Adaptation Strategy Matrix could be applicable and may be included in visualizations of other priority sites. Please reference the Matrix and other priority site visualizations for further information. Please note that the sea level rise conditions depicted in these visualizations reflect changes that will happen over time.



- Highest Astronomical Tide (HAT) - Current
- 1.6' SLR (Sea Level Rise)
- 3.9' SLR (Sea Level Rise)



### Managed Retreat

- Relocation of high-risk development to upland areas
- Prevents repeated property damage and loss
- Mitigates risk to people, property, and the local tax base
- Saves money
- Removal of impervious areas
- Increases wildlife habitat
- Improves water quality
- Lessens effects of sea level rise and storm surge
- Creates new public coastal access and recreation opportunities

### Salt Marsh Restoration

- Protects against erosion and flooding
- Improves water quality
- Provides wildlife habitat



### Dune Restoration

- Prevents erosion and reduces flooding
- Acts as buffer for storm surge
- Provides wildlife habitat

# **Regional Coastal Resilience Plan**



# Climate Ready Coast - Southern Maine

A Regional Coastal Resilience Plan for Southern Maine

November 2023

July 18, 2023

# Thank you!

Questions? Thoughts?  
Please feel free to get in touch!

Jessica Brunacini, PhD

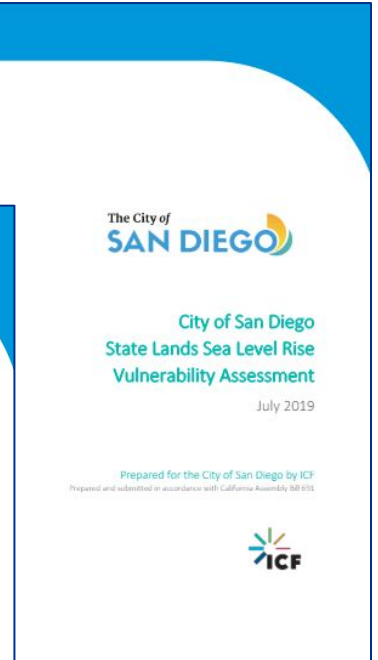
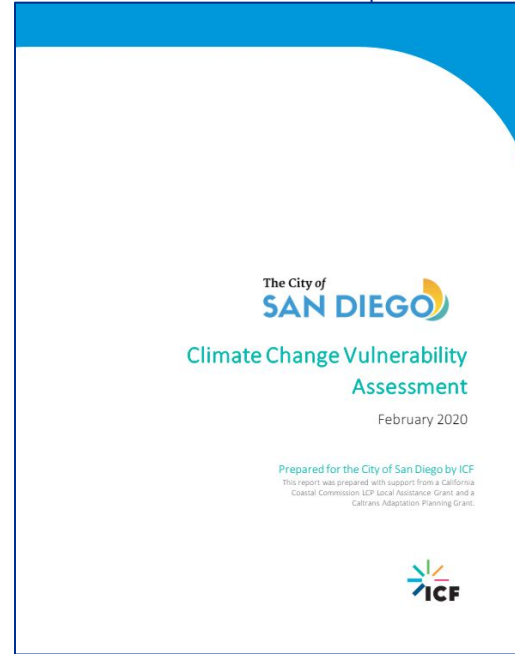
[jessica.brunacini@maine.edu](mailto:jessica.brunacini@maine.edu)

# Case Study 2: San Diego, CA



**Julia Chase**

**Chief Resilience Officer,  
City of San Diego**



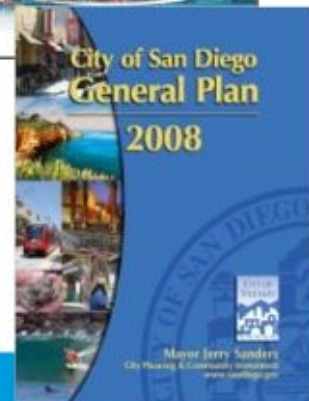
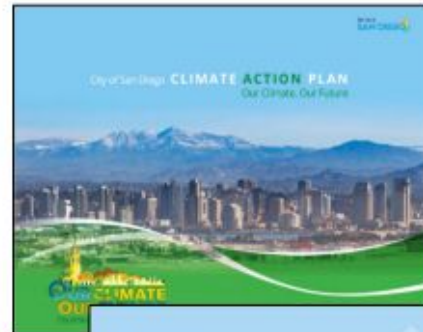
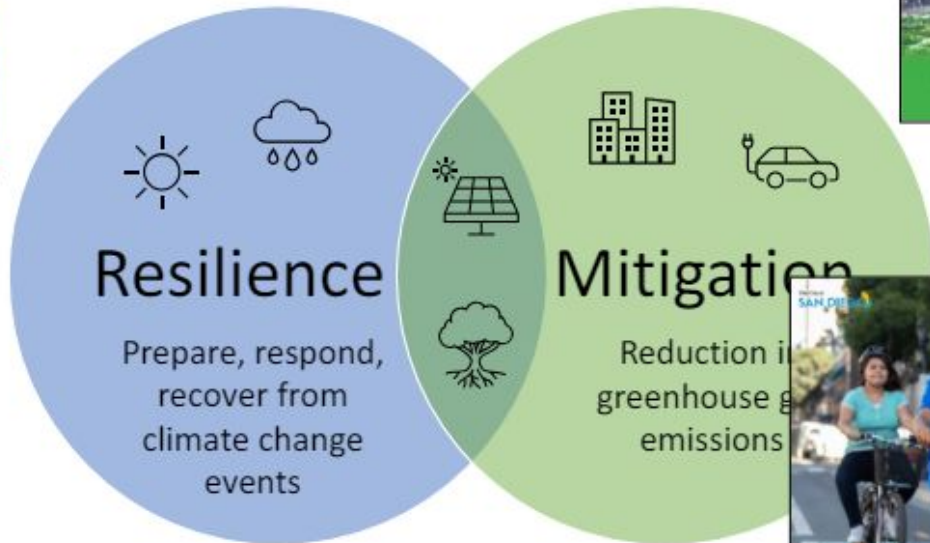
# City of San Diego Vulnerability Assessments

Julia Chase  
Chief Resilience Officer



# City of San Diego





# Building towards Climate Resilient SD



# Vulnerability Assessment: project set up

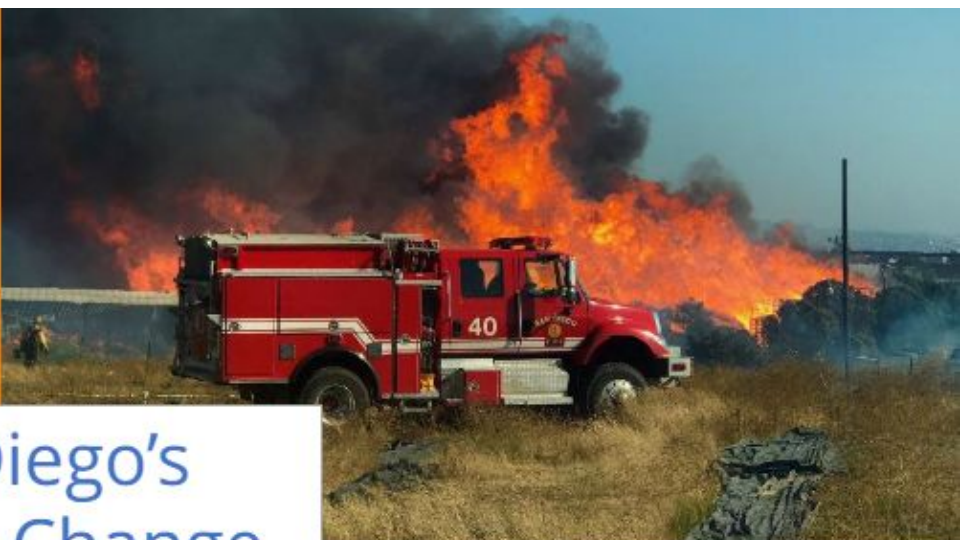
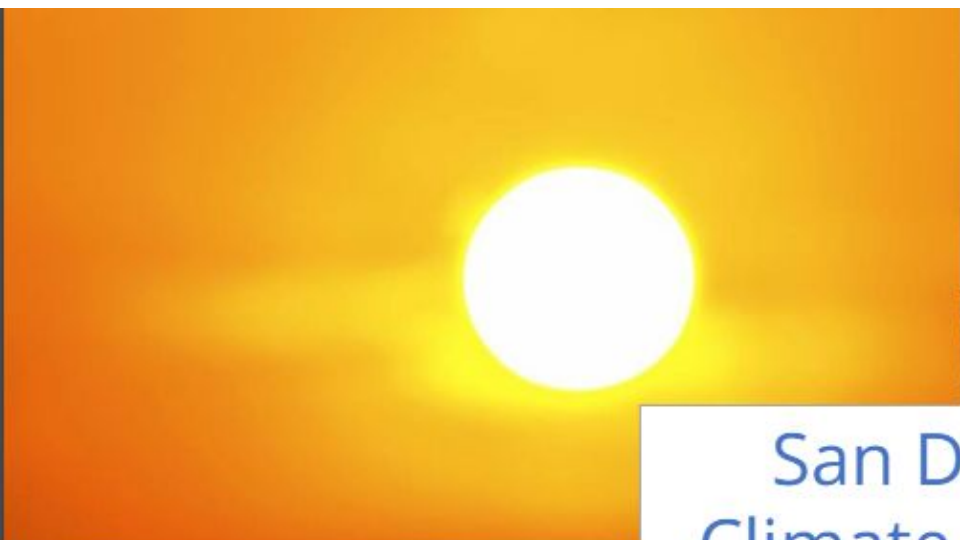
1. Review historical impact data and other relevant reports
2. Identify any gaps in data or technical studies
3. Identify key climate change hazards
4. Analyze relevant climate projections, select future scenarios
5. Determine critical assets, identify project team

## Criteria for critical assets

1. If the asset type/resource (or its function) is necessary for continuity of important City operations;
2. If the asset type/resource (or its function) is a key driver in the City's economy;
3. If loss of the asset type/resource would present equity concerns;
4. If the asset type/resource is critical to safeguarding biological diversity and other environmental priorities.

# Vulnerability Assessment: scope

Sector	City Department(s)	Critical Asset Types
<b>Public Safety</b>	Fire-Rescue, Police	Fire stations, police stations, lifeguard stations, police patrol and specialty vehicles, maintenance facilities, other public safety assets
<b>Water Infrastructure</b>	Public Utilities	Dams, water pipes, wastewater pipes, water pump stations, wastewater pump stations, distribution reservoirs, water treatment plants, wastewater treatment plants
<b>Transportation</b>	Transportation and Storm Water; Real Estate Assets	Major arterials, Brown Field Municipal Airport, Montgomery-Gibbs Executive Airport, bridges
<b>Storm Water</b>	Transportation and Storm Water	Drain pump stations, outfalls, levees
<b>Open Space/ Environment</b>	Parks and Recreation, Environmental Services; Public Utilities	Conservation areas/open space/source water, community parks, Miramar Landfill, beaches
<b>Additional</b>	Real Estate Assets; Parking Organization; Commission for Arts and Culture	Recreation centers, libraries, City buildings, historical, tribal cultural, and archaeological resources



San Diego's  
Climate Change  
Hazards



# Vulnerability

**Exposure:** The presence of people, infrastructure, natural systems, and economic, cultural, and social resources in areas that are subject to harm

**Sensitivity:** The degree to which a system is affected by climate-related stimuli

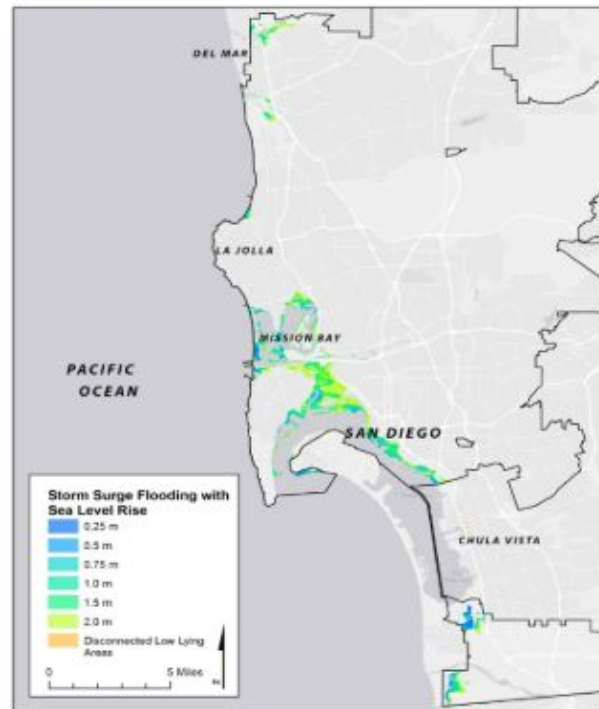
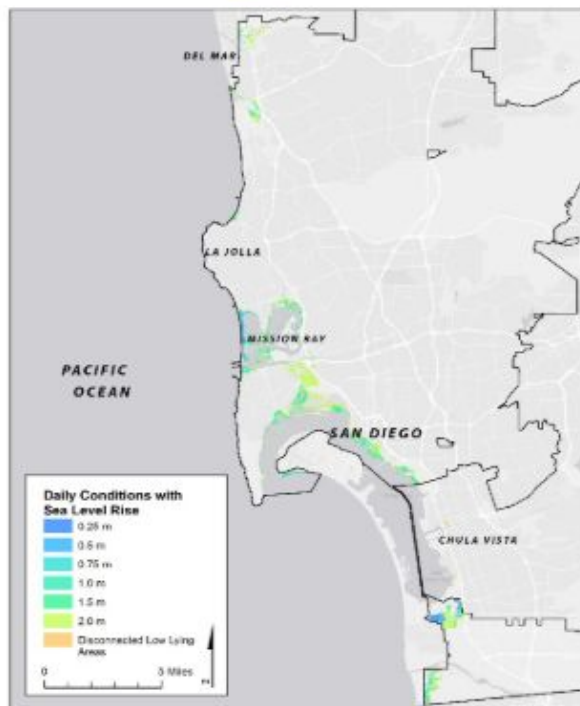
**Adaptive Capacity:** The degree to which a population or system has the ability to make adjustments to respond to actual or expected climate impacts

# Risk

**Likelihood:** The probability that a population or asset/system will be vulnerable to climate impacts

**Consequence:** The effect of climate change exposure on community structures, functions, and populations and on the asset owner or service providers' ability to maintain a standard condition or level of service

## Daily and Storm Surge Coastal Flooding



# Consequences Screening

- Aimed to understand the types of potential outcomes that could occur due to damage, disruption, or failure of assets
- Focused on outcomes that would interfere with City objectives
- Consequences assessed through discussions with City departments

# Vulnerability Assessment Findings

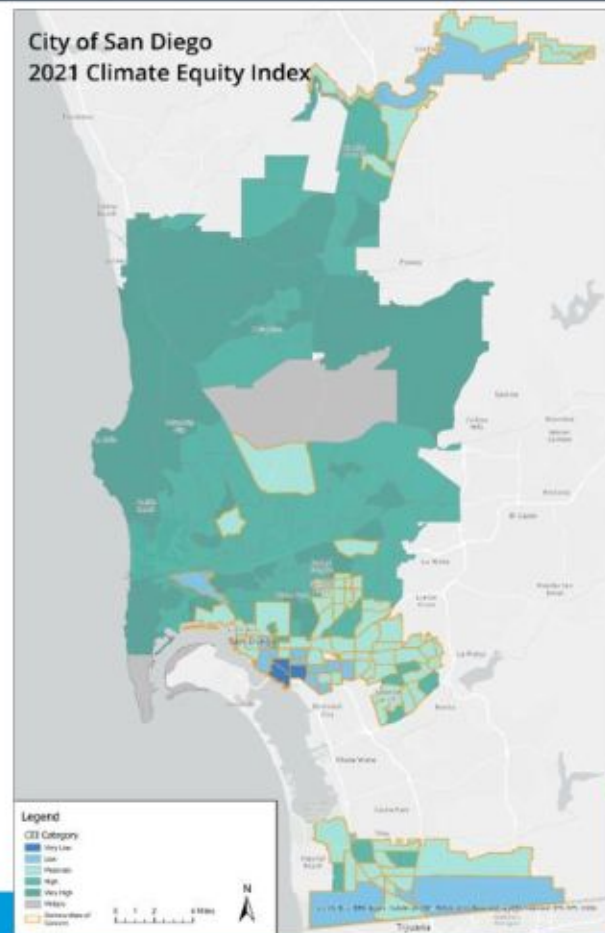
Sectors	Asset Types	Medium Vulnerability	High Vulnerability
Public Safety	Fire Stations	●	
	Police Stations		●
	Lifeguard Stations	● ● ●	● ●
	Maintenance Facilities	● ●	
	Police Patrol and Specialty Vehicles	●	
	Other Public Safety	● ●	●
Water	Dams	●	●
	Water Pipes	● ● ●	●
	Wastewater Pipes	● ● ●	●
	Water Pump Stations	● ●	●
	Wastewater Pump Stations	●	● ●
	Distribution Reservoirs	● ●	
	Water Treatment Plants	●	
	Wastewater Treatment Plants	● ●	
Transportation and Storm Water	Airports	●	●
	Bridges	● ● ●	● ● ●
	Major Arterials	● ● ● ●	● ●
	Drain Pump Stations		● ● ● ●
	Outfalls	● ●	● ● ● ●
	Levees	● ●	
Open Space and Environment	Conservation Areas/Open Space/Source Water Land		● ● ● ● ● ● ●
	Community Parks	● ● ●	● ● ●
	Miramar Landfill	●	
	Beaches	● ● ●	● ●
Additional Assets	Recreation Centers	● ● ●	●
	Libraries	●	
	City Buildings	●	
	Historical, Tribal Cultural, and Archaeological Resources	●	● ● ● ● ●

Coastal Hazards:

- Sea Level Rise
- Storm Surge
- Coastal Erosion
- Wildfire
- Extreme Heat
- Precipitation

# Climate Equity

prioritizing our City's Communities of Concerns to ensure that investments and resources are prioritized for those with the greatest needs and vulnerabilities



# Climate Equity

- Identify vulnerability populations
- Screen for disproportionate impacts
- Inform strategy development and prioritization



# Stakeholder & Community Engagement

- Internal City coordination
- Stakeholder Advisory Group
- Community events
- Brochure & postcard

**CLIMATE CHANGE VULNERABILITY ASSESSMENT**

**Planning for a Better Future**  
As the climate changes the City of San Diego (City) is taking steps to build a resilient future for everyone who lives in and visits San Diego. In 2015, the City developed a Climate Action Plan with an objective to reduce greenhouse gas emissions to sustain a stronger economy and higher quality of life.

Since then, the City has completed a Climate Change Vulnerability Assessment to evaluate which parts of San Diego are at a greatest risk from climate change hazards (coastal hazards, wildfire, extreme heat, and precipitation) and the potential impacts of that exposure might be. This is the first step in creating a plan for a climate resilient San Diego, which will include climate adaptation and resilience strategies to address identified vulnerabilities and support all communities.

Together, we will prepare for a changing climate while focusing on social equity, health, safety, and sustainability.

**Our Steps Towards Climate Resilience**

```

    graph TD
      A[CLIMATE ACTION PLAN] --> B[VULNERABILITY & RESILIENCE ASSESSMENT]
      B --> C[CLIMATE RESILIENCE PLAN]
      C --> D[Stakeholder Engagement]
  
```

**Climate Change Hazards**

- COASTAL HAZARDS**  
Increased coastal erosion and flooding due to changes in storms and rising sea levels.
- WILDFIRE**  
Increased risk for a six days or higher temperatures and drier conditions.
- EXTREME HEAT**  
Higher average temperatures and more frequent heat waves.
- PRECIPITATION**  
The ability to attract rainfall and more intense drought cycles.

Working towards a climate resilient San Diego

The City of SAN DIEGO



# Stakeholder Advisory Group

- Provided feedback and input key points in the vulnerability assessment
- Members included:
  - Internal City departments
  - State and federal agencies
  - Local nonprofit and environmental organizations
  - Community-based organizations
  - Transportation agencies
  - Energy utilities
  - Academic institutions



# Funding Overview

## VULNERABILITY ASSESSMENTS

- State Lands SLR Vulnerability Assessment
- SLR Vulnerability Assessment
- Citywide Climate Change Vulnerability Assessment

## CLIMATE RESILIENT SAN DIEGO

- CCC LCP Grant
- Caltrans SB1

## COASTAL RESILIENCE MASTER PLAN

- NFWF
- State Coastal Conservancy

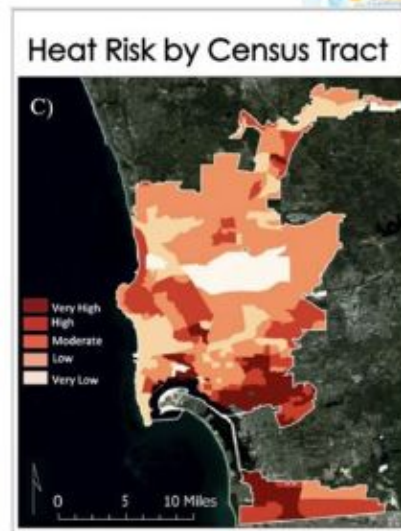
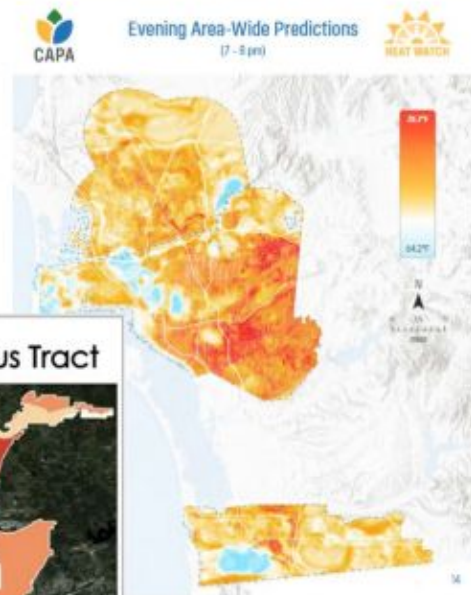
# Additional Considerations

- Legislative requirements
  - AB691
  - SB379
  - SB1035
- State Guidance
  - Ocean Protection Council and California Coastal Commission SLR Policy Guidance



# Additional Considerations

- Living document as science is updated
- Importance of downscaled data



Thank you!

**Julia Chase**

ChaseJ@sandiego.gov

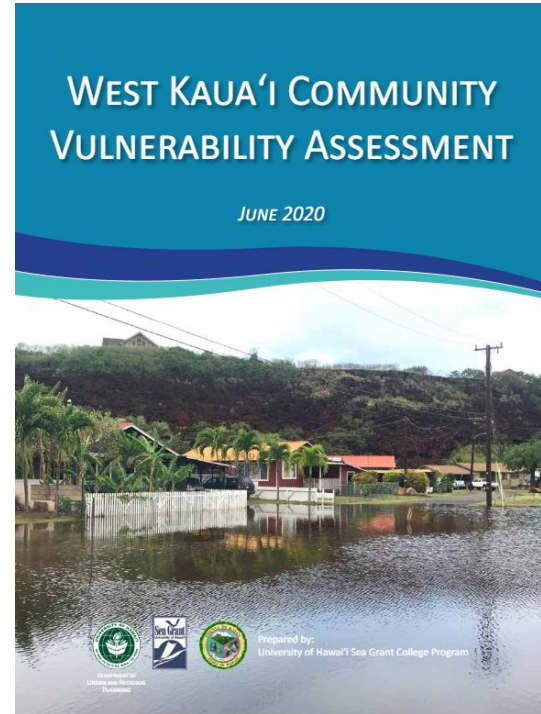


# Case Study 3: Hawai`i



**Ruby Pap**

**Coastal Land Use Extension Specialist  
Hawai'i Sea Grant**



# Integrating Climate Science with Local Knowledge through Community Vulnerability Assessment in W. Kaua'i

Ruby Pap

Coastal Land Use Extension Specialist, UH Sea Grant

Co-Authors: Dr. Danielle Spirandelli, Alisha Summers, Erin 'Bear' Braich



Department of  
Urban and Regional Planning

UNIVERSITY  
of HAWAII  
MĀNOA



# WEST KAUA'I COMMUNITY VULNERABILITY ASSESSMENT

JUNE 2020



Prepared by  
University of Hawai'i Sea Grant



# WEST KAUA'I COMMUNITY PLAN

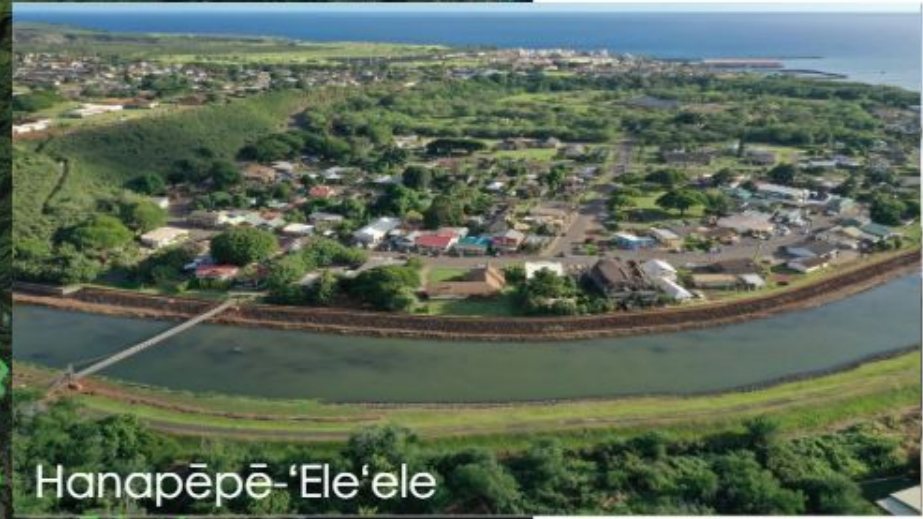
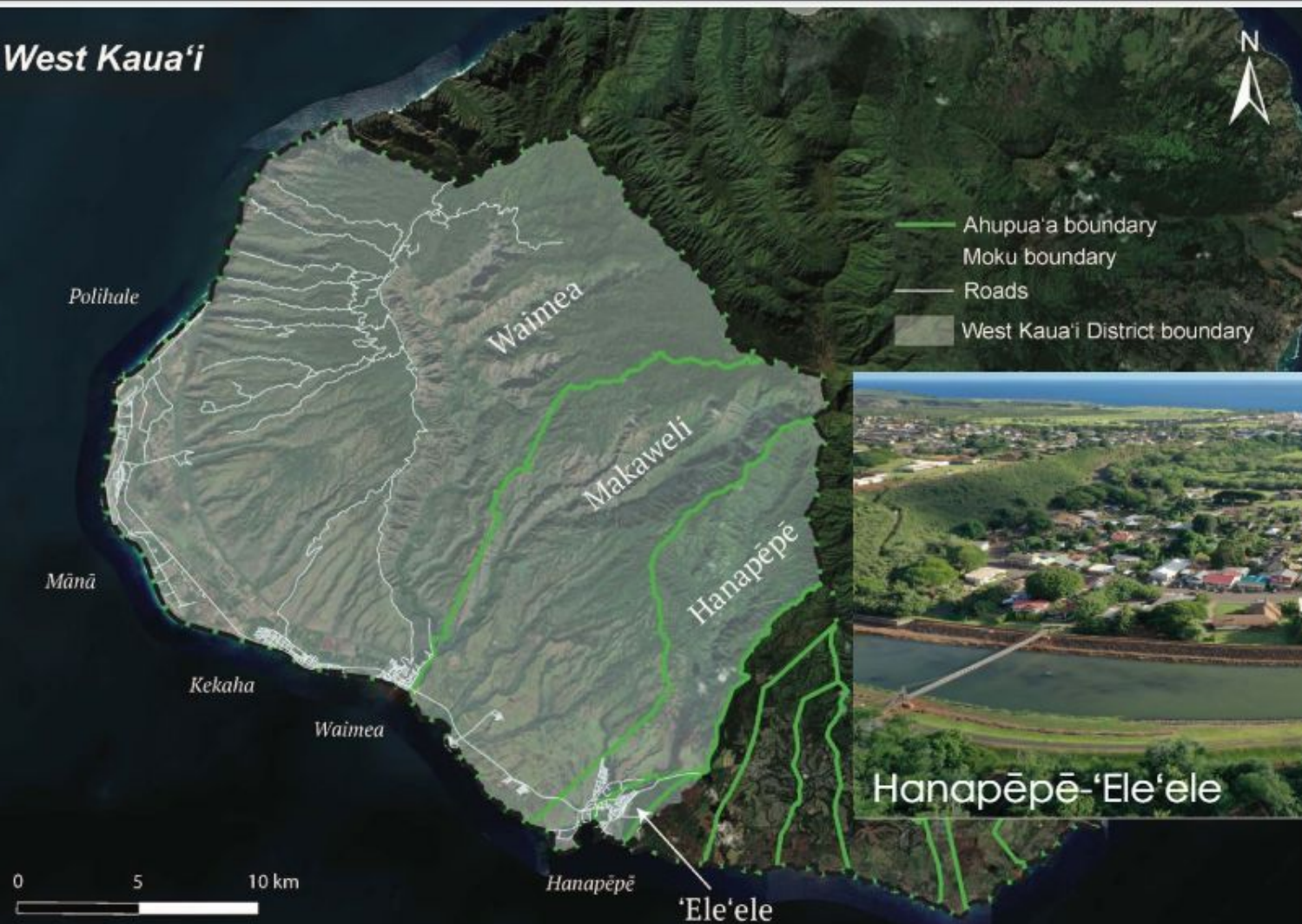
PLANNING COMMISSION APPROVED DRAFT | MAY 26, 2020



University of Hawai'i Sea Grant College Program



# West Kaua'i



Where on the westside do you live or work? (please circle or fill in the blank)

Hanapepe-Eleele

Waimea

Kekaha

Other: \_\_\_\_\_

The following management concerns have been identified by community stakeholders and asset owners on West Kauai. Please let us know if these are the concerns you share for your community, in terms of being vulnerable to coastal hazards and sea level rise (please follow the directions below)

- Circle YES or NO if you agree with the management concern
- Rank the management concerns 1-6 by filling in a number next to each management concern (rank each number once)
- If there are any management concerns you believe have been left out, please fill let us know below

\_\_\_ Agriculture

YES or NO

\_\_\_ Drainage & Levees

YES or NO

\_\_\_ Cultural Assets

YES or NO

\_\_\_ Coastal Properties & Beaches

YES or NO

\_\_\_ Critical Infrastructure (water supply, wastewater, electrical)

YES or NO

\_\_\_ Transportation & Evacuation

YES or NO

Other management concern(s): \_\_\_\_\_

Are you willing to work on any of these issues through a series of meetings, field trips, etc.? If so, please provide contact information below!

Name: \_\_\_\_\_ Email: \_\_\_\_\_

Management Concern(s): \_\_\_\_\_

**Phase 1 (Feb-July 2018)**– Identifying management concerns

**30 Interviews**, background research, data collection

The West Kauai Community Vulnerability Assessment invites the West Kauai Community to:



# TACKLE SEA LEVEL RISE TOGETHER



- A special screening of the award-winning movie, 'Miss South Pacific' from Kauai Producer, Teresa Tico, will be shown!
- Learn about local sea level rise and share your mana'o about vulnerable places in West Kauai.
- Share ideas about how to adapt to sea level rise and coastal hazards. Climate experts will be on hand to answer your questions.
- Receive take home information packets!

**How to start planning!**



ALL WHO LIVE AND WORK IN WEST KAUA'I ARE WELCOME!

SLR exposure mapping + community knowledge through VCAPS scenario building = VULNERABILITY



**Phase 2: Eight 4-Hour Workshops**

University of Hawai'i Sea Grant College Program



# Management Concerns



Transportation & evacuation



Drainage & levees



Other critical infrastructure



Cultural resources

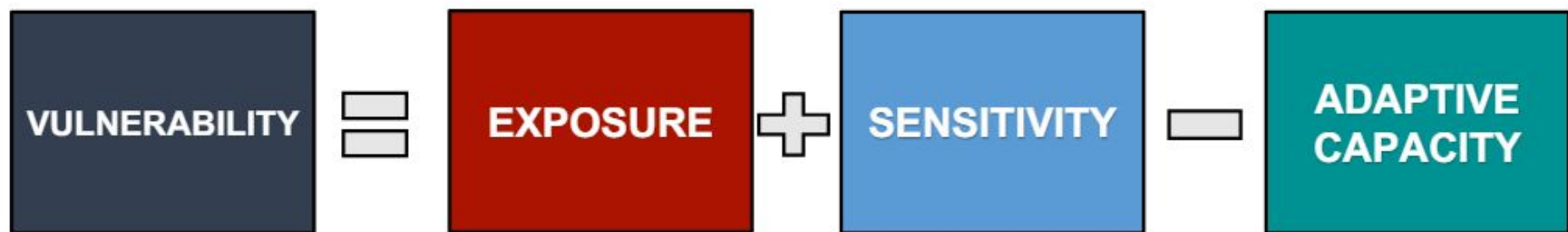


Coastal properties and beaches



Agriculture

# Understanding the Problem



# West Kaua'i Sea Level Rise Impacts

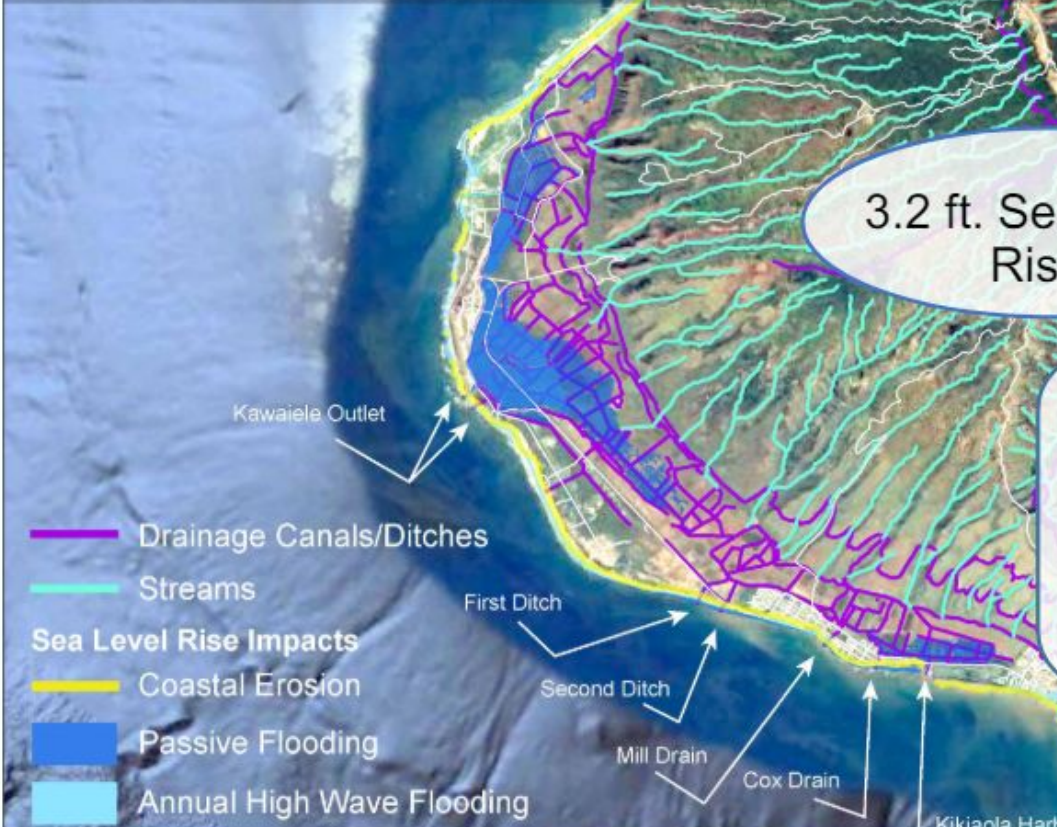
Impact: Coastal Erosion, Passive Flooding, and Annual High Wave Flooding

Scenario: 3.2 ft of Sea Level Rise (mid to late century)

3.2 ft. Sea Level Rise

**Ditches**  
Within SLR-XA: 30.28 miles  
Passive Flooding: 28.09 miles  
Erosion: 0.50 miles  
Annual High Waves: 12.95 miles

Source:  
[hawaiisealevelriseviewer.org](http://hawaiisealevelriseviewer.org)



- Drainage Canals/Ditches
- Streams
- Sea Level Rise Impacts**
- Coastal Erosion
- Passive Flooding
- Annual High Wave Flooding

*Vulnerability and Consequences Adaptation  
Planning Scenarios Process*

**Vcaps**



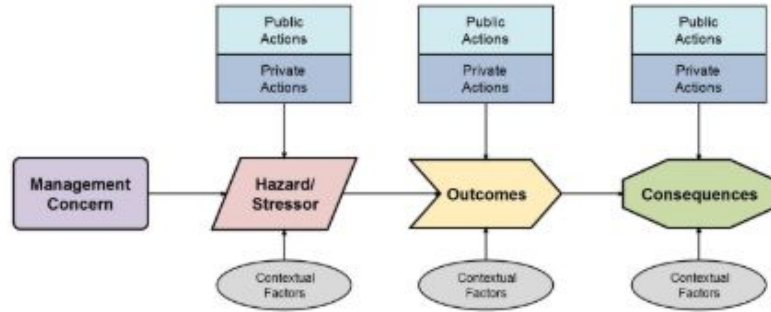
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SOUTH CAROLINA.



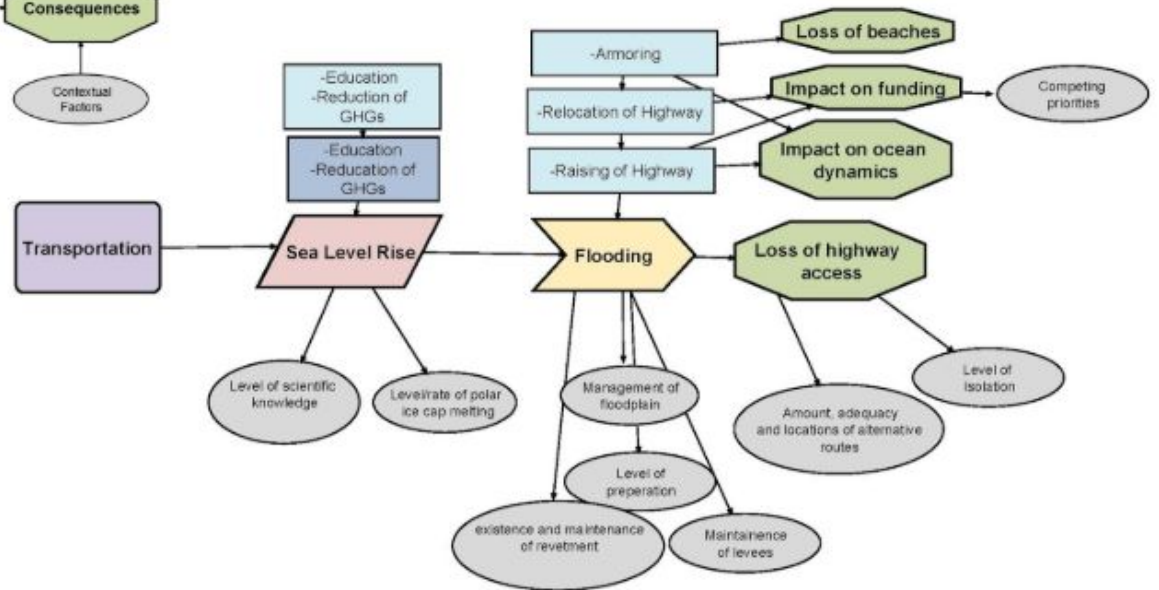
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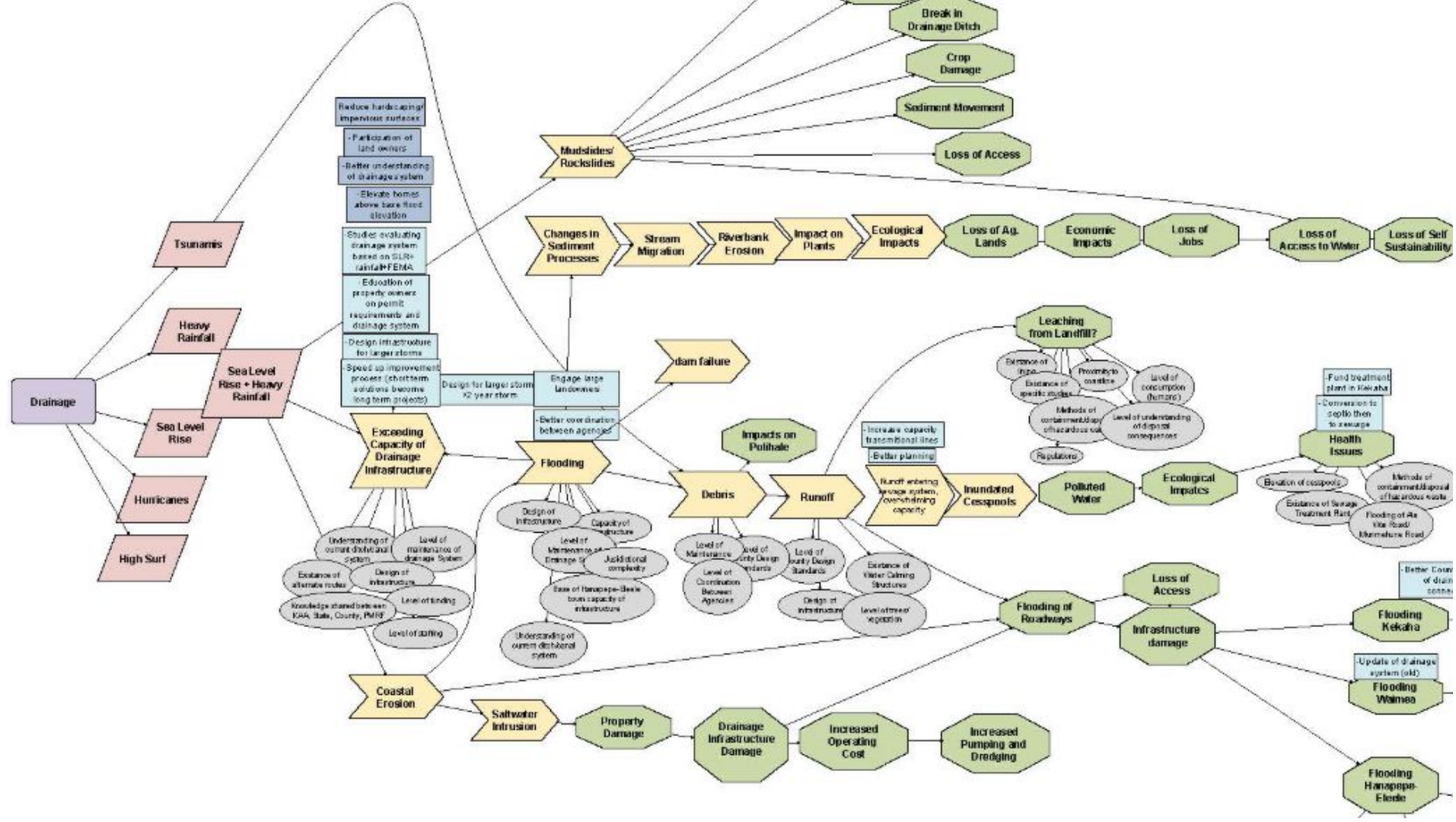


# Scenarios are represented as causal / influence diagrams



## VCAPS diagrams: Building blocks





# Management Concerns



Transportation & evacuation



Drainage & levees



Other critical infrastructure



Cultural resources



Coastal properties and beaches



Agriculture

# WEST KAUA'I COMMUNITY VULNERABILITY ASSESSMENT

JUNE 2020



# WEST KAUA'I COMMUNITY PLAN

PLANNING COMMISSION APPROVED DRAFT | MAY 26, 2020



# An Evaluation of a Community-Based Participatory Process: a case study in West Kaua'i, Hawai'i

*A Master's Thesis by Alisha Summers, UH Mānoa*



Department of  
Urban and Regional Planning

UNIVERSITY  
of HAWAII  
MĀNOA

# Results

**Key Question:** What were the workshop participant's attitude toward the overall process?



Overall, participants were satisfied with workshop process



Collaborative nature of workshop was 'most-liked' but process was insufficient in being inclusive



Limited in engaging cultural science and ancestral Hawaiian knowledge

# Results

Key Question: What was it that was gained and/or what was it that was lost from the utilization of the VCAPS modelling tool?



VCAPS garnered detailed knowledge of climate risks and potential adaptation actions



VCAPS promoted transparency



The VCAPS modelling process can feel intimidating or overwhelming, which may have limited participation

# Results

Key Question: How do the workshop participants perceive the usability and replicability of this community-based participatory process for other climate vulnerability assessments in Hawai'i?



Vulnerability assessments must meaningfully engage the community



Shortening the length of time of the overall process can make this process more usable



It is preferred that a third party leads the assessment and works in collaboration with a government dept.

# Results

Key Question: How did the West Kaua'i Community Vulnerability Assessment inform community planning in West Kaua'i



The WKCVA informed the West Kaua'i Community Plan



The WKCVA informed decision-making by some of the agencies who participated in the process



The WKCVA is informing ongoing west side community planning projects and future climate planning efforts

# Mahalo! Questions?

Ruby Pap

[rpap@hawaii.edu](mailto:rpap@hawaii.edu)

University of Hawai'i Sea Grant College Program



# The 5-W'S



**WHO**

People and Organizations



**WHERE**

Planning Area



**WHY**

Motivations and Vision



**WHEN**

Planning Horizon



**WHAT**

Outcomes and Outputs



# Scope of a Vulnerability Assessment

**Start with the  
end use in mind**



# Scope of a Vulnerability Assessment

**Start with the  
end use in mind**

Tool to identify impacts



# Scope of a Vulnerability Assessment

**Start with the  
end use in mind**

Tool to identify impacts

Tool to inform future actions



# Scope of a Vulnerability Assessment

**Start with the  
end use in mind**

Tool to identify impacts

Tool to inform future actions

Outreach or communication resource



# Scope of a Vulnerability Assessment

**Start with the  
end use in mind**

Tool to identify impacts

Tool to inform future actions

Outreach or communication resource

Support planning requirements



# Scope of a Vulnerability Assessment

**Start with the  
end use in mind**

Tool to identify impacts

Tool to inform future actions

Outreach or communication resource

Support planning requirements

Support funding opportunities



# Balancing Resources for an Assessment

## Constraints and Tradeoffs

- What **data** are needed? What is available?



# Balancing Resources for an Assessment

## Constraints and Tradeoffs

- What **data** are needed? What is available?
- What **budget** is available?



# Balancing Resources for an Assessment

## Constraints and Tradeoffs

- What **data** are needed? What is available?
- What **budget** is available?
- What **technical expertise** is available?



# Balancing Resources for an Assessment

## Constraints and Tradeoffs

- What **data** are needed? What is available?
- What **budget** is available?
- What **technical expertise** is available?
- **When** are the findings needed?



# Balancing Resources for an Assessment

## Constraints and Tradeoffs

- What **data** are needed? What is available?
- What **budget** is available?
- What **technical expertise** is available?
- **When** are the findings needed?
- What types of **outputs** are needed?



# Discussion

**Are there any other key questions you have considered or you think should be considered when approaching a Vulnerability Assessment?**



# Wrap-up



- Vulnerability assessments resource document
- Form for additional input
- Evaluation

# Stay Engaged

- Listserv
- Webinars
- Tools working group
- Newsletter





Questions?  
[ocm.sg@noaa.gov](mailto:ocm.sg@noaa.gov)



To learn more and sign up for our listserv:  
[bit.ly/ci-cop](https://bit.ly/ci-cop)

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ADAPTATION PROFESSIONALS

  
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Coastal Inundation Community of Practice