



State of the Coast

Friday, November 6, 2020

11:40 – 1:00 PM

WELCOME! THIS SESSION WILL BEGIN SHORTLY

Envisioning a resilient Oregon Coast

- Peter Ruggiero, Oregon State University
- John Bolte, Oregon State University
- Jenna Tilt, Oregon State University
- Meredith Leung, Oregon State University
- Dylan Sanderson, Oregon State University
- Katie Santon, Oregon State University

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Peter Ruggiero: Lead, Professor in CEOAS, takes an interdisciplinary approach to assessing the magnitude, frequency, and impacts of coastal hazards.



Jenna Tilt: Research social scientist focused on the relationship between environmental management, land use planning, and human behavior.

John Bolte: Professor and Head of the Department of Biological and Ecological Engineering and is the lead developer of *Envision*.



Katherine Stanton: Recently finished graduate student in the Anthropology Department under the School of Language, Culture and Society under the College of Liberal Arts

Meredith Leung: PhD student in the College of Earth, Ocean, and Atmospheric Sciences (CEOAS)



Dylan Sanderson: PhD student in the school of CCE in the College of Engineering

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Steven Dundas: Environmental economist focused on non-market valuation, coastal ecosystem services, climate change adaptation, and policy evaluation.



Amila Hadziomerspahic: PhD Student in Applied Economics

Dan Cox: Coastal hazards engineering and CH2M Hill Professor in Civil Engineering.



Special Thanks to Recently Retired Pat Corcoran: Coastal hazards extension specialist with significant experience working with coastal stakeholders and the project team.

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☰ Polls

1. Fun Fact - How fast do tsunamis move? Edit

1. How fast can tsunami flood water travel overland?

- As fast as a Boeing 747 (570 mph)
- Like a Nolan Ryan fastball (108.5 mph)
- Olympic sprinter fast (22 mph)
- It's like tidal currents in a bay, so not that fast (5 mph)
- Garden snail fast (0.03 mph)





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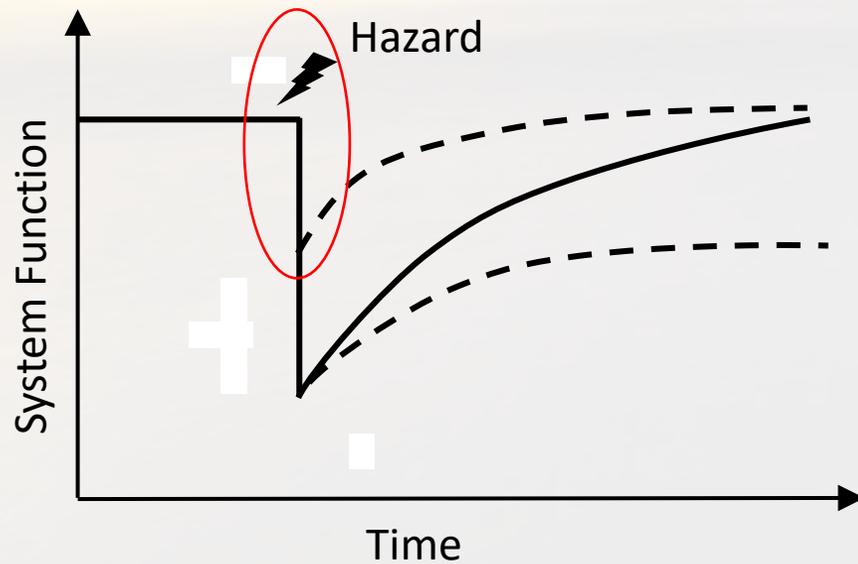


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Notion of Community Resilience

“Ability to resist, absorb and recover from a sudden stress”



❖ Engineering mitigation to increase system robustness

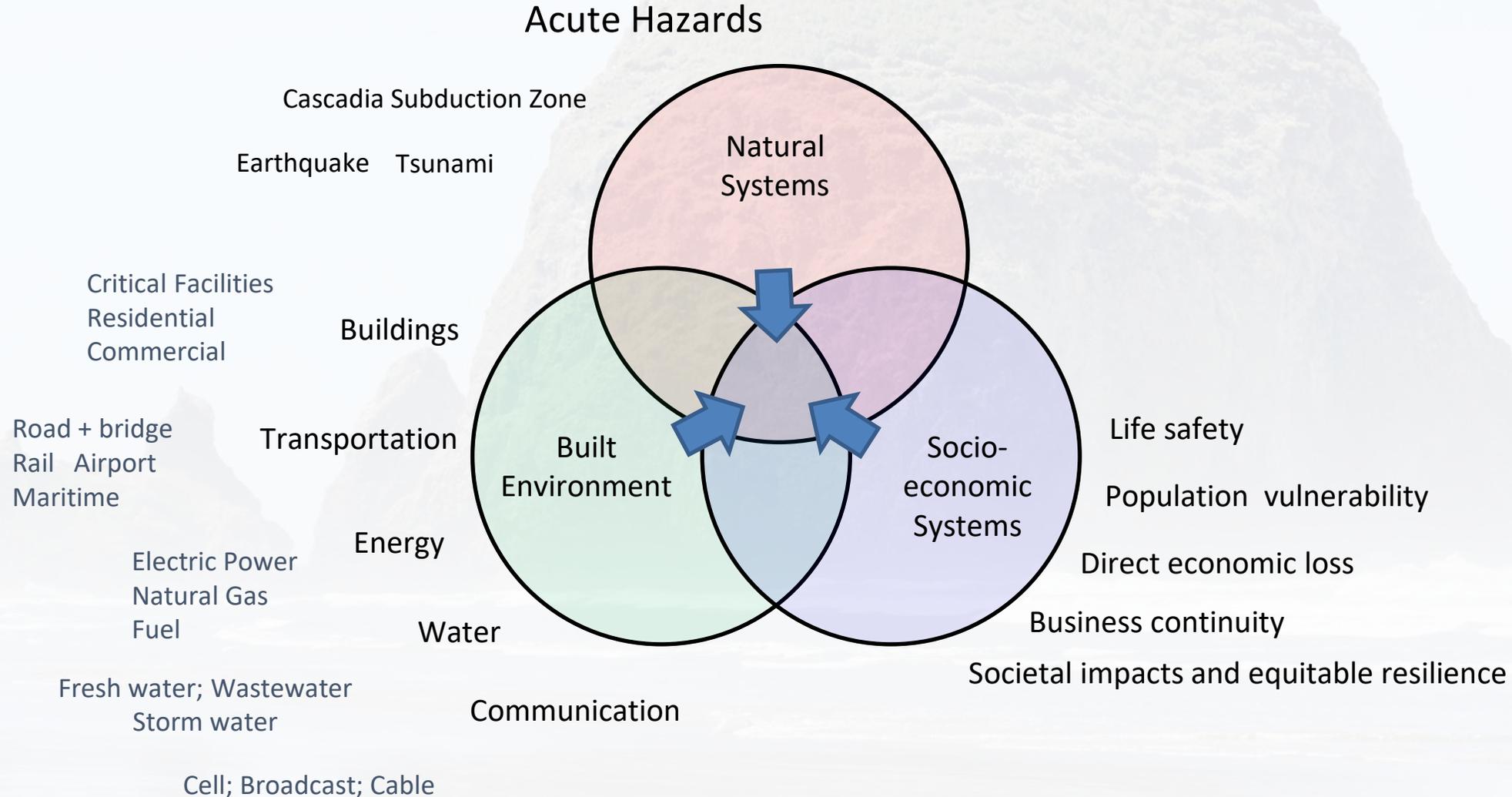


This combination of three photos taken over a six month period shows the March 11 tsunami and its aftermath at Sendai Airport in Sendai, Miyagi prefecture, northern Japan. The top photo taken March 11, 2011 shows the tsunami engulfing the airport immediately after an earthquake. The middle photo, taken June 3, 2011 and the bottom photo, taken Sept. 6, 2011 show the restored and reopened airport. AP / Kyodo News

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Polls

2. Fun Fact - Last Cascadia Subduction Zone event

1. When was the last Cascadia Subduction Zone event?

- 1534
- 1700
- 1964
- It hasn't ruptured before



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3. Fun Fact - Likelihood of a Cascadia Subduction event ▼ Edit

1. On average, how often has the CSZ ruptured?

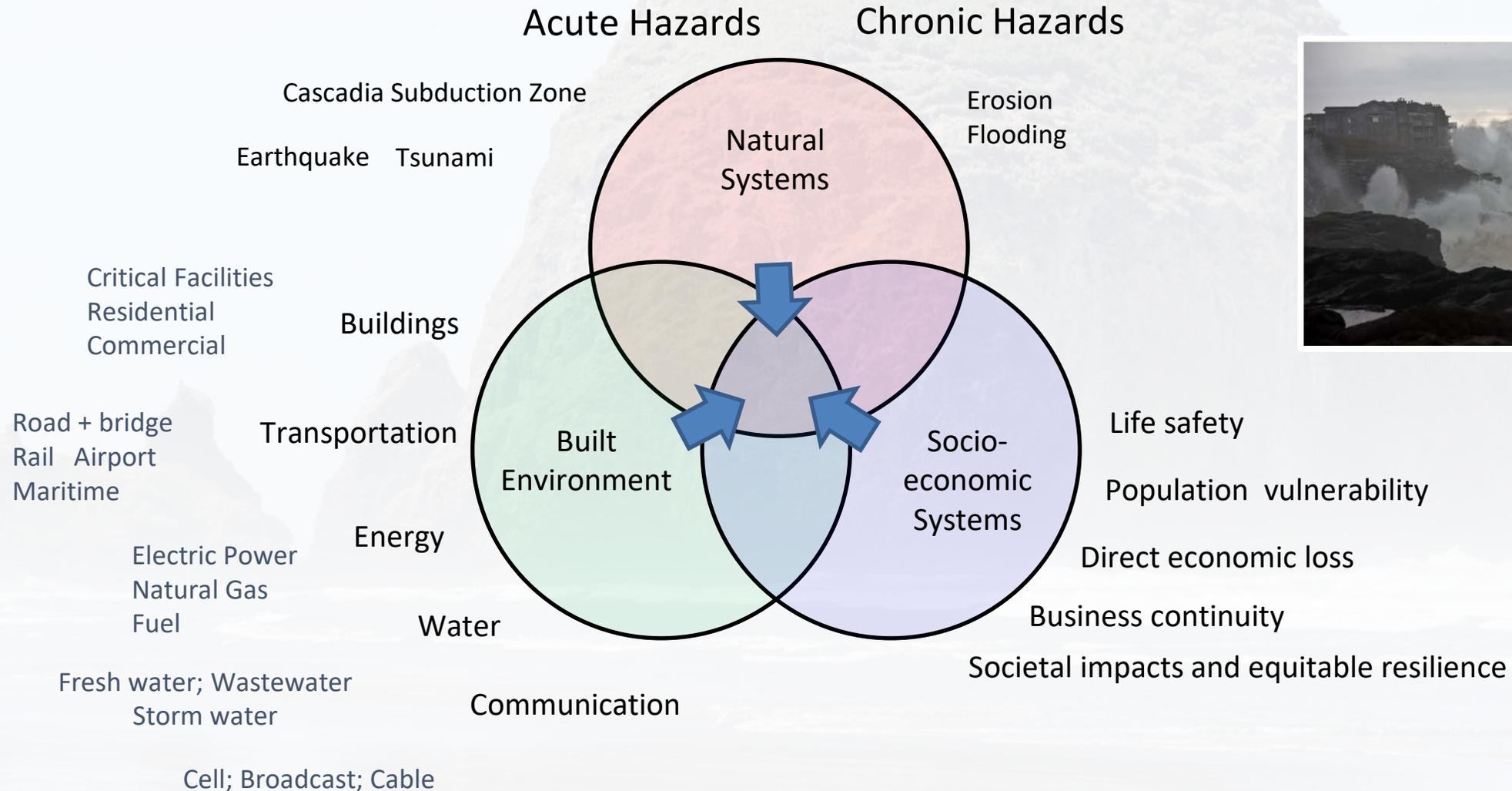
- 50-75 years
- 250-500 years
- 10,000 years
- It hasn't ruptured before



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Climate Controls on *changing* Coastal Community Resilience to Chronic Flooding and Erosion



- **Sea level rise (informed with regional variability including vertical land motion)**
- **ENSO (El Niño - La Niña range)**
- **Trends and variability in storminess patterns (and the associated nearshore processes)**



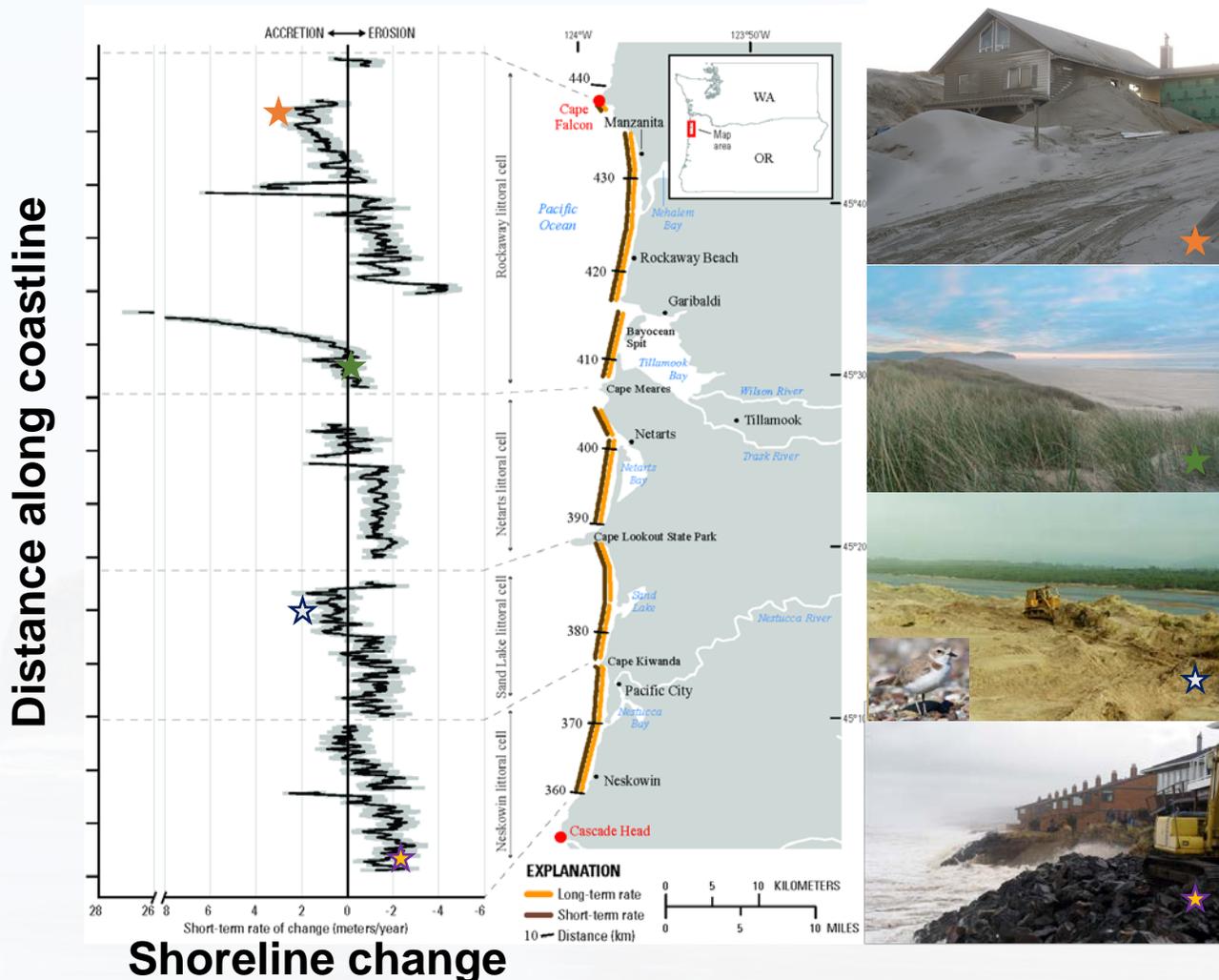
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Existing Adaptation Strategies



- Dune grading to enhance view

- 'Natural' beach/dune system

- Habitat restoration for biodiversity

- Armoring to protect infrastructure

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Polls

4. Fun Fact - Shoreline Armoring

1. What percent of the Oregon coast is armored with riprap revetments/seawalls?

5%

10%

15%

20%



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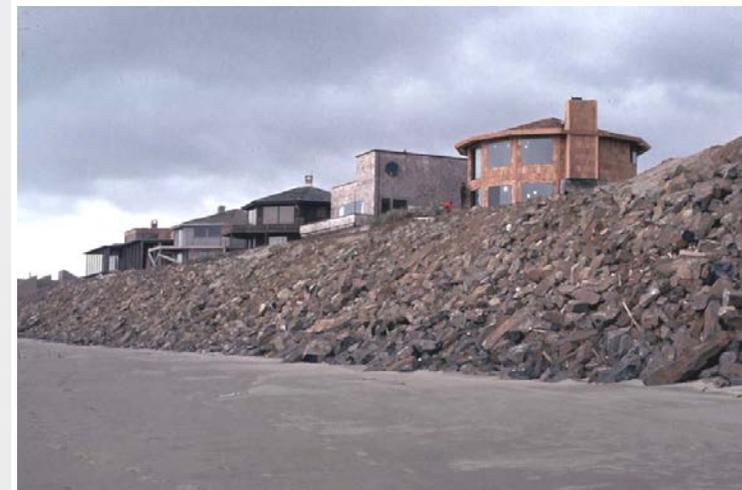


Polls

5. Fun Fact - Shoreline Armoring eligibility

1. Which properties on the Oregon coast are eligible for shoreline armoring

- any property on the coast can build hard protective structures
- properties with development prior to 1977
- properties with development prior to 1977 or is surrounded by armored properties
- certain counties allow armoring and others don't



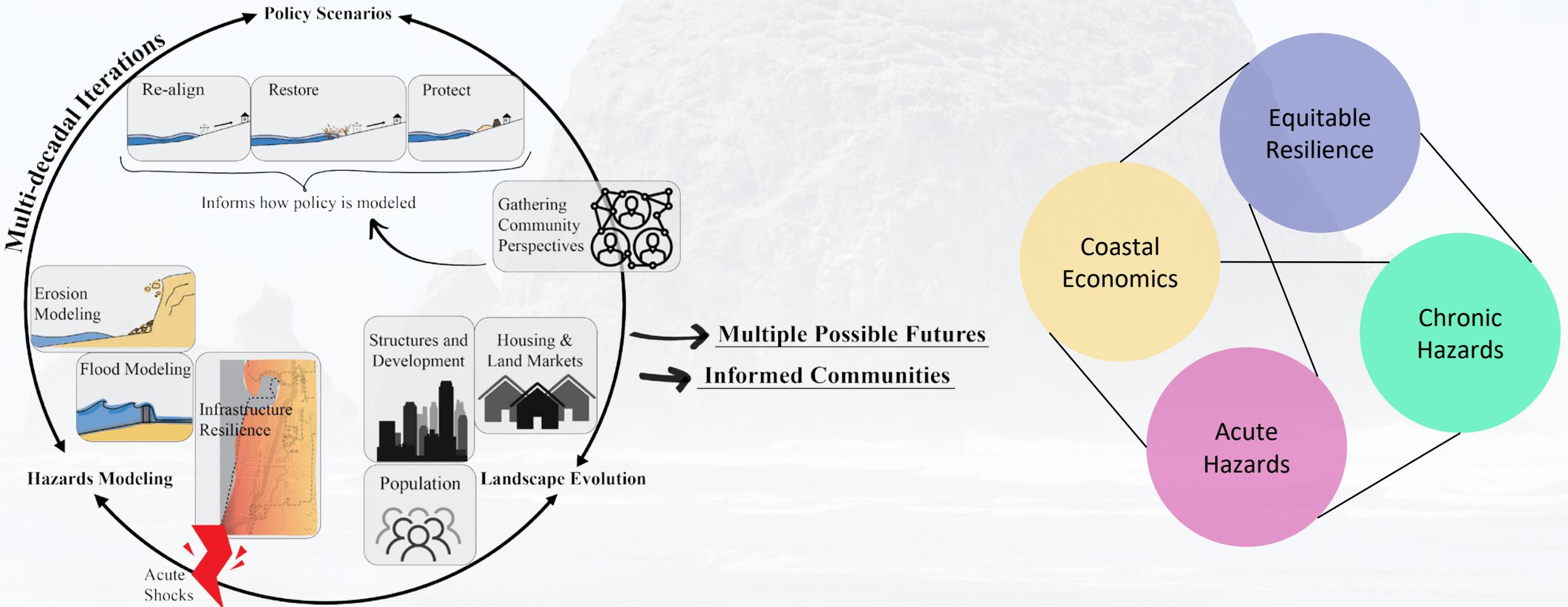
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Project Framework and themes:



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Framework for Assessing Resilience Strategies

1. Hazard Modeling

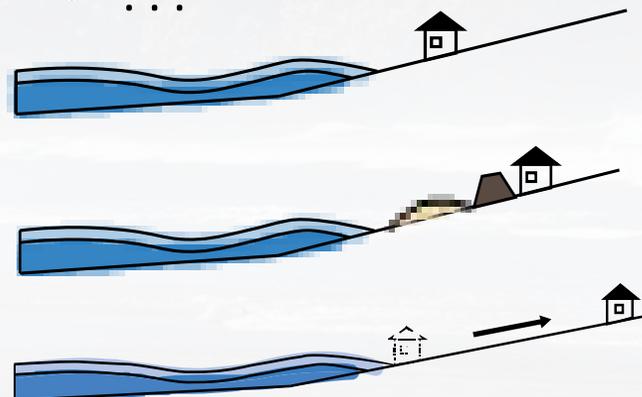
- CSZ: Earthquake + Tsunami
- What scenario? (M7 – M9)
- Timeframe? (2030, 2050)
- Coastal erosion and sea level rise



Probability damage of ~1,000-year event

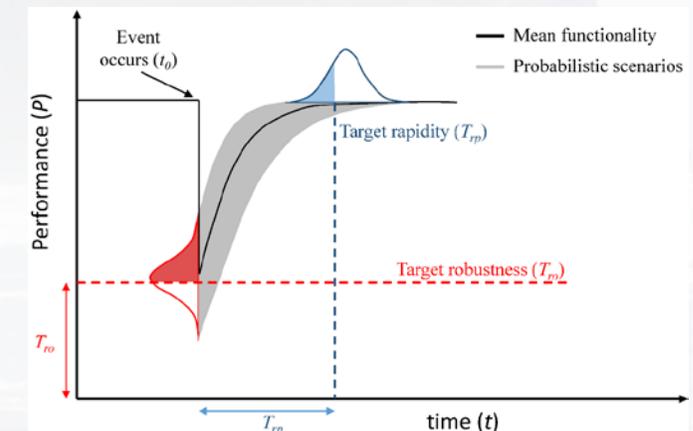
2. Policy options/strategies and Scenarios

- Status Quo
- Protect (retrofit)
- Realign (moving, zoning)
- Restore (accommodate)
- ...



3. Resilience Metrics

- Direct losses (life safety, capital)
- Indirect losses (recovery)
- Social equity (unequal loss)
- ...



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Policy options and Strategies

Landscape policies and strategies are decisions or plans of action for accomplishing desired outcomes.

Policies and Strategies define the **rules** and **management options** that are available to landowners, decision-makers.

Examples:

- 1) Add riprap revetments when erosion rates are high and buildings are impacted
- 2) Restrict new development in areas that have experienced flooding more than twice in the last 10 years
- 3) Move structures to the safest site on lot when subject to frequent flooding



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Policy Scenario Narratives



Protect (PR)

Policies or decisions are implemented that involve resisting environmental change in order to protect existing infrastructure and human activities (e.g. building or strengthening shoreline armor).



Example Policy: Construction of riprap beach protection structures for coastal protection

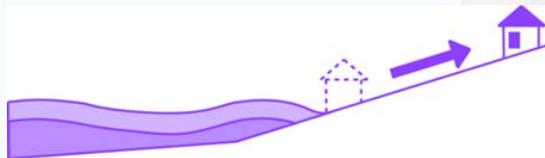
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Policy Scenario Narratives



Realign (RA)

Seawall scenario



Managed retreat scenario



Policies or decisions are implemented that involve *changing* human activities to suit the changing environment (e.g. relocation of infrastructure and/or people).

Example Policy: Hazard zone development restrictions

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Policy Scenario Narratives



Restore (RS)

Policies or decisions are implemented that *accommodate* environmental change and prioritize habitat protection and conservation (e.g. restore dunes or nourish beaches).



Example Policy: Construction of dune restoration projects for coastal protection

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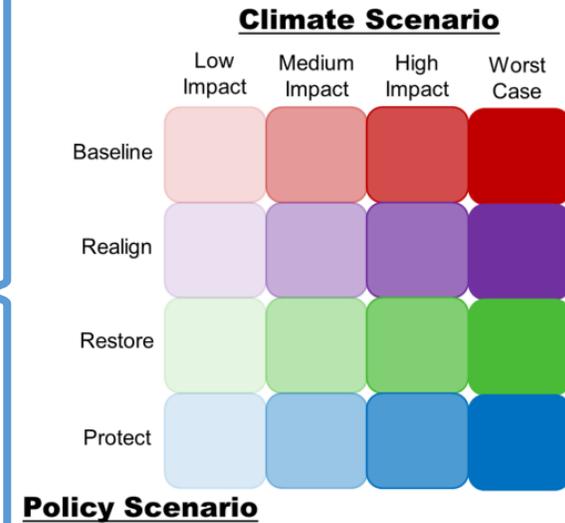


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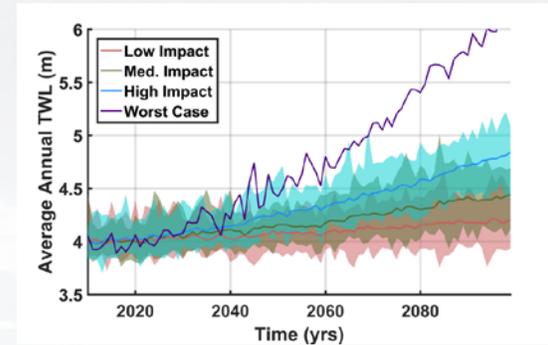
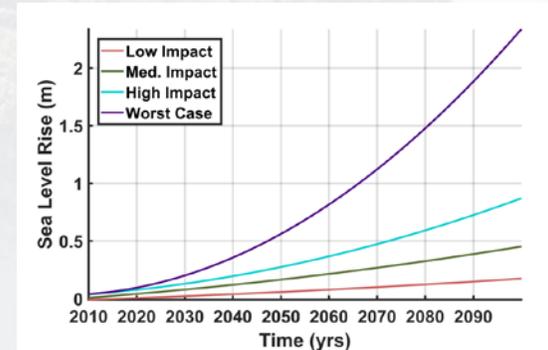


Individual Policies

Policy	BL	RA	RS	PR
BPS Constr.				█
BPS Mainten.	█		█	█
BPS Nourish.	█			█
DRP Constr.			█	
DRP Mainten.			█	
DRP Nourish.			█	
Hazard zone development restrictions		█		
Remove Buildings From Hazard Zone		█		
Remove Critical Infrastructure from Hazard Zones		█		
Raise or Move structure to a new location in the same tax lot		█		█
Raise Critical Infrastructure				█



Climate Impact Scenarios



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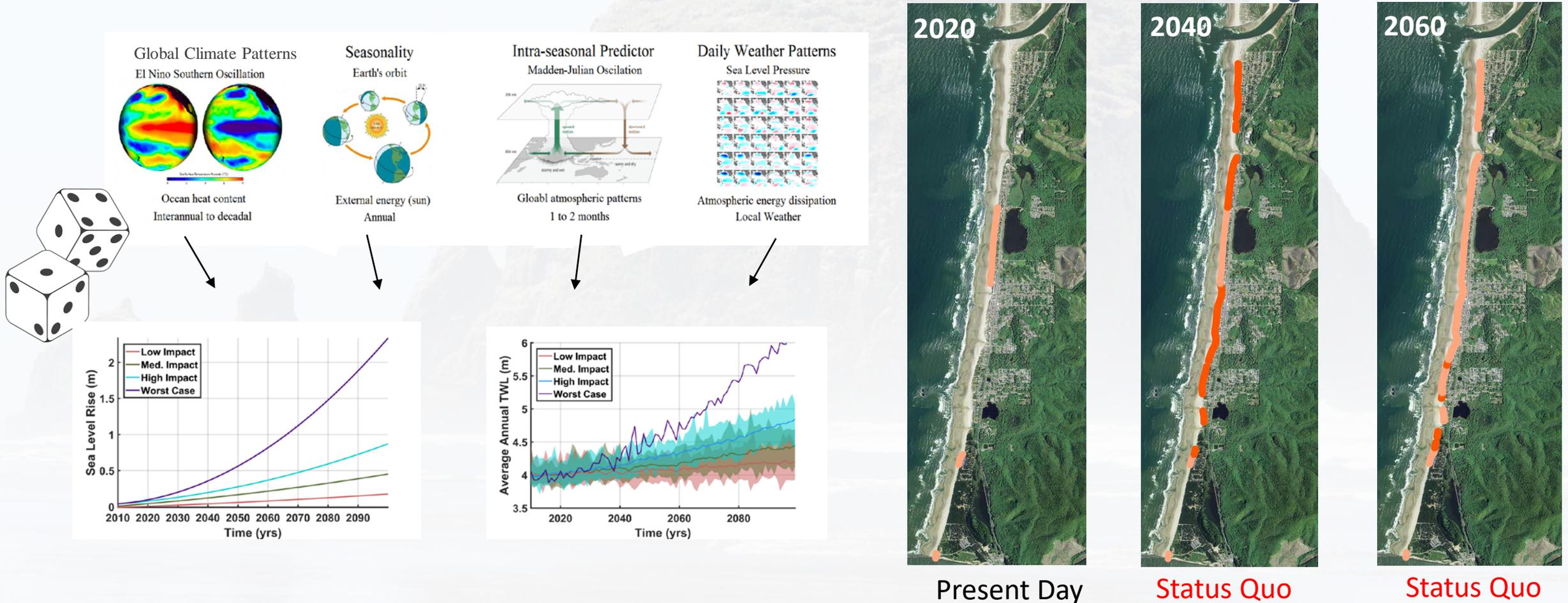


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Modeling Coastal Resilience Metrics with Probabilistic Total Water Levels

Armoring



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Policy driven tradeoffs in resilience metrics: Protection vs Recreation

Armoring



Present Day



Status Quo



Status Quo



■ Limited Beach Access ■ Unlimited Beach Access

Beach Accessibility



Present Day



Status Quo



ReAlign

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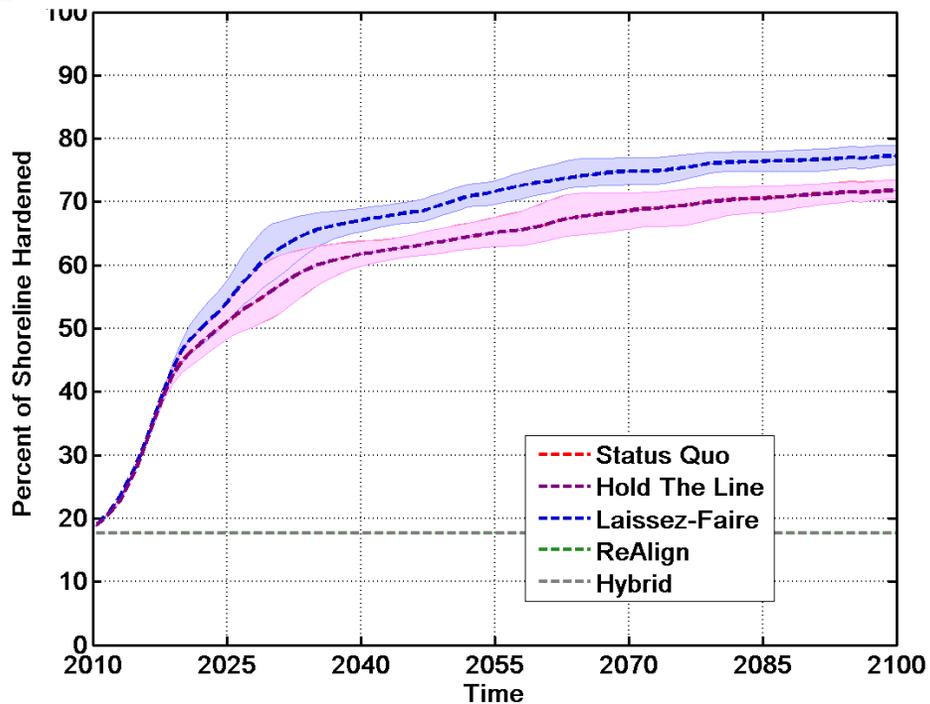


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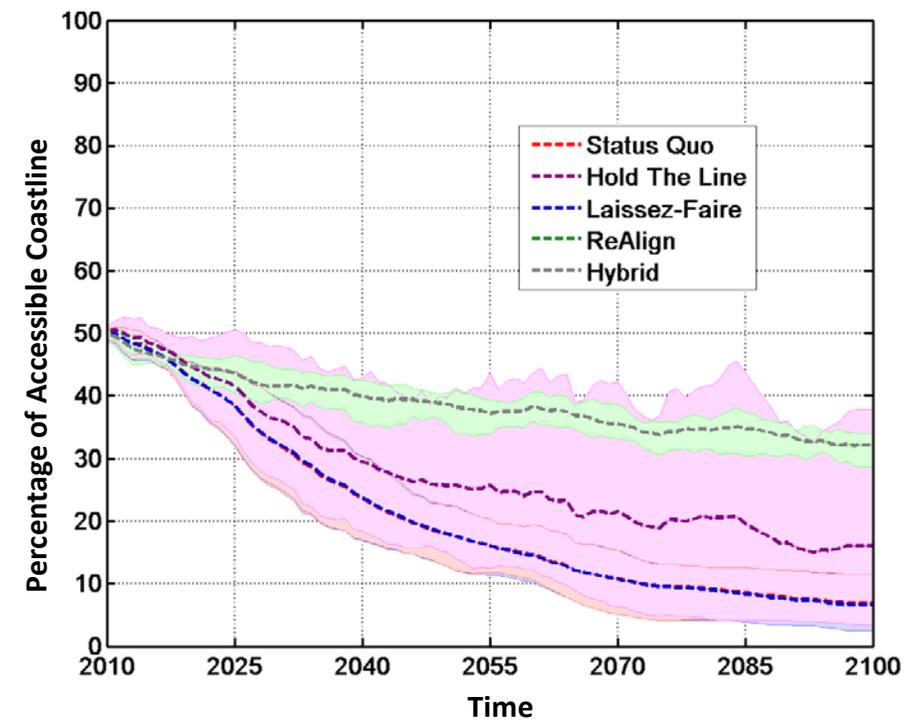
Policy driven tradeoffs in resilience metrics: Protection vs Recreation

Percent Armored (Rockaway Beach)



Red line: Limited Beach Access
Green line: Unlimited Beach Access

Beach Accessibility (Rockaway Beach)





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Break out Rooms!

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Polls

6a. Preferred Policies/Strategies - Acute Hazards

Polling is closed 0 voted

1. Please select your top THREE preferred STRATEGIES to address ACUTE HAZARDS (e.g. earthquakes, tsunamis) along the Oregon Coast (Multiple choice)

Relocate housing away from tsunami zones	(0/0) 0%
Relocate critical infrastructure away from tsunami zones	(0/0) 0%
Harden critical infrastructure in coastal areas	(0/0) 0%
Provide vertical evacuation facilities in coastal communities	(0/0) 0%
Reinforce commercial buildings	(0/0) 0%
Provide resources to vulnerable populations to reinforce housing	(0/0) 0%

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Polls

6b. Preferred Policies/Strategies - Acute Hazards

1. Please select your top **THREE** preferred **STRATEGIES** to address **ACUTE HAZARDS** (e.g. earthquakes, tsunamis) along the Oregon Coast (Multiple choice)

- Leave decisions up to individuals
- Require property laws to disclose information about tsunami zones at point of sale
- Reinforce health and human services buildings (e.g. food banks, community centers, resource centers)
- Expand Urban Growth Boundaries to allow for new development away from tsunami zones
- More stringent building codes
- Something else

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🗳️ Polls

Polling 11: 7. Preferred Metrics - Acute Hazards ▼ Edit

1. Please select your top THREE preferred METRICS to assess ACUTE HAZARDS (e.g. earthquakes, tsunamis) along the Oregon Coast (Multiple choice)

- Number of people/households outside hazardous areas
- Cost of policy/strategy
- Number of businesses outside hazardous areas
- Number of critical facilities outside hazardous areas
- Economic growth (e.g. number of jobs/businesses)
- Number of structures potentially damaged/destroyed by hazard events
- Equitable protection (e.g. strategies do not favor one group over another)
- Something else

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Polls

8a. Preferred Policies/Strategies - Chronic Hazards

1. Please select your top **THREE** preferred **STRATEGIES** to address **CHRONIC HAZARDS** (e.g. erosion, flooding) along the Oregon Coast (Multiple choice)

- Relocate housing away from hazardous areas
- Relocate critical infrastructure away from hazardous areas
- Harden critical infrastructure in coastal areas
- Harden shorelines with riprap revetments or similar reinforcements
- Nourish beaches to reduce erosion/flooding impacts
- Construct dune restoration projects to reduce erosion/flooding impacts

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Polls

8b. Preferred Policies/Strategies - Chronic Hazards

1. Please select your top **THREE** preferred **STRATEGIES** to address **CHRONIC HAZARDS** (e.g. erosion, flooding) along the Oregon Coast (Multiple choice)

- Provide resources to vulnerable populations to address erosion/flooding impacts
- More stringent building codes
- Let individual families/business owners deal with flooding/erosion
- Restrictive zoning (e.g. Hazard Overlay Zone) to limit new growth in hazard areas
- Require property laws to disclose information about coastal hazards at point of sale
- Prohibit new hard or soft protection measures (e.g. riprap revetments, beach nourishment, dikes/levees)
- Something else

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Polls

9. Preferred Metrics - Chronic Hazards

▼ Edit

1. Please select your top THREE preferred METRICS to assess CHRONIC HAZARDS (e.g. erosion, flooding) along the Oregon Coast (Multiple choice)

- Number of structures protected
- Amount of habitat/open space protected
- Cost of policy/strategy
- Equitable protection (e.g. policies do not favor one socio-economic group over another)
- Beach accessibility is maintained
- Number of households/people outside hazardous areas
- Economic growth (e.g., number of jobs/businesses)
- Number of structures potentially damaged/destroyed by hazard events

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Polls

10. Funding Options for Policies and Strategies

Edit

1. Please select your top THREE preferred funding sources for coastal resilience investments for both chronic and acute hazards. (Multiple choice)

- Private homeowner investments to mitigate risk
- Municipal bonds paid back over time through property taxes
- County-level bonds paid back by municipalities through property taxes
- New State-level initiative funded through the legislature
- Funding through existing state program like the Oregon Lottery
- New Regional initiative funded with a mix of private donations, state, and federal funds
- Federal grant funding to mitigate risk before a hazard event
- Federal disaster aid to rebuild and recover after a hazard event

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Polls

11. Distribution of Hazard Mitigation Resources and F... Edit

1. Please select your top THREE preferred strategies to distribute hazard mitigation resources and funding within a community (Multiple choice)

- Distribute resources to the most socially vulnerable populations (e.g., low income, minority, and other marginalized populations)
- Distribute resources to households most exposed to hazards regardless of socio-economic status
- Develop a sliding scale of access to resources based on socio-economic status and exposure risk
- Allocate funds and resources to health and human services and nonprofits to distribute to vulnerable populations
- Provide resources to businesses that are vulnerable to hazard impacts
- Provide resources to critical facilities (e.g., schools, hospitals, police/fire stations)
- No restrictions on who can access resources
- Something else

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Polls

12. Engagement ▼ Edit

1. Do you want to stay engaged in our research?

Yes! I would like to contribute to this research effort

Yes! Please keep me updated on your research results

No. I can seek out research results on my own

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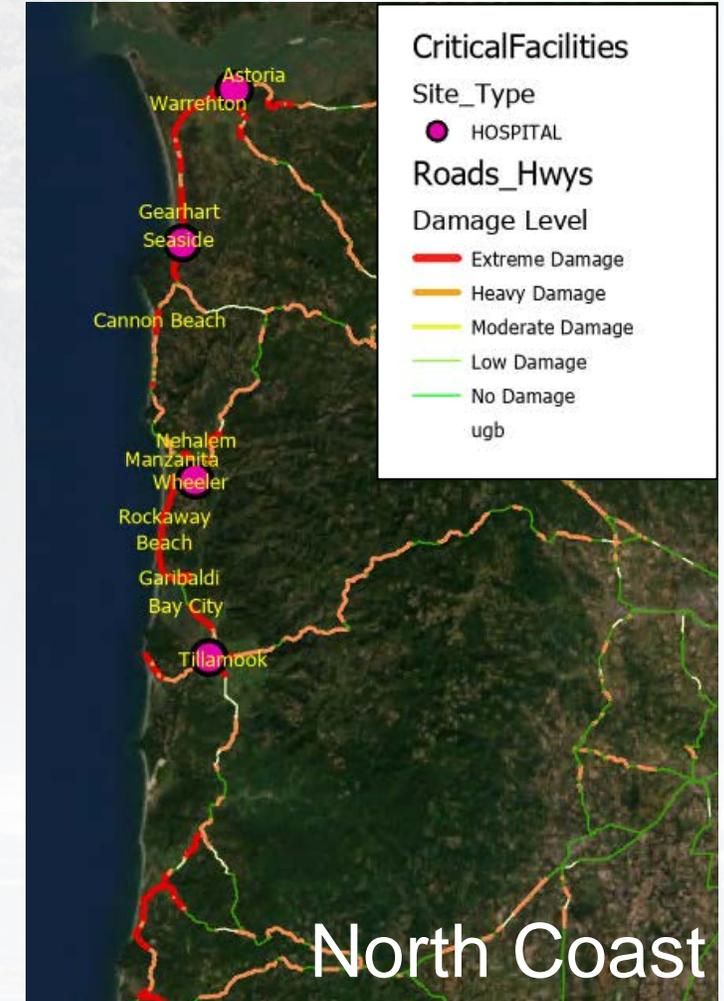


1) Building Infrastructure

- Initial damage and time to recover
- Protect (retrofit) and Realign (zoning) mitigation options
- Quantification metrics:
 - Building damage states (slight, moderate, etc.)
 - Repair costs
 - Recovery times

2) Transportation Network Infrastructure

- Initial damage and time to recover
- Protect (retrofit) and Realign (zoning) mitigation options
- Quantification metrics:
 - Road/bridge segment damage states
 - Road/bridge segment capacity reduction
 - Travel times to critical facilities and community assets
 - Recovery times





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Thanks Very Much!!

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Equitable Resilience Theme Update

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Equitable Resilience

Where we are:

- Envision modeling: Refining retrofit/relocation scenarios to account for socio-demographic variations
- Qualitative assessment of hazard preparedness and response
 - Nonprofit organizations (n=25)
 - Latinx resident focus groups (n=35)
- Residents perceive critical facilities as places that are SAFE but not necessarily places they BELONG, and are hesitant to access these facilities

Determining Critical Community Assets—Where we are headed:

- Prioritizing community assets that provide a sense of safety and belonging to model in Envision
 - **Health and Human services:** Preschools, daycares, nursing homes, mental health services, food banks, shelters
 - **Community Resources:** Churches, libraries, community centers, grocery stores



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Coastal Economics Theme Update

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Economics of Risk

- Tsunami risk and information shocks
 - No evidence that either the Tohoku earthquake or New Yorker article were capitalized into house prices
 - Next steps: GIS viewshed analysis, better matching procedure
- Tsunami blue line project
 - Goal: Study the effect of tsunami blue line signage on property values
 - Nearing end of data collection and investigating a new method to use



Land Use Change

- “Where to move people” model
 - Goal: A population allocation model under the managed retreat policy
 - Use taxlot subdivisions to predict land use change
 - Nearing end of data collection and exploring potential models
- Coastal Armoring
 - Incorporate new TWL data into landowner decision model
 - Link decision model to Envision



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Chronic Hazards Analysis Update

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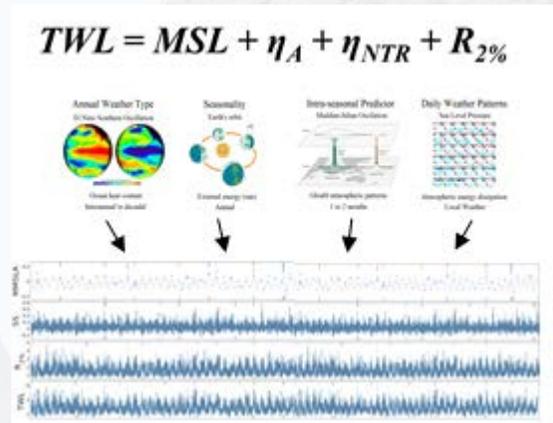
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Chronic Hazards

Where we are:

- Built a stochastic climate emulator for Oregon to model TWL inputs to Envision (TESLA)
- Testing coupling of TESLA TWL hindcasts and forecasts



Where we are headed:

- Provide statewide TWL input to morphologic change models in Envision
- Link up TWLs to peer effects model of coastal armoring in Envision



Key Questions:

- Feedbacks between drivers of chronic hazards and management strategies (e.g. armoring & ENSO)
- Role of changing climate and climate patterns in extreme chronic hazards on OR coast
- Probabilistic assessment of risk



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Acute Hazards Theme Update

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1) Building Infrastructure

- Initial damage and time to recover
- Protect (retrofit) and Realign (zoning) mitigation options
- Quantification metrics:
 - Building damage states (slight, moderate, etc.)
 - Repair costs
 - Recovery times

2) Transportation Network Infrastructure

- Initial damage and time to recover
- Quantification metrics:
 - Road/bridge segment damage states
 - Road/bridge segment capacity reduction
 - Travel times to critical facilities
 - Recovery times

Question: What are the main concerns and impediments regarding mitigation investment strategies intended to reduce the economic risk for a CSZ event?

