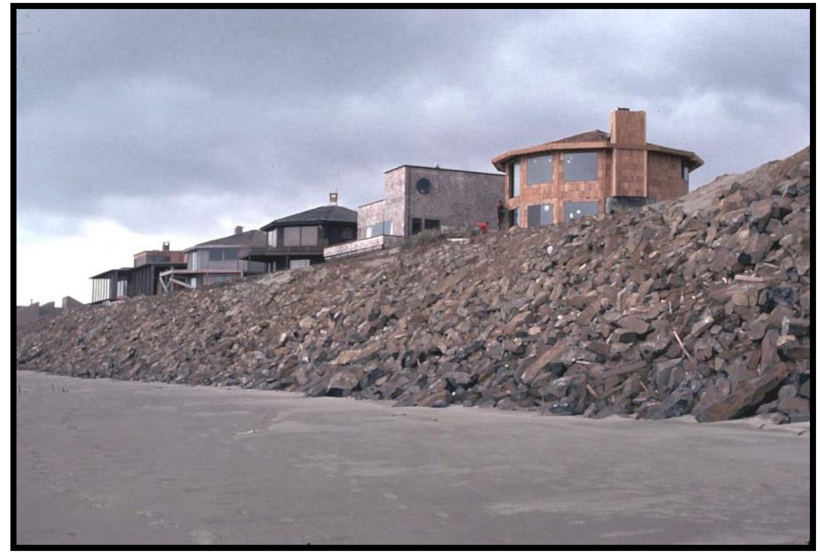
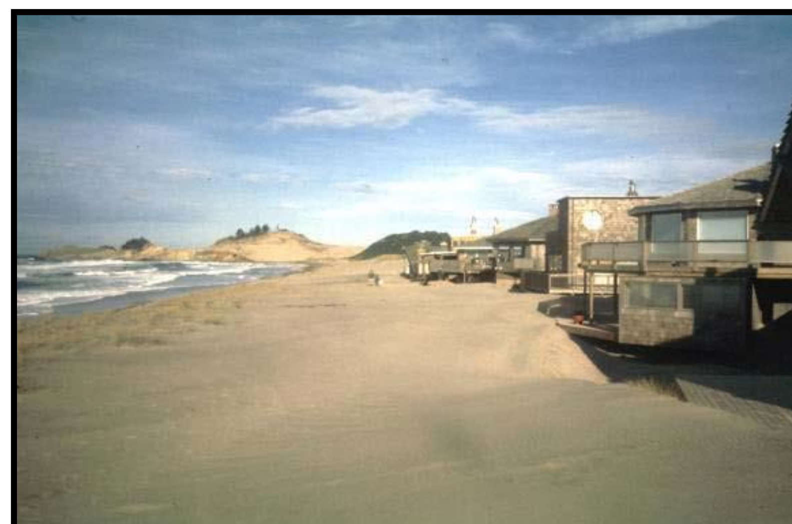
Envisioning a Resilient Oregon Coast

Oregon State University

Sea Grant Oregon





Envisioning a Resilient Oregon Coast:
Co-developing alternative futures for adaptation planning and decision-making

Advisory Council Meeting
8 March, 2019 (1:00 pm – 3:00 pm)
Sea Grant Conference Room

Meeting Objectives:

1. Communicate project goals and set expectations for Advisory Council engagement.

2. Begin to harness the networked expertise of key partners and stakeholders to develop actionable knowledge to inform statewide policies and localized decision-making.

3. Articulate actionable research that can be conducted effectively with the Envision model.

8 March, 2019 (1:00 pm – 3:00 pm)

Agenda

~12:00 – 1:00 **Optional** informal poster session and lunch (opportunity to meet, chat, and eat prior to the meeting)

1:00 – 1:15 Welcome, Introductions, Meeting Overview

1:15 – 2:00 Project Overview, OSU presentations, and demos with continuous feedback/discussion with Advisory Council

- Overview of Past Envisioning Coastal Futures Projects (Chronic Hazards focus)
- Incorporating econometric modeling into Envision framework

- **Questions/Discussion**

Agenda, Cont'd

1:15 – 2:30 OSU presentations and demos with continuous feedback/discussion with Advisory Council

- Incorporating Acute Hazards into Envision Framework
- Discussion of social equity, and consistency concerns of coastal adaptation and resilience decisions in Oregon
- Envision Demo

-Questions/Discussion

2:00 – 2:45 Feedback from Advisory Council and articulation of actionable research our project can tackle

2:45 – 3:00 Wrap up and Next Steps

OSU Project Team: Principal Investigators

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

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

Dan Cox: Coastal hazards engineering and Director of the Cascadia Lifelines Project (CLiP).

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

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

Pat Corcoran: Coastal hazards extension specialist with significant experience working with coastal stakeholders and the project team.

OSU Project Team: Students and Postdocs

Meredith Leung: PhD student in CEOAS

Katherine Stanton: Graduate Student in the Anthropology Department under the School of Language, Culture and Society under the College of Liberal Arts

Dylan Sanderson: PhD student in CCE

Sabarethinam Kameshwar: Postdoc in CCE – soon to be Assistant Professor at LSU!

Amila Hadziomerspahic: PhD Student in Applied Economics

Project Objectives

Research Objective 1: Identify and evaluate alternative strategies for chronic and acute hazard mitigation under multiple constraints to improve decision-making in coastal Oregon.

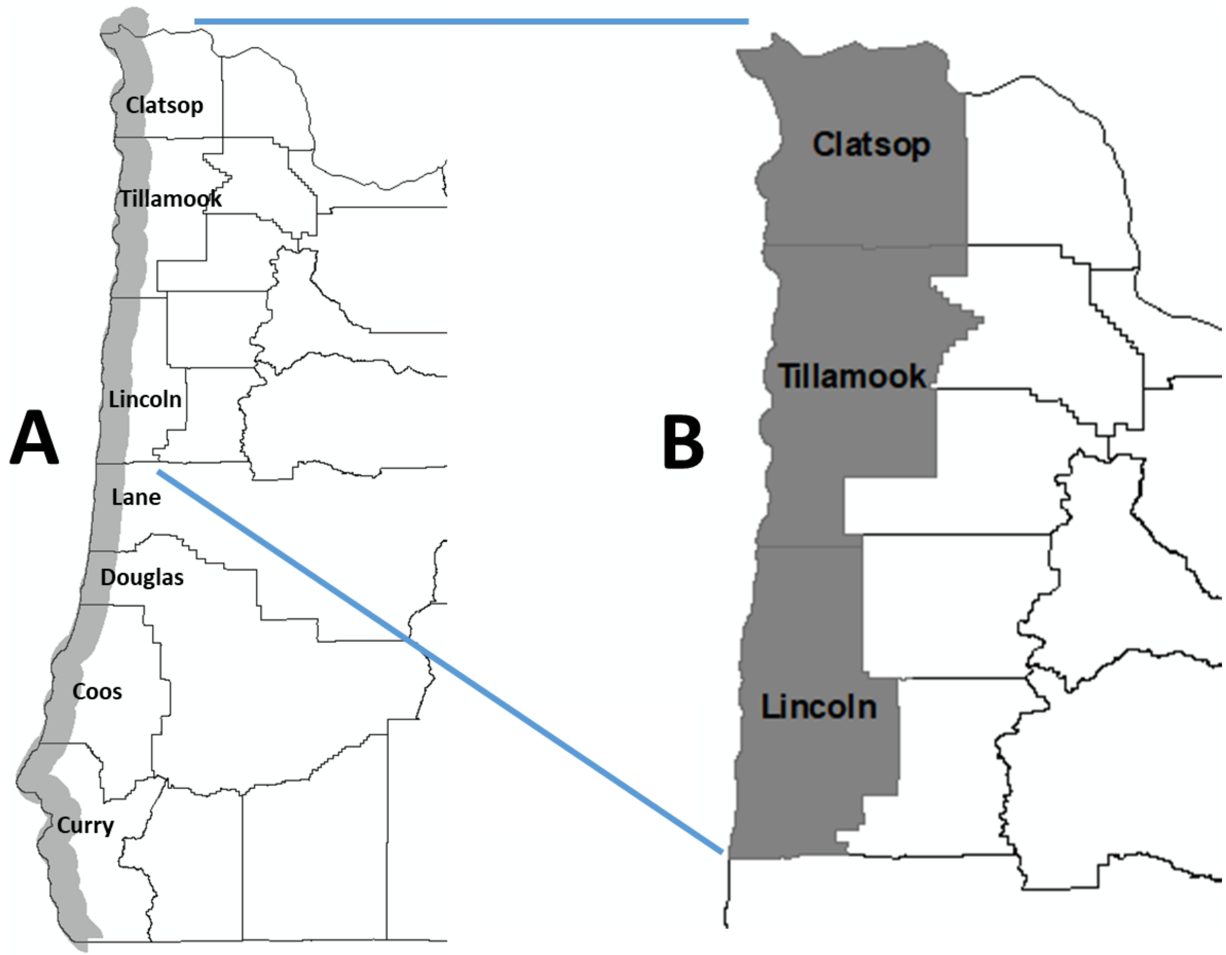
Outreach and Engagement Objective 1: Harness the networked expertise of key local, county, state, and federal officials, NGOs, and academic leaders to develop actionable knowledge to inform coast-wide adaptation policies and localized decision-making.

Research Objective 2: Understand and assess distributional consequences, social equity, and consistency concerns of coastal resilience decisions in coastal Oregon.

Outreach and Engagement Objective 2: Increase community and state literacy and capacity for adaptation to chronic and acute hazards by providing strategies that illustrate community-valued socio-economic costs and benefits with realistic implementation timeframes.

Education Objective 1: Train a cohort of transdisciplinary students in the co-production of actionable knowledge for hazard resilience, enhanced science and risk communication, and disciplinary excellence.

Oregon Coast-wide study area and three county detailed study area



Advisory Council Members

Federal Partners
- Brett Holt; FEMA
- Jarod Norton; USACE
- Gwen Shaugnessy, NOAA

County/Community Partners
- Sarah Absher; County Planner
- Tiffany Brown; County Emergency Mgmt.
- Deb Nicholson; City Planner
- Mark Nicholson; City Emergency Mgmt.
- Regina Martinez; City Emergency Mgmt.
- Jay Raskin; Architect
- David Yamamoto; County Commissioner
- Kent Yu; SEFT Consulting

State Partners
- Michael Bufalino; ODOT
- Mark Ellsworth; Oregon Regional Solutions
- Mike Harryman; State Resilience Officer
- Meg Reed; Oregon DLCD
- Jonathan Allan; DOGAMI
- Althea Rizzo; Office of Emergency Management
- Jay Sennewald; OPRD

NGO/Other Partners
- Jack Barth; Dir. OSU Marine Studies Initiative
- Josh Bruce; Partnership for Disaster Resilience
- Phil Mote; Climate Impacts Research Consortium
- Charlie Plybon; Surfrider Foundation

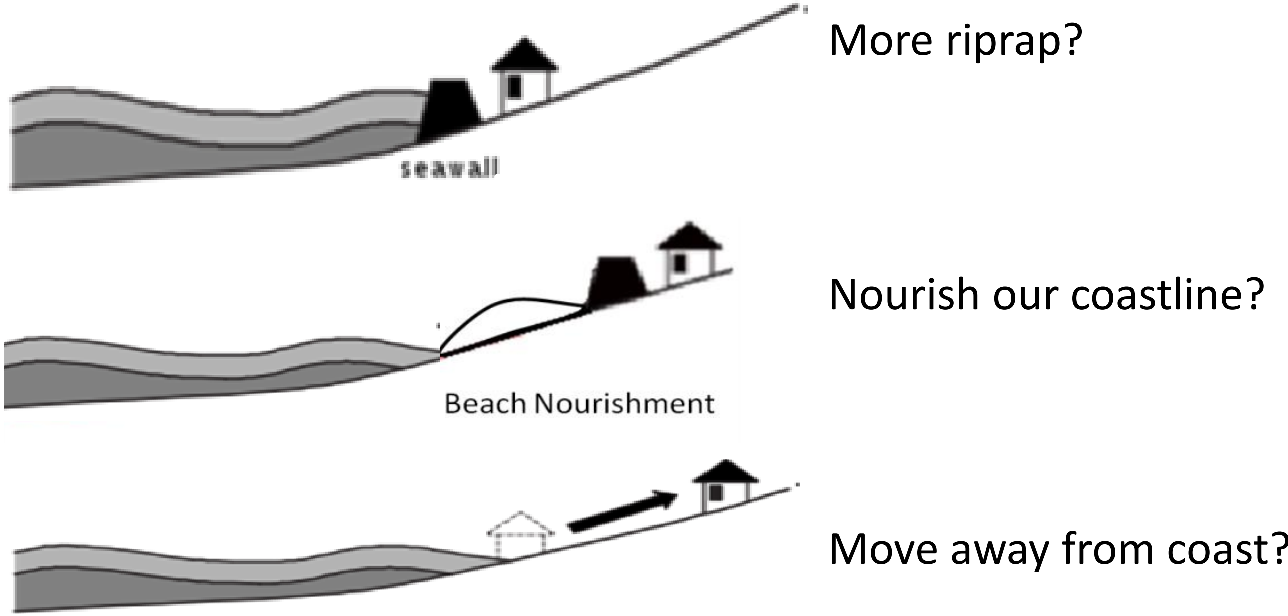
Alternative Futures Questions:

In the context of coastal community planning for climate change and extreme events,

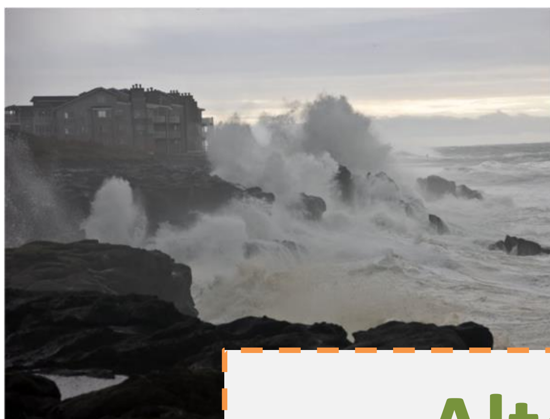
1. What do you care about? In other words, what types of project output, endpoints, or quantified resilience metrics would most benefit your work?
2. What coastal policies would you most like to see incorporated into the project's framework?
3. What is a useful planning horizon?
4. In this project we plan on adding more econometrics, social equity, and feedbacks between acute and chronic hazards. What else would you like to see us tackle?
5. Are there state-level programs or new initiatives in this area that we should be aware of? Do you know of other data sets or models we should be aware of?
6. Who else should be on our advisory council/ who should we be talking to?
7. What else should we be doing to ensure that this work results in actionable knowledge?

Coastal Futures Projects

Envisioning Alternative Coastal Futures: Develop the information and tools necessary to envision future scenarios, assess impacts and vulnerability associated with erosion and flood hazards, and initiate adaptation strategies.

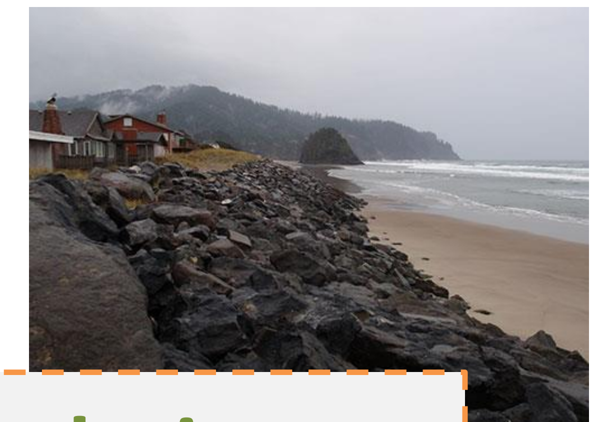


Coastal Futures Projects



Climate

Policy



Alternative Futures Analysis:

Explore how complex coupled natural and human systems dynamically respond to varying adaptation strategies and driving forces.

Alternative Futures Analysis: *Envision*

Bolte et al., 2007

Data Sources

- Landscape Data

Landscape Change Models

- Population Growth
- Development
- Total Water Level
- Coastal Change Models

Scenarios

- Policy Scenario Narratives
- Climate Impact Change Scenarios

Agent Based Model: *Envision*

Resilience Metrics

Flooding
- Structures & Infrastructure Impacted
- Economic Value of Property
- Impacted

Erosion
- Structures & Infrastructure Impacted
- Economic Value of Property
- Impacted

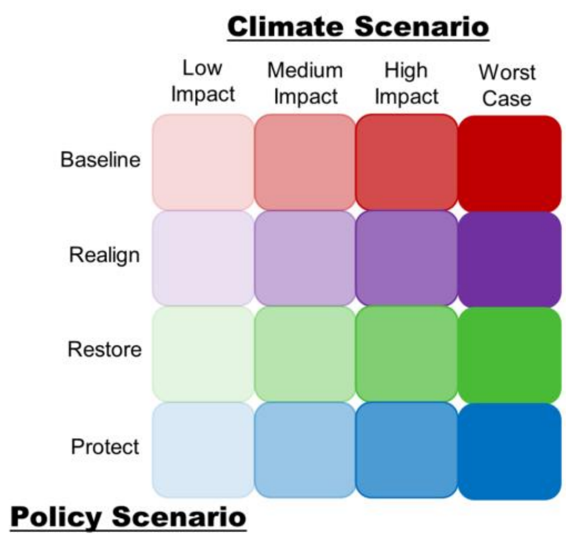
Percent Shoreline Hardened

Beach Accessibility

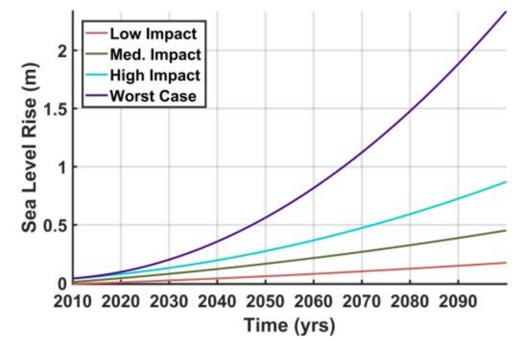
Coastal Futures Projects

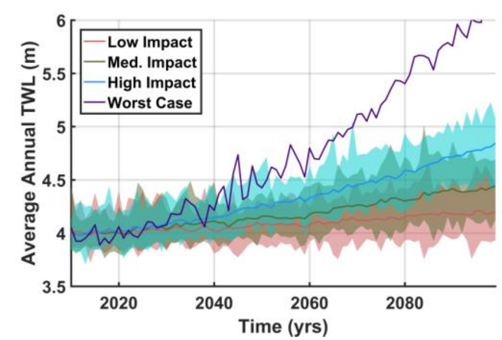
Individual Policies

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 Driven Forcing





Low Impact Scenario
Uses a low-end projection of SLR: Extremely likely to exceed (95%)

Medium Impact Scenario
Uses a mid-range projection of SLR: More likely than not to exceed (50%)

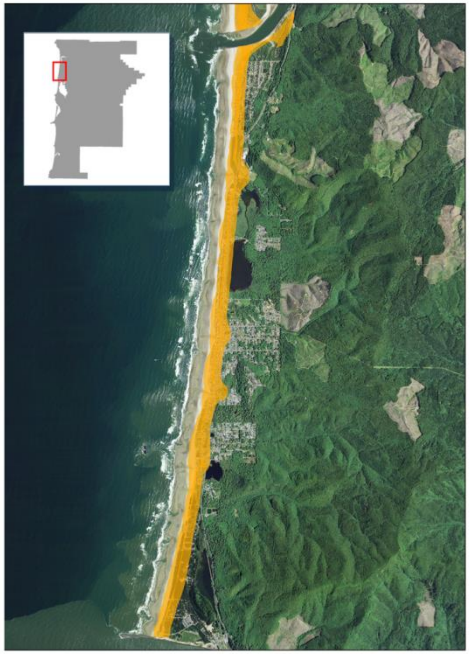
Medium Impact Scenario
Uses a high-end projection of SLR: Extremely unlikely to exceed (5%)

Worst Case Scenario
Uses a "Worst Case" Scenario: Project upper limit (0.1%)

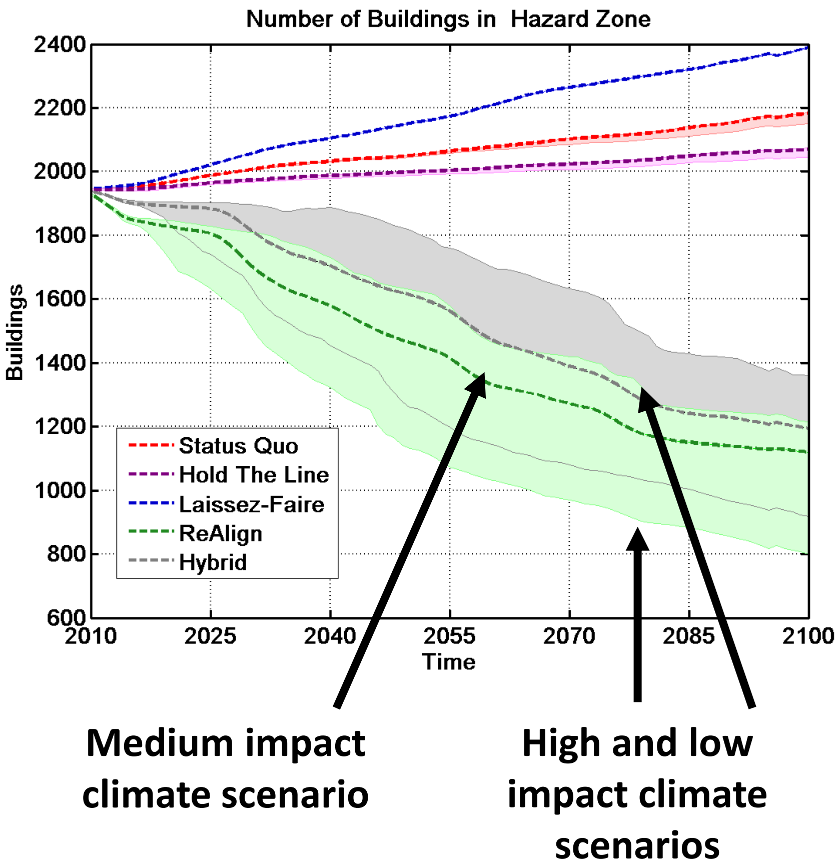
The effect of policies on development patterns

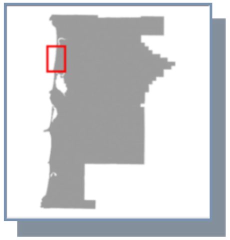
Neskowin

Rockaway Beach



DOGAMI Hazard Zone

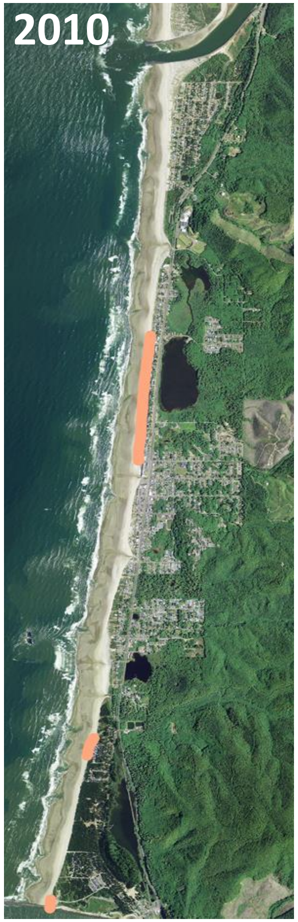




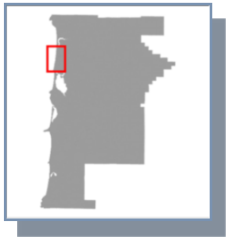
Coastline armored in response to erosion

Rockaway Beach Littoral Sub-Cell

Existing BPS New BPS



Present Day



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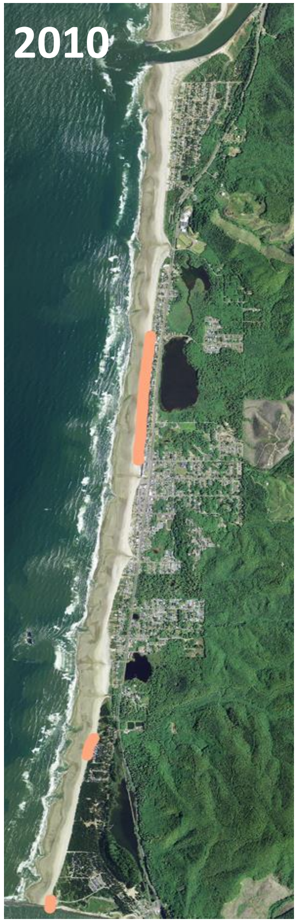
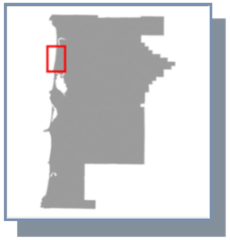
Existing BPS   New BPS



Present Day

Status Quo

Medium Climate Impact Scenario



Coastline armored in response to erosion

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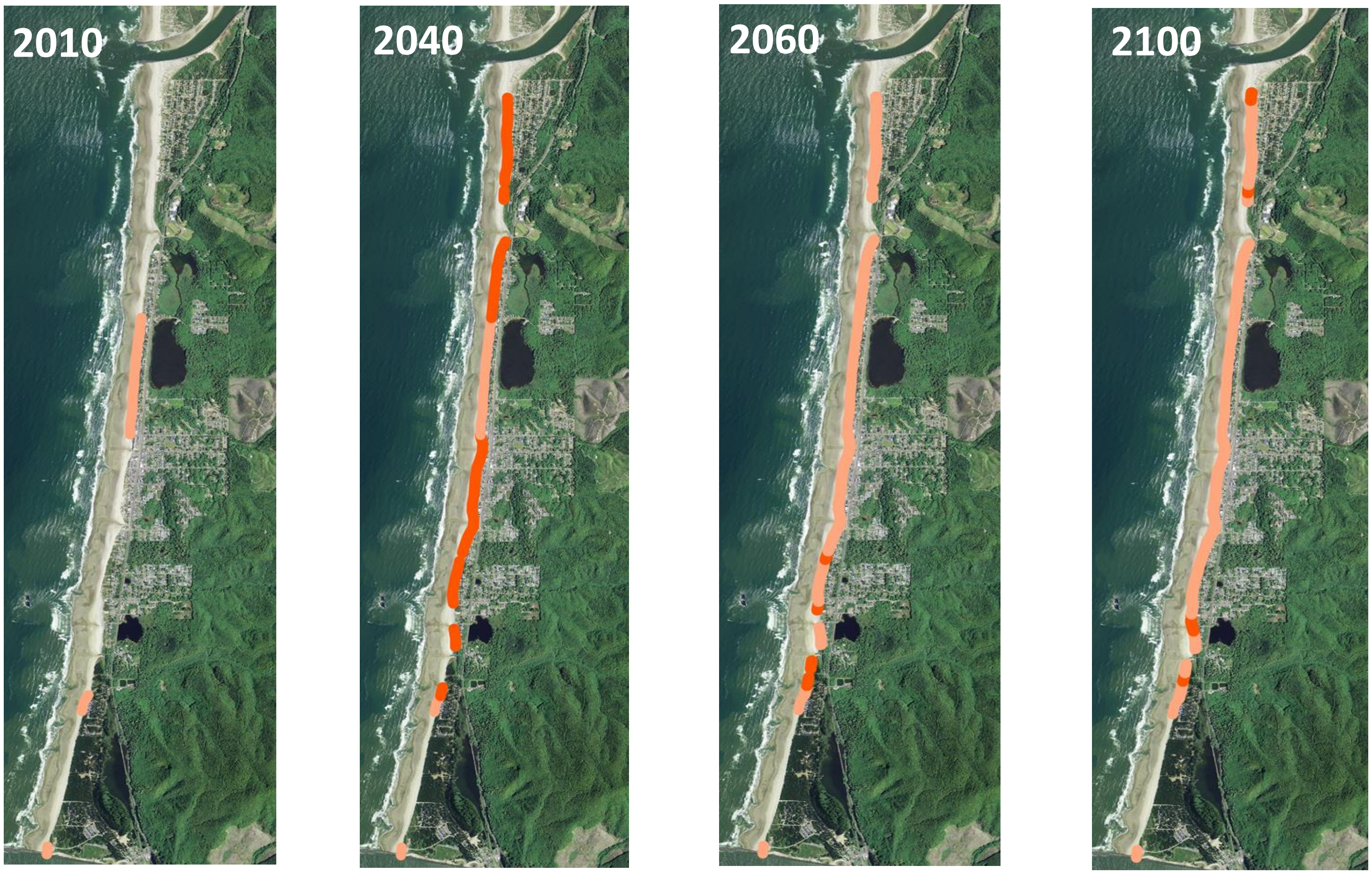
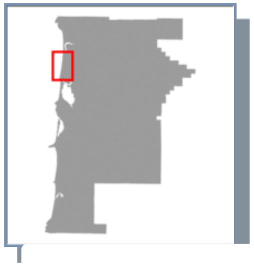
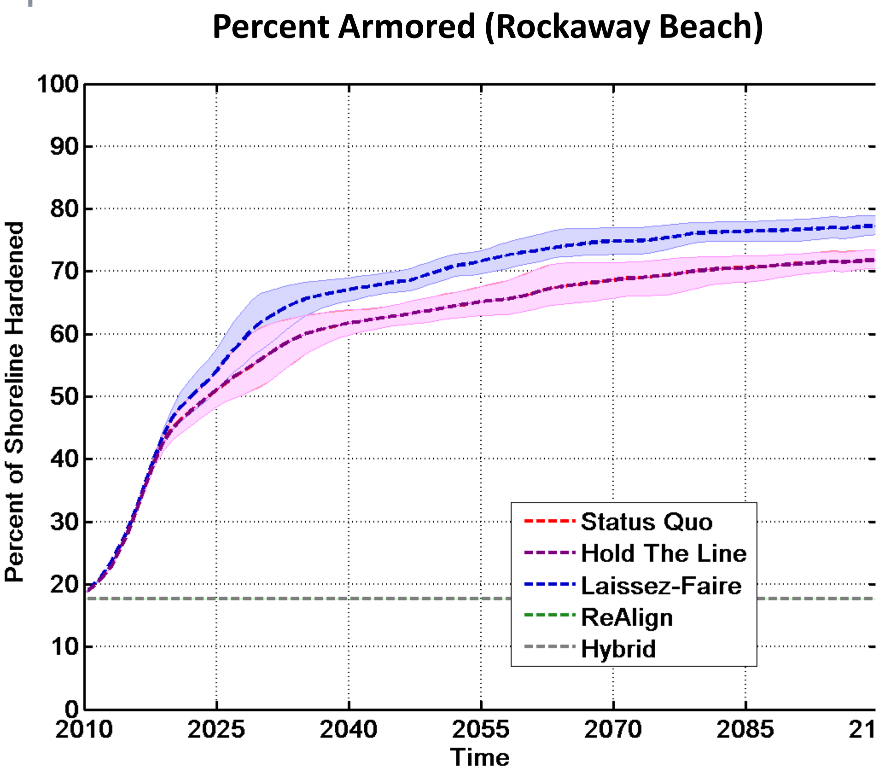
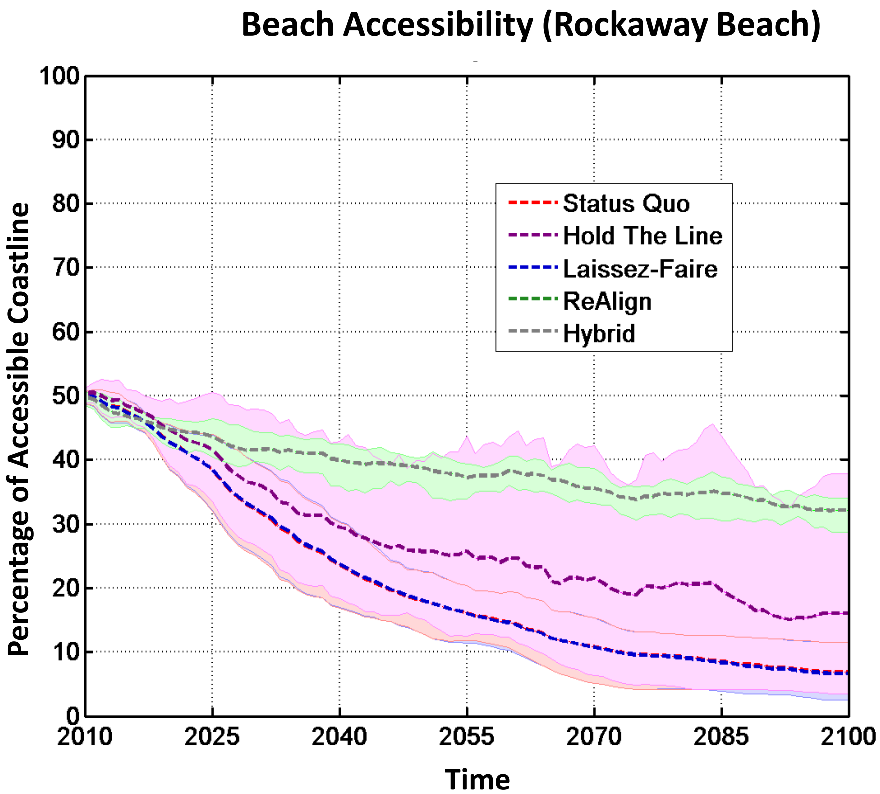


Present Day | Status Quo | Status Quo | Status Quo

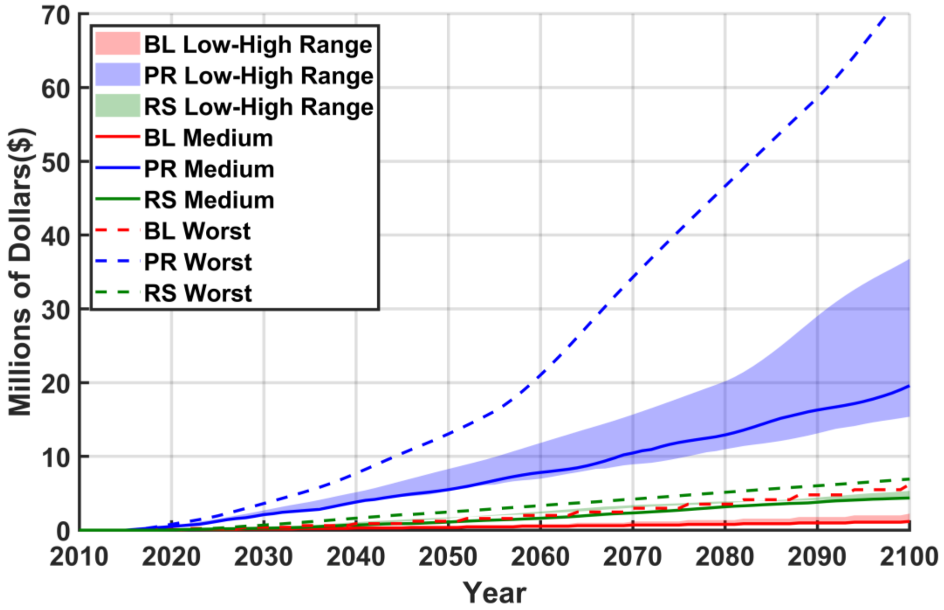
Policy driven tradeoffs in resilience metrics





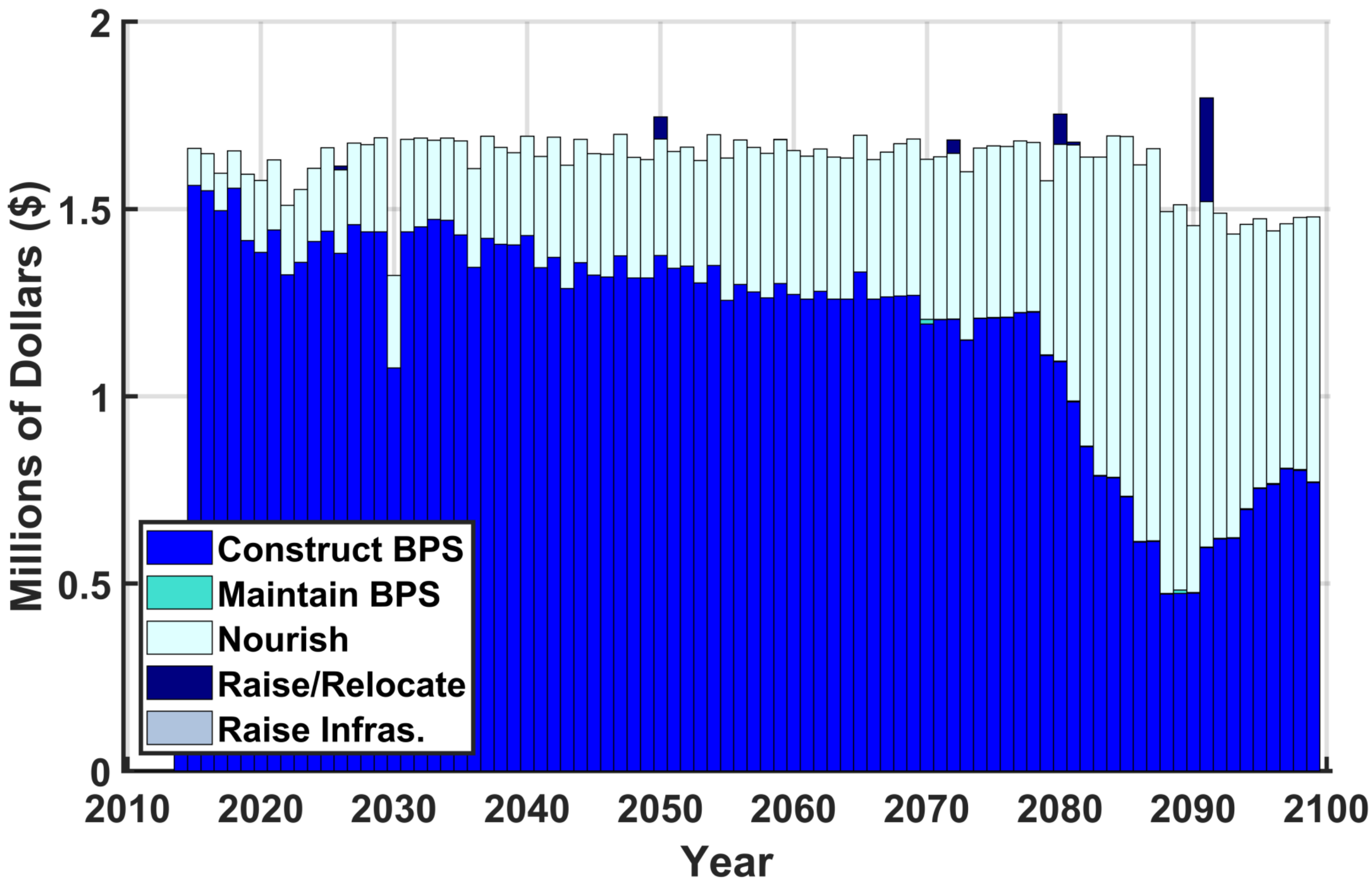


How expensive will adaptation options be in the future?



How expensive will adaptation options be in the future?

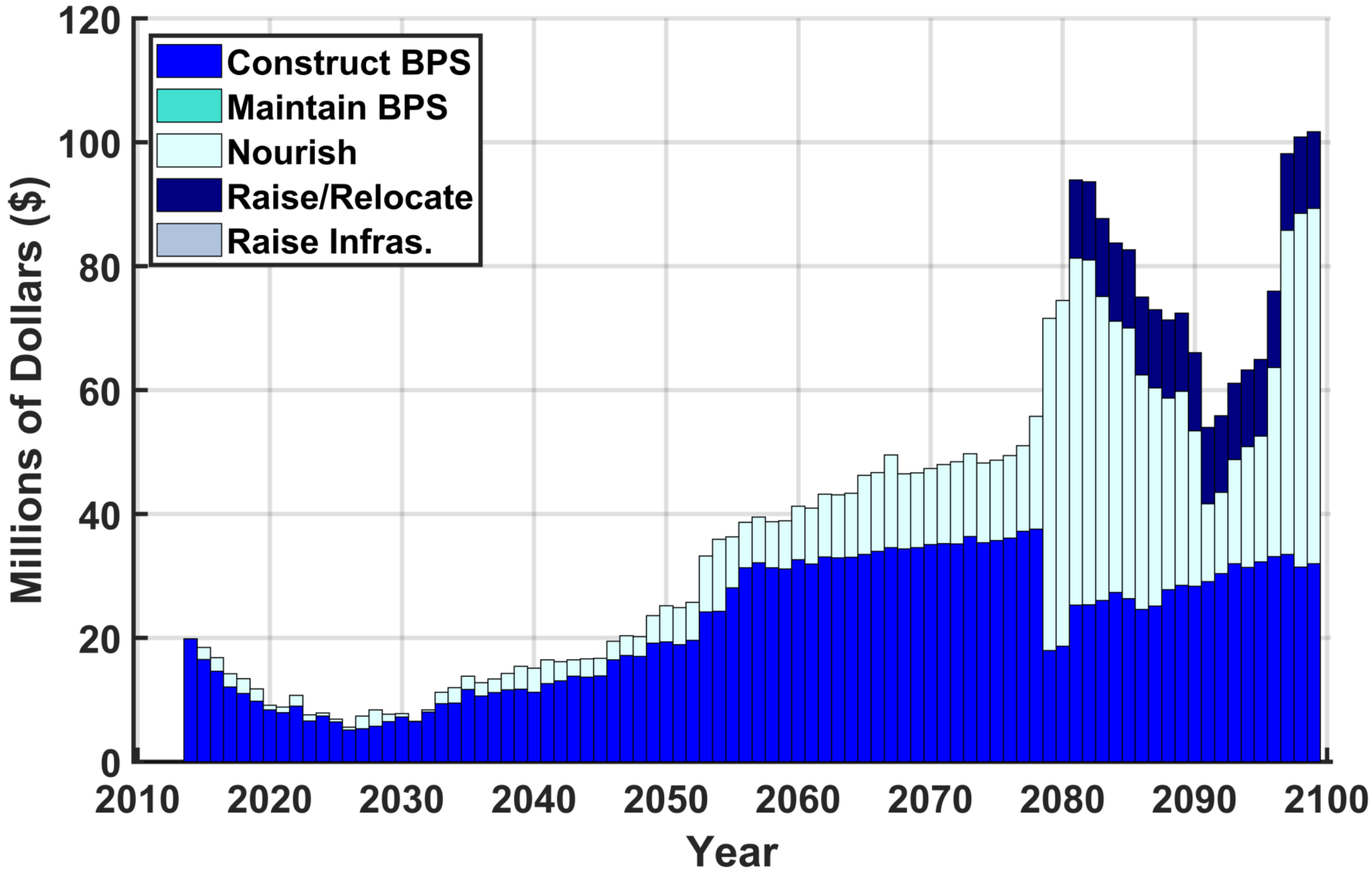
Protect $pent



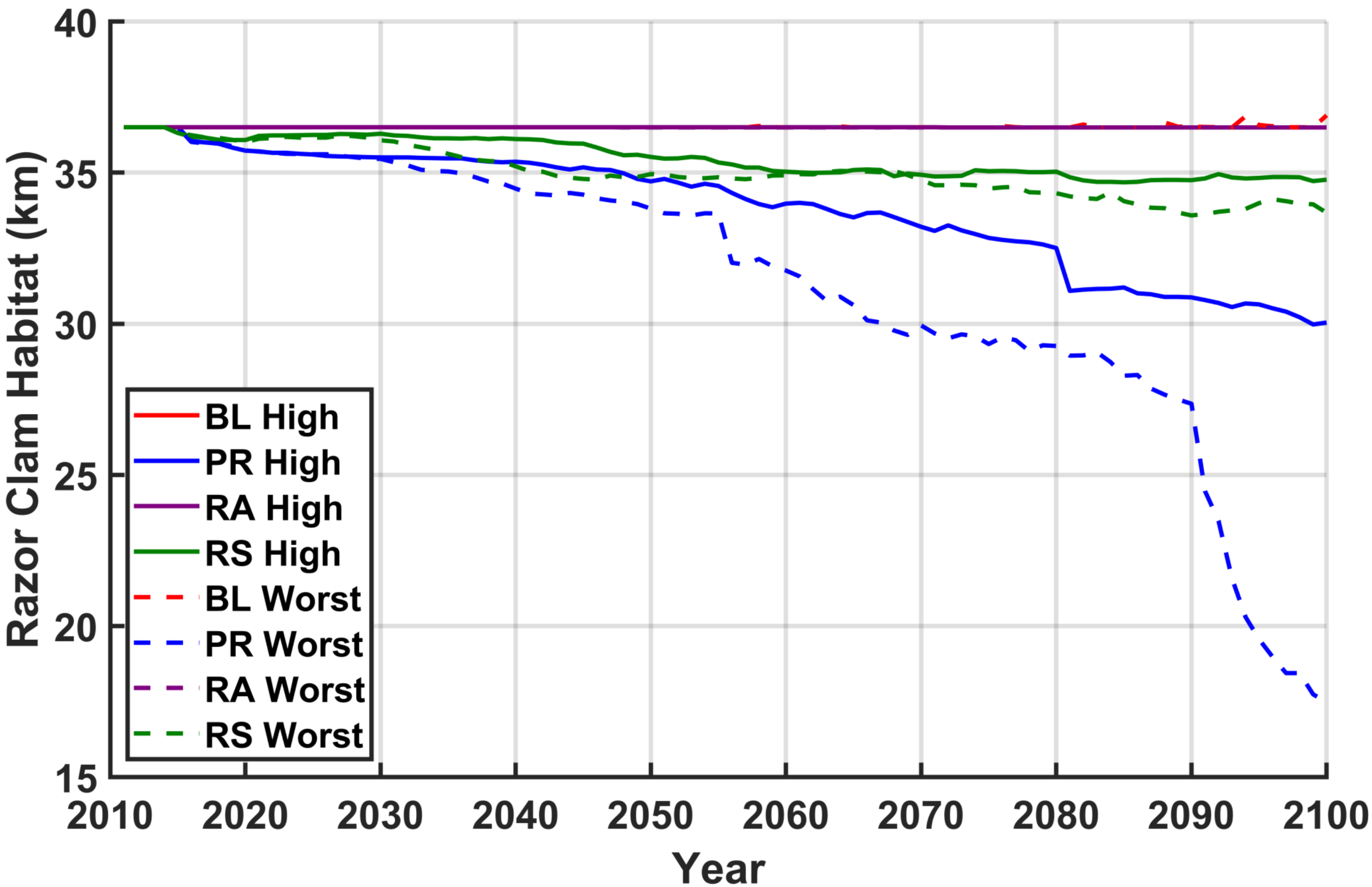
Coastal Futures Projects

How expensive will adaptation options be in the future?

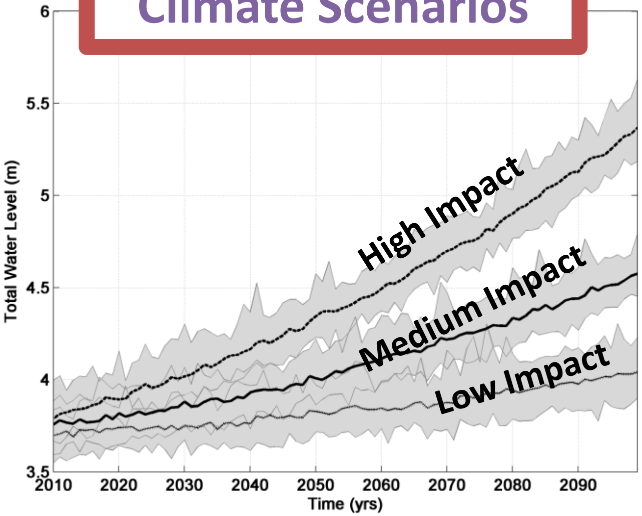
Protect Unmet Demand



Policy and climate induced changes to preferred habitat



Climate Scenarios



Physical

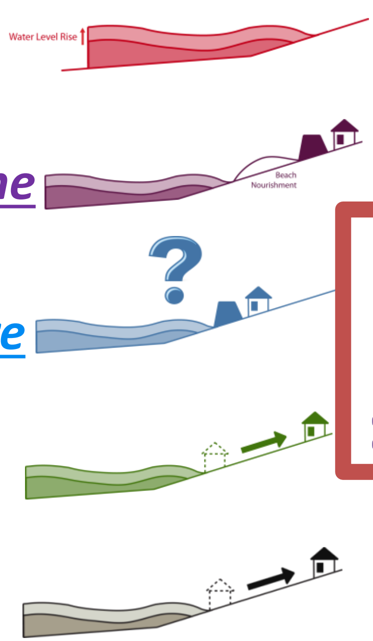
1. Status Quo

2. Hold the Line

3. Laissez-Faire

4. ReAlign

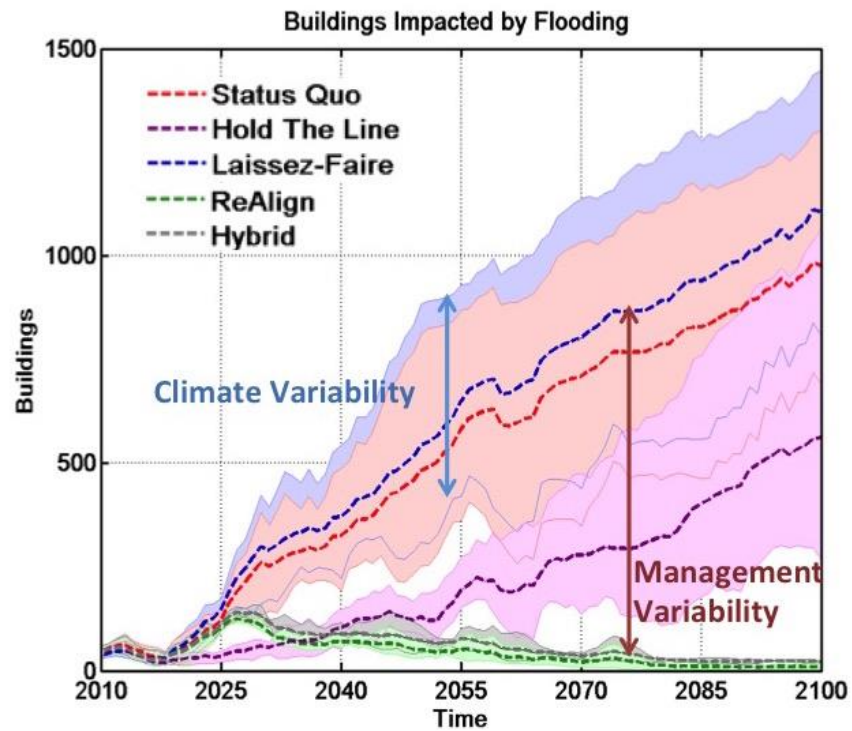
5. Hybrid



Human

Policy Scenarios

Which drivers (human or physical) cause the greatest variation in resilience metrics?



Land Use & Hazard Planning Policies Impact on Housing Markets

- Shoreline Armoring
  - State Planning Goal 18
  - Propensity score matching and regressions used to causally identify price premium for Goal 18 eligible homes
  - Exploit discontinuities in policy implementation to estimate spillover effects on ineligible parcels
- Hazard Planning
  - Tsunami “lines”
  - Difference in differences research design to identify the impacts of risk zone designation and risk information shocks on coastal housing values

Econometric Estimates of Capitalization Effect of Goal 18 Eligibility Option

- Varies by parcel vulnerability

All parcels	No effect
Eroding parcels	+ 13 %
Low Elevation (<= 30') parcels	+ 9 %
Eroding, Low Elevation parcels	+ 22 %

- Spillover effects on adjacent non-eligible neighbors (effect found up to 300'

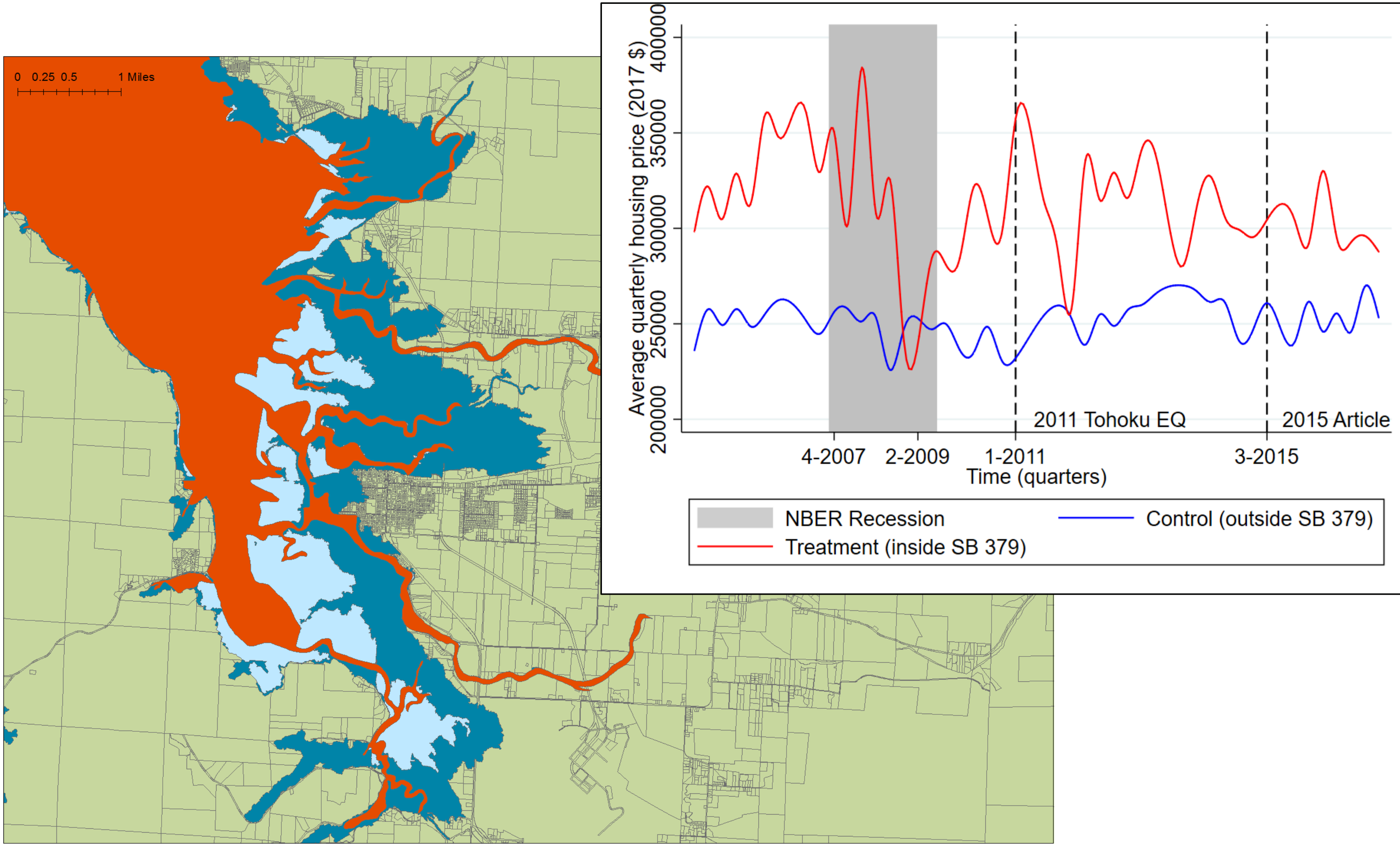
  ↓ Price by 7 – 9 percent

- Apply estimates to each parcel and track changes in value generated by Envision policy scenario exploration

Translating Capitalization Effect to Risk Probabilities

- Oceanfront homeowners have a subjective annual probability that they will experience an irreversible loss absent the option to protect between 0.7 – 1.5 percent.
- Owners of protection-ineligible properties adjacent to eligible parcels have higher subjective risk probabilities (1.4 – 2.2 percent)

Capitalization of Tsunami Risk



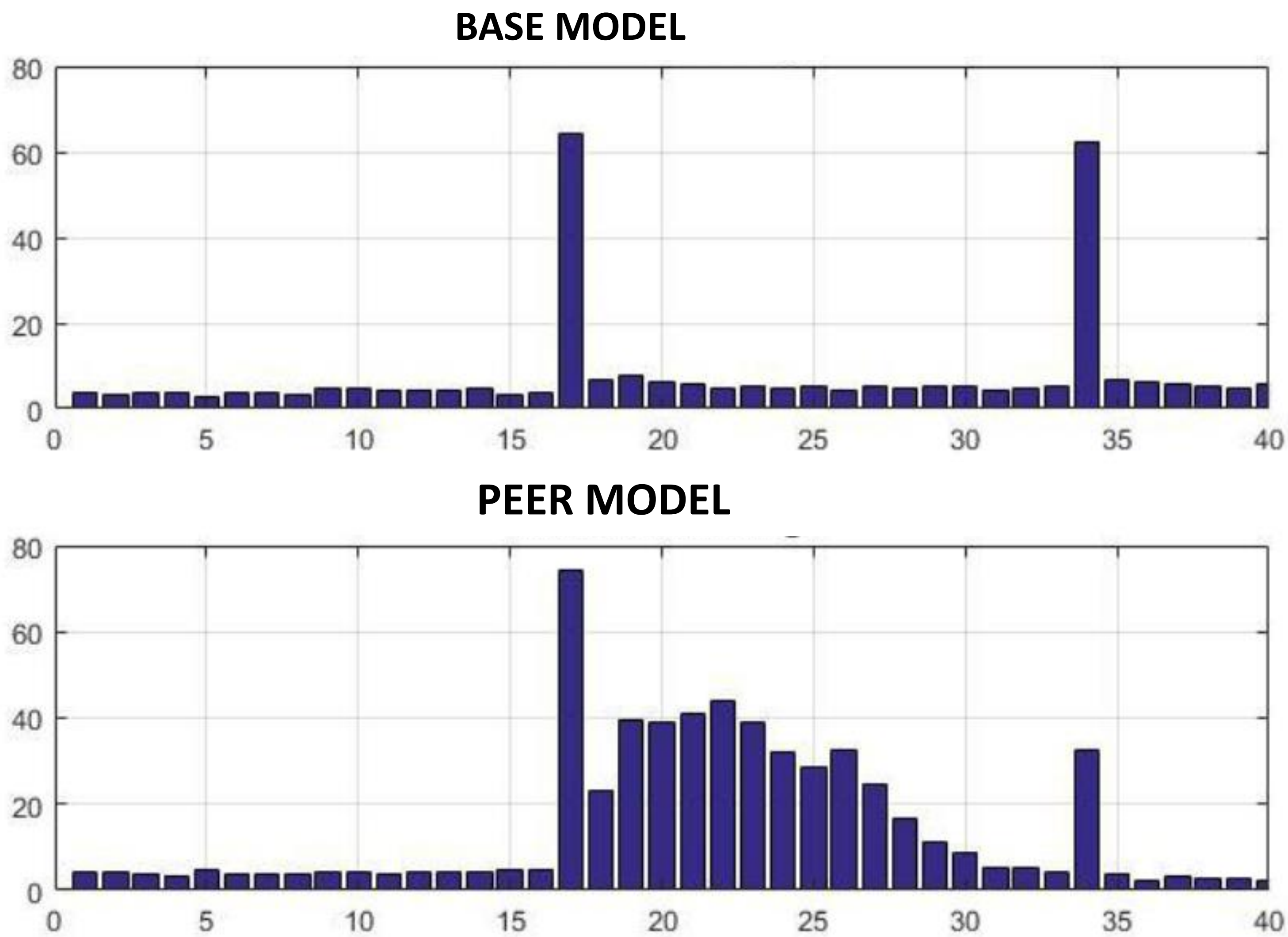
Behavioral Drivers of Coastal Land Use Change

We ask: What factors matter in the decision to install shoreline armoring?

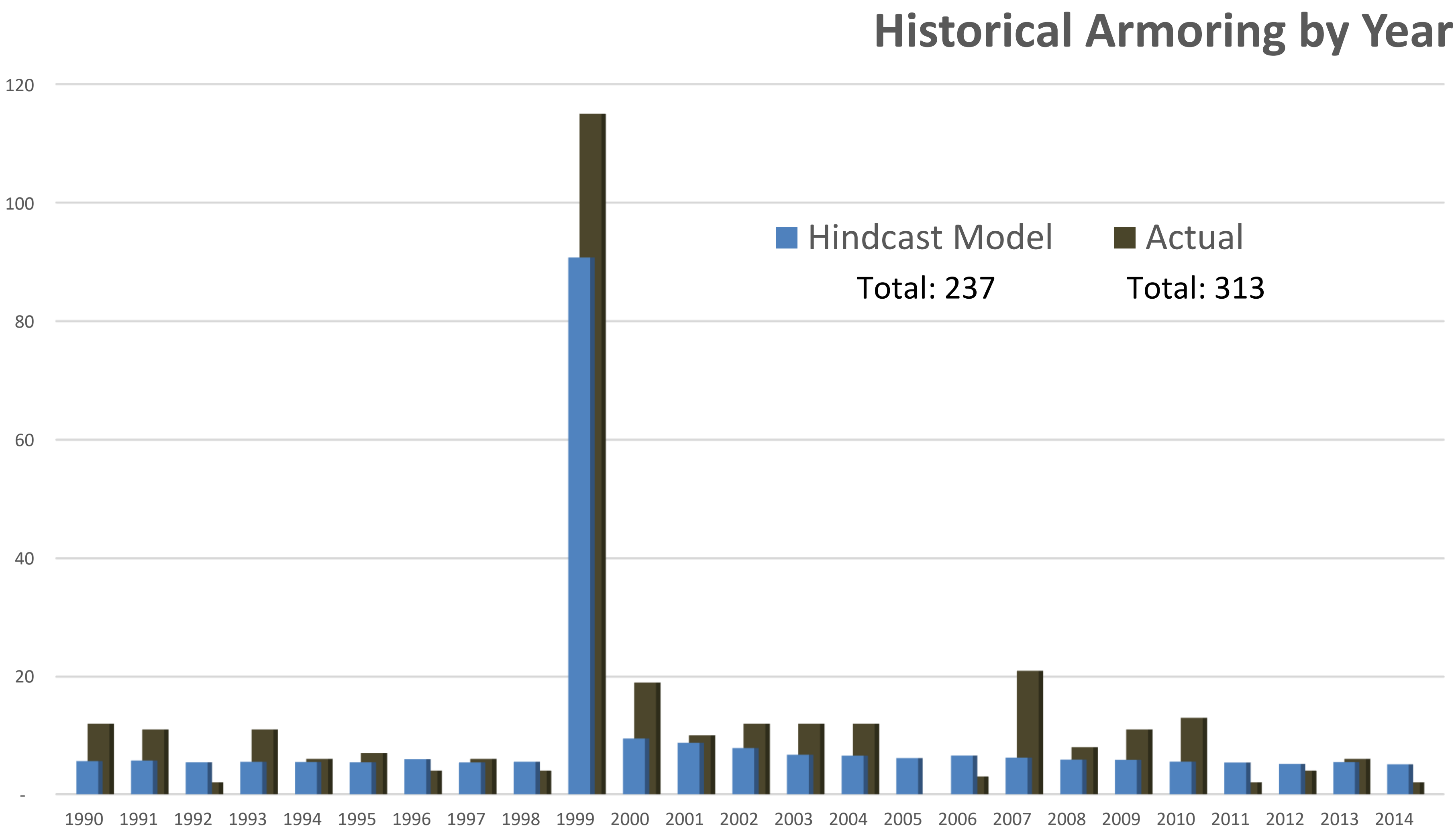
We find a statistically significant increase in probability of armoring from:

1. El Niño events
2. Peer Effects
3. Erosion Rates
4. Parcel Elevation
5. Real Market Value

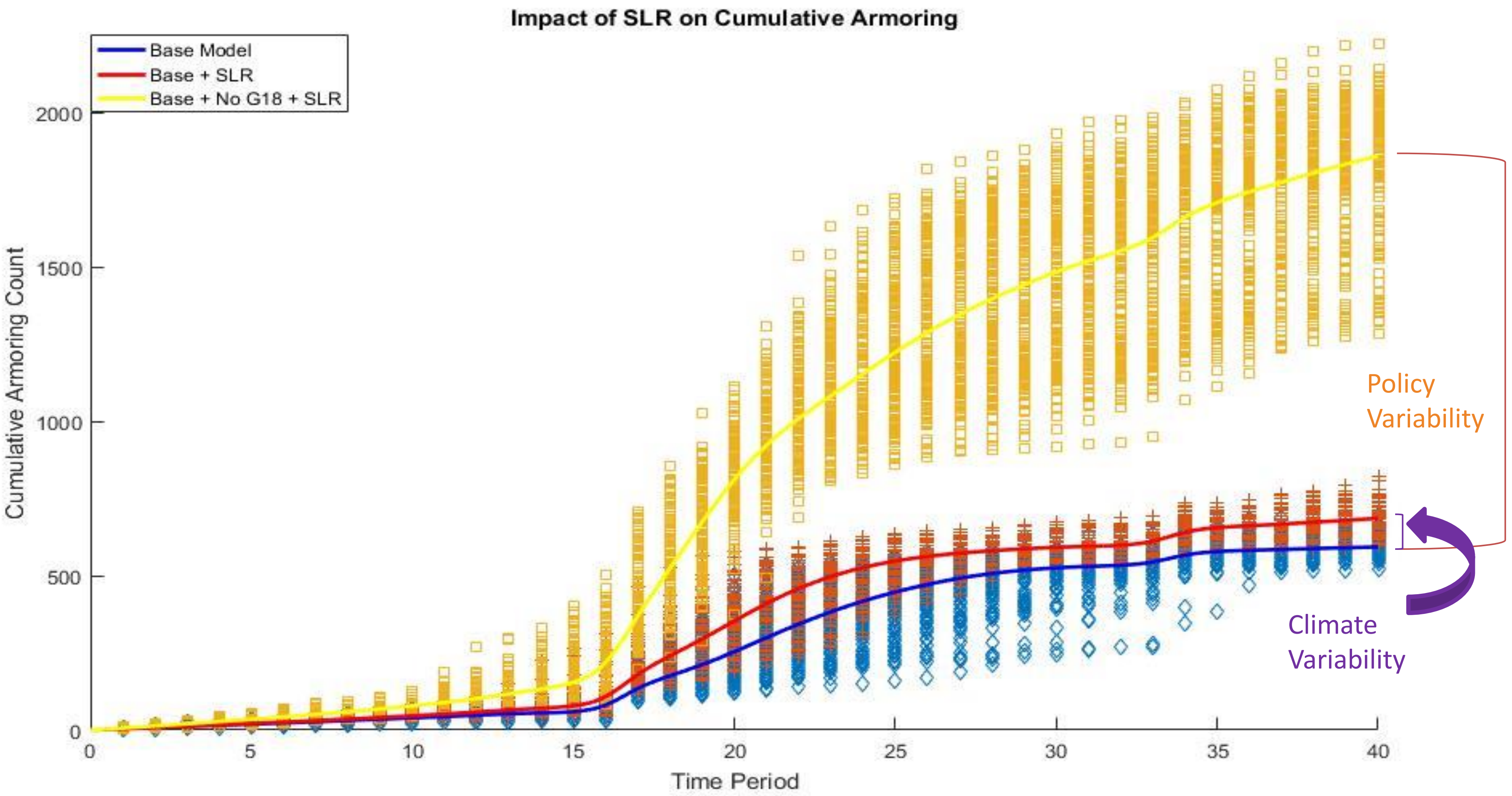
Econometric Land-Use Simulations



Econometric Land-Use Simulations



Econometric Land-Use Simulations



Alternative Futures Questions:

In the context of coastal community planning for climate change and extreme events,

1. What do you care about? In other words, what types of project output, endpoints, or quantified resilience metrics would most benefit your work?
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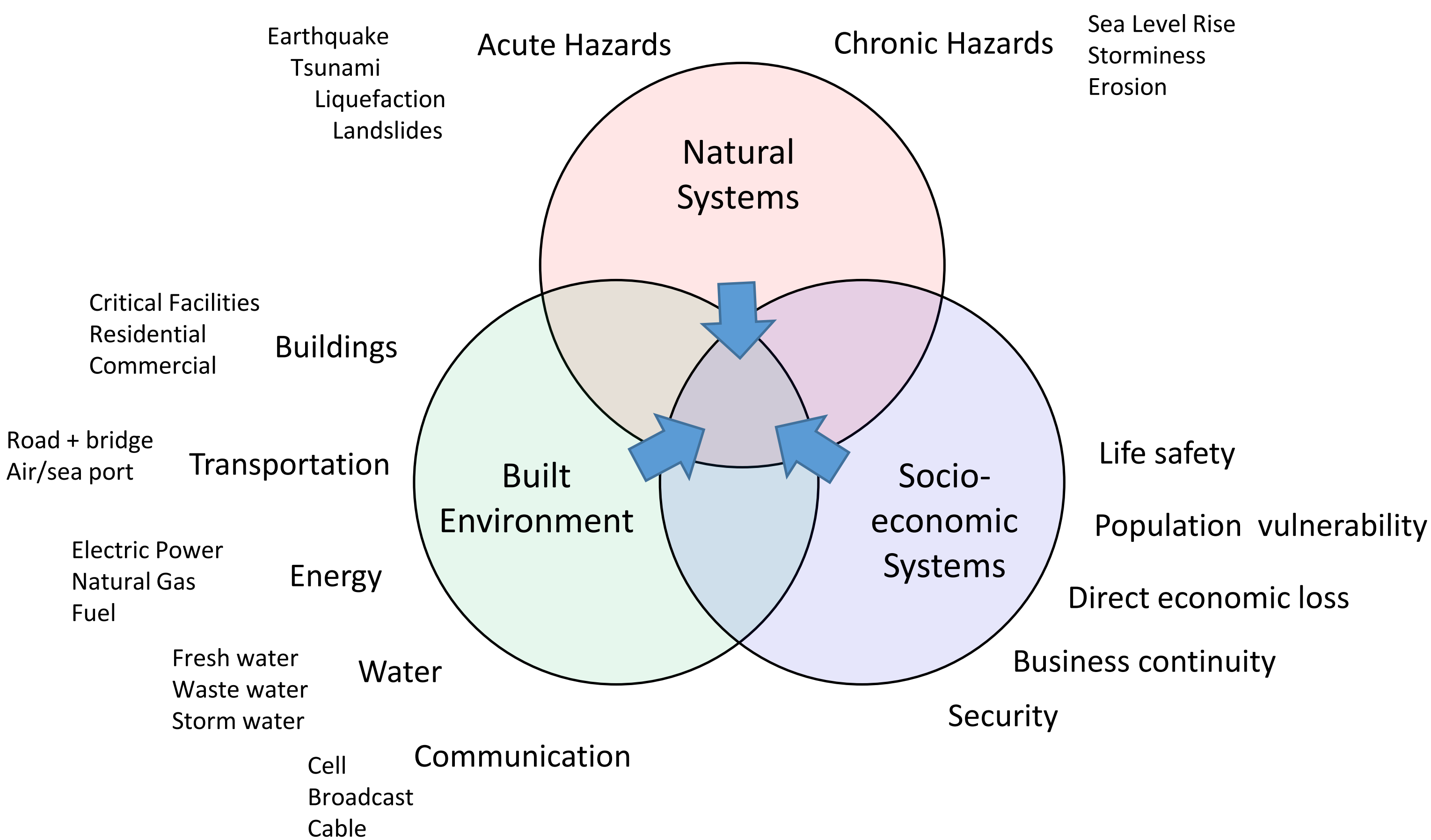
Acute Coastal Hazards

Dan Cox, Sabarethinam Kamewshwar, Dylan Sanderson
March 8, 2019

Natural Hazard and Disasters



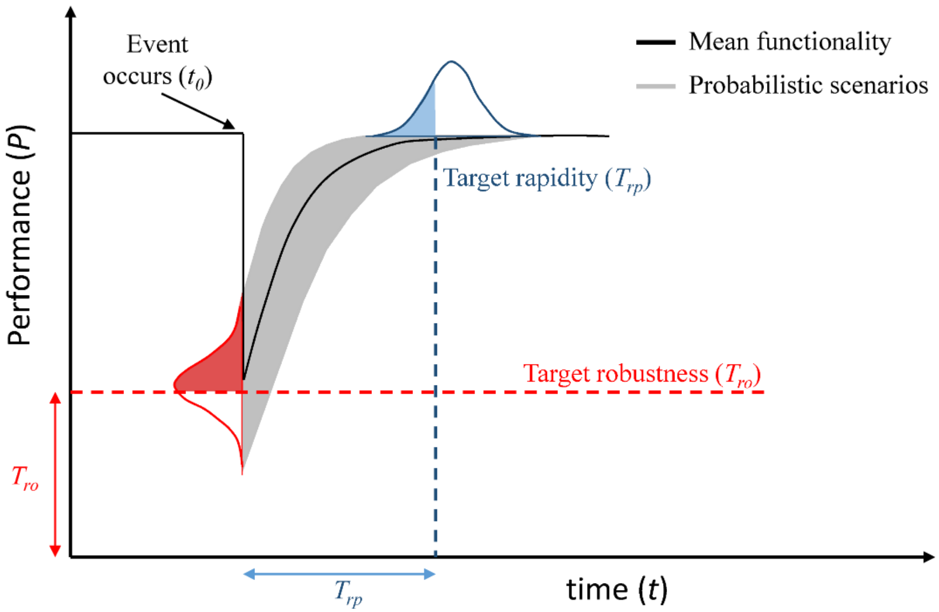
Oregon Resilience Plan and Senate Bill 850

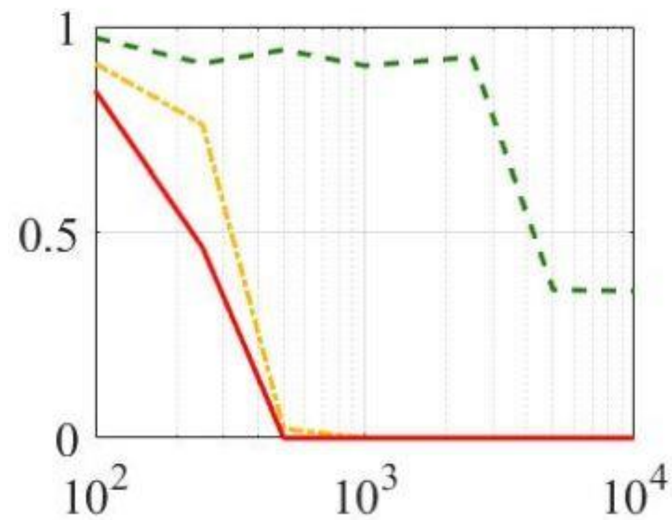
- Oregon Resilience Plan
  - Robustness and Rapidity Objectives
- Senate Bill 850
  - Mass Care and Mass Displacement
  - Encouraging Home Owner Resilience

Comparison of Target States and Estimated Time for Recovery

Infrastructure Facilities	*Event Occurs*	*0 – 24 hours*	*1 – 3 days*	*3 – 7 days*	*1 – 4 weeks*	*1 – 3 months*	*3 – 6 months*	*6 – 12 months*	*1 – 3 years*	*3+ years*
Central Oregon Zone										
▶ OREGON STATE HIGHWAY SYSTEM										
State Highway System - Tier 1 SLR [1]			R	Y	G			S	X	
Roadways			R	Y	G/S		X			
Bridges			R	Y	G		S	X		
Landslides			R	Y	G			S	X	
State Highway System - Tier 2 SLR			R		Y	G			S	X
Roadways			R		Y	G/S		X		
Bridges			R		Y	G		S	X	
Landslides			R		Y	G			S	X
State Highway System - Tier 3 SLR				R		Y	G		S	X
Roadways				R		Y	G/S		X	
Bridges				R		Y	G		S	X
Landslides				R		Y	G		S	X
State Highway System - Other Routes					R		Y	G	S	X
Roadways					R		Y	G	X	
Bridges					R		Y	G	S	X
Landslides					R		Y	G	S	X
▶ AIRPORTS & AIR TRANSPORTATION										
Tier I - Oregon Airports System										
Redmond Municipal Roberts Field Airport - FEMA		R	S		Y	G	X			
Klamath Falls Airport		R	S		Y	G	X			
FAA Facility			R	Y	G					
▶ OREGON RAIL TRANSPORTATION										
UPRR										
CA/OR State Line to Bieber Line Jct. (Klamath Falls)			Y	G	S	X				

Resilience Metrics and

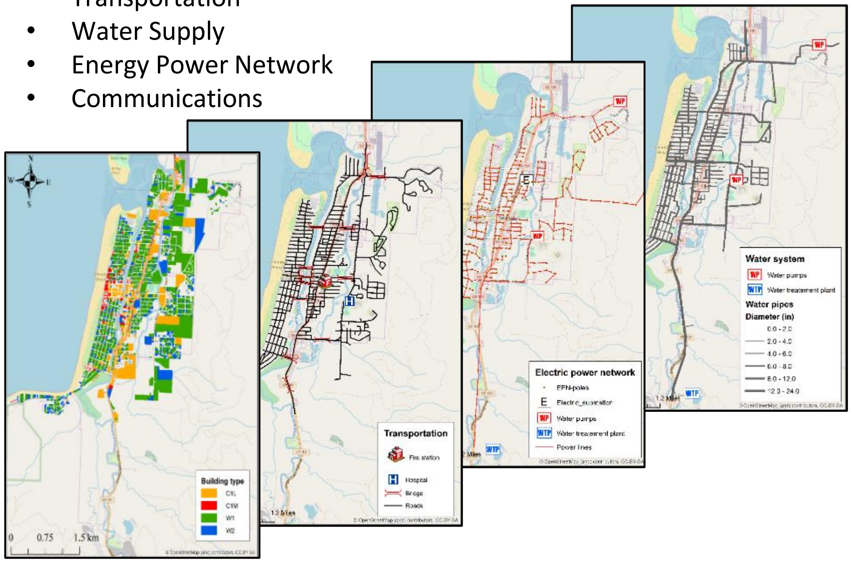


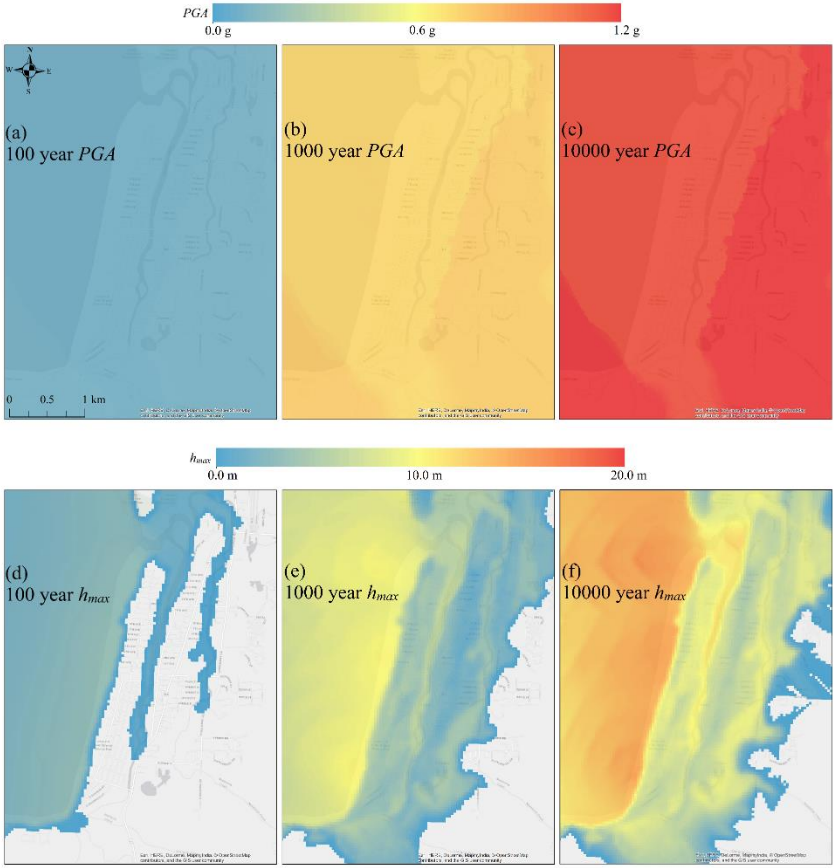


Return Period (years)

Issues

- Multiple hazards:
  - Earthquake and ground shaking
  - Tsunami
  - Liquefaction
  - Landslides
- Critical Infrastructure Systems:
  - Buildings
  - Transportation
  - Water Supply
  - Energy Power Network
  - Communications





Questions and Feedback

1. What are the potential coast wide hazard scenarios (seismic and tsunami)?
2. What infrastructure systems should be considered along the coast?
3. What are potential policy alternatives to improve resilience?
   - Retrofit, insurance, relocating vulnerable populations
4. What are potential resilience metrics of interest?
   - Social, economic, others?
5. How to incorporate policies alternatives with acute and chronic hazards?

Envisioning an (equitable) Resilient Oregon Coast

Jenna Tilt, PhD

tiltj@oregonstate.edu

Geography Program, CEOAS

Equitable Resilience

“Equitable resilience….. takes into account issues of **social vulnerability** and **differential access to power**, **knowledge**, and **resources**; it requires starting from **people’s own perception of their position within their human-environmental system**”…. Matin et al. (2018)

Wealthy's use of private firefighters ignites debate in wildfire country
NBC News 4/4/18

‘I Got Stuck’: In Poor, Rural Communities, Fleeing Hurricane Michael Was Tough
NYT: 10/11/18

The Risk of Maladaptation

- Who are the “winners” and “losers”?
- What are the trade-offs?

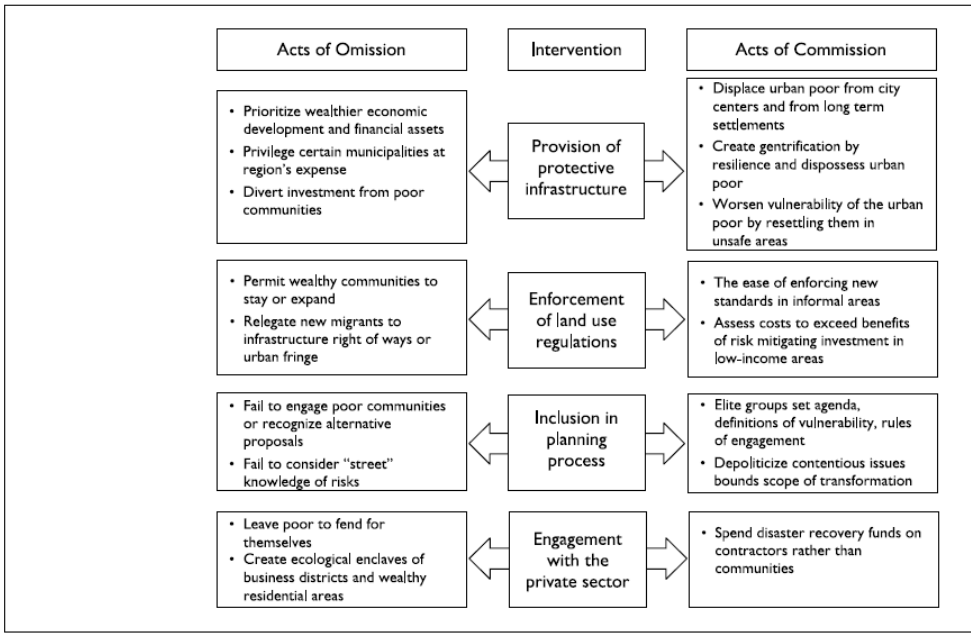


Figure 1. Types of land use planning inequities associated with urban climate change adaptation interventions.

Anguelovski, et al. (2016). Equity Impacts of Urban Land Use Planning for Climate Adaptation: Critical Perspectives from the Global North and South
Journal of Planning Education and Research, 36 (3): 333-348.

Envisioning a Resilient Oregon Coast

Envision: Apply different rates of retrofitting over time based on policy actions and household demographics

Incentivizing Retrofits*

- Tax Credits: Tax credit similar to energy tax credits
- Subsidies: Needs-based grants to offer free or reduced retrofits to low-income homeowners

How does implementation of policy actions alter community resilience?

- Who in the community is most impacted by these policies, and where?
  - *income, ethnicities/race, age*

- Who is left out, and where?
  - *renters, multi-family units*
- What are the community cost and benefits of these policies?
  - *cost of subsidizing retrofits vs. benefit of sheltering in place*
- Over what period of time is adoption of these policy actions most effective?
  - *incremental adoption, priority adoption, free-market adoption*

***OSSPAC Insurance Report**

Envisioning a Resilient Oregon Coast

Is understanding how the impacts of policy actions are distributed across communities something that interests you?

- If so, what types of model output, endpoints, or quantified resilience metrics would most benefit your work?
- What coastal adaptation/resilience policies should we focus on to show these impacts?
- Outside of the Envision model, what qualitative information is important to you in order to understand community perceptions and responses to coastal adaptation/resilience policies?
- Who else should we be talking to?