

Envisioning Resilient Coastal Futures: Exploring alternative scenarios along the Oregon and Washington coastline

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Oregon State
University



Contributing Stakeholders: **Tillamook County and Grays Harbor County Knowledge-to-Action Networks**

Climate and Ecological Controls on *changing* Coastal Community Vulnerability to Flooding and Erosion

- Global rise in sea level (informed with regional variability)
- ENSO (El Niño - La Niña range)
- Trends and variability in storminess patterns (and the associated nearshore processes)
- Dune grass invasions

12 3'98

Socio-economic Controls on *changing* Coastal Community Vulnerability to Flooding and Erosion

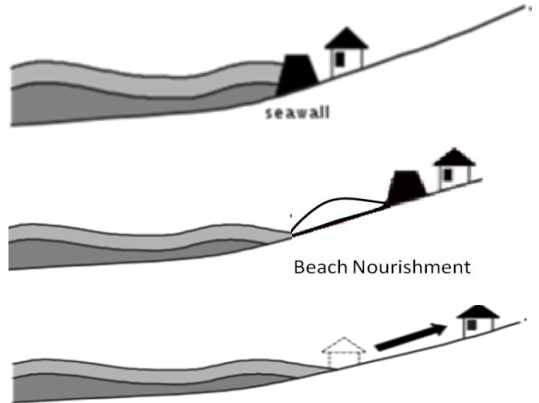
- Population growth
- Development Patterns
- Adaptation Planning
- Mitigation Measures

12 3'98

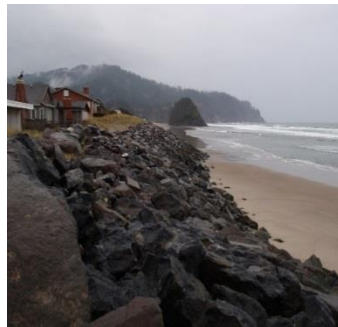
Objective 1: Participate in a ‘**Knowledge-to-Action Networks**’ consisting of **collaborative teams** of stakeholders, researchers, and outreach specialists who will **co-produce knowledge** to inform climate-resilient strategies in **Tillamook and Grays Harbor Counties**.



Objective 2: Collaboratively develop the information and tools necessary to **envision future scenarios, assess impacts and vulnerability** associated with climate change driven erosion and flood hazards, and quantitatively evaluate a **range of adaptation strategies.**



Tillamook County, OR



Erosion
Accretion

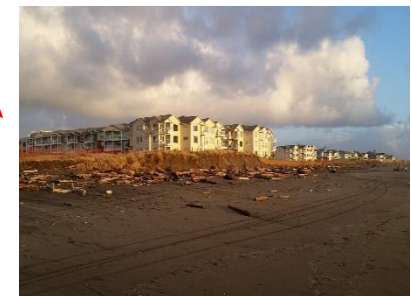


Tillamook County Demographics and Hazard Exposure	
County Area	3450 km ²
County Population	25,000
Population Growth	0.1%
Main Economies	Lumber, Dairy, Tourism
Coastline	80km
Historic Shoreline Change	65% coastline eroding
Estimated Sea Level Rise	0.11-1.42m by 2100 NRC, 2012

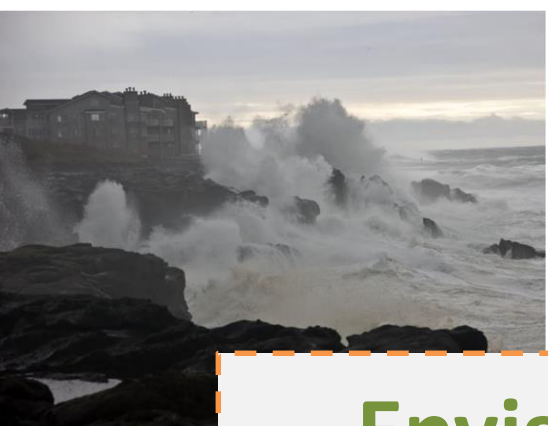
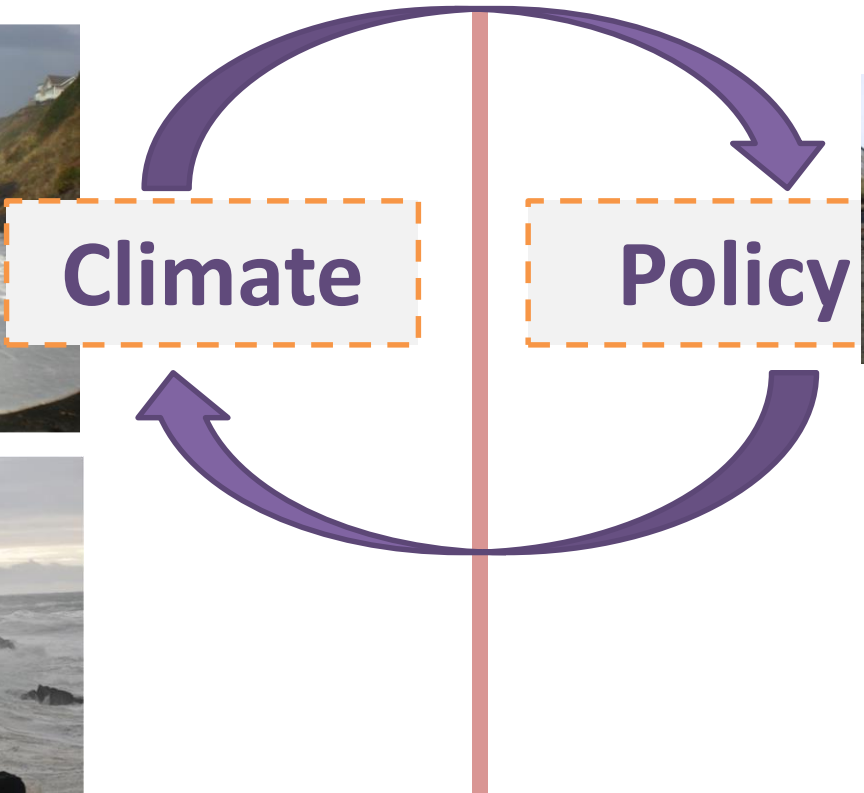
Grays Harbor County, WA



Grays Harbor County Demographics and Hazard Exposure	
County Area	5760 km ²
County Population	71,600
Population Growth	0.3%
Main Economies	Lumber, Seafood and Shellfish
Coastline	82km
Historic Shoreline Change	70-90% coastline prograding
Estimated Sea Level Rise	0.21-0.86m by 2100 Miller, Mauger, in prep..



Erosion
Accretion

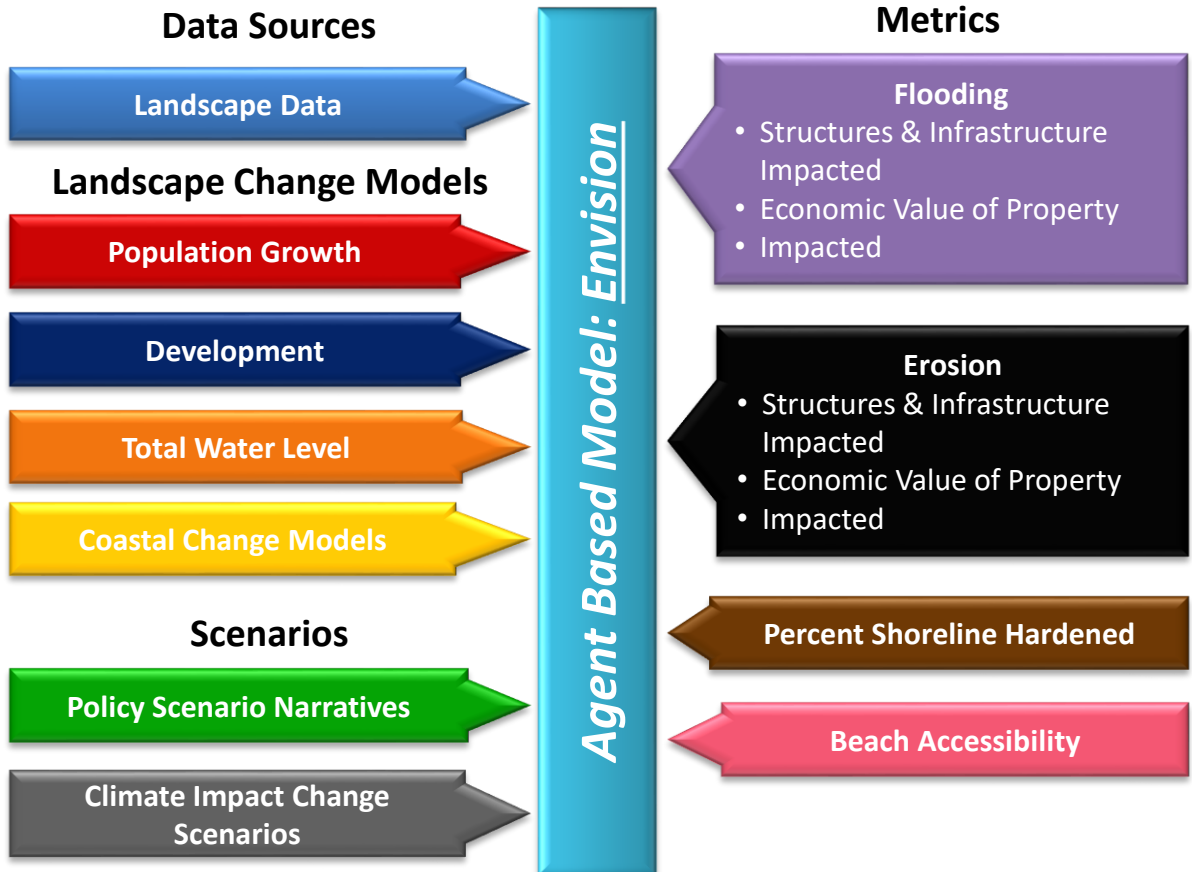


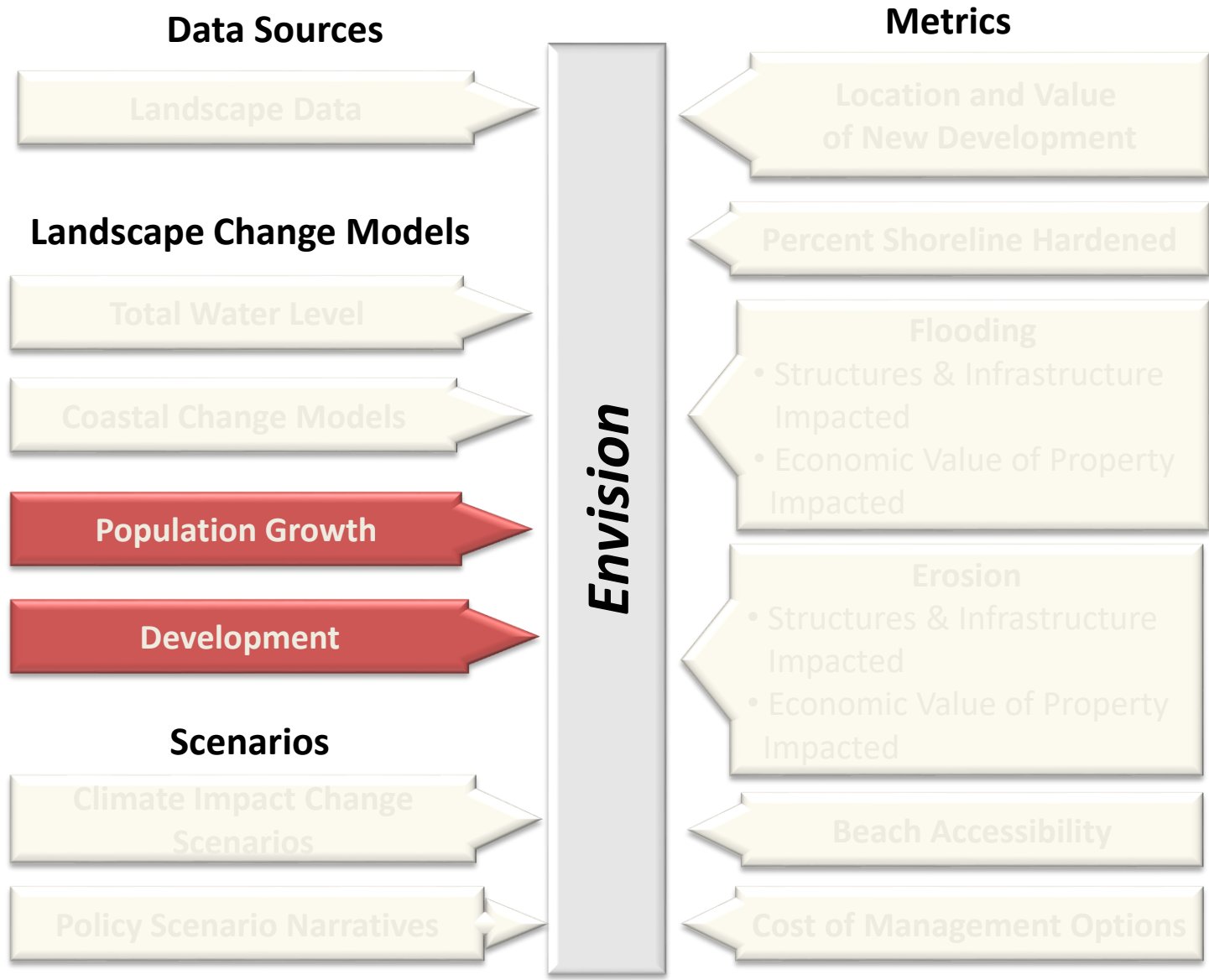
Envisioning Alternative Futures:
Explore how complex coupled natural and human systems dynamically respond to varying adaptation and climate change scenarios.

Alternative Futures Analysis: *Envision*



Bolte et al., 2007





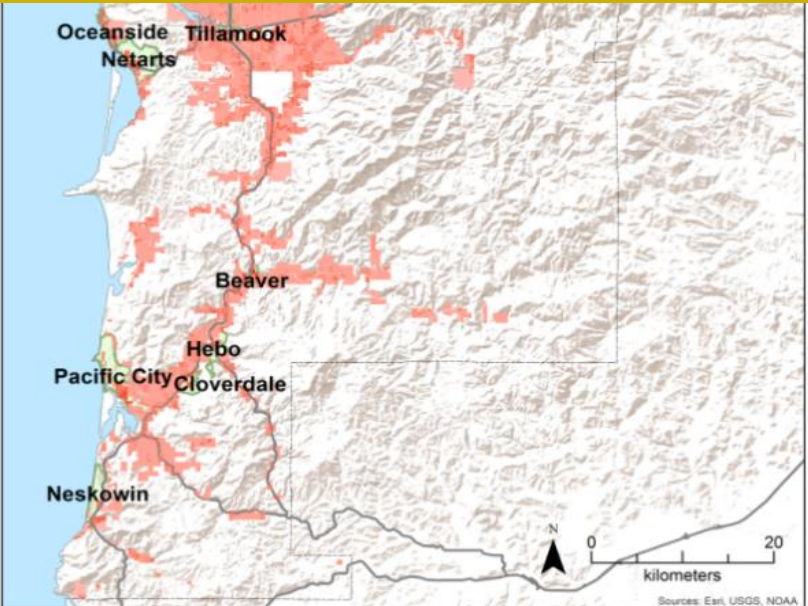
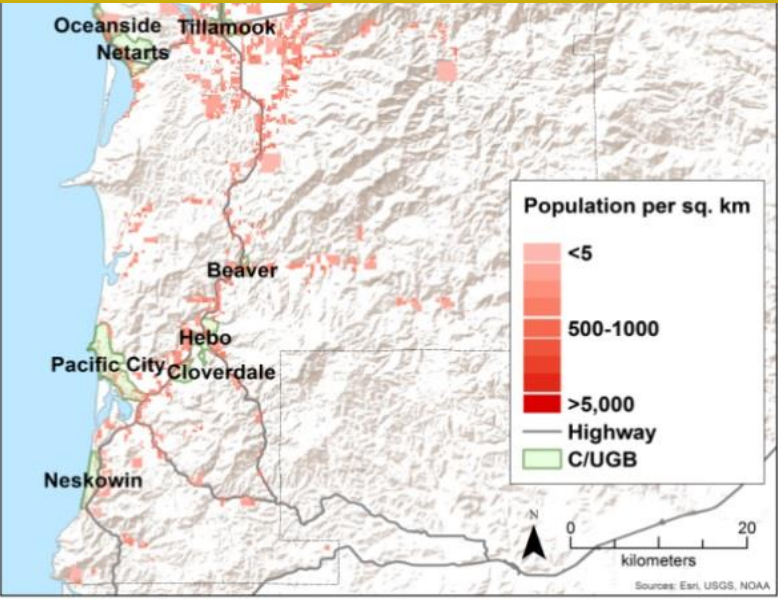
2010

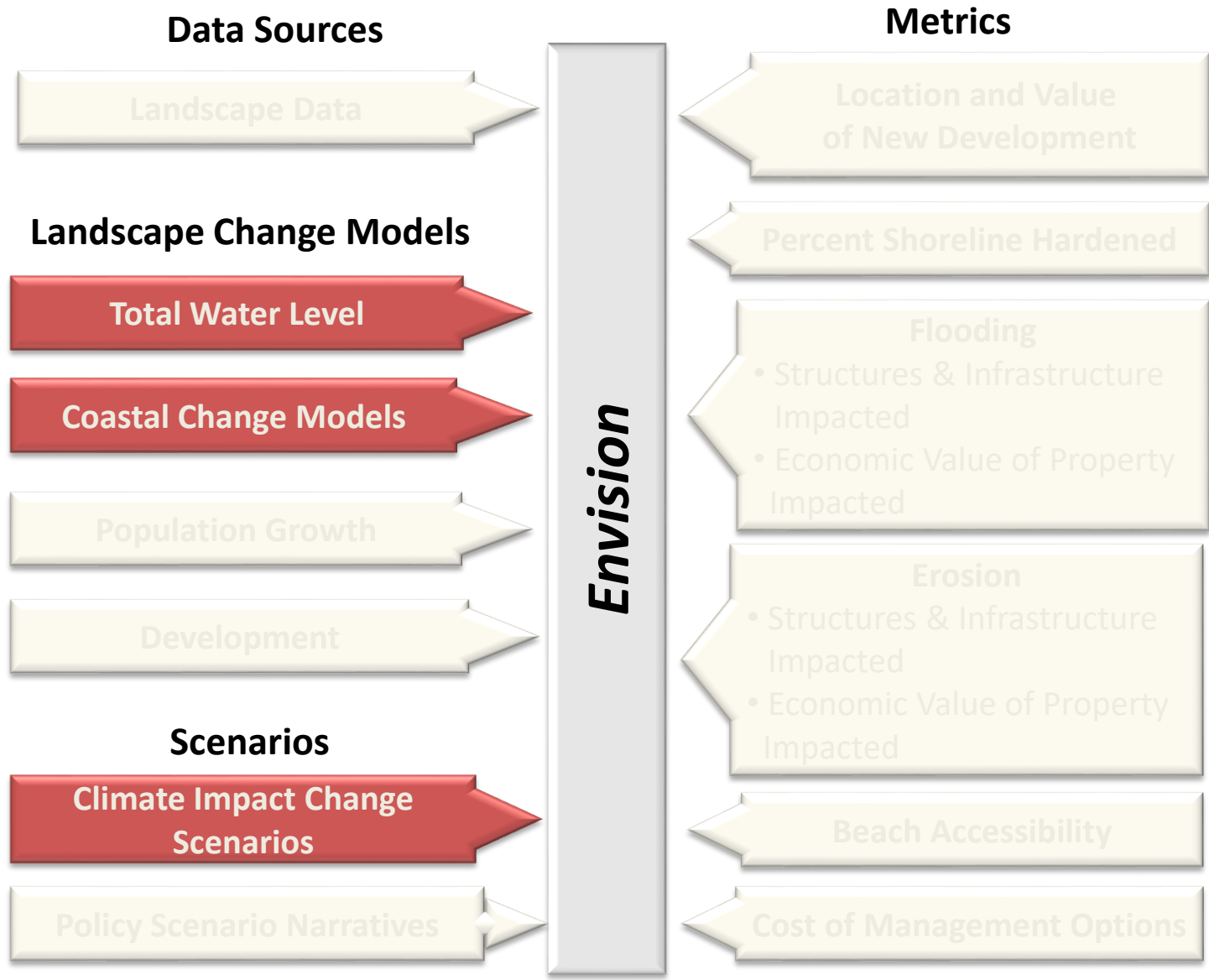
Population Growth and Development Submodels

2100

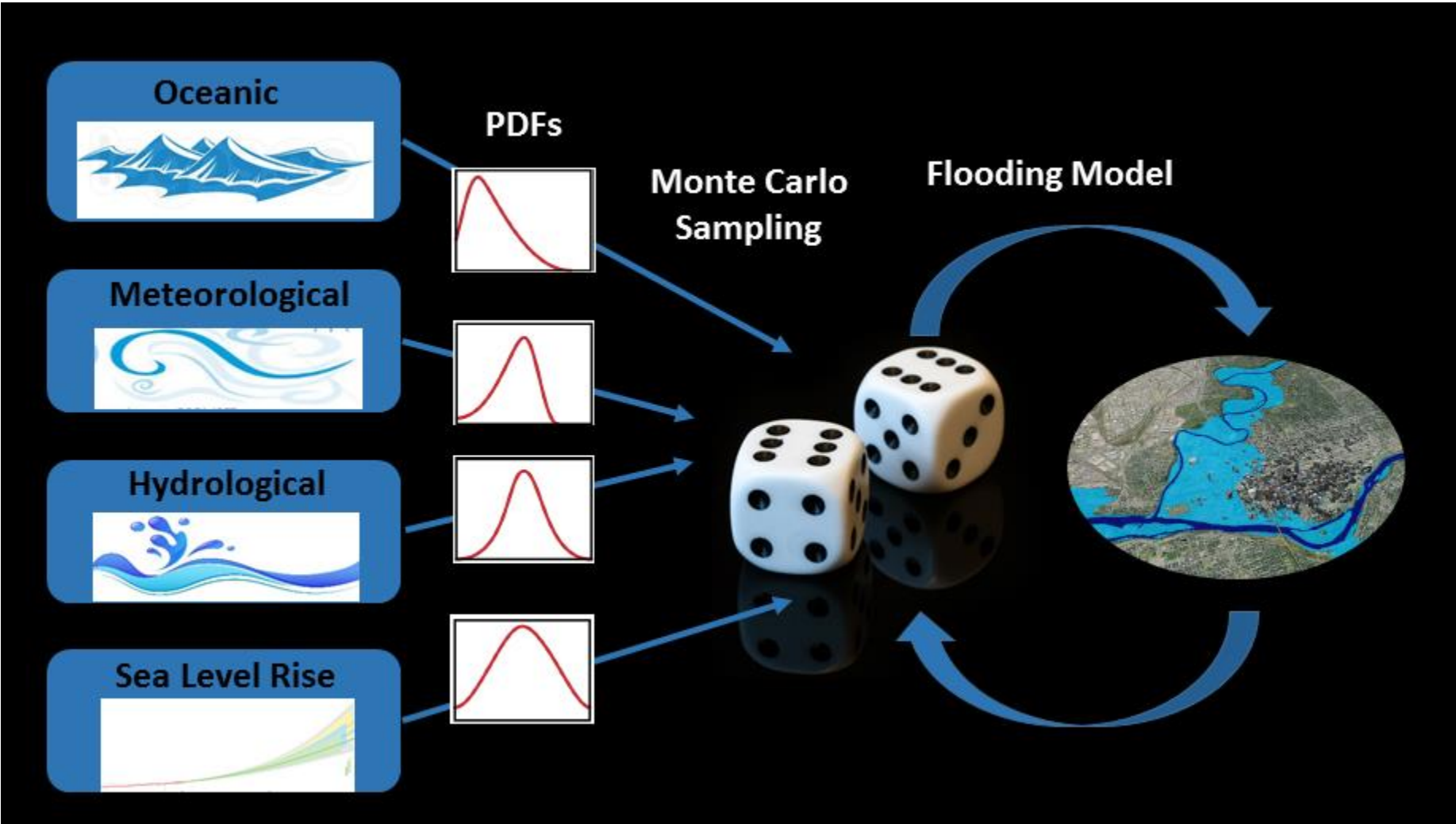


Assessed Value (\$)
 $= f(\text{lot size, distance to shoreline, presence of BPS, distance to major highway, number of buildings, geographic location (within growth boundaries)})$



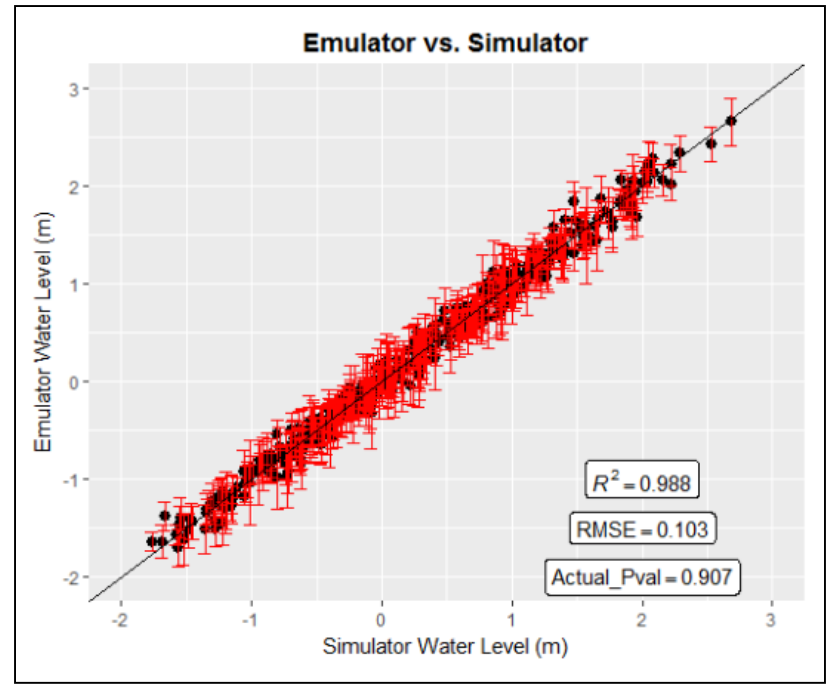
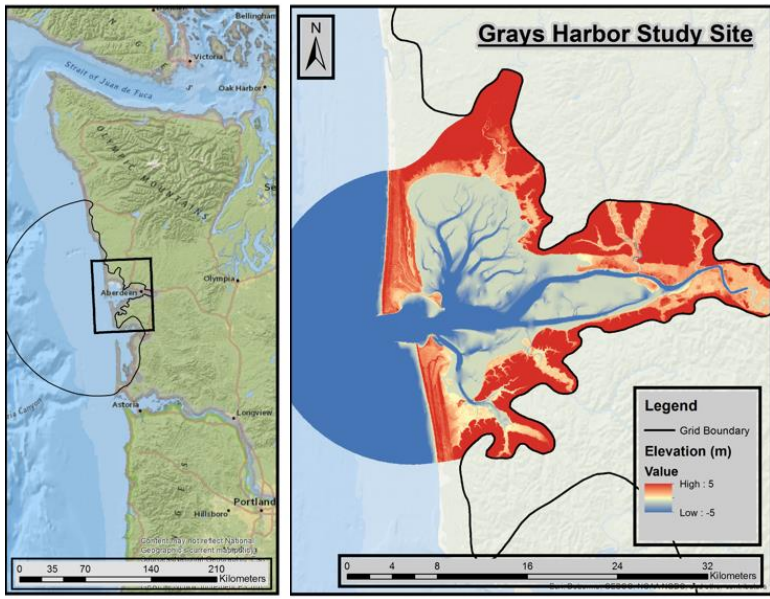
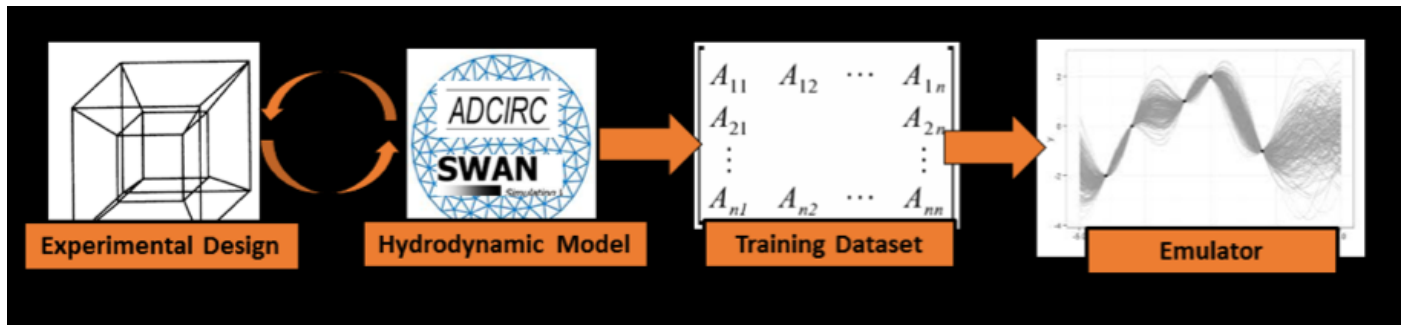


Climate Change Scenarios/TWL Modeling

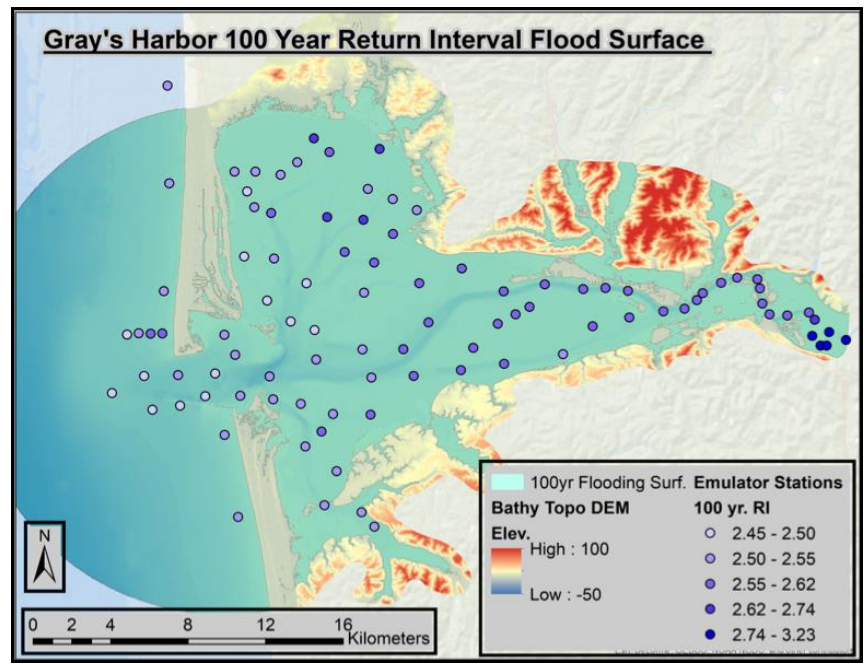
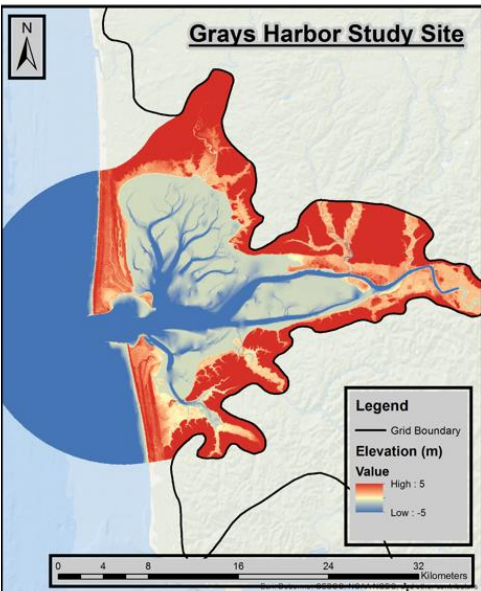
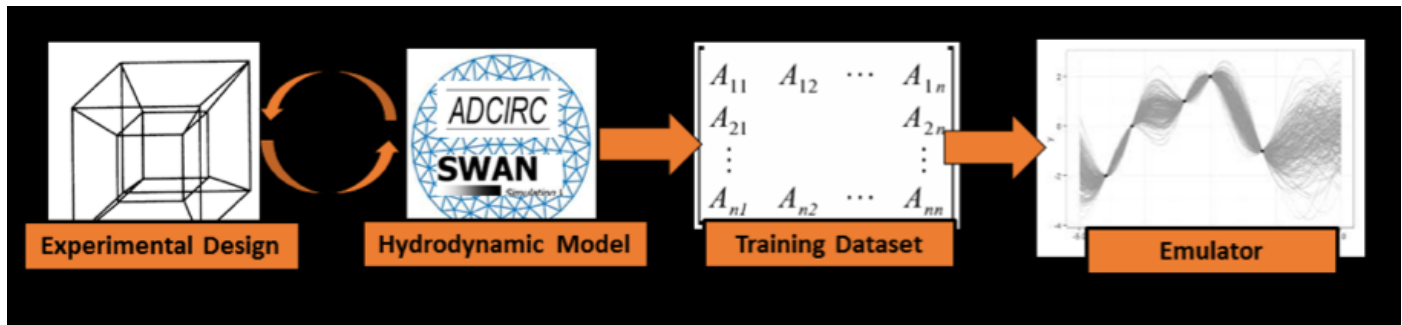


Serafin and Ruggiero, 2014, Miller et al., 2018, Parker et al., in prep.

Climate Change Scenarios/TWL Modeling



Climate Change Scenarios/TWL Modeling

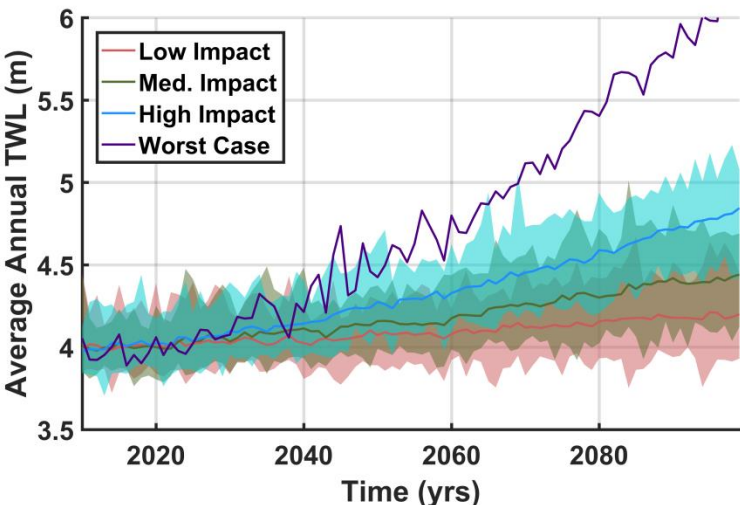
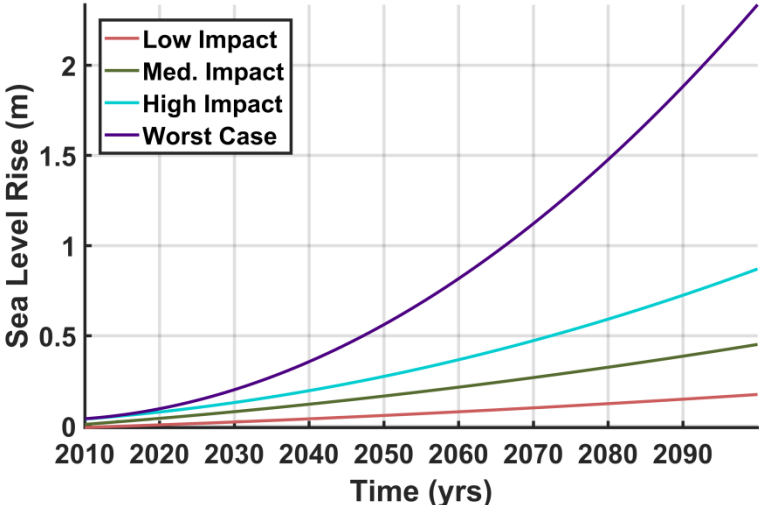


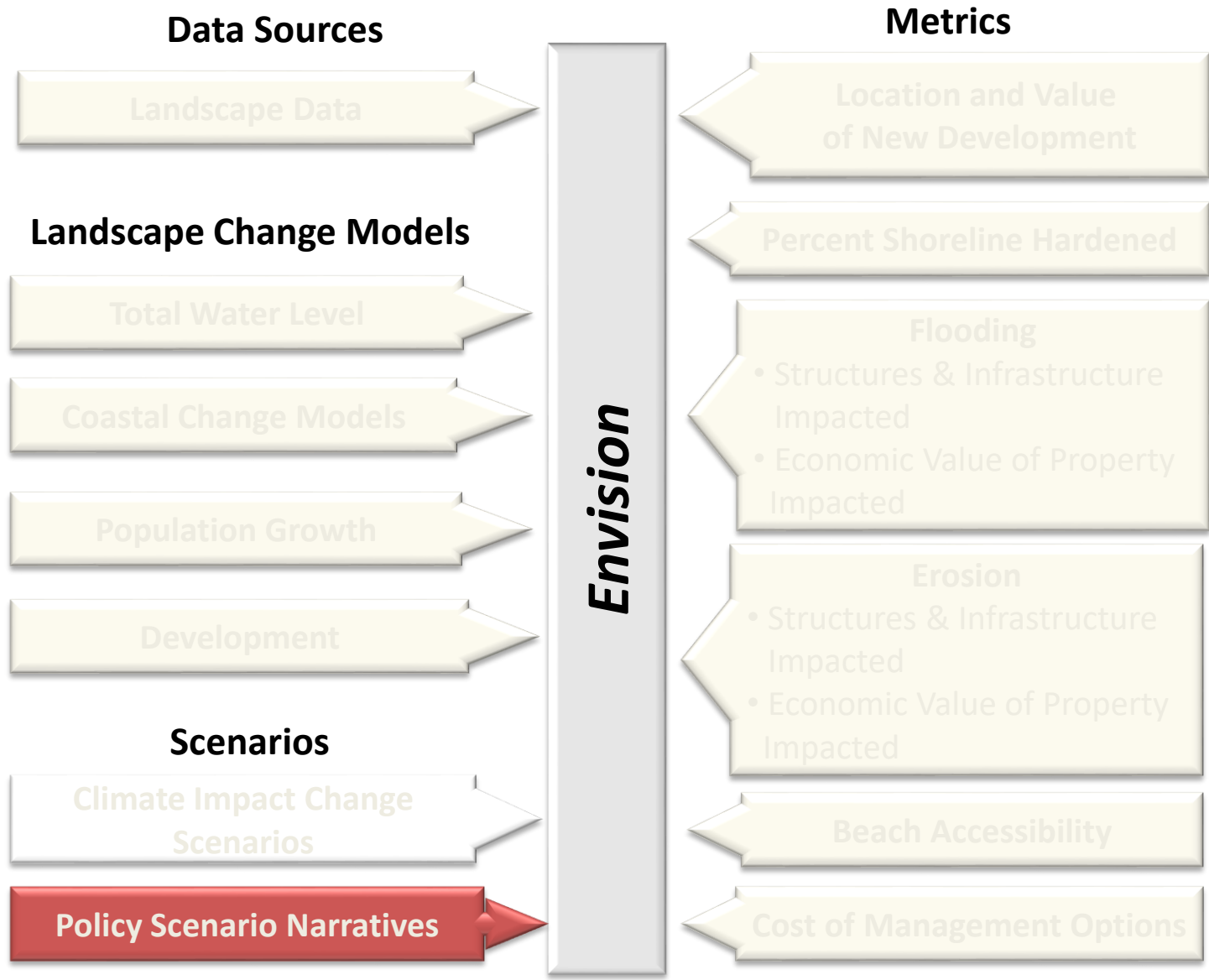
Climate Change Scenarios/TWL Modeling

sea level rise/VLM

wave climate variability

El Niño variability





Co-development of Policy Scenarios



Policy Scenario Narratives



1. Status Quo

Continuation of present-day policies.

Policy Scenario Narratives

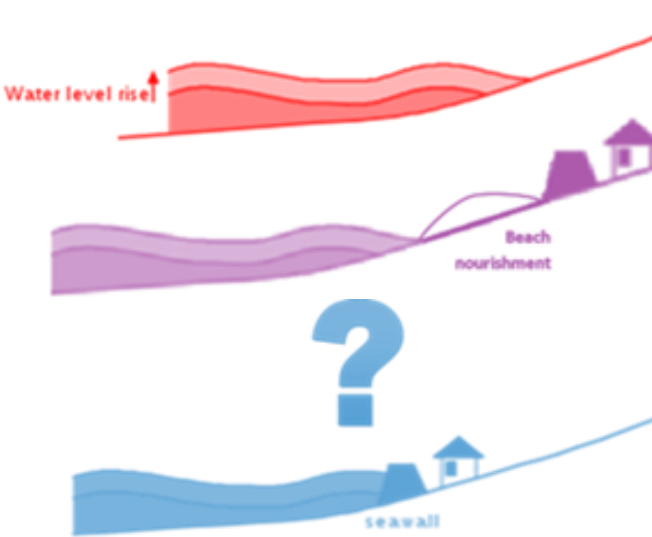


1. Status Quo

Continuation of present-day policies.

Example Policy: Maintain current backshore protection structures (BPS) and allow more BPS to be built on eligible lots.

Policy Scenario Narratives



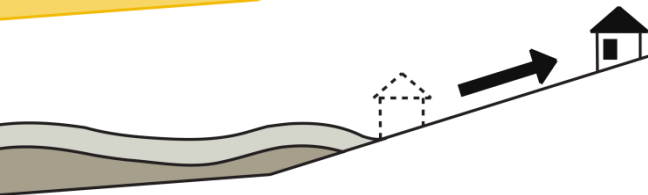
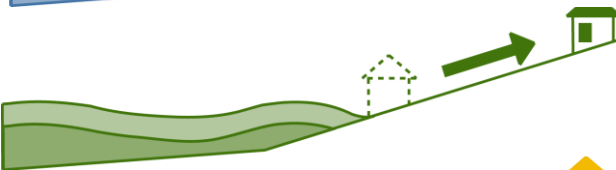
1. Status Quo

2. Hold the Line

3. Laissez-Faire

Current policies (state and county) are *relaxed* such that existing homes, infrastructure and new development all trump the protection of coastal resources, public rights, recreational use, beach access, scenic views.

Policy Scenario Narratives



1. Status Quo

2. Hold the Line

3. Laissez-Faire

4. ReAlign

5. Neskowin

6. Hybrid

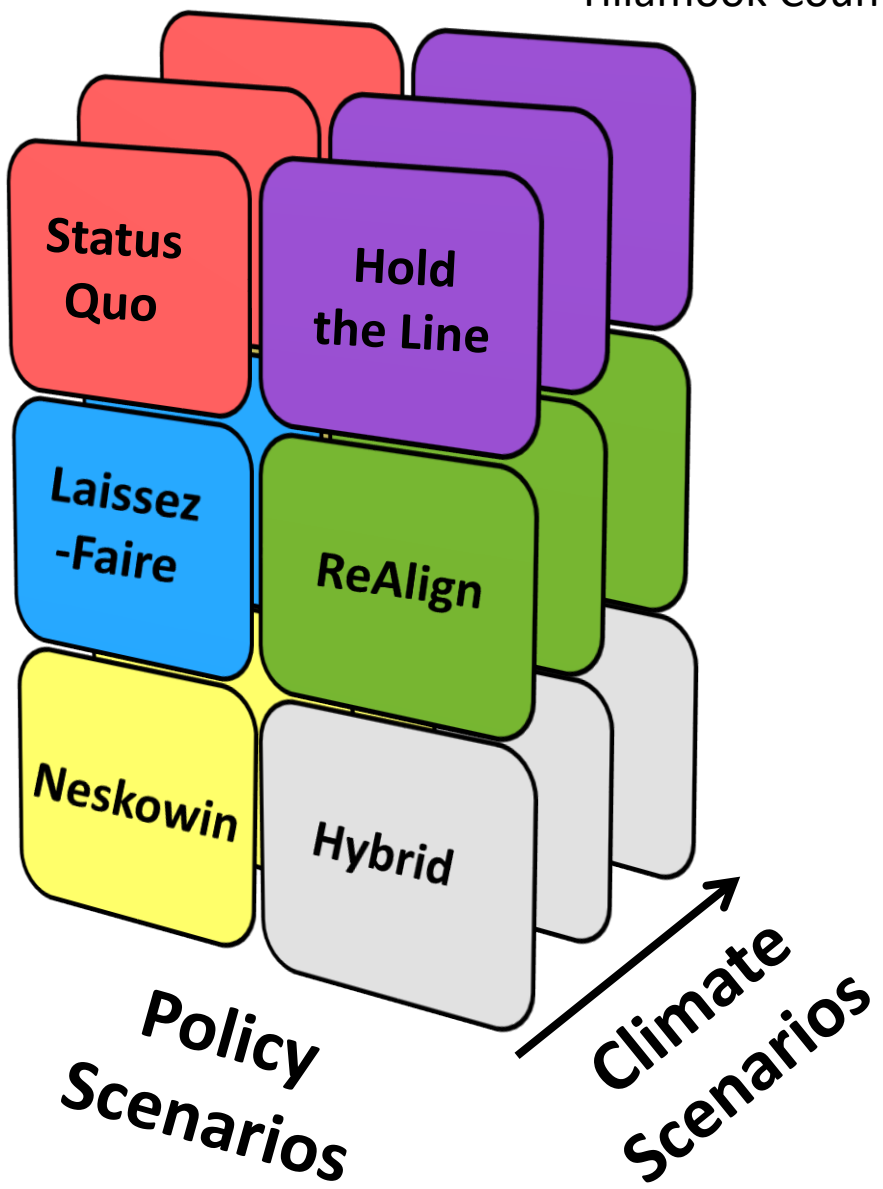
Implement policies in accordance with the preferences established by the KTAN

Tillamook County, OR

**Climate Scenarios
(Physical Drivers)**

X

**Policy Scenarios
(Human Drivers)**

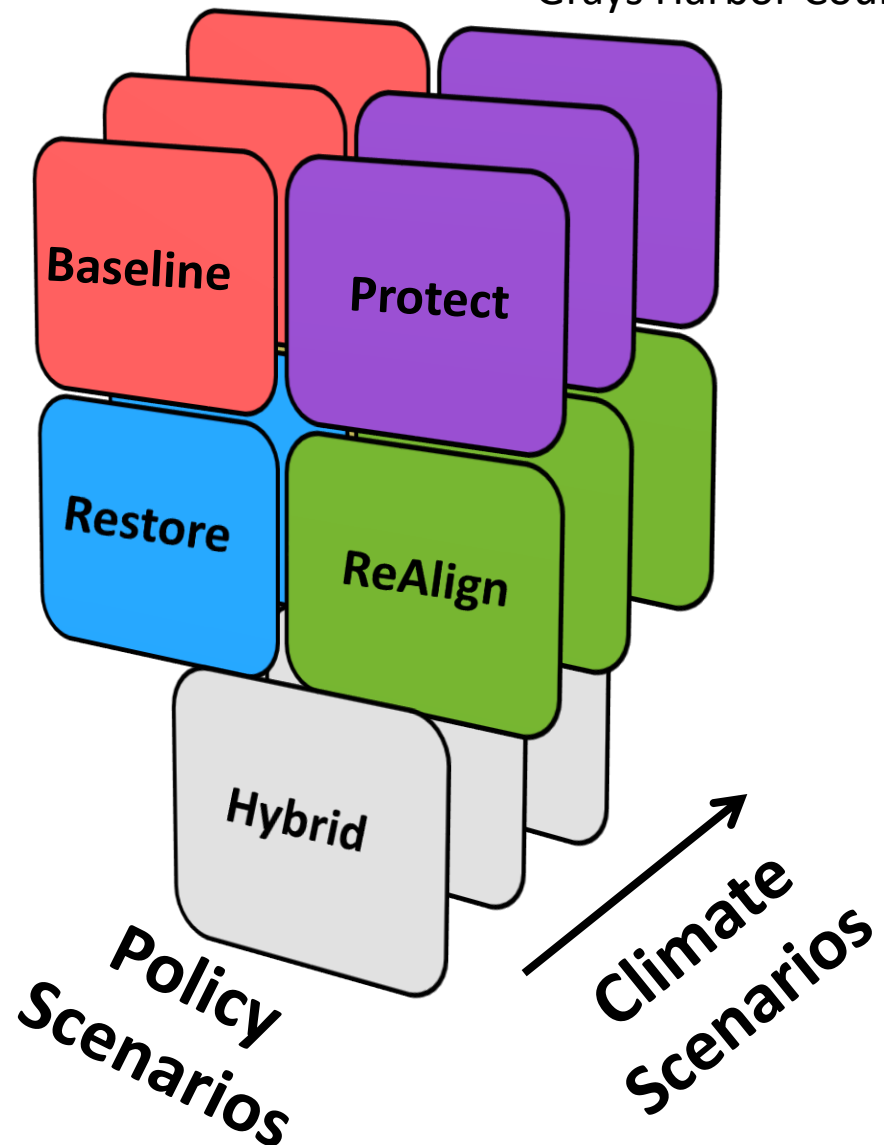


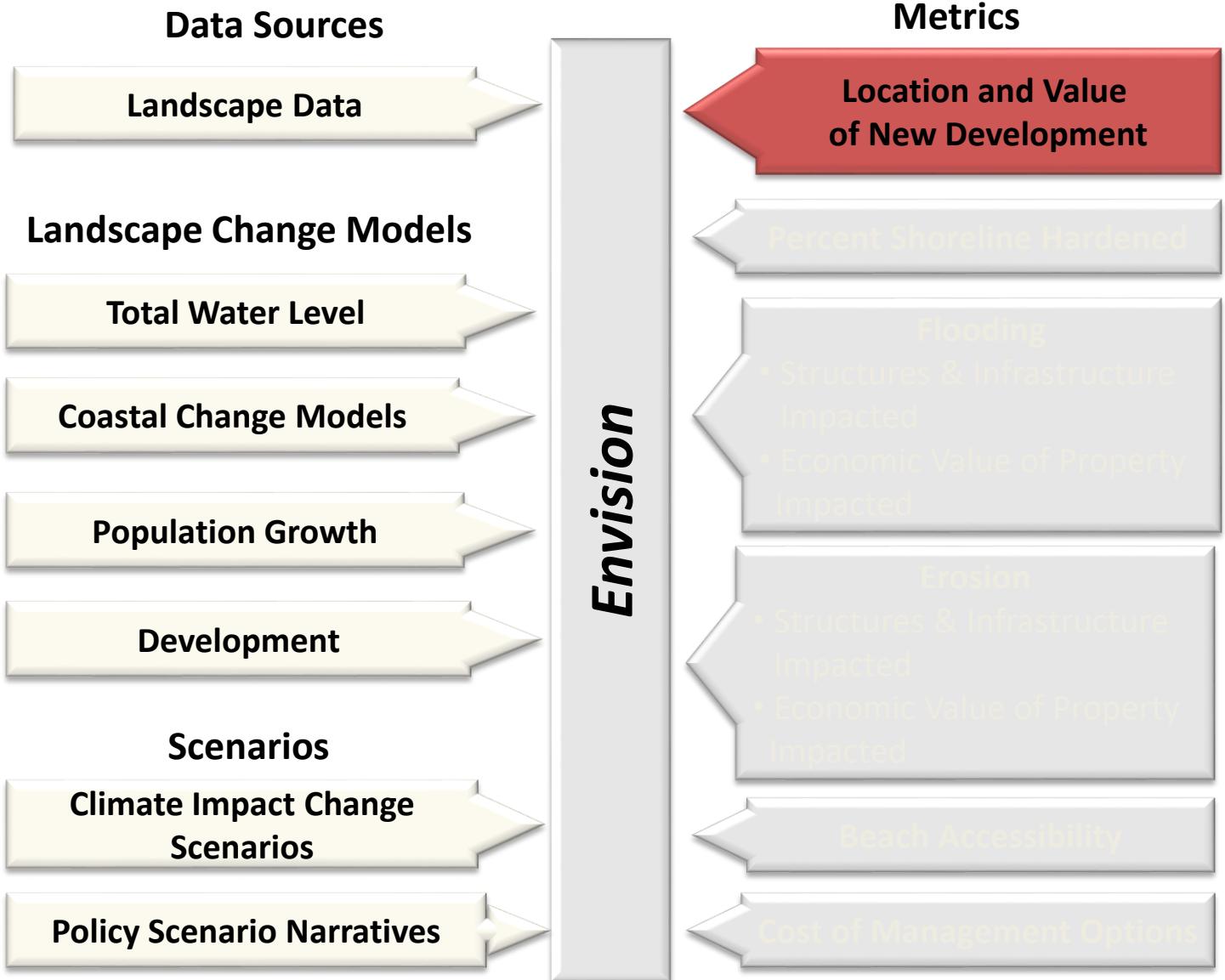
Grays Harbor County, WA

Climate Scenarios (Physical Drivers)

X

Policy Scenarios (Human Drivers)





The effect of policies on development patterns

Neskowin



Rockaway Beach



 DOGAMI Hazard Zone

Land Use Adaptation Policies—


- Prevent further development within hazard zone.
- Remove buildings from hazard zones through easements, etc.

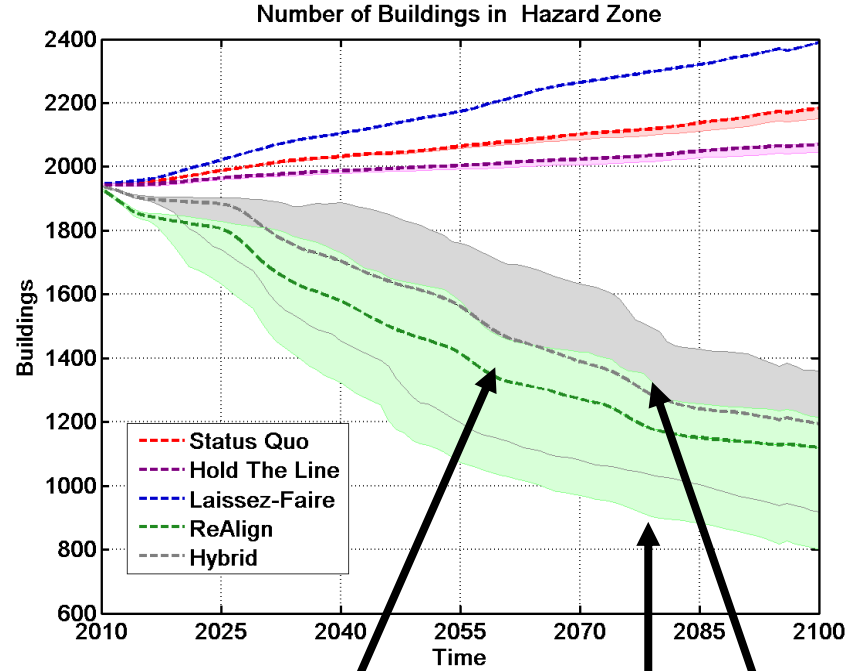
The effect of policies on development patterns

Neskowin

Rockaway Beach



 DOGAMI Hazard Zone



Medium impact climate scenario


High and low impact climate scenarios

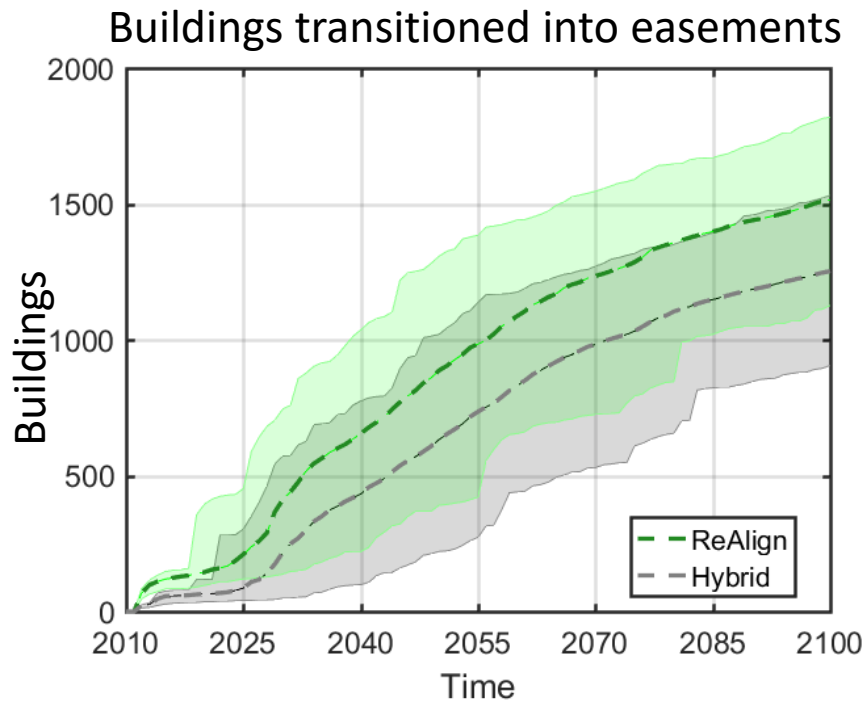
The effect of policies on development patterns

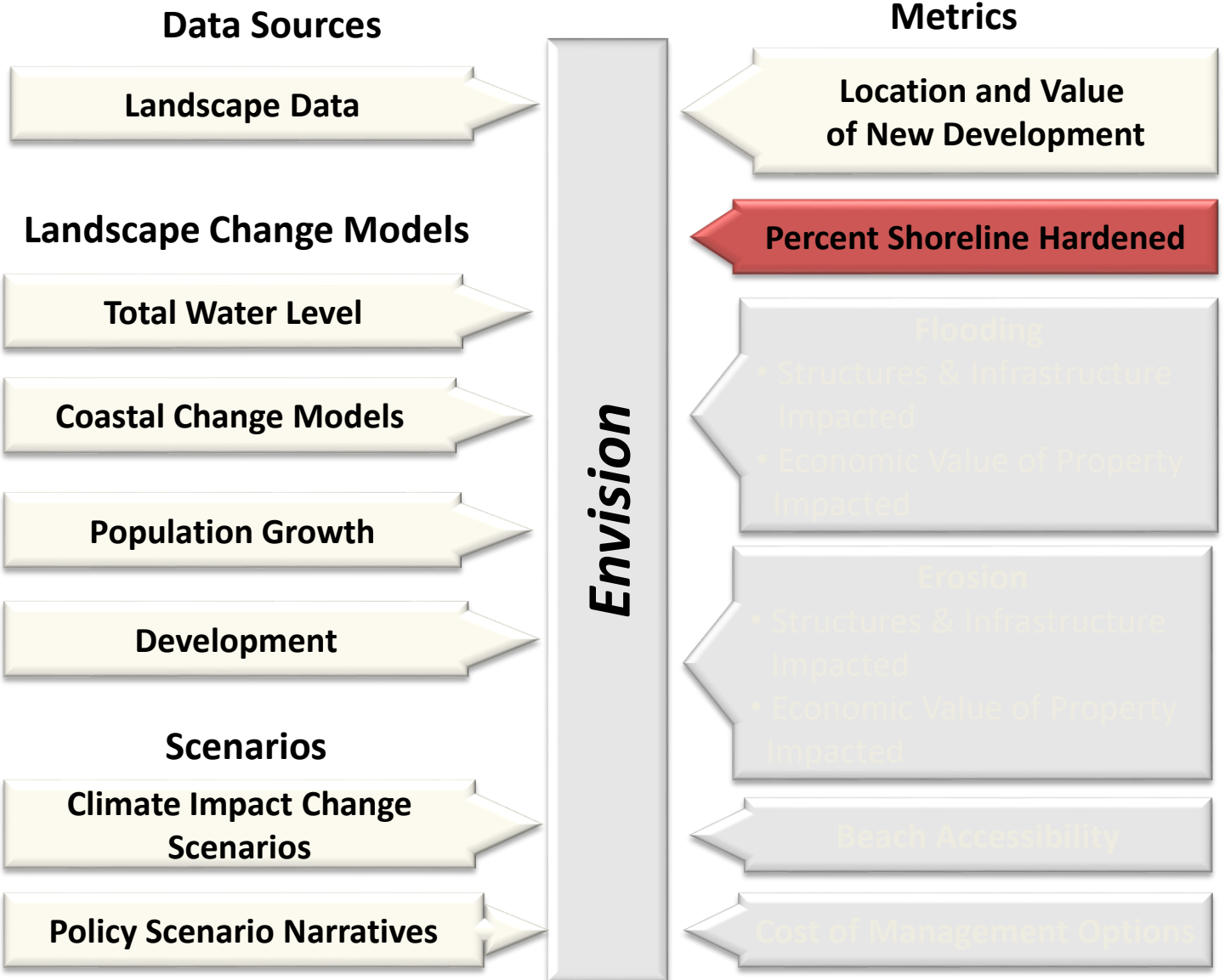
Neskowin

Rockaway Beach



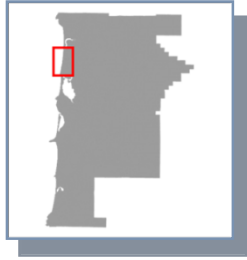
 DOGAMI Hazard Zone



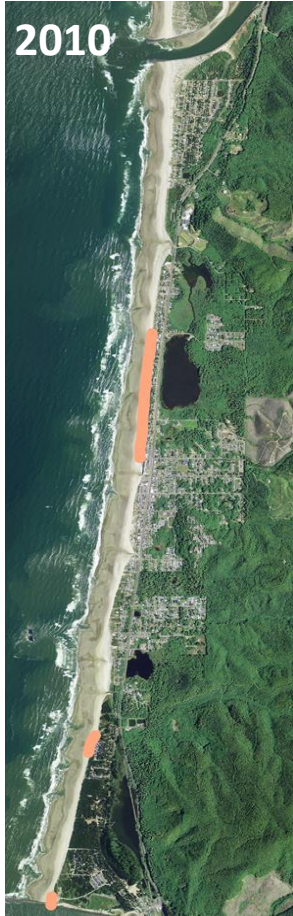


Coastline armored in response to erosion

Rockaway Beach Littoral Sub-Cell



Existing BPS New BPS



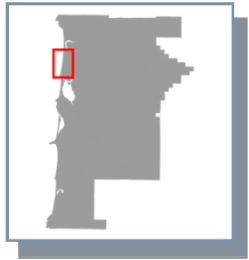
2010

Present Day

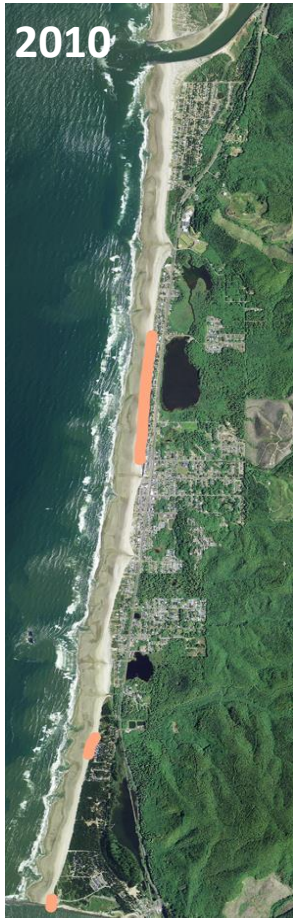


Coastline armored in response to erosion

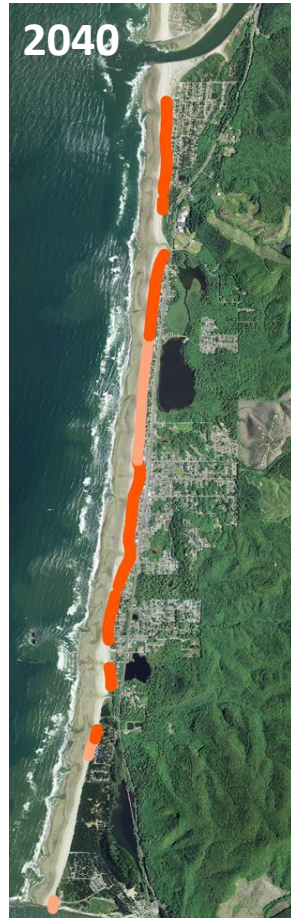
Rockaway Beach Littoral Sub-Cell



Existing BPS New BPS



Present Day



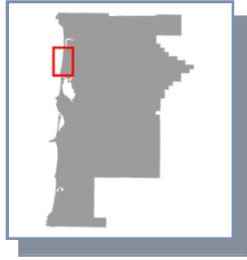
Status Quo



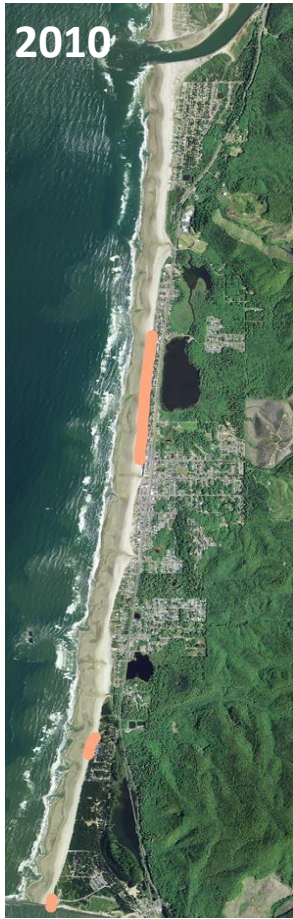
Medium Climate Impact Scenario

Coastline armored in response to erosion

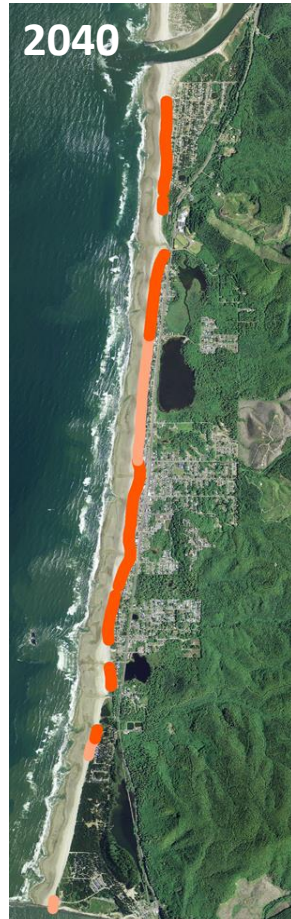
Rockaway Beach Littoral Sub-Cell



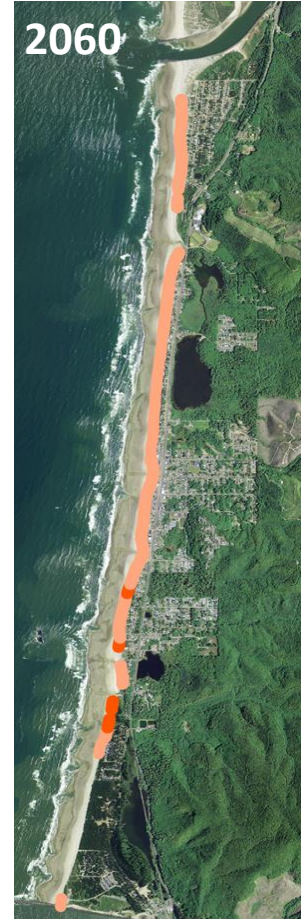
Existing BPS New BPS



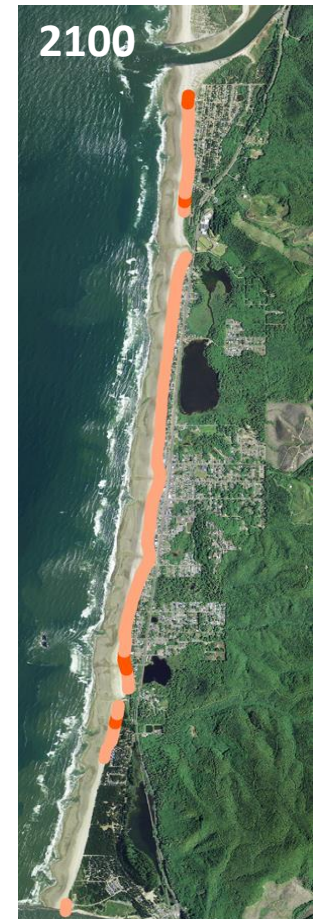
Present Day



Status Quo



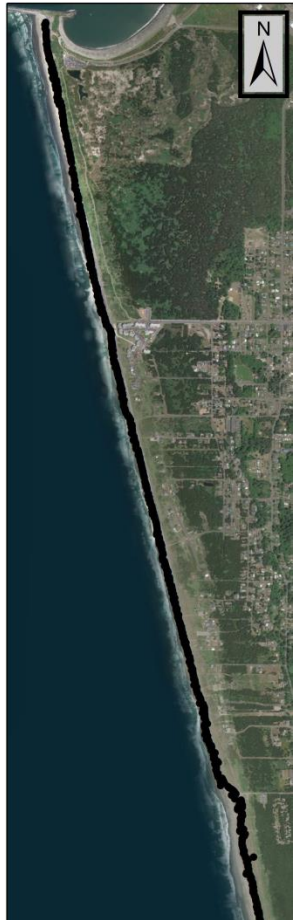
Status Quo



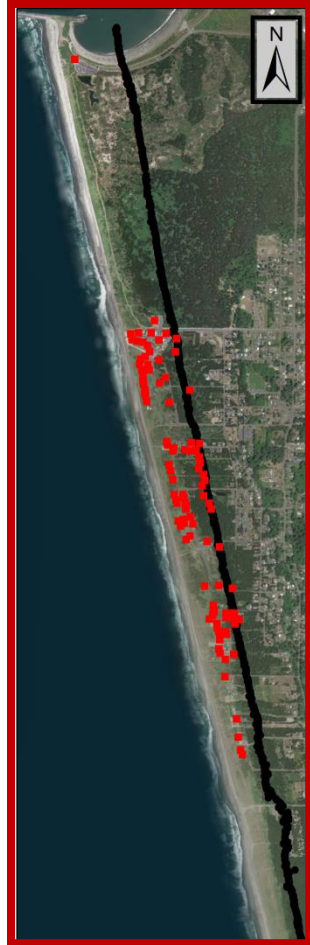
Status Quo

Coastline protected in response to erosion

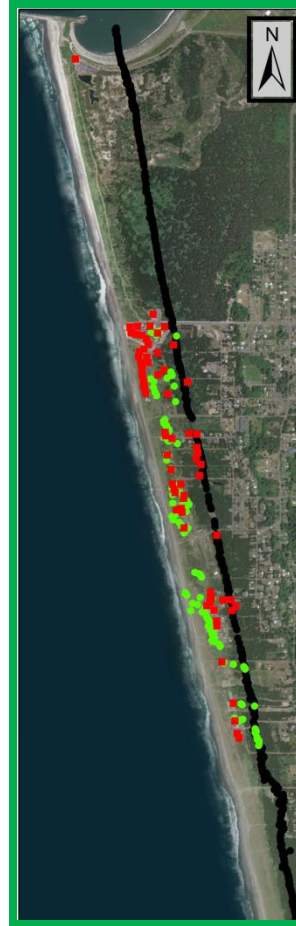
Westport, WA in 2100



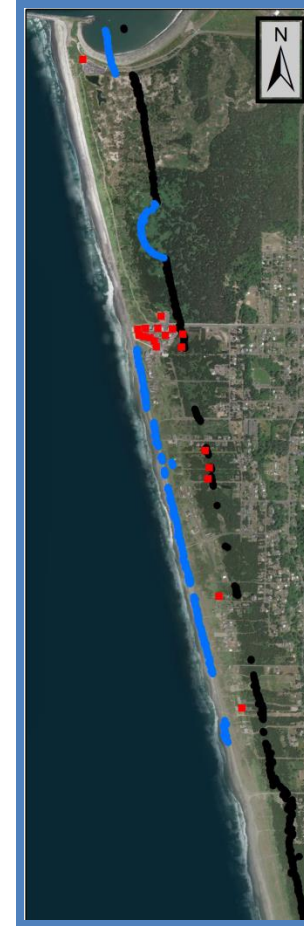
Present Day



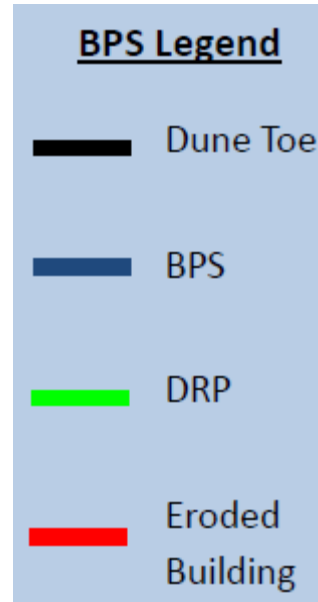
Baseline

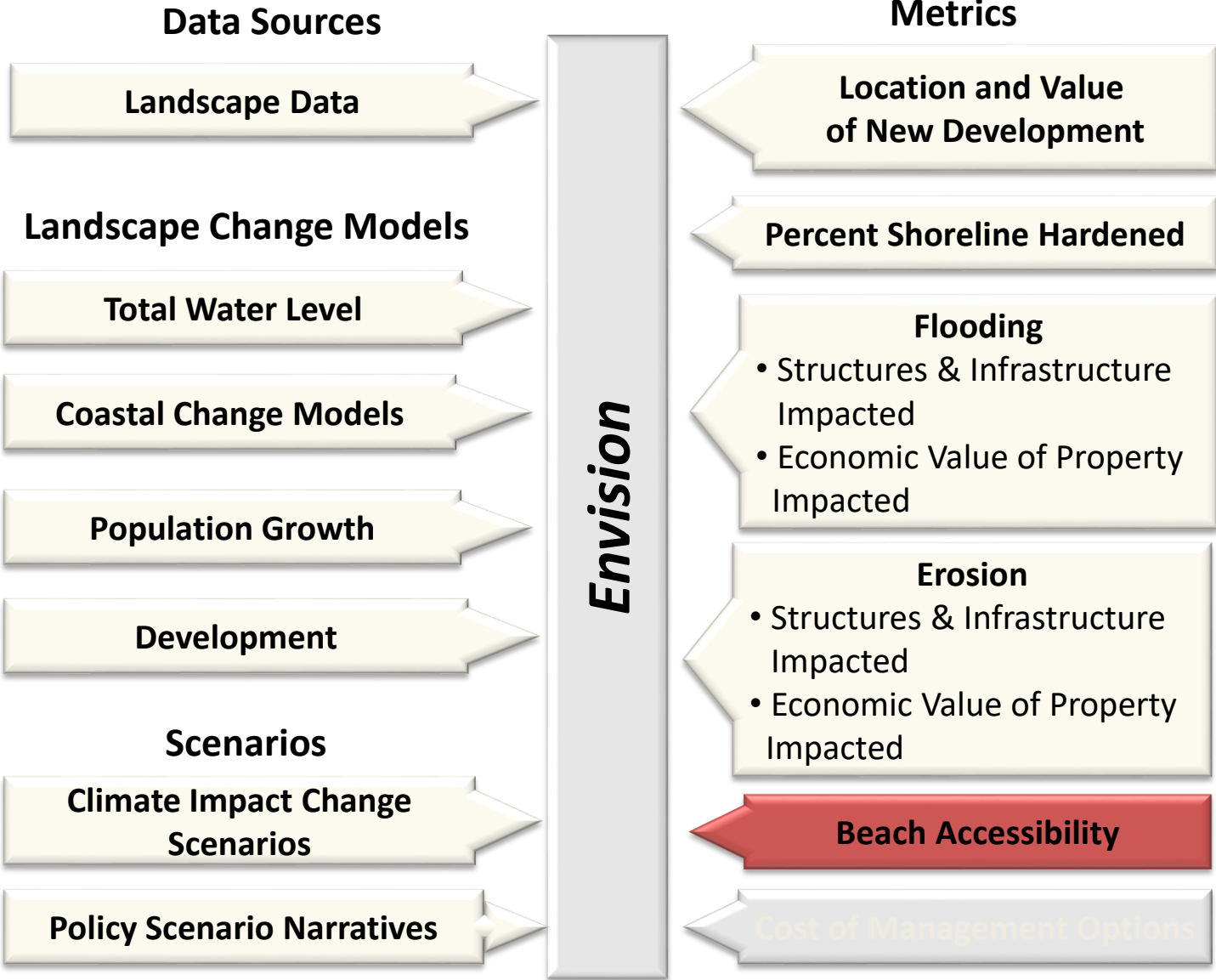


Restore



Protect

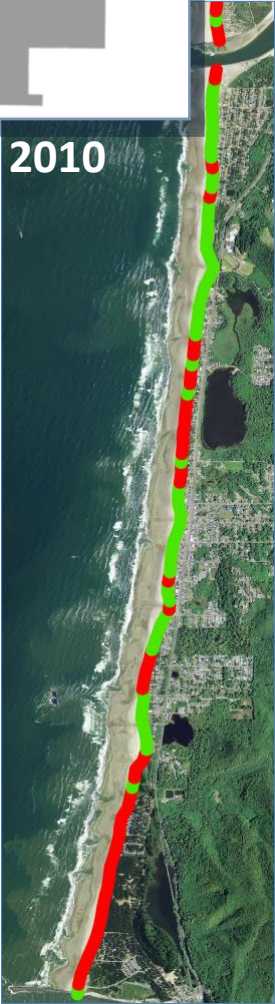




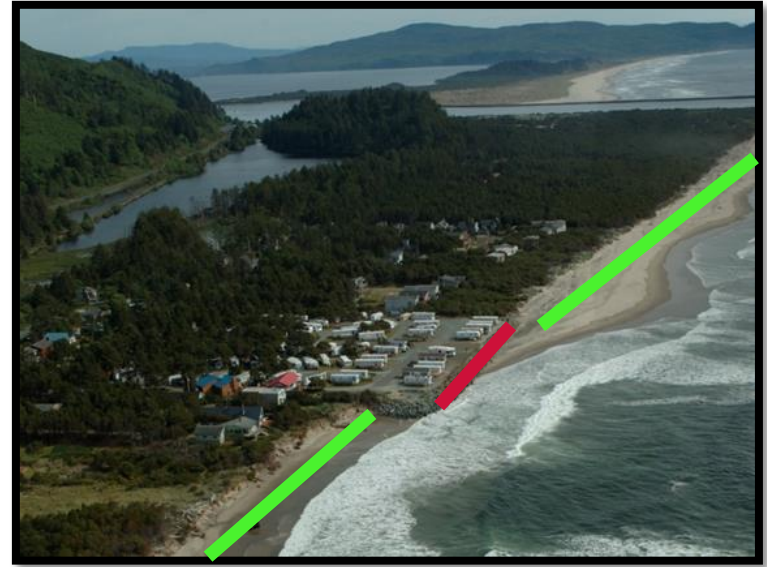
Beach Accessibility



2010



Present Day



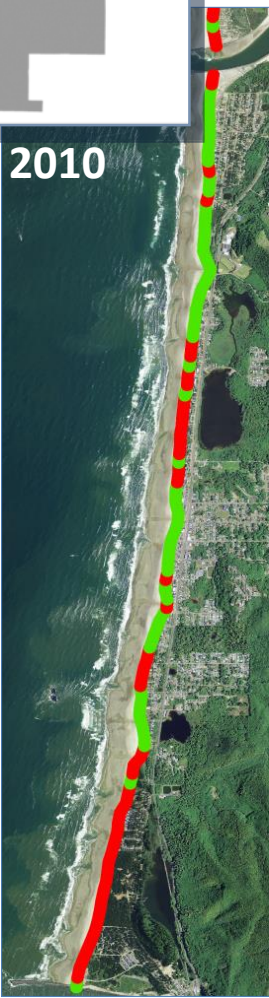
■ Limited Beach Access

■ Unlimited Beach Access

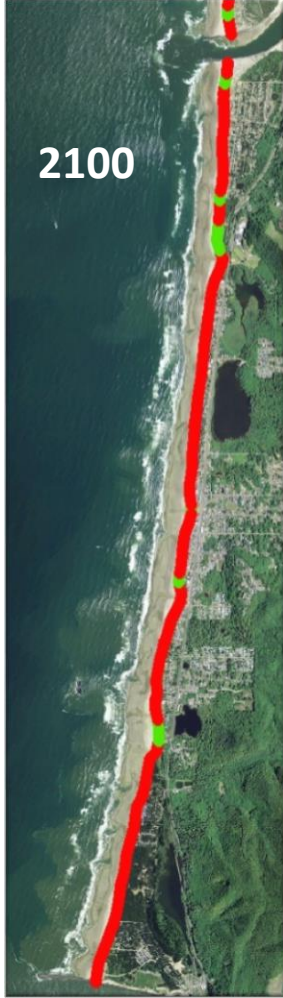
Beach Accessibility



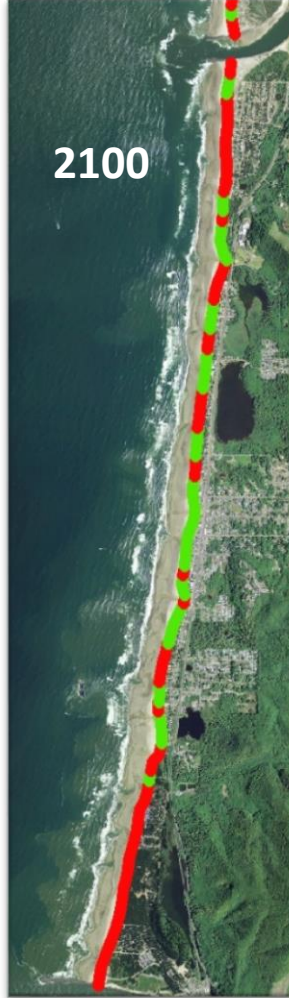
— Limited Beach Access — Unlimited Beach Access



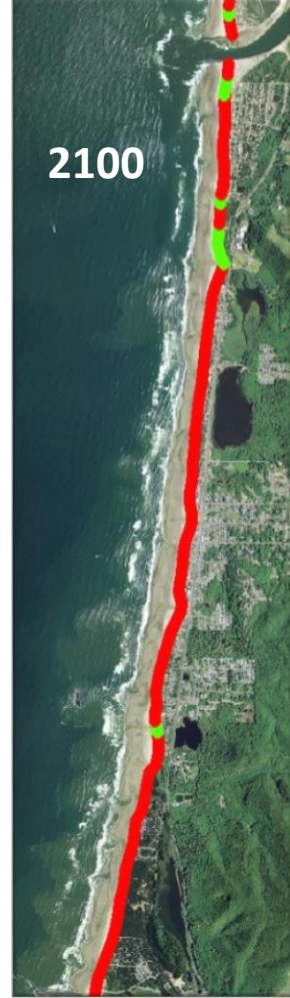
Present Day



Status Quo



Hold the Line



Laissez-Faire

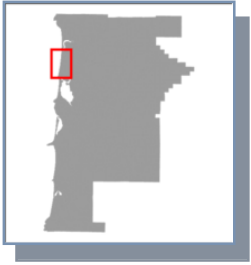


ReAlign

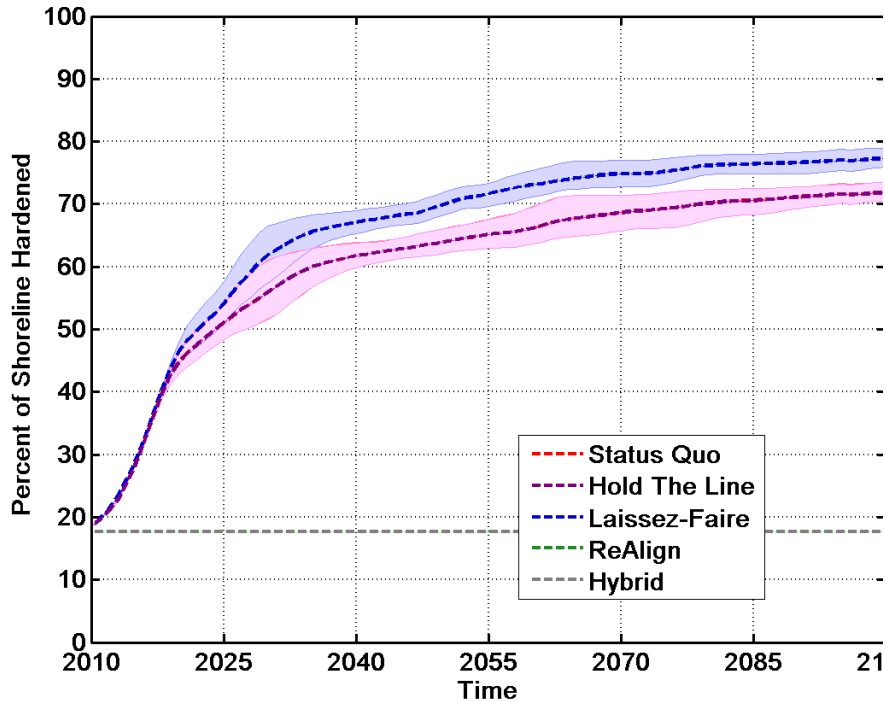


Hybrid

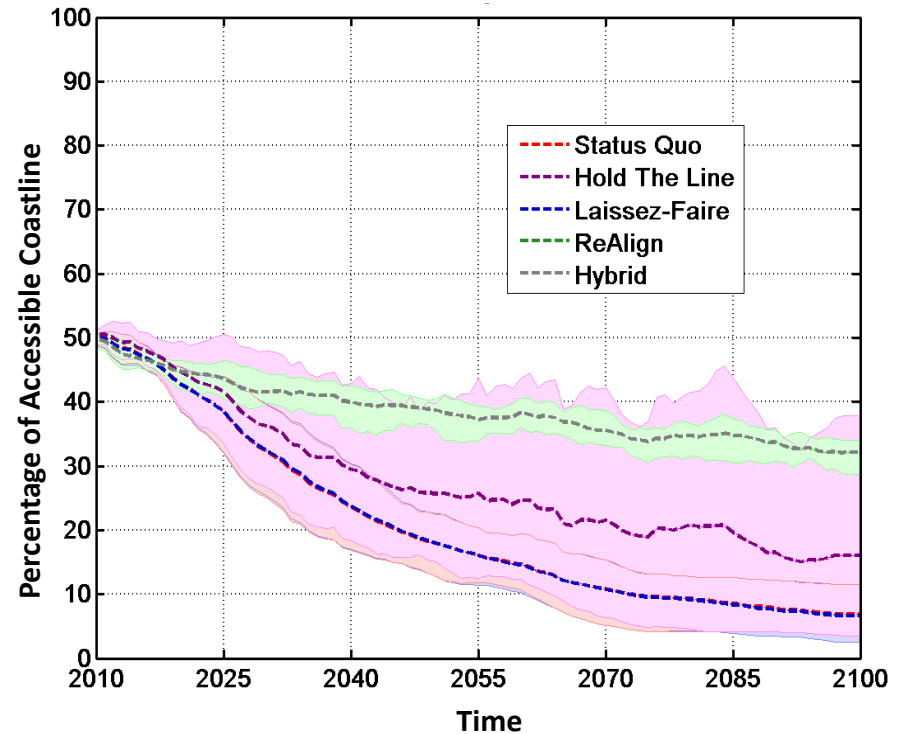
Shoreline Armoring vs. Beach Accessibility

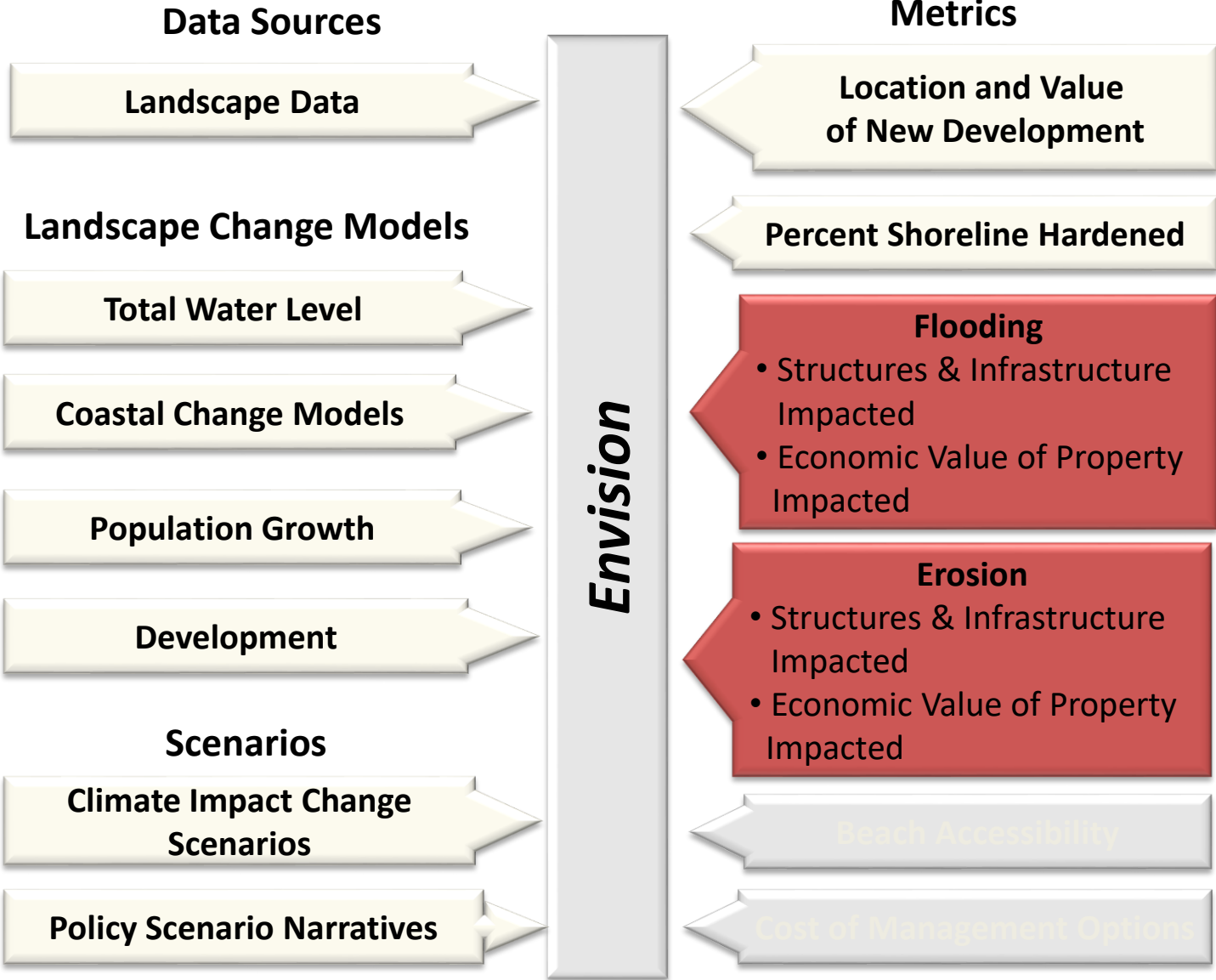


Percent Armored (Rockaway Beach)



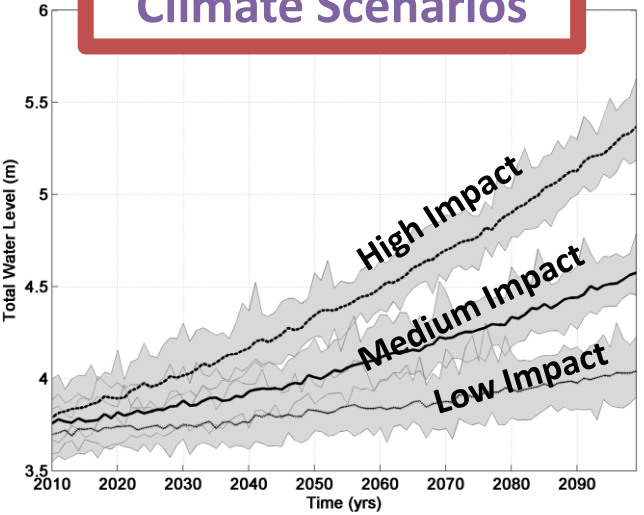
Beach Accessibility (Rockaway Beach)





Which drivers (human and physical) cause the greatest variation in landscape metrics?

Climate Scenarios



Physical

1. Status Quo



2. Hold the Line



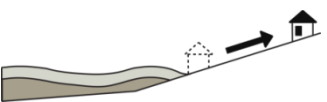
3. Laissez-Faire



4. ReAlign

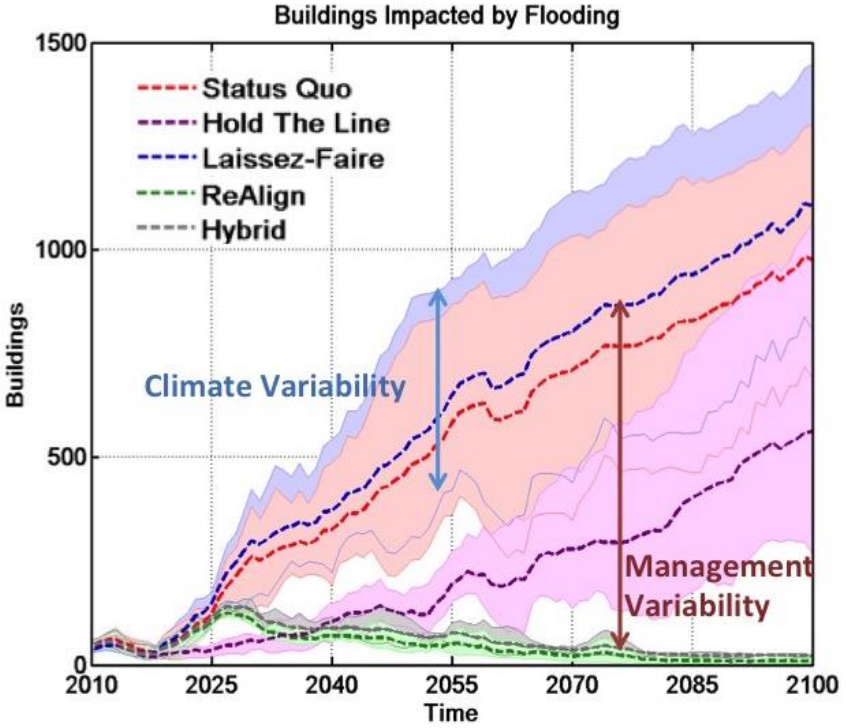


5. Hybrid



Human

Policy Scenarios



General Conclusions

- **The Tillamook County and Grays Harbor County KTANs and Envision** are allowing researchers and stakeholders to explore, visualize, and quantify the effects both a **changing climate** and **management policies** have on the coast
- Simple, **modular** design allows for flexibility of inputs & models; **transferable** over a range of locations and scales
- Evaluation of scenarios through **probabilistic** methodology to quantify coastal change incorporates **climate uncertainty**
- Landscape metrics help decision-makers consider **trade-offs**, cost-benefits, pros, cons, etc.
- Allows for science-based decisions that can **increase adaptive capacity** of communities

Ongoing/Next Steps

- **Scale the ‘Alternative Coastal Futures’ approach** such that it can inform decision making at state or regional scale.
- Explore both chronic and acute hazards.
- Continue dialogue with key regional decision makers regarding how the approach and findings might **inform land use planning and emergency management** to increase resilience to both chronic and acute hazards.

