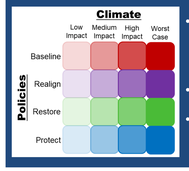
GRAYS HARBOR COUNTY COASTAL FUTURES PROJECT: Recap, Results, and Next Steps Meeting

PUBLIC GOOD STORYLINE

Assumptions



- All dollar amounts are in 2010 dollars.
- Beach accessibility is considered **unlimited** if it is walkable more than 90% of the year. This is measured by how often the daily maximum total water level (TWL) impacts the toe of the feature backing the beach (natural dune, BPS, or DRP).
- Prograding shorelines are not modeled for any climate scenarios.
- Shoreline recession rates are based on the current shoreline change rates as well as a Bruun rule derived recession driven by sea level rise.
- Beach nourishment occurs under the Baseline and Protect policy scenario, in front of BPS, and in the Restore scenario in front of DRPs and is assumed to cost $13/m^3.
- During beach nourishment projects, beaches are widened at 5x the yearly shoreline retreat rate. This is based on the assumption that the nourished sediment will last for approximately 5 years before needing to be replenished.
- Locations receiving a nourishment project can only be re-nourished after 5 years.
- Nourishment projects fronting BPS are triggered under a set of specific instances:
  - The dune toe is impacted by the maximum daily Total Water Level (TWL) >50% of the year on average for 5 years
- Nourishment projects fronting DRP are triggered under a specific set of instances:
  - The dune toe is impacted by the maximum daily Total Water Level (TWL) >50% of the year on average for 5 years **AND**
  - Erosion erodes through the DRP beyond a minimum width requirement.

How often is the beach accessible?

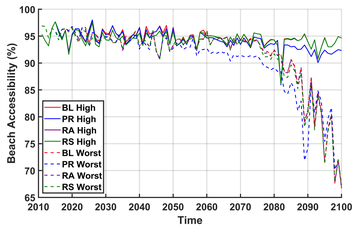


Figure 1: Average Ocean Shores beach accessibility under **high/worst** impact climate scenarios by policy scenario.

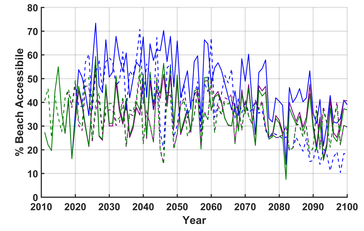


Figure 2: Average Westport beach accessibility under **high/worst** impact climate scenarios by policy scenario.

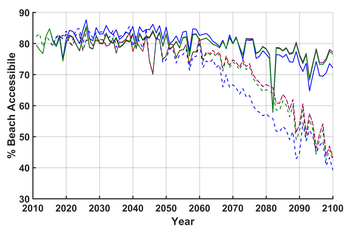


Figure 3: Average county-wide beach accessibility under **high/worst** impact climate scenarios by policy scenario.

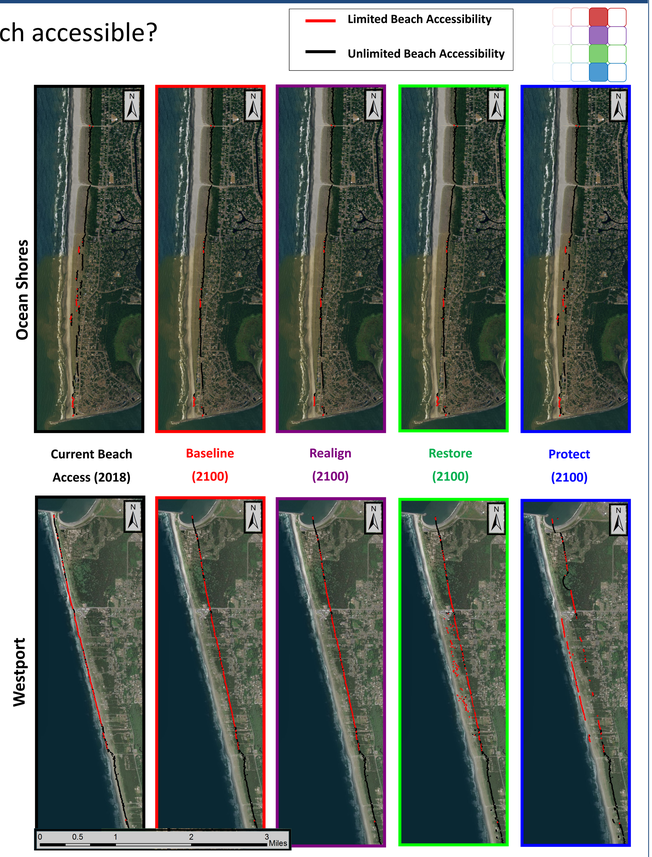


Figure 4: Beach accessibility in 2010 (black outline) compared to beach accessibility in 2100 under a **high** impact climate scenario for **all policy** scenarios in both Ocean Shores (top panels) and Westport (bottom panels).

How much money will it cost to keep the beach accessible?

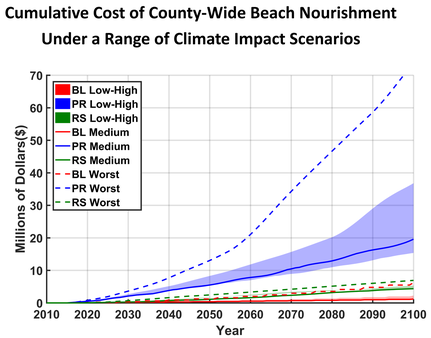


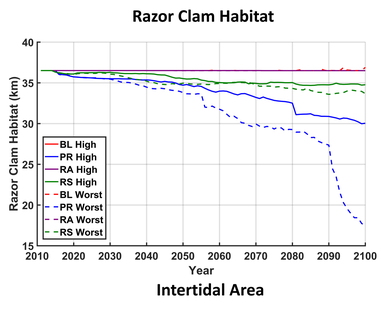
Figure 5 (Above): The cumulative cost of **beach nourishment** county-wide, under the **Baseline**, **Protect**, and **Restore** and scenarios under all climate scenarios. Under **Protect** and **Baseline**, beaches are nourished in front of BPS, and under **Restore** beaches are nourished in front of DRP.

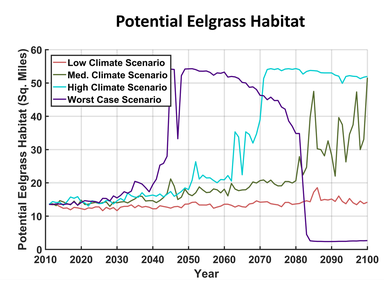
Figure 6 (Top Right): Kilometers of potential Razor Clam Habitat (county wide) for each policy scenario and for the **High** (solid lines) and **Worst Case** (dashed lines) climate impact scenarios. This metric, developed in collaboration with razor clam biologists, quantifies potential razor clam habitat when outer coast beaches have slopes < 0.05. Beach nourishments negatively impact habitat for 5 years.

Figure 7 (Mid Right): Square miles of Intertidal Area for each of the Climate Scenarios. This metric is not sensitive to policy scenario as Intertidal Area is defined as the area within the bay that is between MLLW and MSL. The metric is intended to serve as a simple proxy for foraging bird habitat.

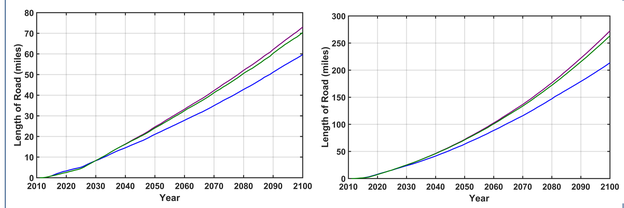
Figure 8 (Bottom Right): Square miles of Potential Eelgrass Habitat. This metric is tracked via examining existing eelgrass habitat depth contours and evolving these into the future as sea level rises. This can be considered as a first approximation of potential eelgrass habitat and only considers possible habitat rather than the fully coupled biological-sedimentological estuarine system.

How does habitat change under Policy Scenarios?

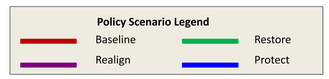




How will roads be impacted by coastal hazards?



Figures 9 and 10: The length of road in Grays Harbor County impacted by **erosion** under **all policy** scenarios under a **low** (left) and **high** (right) impact climate scenario from 2010-2100.



What will beaches look like under progressive backshore modifications?

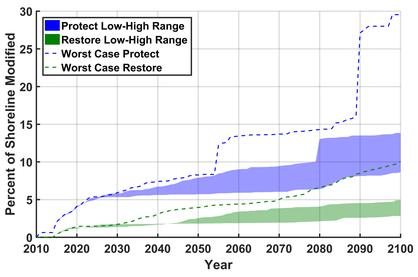


Figure 11: The percentage of Grays Harbor County shoreline that is modified by shoreline protection (either BPS or DRP). This plot shows the **Protect** and **Restore** policy scenarios under **low** and **high** climate scenarios (shaded region) and the worst case scenario (dotted line).

Take Home Messages:

- Currently there is **limited beach accessibility** across the county, although there is only BPS in one location in Ocean Shores (Figure 3).
- Over time, there continues to be relatively **high beach accessibility in Ocean Shores** under **all policy** scenarios (Figure 1).
- Beach accessibility is more limited in Westport, and is less sensitive to climate scenarios (Figure 2).
- Different policies affect beach accessibility differently, with at times the **most accessibility** under the **Protect** and the **Restore** policy scenarios, since they are both nourishing the beach in front of backshore protection structures (BPS) and dune restoration projects (DRP).
- Beach accessibility is **similar** under the **Baseline** and **Realign** policy scenarios, since neither policy significantly impacts the beach.
- Beach accessibility **decreases by 2100** in all scenarios as sea level rises and only some areas of the beach are nourished.
- Under different policy scenarios, **different areas of the beach begin to lose accessibility** at different times, depending where and when the beach is nourished.

Take Home Messages:

- Under the **Protect** , **Restore**, and **Baseline** policy scenarios, beach nourishment **only occurs in front** of BPS or DRP.
- The cost of beach nourishment under the **Protect** policy scenario is **higher** than under the **Restore** policy scenario and much higher than **Baseline** (which is only nourishing in front of the few existing structures)
- The **annual cost** of **beach nourishment** varies (Figure 5) due to a combination of the assumption of when to nourish (every 5 years if needed), budget availability, and storminess.
- **Protect** and **Restore** see the largest drop in Razor clam habitat as shoreline modifications change the beach slope and nourishment projects negatively impact habitat.
- **Intertidal area increases** with more extreme climate scenarios as higher water levels access different portions of the bay profile (note that morphological changes are not modeled).

Take Home Messages:

- Eelgrass habitat increases with more extreme climate scenarios although there may be a tipping point where it begins to decrease (see Worst Case Scenario).
- Erosion impact to roads is higher under the **Baseline** and **Realign** policies than under the **Protect** and the **Restore** policy scenarios (Figures 9-10).
- The **length of roads impacted by erosion increases** over time century (Figures 9-10).
- Flooding impacts to roads (not shown) **varies** under the **Baseline**, **Realign, Protect** and **Restore** policy scenarios , and are highest under **Baseline** which has no hazard alleviation policies.
- The percent of modified shoreline increases over time although the rate depends on both policy and climate scenario.