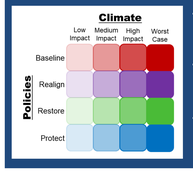
GRAYS HARBOR COUNTY COASTAL FUTURES PROJECT: RECAP, RESULTS, AND NEXT STEPS MEETING

PROPERTY RISK STORYLINE

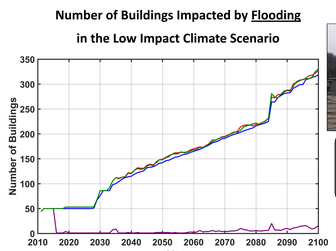
CIRC Climate Impacts Research Consortium | RISA Regional Integrated Sciences and Assessments | Climate Impacts Group | Oregon State University

Assumptions:

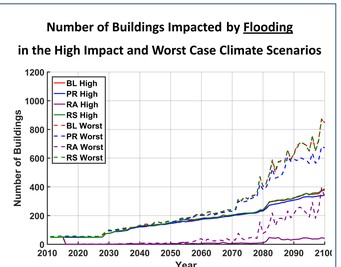


- Backshore Protective Structures (BPS) and Dune Restoration Projects (DRP) are only placed on the outer coast in front of development.
- Event erosion is driven by large storm events, while chronic erosion is driven by sea level rise and sediment budget derived shoreline change rates.
- For these results, BPS and DRP are constructed along multiple tax-lots to meet a minimum length requirement.
- Annually any BPS or DRP is constructed if it fits the trigger criteria (see far right column), and is within cost constraints.
- A building is considered **Eroded** during a particular year if the model cell containing the building experiences either chronic or event erosion at any time during the year.
- A building is considered **Flooded** during a particular year if the model cell containing the building experiences any inundation from the flooding model at any time during the year.
- BPS and DRP are constructed under a specific set of instances (triggers):
  - The beach is dune-backed **AND**
  - The land behind the dune is developed **AND**
  - The dune toe is impacted by the maximum daily Total Water Level (TWL) 50% of the year on average for 5 years **AND**
  - The average event erosion frequently impacts infrastructure 3 out of the last 5 years **AND**
  - The average event erosion distance over 2 years comes within 65ft of infrastructure.

How will buildings be impacted by coastal flood and erosion hazards in the future?

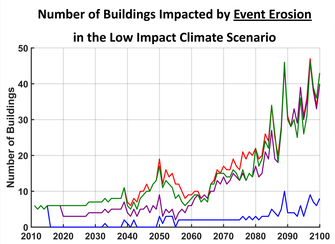


Flooding event driven by large storms

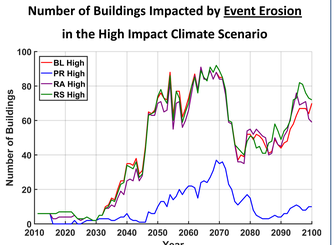


Figures 1 and 2: Number of buildings impacted by **flooding** under **low** (left) and **high/worst** (right) impact climate scenarios from 2010 to 2100 (county-wide, bay and outer-coast).

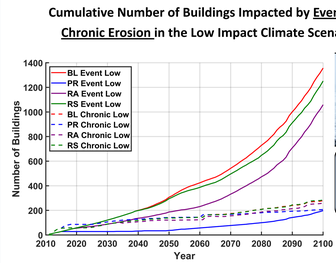
Policy Scenario Legend: Baseline, Restore, Realign, Protect



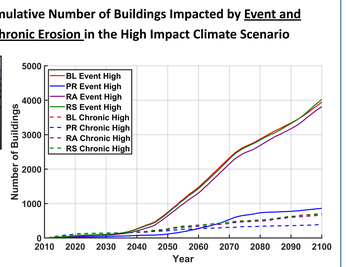
Event Erosion driven by big storms



Figures 3 and 4: Number of buildings impacted by event **erosion** under **low** (left) and **high/worst** (right) impact climate scenarios from 2010 to 2100 (county-wide, outer-coast only).



Chronic Erosion driven by sea level rise



Figures 5 and 6: Cumulative number of buildings impacted by event and chronic **erosion** under **low** (left) and **high** (right) impact climate scenarios from 2010 to 2100 (county-wide, outer-coast only).

Take Home Messages:

- Flooding and erosion impacts are variable from year to year due to climate variability but **more variable for Event Erosion** which is controlled by damaging storms (Figures 1 - 6).
- The **Protect** policy scenario has a **lower number of buildings impacted by event and chronic erosion** as property owners construct BPS to limit/halt erosion (Figures 3—6).
- The **Realign** policy scenario has **fewer buildings impacted by flooding**, as buildings that experience flooding are moved to locations with less flooding risk. (Figures 1—2).

Where will homeowners need modifications (BPS or DRP) to protect their property?

Figure 7: Current BPS location in Ocean Shores.

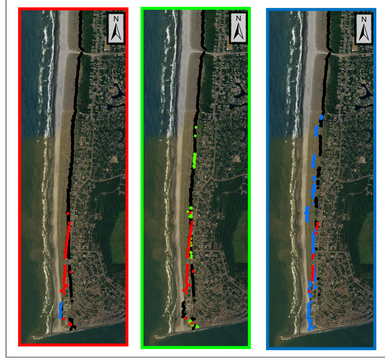
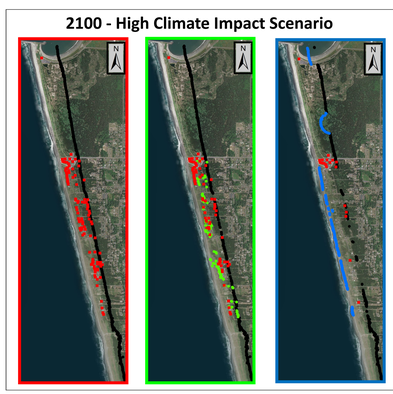


Figure 11: Currently no BPS In Westport.



Figures

8 – 10: BPS and DRP constructed in a **high** impact climate scenario under **Baseline, Restore, and Protect** policy scenarios in Ocean Shores (2100).

Figures

12 – 14: BPS and DRP constructed in a **high** impact climate scenario under **Baseline, Restore, and Protect** policy scenarios in Westport (2100).

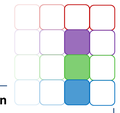
BPS Legend

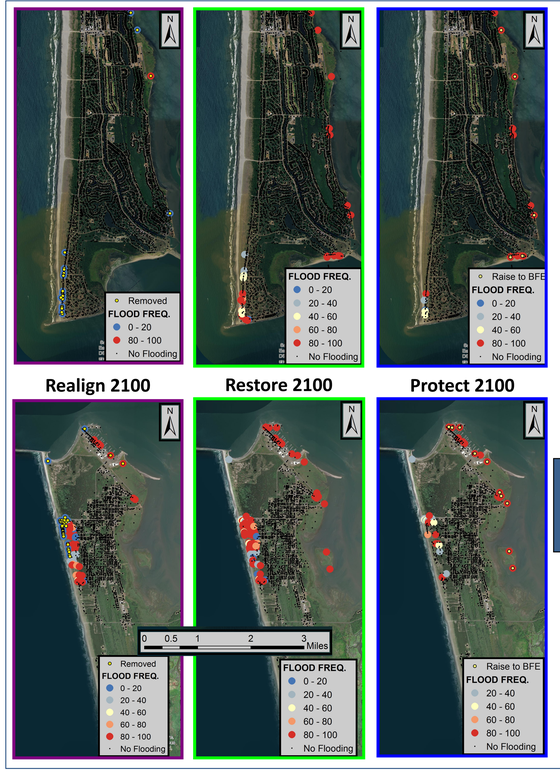
- Dune Toe
- BPS
- DRP
- Eroded Building

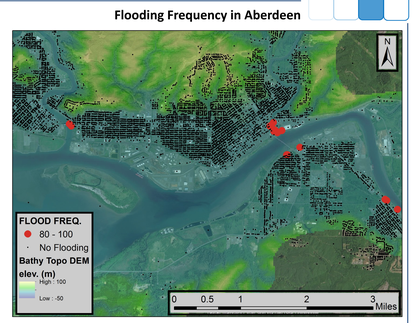
Take Home Messages:

- **Only one area of the county currently has BPS** (in Ocean Shores), with none in Westport (Figures 7 and 11).
- **More BPS and DRP are constructed over time in Westport** than in Ocean Shores (Figures 7—14).
- Areas where no BPS are placed show the dune toe line rapidly eroding landward (Figures 7—14).
- Locations of DRP are staggered in the cross-shore (due to different construction times) while BPS locations are more uniform in the alongshore due to the requirement that they are constructed along multiple tax-lots to meet a minimum length requirement (Figures 8—14).
- Buildings with DRP and BPS modifications experience less erosion hazards than those without.

How will Policy Choices effect Coastal Flooding?







Figures 15 (Above): Flooding Frequency (% number of years of flood occurrence during the most recent 5 year window) of buildings in Aberdeen (in 2100) under a **high** climate scenario. Buildings experiencing no flooding in the model are represented by black dots with red dots indicating building being flooded.

In the current iteration of the Envision model, flooding frequency in Aberdeen is not sensitive to policy scenarios. This is because Policies scenarios currently do not include any flood prevention measures for the back bay.

Figures 16—21 (Left): Flooding Frequency (% number of years of flood occurrence during the most recent 5 year window) of buildings in Oceans Shores and Westport at year 2100 under a **high impact** climate change scenario. Buildings experiencing no flooding in the model are represented by black dots. Policies involving additional modifications to buildings (e.g., removing from the hazard zone for Realign or raising to BFE for Protect) are marked with a yellow dot.

Take Home Messages:

- DRP and BPS within the model are **placed only on the outer-coast** and not in the bay.
- Results show locations of flooding vulnerability in both Westport and Ocean Shores, but with different magnitudes for each policy scenario as different hazard strategies modify the built environment.
- **Realign** shows less flooding frequency than **Restore** or **Protect** as exposed buildings are removed from the hazard zone.
- More buildings are exposed to coastal flooding in Westport that in Ocean Shores due to a combination of development strategies and beach geomorphology characteristics.
- Model results are sensitive to the triggers that initiate adaptation measures (policies), however, the presented results are intended to demonstrate the differences between policy scenarios.
- Erosion hazard damages scale with the magnitude of the climate change impact scenario with damages doubling between the low and high scenario.
- The adaptation measures (policies) implemented in the model are not able to completely minimize erosion and flood hazard damages in part due to budget caps (capping annual expenditures to $2 million/year).
- In particular the adaptation measures (policies) implemented in the model are not able to keep up with erosion and flood hazard damages associated with the worst case climate impact scenario due to its extreme nature.