Background and Goals

- Sea level rise (SLR), increasing storminess, and growing development pressures are intensifying coastal vulnerability on the US West Coast, including in Tillamook County, Oregon.
- Many beaches have not fully recovered from the major El Niño of the late 1990s.
- Under Oregon Statewide Planning Goal 6C, many coastal communities and residents have contract: experience hard engineering and living in active structures.
- Local decision-makers and stakeholder groups often lack the information and tools to reduce their vulnerability and increase the community’s adaptive capacity or “the ability to prepare, adjust, and/or respond to changes in advance” (Galikov, 2006).
- Efforts to develop adaptive capacity in Tillamook County:
  1. 1. Lehigh Coastal Knowledge to Action Networks (CKAN).
  2. Develop methodologies to project existing coastal flooding and erosion based community member engagement work.
  3. Develop the information and tools to help coastal decision-makers implement adaptive strategies and implement beneficial climate change scenarios.

Methods

1. Engaging the Community
   - Creation of a 170+ community members, including individuals from varying departments of state, county, and local government, non-profits, private citizens, Oregon State University (OSU) researchers, and outreach specialists.
   - Formal engagements and as-needed informal discussions to develop and assess narratives and scenarios.
   - Presentation of results in review to connect to the broader community.
   - OSU researchers and outreach specialists work closely with other members of the CKAN to:
     - Identify and facilitate desired actions for the community.
     - Anticipate policy narratives to reach these community goals, and
     - Iteratively review and assess the results of future scenario analyses (described below).

2. Envisioning Future Scenarios
   - The spatially explicit, multi-perspective modeling framework ENVISION is utilized to create and analyze possible future scenarios.
   - Future scenarios include:
     - Future scenarios for the assessment of alternative coastal management options under various population and development trends, coastal and land use pressures and feedbacks, and climate change impacts.
     - Iteratively changing Climate Uncertainty
       - Climate change impact scenarios were developed using recommendations from the National Research Council for SRF on the West Coast and downscaled projected global climate model (GCM) estimates for the Northeast Pacific Ocean (Hemer et al., 2013; Wang et al., 2014).
       - For more details, see Poster P51

3. ENVISION Modeling Components
   - Policy Scenario Narratives
     - Hold The Line: Policy or decisions are implemented that involve existing environmental change (e.g., building or raising flood defenses, building or strengthening shoreline armor), counseling beaches in order to preserve existing beach areas and human activities (e.g., beach access).
     - Loose-Fit: Policy or decisions are implemented that involve changing human activities to suit the changing environment (e.g., mismatched infrastructure and/or people, changing land uses in rural, urban, or beachfront areas, and human activities (e.g., beach access).

4. Land Use Data and Change Models
   - Policy or decisions are implemented that involve existing environmental change (e.g., building or raising flood defenses, building or strengthening shoreline armor), counseling beaches in order to preserve existing beach areas and human activities (e.g., beach access).

5. Landscape Data and Change Models
   - Policy or decisions are implemented that involve existing environmental change (e.g., building or raising flood defenses, building or strengthening shoreline armor), counseling beaches in order to preserve existing beach areas and human activities (e.g., beach access).

6. Analyze
   - Policy or decisions are implemented that involve existing environmental change (e.g., building or raising flood defenses, building or strengthening shoreline armor), counseling beaches in order to preserve existing beach areas and human activities (e.g., beach access).

7. Conclusions
   - Policy or decisions are implemented that involve existing environmental change (e.g., building or raising flood defenses, building or strengthening shoreline armor), counseling beaches in order to preserve existing beach areas and human activities (e.g., beach access).

Example Results

How will coastal flood hazards impact buildings in the future?

- Policy or decisions have different development patterns and adaptation strategies, influencing the number of buildings impacted by flooding with the highest climate impact scenarios (2050 and 2100) for the low and high policy narratives.
- Flood impacts range from year to year due to irregular climate events (damping storms), however, unique trends are evident for four policy narratives.
- When will homeowners need backshore protection structures (BPS) to protect their property?
- To project future coastal hazards under a variety of adaptation strategies, OSU researchers:
  - Apply probability distributions of existing qualitative policies to, use these to:
    - Develop probability distributions of existing qualitative policies.
    - Use these to:
      - Assess the likelihood of flood impacts in the future.
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      - Assess the likelihood of flood impacts in the future.

Example Conclusions

- Under the Hold The Line policy scenarios, most BPS are constructed between 2030 and 2060 (2030 between the years 2020 and 2040).
- Over 40% of the Rockaway Beach coastal embayment needs for BPS are constructed under a specific set of indicators.
- It is essential to determine the impact of future climate scenarios on existing qualitative policies, to do this:
  - Use these to:
    - Assess the likelihood of flood impacts in the future.
    - Assess the likelihood of flood impacts in the future.
    - Assess the likelihood of flood impacts in the future.

Take Home Messages

- OSU members are concerned with developing strategies that balance shoreline development and preservation of ecosystem services.
- Future scenario analysis using ENVISION integrates stakeholder-driven strategies, physical process data, and climate change impact information into an innovative and interactive way, and allows for the analysis of site-specific adaptation policy costs and benefits.
- Community engagement helps to fulfill ETHS vision.
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Next Steps

- Continue to refine the probabilistic total water level model (Kolbe and Ruggiero, 2014) that includes climate variability into ENVISION via Monte Carlo simulations.
- Continue to determine the economic costs and benefits of specific adaptation strategies, and identify “preferred” strategies (those that best support the community’s goals) to model within ENVISION.
- Present information about the final “preferred” strategies to the general public to inform future implementation efforts.