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Engaging stakeholders in coastal adaptation planning in light of climate change in the Pacific Northwest: Comparing Knowledge-to-Action Networks for two coastal communities

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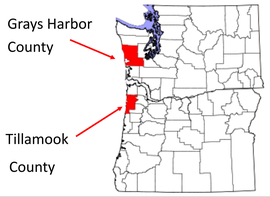
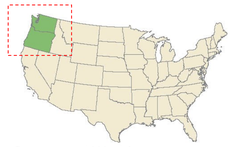
INTRODUCTION: Coastal communities along the US West Coast and elsewhere are at risk of coastal flooding and erosion hazards due to sea-level rise, changing storminess patterns, and possible changes to the frequency of major El Niño events. These issues, coupled with growing development pressures, are intensifying coastal vulnerability in the Pacific Northwest (NW), including Tillamook County, OR, and Grays Harbor County, WA. Due to the complexity and diversity of coastal regions, which face unique problems and concerns, localized adaptation strategies at the county level are appropriate for successful decision-making. Working with local decision-makers and stakeholder groups can increase community adaptive capacity (Gallopin, 2006), particularly when faced with uncertainty with respect to both climate change and policy decisions. In this project we work directly with Knowledge-to-Action Networks (KTANS), and apply *Envision*, a multi agent-based spatially-explicit framework for policy assessment and alternative futuring (Bolte, 2007), to project future climate change and policy scenarios. The KTANs include land use planners, local government members, county commissioners, planning commission members, state coastal zone management representatives, researchers, students, outreach specialists, and other leaders from the community.

GOALS:

1.To build and assess adaptive capacity in coastal Grays Harbor County, WA by:

- Building and fostering a Knowledge-to-Action Network (KTAN)
- Developing information and tools to assess climate change impacts and vulnerability





2. To compare this process to that in Tillamook County, OR by:

- Comparing demographics and KTAN characteristics
- Examining the geography and exposure to coastal hazards
- Assessing initial policy scenario developments

DEMOGRAPHICS

KTAN CHARACTERIZATION

GEOGRAPHY/HAZARD EXPOSURE

SCENARIO DEVELOPMENT

TILLAMOOK COUNTY, OR

Size: 2934 km^2 , 81.4 km of coastline
Tillamook Bay Area: 33.5 km^2 (at high tide)
Population: 25,342 increasing 0.1% per year
Households: 18,463
Poverty level: ~16%
Median household income: $43,676
Per Capita Income: $22,452
Main Economy: Lumber, Dairy, Tourism

KTAN SURVEY RESULTS

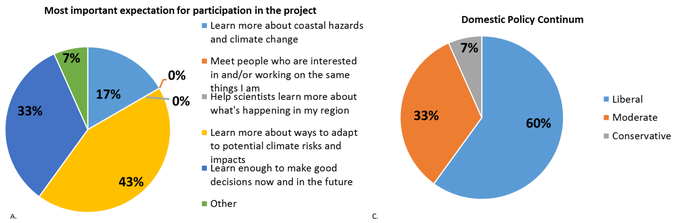


Figure 1. First Tillamook County stakeholder meeting held on June 17, 2013, with 30 surveys collected.

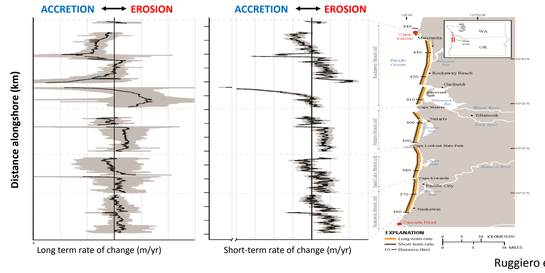


Figure 3.

Ruggiero et al. 2013

- Chronic erosion, particularly at the southern ends of littoral cells
- No major sediment input
- Most of the shoreline is eroding
- Relatively high percentages of the shoreline are currently armored (10% of the county, Gardner, 2015)
- Majority of coastal hazard related issues during El Niño and La Niña years, with additional damage during large winter storms

Strategies/Policies	Endpoints (Metrics)	Scenarios
Protect property from erosion and flooding, according to current policies	Length (amount) of riprap $ property protected Area beach accessibility lost	Status Quo
Allow protection of all beachfront property, eliminate Statewide Planning Goal 18 (limits on armoring)	Length (amount) of riprap $ property protected Area beach accessibility lost	Laissez-Faire
Maintain beach accessibility along coastline at high tide 90% of the time, limit future development, move structures back via easements	% accessible beach at high tide Number of homes impacted and moved back Amount of beach nourishment	Re-Align

To address the problem of chronic coastal erosion, the Tillamook County KTAN co-developed the above policies (strategies), endpoints (metrics), and scenario narratives (grouping of policies).

GRAYS HARBOR COUNTY, WA

Size: 5760 km^2 , 80.4 km of coastline
Grays Harbor area: 260 km^2 (at high tide)
Population: 70,818, decreasing 0.68% per year
Households: 35,258
Poverty level: ~19%
Median household income: $42,405
Per Capita Income: $21,828
Main Economy: Wood & paper products, Seafood processing, Manufacturing

KTAN SURVEY RESULTS

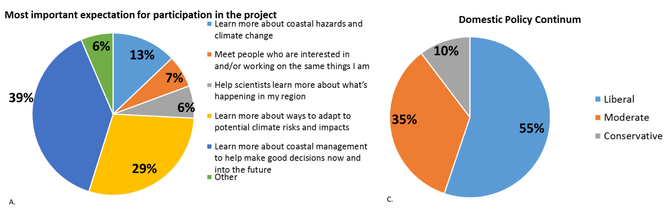


Figure 2. First Grays Harbor County stakeholder meeting held on February 8, 2016, with 27 surveys collected.

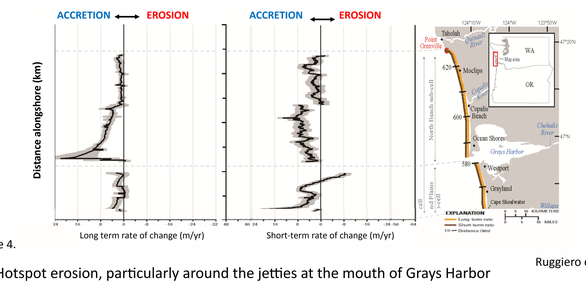


Figure 4.

Ruggiero et al. 2013

- Hotspot erosion, particularly around the jetties at the mouth of Grays Harbor
- Part of the Columbia River littoral cell, positive sediment budget
- Majority of shoreline is prograding
- Small percentage of the shoreline currently armored
- Majority of coastal hazard related issues during El Niño and La Niña years, with additional damage during large winter storms

Strategies/Policies	Endpoints (Metrics)	Scenarios
Allow protection of all beachfront property experiencing erosion/flooding	# homes impacted $ property protected Length (amount) of riprap	??
Nourish the beach to prevent hotspot erosion	$ beach nourishment Volume of sand Area beach increased	??
Decrease flooding in Grays Harbor (bay) by raising and moving structures and protecting/restoring habitat	# homes impacted Area flooded Area habitat restored/protected	??

To address the problems of outer coast hotspot erosion, bay flooding and habitat degradation, the Grays Harbor County KTAN has initiated its scenario building process by suggesting the above strategies (policies) and endpoints (metrics). We plan on iterating with the KTAN several more times in coming months, via webinar and workshops, to develop and refine Grays Harbor County specific scenario narratives.

TILLAMOOK COUNTY COASTAL FUTURES—RESULTS

Our initial efforts in Tillamook County, OR, involved projecting future climate change and policy scenarios, allowing local stakeholders to understand and visualize how policy decisions would affect specific landscape metrics in their county. Over 2 years and 7 meetings, stakeholders developed 6 policy scenario narratives (Figure 5) to explore in *ENVISION,* under 3 different sea level rise scenarios (low, medium, and high; Figure 6). Using these co-developed tools, we examined how these scenarios affected different metrics of interest, such as beach accessibility, coastal flooding, and coastal erosion. In one example, we envisioned how the coastline would be armored in response to erosion, under a status quo scenario, until 2100 (Figure 7). This scenario was then contrasted by results from other scenarios developed by the KTAN to identify what issues were important to them, and what policies could potentially address those concerns. Ongoing work in Tillamook focuses on modeling ecosystem services.

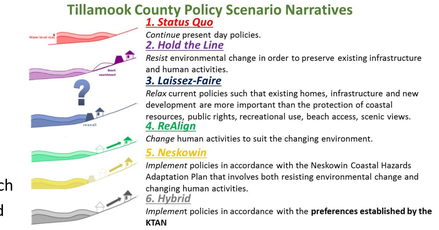


Figure 5. Final policy scenarios developed over two years with the KTAN in the Tillamook County Coastal Futures Project.

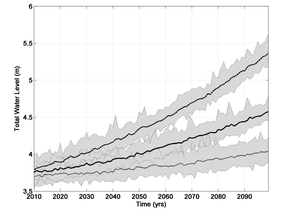


Figure 6. Daily maximum Total Water Level (m) projections including SLR and change to wave heights and El Niño for Tillamook County from 2010 to 2100.

Figure 7. Example of temporal change in backshore protection structures (BPS) in the Rockaway Beach littoral cell in Tillamook County, OR, from 2010 to 2100 under the status quo scenario with medium sea level rise scenario.

GRAYS HARBOR COUNTY COASTAL FUTURES—NEXT STEPS AND EXPECTATIONS

We are now actively transferring this process to Grays Harbor County, WA, to see how differences in KTAN characteristics, demographics, exposure to coastal hazards, and other factors affect scenario development. Grays Harbor County has a predominately prograding shoreline (Figure 4) and some hotspot erosion on the outer coast, and experiences nuisance flooding and ecological issues such as shellfish habitat degradation in the bay. We plan to co-produce policies that address these issues, and others, as they come up with the KTAN. While some of the policies may be similar to those developed in Tillamook, different county priorities and interests may develop into different scenarios, exploring other metrics of interest. Currently in Grays Harbor, the project is starting during a strong El Niño year, while the Tillamook project began during a lull between significant years of erosion, which may change the motivations of the KTAN. In Grays Harbor, the KTAN's main expectation is to learn more about coastal management to make good decisions now and into the future (Figure 2), while in Tillamook, the main motivation of the KTAN was to learn about ways to adapt to potential climate risks and impacts (Figure 1). We will continue to explore these differences, and others with *Envision,* and see how different scenarios develop alternative coastal futures in Grays Harbor County, WA.

CONCLUSIONS—WHERE ARE WE GOING?

During the first two years of this project, the KTAN in Tillamook County, OR successfully created scenarios as bounds within which stakeholders, researchers and policy makers could build shared problem understanding, foster agreement around desirable and undesirable future outcomes, explore trade-offs, and analyze policy options under different future climates. One of the surprising results of the project was that in some cases, strategic planning and human adaptations can have a greater impact on some metrics for future coastal change than the influence of climate change, even under significant climate change uncertainty (Figure 8; Mills, 2015). We plan to investigate if this type of outcome is also true in Grays Harbor County. Due to interests of the KTAN, we also plan to examine impacts to the estuary, which were not explored in Tillamook. It will be very informative to see how those scenarios develop and shape future decision-making in the county. Over the next few workshops, the KTAN will work together to prioritize favorable and unfavorable outcomes and start to develop specific policies, that can then be modeled in *ENVISION*. Once we have a variety of scenarios and can quantify and visualize the outcomes, we can evaluate which scenarios best fit the needs of the KTAN, hopefully resulting in positive policy and management implications.

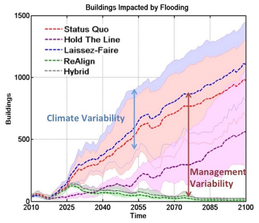


Figure 8. Human and physical drivers that cause variation in the number of buildings impacted by flooding in Tillamook County from 2010 to 2100 across multiple scenarios.

REFERENCES/ACKNOWLEDGEMENTS

Bolte, J. P., Hulse, D. W., Gregory, S. V., & Smith, C. 2007. Modeling biocomplexity - actors, landscapes and alternative futures. Environmental Modelling & Software, 22 (5), 570-579

Gallopin, G. C. 2006. Linkages between vulnerability, resilience, and adaptive capacity. Global Environmental Change, 293-303.

Gardner, M. 2015. Analysis of shoreline armoring & erosion policies along the Oregon coast. State of Oregon DLCD Report.

Mills, A. K. 2015. Exploring the impacts of climate and management on coastal community vulnerability through alternative future scenarios . MS Thesis at Oregon State University, presented 8.24.15.

Lipiec, E. 2015 Assessing coastal community adaptation scenarios in the face of climate change: A Tillamook County, Oregon example. MS Thesis at Oregon State University, presented 6.9.15.

Ruggiero, P., Kratzmann, M.G., Himmelstoss, E.A., Reid, D., Allan, J., and Kaminsky, G. 2013. National assessment of shoreline change—Historical shoreline change along the Pacific Northwest coast: U.S. Geological Survey Open-File Report 2012–1007, 62 p., *http://dx.doi.org/10.3133/ofr20121007.*

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