Oregon State University

Prepared for:
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Achieving a Resilient Oregon Ocean & Coast

State guidance, local action, and enhanced coordination

June 12, 2017

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Main Messages

To inform deliberations on ocean and coastal resilience, we analyzed Oregon's current ocean and coastal policies, interviewed and surveyed ocean and coastal stakeholders, and researched case studies of best practices for resilience planning.

Findings

Strengths of current policy*:*

- The two major strengths we identified in the state policies we examined are as follows:
    1. that they address the full breadth of resilience concepts (e.g., environmental, economic and social) and
    2. that they promote resilience chiefly through strong land-use planning guidelines and inventory requirements.
- Our interviews and surveys also revealed that resilience planning is underway at multiple levels of government, especially with respect to preparing for and responding to the Cascadia earthquake/tsunami.

Areas of improvement for current policy:

- The state's policy focus on land-use planning and data collection/measurement offers both solutions and challenges to building coastal resilience.
- Survey respondents and interviewees suggested that local organizations would benefit from and welcome better coordination, collaboration and information sharing around issues related to ocean and coastal resilience.
- Most survey and interview respondents associate resiliency with the Cascadia Subduction Zone and planning for recovery from a potential earthquake/tsunami.

Best practices in resiliency planning and policy:

- Our multiple methods revealed 4 major best practices that could be implemented to improve Oregon's resilience:
    1. local-level action with state-level coordination and assistance, especially financial assistance;
    2. accessible information, including sample resilience plans and measurements to inform resilience;
    3. strategic use of natural infrastructure; and,
    4. financial mechanisms, such as insurance, safety nets, and incentives.

Recommendations

1. Create or promote an accessible, widely-known clearinghouse of resiliency information and tools to inform local planning and action;
2. Consider non-regulatory, financial, or economic solutions to encourage resilience;
3. Be cognizant of issue saliency when addressing resiliency issues beyond the Cascadia earthquake/tsunami; and,
4. Promote a "big tent" approach to resiliency efforts, ensuring that participation in the process is highly inclusive.

Executive Summary

Research Overview

Our research objectives were: 1) to identify current state-level policies in terms of their potential influence on ocean and coastal resilience; 2) to describe the strengths, limitations and potential challenges of current policies; and 3) to provide examples of best practices in terms of state-level policies related to ocean and coastal resilience. We selected four different strategies to accomplish our objectives: content analysis of existing state policies (Statewide Planning Goals 7 and 16-19, Beach Bill, Oregon Resilience Plan and Territorial Sea Plan), interviews and surveys with relevant stakeholders, and case studies of best practices for resilience planning and policy.

Findings

Strengths of current policy

The two major strengths we identified in the state policies we examined are as follows: (1) that they address the full breadth of resilience concepts (e.g., environmental, economic and social) and (2) that they promote resilience chiefly through strong land-use planning guidelines and inventory requirements. Our interviews and surveys also revealed that resilience planning is already underway at multiple levels of government, especially with respect to preparing for and responding to the Cascadia earthquake and tsunami.

Areas for improvement for current policy

Three main areas of improvement emerged from interviews, surveys, and content analysis. First, the state's policy focus on land-use planning and data collection/measurement offers both solutions and challenges to building coastal resilience. Second, survey respondents and interviewees suggested that local organizations would benefit from and welcome better coordination, collaboration and information sharing around issues related to ocean and coastal resilience. Finally, most survey and interview respondents associate resiliency with the Cascadia Subduction Zone and planning for recovery from a potential earthquake and/or tsunami. This association provides both a challenge and an opportunity for OPAC. However, more chronic risks, such as those related to climate change, may prove difficult to gain traction, unless tied to localized impacts or economic concerns.

Best practices in resilience planning and policy

Our case study research -- with support from interviewees, survey participants, and academic literature -- revealed four best practices for resilience planning and policy: (1) local-level action with state-level coordination and assistance, especially financial assistance; (2) accessible information, including sample resilience plans and measurements to inform resilience planning; (3) strategic use of natural infrastructure; and (4) financial mechanisms, such as insurance, safety nets, and incentives. Promoting social capital and adaptive capacity are common themes across these practices that further contribute to improved resiliency. Our research suggests that these practices improve resilience by improving a community's ability to leverage social, informational, physical, and economic resources at multiple scales.

Recommendations

1. ***Create or promote an accessible, widely-known clearinghouse of resiliency information and tools to inform local planning and action.***

Effective information sharing plays a strong role in building resiliency. Compiling these resources would improve knowledge of resiliency among many different stakeholders and promote information sharing. Research on resiliency shows that data on risks and resources, as well as actions to improve resilience to risks, should both be addressed holistically. A centralized resource with data, reports, recommendations, and other resources would greatly contribute to this goal. It would also be a good first step in creating a resiliency index or checklist that would help local entities track their progress and identify areas for improvement. This future goal should be kept in mind while developing the clearinghouse.

2. ***Consider non-regulatory, financial or economic solutions to encourage resilience.***

Interview and survey participants were often concerned about the economic impacts of disruptions, which can be devastating and long-lasting. Some non-regulatory, financial policies can mitigate these impacts by acting as a financial safety net. Many policies also serve to incentivize resilience-enhancing actions or dis-incentivize resilience-diminishing actions. Examples of such solutions include grant programs, insurance, and market mechanisms.

3. ***Be cognizant of issue saliency when addressing resiliency issues beyond the Cascadia Earthquake and Tsunami.***

There is a clear focus on the Cascadia Earthquake and Tsunami among both stakeholders and recent state resiliency policies and plans. If OPAC is to advise on other resilience-related issues in the name of "resilience",

it will be difficult to overcome the salience of the Cascadia event because it has been firmly established on the policymaking agenda and is at the forefront of the public's and policymakers' minds due to its predicted dramatic and widespread impacts. Policymakers should not lose sight of other resilience issues. Survey participants are strongly concerned about fisheries along the Oregon coast, which continue to struggle from the effects of eutrophication, ocean acidification, and other stressors. Coastal communities need to be prepared for these disturbances, as well as economic disruptions, sea level rise, erosion, and intense storms.

OPAC could employ a strategy that has been discussed in policy process research and theory, in which less salient issues are linked to more salient ones through communication ("framing") of the issue or policy, or through a policy itself. This approach has the additional benefit of being a step toward addressing risks comprehensively, as is recommended by resiliency experts.

4. ***Promote a "big tent" approach to resiliency efforts, ensuring that participation in the process is highly inclusive.***

Improving equity and inclusiveness is especially important to democratic government organizations that represent "the public" as a whole. In addition to meeting normative democratic standards, research shows that inclusive participation in decision-making processes can improve substantive outcomes. OPAC's operating procedures clearly recognize the normative argument for processes that include a variety of opinions. When working to build resiliency in local communities, the need for inclusiveness and consideration of minority opinions may need to extend beyond OPAC's limited membership. Outreach to a wide variety of communities, particularly those that are most vulnerable or most marginalized, will be necessary. Omitting some populations will also leave those populations more vulnerable and may undermine coastal and ocean resiliency more generally.

Research Objectives

1. ***To identify current state-level policies in terms of their potential influence on ocean and coastal resilience.***

What are current state policies that impact resilience efforts related to Oregon's ocean, coastal, and estuarine resources? What state policies impact resilience efforts related to Oregon's ocean, coastal, and estuarine resources?

2. ***To describe the strengths, limitations and potential challenges of current policies.***

What do state and local coastal leaders perceive to be the strengths, limitations and potential challenges associated with current policies in terms of resilience efforts related to Oregon's ocean, coastal and estuarine resources? What do state and local leaders perceive to be policy gaps?

3. ***To provide examples of best practices in terms of state-level policies related to ocean and coastal resilience.***

Are some states considered leaders in state-level policy related to ocean and coastal resilience? If so, what types of state-level policies have they enacted to facilitate ocean and coastal resilience? How did these efforts come together? How do they evaluate success?

Background

In 2016, Oregon's Ocean Policy Advisory Council (OPAC) prioritized the following four issue areas: 1) revisions to the rocky shores management strategy of the Oregon Territorial Sea Plan, 2) ocean acidification, 3) marine debris, and 4) resilience. OPAC contacted Oregon State University's public policy program to research state policies related to ocean and coastal resilience in Oregon.

"Resilience" is a concept that has received increasing attention in recent years, but its nebulous nature means that incorporating it into policy can prove difficult. OPAC has defined resilience as, "the ability to adapt to changing conditions and withstand, and rapidly recover from, disruption".[1] This report is meant to provide information to help guide OPAC's deliberations on improving Oregon's coastal and ocean resilience. The project will provide background on Oregon's existing state policies relating to the resilience of Oregon's coast

and ocean (territorial sea), including estuaries. Our goal is to identify both the strengths of current policy, as well as potential areas for improvement.

Research Overview

Our research objectives were: 1) to identify current state-level policies in terms of their potential influence on ocean and coastal resilience; 2) to describe the strengths, limitations and potential challenges of current policies; and 3) to provide examples of best practices in terms of state-level policies related to ocean and coastal resilience. We selected four different strategies to accomplish our objectives: content analysis of existing state policies (Statewide Planning Goals 7 and 16-19, Beach Bill, Oregon Resilience Plan and Territorial Sea Plan), interviews and surveys with relevant stakeholders, and case studies of best practices for resilience planning and policy.

Research Context

Risks to Oregon's Coastal and Ocean Resilience

The resilience literature identifies a range of risks to Oregon's coastal resilience. These risks include events caused by external forces and risks inherent to human organizations.

The literature shows that risk and uncertainty can originate from human factors, organizational factors, and technological factors.[2] Terrorist attacks and human errors are examples of risks from human factors; poor employee training is an example of an organizational factor; computer network failure is an example of a technological factor.

However, the risks discussed in this report mostly originate from external events. External events can cause acute risks (i.e., severe, sudden onset) or chronic risks (i.e., long developing). The most prominent acute risk to the Oregon Coast is from the Cascadia Subduction Zone, which has a 37% chance of causing an earthquake with a magnitude between 8 and 9 within the next 50 years.[3] This event would cause massive destruction via the earthquake itself and via a large tsunami projected to hit the Oregon Coast shortly after the earthquake[3]. Other acute risks include storm events, which are expected to become less frequent but more intense under changing climatic conditions.[4]

Climate change also creates chronic, long-term risks. Ocean acidification is the ongoing decrease in the pH of the Earth's oceans, caused by the uptake of carbon dioxide (CO_2) from the atmosphere. Research from Oregon State University indicates that coastal organisms in the California and Oregon ecosystems face not only some of the lowest, but also some of the most dynamic, pH environments currently known for surface marine systems.[5] Climate change is also projected to impact coastal regions significantly due to sea-level rise.[6] A possible two to four feet rise in seas by 2100 could lead to erosion and flooding, and, while the Oregon coast may be less vulnerable than more low lying coastal areas, it is not immune.[7]

While this list of threats is not exhaustive, it does represent some of the most significant risks facing Oregon's coast and ocean. Even with knowledge of these potential risks, policy efforts to build resilience often confront several barriers.

Barriers to Building Resilience

Barriers to resilience planning include economic, informational, political, institutional, and psychological factors. One major barrier is insufficient prioritization of natural hazard planning. Local governments tend to prioritize more immediate concerns, such as economic development and education, and have a limited capacity to address large, distant threats.[8] Insufficient knowledge of and data on natural hazards and their effects compounds this problem. Local governments often lack coastal monitoring and mapping capabilities, making it difficult to assess current conditions and predict future threats.[9] While the federal government produces much of the relevant data and information for local adaptation planning, the US Government Accountability Office found that local policymakers cannot easily access it.[10] Additionally, models on a regional scale are not able to determine specific cases of concern for conservation and management on a more local scale.[11] Finally, municipalities may not have personnel with formal training in coastal management.[9]

A related barrier is the current lack of comprehensive metrics for effectively evaluating resilience. According to a targeted survey conducted by the Preparedness Leadership Council International, the gap between available data and the associated necessary actions needing to be taken using that information was the greatest challenge regarding data.[12] Decision-making support tools and easily-understood metrics would aid the resilience planning process but are largely unavailable.[13] The lack of resiliency metrics contributes to the difficulty in assessing cost-benefit tradeoffs of resiliency-enhancing actions, which is a problem in and of itself. While the upfront costs of hazard mitigation and resilience planning are immediate, the full benefits are usually unknown for some time. Although studies show that the savings generated as a return on investments in hazard mitigation projects are substantial, the high upfront costs, uncertain nature of the risk, and lack of

immediate tangible benefits can make these types of investments seem less attractive.[8] Lack of resources and competing priorities are two of the most commonly-cited barriers to coastal resilience.[8] For instance, a 2011 survey showed that acquiring funding for climate adaptation planning is a difficulty for about 90% of all US cities.[10]

Competing resources can also be related to broader political concerns. Restricting development in hazard areas can be politically difficult when the prevailing mindset is pro-growth. Such policies can be perceived as limiting private property rights and imposing costs on the local community. Additionally, the collective action that is necessary to achieve resilience is at odds with the American cultural value of individualism.[8] In terms of policymaking, the short decision-making time frames typical of state and local politics are another barrier to resilience planning. Resilience is a long-term goal, so projects aimed at increasing resilience will rarely be accomplished within a politician's term.[8] Political concerns are also a barrier because there are often differences in priorities between levels of government involved. For example, a study of coastal planners' attitudes toward climate adaptation planning in Alaska, Florida, and Maryland showed that local planners are significantly less likely to favor initiating planning and allocating resources in the immediate and near-term, as compared to state and NGO planners. On the other hand, different motivations at different levels could lead to unique opportunities to work together.[14] Conflict with existing state and federal laws is another barrier for jurisdictions attempting to pass innovative initiatives.[10]

Superficial and contradictory commitment to resilience, as well as fragmented implementation, create additional barriers to resilience.[9,10] For example, in the case of waterfront development, examples exist where municipalities are simultaneously implementing hazard mitigation plans and promoting economic development in high-risk areas.[10] If the goals of resilience planning are neither specified nor prioritized, the term loses substantive meaning and can fall victim to political maneuvering.[9] Also, the literature shows that resilience initiatives can fall short of achieving their goals when they do not address dependencies between and among the social and built environments and when policy solutions are too general and do not consider local variance in social vulnerability and local cultures.[13] Recovery processes that ignore local social conditions have been found to actually impede the recovery process and be detrimental to social, cultural, and psychological conditions within the community.[15,16,17,18]

These barriers demonstrate that improving communication and collection of information relating to resilience is a major step in the resiliency process, but also emphasize the need to carefully consider the complex political and social context of resiliency efforts.

Approaches to Improving Resiliency

With knowledge of the potential risks and barriers to resilience, we now turn to ideas from the literature on how to improve resilience. A review of perspectives on resilience found that international organizations and policy makers tend to focus on component parts of the system, while scholarly approaches emphasize the system as a comprehensive whole.[19] While specific local-level actions addressing multiple kinds of disturbances and multiple dimensions of resiliency will differ, the literature suggests several approaches to improve the overall resiliency of coastal communities. This recommendation for comprehensive, holistic approaches to building resiliency applies to information collection and communication, as well as efforts to improve resiliency through policy or collective action.

Risk analysis is a common practice in government programs and insurance, but measuring resilience goes beyond these metrics. Traditional risk assessment focuses on pre-disaster states, but researchers recommend that resilience measures account for the full life cycle of, for example, an infrastructure system, to capture the recovery stage that is critical to resilience.[20] Several approaches to measuring resiliency incorporate the time dimension through measuring various stages before and after the disturbance (e.g. Argonne National Laboratory's Resilience Measurement Index),[21] or through multi-stage matrices and frameworks that explicitly address recovery over time (e.g. the resilience triangle used in the Oregon Resilience Plan, Figure 1).

Which aspects of resiliency are measured for these broader frameworks varies. Engineering based approaches typically focus on the robustness, redundancy, resourcefulness, and rapidity of built environment or structural features. These approaches are critiqued for their inability to demonstrate overall resilience due to fragmented metrics, as well as a negligence of connectivity between critical infrastructures and of the social processes that affect resilience.[22] The Coastal Resilience Index attempts to incorporate social factors, yet it has been critiqued for lacking generalizability.[20] Even when the index is used to inform plans, community-level resilience often present results without the accompanying quantifiable or comparable metrics. The Oregon Resilience plan is subject to this critique.[23] There are many frameworks for analyzing different aspects of resiliency.

When considering ways in which communities can improve resiliency, one basic distinction to make is between "static" and "dynamic" resiliency options. Static options maintain operation of economic or social processes through, for example, relocation of services. In contrast, dynamic options are post-disaster responses that increase the ability of a system to bounce back from a disturbance. Dynamic options include

prompt mobilization of resources, such as insurance payments, as well as timely removal of debris. To effectively prepare to take these actions, however, there are several recommendations that improve preparedness and resiliency as an attribute of a given system or community.[24] Economic approaches are fairly straightforward, although their implementation may be complex and face logistical or political barriers. The two major economic recommendations are promoting economic diversity between (e.g., expanding terrestrial agriculture to reduce reliance on fishing) and within sectors (e.g., fishing multiple species), and using insurance to both establish a financial safety net and discourage development in high risk areas.[25,26,27]

Similar to recommendations for economic diversity, the community resiliency literature emphasizes that resilience is strengthened by adaptive capacities: tangible or intangible resources that are dynamic, redundant, and quickly accessible. Intangible resources can include social capital and networks, which improve individuals' ability to work together with others to leverage other resources needed to recover.[18] This concept is more complex than economic adaptivity and is more difficult to address through policies, in part because intangible resources are context-dependent, nuanced, and difficult or impossible to measure.

Scholars in different disciplines and focusing on different dimensions of resiliency recommend a local approach to increasing resiliency. From the economic perspective, each community has certain industries that are more resilient than others, and external approaches are less able to understand these assets. From the social perspective, external approaches may come in conflict with local norms and are less able to understand social capital assets. For instance, in a case in which a coastal community in Florida faced both economic and social challenges from the Deepwater Horizon oil spill, social systems that were already undermined by the incapacitation of the fishing industry were further stressed as external aid came in conflict with local norms.[16]

It is important to note, however, that some external help is necessary to guide local efforts. State agencies have additional expertise or resources and could also prevent some problems that arise from flawed local resiliency efforts. For instance, marginalized populations (e.g., ethnic minorities, low-income communities) have fewer financial resources and may not have the same social ties with resiliency planners that other community members have. These disparities mean that marginalized populations are highly vulnerable and face more barriers to recovery than others. State-level guidance and resources to motivate and support special attention to highly vulnerable populations could improve local resilience efforts. Furthermore, local political boundaries are likely to be barriers to the regional planning that is recommended for resiliency to disruptions impacting a wide geographic area. State and federal policies have the purview to provide the coordination between local jurisdictions.

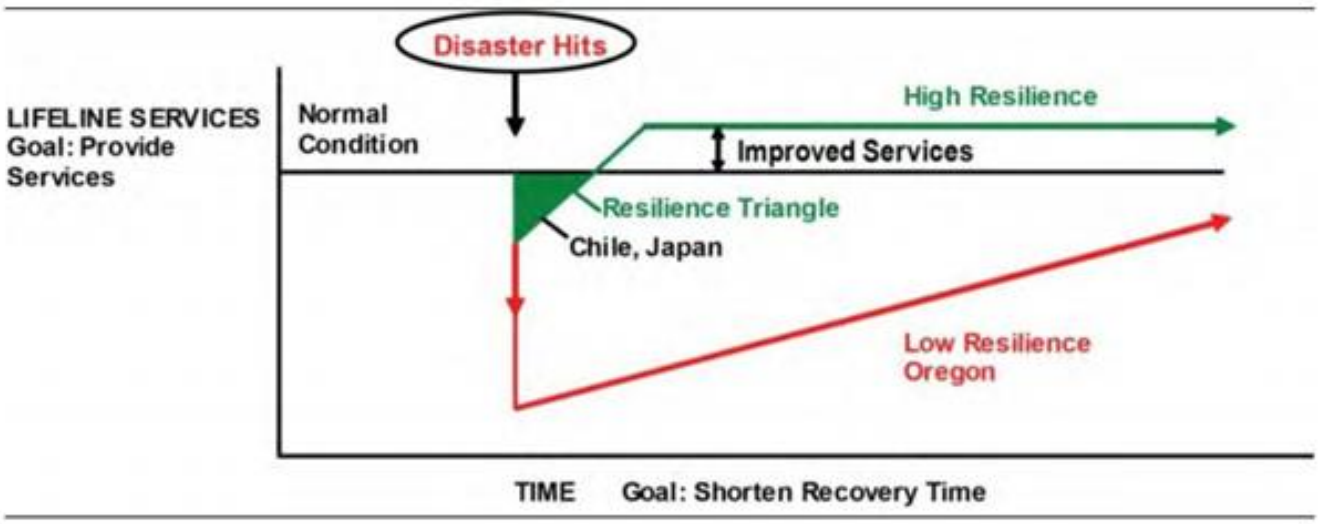


Figure 1. Resilience Triangle in which a smaller triangle represents higher resilience due to shortened recovery time. The Oregon Resilience Plan (ORP) uses the examples of Chile and Japan, which both quickly recovered from high magnitude earthquakes. (Oregon Seismic Safety Policy Advisory Commission 2013, fig. 7.6. From Wang, Bartlett, and Miles 2012).

Methods

Given these insights from relevant literature, we chose four different strategies to accomplish our objectives of identifying relevant state policies related to ocean and coastal resilience, understanding their strengths and areas of improvement, and identifying best practices: content analysis of existing state policies, interviews and surveys with relevant stakeholders, and case studies of best practices for resilience planning.

Content Analysis

To better understand how current state-level policies influence ocean and coastal resilience, we conducted a content analysis of a selection of state policies and plans. The plans and policies were selected based on initial input from OPAC, as well as observation of the Coastal Resilience in the Face of Environmental Change symposium at University of Oregon Law School in April 2017. OPAC advises on policy relating to Oregon's territorial sea, beaches and dunes, rocky shores, and estuaries. Based on this geographical scope, we chose to analyze Statewide Planning Goals 16, 17, 18, and 19; the Beach Bill; and the Territorial Sea Plan. The Coastal Zone Management Program is also of interest, but its primary policy documents are the Coastal Statewide Planning Goals and local Comprehensive Plans. We also chose two statewide policies based on their relevance to resiliency in the face of natural disasters: Statewide Planning Goal 7 (Areas Subject to Natural Hazards) and the Oregon Resilience Plan. We also examined Lincoln County's Comprehensive Plan, which

was identified as a good example of local resiliency planning by interviewees, and spoke with Lincoln County's Planning Director to better understand how statewide policies are implemented at the local level. Through our research, we identified other existing resources related to ocean and coastal resiliency in Oregon. Although analyzing these documents was beyond the scope of this project, the compiled list of resources is provided in the Appendix.

We used Dedoose, an online platform for analyzing qualitative data, to analyze each policy document for seven overarching themes we identified in the literature review as affecting economic, environmental, or social resilience. Thematic coding analysis is a common approach used in interpreting qualitative data.[28] After analyzing our coding, we identified 18 subthemes which demonstrated a clear pattern. To confirm that our coding was reliable, we then used keyword searches. Our codebook listing themes, their definitions and relevant examples can be found in the Appendix.

Interviews

To better understand perceived gaps and potential challenges associated with state policies, we conducted 18 interviews with individuals involved in coastal resilience policy and planning in various capacities. Interviews are particularly well-suited for obtaining data in an adaptable and flexible way and have the potential to provide rich and illuminating material.[30]

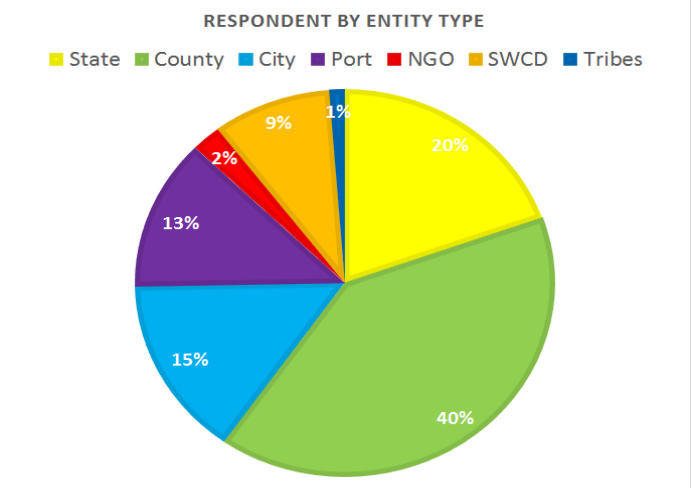
Members of the Oregon Legislature and relevant state agencies, city and county officials, along with other professionals involved in resilience policy and planning were included in the list of potential interviewees. We sent emails requesting interviews to 24 potential interviewees, of which 18 responded affirmatively, generating a 75% response rate. Interview questions covered the strengths and gaps in current state policies related to ocean and coastal resilience, the policymaking process, and policy recommendations. Interviews were based on a common list of questions but were semi-structured, allowing for both comparability of responses and flexibility and follow-up.[30] Interviews were conducted from May 2 through May 23, 2017, in person in Astoria, Newport, Salem, Seal Rock, and Tillamook, as well as over the phone. Interviews ranged from 20 to 80 minutes in length, with an average of about 47 minutes. The final list of interview questions can be found in the Appendix. Interviews were recorded, transcribed, and coded for themes using Dedoose. Our codebook listing themes, their definitions and relevant examples can be found in the Appendix.

Surveys

To further understand the strengths, limitations and potential challenges of current Oregon policies, we surveyed ocean and coastal stakeholders. Survey research is particularly useful for obtaining representative views on a large number of issues, which can then be analyzed for patterns of correlations (Robson, 2011).

Our nine-question survey elicited respondent views on three topics: risks and vulnerabilities, communication and collaboration, and relevant state policy (see the Appendix for the complete survey). After piloting and revising, the survey was distributed via email on May 10, 2017, to 302 coastal stakeholders, including OPAC members, coastal elected officials, leaders of chambers of commerce, and leaders of non-governmental organizations. Our contact list was developed based on perceived proximity to and knowledge of Oregon nearshore resiliency issues.

We collected surveys using Qualtrics, an online surveying platform, for 14 days and received 90 responses from 302 surveys distributed, for a response rate of 29.8%. Figures 2 and 3 provide further information about our survey respondents -- most of whom (60%) were state and county officials from a range of geographic locations.



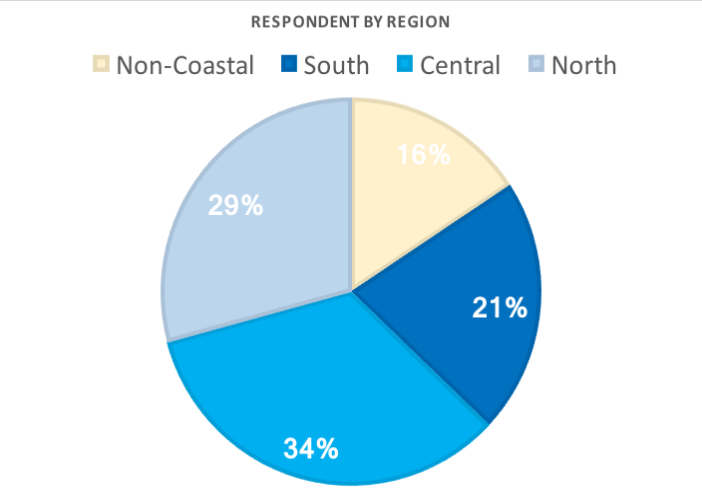


Figure 2. (left) Survey respondents by affiliation. Values denote percentage of total respondents.
Figure 3. (right) Survey respondents by region. Values denote percentage of total respondents

Case Studies of Best Practices

To identify examples of best practices related to ocean and coastal resilience, we identified trends in previous academic research and asked interviewees directly for examples of best practices. We then conducted research informed by our initial project findings. We identified ocean and coastal resilience resources through the literature review, from the interview and survey results, and through internet searches. Our sources included government agencies like the National Oceanic and Atmospheric Administration (NOAA), leading nonprofit organizations like The Nature Conservancy, and academic research. Specific cases were chosen from these resources for further investigation based on geographic and political similarities with Oregon, as well as similar resiliency challenges to those in Oregon (e.g., earthquake and tsunami, flood, and erosion). Cases were analyzed using a template that outlined specific aspects and themes identified as relevant to this research through the literature review process and content analysis of Oregon policies. A table summarizing the case studies can be found in the Appendix.

Results: Objectives 1 & 2

Objectives 1 & 2: Identify current state-level policies in terms of their potential influence on ocean and coastal resilience and describe the strengths, limitations and potential challenges.

As described in the methods section above, we examined the following state-level policies: Statewide Planning Goals 7, 16, 17, 18, and 19; the Beach Bill; the Territorial Sea Plan; and the Oregon Resilience Plan.

Strengths

The two major strengths we identified in the state policies we examined (i.e., Statewide Planning Goals 7 and 16-19, Beach Bill, Oregon Resilience Plan, Territorial Sea Plan) are as follows: (1) that they address the full breadth of resilience concepts (e.g., environmental, economic and social) and (2) that they promote resilience chiefly through strong land-use planning guidelines and inventory requirements. Our interviews and surveys also revealed that resilience planning is already underway at multiple levels of government, especially with respect to preparing for and responding to the Cascadia earthquake and tsunami.

Strength 1: Addressing Environmental, Economic, and Social Resilience

Existing state policies address the need to preserve ecological, economic, and social values, and discuss protecting environment, people, and property on the coast. A comprehensive approach, covering all of these categories of values, has been identified in the literature as foundational to the study and practice of resiliency, as discussed in the background section.[13]

Protecting environments is addressed most frequently and explicitly in the coastal Statewide Planning Goals (16-19) and was coded 32 times. Environmental protection is often discussed in terms of land management, for example, Goal 17 states: "Major marshes, significant wildlife habitat, coastal headlands, and exceptional aesthetic resources inventoried in the Identification Section, shall be protected. Uses in these areas shall be consistent with protection of natural values." Similarly, the Territorial Sea Plan (TSP), which provides guidance on implementing Goal 19, states that its "principal focus…is the conservation and protection of marine habitat" and that it will "give higher priority to the protection of renewable marine resources than to the development of non-renewable ocean resources."

Economic considerations are mentioned a total of 21 times in Goals 16-19. Goals 16, 17, and 18 explicitly note that information about "economic resources" or "economic activity" must be included in inventories for comprehensive plans. For example, Goal 18 states that, "Coastal comprehensive plans and implementing actions shall provide for diverse and appropriate use of beach and dune areas consistent with their ecological, recreational, aesthetic, water resource, and economic values, and consistent with the natural limitations of beaches, dunes, and dune vegetation for development." The TSP also recognizes the importance of ocean resources for the economy and sets as one of its main goals to:

> "Support development of ocean resources that is environmentally sound and economically beneficial to coastal communities and the state…and protect…areas important to fisheries; beneficial uses of ocean resources, such as navigation, food production, recreation, and aesthetic enjoyment that do not adversely affect the resources to be protected in policy items."

Social goals, expressed both as protection from hazards and the preservation of social values, are discussed in more general terms as principals to follow and were coded only 17 times, the least frequent of the three main pillars. Protecting both people and property was discussed eight times. An example of this from Goal 7 is: "Evaluate the risk to people and property based on the new inventory information and an assessment." Social values are also referenced broadly, as in Goal 19: "To conserve marine resources and ecological functions for the purpose of providing long-term ecological, economic, and social value and benefits to future generations." There are also a few references to more specific public benefits, such as recreation and aesthetics, as Goal 16 describes: "Coastal comprehensive plans and implementing actions shall provide for

diverse and appropriate use of beach and dune areas consistent with their ecological, recreational, aesthetic, water resource, and economic values, and consistent with the natural limitations of beaches, dunes, and dune vegetation for development."

Unlike the other policies reviewed, the Oregon Resilience Plan (ORP) is focused only on "infrastructure resilience, help[ing] preserve our communities, and protect[ing] our state economy." Terms related to protecting the environment were not found in the Executive Summary, which led us to conclude that this policy does not encompass environmental or ecological goals. The ORP was the most-frequently mentioned policy in response to interview questions about which policy was most influential for resilience, which is unsurprising given that it has the word "resilience" in its title. The survey results also showed that 73% of respondents believed that the ORP had either "helped" or "helped a lot" in their organization's attempts to make Oregon marine areas more resilient (Figure 4).

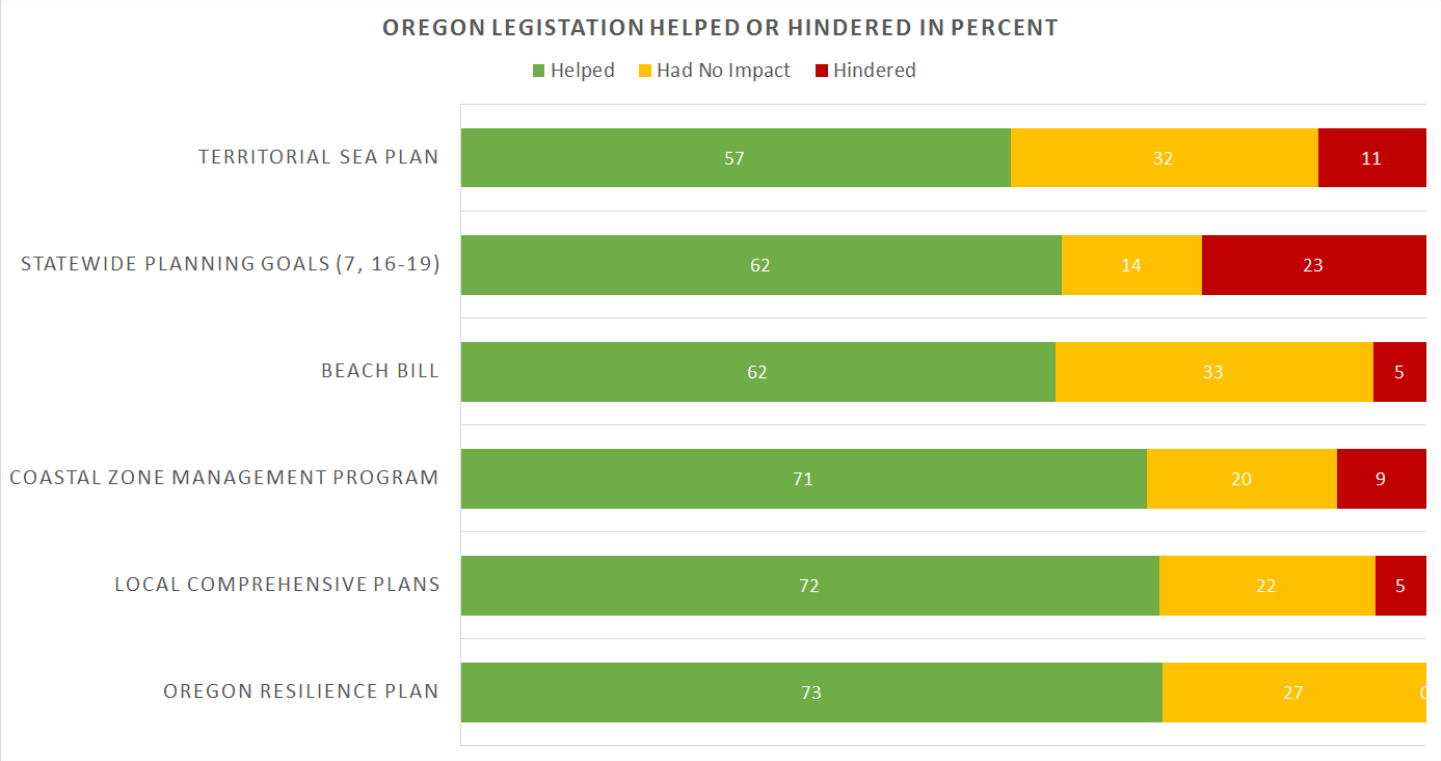


Figure 4. Survey Response: Have the following State of Oregon policies and programs helped, hindered or had no impact on your organization's attempts to make the Oregon marine areas more resilient? Values are in percentage.

Strength 2: Land-Use Planning, Data Collection and Monitoring

Our content analysis of relevant state policies also revealed two additional strengths: (1) land-use planning guidelines and (2) requirements for data collection and monitoring. Land-use planning is an essential

component of resilience planning, and Oregon's land-use planning system is regarded as one of the stronger examples in the resilience literature.[29] A good example comes from Goal 7: "Local governments should coordinate their land use plans and decisions with emergency preparedness, response, recovery and mitigation programs." Interviewees also discussed the pervasiveness of local land use planning in Oregon. For example, Andrew Phelps, the director of Oregon's Office of Emergency Management commented that, "I think at the most basic level, I think most folks along the coast understand that they need to be smart about how they build and where they build."

Developing inventories of resources and site classification is a significant part of the goals with all five goals that we reviewed detailing what needs to be included in inventories to inform comprehensive planning. Goal 19 and the TSP also "encourage scientific research on marine ecosystems, ocean resources, and oceanographic conditions to acquire information needed to make ocean and coastal-management decisions." The scope of the inventory requirements is broad and includes assessments of not only natural hazards, but also other natural, economic, and social conditions. Goals 7, 17, and 18 all mentioned including hazard areas, risks, and vulnerabilities in inventories, including geologic hazards, flooding, erosion, and storms. Also, Goal 16 states that, "These inventories shall provide information on the nature, location, and extent of physical, biological, social, and economic resources in sufficient detail to establish a sound basis for estuarine management and to enable the identification of areas for reservation and areas of exceptional potential for development." The ORP also recommends "comprehensive assessments of the key structures and systems that underpin Oregon's economy." Such data collection and measurement is seen as an important component of resilience planning, as discussed in the background section.

Strength 3: Current Efforts at Resilience Planning

Our survey data shows that resilience planning is already happening to some extent at multiple levels of government: 60% of respondents reported that their organization had participated in a moderate amount or great deal of internal resilience planning, while 66% reported a moderate amount or great deal of resilience planning in concert with other organizations. When interviewees discussed solutions for resilience challenges, mitigation (making preparations ahead of time) and resilience planning were mentioned frequently (Figure 5). Usually, interviewees were discussing how their organizations were planning and preparing for earthquakes and tsunamis. The content of our interviews suggests that most of this resilience planning is associated with preparing for a potential earthquake and associated tsunami. For example, Maryann Bozza, the Hatfield Marine Science Center's Program Manager, discussed some of their efforts to prepare for a possible evacuation:

"There was an overgrown hill with a path that did not inspire confidence for people as an appropriate place to go. The city got FEMA money to build that out. We have a disaster cache up there, which we have really good momentum on filling. We also conduct two drills a year, including a drill where we ask the police to close the highway…"

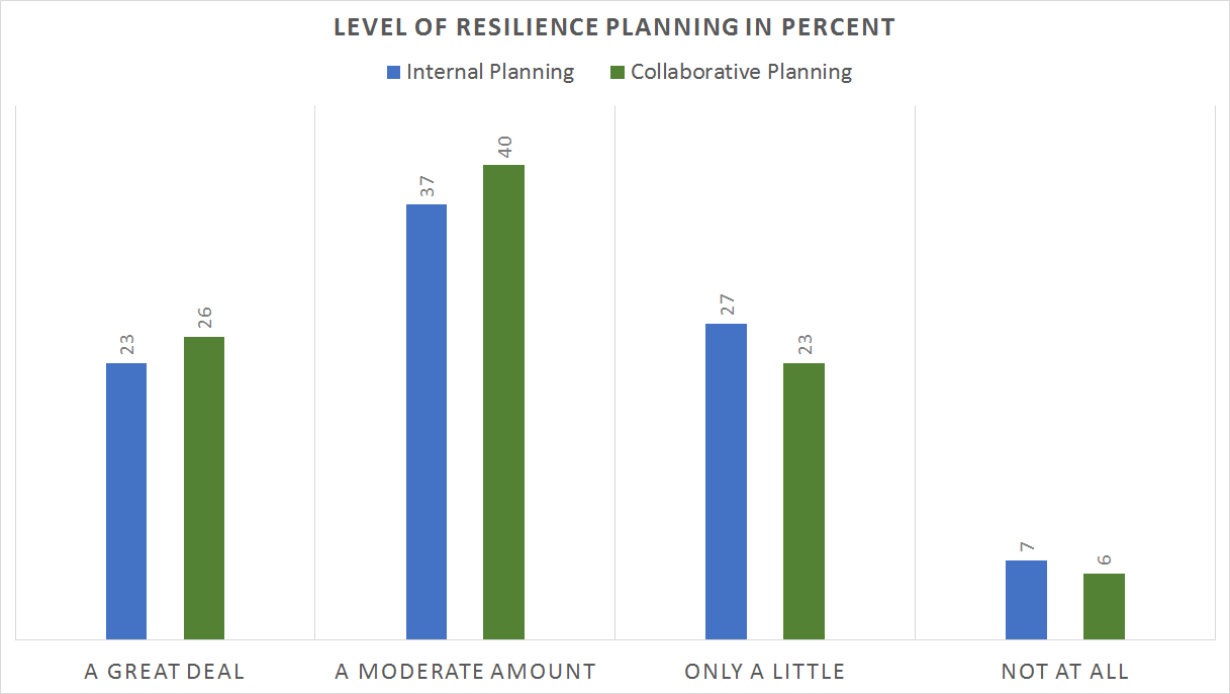


Figure 5. Survey Response: To what extent has your organization engaged in resilience planning in collaboration with other organizations? Values are in percentage.

Areas for Improvement

As we reflected on our results, two themes became clear. First, the Cascadia Subduction Zone earthquake and tsunami is the main resilience challenge that survey respondents and interviewees are focused on. Second, a governance approach that focuses on flexibility, coordination, and collaboration is preferred.

Area for Improvement 1: Land Use Planning and Market Based Approaches

Oregon's policy focus on land-use planning and data collection and measurement offers both solutions and challenges to building coastal resilience for Oregon's marine areas. While the development of comprehensive plans and inventories is mandatory for local governments, some interviewees noted that most of the Statewide Planning Goals only provide guidelines.[38] One of the more specific restrictions is Implementation

Requirement 5 of Goal 18, which states that "permits for beachfront protective structures shall be issued only where development existed on January 1, 1977."

At the same time, the Statewide Planning Goals, which are closely related to land use and coastal infrastructure, are sometimes interpreted as barriers to local resilience planning efforts, as demonstrated in both the surveys and interviews. For example, 23% of survey respondents reported that the Statewide Planning Goals hindered their organization's attempts to make Oregon's marine areas more resilient (Figure 4). Additionally, the five interviewees that specifically mentioned land use planning suggested that there was room for improvement. Anonymous A described how land use policies can hinder resilience efforts as follows: "Most of the coast with the urban growth boundaries and stuff, you don't have a lot of extra places to put your elementary school, or your hospital, or your police station, so that can be a challenge…Ultimately, it's going to be the decision of their board and that agency to make some sort of a definitive stance on what the inundation lines are going to be." Anonymous D recommended that one of the ways that Oregon could improve land use planning on the coast was by "…converting some pieces of forest-use land in the counties to be a residential/commercial or business development. That's harder to do in the policy or land use environment, but it's a lot easier to change a land use policy than to outrun a tsunami." This change could give greater flexibility with regard to land use issues on the coast.

Finally, we noted a lack of non-regulatory or market based options in existing policies. In fact, Statewide Planning Goal 7 was one of the few to mention non-regulatory approaches:

> "Local governments should consider non-regulatory approaches to help implement this goal, including but not limited to: A. Providing financial incentives and disincentives; B. Providing public information and education materials; C. Establishing or making use of existing programs to retrofit, relocate, or acquire existing dwellings and structures at risk from natural disasters."

Interviewees also mentioned insurance, specifically the National Flood Insurance Program, as an alternative, market-based approach that has proven successful at increasing coastal resilience. The Oregon Resilience Plan also includes capital investment and incentives as a way to increase resilience. Other successful approaches mentioned by interviewees included Oregon's Seismic Rehabilitation Grants Program for K-12 schools, community colleges, and emergency response facilities. In fact, several interviewees wished to see this program expanded to other types of critical infrastructure. Diversifying Oregon's policy approach could further increase the resilience of marine areas.

Area for Improvement 2: Multi-level Coordination

The policies we researched outline the responsibilities of the different levels of government and encourage coordination between them. However, our interview and survey findings indicate that there are some gaps in coordination, demonstrated by a lack of stakeholder knowledge on specific resilience topics, and a lack of awareness and knowledge within the general population. Also, while current state policies discuss coordination, they do not provide guidance on how to achieve it.

Two of the barriers to ocean and coastal resilience brought up in interviews related to lack of knowledge and information on resilience topics. First, interviewees cited lack of awareness and knowledge within the general population, particularly visitors to the coast. Second, interviewees cited information gaps on resilience issues and/or incomplete planning. When codes for these barriers were combined, lack of knowledge was tied with lack of funding as one of the two most-discussed barriers to resilience in interviews.

One specific gap in knowledge and awareness is that many people do not know how long they need to prepare for before emergency help arrives. Anonymous B describes this issue as follows: "I think a lot of people are aware that something like that is going to happen, but it's difficult to get people to wrap their heads around that there may or may not, depending on what happens, a lot of assistance right off the get go. And that's kind of the biggest challenge." Anonymous C described her understanding of the current state of resilience planning as follows: "There is a culture of preparedness around what to do in the case of an emergency. We have not yet gotten to how to rebuild after the event. And that's where I think resiliency lies."

Our survey results show that all organizations providing information on coastal resilience could improve the effectiveness of their communication strategy. State government was the only organization listed on the survey that more than 50% of respondents considered to be "moderately" or "extremely effective" at communicating and collaborating on issues of ocean and coastal resilience (Figure 6). We also asked about federal government, local government, national non-profits, local community groups, and universities. No other organization type had more than 50% of respondents saying their communication or collaboration is moderately or extremely effective. Moreover, in 11 out of 18 interviews, collaborative governance was discussed in positive terms, indicating that stakeholders would welcome the opportunity to share information, coordinate activities and collaborate on planning efforts.

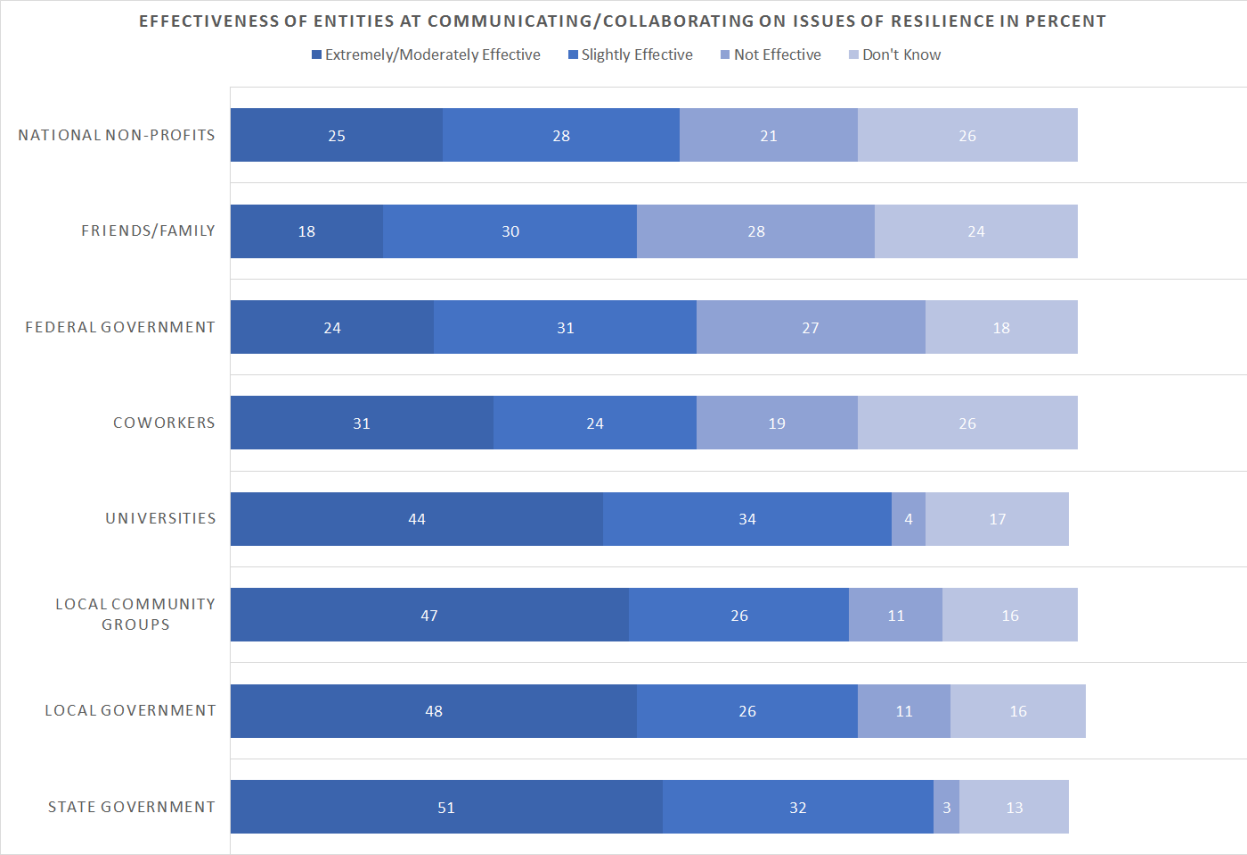


Figure 6. Survey Response: How effective do you think the following entities are at communicating and collaborating on issues of ocean and coastal resilience? Values are in percentage.

Information-sharing and coordination are recognized as important aspects of building resilience in the literature.[29,18] However, information-sharing is not discussed directly in the Statewide Planning Goals but implied through discussion of coordination. Assistance from and coordination among state and federal governments was mentioned 8 times in Goals 7, 16, 17, and 19. However, local governments are not encouraged to share across localities. This gap could be filled by state efforts to provide coordination across localities, as local governments are already involved in resilience planning and engaged in data collection and monitoring.

Existing efforts like the TSP's checklist and computerized ocean-resources information system could be expanded or modified with resilience specifically in mind to facilitate information sharing and coordination across localities. The TSP also authorizes OPAC "to recommend changes to both local comprehensive plans and ordinances to help the local plans become consistent with the Territorial Sea Plan." Such recommendations from OPAC related to coastal and ocean resilience could provide localities with help figuring out where to get started on resilience planning, especially if they're provided in a user-friendly format like the soon-to-be-released Cascadia Playbook. Moreover, survey respondents indicated that they most

often turn to the state government for information about resilience, with approximately 71% of respondents indicating that they do so occasionally or frequently. The next most reported source of information was local government (61%), followed closely by local community groups (60%). Thus, OPAC and other state-level entities also appear to be trusted sources of information on this topic (Figure 7).

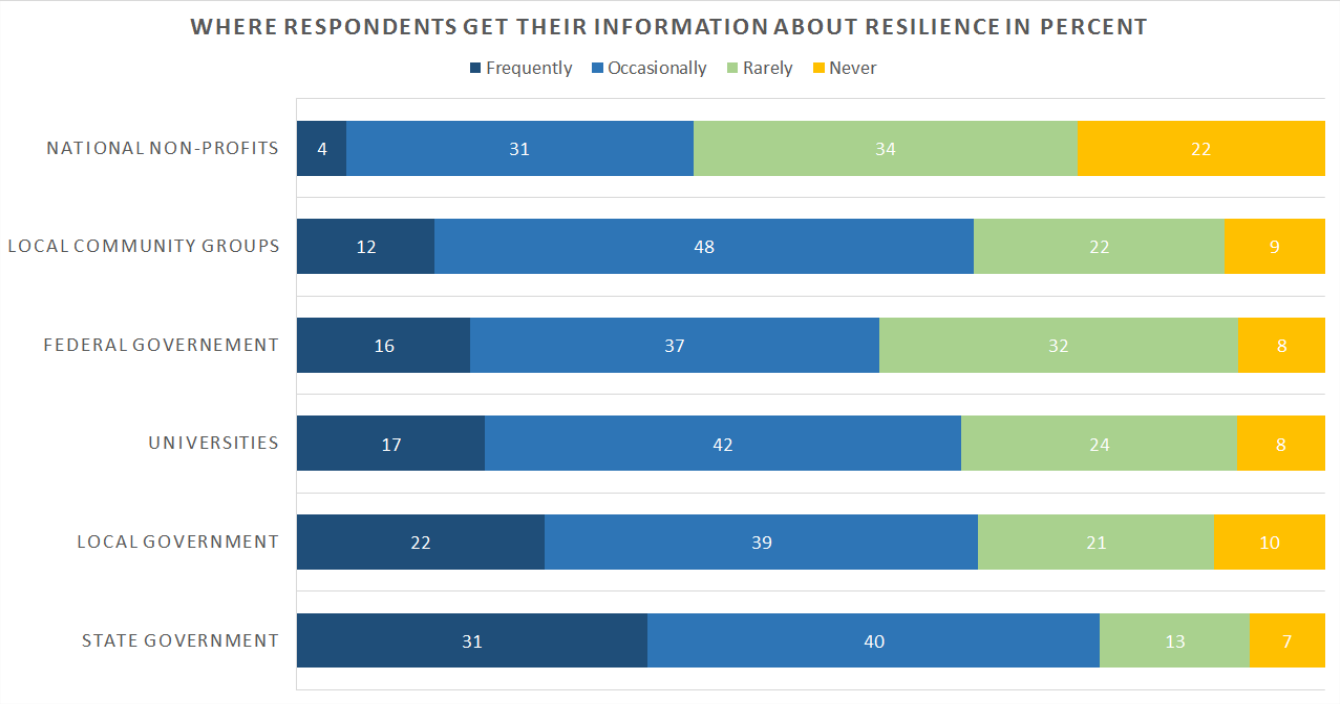


Figure 7. Survey Response: How often do you turn to the following entities for information about the resilience of marine areas? Values are in percentage.

Area for Improvement 3: Issue Salience: Cascadia Subduction Zone vs. Other Resilience Challenges

Before the 9.0 magnitude earthquake and subsequent tsunami in Japan in 2011, Cascadia Rising was of little concern to Oregon's coastal stakeholders. Images from across the Pacific during and media coverage following this catastrophe caught everyone's attention:

> "I think after Japan, everyone saw news footage of the tsunami coming in and that's a very visible thing… When people think of a Cascadia event, tsunami comes to mind before other impacts like buildings collapsing or landslides" (Anonymous B).

Subsequent coverage of predictions for the probability and potential consequences of such an event in The New Yorker and other media outlets, as well as the development of an Oregon Resilience Plan specifically

focused on this risk, have meant that resilience has largely become synonymous with earthquake and tsunami preparations and recovery. Our interviews and surveys demonstrate that the Cascadia earthquake/tsunami is the most important resilience concern for stakeholders, with 52% of respondents reporting being extremely concerned about an earthquake/tsunami (Figure 8). For the second most concerning issue, fishery collapse, 44% of respondents were extremely concerned. Our interviewees were even more focused on this risk: the threat of an earthquake and/or tsunami was discussed at least 6 times more than any other top concern identified (i.e., dead zones, ocean acidification, erosion or fisheries). Anonymous E recognized this overwhelming focus: "When you hear the word resilience you automatically think earthquakes and tsunamis."

Several interviewees noted that preparing for a Cascadia event is an effective standard of measurement for other external events. For example, Maryann Bozza, Program Manager for the Hatfield Marine Science Center, said: "I have taken the approach that the planning that we've been doing for a 9-something earthquake and tsunami pretty much encompasses all of our other potential disasters. For example, if our facility were to flood, we would need to get to higher ground, and we could." While the Cascadia Subduction Zone is a rallying cry for resiliency, such a sharp focus on planning for a single event can be an issue when there are other concerns in the community, like ocean acidification and fishery collapse. Moreover, while "natural hazards" like an earthquake or tsunami have their own goal in the statewide planning goals, and flooding and erosion are explicitly discussed, ocean acidification and sea level rise are never mentioned.

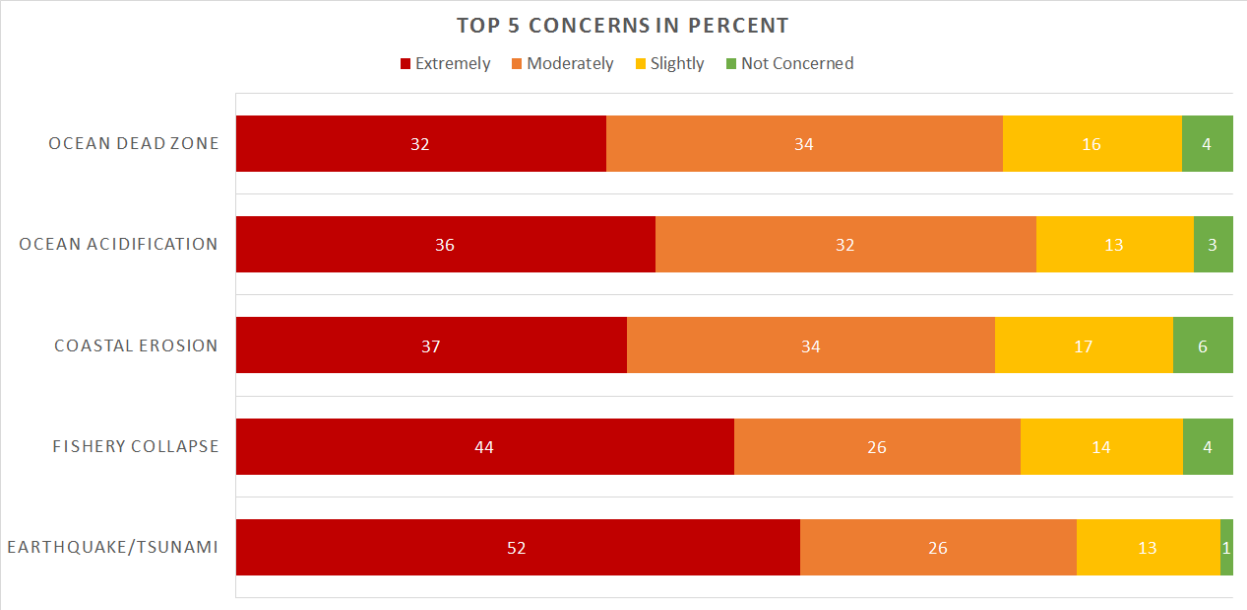


Figure 8. Survey Response: How concerned are you about the ability of Oregon's marine areas (this includes ocean and coastal areas) to adapt, withstand, and rapidly recover from the following types of disruptions? Values are in percentage.

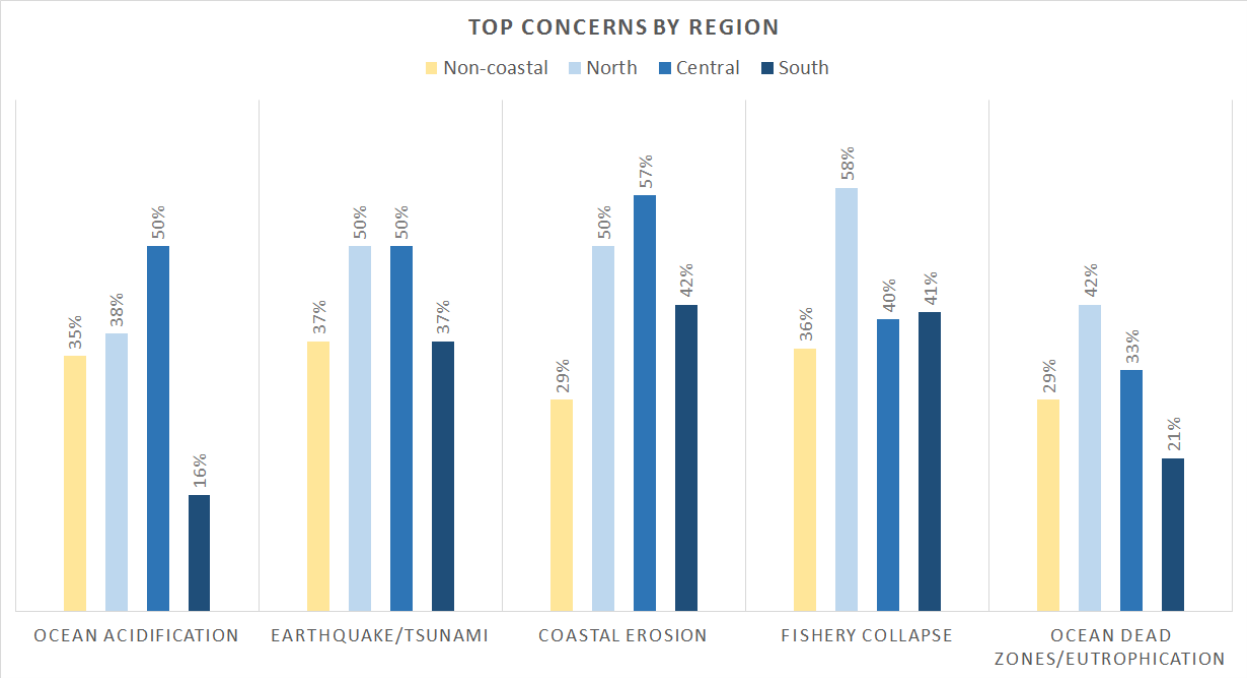


Figure 9. Survey Response: How concerned are you about the ability of Oregon's marine areas (this includes ocean and coastal areas) to adapt, withstand, and rapidly recover from the following types of disruptions? Values are in percentage and responses are broken down by Oregon coastal region.

The survey results also indicated that there was a significant divide in opinion between the North, Central, and South Coast in terms of concerns beyond earthquakes and tsunamis (Figure 9). The South coast

represents the area of Oregon's coast from Brookings to Reedsport, the Central Coast encompasses Florence to Newport, and the North Coast is Tillamook to Astoria. Respondents from the North Coast areas were particularly concerned about fishery collapse. Whereas, those from the Central Coastal were most concerned about ocean acidification. This finding provides insight into the different ways each coastal region thinks about resilience and the importance of localized planning efforts.

The current focus on the Cascadia Subduction Zone provides both a challenge and an opportunity for OPAC. To the extent that resilience planning efforts can be tied to earthquake and tsunami planning and also address other resilience concerns, policy makers may be particularly attuned. However, more chronic risks, such as those related to ocean acidification and sea level rise, may prove difficult to gain traction, unless tied to localized impacts or economic concerns.

Results: Objective 3

Objective 3. To provide examples of best practices in terms of state-level policies related to ocean and coastal resilience

Our multiple methods revealed four major best practices that could be implemented to improve Oregon's resilience: (1) local-level action with state-level coordination and assistance; (2) accessible information and measuring resilience; (3) strategic use of natural infrastructure; and (4) financial mechanisms (e.g. insurance) to act as safety nets and incentives. These best practices are actions that can be taken or encouraged by state and local agencies, non-profits, or other organizations promoting resiliency. There are also several themes throughout these practices that further aid resiliency, such as increasing social capital and adaptive capacity.

Best Practices 1: Local-level action with state level coordination and assistance

Benefits: best leveraging local resources, flexibility

Our interviewees and survey respondents confirmed the recommendations in the academic literature to focus the control of resiliency efforts at the local level. Potential benefits of this practice include better understanding of local conditions and priorities, which allows for leveraging local resources and flexibility to fit policies or programs to be more appropriate to each distinct community. Local resources include social capital, which can be thought of as the connections between people or organizations that can be used to

collaboratively solve problems. Similarly, cultural connections with the local place or resiliency processes can be advantageous.[16,18]

> "In North Tillamook County we have a very robust emergency preparedness coalition, it's the Nehalem Bay Emergency Volunteer Corps. So as an example of rallying people around a *culture of emergency preparedness*, they are the gold standard."
>
> --Jennifer Purcell, North Coast Regional Solutions Coordinator, Oregon Department of Environmental Quality (emphasis added)

As is true of many complex issues involving multiple dimensions of environment and society, "it's hard to put one model down that applies to every community across the state" (Anonymous B). In an interview with one of our researchers, State Resilience Officer Michael Harryman also highlighted that localizing resilience improves response time: "all decisions need to happen at the local level because all emergencies happen at a spot on the map and that's a local level. Federal, state agencies can come in later and help out later, but it will take time for them to get there." Both of these advantages are related to the flexibility or adaptation that localized efforts offer.

It is important to note that while most of our interviewees (11 of 18) agreed that the local level is the most appropriate level of government to address resiliency, the concept may face some resistance. Michael Harryman noted that he has heard the contradicting opinion "that the local actors can hinder these [resiliency] processes."

In addition to the evidence presented in this report, further evidence of the benefits of localization may come from successful efforts both outside of and within Oregon. For instance, the Nehalem Bay Emergency Volunteer Corps was identified by several interviewees as a strong example of locally building resilience. Examples from Chile and Alaska highlight, respectively, the social capital and flexibility benefits of a local focus. Research in Chile showed that fishermen with large, diverse social networks experienced faster economic recovery from disturbances than those with lower social capital resources.[32] In other Alaskan fishing communities, Community Purchase Programs were implemented to provide much needed local flexibility to the federal Individual Fishing Quotas (IFQ) program.[30]

While local actors and communities have some social and knowledge resources that state or federal actors do not, they often lack other knowledge, coordinative, and financial resources that state and federal actors have. Coordination across local jurisdictions is one benefit of state level involvement suggested in the academic literature, but our interviewees emphasized financial assistance from the state. In particular, the Seismic Rehabilitation Program was discussed by several interviewees as very beneficial in supporting local resilience

efforts. One interviewee recommended the grant program be expanded to include other entities that are not directly benefiting from the program but are involved in local emergency preparedness. Other funds that are not be directly involved in resiliency or emergency preparedness may also be important. For instance, economic resiliency in Homer City, Alaska was supported by Natural Resource Conservation Service "Environmental Quality Incentives Program" (EQIP) grants that facilitated expansion of the growing agricultural sector there.[27] Finally, it is important to consider the health and diversity of local industries. Coos County Commissioner Bob Main indicated that financial difficulty in the forestry industry has proven to be a challenge to resiliency:

> "Most ocean and coastal counties have an economic crisis for resiliency generated by general BLM policies for utilizing the ocean and coastal forest… Without those funds [from a profitable forestry industry], it makes it very difficult to respond to the natural disasters that may happen, locally and in an immediate fashion, because we don't have the funding"

Best Practices 2: Accessible Information & Measuring Resilience

Benefits: Stakeholder awareness and engagement, improved coordination, better leveraging resources

Knowledge is an asset to all stakeholders involved in emergency preparedness and resiliency planning for long-term disturbances like ocean acidification. There are three ways in which use of data and other information can be made more effective in this context: accessibility, sharing between organizations, and measuring resilience itself.

Accessible Information

Although Oregon has made great strides in increasing awareness for disaster planning, especially along the coast related to the Cascadia Subduction Zone earthquake and tsunami, there are still opportunities to improve the preparation resources available to coastal communities. Some interviewees were unsure of what policies impacted their resilience efforts, and some mentioned that there is some difficulty in "knowing where to start" with resiliency efforts. Several existing websites can be used to inform the improvement of information accessibility. Representative Paul Evans suggested the "Be Ready Utah" program for emergency preparation as an example. This program's website (beready.utah.gov/) for citizens of Utah organizes resources into those for families, businesses, schools, and communities. The advantage of Utah's website is the user-friendly platform that has very specific action items depending on the entity engaged in emergency planning.

Oregon's Office of Emergency Management (http://www.oregon.gov/OEM/Pages/default.aspx) similarly links to sections for individual, business, or community preparedness. This website, however, is not well known, doesn't appear quickly in a google search, and only addresses acute risks. Accessibility must also include awareness of the resource. According to survey data, the state government appears to be the most source of information on coastal resilience issues. Thus, improving accessible information from the state would be a great benefit to coastal resiliency stakeholders, although encouraging improving and connecting diverse range of information sources would also be beneficial to ensure reaching multiple audiences.

Sharing between organizations

Collecting and sharing other information relating to industries, organizations, or physical assets involved in resilience efforts can also be essential to improving resilience. For instance, analyses of Alaskan salmon fisheries suggest that the economic impacts of fishery decline can be mitigated if there is an accurate and early prediction of fish populations that season and if fishing communities are adequately informed of the quantity and location of the availability. In addition to data sharing, information sharing can include practices or strategies, such as the incorporation of local knowledge and successful practices into government agency considerations for management policies. Information sharing is closely related to partnerships and networks, which are in turn an aspect of developing social capital.

One way to facilitate information sharing is to establish partnerships between multiple levels of government, non-governmental organizations, and privately-owned business. Some partnerships addressing coastal issues that impact resiliency already exist. For instance, the Tillamook Bay Estuary Partnership is a collaborative effort between federal, state, local, and nonprofit actors that aims "to protect and restore the health of estuaries while supporting economic and recreational activities." Bringing together multiple levels of government with other stakeholders provides a forum for sharing data, practices, lessons learned, and other important information.

Measuring resilience

The first step in establishing accessible information resources is often ensuring sufficient data collection is occurring to understand the areas where resilience is most needed, which is also recommended in the literature. The Texas Sustainable Coastal Initiative at Texas A&M developed the Community Disaster Resilience Index, which consists of a set of parameters that were used to evaluate the resilience of different communities. After deciding on resilience indicators (e.g. concentrations of housing units built 20+ years ago, poverty), that information was put into a geospatial database so that local decision makers were able to

leverage the information to assess risks and decide what resilience planning mechanisms to promote.[31] Another, more narrow, way to measure resilience was developed for ports in the Gulf of Mexico. This Port Resilience Index was the result of a NOAA grant to extend the Community Resilience Index. Although the Gulf Coast indices focus on hurricane risks, it could easily be modified to add earthquake/tsunami risks and adopted by Oregon. By assessing the current resilience level with tools like the Community Disaster Resilience Index and the Port Resilience Index, Oregon would be more informed to make determinations for how to use scarce resources to increase resilience.

Best Practices 3: Strategic Use of Natural Infrastructure

Benefits: protects both the environment and communities, compatible with Oregon coastal policies' limitations on protective structures, aesthetically pleasing

There is some evidence of the importance of natural infrastructure in protecting coastlines from hazards, as well as evidence of built protective structures such as jetties being detrimental to neighboring properties. Several features commonly discussed in the literature on natural infrastructure are wetlands, dunes and oyster reefs. While built infrastructure usually just provides value during an extreme event, natural infrastructure provides additional resilience-enhancing benefits, such as "plant and animal habitat, water and air quality regulation, carbon sequestration, nutrient cycling, and opportunities for tourism, recreation, education, and research,"[32] as well as supporting fisheries. Natural infrastructure thus provides social, environmental, and economic co-benefits beyond hazard mitigation. Built infrastructure is better understood than natural, but it is known to impact sediment movement and other factors, weaken over time, and is not able to adapt to changing conditions over time, whereas natural infrastructure is adaptable and strengthens over time. Hybrid infrastructure, which uses built techniques to support natural infrastructure, also holds promise but may have limited applicability in Oregon. Both Oahu, Hawaii, and Ventura, California, are examples of communities that have successfully used dune restoration to combat coastal erosion. In Oahu, sand dunes were restored to protect coastal homes as an alternative to seawall construction. In Ventura, a parking lot and bike path were moved back away from the beach in an example of managed retreat. Sand from downcast beaches was brought in to cover a cobble mattress and create dunes. The dunes were planted with native plants by volunteers and a stormwater filtration system was installed to filter water from the new parking lot and release it into the estuary.

Oregon's Statewide Planning Goals discourage built infrastructure, yet there appears to be room for improvement on its main alternative—i.e., natural infrastructure. One survey respondent noted that, "Oregon is far behind the rest of the nation in thinking and deploying nature-based solutions." While there is strong

evidence of the potential of natural infrastructure to mitigate the harmful impacts of natural hazards, the scientific research conducted to date has been relatively limited and it is clear that natural infrastructure-based solutions are context-dependent. State and local governments could assist efforts to pilot and monitor different ecosystem types, which would be best to do in low-risk areas where there is minimal development. Oregon's strong emphasis on public access to beaches creates a paradox. While the value of this access could motivate the use of natural infrastructure solutions due to its resilience benefits as well as aesthetics, too much access could impede natural infrastructure restoration.

Best Practices 4: Financial and Economic Mechanisms

Benefits: Financial safety net for vulnerable populations, non-regulatory approach creates better relationship with stakeholders, potentially reduces cost of monitoring and enforcement

Financial and economic mechanisms for promoting resiliency can broadly include the financial assistance programs discussed in Best Practice 1, but also include insurance programs and the creation of markets to prevent negative externalities, such as pollution or overfishing. The ORP and Statewide Planning Goal 7 both recommend "financial incentives and disincentives," and the ORP also recommends capital investment (e.g., Seismic Rehabilitation grants). Interviewees and survey participants frequently expressed economic concerns when asked about impacts beyond the immediate results of natural disasters. To rapidly recover from disruption, monetary risk can be spread throughout communities and over longer time periods by utilizing insurance programs for potential disasters, such as floods, or for industries, such as fishing, that are prone to disturbances. The Intergovernmental Panel on Climate Change lists financial mechanisms to increase resilience, which include micro-insurance, insurance, reinsurance, and national, regional, and global risk pools. Oregon could apply these recommendations by evaluating current economic vulnerabilities to determine where and what types of additional risk-transfer mechanism may be appropriate.

Subsidies, bailouts, and the creation of markets have also been tools to reduce the economic harm from disasters. In 2017, Oregon and California have petitioned for federal assistance for fisheries due to depleted Coho Salmon runs. Planning to have these funds available under current budget constraints, however, may not be feasible. Another option is to create markets for previously non-monetized assets, rights, or externalities. This kind of policy is often discussed in the context of greenhouse gas emissions, but has also been applied nationwide to fishing rights by the implementation of Individual Fishing Quotas (IFQs). IFQs discourage overfishing by setting a limit on the amount of fishing in a particular fishery by having a limited number of quotas. In theory, selling IFQs can also supplement income in years with low catches or for fishers transitioning out of the industry.

Each of these mechanisms must also take local context and effects into account. Insurance programs might require exceptions or assistance (e.g., relocation grants, subsidized insurance) for pre-existing entities in high-risk zones to mitigate unfair and unexpected costs. Research on community resilience from a sociocultural perspective has produced some evidence that subsidies and bailouts can clash with local norms, thereby undermining the social capital necessary for disaster recovery.[16] IFQs In practice, in at least California and Alaska, decreased local control and incomes as quotas were sold and consolidated. Thus, market mechanisms must be carefully crafted to encourage the desired outcome. Following the side-effects of IFQs, one Alaskan community responded by creating a "Community Purchase Program" that allowed for community ownership of quotas and facilitated the original intent of the IFQs.[32]

Recommendations

Based on our analysis of existing policies relating to coastal resilience, interviews and surveys with stakeholders, and investigation of cases of resiliency efforts within and outside of Oregon, we have identified four major recommendations for OPAC and the state:

1. Create or promote an accessible, widely-known clearinghouse of resiliency information and tools to inform local planning and action;
2. Consider non-regulatory, financial or economic solutions to encourage resilience;
3. Be cognizant of issue saliency when addressing resiliency issues beyond the Cascadia Earthquake and Tsunami; and,
4. Promote a "big tent" for resiliency efforts, ensuring that participation in the process is highly inclusive.

Recommendation 1: Resiliency Resources Clearinghouse

It is clear that effective information sharing plays a strong role in building resiliency. There are several existing models for resiliency resource websites, including the Texas A&M's Community Disaster Resilience Index website, NOAA's Climate Resilience Toolkit, and OEM's Hazards and Preparedness site. Each has room for improvement to be the robust resiliency clearinghouse that would best address Oregon's needs. State Resilience Officer Michael Harryman has expressed interest in contributing to this effort. OPAC could also collaborate with OEM to improve their existing website or create another, broader online resiliency resource. A "collaborative space" could be further developed by linking the clearinghouse to workshops, annual

conferences, or similar face-to-face interaction to further build connections between key resiliency stakeholders and leaders.

The clearinghouse would need to provide: (1) information for multiple audiences, including county officials, city officials, non-profits, businesses, and citizens; (2) steps for planning for these multiple audiences; (3) information or links to key players promoting resiliency; and (4) information on multiple kinds of risks and on preparing for multiple risks in a comprehensive or holistic manner. The clearinghouse would need to be easy to find, user-friendly, and connected to other resiliency resources, which it cannot fully replace.

> "You want to set the coastal communities up to be successful as opposed to setting them up to have to carry out what the state is saying they should be doing. So if we can create this collaborative space, this collaborative environment, where innovation can flourish and emerge from that local level, that's probably where we can best position ourselves as a state." -
> -Andrew Phelps, the director of the Office of Emergency Management

Compiling these resources would improve knowledge of resiliency among many different stakeholders and promote information sharing. Research on resiliency shows that data on risks and resources, and actions to improve resilience to risks should both be addressed holistically. A centralized resource with data, reports, recommendations, and other resources would greatly contribute to this goal. It would also be a good first step in creating a resiliency index or checklist that would help local entities track their progress and identify areas for improvement. This future goal should be kept in mind while developing the clearinghouse.

Recommendation 2: Consider non-regulatory, financial or economic solutions

The first priority in disaster preparedness is often the immediate impacts to human health and safety. Interview and survey participants were often concerned about the economic impacts of disruptions, however, which can be devastating and long-lasting. Some non-regulatory, financial policies can mitigate these impacts by acting as a financial safety net. Many also serve to incentivize resilience-enhancing actions or dis-incentivize resilience-diminishing actions.

Types of non-regulatory, financial or economic solutions to consider include grant programs; insurance based on natural risk or on industry; and market mechanisms and mechanisms for local or collaborative management

Federal and State grants can be critical resources for local communities, and can also help guide how communities increase resiliency. Interviewees frequently identified the Seismic Rehabilitation Grant program as an important tool in their resilience and disaster planning. In fact, Sue Graves, Safety Coordinator for

Lincoln County School District, suggested that expanding this program would be "a good, reasonable, logical, and small next step." Similar grant programs for other risk-reducing actions could also be beneficial.

Insurance against natural hazards, such as the National Flood Insurance Program, is a common way to be financially prepared for a disaster. High insurance prices can also deter development in high-risk areas, thereby preventing some damage. At the same time, sudden increases in insurance prices or extreme difficulty in obtaining insurance would place unfair burdens on pre-existing landowners, so the state may need to consider mechanisms for reasonable exceptions and assistance. Alternatively, insurance programs can address specific industries. For instance, insurance against disease and fish mortality exists in the aquaculture industry in the U.S., and similar insurance options exist for other kinds of fisheries in the Philippines.[33]

Incentives or disincentives can be created through the establishment of market mechanisms. A well-known example of a market mechanism is the use of tradeable permits for air emissions. IFQs are another example. Both can have unexpected consequences from the concentration of permits or quotas and must therefore be implemented with caution and attention to local context. Ownership of quotas or resources by a community, like in Alaska's Community Purchase Program, rather than by a single individual or organization can overcome some of these unexpected consequences.

Recommendation 3: Issue Saliency

There is a clear focus on the Cascadia Earthquake and Tsunami among both stakeholders and recent state resiliency policies and plans. If OPAC is to advise on other resilience-related issues, it will be difficult to overcome the salience of the Cascadia event because it has been firmly established on the policymaking agenda, and is at the forefront of the public's and policymakers' minds due to its predicted dramatic and widespread impacts. Preparing for the event seems even more pressing due to the devastating 2011 Tohoku earthquake and tsunami, which has stayed fresh in Oregon stakeholders' minds as more recent but less disastrous earthquakes have hit Japan and Chile in 2016 and 2017.[34,35]

At the same time, survey participants are strongly concerned about fisheries along the Oregon coast, which continue to struggle with the effects of eutrophication, ocean acidification, and other stressors. Coastal communities need to be prepared for these disturbances as well as economic disruptions, sea level rise, erosion, and intense storms.

OPAC recommendations on these other issues, however, may not be given full consideration while the limited policymaking and public attention is drawn to the earthquake and tsunami. OPAC could employ a

strategy that has been discussed in policy process research and theory, in which less salient issues are linked to more salient ones through communication ("framing") of the issue or policy, or through a policy itself. This approach has the additional benefit of being a step toward addressing risks comprehensively, as is recommended by resiliency experts.

Recommendation 4: A "Big Tent"

Promoting a "big tent" approach for resiliency efforts that ensures inclusiveness is recommended for both normative and substantive reasons. Improving equity and inclusiveness is especially important for democratic government organizations that represent "the public" as a whole. In addition to meeting normative democratic standards, research shows that inclusive participation in decision-making processes can improve substantive outcomes.

OPAC's operating procedures clearly recognize the normative argument for processes that include a variety of opinions. They emphasize the process of consensus-building among members, which includes the requirement that "all products and positions of the Council will reflect minority positions, with minority language to be approved by minority members".[36] When working to build resiliency in local communities, the need for inclusiveness and consideration of minority opinions may need to extend beyond OPAC's limited membership. The clearinghouse and potential in-person fora for discussion of resiliency can provide a venue for this, but inclusiveness will not follow spontaneously from these resources. Outreach to a wide variety of communities, particularly those that are most vulnerable or most marginalized, will be necessary.

Each community has its own valuable perspectives, knowledge, and resources to contribute to the resiliency of the Oregon Coast more broadly. In Alaska, indigenous knowledge that was previously neglected in fisheries management has become a valuable part of resilient fisheries management.[26] Omitting some populations from the decision-making process may result in missed opportunities, but will also leave those populations more vulnerable. More specifically, ethnic minorities and populations with low socioeconomic status face more barriers to recovering from disturbances than other populations, in part due to limited financial and informational resources.[13] Including these populations and others in planning, decision-making, and preparation will contribute to improving social equity on the coast in addition to improving resiliency.

Conclusion

It was found throughout the research performed on this project that there were a variety of different opinions and options available to OPAC. Oregon, like any state, has both its strengths and weaknesses in regard to coastal resilience. For example, one of these strengths is that existing state policies address the need to preserve ecological, economic, and social values, and discuss protecting environment, people, and property on the coast. Extensive land-use planning and data collection also positions Oregon well in terms of resilience. And survey data found that 60% of respondents planned at least a moderate amount internally in their organizations. This bodes well for future resilience planning in Oregon. However, there are also possible areas of improvement for Oregon. Our data pointed towards the lack of non-regulatory approaches to resilience, multi-level coordination, and issues related to issue saliency.

The areas of improvement that were identified led to four concrete recommendations. The first recommendation is the creation of a resiliency resources clearinghouse. Compiling resilience resources would improve knowledge of resiliency among many different stakeholders and promote information sharing and coordination. The second recommendation is to promote non-regulatory, financial, or economic solutions. Incentives or disincentives can be created through the establishment of market mechanisms which enhance resilience. Other states, like Alaska, have had success with programs that fit this mold like the Community Purchase Program. The third recommendation is to confront issue saliency in Oregon. There is a clear focus on the Cascadia earthquake and tsunami among both stakeholders and recent state resiliency policies and plans. OPAC could employ a strategy that has been discussed in policy process research and theory, in which less salient issues are linked to more salient ones through communication ("framing") of the issue or policy, or through a policy itself. The last recommendation is to promote a big tent approach to resiliency issues. This will allow greater agency and inclusion for stakeholders in Oregon.

It is also important to mention that our research was limited by time and scope. Further research is necessary to obtain a complete understanding of the issues related to Oregon's coastal resilience, and could involve investigating the recommendations further. Conducting this research will allow for further recommendations about how to improve Oregon's resilience.

Acknowledgements

We would like to thank the following people for their support throughout this project: Shelby Walker, Jennifer Purcell, Walter Chuck, Jena Carter, Jay Rasmussen, Onno Husing, Kris Wall, and OCZMA. Additionally, we would like to thank all of our survey respondents and interviewees. We extend our appreciation as well to the Hatfield Marine Science Center for hosting us for the presentation. Lastly, we want to extend a huge thank you to our professor, Hilary Boudet, for her knowledge, guidance, and edits throughout the project.

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