

Methods for Engaging Leaders in Climate Science
and Providing Local Decision Support

by

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INTRODUCTION

Climate change presents a challenge for those concerned with the well being of a community for many reasons. The effects of climate change can vary spatially and temporally, in magnitude and in probability. Research into this unfolding story of human communities and the environment will continue to inform of potential impacts, but predicting how individual communities and socio-ecological systems (SES) will fare is becoming difficult, especially as the nexus between science, policy, and culture becomes muddied by public debate. More simply put, climate change has been labeled a moving target and presents greater uncertainty in predicting future environmental hazards. To make deciding a response even more complicated is the question of what role humans play in affecting climate change. For example, to what extent is climate change caused by current human activities versus natural processes of the earth? What will the impacts of climate change be? Identifying anthropogenic causes as contributing to climate change can mean lifestyle changes. Identifying regional risks can mean new regulations and policies.

To be sure, more uncertainty about conditions in the natural environment can overwhelm the imagination to the point of creating hopelessness, helplessness, and even a sense of disbelief. Some people are alarmed at the potential risks associated with climate change. Some people question scientific results showing climate change is happening. Others simply dismiss climate change as an issue unworthy of research dollars and a policy response. So what is the best way to engage policy makers and provide them with the most up-to-date information for policy-making toolboxes?

This study focuses on coastal regions, which could be characterized as the front line for trying to understand how environmental change affects communities—these communities already experience the highly dynamic environment where

land meets sea. Oregon Sea Grant and its partner states have received a Sectoral Applications Research Project (SARP) grant from the National Oceanic and Atmospheric Administration (NOAA) to refine outreach methods for coastal communities with specific attention to climate change. This paper will focus on the SARP project and a related case study with county leaders in Oregon, and will answer the following research questions: How do Oregon coastal leaders in our case study perceive the risks associated with climate change? What does applying the Social Construction Framework (Schneider and Ingram, 1993) show about climate change leaders and the policy process? The ultimate goal of this study, though, aligns with the goal of the SARP grant to analyze information users for better engagement on the topic of climate change.

The approach taken to analyze information users includes collecting county leaders' responses on the risks posed by climate change through semi-structured interviews and analyzing those responses for the purpose of recommending further activities and materials that might be useful to this chosen group of leaders. Presented in the following sections of this essay are a literature review, an outline of my methods and study design, the findings from interviews, an analysis of those findings, and a discussion of recommendations and policy implications based on this study.

LITERATURE REVIEW

This study is focused on how to engage community decision makers and members of the public on the topic climate change. In the past, this process might have been called *educating the public*, which designates a one-way flow of information from the knowledgeable group to the less knowledgeable. The term *informing* also denotes a similar process. The term *engaging*, on the other hand, denotes a process between parties who have something of value to gain and to share, and is interdisciplinary in nature. Engaging stakeholders is what the

Oregon Sea Grant program routinely does. In this SARP project, funded by the NOAA Climate Program Office, the driving question has been, How do we engage decision makers and leaders in the community on the topic of climate change? In order to answer that question, project leaders have recommended a method that uses expert scientific models of climate scientists, an assessment risk perception, and the act of crafting messages for a specific population. Figure 1 represents how specialists work together for this project in order to engage information users.

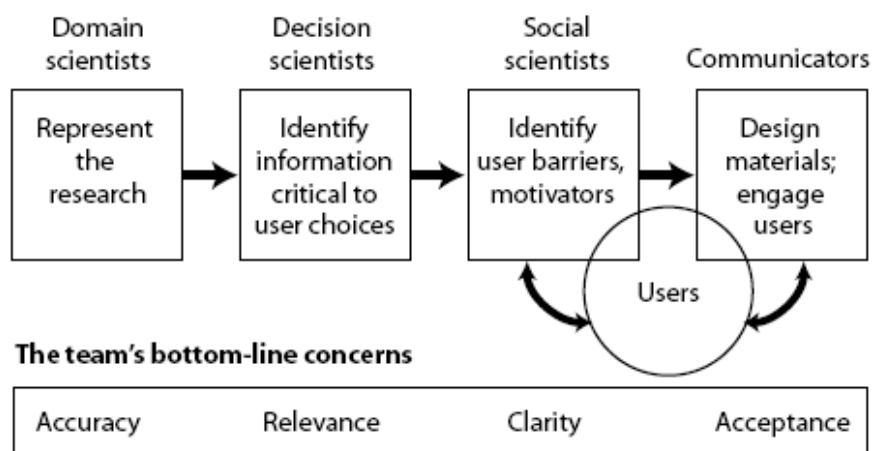


Figure 1 Specialists and Process (Cone, 2009)

The method presented in this paper is part of an attempt to define factors and barriers that shape the use of climate science in local decision-making. This model shows how specialists from various parts of the decision-making domain—or the physical and cultural environment in which decisions are made—work together to engage, in this case, decision makers.

Risk Communication Method

Baruch Fischhoff of the Center for Risk Perception and Communication at Carnegie Mellon University discusses the divide between advocacy for a certain position in

the scientific realm and in the public realm (2007), making the case that these are somewhat incompatible realms with the outcome of the public being “blamed” for the failure of science not getting a fair hearing: “It [the public] might be blamed directly, for not understanding the science, or indirectly, for falling prey to the other side’s advocates, who exploit its scientific illiteracy” (2007: 7205). Leiserowitz, in his audience research clarifies this problem—the American public is varied in its understanding of and response to climate science so that engaging each of the groups requires different approaches (2009). Application of a method for outreach in our SARP research works to create a tailored means for information-user engagement. This approach will be referred to as the Risk Communication Method. As mentioned earlier, it combines domain science, decision science and social science, addressing the divide between information users and producers (Fischhoff, 2007: 7206). The researchers at the Center for Risk Perception further describe the Risk Communication Method as a *non-persuasive* approach to public engagement through the understanding of *perceptions* of target audiences.

The Nexus Between Climate Science, Culture, and Policy

The field of climate change science is no different from other fields of scientific research and development in its use of the scientific method, peer reviewed journal publications, and attempts at testing hypotheses. Yet, currently, climate change science, its predictions, and the implications of its findings have become part of polarizing public discourse that casts shadows on the use of climate science in policy.

To better understand this problem, consider the importance of general research and development (R & D)—a mode of moving the economy forward, encouraging innovation, and dealing with problems facing society through new technologies. Research is a scientific endeavor that unveils new technologies or methods, and

development is the phase, in the economic sense, where science is translated into useful product. Words associated with research and development might include *innovation, discovery, and invention*. But scientific research, when released to the general public or put to the policy test, undergoes a different type of scrutiny than when reviewed by the scientific community—that is to say, the general community might understand the usefulness of scientific findings differently than the scientific community, or might misunderstand or misperceive scientific findings. This difference in perspective translates into conflicts over the theory of climate change science that is shaped by a number of variables.

Three popular labels describing those who take a stance on climate science include: *deniers, skeptics, and supporters*. A 2001 article in the conservative *American Spectator* represents climate change *deniers* and focuses on Art Robinson, the 2010 Oregon congressional candidate and proclaimed originator of the petition containing 17,000 signatures of “scientists” (The Oregon Petition) against the theory of man-made climate change. The article summarizes one viewpoint that plays out in community policy making. The article begins by mentioning an op-ed piece he did for the *Wall Street Journal* and subsequent criticisms of this article. It continues by discussing his approach to what he terms “cultural warfare,” stating:

He [Robinson] studied the Union of Concerned Scientists’ manual on handling the media. He had seen in print claims of “consensus” among scientists about the cause of global warming. He knew this wasn’t true, although something resembling a consensus had been concocted by some journals such as *Science*, which Art calls “highly politicized...” (*The American Spectator* online, 2001, paragraph 29).

This article presents opinions about scientific hypotheses, how they should be

used in policy, and militant statements and language used to describe climate scientists, scientific funding and the policy process. For example, he is quoted as saying about “environmentalist” scientists who buy in to global warming, “They don’t have much for brains...And the difference between truth and falsehood in matters of science is not something that concerns them at all” (*The American Spectator* online, 2001, paragraph 30). Robinson’s rhetoric provides anecdotal evidence of the climate change denier’s presence in the policy arena.

Anecdotal evidence of *skepticism*, a second popular label, can be found in the writings of Richard Lindzen, Alfred P. Sloan Professor of Meteorology, Department of Earth, Atmospheric and Planetary Sciences researches at MIT, who wrote an opinion piece in the *Wall Street Journal* in 2007. He says, “Ambiguous scientific statements about climate are hyped by those with a vested interest in alarm, thus raising the political stakes for policy makers who provide funds for more science research to feed more alarm to increase political stakes” (*Wall Street Journal*, 2007). His main concern is what he terms the “iron triangle of climate scientists, advocates and policy makers” that leads to a “strange reluctance to actually find out how climate really behaves” (*Wall Street Journal*, 2007). This problem, he states, leads scientists to pander for grants by misrepresenting the full picture of what is happening in the climate or not standing up to “bullying” politicians such as Al Gore. Lindzen does not deny that the climate is potentially changing; however, he is skeptical of the peer-reviewed science.

Yet another viewpoint can be found in a letter to *Science* magazine (2010). Peter Gleick of the Pacific Institute writes on behalf of the scientists of the Academy of Sciences. In this letter he states, “Many recent assaults on climate science and, more disturbingly, on climate scientists by climate change deniers are typically driven by special interests or dogma, not by an honest effort to provide an

alternative theory that credibly satisfies the evidence” (Gleick, 2010: 689). He also refers to the International Panel on Climate Change (IPCC) and other scientific assessments saying that when mistakes are pointed out, they are corrected, but that the *fundamental* (and unmistakable) conclusions that can be made about climate change are: (1) the planet is warming, (2) most of the recent heat trapping gases are due to human activities, (3) natural causes also play a role, but are being overwhelmed by human activities, (4) warming will cause many climatic patterns to change and quickly, and (5) the combination of changes threatens socio-ecological systems (Gleick, 2010). Finally, in addition to giving fundamental conclusions, he calls for an end to the “threats” of “criminal prosecution” to scientists based on “innuendo and guilt by association,” the lies about scientists, and, finally, an end to the harassment of scientists by politicians who want to avoid taking action (Gleick, 2010: 689). Gleick is an example of a climate science *supporter*.

The divide among those with varying viewpoints on climate change is clear, but it is important to note that labels such as *deniers*, *skeptics*, and *supporters* have not been empirically tested and shown to represent the various responses to the topic of climate change. Other labels, though, have been empirically tested. A national study defines six labels describing clusters of responses to global warming in the U.S. (Leiserowitz, Maibach, and Light, 2009). The survey creates metrics for categorizing groups of people in order to better understand which engagement activities would work best, evaluating topics such as beliefs, attitudes, motivations, and policy preferences. In fact, the study is dubbed *an audience segmentation analysis*. The labels include: the alarmed, the concerned, the cautious, the disengaged, the doubtful, and the dismissive. Two patterns are identified as most prominent in these stances on climate change. First, the degree of certainty people have on the topic of climate change is a prominent characteristic of people’s viewpoints. Second, those who disagree most—the

alarmed and the dismissive—are also the most involved in either promoting or dismissing the issue (Leiserowitz, et al., 2009). The labels of denier, skeptic, and supporter, however, will be used in this study to show how interviewees described themselves rather than how I empirically evaluated and labeled them.

Other social scientists continue research to further define and test patterns in society, providing inroads for addressing a perceived conflict over climate science. For example, experts gathered in one national panel discussion and workshop offered ways to facilitate climate change responses (Figure 2). This figure summarizes statements made by those of the “Panel on Addressing Change Through the Behavioral Social Sciences,” which was organized to tackle two areas thought to be neglected: (1) mitigation and (2) adaptation.

Lead	Study topic	Main tenets
Anthony Leiserowitz, Yale University (2010)	Study of the six Americas	<ol style="list-style-type: none"> 1) The research shows that the Earth is warming, and humans are the primary cause. 2) Climate change is rooted in factors that drive human decision-making and behavior and will require humans to choose and act differently. 3) Future human behavior highly affects climate. 4) The American response to science is not homogenous, and varies due to a number of factors
Susanne Moser, Research and Consulting (2010)	There are multiple reasons why climate change is hard for non-specialists to understand.	<ol style="list-style-type: none"> 1) Modern human beings have a difficult time perceiving changes in the environment. 2) Different audiences require different frames for understanding climate change. 3) People reject information that contradicts their beliefs which leads to polarization. 4) Different forums are needed to

		understand the worldviews of others.
Daniel Read, Yale University (2010)	Have public mental models changed since 1992 research? Little has changed.	<ol style="list-style-type: none"> 1) Current respondents are less likely to attribute warming to ozone depletion or loss of biomass. 2) Public understanding is volatile—and both consistent and inconsistent with scientific models at the same time.
Elke Weber (2010)	Ingrained cognitive and affective responses to risk can lead people astray.	<ol style="list-style-type: none"> 1) Uncertainty and time delay challenge current response to climate change. 2) If actions are successful in preventing future consequences, they may appear to be unnecessary. 3) People are not always risk averse when it comes to economic or environmental loss. 4) Visceral reaction matters: non-analytical processes guide thinking processes as well as analytical.
Riley Dunlap (with Peter Jacques), Oklahoma State University (2010)	The organized climate change denial counter movement has increased polarization stems all the way back to the 1960s and 70s.	<ol style="list-style-type: none"> 1) Challenging scientific evidence has been a key strategy for anti-green lobbies. 2) Social scientists need to pay attention to the increasing flow of messages that are undercutting mainstream climate science. 3) The scientific community must take into account the barrage of 'disinformation' the public receives from those intent on undermining the credibility of climate science. 4) Climate change denial is a proxy for conservative ideology.

Figure 2 Presentations of Social Science Research: adapted from Kasperson and Stern, ed. (2010: 7-37)

This table summarizing social science research as presented by the panel on the public understanding of climate change identifies a few themes important in my study. First, it is clear that there is a connection between human actions and the environment in which they live, so that decision-making both affects and is affected by climate change (e.g., Leiserowitz, 2010; Weber, 2010). Second, the American public has a non-homogenized response to climate science; non-analytical and visceral reactions to events; and a volatile understanding of scientific data (e.g., Leiserowitz, 2010; Read, 2010; Weber, 2010). Also, different frames and forums are needed for different audiences, and there are lobbies that are working to undercut the use of climate science in policy making (e.g., Leiserowitz, 2010; Moser, 2010; Dunlap, 2010). Finally, it is necessary to address public understanding and use of climate change science at a local scale and take an interdisciplinary approach that realizes the complexity of the decision-making process (e.g., Moser, 2010; Dunlap, 2010). It can be said that figure 2 focuses on barriers to public understanding and use of climate change science.

These barriers, or what might stand in the way of intention and action, vary depending on the community, and are related to beliefs about outcomes to actions, as well as personal capacity for taking action (Cone, 2008). Our project seeks to address the barriers associated with the understanding and use of climate change science in policy, but as the SARP project narrative (Cone, 2009) denotes: (1) simply providing climate science information is insufficient for changing behavior; (2) personal attitudes, aptitudes, and levels of support constrain individual decision makers (Fishbein and Yzer, 2003); and (3) decision makers face other barriers that hinder climate-related actions (Moser and Dilling, 2007). As seen in the social science research (Figure 2), educating decision-makers by *providing information* alone is not effective. It is necessary to address barriers to information use by taking into account factors such as beliefs, values, and attitudes. Analyzing information about a target population of decision-

makers and the environment in which they make decisions is essential to addressing barriers.

Social Construction Policy Framework

The Social Construction Framework (SCF) analyzes both the perceived power of groups as well as the perceptions policy makers have of those groups. Social constructions of groups are characterizations or popular images of persons or groups of people as created or constructed in culture. A simple example of a social construction of groups can be found in the publication on the Six Americas (Figure 3). Images of people representative of the various demographic most associated with a particular viewpoint (e.g., first picture at top-left represents the alarmed viewpoint) are presented as part of the report.

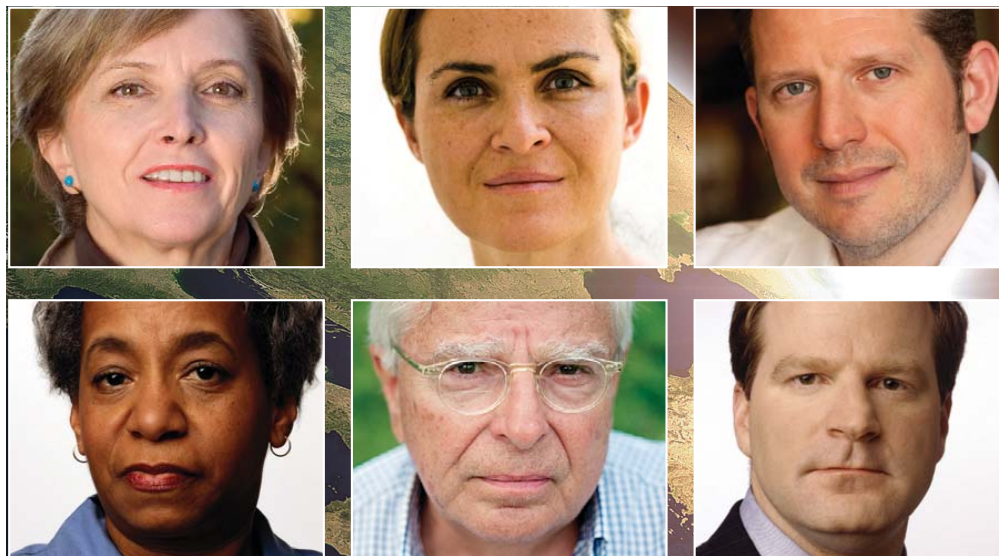


Figure 3 Example: The Construction of Groups (Leiserowitz, et al., 2009)

The SCF as a policy analysis tool further analyzes the treatment of groups and creates labels that rest in a matrix, where one axis denotes the level of power the group has, and the other axis denotes how the group is constructed and characterized by dominant culture or popular images (Figure 4). Although there

are limitations and exceptions to any labeling schema, these categories are meant to be descriptive rather than prescriptive in the analysis.

		Constructions	
		Positive	Negative
Power	strong	Advantaged the elderly business veterans scientists	Contenders The rich Big unions Minorities Cultural elites Moral majority
	Weak	Dependents Children Mothers The disabled	Deviants Criminals Drug addicts Communists Flag burners Gangs

Figure 4 Social Constructions and Political Power: Types of Target Populations (Schneider and Ingram, 1993: 336)

To clarify, those using the framework try to understand how *different groups* are constructed and what *benefits* and *burdens* they receive based on that construction. Social constructions, according to the policy framework, can affect everything from what messages certain groups receive and how much they participate in public life, to what policies are affected by their constructions. As a matter of decision-making, “the topic of social construction of target populations is important to political science because it contributes to studies of agenda setting, legislative behavior, and policy formulation and design, as well as studies of citizen orientation, conception of citizenship, and style of participation” (Schneider and Ingram, 1993: 334). In my study, for example, the social construction of scientists as a group may affect how decision-makers perceive

not only the scientists, but also the legitimacy of the science itself. In relationship to the research represented here, exploring how leaders construct climate change scientists, as well as how climate change communicators construct leaders, can provide insight into issues of public engagement and resulting policy implications.

To be sure, the SCF is not the *only* policy framework that might apply to this study. However, it is compatible with trying to understand how identified leaders perceive different groups' power and intentions, and how different groups are included in the policy process and why—all important details to understanding patterns of engagement.

Communicating Climate Science

A final topic that emerges is the communication of climate science, itself. If the main goal of a project is engagement with leaders and policy makers, how does one address the specific conflict over climate change science between those who are concerned and those who are dismissive (Leiserowitz, 2009)? One challenge contributing to this conflict is translating the concept of scientific method into the public discourse (McComas and Shanahan, 1999; Wilson, 2000; Boykoff, 2008; Ward, 2008; Boholm, 2003). Another problem is representing scientific uncertainty and the concept of scientific consensus. "It is the nature of science that many initial findings are preliminary, uncertain, and often hypothetical" which translates into seeming uncertainty and lack of consensus (Weingart et al., 2000: 262). Scientific uncertainty, for example, has a subtle meaning that can easily be construed in many ways: "Uncertainty offers the opportunity for various interests to confuse and divert the public discourse" (Morgan et al., 2009: 73). In a handbook for climate communication by the Center for Research on Environmental Decisions, Marx and Shome, state, "too often discussions of climate science uncertainty convey the mistaken impression that scientists are

hopelessly confused about this complicated subject” (2009: 25) when really uncertainty is more about *how much* the planet will change and not *whether* change will happen. So what is the best way to engage the public, and who should be playing what role? Different approaches for different groups seem to be the recommended route.

The Best Practice Approaches for Characterizing, Communicating, and Incorporating Scientific Uncertainty in Decision-making (Morgan et al., 2009) offers a way forward. This document states: “in many decision settings, [rational and emotional parts of the human psyche] can play an important role along with more analytical styles of thought” (Morgan et al., 2009: 65). The report mentions projects by Bostrom et al. (1994) and Read et al. (1994) using the Risk Communication Method to produce communication brochures, as well as other projects related to this research and outreach method in Morgan and Smuts, (1994); Kempton, (1991); Kempton et al., (1995); Reiner et al., (2006). In another paper on misperceptions of global climate change, it is noted that for laypeople (1) understanding key relationships in models is important for informing policies (Moxnes & Saysel, 2009); and (2) that the climate change problem is complicated enough to cause misperception of the significance of scientific models (Kempton, 1991; Bell, 1994; Read et al., 1994; Bord et al., 1998; Dunlap, 1998; Groves and Pugh, 1999; Meadows and Wiesenmayer, 1999; Seacrest et al., 2000; Stamm et al., 2000; Rebetez, 1996; Shanahan and Good, 2000; Palutifok et al., 2004; Moxnes and Saysel, 2009). The scene is set for this qualitative study of community leaders that assesses their understandings of the science, their values and beliefs about the risks of climate change, and their constructions of the different groups who might be affected by climate change policies.

METHODS

Risk Communication Method

The survey protocol for this study was based upon recommendations made by authors of the Risk Communication Method, which sets forth very specific guidelines for creating and using survey instruments for measuring lay perceptions about a particular risk (Morgan, Fischhoff, Bostrom and Atman, 2002). The goal of this approach is to help the sponsoring organization and other outreach practitioners to better understand information users and the domain or environment in which their decisions are made, then to create avenues for communication between communities and other specialists who might provide decision support.

For the goals of this project this model works very well. Termed a *non-persuasive* approach, the method has quite a few steps for creating communications and engaging a particular community of information users. Ideally, a number of experts are involved in the process, including scientists, social scientists, and creators of communication media. This paper will focus on the application of the method's first steps including creating an expert model, conducting semi-structured interviews, analyzing responses, and recommending items for a confirmatory questionnaire. Suggestions for proceeding to the next phases of the Method not contained in this study will be included in my discussion. It is important to note that anonymity was assured to interviewees, and many of the interviewees hold highly visible and public positions in the county; therefore, a detailed description of the county, itself, will be omitted from this report in order to protect confidentiality.

The Expert Model

The first step in the Risk Communication Method includes creating an expert model. This model uses current scientific knowledge about the nature and magnitude of risks and summarizes from the perspective of what can be done about the risk (Figure 5). For this study, the expert model focuses on climate change hazards in an Oregon coastal county. The expert model is based on an earlier model created for the community of Port Orford, Oregon (Cone et al., 2009). To create the model, literature on coastal hazards associated with climate change was reviewed and formatted based on a guidance manual out of New Zealand (*Coastal Hazards and Climate Change: Guidance Manual*, 2008). The final expert model was reviewed by our internal team, as well as by a climate scientist from the region. It is assumed that this expert model contains the best available information at this time about the hazards in the study region—which can be described as the socio-ecological system. The model represents a scientific expert’s point of view and describes the domain or environment in which decisions will need to be made. Influence diagrams are an alternative to this type of model and have been used in similar studies. Instead, I took a different approach, looking at risks, drivers, pathways, and receptors and simplifying the model in order to target a few key areas in the socio-ecological system.

Risks	Drivers	Pathways	Receptors which must be managed or protected
Coastal Erosion and Landslides	<ul style="list-style-type: none"> • Sea level (tides, storm surge) • Waves • Sediment supply • Stormwater discharge • River/stream flow • Influence of 	<ul style="list-style-type: none"> • Continuous retreat of coastline (due to episodic storms) • Retreat (due to fluctuations in the short-medium term) • Fluctuations in 	<ul style="list-style-type: none"> • Property • Infrastructure • Ecosystems • Landscape and natural character of place • People

	ENSO	coast position due to inlet and river mouth dynamics • Overstepping of coastal barrier	
Freshwater Contamination	<ul style="list-style-type: none"> • Sea level (tides, storm surge) • Stream flow 	<ul style="list-style-type: none"> • Breaching of natural & man-made shoreline • Inundation of low-lying coastal margins, rivers, streams • Backed up stormwater systems • Increased flooding 	<ul style="list-style-type: none"> • People • Infrastructure • Ecosystem
Altered estuary productivity	<ul style="list-style-type: none"> • Stream flow • Sea level (tides, storm surge) • Changes in coastal upwelling and current systems 	<ul style="list-style-type: none"> • Breaching of natural & man-made shoreline • Inundation of low-lying coastal margins, rivers, streams • Backed up storm water systems • Increased flooding • altered winds and coastal currents 	<ul style="list-style-type: none"> • Ecosystem • Landscape and natural character of place (floodplain levees, tide gates, etc.)
Altered ocean stocks (fish and shell fish)	<ul style="list-style-type: none"> • Ocean temperature • Ocean chemistry • Changes in coastal upwelling and current systems 	<ul style="list-style-type: none"> • Change in cycles such as upwelling • Increased levels of carbon dioxide • changes in dissolved oxygen • changes in species distribution and productivity 	<ul style="list-style-type: none"> • Local economy (people) • Ecosystem • Landscape and natural character of place

Forest Fire	<ul style="list-style-type: none"> • Rainfall • Temperature • Stream flow • soil moisture/water deficit • wind and weather patterns 	<ul style="list-style-type: none"> • Decrease in summer stream flow due to reduced snowpack and rainfall • Increased annual atmospheric temperatures • Change in forest regime (plant and insect species; vegetative cover and density) 	<ul style="list-style-type: none"> • Local economy (people) • Ecosystem • Landscape and natural character of place
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Figure 5 Expert Model—Socio-ecological System of Oregon Coastal County

Interview Questions

The second step of the Risk Communication Method includes conducting semi-structured interviews with the target group. Questions for these semi-structured interviews started out broadly, giving the interviewee space to respond to the topic of climate change in general. Broad responses were followed-up with a set of more specific questions, so as not to miss important points in the minds of the interviewees. Follow-up questions and probes were used in order to encourage the interviewee to tell more; however, care was taken not to introduce concepts, connections, and ideas that were not already in the minds of the interviewees. This type of interviewing seeks to build rapport so that a “dumping” of the interviewees’ thoughts can occur. At the same time, one seeks to maintain neutrality so as not to influence the responses.

Questions for the interviews were written in order to assess the interviewees’ basic knowledge about climate science, their attitudes toward current and future changes that may occur, their opinion on community vulnerability, their

priorities for managing climate change, and their perceived role in the community (see Appendix A). Demographic information was also gathered including length of residency in the community, leadership positions both formal and informal, as well as their occupation. As mentioned earlier, questions were ordered so that, initially, the interviewees talked freely without much direction from interviewer. Gradually, questions became more specific, in order to direct the interviewee to any details that might have been missed.

Interviewees

The data collected was in the form of semi-structured interviews with a select population of coastal residents using purposive sampling. After creating a list of county departments and elected positions, I identified more than 15 *climate change leaders* as having some influence or specialized knowledge in the county on matters such as zoning, emergency management, public health, public works, water, infrastructure, and policy making. At least one person from each of identified categories was interviewed for a total of 8 interviews on the first round. First round interviewees were then asked to recommend opinion or community leaders who might be beneficial to talk with, so the snowball technique was used to identify the second round of interviewees. The more times a potential interviewee was mentioned during the first round, the more likely that person made it into second round. These second round interviews were comprised of private industry or non-profit leaders and active members of the community. Altogether, five individuals were contacted for the second round of interviews. Only one refused to participate claiming that global warming is “a scam.” Care was taken to represent the main viewpoints of residents in the community; however, this round of qualitative research does not represent a statistically significant sample. The findings here are not meant to be generalized to the greater public, but rather to produce content for a future quantitative survey instrument.

The rationale for choosing these populations follows the goals of the greater SARP project, which: (1) seek to identify how a problem faced by the community is perceived; and (2) work with influential members of the community to identify barriers to engagement. The interviewees are highly involved in the community, either by choice—“opinion leaders” are voluntarily involved as leaders; by default—business leaders interact with both the general public and government; or through the political process. In the end, the hope is to better understand how to engage potential climate leaders.

Coding and Analysis

After the interviews were conducted and recordings were transcribed, the responses were coded two ways. The first way was by tallying where interviewees’ perceptions intersected with the expert model. When an interviewee expressed knowledge or beliefs consistent with the expert model, the topic was tagged as coinciding with the expert model for that interviewee. This content was termed “congruence.” The number of interviewees who mentioned a certain topic was then added up to see how the composite perception of the interviewees compared with the expert model (see Figure 5). Analysis of this comparison between interview responses and the expert model was used to also identify misconceptions, background beliefs, and peripheral beliefs. Direct misconceptions about the legitimacy of the expert model, itself, were also tagged. For example, if an interviewee claimed there was not enough data to support climate change, this response was considered a misconception and noted.

A second coding exercise, one not included in the original Risk Communication Method protocol, was used for the policy framework analysis. This coding tracked *groups* who were mentioned, how they were constructed, and what perceived benefits, burdens, or messages they received. This analysis was

completed through collecting qualitative statements by interviewees about groups, assessing the content and context of the statement, and drawing conclusions about the particular groups that were mentioned most frequently. I was interested in the spectrum of responses characteristic of the community, and particular attention was paid to instances representing consensus about groups as well as polarized views.

The Risk Communication Method uses mixed methods, meaning that once the interviews are completed, a confirmatory survey should be conducted to strengthen conclusions made based on the interviews, or to show which conclusions should be rejected. This initial research serves the purposes of creating hypotheses or conclusions for furthering testing. The survey has not yet been completed, and this analysis and discussion will hopefully serve the end of crafting further questions about misconceptions and gaps in knowledge.

FINDINGS

Results from Interviews with Oregon Coastal County Leaders

One purpose of this project paper is to use the Risk Communication Method in a local community, and this study fulfills completion of the first phase of information gathering from the target community. As mentioned earlier, findings here are based on semi-structured interviews and will be used for creating a confirmatory questionnaire or focus group session, which will then lead to the creation of engagement and outreach materials. The findings can be grouped into two main categories: (1) congruent beliefs that relate directly to the expert model about the risks, drivers, pathways, and receptors; and (2) the social construction and subsequent policy treatment of various groups.

It should be noted that deciphering the responses of interviewees can be a subjective activity, and reporting some of the statements, themselves, maintains the richness of the responses—so example statements are included here. It is also important to note that this portion of our study does not produce statistically significant results.

Congruent Beliefs and Perceptions

“We’re getting increasing wave heights, worse and worse winter storms, and more and more coastal erosion.”

Interviewees’ perceptions, overall, were congruent with the expert model in quite a few areas. To be sure, interviewees represented a wide range of professional and scientific expertise, and focused on a different area of the expert model depending on their office or management responsibility in the community. Certain trends, though, can be seen when tallying the range of topics discussed. The bolded numbers on Table 1 represent the number of interviewees who accurately identified the topic, but not the number of times the topic was mentioned per interview. Interviewees showed familiarity with the decision-making domain (the expert model) when they referred to a topic from the expert model; and how frequently the topic was mentioned *might* show its importance. However, we are looking for gaps in knowledge and misconceptions. That a topic was mentioned in relation the theme of climate change hazards indicates that topic is in the interviewee’s perception of the problem.

Table 1 Perceptions of Climate Change Leaders (numbers represent number of interviewees who mentioned topic)

Risks	Drivers	Pathways	Receptors which must be managed or protected
Coastal Erosion & Landslides (8)	<ul style="list-style-type: none"> • Sea level (tides, storm surge) (10) • Waves (4) • Sediment supply, (1) • Stormwater discharge (1) • River/stream flow (5) • Influence of ENSO (7) 	<ul style="list-style-type: none"> • Continuous retreat of coastline (due to episodic storms) (4) • Retreat (due to fluctuations in the short-medium term) (3) • Fluctuations in coast position due to inlet and river mouth dynamics (2) • Overstepping of coastal barrier (5) • Increased flooding (10) 	<ul style="list-style-type: none"> • Property (9) • Infrastructure (9) • Ecosystems, (1) • Landscape and natural character of place (8) • People (9)
Freshwater Contamination (3)	<ul style="list-style-type: none"> • Sea level (tides, storm surge) (7) • Stream flow (5) 	<ul style="list-style-type: none"> • Breaching of natural & man-made shoreline (2) • Inundation of low-lying coastal margins, rivers, streams (3) • Backed up stormwater systems (2) • Increased flooding (7) 	<ul style="list-style-type: none"> • People (3) • Infrastructure (3) • Ecosystem, (1)
Altered estuary productivity (3)	<ul style="list-style-type: none"> • Stream flow • Sea level (tides, storm surge) (5) • Changes in 	<ul style="list-style-type: none"> • Breaching of natural & man-made shoreline • Inundation of 	<ul style="list-style-type: none"> • Ecosystem, (2) • Landscape and natural

	coastal upwelling and current systems (1)	low-lying coastal margins, rivers, streams (1) <ul style="list-style-type: none"> • Backed up storm water systems • Increased flooding (5) • Altered winds and coastal currents 	character of place (floodplain levees, tide gates, etc.) (3)
Altered ocean stocks (fish and shell fish) (6)	<ul style="list-style-type: none"> • Ocean temperature (6) • Ocean chemistry (5) • Changes in coastal upwelling and current systems (1) 	<ul style="list-style-type: none"> • Change in cycles such as upwelling (1) • Increased levels of carbon dioxide (1) • Changes in dissolved oxygen (1) • Changes in species distribution and productivity (4) 	<ul style="list-style-type: none"> • Local economy (people) (8) • Ecosystem (5) • Landscape and natural character of place (3)
Forest Fire, (2) (Swiss needle cast) (2)	<ul style="list-style-type: none"> • Rainfall (1) • Temperature • Stream flow, (1) • Soil moisture/water deficit (1) • wind and weather patterns (2) 	<ul style="list-style-type: none"> • Decrease in summer stream flow due to reduced snowpack and rainfall • Increased annual atmospheric temperatures • Change in forest regime (plant and insect species; vegetative cover and density) (1) 	<ul style="list-style-type: none"> • Local economy (people) (2) • Ecosystem (3) • Landscape and natural character of place (1)

In the table, one can see that many interviewees had indiscriminate beliefs—meaning, they mentioned a topic that intersected with the expert model such as sea level rise, but interviewees did not go into specific detail about the bigger systematic relationships and connections. This is signified by the lack of respondents mentioning other topics across the entire row of a model. In other words, most interviewees had a sense about one risk, driver, pathway, or receptor but did not express connection between the related parts (i.e., risks→drivers→pathways→receptors). For example, ten people mentioned the concept of *sea level* as a driver of change, but did not necessarily express *ecosystems* as a receptor of the effects of sea level change. It is unclear whether this is due to the way the questions were asked and limited time for interview; due to the priorities of the interviewee; or possibly due to a lack or gap in knowledge. It can be said that the most prominent indiscriminate beliefs were that changes would occur, in general, in the temperature, wind, flooding, sea level, and amount of rain. The most prominent receptors mentioned were people, property, and infrastructure.

Another related finding is that most interviewees would focus on one particular area such as erosion, and discuss the entire system of risks, drivers, pathways, and receptors in this one area; however, discussion of other topics on the model, such as freshwater contamination would be left out. Only two of the interviewees were nearly complete in their responses and discussed most of the rows and columns in the expert model. Because the interview lasted less than an hour, it may be that interviewees simply did not have enough time to go into detail. Also, it should be noted that the self-described climate change deniers and skeptics, while they did *not* attribute risks, drivers, or pathways to human-induced climate change, in particular, they did discuss topics about climate hazards from the expert model. Self-identified skeptics and deniers attributed particular changes in

climate mostly to the natural cycles of climate fluctuation that are a part of living in a dynamic coastal environment.

Topics of regional importance mentioned that were not included on the original expert model, but could be added as a result of interaction with interviewees, include: (1) forest management practices combined with climate change effects as they cause inland erosion and watershed health; and (2) the Swiss Needle Cast fungus that might emerge due to climate change (this is a bit specific, but nonetheless important enough to be mentioned by a few of the interviewees). Finally, it is important to note that even though certain topics were not mentioned during the interview, and therefore not tallied in the table, these may have been purposeful omissions by the interviewee assumed to be a shared background belief and too obvious to mention. More research into whether these climate change leaders are aware of the topics and system as presented in the expert model would show this.

Receptors: Human Dimensions

“So it’s a tough issue when you’ve got unincorporated communities that want something done, but yet the county doesn’t have the resources or the ability, other than changing rules and regulations on where people build.”

Most interviewees discussed the human dimension of climate change, which was the most mentioned *receptor* of risks by interviewees congruent with the expert model. One topic that was mentioned in the majority of the interviews was land development and the newcomers who would like to build on a property.

Respondents were mixed in their approach to a solution. A few considered private responsibility to be paramount—that due diligence should prevent public dollars being allocated to those who choose to develop in hazardous areas. Nearly all expressed the need for better land use planning, but also expressed the complexity of coding regulations, permitting structures, and being able to afford changes and improvements to infrastructure.

A frustration expressed by the majority of interviewees was the perceived polarization around the issue of climate change itself. Some expressed a desire to have more “education” so that long- and short-term planning could take into account climate change hazards—but also believed that a portion of the community feels very strongly *against* the addressing the topic of climate change, so that it is difficult or impossible to consider the topic during long- and short-term planning. The minority of interviewees (two of them) mentioned public health—specifically freshwater contamination. Also, only a very small portion of interviewees mentioned the socio-ecological system—meaning the ecosystem in relation to the community. Again, these omissions may not be attributed to misconceptions or lack of knowledge; and I mention these here because it is surprising these topics did not come up more often when interviewees were asked about long- and short-term planning goals.

Pathways: Flooding

“The most prominent disaster of climate-related events we have here is flooding.” Flooding was mentioned by ten of the interviewees making it *the* major climate-related event in the area. Some interviewees noted that flooding seemed to be getting worse in recent years, but did not necessarily state that climate change was contributing. In relation to flooding, three items were most referenced: (1) a local institutional response; (2) a local non-institutional response; and (3) the federal management response. Interviewees spoke highly of the local institutional response and emergency management crew’s work, and believed response to disaster has improved with current planning efforts. Other opinions about the local institutional response were mixed on building codes regulations, road repairs, and land development to providing more resources for citizens to help themselves. The (2) local non-institutional response to flooding was most highly favored. One group that was mentioned often was the *local businesses* that

either provided support for the general community or maintained business-as-usual for local agricultural production. Another group mentioned were the community members, themselves, and their ability to help their neighbors or families. Finally, reaction to (3) federal involvement in updating the flood zone maps was mixed—both positive and negative. Some interviewees believed the zoning would help people (e.g., businesses and private home owners) be better informed of hazards. Some felt the mapping was controversial and not completely accurate to be of use. Also, because the mapping led to related flood mitigation programs, it has had implications for building and land.

Global Warming vs. Climate Change

“Well, I think when somebody says climate change and global warming, I think most people figure it’s synonymous.”

The topic of associations with the terms *climate change* and *global warming* was not a part of the *content* of the expert model—but part of a question from the survey instrument. When asked about associations with the terms *global warming* and *climate change*, most interviewees responded that they were related somehow—and tended to prefer the term *climate change* as more accurate. Interviewees did see the terms as politically charged. A few opinions that were unique in the group, but most likely represent opinions of the community, included: (1) wanting to avoid the terminology *climate change* and *global warming* altogether because it was too politically charged and, therefore, counterproductive to use; (2) believing that both terms were tied to alarmist mentality; and (3) that *global warming* was manmade and *climate change* may or may not be. Eight of the interviewees said they were certain *climate change* was in fact happening or going to happen. The others were skeptical.

Groups

“If you want to build your house at low tide, that’s your choice....”

Within the process of describing managing risks, drivers, and pathways in relation to various receptors, interviewees referred to specific groups of people. Within these references and labels was also recognition of the interviewee's own role and position in relation to these groups. For example, many interviewees would refer to "people" as the general public; however, this reference to "people" as general public could apply to a number of groups. References to "the people" or "some people" were often used when explaining a point of view or type of reaction to a stand on the topic of climate change. Other nonspecific references included "we" as leaders, "they" as state and federal agencies, "we" as business owners, "man" as the whole human race, and "you" as the organization conducting the study (see Table 2 for examples of characteristics statements). Other times, interviewees became more specific when they mentioned groups. Categories of more specific groups include old-timers, long-time residents, farmers, community leaders, Oregonians, newcomers, businesses and businesses owners, and scientists. While identification of groups and their labels might not seem important at first, understanding perceptions of leaders in relationship to others gives insight into patterns of engagement. Were certain groups frequently mentioned? Indeed, consistently a number of groups were most often identified and labeled. For the purposes of this study, six groups most often mentioned in the interviews will be analyzed in the final section of this paper: (1) scientists, (2) private property owners, (3) newcomers, (4) farmers and fishers, (5) long-time residents, and (6) business owners.

Table 2 Example statements about different groups

People	<p>"And so...how to get people to understand that their actions today are going to have...effects in the foreseeable future."</p> <p>"It's not a problem until people are impacted."</p> <p>"There are a lot of people who don't want to believe that [humans</p>
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	<p>induced global warming].”</p> <p>“And so there was people that said, why did you allow this to happen?”</p>
Scientists	<p>“And it depends on how you want the answer to come to what science you take.”</p> <p>“Poor guy, he doesn’t know who’s paying him.”</p> <p>“And the scientists could tell you what it is.”</p>
Fisherman, Farmers	<p>“Well, commercial fisherman will tell you that’s always been the case” (in reference to dead zones).</p> <p>“From the farmer’s perspective, the flooding is devastating for them.”</p> <p>“Most people here [involved in agriculture/resource based economy] have to be sensitive about the way they use the environment.”</p> <p>“Farming, historically, gets a pretty good free ride in a lot of ways, just to lessen the impact on their business operations.”</p>
Businesses	<p>“Businesses are leaving the area. FEMA has gone in and bought them out.”</p> <p>“There’s two groups here, so as a business person, you have to be very sensitive to that and not take stands.”</p> <p>“We make a lot of donations to the community.”</p>
Community leaders—elected/government	<p>“...county officials all across the nation, especially those in the more rural areas just don’t believe in it.”</p> <p>“...she’s like every politician. I mean, she’s got to be careful to make sure that she keeps her job.”</p> <p>“But part of the oath that I took was...public safety. And this is a public safety issue.”</p> <p>“I do get drug in on a fair amount of meetings...but I’m not stepping up to take a leadership role yet.”</p>
Old timers/long time residents	<p>“Not a local yet...you’ve got to live here for like forty years to be a local.”</p> <p>“I think in an older community where your vision of the future is a little shortened...and your history is so much longer than the future...if they can come to terms with it, I think you would see huge changes.”</p>
Newcomers	<p>“People aren’t doing their due diligence.”</p>
Citizens/community members	<p>“And the citizens are really picking up the ball to fill in the gaps...”</p>

In addition to how leaders saw themselves, responses contained a sense of how they saw their roles in addressing climate change in the community. Examples of perceived roles varied quite a bit, as might be predicted, but not enough specific detail on individual community leaders was gathered to speculate on why variation occurred. Some interviewees believed in taking a hands-off approach, equipping the general public to take their own precautions or allowing county government intervention as long as it did not invade on other rights and priorities. Others varied, and felt their role was one of public service—which included either preparing or participating on emergency management teams, somehow becoming involved in measures to manage infrastructure and development, or looking out for the broad cross-section of citizens interests and public safety. Finally, another group felt their role was indirectly associated with long- and short-term planning and not central or vital to the expressed cause of climate change risks. Three interviewees expressed the desire to not become publicly involved due to the controversial nature of the subject.

Ways of Knowing

“Swallows seem to be getting here a little sooner, but I can’t quantify that for sure.”

The topic of ways of knowing came up during reference to groups, and either related to scientists and data, or to those with local sources of knowledge, including the interviewees themselves. For example, all interviewees mentioned a range of ways of knowing what is happening in the climate—from personal memory to what “old-timers” remember to what the federal government considers a disaster (Table 3). Interviewees often used these statements to qualify an assertion about the climate such as “It seems like x is happening, but I can’t really say because of y.” What these statements signify is hard to determine from these initial interviews. It is possible these statements are a part of political rhetoric, avoidance of taking a stand on the issue, or simply not knowing.

Separate from reference to self or other groups, was a misconception about climate change, itself, that should be mentioned. One of the statements about science and data that came up often was the belief that there is not enough data—either over time or for the overwhelming amount of variables involved in the climate—to really consider the risks associated with climate change as drivers of public policy.

Table 3 Ways of Knowing

Statements on length of residency	<p>“I don’t really have a long enough history to say there’s been dramatic change.”</p> <p>“Now whether I can, in my short little flicker of lifespan, you know...what does it mean?”</p> <p>“So, to me, really, our viewpoints of what we’ve experienced in life is a very narrow perspective.”</p>
Statements on expert knowledge	<p>“I’m not a climatologist or anything like that, ...”</p> <p>“I wouldn’t say I’m a technical expert by any means.”</p> <p>“Scientifically...I think I’d have to say that I may have seen some events, but may not have...I can’t quantify for sure.”</p> <p>“Scientists could tell you what it is. It’s been small enough that I haven’t seen it.”</p>

Limitations

This report represents a *preliminary* survey of leaders in the county. Also, views represented here only take into account most frequent responses or instances of polarization on a topic. Some topics did not make this analysis simply because they seemed too peripheral to the subject matter and decision-making domain. For example, one interviewee went into detail about the complexity of federal building codes—which is important information, but peripheral, and not included here. On the other hand, only one interviewee discussed how funding might affect outcomes of research studies—questioning the motive of climate scientists and resulting policy implications. This viewpoint *is* included in the *Groups* section because it represents a polar opposite view to the majority of interviewees’

opinion on the matter, not because it was a frequently mentioned viewpoint. This report is meant to capture the varying views of community leaders; however, it is likely that certain viewpoints are not represented here. It is hoped that a confirmatory questionnaire would tell more about the prominence of the views presented here.

DISCUSSION AND RECOMMENDATIONS

This paper set out to: (1) produce results using the Risk Communication Method in a case study community; and (2) apply a theoretical framework to the findings in order to make policy recommendations—which in this study means recommending ways to better engage climate change leaders. What follows is a discussion of findings in general; a discussion of the Social Construction framework and insights produced through using this lens for analysis; and, finally, recommendations for creating the confirmatory survey.

Discussion: Expert Model and Flooding

A few observations can be made about the first set of findings. First, while some responses coincided with the expert model, interviewees did not portray a systematic understanding the risks, drivers, pathways, and receptors of climate change hazards. This focus on single topics rather than systematic relationships might be described as a lack of depth of understanding, especially since follow-up questions tended to push the interviewee to expound. It might also be described as a failure *to express* deep understanding for any number of reasons. Second, interviewees seemed most concerned about risks associated with their occupation or special role within the county leadership. This is to be expected—and one must wonder if there is a value to leaders being able to express both breadth and depth of knowledge, or if simply having a general concern about the likelihood of climate change and an area of expertise is sufficient. Third, understanding how the community relates to a current hazard—flooding—might

give insight into other climate hazards. In other words, analyzing the county’s response to flooding, identifying what is effective and politically supported could give insight into other future risks. One would have to assume, though, that patterns of behavior and values would be consistent across all hazards. Additionally, more examination of the relationships between community leaders and federal and state agencies is needed in relation to issues of flooding. For example, the unfavorable response of certain groups in the community to the redrawing of flood maps signifies a divide in the county that should not be ignored. Fourth, it should be noted that climate change hazards might be placed into two categories—those that are *chronic* and those that are *catastrophic*. The flooding represents a catastrophic event, and attention to only catastrophic events excludes an important part of the decision-making domain. Further distinguishing this dual nature of climate change in the minds of county leaders seems necessary, especially as it related to long- and short-term planning. Figure 9 summarizes these four topics for further exploration and suggests potential survey tools for confirming whether these topics are relevant to our task of community engagement.

Topic	Finding	Approaches to confirming finding
Systematic Understanding of Climate Change (depth of knowledge)	Interviewees often focused on one part of the expert model’s system, rather than expressing understanding of the relationships between risks, drivers, pathways, and receptors	<ul style="list-style-type: none"> • Survey to understand whether people are “connecting the dots” between parts in the system. • Mind mapping session, also, might show more clearly where folks are missing the connection between parts of the system
Breadth Of Knowledge	Most interviewees did not usually refer to other in-town experts and related knowledge within county leadership except in the	<ul style="list-style-type: none"> • Focus group discussion with representative local “experts” including business leaders would confirm whether knowledge is, in fact,

	case of emergency management related to flooding	isolated. • Additionally, a survey could tell whether there's a willingness to share human capital on issue of climate change
Current Responses to Hazards	Interviewees had working knowledge of county response in the area of annual flooding; however, not all agreed on best practices for mitigating or adapting	• Confirmatory survey might gauge public's response to flooding "narrative," example questions might include 1) a ranking of effectiveness of institutional and non-institutional responses, 2) inquiry into factors that contribute to resilience, and 3) inquiry into beliefs about climate change and other similar hazards
Catastrophic v. Chronic Climate Change Impacts	Interviewees did not necessarily make the distinction between catastrophic and chronic change, the distinction between long- and short-term planning in response to climate change was ambiguous	• Confirmatory survey could inquire about whether distinction is being made and whether there would be willingness to dedicate time to aligning long- and short-term planning goals based on the dual nature of climate change

Figure 6 Topics, Findings, and Approaches

State and federal agencies as well as county officials are already working on topics related to climate change hazards. Our organizational goal, though, is to pinpoint a few areas where engagement might be needed and useful. The table above and findings in this paper do not go into detail about workgroups and research already established in the county. Instead, it focuses on a few areas where our organization might specifically engage and create information networks.

As mentioned earlier, language used in the national debate about climate change affects the perceptions of climate leaders in the Oregon case study and shapes notions about science. Recall the topic of scientific uncertainty: “It is the nature of science that many initial findings are preliminary, uncertain, and often hypothetical” which translates into seeming uncertainty and lack of consensus (Weingart et al., 2000: 262). When interviewees believed that climate change was probably going to happen, but were not certain whether or not it was manmade, they tended to justify their ideas using the reason of scientific uncertainty. Indeed, this way of speaking about the problem of science has made its way into the public discourse of the study community. If the majority of leaders in a community buy into the idea that the science is shaky, uncertain, and too preliminary to act on, dismissing the topic altogether might occur.

Another topic mentioned in the literature—how there are perceived consequences for doing something about climate change (Marx and Shome, 2009; Nisbet, 2009)—also showed up in the interviews. For example, a number of potential leaders on the subject of climate change provisions are choosing to maintain a low-profile on the topic in order to protect their political standing, business dealings, or to maintain “productivity” for dealing with the problem. Most interviewees were concerned about climate change, but the price for advocating for climate change science is costly. Avoiding the topic altogether seems to be a productive way to *do* something it. How much this perception affects peoples’ opinions and behavior is worth exploring, perhaps, in a confirmatory questionnaire.

More specifically, the fact that climate change risks potentially constitute one more budgetary consideration in an already strained financial environment plays a large role in willingness to engage in further conversation and planning on the topic of climate change. Feeling that doing something about climate change might

be costly or require greater allocation of resources, or that regulations will compromise future payoffs of current financial investments is a barrier for many. A follow-up survey measuring potential engagement might include questions about how much of a barrier economic hardship or investment poses. These recommendations for questions are listed in Figure 7.

To be measured	Proposed questions (Scale: disagree to agree)
Support of Climate Change Science	<ul style="list-style-type: none"> • Conducting workshops where community members can talk with scientists about climate change hazards will cost me more money than it is worth. • I would be likely to support climate change research if I could be assured it would not cost me more money. • Scientists are biased to report results that reflect the values of the organization paying their salaries. • Climate change science may be valid, however the planning for potential hazards is too costly.
Private Economic Considerations	<ul style="list-style-type: none"> • I believe funding private businesses to work with scientists in understanding the effects of climate change hazards would be beneficial. • I would continue to support businesses that participate in climate change workshops <i>if there were no cost to me.</i> • I believe private businesses would pay the price financially if climate change hazards were considered in local policies.

Figure 7 Potential survey questions: budgeting for climate change

Conflict Management

As far as the spectrum of climate change attitudes—from the concerned to the skeptics to the deniers, it is more likely that self-proclaimed deniers feel so strongly about their views that engaging them may very well be impossible, whereas self-identified skeptics and believers might be willing to participate in further activities around the topic. Additionally, according to interviewees, self-identified climate change deniers might even go so far as to create conflict for

those trying to understand the issue and make decisions about long- and short-term planning.

As mentioned earlier, a number of interviewees were very hesitant to advocate for their position in public due to the perceived volatile nature of debate over the issue. Conflict management will be needed as an engagement activity so that those who wish to participate in exploring the issue of climate change feel assured that their participation, and even leadership, will not put other valuable relationships at risk. When considering the potential for future conflict, applying a management method might provide insight. For example, one conflict management method discusses the importance of balancing three vital areas that can cause conflict: *relationships*, *the facts*, and *processes* or policies (Walker's "Progress Triangle"). If self-proclaimed climate change skeptics or believers are worried that their personal or public *relationship* with deniers might be vulnerable, they will be less likely to engage in discussion about climate change hazards. When it comes to the *facts*, the application of the Risk Communication Method found in this study will aid in identifying misconceptions and misinformation so everyone can get on the same page, so to speak. Considering *procedures* for interaction, good planning for the setting and tone of engagement activities is necessary. For example, conducting a county-wide meeting on the topic might be a good way to begin engaging in planning and discussion; however, without a clear process for lodging complaints or conducting oneself in the forum, tempers may rise and conflict become acute (e.g., town hall meetings about health care legislation). Also, for those leading the hypothetical forum, having an understanding of how participants reason their arguments as well as their relationships with key groups would be worth exploring. Finally, a welcoming environment that is safe for people to discuss ideas and doubts and common ground would be essential to create, too. Fortunately, university Extension personnel and others in the area have already run these types of

forums and are well versed in creating a workable environment in communities, which contributes to conflict management.

Social Construction: Groups

Groups of people and their constructions are important to understanding how the community approaches a difficult and controversial problem such as climate change hazards. As mentioned in the findings, a number of groups were referred to in almost all interviews. These include: (1) scientists, (2) private property owners, (3) newcomers, (4) farmers and fishers, (5) long-time residents, and (6) business owners.

According to Schneider and Ingram (1993), within the SCF, scientists are usually placed in the *advantaged* group in that policy sends messages that they are highly educated, that their problems are of great concern to society, and that they generally are delivered immediate benefits and very few burdens. Based on the interviews with climate change leaders, it should be noted that some interviewees placed scientists in this *advantaged* category while others placed scientists in the *contender* category. Those making policy to deal with contenders tend to treat them with caution and believe their intentions are crooked when it comes to the political game. Contenders' benefits are only delivered if necessary to achieve economic or defense goals, and their burdens are necessary to correct greediness (Schneider and Ingram, 1997a).

Statements by interviewees show that policy makers and leaders do not agree on how scientists should be approached. This point is similar to the problem of translating scientific uncertainty into public discourse, but different in important ways. For example, if policy makers believe that scientists should be treated like *contenders*, they will treat scientists with suspicion, questioning their motives; whereas, if policy makers believe scientists should be treated like *advantaged*

citizens, they will treat scientists with trust and deference, giving them the benefit of the doubt. Here it must be noted that most of the interviewees have scientific training but do not work as research scientists, which may contribute to perceptions about scientists. Perhaps this line of thinking can get at a cause of perceived polarization in the community, or at least inform a conflict management strategy, as mentioned earlier, that might further the goal of community engagement. It is important to note that treating scientists as a group either like “advantaged” or “contenders” has strengths and weaknesses. A little skepticism may contribute to the ability to critically evaluate legitimacy of information are skills decision-makers use, ideally, to decipher information. Survey questions to better understand how conflict over the construction of scientists creates a potential barrier to engagement can be found in Figure 8.

Topic	Potential Survey Question
Advantaged status	<ul style="list-style-type: none"> • Scientists work hard to produce unbiased results. • I believe that scientists are important to understanding most problems facing the community. • Scientists should receive more funding for carrying out their work.
Contender status	<ul style="list-style-type: none"> • Scientists’ results usually reflect the goals of their funders. • Scientists need to be more transparent in their motives for conducting research. • Climate scientists are different than other scientists in their reporting of facts

Figure 8: Social Construction of Scientists

A similar observation about private business owners, farmers and fisheries can be made when interviewees’ responses are filtered through the SCF—disagreement occurs over how these groups should be treated when it comes to policy. During the interviews, these groups were treated either with respect or with caution; and either as deserving of necessary benefits or with disdain (e.g.,

agriculture “getting a free ride”). When it came to the problem of annual flooding, business owners and farmers were perceived as either heroic or controversial (e.g., problem with FEMA remapping). More importantly to this study, though, is the issue of whether these groups are engaged in the policy process, and whether their goals are conflicting with those interested in further addressing the topic of climate change hazards.

In relation to the Social Construction framework, long-time residents might be considered an *advantaged group* by everyone when it comes to what messages they receive, their perceived participation, and in their orientation to the political game (Schneider and Ingram, 1997). More specifically, interviewees showed that they were affected by the opinions of what they perceived to be long-time residents—sending the message that policy makers treat these community members with deference. Interviewees also believe that long-time residents’ participation is high and that they have particular sway in the community. Many interviewees expressed two details about long-time residents in the county. First, permanency is a characteristic of county residents and that long-timers are recognized as holding special knowledge and status in the county. Potentially, this permanency in the community gives long time residents both special knowledge of how the climate has fluctuated during their lifetime as well as power over the public opinions. Interviewees verbalized valuing the opinions of long time residents as much as they took into account the findings of scientists regarding the local climate.

The second viewpoint on long-time residents focused on what is perceived to be a barrier in garnering their support for climate change talks in policy. It seems that interviewees believe long-time residents are resistant to engaging on the topic of climate change because—according to interviewee responses—they are not focused on the future or are too set in their ways to consider the topic. In the

minds of interviewees, these long-time residents are an identifiable group with clear characteristics that affect the leaders' opinions and, at times, behaviors. Further research into defining exactly who comprises this group and what their opinions really are might help demystify their involvement in the policy process. For example, long-time residents may not have as much in common with each other as assumed by interviewees. Or they may, in fact, be willing to engage in conversation about climate change and its effects. Further research may support the assumption that this group is highly influential. It may also show that community leaders do not need to verbalize deference or disengage from climate change talk as part of the political realities of serving a constituency.

Newcomers to the area were mostly constructed like *contenders* in some areas and *dependents* in others. Many interviewees believed that newcomers were mostly interested in developing land, did not do their due diligence or consider climate when choosing to move to the county, and that regulation was needed to curb their actions. Newcomers seem to be treated with caution and are seen as having problems that are in conflict with others. It is not entirely clear how this group tends to insert itself into engagement, according to interviewees, on issues such as climate change hazards. It would be beneficial to confirm whether or not this group would be targeted participants in decision making around the topic of climate change, or are merely seen as disinterested, passive residents who need to be regulated rather than engaged. Perhaps this group might provide a counterbalance to the yet-to-be-defined long-time residents and provide insights into climate change hazards.

Summary of SCF Analysis

In summary, application of the SCF provides insight into policy makers and their engagement on the topic of climate change. First, leaders do not agree on how to approach different groups in the community who have power such as scientists

and private business owners. Addressing how these groups are perceived may influence how leaders engage in the topic of climate change, as well as change participation patterns of these groups. This may also be true of other lobbies in the area such as the land or ocean—examining ways these groups are seen might increase their engagement in the topic of climate change and draw out new leaders in the policy process. Additionally, it is necessary to uncover the true opinions of long-time residents and newcomers and understand how they might, in fact, support engagement activities. There may be new leaders and participants in climate change engagement activities yet to be identified in all these groups, which might increase knowledge-action networks and the attention paid to the topic of climate change science.

Recommendations and Policy Implications

Based on the findings, the discussion focused on misconceptions about climate change of the study group as well as perceptions about groups in the community. Potential questions for a confirmatory survey and approaches for focus group sessions were suggested, as well as specific topics to be considered. The recommendations here relate to how Oregon Sea Grant can support community leaders and engage them in the topic of climate change. Policy, it seems, may be directly affected by these recommendations, especially in the areas of agenda setting and levels of participation of different groups.

The most important action, aside from a confirmatory survey, that might be taken from this analysis is an activity, meeting series, forum, or workshop that brings together groups of people to engage in conversation about the topic of climate change. Utilizing some sort of exercise to provide a clearer picture of the expert model and the socio-ecological system would be beneficial. Including individuals representative of both the policy makers and also the other groups mentioned by interviewees including long-time residents, newcomers, business leaders,

farmers and fishers, and scientists would be key. Prior to a meeting series, establishing the process or procedure to make the working environment hospitable, as well as considering ways to encourage participation by all the groups would be necessary for productive engagement. One example of this might be meeting with a group of farmers or long-time residents who might be skeptics individually, constructing their concerns as important public matters, and creating a process for engaging in discussion over those concerns.

Another action would be to measure exactly how much sanction there would be against those who attempt to engage in conversation about climate change hazards. For example, would residents truly boycott a business if they knew the owner was a climate change supporter—as some interviewees fear? Gauging a public response may help build a critical mass of leaders who are willing to engage in climate change activities. By increasing the number of leaders who are willing to engage on the topic of climate change, it seems that the topic would more easily and naturally become part of the agenda setting process. If being a climate change leader will truly lead to sanctions, as feared, more research into the basis of these sanctions may become necessary.

Another next step might be to create outreach materials such as bulletins, podcasts, videos, or articles made available to interested climate change leaders in the county. Content-areas tailored to this particular community may include clarification on the difference between chronic and catastrophic change. Policy makers and leaders who understand the difference between these types of changes might further distinguish both short- and long-term planning goals. Another content area for engagement materials is the relationship between climate change actions and current actions for dealing other environmental hazards such as flooding.

CONCLUSION

Organizations and projects in the Pacific Northwest and other regions of the U.S. are forming in order to aid communities in planning for and dealing with climate change. Research activities and recommendations such as found in this report seek to create localized support, gauging the unique qualities of a community and its leadership, and finding ways to overcome barriers to the use of climate science in decision-making. To be sure, some barriers will remain despite growing evidence of changes in the climate. However, support for building knowledge-action networks and further engaging in the topic of climate change is available to leaders. This research paper focused on the socio-ecological system and how it might be affected by climate change, some misconceptions and gaps in knowledge in a target community, and how leaders perceive different groups in the community. The Risk Communication Method helped establish a protocol for a qualitative assessment of county leadership. The Social Construction framework aided in better understanding groups in the county and how perceptions about them affect agenda setting, levels of involvement, and conflict over topics such as scientific legitimacy.

Further research activities related to this study have already been recommended, such as a confirmatory survey. In fact, the Risk Communication Method specifies this survey as an important next step for confirming findings from the semi-structured interviews. Adding the metric used in the Six Americas survey (Leiserowitz, et al., 2009) to this confirmatory survey would help better define labels, replacing the untested labels *denier*, *skeptic*, and *supporter* used in the this initial study. Another related research project might include further evaluation of how networks in a community affect levels of engagement. For example, are self-identified skeptics more likely to engage in climate change activities if they are closely aligned with a supporter? Another study might measure whether leaders can avoid the topic of climate change, as some interviewees in this study desired,

and still prepare for potential hazards. Yet another study might measure *where* engagement is happening in the study community. For example, is engagement on the topics of climate change more likely to happen in informal settings, such as a local coffee shop? Finally, a formal of evaluation of this 2-year SARP grant project would show which activities and questions produced the most effective materials and avenues for engagement.

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APPENDIX

APPENDIX A: Semi-structured interview protocol and questions

Informed Consent Process: Verbal Preview

Before we begin, I need you to understand and consent to the interview. The interview format has been approved by Oregon State University, and this form [hand it to interviewee] lets you know that this interview poses no risk to you, all of your responses will be anonymous and confidential, and the recording we'll make will only be listened to by the research team. Also, you have the right to end the interview at any point, although it will really help us most if we're able to complete the interview. It should take about a half-hour.

Goals for the study according to the CCCAI grant proposal: Purpose is to understand the mental models of a) climate-related risk and b) effective responses to those risks that these leaders perceive.

Outline of Questions

Reminder Note for Interviewer: At the beginning it's important to conduct the interview in an open-ended way, following and clarifying as needed what the interviewees offer. We're trying to elicit their views, and each of the first three questions should be allowed to stretch out to capture what's on their minds.

Interviewer:

1. In this project, we're trying to find out what's on coastal residents' minds relating to the climate. There aren't "right" or "wrong" answers, we're really just interested in knowing what you think. So to get us started, please tell me what comes to your mind about the Oregon coast and climate.

2. What associations do you have with the topic of "global warming"?

3. What associations do you have with the topic of "climate change"?

Clarifying question: What comes to mind as you consider these terms?

--More Specific Questions: Funneling Down to Finer Details--

I am going to ask you some more specific questions. Some of them may seem to repeat things that you have already said. Please bear with me; I need to ask all of the questions to make sure I have covered everything. If you feel you have already answered a question and you have nothing more to say on the topic, feel free to refer to a previous answer.

4. What are some major climate-related events you have seen in the County?

5. Do you know how these climate-related events were dealt with or managed?

Follow-up if warranted: Do you have an opinion about the effectiveness of this response?

7. Do you think that the coastal climate in the County may be changing now?

8. Do you think the coastal climate may change in the near future? How so?

9. What are the possible effects of the changing climate in the County? Which effects are you most concerned about? Do you think about risks that might be associated with those effects?

Follow-up: Do you think there are risks associated with changes in [all of the following that respondent does not address in previous question] ocean temperature . . . rainfall . . . coastal storms, winter wave heights, and ocean chemistry?

10. Have you heard how other coastal community leaders anywhere in the country or in Oregon are dealing with the potential effects of climate-related risks?

11. What actions do you think should be taken for dealing with climate-related risks in the County?

12. What sort of priority do you place on dealing with such risks?

13. Do you make a distinction between long-term and short-term planning for climate-related risks?

14. What problems do you see, if any, with your community addressing the climate-related risks you've been talking about?

-Photo Association Question-

15. I'd like to show you some pictures. Please describe what you see as you would to a friend.

[Show photos/illustrations of the greenhouse effect, ozone hole, coastal winter storms, mountain snowpack, highway landslides, surf runup on beach, house on bluff, drinking waterglass, ocean recreation fishing, sunny day.]

- Wrap-up Questions -

16. What is your leadership role – formal or informal -- in the County?

17. How long have you lived there?

18. What is (or was) your profession/work?

19. As I'm trying to understand who certain kinds of leaders are in the county, I'd like your suggestions about the following sorts of individuals:

- People who seem to know a great many people and who enjoy making connections for them and between them

- People who seem to have the mission in life to share information with others, particularly high-value information that provides the others a real benefit

- People you'd really want on your side if you were trying to influence others, because they seem to instinctively "get" other people and know what resonates with them.