Climate Change Adaptation: Information Needs, Concerns, and Behavioral Intentions among Oregon Coast Professionals

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ABSTRACT

The social and economic impacts of climate change on the Oregon Coast may be reduced if coastal managers begin planning now to put in place adaptation measures. Oregon Sea Grant conducted a web-based survey of Oregon coastal professionals to target climate change adaptation outreach and engagement efforts toward this audience. The following variables were examined in this research: climate change information needs, subjective norms about climate change, perceptions of climate change risk, feelings of responsibility to respond to climate change, and behavioral intentions to adapt to climate change. Relationships among these variables were investigated using an ordinary least squares regression path analysis. While coastal professionals are highly concerned about effects of climate change and feel responsible to mitigate and adapt to effects, they have low amounts of information on the climate change topics they consider important for the performance of their work. Coastal professionals who have more information on climate change have lower perceptions of risk and lower feelings of responsibility to adapt to climate change, possibly because greater information suggests that climate change is less of an issue. Perceptions of risk and feelings of responsibility were found to positively influence behavioral intentions to adapt to climate change, explaining one third of intentions. The low level of information on important climate change topics among coastal professionals indicates a need to engage them on issues of concern. Follow up focus group meetings and interviews could provide insight into the negative relationship between information and perceptions of risk, and feelings of responsibility for adapting to climate change; and an improved understanding of the drivers of behavioral intentions to adapt.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

Climate Change Adaptation: Information Needs, Concerns, and Behavioral Intentions among Oregon Coast Professionals

1. INTRODUCTION

1.1 *Project Impetus*

Global and regional climates are changing due to natural and human induced causes, and these changes will have ecological, social, and economic implications (IPCC, 2007; Karl, Melillo, & Peterson, 2009). Impacts are expected to vary regionally, with coastal regions being particularly vulnerable. According to a recent report by the United States Global Change Research Program (Karl et al., 2009), coastal cities, particularly low-lying and subsiding regions, will be adversely affected by sea-level rise and storm surges. Further, coastal ecosystems will be altered by higher water temperatures, changing ocean currents, and an increase in spring runoff, leading to reduced oxygen in coastal waters and ocean acidification through increased carbon dioxide uptake (Karl et al., 2009).

Consensus is growing that coastal communities will need to adapt to the changing climate over the next century (Adger et al., 2007; Littell, McGuire Elsner, Whitely Binder, & Snover, 2009; Mote et al., 2003; Nicholls & Tol, 2006; Karl et al., 2009; Snover et al., 2007; Wilbanks & Sathaye, 2007). However, there are many challenges associated with adapting to climate change. Climate change is a complex scientific issue characterized by uncertainty. Further, adapting to climate change goes beyond understanding climate change science and the best technical strategies to adapt as it is a social, political, and economic process (Tol, Klein, & Nicholls, 2007).

In the Pacific Northwest, increases in sea level, storm surges, and inundation are expected to have cumulative effects on coastal erosion and flooding (Komar, 1998; Karl et al., 2009). These, in turn, could lead to coastal infrastructure damage, beach and bluff breaching of the natural and manmade shoreline, increased landslides, and road washout. A reduction in spring snowpack has been detected and is expected to continue in this region, resulting in reduced summer streamflow (Knowles & Cayan, 2002; Littell et al., 2009). This reduction of summer streamflow is affecting municipal water supplies, and when combined with increased water temperatures, is negatively impacting salmon and other temperate species that Pacific Northwest communities rely on (Littell et al., 2009; Karl et al., 2009). Oxygen depleted zones ("dead zones") have been detected in the Pacific Northwest as a result of changes in the California Current, killing crab, rockfish, and other marine species of economic importance (Dybas, 2005). Further, forest ecosystems are being affected by higher temperatures and reduced snowpack (Littell et al., 2009; Karl et al., 2009). The resultant increases in wildfires and insect outbreaks, as well as changes in species composition, will reduce timber production, an important economic resource to Pacific Northwest coastal communities (Karl et al., 2009).

In Oregon, adapting to climate change needs to be considered in light of the historical highly variable coastal climate of the region. The Oregon coastline has been accreting and eroding over geologic time due to substantial seasonal wave activity, tidal cycles, and long-term trends such as El Niño events (Komar, 1998; Wright & Thom, 1977). While sea level rise has the potential to increase coastal erosion, the Oregon coast resides on a tectonically active plate that is rising faster than the rate of sea level rise along much of the coast (Burgette, Weldon II, & Schmidt, 2009). Marine and terrestrial ecosystems have evolved to withstand high interannual and

interdecadal variability in temperature, wind, precipitation, and ocean currents (Stenseth, Mysterud, Ottersen, Hurrell, Chan, & Lima, 2002), and Oregon coastal communities have lived with the ever-changing coastline and shifts in marine conditions and ecosystem assemblages.

Although some of the physical and ecological effects of these long term trends may be masked by these highly variable conditions, others will be exacerbated by climate change. This high uncertainty in climate change effects indicates that it may be prudent for Oregon coastal communities to be prepared for a wide range of potential climate change effects. This is of particular importance because climate change impacts on Pacific Northwest coastal communities will be amplified as coastal populations and development increase (Mote et al., 2003). Additionally, rural communities that predominate the Oregon coast may be more susceptible to climate change than urban areas due to their reliance on natural resources that are highly influenced by the changing climate (Wall & Marzall, 2006).

According to Snover and others (2007), local, regional, and state governments are in a stronger position than the federal government to tailor climate change preparedness strategies to their specific regional circumstances. Some policy steps have been taken in Oregon to begin addressing climate change adaptation. Oregon's Governor, Ted Kulongoski, established a Climate Change Integration Group that created a framework for addressing rapid climate change in Oregon. Additionally, Governor Kulongoski has partnered with the Governors of California and Washington to address climate change adaptation through the West Coast Governors' Agreement on Ocean Health (Gregoire, Kulongoski, & Schwarzenegger, 2008). Specific to the Oregon coastal zone, Oregon's State Coastal Management Program has coordinated efforts

towards climate change with the Governor's Office of Climate Change, Oregon Sea Grant, and the South Slough National Estuarine Research Reserve (Coastal States Organization, 2007). The Oregon Coastal Management Program produced a report in 2009 on strategies to adapt to impacts of climate change on the Oregon coast (Oregon Coastal Management Program, 2009).

Prior to 2007, little had been done to direct climate change adaptation outreach efforts toward the specific challenges facing Oregon's coastal communities. Obstacles can exist that prevent individuals and governments from responding to climate change including financial and technical deficiencies (Tribbia & Moser, 2008); as well as psychological barriers, such as attitudes and perceptions of risk (Ajzen & Fishbein, 1980; Finucane, Alhakami, Slovic, & Johnson, 2000; Fishbein & Ajzen, 1975; Fisbhbein & Yzer, 2003; Leiserowitz, 2006; Slovic, 1999; Slovic, Finucane, Peters, & MacGregor, 2004). Therefore, climate change outreach and engagement that address both climate change information needs and psychological barriers may be necessary for successful adaptation[1]. Tribbia and Moser (2008) suggest that *boundary organizations* - intermediary organizations that facilitate dialogue between and among scientists, policy-makers, and the public – can play a critical role in guiding the creation of valuable information and promoting it's use in decision-making.

1.2 *Oregon Sea Grant Climate Change Outreach and Engagement Project*

The Oregon Sea Grant program, based at Oregon State University since 1968, has a long history of marine-related research as well as outreach and engagement with coastal communities, and often plays the role of a boundary organization. Oregon Sea Grant received a grant for 2007-09

[1] The principal difference between "outreach" and "engagement" is in the two-way mode of interaction, of joint learning and communication, that is central to the latter but not the former.

from the NOAA Climate Sectoral Application Research Program to conduct outreach and engagement activities with coastal decision-makers and communities to help them prepare for climate change.

The Oregon Sea Grant project began in Fall of 2007, and had two primary goals: (1) to create targeted climate change outreach materials toward Oregon coastal stakeholders, and (2) to conduct a case study of community-based engagement to assist an Oregon coastal community in planning to adapt to climate change. Targeted outreach efforts involved stakeholder group meetings to help guide direction of the project, a web-based survey of coastal professionals (see Section 1.3), and open-ended interviews with the general public. All of these components helped guide the final outreach product – a set of short educational videos involving interviews with climate change experts aimed to dispel climate change misunderstandings and provide information where needed. The case study of community-based engagement involved Port Orford, Oregon, and was considered a case-study because the work being done was exploratory and required evaluation to determine if efforts were effective. The community-based engagement involved two workshops that consisted of structured collaborative brainstorming activities, a presentation comparing Port Orford's climate change adaptation knowledge (as ascertained from the brainstorming activities) with that of climate change experts, and a discussion of future directions to take to prepare for climate change. These workshops were followed-up with interviews of workshop participants to evaluate project effectiveness. Throughout the Oregon Sea Grant project, efforts were coordinated with other state agencies and non-profit organizations by maintaining a Wiki (a collaborative website that allows all with access to add or remove documents) of Oregon coastal climate change outreach activities.

1.3 *MRM Final Project*

An essential component of creating targeted climate change adaptation outreach is understanding the information needs and psychological barriers that may influence behavioral intentions of the audience. To address this, a web-based survey was conducted with Oregon coastal professionals who make decisions about development in the coastal zone. This group was identified because they are likely to be on the forefront of addressing climate change adaptation.

As part of the broader Oregon Sea Grant project, this research project is an evaluation of the web-based survey. This project assesses professionals' current climate change information needs and concerns, and investigates influences on behavioral intention to adapt to climate change by considering human behavior theory. Four concepts and their direct and indirect influence on behavioral intention were assessed, including: the amount of information professionals have on climate change, subjective norms on climate change, perceptions of climate change risk, and ascription of responsibility to adapt to climate change. Specific research questions addressed in this paper are:

1. How much information on climate change do Oregon coast professionals currently have?
2. What information do coastal professionals need?
3. What are their subjective norms, perceptions of risk, feelings of responsibility, and intentions to adapt to climate change?
4. Are there differences in responses based on profession (public versus private sector professionals)?
5. What are the relationships among information, subjective norms, perceptions of risk, feelings of responsibility, and behavioral intentions to adapt to climate change?

Survey results have been used to help inform other aspects of the broader Oregon Sea Grant project, such as, production of the outreach videos. Additionally, preliminary results were presented at the biennial conference of The Coastal Society in Redondo Beach, California in July 2008; and at a workshop aimed to coordinate climate change outreach and engagement efforts on the Oregon coast held in Corvallis, Oregon in April 2009. Ideally, this research will be utilized and followed up on by others working towards climate change adaptation on the Oregon coast.

2. BACKGROUND

2.1 *Climate Change*

2.1.1 Global Climate Change

The climate is changing and according to the International Panel on Climate Change (IPCC, 2007), atmospheric and ocean temperatures have been increasing over the last century, sea level is concurrently rising, and more extreme weather events are being experienced (e.g., tropical cyclones). These effects are expected to become amplified as the concentration of greenhouse gasses in the atmosphere continues to rise. Through modeling a range of emission scenarios, various global climate change predictions have been made over the next century (IPCC, 2007).

The average global atmospheric temperature is rising and is predicted to increase from 1.1 to 6.4˚C by 2100, leading to physical and biological effects in terrestrial and marine systems (IPCC, 2007). The rise in atmospheric temperature is increasing mean global ocean temperature, which is causing the sea level to rise through thermal expansion. A wide range of sea level rise predictions have been made for the next century, with variations due largely to differences in models, emission scenarios, and degree of polar ice melt. On the lower range of recent estimates, the IPCC (2007) predicted that sea level will rise from 0.18 to 0.59 meters by 2100; while a study that looked at the last interglaciation period produced a more extreme scenario with sea level predicted to increase from 4 to 6 meters (Overpeck, Otto-Bliesner, Miller, Muhs, Alley, & Kiehl, 2006). Rahmstorf (2007) calculated a more moderate and increasingly accepted range of sea level rise projections, 0.5 to 1.4 meters by 2100, by looking at the semi-empirical relationship between global mean surface temperature increase and global sea level rise.

The projected rise in atmospheric and ocean temperature is also altering coastal ecosystems through changing ocean currents, increasing spring runoff, and changing ocean salinity (IPCC, 2007; Karl et al., 2009). These, in turn, are causing ocean acidification and reduced oxygen in coastal waters, and are leading to shifts in species ranges and alterations of migration patterns (IPCC, 2007; Karl et al., 2009).

2.1.2 Climate Change on the Oregon Coast

Although global climate change is often the topic of discussion, the effects vary regionally (IPCC, 2007; Karl et al., 2009). These regional effects are more relevant than global trends when considering adapting to climate change. Of particular note in Oregon are relative sea level rise (the experienced sea level rise for a given region) and the historically evolving coastline from seasonal and long term coastal climate variability.

Oregon resides on a tectonically active plate with the Cascadia Subduction Zone driving uplift of the coastal margin. In the southern part of the coast (south of Florence), uplift is occurring at a faster rate than the current rate of sea level rise, while on the northern coast (Florence to south of Astoria), sea level rise is occurring faster than the rate of uplift (Burgette et al., 2009; Mitchell, Vincent, Weldon II, & Richards, 1994). Whereas sea level rise impacts will vary along the Oregon coast, the entire Oregon coast is expected to be less vulnerable to global sea level rise than regions that do not have tectonic uplift (e.g., the East Coast of the United States; Karl et al., 2009).

Although more difficult to plan for, a major earthquake on the Cascadia fault would drastically alter the current coastal uplift. This could lead to rapid subsidence of the Oregon coastline, and thus rapid relative sea level rise, flooding, and inundation. Major earthquakes on this fault occur approximately every 300 to 500 years, with the last one occurring in 1700 (Goldfinger, Nelson, & Johnson, 2003).

In addition to sea level rise and tectonic activity, the Oregon coast is affected by seasonal and long term ocean climate trends - all resulting in substantial coastal erosion and accretion through sediment transport (Komar, 1998). Recent changes have been discovered in some of these trends. In the winter, Oregon has one of the highest levels of wave energy in the world (Komar, 1998). Through the use of historical buoy data, Allan and Komar (2006) determined that the mean significant wave height has increased over the past decade on the Oregon coast. Seasonal events can amplify this increase in wave height. For example, El Niño years in the Pacific Northwest often bring increased erosion, flooding, and inundation (Komar, 1998).

The extent that changes in these seasonal and long term trends are related to climate change is largely unknown. However, it has been speculated that climate change may be experienced through changes in these trends resulting in altered patterns of climate variability (Miles, Snover, Hamlet, Callahan, & Fluharty, 2000). Therefore, understanding how the wave climate, El Niño cycles, and other trends may change with climate change is critical in assessing Oregon's vulnerability.

Regional biological effects of climate change are also being experienced in Oregon. According to Mote and others (2003), a reduction of spring snowpack and lower summer stream flow is one of the greatest concerns of climate change for the Pacific Northwest. Communities rely on this as a source for municipal water during the region's arid summer months (Littel et al., 2009; Mote et al., 2003). When reduced summer streamflow is combined with increased water temperatures, salmon are expected to be negatively impacted due to their reliance on cold flowing streams for spawning (Littell et al., 2009; Mote et al., 2003; Karl et al., 2009). Marine species are being negatively affected by climate change as well due to changing temperatures and currents (Karl et al., 2009). Crab, rockfish, and other marine organisms are threatened by oxygen depleted zones ("dead zones"), increasingly occurring in the Pacific Northwest from changes in the California Current (Dybas, 2005). Increases in wildfires and insect outbreaks have been detected in the Pacific Northwest from higher temperatures altering forest ecosystems (Karl et al., 2009). Oregon coastal communities rely heavily on natural resources of the region, and will thus likely be affected by these changes in salmon, crab, timber, and other resources of economic importance (Dybas, 2005; Littell et al., 2009; Mote et al., 2003; Karl et al., 2009).

2.2 *Climate Change Policy*

2.2.1 United States Climate Change Policy

An issue such as climate change poses substantial challenges to creating broadly accepted policy because it involves complex interactions with biological, physical, and social systems, with solutions relying on cross-discipline and stakeholder collaboration (Lemos & Morehouse, 2005). Further complicating climate change policy is that it is a global and value-driven issue (Leiserowitz, 2006). Addressing climate change nationally and globally is twofold, involving

mitigation (working to reduce effects of climate change) and adaptation (preparing for or responding to effects of climate change). To date, most policy efforts have focused on mitigating climate change effects – largely in terms of reducing greenhouse gasses in the atmosphere (thought to be the primary contributor to climate change). The need to incorporate adaptation strategies into climate change policy is becoming increasingly recognized (Wilbanks & Sathaye, 2007).

2.2.2 United States Coastal Zone Climate Change Adaptation Policy

The physical and biological effects resulting from climate change pose substantial future challenges to coastal states (Beatley, Brower, & Schwab, 2002; Karl et al., 2009). Proactive adaptation (as opposed to reactive response) can greatly reduce the impact of climate change in the coastal zone (Nicholls & Tol, 2006), although it requires adjustment of coastal management policies to changing circumstances. Consequently, adaptation to climate change is a social, political, and economic process, rather than merely an exercise in determining the best protective structures to build to protect for sea level rise (Tol et al., 2007).

Federal Coastal Zone Management Act

The United States coastal zone is managed at a federal level by the Coastal Zone Management Act (CZMA) of 1972. This Act established a voluntary program to encourage states to design and implement programs to manage their coastal resources. The CZMA, administered by the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, provides grant-based funding for states with federally approved Coastal Management Programs. At both federal and state levels, adapting to climate change is beginning to be incorporated into

already existing hazards management plans. The responsibility for addressing sea level rise is defined under the Coastal Zone Management Act (CZMA) coastal zone enhancement objective:

> Preventing or significantly reducing threats to life and destruction of property by eliminating development and redevelopment in high-hazard areas, managing development in other hazard areas, and anticipating and managing the effects of potential sea level rise and Great Lakes level rise (CZMA, 1972).

According to the Coastal States Organization (CSO), "the CZMA should be recognized by Congress and the Administration as one of the primary statutes that can foster adaptation to climate change at the state and local levels" (CSO, 2007, p. 23).

CZMA State Management Programs

Local, regional and state governments are likely in a stronger position than the federal government to tailor climate change preparedness strategies to their specific regional circumstances (Beatley et al., 2002; Snover et al., 2007). In 2006 the Coastal States Organization (CSO) polled CZMA State Management Programs to determine if and how they are responding to climate change (CSO, 2007), and found that state coastal programs are serving an important function in climate change adaptation strategies. Several states plan to develop both retreat and protection policies incorporating accelerated rates of sea level rise through regulations that require infrastructure setbacks, elevation, and siting; wetland conservation and restoration; and considering alternative protective structures for the coastline (CSO, 2007). However, according to the CSO (2007) report, numerous obstacles remain for state programs in preparing for climate change, including:

- the need for more information, particularly in terms of geomorphology, socioeconomics, and model projections;
- the need to incorporate recent and changing levels of sea level rise into coastal management plans, rather than stable rates of sea level rise; and
- the need to coordinate efforts among federal, state, and local governments.

2.2.3 Oregon's Climate Change Policy

In 2004, Governor Kulongoski appointed the Governor's Advisory Group on Global Warming (GAGGW), and directed the group to determine a strategy for reducing greenhouse gas emissions in Oregon. The Climate Change Integration Group (CCIG) was established in 2006 to expand on the work of the GAGGW. Specifically, Governor Kulongoski requested that the CCIG incorporate a plan for preparing to adapt to the impacts of climate change. In response, the CCIG created a framework for addressing rapid climate change in Oregon.

Oregon Coastal Climate Change Adaptation Policy

Oregon's CZMA Coastal Management Program, administered by the Oregon Department of Land Conservation and Development, works with a number of state and federal agencies toward management of the Oregon coastal zone. Coordination of efforts toward climate change has been established with the Governor's Office of Climate Change, Oregon Sea Grant, and the South Slough National Estuarine Research Reserve. Following the lead of the climate change report produced by the CCIG, the Oregon Coastal Management Program produced a report in 2009 on strategies to adapt to impacts of climate change on the Oregon coast (Oregon Coastal Management Program, 2009).

A regional effort that includes coastal climate change adaptation is currently underway with California, Oregon, and Washington through the West Coast Governors' Agreement on Ocean Health (WCGA; Gregoire et al., 2008). The WCGA Climate Change Action Team has been charged with developing a framework that assists state and local governments in planning for shoreline impacts resulting from climate change over the next several decades.

2.3 *Conceptual Framework for Evaluating Climate Change Adaptation in Coastal Oregon*

2.3.1 Adaptive Capacity

There are numerous and complex factors that determine the level to which individuals and governments are responding to climate change. The capacity to adapt varies between and within countries – with wealthier and less populous regions being more adept to respond (Nicholls & Tol, 2006). These regions can afford to invest in and utilize technologies to respond to the changing coastline. The ability to adapt can also be improved through social networks, institution and governance, and human resources (Adger et al., 2007). However, having the capacity to adapt does not, in fact, dictate action, as there can be both informational and psychological barriers inhibiting individuals and governments from taking steps towards preparing for climate change. Therefore, creating outreach materials with an understanding of informational and psychological barriers has the potential to assist communities in overcoming these challenges, and moving forward in planning to adapt to climate change.

2.3.2 Conceptual Framework

Climate Change Information

Climate change is complex and uncertain with disagreement among experts, and much media-hype (Orscheln, 2006). Discrepancies in messages often result in confusion and misunderstanding by non-climate experts. To further complicate matters, scientific knowledge about climate change is rapidly changing and many scientific unknowns remain. Some research suggests that not having enough information, or having misperceptions about a topic pose challenges for scientists, the public, and policy makers in decision making (Myatt, Scrimshaw, & Lester, 2003). Where other research specific to climate change indicates that it is not merely the amount of information that is important, rather, climate information is more likely to be used in decision making if it is relevant and important to potential users (Cash & Buizer, 2005; Tribbia & Moser, 2008). This research, thus, investigates how much information coastal professionals who make decisions about development in the Oregon coastal zone have on climate change and how important they believe having that information is to the performance of their work.

Behavioral Intentions

Of particular interest to this research was assessing behavioral intentions to adapt to climate change because intention is often the most direct and accurate predictor of an individual's corresponding behavior (Fishbein & Manfredo, 1992). Further, the main drivers of intention to respond to climate change were investigated to learn why respondents' intend to, or do not intend to adapt. Several human behavior models and theories helped guide this research – namely, the integrative model of behavior change, the norm activation model, and risk perception theory. Along with these, the role that climate change information plays in influencing intention was

considered because of the complexity of climate change science and the potential discrepancies of information available among Oregon coastal professionals.

According to the integrated model of behavior change, intention to perform a particular behavior is driven by attitudes, perceived peer-group norms, and feelings of self-efficacy, which are influenced by demographics, culture, stereotypes and stigma, perceptions of risk, moods and emotions, media exposure, as well as other "distal" variables (Fishbein & Yzer, 2003). This theory builds largely on the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which states that intention is a function of attitudes (one's beliefs about the positives and negatives of performing a given behavior) and perceived norms (the perception that important others think one should perform a certain behavior). Further, similar to the theory of planned behavior (Ajzen, 1991), the integrative model of behavior change considers social cognitive theory (Bandura, 1977), by adding self-efficacy (the belief that one can perform the behavior in spite of various challenges) as a predictor of behavioral intention.

Once someone has the intention to perform a certain behavior, external challenges can remain that may prevent them from performing the intended behavior, including environmental constraints (e.g., lack of funding) and/or lack of skills (e.g., not knowing the best method to reduce erosion rates; Fishbein & Yzer, 2003). Therefore, measuring intention alone is not as informative as measuring intention relative to influences on intention. The intention considered in this research is Oregon coastal professionals' intentions to prepare for or respond to effects of climate change. The complexity of climate change science, the many unknowns that remain regarding potential effects, and the values and stigmas associated with the topic can all influence

whether or not coastal professionals intend to adapt to climate change. Therefore, this research evaluates the role that some of these factors play in influencing intention to adapt to climate change.

Subjective Norms and Ascription of Responsibility

Schwartz's norm activation model (1968, 1973, 1977) states that behavior is influenced by subjective norms (the influence of people in one's social environment; Miller, 2005) when individuals are aware of the consequences their behavior has on others, and when they ascribe responsibility for their actions to themselves. Although Schwartz's model was designed to explain altruistic behaviors, it has been demonstrated that it also applies to ecological behavior. Heberlein (1972) found that many environmental decisions have become moral issues and thus can be driven by the norm activation model (e.g., awareness of consequences and feelings of responsibility to mitigate for climate change can lead to a morally-driven decision to reduce greenhouse gasses). This has since been confirmed in studies of recycling behavior (Hopper & Nielsen, 1991; Vining & Ebreo, 1992), and in research considering feeling of responsibility as a predictor of general ecological behavior (Kaiser & Shimoda, 1999). Schwartz's model has also been found to extend beyond individual actions since environmental-based movements often emphasize the importance of collective goods (Stern, Dietz, Abel, Guagnano, & Kalof, 1999). Therefore, ascription of responsibility has been found to influence judgments about the moral responsibilities of governments and industry, as well as individual responsibility (Stern, Dietz, & Black, 1986).

Based on the relationship of subjective norms and ascription of responsibility with behavior, this paper examines the influence of coastal professionals' climate change subjective norms on their feelings of responsibility to adapt to climate change. Since climate change is a social, environmental, and global issue that involves the collective good, this research considers coastal professionals' ascription of responsibility to both individuals and the government. Further, it considers the influence of information on feelings of responsibility.

Perceptions of Risk

Perceptions of risk are the subjective judgments that people attribute to the likelihood of a threat occurring, and how concerned they are with the consequences (Sjöberg, Moen, & Rundmu, 2004). Risk perceptions are formulated by both cognitive analysis – driven by knowledge, rules, and probability; and through experience – driven by affect, emotion, and personal experience (Finucane et al., 2000; Slovic et al., 2004). Research has found that experts' risk perceptions are driven largely by cognitive analysis, where laypeople's perceptions are formulated by emotion, affect, worldviews, ideologies, and values in addition to analysis (Slovic, 1999). In general, people are less concerned with risks when they feel that they have personal control over the situation (Sjöberg et al., 2004).

Understanding Oregon coastal professionals' perceptions of risk was of interest to this work because a community's adaptive capacity depends, in part, on the community's perceived climate change risks (Wall & Marzall, 2006). Perceptions of risk have been shown to influence decision making, with risk perceptions and concerns driven by fear or anxiety having the potential to motivate risk-averse behavior (Lowenstein, Weber, Hsee, & Welch, 2001).

However, anxiety has alternatively been found to lead to avoidance of information that promotes negative feelings (Lowenstein et al., 2001). Further, tradeoff difficulty in decision making (feelings of conflict at the time of decision making) can arouse negative emotions that have nothing to do with the consequences, but can prevent a decision-maker from making a decision altogether (Lowenstein et al., 2001).

This paper examines the general level of perceptions of climate change risk among coastal professionals, the influence of climate change information on perceptions of risk, and the influence of perceptions of climate change risk on feelings of responsibility and behavioral intentions to adapt to climate change. Further, the relationship between information and perceptions of climate change risk was evaluated because of the unique regional climate change effects on the Oregon coast. Although a bit counterintuitive, this research speculates that coastal professionals who have more information on climate change may have lower perceptions of risk because those with more information are more likely to understand Oregon-specific climate effects, such as the fact that uplift is occurring and reducing the effects of sea level rise.

With considering the behavior models and theories discussed above, the direct and indirect influences of four concepts on behavioral intention to respond to climate change were investigated: (1) the amount of information professionals have on climate change, (2) subjective norms on climate change, (3) perceptions of climate change risk, and (4) ascription of responsibility to respond to climate change. This research investigates coastal professionals' perceptions of climate change risk and how they are influenced by the amount of information they have on climate change and their subjective norms on climate change. Further, the

influences of information, subjective norms, and perceptions of risk on their feelings of responsibility to respond to climate change were evaluated. Lastly, the influences of perceptions of risk and feelings of responsibility on behavioral intention to respond or adapt to climate change were investigated. Figure 1 demonstrates the conceptual model to explain behavioral intention to respond to climate change.

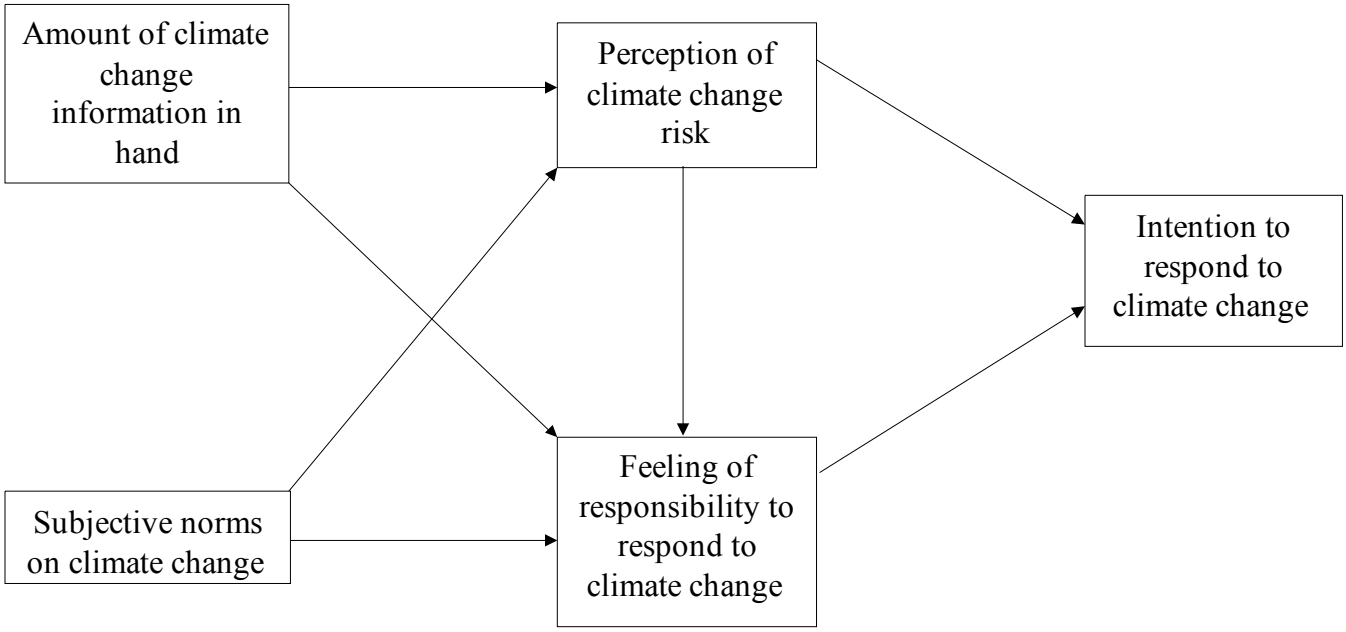

Figure 1. Conceptual model of influences on the intention to respond to climate change.

3. METHODS[2]

3.1 *Data Collection*

A web-based survey was designed and administered using SurveyMonkey software and dissemination tools. The project research team developed a purposeful sample of Oregon coastal professionals – meaning, participants were selected who were expected to have experience with climate change, the key concept being explored (Creswell & Clark, 2006). Coastal professionals were defined as professionals who deal with development related decisions in the coastal zone, and included: elected and appointed officials, port managers, fisheries managers, tribal representatives, transportation managers, bankers, geologists, geotechnical consultants, other coastal scientists, realtors, developers, and others.

Survey participants were recruited using a snowball-type design (Goodman, 1961) – where existing survey participants were asked to recruit future participants from among their coworkers and collaborators. Recognizing that snowball sampling has limitations, this method was utilized because it is both cost and time effective. In this research, two strategies of inviting survey participants were employed through the assistance of key representatives of coastal professionals. Where possible, representatives provided the researchers with a list of email addresses to which an individualized survey link could be sent (the "direct" contact method). When the representatives were unable to provide email addresses to the researchers, they were asked to forward an anonymous survey link to their colleagues (the "indirect" contact method). This direct/indirect split was necessary to assure participation.

[2] Methods are drawn largely from an Oregon Sea Grant report summarizing survey results (Borberg, Cone, Jodice, Harte, & Corcoran, 2009).

In all cases, representatives were asked to communicate with their colleagues about the survey with an e-mail either announcing the survey or providing the anonymous link. Representatives who forwarded an anonymous link were also asked to indicate the number of people contacted by their communications (e.g., number of people on their mailing list). There was one case in which the representative provided the number of people on their mailing list, but noted that an unknown proportion of their list does not live or work on the coast, and therefore, would likely not participate in the survey.

Three rounds of emails were used to administer the survey from the direct method, and four sets were sent out via the indirect method. For all mailings, a reminder email was sent 1-2 weeks after the initial mailing. In total, the survey was emailed to 876 individuals and 300 surveys were completed, yielding a 34% response rate. Limited resources prohibited a check of non-response bias.

3.2 *Analysis Variables*

Climate Change Information

Survey participants were given a list of 14 topics related to climate change and were asked to rate them in terms of how much information they currently have on that topic and the importance of that topic in the performance of their job. The 14 topics included climate change related effects that may be experienced on the Oregon coast, and primarily consisted of statements representing physical effects, but also ecological effects and social and economic impacts (Table 2). This list of topics was created based on current Pacific Northwest climate change science and was reviewed by climate change specialists from this region. Responses were coded on a five

point scale of information available (1=No information, 2=Little information, 3=Some information, 4=Good amount of information, 5=All necessary information) and importance (1=Not important, 2=Slightly important, 3=Somewhat important, 4=Important, and 5=Very important).

Subjective Norms of Climate Change

Subject norms of climate change were measured with the following two statements: (1) I'm not hearing any urgency about local climate change effects from those who influence or assign my work, and (2) I'm not hearing any urgency about local climate change effects from those who influence me outside of work. Survey participants rated these statements in terms of the level to which they agreed or disagreed with them. Responses were coded on a five-point scale from "strongly disagree" (1) to "strongly agree" (5).

Perception of Climate Change Risk

Perception of climate change risk was measured with the following two statements: (1) I am concerned about reported changes and variability in the Earth's climate, and (2) I am concerned about how changes in the Earth's climate might affect the Oregon coast during this century.[3] Survey participants rated these statements in terms of the level to which they agreed or disagreed with them. Responses were coded on a five-point scale from "strongly disagree" (1) to "strongly agree" (5).

[3] Statements of concern have been included in prior surveys to measure perceptions of risk (e.g., Leiserowitz, 2006; Wildavsky & Dake, 1990)

Ascription of Responsibility for Climate Change

Ascription of responsibility toward climate change was measured with four statements. Respondents indicated the level to which they agreed or disagreed with each of the following statements: (1) It's important for governments to take immediate steps to reduce the apparent causes of global climate change, (2) It's important for individuals to take immediate steps to reduce the apparent causes of global climate change, (3) It's important for governments to prepare for the effects of climate change that are predicted to occur in Oregon by reducing local vulnerability, and (4) It's important for individuals to prepare for the effects of climate change that are predicted to occur in Oregon by reducing local vulnerability. Responses were coded on a five-point scale from "strongly disagree" (1) to "strongly agree" (5).

Behavioral Intention to Adapt to Climate Change

Behavioral intention to adapt to climate change was measured with six statements. Respondents indicated the level to which they agreed or disagreed with each of the following statements about adapting to climate change effects at the Oregon coast as it involves their work: (1) I don't believe climate change requires action from me in the next year or two (2) I'd be willing to take action in my work if I had compelling information about anticipated risks in the future, (3) I'd be willing to take action in my work if there were new funding available to do so, (4) I'd be willing to take action in my work if I hear a sense of local urgency to do so, (5) I'm ready to be a leader on this issue, and (6) I'm prepared to devote time and resources to this issue. Responses were coded on a five-point scale from "strongly disagree" (1) to "strongly agree" (5).

Public and Private Sector Professionals

Respondents were comprised of a wide range of coastal professions (Table 1). To investigate differences in responses by these coastal professionals[4], they were divided into two groups: 1) Public Sector (defined as those who work for the government at any level) and 2) Private Sector (defined as non-government employees). It should be noted that the Private group is comprised predominantly of realtors (65%), due largely to inherent biases in the snowball sampling method (see Section 3.4).

Table 1. Professions of respondents in the Public Sector and the Private Sector subgroups.

Professional subgroups	N[1]	%[2]
Public sector professions		
City	50	33
State	28	19
Emergency/Safety	15	10
Miscellaneous	13	9
Federal	12	8
Scientist	11	7
County	11	7
Port	9	6
Tribal	2	1
Private sector professions		
Realtor	79	65
Geotechnical consultant/Geologist	17	14
Banking/lending	8	7
Environmental consultant	7	6
Legal	2	2
Captain/Seaman	2	2
Environmental/Conservation organization	2	2
Hospitality/Tourism/Restaurant	2	2
Ocean Engineer	1	1
Survey and Mapping	1	1

[1] Total sample size for public sector professionals = 151, and for private sector professionals = 121

[2] % represents the percent of respondents in a given profession within each subgroup

[4] The term "coastal professionals" is used throughout this report to describe the survey respondents, and is not intended to imply that the sample is representative of all Oregon coastal professionals.

3.3 *Data Analysis*

Climate change information needs were evaluated by graphing and comparing mean ratings for each of the fourteen topics in terms of information available and the importance of that information to their work. General trends in responses to the analysis variables were assessed by calculating the percent of responses that fell into the various rating categories.

Internal consistencies of the survey items for information available, subjective norms, perceptions of risk, ascription of responsibility, and behavioral intention were examined using Cronbach alpha. A high Cronbach alpha coefficient (0.65 or greater) indicates that survey items are measuring the same concept and justifies combining them into a single index (Cortina, 1993; Nunnally & Bernstein, 1994). Based on this, mean indices were computed to represent the concepts of climate change information, subjective norms on climate change, perceptions of climate change risk, ascription of responsibility for climate change, and behavioral intention to adapt to climate change.

Differences between public and private sector subgroups for the five computed concepts were examined using *t*-tests and non parametric Mann-Whitney *U*-tests. Effect size indicators (r_{pb}) were reported where appropriate. Relationships between computed concept indices were investigated by conducting a path analysis using ordinary least squares regression. A path analysis is an analytical method for examining the strength of relationships between variables or concepts (Vaske, 2008).

3.4 *Data Limitations*

Due largely to sampling methods, results can not be considered representative of all Oregon coastal professionals. The snowball sampling method can lead to biases in the sample as it is weighted based on the initial contacts (key representatives) and the email addresses they were able to provide. One example of such a bias is the large number of realtors in the sample (comprising 65% of the private sector subgroup), as the realtor contact for this project provided the largest list of email addresses among the range of professions sampled.

In order to have a representative sample of a particular population, the sampling process must provide a calculable chance of each individual in the population being selected, and the resultant sample must closely represent the characteristics of the population being sampled (Mitra & Lankford, 1999). To provide a more representative sample of Oregon coastal professionals, alternative sampling methods that could be used in future research are simple random sampling or stratified random sampling. With simple random sampling, each person in the population would have an equal chance of being selected (Scheaffer, Mendenhall, & Ott, 1996); however, a better alternative may be stratified random sampling to ensure that each profession is represented in the selected sample. In stratified sampling, the population is divided into strata (in this case, professions), and then the sample is drawn from within each strata using simple random sampling (Scheaffer et al., 1996). One caveat to utilizing either of these sampling methods is that a comprehensive list of all Oregon coastal professionals and their contact information would be needed, and such a list does not readily exist.

The relatively low response rate (34%) further reduces the amount that results can be generalized beyond the sample population. A response rate of less than 70% for a survey of a specific group was considered problematic by Salant and Dillman (1994). However, 34% is a reasonably good response rate when compared to other electronic surveys (Sheehan, 2001). For the sample audience in this research, it is unlikely that access to a computer and the internet was problematic. Further, when breaking down response rates for the different data collection methods, the lowest response rate (10%) was for the indirect contact group in which the key representative noted that an unknown proportion of their email list works on the coast. With this group eliminated, the overall survey response rate would have been 43%.

Given the data limitations, this research still provides good insight into the climate change adaptation needs on the Oregon coast. The sample size of 300 coastal professionals is one of the largest samplings of the Oregon coast to date on this issue, and helped guide the direction of outreach and engagement efforts. This research lays a solid foundation for future research to build upon.

4. RESULTS

4.1 General Concept Trends

Climate Change Information

Climate change information needs were found to be high, with coastal professionals having low amounts of information on topics that they consider important for the performance of their job. Mean ratings for the amount of information that coastal professionals currently have on the 14 climate change topics ranged from 1.6 to 2.5, while ratings of importance on those same topics ranged from 3.6 to 4.2 (Figure 2). The overall mean rating across the 14 topics was 2.0 for amount of information professionals have, and 4.0 for information importance.

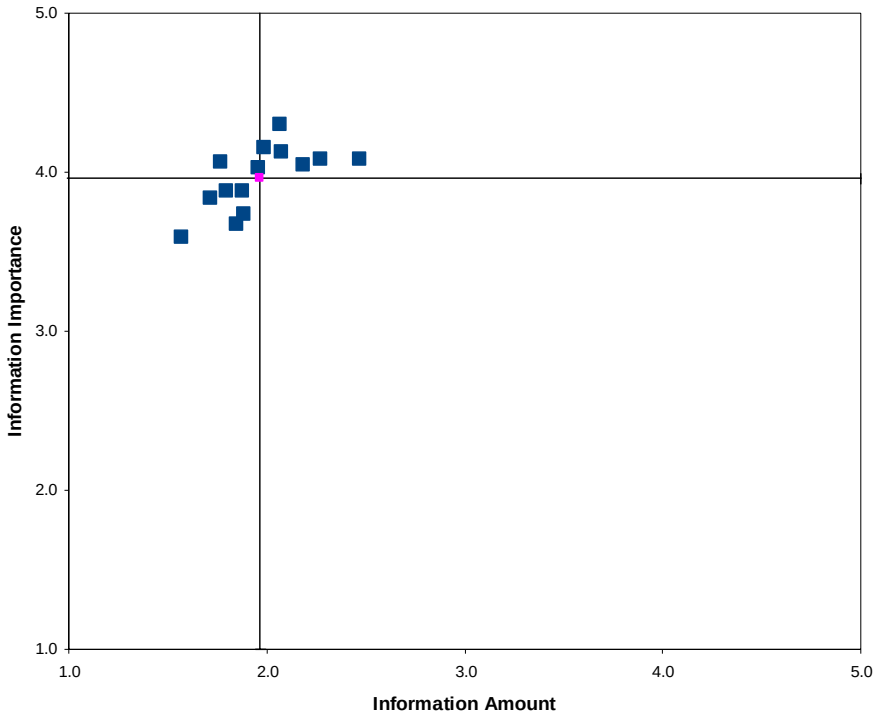

Figure 2. Mean ratings of amount of information professionals have on climate change related topics versus importance of that topic in the performance of their work. Topics were rated on a 5-point scale of information amount (1=no information and 5 = all necessary information) and importance (1=not important and 5 = very important). The overall mean values are represented by gridlines.

Only 3% to 15% of professionals responded that they have a good amount or all necessary information for each topic (Table 2). Information availability was particularly low (less than 5% responding that they have a good amount or all necessary information) for the following climate change topics: climate change effects on community infrastructure, changes in climate which may introduce new diseases and pests, changes in frequency and intensity of storms and the effects on building design standards, location specific effects of climate change, and projected economic costs and benefits of climate change.

Coastal professionals believe that having information on the given climate change topics is important in the performance of their job, with 65% to 84% rating each topic as important or very important (Table 2). Survey items that were rated the most important by coastal professionals (greater than 75% responding that topics were important or very important) include: changes in flood elevation, shoreline changes, and beach width; effects of sea level rise on existing shoreline protective structures; updates on latest climate change scientific data and how the Oregon coast may be affected; changes in ocean conditions which may affect Oregon's marine ecosystems, ocean productivity, or marine species composition; and changes in rainfall which might increase landslides.

Table 2. Coastal professionals' ratings of the amount of information they currently have on climate change topics provided in the survey (information available) and how important they feel that information is for the performance of their work (information importance).

	% Information Available						% Information Importance					
Climate Change Topics	No Information	Little information	Some information	Good amount of information	All necessary information	N	Not important	Slightly important	Somewhat important	Important	Very important	N
Sea level rise predictions	17	36	32	12	3	214	5	8	13	24	51	223
Climate change effects on coastal weather	20	42	31	7	1	211	6	5	12	28	49	223
Changes in flood elevations, shoreline erosion, and beach width	31	39	24	6	0	206	4	4	8	26	58	220
Changes in ocean conditions which may affect Oregon's marine ecosystems, ocean productivity or marine species composition	25	41	25	5	3	204	8	7	7	29	50	220
Updates on the latest climate change scientific data and how the Oregon coast may be affected	29	42	24	3	2	206	3	6	12	31	47	216
Effects of sea level rise on existing shoreline protective structures	36	38	20	6	1	205	5	6	8	28	53	219
Changes in rainfall which might increase landslides	37	38	19	5	1	205	6	5	13	33	43	217
Changes in frequency and intensity of storms and the potential effect on building design standards	40	37	18	3	1	203	8	9	9	36	38	218
Climate change effects on community infrastructure: water systems, sewer, streets/roads, bridges, and public buildings	46	37	14	2	1	204	5	6	9	35	44	219
Location-specific effects of climate change	51	31	14	3	1	204	7	6	14	41	31	217
Climate change impacts on energy resources	41	37	17	3	2	203	10	10	13	31	36	216
Projected economic costs and benefits of climate change	44	38	14	2	2	207	7	8	14	29	41	216
Changes in rainfall which might alter ocean or bay salinity and other aspects of estuarine habitat	43	35	17	4	1	203	11	10	14	34	32	219
Changes in climate which may introduce new diseases and pests to the area	57	33	7	2	1	199	13	12	9	32	33	218

A reliability analysis was run on professionals' ratings of how much information they have on the 14 climate change topics to determine how well they measure overall information available. The resultant Cronbach alpha coefficient was 0.94, corrected inter-item correlation coefficients were all greater than 0.40, and deleting any item from the index did not improve reliability (Table 3). The high Cronbach alpha coefficient indicates that items are measuring the same concept and justifies combining them into a single index (Cortina, 1993; Nunnally & Bernstein, 1994). Based on this, a mean index was computed for climate change information.

Table 3. Reliability analysis for information available on climate change.

Survey Item[1, 2]	Mean	% Have good or all information	Corrected item total correlation	Cronbach's alpha if item deleted
Sea level rise predictions	2.5	15	.60	.94
Climate change effects on coastal weather	2.3	8	.68	.93
Projected economic costs and benefits of climate change	1.8	4	.76	.93
Updates on the latest climate change scientific data and how the Oregon coast may be affected	2.1	5	.69	.93
Climate change impacts on energy resources	1.9	5	.75	.93
Changes in ocean conditions which may affect Oregon's marine ecosystems, ocean productivity or marine species composition	2.2	8	.63	.93
Changes in rainfall which might alter ocean or bay salinity and other aspects of estuarine habitat	1.8	5	.72	.93
Location-specific effects of climate change	1.7	4	.72	.93
Effects of sea level rise on existing shoreline protective structures	2.0	7	.74	.93
Changes in flood elevations, shoreline erosion, and beach width	2.1	6	.74	.93
Changes in rainfall which might increase landslides	2.0	6	.71	.93
Changes in frequency and intensity of storms and the potential effect on building design standards	1.9	4	.69	.93
Climate change effects on community infrastructure: water systems, sewer, streets/roads, bridges, and public buildings	1.8	3	.70	.93
Changes in climate which may introduce new diseases and pests to the area	1.6	3	.59	.93

1. Overall scale Cronbach alpha = .94.

2. Variables were rated on a five point scale, where 1 = No information, 2 = Little information, 3 = Some information, 4 = Good amount of information, and 5 = All necessary information.

Subjective Norms on Climate Change

Coastal professionals had moderate levels of both agreement and disagreement with statements addressing subjective norms about climate change (the influence of people in their social environment), with slightly more coastal professionals hearing a sense of urgency about local climate change effects from outside of work than from within work. More professionals agreed than disagreed that they were not hearing any urgency about local climate change effects from those who influence their work (49% agreed or strongly agreed, while 30% disagreed or strongly

disagreed; Table 4). At the same time, slightly more professionals disagreed than agreed that they were not hearing urgency from outside of work (41% agreed or strongly agreed, while 46% disagreed or strongly disagreed).

Table 4. Coastal professionals' agreement with statements addressing subjective norms, perceptions of risk, and ascription of responsibility.

	Percent agreement					
	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	N
Subjective norm						
I'm not hearing any urgency about local climate change effects from those who influence or assign my work.	8	22	21	34	15	249
I'm not hearing any urgency about local climate change effects from those who influence me outside of work.	8	38	13	31	10	247
Perceptions of risk						
I am concerned about reported changes and variability in the Earth's climate.	4	4	9	37	46	278
I am concerned about how changes in the Earth's climate might affect the Oregon coast during this century.	4	5	9	36	47	279
Ascription of responsibility						
It's important for governments to take immediate steps to reduce the apparent causes of global climate change.	6	9	9	30	45	277
It's important for individuals to take immediate steps to reduce the apparent causes of global climate change.	4	7	9	34	45	278
It's important for governments to prepare for the effects of climate change that are predicted to occur in Oregon by reducing local vulnerability.	5	8	8	33	45	275
It's important for individuals to prepare for the effects of climate change that are predicted to occur in Oregon by reducing local vulnerability.	4	6	9	38	43	274

These items were found to have high internal consistency with a Cronbach alpha of 0.75 and corrected inter-item correlations of 0.60, which justified computing a mean index for subjective norms on climate change (Cortina, 1993; Nunnally & Bernstein, 1994; Table 5).

Table 5. Reliability analyses for climate change subjective norms, perceptions of risk, and ascription of responsibility.

Survey Item[1]	Mean	% Agree[2]	Corrected item total correlation	Cronbach's alpha if item deleted	Cronbach's alpha
Subjective norm					.75
I'm not hearing any urgency about local climate change effects from those who influence or assign my work.	3.3	49	.60	--	
I'm not hearing any urgency about local climate change effects from those who influence me outside of work.	3.0	41	.60	--	
Perceptions of risk					.95
I am concerned about reported changes and variability in the Earth's climate.	4.2	82	.90	--	
I am concerned about how changes in the Earth's climate might affect the Oregon coast during this century.	4.2	82	.90	--	
Ascription of responsibility					.94
It's important for governments to take immediate steps to reduce the apparent causes of global climate change.	4.0	76	.88	.91	
It's important for individuals to take immediate steps to reduce the apparent causes of global climate change.	4.1	79	.86	.91	
It's important for governments to prepare for the effects of climate change that are predicted to occur in Oregon by reducing local vulnerability.	4.0	78	.84	.92	
It's important for individuals to prepare for the effects of climate change that are predicted to occur in Oregon by reducing local vulnerability.	4.1	81	.83	.92	

[1] Variables were rated on a five point scale, where 1 = Strongly disagree, 2 = Disagree, 3 = Neither, 4 = Agree, and 5 = Strongly agree.
[2] "% Agree" represents those who agree or strongly agree.

Perceptions of Climate Change Risk

Oregon coast professionals have a high perception of climate change risk, with 82% who agreed or strongly agreed that they are concerned about changes in the Earth's climate and about how these changes may affect the Oregon coast (means = 4.2; Table 4). The survey items had high internal reliability with a Cronbach alpha of 0.95 and corrected inter-item correlations of 0.90, which justified computing a mean index for perceptions of climate change risk (Cortina, 1993; Nunnally & Bernstein, 1994; Table 5).

Ascription of Responsibility for Climate Change

The four survey items measuring ascription of responsibility indicate that Oregon coast professionals feel that both governments and individuals should be taking action to mitigate and prepare for climate change. At least 76% of respondents agreed or strongly agreed with each

survey statement (mean ≥ 4.0, Table 4). The resultant Cronbach alpha coefficient was 0.94, corrected inter-item correlations ranged from 0.83 to 0.88, and the overall alpha was not improved if any of the items were deleted (Table 5). Based on this, a mean index was computed for ascription of responsibility for climate change (Cortina, 1993; Nunnally & Bernstein, 1994).

Climate Change Intentions

In general, respondents agreed that they would be willing to take action to respond to climate change if they had compelling information, new funding, and a sense of local urgency, with 74% to 76% who agreed or strongly agreed with the statements (means = 3.9, Table 6). Additionally, most respondents believed that climate change requires action from them in the next year or two (67% disagreed or strongly disagreed with the statement that they do not believe climate change requires action from them). However, fewer coastal professionals responded that they are ready to be a leader or are prepared to devote time and resources to the issue of climate change. Many professionals neither agreed nor disagreed that they are ready to be a leader (42%), and only 31% agreed or strongly agreed that they are ready (mean = 3.1); while 45% of respondents are prepared to devote time and resources to climate change (mean = 3.3).

Table 6. Items were rated on a five-point scale from strongly disagree to strongly agree.

	Percent agreement					
Survey Item	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	N
I don't believe climate change requires action from me in the next year or two.	21	46	14	13	6	247
I'd be willing to take action in my work if I had compelling information about anticipated risks in the future.	1	3	18	61	16	238
I'd be willing to take action in my work if there were new funding available to do so.	3	4	19	48	27	229
I'd be willing to take action in my work if I hear a sense of local urgency to do so.	3	5	18	54	21	241
I'm ready to be a leader on this issue.	8	19	42	22	9	237
I'm prepared to devote time and resources to this issue.	6	14	35	36	9	238

A reliability analysis of these six survey items was run to determine how well they measure the concept of behavioral intention to adapt to climate change. The resultant Cronbach alpha coefficient was 0.84, corrected inter-item correlation coefficients were all greater than or equal to 0.49, and deleting any item from the index did not improve reliability (Table 7). Based on this, a mean index was computed to represent behavioral intention to adapt to climate change (Cortina, 1993; Nunnally & Bernstein, 1994).

Table 7. Reliability analysis for behavioral intention to adapt to climate change.

Survey Item[1,2]	Mean	% Agree[3]	Corrected item total correlation	Cronbach's alpha if item deleted
I don't believe climate change requires action from me in the next year or two.[4]	2.3	19	.46	.84
I'd be willing to take action in my work if I had compelling information about anticipated risks in the future.	3.9	77	.52	.82
I'd be willing to take action in my work if there were new funding available to do so.	3.9	74	.66	.80
I'd be willing to take action in my work if I hear a sense of local urgency to do so.	3.9	74	.69	.79
I'm ready to be a leader on this issue.	3.1	31	.63	.80
I'm prepared to devote time and resources to this issue.	3.3	45	.74	.78

[1] Overall scale Cronbach alpha = .84.

[2] Variables were rated on a five point scale, where 1 = Strongly disagree, 2 = Disagree, 3 = Neither, 4 = Agree, and 5 = Strongly agree.

[3] "% Agree" represents those who agree or strongly agree.

[4] Item reverse coded.

4.2 Professional Differences

There were few differences in the concepts between the public and private sectors. These professional groups did, however, differ significantly on subjective norms, with the private sector more likely to agree that they are not hearing any urgency about local climate change effects from within work or outside of work ($t = 2.57$, $p = .011$, Table 8). The point-biserial correlation effect size, however, suggests that these differences were "small" or "minimal" ($r_{pb} = .16$; Cohen, 1988; Vaske, Gliner, & Morgan, 2002). The public and private sector responses did

not differ significantly for the computed indices of information available, perceptions of risk, ascription of responsibility, or behavioral intention. Results of the Mann-Whitney *U*-test were similar to the *t*-test, with subjective norms showing the only significant difference in responses between the public and private sectors.

Table 8. Comparison of public and private sectors for information available, subjective norms, perceptions of risk, ascription of responsibility, and behavioral intention to adapt to climate change.

	Professional Category[1]					
Survey Item	Public sector	Private sector	Total	t-value[2]	*p* -value	r_{pb}
Information available[3]	2.0	1.9	2.0	.48	.635	.034
Subjective norm[4]	3.0	3.3	3.1	2.57	.011	.163
Perception of risk[4]	4.2	4.1	4.2	1.00	.317	.061
Ascription of responsibility[4]	4.1	4.0	4.1	.74	.463	.045
Behavioral intention[4]	3.7	3.6	3.6	.92	.357	.059

[1] Cell entries are mean ratings of the computed variables.

[2] Non-parametric test comparable to t-test results: Ascription of responsibility (Mann-Whitney U = 8556.5, p = 0.654), perception of risk (Mann-Whitney U = 8330.0, p = 0.402), subjective norm (Mann-Whitney U = 5870.5, p = 0.014), behavioral intention (Mann-Whitney U = 6825.5, p = 0.406), and information available (Mann-Whitney U = 4621.5, p = 0.489).

[3] Variables were rated on a five point scale, where 1 = No information, 2 = Little information, 3 = Some information, 4 = Good amount of information, and 5 = All necessary information.

[4] Variables were rated on a five point scale, where 1 = Strongly disagree, 2 = Disagree, 3 = Neither, 4 = Agree, and 5 = Strongly agree.

4.3 Influences on Behavioral Intentions[5]

Since there were minimal differences between the public and private sectors in their responses to the five concepts, all responses were combined for investigating the relationships among these concepts.

Perceptions of climate change risk ($\beta = 0.27$, $p = .010$) and feelings of responsibility to respond to climate change ($\beta = 0.34$, $p = .001$) were significant predictors of intention to respond to

[5] Further analyses conducted post-defense revealed that a four factor model may be more appropriate than the five factor model presented in this report. A confirmatory factor analysis conducted on the variables assessing perceptions of climate change risk and ascription of responsibility were found to be measuring only one factor. A subsequent reliability analysis confirmed that the variables were, in fact, measuring the same concept.

climate change (Figure 3). These two variables explained 33% of the variance in the behavioral intention to respond to climate change, with both having positive influences on intention.

Perceptions of climate change risk, the amount of climate change information people currently have, and subjective norms on climate change explained 68% of feelings of responsibility to respond to climate change. Among these concepts, perceptions of climate change risk was the strongest predictor, with high perceptions of risk leading to increased feelings of responsibility ($\beta = 0.75$, $p < .001$). The amount of information that professionals currently have on climate change had an inverse relationship with feelings of responsibility ($\beta = -0.15$, $p = .001$). Those who have more information feel less responsible to respond to climate change. Professionals who are not hearing a sense of local urgency (subjective norms) had lower feelings of responsibility ($\beta = -0.10$, $p = .017$).

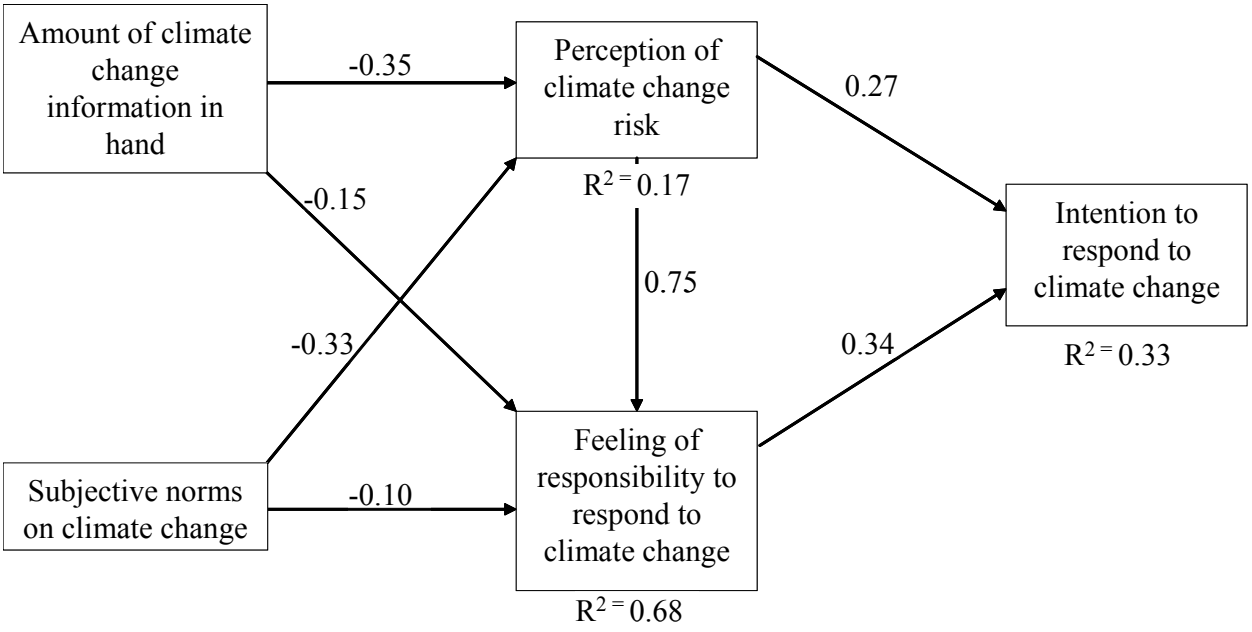

Figure 3. Analysis of predictions of intention to respond to climate change. All paths are significant at $p < 0.05$.

Perceptions of climate change risk were significantly predicted by the amount of information available and subjective norms on climate change, with 17% of the variance explained by these two concepts. The amount of climate change information professionals have was inversely related to perceptions of risk ($\beta = -0.35$, $p < .001$). Those who have more information have lower perceptions of climate change risk. Subjective norms on climate change also had a negative relationship with perceptions of risk ($\beta = -0.33$, $p < .001$), with professionals who are not hearing a sense of local urgency having lower perceptions of risk.

5.0 DISCUSSION

5.1 *General Conclusions*

This research found that, in general, professionals on the Oregon coast have low amounts of information on climate change, and that they believe that having that information is important for the performance of their job. Few respondents (from 3% to 15%) said that they had a good amount or all necessary information on any of the climate change topics provided. Although behavioral intentions to respond to climate change were moderate, perceptions of climate change risk and feelings of responsibility to adapt to climate change were quite high. Differences in responses between public and private sector professionals were small, with the only statistically significant difference being for subjective norms.

Based on the professions comprising each group, it seemed plausible that the public sector professionals would have more information on climate change, and may feel more responsible to respond to climate change than the private sector; however, a number of reasons could explain why few differences were found between these groups. The private sector was comprised of a diverse group of professions – realtors being the predominant group, but geotechnical and environmental consultants comprised 20% of the sample. Since many of these consultants are specialists in physical and ecological sciences, the amount of information they have on climate change likely exceeds that of some public professionals. Further, a focus group of Lincoln County realtors was conducted as part of the broader Oregon Sea Grant project, which revealed that this group of realtors was quite concerned about climate change – both in terms of impacts on their communities, and regarding their career and possible legal ramifications of selling

homes that may be impacted by climate change (e.g., could they be sued if they knowingly sell a house that is at risk of sea level rise).

In examining influences on behavioral intentions to adapt to climate change, the regression model showed that one third of intentions were predicted by perceptions of risk and ascription of responsibility. Ascription of responsibility to adapt to climate change was found to be largely driven by perceptions of climate change risk. Further, the amount of information that coastal professionals have negatively influences their perceptions of risk, and more notably, their feelings of responsibility.

The result of people with more information having lower perceptions of risk is supported by past research. Slovic, Fischhoff, and Lichtenstein (1986) found that in some instances, scientific experts on a particular issue (e.g., nuclear power) have lower perceptions of risk on that issue than the general public. Although it is not technically correct to call those with more information from this sample "experts", the idea follows the same logic where those who have more information on a scientific topic have lower perceptions of risk. It should be noted that the model only explained a small portion of climate change risk perceptions, with 83% of the variance not explained by the model.

The finding that professionals with more information on climate change have lower ascription of responsibility to adapt was not expected. Although the influence of information on ascription of responsibility was weak relative to perceptions of risk, it is interesting to explore this relationship as this result is not explained by theory or past research. In exploring this relationship, it is

important to consider it in terms of where the survey took place - the Oregon coast - and the climate change effects being experienced and predicted on the Oregon coast versus other environmental events, and other priorities of coastal professionals. The fact that Oregon resides on a tectonically active plate with coastal uplift means that along much of the Oregon coast land level is rising faster than or similar to sea level rise. So the relative effects of sea level rise are predicted to be small when compared to other geographic regions. Therefore, the professionals who have more information on climate change may be more knowledgeable on this particular regional effect on the Oregon coast, and thus feel less of a need (and less responsible) to prepare for sea level rise.

A second possible explanation is that coastal professionals who have more information on climate change effects also have more information on other coastal hazards on the Oregon coast. While, at present, Oregon's tectonically active plate is driving uplift, a major earthquake would result in rapid subsidence of the Oregon coastline. Since the last one occurred in 1700, a major earthquake could occur on this fault at any time. Further, this earthquake would likely be followed by a tsunami that would lead to substantial social and economic damage in Oregon. Since coastal professionals operate under limited economic resources, they may feel the need to weigh coastal hazards in terms of imminence and potential devastation. Thus, professionals with more information on coastal hazards in general may feel more responsible to prepare for a coastal hazard such as a tsunami, than they feel to prepare for climate change.

A third possible explanation for professionals with more information having lower feelings of responsibility to respond to climate change is the enormity of the issue of climate change, and

the potential for information overload (receiving too much information; Eppler & Mengis, 2004). Research has found that individual performance is positively correlated with information received up to a certain point, and then performance rapidly declines if information continues to be delivered (Chewning & Harrell, 1990). Once information becomes information overload, it can no longer be incorporated into decision-making, and the load of excess information has been found to confuse the individual and affect his or her ability to set priorities (O'Reilly, 1980; Schick, Gorden, & Haka, 1990). Therefore, professionals with more information on climate change may not be able to process and utilize it all in decision making, and further, it may actually hinder their judgement.

5.2 Management Implications

Outreach and Engagement

It is important to address the need for climate change information among Oregon coast professionals. In a recent survey conducted in California, Tribbia and Moser (2008) also found coastal managers to be lacking information on climate change. Through interviews, they discovered that the challenge for managers is access to available information rather than information not existing. It would be useful to determine if this is the case in Oregon as well – does the information not exist, or is it merely not accessible to coastal professionals? If accessibility is the problem, it would be good to explore feasible and effective strategies to make climate change information more readily available.

In considering outreach strategies for providing climate change information to coastal professionals, the findings of no significant difference between public and private sectors in

terms of how much information they currently have indicates that outreach efforts can be virtually the same for these two sectors. However, before creating a "one-size-fits-all" outreach approach, it would be useful to compare responses between the more technical fields (e.g., coastal geologists and geotechnical consultants) and the less technical fields (e.g., realtors and bankers) to see if this elicits differences. It seems plausible that base knowledge may be different between these groups – which would indicate a need for multiple outreach strategies.

Influencing Behavioral Intention

There are numerous and complex factors that determine the level to which individuals and governments are responding to climate change – and this research provides some insight into what the drivers are among Oregon coastal professionals. Further research could help fill in some of the identified gaps, and clarify some of the unexpected findings – ultimately improving our understanding of behavioral intention to adapt to climate change.

Although feelings of responsibility and perceptions of risk were significant predictors on intention, they only predicted 33% of the variance. Based on theory and past research, attitudes toward adapting to climate change would likely be a significant predictor on intention to adapt to climate change (Fishbein & Ajzen, 1975; Fishbein & Yzer, 2003). Therefore, learning more about climate change attitudes could prove useful in understanding intentions.

Understanding the drivers of climate change risk perceptions is particularly important because our model showed that perceptions of risk on climate change strongly influence feelings of responsibility to adapt to climate change. While risk perceptions are formulated by both

analytical knowledge and experiential knowledge (Slovic et al., 2004), according to Epstein (1994), experiential knowledge often has a larger influence than abstract knowledge on behavior. This research considered the influence of analytical knowledge (information available) on perceptions of risk, but did not investigate experiential knowledge. Further research to determine the level to which Oregon coastal professionals are experiencing climate change, and the emotion that they feel in regards to climate change could provide an improved understanding of climate change perceptions of risk.

The negative relationship between the amount of information professionals have and feelings of responsibility has substantial management implications. If managers decide to provide people with more information on climate change, perceptions of risk and in turn, feelings of responsibility and behavioral intentions to adapt to climate change could diminish. But promoting a sense of fear or dread by withholding relevant information from coastal professionals is not a solution. Rather, it is important to better understand this complex relationship in order to assist coastal professionals in making decisions based on a sound understanding of climate science. It should be noted that the survey questions elicited subjective knowledge rather than factual knowledge (professionals gave self-ratings of how much information they have). Through follow up interviews, it could prove useful to learn if having more information on climate change is driving this relationship, or having more information on coastal hazards in general is the main factor (e.g., ask coastal professionals to rank a list of coastal hazards in terms of how much information they have on them, and in terms of importance and/or feelings of responsibility to prepare for them). Further, since the survey inquired about how much information professionals have on specific effects that pose physical and ecological

risks, it would be helpful to learn how much information, or how high of certainty, they believe they need in order to respond to climate change.

5.3 *Recommendations for Future Research*

The sample size of 300 Oregon coastal professionals provided a good indication of climate change knowledge, concerns, and intentions of the audience and aptly served the purpose of creating targeted outreach materials. However, the sample cannot be considered representative of the larger population of coastal professionals due to inherent biases in the snowball sampling method and to the relatively low response rate. Further, questions remain about the adaptive capacity of Oregon coastal communities. Following up the survey with focus group meetings and/or interviews could provide further insight for assisting Oregon coastal communities in preparing to adapt to climate change. Some future recommended questions include:

1. For information on climate change related topics that coastal professionals do not currently have – does the data not exist or is it not accessible to them?
2. How much information and how high of certainty do Oregon coastal professionals believe they need to prepare for climate change?
3. How do coastal professionals prioritize preparing for climate change versus other coastal hazards? How do they prioritize climate change compared to day-to-day and ongoing work responsibilities?
4. How does experiential knowledge (versus analytical knowledge) influence Oregon coastal professionals' perceptions of climate change risk?
5. What are the attitudes of coastal professionals regarding adapting to climate change and how do these influence behavioral intention to adapt?

6. Among professionals who have intention to adapt to climate change, in what capacity do they plan to adapt (e.g., do they plan to respond as an individual or within their institution?)

Addressing climate change is an immense challenge for individuals and organizations on the Oregon coast and elsewhere. Outreach and engagement agents, as well as climate scientists, can assist in the process through providing credible and relevant information that reflects the needs of professionals who will be leading and supporting adaptation efforts. Further, presentation of this information should consider some of the psychological barriers that accompany the issue, and understand how these barriers influence people to respond, or not respond to climate change. As adapting to climate change in coastal communities is an emerging issue that is not unique to Oregon, research efforts and findings should be coordinated, shared, and discussed nationally and internationally to promote knowledge and understanding of climate change science, impacts on coastal communities, adaptation strategies, and how to best assist communities in planning to adapt.

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APPENDIX A. Web-based survey of Oregon coastal professionals

Climate Survey

Introduction

In taking the survey, your responses will be added together with others and recorded as a group. Special precautions have been established to protect the confidentiality of your responses. If the results of this project are published your identity will not be made public. You may refuse to answer any question(s) for any reason.

There are no foreseeable risks to you as a participant in this project. Upon request, participants will be entered in a prize drawing for membership in The Coastal Society, a professional organization, and participants may also request a summary of survey results.

If you have any questions about the survey, please contact Joe Cone at (541) 737-0756 or by email at joe.cone@oregonstate.edu. If you have questions about your rights as a participant in this research project, please contact the Oregon State University Institutional Review Board (IRB) Human Protections Administrator at (541) 737-4933 or by email at IRB@oregonstate.edu.

Take Survey
To go to the online survey now click "NEXT"

Questionnaire

NAVIGATION INSTRUCTIONS:

The "Next" button at the bottom of each page allows you to proceed to the next page of the survey.

If you wish to return to the previous survey page, please do not use the "back" function of your web browser; instead use the "Prev" button at the bottom of the survey page.

If you wish to leave the survey temporarily and return later, you can click the original link you received in the email invitation and you should be returned to the same location of the survey where you stopped.

1. In what county does your main work occur?

- ○ Clatsop
- ○ Tillamook
- ○ Lincoln
- ○ Lane
- ○ Douglas
- ○ Coos
- ○ Curry
- ○ Other

Other (please specify)

2. Do you now live at the Oregon Coast?

- ○ Yes
- ○ No

Years on Oregon Coast

3. Approximately how many years in total have you lived at the Oregon coast?

Climate change

Climate Survey

4. Please indicate your personal level of agreement with the following statements. Note that the statements are different from each other in certain details, which are highlighted by CAPS:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	No opinion
I am concerned about reported changes and variability in the Earth's climate.	○	○	○	○	○	○
I am concerned about how changes in the Earth's climate might affect THE OREGON COAST during this century.	○	○	○	○	○	○
It's important FOR GOVERNMENTS to take immediate steps to reduce the apparent CAUSES of global climate change (for example, by reducing fossil fuel emissions).	○	○	○	○	○	○
It's important FOR INDIVIDUALS to take immediate steps to reduce the apparent CAUSES of global climate change (for example, by reducing fossil fuel emissions).	○	○	○	○	○	○
It's important FOR GOVERNMENTS to prepare for the EFFECTS of climate change that are predicted to occur IN OREGON by reducing local vulnerability.	○	○	○	○	○	○
It's important FOR INDIVIDUALS to prepare for THE EFFECTS of climate change that are predicted to occur IN OREGON by reducing local vulnerability.	○	○	○	○	○	○
I consider myself well-informed about the expected EFFECTS of global climate change ON OREGON.	○	○	○	○	○	○

Information sources

5. Which of the following do you use to obtain information about climate change? (Please choose the most applicable response)

	Don't use	Sometimes	Frequently	No access to
Science Web sites	○	○	○	○
News Web sites	○	○	○	○
TV news	○	○	○	○
Newspapers	○	○	○	○
News magazines	○	○	○	○
Documentary films/videos	○	○	○	○
Books or other publications	○	○	○	○
State agencies	○	○	○	○
Federal agencies	○	○	○	○
Oregon universities	○	○	○	○
Personal contacts with scientists	○	○	○	○
Professional colleagues	○	○	○	○
Personal experience	○	○	○	○
Other	○	○	○	○

Other (please specify)

Climate Survey

Your professional needs

The next questions ask you to reflect on the work you do as part of your regular profession, a voluntary position, or appointed position on a board, council or other organization where your work tasks are related to coastal planning, management, or economic development.

6. How many years have you been involved in a coastal-related profession or position?

7. Please select the category that best matches your primary profession or position. (Choose only one)

- City council member
- County commissioner
- Tribal official
- Port staff
- Port commissioner
- Planning commission member
- City/town manager
- City/town planner
- City/town engineer
- Realtor
- Developer
- Chamber of Commerce
- Environmental consultant
- Geotechnical consultant
- Insurance (property)
- Insurance (other)
- Banking/lending
- Other

Other (please specify)

Your professional needs continued

8. In the comment boxes below, please express briefly in your own words as many as five RISKS that you associate with the effects of climate change on the Oregon coast.

Risk 1

Risk 2

Risk 3

Risk 4

Risk 5

Your professional needs continued

Climate Survey

9. Please indicate your level of agreement with each of the following statements about responding or adapting to climate change effects at the Oregon coast, as it involves your work.

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly Agree	No opinion
I already have a full load of activities and can't add another.	○	○	○	○	○	○
I don't have enough information about how climate change may affect my work (such as the resources, areas, or community infrastructure within my responsibility).	○	○	○	○	○	○
I know of no authoritative sources for climate information in Oregon.	○	○	○	○	○	○
I don't believe climate change requires action from me in the next year or two.	○	○	○	○	○	○
I'm not hearing any urgency about local climate change effects from those who influence or assign my work.	○	○	○	○	○	○
I'm not hearing any urgency about local climate change effects from those who influence me OUTSIDE OF WORK.	○	○	○	○	○	○
No other coastal community like mine anywhere in the United States is addressing climate change in a significant way.	○	○	○	○	○	○
I'd be willing to take action in my work if I had compelling information about anticipated risks in the future.	○	○	○	○	○	○
I'd be willing to take action in my work if there were new funding available to do so.	○	○	○	○	○	○
I'd be willing to take action in my work if I hear a sense of local urgency to do so.	○	○	○	○	○	○
I think climate change is more important for the next generation of decision-makers.	○	○	○	○	○	○
Given the predicted timeframe of climate change effects, it's important to involve people now aged 21-31 in public decision-making processes.	○	○	○	○	○	○
Options on how to successfully address climate change impacts on my community will be greater in the future than now.	○	○	○	○	○	○
I'm ready to be a leader on this issue.	○	○	○	○	○	○
I'm prepared to devote time and resources to this issue.	○	○	○	○	○	○

Your professional needs continued

Climate Survey

10. Please rate each of the following potential GENERAL areas of assistance according to your need for them during the NEXT 2 YEARS.

	Don't Need	Not sure	Need - but sources are available to me	Need - and sources are NOT available to me
Data or information to better understand or predict the likely effects of climate change on coastal communities	○	○	○	○
Assistance with community vulnerability or risk assessments.	○	○	○	○
Planning assistance to adapt to the anticipated effects of climate change on the built environment, including water systems, sewer, streets/roads, bridges, and public buildings.	○	○	○	○
Funding to assess vulnerability, develop adaptation plans, or to implement adaptation measures.	○	○	○	○
Credible, relevant informational materials to provide to the public about climate change	○	○	○	○
Other	○	○	○	○

Other (please specify)

Your professional needs continued

11. Please review the following list of topics related to climate change. First rate the importance of that topic in the performance of your present job, then indicate how much information you currently have on that topic.

	Importance of information	Amount of information you currently have
Sea level rise predictions		
Effects of sea level rise on existing shoreline protective structures		
Changes in flood elevations, shoreline erosion, and beach width		
Changes in frequency and intensity of storms and the potential effect on building design standards		
Changes in ocean conditions which may affect Oregon's marine ecosystems, ocean productivity or marine species composition.		
Changes in rainfall which might increase landslides		
Changes in rainfall which might alter ocean or bay salinity and other aspects of estuarine habitat		
Climate change effects on coastal weather		
Climate change effects on community infrastructure: water systems, sewer, streets/roads, bridges, and public buildings		
Climate change impacts on energy resources		
Updates on the latest climate change scientific data and how the Oregon coast may be affected		
Location-specific effects of climate change		
Changes in climate which may introduce new diseases and pests to the area		

Climate Survey

Projected economic costs and benefits.

Your professional responsibilities

12. Which of the following ocean or coastal management issues do you/does your organization focus on? (check all that apply)

- [ ] Water quality/drinking water protection
- [ ] Watershed management
- [ ] Soil erosion control
- [ ] Storm water management
- [ ] Climate change mitigation (reducing causes)
- [ ] Climate change adaptation
- [ ] Coastal development/review of development plans
- [ ] Wetlands protection
- [ ] Septic and sewage systems
- [ ] Land or habitat conservation
- [ ] Compliance with environmental regulations and code enforcement
- [ ] Port and marina infrastructure
- [ ] Dredging and disposal of dredged material
- [ ] Public access to beaches, coastal waters, and natural resources
- [ ] Recreation and tourism
- [ ] Coastal erosion
- [ ] Tsunami preparation
- [ ] Fisheries management
- [ ] Other

Other (please specify)

Your professional responsibilities

13. How much of your work time on a daily basis is committed to focusing on the ocean or coastal resource management issues you just reviewed in the previous question?

- ○ I don't focus on ocean and coastal resource management issues
- ○ My organization doesn't focus on ocean and coastal resource management issues
- ○ At least 1/4 of my time
- ○ 1/2 of my time
- ○ 3/4 of my time
- ○ All of my time

14. How often do you attend professional development programs relevant to ocean or coastal resources?

- ○ I never attend such programs
- ○ Less than once a year
- ○ About once a year
- ○ More than once a year
- ○ I don't know

Climate Survey

15. Does your position require that you receive any type of continuing education credits to maintain your position or to achieve promotion?

- ○ Yes
- ○ No
- ○ Not sure

Continuing Education Credit

16. If you answered yes, what are the units of continuing education credit that are required?

- ○ Professional Development Hours (PDH)
- ○ Continuing Education Units (CEU)
- ○ American Institute of Architects (AIA)
- ○ Don't remember
- ○ Other

Other (please specify)

Sources of information

17. Please rate the following sources of coastal scientific and technical information, first on whether you have used information from them and second, how you value them as information sources.

	Frequency of use	Value as information source
My colleagues at work		
Private consultants		
National Oceanic and Atmospheric Administration (NOAA) – other than NOAA's National Weather Service		
National Weather Service		
Oregon Department of Land Conservation and Development (DLCD)		
Oregon Department of Geology and Mineral Industries (DOGAMI)		
Oregon Coastal Zone Management Association (OCZMA)		
Oregon State University		
Oregon Sea Grant		
University of Oregon		
Local or state conservation organization (Please specify in blank below)		
National conservation organization (Please specify in blank below)		
My professional association (Please specify in blank below)		

Climate Survey

18. Please specify the information sources listed below if you indicated use in the previous question.

Local or state conservation organization	
National conservation organization	
My professional association	

Information delivery preferences

19. Assuming that it would fit your needs and cost little or nothing, please rate the following methods of delivering information to you, according to whether you would use them or not.

	Potential for use
Workshop (within one hour of your workplace)	
Workshop at OSU in Corvallis	
Customized training to meet specific local needs	
Printed material (mailed)	
Printed material (download from Web)	
Audio/visual material (DVD, mailed)	
Audio/visual material (download from Web or viewed online)	
Audio/visual material (broadcast on TV)	
Audio material (broadcast on radio or podcast)	

Oregon communities and climate change

20. What is your feeling about how the following terminology is accepted, or would be accepted, in Oregon coast communities?

	Well accepted	Accepted	Neutral	Not accepted	Strongly not accepted	No opinion
"Climate change"	○	○	○	○	○	○
"Global warming"	○	○	○	○	○	○
"Community resilience"	○	○	○	○	○	○
"Community adaptability"	○	○	○	○	○	○

Your background

Finally, please answer the following questions about your background. This information will only be used in a general summary about survey respondents and will otherwise be kept confidential.

21. What is your age?

Climate Survey

22. What is your gender?

- ○ Male
- ○ Female

23. Please indicate the highest education level you have completed.

Your comments

24. Please use the box below to provide additional comments on any of your responses or other input you think will be important to determining climate change information needs of individuals in your profession.

25. FOR SURVEY REVIEWERS: Please use this space to critique the survey on technical or grammatical/wording problems AND questions, formatting and other issues that you think may affect survey response by coastal decision-makers.

Thank you

Thank you for participating in this survey. Your input will be valuable to determining information needs for ocean and coastal managers and decision-makers on the Oregon Coast

Below we offer some opportunities as a thank you for your participation in this survey. By checking yes for either opportunity, you give us permission to retain your email address solely for purposes of contacting you to follow up.

26. If you'd like to be entered in a prize drawing for two one-year individual memberships (or extensions) with The Coastal Society (value: $60 each), please check the following box.

- ○ Yes, please enter me in the drawing for a TCS membership
- ○ I am not interested in the drawing

27. If you'd like to receive a summary of the research results, please check below.

- ○ Yes, please send me a summary of the research results
- ○ Do not send me a summary of the research results