

An Analysis of a Survey
of Oregon Coast
Decision Makers Regarding

Climate Change

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Executive Summary

SUMMARY OF KEY FINDINGS

1. Most participants in this 2008 survey were concerned about climate change and how it may affect the Oregon coast, and they believed that governments and individuals should take action to reduce the causes and prepare for effects of climate change.
2. The most frequently cited risks associated with effects of climate change on the Oregon coast involved physical processes (for example, sea level rise and erosion), followed by ecosystem effects and specific social and economic impacts.
3. Few survey participants were ready to respond to climate change now, with less than half stating that they were prepared, at the time of their 2008 response, to devote time and resources to climate change, and only one-third ready to be a leader on this issue.
4. People would be willing to take action in work if there were compelling information, new funding, and a sense of local urgency. However, there was little urgency within the workplace about local climate change, and half of respondents did not have enough information about how climate change might affect their work.
5. Coastal professionals had needs for assistance regarding climate change, particularly credible,



relevant information to provide the public, and also data or information to better understand or predict the likely effects of climate change on coastal communities. Additionally, public-sector professionals had a need for new funding to address climate change. This was not rated as important of an issue by private-sector professionals.

6. Coastal professionals had low amounts of information on climate change topics that they consider important for the performance of their work, with the top information needs (in terms of importance versus amount) including climate change effect on community infrastructure, and effects of sea level rise on shoreline protective structures.

Introduction



BACKGROUND AND PURPOSE

The global climate is changing, and these changes will have ecological, social, and economic implications. Impacts are expected to vary regionally, with coastal regions being particularly vulnerable. In the Pacific Northwest, increases in sea level, storm surges, and inundation are expected to have cumulative effects on coastal erosion and flooding. These, in turn, could lead to coastal

infrastructure damage, beach and bluff breaching of the natural and human-made shoreline, increased landslides, and road washout. These effects will be amplified as coastal populations and development continue to increase. To date, little has been done to direct climate change outreach toward the needs of Oregon coastal communities.

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. The program often plays the

role of a “boundary organization,” facilitating dialogue between and among scientists, policy makers, and the public (Tribbia and Moser, 2008). Oregon Sea Grant received a grant for 2007–09 from the NOAA Climate Program Office to conduct outreach and engagement activities with coastal decision-makers and communities to help them prepare for climate change. An essential component of this effort is understanding the opinions, attitudes, and

information needs of the individuals we hoped to assist—specifically, Oregon coast professionals who make decisions about development in the coastal zone. This study, conducted during 2008, evaluated their perceptions and opinions about climate change and climate change information; their motivation toward and barriers to undertaking climate change-related activity; the importance they attached to being able to respond to specific climate change effects; and what assistance, if any, they believed they needed in order to respond.

RESEARCH QUESTIONS

- What are the climate change perceptions and opinions of Oregon coastal professionals?
- What are the climate change information needs of Oregon coastal professionals?
- What barriers (psychological; social; institutional) exist that may hinder, impede, or prevent adaptation to climate change?
- How do coastal professionals obtain climate change information, and what are their preferred sources of information?
- How do Private-sector respondents differ from Public-sector respondents?

Methods

SURVEY DESIGN AND ADMINISTRATION

During February 2008, the project research team developed a purposeful¹ sample of coastal managers and practitioners by contacting coastal leaders who could assist with providing access to e-mail lists of their associates. These lead contacts included city managers, port managers, fisheries managers, legislators, tribal representatives, transportation managers, bankers, geologists, other coastal scientists, real estate developers, and marine consultants. This solicitation of contacts resulted in survey invitations going to 876 individuals (the response rate is

summarized in the Results section).

The project team asked our lead contacts to provide us with e-mail addresses to which an individualized link to an online survey could be sent (the “direct” contact method). If these contacts felt it was inappropriate to share the e-mail addresses with the researchers, they were asked to forward an anonymous survey link to their colleagues (the “indirect” contact method). This direct/indirect options were necessary to ensure participation.

In all cases, contacts were asked to communicate with their colleagues about the survey with an e-mail either announcing the survey² or providing the anonymous link.

Contacts who forwarded an anonymous link were also asked to indicate the number of people contacted by their communications (that is, the number of people on their mailing list). There was one case in which the lead contact provided us with the number of people on his/her mailing list, but noted that an unknown proportion of the list does not live or work on the coast and therefore would likely not participate in the survey.

The survey was administered online in the spring of 2008

using SurveyMonkey software and dissemination tools. SurveyMonkey allows for survey administration in either the direct or indirect method, described above. The software enables tracking of response rate. A reminder e-mail was sent either via SurveyMonkey approximately one week after the initial mailing (direct method) or by the lead contact approximately one to two weeks after the initial mailing (indirect method).

DATA LIMITATIONS

The sampling method was chosen because it allowed us to feasibly sample a substantial number of Oregon coast professionals (n=300). However, since it was not a random sample, results cannot be considered representative of the target population (for example, some professions are better represented in the sample than others). Additionally, survey responses were dominated by the north Oregon coast (from Lincoln County northward), with less participation from the south coast. This was largely by design, as we had made a preliminary determination to focus the project on the north coast, because a key expected climate effect—sea level rise—was of greater relevance and likely to be of greater concern there. Given these limitations, this survey is one of the largest samplings of the Oregon coast to date on climate change adaptation, and provides good insight into the concerns, knowledge, and barriers-to-action of Oregon coast professionals.



¹ Purposeful sampling is selection of participants “who have experience with the central phenomenon or the key concept being explored” (Creswell and Clark 2007, 112).

² The message advised recipients that “you will receive a survey e-mail soon from Joe Cone of Oregon Sea Grant.” That second e-mail provided a link (URL) to the survey that was unique to the participant.

Results

RESPONSE RATE

A total of 300 out of 876 invitees participated in the survey, resulting in a total response rate of 34%. Participation for the direct-contact method (survey sent via SurveyMonkey) resulted in a response rate of 45%. Participation for the indirect-contact method (when number of total contacts was known) resulted in an average response rate of 22%; and in the case where the gatekeeper provided us with 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 (survey was not relevant), the response rate was 10%.

DEMOGRAPHICS

Primary profession or position

Respondents represented both Public- and Private-sector professions (Table 1) and included city, county, tribal, port, state, and federal agency positions as well as realtors, environmental and geotechnical consultants, and bank/lending positions. The respondents were split into two subgroups: (1) Public sector (defined as those who work for the government at any level), and (2) Private sector (defined as nongovernment employees). It should be noted that the Private group is comprised predominantly of Realtors (65%). Where appropriate, Public- and Private-sector responses to survey questions were compared using Mann-Whitney *U* and Chi-square statistical tests, and significant differences ($p < .05$) are noted where found.

The majority of respondents have worked more than 5 years in their

Public-sector professions	% Public
City	33
State	19
Emergency	10
Misc	9
Federal	8
Scientist	7
County	7
Port	6
Tribal	1
N	151

Private-sector professions	% Private
Realtor	65
Geotech	14
Banking	7
Environmental consultant	6
Legal	2
Captain/Seaman	2
Environmental/Conservation org	2
Hospitality/tourism/Restaurant	2
Ocean engineer	1
Survey and mapping	1
N	121

Table 1. Profession of respondents in the Public- and Private-sector subgroups.

County	% Public	% Private
Lincoln	30	68
Tillamook	21	13
Clatsop	21	2
All Oregon coastal counties	6	3
Oregon non-coastal counties	6	6
Coos	5	3
Curry	4	1
Entire State of Oregon	3	3
Washington State	2	3
Lane	1	1
Douglas	1	0
Other (offshore, Hawaii)	1	0
N	146	120

Table 2. County/region in which respondents' main work occurs, in descending order of percent Public.

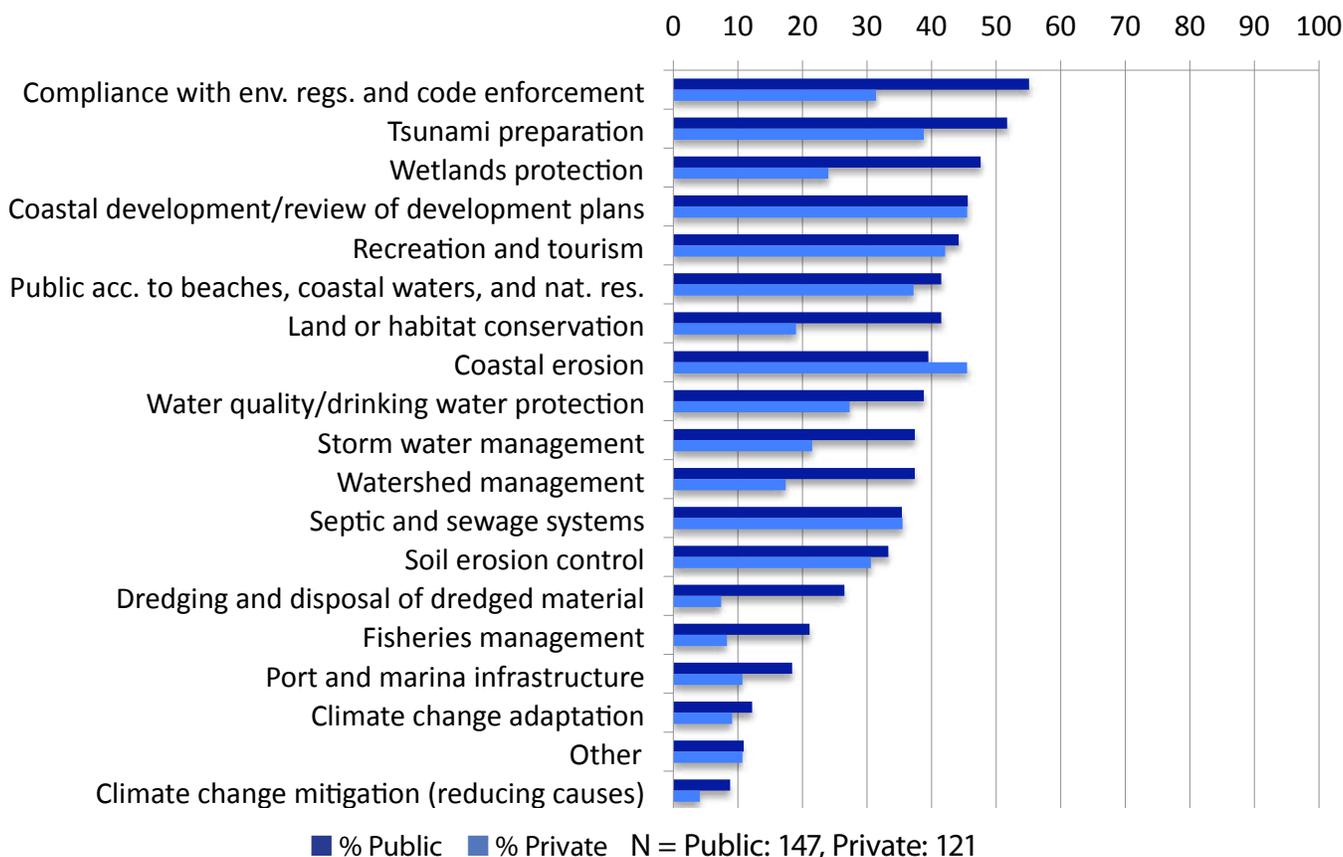


Table 3. Ocean and coastal management issues focused on by the Public- and Private-sector respondents, in descending order of percent Public.

noted capacity (78%), with a mean of 15 years’ experience (N=266). There is no significant difference between Public and Private groups for number of years in a coastal management-related profession.

Presence on the coast

Most respondents live at the Oregon coast (72%, N=295). Of those living on the coast, the mean residence time is 19 years, and 82% have a history of living on the coast for more than 5 years. A distance qualifier (such as, *Do you live within 10 miles of the shore?*) was not included in the survey question. There is no significant difference between Public and

Private for number of years living on the Oregon coast.

Lincoln, Tillamook, and Clatsop are the counties in which most of the Public group’s work occurs, with the Private group representing primarily Lincoln County (68%, Table 2). It should be noted that among the Private group respondents, 95% of the Realtors are from Lincoln County.

Ocean and coastal management issues focused on at work

Slightly over half of the Public-sector participants responded that they spend at least a quarter of their work time on coastal and ocean resource management issues at work (55%);

while less than 16% of Private focus on these issues at work.

Survey participants were provided a list of ocean and coastal management issues, and were asked to mark all issues that they or their organization focus on (Table 3).

For the Public sector, the top three management issues that they address are *Compliance with environmental regulations and code enforcement* (55%), *Tsunami preparation* (52%), and *Wetlands protection* (48%). Private respondents listed *Coastal development/review of development plans* (46%), *Coastal erosion* (45%), and *Recreation and tourism* (42%) as the top coastal management issues they deal with.

Age, gender, education

The mean age for all respondents is 51 years (N=217) and ranges from 24 to 80. There is no significant difference between mean age for Public (50, N=118) and Private (53, N=92) groups.

Two-thirds of all respondents are male. There is a significant difference between Public and Private for gender ($\chi^2=8.7$, $df=1$, $p<.01$), with the Public group having a larger percent of males than the Private group (74% and 53%, respectively).

Most respondents have a bachelor's degree or higher (68%), with a master's degree being the most common education level for both Public- (37%) and Private- (30%) sector subgroups.

RESPONSE TO CLIMATE CHANGE

There are numerous and complex factors that influence how individuals and governments are responding to climate change. This research investigates Oregon coast professionals' behavioral intentions to adapt to climate change because

intentions have been found to be the most direct and accurate predictor of an individual's corresponding behavior (Fishbein and Manfredo, 1992). We were guided by psychological research that has found that an intention to perform a particular behavior is driven mainly by attitudes, perceived peer-group norms, and feelings of self-efficacy (Fishbein and Yzer, 2003). These "proximal" variables are influenced by demographics, culture, stereotypes and stigma, perceptions of risk, moods and emotions, media exposure, and other "distal" variables.

Attitudes are based on one's beliefs about the positives and negatives of performing a given behavior; perceived norms develop from what others around us are doing or not doing; and self-efficacy, or perceived behavioral control, is the belief that one can perform the behavior in spite of various challenges. Once someone has the intention to perform a certain behavior, external challenges can remain that may prevent them from performing the intended behavior, including envi-

ronmental constraints (for example, lack of funding) and lack of skills (for example, not knowing the best method to reduce erosion rates). Therefore, since measuring intention alone is not as informative as measuring intention relative to barriers, this research investigates coastal professionals' behavioral intentions to respond to climate change as well as some of the factors that have been found to directly or indirectly influence intention.

Behavioral intention and barriers

Participants were asked their level of agreement with statements that represent intention to respond to climate change, willingness or ability to take action on climate change given certain barriers, and personal and social normative belief barriers. Level of agreement was answered on a scale of 1=Strongly disagree, 2=Disagree, 3=Neither agree nor disagree, 4=Agree, 5=Strongly agree.

Less than half of the survey respondents are prepared or ready to respond to climate change in their work, with only 45% prepared to

Statement ¹	% who Agree or Strongly agree ²	N
I'm ready to be a leader on this issue.	31	237
I'm prepared to devote time and resources to this issue.	45	238
I don't believe climate change requires action from me in the next year or two. ³	19	247
I'd be willing to take action in my work if I had compelling information about anticipated risks in the future.	77	238
I'd be willing to take action in my work if there were new funding available to do so.	74	229
I'd be willing to take action in my work if I hear a sense of local urgency to do so.	74	241

1 Statements were rated on a five-point scale from 1=Strongly disagree to 5=Strongly agree.

2 Percent Agree and Strongly agree were combined.

3 Survey statement was negatively framed, which is reflected in the low percent agreement.

Table 4. Level of agreement for all survey respondents regarding their intention to take action to respond to climate change in their work.

devote time and resources to climate change, and only 31% ready to be a leader on this issue (Table 4). At the same time, most survey participants agreed or strongly agreed with statements about being willing to take action in work *if* they were able to overcome a particular barrier. These barriers include the need for compelling information (77% agreement), new funding (74% agreement), and a sense of local urgency (74% agreement).

About half of the survey participants were found to have either personal barriers or social norm barriers that may prevent them from responding to climate change (Table 5). We grouped as “personal barriers” statements that reflected both *attitudes* and a sense of *self-efficacy* toward responding to climate change effects on the Oregon coast. (The wording of the response choices does not permit finer discrimination.) Over half of the survey participants do not have enough information



about how climate change may affect their work (53% agree or strongly agree), and half are not hearing urgency about the local effects of climate change from those who influence their work (50% agree or strongly agree).

Public and Private professionals’ responses were significantly different on the following statements: *I’d be willing to take action in my work if there were new funding available to do so* ($U=4572.0, p<.01$), and *I’m not hearing any urgency about local climate change effects from those who*

Barrier type	Statement ¹	% who Agree or Strongly agree ²	N
Personal Barrier	I don’t have enough information about how climate change may affect my work.	53	234
	I know of no authoritative sources for climate information in Oregon.	34	239
	There will be more options in the future to successfully address the effects of climate change on my community.	43	227
Social Norm Barrier	I’m not hearing any urgency about local climate change effects from those who influence or assign my work.	50	241
	I’m not hearing any urgency about local climate change effects from those who influence me outside of work.	40	214
	No other coastal community like mine anywhere in the United States is addressing climate change in a significant way.	15	171

1 Statements were rated on a five-point scale from 1=Strongly disagree to 5=Strongly agree.

2 Percent Agree and Strongly agree were combined.

Table 5. Level of agreement for all survey respondents with statements regarding personal barriers and social norm barriers.

Statement ¹	% who Agree or Strongly agree ²	N
I am concerned about how changes in the Earth’s climate might affect THE OREGON COAST during this century.	82	219
I am concerned about reported changes and variability in the Earth’s climate.	81	217
It’s important FOR INDIVIDUALS to prepare for THE EFFECTS of climate change that are predicted to occur IN OREGON by reducing local vulnerability.	80	210
It’s important FOR INDIVIDUALS to take immediate steps to reduce the apparent CAUSES of global climate change.	78	209
It’s important FOR GOVERNMENTS to prepare for the EFFECTS of climate change that are predicted to occur IN OREGON by reducing local vulnerability.	77	205
It’s important FOR GOVERNMENTS to take immediate steps to reduce the apparent CAUSES of global climate change.	75	200

1 Statements were rated on a five-point scale from 1=Strongly disagree to 5=Strongly agree.

2 Percent Agree and Strongly agree were combined.

Note: Words in ALL CAPS appeared as such in the original survey to help make distinctions between statements.

Table 6. Level of agreement for all survey respondents with statements about climate change concerns and importance for action.

influence or assign my work (Mann-Whitney $U=5741.5, p<.01$). Public respondents are more willing to take action in work with new funding than Private professionals (80% and 65% agreement, respectively), while Public respondents are less likely than Private to *not* be hearing urgency from those who influence or assign their work (42% and 61% agreement, respectively).

Perceived importance of climate change

Respondents ranked statements regarding concerns about climate change and importance of government and individual involvement on a five-point scale (Strongly disagree, Disagree, Neither disagree nor agree, Agree, Strongly agree) or No Opinion (Table 6). The majority of respondents agreed or strongly agreed with all statements regarding concerns about climate changes

and importance of government and individual involvement (75% or higher). The highest agreement was with the statements, *I am concerned about how changes in the Earth’s climate might affect the Oregon coast during this century* (82%), and *I am concerned about reported changes and variability in the Earth’s climate* (81%). A non-parametric Mann-Whitney test demonstrated there was no significant difference between Public and Private sectors on these issues.

Perceived risks

Participants were asked to list up to five risks that they associate with the effects of climate change on the Oregon coast (not in ranked order). This was an open-ended question (five blanks) and was intentionally placed prior to questions referring to any specific risks to avoid priming the respondent. Responses were

reviewed independently by two researchers (climate change extension professionals working with Oregon Sea Grant) who came to consensus on a list of 10 thematic codes. These codes were then used by one of these researchers to code all risk statements (Table 7). The most common theme was *Impacts of climate change on ocean and coastal processes: sea level rise, shoreline erosion, sediment transport and beach width, flood elevations*. Significant difference between Public and Private sectors were not evaluated for these perceived risks (given 883 total responses and as many as 5 responses from each respondent).

ASSISTANCE PERCEPTIONS

Participants were asked to rate their level of need for assistance on a given list of topics during the next two years based on four categories: Don’t need, Not sure, Need and resources

are available to me, and Need and resources are not available to me. The highest area of perceived need for climate information or assistance is *credible, relevant informational materials to provide to the public*

about climate change (76% responded that they need that information, and of those who need it, 69% responded that the resource is not available to them; Table 8).

The Public sector is more likely

than the Private to respond that they need *funding to assess vulnerability, develop adaptation plans, or to implement adaptation measures* (68% and 49%, respectively; Mann-Whitney $U=5096.5, p<.001$).

Risk categories	% of total
Impacts of climate change on:	
Ocean and coastal processes: sea level rise, shoreline erosion, sediment transport and beach width, flood elevations	32
Coastal weather and storms	17
Terrestrial and riverine ecosystems: forest fires, landslides, stream flow, exotics	13
Marine ecosystems: ocean productivity, species composition, endangered species, exotic species	12
Community infrastructure: roads and bridges, water and sewer systems, public buildings and existing shoreline protective structures, jetties, ports	8
Human livability and safety: diseases, agriculture, public access to recreation	6
Economics, and costs and benefits: net migration, loss of productivity, building design standards, transportation, tourism, etc.	6
No worries, I'm not buying it	3
Estuarine ecosystems: salinity, rainfall	3
Energy resources	0
Total statements	883

Table 7. Frequency of listed climate change risks that fell into each of 10 risk themes, in descending order of percent of total risk statements.

Data or information type/format¹	% Need	% Need but not available	N
Credible, relevant informational materials to provide to the public about climate change	76	69	231
Data or information to better understand or predict the likely effects of climate change on coastal communities	72	58	232
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.	63	68	229
Assistance with community vulnerability or risk assessments.	61	63	232
Funding to assess vulnerability, develop adaptation plans, or to implement adaptation measures.	60	85	233

¹ Statements were rated as Don't need, Not sure, Need and sources are available to me, and Need and sources are not available to me.

Table 8. Percent of all respondents who need climate change assistance during the next two years; and of those who need assistance, the percent who said that the resource is not available to them.

**INFORMATION TOPICS—
IMPORTANCE VERSUS
AMOUNT POSSESSED**

Survey participants were asked to review a list of topics related to climate change and rate them by importance of information in the performance of their work (1=Not important, 2=Slightly important, 3=Somewhat important, 4=Important, 5=Very

important) and by amount of information they currently have (1=No information, 2=Little information, 3=Some information, 4=Good amount of information, 5=All necessary information).

Ratings of high importance (*Important* or *Very important*) were combined, and ratings of high information (*Good amount of information* or *All necessary information*) were

combined to determine the topics considered the most important and the topics with the most and least amounts of information among survey participants (Table 9). In order to determine information needs, ratings of information importance were compared with information amount by plotting the mean ratings of each for all of the provided climate change topics (Figure 1). An overall

Climate change topic ¹	% saying Highly important ²	N	% saying High information ³	N
Changes in flood elevations, shoreline erosion, and beach width	84	179	7	138
Effects of sea level rise on existing shoreline protective structures	79	168	7	148
Climate change effects on community infrastructure: water systems, sewer, streets/roads, bridges, and public buildings	78	166	4	161
Changes in ocean conditions which may affect Oregon’s marine ecosystems, ocean productivity or marine species composition	78	165	7	132
Updates on the latest climate change scientific data and how the Oregon coast may be affected	77	163	5	141
Changes in rainfall which might increase landslides	76	162	7	147
Climate change effects on coastal weather	76	164	7	127
Changes in frequency and intensity of storms and the potential effect on building design standards	74	157	5	150
Sea level rise predictions	74	160	14	111
Location-specific effects of climate change	71	151	4	163
Projected economic costs and benefits of climate change	68	144	4	164
Climate change impacts on energy resources	66	140	5	155
Changes in rainfall which might alter ocean or bay salinity and other aspects of estuarine habitat	66	139	5	154
Changes in climate which may introduce new diseases and pests to the area	65	137	3	172

1 Climate change topics were rated on a five-point scale for information importance (1=Not important, 2=Slightly important, 3=Somewhat important, 4=Important, and 5=Very important) and information amount (1=No information, 2=Little information, 3=Some information, 4=Good amount of information, and 5=All necessary information).

2 Percent ratings of Important and Very important were combined to represent “Highly important.”

3 Percent ratings of Good amount and All necessary information were combined to represent “High information.”

4 “Information need” was calculated by subtracting percent ratings of “High information” from “Highly important” for each climate change topic.

Table 9. Based on a provided list of climate change-related topics, percent of respondents who gave ratings of high importance and percent who said they have high amounts of information, in descending order of information importance.

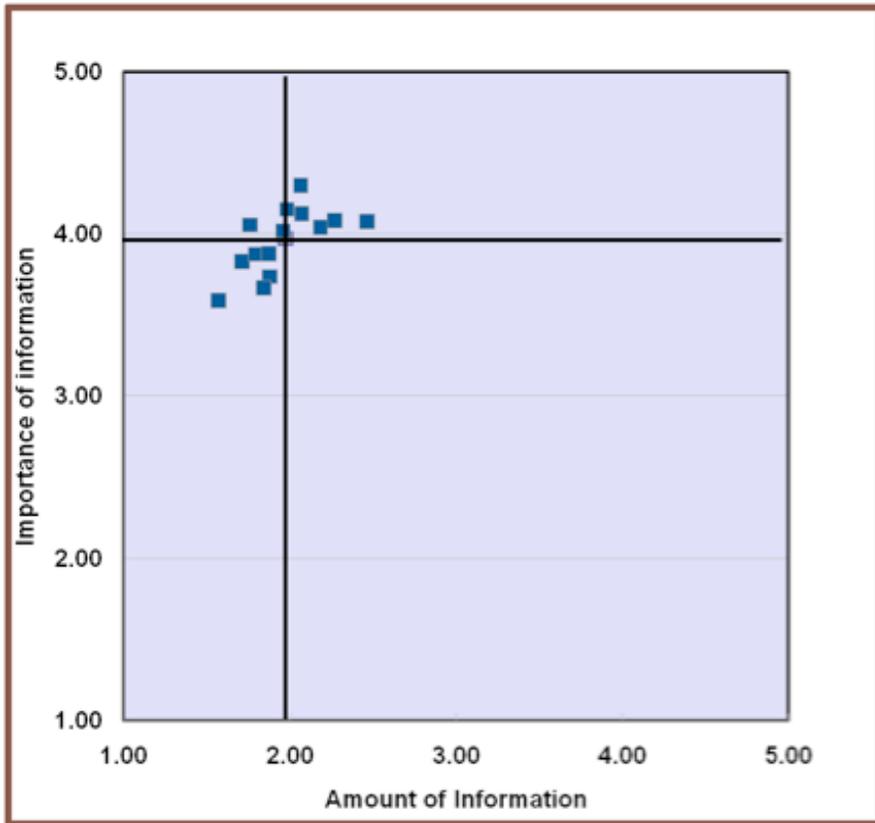


Figure 1. The amount of information the respondents currently have (x-axis) versus how important that information is for the performance of their work (y-axis) for climate change related topics. Gridlines represent the overall mean rating of information amount (2.0 out of 5.0) and importance (4.0 out of 5.0).

mean value was calculated for the two criteria, and topics that fell above the overall mean for both information importance and information amount were considered areas of highest need, and thus, potential areas to focus outreach and engagement efforts.

All of the climate change topics were rated as important to have (65% to 84% saying *Important* or *Very important*), while at the same time, respondents have very little information on those topics (only 3% to 14% saying they have a *Good amount* or *All necessary information*). The climate change topic rated most important was *Changes in flood elevations, shoreline erosion, and beach width* (84% said *Important* or

Very important), and the topic where respondents have the least information is *Changes in climate which may introduce new diseases and pests to the area* (3% said they have a *Good amount* or *All necessary information*). The topics with the highest information needs (fell above the overall mean values for importance and amount) were: *Climate change effects on community infrastructure* and *Effects of sea level rise on existing shoreline protective structures*.

The Public and Private sectors did not differ significantly in their ratings of how much information they have on the provided climate change topics; however, they did differ significantly in ratings of im-

portance for some of the topics. The Private sector gave higher ratings of importance for the following climate change topics: *Sea level rise predictions* (Mann-Whitney $U=4811.0, p<.05$), *Climate change impacts on energy sources* ($U=4513.0, p<.05$), *Effects of sea level rise on existing shoreline protective structures* ($U=4639.5, p<.05$), *Changes in flood elevations, shoreline erosion, and beach width* ($U=4771.0, p<.05$), *Changes in frequency and intensity of storms* ($U=4382.5, p<.01$), and *Changes in climate which may introduce new diseases and pests* ($U=4438.5, p<.05$).

WHERE RESPONDENTS OBTAIN INFORMATION ABOUT CLIMATE CHANGE

Frequency of information use

Participants were given a list of information media sources and asked how often they use each source (Table 10). The most popular information sources (highest percentage for “Frequently” use) are *Newspapers* (52%), *TV news* (43%), and *News Web sites* (36%). Some survey participants



Information type ¹	% who	
	Frequently use	N
Newspapers	52	256
TV news	43	256
News Web sites	36	256
Personal experience	34	248
Documentary films/videos	34	259
Books or other publications	31	251
News magazines	30	253
Professional colleagues	27	251
Science Web sites	23	252
State agencies	22	255
Federal agencies	21	252
Oregon universities	19	253
Personal contacts with scientists	17	248

1 Information sources were rated as Don't use, Sometimes use, Frequently use, or No access.

Table 10. Ratings of use for various information sources for all survey respondents.



(10%) wrote in other sources, the most common of which was radio (20% of respondents who wrote in a source for “other” listed National Public Radio).

Public-sector and Private-sector groups were significantly different in frequency of use of certain information sources. Public professionals are less likely than Private to use news Web sites (Mann-Whitney $U=6835.5$, $p=.02$) and TV news ($U=6602.5$, $p=.01$), and more likely than Private to use state ($U=6274.5$, $p=.001$) and federal agencies ($U=5902.5$, $p<.001$).

Specific information sources (frequency and value)

Participants were asked to evaluate more specific sources of information by frequency of use and perceived value. Frequency of use (Scale=Never, Seldom, Occasionally, or Often) and perceived Value

(Scale=Poor, Fair, Good, or Excellent) are reported in Table 11.

The information source that the most respondents ranked as using Occasionally or Often were *My colleagues at work* (65%), the *National Weather Service* (65%), and NOAA (*other than the Weather Service*) (61%). The information sources that received the highest percent of responses for Good to Excellent value were NOAA (*other than National Weather Service*) (91%), *Oregon State University* (91%), and the *National Weather Service* (90%).

Public- and Private-sector respondents are significantly different in frequency of use for all information sources in Table 10, except for *Private consultants*, *National Weather Service*, and *My professional association* (Chi-Square, $p<0.05$). In all cases of significance for frequency of use, the Public sector uses these sources

more frequently than Private. For value of information sources, Public and Private differ only for *National Weather Service* (rated higher by Public) and *National Conservation organization* (rated higher by Private; $p<0.05$).

Information delivery preferences

Survey participants were asked to rate various methods of information delivery (most likely use, likely use, somewhat likely to use, probably would not use, and would not use), and were told to assume that the delivery would fit their needs and cost little or nothing. Survey participants preferred information to be delivered as mailed printed material (68%), via a workshop within one hour of their workplace (65%), or through printed material downloaded from the Web (63%; Table 12).

Information source ¹	Frequency of use ²		Value ³ Good to Excellent	
	Occasionally to Often	N		N
My colleagues at work	65	197	73	159
National Weather Service	65	197	90	150
NOAA (other than National Weather Service)	61	190	91	153
Oregon State University	54	189	91	106
My professional association	49	192	77	127
Oregon Department of Geology and Mineral Industries	47	194	85	97
Oregon Coastal Management Program in OR DLCDC	42	188	73	118
Private Consultants	35	189	66	96
Oregon Sea Grant	32	187	85	94
Local or state conservation organization	31	191	60	103
Oregon Coastal Zone Management Association (OCZMA)	31	195	63	98
National conservation organization	26	194	67	117
University of Oregon	23	190	81	105

1 Information sources were rated for frequency of use (Never, Seldom, Occasionally, or Often) and value (Poor, Fair, Good, or Excellent).

2 Percent who responded that they use the information source occasionally or often.

3 Percent who gave a value rating of good or excellent.

Table 11. Frequency of use and perceived value of specific information sources for all survey respondents. In descending order of percent that use the information source occasionally or often.

Information delivery type	% Likelihood of use ¹			N
	Unlikely ²	Somewhat likely	Likely ³	
Printed material (mailed)	9	23	68	203
Workshop (within one hour of your workplace)	10	25	65	204
Printed material (download from Web)	10	27	63	206
Customized training to meet specific local needs	15	23	62	201
Audio/visual material (DVD, mailed)	18	30	52	204
Audio/visual material (download from Web or viewed online)	20	29	51	203
Audio/visual material (broadcast on TV)	32	28	40	203
Audio material (broadcast on radio or podcast)	40	25	35	201
Workshop at OSU in Corvallis	41	28	31	200

1 Information delivery types were rated on a five-point scale of Would not use, Probably would not use, Somewhat likely to use, Likely to use, and Most likely to use.

2 Percent who responded that they would not use or probably would not use the delivery type.

3 Percent who responded that they would likely use or most likely use the delivery type.

Table 12. Preferences for information delivery for all survey respondents, in descending order of percent that responded that they were either *likely to use* or *most likely to use* the information delivery type.

There were no significant differences in responses between the Public and Private sectors, except that the Public responded that they would be more likely than Private to use a Workshop at Oregon State University ($\chi=16.2$, $df=5$, $p<.01$).

PROFESSIONAL DEVELOPMENT AND CONTINUING EDUCATION

Public-sector respondents are more likely than Private to attend professional development programs, with 55% of Public attending one or more times a year, while 40% of Private attend one or more programs a year (Mann-Whitney $U=5058.0$, $p<0.05$). About a quarter of all respondents never attend professional development programs. However, Private-sector respondents are more likely than Public to be required to maintain continuing education credits for promotion (72% and 23%, respectively; $U=3119.5$, $p<0.001$).



PERCEPTION OF ACCEPTANCE OF CLIMATE CHANGE TERMINOLOGY

Four terms were evaluated for acceptance in Oregon coastal communities: Climate Change, Global warming, Community resilience, and Community adaptability. Of these four, respondents believe

that the most well-accepted term is Climate Change (79% indicated Accepted or Well accepted), and the least-accepted term is Global warming (24% indicated Not accepted or Strongly not accepted). There were no statistical differences in acceptability between the Public and Private sectors for the four terms.

Discussion

Overall, survey participants are concerned about climate change and how it may affect the Oregon coast over the next century. Further, over 75% agree or strongly agree that governments and individuals should take action to reduce the causes as well as prepare for the effects of climate change. Risks that participants most frequently associated with climate change were physical processes (for example, sea level rise), followed by ecological effects, and social and economic impacts. Psychological research has found that negative experience—or even expectation of negative experience (such as increased erosion)—provides a strong explanation for perceptions of risk (Slovic et al., 2002). Although theory has found perceptions of risk to influence decision making, with risk perceptions and concerns driven by fear or anxiety having the potential to motivate risk-averse behavior (Lowenstein, et al., 2001), this research found that while concern and perceptions of risk were high, few survey participants are ready to act now to respond to climate change.

Barriers exist, both psychological and technical, that may be preventing coastal professionals from responding to climate change. Specifically, coastal professionals

responded that they would be willing to respond to climate change if they had compelling information, new funding, and a sense of local urgency. The need for new funding appears to be one of the largest barriers to taking action among the Public sector respondents, with 80% agreeing that they would take action with new funding available to do so. We consider this focus on lack of funding as an indirect assessment of self-efficacy, one that concentrates on an antecedent condition. Having said that, lack of funding is a legitimate concern; interviews conducted with California coastal professionals also found lack of funding to be a significant concern (Tribbia and Moser, 2008). These barriers—the need for compelling information, new funding, and a sense of local urgency in work—should be addressed, or at least carefully considered, when producing any climate change outreach materials for Oregon coastal professionals. Social norm barriers were found as well, with most coastal professionals stating that they are not hearing urgency to respond from within the workplace. This was particularly the case for Private-sector respondents.

In addition to behavioral barriers, coastal professionals have a number

of technical needs regarding climate change, particularly credible, relevant information to provide the public with; and data or information to better understand or predict the likely effects of climate change on coastal communities. When asked about specific information needs, this research found that coastal professionals have low amounts of information on climate change topics that they consider important for the performance of their work. The top information needs (in terms of importance versus amount) were climate change effects on community infrastructure and effects of sea level rise on shoreline protective structures. It is important to address the need for climate change information among Oregon coast professionals. Again, in Tribbia and Moser's (2008) research in California, they 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 whether 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.³

We recognized that a great deal of science communication fails because it is based on a false premise.

We were interested in understanding psychological and social barriers to climate adaptation behaviors, in addition to technical needs, because we recognized that a great deal of well-intentioned communication about scientific and technical topics fails because it is based on a false premise. That premise—that behavior change will follow from provision of technical information alone—has been consistently challenged in recent years (for a review, Nisbet and Mooney, 2007), and yet this so-called “information deficit model” of communication continues to be routinely applied by practitioners of public communications and involvement. A much more satisfactory model of communication involves both providing the information that an individual wants and needs in order to make an informed decision and lowering the barriers in the way of that decision and subsequent action (Moser and Dilling, 2006).

To understand barriers, we constructed questions guided by the integrative model of behavioral prediction (Fishbein and Yzer, 2003). This model summarizes the findings

of decades of psychological research and predicts that an individual’s behavior will be driven by the individual’s attitudes relating to the behavior, peer-group norms, and self-efficacy (the perceived ability to perform the behavior under a variety of challenging circumstances). A barrier or impediment may apply to the attitude, norm, or sense of self-efficacy.

Because project objectives include providing targeted outreach materials for coastal professionals, it was critical to understand what sources of information they currently use and value. The survey revealed that newspapers and television are the most frequently used sources of information on climate change, indicating that these media should likely be part of a strategy for presenting scientific information to these audiences. Participants for all subgroups responded that the source they use the least frequently for obtaining information on climate change was personal contact with scientists and Oregon universities (Table 10). This is again similar to results of a survey conducted with California coastal professionals (Tribbia and Moser, 2008). Since scientists and other university experts are arguably the most reliable sources of unbiased and timely information, the finding that they are not frequently used represents an important challenge to them. However, it’s worth noting that almost 40% of respondents ranked Oregon State University, Oregon Sea Grant, and the University of Oregon as excellent in terms of value as an information source.

RECOMMENDATIONS FOR FUTURE RESEARCH⁴

The sample size of 300 Oregon coastal professionals provided a good indication of climate change concerns, intentions, psychological barriers, and information needs 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 sampling method. Further, questions remain about the adaptive capacity of Oregon coastal communities. Following up the survey with focus-group meetings 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. Among professionals who have intentions to adapt to climate change, in what capacity do they plan to adapt (for example, do they plan to address coastal erosion... prepare for changes in fisheries?)

³ *The discussion of information access is drawn largely from Borberg, 2009.*

⁴ *Recommendations for future research are drawn largely from Borberg, 2009.*

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