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Community Planning for Climate Change: Visible Thinking Tools Facilitate Shared Understanding

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Community Planning for Climate Change: Visible Thinking Tools Facilitate Shared Understanding

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Abstract

An engagement project examined the effectiveness of the visible thinking tools of concept mapping and influence diagramming to facilitate community planning for climate change through a series of workshops. The workshops were developed in coordination with a local nonprofit as part of a strategy of communicating about climate risks. Guided by university engagement faculty, workshop participants thoughtfully identified and mapped how specific risks associated with climate change may affect their rural coastal community, what could be done to address each risk, and who was responsible for taking action. Post-workshop interviews and surveys revealed that participants recognized the civic importance of facilitating dialogue on the contended issue of climate change and that visible thinking tools were beneficial towards developing understanding and consensus. Through the project, the community members and university personnel learned about local climate change concerns and some effective means for future collaboration, and the community set initial action priorities.

Introduction

Many coastal communities in the United States and, indeed, throughout the world, will need to adapt to the changing climate over the next century (Adger, Agrawala, Mirza, Conde, O'Brien, Pulhin, Pulwarty, Smit, & Takahashi, 2007; Nicholls, Wong, Burkett, Codignotto, Hay, McLean, & Woodroffe, 2007). Coastal communities in the location of this study, the Pacific Northwest, are already affected by major storms, shifts in ocean currents, and tectonic uplift and subduction, among other effects (Burgette, Weldon, & Schmitt, 2009; Huppert, 2009; Oregon Climate Change Research Institute, 2010). Anticipated future effects from changes in Pacific Northwest's climate include increased air and water temperatures, shifts in marine ecosystems and fish species, increased flooding, and coastal erosion worsened by sea-level rise and increasing wave heights (Oregon Climate Change Research Institute, 2010).

Despite these stresses occurring or anticipated in the natural system of which they are part, rural communities that typify the Oregon coast have not been urgently preparing for climate change. While our research shows that lack of information about anticipated local effects of climate change is one impediment to local planners (Borberg, Cone, Jodice, Harte, & Corcoran, 2009), the lack of institutional resources (including expertise and funding) to address the issue is also a concern (Tribbia & Moser, 2008). Knowing where to begin and how to proceed with such a potentially long and complex undertaking presents many additional hurdles (Snover, Whitely Binder, Lopez, Willmott, Kay, Howell, & Simmonds, 2007). These conditions provide an opportunity for university specialists to assist communities.

Community engagement, in part, involves such specialists interpreting the results of applied and basic research in ways that can be adopted by community members (National Sea Grant, 2000). The principal difference between engagement and the older concept of "outreach," however, is that engagement fundamentally involves a two-way, collaborative mode of interaction between scientists, university personnel, and community members, all of whom are seen to be specialized-information holders. In traditional models of outreach or extension, outreach is seen as transmission or translation of "expert" knowledge from the university specialist out to users who are seen to have little to no important contribution to that knowledge. Such "conduit" models of university communication (Reddy, 1979) have given way in recent years to models of communication that see all participants as possessing expertise. The role of the community members in engagement as co-producers of knowledge rather than passive consumers is thus crucial. Engagement in this sense is only secondarily about interpreting applied research. Priority must first be given to working with communities to understand their needs and interests, their own specialized knowledge, and the constraints on putting into action the resulting co-generated knowledge.

In its first steps, this work of engagement

requires getting to know communities and providing forums for their interaction with university research, researchers, and communicators. Therefore, before engaging a specific coastal community, the project's university team, comprised of Oregon Sea Grant[1] research and engagement faculty and graduate students, had undertaken some preliminary inquiry of the study population. This included a largest-ever coastwide survey of Oregon coast professionals regarding climate change. Needs, interests, and barriers to action were explicitly queried in that 2008 survey. (The findings, the subject of a master's thesis, are published and available at http://seagrant.oregonstate.edu/sgpubs/onlinepubs/s09001.html). In addition, the university team conducted a set of in-depth interviews with a small sample of coastal residents (n=14 interviews with 19 total participants) who visited the Visitor Center at the Hatfield Marine Science Center or the Oregon Coast Aquarium, both in Newport, Oregon. While surveys and interviews are traditional methods for carrying out assessments with target audiences (Davidson, 2005; Patton, 2001), these don't provide substantive opportunity for two-way communication among university engagement professionals or researchers and public decision makers. Therefore, in addition, two group discussions with coastal decision makers (n=20) were conducted with that goal in mind.

Method

Rationale. Anticipating that the community engagement project described here would be the first of a number of such climate planning projects in Oregon and potentially in other states involving members of the university team, we conceived the initial community project as a pilot, particularly to examine the usefulness of certain methods while at the same time providing value to the community and direct feedback to participating scientists. Before the community engagement began, the university team had an overarching goal to assist the community in becoming more resilient[2] to climate change. We had multiple potential communities with which we could work. Our selection criteria for this pilot were (1) a community of a manageable size and local issue complexity; with (2) an existing community organization with a good reputation; which was (3) able to convene community participants; and had (4) constructive working relationships with university and team members, reflecting apparent trust and goodwill between the parties; and (5) an interest in participating in a project aimed at improving the community's resilience to climate change.

The small coastal community of Port Orford, Oregon (population 1,200) met these criteria. The university team approached the leadership of the Port Orford Ocean Resource Team (POORT), a local nonprofit organization, to act as community convener of the project and chief collaborator. POORT, directed by local commercial fishermen, dedicated to natural resources, and with a history of success in novel approaches to resource issues, agreed to convene an ad-hoc community group. Community members who participated in the working group included both public officials and interested citizens, but our intention was for the working group to be completely voluntary, without any official capacity. [A sidebar to this article provides a characterization of the organization, community, and project from the perspective of a community participant and staff member of POORT.]

Once the community of Port Orford was identified, this project proceeded with the following components: (1) empirical research to understand climate-related opinions, values, and information interests of the community; (2) engagement workshops to involve community members in identifying climate change risks and possible actions; (3) inter-workshop assessment of potential climate information needs by comparing results of the first workshop with an expert climate-change model; (4) a formative evaluation of the effectiveness of the project through interviews with participants, leading to (5) a determination of additional activities in the project.

Structured Decision Making. We recognized that the community would want to know what knowledge and advice climate scientists would have for Port Orford. We did have some insights from the domain scientists, but in order to create conditions for two-way communication and the co-generation of interpretations of those recommendations, the workshop process would not begin with it. Nor would we begin with the "vulnerability assessments" that have become routine in the methodology of climate adaptation as conducted with professional and technical groups (NOAA Coastal Services Center, 2011). Instead, our approach was grounded

[1] Oregon Sea Grant is a marine research and education program based at Oregon State University since 1968.

[2] Resilience has been defined in many ways (Moser, 2008), but here it can be understood as the capacity of a system to experience schocks while retaining essentially the same function, structure, and feed-backs, and therefore identity. A system can be social or ecological or their combination.

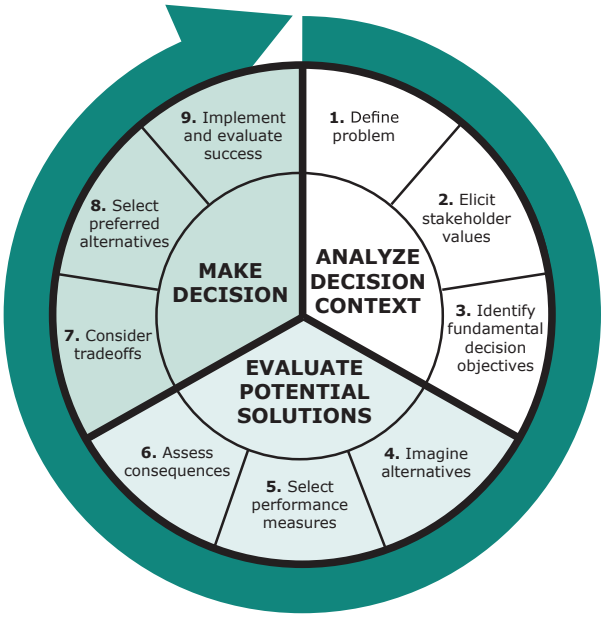

Figure 1. From Wilson & Arvai, 2011

The Decision Cycle

Analyze decision context

1. Identify group definition of the problem
2. Elicity diverse stakeholder values in the form of problem-relevant objectives.
3. Separate the means from ends (fundamental) objectives.

Evaluate potential solutions

4. Create list of potential alternatives.
5. Select practical performance measures to evaluate the alternatives.
6. Use performance measures to assess the consequences of each alternative for each end objective.

Make decision

7. Identify and conduct tradeoffs to reach best-possible alternative.

in a structured decision-making cycle (figure 1), the first two steps of which are for the decision makers (here, the working group) to define the problem as they see it and clarify objectives that matter to them (Wilson & Arvai, 2011). These steps, we believed, are critical to successful engagement, since without them, target audience voices are not part of the interpretation of research findings. However, simply documenting how participants' defined the focal problems and their objectives is not enough. Underlying both how a person defines a problem and conceives of objectives to address it are that person's values, and identifying and acknowledging these are important aspects of creating forums for two-way communication about decision making.

Substantial research over the past 20 years demonstrates the critical role of values in the decision-making process. Decision processes that focus on discussing personal and social values in addition to arraying technical alternatives have been shown to lead to not only greater participant satisfaction but also better informed processes than those that focus on generating technical alternatives alone (Keeny, 1992; Gregory, McDaniels, & Fields, 2001; Arvai, Gregory, & McDaniels, 2001). "Value-focused thinking" (Keeny, 1992) has become a key feature of varying formulations of behavioral decision-making processes, including the "decision-aiding" model advanced by Gregory and colleagues (2001), the now prevalent notion of "decision support" (Moser, 2009; National Research Council, 2009), and the approach of "deliberation with analysis," regarded as best practice by the NRC panel (2009) that examined Informing Decisions in a Changing Climate.

The planned design of the workshops was derived from a well-established framework developed in the disciplines of behavioral decision-making and risk communication. One synthesis of these two disciplines is a model of multi-party communication known as "nonpersuasive communication" (Fischhoff, 2007). The essence of this model is that successful communication about scientific and technical issues is far more than just presenting the "best available [physical] science" –which is often all that is provided to decision makers (National Research Council, 2005). Instead, communication that is successful, in the sense that it results in well-considered decisions, depends critically upon understanding the scientific issue (here, the effects of climate change) from the perspective of the user, stakeholder, or community (National Research Council, 2005; Cone, 2009).

Climate Concept Mapping and Influence Diagramming. The 20 questions of the 2009 survey provided a baseline for understanding participants' perspectives. To start the workshops, we knew we wanted to establish more clearly what the community participants believed about the local effects of climate change and the risks that the community faced from their perspective (the decision problem) as well as something about the values underlying

those beliefs. While interviews and ethnographic work can be used effectively to document these things, we are particularly interested in tools that help target groups articulate to themselves and with researchers their beliefs, knowledge, and values. Our assumption was that unidentified differences in understanding, beliefs and values are often the cause of miscommunication in engagement settings. We were interested particularly in testing tools that make individual and group thinking visible to all participants as a way to identify areas of divergence and convergence in thinking about climate change and climate change decision making. Making thinking visible, we believed, is a primary step in co-generating expert knowledge and putting it to use in decision-making. Based on our team's previous work with visible thinking routines, we chose two tools for use in this context: concept maps and influence diagrams.

Concepts maps are simple, visual diagrams that link concepts (nodes) and propositions about them (connecting lines) from their creators' perspectives (Novak & Gowin, 1984; Howard, 1989); they are used in many formal educational and informal learning settings as visual aides to learning as well as for assessment (Ritchhart, Palmer, Church, & Tishman, 2006; Novak & Cañas, 2006; Cañas, 2005; Stoddert et. al., 2000). Influence diagrams are graphs that show key variables of a system and the direction of influence of those variables. As specialized visualizations for thinking about risk, they have been used traditionally in risk analysis and risk communication processes, especially those involving both risk specialists and non-specialists, such as members of the public (Morgan, Fischhoff, Bostrom, & Atman, 2002).

Review of such visible-thinking with others can be valuable for several reasons: notably, individuals may refine, clarify, and negotiate individual understanding; diverging beliefs and values may be identified and honored without becoming the focus of discussion; unanticipated (from the researchers' perspectives) ideas, beliefs and sources of fear or expertise may emerge (Wood, Bostrom, Bridges, & Linkov, 2012). The result is better communication within the group as well as a visible artifact for reporting back to that group (for member checking) as well as communicating to other groups (in this case university scientists and engagement professionals). Such outcomes have been demonstrated for many learning contexts (Kane, 2007; Markham, Mintzes, & Jones, 1994).

While sophisticated, computer-mediated, concept mapping has shown value in resolving conflict-laden social decisions (Trochim, Milstein, Wood, Jackson, & Pressler, 2004), these tools require familiarity with software, training of participants, and computer access. In engagement contexts, facilitators often do not have access to technology, and time is limited, so training is not feasible unless it is part of long-term efforts. Members of our team had had positive experiences with more "free-hand" paper-and-pen approaches to concept mapping in a variety of teaching, communicating and group-decision making processes, and we wanted to test such low-tech methods here.

Procedure

Pre-workshop Surveys. Two workshops were planned for Port Orford in 2009. In consultation with the POORT conveners, the project team designed the workshops to address shared goals in a sequential way, to be partly planned and partly adaptive to what arose in the workshops. With the results of our previous coastwide survey, interviews, and group discussions as a foundation, the team invited prospective participants from Port Orford to take the same survey prior to the first workshop in 2009. Survey responses showed the working group-respondents strongly agreed that climate change was a concern to which both individuals and government need to respond. These respondents were also particularly agreed about their willingness to "take action in my work if I hear a sense of local urgency to do so." In addition, while the respondents from Port Orford showed general similarity with coastwide respondents from the larger survey with respect to perceptions of climate risks[3] one notable difference was the Port Orford respondents' emphases on livability and safety concerns. Knowing those community-based concerns helped prepare the university team for the workshops.

Climate Concept Mapping and Influence Diagramming. The initial workshop was conducted on a January 2009 afternoon and scheduled for five hours, beginning with a hosted lunch and ending by 5 p.m. The first activity began with the university team introducing the notion of "visible thinking routines" (Vygotksy, 1934/1986; Richert & Perkins, 2008) and the research that attests to the value to individuals and groups of making thinking visible. This was followed by a concise training on the rationale for and process of concept mapping.

[3]The question was open ended and provided no cues about answering; its position in the survey was prior to any other in which specific risks were named.

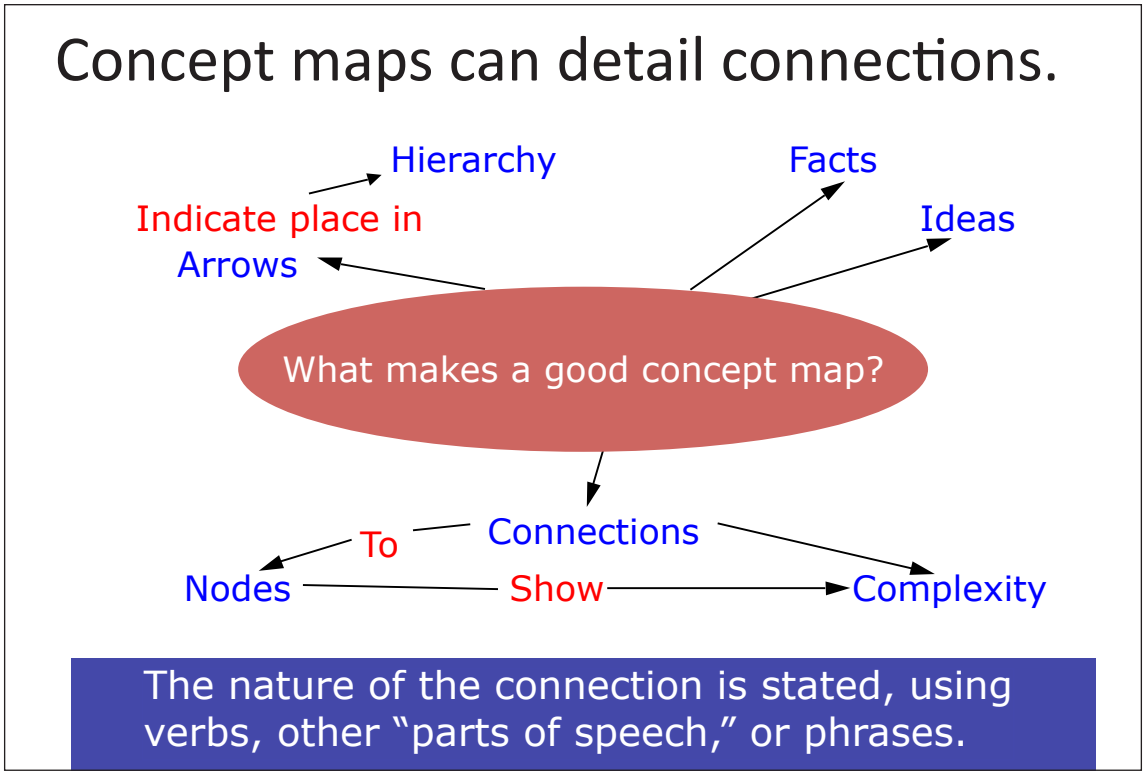

Figure 2. Concept mapping

Two points were emphasized. First, by explaining the process through simple diagrams, (e.g., figure 2), we demonstrated that making a concept map is technically easy to do. Second, we underscored that the making of such maps enabled participation by all group members in a process of group understanding and co-generation of knowledge.

After this ten-minute introduction, the team asked the 10 community participants to write on sticky notes their concepts of how climate change might affect their community. Only one effect was to be written on each note sheet. Following ten minutes of the group working independently and silently, the university facilitators then collected the sticky notes onto big sheets of paper. Asking the group members about the sorting as they proceeded, they organized the notes into a rough concept map that was later converted to digital format (figure 3).

During the sorting and organizing to create the concept map, group members considered how their individual elements were related to each other (such as causes, effects, or categories), and added new concepts (on sticky notes) to make certain relationships more explicit. From this activity, the group identified five broad climate change-effect categories of concern to them: effects associated with infrastructure, marine ecosystems, terrestrial ecosystems, economic issues, and extreme weather. In addition, the group generated new conceptual relationships from the primary groupings, pointing to second-order effects of a changing climate, such as new invasive species or new government regulations.

In the next step, participants were coached to create influence diagrams on poster paper by using the concepts generated in the previous steps. To begin, the learning researcher on the university team[4] made a brief presentation to the group on influence diagrams, using a simple example of the risk of falling down stairs (Morgan, Fischhoff, Bostrom, & Atman , 2002, p. 37), in which an unseen toy on a staircase can cause a fall unless a decision is made to remove it. Influence diagrams are directed graphs, with arrows, indicating influences, connecting various "nodes" in a system. For our purposes, the nodes were causes, effects, and decisions that could be made to affect them. Then the task was presented to the group: to take one group/category at a time (e.g., Infrastructure effects) and list all of the risks associated with that category; identify what could be done to address each risk; and indicate who was

[4]Shawn Rowe, who specializes in free-choice learning research, that is, how people learn in non-school settings when they perceive they have a choice and control over their learning.

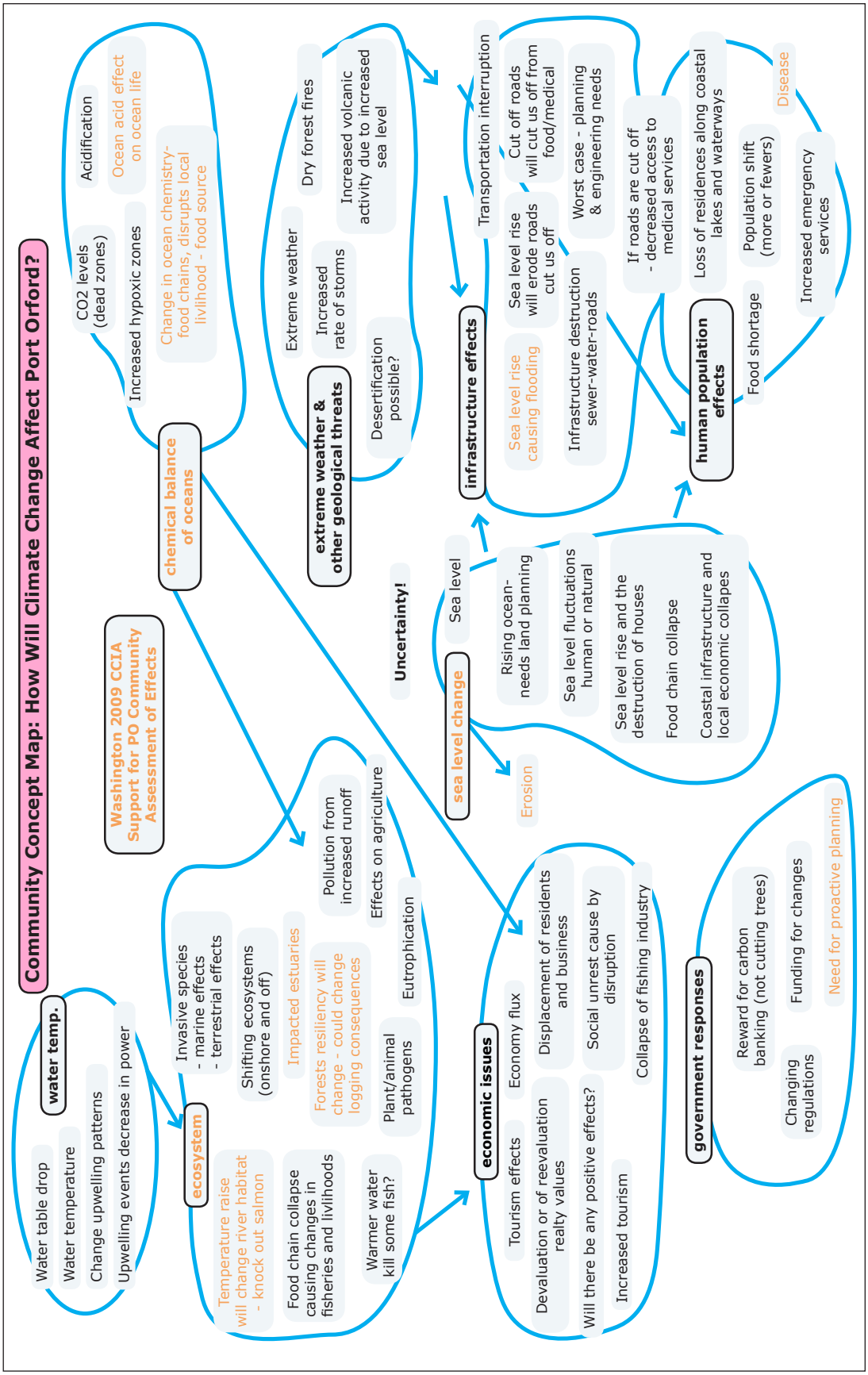

Figure 3. A community concept map regarding climate change

or could be responsible for taking action.

To model the task, two members of the university team (an Extension community planning specialist and the learning researcher) demonstrated the diagram-development process to the group with two categories of climate effects. These team members listed risks associated with the given category as community participants called them out, the list being written on poster paper on the wall for all to see. (The team members used the sticky notes generated in the previous step for reference, but did not actually pull them off of the paper, thereby retaining their agreed-upon concept placements.)

After 45 minutes of diagramming the first two effect-categories in plenary session, the group was divided into three sub-groups, each comprised of two or three individuals, to complete the remaining three climate-effect categories. Each group started with a separate category and was directed to refer to the initial concept map as a starting point for their development of a list of risks associated with the effects of climate change. After another 20 minutes, the groups shifted to consider and add ideas to diagrams on which the other groups had been working. Each group had a different color pen, so their contributions would be apparent. After five minutes, the groups shifted to their final diagram.

Following a ten minute break, the university team redirected the groups to consider what decisions could be made to lessen the risks identified previously. The task was posed as starting with your highest priority risk, identify some decision "nodes"–places where a decision needs to be made in order to mitigate or manage that risk.

As before, the learning researcher demonstrated the procedure, referring again to the textbook falling-on-a-staircase example, and then applying it to one of the influence diagrams. The three small subgroups were then directed to resume with the diagrams, using sticky notes for the decision nodes and identifying who is responsible for making that decision. Each group had a different color pad of sticky notes for identifying decision nodes. Each had 15 minutes at the first diagram and then about 5 minutes at the remaining maps to identify anything the prior groups had missed.

Finally, after another very short break, the question was posed to the working group: Who has, or should have, the capacity and resources to act on these decisions that you've identified?

Again subgroups went to one of the five influence diagrams to identify the person/organization who needs to make the decision (based on the decision node). If known, they were asked to make a note if that party has the capacity or resources to address the risk or decision.

Thus, after about three hours of learning from each other and working together, this diverse community working-group had shared and consolidated its views on the effects of a changing climate about which they were concerned. And they described and diagrammed the risks those effects posed, the decisions that could be made about those risks, and by whom, into influence diagrams.[5]

Inter-workshop Comparison of Influence Diagrams and the Climate Specialists' Model. Prior to the workshops, as part of the project design the team produced a climate science influence diagram that visualized the major climate change effects for the Oregon coast as predicted by university and agency scientists. This diagram was reviewed by regional climate change experts and changed with their input. Following the first workshop, the university team transferred the hand-written "community" concept map and influence diagrams to digital form (using CMap Tools–available at http://cmap.ihmc.us/download/). The intent was to make all elements legible and in a more permanent, sharable form, thereby permitting both ongoing analysis of the maps and the ability to share the maps with participating scientists, other community members, and engagement professionals. The resulting digital maps are artifacts for keeping the conversation going in co-generative ways.

One step in that co-generation was to return to the climate specialist's concept map described above that had been assembled prior to the workshop. The project team compared the concept maps created in the workshop by the community with this specialists' map, to better identify where regional climate scientists' knowledge, beliefs, and values met or diverged from those of the Port Orford community. This assessment would help guide the second workshop, where the similarities and differences between the scientist and community maps would be displayed and discussed in terms of options for how best to proceed with co-generating useful interpretations of available information for future local decision-making.

Participant Evaluation. After the second workshop we planned a set of interviews to sample satisfaction and interest in future engagement. The

[5]Specialists familiar with traditional influence diagram notation would note the differences in the graphical approach used during the workshop, which reflects the group's deliberation sequences and seemed natural and appropriate for the team to support.

plan was for two or three of the university team to interview by phone about half the working group participants with a set of questions.

Results

Comparison of Influence Diagrams and the Climate Specialists' Model. A critical question for a lay community group addressing a specialized topic is, how does our understanding compare to that of specialists in the topic? Comparing the climate science map with the maps produced during the workshop allowed project personnel and (ultimately) community participants to see where community knowledge, beliefs, and values coincided with or diverged from ongoing research and the knowledge, beliefs and values of regional climate scientists. There was actually considerable convergence.

Very little climate-prediction information was available that specifically focused on the Port Orford vicinity, a well-recognized limitation of much climate prediction, namely, that it largely depends on models which have focused historically on regional geographic areas (Sarachik, 2008). In the absence of climate science data specific to the Port Orford area, the team's development of the Climate Specialists' Model for the coastal Pacific Northwest provided a serviceable approximation[6]. The team noted similarities between what scientists and the community participants recognized as significant effects of climate change. To highlight this similarity and display additional information developed by the working group, the team compiled the community influence diagrams into a community model (Figure 4). The team's premise was that organizing and making visible a great deal of disparate information in a diagrammed form might help the community members and climate scientists see connections clearly that might otherwise not be seen (areas of overlap between community members and climate scientists are emphasized in Figure 4 by darker colors).

The community model was structured in columns containing items that linked graphically and conceptually from left to right, from broader climate effects to primary biophysical impacts to biophysical risks to potential social/economic impacts to potential interventions. The final column considered "who is responsible" for making those interventions. Both the climate scientists' and community models highlighted infrastructure effects, a decrease in drinking water, impacts on fisheries, and increased disease and public health effects. The Port Orford community members' model differed somewhat in focus, with stronger emphasis on social impacts, including displaced population, increased isolation, disruption in local livelihood, and loss of jobs.

It should be noted that the community model assembled by the university team did not include every detail contained in the influence-diagram sources. Also, the number of arrows shown converging on a particular column-topic is an indication of the factors associated with that topic and the degree of participant attention on them, rather than a strictly quantitative valuation of importance. Indeed, we did not attempt higher-order quantitative analyses that are sometimes developed when both the specialist and lay models are more detailed than existed in our situation (Wood et al., 2012).

Participant Evaluation. An evaluation was conducted at the end of the first workshop simply to determine what participants liked or felt needed to be changed (for other workshops). Among other points, participants requested more information on climate change and community effects–indications that the workshop engaged them and prompted further thinking. One unexpected and positive outcome of the workshop training occurred shortly afterwards, as POORT staff put to use their training in developing concept maps in conducting a planning workshop of their own.

Following the second workshop, university team members interviewed by phone four workshop participants. The interviewees were asked the same questions[7] and the interviews recorded and analyzed.

The interviewed participants described satisfaction with the workshops, stating that their participation caused them to consider risks of climate change that they would not have thought about otherwise and as they will affect their community (rather than as a global and distant issue). One participant noted the range of backgrounds of workshop participants and the civic importance of bringing such a range of community members to a shared understanding of the climate issue. Another participant noted that influence diagrams worked well as a workshop tool because it allowed the group to work together, with everyone included, and helped the group come to consensus.

[6]It was assembled from available published sources that had either a regional Pacific Northwest context (Huppert, 2009) or a coastwide Oregon context (Weber, 2009). In addition, qualified members and associates of the university team reviewed the specialists' model for accuracy.

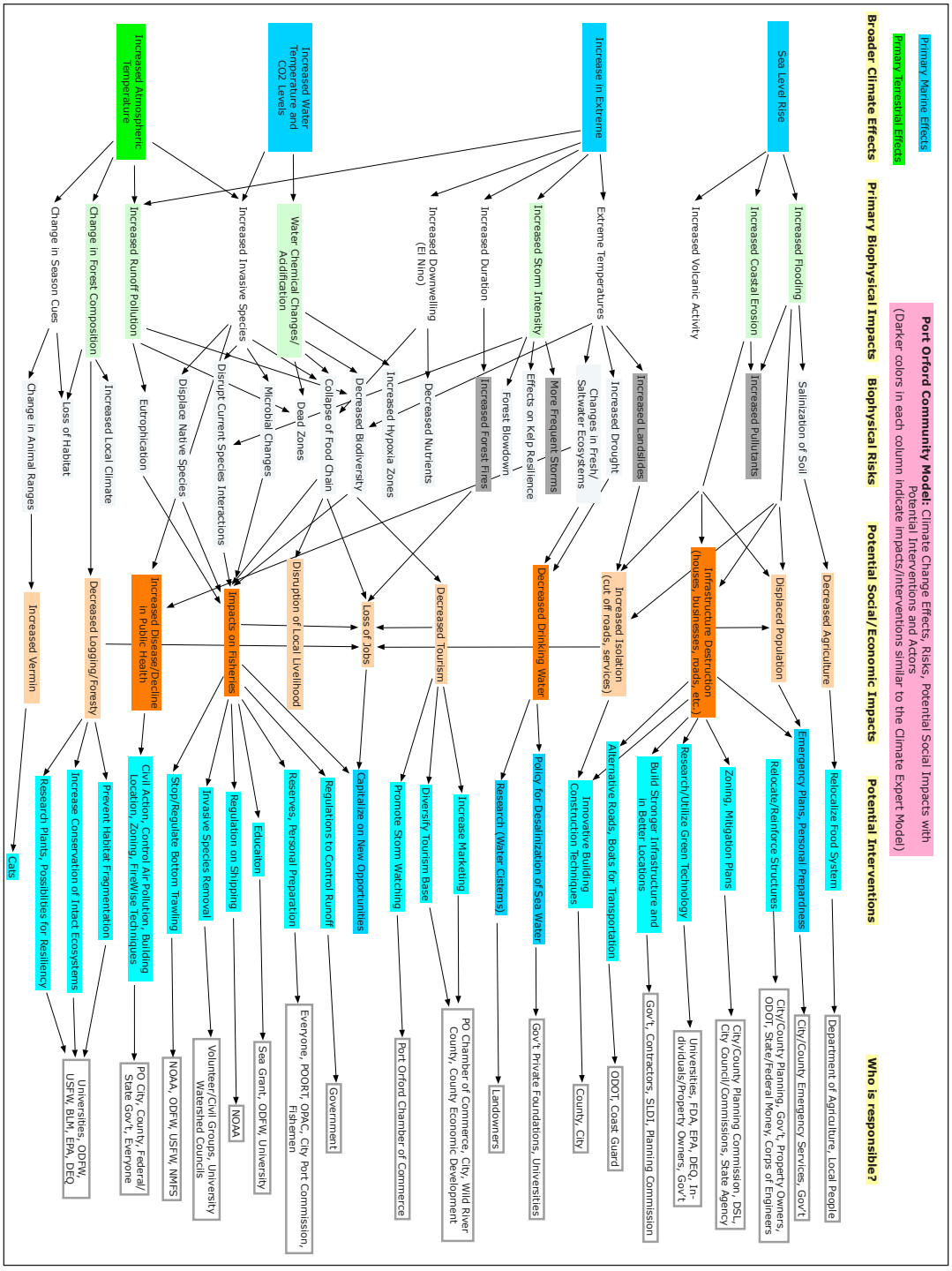

Figure 4. A community model of climate change effects, risks, impacts, and interventions

The interviewees suggested how additional workshops and related activities could be of value to the community, and the university team began planning to implement these suggestions for the following years.

In addition, the working group appears to consider the visible thinking methods valuable: In a 2011 follow-up survey, seven of eight participants in the first workshop in 2009 (which focused on

[7] How would you say the workshops have gone so far? How would you describe your current thinking about how Port Orford needs to respond to climate change? Have the workshops had any influence on this way of thinking? What is/are the next step/s that you think the community needs to take with respect to preparing for the effects of climate change? How can our project help you take that step? What would cause you to come to a third workshop?

the concept mapping) considered "production and publication of concept maps and related diagrams" as of high or medium value. The aggregate score placed these methods near the top of a list of 10 project activities. The 2011 survey also revealed a modest improvement in the amount of information respondents held about how climate change would affect their work, over pre-project survey levels of 2008. And this working group had an undiminished willingness "to take action in my work if I hear a sense of local urgency to do so" (average 4.3 on a 5-point scale[8] in both survey years). Yet the 2011 survey respondents perceived, as they had in 2008, no great sense of urgency about local climate change effects from others in the community.

Discussion

This community engagement project follows the recommendations of a NRC panel (Dietz & Stern, 2008) in recognizing that public participation in planning can create significant value. It also mirrors the current understanding that public participation in research can have far reaching implications for the valuing and relevance of climate-related science for public audiences (Bonney, Ballard, Jordan, McCallie, Phillips, Shirk, & Wilderman, 2009). Rather than a notion of participation in scientific or technical decision-making in which citizens are viewed as a hindrance and are consulted only via a public "hearing" or some other partial involvement, often late in the decision-making process, the university team held the premise that the community's knowledge, views, values, and the objectives that derive from them are not only legitimate in their own right but should be heard before the presentation of specialist knowledge and incorporated in the interpretation of that knowledge. In short, the reason to engage the community is a belief that doing so improves both the quality of science long-term (Bonney et al, 2009) and what the NRC termed the "quality" and "legitimacy" of the resulting assessments and decisions.

As crucial as understanding and making decisions based on climate science is to long-term community resilience, these are very unlikely to occur with public participants of widely varying views if the process does not explicitly consider the values of the participants and make them part of the two-way conversation with university and agency scientists. Analytic techniques framed by non-community "experts" may reflect value choices that may not be shared by the community (National Research Council, 2005). Indeed, those facilitating climate-change discussions do well to remember that all participants–scientists, engagement practitioners, and other citizens–see the claims of science through the lens of their own values. These may be deeply held and not easily negotiated, as recent "cultural cognition" research illustrates. That framework highlights the role of certain pervasive "cultural" values in the U.S.–labeled dichotomously "individualistic" or "communitarian", and "hierarchical" or "egalitarian"–in determining individuals' receptivity to science (Kahan, Jenkins-Smith, & Braman, 2010).

In exploring the creation and use of concept maps and influence diagrams as well as developing other visual thinking routines for co-generative dialogue (Tobin, 2006), this project provides useful experience on the value of these techniques. Learning research has previously identified (Halford, 1993) that the ability to visually represent thinking with concept maps and diagrams illustrates two essential properties of understanding: the representation and the organization of ideas. To understand a concept means having an internal representation or mental model that reflects the structure of that concept; a concept map makes that mental model explicit so that it can be reviewed with others. It furthermore makes the beliefs and values that underlie those mental models explicit for participants as they rationalize or explain their thinking and their maps to themselves and each other.

Using these visible thinking methods, the Port Orford workshop participants produced thoughtful and detailed assessments of climate change risks that their community faces. Further, they identified actions that could be taken to reduce these risks. For example, in the Marine Ecosystem Effects category they recognized that climate change could lead to a loss of biodiversity, which could cause a decrease in tourism, and this could be addressed through diversifying the tourism base, with the local Chamber of Commerce taking the lead.

Given the likely continuing need for attention to a changing climate, developing shared understandings through techniques such as the mental model diagramming used here, and then proceeding as the community has capacity and intent, seems to us very sensible.

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[8] Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree. No opinion/doesn't apply was also available but not scored if selected.

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COMMUNITY PARTNER REFLECTION

Port Orford is not exactly the quaint fishing village it is painted to be. Among other things, it is vibrant, diverse, hard working, and progressive. We have a very active artist community and a working port that contributes to a quarter of the jobs in Port Orford. The community is driven by dedicated volunteers and has a large retirement population. Port Orford was the first community on the southern Oregon coast to pass a community

supported stormwater ordinance and gained successful designation as a community supported marine reserve.

Most conservation organizations in the area work with the resource users themselves to find the best possible solutions for the users and the environment. The Port Orford climate change workshops worked very well because they were locally driven, as opposed to people from outside of town telling residents what would work best for them. Local knowledge was truly respected throughout the process. The design created by the Sea Grant Team could work in every community as long as the community is willing to shape the process.

The Port Orford Ocean Resource Team (POORT), as the local coordinating body, was asked to determine and recruit workshop participants. POORT chose community leaders who had the power to disseminate information to the community and to inform decisions at the local level. To ensure that the climate working group would be able to successfully act once decisions were made, a diverse group of stakeholders were engaged including local politicians, conservation organizations, educators, and commercial fishermen. The diversity of the working group reflected Port Orford and ensured that multiple viewpoints would be considered in discussions. The group had a strong sense of how natural processes affect our local community.

The process used by the project team to engage the ad hoc group was very effective. Asking community group members what they thought established a level of trust and respect between the group members and the project team, quickly establishing rapport that increased the comfort level of participants and contributed to a willingness to participate freely.

Providing an opportunity for individuals to write their responses to all discussion topics before holding discussions as a whole group allowed even the most reserved of participants to have a voice. All discussions and ideas were written in an area that could easily be viewed by all participants. Using this visual process allowed group members to remain constantly aware of discussion topics, allowing members of the group to elaborate and build off of each other's ideas.

The technique of creating influence diagrams in small groups was both efficient and effective. Each individual had the opportunity to record his or her own thoughts on the diagrams and then had the chance to discuss their ideas with small groups. This process was very thorough without exhausting participants' attention. Creating the diagrams allowed for participants to stay within their comfort zones by including both oral and written forms of communication, thereby making it more comfortable for multiple personality types to engage in the process.

The strength of having community members create concept maps themselves is that a usable, community-supported document results. This process allowed the people that understand the community best to prioritize areas of vulnerability, thereby allowing the project team to provide focused information. Participants were able to take more out of the workshop because they directed the content.

The concept maps created from the workshop on climate change effects, combined with the influence diagrams, resulted in a visual representation of the community's concerns, potential interventions and responsible parties. The concept maps made it easy for any community member outside of the ad hoc group to understand the discussions and conclusions of the workshops. Furthermore, having the community design the concept maps created a sense of ownership and responsibility when it came time to take next steps.

In Port Orford, a slow, careful process for decision making works best. Community members value being informed and having their questions answered before supporting any decisions. For this reason, the Climate Change Working Group chose to start small with their next steps to ensure community support before taking stronger action. The first step at the conclusion of the workshops was to make a presentation to the Port Orford Planning Commission about the increasing wave height and workshops. The commission was amenable to including changes in the climate in their comprehensive plan and was open to continuing a dialogue with Sea Grant and the Climate Change Working Group.

The mistake in this project was not setting up permanent, local support, which has left some of the action items unfinished. Though there was significant interest in continuing to meet, once funding diminished, the working group stopped meeting. In a community where volunteers are spread thin and the city planner is only on contract, it is necessary to staff projects such as the climate change working group. Fortunately, the concept maps, intervention, and responsible parties will not soon be outdated and could be picked back up if funding were to become available.

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