

Informing coastal management adaptation planning and decision making for climate change using an interactive risk-based vulnerability assessment tool

FINAL PROJECT REPORT

NOAA Award NA09OAR4310151

Overview

This project consisted of refining and testing a process to inform scenario-building and planning for coastal management. Central to this process is a computer-based diagramming tool that allows users to represent information about pathways that link hazards, impacts, vulnerabilities, and management actions. Users create vulnerability and consequence scenarios.

We are calling this the Vulnerability and Consequence Adaptation Planning Scenarios (VCAPS) process. The computer-based diagramming tool that is used in the process we call the VCAPS tool. The tool is used to mediate the scenario building.

Our goal was to examine the support VCAPS can offer local decision makers in coastal management planning. We recognize that there are two important aspects of this: creating a useful tool and enabling its use.

Our *two objectives* were to:

1. Apply VCAPS using a mediated modeling approach in a community currently engaging with coastal management planning and climate change risks.
2. Evaluate the practicality and usefulness of VCAPS and the mediated modeling approach for local decision makers in coastal management and climate change planning with the collaborative input of coastal managers, scientists, and community members.

During the course of our project we revised our workplan and received approval for revisions. These revisions included implementation of the VCAPS process in additional communities, conducting a training workshop at the Coastal Zone 2011 conference, and conduct fewer outreach workshops in the southeast (these are described in an earlier progress report).

Project Overview

In this section we describe the conceptual underpinnings of VCAPS: participatory modeling, causal structure of hazards, and vulnerability in coupled human-environment systems. The VCAPS process is, at its core, a participatory modeling exercise. In the VCAPS process stakeholders and decision makers document causal linkages between climate stressors and downstream consequences. We organize these efforts using concepts and understandings of the causal pathways that link stressors and consequences and by using concepts of vulnerability in coupled human-environment systems. The idea of vulnerability helps to reveal the dynamic way that coupled human-environmental systems respond to exposures and the reasons that individuals and groups may experience consequences differently.

Participatory modeling

Participatory modeling (Mendoza & Pradbu, 2006, 2005), also known as mediated modeling (van den Belt 2004), cooperative modeling (Cockerill et al., 2006), group model building (Rouwette et al., 2002), or computer-mediated collaborative decision-making (Cockerill et al., 2008) is a way of bringing stakeholders together to turn complex system concepts into useful decision-making tools. Humans tend to understand complex systems by simplifying them in mental models (Morgan et al., 2001), and mediated modeling methodologies exploit this tendency to facilitate bringing scientists and stakeholders together to enhance system understanding by organizing group interactions around building models (van den Belt, 2004).

When applied, mediated modeling must be adapted to particular places and problems. There is not a “one-size fits all” approach. The key is to tap into individuals’ intuitive understandings of the system and how it dynamically functions and then to integrate different stakeholder perspectives into a single model. Scientists are integral participants in mediated modeling, serving as both facilitators for integrating multiple stakeholder perspectives and as consultants on relevant scientific information (van den Belt, 2004). As a result, the collaborative bottom-up process of creating a computer-based model through a carefully designed and well-managed mediated modeling exercise can promote group learning and consensus building, ground the model in both stakeholders’ reality and the best available science, and enhance the likelihood that the model will remain useful in decision-making (Costanza and Ruth, 1998, Größler, 2007, Cockerill et al., 2008, Tidwell and van den Brink, 2008). Although unsuccessful mediated modeling has been documented in the literature (Größler, 2007), there are numerous cases where mediated modeling was very successful (Otto and Struben, 2004, Cockerill et al., 2006, Tidwell and van den Brink, 2008, Metcalf et al., 2010).

According to van den Belt (2004), mediated modeling’s success is rooted in several advantages. It is a powerful tool in encouraging group learning and increasing shared understanding. It also assists participants in developing a consensus on the structure and function of the system in question. Additionally, the final model serves as a foundation for decision analysis and policymaking. In mediated modeling participants feel ownership of the resulting recommendations or decisions, which helps the participants move forward on decisions and actions (Luna-Reyes et al., 2006). Building this sense of ownership is vital to addressing concerns of resource managers, and they are more likely to use climate-related decision tools when they understand their structure and believe that the tools are relevant (Rayner et al., 2005, Dow and Carbone, 2007, Yarnal et al., 2006, Tribbia and Moser, 2008).

The causal structure of hazards

The second conceptual piece of VCAPS is the causal taxonomy of hazards and hazard management. We focus attention on cause-effect relationships (both positive and negative), and suggest relevant indicators that can be used in assessments (e.g., vulnerability and adaptation assessments). Conceptual frameworks for understanding risk and vulnerability can be most useful when they (e.g., Turner et al. 2003): direct attention to the human-environment system; identify complexities, interconnectedness, and iterativeness of components; shed light on nested temporal and spatial scales of the problem; draw attention to potential dynamics within the human-environment system that give rise to new hazards and the continuation of stresses and perturbations; facilitate the identification of critical interactions in the human-environment system that suggest opportunities for response; support both quantitative and qualitative data and

methods for assessment; and assist in the development of indicators, measures, and models for implementation.

In our case these benefits are achieved by using a conceptual model of the causal structure of environmental risks and hazards, which depicts threats and consequences as a causal sequence resulting from a stream of choices and activities (Kates et al. 1985). This particular framework has been applied to many human-environment challenges, such as nuclear waste disposal, coastal flooding, and sewage sludge disposal (Kates et al. 1985, Clark et al. 1998, Webler et al. 1995). A simple causal chain is represented as a flowchart of boxes with arrows showing how one thing causes another. Figure 1 summarizes the main building blocks of the causal model used in VCAPS, but it also illustrates the fundamental ideas of the original causal model theory of hazards. The chain starts with a concern or stressor on the left side. At the end of the diagram, on the far right side, are consequences we seek to avoid, for example, loss of life, economic costs, decline in fish populations, and so on. To avoid these consequences, hazard managers seek to interfere by blocking intermediary outcomes in the causal chain. These management actions are captured in the boxes along the top of Figure 1. While there are strong benefits associated with blocking the causal chain early on, there can also be significant costs to doing this. For instance, economic loss from coastal storms can be mitigated by reinforcing or raising coastal infrastructure. However, these can be costly and controversial. Likewise, allocating too many hazard management resources at the far right side of the diagram is also problematic. Reimbursing people for economic damages may not adequately compensate people for all the losses they experienced. In conclusion, a good hazard management strategy includes actions at multiple points in the causal chain (Webler et al. 1995).

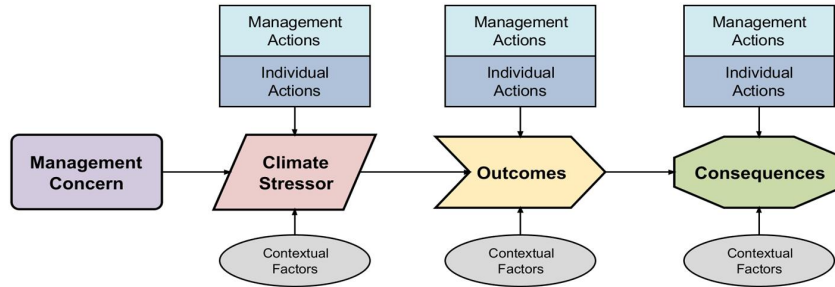
Vulnerability in coupled human-environment systems

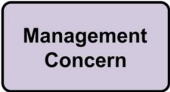
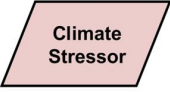
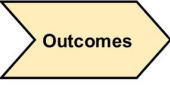
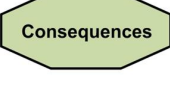
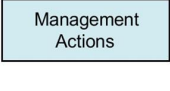


The third conceptual component is vulnerability (Turner et al. 2003). Scholarship on vulnerability has developed rapidly over the last quarter century (Dow 1992, Kasperson et al. 2005, Turner et al. 2003). We view vulnerability as the “differential susceptibility to loss from a given insult” (Kasperson et al. 2001: 24) and we agree with many other scholars who define it according to three dimensions: exposure to a hazard, sensitivity to harm from the exposure, and resilience to plan for or cope with the harm (exposure information is implicit to the original causal model). There are many things in the physical or social environment that help shape the form or extent of a climate stressor, outcome, or consequence. They can be anything that makes a climate stressor, outcome, or consequence bigger, smaller, better, worse, or simply different. That is, they mediate the causal relationships between these different elements in the causal chain. In VCAPS we refer to vulnerabilities, features of the system that mediate causal linkages, as contextual factors as shown in Figure 1.

Integrating vulnerability into the causal chain of hazards improves the ability to characterize and manage impacts in two ways. First, it clarifies that different entities are affected differently by the same exposure. For example, summer tourism businesses have a low susceptibility to harm from a coastal storm in winter, but retail businesses that serve the permanent population are susceptible anytime during the year. Second, it adds the notion of adaptive response (which includes coping, prevention, avoidance, adaptation or, very broadly, resilience). Adaptive responses are taken by the affected entities before or during the hazard event intended to mitigate harm. For example, people evacuate town before the storm hits, or they build their homes to withstand expected levels of wind stress.

FIGURE 1.

Key Elements in Diagramming Tool



Element	Definition	Purpose	Examples
	An issue or topic of concern for managers & decision makers.	Organize diagrams based on issues of common concern.	Stormwater Wastewater Erosion
	An event or process that may be aggravated by climate change.	Identify the dominant physical event(s) or process(es) affected by climate change that impact the management concern.	Heavy precipitation Abnormally high tides Sea level rise (SLR)
	An additional process(es) or event(s) that occurs in socio-logical systems as a result of the climate stressor.	Identify the process(es) & event(s) that occurs as a result of the climate stressor & lead to consequences.	Runoff (outcome) occurs as a result of heavy precipitation (climate stressor).
	Implications of the outcome(s) that affect individuals, communities, institutions or ecosystems.	Identify the point in which the outcome(s) affect individuals, communities, institutions, or ecosystems.	Harmful algal blooms (outcome) lead to contaminated shellfish beds (outcome), consumer illnesses (consequences) & loss of sales (consequences).
	Protective or reactive actions of managers that are intended to mitigate climate stressors, outcomes or consequences.	Identify the actions that can be taken by managers to reduce or eliminate the consequences of the stressor(s).	Modify impervious surface regulations (management action) to minimize runoff (outcome).
	Protective or reactive actions of individuals that are intended to mitigate climate stressors, outcomes or consequences.	Identify the actions that can be taken by individuals to reduce or eliminate the consequences of the stressor(s)	Homeowners plant vegetation in strategic places on their property to help absorb rainwater & anchor the soil.
	Characteristics of the social or physical environment that affect the magnitude of the climate stressors, outcomes, or consequences.	Identify the site specific characteristics that affect the magnitude of the climate stressor, outcome or consequence.	Severity of runoff is influenced by topography, impervious surfaces & existing stormwater infrastructure.

The VCAPS process

The VCAPS process uses participatory modeling techniques and the conceptual frameworks of causal structure of hazards and vulnerability. A VCAPS process couples structured discussion with an interactive computer-based diagramming program, the VCAPS tool, to help local officials, local staff, and stakeholders collectively design qualitative scenarios that depict potential impacts of climate stressors on their communities and suggest collective and individual response (or adaptation) options.

The VCAPS tool promotes structured and efficient dialogue among a diverse group of individuals. The computer diagramming tool enables a facilitator to summarize discussions visually, in real-time. This promotes reaching efficient closure on different group discussion points. It highlights vulnerabilities and management interventions that can be taken to adapt to or mitigate consequences. It also creates a record of a shared understanding of the local adaptation issue.

After a determination has been made to implement the VCAPS process in a community, the basic steps involved in implementing a VCAPS process include:

- Review background materials about the community, including existing hazards, hazard mitigation and climate adaptation strategies, etc.
- Contact key informants to identify participants and logistics, and then schedule workshops and invite participants.
- Conduct 2-4 facilitated meetings (aka diagramming sessions). The first meeting includes an introduction to VCAPS, presentation about locally relevant climate stressors, primer on VCAPS building blocks, and interactive diagramming time. Subsequent meetings include interactive diagramming time, reflections and wrap-up (e.g., next steps).
- Conduct follow-up participant interviews to gather feedback about the process and outcomes.
- Compile information developed during the facilitated meetings into a lessons learned document, which also includes the diagrams representing scenarios of climate change impacts and adaptation strategies.

Creating VCAPS diagrams

We use a software package to create diagrams linking climate stressors, outcomes, consequences, information about vulnerabilities (i.e., contextual factors), and management actions about particular issues or management concerns (e.g., stormwater management, wastewater management, coastal infrastructure). We currently use VUE freeware from Tufts University: vue.tufts.edu. The diagramming process is elaborated in our VCAPS User Guide (attached with the Final Report). In general, we start simple, and gradually make the diagram more complex. With the meeting participants a management concern or issue (e.g., stormwater management) and climate stressor (e.g., more severe storm events) are selected to focus on. Through a facilitated discussion, participants are then asked to identify specific outcomes and consequences that can emerge from the climate stressor, contextual factors that influence the severity or likelihood of outcomes and consequences, and actions that can be taken to mitigate or adapt (by either public agencies or private parties). Completing a diagram can take 2-4 hours, depending on the level of complexity that group participants pursue.

A wide variety of group process and elicitation techniques – focus groups, Delphi methods, photo elicitation, and others – with the potential to foster dialogue have been developed. In the VCAPS process, we rely on group diagramming, also identified under the umbrella terms participatory diagramming or graphic elicitation. Review of this approach indicates that it is well

suiting to capturing complex pathways, such as outcomes of potential climate-related changes, to situations that generate a unique data set and synthesis of understanding (Umoquit et al. 2011). In their review of 80 studies that used diagramming techniques for data analysis, Umoquit et al. (2011) reported benefits, including helping participants recall, self-reflect, and verbally organize their thoughts. Many of the studies reviewed noted that the diagramming approach supports their ability to obtain unique and unsolicited data. Some of the drawbacks identified include participant difficulty with the diagramming task and time needed for analysis. The VCAPS process can address these issues, as researchers assist in the diagramming and the diagram itself is the analytical product.

In a VCAPS process the diagrams help in three specific ways:

1. The diagrams made with the program can serve as a library of what the community knows about the unique and special ways that it is vulnerable and resilient to different kinds of climate stressors. The diagrams can be used to summarize a tremendous amount of experience and knowledge in one place. They can be used to review the adequacy of knowledge. Gaps in knowledge or planning should be easy to spot. The community can then come up with a plan for filling in those gaps, if they are important.
2. The diagrams help participants identify actions that can be taken by the community to prevent or mitigate consequences, or to adapt to them. They can give a clear understanding of where, what and how the community is already acting to address problems. Communities can also use the diagrams to realize potential future actions. This makes transparent to people in different departments how they are working in a coordinated way to protect the town. As action-planning strategies, the diagrams are also helpful because they clarify where and when action is being taken.
3. Communities may also use the diagrams as part of outreach and education activities. Community residents might want to better understand what the town is (or is not) doing to protect their property or safety and why (or why not). The diagrams can serve as useful visual aids to help explain decisions to residents. Transparency can help to build the support necessary for taking action, including the raising and spending of funds.

A modification to the VCAPS process initially proposed in our grant application involved the diagramming tool. Initially, we planned to develop our own diagramming software that was custom designed for illustrating causal linkages among climate stressors, outcomes, consequences, vulnerabilities, contextual factors, and management actions. We developed a prototype, which we used in our first case study, described below, with Sullivan's Island, South Carolina. Subsequently, we found that the program had several flaws: it needed updating whenever the Microsoft Explorer platform was updated, printing diagrams was problematic, and illustrating partial diagrams was problematic. While these problems could have probably been resolved, this was not possible given the budget constraints in this project for programming related costs. Subsequently, we identified the open source program, the Visual Understanding Environment (VUE), which was significantly improved in 2010 and thus able to meet the needs we identified during the Sullivan's Island case study. VUE was developed at Tufts University (for more information see: <http://vue.tufts.edu/>). This proved to be more flexible and very user-friendly, and we were able to develop specific templates that could be used as part of the VCAPS diagramming (see User Guide attached with the Project Final Report).

Project Achievements

Objective 1: Apply VCAPS using a mediated modeling approach in a community currently engaging with coastal management planning and climate change risks.

Initially we planned to implement VCAPS in just one community. However, we found that the effort required to implement the VCAPS process was less than expected. Through the contacts and work of Jessica Whitehead we identified additional communities interested in participating in the project work. They felt that VCAPS could benefit their coastal planning activities and climate change adaptation discussions. Thus, we implemented VCAPS in two additional communities.

The three communities in which we implemented VCAPS were:

- Sullivan’s Island, SC: During May 2010 we held four two-hour meetings. Nine people from Sullivan’s Island participated, including the Town Administrator, members of the Planning Commission, Building/Zoning Inspector, Comptroller, Water and Sewer Manager, and Real Estate Committee Chair. We focused on two topics during the VCAPS modeling effort: stormwater management and zoning.
- McClellanville, SC: On March 31 and April 1, 2011, six members of McClellanville’s management boards and committees met with the research team to begin addressing some of these issues in their community. We held two two-hour meetings, during which the participants identified current stormwater and drainage management challenges that may be intensified by environmental changes. By consensus, the group decided to focus its attention on how more frequent heavy precipitation events and sea level rise could affect McClellanville’s drainage issues.
- Plymouth, NC: On October 4 and 5, 2011, seven community leaders and managers met for a total of five hours for a discussion and scenario building process focused on a complex discussion of stormwater management and the town’s wastewater infrastructure.

In each community the basic outline of activities during a series of VCAPS meetings included:

- Introduction of project goals, meeting goals, and the benefits of the computer-based diagramming tool for building scenarios of change and response.
- An overview of the state of the science on climate change stressors in the region.
- Illustration of how to build scenarios. We provided the participants with a simple example that linked information about climate change stressors to possible consequences, vulnerabilities, and response actions in the context of, for example, stormwater management.
- Development of diagrams representing scenarios related to specific “management concerns” and climate stressors. The participants determined the infrastructure or management issue they wanted to focus on, as well as the most important climate stressors facing their community (e.g., sea level rise, storm surges).
- A discussion of next steps and initial feedback about how the outcomes of the VCAPS process might inform planning in the community.

In response to the feedback we received from local officials in these communities we adapted the initial process design for implementing VCAPS. In the proposal we had articulated a series of three workshops, some of which would be a full day, and spread over 5-6 months. However, for example, the participants from Sullivan’s Island were quick to tell us that full day meetings would be impossible because of town staff schedules and the fact that others on town commissions had other day jobs. They asked us not to schedule meetings in the evenings or on weekends. They also preferred to do something that was more compact in time, rather than the 5-6 month process we

had proposed. Similar feedback was given to us by the local officials in McClellanville and Plymouth.

Some time after the last meeting we provided the participants with a narrative summary and diagrams representing the scenarios developed during the meetings. We also gathered feedback from participants via phone interviews and written questionnaires.

Attached with the Project Final Report are:

1. A project overview handout provided to prospective participants, announcing the project and its purposes.
2. A handout defining the “building blocks” elements in VCAPS diagrams.
3. An example of the “state of the climate science” presentation given during the first meeting in each community.
4. Narrative summaries of the outcomes of the VCAPS process from Sullivan’s Island and McClellanville. The Plymouth, NC narrative is part of a longer report from the NC Sea Grant Program about other, ongoing work with this town, and it is not yet ready for public distribution.
5. VCAPS diagrams produced in each of the three communities.

Objective 2: Evaluate the practicality and usefulness of VCAPS and the mediated modeling approach for local decision makers in coastal management and climate change planning with the collaborative input of coastal managers, scientists, and community members.

Our assessment of the VCAPS process, informed by participants’ feedback and observations of participants interactions lead us to conclude that it is a useful and practical approach for local decision makers in coastal management and climate change planning.

Our observations suggest that the VCAPS process is useful for:

- facilitating individual learning,
- facilitating group deliberation and learning,
- improving understanding of factors that affect vulnerability and adaptation planning in local contexts, and
- facilitating planning.

These outcomes are promoted by

- Use of a conceptual framework structured thinking and discussions (i.e., integration of causal model of hazards and vulnerability),
- Self-generated scenarios, as opposed to having “outside experts” explain potential impacts and adaptation or mitigation strategies,
- Presentation of locally relevant climate change science to inform discussions,
- Real-time diagramming that supported understanding and sharing of information.

We also conclude that the VCAPS process is practical. It places relatively few demands on the time or resources of local officials. Development of diagrams is efficient; in our cases a useful diagram about a particular management concern or issue took 2-4 hours of meeting time. Project staff worked additional hours to check and “clean-up” diagrams in between meetings; this took about 2-3 hours additional work. Project staff also wrote summary reports, which were then provided to the participants for feedback.

The VCAPS process supports planning of local communities. It does this by:

- Gathering and summarizing information, knowledge, and experience that exists within a community.
- Stimulates thinking and conversation about how to manage consequences.
- Highlights multi-hazards approach, timing, and flexibility.
- Identifies issues or data needs that people may want to explore further.

We evaluated the practicality and usefulness of the VCAPS process in two ways (as discussed in Step 5.1 of the proposal): 1) gather feedback from participants in the communities in which VCAPS was implemented and 2) gather feedback from participants in outreach workshops.

First, we gathered feedback from participants in VCAPS processes in the three communities. We did this via written evaluation forms and follow-up phone interviews. Feedback from participants suggests that, in general, they were very excited about the benefits of using the process to structure deliberation among community decision-makers. Participants said they learned a lot, and they got excited about being better able to visualize both how their town was vulnerable to climate hazards and how it could respond to them. Although we worked with small communities where officials and staff know each other well and interact frequently face-to-face, they recognized the added value of a structured discussion that also: visually organized existing knowledge and experience, produced a final outcome summarizing that knowledge, and allowed for participants to question and learn from each other in an atmosphere not charged with politics or controversial decision-making.

The VCAPS process facilitated planning in four ways. First, participants noted that the scenario diagrams could be effective at convincing local residents and county/state/federal officials of the need to address climate related hazards. Second, they identified a number of actions that were already being taken or possible no regret or low regret climate adaptation strategies; this left them feeling more empowered to implement actions rather than feeling overwhelmed or lacking in control. Third, participants benefited from a process that encouraged long range thinking; while they often talked about more near-term planning needs we were struck by how existing management “silos” created barriers to climate change adaptation planning. Finally, participants expressed strong interest in using the outcomes of VCAPS to develop an action plan for their towns and/or they wanted the action plan to help them advocate for various actions and policies with county, state, or federal authorities.

In summary, examples of individual and group learning included new or deeper understandings that:

- potential impacts will be multi-faceted, and include public and occupational health, property damage, financial costs to town, economic loss to businesses, damage to critical infrastructure, and nuisance,
- there are opportunities for no/low regret strategies and co-benefits,
- there are opportunities for “upstream” preventative mitigation and adaptation strategies and “downstream” coping and adjustment actions by both public agencies and private parties,
- management strategies can have unintended consequences, and
- there can be tradeoffs among adaptation options.

Feedback we received about the VCAPS process specifically included comments such as these:

- “VCAPS provides the structure that allows for a focused discussion.”
- “This is good because you pull global issues into a local context.”
- “Laundry lists are useless [and VCAPS avoids creating them].”

- “Helps show how the problems we have now might get worse.”
- “Surprising how much agreement we found.”
- “For 4 hours, this is a respectable amount of work, another 4 hours and we’d have a finished action plan.”
- “I am enthralled with the idea of doing another session.”
- “It was an opportunity to get everybody together and get information out on the table in a format that was easily digestible. Now the chart is obviously very complex. But working through the chart one step at a time, one issue at a time, one idea at a time and one possible solution at a time was advantageous to everybody there. ”
- “Even though we did not focus the discussion on climate change, we ended up addressing all the key issues that are relevant to planning for it.”

Second, we gathered feedback from participants in outreach workshops (these workshops are discussed further below, in the section on Outreach and Dissemination). For example, as part of the training workshop conducted at the Coastal Zone 2011 meeting we gathered written feedback from participants. These are some of the things we were told, in response to the question “can you envision using a tool like VCAPS in your work?”:

- “I think having this visual way of capturing a conversation, beyond simply catching notes on flip charts, is very helpful. I think it will help people keep on track a bit more because people can see where their comments get “binned.” When you use a more linear, flip chart approach, it’s hard to get people to stay focused on what is a consequence, which is an outcome etc. This helps people in the room see which is what and essentially provides a visual training for everyone to make sure everyone in the room is using the same vocabulary. This is often times the biggest challenge in any structured dialogue! One limitation is one that we discussed at the workshop; there isn’t a built-in way to prioritize the next steps for action. I see this as a tool that is used in the beginning of a conversation, but there then has to be more work to transfer this into any sort of action or implementation plan. But...I can also see how the VCAPS products can easily lend themselves to some sort of prioritization process and ultimately to a plan of some sort.”
- “Yes, though I think we would need to bring someone in from the outside to act as a facilitator and climate change expert.”

At a workshop with extension agents and planners from the Gulf Coast, we heard the following comments after introducing VCAPS and completing a short diagramming exercise:

- “very productive, good conversation.”
- “So much more we could have done with more time.”
- “Lots of interconnections.”

We were also encouraged about the usefulness and practicality of VCAPS by feedback we received after workshops and presentations because participants have expressed interest in using VCAPS in their own work in Puerto Rico, Los Angeles, CA, Tybee Island, GA, and Ocean Beach, MS.

The feedback, illustrated by the quotes, shows that many participants found VCAPS useful and practical. However, not everyone agreed. For example,

- “How it works depends on who is participating.”
- “Time went by quickly. Ideas came forward very fast. Difficult to capture all the ideas that were being said.”
- “Local officials and planners may not get a lot of time to sit and talk and think, but as academics, we do things like this a lot – concept mapping [so its nothing new].”

- “It just seemed like too much emphasis was spent on getting the diagram to look good with all the right colors and connectors rather than the important discussion that could have been occurring. As a result, the tool seemed to be more of a distraction than an aid to illustrate the concepts. I have done similar work with influence diagrams, but developed the diagrams after the conversation. A second meeting was then used to go over the diagram and make any necessary changes. Maybe a hybrid of the two approaches would be more useful so that the group’s excitement on the discussion is hindered by the relatively slow development of the diagram.”

This should not be surprising. No tool or process is good for all purposes, contexts, or personal preferences. Further evaluation and research should help to clarify contexts for which VCAPS is more or less useful and practical.

In addition, few local officials expressed a desire to use VCAPS on their own. They wanted the support of outside facilitators, extension agents, or academics to conduct the process. They did not indicate a desire to learn how to use the diagramming program (VUE).

Finally, we found that the results of a VCAPS process are unlikely to be used unless the process is closely tied to an on-going planning activity or decision process and explicit attention is given to integrating the information emerging from VCAPS with the planning or decision.

Outreach and dissemination of VCAPS

As part of our proposal we planned to conduct workshops and presentations with planners and extension staff about VCAPS and to disseminate information about VCAPS and lessons learned for other communities, regional planners, and extension workers.

Specifically, we proposed to:

- Conduct three outreach meetings with decision-makers and stakeholders in the southeast (Step 4.1 of the proposal).
- Write a report that describes the process and lessons learned for others working with coastal communities (Step 5.2 of the proposal).

Outreach and training

During the course of the project we determined that local officials, planners, and other local government staff were uninterested in implementing VCAPS by themselves. While they valued the process and its outcomes, they did not feel confident in being able to implement the process on their own. They wanted the help of extension staff, academics, or consultants. Consequently, we focused on training and outreach to such people.

We presented our work at the following conferences and meetings:

- 1) The 8th Annual Water Resources Conference, April 7, 2011 in Amherst, Massachusetts (no travel cost to project).
- 2) The Sixth Symposium on Policy and Socio-economic Research, held as part of the AMS 91st Annual Meeting, 23-27 January 2011 in Seattle, WA.
- 3) The 2011 Land Grant and Sea Grant National Water Conference, Washington DC, 31 January - 1 February 2011. We were invited to provide a poster presentation about the project (no travel cost to project).
- 4) The 2011 State of the Sounds Symposium, Albemarle-Pamlico National Estuary Program, New Bern, NC, November 17, 2011.

- 5) Invited presentation, *Interdisciplinary and Global Studies Division Seminar Series*, Worcester Polytechnic Institute, Worcester, MA. 22 November, 2010.
- 6) Invited presentation, *Improving Understandings of Consequences, Vulnerabilities, and Adaptation Strategies to Climate Change Related Hazards*, MIT Sea Grant, Cambridge, MA, 8 February, 2012. See: http://seagrant.mit.edu/press_releases.php?ID=292
- 7) Invited presentation, NOAA in the Carolinas meeting, Charleston, SC, March 15, 2012.

An example of the presentations is attached with the Project Final Report.

We conducted training workshops on VCAPS at the following:

- *Gulf of Mexico Climate Outreach Community of Practice workshop* on June 1-2, 2011 in Biloxi, Mississippi. We introduced VCAPS to approximately 100 participants, including an exercise in using the diagramming process.
- *Coastal Zone 2011 meeting*, Chicago, IL 17 July 2011, entitled *Helping Coastal Communities Strategize Adaptations to Climate Change: How to Implement a Structured Dialogue Using an Interactive Diagramming Program*. 12 people participated.
- *Social Coast Forum*, Charleston, SC. 15-16 February, 2012. We participated in a Tool and Job Aid Demonstration Roundtable to illustrate the use of VCAPS to about 15 individuals, entitled *Helping Coastal Communities Adapt to Climate Change Using the Vulnerability and Consequences Adaptation Planning Scenarios (VCAPS) Process*.
- *Mississippi-Alabama Sea Grant Consortium webinar*, March 1st, 2012. 20 individuals participated in the hour-long webinar.

We have also been invited to present about VCAPS at the Climate Adaptation Training for Local Governments in Southeastern Massachusetts Workshop, scheduled for 24-26, April, 2012 (see www.waquoitbayreserve.org/eventshow.aspx?eventid=337 for more information) and the Southeast and Caribbean Climate Outreach Community of Practice meeting, scheduled for June 12-14, 2012, in Jacksonville, FL.

Based on the presentations at the State of the Sounds Symposium and the NOAA in the Carolinas meetings, several outreach entities in the Carolinas have expressed interest in developing teams of trained VCAPS facilitators in each state. These teams would produce local personnel well versed in all aspects of VCAPS facilitation who would be able to assist individual outreach institutions, such as Sea Grant programs, National Estuarine Research Reserve Coastal Training Programs, and county cooperative extension offices, with facilitating VCAPS exercises on climate and hazards when requested by communities. In the past, such entities have expressed a preference for having members of the original VCAPS development team present for each community exercise; by increasing outreach personnel's comfort with the exercise VCAPS would be able to successfully transition beyond the research team. The SC Sea Grant Consortium and NC Sea Grant are working on developing this idea for Fall 2012 under the Carolinas Coastal Climate Outreach Initiative, with potential workshops and webinars to be considered near the end of the year or in early 2013.

Example abstracts for the Coastal Zone 2011 and Social Coast Forum training workshops are attached with the Final Report.

Reports

SERI maintains a website with information about the project and documents related to the project: www.seri-us.org/content/coastal-adaptation-planning.

These include a Users Guide and Facilitation Guide for implementing VCAPS, an Introduction to the VCAPS Process report, and conference presentations. Several of these are attached with the Project Final Report. As further reports and publications emerge from the project they will be posted to this website.

Finally, at this time we are preparing multiple manuscripts for submission to peer-reviewed journals:

- An overview of the conceptual basis for the VCAPS process, that also discusses the benefits of integrating real-time diagramming of scenarios and deliberation among local officials.
- A case study of Sullivan's Island, with a discussion of the challenges facing barrier islands.
- A discussion of how decision support tools and mediated modeling processes (like VCAPS) can support individual learning and a framework for overcoming the challenges of meaningfully assessing the character of individual learning.

Future research activities

SERI has received an award from MIT Sea Grant to further develop and implement the VCAPS process in coastal Massachusetts' communities. In this project the goal is to integrate the VCAPS process into routine hazard mitigation planning and assess the value added by VCAPS. Our success in gaining the participation of communities in Massachusetts is a direct result of our successes in the Carolinas as part of the SARP project. We are working with the City of Boston, City of New Bedford, and Town of Plymouth. The MIT Sea Grant project is from 1 Feb 2011 – 31 January, 2013. It offers an opportunity to make further progress on understanding effective ways of promoting coastal community adaptation planning for climate change. More information about this project can be found at:

www.seri-us.org/www.seri-us.org/content/MA-Coastal-Hazard-Mitigation-Planning

Additionally, several NOAA Sea Grant programs proposed using VCAPS as integral parts of the recent call for NOAA Sea Grant Coastal Communities Climate Adaptation Initiative (CCCAI) proposals. VCAPS was included as part of the proposed work plans submitted for review by California Sea Grant, Georgia Sea Grant, and the South Carolina Sea Grant Consortium. Awards under the CCCAI grant program are pending and have not been formally announced.

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