

# **Stakeholder Meetings Final Report**

**Climate Change Science Program  
Synthesis and Assessment Product 4.1**

**Coastal Elevations and Sensitivity to Sea Level Rise**

**October 15, 2007**



# **Stakeholder Meetings Final Report Climate Change Science Program Synthesis and Assessment Product 4.1**

## **Introduction**

**The purpose of these stakeholder meetings was to include a required stakeholder review in the development of the Synthesis and Assessment (SAP) 4.1 Product. Details of the product and the complete review process can be found at:**

**<http://www.climatescience.gov/Library/sap/sap4-1/default.php>**

**The Environmental Protection Agency (EPA) is the coordinating lead agency for SAP4.1, with the United States Geological Survey (USGS) and the National Oceanic and Atmospheric Administration (NOAA) as supporting lead agencies. During the stakeholder review, the lead and contributing agencies solicited comments on a stakeholder review draft from state and local governments, and from other stakeholders who expressed an interest. The lead authors then modified the product to incorporate the stakeholder concerns and prepare a subsequent draft version. Along with review by the author teams, the individual meeting stakeholder reports were also sent to each of the participants for review. Agency author teams were led by James G. Titus (EPA), Eric K. Anderson (USGS) and Stephen K. Gill (NOAA). NOAA was responsible for funding, planning and facilitating the three stakeholder meetings and has submitted this report:**

**Stephen K. Gill, NOAA, National Ocean Service  
Center for Operational Oceanographic  
Products and Services**

**Linda Hamalak, NOAA Coastal Services Center**



**Stakeholder Meetings Final Report  
Climate Change Science Program  
Synthesis and Assessment Product 4.1**

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## **COASTAL ELEVATIONS AND SENSITIVITY TO SEA LEVEL RISE**

### **Climate Change Science Program (CCSP) Synthesis and Assessment Product 4.1 Stakeholder Meeting Agenda For Maryland, New Jersey and North Carolina Meetings**

<b>0900 am – 0930 am:</b>	<b>Arrival and registration</b>
<b>0930 am – 0950 am:</b>	<b>Overview of the Climate Change Science Program (CCSP) – Purpose of this meeting - Introductions</b>
<b>0950 am – 1030 am:</b>	<b>Overview of the CCSP Synthesis and Assessment Product (SAP) 4.1 – the Prospectus and schedule.</b>
<b>1030 am – 1045 am:</b>	<b>Morning Break</b>
<b>1045 am – 1100 am:</b>	<b>Introduction to the CCSP SAP 4.1 Stakeholder Draft</b>
<b>1100 am – 1200 pm:</b>	<b>Stakeholder led discussion of key questions 1 and 2.</b>
<b>1200 pm – 0100 pm:</b>	<b>Lunch (provided on-site)</b>
<b>0100 pm – 0230 pm:</b>	<b>Stakeholder led discussion of key questions 3, 4, and 5.</b>
<b>0230 pm – 0245 pm:</b>	<b>Afternoon Break</b>
<b>0245 pm – 0330 pm:</b>	<b>Stakeholder led discussion of key questions 6 thru 10.</b>
<b>0330 pm – 0400 pm:</b>	<b>Summary and wrap-up; schedule for written comments.</b>

**The morning program overviews were made by the CCSP SAP4.1 Authors. The discussions of the key questions were primarily stakeholder led and facilitated by a contributing author. Notes were taken and summarized for subsequent report out to all participants. Written comments were solicited to ensure maximum feedback. Copies of the Prospectus and the Stakeholder Draft were made available at the meetings.**





# **COASTAL ELEVATIONS AND SENSITIVITY TO SEA LEVEL RISE**

## **Climate Change Science Program (CCSP) Synthesis and Assessment Product 4.1**

### **Stakeholder Meeting**

**9:00 a.m. to 4:00 p.m.**

**June 5, 2007  
Tidewater Inn  
Easton, Maryland**



Blackwater Wildlife Refuge – photo credit Lisa M. Mayo and  
U.S. Fish and Wildlife Service

Climate Change Science Program Synthesis and Assessment Product 4.1  
Coastal Elevations and Sensitivity to Sea Level Rise

Maryland Stakeholder Meeting Report  
Tidewater Inn  
June 5, 2007 Easton, Maryland

## **Introduction**

The purpose of this meeting was to support the completion of a required stakeholder review process for the development of the Climate Change Science Program (CCSP) Synthesis and Assessment Product (SAP 4.1). During the stakeholder review, the draft version of the stakeholder report was provided to the meeting attendees. The meeting followed a preliminary agenda provided earlier to each attendee and discussions were held on each of the key questions that form the basis for the structure of the report. These questions are also found in the agenda.

After introductions of the meeting attendees and SAP4.1 authors (attendee list attached), Jim Titus (EPA) gave a brief opening statement:

“As far as we know, the waters that surround the Delmarva Peninsula have been rising for as long as people have been living here. But this is the first generation to pay attention. Maybe that’s because we can measure the sea level better—maybe it’s because people are putting more and more permanent structures in the areas that are going to be inundated. Maybe it’s because people are changing the climate, which raises the sea—and we have a responsibility to understand the consequences of our actions. The authors of this report have been entrusted with putting out a report that explains what we know—and what we suspect—about the risks of rising sea level. But many of you are entrusted with the far more important responsibility of formulating the decisions that will determine whether rising sea level is a nuisance for which we are prepared, or a disaster because we didn’t. Please tell us what we can do to help.”

A presentation was given by Steve Gill (NOAA) on the overall CCSP program, putting into context this SAP4.1 effort with the overall process and timeline. The SAP4.1 Prospectus was reviewed and an overview provided on the history and status of the report. The meeting attendees were provided with binders with CCSP information, the SAP4.1 Prospectus, and with the draft stakeholder report sections.

This specific meeting was the first in a series of three stakeholder meetings held in June 2007, with the second in Red Bank, NJ and the third in Plymouth, NC. Meeting reports are being prepared and distributed to each of the attendees for comment. In addition, at each of the meetings, a handout was given to the attendees in which they were given the opportunity to make comments on the report outline, and to provide comments on

specific key questions and map layouts. A summary of these comments will be included in the final meeting report.

## **Discussions, Comments, and Questions**

### **1) The discussion on Question 1:**

#### **Question 1) Which lands are currently at an elevation that could lead them to be inundated by the tides without shore protection measures?**

The discussion on Question 1 was led by Zoe Johnson (MDDNR). Zoe opened the discussion by asking how best to answer the question. How vulnerable are we? How do we know which low lying lands will be inundated by sea level rise? The states have been trying to obtain better topographic data sets, such as from LIDAR in order to develop inundation models. Dixie Birch (Chesapeake Wetlands NWR) suggested most county planners are unaware of risks and there are needs at state and county planning level.

The next discussion was on the need to have some statement of uncertainty or error bars on the elevation data because of the variable quality and resolution of the source data.

David Carter (DNREC) recommended the need for caveats on use of high resolution data for the policy maker in order for them to understand vulnerability. Don't just overlay, put caveats up front. Delaware has flown the LIDAR and they are within two months of having statewide LIDAR with 2-foot contour lines that would let you get one foot resolution. He is very wary with misapplication of LIDAR, because people will just take the data without proper caveats and post-processing and will make bad decisions. He asked how we should generate meaningful regional data, not piece meal data sets. Can we answer the question of what will it look like in 100 years? How do we take into account regional and local subsidence? It is clear these CCSP 4.1 questions are linked.

Zoe gave an overview of the Maryland programs. They have the LIDAR and they have done elevation mapping and floodplain maps. Changes were made in the state comprehensive plan in terms of calling to evaluate freeboard standards of 2-foot above floodplain. For this report, answers to Question 1 will set the stage for accepting vulnerability to basic inundation. Zoe gave an overview of the Worcester County, MD study performed by NDDNR and USGS on potential combined effects sea level rise and storm surge and produced a set of map products for use by county planners. This has been an example of a comprehensive planning product that could lead to planners making changes in local policy.

Zoe asked how important is Question 1 in the context of the other questions? Is it critical to use the best available data? When Maryland started their work, they only had limited tools and data and did the best they could. The data sets reveal only a snapshot in time as well. And you can't always do things on a larger mid-Atlantic wide scale and be up-to-date everywhere.

Audra Luscher (MDDNR) talked of the need to use the figures in this chapter as a tool for approaching federal agencies. The maps are piecemeal products that show where you are. Use the maps to take a message on a federal level to show how to get people to work together to get national imagery for the nation across jurisdictional boundaries and could be used to drive policy. These piecemeal products on small areas may not be efficient to the local user, but to send a national message, they are.

Bob Scarborough (DNERR) suggested coupling Question 1 with Question 2 to address if these identified areas accrete, erode, more or less. You need to predict what the land elevation will be when the sea rises. The authors suggested that we would discuss that coupling when we discuss Question 2. Skip Stiles (Wetlands Watch) suggested also try to discuss subsidence and those effects coupled with sea level rise.

Mike Kearney (UMD) pointed out that many people do not realize how low these areas are. There is very little slope to the land anywhere and a good part of the Eastern shore you must go well inland to find any topographic relief. The graphic such as found in this chapter showing what it means is very useful.

Zoe commented that assessing impacts of sea level rise is a complex picture and we must look at the total picture, include coupled effects of variations in tidal range, include impacts of inundation from coastal storms and hurricanes and we need to emphasize the extent of inundation on the low-lying land for the total picture.

Wanda Cole (Environmental Planner) talked about how in Dorchester County especially, the soils have loose consolidation. This causes soils to disintegrate quickly when stressed. Marsh erosion converts to open water. The old photography shows huge sections of marshland that have disappeared. She recommended having a soil scientist look at the soils to predict how much water it takes to cause the marsh to disintegrate.

David Carter talked about the importance of high-accuracy elevation data as the base to build upon. He would like to see a technical document that builds on that, to help justify additional information. He needs a tool to use so he can take it to management to make a forceful argument for policy change. He also felt it was important to have a document showing the steps needed to get the desired LIDAR data results; the uncertainties; the costs, and the post-processing often necessary to produce a usable product from LIDAR. The authors are discussing a having sidebar for LIDAR in the report or including it into the research plan as a topic.

## **2) Discussion on Question 2:**

**Question 2) How does sea-level rise change the coastline? Among those lands with sufficient elevation to avoid inundation, which land could potentially erode in the next century? Which lands could be transformed by related coastal processes?**

Discussion on Question 2 was led by Zoe Johnson (MDDNR). The focus of the existing chapters addressing Question 2 was discussed as it is focused on outer coast erosion issues and not on inland and estuarine shorelines. It was pointed out that when we talk about erosion, we also have episodic erosion, from chronic erosion from boat traffic to extreme events erosion from hurricanes. For instance, in Calvert County, MD shore erosion is significant on the western shore bluffs. Erosion from sea level rise is a long-term effect that is integrated with the shorter term events. Zoe pointed out that Maryland has been very aggressive at addressing erosion in the Chesapeake Bay with establishment of shore erosion task forces and that dealing with erosion strategies was complementary with sea level rise strategy.

Several attendees then discussed beach nourishment issues. It was pointed out that the Virginia Institute of Marine Science (VIMS) has shoreline inventory. Are we addressing all areas? Are we addressing how beach nourishment changes shoreline erosion? Dixie Birch asked how sustainable are present practices for beach nourishment such as for Ocean City, MD? Jeff Scarborough asked what happens in 50 years? Mike Kearney pointed out that the time scales of the loss due to erosion, the time scales of major storms, and the time scales of the cost and engineering project life-cycles are all interrelated. The reliability and sustainability of source material for beach nourishment must always be considered. David Carter mentioned that Delaware has lost the sandy habitat on Delaware shores. The only sandy habitat that remains is artificial nourishment. Zoe pointed out that protection from loss of personal property can also be a beach nourishment issue. On the outer coast the USACE deals with the long-term nourishment, but not so much inside some of the estuaries.

Danielle Kreeger (Partnership for the Delaware Estuary) explained that we need to be aware of certain threshold conditions being reached when trying to answer this question. Perhaps once these threshold conditions are reached, then increased loss starts occurring. Potential mitigation strategies include use of living shorelines, living reefs and armoring. Jeff Williams (USGS) briefly discussed threshold conditions or “tipping points” for coastal processes and how they are not necessarily aligned with policy making time frames and that they are complex non-linear processes. He commented that because of these tipping points, it is very hard to predict the future based on the past for answering this particular question. Danielle Kreeger followed with a comment on the need for an integrated landscape and/or watershed approach and on the need to integrate several of the CCSP SAP4.1 questions in order to answer them in context.

David Carter talked about the level of loss in Delaware and the extreme coastal erosion rates along some shores such as Bombay Hook. The Delaware Bay has different issues than the outer coasts. There is very little natural habitat left in Delaware Bay as a result. The question is how do we maintain the very thin veneer of wetland that we have left? The habitat issues will be addressed again in Question 8.

Mike Kearney then discussed sediment transport, noting the important role of longshore transport along coasts and in estuaries, but it has not been identified and studied well and people are not dealing with it very well. It is known the sediment transport is strongly

affected by engineering modifications along the shoreline and affected by waves and erosion however many modifications are made without understanding the regional affects. There is very little policy in place when it comes to dealing with transport issues. Curt Larsen (USGS) has done bluff stability analysis in Maryland and found that if when you stabilize erosion of some bluffs, the slopes fail and the angle of response flattens and that also eventually increases erosion. A major science issue is to understand littoral processes and implications. It was noted that Question 2 and Question 6 of SAP4.1 are closely related and need to be discussed in context.

The group then discussed if any aspect of this SAP4.1 effort is geared toward public education. How accessible will the information be? What will we say about sea level rise rates? And will there be federal design criteria coming from this? Jim Titus explained that we can go up to the point of explaining design criteria that others have done. Dave Carter explained that Delaware has been looking at the education issue for a long time and that perhaps a role of this SAP document may tighten the uncertainty in sea level rise impacts.

Bob Abele (Maryland Coastal Bays Foundation) discussed public perception of impacts of sea level rise and what it takes to make an impact to the public such that they can , in turn, drive their elected officials to action. It is important to articulate dollar costs to the impacts. If the public does not perceive a threat, then action will not happen. How can the impacts be best dramatized? The example of the public reaction to the wind farm issue was brought up as a recent example. We need to think about long-term strategies and vision when it comes to public perception as well.

Skip Stiles (Wetland Watch) drove the point home that these large scale issues need to be localized as much as possible. That is where this gets fixed and policy decisions made – at that local zoning level. To the extent that you keep it (the planning and implementation process) local, it helps to drive the issue home. Ken Hranicky commented that this report could be used to construct a set of toolbox questions that need to be examined by local governments. Just stating the risks is not enough and we should add a list of the recommended questions to ask. Zoe mentioned how Maryland is developing a plan for how to do this transfer of knowledge to local policy makers. It will be given to local government. Audra Luscher added that these SAP questions enumerate all the things you need to look at, but to actually make a difference at the local planning scale, we need to provide guidance on how to interpret information and how to drill down into the details such that they make sense to the local user.

David Carter favored a statewide approach for the questions and thought that the state should then make it scalable to the local planner. He used Sussex County in Delaware as an example of a county for which the state could help to steer and guide it using this report. He would like a list of modeling priorities on how to do it and would like to see a list of models and model approaches, scalable for different areas. He wants guidance that they can build on.

Danielle Kreeger thought that local stories are important to capture key points. Her example was freshwater flow management from NY and PA? Their attention to salinity gradient increasing by 2.0 ppt will push oysters past the threshold point of no return so we need to look at whole systems when answering these questions.

It was noted that New Jersey was taking natural capital concept done in terms of ecological services when trying to cost out strategies. The socioeconomic value needs to be integrated into the question discussions.

### **3) Discussion on Question 3:**

**Question 3) What is a plausible range for the ability of wetlands to vertically accrete, and how does this range depend on whether shores are developed and protected, if at all? That is, will sea-level rise cause the area of wetlands to increase or decrease?**

Mike Kearney (UMD) led the discussion for Question 3 and showed and discussed a few illustrative powerpoint slides to open the discussion. He gave an overview of climate and environmental drivers influencing vertical and horizontal wetland development. He discussed the importance of thresholds and tipping points to the wetland processes and suggested that, for instance, there has been more change in the time period 1999-2001 than there was in the previous period from 1988-1999. Thresholds may be particularly applicable to micro-tidal areas with low tidal velocities with slow accretion rates and low sediment transport. Sudden die-back of marsh species is also a big issue due to climate change from more than just sea level rise. Mike felt that in there may be no Chesapeake Bay marshes (at least like the current ones) by 2100 and that proactive mitigation efforts must begin soon on a large scale. Dixie Birch gave an overview of the Blackwater marsh nourishment project plans for using clean dredge from Baltimore harbor entrance channels.

Audra Luscher asked about re-framing the CCSP 4.1 question in terms of doing protection of marsh for preservation – is that considered a form of shore protection?

David Carter asked how can we do better sediment management? What are the decision points for using beneficial use of dredge material vs. sediment management? Is there a regional approach? How do we do triage? What are ecosystem services provided by marsh? If we can determine the ecosystem services value, then use to value the triage. We need to know which wetland systems to restore and save first and which ones make sense to attack strategically over the longer term.

Danielle Kreeger added stating we need information to be able to make decisions relative to the long-term “bang for the buck”. How do we invest in marshes re sustainability vs. restoration? Need to ask which marsh can realistically be saved in a cost-effective manner. Location matters as some wetlands will not be able to move upland next to developed areas.

Jim Titus asked how are marshes affected by upstream development? The present report doesn't address upstream sediment loading and potential sources of sediment over the long-term. This led to a group discussion on thinking about working by small watershed, saving key inland land uses, e.g. agriculture that provide sediment source, but protecting estuary health at the same time. There is a need to worry about sediment toxicity and maximum loads, etc. The kind of sediment being used for restoration is also important. This is a science issue needing more research.

Audra Luscher discussed long-term vs., short term issues in the context of the eastern Shore of Maryland, which has elevation terraces shown from the LIDAR data which will have different effects on the ability of wetlands to move upland over various time scales. For instance at Blackwater, the second terrace may have to move to a "hub & corridor" planning approach to allow natural progression.

Curt Larsen discussed the importance of tidal exchange and strong tidal velocities in sediment transport budgets and if a system is in a net-ebb transport mode then sediment addition will not stay and interior marsh will begin to be lost. There is much more needed in understanding marsh hydraulics.

One Important concept discussed was how can coastal environmental programs be improved to deal with sea level rise issues?

#### **4) Discussion on Question 4:**

**Question 4) Which lands have been set aside for conservation uses so that wetlands will have the opportunity to migrate inland; which lands have been designated for uses requiring shore protection; and which lands could realistically be available for either wetland migration or coastal development requiring shore protection?**

Dixie Birch (Chesapeake Wetlands NWR) led the discussion of question 4. The complexity of this question was acknowledged. Jim Titus discussed the context of this question relative to which dry lands would be allowed to become wet and which dry lands will remain dry though protective measures. The efforts to save some of the Chesapeake Bay Islands was used as an example of a proactive shore protection measure because if these islands were lost, then the more populated mainland areas would be unprotected and then be at immediate risk of coastal erosion.

Danielle Kreeger put the question in the context of if we do nothing, what would happen, and then what are the actions we know we can do?

David Carter proposed looking at it in terms of a cost-benefit analysis. The New Orleans levees are one extreme, the use of impoundments, are another. There is a need to cost out various strategies and there is a need for guidance on how to best align land acquisition strategies with the most beneficial response to sea level rise issues. What are



the impacts of land use strategies on the ecosystems, on habitat, etc.. What are the environmental benefits and socioeconomic benefits of one approach over another?

The use of ecosystems based management was discussed in this context – very good idea, very hard to execute. Political boundaries divide the ecosystems and put in place classic institutional barriers. It was noted that as a strategy that the Chesapeake Bay Program has classic 5 “pillars”: 1) Restoring Healthy Waters, 2) Restoring Healthy Habitats, 3) Ecosystem-based Fisheries Management, 4) Bay-friendly Watershed Management, and 5) Fostering Chesapeake Stewardship for use as a regional approach.

The authors asked the attendees to think about what are the institutional barriers to a sound decision-making process. This gets to the later Question 10.

### **5) Discussion on Question 5:**

**Question 5) What are the potential impacts of sea-level rise on coastal floodplains? What issues would FEMA, coastal floodplain managers, and coastal communities face as sea level rises?**

Ken Hranicky (Baltimore City Dept. of Planning) led the discussion and first discussed some of the fundamentals of the FEMA floodplain process and it fundamentally being a process to protect existing development and investment. Funds for updating Floodplain maps do not come from FEMA as their map modernization process is just digitizing existing maps that may or may not have updated information. This varies by state. Two foot contours are needed minimum to be useful for sea level rise implications, but that resolution is not readily available. Delaware and Maryland have used their own funding sources to obtain updated LIDAR data to update floodplain maps. The discussion centered on the need to make investment in updated information in order to get truly modernized floodplain maps. The drawback of the floodplains being demarcated by a flat water surface elevation approach instead of using hydraulics or hydrodynamic knowledge to describe the floodplains was discussed. The use of older maps having old drainage patterns was seen as a disadvantage. It is known that development changes flood plain because of impermeable surfaces and floodplain maps should be adjusted for development using hydraulic studies.

The need to expand the map usage beyond insurance applications to include proactive use for emergency managers and disaster mitigation applications was expressed. Wanda Cole suggested that the floodplain process should be more closely integrated with the CZM process and for use in mitigation planning and emergency management.

This was pointed out by the authors as an area to highlight institutional barriers for obtaining a useful product.

Audra Luscher pointed out the need for real national mapping program that addresses real needs and that the existing FEMA map modernization falls short because it just converts old paper products to digital form. The map products should include the effects of

situational storm case studies – studies of local impacts. The CBOS modeling study on Potomac River inundation study was mentioned as a prototype example. High resolution studies would include effects of backwater storm surge elevations. Products would include information on the infrastructure at risk in the floodplains that could be used by county and city governments. The products need to be more closely linked to congressional policy-making processes and timelines.

## **6) Discussion on Question 8:**

### **Question 8) Which species depend on habitat that may be lost due to sea-level rise given various levels of shore protection and other response options?**

The discussion was opened by Ann S. Jones (IEC/EPA). Ann pointed out that some of the documented impacts are part of the stakeholder draft handout and they are the background detailed documents being used to answer Question 8. The maps and discussions found in Questions 2 and 3 form the basis for the discussion in Question 8. The answers are present regional in scope and describe a species by species approach.

One idea for linkage between these questions was the use near shore oyster reefs to weaken wave energy to protect marshes while improving a particular habitat species.

Dixie Birch pointed out some specific endangered species in the Chesapeake Bay NWR: losing piping plover, losing fox squirrel at Chincoteague; Bald Eagles at Blackwater, Horseshoe crab in Delaware Bay etc... Danielle Kreeger pointed out that the changes in salinity change due to climate change and sea level rise will affect certain species and these types of changes are not on anyone's radar screen. There are also secondary HAZMAT types of effects: for instance inundation of old oil tank farms that could have detrimental effect on habitat if not addressed. Skip Stiles mentioned that the cumulative impacts on back bays need to be addressed. The tidal headwater habitats can't be ignored and we need to consider cumulative loss of habitat along Atlantic Flyway.

Danielle Kreeger continued the discussion by noting that the CCSP report needs to address the long-term indirect effects on species from the ecosystem change standpoint. For instance, the changes in carbon and nutrient sources and sinks due to climate change, the fisheries dependency on the food web, and all the linkages and interactions in an ecosystem all need to be addressed appropriately.

Bob Abele pointed out the need to discuss habitat change by physical changes in response to sea level rise, such as new dikes, breakwaters and levees, the effects of sediment compaction mentioned earlier causing marshland to convert to open water. The discussion closed on comments on some habitat changes will rest on what dikes and impoundments are maintained in response to sea level rise.

## **7) Discussion on Questions 6, 7, 9 and 10:**

**Question 6) What are the population, infrastructure, economic activity, and value of property within the area potentially inundated by rising sea level given alternative levels of shore protection?**

**Question 7) How does sea-level rise affect the public's access to—and use of—the shore?**

**Question 9) Which decisions and activities (if any) have outcomes sufficiently sensitive to sea-level rise so as to justify doing things differently, depending on how much the sea is expected to rise?**

**Question 10) What adaptation options are being considered by specific organizations that manage land or regulate land use for environmental purposes? What other adaptation options are being considered by Federal, state, or local governments? What are the specific implications of each option? What are the institutional barriers to preparing for sea-level rise?**

Questions 6, 7, 9 did not have sections in the stakeholder draft and were not discussed in detail. Question 10 was also not included in the stakeholder draft, however the attendees were asked specifically to think about what institutional barriers exist in their experience in dealing with effects of sea level rise and to make sure they included those in their written comments.

For these questions, there was brief general discussion on concerns about wetlands protection in the face of development, increased surface runoff, grandfather clauses in present growth plans, and the lack of attention to impacts of sea level rise in present comprehensive plans. Most areas designated as critical areas in comprehensive plans are not really no-build laws. It was felt that local governments and local politics are the key decision-point in making a difference and there was discussion on the need to put together incentives and benefits packaging targeted to that audience in order to drive change in present practices or to change local laws and local zoning.

## **Meeting Conclusion**

Meeting attendees were asked to fill out the general questions document handed out at the meeting and were asked to provide written comments within two weeks of this meeting. They were told they will have the opportunity to review and comment on a meeting report.

## List of Attendees

MD STAKEHOLDERS		
First Name	Last Name	Organization
Bob	Abele	Maryland Coastal Bays Foundation
Tammy	Banta	Maryland Environmental Service EPATS
Dixie	Birch	Chesapeake Marshlands NWR Complex
John	Blandin	Wetlands Watch
Michael	Bonsteel	Dorchester County Planning and Zoning
David	Carter	DNREC/Delaware Coastal Programs
Wanda	Cole	Environmental Planner, Maryland
Bobby	Fenwick	Calvert County Emergency Management
Ken	Hranicky	Baltimore City Department of Planning
Ric	Kautz	Sussex County Land Use Planner
Audra	Luscher	MD DNR - Coastal Program
Steve	Olson	Washingtonian
Wayne	Robinson	Dorchester County Emergency Mgt Agency
Erin	Ross	Worcester County
Bob	Scarboroughh	Delaware National Estuarine Research Reserve
John	Sittler	Maryland State Highway Administration
Stanley	Snarski	Maryland Environmental Service
Skip	Stiles	Wetlands Watch

MD AUTHORS		
First Name	Last Name	Organization
Eric	Anderson	USGS
Mark	Brinson	East Carolina University
Don	Cahoon	USGS
Stephen	Gill	NOAA/NOS/CO-OPS
Ben	Guitierrez	USGS
Zoe	Johnson	Maryland DNR
Ann S.	Jones	Industrial Economics
Mike	Kearney	University of Maryland
Danielle	Kreeger	Partnership for the Delaware Estuary
Curt	Larsen	USGS
Liz	Strange	Stratus Consulting
Jim	Titus	EPA
Anne	Waple	NOAA/ National Climatic Data Center
Michael	Weinstein	NJ Marine Sciences Consortium
Jeff	Williams	USGS

# **COASTAL ELEVATIONS AND SENSITIVITY TO SEA LEVEL RISE**

## **Climate Change Science Program (CCSP) Synthesis and Assessment Product 4.1**

### **Stakeholder Meeting**

**9:00 a.m. to 4:00 p.m.**

**June 12, 2007  
Molly Pitcher Inn  
Red Bank, New Jersey**



Courtesy: Jacques Cousteau National Estuarine Research Reserve

Climate Change Science Program Synthesis and Assessment Product 4.1  
Coastal Elevations and Sensitivity to Sea Level Rise

New Jersey Stakeholder Meeting Report  
Molly Pitcher Inn  
June 12, 2007 Red Bank, NJ

## **Introduction**

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This specific meeting was the second in a series of three stakeholder meetings held in June 2007, with the first held in Easton, Maryland and the third in Plymouth, NC. Meeting reports are being prepared and distributed to each of the attendees for comment. In addition, at each of the meetings, a handout was given to the attendees in which they were given the opportunity to make comments on the report outline, and to provide comments on specific key questions and map layouts. A summary of these comments will be included in the final meeting report.

### **1) Discussion on Question 1:**

**Question 1) Which lands are currently at an elevation that could lead them to be inundated by the tides without shore protection measures?**

Jim Titus (EPA) led the discussion for Question 1 and gave an overview of the map products addressing this question and what the term inundation means in this context. Norbert Psuty (Sandy Hook Cooperative Research Program Institute) objected to the use of the term “shore protection” in this context and the potential misuse of the term. It is a broad term with many meanings. Titus asked for a better term that includes protection from both erosion and flooding, e.g. beach nourishment, seawalls, dikes, drainage. In this context, Jim explained that we are trying to also depict those dry lands that society would

try to keep from being wet for given scenarios of sea level rise in this report (see Question 4).

As examples of inundation, Titus mentioned Joey's Pizza in Beach Haven Crest, whose sign says "occasional waterfront dining" because the parking lot floods during spring tides. Michael Craghan (MACGES) and Linda Brennan (Monmouth County) added other New Jersey areas that flood during spring tides, including Sea Bright, Monmouth Beach, Manasquan, and small areas in parts of Brielle and West Wildwood. Avalon also requires pumping in some low areas.

There was discussion on the source data for the maps and it was mentioned that if more data becomes available before the report deadlines and if someone could do the analysis necessary, the authors would incorporate those results.

There was also a discussion on making sure the reader knew about the quality or uncertainty in the underlying data for these maps. Michael Weinstein (NJMSC) felt that there needs to be information on the bounds of uncertainty in the product. The product is a patchwork of data sources with varying degrees of uncertainty and resolution and with some spatial gaps and we need to make sure we provide the reader with a sense of the confidence in the data in context with the intended outcome of the product. Perhaps a detailed case study would be appropriate to explain the nature of the uncertainties for a given product.

Michael Craghan added that it is important to explain the confidence in these numbers as a starting point, but we also need to explain the ranges of confidence in the sea level rise projections being used in context of the contour intervals of the source data for the maps. The various sea level rise scenarios being used for this study were reviewed.

## **2) Discussion on Question 2:**

**Question 2) How does sea-level rise (SLR) change the coastline? Among those lands with sufficient elevation to avoid inundation, which land could potentially erode in the next century? Which lands could be transformed by related coastal processes?**

Duncan FitzGerald (Boston University) led the discussion on Question 2 and started with a general explanation of coastal mainland,/bay/ barrier island systems and some of the coastal processes involved in those systems as they respond to sea-level rise. One of the important impacts of accelerated sea-level rise concerns the response of the equilibrium profile, which affects the transfer of sand between the beach and nearshore. -SLR also affects discharge through tidal inlets, which controls the volume of sand contained in the sand shoals fronting and backing the inlet. One of the products of sea-level rise may be the conversion of marshlands to open water thereby increasing tidal exchange. This increase in tidal prism will result in larger inlet cross sections and perhaps alter the tidal dominance. The sequestration of sand on the ebb tidal delta is a function of tidal prism, so sea-level rise may ultimately lead to the transfer of sand from barrier to the offshore tidal shoal. An increase in open water area in the back-barrier may also lead to flood

dominance resulting in greater sand transport into the back-barrier. Time scales and volumes of sand sequestered offshore and inside inlets will be determined by the rate of sea level rise. Bay tidal prisms may also be altered by the formation of new inlets large storms. Discrete storm events may dominate coastal change and coastal erosion more than long-term effects of sea level rise. Norbert Psuty added that sediment budgets are significantly altered by storm events and storms tend to build flood shoals behind barrier islands. Barrier island rollover and catastrophic loss only occurs after thinning and dune loss.

Jeff Gebert (USACE) asked how we should try to answer this question. In case of NJ, we can not answer Question 2 without making an assumption of shore protection. There are many projects for pumping sand on shore, on back sides of islands, etc.. and in most instances, they are political decisions. There are various costs associated with doing nothing or continuing present policies. Jeff Williams (USGS) reiterated that Question 2 so far focuses at the open ocean shore. We have not yet determined the volume of sand that will be required for future beach nourishment projects and whether there is enough sand to sustain these needs. However, we were not in a position to factor nourishment projects into this report, so we are focusing on the natural coast. Jeff went on to explain the contents of the stakeholder draft sections dealing with Question 2.

Norbert Psuty then discussed that the shore profile response may shift inland with sea-level rise. A question was raised as to how the dune systems would respond? Would they maintain the same potential/resistance? Jeff Williams replied that they do not have a good understanding of dune response dynamics. The panel of experts convened to examine Question 2 had to limit their discussion to general concepts given the short time allotted. This question highlights a research need however. Norbert also pointed out the uncertainty in the coastal response – would there be a gradient slowly towards increasing vulnerability, a more uniform response, or one of non-uniform points of change due to storms for instance.

Wendy Carey (Delaware Sea Grant) asked if hindcast information can be used to demonstrate a scenario, if no action or no beach management is used to respond. This may help to get the message to government officials if we can make it clear what would happen if there is a no action scenario. Jim Titus and Jeff Williams responded that this report does not get into this kind of “what if” scenario because of the complicated processes involved and the interaction of the natural environment with human intervention. The report does acknowledge human interaction, but we are not in a position to forecast if present activities will continue into the future. There was then some “what if” discussion of what might happen to various barrier systems – if they would thin, form new inlets, or convert to open water.

Mike Craghan disagrees with the equilibrium profile assumption and the use of the Brunn Rule. Due to changing climatology, the past cannot be used to predict the future very well. There are two types of shorelines – those developed and those un-developed. There is a difference in the response. Ben Gutierrez (USGS) reiterated that this chapter is trying to just assess how it is today and pointed out the Fire Island case study in the report



as a reference. However, it was pointed out by FitzGerald that dynamic equilibrium profiles do exist along sand coasts and that the concept has relevancy in considering a translation of the shoreline landward.

There was a short discussion on the effects of climate change on the wave climate and how that would interact with sea level rise and with coastal processes. There is/will be some relationship and research is needed to use physics of coastal processes to predict response in the future.

Michael Craghan acknowledged that there is not enough data or data sets available to understand the dynamic equilibrium of these processes or to understand if the dynamics are changing. Norbert Psuty added that the shore profiles are variable depending upon many other variables and the equilibrium conditions for using the Brunn Rule are rarely met. One way to look at the possible impacts is that there will be an equilibrium shift to a new equilibrium state. There are potential thresholds in conditions that will cause these sudden shifts and the change may not be smooth or continuous. Michael Craghan followed stating that so many conditions are not the same as they were in the past, from dredging, temperature regimes, etc.. and we find it hard to predict based on past history alone. Jeff Williams added that the expert panel discussed thresholds, but that not much is really known and it is an area for research. He gave an example of Chandeleur Island in Louisiana as a possible good example of a barrier island that has reached threshold conditions and is deteriorating very rapidly. New data collected recently suggest that the Chandeleur Islands are rebuilding and their demise is not imminent.

Michael Craghan added that the human component must be taken into account somehow. What actions are humans doing that significantly interact with these processes – dredging, nourishment, etc.. and can we assess what is being done now and in the future. Perhaps the flow of the report could be more aligned with what is being done now, in the short-term, and then into the future and how might those timescales interact with potential threshold events. Jay Tanski followed that by suggesting that we need to incorporate the timescales we are talking about for sea level rise. A lot of controversy or uncertainty confuses people because people are talking about different time scales for geological to political. Jeff Williams added that this particular CCSP 4.1 effort is focused on the next 100 years, not the next 1000 and looking at 25, 50 and 100 cm rises in sea level over that time period.. People will not be concerned about 1000 years.

Tony Pratt (DEDNREC) asked in context what changes in longshore transport from where you want sand to where you don't could be caused by sea-level rise. Within CCSP study area, we understand a lot about sediment pathways and sink, but lack good understanding of sources. How will sea level change the coast? We need a better handle on all of these issues, including sediment budgets, rates of sediment transport and the sediment distribution system.

### **3) Discussion on Question 3:**

**Question 3) What is a plausible range for the ability of wetlands to vertically accrete, and how does this range depend on whether shores are developed and protected, if at all? That is, will sea-level rise cause the area of wetlands to increase or decrease?**

Michael Craghan (MACGES) led the discussion on Question 3 and explained the nature of wetlands and their risk to sea level rise, pointing out that if they cannot accrete fast enough to keep up with sea level rise, they will not survive. Michael showed figure 3.3.1 and gave an overview of the climate and environmental drivers influencing vertical and horizontal wetland development. It was commented that tides should be added as a driver in this figure. Norbert Psuty noted that this figure only depicts marginal marsh. There are also deltas and deltaic wetlands. Michael then discussed Figure 3.3.3 showing the geomorphic settings of mid-Atlantic tidal wetlands and commenting on how complicated and diverse system it is. The figure does not depict glaciation history and it was noted that there is a different glaciation history between North Jersey and Chesapeake Bay. Figure 3.3.4 was then shown and discussed on wetland survival in response to three sea level rise scenarios.

This led to a discussion on scales and the fact that the maps were at big geographic scales and that perhaps a finer scale map would be useful because there are significant variations at those finer scales. Don Cahoon (USGS) then discussed how the expert panel was convened to help to answer this question based on expert opinion of panel members, inductive reasoning and the use of peer reviewed research and literature. The hard data do not yet exist at the finer scales needed. It is recognized that numerous exceptions to these general characterizations exist.

Norbert Psuty commented on many areas that he has studied and has drawn the conclusion that by and large, the wetlands on the NJ area are marginal today. That is, the color red on these maps would be more appropriate. Wetlands in particular location keep pace—the ones that are there, but that is because overall the area is decreasing. He suggested that it is important to look at the net “aerial” changes in marsh, not just the vertical extent. Jim Titus noted that the CCSP4.1 Federal Advisory Committee urged the authors to get more regional input and that the maps could be revised if we were able to obtain new research data in the next few weeks.

Michael Craghan asked if there has been an increase in salt marsh that would show landward migration. He mentioned that the panel included known problems areas at risk, like Jamaica Bay, NY as places where red is depicted and that it was related to availability of sediment. There was discussion of fluvial input, due to land use changes. There was also discussion of changing tidal conditions. Mike re-iterated that the purpose of this presentation today was to solicit input to and comment to these maps. There was discussion of how human-induced effects should be handled in this question.

Duncan FitzGerald (BU) felt the accretion rates being used maybe too high. Wendy Carey commented on effects of sea-level rise in a vertical sense only. How do changes in wave climate interact with sea-level rise. What other complicating factors are there and how do you separate them.

Tony Pratt added that one of the factors to consider is annual biomass. To resource managers, one of the issues is change in climate. The question posed was how does climate change alter the biomass accumulation. Black needle rush marsh might take over patens for instance thus changing to a more southern climate regime. This would tend to be a negative feedback, reducing accumulation of biomass during the transition. This is not a simple problem. Spartina typically needs to be out of the water for 4-4.5 hours and how would sea-level rise alter this? Published literature includes bio-generation research that should be taken into account.

#### **4) Discussion on Question 4:**

**Question 4) Which lands have been set aside for conservation uses so that wetlands will have the opportunity to migrate inland; which lands have been designated for uses requiring shore protection; and which lands could realistically be available for either wetland migration or coastal development requiring shore protection?**

Jay Tanski (NYSeaGrant) led the discussion on Question 4. He explained that there was not expert panel convened for this question and that it was basically a planning study done over the past few years before the previous three questions were addressed. The eight coastal states in the mid-Atlantic study area use local home rule for local land use control and being able to capture the local response is key to this question. The figures in Chapter 4 depicting the likelihood of shore protection for various coastal sections were referred to and noted that they are land-use driven.

Jay noted that in New York at least, there is not much undeveloped land left along the coast. The variables of how fast sea level rises versus the costs of shore protection, and the future political response are not well understood. Tony Pratt commented that Sussex County points to the example of how agriculture land would be treated very differently than other types of developed and undeveloped land and how would that be captured in this report. He gave an example scenario of a farmer whose field graded down to very low elevation just above regular inundation. He probably had occasional flooding. At some point, it floods more often. Resulting action: He tossed dirt to create a berm at the wetland boundary. He created a 1-2 ft berm. Is this considered shore protection in the context of this report? The original assumption would be that this farmland would have just been left to convert because it was not in a developed area.

Tony continued with another example for Assateague Island, VA which is shown as no-shore protection. There is now a plan to nourish the northern 3 miles. The present maps are based on policy of National Park Service, however protecting Ocean City leads to activities to go beyond the domain of NPS. There will be more of that... This needs to be a living document and it will have to be fine-tuned.

Wendy Carey commented that the figures are probably going to be more important to the reader than the text, so they need to be carefully captioned and explained so they communicate a message to the reader without having to read several pages of text. County planners need to be a target audience and need to be involved in this process. CCSP authors' note: We need to add appropriate caveats perhaps listing the year of the map data with clear indication that this is changing. Another idea would be to include a terse explanation with each map. That is, a 1-paragraph caveat may work better if tailored.

Jeff Williams noted that the report does not address the economics of the decision-making process. There could be different answers to this question depending upon if the Federal/State government pays vs. the local counties or the private landowner.

Norbert Psuty asked about the concept of protection in the context of these questions. Would shore protection be some hard barrier constructed vs. other means? Jay Tanski added that shore protection would be varied depending on location and circumstance. Mitigation is not detailed in the report and assumes we would do something, but that it is undefined. Wendy Carey suggested that the report should be able to help the coastal planner make the jump from land use to zoning by helping them understand what future conditions might be.

Michael Weinstein suggest widening the scope of potential responses giving examples such as farmers volunteering lands as riparian borders, taking advantage of national wetland trusts, using a gradual approach to set aside lands for "soft-uses", and taking advantage of the public's desire to do restoration.

Authors' follow-on note on figure captions: need to figure out the problem of iterating to the characterization of likelihood of shore protection. Question: Do we stick with the likelihood? Or do we specifically articulate the map colors using different keys for each state, to match the fact that the data differs in each state?

## **5) Discussion on Question 5:**

**Question 5) What are the potential impacts of sea-level rise on coastal floodplains? What issues would FEMA, coastal floodplain managers, and coastal communities face as sea level rises?**

Michael Craghan led the discussion on Question 5 and gave a generic overview of floodplains in the FEMA context. Floodplains are generally areas that are normally dry and may get water where water is normally not supposed to be. The frequency of inundation and the probability of inundation are major components. The floodplains are defined in the context of land use and insurance. A Base Flood Elevation (BFE) is defined as the elevation for a 1% chance in being inundated – the 100-year event.

Sea level rise has the potential to change the BFE and how permits, land uses and funding sources would change. FEMA processes are not going to change very much due to a relatively slow process such as sea level rise. The BFE's will increase as time goes by. The Flood Insurance Rate Maps (FIRMS) are base conditions at the time that the maps were made and are very old. They are being digitized, however there are no funds to redo them or update them to latest conditions. The digital mapping process is ignoring updated studies however some new studies are being used in some regional efforts (such as New Orleans. Jeff Williams pointed to a recent congressional action inquiring how FEMA intends to take into account latest conditions in their mapping process, however results from that study it at least 15 years away.

Barry Pendergrass (NYDCR) noted that FEMA not using updated hydrologic, hydraulic or topographic data to estimate flood elevations which leads to greater uncertainty in the products. He suggested that systematic hydrodynamic flooding models need to be run and results implemented instead of using the best available data from a variety of sources.

Michael Craghan noted that coastal flood study can not be done at the community-by-community level. Region 3 is doing all of Chesapeake Bay for instance.

Tony Pratt noted that FEMA is funding LIDAR in many areas through grants. He went on to discuss the discontinuity between FEMA A-zone and V-zones. These zones control implementation of local ordinances. You get mortgage based on those assumptions. If flood zone is higher than assumed, financial community gets losses. The problem is that some buildings are in the flood zone, but do not have flood insurance in place.

Tony and Wendy then discussed the education and outreach component of floodplains. People can build beyond code. Some people build outside the designated floodplain, and thus assume they will never get flooded, which is not the case. Perhaps adding a foot of freeboard to the FIRM BFE's is needed.

The discussion turned wetland accretion and barrier island development. We tend to fix the elevation of developed barrier islands. However in a natural setting, barrier islands rise and migrate, but then we fix interior boundary of barriers as well. We always recover or use the old elevation, even though it needs to be elevated to reflect sea level rise. There are no longer natural processes in play and what will the sea level rise thresholds be for these locations? How do you elevate the barrier islands?

The follow-on question would be what does FEMA want to do? Does sea level rise change the paradigm? Does it change the loss they are on the hook for? Nationally, coasts have been fiscally sound on a insurance basis. Even after Katrina, it is sound in the post-FIRM. It is just the pre-FIRM that is the problem. Pre-FIRM keeps getting extended and the program does not keep up with the risk.

## **6) Discussion on Question 8:**

### **Question 8) Which species depend on habitat that may be lost due to sea-level rise given various levels of shore protection and other response options?**

Michael Weinstein (NJ Marine Sciences Consortium) led the discussion on Question 8. The authors were informed that Question 8. was worked on in more detail in an focused authors meeting after the Maryland Stakeholders meeting held the previous week. Michel Weinstein opened with comments on the broad interactions of habitat, wetlands, and sea level rise. Coastal wetlands and fisheries are part of a larger ecosystem that includes movement and export of biomass. He mentioned the importance of the clean water act and the effect on wetlands and noted that wetlands have ecosystem production values and recreation value. He compared the individual species by species approach to answering this question vs., the ecosystem based management approach to answering it. The function of wetlands is lost in the species by species approach and their needs to be re-emphasis on the interconnectivity of the entire system. He used the Delaware Bay to explain the relationships between marsh plants, phytoplankton, benthic macro algae, biogeochemical conditions, and the seasonal patterns of the weakfish fish stock. The existence of tidal creeks is more important to growth of the fishery than the condition of the open water. Climate change could alter this pattern because everything is so interconnected. The health of the wetlands is important ecosystem-wide, not just for the local species that spend their entire life cycle within the marsh. Unless we understand the “whole” system, then we are working in a vacuum to understand impacts of climate change.

Norbert Psuty noted that another term for shore protection could be action and measured response as would be the case for protecting wetlands. Jim Titus followed by asking if there is a ecosystem value difference in planting estuarine beaches with marsh grass and trying to restore vast areas of wetlands vs. creation of grass covered breakwaters. This led to a discussion of fringe marsh or urban vs. large natural marsh habitats.

The concept of thresholds for habitats was discussed with perhaps tipping points would be reached that result in new stable marsh habitat states that would support different species than at present. Perhaps they would change from fishery habitats to water fowl habitats for instance. The question needs to be answered as to which species are in jeopardy in the face of climate change and in the context of a complex ecosystem. What changes can be expected?

A follow-on point was made on the potential harmful effects to habitat given sea level rise if existing dump sites and oil farms are inundated and become sources of contaminants to the ecosystem. How well are we prepared for mitigating or preventing those risks?

And lastly the secondary effect of a changing salinity gradient and temperature gradient in wetlands and estuaries due to sea level rise was brought up as an unanswered question.

**7) Explanation of questions 6, 7, 9 and 10:**

**Question 6) What are the population, infrastructure, economic activity, and value of property within the area potentially inundated by rising sea level given alternative levels of shore protection?**

**Question 7) How does sea-level rise affect the public's access to—and use of—the shore?**

**Question 9) Which decisions and activities (if any) have outcomes sufficiently sensitive to sea-level rise so as to justify doing things differently, depending on how much the sea is expected to rise?**

**Question 10) What adaptation options are being considered by specific organizations that manage land or regulate land use for environmental purposes? What other adaptation options are being considered by Federal, state, or local governments? What are the specific implications of each option? What are the institutional barriers to preparing for sea-level rise?**

These questions were not addressed in the stakeholder draft and were not discussed in detail at the New Jersey Stakeholder meeting.

**Meeting Conclusion**

Meeting attendees were asked to fill out the general questions document handed out at the afternoon break and were asked to provide written comments with two weeks of this meeting. They were told they will have the opportunity to review and comment on a meeting report.

## Attendee List

NJ STAKEHOLDERS		
First Name	Last Name	Organization
Doug	Adamo	National Park Service/ Gateway national Recreation Area
Todd	Bates	Ashbury Park Press
Linda	Brennen	Monmouth County Planning Board
Wendy	Carey	University of Delaware Sea Grant
Jennifer	Cox	Regional Plan Association
John	D'Agonstino	State of New Jersey, Dept of Environmental Protection/Office of Coastal Mgt.
Tim	Dillingham	American Littoral Society
Jennifer	DiLorenzo	Urban Coast Institute - Monmouth University
Jefferey	Gerbert	US Army Corps of Engineers, Philadelphia District
Tom	Herrington	NJ Sea Grant Cooperative Extension in Coastal Processes
Paul	Higgins	Port Authority of NY & NJ/Office of Environmental Policy, Programs and Compliance
Haroon	Kheshgi	Exxon Mobile Research & Engineering Company
Jon	Miller	Steven - NJ Sea Grant
Tom	Noji	Northeast Fisheries Science Center/James J. Howard Marine Sciences Laboratory
Helen	Owens	NJDEP Land Use Management
Barry	Pendergrass	New York State Dept. of State/Division of Coastal Resources
Tony	Pratt	DE DNREC
Norbert	Psuty	Sandy Hook Cooperative Research Program Institute of Marine and Coastal Sciences
Dave	Rosenblatt	NJDEP Engineering and Construction
Brad	Stratton	The Nature Conservancy
Mark	Tedesco	EPA Long Island Sound Office Government Center
Courtney	Vanous	Delaware River Basin Commission

NJ AUTHORS		
First Name	Last Name	Organization
Eric	Anderson	USGS
Don	Cahoon	USGS
Michael	Craghan	MACGES
Duncan	Fitzgerald	Boston University
Stephen	Gill	NOAA/NOS/CO-OPS
Ben	Guitierrez	USGS
Jay	Tanski	New York Sea Grant
Jim	Titus	EPA
Michael	Weinstein	NJ Marine Sciences Consortium
Jeff	Williams	USGS



# **COASTAL ELEVATIONS AND SENSITIVITY TO SEA LEVEL RISE**

## **Climate Change Science Program (CCSP) Synthesis and Assessment Product 4.1**

### **Stakeholder Meeting**

**9:00 a.m. to 4:00 p.m.**

**June 26, 2007  
Vernon G. James Conference Center  
Plymouth, North Carolina**



Photo courtesy of NC NERRS

Climate Change Science Program Synthesis and Assessment Product 4.1  
Coastal Elevations and Sensitivity to Sea Level Rise

North Carolina Stakeholder Meeting Report  
Vernon G. James Conference Center  
June 26, 2007 Plymouth, North Carolina

## **Introduction**

The purpose of this meeting was to support the completion a required stakeholder review process for the development of the Climate Change Science Program (CCSP) Synthesis and Assessment Product (SAP 4.1). During the stakeholder review, the draft version of the stakeholder report was provided to the meeting attendees. The meeting followed a preliminary agenda provided earlier to each attendee and discussions were held on each of the key questions that form the basis for the structure of the report. These questions are also found in the agenda.

After introductions of the meeting attendees and SAP4.1 authors (attendee list attached), a presentation was given by Steve Gill (NOAA) on the overall CCSP program, putting into context this SAP4.1 effort with the overall process and timeline. The SAP4.1 Prospectus was reviewed and an overview provided on the history and status of the report. The meeting attendees were provided with binders with CCSP information, the SAP4.1 Prospectus, and with the draft stakeholder report sections.

This specific meeting was the third in a series of three stakeholder meetings held in June 2007, with the first meeting held in Easton, MD and the second in Red Bank, NJ. Meeting reports are being prepared and distributed to each of the attendees for comment. In addition, at each of the meetings, a handout was given to the attendees in which they were given the opportunity to make comments on the report outline, and to provide comments on specific key questions and map layouts. A summary of these comments will be included in the final meeting report.

## **Discussions, Comments, and Questions**

### **1) The overall process**

An overview of the contents and the chapters and sections of the draft report was given by Jim Titus (EPA). The shortcomings of this present version were explained and caveat and disclaimers provided. Jim indicated that he wished that we had been able to provide a more complete draft. Court Stevenson indicated that Jim Titus did not need to be so apologetic for starting with a rough draft. A problem with the previous USGCRP Mid-Atlantic assessment—conducted by Penn State--had been that stakeholders were not really involved before the report was written, and thus had no real opportunity to influence the content and direction.

A number of people sought clarification of the process. One person asked who we invited to the meeting. In written comments provided before the meeting, Stan Riggs indicated that many key people were likely to miss this meeting because they had not heard about it in time. Dr. Riggs further indicated that it is not yet clear whether this meeting is the *beginning* of a stakeholder process or a one-time meeting. If all we do is give people two weeks to review the rough draft, then we are likely to do more harm than good. But if this meeting and rough draft are the first step of a stakeholder process, in which we take comments now on our overall direction and a rough draft of the report, and then provide a complete and more refined draft later and come back for a second meeting, then this process would be very useful. He added that there is a large community of people researching the impacts of sea level rise would probably welcome the opportunity to provide detailed comments on the report if we were to come back for a second meeting. Jeff DeBlieu of The Nature Conservancy indicated that he agreed with Dr. Riggs on that point. (Titus briefly summarized Riggs comments at the end of the meeting. Dr. Riggs will be asked to submit his comments to the CCSP 4.1 Lead Author Team for the record)

## **2) Explanation of questions 9 and 10:**

**Question 9) Which decisions and activities (if any) have outcomes sufficiently sensitive to sea-level rise so as to justify doing things differently, depending on how much the sea is expected to rise?**

**Question 10) What adaptation options are being considered by specific organizations that manage land or regulate land use for environmental purposes? What other adaptation options are being considered by Federal, state, or local governments? What are the specific implications of each option? What are the institutional barriers to preparing for sea-level rise?**

Jim Titus was invited to lead a discussion of question 1. He started out by saying that because questions 9 and 10 come at the end, we had not had much of a discussion of those questions at the last two meetings; and he feared that might happen again. So he wanted to at least walk everyone through the issues so that as the rest of the day progressed, they would be thinking about these decision questions. Hopefully, we will have time to discuss them, he said, but if we don't, then at least this background may help you to provide better written comment. The stakeholder draft does not include discussions of these questions, and the stakeholder attendees were encouraged to review them and provide input and comments as the questions specifically ask what decisions, options, and activities are ongoing, or should be considered in their planning activities and their policy decisions. They were specifically asked to provide feedback what institutional barriers they had to deal with. He then proposed to move into his

assignment of explaining the answer to question 1. But first, a few people had some overview comments on the rate of sea level rise.

2) General comment was made by Court Stevenson (UMD) on the rate dependencies for sea level rise and what the rational response of society would be in terms of retreat or building mega structures such the Netherland dikes. The question was asking if this report using too low of rate of projected sea level rise? Using too low of rate may not be sending the right proactive message to the public. John Thayer reiterated that the rates of sea level rise chosen really matters in how the message of the report is fashioned and how the results are presented. Titus indicated that this report mainly focused on three scenarios: the current rate, the current rate plus 2 mm/yr, and the current rate plus 7 mm/yr. He explained how those reports relate to the 2007 IPCC report. Another stakeholder suggested that the report should provide an explanation of the rates and how they are being used in the report.

### **3) A discussion was held on Question 1:**

#### **Question 1) Which lands are currently at an elevation that could lead them to be inundated by the tides without shore protection measures?**

The elevation maps 3.1.1 and 3.1.2 in chapter 3.1 were reviewed and explained by Jim Titus followed by an explanation of maps NC-0, NC-4 and NC-5 in Chapter 4.1 (which provide elevations with a contour interval of 50 cm).

Tonda Shelton (NCFMP) commented on the source of the LIDAR data for the NC maps and the NC floodplains and the fact that the LIADR data are accurate only to 0.5 foot. The NC LIDAR was paid for by the state, and not FEMA or the federal government. She noted the existence of a geologic north-south running ridge line separating the wetlands to the east and the uplands to the west in NC. Anything in green on the maps is below 3.0 ft. The barrier islands actually have higher elevations than the wetlands themselves.

Mike Kearney (UMD) commented on the color scheme used in the maps and suggested that perhaps the areas at most risk should be colored red as that is the color most associated with a level of danger.

Tancred Miller (NCDOCM) commented that the draft report seemed to be missing NC-4. Titus said that he construed that comment as pointing out that the report did not have a map with the same frame as map NC-2, but using the format of NC-3. ( Later sections do have a map called NC-4, but it addresses a different topic.) Titus explained that he had omitted that additional map because he wasn't sure that it would be necessary to include two maps of the area below Cape Lookout, given the relatively small amount of low land that is visible at such a small scale. So he initially assumed that perhaps the only map needed is NC-2 and not a second map—but that we welcome comments on this issue. Titus urged people to comment on whether we need one or both of these maps—and if we only need one map, is it better to keep NC-2 which shows that most of the low land is wetland (at the expense of greater vertical prevision) or is it better

to follow the format of NC-3 and provide better vertical precision, at the expense of obscuring the fact that most of the low land is wetland.

Spencer Rogers (NC Sea Grant) asked what the definition of shore protection is for this report. This has been a recurring question in the meetings and will need to be addressed and defined up-front. Titus indicated that this relates to question 4—and suggested we revisit that issue when we get to question 4. Rebecca Feldman (CEM Duke) felt these maps were important because many readers would not read further in such a long document. Carl Hobbs (VIMS) felt perhaps the maps are a bit misleading because sea level is a dynamic process with lots of shoreline change. Discussion was also held on the base elevations of spring high water reference for the maps.

Jim Thayer (NC DENR) asked how the groupings of the counties in some of the tables were made and suggested that some of the groupings should be changed and would provide suggestions.

Alex Kolker (Tulane) commented on the Louisiana/ Katrina example the impact of not knowing correct and recent elevations and this led to the discussion of outreach on the maps and what they actually depict.

Paul Liu (NCState) started a discussion of having maps that also depict the effects of storm tides and inundation/flood maps on top of sea level rise. The first several comments indicated that such maps would be very helpful. Liu suggested that the report should try to include maps that show how sea level rise might affect flooding. Spencer Rogers suggested using the flood map base elevation map and adding a sea level rise rate and also mentioned that the effects of waves and wave heights on top of storm surge and sea level rise need to be taken into account in those depictions. Titus said that he would love to see some flood maps and asked whether the people in the room could provide such a map—if possible showing an example storm with and without sea level rise. But if that is not possible, a map showing the existing flood risk would be useful, he said.

A wide ranging discussion ensued concerning the difficulties of providing such maps. There is a need to take into account the dynamic processes as the effects of sea level rise and storm tides and waves is not a linear additive process. A suggestion was made by Jack Spruill (PenderWatch) that perhaps some simulations need to be run on top of sea level scenarios. – this would be a research gap that could be identified. Paul Liu and Alex Kolker followed with the added comments on what a complex prediction process this would be and could not be done in time for this report. Kolker said that a map by Vivian Gornitz of the New York area could be included. Court Stevenson said that he thought that Ming Lee may be able to provide the map we need for North Carolina, and agreed to contact him.

Tonda Shelton said that an important barrier is the fact that FEMA has a moratorium of coastal studies that could be used to update the floodplain maps. And the discussion led to perhaps adding a case study of effects of storm tides by drawing on some peer-reviewed storm surge models and report outs from Hurricane Isabel.

#### **4) Discussion on Question 2:**

**Question 2) How does sea-level rise change the coastline? Among those lands with sufficient elevation to avoid inundation, which land could potentially erode in the next century? Which lands could be transformed by related coastal processes?**

Discussion on Question 2 was led by Rob Thieler (USGS) and provided an overview of Section 3.2 of the report showing maps in Figures Q2-1 and Q2.2. The point was made that 90-95% of the outer coast of the Mid-Atlantic study area consists of barrier islands and that it is very difficult to predict future shorelines in the face of sea level rise and not models currently exist. He then reviewed the process for how an expert panel was convened to help answer this question.

There was discussion on the classification of Outer Banks shorelines being classified as less vulnerable to disintegration in the report and that at least sections of the Outer Banks need the classification changed to more vulnerable colors from brown to orange or red.

A constraint of the present study is that only the outer coasts are considered and the shorelines of the estuaries and the back sides of the barrier islands are not included.

There was mention that perhaps more areas of NC could be included by drawing upon existing studies such as an effort in Core Banks, however the reluctance to use non-completed and non-peer reviewed literature and reports was explained. This report can report out on existing activities but cannot make findings based on non-vetted material.

Comments were also offered on the need to clarify likelihood and the map categories. One commenter suggested that the report needs a table to relate the likelihood terms to each of the terms used in the map legends.

#### **5) Discussion on Question 3:**

**Question 3) What is a plausible range for the ability of wetlands to vertically accrete, and how does this range depend on whether shores are developed and protected, if at all? That is, will sea-level rise cause the area of wetlands to increase or decrease?**

Mike Kearney (UMD) led the discussion for Question 3 and referred to pages in chapter 3.3 of the stakeholder draft. He explained how a comprehensive literature review was first performed by Denise Reed (UNO) and followed with convening a panel of experts to synthesize and assess the current state of knowledge of wetland accretion. Mike felt that the present effort is a “mixed bag” of information because of the diversity of information and the diversity of the geographic area. Many areas simply lack the data to make too many assumptions and findings. One example is that wetlands in brackish areas are much more complex ecosystems than typical saltwater marshes and long-term effects of

climate change and sea level rise are very difficult to predict. Figures 3.3.3 and 3.3.4 were reviewed.

Jeff DeBlieu (TNC) asked how much is NC wetlands considered in this report. It was explained that the effort so far of the expert panel was from New York to Virginia and the NC has not yet been included in the report. This gap was acknowledged by the authors and it was explained that this NC question would be addressed by the authors at their meeting in Columbia, NC on Wednesday, June 27 and input by NC scientists and groups is needed to provide the local knowledge.

Spencer Rogers asked if there had been any studies or research on not just vertical accretion rates for wetlands, but studies on the lateral migration. This led to further discussion on ability of wetlands to move and if there were maps available shown estimated acreage changes in wetlands. There have been some global scale studies with very low resolution at the state level by Nichols et al. Court Stevenson said he thinks there are such data for Maryland.

Jack Spruill brought up the linkage to wetland and habitat loss to saltwater intrusion as sea level rises and also discussed the effect in this NC region on logging down to the waters edge without leaving buffer zones for wetland edge marshes. He asked if there were any studies or lessons learned regarding the effect of sea level rise on cypress trees and mentioned that NC has no regulation or protection of vegetation upland of the setback zones. Alex Kolker felt that in general, the physical processes involved in the effects of sea level rise are much more understood than the ecological effects, including wetlands.

Carl Hobbs brought up the potential “threshold” factor for wetlands and suggested that it should be accounted for in this study. That is as sea level rises a certain elevation may be reached that produces a relatively sudden impact such as a berm or barrier being breached. Paul Liu then discussed the non-linear nature of all of these processes on various time and space scales and felt some lessons learned could be obtained from the past geologic records of wetland response. Mike Kearney closed out with the comment that sea level rise is only one effect of climate change that could stress a marsh habitat. Sudden dieback could also be due to triggers set off by climate change such as low rainfall and increased temperatures. Do we really know how sea level rise should be coupled with these other stressors?

#### **6) Discussion on Question 4:**

**Question 4) Which lands have been set aside for conservation uses so that wetlands will have the opportunity to migrate inland; which lands have been designated for uses requiring shore protection; and which lands could realistically be available for either wetland migration or coastal development requiring shore protection?**

Jeff DeBlieu led a discussion on Question 4 and provided a review of the issues regarding this question. The baseline assumptions were that the maps were addressing dryland only

and excluded wetlands and asked when and how do wetlands take over dryland and how do we characterize that.

The maps provided in the stakeholder draft drew several comments; first from Paul Liu asking what the terms such as unlikely mean and what does shore protection mean? There were also several comments on the source of data for these maps. Are they totally opinion based and are they credible sources? For the most part county planners and other state officials were interviewed and shown elevation maps on which they delimited areas where they thought shore protection would be likely, unlikely, etc.. for characterization of the maps in this chapter.

Bonnie Bendell (NCDOCM) saw three problems with the maps. First, they are based on the opinions of county planners and NCDENR staff. Second, they leave the impression that planners expect that all of Perquimans county and other low-lying counties will be given up to the sea, when in fact county officials have but a high priority on trying to protect their counties. Third, the maps (NC-4 and NC-5) are based on information that may be too old (4-5 years) to be useful, because so much change and development has been made in some areas. Regarding her second point, John Thayer indicated that the maps do show a lot of the Perquimans county shore as likely to be protected, but that it is hard to see at the scale of the maps in this report. Others said that—if anything—the maps seem to overstate how much of the shore will actually be protected because much of the shore protection that will be attempted will actually fail.

Jim Titus responded to these points. The study is actually based on land use data where we could get it, and planner observations of where development is or is expected. These are factual observations. The only opinion portion is that the planners did indicate the particular land categories that are likely to be protected—but those opinions are generally accepted. “Does anyone here doubt the opinion that people will try to protect residential, commercial, and industrial lands?” Regarding the out-of-date aspect, Titus said that if NC DENR could provide a statewide layer of existing development, we could update the maps. Some of the DENR staff doubted that they had such a layer; but others from DENR indicated that they probably had a two-year old land cover dataset that would be useful. They will check into it and get back to Titus, they said.

Jeff DeBlieu felt that much of the problem related to this question is that there is no overarching framework in the NC region to address the question properly. There is no political will in NC to make decisions in the face of development in at-risk areas and no strategies in place to develop the infrastructure or shoreline protection options. Jeff was also concerned on how do we protect shoreline characterized as wetlands shoreline?

There was some discussion of the economic dimension of this question with Paul Liu suggesting perhaps a “price per scenario” for shore protection plan be developed, using science –based analysis from which practical choices can be made. Court Stevenson said that the real value in these maps is that someone can use them to estimate the cost of shore protection. It was noted that this report suffers from the lack of USACE



participation for determining various options and their related costs. He also noted that this highlights the need to control greenhouse emissions.

This discussion closed with a lengthy discussion of the best terminology and language to use in describing the various scenarios. There was general discomfort with the whole “certain” and “likelihood” approach. The suggestion of using a priority-based classification was discussed and met with general enthusiasm because it addressed the concerns in this paragraph, in addition to those raised by Bendell and others regarding the level of knowledge, foresight, understanding of costs, etc. in the sampled population of planners. For example “shore protection certain” would be “high priority for protection,” “shore protection likely” would be “moderate priority for protection,” etc. The use of “Shore Protection Certain” was also criticized because that does not cover circumstances where shoreline protection is attempted but not successful and leaves the wrong impression. Perhaps “Upland Protection” is better than “shore protection” for instance. Others suggested “shoreline engineering.” Another point was that the legend implies: “Shoreline engineering almost certain to be attempted” would be more accurate.

The comment was made to try to clarify the language and add better caveats to the underlying assumptions of this chapter and the maps. The list of CCSP categories of uncertainty were read out to the group from the draft report.

### **7) Discussion on Question 5:**

**Question 5) What are the potential impacts of sea-level rise on coastal floodplains? What issues would FEMA, coastal floodplain managers, and coastal communities face as sea level rises?**

Tonda Shelton led the discussion of Question 5 and gave an overview of FEMA’s role. She highlighted the fact that FEMA produces the Flood Insurance Rate Maps (FIRMS) but does not regulate what can be developed or built in a flood zone. It is information used for the flood insurance industry more than anything. Policy and regulations are the roles of the counties and states and FEMA cannot tell folks living in floodplains to move or stay.

Addressing sea level rise in the context of floodplain management has not been a high priority in NC. The question was asked whether sea level rise is a flood issue or a disaster issue. And how would that characterization affect policy? The issue could be handled under disaster and hazards response or under the insurance rate response. This was followed by the comment by Carl Hobbs that for floodplain purposes it is a mortgage lender risk assessment issue more than anything and there is a need for an education process on exactly what FEMA and floodplains mean.

Spencer Rogers again brought up that it is a multi-faceted issues and includes dealing with baseline elevations, sea level rise scenarios, and storm surge. Long term future conditions are not dealt with when it comes to floodplain regulations. The issue is

complicated because the impacts of storm surge and sea level rise on floodplains are not well-modeled and existing models are not very accurate at the scale required.

John Thayer made the point that the rates are also dependent on the vertical bench mark elevation used on the inundation maps. Tonda Shelton made mention of the lack of coordination between the timescale of the issue vs., the political time scales of decision-making.

A final comment on question was that perhaps it has too tight of a focus on sea level rise, when in reality, the answer to Question 5 depends upon much more.

*Note: The last part of the discussion of question 1 dealt with flood maps, which would actually go in this section of the report.*

### **8) Discussion on Questions 6 and 7:**

**Question 6) What are the population, infrastructure, economic activity, and value of property within the area potentially inundated by rising sea level given alternative levels of shore protection?**

**Question 7) How does sea-level rise affect the public's access to—and use of—the shore?**

Questions 6 and 7 do not have sections in the stakeholder draft and were not discussed. Question 6 data analyses and discussion are awaiting completion of the underlying data analyses by NOAA.

### **9) Discussion on Question 8:**

**Question 8) Which species depend on habitat that may be lost due to sea-level rise given various levels of shore protection and other response options?**

Don Cahoon (USGS) led the discussion for Question 8 and provided an overview of the new outline developed by a group of authors at the last stakeholder/authors meeting in New Jersey. He described the underlying research approach used and how the next version will have a more ecosystem based approach rather than a species-by-species approach.

During the following discussion, Jack Spruill asked if effects on the bird and turtle populations on the Outer Banks were being considered. The discussion led to how to distinguish between estuarine beaches and ocean beaches. Will the report address the fact that increased shore protection in the face of sea level rise may result in less natural ecosystem for habitat to thrive and may ultimately shift the ecosystem to a completely different system that may not be as productive.

Bonnie Bendell felt that the report should address how particular projects could be used to maintain habitat function that would do the least amount of damage.

### **Meeting Conclusion**

Meeting attendees were asked to fill out the general questions document handed out at the afternoon break and were asked to provide written comments with two weeks of this meeting. They were told they will have the opportunity to review and comment on a meeting report next week.

Some concluding comments were to make sure this report is the best possible report and to not settle for just an adequate or good report just to meet the deadline. The Director of the Tar-Pamlico estuary program said that the report should accurately capture the actual issues facing North Carolina, and not be constrained by a stovepipe approach of answering each of the questions in the prospectus one at a time. This is important given the fact that this report may very well be used by decision-makers in NC to develop policies and guide regulations that will have significant impact.

### **Postscript: Extending the Wetland Accretion Analysis to North Carolina.**

The next day, the authors met in Columbia. The first topic was to address the recommendation by the Federal Advisory Committee monitoring this study, that the wetland accretion analysis should include North Carolina. The result of that meeting was that the report authors from North Carolina will explore the possibility of creating a panel of wetland experts from North Carolina to create an assessment analogous to the assessment that appears in Section 3.3 of the rough draft. Their vision is that the meeting would probably take place in Greenville. To keep both panel assessments comparable, all of the CCSP authors who attended the first panel assessment would also attend the NC panel meeting (Reed, Cahoon, Titus, Kolker, Kearney), if possible.

## Attendee List

NC STAKEHOLDERS		
First Name	Last Name	Organization
Mary	Alsentzer	Pamlico-Tar River Foundation
Dorothea	Ames	ECU/Dept. of Geological Sciences
Bonnie	Bendell	NC Division of Coastal Mgt
Dave	Emmerling	Pamlico-Tar River Foundation
John	Fear	NC National Estuarine Research Reserve
Rebecca	Feldman	Duke University / Coastal Environmental Mgt
Carl	Hobbs	VIMS
Heather	Jacobs	Pamlico-Tar River Foundation
Paul	Liu	NC State University
Tancred	Miller	NC Division Of Coastal Mgt
Stan	Riggs	ECU/Dept. of Geological Sciences
Spencer	Rogers	NC Sea Grant
Tonda	Shelton	NC Emergency Management NCFMP
Anthony	Snider	NC National Estuarine Research Reserve
Jack	Spruill	PenderWatch and Conservancy
Guy	Stefanski	NC Division of Coastal Mgt
Tom	Stroud	Partnership for the Sounds
Woody	Webster	NC Division of Coastal Mgt
NC AUTHORS		
First Name	Last Name	Organization
Eric	Anderson	USGS
Don	Cahoon	USGS
Jeff	De Blieu	TNC
Stephen	Gill	NOAA/NOS/CO-OPS
Mike	Kearney	University of Maryland
Alex	Kolker	Tulane University
Lynn	Leonard	UNCW
Court	Stevenson	University of Maryland Ctr for Environmental Science
Rob	Thieler	USGS
Jim	Titus	EPA

**Summary of responses to list of general and specific questions asked of each of the meeting stakeholder participants.**

**PART I. FEEDBACK ON GENERAL QUESTIONS**

**1. The outline that the authors have been using to write the report assumed that about 60% of the report would be issue-by-issue (or process-by-process) at the national or mid-Atlantic scale, while 40% of the report would attempt to integrate all the issues on a place-by-place basis. The actual page allocations are shown below. Is this about right? \_\_\_\_\_  
Or would you favor changing the allocation.**

<b>Suggestion</b>	<b>Outline</b>
<b>Ch1 Background section explaining coastal change in general</b>	<b>12.5%</b>
<b>Ch2 Explanation of new studies</b>	<b>6.5%</b>
<b>Ch 3,5,6 Results/Discussion--National and Mid-Atlantic scale</b>	<b>25%</b>
<b>Ch4 Place-by-Place results and discussion</b>	<b>43.5%</b>
<b>Ch7 Research Plan</b>	<b>12.5%</b>
<b>Please explain</b>	

**Summary of Responses:**

**Is this about right? Yes – 10; No, Change the allocation – 7; No Comment – 8**

**4 specific new allocations were recommended.**

**Responses:**

- 1) Is this about right? Yes, with explanation “looks good to me. Maybe in Research Plan, highlight key data gaps, cross linkages, and need for holistic ecosystem based strategy development.”
- 2) Is this about right? “I don’t feel I’ve really had time to address this question because I haven’t had much time to look over the entire notebook yet. I encourage more info rather than less with an Index, Glossary, and a really good table of contents and an executive summary so people can pick and choose what they want to read.”
- 3) Is this about right? Yes

- 4) Is this about right? Yes
- 5) Is this about right? Yes Added comment – Ch3,5,6 – why national if study area is only mid-atlantic? And suggested putting research plan in an appendix.
- 6) No comment
- 7) Is this about right? Yes
- 8) No comment
- 9) Change allocation: “Perhaps more emphasis should be spent on explaining coastal change in general”
- 10) Is this about right?  
Response: We understand the effort is aimed at (1) synthesizing federal and non-federal data sources in order to assess potential impacts of sea level rise, (2) developing a plan for future research, and (3) analyzing how coastal environmental programs can be improved to “adapt to sea level rise while enhancing economic growth.” (Prospectus, p. 2)

We believe the report does an excellent job interpreting potential future change to shoreline areas for generalized coastal regions. It does not go into specific detail concerning local conditions due to resource limitations. We did not see a thorough or consolidated list of future research needs, although references to information gaps appear. It would be valuable to include a more thorough discussion of research needs and prioritize them. We would also like to point out that sociological information on how people can adapt to changing shoreline conditions is needed, as well as scientific information on coastal processes. What are the impacts to individuals, families and communities of resource impacts and displacement associated with sea level rise? What are the market impacts? This information is in accordance with CCSP goal 4.

Similarly, we did not find an evaluation of how management of the coastal environment can be adapted or improved. An overview of the legal rights of property owners, state and local laws regulating nearshore property, historic and current uses, economic impacts and the adaptability of existing programs is needed. If these topics will not be covered in Assessment Product 4.1, then the subject must be more narrowly defined and the need for supporting information highlighted.

We have questions regarding the interpretation of impacts and the relationship of ecosystem services and human welfare. We assume other components of the CCSP will address human impacts. However, we would emphasize that ecosystem services are invaluable to the human economy and drawing these connections will help establish the need for active management measures. Some of the existing report content touches on these subjects, such as fisheries production and flood mitigation. We feel more information along these lines would reinforce critical economic impacts to human activities and habitation near the coast. Among these impacts we would emphasize wastewater management, transportation, marine commerce, storm water management, water quality, recreation and tourism. While wetlands have intrinsic value in themselves, it is

the services they provide that will force society to undertake adaptive measures or pay directly to provide those services if sea level rise reduces their productivity.

- 11) Change allocation: Have less of a local focus for Ch4. Although county/local knowledge of protection likelihood is necessary for product, need more general meso-scale assessment.
- 12) No comment
- 13) No comment
- 14) No comment
- 15) Is this about right? “Looks reasonable, but today is the first time that I have the report in hand.”
- 16) Is this about right? Yes
- 17) Change allocation to:

Ch 1	10%
Ch 2	10%
Ch 3,5,6	35%
Ch 4	35%
Ch 7	0%
- 18) Is this about right? Yes
- 19) Change allocation to:

Ch 1	12,5%
Ch 2	10%
Ch 3,5,6	22.0%
Ch 4	43.0%
Ch 7	12.5%

Comment: “ I think there needs to be a greater discussion of the limitations of the data presented in the report.”
- 20) Is this about right? Yes
- 21) Comment “Add more North Carolina”
- 22) Change allocation to:

Ch 1	5.0%
Ch 2	5.0%
Ch 3,5,6	30.0%
Ch 4	40.0%
Ch 7	20.0%

Comment: “ This document size precludes use by the general public, spending any more than a passing mention is a waste.”
- 23) No comment
- 24) No comment
- 25) Is this about right? Yes

**2. The prospectus for this report says that this report is written for two audiences: The coastal practitioner and the general public. Given these two audiences, which of the following views are more likely to be correct regarding the length of this report?**

- a. Most people would prefer to read the entire report from beginning to end. Therefore, it is better to keep the report reasonably short even if doing so prevents complete explanations of particular issues or locations.**
- b. Most people prefer a complete explanation of the issues that interest them. Therefore, it is better to provide complete explanations about particular issues and locations, even if doing so makes the report longer.**
- c. To meet the needs of both audiences, the authors need to concentrate on designing the report so that one can easily find the sections that will interest them and skip the sections that do not.**
- d. To meet the needs of both audiences, the final CCSP report should be short with an invitation to contact the authors directly if one needs further information.**

**Summary of Responses:**

- a. – 1**
- b. – 1**
- c. – 11**
- d. – 1**
- a. and other, e. – 1**
- b. and c. – 3**
- c. and other, e. – 3**
- other e. - 3**
- no choice - 1**

**Responses:**

- 1) C and other, E “variation of both, why not have an executive summary and a companion report with the in-depth information?”
- 2) C and other, E “it is a tough assignment to effectively meet the needs of both audiences - I suggest a glossary with explanation of terms for the public.”
- 3) No Choice, but underlined “general public” and added “I don’t think many here are good judgments of this (question) – Aren’t there people who specialize in usability issues for publications?”
- 4) D
- 5) A and other, E “consider a longer-than-normal executive summary.”
- 6) B and C and other , E “include a 10-20 page executive summary.”
- 7) C



- 8) Emphatically said no for D and added other, E “Combine A and B above with short version and a technical version accessible on-line by request (two documents).”
- 9) B and C “This should be an authoritative, comprehensive report that is easily navigable. I suggest an executive summary section including recommendations/important conclusions/interesting observations.”
- 10) Other, E “Consider organizing the report in such a way as to allow readers to obtain detailed information from appendices at their option. This could help the address the needs of both audiences.”
- 11) Other, E “Abbreviated and comprehensive versions should be readily and publicly available.
- 12) C
- 13) C
- 14) C
- 15) C
- 16) C
- 17) C
- 18) B
- 19) C
- 20) C and other, E “Abstracts of “Executive summaries” of each section so that persons not specifically interested in a given section still might read the basics.”
- 21) A
- 22) C
- 23) B and C
- 24) C
- 25) C

**3. Which of the following scales are useful for tables of results (e.g. area of low land, population in the vulnerable area).**

- nationwide
- Mid-Atlantic wide
- statewide
- county (or city) wide
- estuary wide

**Please explain**

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**Summary of Responses:**

- 3 nationwide
- 11 Mid- Atlantic wide
- 14 statewide
- 12 county (or city) wide
- 10 estuary wide

Responses:

- 1)  3 nationwide  
 2 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 1 estuary wide

Please explain: “Watershed basis (e.g. Chesapeake, Delaware, etc.. allows for best description of system attributes, differences, and solutions. Nature does not recognize political boundaries per se.”

- 2)  nationwide  
 X Mid-Atlantic wide  
 statewide  
 X county (or city) wide  
 estuary wide

Please explain: “Have county (or city) wide tables as an appendix or have ways for interested parties to get this information easily.”

- 3)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “State and County context are good for political divisions and communicating with legislators. Estuary scale a better tool for system-scale planning.”

- 4)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: No comment.

- 5)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “Need a full range to give both overall perspective and a local actionable decision level.”

- 6)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “Show regional picture and at a level close enough to see particular items (county).”

- 7)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: A larger scale could be too general to be useful and a smaller scale would be too much information.”

- 8)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “If you want on-the-ground mitigation, need relevant, local data.”

- 9)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “Although I feel that this report should have included more nation-wide information, the Mid-Atlantic scales are good for an overview. Unfortunately, local policy makers will have a hard time using this scale. When case studies are presented, result tables should be at a more local scale – with discussions/explanations given of more specific areas. As long as data limitations don’t prohibit using a smaller scale, the smaller scales are more usable. If you have tables that do not relate to the text as written (for instance, you have a map at a smaller scale, but it is not discussed in the text at that level) it would be better to include these in an appendix.”

- 10)  nationwide  
 3 Mid-Atlantic wide  
 1 statewide  
 county (or city) wide  
 2 estuary wide

Please explain: “We would rank the statewide scale first, estuary wide second and Mid-Atlantic wide third. We expect local interests will seek help from state and federal agencies to interpret and apply the available information. We find the nationwide scale fairly meaningless, given the wide divergences in geographic setting, economic uses and historic development patterns.”

- 11)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “Tables would be valuable as a referenced hierarchy that can be digitally accessed and referenced based on scale.”

- 12)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: No comment.

- 13)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: "Stay on target – do not dilute."

- 14)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: No comment.

- 15)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: No comment.

- 16)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: "Relation to nation and state justification important. Science may well be more relevant to estuary."

- 17)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: No comment.

- 18)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “For effective local changes and adaptation to local zoning – county wide information needs to be determined.”

- 19)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “nationwide is too coarse, but the ability to zoom in at regional, state and local level has applications for regional and local planning.”

- 20)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “The report covers the mid-Atlantic so that is appropriate. As regulations vary by state, state wide is necessary. County data maybe held by states – estuary wide data can be pulled from the county data by those (scientists) who want it.”

- 21)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: No comment.

- 22)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “too wide a scale loses seriousness, too narrow a scale is too long.”

- 23)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “People want to see what the impacts will (may) be to their county.”

- 24)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “People want to know what affects them. Perhaps provide a higher level view with Internet links to the more local tables. Design as an Internet website could help navigation in an intuitive manner.”

- 25)  nationwide  
 Mid-Atlantic wide  
 statewide  
 county (or city) wide  
 estuary wide

Please explain: “Summaries can be regional but specific sections should be at the appropriate scale.”

4. The various chapters include maps and figures. If the final version has the same length as the current version, what is your opinion of the mix of graphics and text: (a) about right, (b) chapter needs more words and fewer graphics; (c) chapter needs fewer words and more graphics ?

Chapter 2 \_\_\_\_\_

Chapter 3 \_\_\_\_\_

Chapter 4 \_\_\_\_\_

Summary of responses:

Chapter 2 \_\_\_ a – 11, b – 0, c - 9 \_\_\_\_\_

Chapter 3 \_\_\_ a – 8, b – 0, c – 11 \_\_\_\_\_

Chapter 4 \_\_\_ a – 8, b- 0, c - 11 \_\_\_\_\_

No comment - 4

Responses:

1) Chapter 2 \_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_ a \_\_\_\_\_  
Chapter 4 \_\_\_ a, Words ok, more graphics might brighten it (e.g., photos \_\_\_\_\_

2) Chapter 2 \_\_\_\_\_  
Chapter 3 \_\_\_\_\_  
Chapter 4 \_\_\_\_\_

Comment: “I think all 3 need more graphics and the same or more words. A picture is worth a thousand words but they need really good captions to explain the information that is being shown for the general public.”

3) Chapter 2 \_\_\_ c \_\_\_\_\_ (3.2)  
Chapter 3 \_\_\_ a \_\_\_\_\_ (3.3)  
Chapter 4 \_\_\_ c \_\_\_\_\_ (3.4)

4) Chapter 2 \_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_ d more words, but not less figures \_\_\_\_\_  
Chapter 4 \_\_\_\_\_

5) Chapter 2 \_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_ c, particularly certain sections \_\_\_\_\_  
Chapter 4 \_\_\_ a \_\_\_\_\_

6) Chapter 2 \_\_\_ c \_\_\_\_\_  
Chapter 3 \_\_\_ a \_\_\_\_\_  
Chapter 4 \_\_\_ c \_\_\_\_\_



7) Chapter 2 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ a \_\_\_\_\_

8) Chapter 2 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ c \_\_\_\_\_

9) Chapter 2 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ c \_\_\_\_\_

Comment: “Graphs and tables are often read instead of the text. Because of this, it would be nice to have an explanation below these images/graphs so that they aren’t misinterpreted. I also feel that the text has quite a bit of repetition and, in parts, is hard to follow. Graphics explaining the important points will help emphasize the important information to the audience.”

10) Chapter 2 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ a, some maps should be larger to show more detail (map such as 3.1.1 \_\_\_\_\_)  
Chapter 4 \_\_\_\_\_ a, again some maps could be larger, such as 4.6, 4.7 \_\_\_\_\_

11) Chapter 2 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ a \_\_\_\_\_

12) Chapter 2 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ a \_\_\_\_\_

13) Chapter 2 \_\_\_\_\_  
Chapter 3 \_\_\_\_\_  
Chapter 4 \_\_\_\_\_

No response

14) Chapter 2 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ a \_\_\_\_\_

15) Chapter 2 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ c \_\_\_\_\_

Comment: “Can’t say until after I read report – generally, I’d say answer (c).”

16) Chapter 2 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ c \_\_\_\_\_

17) Chapter 2 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ c \_\_\_\_\_

Comment: "But with adequate captions/explanations."

18) Chapter 2 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ c \_\_\_\_\_

Comment: "More graphics are important for imparting concepts to resource planning managers."

19) Chapter 2 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ c \_\_\_\_\_

20) Chapter 2 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ a \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ a \_\_\_\_\_

Comment: for copy edit – some maps have a scale in miles, others in km. – be consistent."

21) Chapter 2 \_\_\_\_\_  
Chapter 3 \_\_\_\_\_  
Chapter 4 \_\_\_\_\_

No comment.

22) Chapter 2 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ c \_\_\_\_\_

23) Chapter 2 \_\_\_\_\_  
Chapter 3 \_\_\_\_\_  
Chapter 4 \_\_\_\_\_

No comment.

24) Chapter 2 \_\_\_\_\_  
Chapter 3 \_\_\_\_\_  
Chapter 4 \_\_\_\_\_

No comment.

25) Chapter 2 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 3 \_\_\_\_\_ c \_\_\_\_\_  
Chapter 4 \_\_\_\_\_ c \_\_\_\_\_

**5. Physical and social factors both determine vulnerability to sea level rise. In your view, what is a good mix (in terms of page allocation) for those factors?**

**Why?** \_\_\_\_\_

**Summary of Responses:**

- 8 felt Physical Factors were more important.**
- 5 felt Social factors were more important.**
- 5 felt Physical and Social factors were equal.**
- 7 had no suggestion of the mix.**

**Responses:**

- 1) 60% Physical 40% Social  
Comment: "System shifts with climate change need to be firmly and thoroughly described to lay foundation for vulnerability. But much policy will be necessarily connected to social factors, so they should be considered secondarily but prominently."
- 2) 40% Physical 60% Social  
Comment: "Focus more on social for the public – most scientists know the physical or know how to get to it."
- 3) 60% Physical 40% Social  
Comment: "There are a wide range of physical factors that must be addressed but social factors must be addressed."
- 4) More Physical than Social.
- 5) 2:1 Physical: Social  
Comment: "General impression of the relative issues (very seat of the pants)."
- 6) 50% Physical 50% Social  
No comment.
- 7) 50% Physical 50% Social  
Comment: "Will reach a wider audience."
- 8) 40% Physical 60% Social  
No comment.
- 9) 65% Physical 35% Social  
Comment: "Social factors are important, but are much more subjective and contingent on the specific locale. In addition, most policy makers are more familiar with social factors than the physical factors. This report needs to establish what is known about the physical processes and touch on social factors."

- 10) Comment only: “If your assessment shows one or the other to be the dominant factor, that argues for allocating more of the report to those issues. However, in our view, social factors (development patterns, investment, cultural affinity, community values, personal attachment) have significant weight in decision making and are not widely understood or addressed in coastal management science. There is substantial evidence that certain behaviors have significant adverse environmental consequences (for example, building bulkheads), yet they persist. If this report is focused on geographic data interpretation, consider identifying needs for additional research and management recommendations that address social factors.”
- 11) Comment only: “Important for vulnerability to not be a static snapshot but a “trending” assessment of future process results.”
- 12) 2:1 Physical: Social  
Comment: “It’s important to show the physical factors that support the need for social change.”
- 13) No suggested mix. No comment.
- 14) 40% Physical 60% Social  
No comment.
- 15) 50% Physical 50% Social  
No comment.
- 16) No suggested mix. No comment.
- 17) 30% Physical 70% Social  
Comment: “Based on a built-out New Jersey. This is site specific.”
- 18) 50% Physical 50% Social  
Comment: Societal needs are an important factor in determining local gov’t response to sea level rise.”
- 19) 50% Physical 50% Social  
Comment: “Both very important.”
- 20) 65% Physical 35% Social  
Comment: “The physical factors are more stable than the social. As people (continue to) move to the shore, infrastructure and social pressures will change.”
- 21) No suggested mix. No comment.
- 22) 80% Physical 20% Social  
Comment: “Social factors too ambiguous, physical factors tough enough.”
- 23) No suggested mix. No comment.
- 24) No suggested mix. No comment.
- 25) No specific suggested mix: Comment: “More social. General public is more interested in how it will impact them personally.”

## **PART II. FEEDBACK ON SPECIFIC QUESTIONS**

**Question 1: The maps provide 6 elevation bands for dry land, two elevation bands for nontidal wetlands (purple), plus tidal wetlands and open water. The authors assumed that the maps would have been too confusing if they had included 6 different colors for nontidal wetland 0 but that it is useful to distinguish nontidal wetlands from dryland.**

- a. Do you agree that it is useful to distinguish the nontidal wetlands from the dryland?**
- b. If so, do you agree with using just two shades to show elevations of nontidal wetlands? If not, how many elevation bands would you favor and what colors should be used?**

**Summary of responses.**

- a. Agree – 19 Disagree – 1**
- b. Agree – 11 Disagree - 5**
- No opinion or comment - 5**

Responses:

- 1) a. Agree  
b. Agree  
Comment: “Land use in buffer zone around tidal marsh (built out or not, protected, etc..) important.”
- 2) a. Agree  
b. Agree
- 3) a. Do not agree if there is a low probability of SL Rise impact on them.  
Comment: “(The maps) need to be at a smaller scale to easily see the divisions.”
- 4) a. Agree  
b. Agree
- 5) a. Agree, even though the area is minimal.  
b. Disagree, I would just show one – it’s hard enough to discern the colors in those small areas – maybe keep 2 shades in appendix for scientists.
- 6) a. Agree  
b. Disagree. Should use 4 elevation bands.
- 7) a. Agree  
b. Agree
- 8) a. Agree, in Maryland they are regulated concurrent with the USACE.  
b. Comment: Depends on the size of the graphic. Too many colors on small graphic would blur and be too chaotic.

- 9) a. Agree  
b. Agree, It might be helpful to insert major cities (especially on maps with smaller scales) and state abbreviations for larger scales.
- 10) a. Agree  
b. "We are uncertain it is beneficial to show more than one elevation of non-tidal wetlands unless the impacts, time of impact or management options differ. Is there a way to display when non-tidal wetlands will become inundated over the course of time?"
- 11) a. Agree  
b. Agree
- 12) a. Agree  
b. No comment.
- 13) No comment
- 14) a. Agree  
b. No comment.
- 15) a. Agree  
b. Agree
- 16) No opinion.
- 17) No comment.
- 18) a. Agree  
b. Agree
- 19) a. Agree  
b. Agree
- 20) a. Agree  
b. Agree
- Comment: "Consider changing colors as the reds now show the higher areas not the most actually at risk."
- 21) a. Agree  
b. No comment.
- 22) a. Marginally useful  
b. Disagree, 3 bands of shades of a single color that are dissimilar from the other map colors.
- 23) a. Agree  
b. Agree
- 24) No comment.
- 25) No comment

**Question 1: The maps provide 6 elevation bands for dry land. Where the data is better, the contour interval is 50 cm. But where the elevation data is poorer, the contour interval is 100 cm. The legend states the contour interval. Do you find it confusing to see maps with two different contour intervals based on data quality? Would it be better to simply show three elevation bands up to 3 meters in areas with the poorer data, or is it better to show 6 elevation bands?**

**Summary:**

**Better to show 6 elevation bands – 13**

**Better to show three elevation bands - 4**

**Offered comment instead of selection - 4**

**No comment or opinion - 4**

Responses:

- 1) “If better data exist per watershed or estuary, I would report the higher quality where it exists.”
- 2) It is better to show 6 elevation bands. “More data info is better than less – especially if you have greater levels of detail to provide. Also, there is such a tremendous level of effort that has gone into this. I encourage you to report it and then people can cite it later – excellent resource.”
- 3) a – Include a second scale w/hatch marks to indicate 50 cm contour interval.  
b – needs to be smaller scale to clearly see divisions.
- 4) Show 6 elevation bands.
- 5) I would be better to show three elevation bands. “6 is too many for general public, maybe keep 6 in Appendix for scientists.”
- 6) Answer was “No” (Editors note: but not sure to what part of question being addressed)
- 7) “Yes, it is confusing to see maps with two different contour intervals. It would be better to use bands up to 3 meters. Higher quality data could be shown separately in the descriptions of a case study for the area with better data.”
- 8) “It is not confusing to me – working with maps is what I do. However, if intended for general distribution, you would want to keep the scale the same or not include the graphic at all.”
- 9) “Yes, it is alright” (as is).
- 10) “Assuming maps such as 3.1.1 and 3.1.2 are examples, we find the existing display clear and unambiguous. Keep it the way it is.”
- 11) “6 elevation bands is more effective in illustrating data variation (and hence, needs).”
- 12) “For the scientist, the maps are not confusing, however for the general public sector, simpler maps may be required.”
- 13) No comment.
- 14) “Best to show all bands.”
- 15) “I prefer to see 6 bands where you have the needed precision. Most casual readers probably would prefer less detail.”

- 16) No Opinion
- 17) No comment.
- 18) "6 is better."
- 19) "The report should indicate the quality of all data presented. The current format is fine."
- 20) "The six areas are OK – show the best data that is available."
- 21) It would be better to simply show three elevation bands up to 3 meters in areas with the poorer data.
- 22) "Yes, 6 elevation bands."
- 23) "6"
- 24) No comment.
- 25) No comment.



**Question 2. Should the answer to Question 2 address shores of Chesapeake and Delaware Bay? If so, can you help us find a contributor who could write the necessary text to do so?**

**Summary:**

**Yes, it should – 14**

**No, it should not – 2**

**No comment – 9**

**Suggested potential contributors – 3**

**Responses:**

- 1) Yes, if possible. Doesn't USACE have people looking at this for DE? Also DNREC shoreline surveys underway now, not bay wide yet.
- 2) Yes. Ralph Tiner of FWS in DE; [Ralph.Tiner@fws.gov](mailto:Ralph.Tiner@fws.gov) and Greg Breeze of FWS in DE: [greg\\_breeze@fws.gov](mailto:greg_breeze@fws.gov).
- 3) Yes! Even if it is a cursory explanation of general erosional trends and rates. Maybe can find someone.
- 4) Yes. Not sure who to suggest.
- 5) Definitely for the Chesapeake, and yes for the Delaware if it is a perceived problem. Not familiar with potential contributors.
- 6) Yes.
- 7) Yes. Cannot help with a contributor.
- 8) Definitely.
- 9) Yes. These two areas are very important in the region and you have already spent time in other sections explaining it. Potential contributors:  
Michael D. Beevers, [mbeevers@gvpt.umd.edu](mailto:mbeevers@gvpt.umd.edu), [mbeevers@Princeton.edu](mailto:mbeevers@Princeton.edu)  
Tony Broccoli, [broccoli@envsci.rutgers.edu](mailto:broccoli@envsci.rutgers.edu), 732-932-9800 x6202
- 10) Yes. We are nor familiar with a suitable contributor.
- 11) No comment.
- 12) Not necessarily.
- 13) Yes – It is affected by SLR.
- 14) No comment.
- 15) Yes.
- 16) No comment.
- 17) No comment.
- 18) Yes.
- 19) No comment.
- 20) Yes. I'm glad to help where I can (Carl Hobbs, [hobbs@vims.edu](mailto:hobbs@vims.edu) 804-684-7271).
- 21) No comment.
- 22) No.
- 23) No comment.
- 24) No comment.
- 25) No comment.

**Question 3. In many cases, the summary map indicates that wetlands would be “marginal” for a given rate of sea level rise. In that context, marginal means that the wetlands may or may not be able to keep pace with rising sea level, depending on how they are managed. Can you provide additional details on how human activities may be – or could-help or hinder wetland accretion?**

**Summary: Most chose not to respond to this question ( 15 out of 25). The other 10 offered a wide range of comments, however dredging activities came up as a human activity that could help or hinder wetland accretion, as well as sediment management programs.**

Responses:

- 1) “Subsidence (groundwater), regional sediment management, water quality and nutrients.”
- 2) “Building houses in floodplain areas – increasing the impervious surfaces within the Chesapeake or Delaware Bays.”
- 3) “Would have to read what is currently included.”
- 4) “Dredged material placement.”
- 5) “Obviously, dredging with upland placement reduces amount of material available for deposition by storms. Also, hardened shore protection minimizes opportunity for accretion.”
- 6) No comment.
- 7) No comment.
- 8) No comment.
- 9) No comment.
- 10) Response: “Upland land use and storm water management have significant effects on sediment loads, discharge velocities and volumes and the availability and stability of sediment. Maintenance and use of navigation channels significantly affects wetlands by withdrawing sediment from the environment and exposing shallow areas to impacts from boat wakes and propeller wash. Excavation of mosquito ditches (to enhance drainage, thereby reducing mosquitos) may be with wetland loss in some areas. More information is needed on inlet management and associated reduction in sediment availability. Does increased tidal exchange as a result of inlet dredging evacuate sediment from bays, diminishing wetlands? Prevention of natural barrier processes such as washovers, and inlet migration by means of structural shore defenses reduces sediment to bays. Some of these impacts are mentioned in the report but others are not recognized, nor are the effects, level of understanding and remediation , adaptation or management of the impacts fully explored. More specifics, recommendations and identification of research needs would be helpful. To be most beneficial the report must not only estimate wetland losses but it must explicitly identify causes of wetland impacts or recognize knowledge gaps and recommend the additional data collection, research and analysis necessary to address those questions to improve management.”

- 11) No comment.
- 12) “Activities that reduce erosion, calving, and other factors that degradable wetlands may allow them to be more viable – responsive to sea level rise.”
- 13) “Many different marsh areas – need to differentiate. Need to include discussion of area and vertical dimensions.”
- 14) No comment.
- 15) No comment.
- 16) No comment.
- 17) No comment.
- 18) No comment.
- 19) “Human impacts in high-density population areas are eroding marsh lands faster than sea level rise. These impacts include trampling and wave/wake impacts from pleasure watercraft. To protect the marsh in the future, we first have to address the non-natural impact.”
- 20) No additional details offered.
- 21) No comment.
- 22) “In North Carolina, studies have shown that small amounts of dredge material added to estuarine marshes can help it keep pace with water levels without damage to the marsh.”
- 23) No comment.
- 24) No comment.
- 25) No comment.

**Question 4. The end of this section has a table on “conservation goals” which represent the portion of wetlands that must keep pace with rising sea level to achieve no net loss, as a function of shore protection and the rate of sea level rise.**

**a. Is this useful information? \_\_\_\_\_**

**b. The table makes two alternative assumptions (a) potential conversion of nontidal wetlands to tidal wetlands should count as tidal wetland creation, and (b) conversion of nontidal wetlands should not count. The report does not analyze whether dry land will convert to nontidal wetlands from any backwater effect of the higher sea level. Should the tables include both (a) and (b), or simply one or the other?**

**Summary of responses:**

**a. Is this useful information? Yes – 12, No – 1, Comments – 3, Could not find the table – 3, No comment – 6**

**b. Include both a and b? Yes – 12, No – 1, Comments – 3, No Comment - 9**

Responses:

1) a. Yes, with comment.

b. Include both a and b. “Tell it like it is.”

Comment: “Add text to say they need to maintain condition as well as extent (linked). e.g. “No net loss” often interpreted as extent, no functionality. We may decide to invest limited resources in stabilizing weakened marshes in poor condition rather than restoring acreage. The farmer does not have the political support because no “new” acres are added, but the net preservation (acres in 10-years, functionality) and conservation endpoints might be stronger.”

2) a. Yes

b. Include both a and b. “More info for both the practitioners and the general public is better.

3) a. Yes

b. Comment: “The whole chart is a mind bender – ugh – Is there a better way to more clearly present this information? No lay person will take the time to figure it out.”

4) a. Yes

b. No comment.

5) a. Yes

b. Include both a and b, broken down separately.

6) a. Yes

b. Include both a and b.

7) No comment.

- 8) a. Could not find the table.
- b. Include both a and b.

Comment: “They will be real world scenarios that local governments need to plan for and regulate.”

- 9) a. Where is this table? At the end of section 3.4? Is this table 3-4.7? This table doesn’t say anything to me. As a policy person, I need someone to interpret what it means. Can we do that underneath the table? Is there a section that tells us how we can most likely reach these conservation goals? This information may be scattered throughout the report, but a section (like an executive summary) would be nice.

- b. No comment.

- 10) a. “It is useful to quantify the scope, size and location of declining resources. One issue seems to be uncertainty in the rate of sea level rise combined with the uncertainty of wetland adaptation and recruitment. Can the “No Net Loss” table be compared to projected losses to identify shortfalls? Losses would be more useful in conjunction with maps showing the distribution of projected losses. Is it be possible to add information on historic wetland losses? Most wetlands have already experienced significant losses and ecosystem degradation. Efforts to improve resource management need to address the combined effects of historic and future losses and impairments due to sea level rise.”

- b. “In terms of resource management, it is obviously worthwhile to observe conversion of non-tidal wetlands to tidal wetlands because the conversion represents a loss of non-tidal wetlands and their associated ecosystem services. Since it is uncertain whether converted non-tidal wetlands will provide the same ecosystem services as existing tidal wetlands, we suggest showing a different category (conversion of non-tidal wetlands to tidal). We do not support representing conversion of non-tidal to tidal wetlands as “creation” of new wetlands, since it still represents consumption of one type. Therefore, option (a), above, should be eliminated.”

- 11) a. “So much as the definition of “not net loss” refers to area, not a line of demarcation.”

- b. Include both a and b.

- 12) “Could not find the table”

- 13) a. Probably

- b. “Try to be realistic – characterize that zone that will be modified with SLR.”

- 14) a. Yes

- b. No comment.

- 15) a. Yes

- b. Include both a and b.

- 16) a. “is science advanced enough to give clear answer to this?”

- b. Include both a and b.

- 17) No comment.

- 18) a. Yes

- b. Include both a and b.

- 19) a. Maybe, but rates seem high.

- b. Include both a and b.

- 20) a. “hard to say. Should “conservation goals” be contrary to physics. Rapid transgression interrupts stability – “no net loss” to natural processes ....(unreadable text...)  
b. “Include both a and b, both are likely to happen and play into the no net loss equation.”
- 21) a. No  
b. Include both a and b.
- 22) No comment.
- 23) No comment.
- 24) No comment.
- 25) No comment.

**Questions 1, 3, 4: Interrelationship. The net change in tidal wetland area depends on topography (question 1), wetland accretion (question 3), and shore protection (question 4). Which approach makes the most sense for discussing wetland loss?**

- a. **Discuss net wetland loss in the discussion of question 3.**
- b. **Discuss net wetland loss at the end of the discussion of question 4.**
- c. **make the issue a separate question that integrates the results from questions 1, 3, and 4.**
- d. **Discuss net wetland loss at the end of each of the separate sections on questions 1,3,and 4.**

**Summary:**

- 2 selected a. Discuss net wetland loss in the discussion of question 3.**
- 0 selected b. Discuss net wetland loss at the end of the discussion of question 4.**
- 12 selected c. make the issue a separate question that integrates the results from questions 1, 3, and 4.**
- 3 selected d. Discuss net wetland loss at the end of each of the separate sections on questions 1,3,and 4.**
- 8 had no comment or selection.**

**Responses:**

- 1) c.  
Comment: “The statement above seems to make a good case for a synthesis approach. Since extent depends upon the horizontal (migration), vertical (accretion and subsidence) and the edge effect (protection), it would be less clear to assign the topic only to one area, in my opinion. In this section, it might be worth noting that additional factors might be locally important as well, such as biological effects (e.g. snow geese, dieback, invasives, water quality effects (nutrient ratio imbalances), management practices (mosquito ditching, long piers, sediment management), etc... “
- 2) c.
- 3) d.
- 4) a.
- 5) c.
- 6) c.
- 7) d.
- 8) c.
- 9) c, “I think it would be helpful to have a separate section for it. It is important. Having its own section would emphasize it and make it easier to find.”
- 10) c, “It is possible to prepare the report discussing the impacts in each topic area. However, at some point, readers will seek a summary of impacts and synthesis of the whole investigation. Therefore, a separate summation is recommended.”

- 11) d.
- 12) c.
- 13) No comment.
- 14) c,
- 15) No comment.
- 16) No opinion.
- 17) No comment.
- 18) c.
- 19) a.
- 20) c.
- 21) No comment.
- 22) c.
- 23) No comment.
- 24) No comment.
- 25) No comment.



**Question 8. (Environmental Impacts)**

**EPA sponsored a series of 16 miniature literature reviews on the environmental implications of sea level rise for specific areas (e.g. Hampton Roads, Western Shore of Chesapeake Bay, Atlantic Coastal Bays) generally corresponding to the subregions discussed in Chapter 4. EPA planned to extract the most important impacts (102 pages) from each of these reviews, and insert them into the corresponding section of Chapter 4—hopefully in a fashion that would keep the discussion fresh by making different points for each region (while referring the reader to other sections whenever the impact has already been explained.)**

**So far, EPA has only made such extractions for three subregions: Hampton Roads (Section 4.2.2.4), Middle Peninsula/Northern neck (Section 4.2.3.3) and Delaware bay (Section 4.4.1.3).**

**EPA is interested in stakeholder feedback on the following question:**

**a. Should EPA extract the key environmental information from these other miniature literature reviews? b. If so, how many (single spaced) pages should be included for the environmental implications of**

- Potomac River**
- Western Shore of Chesapeake Bay**
- Eastern Shore of Chesapeake Bay**
- The Atlantic coastal bays of Maryland, Virginia, and Delaware**
- The New jersey Atlantic Coast**
- Raritan Bay/NY Harbor**
- South Shore of Long Island**
- Long Island Sound**

**Summary of Responses:**

**14 responded “Yes” to extracting from other regions, giving either page length recommendations or selected specific regions to include.**

**9 had no comment.**

**2 gave comments but no specific recommendation.**

Responses:

- 1) No comment.
- 2) a. Yes.  
b. Pages:
  - 1   Potomac River
  - 1   Western Shore of Chesapeake Bay
  - 5   Eastern Shore of Chesapeake Bay\*
  - 5   The Atlantic coastal bays of Maryland, Virginia, and Delaware\*
  - 2   The New jersey Atlantic Coast
  - 1   Raritan Bay/NY Harbor
  - 1   South Shore of Long Island
  - 2   Long Island Sound

\* more pages because these areas are at higher risk from sea level rise
- 3) No comment.
- 4) a. Yes.  
b. Pages:
  - 2   Potomac River
  - 2   Western Shore of Chesapeake Bay
  - 2   Eastern Shore of Chesapeake Bay
  - 2   The Atlantic coastal bays of Maryland, Virginia, and Delaware
  - 2   The New jersey Atlantic Coast
  - 2   Raritan Bay/NY Harbor
  - 2   South Shore of Long Island
  - 2   Long Island Sound
- 5) a. Yes.  
b. Pages:
  - 1-2   Potomac River
  - 1-2   Western Shore of Chesapeake Bay
  - 1-2   Eastern Shore of Chesapeake Bay
  - 1-2   The Atlantic coastal bays of Maryland, Virginia, and Delaware
  - 1-2   The New jersey Atlantic Coast
  - 1-2   Raritan Bay/NY Harbor
  - 1-2   South Shore of Long Island
  - 1-2   Long Island Sound

Comment: 1-2 pages on each to keep people focused and interested in their particular area of interest.

- 6) a. Yes, limited to:  
 b. Pages:  
 Potomac River  
 Western Shore of Chesapeake Bay  
 Eastern Shore of Chesapeake Bay  
 The Atlantic coastal bays of Maryland, Virginia, and Delaware  
 The New jersey Atlantic Coast  
 Raritan Bay/NY Harbor  
 South Shore of Long Island  
 Long Island Sound
- 7) No comment.
- 8) a. Yes, limited to:  
 b. Pages:  
 Potomac River  
 Western Shore of Chesapeake Bay  
 2-3 Eastern Shore of Chesapeake Bay  
 1-2 The Atlantic coastal bays of Maryland, Virginia, and Delaware  
 The New jersey Atlantic Coast  
 Raritan Bay/NY Harbor  
 South Shore of Long Island  
 Long Island Sound
- 9) a. Yes, it should include information from these areas. It should include however many pages necessary to explain the unique and more important impacts.
- 10) “From the point of view of state and local governments, each item of site specific information is beneficial. The question does not state whether unique information will be obtained from each of the specific areas listed. To the extent that particular circumstances are revealed, all specific areas would be beneficial. How will readers with equivalent conditions in other locations be aware of the transferable content in the miniature literatures? How will they recognize unique circumstances not represented?”
- 11) a. Yes, limited to:  
 b. Pages:  
 Potomac River  
 Western Shore of Chesapeake Bay  
 Eastern Shore of Chesapeake Bay  
 The Atlantic coastal bays of Maryland, Virginia, and Delaware  
 The New jersey Atlantic Coast  
 Raritan Bay/NY Harbor  
 South Shore of Long Island  
 Long Island Sound

- 12) a. Yes.  
 b. Pages:  
 2 Potomac River  
 2 Western Shore of Chesapeake Bay  
 2 Eastern Shore of Chesapeake Bay  
 2 The Atlantic coastal bays of Maryland, Virginia, and Delaware  
 2 The New jersey Atlantic Coast  
 2 Raritan Bay/NY Harbor  
 2 South Shore of Long Island  
 2 Long Island Sound
- 13) a. Yes.  
 b. Pages:  
 2-3 Potomac River  
 2-3 Western Shore of Chesapeake Bay  
 2-3 Eastern Shore of Chesapeake Bay  
 2-3 The Atlantic coastal bays of Maryland, Virginia, and Delaware  
 2-3 The New jersey Atlantic Coast  
 2-3 Raritan Bay/NY Harbor  
 2-3 South Shore of Long Island  
 2-3 Long Island Sound
- 14) a. Yes, limited to:  
 b. Pages:  
 Potomac River  
 Western Shore of Chesapeake Bay  
 Eastern Shore of Chesapeake Bay  
 The Atlantic coastal bays of Maryland, Virginia, and Delaware  
 The New jersey Atlantic Coast  
 Raritan Bay/NY Harbor  
 South Shore of Long Island  
 Long Island Sound
- 15) a. Yes.  
 b. Pages:  
 1-2 Potomac River  
 1-2 Western Shore of Chesapeake Bay  
 1-2 Eastern Shore of Chesapeake Bay  
 1-2 The Atlantic coastal bays of Maryland, Virginia, and Delaware  
 1-2 The New jersey Atlantic Coast  
 1-2 Raritan Bay/NY Harbor  
 1-2 South Shore of Long Island  
 1-2 Long Island Sound

Comment: "Even 3 or 4 pages if a larger or complex region."

- 16) No Comment.  
 17) No Comment.

- 18) a. Yes, limited to:  
 b. Pages:  
 \_\_\_\_\_ Potomac River  
 \_\_\_\_\_ Western Shore of Chesapeake Bay  
 \_\_\_\_\_ Eastern Shore of Chesapeake Bay  
 \_\_\_\_\_ The Atlantic coastal bays of Maryland, Virginia, and Delaware  
 \_\_\_ 2 \_\_\_ The New jersey Atlantic Coast  
 \_\_\_ 2 \_\_\_ Raritan Bay/NY Harbor  
 \_\_\_ 2 \_\_\_ South Shore of Long Island  
 \_\_\_ 2 \_\_\_ Long Island Sound
- 19) a. Yes, limited to:  
 b. Pages:  
 \_\_\_\_\_ Potomac River  
 \_\_\_\_\_ Western Shore of Chesapeake Bay  
 \_\_\_\_\_ Eastern Shore of Chesapeake Bay  
 \_\_\_\_\_ The Atlantic coastal bays of Maryland, Virginia, and Delaware  
 \_\_\_ 2 \_\_\_ The New jersey Atlantic Coast  
 \_\_\_ 2 \_\_\_ Raritan Bay/NY Harbor  
 \_\_\_ 2 \_\_\_ South Shore of Long Island  
 \_\_\_\_\_ Long Island Sound
- 20) Comment: “Have not yet had (made) time to study the 3 sections above – but the sections should be short or the total report will drive readers away.”
- 21) No Comment.
- 22) a. Yes.  
 b. Pages:  
 \_\_\_ 1 \_\_\_ Potomac River  
 \_\_\_ 1 \_\_\_ Western Shore of Chesapeake Bay  
 \_\_\_ 1 \_\_\_ Eastern Shore of Chesapeake Bay\*  
 \_\_\_ 1 \_\_\_ The Atlantic coastal bays of Maryland, Virginia, and Delaware\*  
 \_\_\_ 1 \_\_\_ The New jersey Atlantic Coast  
 \_\_\_ 1 \_\_\_ Raritan Bay/NY Harbor  
 \_\_\_ 1 \_\_\_ South Shore of Long Island  
 \_\_\_ 1 \_\_\_ Long Island Sound
- 23) No Comment.
- 24) No Comment.
- 25) No comment

**Questions 9 – 10. A) Do you make decisions whose outcomes depend on how much the sea rises? B) Do you know someone who makes decisions whose outcomes depend on how much the sea rises? C) In either case, please explain how that decision depends upon sea level rise, and any barriers to properly addressing sea level rise. D) Is this a decision that the CCSP report should discuss (either specifically or in general)?**

**Summary of Responses:**

- A) Yes – 9, No – 3**
- B) Yes – 7, No -1**
- C) 11 gave explanations**
- D) Yes – 3, No – 0**
- No Comment to any part: 11**

Responses:

- 1) C) Explanation: “ To show the value at the local planning and managing level, it is important to highlight the types of dilemmas and choices the will need to be foreseen, if they aren’t yet realized. With limited resources, regional decision-makers need the base SLR projections to target areas for conservation, protection, etc.. Although outside the bounds of this report, it might be noted that natural capital valuation in addition to built-out valuation needs to be considered more in the future for prioritizing regional responses to SLR.”
- 2) A) Yes, B) Yes, C) Explanation: “Barriers: lack of funding; lack of awareness by agency managers; lack of awareness by county officials; lack of effective planning; excessive workload and lack of adequate staff.” D) Yes “ Please discuss these barriers and the problems they present.” (Note: the author is Dixie Birch and she has volunteered to do some writing on this section).
- 3) No comment
- 4) No comment
- 5) A) Yes, used to, B) Yes C) No comment. D) “I was primarily involved in USACE Regulatory program which makes decisions in filling in wetlands and construction in tidal waters. CCSP Report should address in general terms how sea level rise would affect that jurisdiction (primarily in wetland areas.”
- 6) No comment
- 7) No comment
- 8) A) Not yet, B) No, C) Explanation: “County Council process and personalities”. D) No comment

9) A) No, B) Yes, with Explanation: “For instance, rising sea levels affects salinity levels in the tidal portion of the Delaware River. As sea level rises, it may be necessary to reevaluate the Delaware River basin Commission’s drought operating plan, which includes flow targets for the Delaware River at Trenton, NJ intended to repel salinity in the upper portion of the Delaware Estuary. These flow targets help maintain acceptable salinity levels for lower Delaware water intakes (such as City of Philadelphia’s water supply).”

10) A) Do you make decisions whose outcomes depend on how much the sea rises?

Response: The New York State Department of State, Division of Coastal Resources (DCR) administers the states’ Coastal Management Program (CMP). We review federal activities in the coastal area to verify compliance with state coastal policies. This includes policies addressing coastal hazards such as erosion, flooding and sea level rise. We help municipalities prepare and implement coastal area planning through Local Waterfront Revitalization Plans (LWRPs), which become elements of the CMP. We provide guidance to others on state coastal policies and lead the development of a state approach to ecosystem management through the New York Ocean and Great Lakes Ecosystem Conservation Act of 2006. As a result of these responsibilities, we regularly apply coastal policies, including those aimed at reducing impacts from flooding and erosion hazards, to decisions affecting projects, planning and development in the coastal area.

Further comment: Individual decisions on coastal consistency frequently incorporate environmental information based on current conditions and historic experience with sea level rise. LWRPs aim to restore and enhance community waterfront areas using existing and historic conditions as a baseline for planning. If environmental conditions such as sea level rise are changing significantly, managers must find ways to understand, communicate and incorporate that information into planning and adaptive decision making. Sea level rise is a critical concern to ecosystem function and by extension to the economic well being of the state’s coastal communities. The state is cognizant of accelerating sea level rise and potential impacts, but has not undertaken a comprehensive review of potential impacts across the entire coastal area. We find the site and impact characterizations of CCSP Product 4.1 valuable and encourage further development. We hope the final report from Product 4.1 will provide sufficient grounds for adapting practices to preserve and improve coastal ecosystems. In addition to projecting impacts of sea level rise, the report should identify uncertainties, including climate change, environmental impacts and the effects management measures have on resources. Recommendations for monitoring and further study of environmental change, anthropogenic impacts and the relative success of management alternatives would be valuable. Financial support, data protocols, distribution networks and a strategic framework for monitoring need to be established. We advocate continuing development of the Integrated Ocean Observing System (IOOS). Product 4.1 might consider recommendations that could be advanced within IOOS. Assessment of opportunities to improve coastal

management with regard to the projected sea level rise would be welcome as well. If CCSP Product 4.1 has adequate confidence in projections it might consider recommendations for planners and designers, highlight reasons why existing design parameters are no longer reasonable and make recommendations for additional study to develop adequate performance standards. It appears that global warming and sea level rise have entered a period of unprecedented change and existing land use patterns and shore defenses may be insufficient in the face of accelerating risks. Questions regarding how to adapt political, economic, institutional and legal systems in order to manage these changes remain to be answered and in some cases have not been expressed. We value the expertise of the authors and welcome the breadth of the report's investigation of sea level rise impacts. At the same time we emphasize that individuals and local governments are most responsive to information that affects their expenditures and decision making. While we recognize the intrinsic value of individual species and the ecosystems that support them, legal, political and market decisions are based on individual interests and documented impacts. The message that loss of wetlands and the services they provide will have direct financial impacts on individuals and communities would make the report more compelling to decision makers.

- 11) No Comment
- 12) No Comment
- 13) A) "Yes, I make recommendations to managers regarding changing exposure to storm effects with SLR. I create topographic models of coastal change related to storm surges and increased mobility of coastal topography."
- 14) A) Yes, B), Yes C) Explanation: "We make decisions on habitat management. Much of the decision making will be based on location of habitats, movement of habitats, and enabling factors for management. Issues addressed in Question 6 will be critical to this enabling and it should be addressed much more thoroughly."
- 15) A) No, B) Yes, C) Explanation: "20'th century SLR has driven little of the USACE response re: beach fill – shore protection in NJ and DE. SLR could continue or accelerate x 2 and still be an a minor component."
- 16) No Comment
- 17) No Comment
- 18) A) Yes, B) No comment, C) No Comment, D) "CCSP should be able to make recommendations that local gov't and state gov't can implement in the future."
- 19) A) Yes, I make decisions on coastal protection levels that incorporate sea level change over the useful (expected) life of the structure/system. Typically historic (tide gauge) records are utilized, C) Explanation: " A good substantiated range of expected changes in sea level rise rates would be useful to provide bounds for these extremes."



- 20) C) Explanation: “1) In terms of encroachment of water over land, one needs to be aware of the difference between “transgression” and “erosion” wherein “erosion” entails (substantial) movement of sediment. Erosion is a subset of transgression. 2) Sea Level Rise is a “chronic” versus “acute” problem of “emergency”. I think riparian law -which sometimes is extended to the coast – differentiates between slow, gradual changes due to erosion and deposits and rapid changes - avulsion. In terms of SLR, mortgage lenders may be more important than insurance co’s. Should FEMA have a “non-storm” role? Probably not.” 3) The public needs accessible, unbiased information. There is ample evidence of SLR without reference to cause. Stressing this might help de-politicizing the conversation. The notebook we were given on 6/26 is not “accessible” information. Very, very few people will read the whole thing. We need to find a way to write something to the layman as well as for the individual professional, BGO volunteer, etc..”
- 21) No comment
- 22) A) Yes, B), Yes, C) Explanation: “I manage the Buckridge Coastal Reserve and habitat restoration is largely governed by projected sea level rise. Barriers are not enough data on the effects seen on organic soil and forests and how canals exacerbate sea level rise issues, etc..”
- 23) A) Yes, local land-use decisions depend upon this and I participate in local gov’t as an activist. C) Explanation: “Perhaps maps showing anticipated sea level rise levels are important.
- 24) No comment.
- 25) No comment.