Averting Disaster: Strategies to Avoid, Respond, and Plan for Major Floods in Coastal South Carolina

By Bridget Callahan Lussier, Charleston, South Carolina. Email: bridgetlussier@gmail.com. Dedicated to the memory of Dr. Edward Lancelot Miles, mentor and climate change scholar, 1939-2016.

Abstract

In October and December 2015, record rainfall lashed South Carolina, causing major floods. Climate forecasters predict that such extreme high water conditions will occur more frequently and the geographic range and severity of floods will increase. Considering the seventeen deaths and damage from the record-setting precipitation, South Carolina is vulnerable to flooding.

The following describes strategies that decrease vulnerability and increase capacity to respond to floods with a focus on the Edisto River. These no-regrets strategies lead to a more secure future, better human welfare, and resilient landscapes at little cost.

The Clean Water Act and other legal tools protect wetlands. Wetlands provide natural support for society's water needs by maintaining water quality, levels of groundwater and surface water, and moderating water flows. The effects that intact wetlands have on improving climate change adaptation deserve greater attention. The study focuses on how wetland conservation and restoration support climate change adaptation policies. It measures the level of agreement among managers and academics on five climate change adaptation strategies.

With flooding identified as a critical vulnerability, the respondents agreed that the following strategies will help: 1) Provide incentives to protect flood prone areas and flood plains from development, such as along rivers and in wetlands, 2) De-incentivize living in flood prone areas, 3) Incorporate data and forecasted problem areas into the planning process and development permitting system, and 4) Increase warning and evacuation systems.

By integrating these strategies into the planning and permitting process, ongoing plans and activities, such as wetland regulation, incorporate climate adaptation into the mainstream. They work within the existing system and cost less than a redundant review process. They incentivize climate-change friendly development and planning, making it easier to address today's needs and to respond and adapt to future extreme events.

Edisto River Basin

The Edisto River is one of the longest free-flowing blackwater rivers in the US. In recent years, excessive water withdrawals and water quality problems threatened this treasure. The Edisto provides habitat for myriad rare species, water for recreational activities, irrigation, and much more from its headwaters in the Sandhills, to where it meets the ocean in the wildlife-rich ACE Basin. Many reasons highlight the importance of protecting and preserving the water quality and habitat of one of America's last "wild" rivers.

The Edisto has no dams or other structural means to control or prevent flood disasters. Records for the flood gage at Givhans Ferry range from 17' in 1904 to half of a foot in 2011[1]. The wide flow range and lack of flood control makes the basin vulnerable to flooding. Edisto water needs include fisheries, municipal supply, agriculture, recreation, wildlife habitat, and other resource uses. With no storage, instream flows are critical.

The 2 million acre basin is only 6% urban, 38% forested, 34% agricultural, 18% forested wetland, and 3% non-forested wetland[2]. Due to public and private partnerships, 7% of the watershed is protected from development[3]. Wetlands comprise over 20% of the Edisto River Basin. Conserved and restored wetlands store water for low flow periods, when it is released slowly, and store water during high flow periods in the floodplain.

2015 Floods

Last year's floods heightened awareness of the vulnerability throughout the Edisto River basin. Flooding resulted in evacuations of homes for extended periods, emergency rescues, and property loss along the Edisto River.

Previously, concerns for water resource management had focused on dry years, but this 100 year event showed the vulnerability to flooding.

In South Carolina alone, flooding caused 17 deaths, 160,000 lost homes, and an estimated $12 billion in damages. The economic impact exceeded Hurricane Hugo's[4]. Yet the media scarcely mentioned the connection between wetland fill and vulnerability to flooding.

Methods

Wetland protection may offer multiple benefits for climate change adaptation, habitat, and water resource needs. To evaluate the readiness of the management system to promote wetland conservation as a climate adaptation strategy, the author created an online survey about wetlands, flooding, and climate change adaptation in the Edisto River watershed.

If water resource managers and stakeholders can anonymously agree about the benefits of using wetland conservation and restoration to help society adapt to climate change, then this is a valid strategy.

A selective list of water resource managers and stakeholders received the survey invitation in July 2016. Recipients had attended climate change workshops, or their organization's mission includes water quality, water supply, wetland conservation, or climate change. Recipients included the US Army Corps of Engineers, National Oceanic and Atmospheric Administration, Environmental Protection Agency, US Fish and Wildlife Service, Natural Resource Conservation Service, US Geological Survey, US Forest Service; SC Department of Health and Environmental Control, Department of Natural Resources, Emergency Management, State Parks, Sea Grant; environmental non profits, University of South Carolina, Clemson, and the College of Charleston, and private companies. A total of 54 people with a connection to Edisto River water resource management, conservation, or climate change adaptation received the online survey invitation.

The survey focused on wetlands, climate change, flooding, water quality and quantity, and the relationships between them. Respondents rated perceptions along a 6 point scale and each question allowed comments. To boost participation, respondents could enter in a random drawing for cash, and survey answers remained anonymous.

The questions tested perceptions on the five strategies for climate change adaptation: 1) Provide incentives to protect flood prone areas and flood plains from development, such as along rivers and in wetlands, 2) De-incentivize living in flood prone areas, 3) Incorporate data and forecasted problem areas into the planning process and development permitting system, 4) Increase warning and evacuation systems, and 5) Increase flood control capabilities.

Results

Respondent Profile

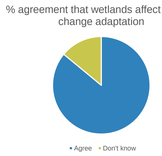
Of the respondents, 60% serve in government as a planner, regulator, or manager, 30% work in academia, and 10% serve in public water supply.

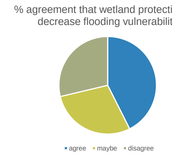
Most (90%) of respondents ranked instream flows for fisheries as the highest priority use of water resources, with municipal water supply as the second highest priority (10%). They gave no priority to agriculture, private water supply, industrial water supply, or instream flows for recreation.

All respondents noted conflicts between water resource users on the Edisto River, and some noted the problem of excessive agricultural withdrawals causing conflicts during droughts.

In addition to their work responsibilities related to the Edisto, they also use it for recreation: 100% of the respondents have participated in recreational activities on the Edisto River, including kayaking, canoeing, bird watching, fishing, floating, camping, boating, collecting fossils or shark's teeth, and hunting, swimming, or hiking.

Results





Flooding and Climate Change Perceptions

When asked if they have noticed any change in the climate in South Carolina, 70% said yes, 15% said maybe and 15% said they didn't know.

When asked if major floods on the Edisto River are more likely to occur in the future due to climate change, 60% said yes, 10% said no, and 30% didn't know. However, most (60%) considered the Edisto River basin only somewhat vulnerable to flood disasters, with 30% rating it as 'vulnerable,' and 10% 'very vulnerable.'

Regarding providing incentives to protect flood plains from development, all found this important and almost 90% emphasized we should do more.

Uncertainty hovered over the benefits of protecting wetlands to decrease the area's vulnerability to floods. Only 40% agreed this would work while 30% were unsure, and 30% disagreed. However, 100% agreed on the importance of discouraging people from living in flood prone areas in the Edisto River watershed.

When asked about the sufficiency of flood warning and evacuation systems in the Edisto River watershed, 60% didn't know, 30% said maybe, and 10% said that the while the evacuation system works, the warning system does not.

In rating the importance of increasing the flood control capabilities on the Edisto River, 40% agreed that it was very important, 30% unimportant, and 30% thought this implied adding dams or structures, which they did not support.

Respondents ranked the importance of wetlands for maintaining and moderating stream flow in the Edisto River. 90% considered this function and value very important, or important, and 10% considered the river channel most important.

When asked if additional informational, financial, or other types of resources were needed to better respond to flooding on the Edisto River, 70% said they needed more information, 10% needed more money, and 20% didn't know.

Perceptions on Using Wetland Conservation to Adapt to Climate Change

When asked if wetlands affect our ability to adapt to climate change, 90% of respondents said yes, and 10% said that they didn't know.

All of the respondents agreed on the importance of wetlands for maintaining water quality, and for managing levels of surface and groundwater.

The respondents agreed that incorporating climate change adaptation strategies into the planning process and development permitting system would help.

Respondents unanimously agreed about the benefits of using wetland regulations to discourage people from developing in the Edisto River watershed. However, 30% commented that the regulations have potential but are not put into practice.

Conclusions

The Edisto River Basin system, with wetlands covering over 20% of its watershed, presents a prime opportunity for wetland conservation and restoration to reduce flood risks while adapting to climate change.

The river's variability in flow volume and timing during the year and between years means that what may appear as buildable land in dry years like 2008-2011 can be flooded in wet years like 2015. As a result, preservation and enhancement of wetlands along the river is critical for flood protection and other wetland functions. Without wetlands to act as a natural sponge that buffers extreme flows, river flood levels can become more pronounced, risking the loss of life, property, homes, roads, and other structures.

Water resource managers and researchers agree that incentivizing wetland protection, discouraging development in wetlands, incorporating climate change strategies into the permitting system, and improving the flood warning systems will help adapt to climate change in the Edisto River system. They do not agree that additional flood control is needed. They agree that wetland conservation and restoration are valid strategies for climate change adaptation. Challenges lie in applying the existing regulations to advance wetland conservation and restoration, and in effect, help climate change adaption. The benefits of implementing the strategies include more resilient landscapes, less flood vulnerability, and less costly climate related impacts.

Notes

1. USGS Streamflow Gage for Station 02175000 of the Edisto River near Givhans, SC. Accessed March 2016 at http://waterdata.usgs.gov/sc/nwis/uv.
2. South Carolina Department of Health and Environmental Control. 2016. Watersheds 50205-03 and 50206-03. Four Holes Swamp and Edisto River. Accessed online on April 12, 2016 http://www.scdhec.gov/HomeAndEnvironment/Water/Watersheds/WatershedMap/EdistoWatershed/index.htm .
3. American Rivers. 2016. Edisto River among America's Most Endangered Rivers of 2015. Accessed online on April 12, 2016 at http://www.americanrivers.org/newsroom/press-releases/edisto-river-among-americas-most-endangered-rivers-of-2015/
4. Burris, Roddie. December 1, 2015. The State. South Carolina's Floods' damage: $12 billion, economists say. http://www.thestate.com/news/local/article47471060.html