Sea Level Rise and Smart Historic Coastal Communities: Lessons from Savannah, GA and St Augustine, FL

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Abstract

Experience and lessons learned suggest that the most effective strategies will require designing a number of responses at both the regional and local levels. Many efforts have underemphasized community-based research and have subsequently resulted in outcomes of climate models and scenarios that are too broad for effective planning and adaptation at local scales. There is a need for a 360 degree assessment of the critical issues based on a case study approach. The research presented in this paper investigates impact of projected Sea Level Rise (SLR) on representative historic buildings in coastal communities in the South East focusing specifically on St Augustine Florida and Savannah Georgia. Several lessons can be drawn from the natural and man-made artefacts in such historic cities. The paper discusses specific ways through which such cities exemplify practical responses to the climate. This notwithstanding it is important to bear in mind that they have not been exposed to environmental conditions that are drastically being altered through climate change. There is a need for a 360 degree assessment of the critical issues. The discussion in this position paper culminates into a description of an emerging collaboration framework that is directed at enabling stakeholders to perform such an assessment.

Keywords: Sustainability, Historic Communities, Sea Level Rise, Adaptation Planning

1. Introduction

2011 and 2012 may well be remembered as the point at which the "average American" developed a good understanding of climatic scale impacts in the form of extreme weather events (Institute for Sustainable Communities, 2012). The summer of 2011 became the second hottest on record with most States experiencing summer highs in excess of 100˚F (NOAA, 2011). July 2012 set the record as the hottest July and the hottest month ever observed since records began in 1895. The summer of 2011 and the summer of 2012 are

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second and third behind the summer of 1936. Drought conditions that gripped a record number of counties by mid-summer were reported as being the worst experienced since the Dust Bowl years of the 1930s. National Oceanic and Atmospheric Administration (NOAA) pointed out that heat wave and drought events affected 90 million and 80 million people across the U.S. in 2011 and 2012 respectively. The impact on human settlement has been catastrophic. For example, in 2011, U.S. experienced 14 extreme weather events that exceeded $1B in total damage (NOAA, 2011). The impacts of the more recently tropical storm Sandy included over two million households in the state of New Jersey, 72,000 homes and businesses were destroyed, and loss of human life. Storm surge and flooding affected a large swath of the state.

As a direct result of the growing frequency of these extreme weather events, climate change adaptation has rapidly moved up the policy agenda for many local governments which is a shift from the previous years when the focus was on mitigation. Climate change adaptation in this context refers to “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.” Climate change “mitigation” as used here means an action designed “to reduce the sources or enhance the sinks of greenhouse gases” associated with global climate change (Institute for Sustainable Communities, 2012). There has been a growing interest in understanding Sea Level Rise (SLR) and the associated risks of elevated tidal inundation, increased flood frequency, accelerated erosion, rising water tables, increased saltwater intrusion, and a suite of ecological changes.

This notwithstanding, many of the efforts have underemphasized community-based research (Riedlinger and Berkes, 2001). Such approaches result in outcomes of climate models and scenarios that are too broad for effective planning and adaptation at local scales (Jones, 2001). The authors’ research focusses specifically on assessing the local responses using natural and man-made artefacts in historic cities, which exemplify practical responses to the climate. Climatic changes are expected to affect coastal communities around the world, many of which are already considered vulnerable to on-going climatic variability (IPCC, 2001; Monrul and Mizra, 2003). As Klein and Nicholls (1999) point out, these biophysical changes result in socio-economic impacts such as loss of land infrastructure and coastal resources as well as declines in associated economic, ecological, cultural and subsistence values.

There are some efforts underway in industry and at every level of government to incorporate adaptive responses into existing climate change initiatives. As pointed out by the Institute for Sustainable Communities (2012), the US generally lags behind in international efforts on climate adaptation. The discussion in this paper is directed at specifically investigating the internal mechanisms, skill sets, and performance incentives within US communities that can enable them to transition towards a climate-change adaptive culture. The research presented in this paper investigates impact of projected SLR on representative historic buildings in coastal communities in the South East focusing specifically on St Augustine Florida and Savannah Georgia.

The discussion in this position paper is based on an on-going research project directed at assessing specific ways through which environmental conservation, green building and historical preservation professionals can collaborate to develop strategies for adapting to impacts of climate change and mitigating the associated threats through sustaining the built and natural environments.

2. Research Approach

Experience and lessons learned suggest that the most effective strategies will require designing a number of responses at both the regional and local levels. Many efforts have underemphasized community-based research and have subsequently resulted in outcomes of climate models and scenarios that are too broad for effective planning and adaptation at local scales. There is, therefore, a need for a 360 degree assessment of the critical issues based on a case study approach. As previously indicated this on-going research is directed at investigating the impact of projected climate change, focussing specifically on SLR, on representative historic buildings in coastal communities in the South East. Part of the work involves assessing case study buildings in St Augustine, Florida and Savannah Georgia. The context is culturally very significant. In 2015, the United States will celebrate the 450th birthday of its first successful colonial settlement – St. Augustine, Florida. Many of the original settlers' buildings still exist in St. Augustine as a testament to the long and storied history of this oldest continuously occupied American city. Savannah is unique among American cities. Not only does it retain Oglethorpe's original town plan of 1733, but much of its celebrated 18th, 19th and early 20th century architecture is extant as well. The Hostess City features a 2.2 square mile National Historic Landmark District—reputedly the largest of its kind in the United States—and that Landmark District includes thousands of historic buildings. Several lessons can be drawn from the cities' natural and man-made artefacts.

The authors are currently conducting a case study of historical buildings in the selected regions. The study will provide insights of current best practices, lessons baseline case of SLR impacts on historical buildings. Many of the efforts focusing on SLR (along with the associated risks of elevated tidal inundation, increased flood frequency, accelerated erosion, rising water tables, increased saltwater intrusion, and a suite of ecological changes) have underemphasized community-based research (Riedlinger and Berkes, 2001). Such approaches result in outcomes of climate models and scenarios that are too broad for effective planning and adaptation at local scales (Jones, 2001). Consequently, the longer term goal of the research is to tie any existing efforts into a broad framework of resilient, sustainable and smart coast community development. The authors will engage with different stakeholders to identify and prioritize the immediate threats specifically related to SLR; create a preliminary strategic plan for adapting using a SWOT analysis; and set up timeline for continuous improvements. This approach is expected to result in the development of a knowledge base and professional network for strategic planning for the adaptation of historic coastal communities to the threats associated with SLR.

3. Projected Climate Change for the Case Study Context

Research on global systems suggests that coastal communities and regions are becoming increasingly vulnerable to sea level rise (SLR) and climate change. As a result, researchers and practitioners are developing processes, tools and strategies for adapting to future impacts and the challenges to public safety, local economy and native ecosystems. The historic coastal communities selected for the study are among the oldest civilizations in the United States, which makes cultural and historic preservation an essential part of the national, regional and local initiatives on developing adapting strategies and best management practices (BMPs). Given that buildings are best representatives of the social, economic and environmental profile of a local community, it is of great interest to stakeholders at all levels to understand the potential threats SLR has imposed on buildings, the severity, and the efforts needed to mitigate such hazards. Unfortunately, there is very little literature in place addressing this issue, or there is no consistent records showing that a systematic and validated approach has been taken to assess the impacts of SLR on historical buildings in coastal communities.

Existing and projected changes to climate patterns around the world are expected to begin altering the behavior of hydro-meteorological phenomena within our lifetimes. Climate change is considered by many as the most far reaching and wide-ranging problem of our time. As it is expected to affect every sector of human life for years to come, there is a need for a holistic assessment of the critical issues. Rising sea levels and the risks triggered by changing weather patterns pose a substantial problem to the large portion of the world's population residing along the coasts and in cities built along major rivers including historic cities in Florida and Georgia. Table 1 gives specific examples of some of these changes (Ammon et al, 2009, Alvarez et al, 2001, Wilbanks et al, 2010 and Nearing et al, 2004).

4. Stakeholder Engagement and Participatory Capacity Building

Climate change is likely to have dramatic impacts on sea change communities through diminished potable water supplies, rising sea levels, storm surges, and increased intensity of flood events – with indirect impacts on health, financial sectors, and biodiversity. A comprehensive review of the existing body of knowledge has revealed that minimal work has been to develop adaptation strategies for climate change-buildings at the regional and community level, which entails the complexity of various building types across a spectrum of life spans, the embedded historical and cultural legacies, and the socioeconomic ties with the local context. Given the inherent diversity within sea change communities with regard to age, culture, and socio-economic status there are likely to be differences in ways of adapting (Smith et al, 2011). Early approaches to adaptation took a ''top-down'' perspective, moving from global climate model scenarios to sectoral impact studies and then to assessments of adaptation options (Van Aalast et al, 2008).

Buildings provide an interface between the outdoor environment, which is subject to climate change, and the indoor environment, which needs to be maintained within a range that keeps the occupants safe and comfortable, and which is suitable for any key processes that are executed within the enclosed space (De Wilde and Coley, 2012). Given that the performance of buildings with respect to this parameter heavily depends on exposure to weather elements, their design, construction and maintenance should factor in both the current and future climatic conditions. The current practices must be re-evaluated based on the possible climate change scenarios (Morton et al, 2011). Some researchers have tried to address this through focusing on the adaptation and resilience of buildings to a changing climate. Most of such efforts assess use relatively straightforward performance indicators such as energy use for heating, energy use for cooling, and building overheating (De Wilde and Coley, 2012).

Table 1: Summary of Projected Climate Changes

Climatic Condition	Florida	Georgia
Temperature	Florida may experience increases in average temperature of between 4 and 10°F over the next 100 years. This change will also be associated with warmer summer highs and cooler winters. The summer heat index, which reflects both temperature and humidity, will increase by 8 to 15°F by the year 2100.	Existing climate models have been predicted that the temperature could be increased by 4.5 to 9°F on average by 2080s.
Precipitation	Rainfall amounts in Florida are projected to either increase or decrease by as much as 20%. This could result in longer stretches of wet and dry periods with droughts more likely to occur.	Precipitation could increase or decrease by 20% in the next century
Soil moisture	The rainfall amount and intensities are the major factors controlling erosion under climate change. The results of simulation study suggest that erosion will increase approximately 1.7% of each 1% change in annual rainfall.	Rainfall is the major factor controlling erosion under climate change. The results of simulation study suggest that erosion will increase approximately 1.7% of each 1% change in annual rainfall.
Sea level	Sea level is expected to rise roughly 8 to 16 inches without taking into account on-going land subsidence (which varies by location). Taking subsidence into account, actual sea level rise of 16 inches is likely and as much as 30 inches may be possible in significant areas of Florida.	The average sea level rise estimated to be somewhere between 8 and 24 inches by 2010.

Climate impact assessment studies require a definition of the future conditions that will be considered in the analysis (i.e. the climate change scenario and the control settings), a definition of the object under investigation (a building and its subsystems), and a focus for observation and quantification (definition of appropriate performance metrics). The emerging body of knowledge, as summarized by De Wilde and Coley (2012), covers the following areas:

- Climate data for building performance studies (e.g. Guan, 2009, Gaterell and McEvoy 2005, Nik et al, 2012);
- Climate change impact studies for the built environment (e.g. Hacker et al, 2005, Wan et al, 2011, Jentsch et al, 2008);
- Performance metrics for climate change impact studies (e.g. De Wilde et al, 2011, Williams et al, 2011).

The contents of these studies captured the spectrum of individual buildings, building systems as well as the urban realm, and investigated issues across the life cycle of buildings from planning, design (Pyke et al, 2012, Robert and Kummert, 2012), construction, to facility management (De Wilde and Tian 2012). There is consensus across such studies that the existing policy and regulatory framework is based on historic climate. The review of such efforts supports the authors' original assumptions concerning the e absence of strong external pressure to incorporate climate change issues into decision-making (regulation or taxation in this case). Coupled with the existence of forces that directly work against this (that is, the cost of climate-related measures combined with limited liability for future buildings), in combinations with the inherent uncertainty of climate change, there is no incentive for the stakeholders to shift their mode of operation from the prevalent "wait and see" approach to a more pro-active one that requires taking action now (Morton et al 2011, Steemers, 2003).

Hertin et al. (2003) highlighted that the currently loose incentive structure is likely to lead to questions of climate change adaptation being driving by principles of "satisficing rather than optimizing". That is, climate relevant decisions are likely to be made in response to specific events and governed by the practical constraints that surround these (i.e., time, money, and regulation) rather than by more long-term goals and ideals (e.g., to design and construct buildings that will remain resilient and function given a changing future climate).

In addition to conducting a comprehensive review of existing literature, the authors have also interviewed different stakeholder to establish the baseline cases of SLR impacts on local historical buildings. The initial findings have revealed that knowledge gaps remain a key barrier to designing and implementing strategies for adequately responding to the threats associated with sea level rise. The targeted stakeholders have expressed a strong interest in working within a multi-disciplinary setting to develop a comprehensive understanding of the threats from projected sea level rise. As a direct response to this request, the authors are convening a workshop in the city of Savannah that will be hosted by Georgia Southern University. Confirmed participants include city planners, building officials, owners, designers, contractors, and community representatives. The focus of the workshop will be building consensus on defining the problem and seeking for adapting strategies. SWOT analysis and other strategic planning models will be utilized to fully understand the impacts, risks, resources and opportunities associated. The deliverables will be a consensus report on identified major impacts of SLR on historical buildings, the social, economic and environmental risks of such threats, critical financial and personnel resources needed to mitigate such risks and the opportunities in developing effective action plans through broad collaboration among stakeholders.

5. Conclusions and Further Work

Although climate change is a global threat, action implementation is local. In order to effectively prepare for and adapt to the impacts of climate change, local action at the state, city, or even neighbourhood level must be coordinated efforts on a wider scale. The success or failure of such depends on community perception. As Rebetez (1996) points out, “perceptions play a crucial role in the ability of a community to adapt to climate change as misguided views can impede a group’s response or ability to cope with external stresses, leaving them vulnerable.” Community vulnerability is exacerbated when community perceptions about their environment are adversely affected by the introduction of new technologies that alter the way in which they access (indigenous) traditional resources Alessa (2007). While it is clear that new technologies and local knowledge impose conflicting tensions on community vulnerability, it remains uncertain how these two processes interact with each other to influence individuals’ perceptions of their local climate, and how this leads to the emergence of an overall community perception that drives local decision-making. In order to gain perspective on the tension between new technologies and local knowledge, the authors will in subsequent efforts also investigate how community perceptions evolve over time when subject to changes in technology and local knowledge, and how these dynamic perceptions influence the vulnerability of a community to climate change.

As previously indicated, there is a great need for collaboratively developing and distribution knowledge among different stakeholders. In subsequent efforts the authors will contribute to dissemination and awareness creation activities through the use of existing collaborative partnerships. Within the University of Florida this will be achieved through partnerships with i) the Shimberg Center headed by Bill O’Dell has extensive experience in undertaking community-based projects with different stakeholders in Florida including but not limited to State Officials and champions of the needs of Low Income Families; ii) the Urban Planning/ Landscape Architecture driven Sea Level Rise project in Levy County and St John Florida initiative headed by Kathryn Frank (Dr Obonyo is a senior personnel in this project); iii) Morris Hylton who has extensive Historic Preservation spanning several regions including New Orleans and Nantucket.

In Savannah, Georgia this goal will be achieve through collaborative efforts with i) the USGBC Georgia Chapter, Savannah Branch led by Jean Uhl. Jean is actively collaborating with building officials and green building professionals in the Savannah area; ii) Jackie Jackson Teel, Director of Comprehensive Planning at Chatham County – Savannah Metropolitan Planning Commission. Jackie has extensive experience in environmental planning and policy-making process as an expert in stakeholder involvement in Chatham County – Savannah area; iii) the Sea Grant Community Climate Adaptation Initiative funded by NOAA and led by Jason Evans from the University of Georgia Carl Vinson Institute of Government. Dr. Evans is an environmental sustainability analyst in the Institute’s

Environmental Policy Program and an expert in developing policy recommendations that take into account the wide range of possible environmental implications.

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