Building Capacity to Adapt to Climate Change in Negril, Jamaica

Final Report

Prepared for the Robin Rigby Trust

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Introduction:

Located on Jamaica's west coast, Negril is a small coastal community whose local economy depends primarily on tourism and fisheries industries. Over the past 40 years, Negril has experienced a rapid increase in coastal development, growing from a small fishing village into the third largest tourist resort area in Jamaica. This development boom, coupled with increased frequency and intensity of storm events and the degradation of coastal ecosystems such as coral reefs and seagrass beds, has resulted a net loss of 30 m of sand along Negril's famous Seven Mile Beach. Several tourist establishments and coastal infrastructure are now located below the high tide line where they are extremely vulnerable to the impacts of climate change.

Adapting to climate change is an extremely complex issue, especially in areas, such as Negril, where the local economy depends on an actively eroding and highly developed beach environment. Actions are required to protect and restore coastal ecosystems in order to increase resiliency to the threats of climate change while still meeting the expectations of tourists. Research has been done to examine the climate change risks in Negril and specifically to model future coastal erosion from associated sea level rise. A key recommendation of past climate change studies in the area has been the need to identify sustainable adaptations to the impacts of projected sea level rise, including erosion control approaches that are compatible with tourist demands for beach access and uninterrupted sightlines to the sea[1].

The federal government of Jamaica has received funding from the United Nations Environment Program's (UNEP) Adaptation Fund to restore and protect Negril's coastline. Projects to be undertaken in coming years include restoration of seagrass beds and mangroves, a public education campaign on vulnerability and mitigation to natural hazards and coastal disasters and the installation of offshore breakwaters. The breakwaters will be located along highly degraded sections of the coral reef to minimize the impact of waves and slow coastal erosion. The project is being lead by the National Environment and Planning Association (NEPA), the Ministry of Tourism and the Planning Institute of Jamaica.

This report will outline various research, education and outreach activities that were undertaken by Ashley Sprague during a four-month stay in Negril, with support of the Robin Rigby Trust. Recommendations in this report can support and increase the long-term sustainability of the federal government efforts to protect and restore Negril's Seven Mile Beach.

Project objectives and outcomes:

The research conducted in Negril was part of a larger study known as the Partnership Caribbean Community Climate Change Adaptation (ParCA). PacCA is a 5 year project co-led by the University of Waterloo and the CARIBSAVE Partnership that aims to understand the

physical and social conditions that influence vulnerability and capacity to adapt to climate change in small and medium-sized coastal communities. One study site has been selected in each of four regions: Jamaica, Tobago, Nova Scotia, and Prince Edward Island. Information collected during this study will inform policy and adaptation options and assist local governments in prioritizing adaptation responses.

In order to meet the objectives of this project, I spent four months living in Negril between September 1 and December 28, 2012. During that time I had the opportunity to develop many skills and gain valuable insight into the factors that influence, and specific methodologies to assess, vulnerability and capacity of coastal communities to adapt to climate change. Specific project objectives and outcomes of the project are described below:

1. Assess vulnerability to climate change using two methods - GIS-based shoreline characterization and Community Based Vulnerability Assessments (CBVA)

Shoreline Characterization:

Using GIS, I surveyed and characterized a 40km section of coastline between Negril and Lucea. The study area was surveyed on foot where possible, and by boat for areas of the coastline that were inaccessible by land. The shoreline characterization methodology was developed by Barbara Pietersma-Perrott and Dr. Danika van Proosdij of Saint Mary's University[2] and includes assessing shore composition, shoreline stability, geomorphology, beach width and slope, and presence of anthropogenic structures to identify areas of the coast that are most vulnerable to storm surge and sea level rise. The shoreline characterization was completed on two coastal zones – the foreshore and the backshore.

Coastline characteristics were documented using a Trimble Yuma tablet computer with integrated global positioning system (GPS) and a geotag-enabled camera. A geotagged photo was taken at all locations of change, for example from a built structure to a vegetated area and all photos are built into the final GIS maps.

Local ecological knowledge was also integrated into the maps. A point on the map was created to represent areas where relevant local climate change information was collected. Each point is linked to a specific comment, anecdote or in some cases a video clip. This is a unique way to spatially and visually represent social information. The maps produced will aid coastal managers in identifying at-risk locations where adaptation measures should be prioritized. Highly vulnerable areas may, in the future, require a hard engineered solution to manage shoreline erosion, such as a seawall or other form of shoreline armouring. Areas identified as being less vulnerable may be appropriate for more natural 'Living Shoreline' approaches to managing coastal erosion. The maps will be completed in April 2013 and submitted to the Robin Rigby Trust at that time.

Measuring beach slope

Community Based Vulnerability Assessment (CBVA):

In November, I was joined in Negril by a team of ParCA researchers from the University of Waterloo, the University of West Indies (MONA campus in Kinston) and the Caribsave Partnership. I worked with the team to collect local knowledge through a semi-structured interview process known as CBVA. Over a period of one month, we collected over 150 interviews with individuals involved in the local fisheries and tourism sectors to understand the social, economic and environmental changes that affect their various industries and to examine ways in which people are adapting to these changes. Each interview was recorded with a digital voice recorder and later transcribed by a student at the University of West Indies in Kingston. Master's and PhD students at the University of West Indies and University of Waterloo will analyze the data collected as part of their research.

Having the opportunity to hear the stories of so many different people was an incredible learning experience for me. In the tourism industry, my interviewees ranged from hotel owners to boat tour operators to beach vendors. One climate change related impact that I had not previously considered, was the high number of locals involved with the tourism industry who are unable to work during large storm events. When storm events cause tourists to leave the area, or stay in their hotel rooms, they are no longer feeding money into the local economy by using taxis, booking tours or buying crafts or other items from beach vendors. Marine related tourism outfits such as glass bottom boat operators or SCUBA centres, can be impacted for several days following storm events if the sea is too rough. These storm events present an ongoing challenge for the tourism industry and the

local economy, and this issue will likely escalate as climate change leads to more frequent and intense storm events.

The information collected from the CBVA will help to identify vulnerabilities, understand different approaches being used to manage the climate change related impacts and ultimately inform policy documents and adaptation strategies for the Jamaican government. This data will also allow for a comparison of adaptation and maladaptation practices between the four ParCA study sites. A follow-up workshop will be held in Negril with key stakeholders to review the results of the CBVA in the fall/winter of 2013.

2. Increase the awareness of coastal property owners in project area about coastal processes and functions and less destructive ways to manage erosion

In order to understand the existing level of knowledge on coastal processes and coastal change, as well as to gain a better understanding on how climate change has affected local the community, I began my research by collecting local ecological knowledge and networking with local NGOs, researchers and the National Environment and Planning Agency (NEPA). Through conversations, photos and videos, I documented how locals are responding to these changes, both with adaptive and maladpative practices. This information was incorporated into a powerpoint presentation and delivered to the Negril Chamber of Commerce, which is the key decision making body in Negril. The presentation, attended by local tourism operators and coastal property owners, reviewed coastal

processes, the important role of coastal ecosystems in climate change adaptation, and highlighted recommendations for increasing adaptive capacity in Negril.

Additional outreach and awareness building efforts during my time in Negril included:

- A half hour live interview on national radio on impacts of climate change on urban and coastal development and best practices to manage stormwater runoff, flooding and erosion
- A presentation to the environmental club at the local public school on coastal processes, functions, climate change and best practices to manage coastal erosion
- Circulating information on best practices for managing seagrass debris to local tourism operators (See Seagrass Case Study included as an appendix to this report)

Presenting to local Environmental Club

3. Identify sustainable recommendations to build Negril's capacity to adapt to climate change.

The erosion occurring along Negril's Seven Mile Beach is causing great concern among local tourism operators and coastal property owners. It was evident from discussions with stakeholders that they were unclear on how to best manage the changes occurring on the beach and in general, people were very open to learning about new approaches to help stabilize their shoreline. Below are two key recommendations to build awareness and understanding for landowners to manage coastal erosion occurring on their property.

Replant coastal and beach Vegetation:

Much of coastal vegetation along Seven Mile Beach has been removed in order to make room for new development and to provide tourists with a clean, white sandy beach. There are several benefits to replanting coastal vegetation. Plant roots increase beach stability by binding and trapping sediment. Plant leaves interrupt the wind, encourage sediment deposition and can enhance beach growth. Plants also provide natural shade for tourists. This important action is a low-cost and low-maintenace option for landowners that will help to sustain the long-term effectiveness of engineered solutions that will be implemented in coming years under the UNEP's Adaptation Fund.

In order to have the highest likelihood of survival, plants and grasses should be salt tolerant, native, deep rooted and planted above the high tide mark. UNESCO recommended the following species for restoring beaches in the Caribbean[3]:

Trees:

Sea grape (Coccoloba uvifera)
Seaside mahoe (Thespesia populnea)
West Indian almond (Terminalia catappa)
Coconut palm (Cocus nucifera)
Casuarina (Casuarina equisetifolia)

Grasses/smaller plants:

Seashore dropseed (Sporobolus virginicus)
Panicgrass (Panicum amarum v. amarulum)
Beach morning-glory (Ipomoea pes-caprae)
Beach bean (Canavalia maritima)
Sea purslane (Sesuvium portulacastrum)

Organize a coastal erosion workshop:

It is recommended that a practical, interactive workshop be organized to transfer knowledge and encourage communication around best practices for managing the impacts of climate change. The workshop would be intended to help contractors, developers, coastal landowners, tourism operators and government decision makers learn new approaches to managing coastal erosion and mitigating impacts of storm events. The workshop could explore alternative 'Living Shorelines' approaches to managing erosion that use a range of techniques to stabilize coastal features, while maintaining natural shoreline processes, and wildlife habitat. Living Shorelines rely heavily on re-establishing vegetation cover, and working with natural materials found on site.

Suggested speakers for the workshop include:

- Daniel Grizzle, Chairman of the Negril Beach Restoration Committee

- Andrew Ross, Managing Director, Seascape Caribbean: Coastal Ecosystem Services. Works on coral reef restoration
- Pierre Diaz, Director, Sea Control Oceanographic Consultants. Has designed nearshore breakwaters for a private property owner in Negril
- Representatives from local the NGO (Negril Environment Protection Trust) and government (Negril Environment and Planning Agency)

The workshop could be organized by the ParCA team and held in conjunction with the workshop to discuss the CBVA results with the community. Alternatively, the workshop could be organized by the Negril Chamber of Commerce or the Negril Environmental Protection Trust.

4. Assess potential "Living Shoreline" demonstration projects on beaches and other vulnerable shoreline types

One of the most important actions Negril could undertake to build adaptive capacity is to create public demonstration areas that showcase best practices for managing coastal erosion through enhancement of natural coastal processes, features, and vegetation. Establishing Living Shoreline demonstration sites will provide the needed on-the-ground evidence that coastal vegetation can play a key role in stabilizing shorelines and mitigating the impacts of climate change. Incorporating some interpretive signage on the site could help to change the attitudes of locals and tourists to make them more accepting of naturally functioning landscapes.

Two potential demonstration sites in Negril were identified where soft-engineered strategies could be implemented to improve the resiliency of the site through the planting of native, coastal species and improving current land-use practices, such as driving on coastal vegetation. Both sites are public areas and include the Norman Manley Beach Park and Long Bay Beach Park. The concept of creating Living Shoreline demonstration sites was presented to the Negril Chamber of Commerce and interest was expressed in exploring this idea further. Funding is currently set aside to upgrade Norman Manley Beach Park, and this presents a great public education opportunity by demonstrating how to plant and care for native coastal vegetation.

Negril presents an interesting opportunity to promote environmental stewardship among tourists. The majority of tourists that vacation in Negril are repeat visitors who return to the area year after year. These repeat tourists have noticed the drastic changes to the beach environment and are concerned about the future of the area. Demonstrating how a more natural beach environment with the reestablishment of come coastal vegetation could help slow coastal erosion and preserve the longevity of the beach could engage tourists in beach conservation efforts and build a culture of acceptance for vegetation regrowth on beaches.

5. Prepare joint funding applications to implement and monitor practical adaptation strategies identified through site assessments

The possibility of pursuing funding to create a Phase II of this project, that would implement and monitor Living Shoreline demonstration sites in Negril, will be discussed with the lead researchers of the ParCA at the upcoming annual meeting which will be held in Nova Scotia in May 2013.

Other work:

Documenting Hurricane Sandy:

In late October, 2012, Negril was hit by Hurricane Sandy. In the two weeks following the storm, I was able to witness first-hand how the community responded to the impacts of a large storm event. By talking with local property owners, I was able to better understand how decisions were made to respond to the many environmental changes that had occurred on the beach. I documented the changes and put together a short video on the impacts of hurricane Sandy in the week following the storm. (http://www.youtube.com/watch?v=Fz57z7OBIOI).

Key observations made during and after the storm include:

- In preparation for the storm, many property owners installed sandbags to protect structures on the beach
- In days following the storm, a sandbar formed across the mouth of the Negril River that prevented fishermen and glass bottom boat operators from entering or leaving the river and had a major economic impact to the boat operators
- The beach experienced a net loss of sand and many structures that had previously been buried became uncovered such as old sandbags and tree roots.
- Two days following the storm, hotels and restaurants on the high limestone cliffs of Negril's West were damaged by rocks and boulders thrown ashore by high waves
- Five days following the storm, massive mounds of seagrass (up to 6 m wide), washed up on the beach. Due to pressure from tourists, property owners had to quickly decide the best to remove the debris. I have prepared a case study on how the seagrass debris was managed that is included as an appendix to this report.

The concrete bases of these fence posts became exposed following Hurricane Sandy.

Final Comments:

Through the ParCA project, I was provided with an exceptional opportunity to receive training and support that was key to the learning the skills that I used on the ground during my time in Negril. In May, 2012, I attended a CBVA training workshop in Tobago with other members of the ParCA team. In summer 2012, I was trained in basic GIS and the shoreline classification methodology at Saint Mary's University.

Spending time in Negril was a wonderful experience for me. I was able to make friends, visit amazing sites and gain a true appreciation for Jamaican culture. The skills I have gained will greatly benefit my climate change adaptation work in Nova Scotia. I am extremely grateful to the Robin Rigby Trust for providing me with this invaluable opportunity.

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Seagrass removal in Negril, Jamaica, following Hurricane Sandy: A Case Study

The Issue:

On October 25-26th, 2012, in the days following Hurricane Sandy, small amounts of seagrass began to wash ashore onto Negril's Seven Mile Beach. Hotel managers and coastal property owners were able to dealt with the issue quickly in one of two ways:

1. by pushing it back out to sea where the currents would carry the debris further down the beach. This would compound the problem for property owners at the west end of the beach where the currents were depositing the debris.
2. by raking the seagrass into piles and using shovels to bury it in the sand.

Small piles of seagrass were buried in the sand

On November 1st, five days following the storm, much larger amounts of seagrass washed ashore. On some stretches of beach, the massive mounds of debris reached up to 6 m wide and 2-3 m high. The largest deposits of seagrass occurred along the south end of Seven Mile Beach, where longshore currents carried the debris that had been pushed back out to shore by hotels further up the beach. Several locals commented that similar events had happened in the past, however, this was the most seagrass they had ever seen.

Hotel employees attempting to break up the seagrass mounds
and push it back out to sea.

Managing the Issue:

Although seagrass debris preforms many positive ecological functions for the beach environment, such as acting as a buffer to protect the beach from erosion and naturally nourishing the beach by depositing sand and shells, large mounds of seagrass can quickly become a nuisance and lead to several problems for tourism operators. Large sections of the ocean became inaccessible and resulted in dissatisfied tourists who were unable to swim and enjoy the beach. Many of these tourists had come to Negril for short, weeklong vacations, and in order to enjoy their limited time away, some people began checking out of their accommodations and moving to alternative locations along the northern end of the beach where lesser amounts of washed up seagrass had been removed. Tourism operators along the most impacted sections of the beach were feeling pressured to remove the debris as quickly as possible.

The large all-inclusive hotels have a system in place to quickly deal with this issue. They use a backhoe to scoop up the seagrass and transport it to an off-site location, often depositing it in ditches across Norman Manley Boulevard. Smaller independent hotels often do not have the resources to remove the seagrass in this way, nor do they have access to an appropriate dumping site. This resulted in two very different beach environments in Negril – the northern end of Seven Mile Beach where the all-inclusive hotels are located was cleaned up and no evidence of the storm remained. Tourists staying in these accommodations were satisfied, they could swim in the crystal clear water and enjoy long, clean stretches of beach. On the southern end of the beach, where smaller, independent hotels are located, mounds of seagrass remained for days and tourists were becoming increasingly dissatisfied.

Several property owners commented that they felt the best method to deal with the mounds of seagrass was to simply leave it alone. They believed that this was a natural cycle of 'the ocean cleaning itself' and that rough seas would come and carry the seagrass back out to sea. Many property owners did leave the seagrass mounds alone for 1-2 days, presumably to see if the debris would in fact be removed by the waves. However, due to increasing pressure from tourists, property owners had to take action and quickly remove the large amounts of debris. This resulted in some maladaptation practices that could cause long-term damage to the beach.

Due to the size of the seagrass mounds, using a shovel to bury the debris was no longer an option. Several independent hotels opted to use heavy machinery to dig up seagrass and bury it in large holes on the beach. One hotel attempted to bury the seagrass by pushing sand from the backshore of the beach into the water to cover up the seaweed. When concern was expressed that this would lead to sediment loss and accelerated beach erosion, I was told that this practice was acceptable because there was an 'excess of sand' on this area of the beach and that 'we won't lose any sand because nature would bring all back'. There seemed to be very little understanding or acknowledgement that physically removing sand from the beach and pushing it into the water could have a long-term negative effect. It is worth noting that in this circumstance, work was being done at night when it was very dark. The following morning only 1-1.5 m wide mounds remained and workers, both from the hotel and glass bottom boat operators who docked their boats in the impacted areas, began working to break up the remaining debris and push it back out to the ocean. The workers did realize that this action would move the debris further down beach and 'become someone else's problem'.

By November the 5th, two days after the backhoe 'buried' the seagrass and 9 days after the storm, the washed up seagrass was all gone.

Communication and Decision Making:

In the aftermath of Hurricane Sandy, individual hotels made decisions on how to best manage the seagrass debris independent of, and with little communication between, neighbouring hotels. One manager commented that in the past when seagrass washed ashore, several hotel managers would get together to discuss how to manage the issue. If heavy machinery was needed, they would each pay a small amount to hire a backhoe and have the operator clean up a large section of the beach. However, in recent years that communication has stopped and all beach management decisions are made independently.

On the evening of November 3rd, when one hotel was observed using a backhoe to push sediment that has accumulated in the backshore into the water in an attempt to bury the seagrass, it was very clear that no one of any authority from the hotel was overseeing the work. The backhoe operator was asked to quickly remove the seagrass, and with no further direction or supervision from hotel staff, the backhoe operator was the main person deciding on the best approach to manage the issue.

Some hotel managers indicated that they had received information in the past from the local NGO Negril Environmental Protection Trust (NEPT), on how to manage seagrass debris. Other hotels indicated that they had never received information on this issue and they had no idea who to ask for guidance on removal.

Next steps:

There is a need in Negril to produce and distribute locally-relevant educational materials to help tourism operators and coastal landowners manage the issue of seagrass removal in ways that will cause minimal damage to the beach. When the large seagrass mounds first washed ashore, several hotel managers along the southern end of the beach began asking me for advice on how to best deal with the issue. I reached out to international beach experts to ask advice and conducted some internet research and from these sources, I compiled some recommendations and information that I circulated to various hotels. This small gesture was extremely appreciated by those who received the information.

My research concluded that the recommended practice to remove seagrass and have the least damaging impact on the beach was to bury the debris below the beach surface to avoid loss of sand and seagrass-associated minerals. Heavy machinery should be used only as an absolute last resort. Tractors, trucks and backhoes can cause considerable physical damage to the beach and can lead to the unintentional removal of large amounts of sand that gets scooped up along with seagrass debris. Also, tourism operators should be strongly discouraged from physically removing near-shore seagrass beds, as this practice can lead to increased beach erosion.

It is unlikely that the Negril Environment Protection Trust would have the time or resources to lead a public education and outreach campaign on seagrass removal at this time. Therefore, the education efforts may need to be undertaken by the National Environment and Planning Agency or another federal body.