Building readiness for coastal resilience decision-making and implementation across contexts:

Lessons from our portfolio of projects in Africa, Rhode Island and Northeast coastal parks

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The Coastal Resources Center

including coastal hazards and climate change impacts in
a wide range of settings
A global perspective on local needs
Global exposure to hazards

cyclones, floods, sea level rise, storm surge, tsunamis

Source: Beck, M. ed. 2014. Coasts at Risk: An Assessment of Coastal Risks and the Role of Environmental Solutions. UN University, TNC, CRC
Global susceptibility to hazards

Figure 8: Susceptibility map  (public infrastructure, nutrition, poverty and dependency, economic capacity and income, natural capital)
The coastal communities we work with are pioneers in hazard mitigation and climate adaptation, breaking new ground that needs to be shared with their neighbors and which should inspire national scale support and action to bring climate change adaptation into the mainstream.

1. *Make the commitment and take enough time to prepare an adaptation plan that most everyone supports*

2. *If the process works, communities will want to take action so be prepared to follow-up on a few key tangible actions right away.*
3 Some local adaptation actions face barriers that need broad support from beyond the community itself to overcome.

4 Local adaptation plans have to become part of the mainstream in coastal development planning and hazard management.

Sharing the results of vulnerability assessments and adaptation plans with neighboring communities can encourage them to act. In addition, making sure district, regional and even national leaders become aware of community needs and priorities can help insure that community-level climate adaptation is a centerpiece of every country’s climate change policy.
Coastal Resilience

...building the ability of a community to "bounce back" after hazardous events such as hurricanes, coastal storms, and flooding – rather than simply reacting to impacts

Response, recovery and redevelopment must be integrated with the fabric and vision of the community.
Atoll-level resilience planning within a national conservation framework
Integrating Tools in Each Step

Guidelines, steps, process....
Interactive Engagement to reveal issues and assets

- Historical timeline
- Annual calendar
- Community mapping
- Personal Interviews

...plus active local engagement...
Prioritizing Threats

**Worksheet 8: Prioritizing the Threats**

<table>
<thead>
<tr>
<th>Highest Priority Threat</th>
<th>Total Score</th>
<th>Climate Sensitivity</th>
<th>Direct or Indirect</th>
</tr>
</thead>
<tbody>
<tr>
<td>KWOPEJ</td>
<td>14</td>
<td>H</td>
<td>I/D</td>
</tr>
<tr>
<td>ENE JAKOLAK</td>
<td>13</td>
<td>I</td>
<td>A/D</td>
</tr>
<tr>
<td>OKTAK SEASON KO</td>
<td>13</td>
<td>E</td>
<td>A/D</td>
</tr>
<tr>
<td>INVASIVE Species</td>
<td>12</td>
<td>E</td>
<td>A/D</td>
</tr>
<tr>
<td>ELŌN JIKIN KO REJ</td>
<td>12</td>
<td>I</td>
<td>A/D</td>
</tr>
<tr>
<td>IBWIJI</td>
<td>12</td>
<td>E</td>
<td>A/D</td>
</tr>
<tr>
<td>EIE T LAK MENIN LOJET</td>
<td>11</td>
<td>I</td>
<td>A/D</td>
</tr>
<tr>
<td>EJORĀĀN KEI EKKAN</td>
<td>7.5</td>
<td>E</td>
<td>A/D</td>
</tr>
</tbody>
</table>

...plus active local engagement...
Adaptive Capacity

Community Monitoring Techniques

Outside Technical Assistance

...plus active local engagement...
The Equator Prize

Clarence Luther, Namdrik Atoll
Republic of the Marshall Islands

...yields an international model...
Rhode Island: addressing hazards, climate at state & municipal levels
Storm Impacts Increasing

M. Devine, 2012

Newport Daily News

RIDOT, 2010

http://media.masslive.com
Baseline
No storm
No sea-level rise
No damage projected

100 year Return Period Storm
7' sea-level rise
Projected percent damage
“Similar to individual bricks that make up a wall, Rhode Island needs to start implementing site-scale solutions in our cities and towns that build incrementally, so our state as a whole is more resilient to coastal hazards.”

Grover Fugate, Executive Director RICRMC
1. projected impacts
2. methods of adapting
3. mechanisms to mainstream
The Time is Now!

- Legislation passed
- Policies established
- Maps developed
- Plans initiated
- Pilot activities underway
- Capacity building
- Science synthesis
- Adaptation summaries
Municipal Adaptation Strategies

URI Landscape Architecture, Junior Studio,
SLAMM Project is part of the Shoreline Change (Beach) SAMP
Assessment of Risk in North Kingstown

http://seagrant.gso.uri.edu/climate/slr_tools.html
Neighborhood Analysis and Prioritization

The three maps on the right illustrate sea level rise scenarios for the Wickford Historic area of North Kingstown, RI using a digital elevation model and an aerial photograph with a “bathtub model” approach to show the projected boundaries of two high tides per day on the municipal landscape.

The accompanying illustrated maps (underneath each SLR scenario map) show the individual parcels and properties that intersect each sea level rise scenario, as well as specific segments of roads and bridges that are projected to be at risk from projected sea level rise scenarios in North Kingstown.

The green map below shows the FEMA flood zones for the Wickford Historic area.

These draft maps are intended for illustrative purposes only.
A practical approach at the local level

- Recognizing Climate threats
- Identifying Local assets exposed to climate and non-climate stresses
- Determining the Sensitivity of these assets to climate impacts
- Evaluating the community’s ability to adapt
- Drawing conclusions about vulnerability
- Proposing and testing “No regrets” Adaption actions
- Incorporating climate adaptation into local and regional development plans
Source: The Gulf of Guinea Large Marine Ecosystem, McGlade et al. 2002
Ghana shoreline rate of change

Recognizing Climate and Natural Hazard threats

Average rate of erosion in Ghana 1.58m/year ±0.29

Keta sea defense
Risk and vulnerability assessment

Computation of Coastal Vulnerability Index (CVI) from geomorphology, coastal geology, coastal elevation, relative sea-level rise, shoreline erosion/accretion, tidal range and wave height.
Ghana: addressing hazards, climate at national level, gradually working down to coastal districts
Focus initially on one region, mainly fishing communities

Source: Department of Geog. & Regional Planning, UCC, Cape Coast, Ghana
Adaptive Capacity for Resilient Coastal Communities: Climate Change and Natural Hazards Issues in Coastal Districts of Ghana’s Western Region

Some knowledge of physical exposure & potential impacts
Need to understand adaptive capacity

<table>
<thead>
<tr>
<th>ADAPTIVE CAPACITY FACTOR</th>
<th>AVERAGE SCORE, all Locations (77)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security, Law and Order</td>
<td>2.36</td>
</tr>
<tr>
<td>Leadership and local organization</td>
<td>1.96</td>
</tr>
<tr>
<td>Public awareness of local conditions such as erosion, shifting or river course/delta</td>
<td>1.87</td>
</tr>
<tr>
<td>Land Use Decision Making and Planning</td>
<td>1.32</td>
</tr>
<tr>
<td>Condition of coastal resources</td>
<td>1.17</td>
</tr>
<tr>
<td>Attention to the needs marginalized groups</td>
<td>1.08</td>
</tr>
<tr>
<td>Livelihoods and rural economy</td>
<td>0.51</td>
</tr>
<tr>
<td>Emergency Preparedness</td>
<td>0.47</td>
</tr>
</tbody>
</table>
**Adaptive Capacity and Exposure to Physical Hazards:**

Coastal Communities of Ellembele District.

**Exposure:** size of circle

**Adaptive capacity:** color of circle

*NOTE:* Number denotes total count of physical exposure present in each community as listed below:

- *Estuary*
- *Wetlands*
- *Drains*
- *Broken Bridges*
- *Flood*
- *Sea Defence Walls*
- *Rivers*
- *Coastal Resources*
- *Sea Erosion*

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USAID

Promoting the Resilience of Small-Scale fisheries through Integrated Management

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Sanwoma
Sanwoma: high potential impacts

Table 5 Adjusted Rank order of community resilience (fraction of total possible score on the 8 adaptive capacity areas) Ellembelle District

<table>
<thead>
<tr>
<th>Settlement in Ellembelle District</th>
<th>Overall adjusted score (higher is better)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atuabo</td>
<td>41.25</td>
</tr>
<tr>
<td>Azulenloanu</td>
<td>41.25</td>
</tr>
<tr>
<td>Sanzule</td>
<td>41.25</td>
</tr>
<tr>
<td>Ngalechie</td>
<td>39.38</td>
</tr>
<tr>
<td>Anochie</td>
<td>38.13</td>
</tr>
<tr>
<td>Baku</td>
<td>38.13</td>
</tr>
<tr>
<td>Eikwe</td>
<td>38.13</td>
</tr>
<tr>
<td>Bakanta-Akonu</td>
<td>38.13</td>
</tr>
<tr>
<td>Anyanzinli</td>
<td>38.13</td>
</tr>
<tr>
<td>Ampain</td>
<td>38.13</td>
</tr>
<tr>
<td>Kikam</td>
<td>38.13</td>
</tr>
<tr>
<td>Boblama</td>
<td>38.13</td>
</tr>
<tr>
<td>Krisan</td>
<td>35.63</td>
</tr>
<tr>
<td>Esiama</td>
<td>33.75</td>
</tr>
<tr>
<td>Ngalepkole</td>
<td>31.88</td>
</tr>
<tr>
<td>Sanwoma</td>
<td>26.88</td>
</tr>
<tr>
<td>Asemkor</td>
<td>26.25</td>
</tr>
<tr>
<td>Asanta</td>
<td>21.25</td>
</tr>
</tbody>
</table>

Very low adaptive capacity
Figure 7: Estimation of shoreline erosion/accretion at Ankobra estuary Sanwoma
Figure 15: Extent of daily double flooding at the Ankobra estuary
Sanwoma

Applying new information to aid in decisions about funding and siting livelihood projects (low impact fish smokers) in safe locations

Monitored village after recent high wave event

Kitchens: (fish smoking ovens)
Goal:
Provide practical & actionable options for adaptation to sea level change & storm impacts in coastal parks

Focus:
Infrastructure, visitor access, planning, communication, cultural resources, and natural resources

Reports
• Coastal Assets Report (2015)
• Coastal Adaptation Strategies Case Studies (2015)
• Coastal Adaptation Strategies Handbook (2016)
• Sea Level Change in the National Park Service (in prep)
• Cultural Resources Climate Change Strategy (in prep)
• Sea Level and Storm Surge Projections (in prep)

https://www.nps.gov/subjects/climatechange/coastalhandbook.htm
Preparing vulnerability assessment for combined resources: cultural, natural and facilities
Piloting Methods for an Integrated Climate Change Vulnerability Assessment for Colonial National Historical Park

Facilities, Cultural, Natural Resources divisions are working together, to generate the following information:

1. Articulate Existing Goals and Priorities.
2. Identify Priority Resources/Assets.
3. Determine Key Stressors.
4. Select Geographic Focal Areas.
5. Identify Major Decisions/Milestones.
6. Identify Desired Data.
7. Rate sensitivity, determine potential impacts.
8. Estimate adaptive capacity and vulnerability.
9. Find common ground on priorities, make recommendations.
COLO assessment Process

Preparation
- Establish Working Groups
- Asset Identification and Mapping
- Climate Projections
- Exposure Mapping

Workshop 1
- Exposure Analysis and Mapping
- Sensitivity Analysis
- Integration

Workshop 2
- Potential Impact Analysis
- Adaptive Capacity Analysis
- Integration

Workshop 3
- Vulnerability Analysis
- Risk Analysis
- Recommendations

Final Deliverables
- VA Results, Methodology
- Sharing
Climate drivers include sea level rise, flooding, erosion, storm surge
Facilities Resources Working Group: Sensitivity and potential impact for all exposed structures
Natural Resources Working Group:

Exposure and Sensitivities rated, then added across the seven climate stresses for three climate scenarios.

<table>
<thead>
<tr>
<th></th>
<th>POTENTIAL IMPACT (Exposure * Sensitivity)</th>
<th>2020</th>
<th>2050</th>
<th>2100</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>POTENTIAL IMPACT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1. Forest vegetation (UPLAND)</td>
<td>6</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>2. Riparian Forest</td>
<td>16</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>7</td>
<td>3. Non-tidal wetlands</td>
<td>6</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>4. Tidal wetlands (In General)</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>4a. Beaches</td>
<td>9</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>4b. Disturbed Tidal Hardwood Swamp</td>
<td>7</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>11</td>
<td>4c. Salt Scrub</td>
<td>10</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>4d. Tidal Bald Cypress Forest / Woodland</td>
<td>6</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>13</td>
<td>4e. Tidal Freshwater Marsh</td>
<td>13</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>14</td>
<td>4f. Tidal Mesohaline and Polyhaline Marsh</td>
<td>8</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>15</td>
<td>4g. Tidal Oligohaline Marsh</td>
<td>12</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>16</td>
<td>4h. Tidal Shrub Swamp (Wax Myrtle Type)</td>
<td>9</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>17</td>
<td>5. Herps (COASTAL)</td>
<td>10</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>18</td>
<td>6. Herps (UPLAND)</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>19</td>
<td>7. Eagles</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>8. Marsh birds</td>
<td>10</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>21</td>
<td>9. Bluffs (Yorktown)</td>
<td>8</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td>148</td>
<td>153</td>
<td>181</td>
</tr>
</tbody>
</table>
The boundary of the Green Spring cultural landscape will not be affected by climate change; however, the terraces, mounds, road traces, and contributing natural systems and features may be impacted.

The coastal portions of the parkway will be highly susceptible to coastal impacts of climate change.

At its low elevation, much of the Jamestown Island Area cultural landscape is within the zone that will be impacted by coastal stressors, like sea level rise, storm surge, and coastal erosion.

The Moore House Cultural Landscape is not likely to be significantly affected by climate change as the significant area and contributing resources are located at a higher elevation.

Contributing topography and resources in the Yorktown cultural landscape may be particularly susceptible to runoff and erosion.

Cultural Resources Working Group: Sensitivity and potential impact for cultural assets of all types
Combined potential impacts, all COLO Divisions, 2100

Now working on adaptive capacity, vulnerability, recommendations toward adaptation policy/plan for Park

Aim is to work toward integrated priority action recommendations to Park Superintendent
Common elements of CRC approach across this portfolio

(1) Engage citizens and stakeholders in adaptation science and interpretation of findings;
(2) Conduct locally validated vulnerability assessments;
(3) Use stakeholder-friendly modeling and mapping tools for visualizing risk and impacts;
(4) Design good practices that combining public and private sector stakeholder perspectives;
(5) Use a nested, networked governance strategy to align local, municipal, regional and national policies, decisions, and material support; and
(6) Establish a sustainable program of monitoring and learning.
For more information

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