Evaluating the vulnerability of climate change in the coastal region of Bangladesh

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Introduction

- Climate change is the long-term change in weather pattern.
- Climate change could produce more frequent and stronger storms that threaten coastal communities.
- Shoreline changes due to Sea Level Rise (SLR) has increasingly become a major social, economic and environmental concern to a large number of coastal countries.
- Bangladesh is considered as one of the most vulnerable countries in the world to climate change and sea level rise.
The objective of this research was to evaluate the vulnerability of rising water in coastal Bangladesh, either caused by storm surge or sea level rise.

Research Questions

1. Which land use and land cover (LULC) is most vulnerable in the case of two different flooding scenarios?
2. How much particular LULC will likely to be inundated by the rising water?
3. What is the effect of flooding to the total land use and land cover?
4. How large a population would be impacted by flooding?
Study area and Data collection

- The study area is Bangladesh, a low lying delta county in South East Asia that is also frequently stricken by cyclones.

Cyclones and sea level rise result in the loss of land through inundation, soil and water salinization, reef fisheries infestation and property damage.
Data collection

- Digital Elevation Model (DEM) derived from SRTM were collected from the U.S. Geological Survey (USGS) website.
Land Use and Land Cover (LULC) map

Source: Department of Geography, University of Maryland, Maryland

Cartography By: Niaz Morshed
4/10/2013
Data Analysis

• The elevation models were arranged into tiles, each covering one degree of latitude and one degree of longitude.

• The following three major steps were followed during data analysis:
  - Preparing country boundary
  - Building Digital Terrain model (DTM) mosaic
  - Identifying inundation zones and overlaying that with Land covers
Results and Discussion

• Among 11 land use and land cover classes, the four most vulnerable land cover classes were analyzed for different flooding scenarios.
  ➢ Cropland
  ➢ Grassland
  ➢ Woodland
  ➢ wooded grassland
Results and Discussion

Impact on woodland and wooded grassland

Land Use Land Cover
- Woodland
- Wooded grassland
- Woodland with elevation 0 - 5m
- Woodland with elevation 5 - 10m
- Wooded grassland with elevation 0 - 5m
- Wooded grassland with elevation 5 - 10m

Source: USGS, ESRI, MSU Resources
Cartography By: Niazi Morshed
4/11/2013
Results and Discussion

- **Impact on Woodland and Wooded grassland**

<table>
<thead>
<tr>
<th>Land Cover</th>
<th>Sea Level Rise</th>
<th>Area (Km²)</th>
<th>Inundated areas of each classes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodland (8907 km²)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 To 5m</td>
<td>74</td>
<td></td>
<td>0.83</td>
</tr>
<tr>
<td>5 To 10m</td>
<td>661</td>
<td></td>
<td>7.42</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>735</strong></td>
<td></td>
<td><strong>8.25</strong></td>
</tr>
<tr>
<td>Wooded grassland (10636 km²)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to 5m</td>
<td>521</td>
<td></td>
<td>4.90</td>
</tr>
<tr>
<td>5 To 10m</td>
<td>2201</td>
<td></td>
<td>20.69</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2722</strong></td>
<td></td>
<td><strong>25.59</strong></td>
</tr>
</tbody>
</table>

- **Overall 17.69% of Woodland and wooded grassland are within the 10 meter in elevation.**
Results and Discussion

Impact on cropland and grassland

Land Use and Land Cover
- Cropland
- Grassland
- Cropland with elevation 0-5 m
- Cropland with elevation 5-10 m
- Grassland with elevation 0-5 m
- Grassland with elevation 5-10 m

Source: USGS, ESRI, MSU Resources
Cartography By: Niaz Morshed
4/11/2013
Results and Discussion

Impact on cropland and grassland

<table>
<thead>
<tr>
<th>Land Cover</th>
<th>Sea Level Rise</th>
<th>Area (km²)</th>
<th>Inundated area of each classes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cropland (56687 km²)</td>
<td>0 To 5m</td>
<td>5476</td>
<td>9.67</td>
</tr>
<tr>
<td></td>
<td>5 To 10m</td>
<td>13227</td>
<td>23.33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>18703</td>
<td>33.00</td>
</tr>
<tr>
<td>Grassland (30337Km²)</td>
<td>0 To 5m</td>
<td>6074</td>
<td>20.02</td>
</tr>
<tr>
<td></td>
<td>5 To 10m</td>
<td>11375</td>
<td>37.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>12888</td>
<td>57.52</td>
</tr>
</tbody>
</table>

41.54 % of Cropland and grassland are in 10 meter in elevation.
Results and Discussion

- Impact of flooding on total land use and land cover

- 0 to 5m: 11.82%
- 5 to 10m: 25.39%

Sea Level Rise Map

Source: Department of Interior, USGS and ESRI
Cartography By: Niaz Morsheed
04/03/2013
Population affected

• Total population of Bangladesh is 146 million.
• The population density of costal zone is 742 per \( \text{km}^2 \)
  - 0 to 5 m - 10.70 million
  - 5 to 10 m - 22.97 million
Results and Discussion

1. Woodland, wooded grassland, cropland and grassland are the most vulnerable land cover.

2. Relative percentage of the vulnerable land covers
   - Woodland – 8.25%
   - Wooded grassland – 25.59%
   - Cropland – 33.0%
   - Grassland – 57.52%

3. In total, 37.21 % of Bangladesh is below 10m in elevation that are subjected to flooding.
Consequences

- Bangladesh is a densely populated developing country.
- Nearly half of the populations are employed in the agriculture sector.
- Almost every year natural disaster affects agricultural activities that are also subjective to the effect of sea level rise and climate change.
Consequences

- This study identifies that, the impacts of flooding would reach the inland, which would pose as one of the biggest threat for Bangladesh.

- Frequent Cyclone and storm surge could impact crop production, coastal shrimp culture, livelihood and human health.
Conclusion

- Climate change is already happening now. It is not a vague future threat that can be overlooked.
- The location and geography of Bangladesh makes it not only particularly susceptible to the effects of climate change, but also extremely hard to predict the impact.
- The outcomes of this research would set a firm basis for sustainable development policies at national and international levels and strategies for rehabilitation of the densely populated country.
References


Poncelet, A., 2009The Land of Mad Rivers. Bangladesh Case Study Report. EACH-FOR. CEDEM.
Thanks for your patient hearing

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