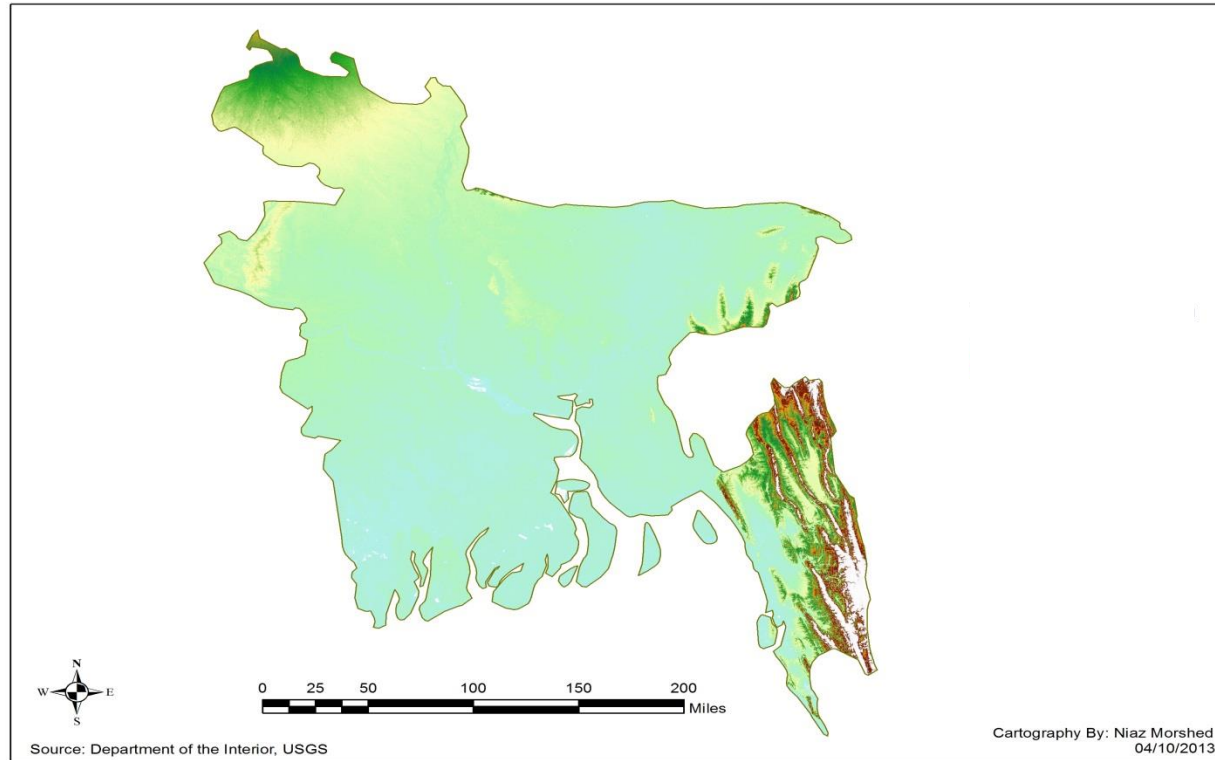


# Evaluating the vulnerability of climate change in the coastal region of Bangladesh



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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.

# Research Questions

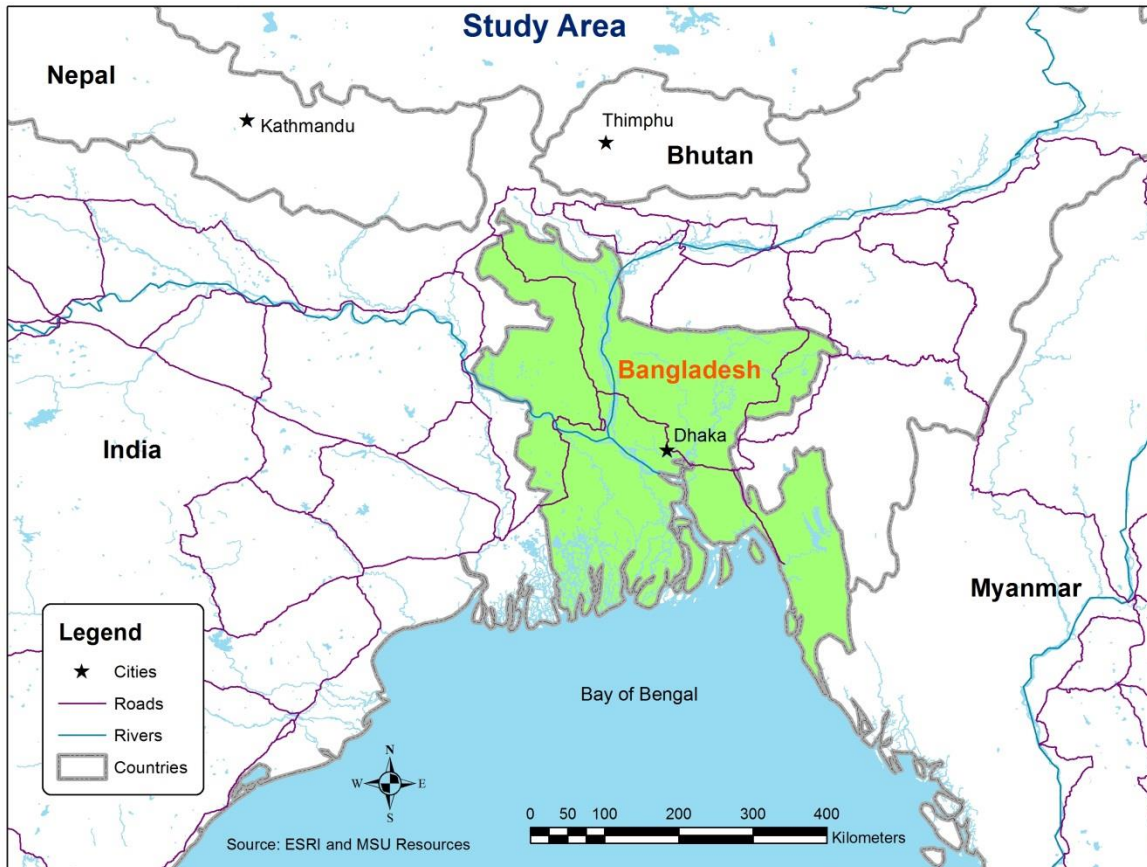
- The objective of this research was to evaluate the vulnerability of rising water in coastal Bangladesh, either caused by storm surge or sea level rise.

## 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

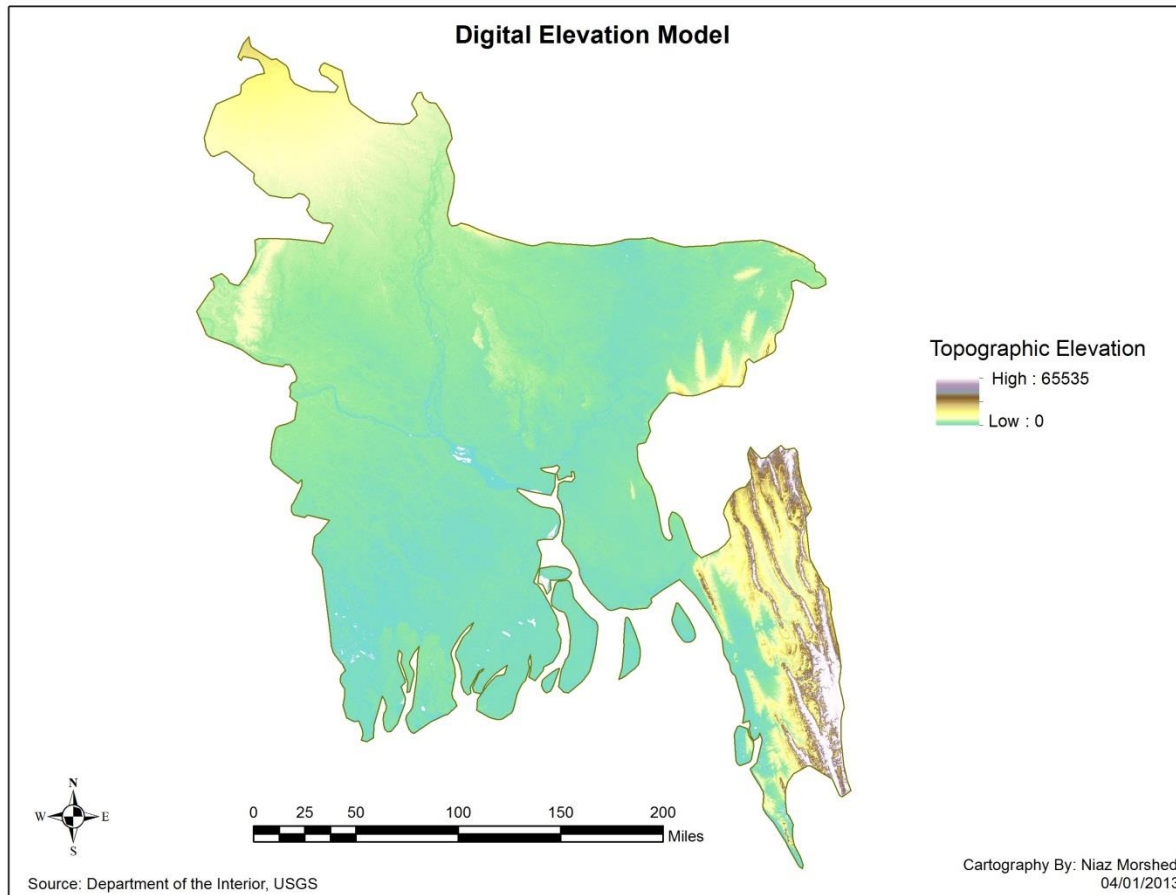
- The study area is Bangladesh, a low lying delta county in South East Asia that is also frequently stricken by cyclones.



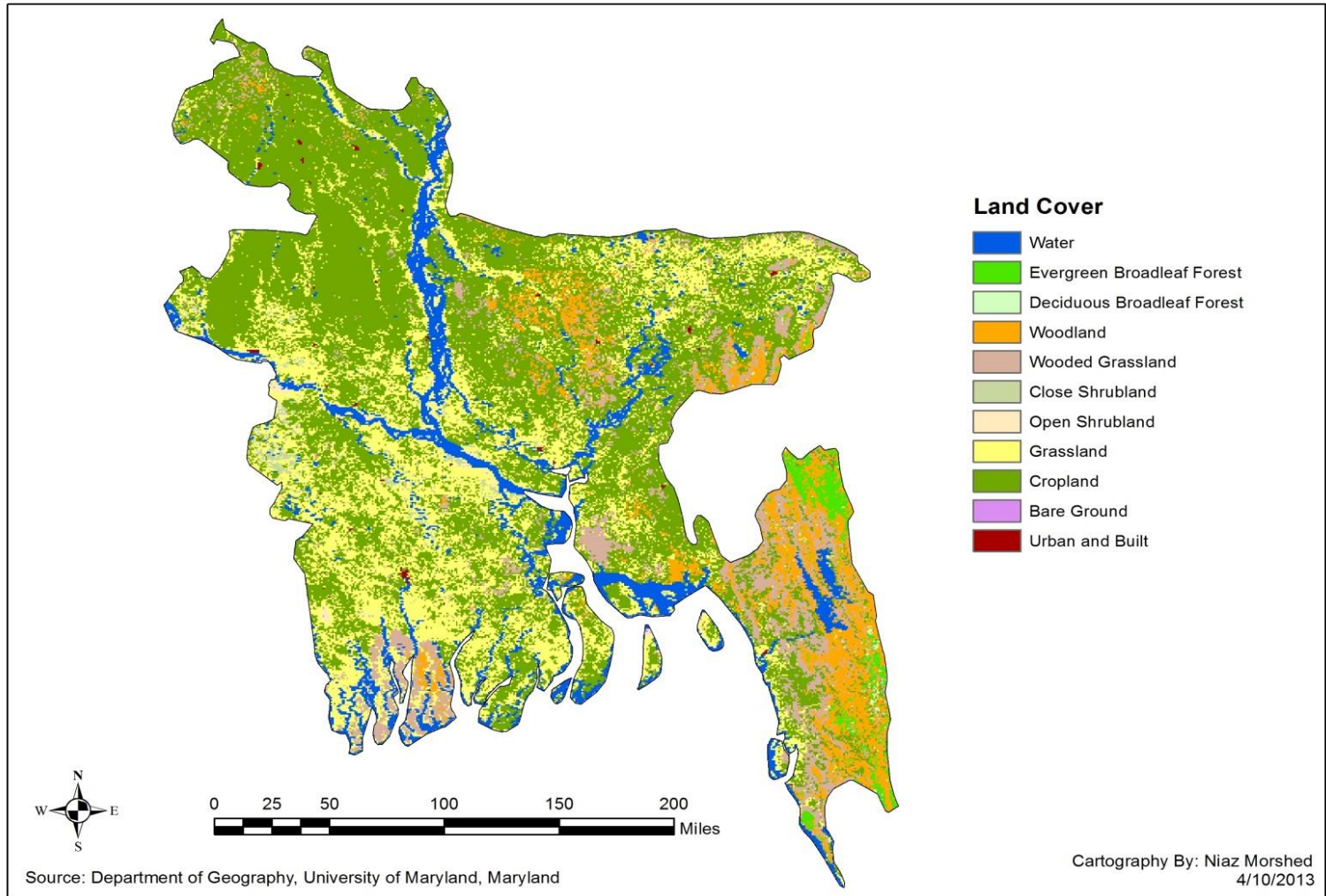
Cyclones and sea level rise result in the loss of land through inundation, soil and water salinization, reef fisheries infestation and property damage.

# Data collection

- Digital Elevation Model (DEM) derived from SRTM were collected from the U.S. Geological Survey (USGS) website.



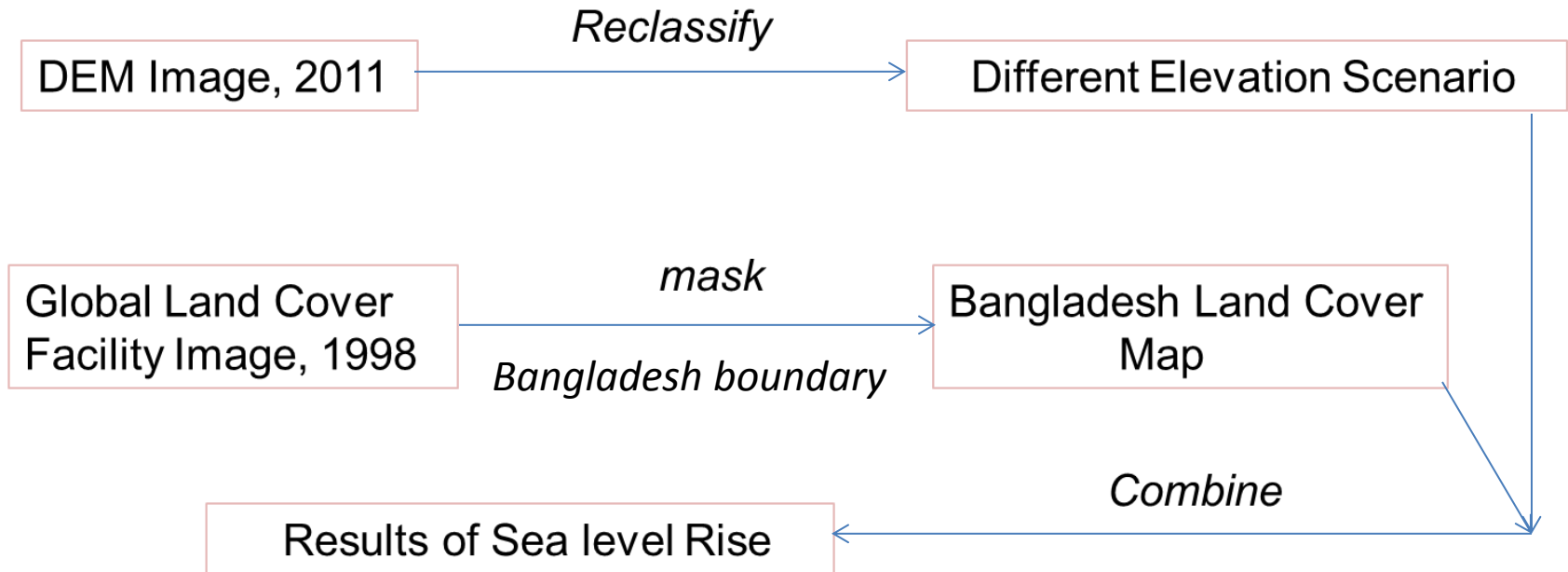
# Land Use and Land Cover (LULC) map



# 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

# Data Analysis – Flow Chart



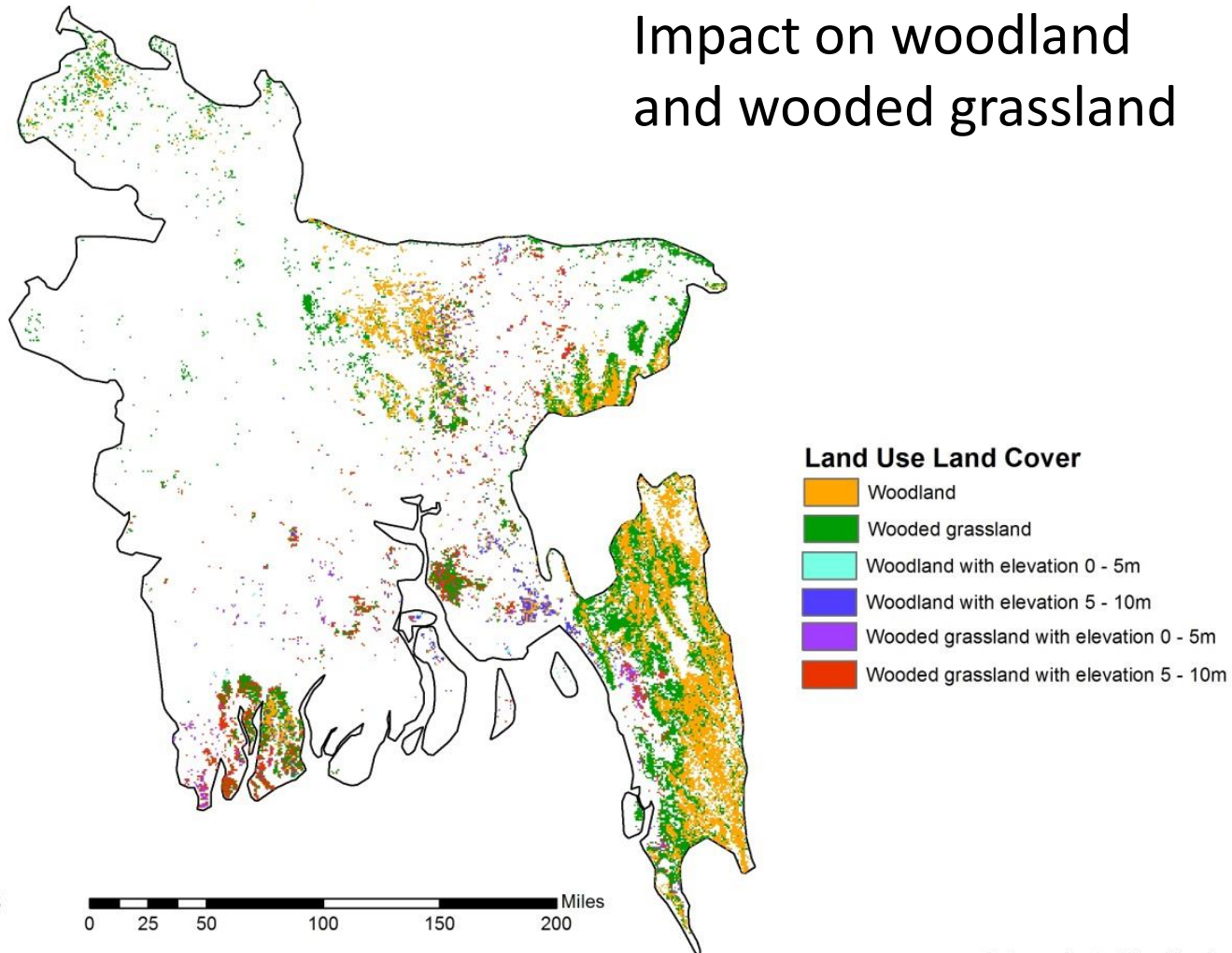


# Results and Discussion

- 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



Source: USGS, ESRI, MSU Resources

Cartography By: Niaz Morshed  
4/11/2013

# Results and Discussion

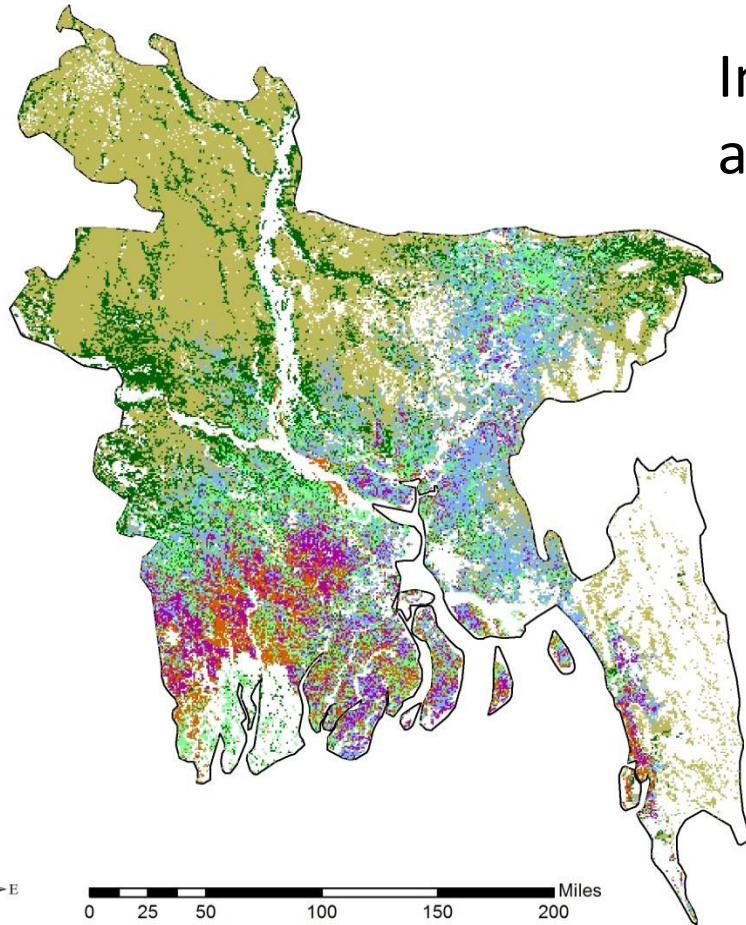
## ➤ Impact on Woodland and Wooded grassland

Land Cover	Sea Level Rise	Area(Km <sup>2</sup> )	Inundated areas of each classes (%)
Woodland (8907 km <sup>2</sup> )	0 To 5m	74	0.83
	5 To 10m	661	7.42
	<b>Total</b>	735	8.25
Wooded grassland (10636 km <sup>2</sup> )	0 to 5m	521	4.90
	5 To 10m	2201	20.69
	<b>Total</b>	2722	25.59

## ➤ 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 5-10m
- Grassland with elevation 0-5 m
- Grassland with elevation 5-10 m



0 25 50 100 150 200 Miles

Source: USGS, ESRI, MSU Resources

Cartography By: Niaz Morshed  
4/11/2013

# Results and Discussion

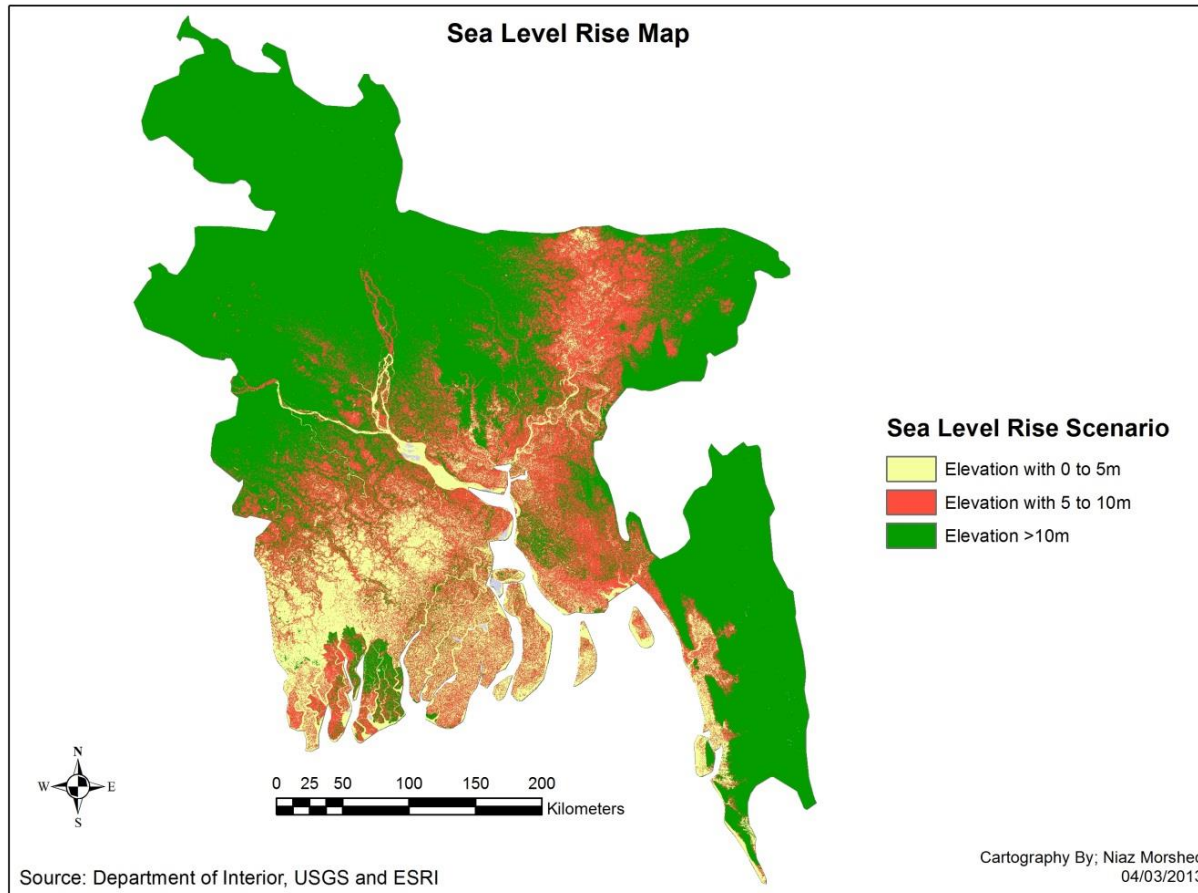
## ➤ Impact on cropland and grassland

Land Cover	Sea Level Rise	Area(km <sup>2</sup> )	Inundated area of each classes (%)
Cropland (56687 km <sup>2</sup> )	0 To 5m	5476	9.67
	5 To 10m	13227	23.33
	<b>Total</b>	18703	33.00
Grassland (30337Km <sup>2</sup> )	0 To 5m	6074	20.02
	5 To 10m	11375	37.50
	<b>Total</b>	12888	57.52

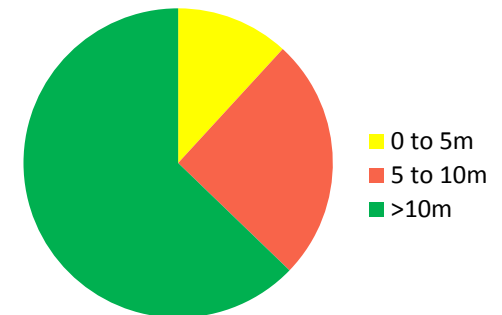
41.54 % of Cropland and grassland are in 10 meter in elevation.

# Results and Discussion

## ➤ Impact of flooding on total land use and land cover



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



# Population affected

- Total population of Bangladesh is 146 million.
- The population density of costal zone is 742 per km<sup>2</sup>
  - 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

- BBS (Bangladesh Bureau of Statistics), 2005. Statistical Yearbook of Bangladesh. BBS, Dhaka, Bangladesh.
- Bijlsma, L., J. O'callahan, R. hillen, R. misdorp, B. mieremet, K. ries and J.R. spradley. (eds.), 1992. Global Climate Change and the Rising Challenge of the Sea. Report of the Coastal Zone Management Subgroup, Response Strategies Working Group of the Intergovernmental Panel on Climate Change. The Hague, Netherlands: Ministry of Transport, Public Works and Water Management, viii + 35 pp. + apps. 2p.
- Church, J.A., J. M. Gregory, P. Huybrechts, M. Kuhn, K. Lambeck, M.T. Nhuan, D. Qin, P.L. Woodworth, 2001. Changes in sea level. In: Houghton, J.T., Ding, Y., Griggs, D.J., Noguer, M., van der Linden, P.J., Xiaosu, D. (eds.) Climate Change 2001. The Scientific Basis. Cambridge University Press, Cambridge, pp. 639–693.
- Dasgupta, S., B. Laplante, C.Meisner, D. Wheeler and J. Yan, 2007. The impact of sea level rise on developing countries: a comparative analysis. In: World Bank Policy Research Working Paper. no. 4136. The World Bank, Washington D.C.
- Finan, T. (2009): Storm Warnings: The Role of Anthropology in Adapting to Sea Level Rise in Southwestern Bangladesh. In: Crate, S.A.; Nuttall, M. (Eds.): Anthropology and Climate Change: From Encounters to Actions. Left Coast Press, Walnut Creek, CA.
- IPCC, 2001a: Climate Change 2001: The Scientific Basis – Contribution of Working Group I to the IPCC Third Assessment Report 2001.
- IPCC, 2007. Climate Change 2007: Impact, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the IPCC. Cambridge University Press, UK, 976p.
- McGranahan, G., D. Balk, B. Anderson, 2007. The rising tide: assessing the risks of climate change and human settlements in low elevation coastal zones. In: Environment and Urbanization. vol. 19, no. 17, pp. 17–37.
- MOEF, 2005. National adaptation program of action. Final Report, Ministry of Environment and Forest, Government of Bangladesh.
- Murty, T.S., R.A. Flather and R.F. Henry, 1986. The storm surge problem in the Bay of Bengal. Progress in Oceanography 16, 195–233.
- Poncelet, A., 2009The Land of Mad Rivers. Bangladesh Case Study Report. EACH-FOR. CEDEM.

# Thanks for your patient hearing

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