

# My Journey through the Landscape and People of Bangladesh.

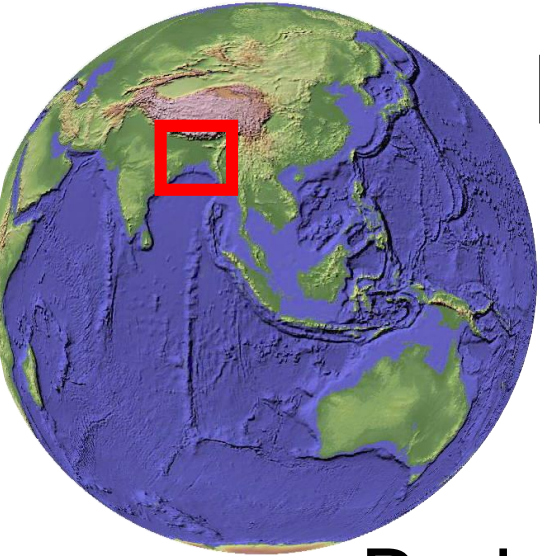
Michael S. Steckler

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Lamont -Doherty Earth Observatory of Columbia University, Palisades, NY, USA*



LAMONT-DOHERTY EARTH OBSERVATORY  
COLUMBIA CLIMATE SCHOOL

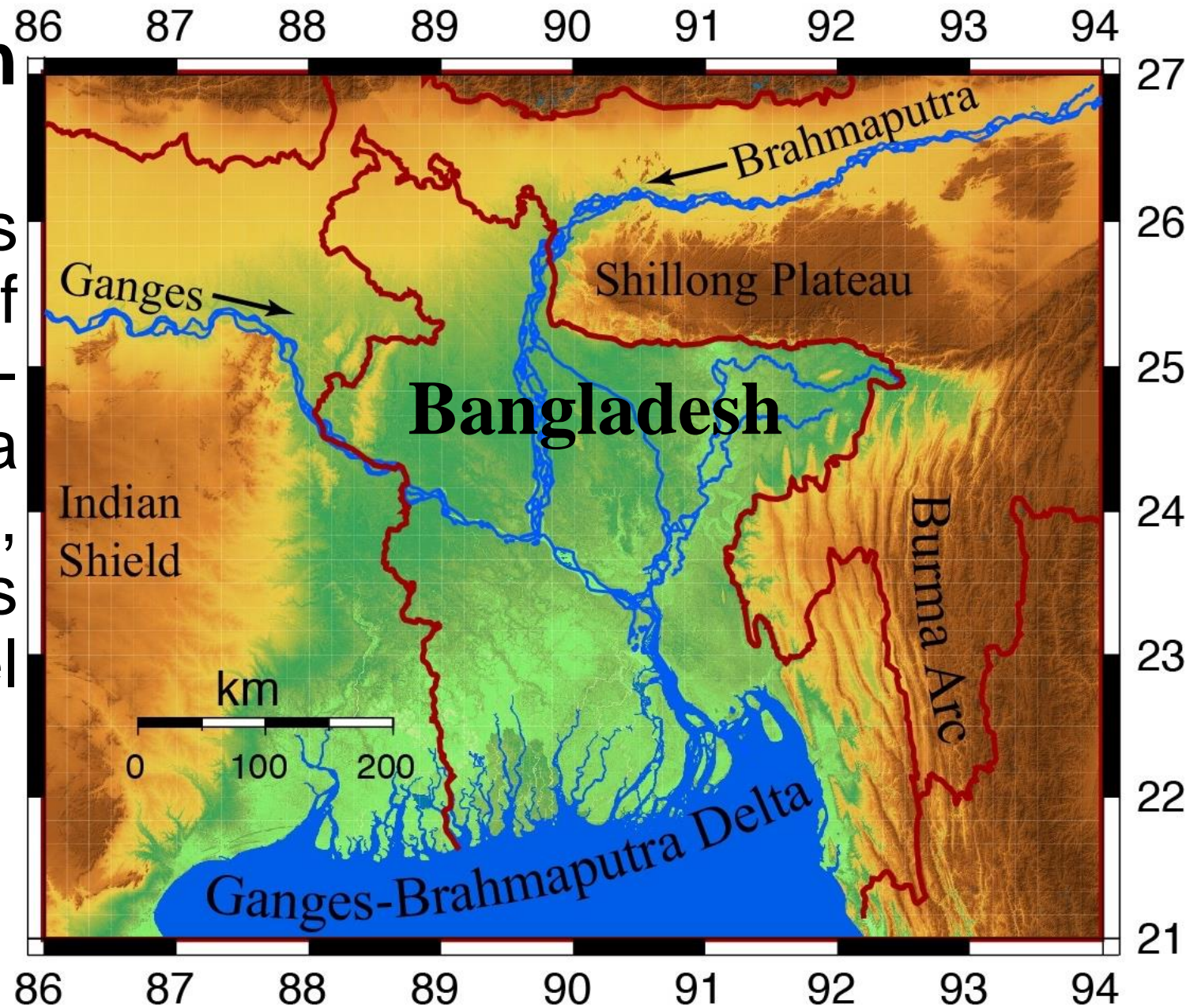
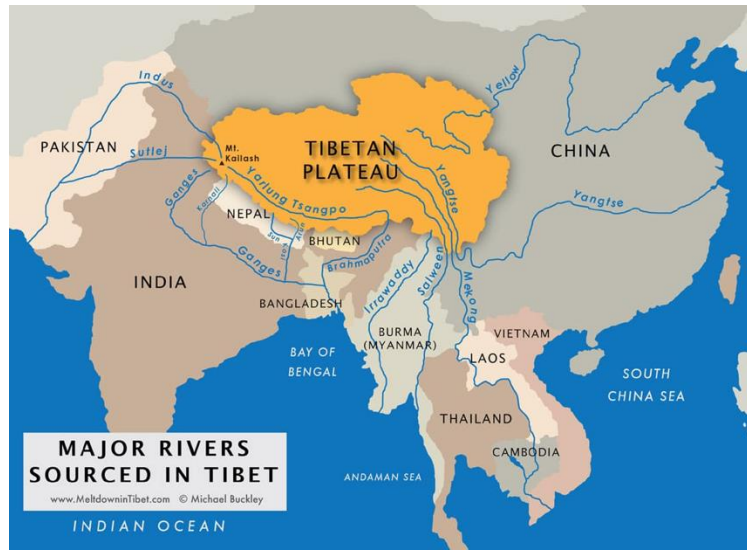




# Bangladesh

Occupies  
most of  
Ganges-  
Brahmaputra Delta

Largest delta on Earth,  
where 1/2 the land is less  
than 30 feet above sea level



# A land subject to multiple disaster:

Cyclones

Storm Surges

River floods

Flash floods

Earthquakes

Arsenic poisoning

Riverbank erosion

River avulsions

Sea level rise

Coastal land loss

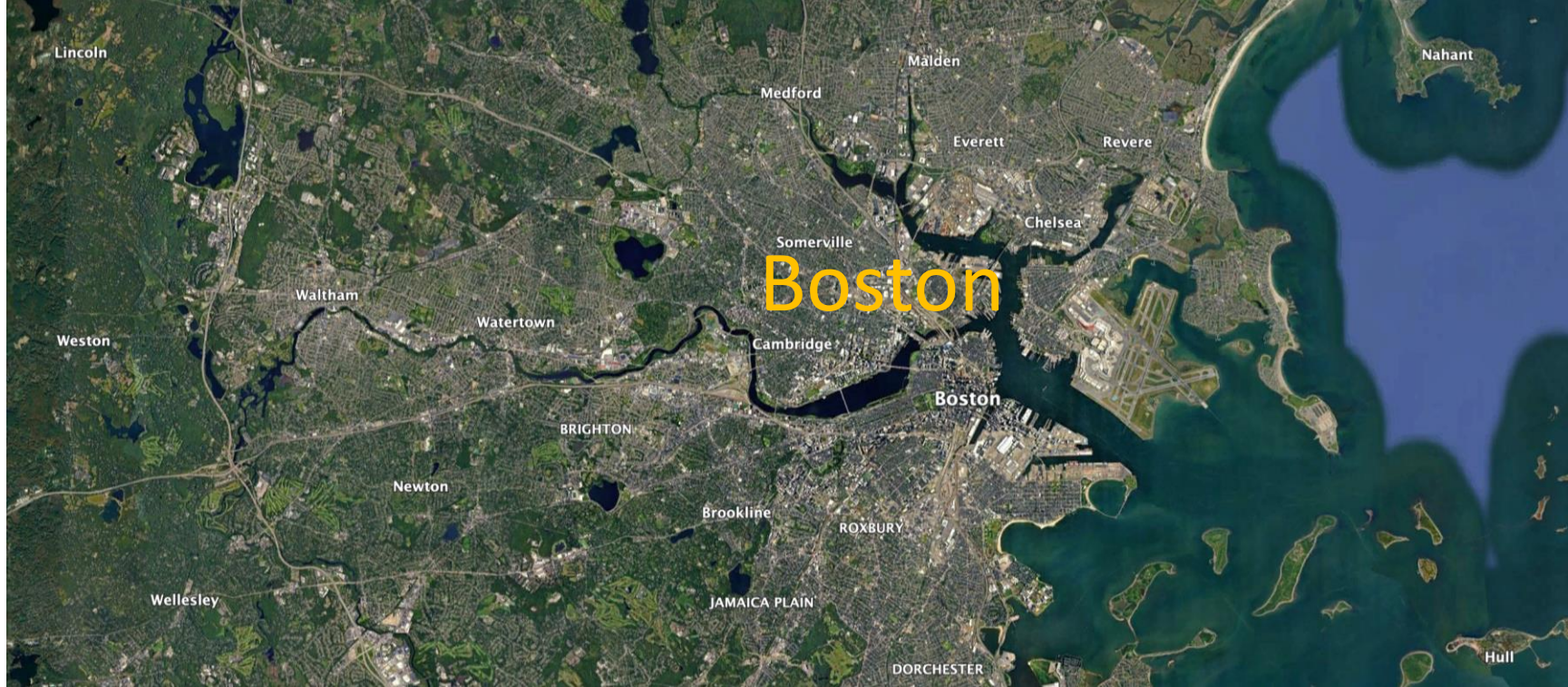
Land subsidence

Groundwater

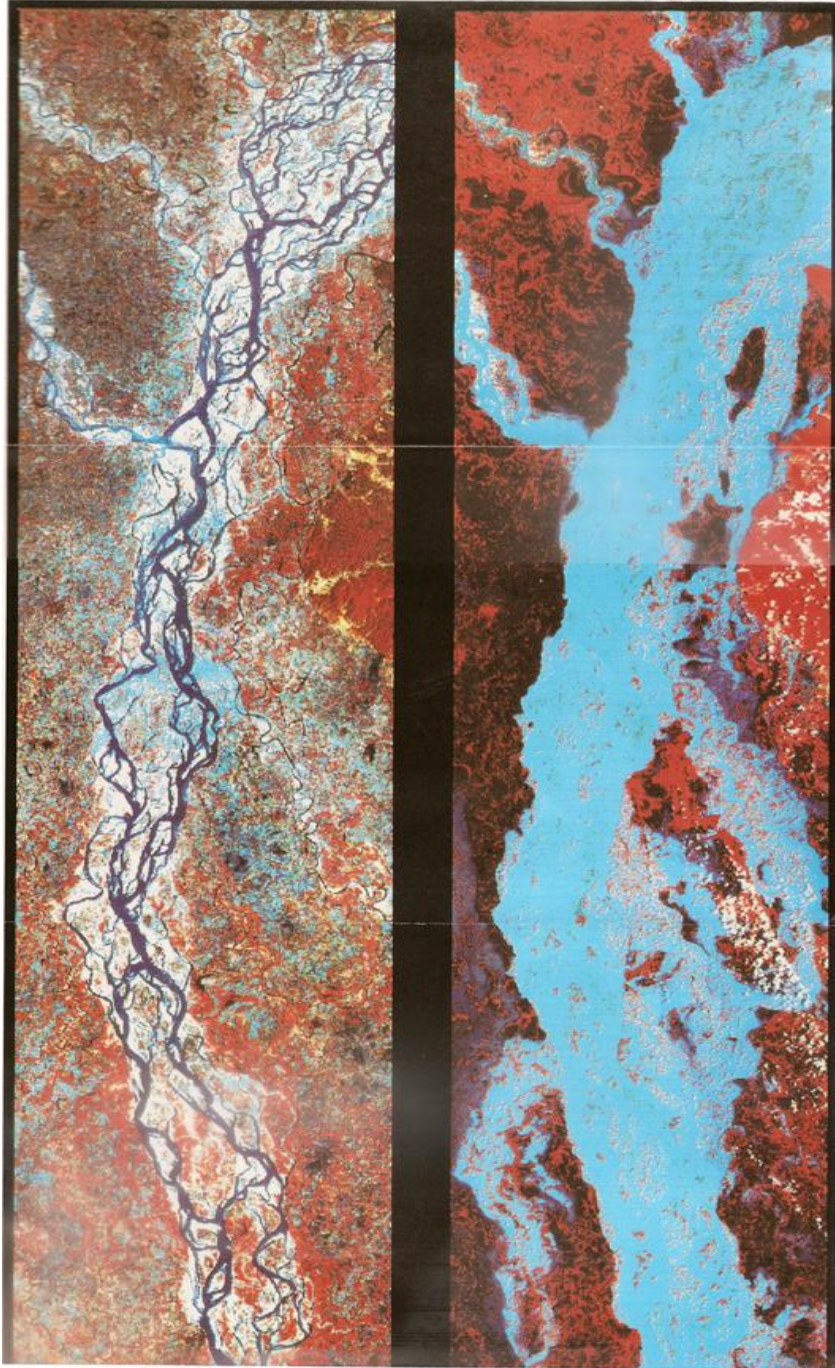
depletion

Salinization

But also the most resilient people I know

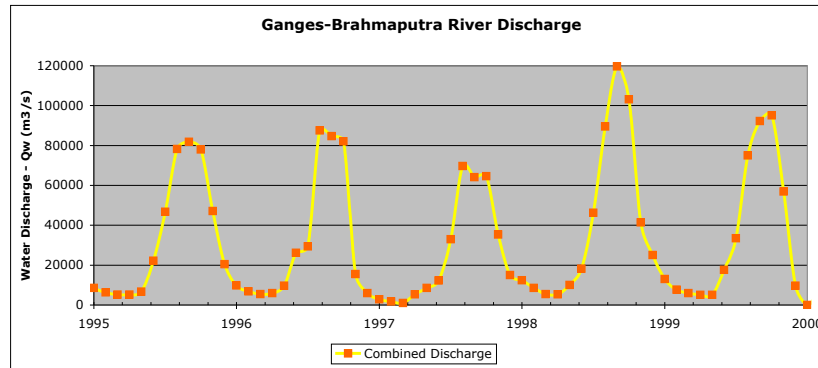


Brahmaputra at Low Flow - February 1987



Brahmaputra at High Flow - August 1987

**80% of water and 95% of sediment flows during summer monsoon**

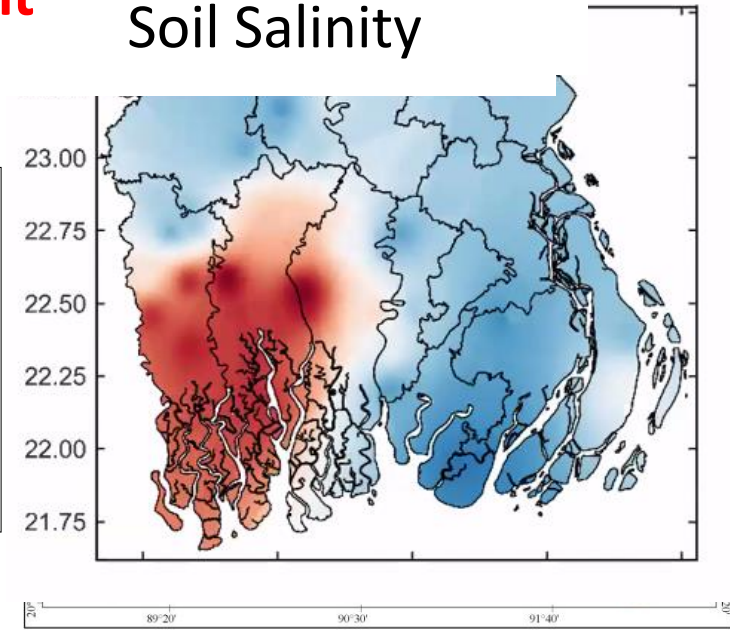


In a normal flood year, fields are flooded while villages and roads remain dry. Flooding is 20% in normal year; 67% in extreme year.



Cyclone Strikes Low-Lying Bangladesh in 1991

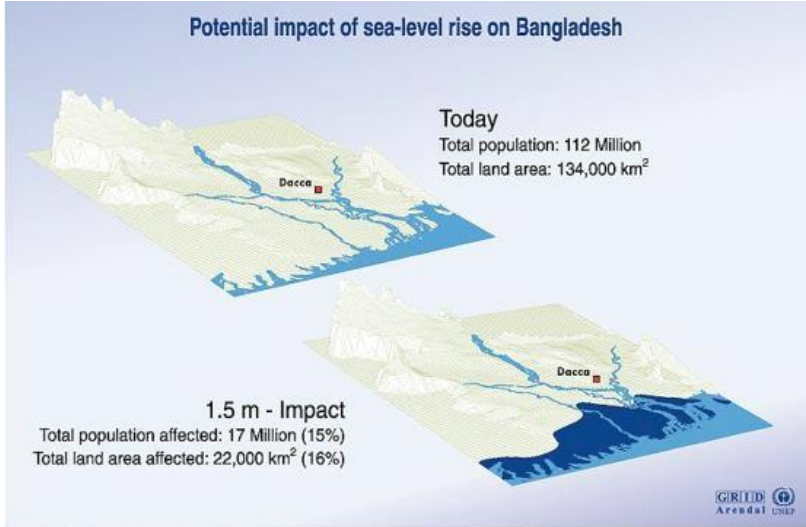
### Soil Salinity



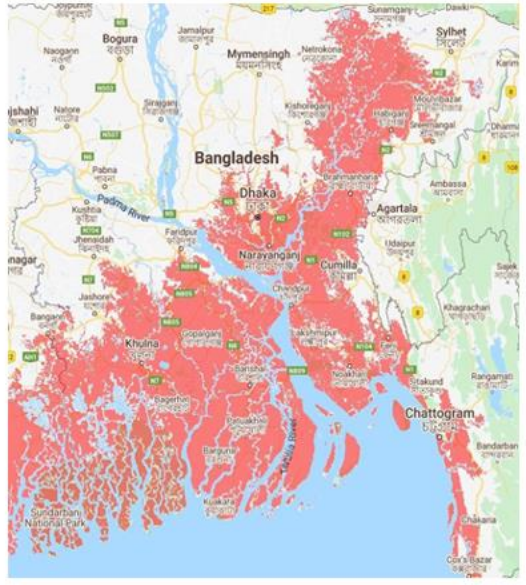
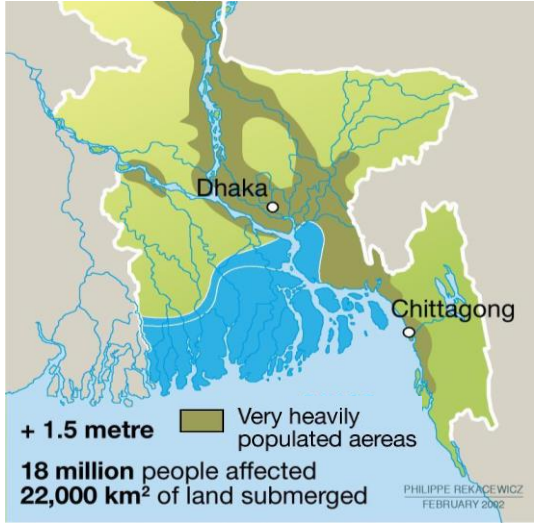
Severe Heatwave April-May 2024  
Temperatures reached 108°F



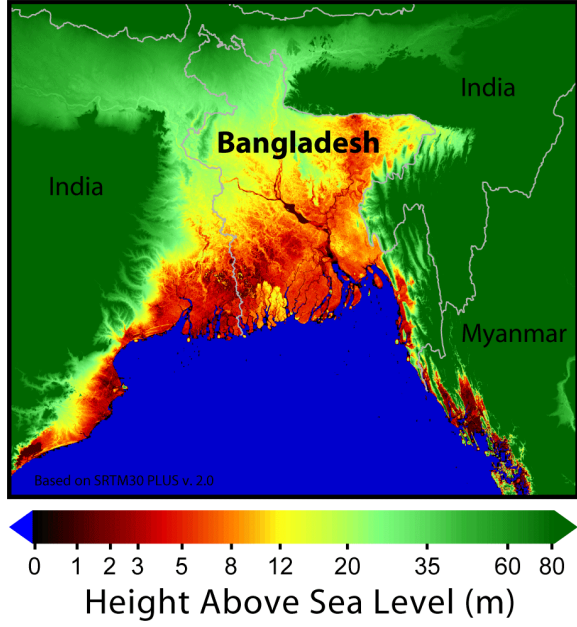
# Dire predictions of land loss due to sea level rise



Source : UNEP/GRID Geneva; University of Daegu; JRO Munich; The World Bank; World Resources Institute, Washington D.C.



## Sea Level Risks - Bangladesh

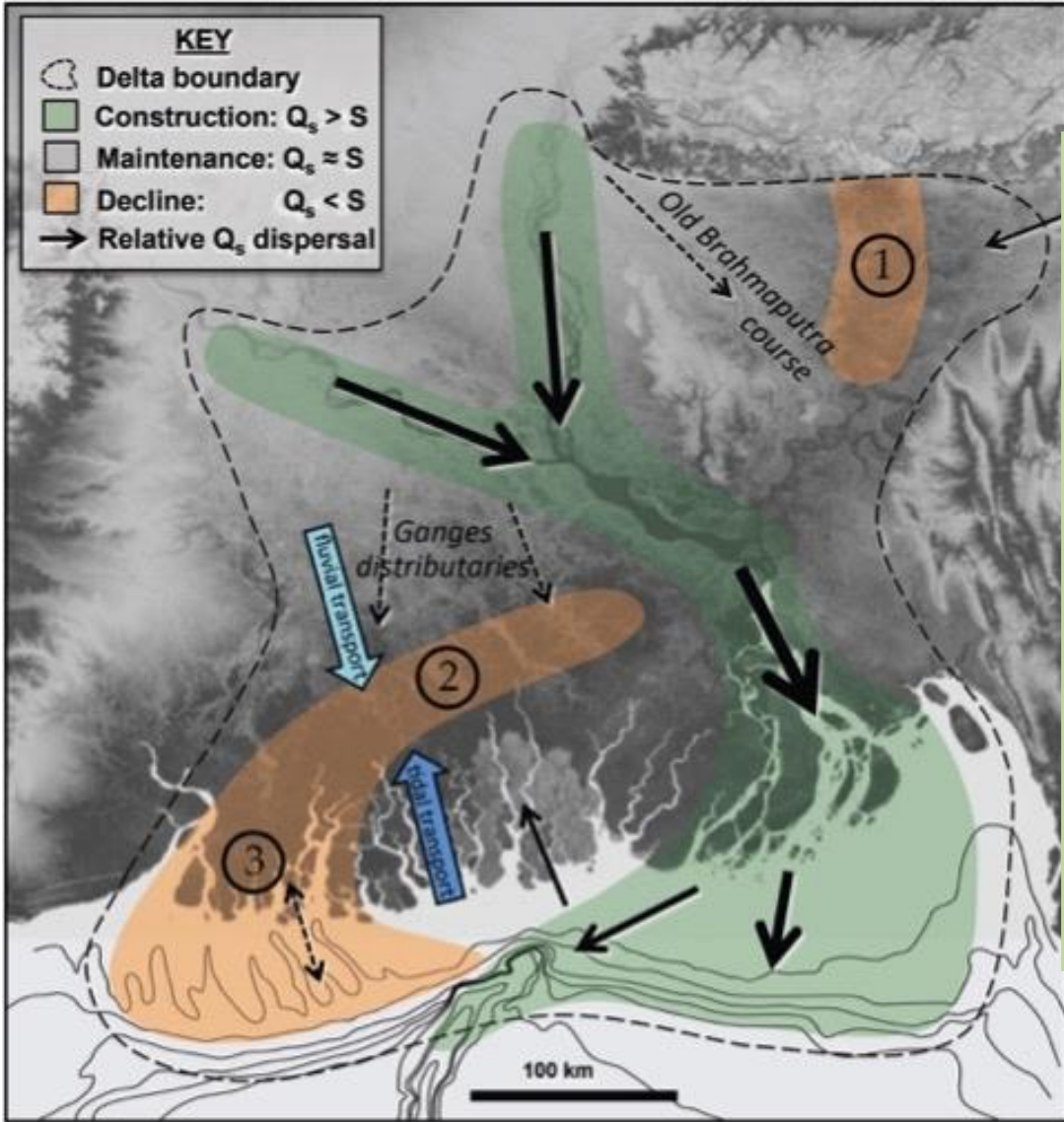


... but all these projections use "bathtub" models of fixed land

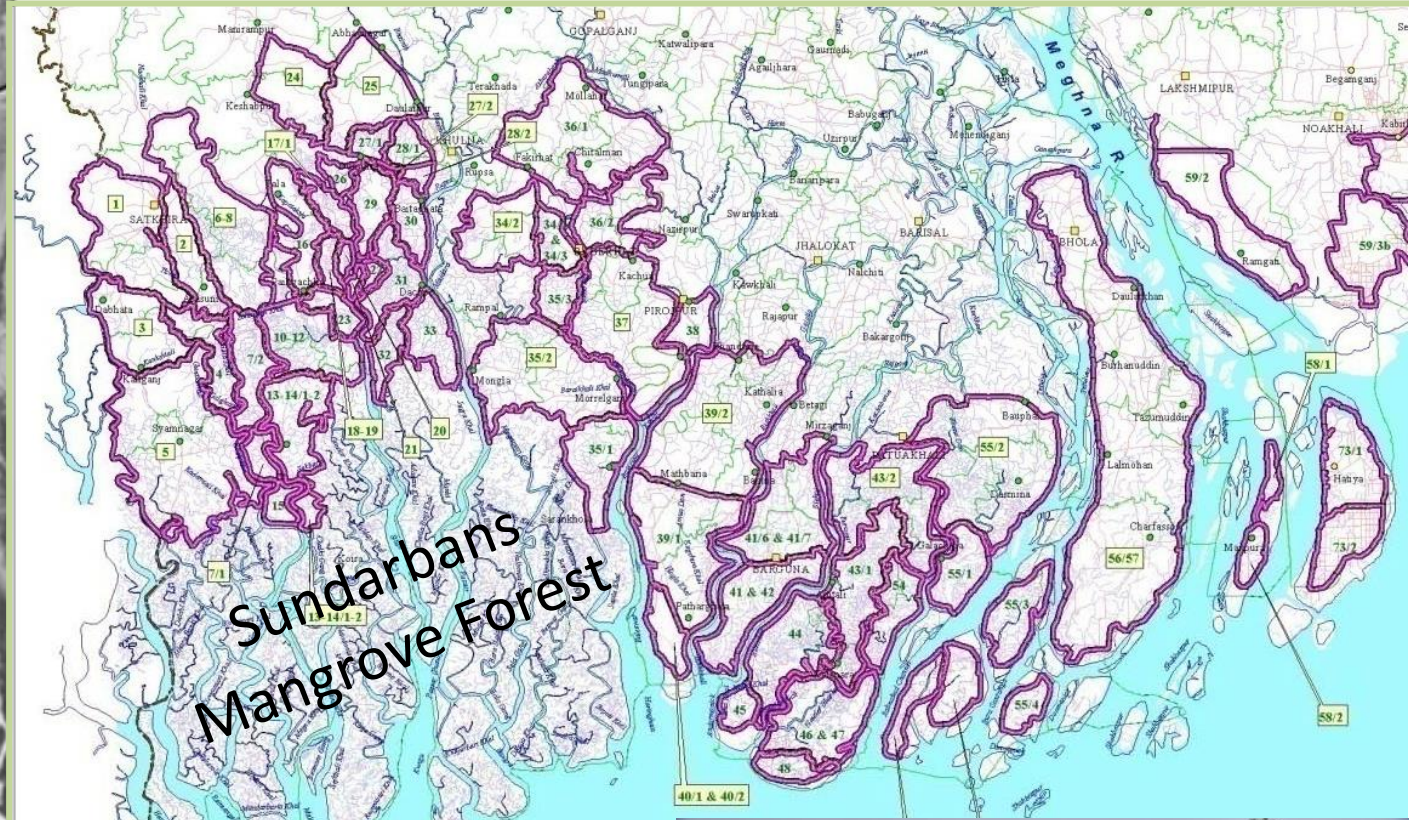
Subsidence increases the effect of sea level, while sedimentation counters it by depositing new land

the UN estimates that **by 2050,** **17% of the country** will be **submerged** by rising sea levels leaving **20 million people without a home.**

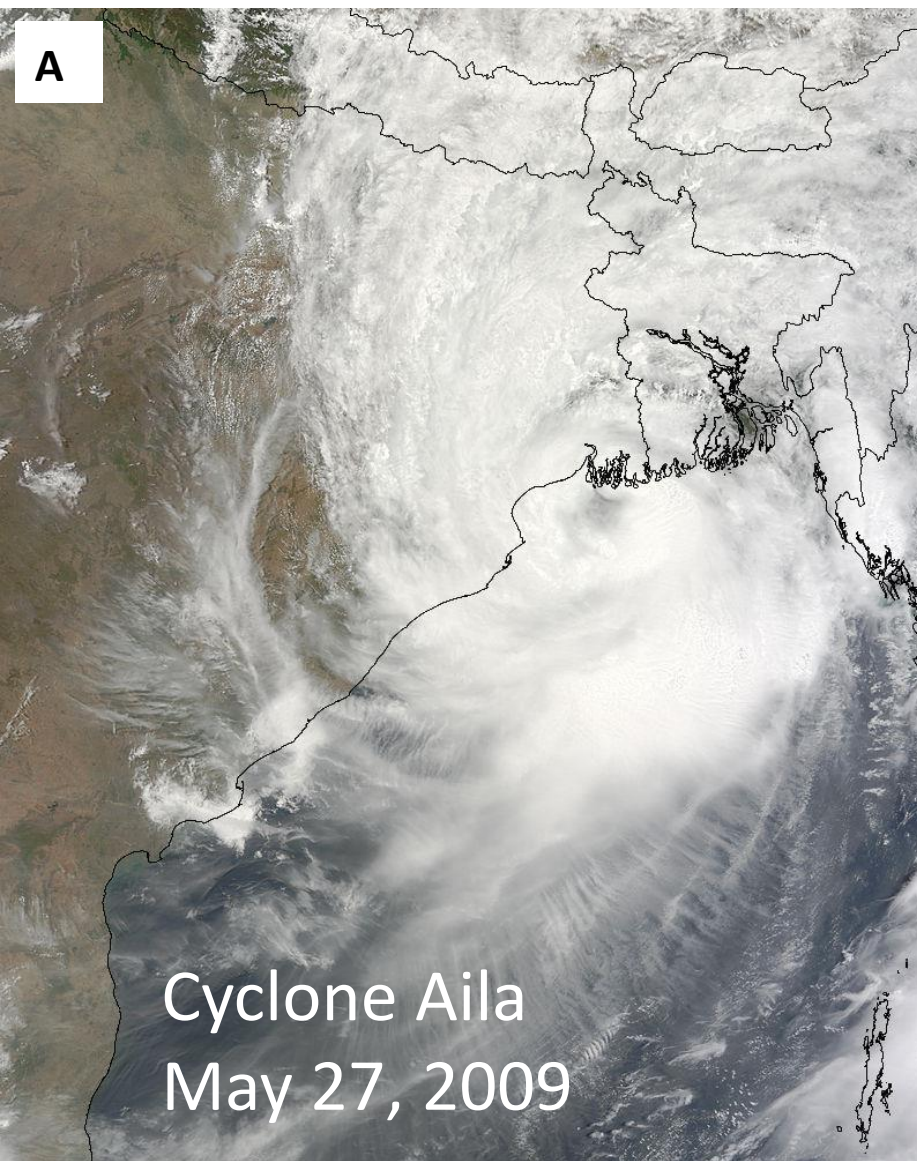




## Extensive poldering of coastal plain



The huge sediment supply is sufficient to maintain the delta, but it is not evenly distributed, so the river mouth is gaining land, but the SW region is losing land.



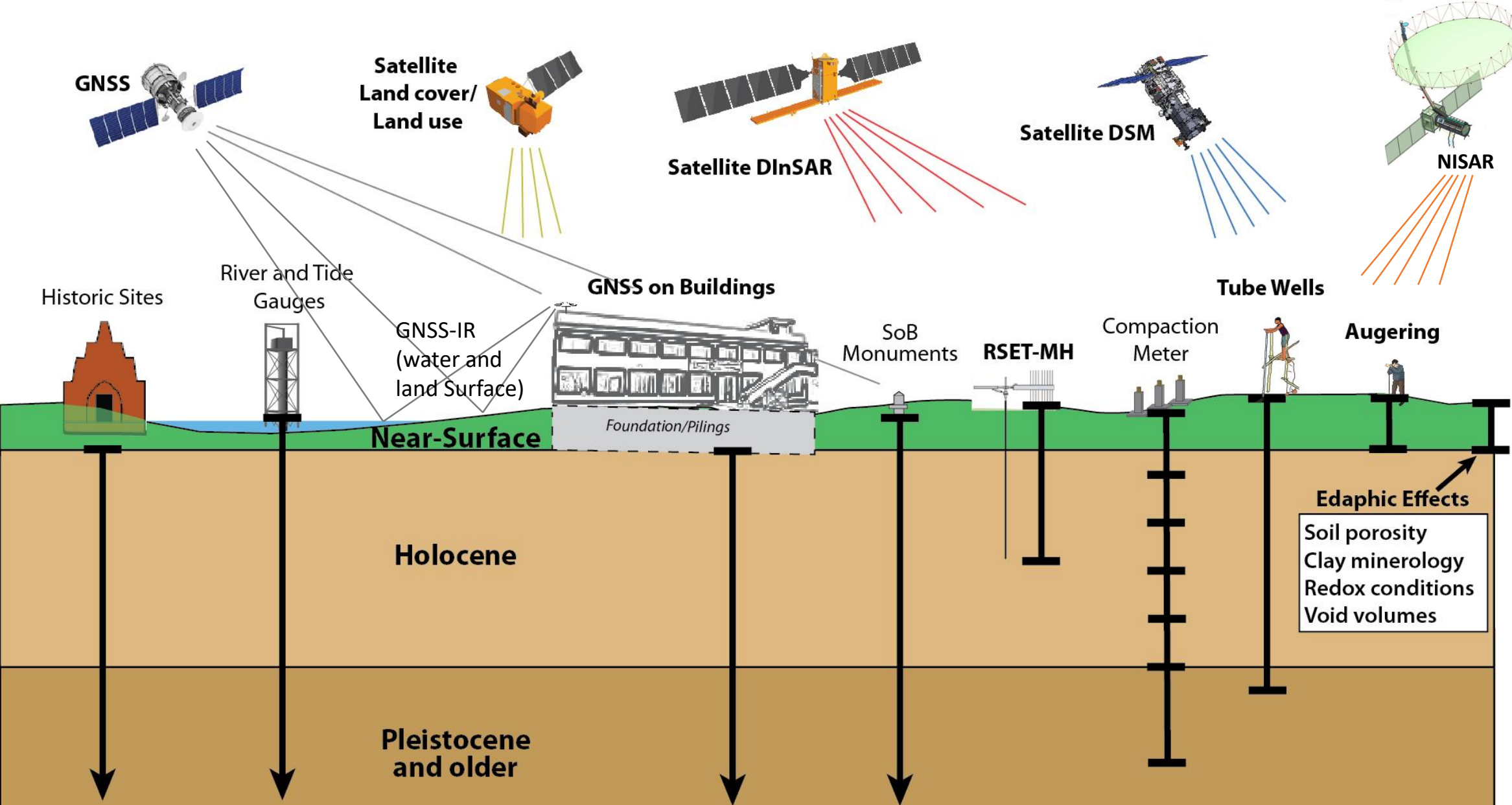
January 2009 (A) prior to Cyclone Aila; January 2011 (B)



The subsidence of the land inside the polders (where sediment cannot reach) has led to rice fields being converted to shrimp and crab farms that can grow in salt water



# Multitude of observations of Subsidence, Elevation Change

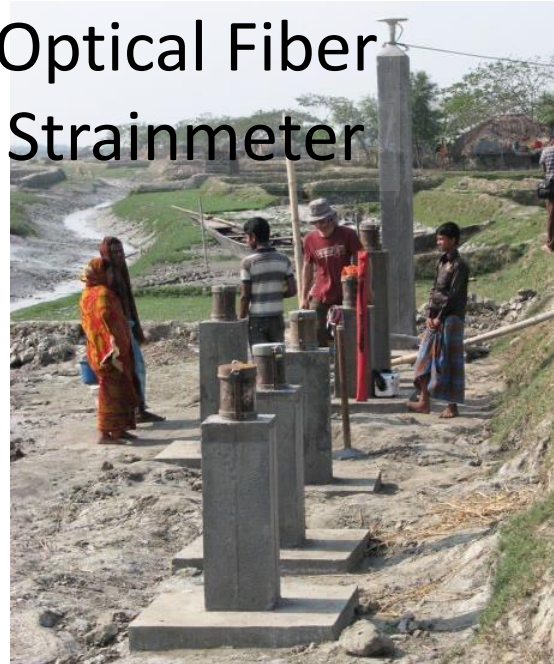


# Measuring Subsidence in Bangladesh

Continuous GNSS (GPS)



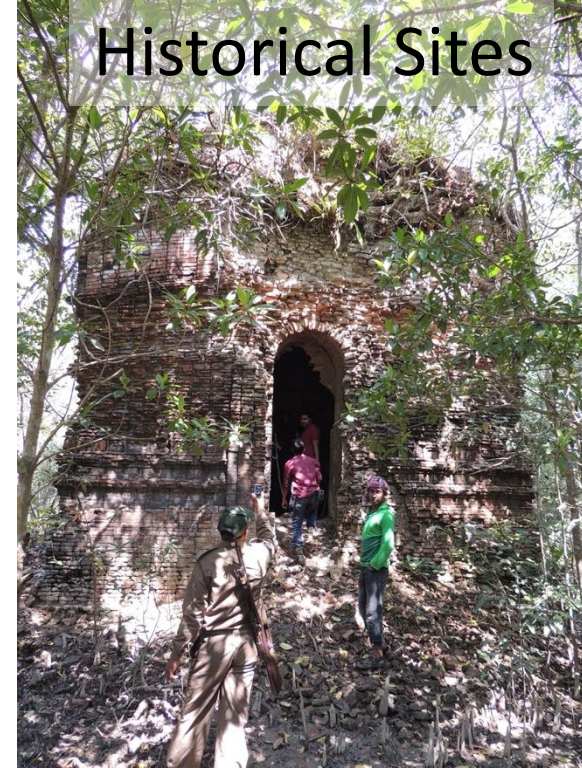
Optical Fiber Strainmeter



Tube Wells



Historical Sites

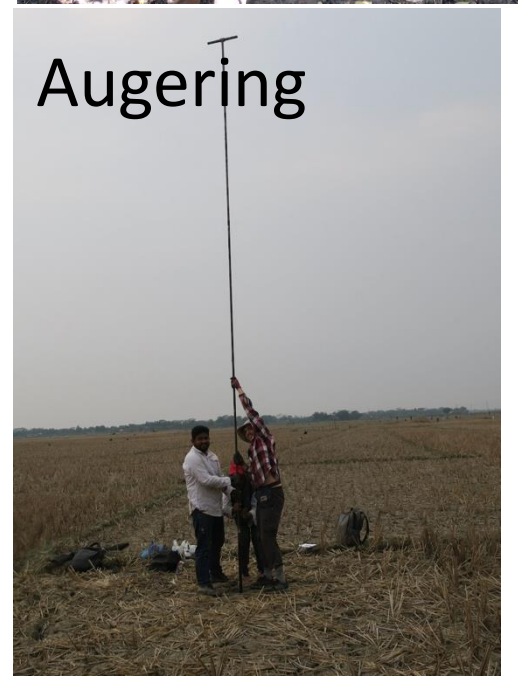


Campaign GNSS (GPS)



RSET-MH

Augering





The Islam-Rahaman family that hosted the Khulna Compaction Meter (KHLC) near their home making weekly measurements of the optical fiber length.





Krishna Family hosts Carol Wilson's RSET



Bachchu hosts both an RSET and a GNSS



on their farm on Polder 32



on his farm in Sonatola

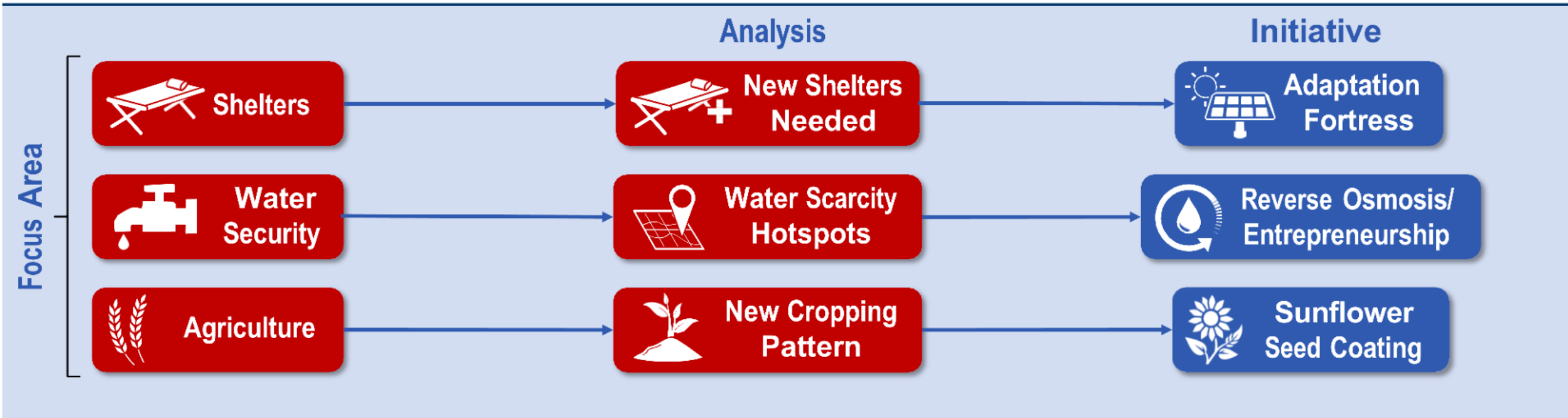


I teach a class SDEV3550: Bangladesh – Life on a Tectonically Active Delta, in which the class has group projects often sponsored by social scientists working in Bangladesh. Many include interviews of local villagers. This has connected me more to the people living on the delta and the impact of our observations of the physical changes to the delta.

## Desires for In Situ Adaptation Versus Out-Migration? The Impact of Flooding and Cyclones on Polder Communities in the Bangladesh Delta

Emily Stone<sup>1,2</sup>  | Rebecca Holloway<sup>2</sup> | Brendan Moore<sup>3</sup> | Michael Steckler<sup>3,4</sup> | Robert Stojanov<sup>5</sup> 

# Jameel Observatory - Climate Resilience Early Warning System (JO-CREWSnet) based at MIT has gotten me involved in direct activities to secure water, livelihoods, & flood and heat shelters in coastal Bangladesh



## Impact Mechanisms

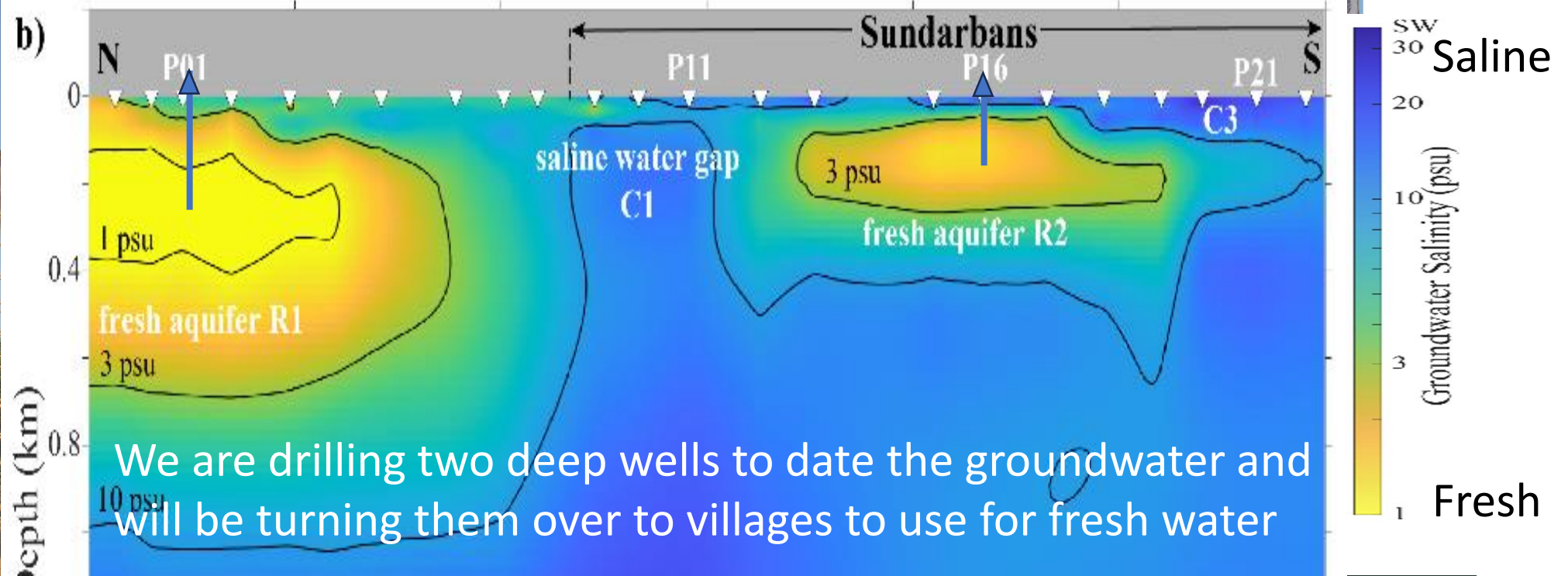
Decision Support Tool

Web Site

Adaptation Center

# JO-CREWSnet based at MIT has gotten me involved in direct activities to secure water, livelihoods, & flood and heat shelters in coastal Bangladesh

Adaptation Fortress





Thank you ধন্যবাদ

