Restoration of coastal resilience through tidal river management

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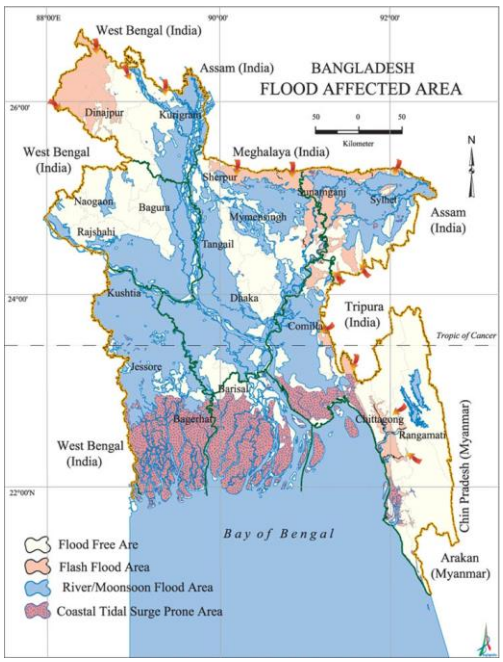
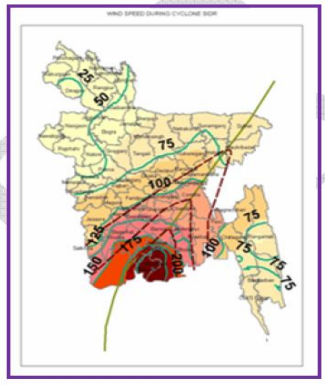


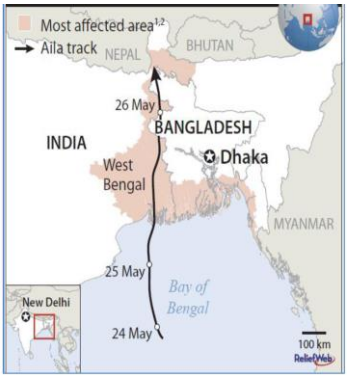
The coastal region

Cyclone tracks

Sidr (2007)



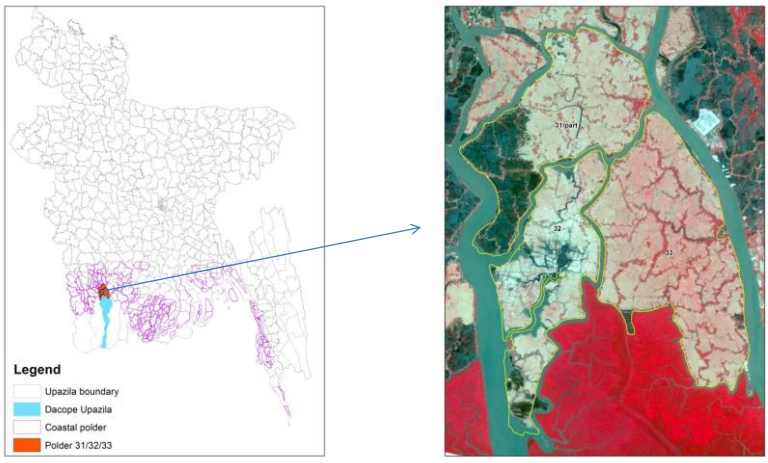
Aila (2009)



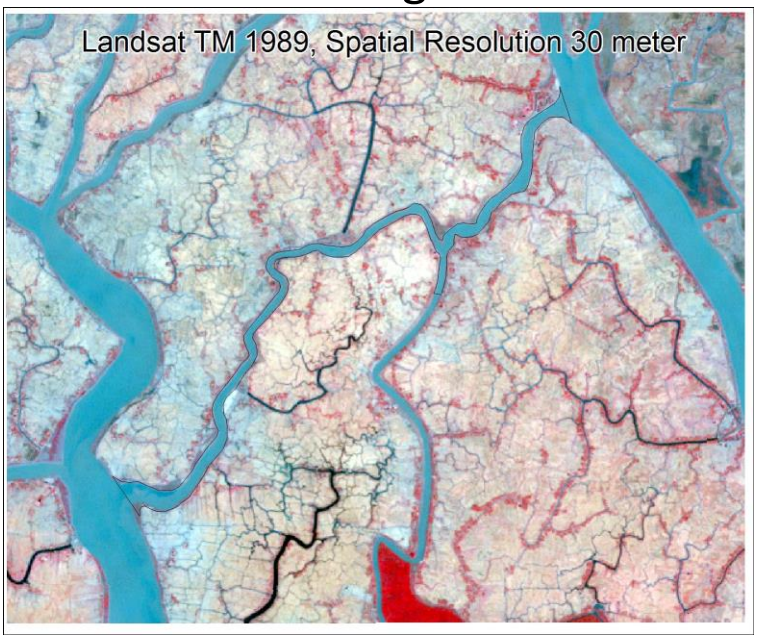
Difficulties in rehabilitation

- Very old polders
- Severe labor shortage
  - Migration
  - Lack of proper living condition
  - Lack of drinking water
- Morphological changes
  - Silted up and wider channels because of polderization
  - New channels formed to convey storm surge

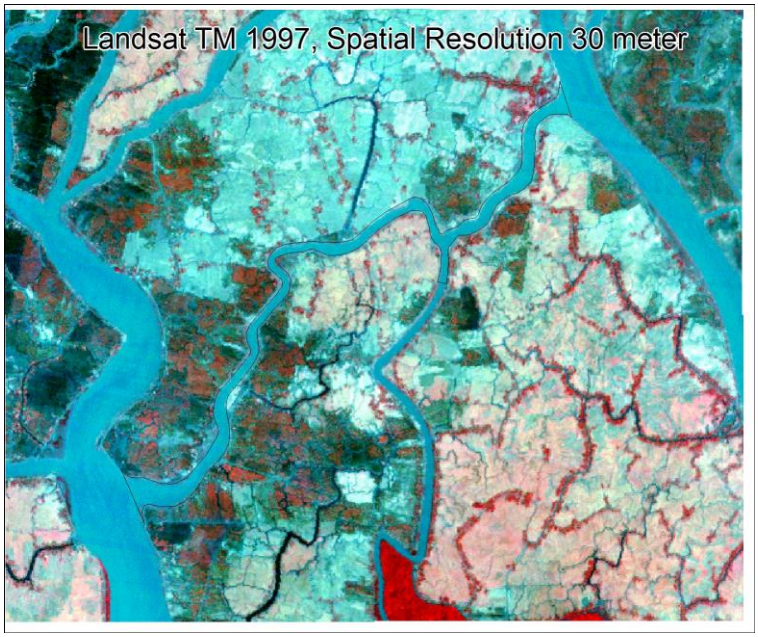
Polders 31/32/33



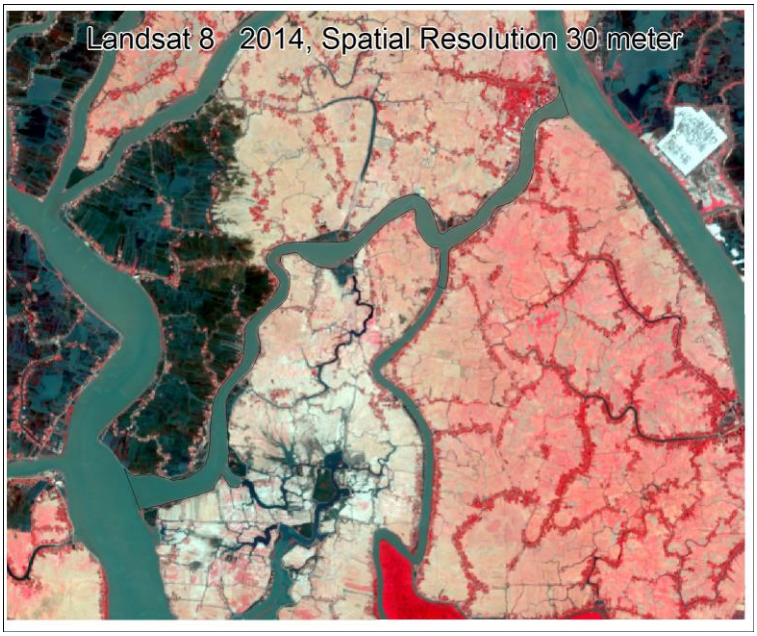
Satellite image 1989



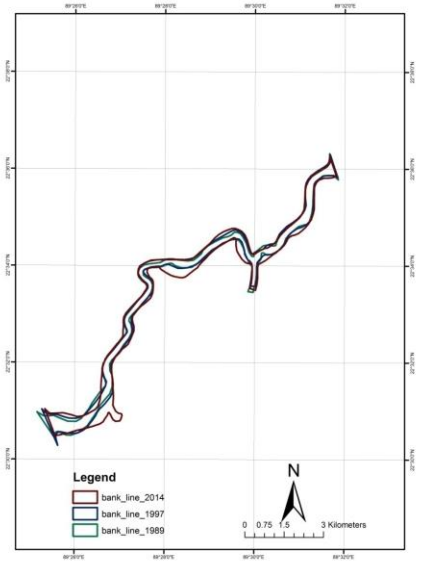
Satellite image 1997



Satellite image 2014



Change in bank line



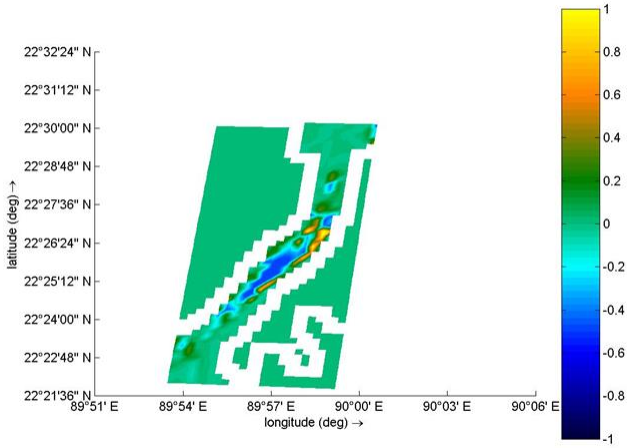
A typical storm surge can exert a force on the channels which is almost 100 times larger than the force that is exerted on the same channel in the normal condition.

To study the effect on channel morphology of this huge accelerated force during the storm surge, a numerical model (Delft 3D Dashboard) is applied for a typical cyclonic storm surge (Aila-like) in the coastal region of Bangladesh.

Location where the model results are shown

Yearly resultant erosion / sedimentation in meter in normal flow condition

White Lines - Polder



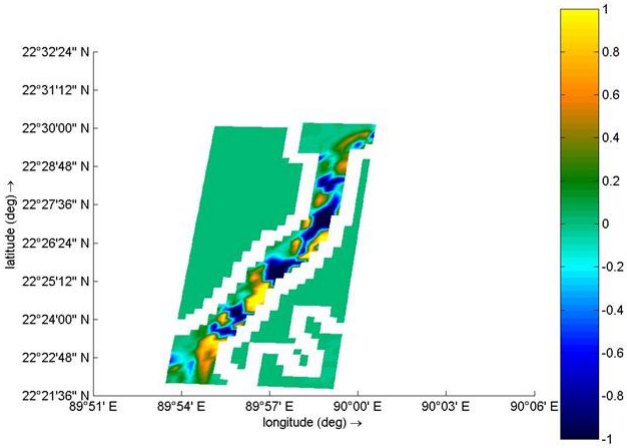
Positive value- sedimentation

Zero value – No erosion/sedimentation

Negative value - erosion

Resultant erosion / sedimentation in meter in few hours during a storm surge

White Lines - Polder



Positive value- sedimentation

Zero value – No erosion/sedimentation

Negative value - erosion

Observations

- The storm surge is causing a huge morphological changes in few hours
- This is mainly due to the accelerated force acting on the water body due to storm surge
- It is unlikely that the river will attain its pre-storm surge equilibrium even after a long term normal flow condition
- The initial model run supports this hypothesis.

Difficulties in rehabilitation

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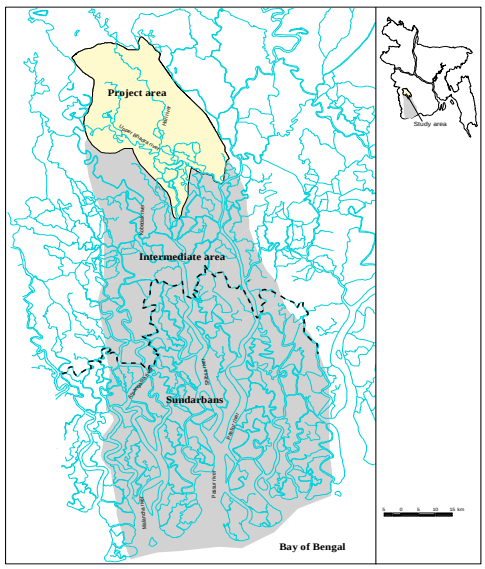
➢ Loss of system resilience

Give space to the rivers

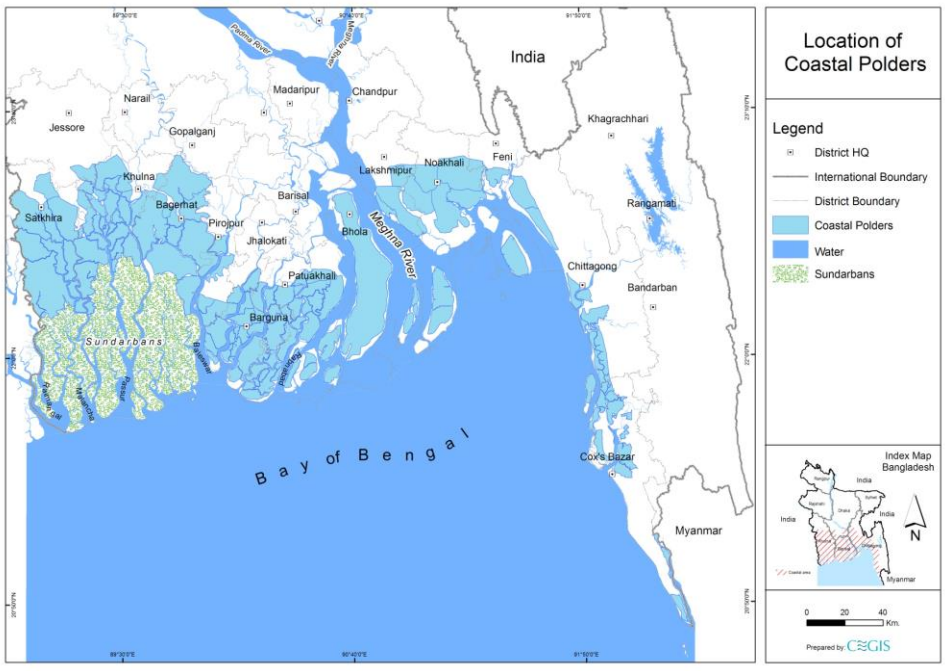
- Retiring embankments
- Retiring polders
- Rotating tidal basins

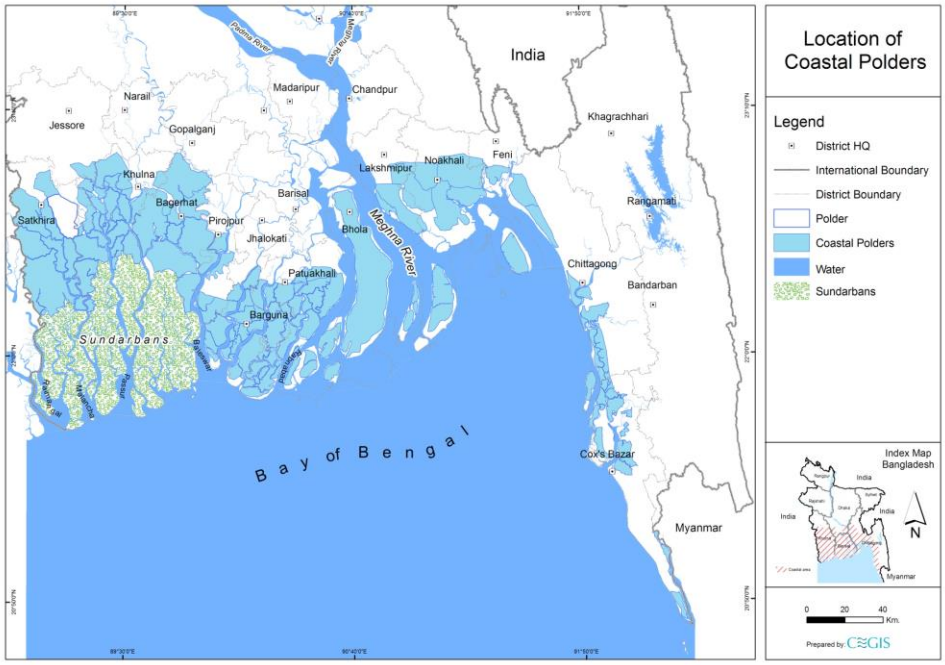
Khulna-Jessore Drainage Rehabilitation Project (KJDRP)



Context of KJDRP

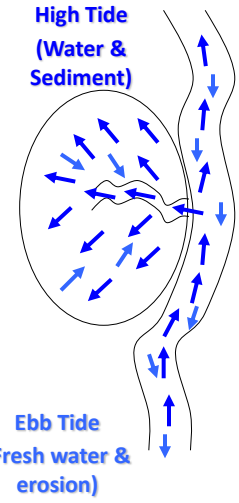
- Coastal Embankment Project in the 60s
- Good crop production in the 70s
- Drainage congestion in the 80s
- KJDRP undertaken in the 90s
- Tidal basin operation in 00s



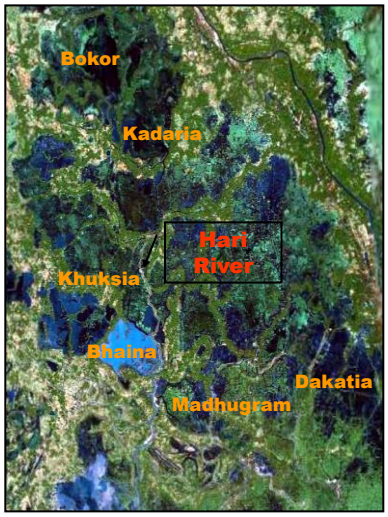


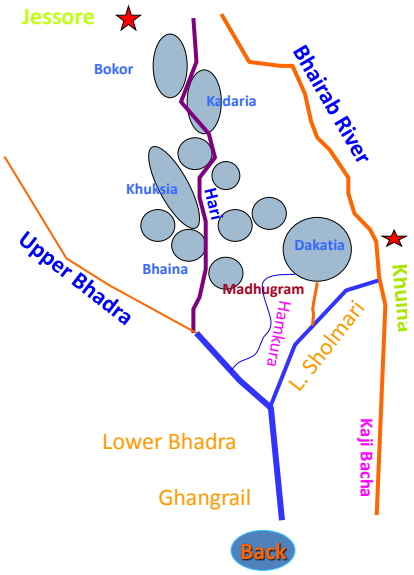
TBM Concept

1. **Water allowed to enter tidal basin during high tide**
2. **Sediments get deposited in the basins**
3. **Water carrying less sediment cuts its way back through rivers during low tide**
4. **Conveyance capacity of river increases**
5. **Sustainable drainage system**



Tidal basins at KJDRP





Size of tidal basins

- O'Brien formula (1969)
- $A = 41.5\ 10^{-6}\ V$

- Required size
- 400 ha in Kedaria Beel for Hari river
- 200 ha in Buruli-Panjia-Pathra beel for Upper Bhadra river

Potential of TBM – 3R

- Replication elsewhere
- Restoration of resilience of the coast
- Rising land to face rising sea level

Let us move forward towards a resilient coast