Projecting the Impacts of Climate Change and Sea-Level Rise on Floral and Faunal Assemblage in the Sundarbans, the World's Largest Mangrove Forest

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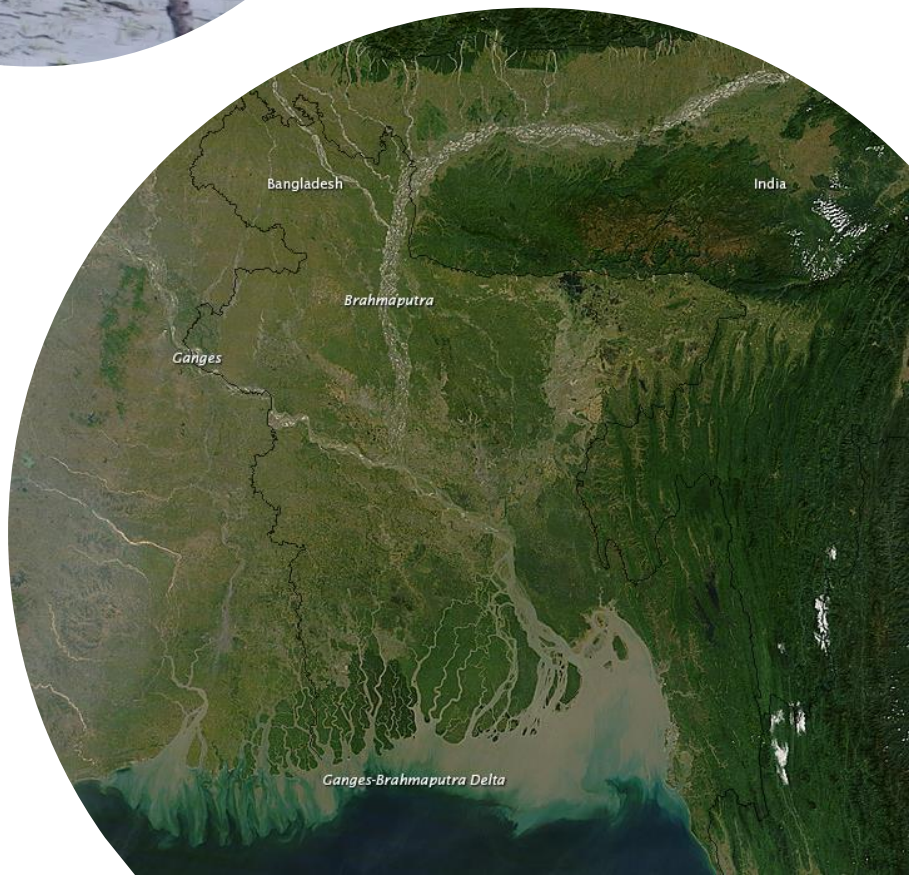
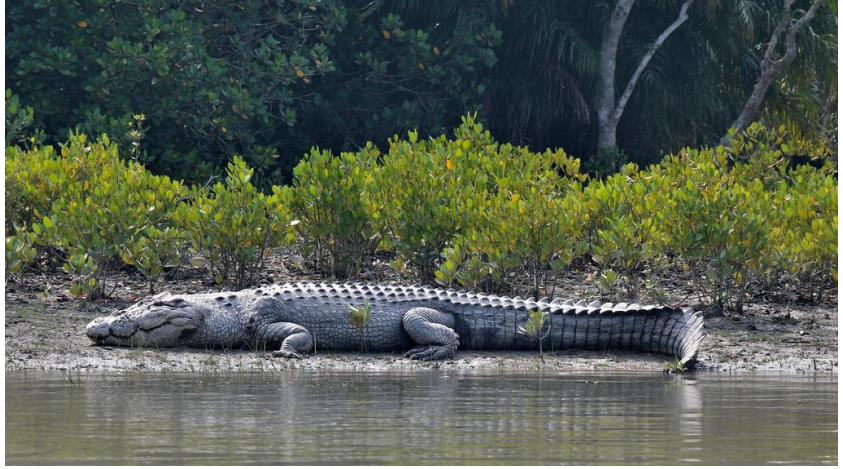
Sundarbans mangrove forest

- Active delta in the lower Ganges-Brahmaputra basin;
- The World's largest contiguous mangrove forest with an area of about 10,200 square kilometers in Bangladesh and India (also a World Heritage Site and Ramsar site);
- The largest habitat of Globally Endangered Bengal tiger (*Panthera tigris*), and only habitat where tiger is adapted to live in a mangrove ecosystem;
- Historically, eight out of ten deadliest tropical cyclones in the world have originated over the Bay of Bengal where Sundarbans is located (~ 15% of the tropical cyclones originated near the Sundarbans region).











Significance to livelihood

- Nearly 8 million people (4.5 million in India and 3.5 million in Bangladesh), including some of South Asia's poorest and most vulnerable communities live and depend on Sundarbans;
- Employments, such as fishing, ecotourism, and non-timber forest products (honey, thatching materials, fuelwood, etc.);
- Fish seed collection by women, children and vulnerable groups.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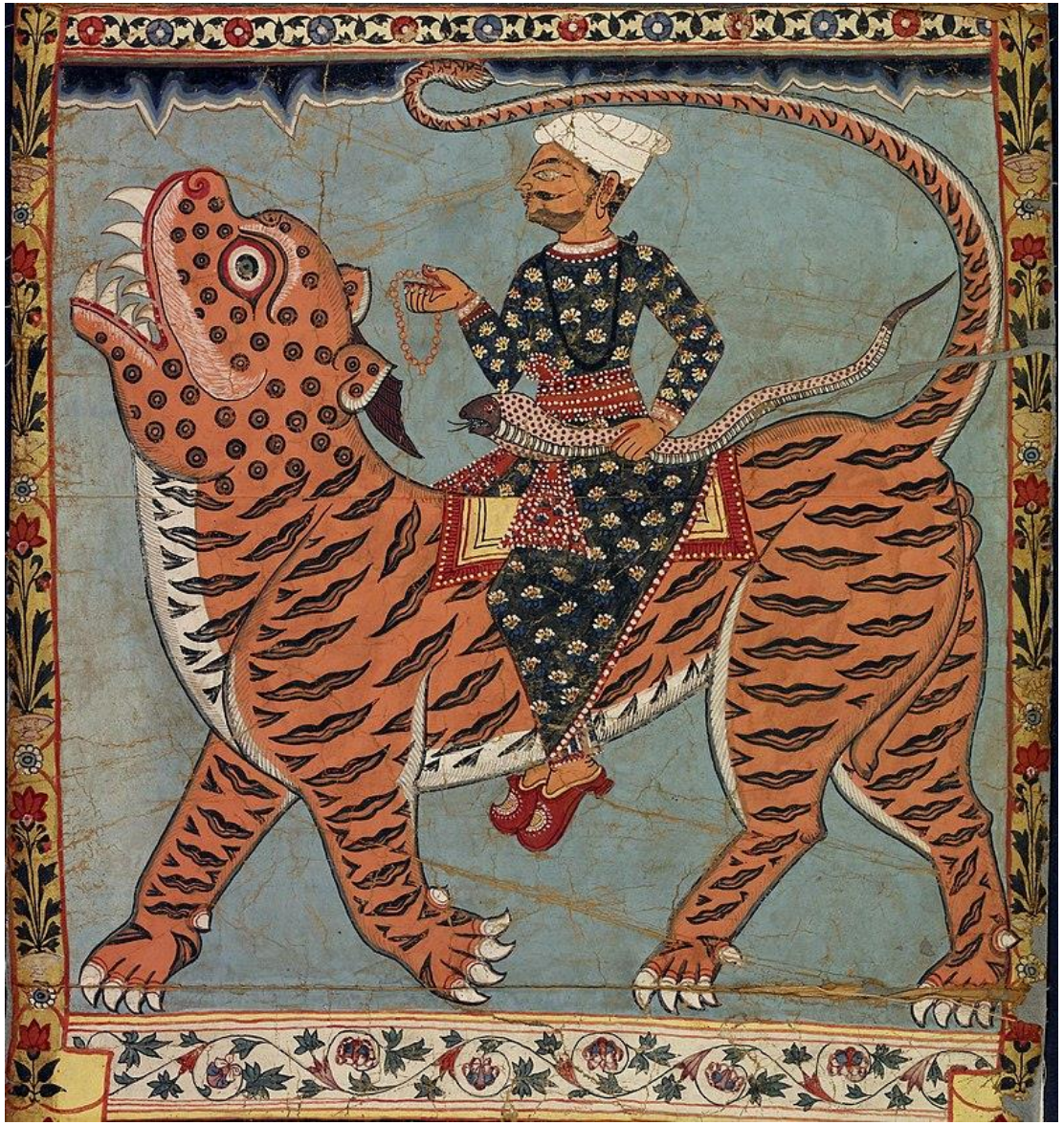
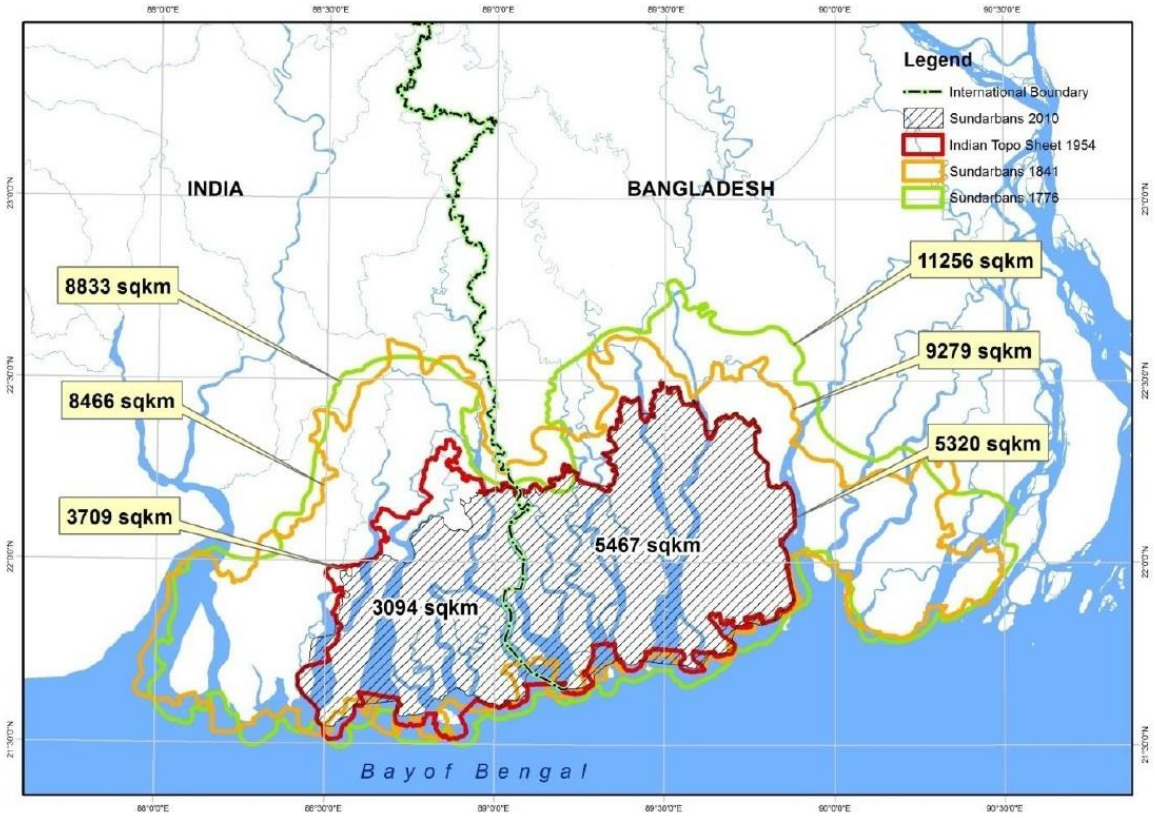
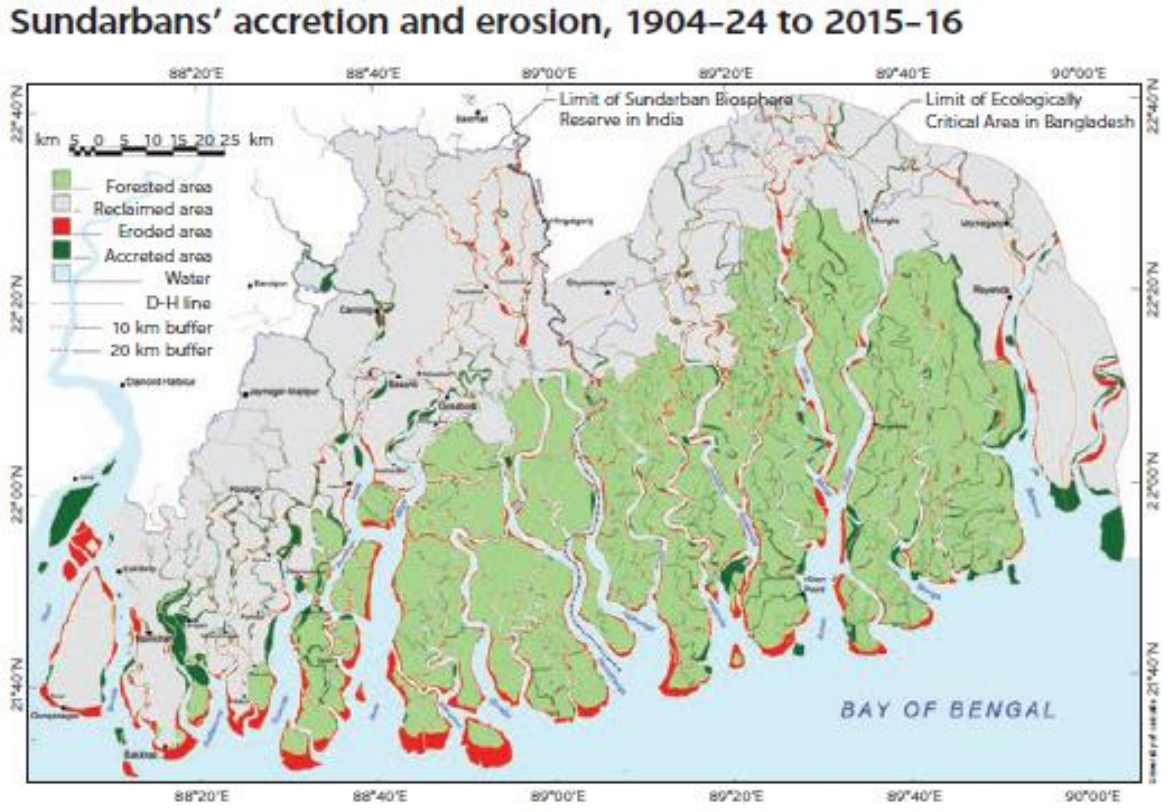


Historical Changes in the Extent and Erosion-Accretion in Sundarbans





Climate Change in the Sundarbans

- Sundarbans' elevation ranges from 0.5 to 3.0 meters above sea level, with about 70 percent of the area lying under 1 meter above sea level;
- Due to the low elevation, sea level rise will have a catastrophic effect in the Sundarbans;
- Increase in sea surface temperature, which rose in the Sundarbans at 0.5°C per decade from 1980 through to 2007 – around eight times higher than the globally-observed warming rate;
- In the Bay of Bengal along the Sundarbans, the occurrences of cyclones increased by 26% between 1881 and 2001;
- Four major cyclones have hit the Sundarbans in the last three years, killed thousands of people and caused losses of nearly USD 20 billion;

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Combined effects of climate change and sea-level rise project dramatic habitat loss of the globally endangered Bengal tiger in the Bangladesh Sundarbans

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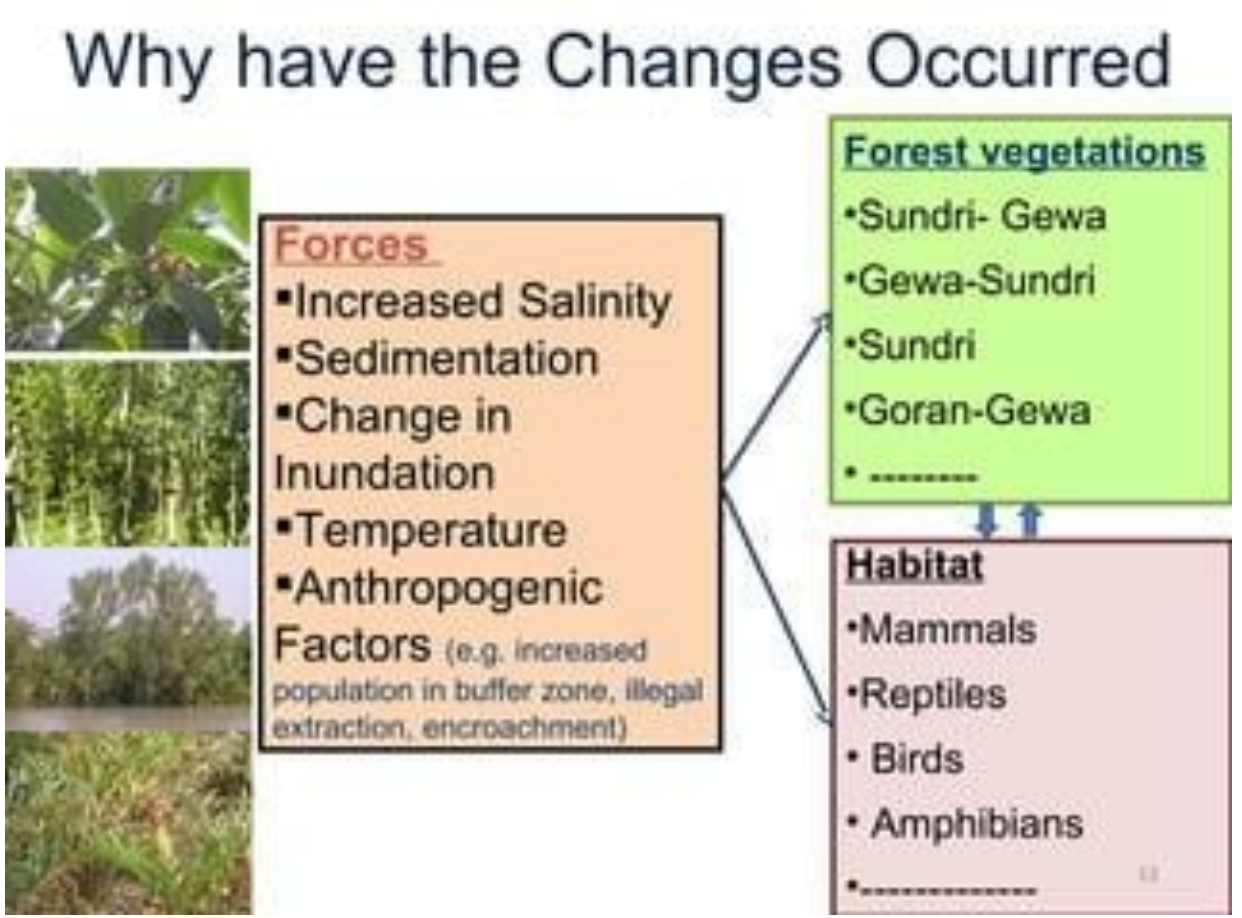
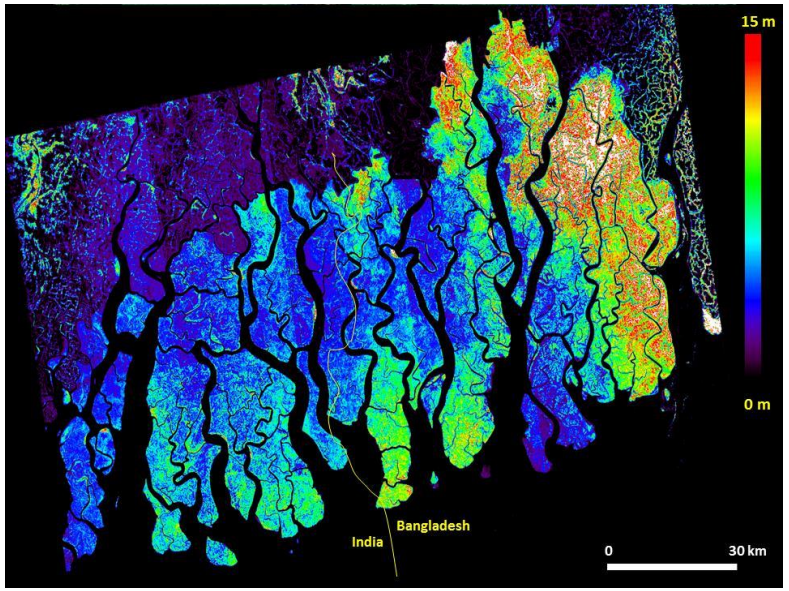
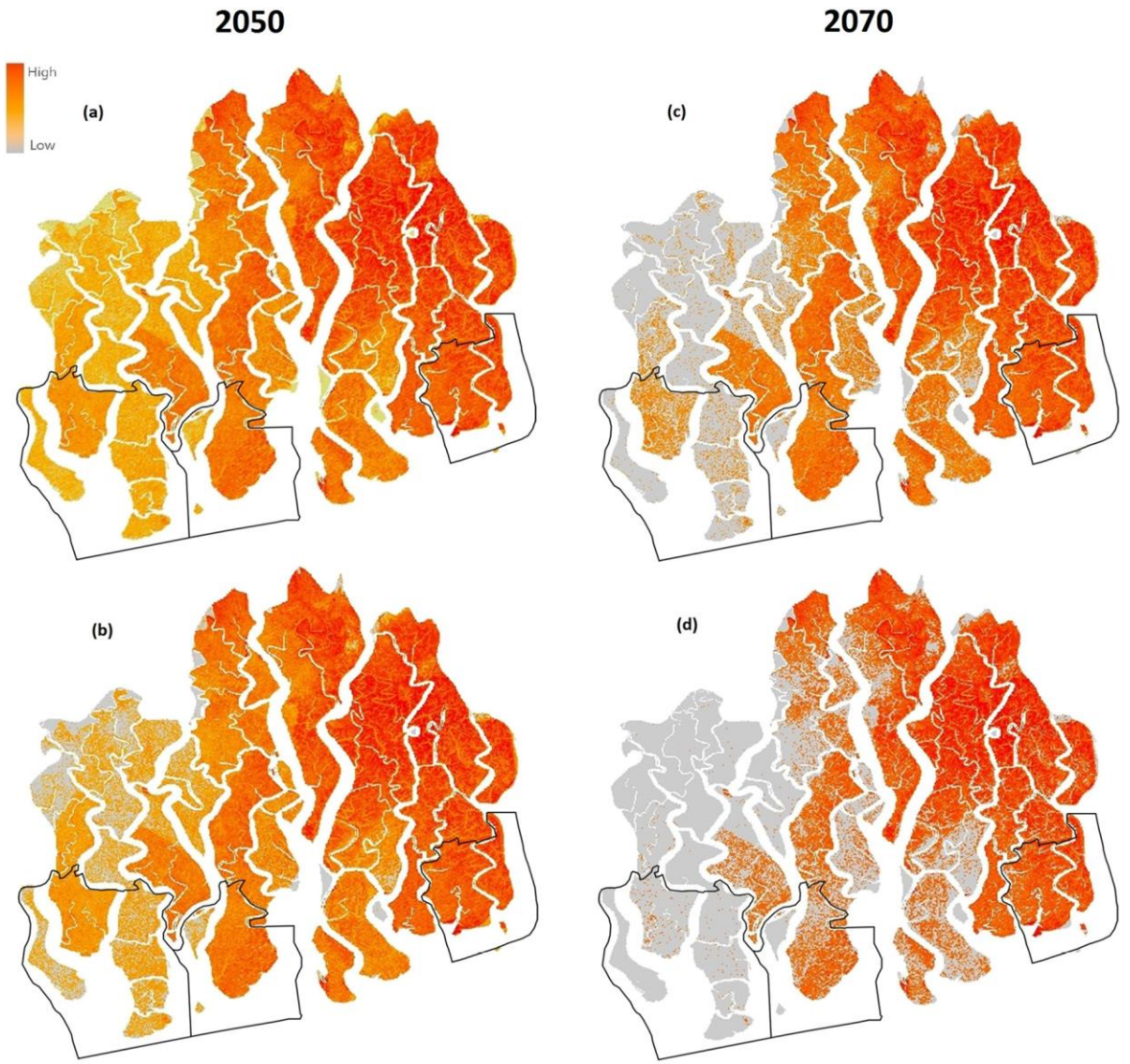
HIGHLIGHTS

- The likely future distribution of Bengal tiger in the Sundarbans forest was modeled using IPCC RCP6.0 and RCP8.5 scenarios.
- Our results suggest a rapid decline in the Bengal tiger population and suitable habitats in the Sundarbans.
- By 2070, there will be no suitable tiger habitats remaining in the Bangladesh Sundarbans.
- Climate change will have a more pronounced effect on tiger habitats than that of sea level rise in the area.

Climate-driven changes in the Sundarbans







Projected sea level rise impacts in the Bangladesh Sundarbans – (a) areas after IPCC's RCP6.0 projection for 2050, (b) areas after IPCC's RCP8.5 projection for 2050, (c) areas after IPCC's RCP6.0 projection for 2070, (d) areas after IPCC's RCP8.5 projection for 2070.

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Changes in mangrove species assemblages and future prediction of the Bangladesh Sundarbans using Markov chain model and cellular automata

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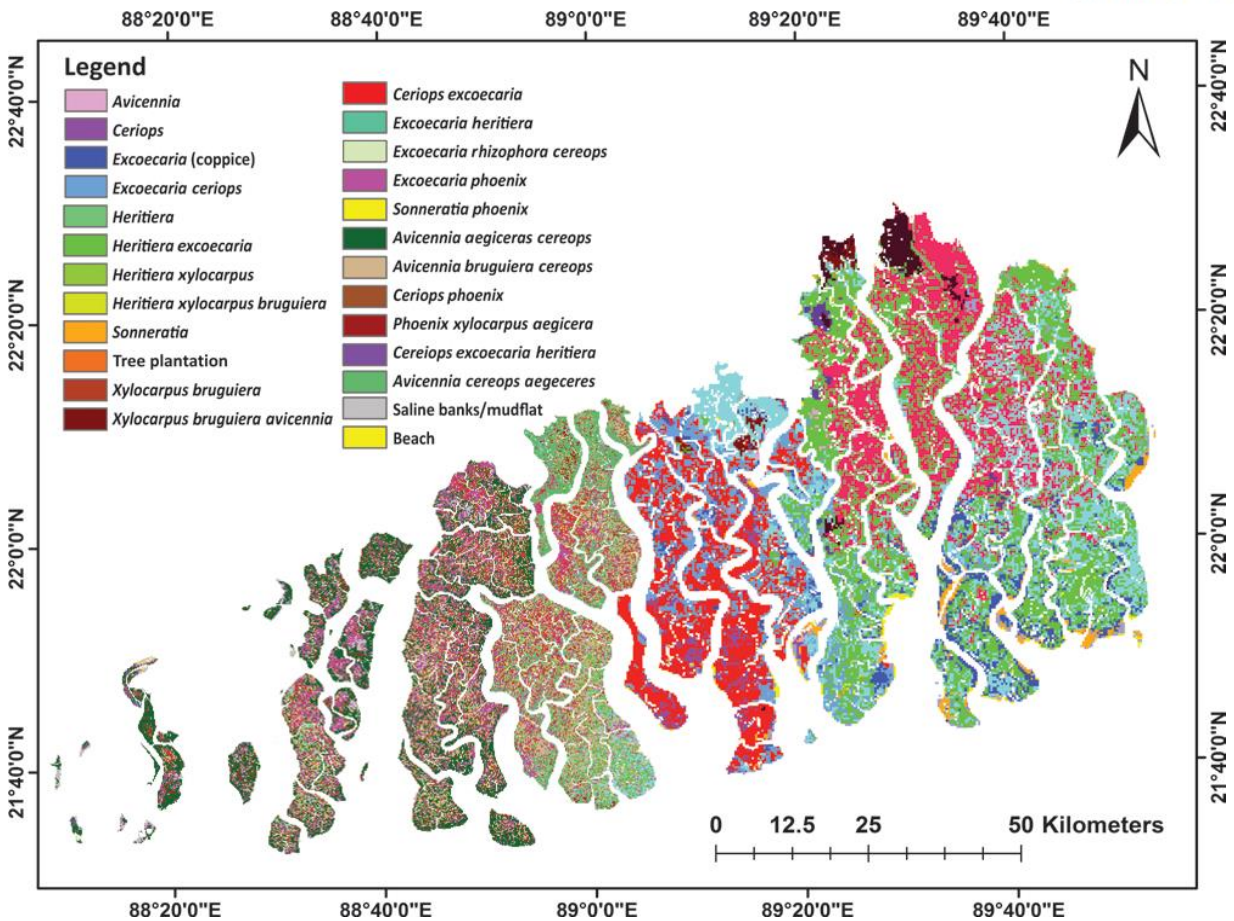
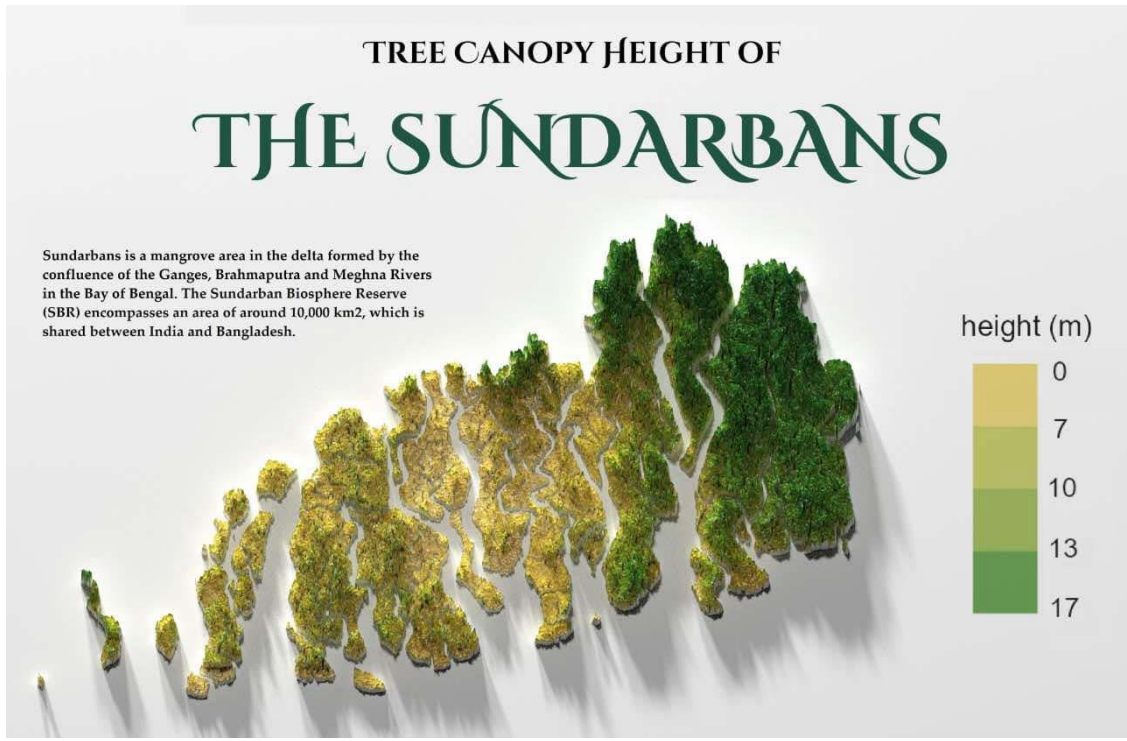
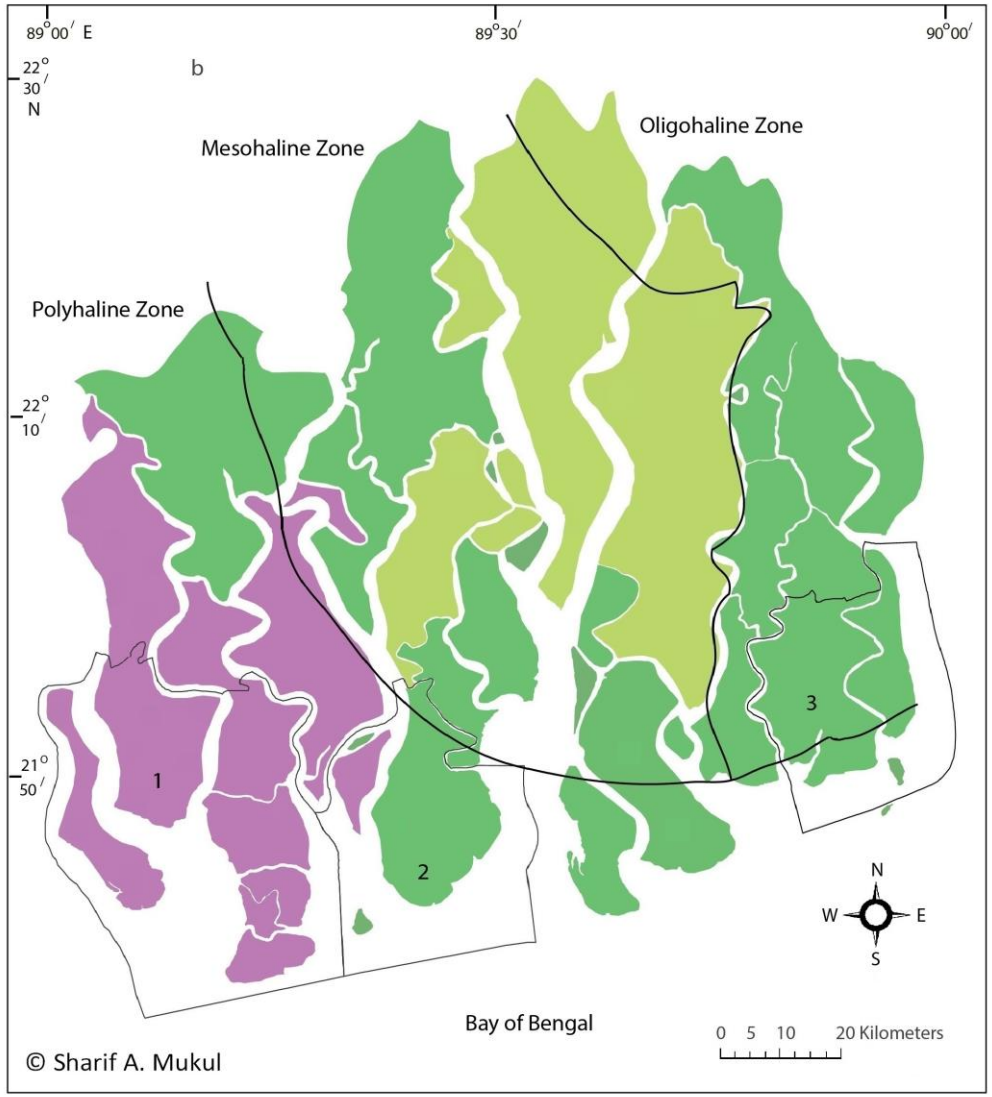
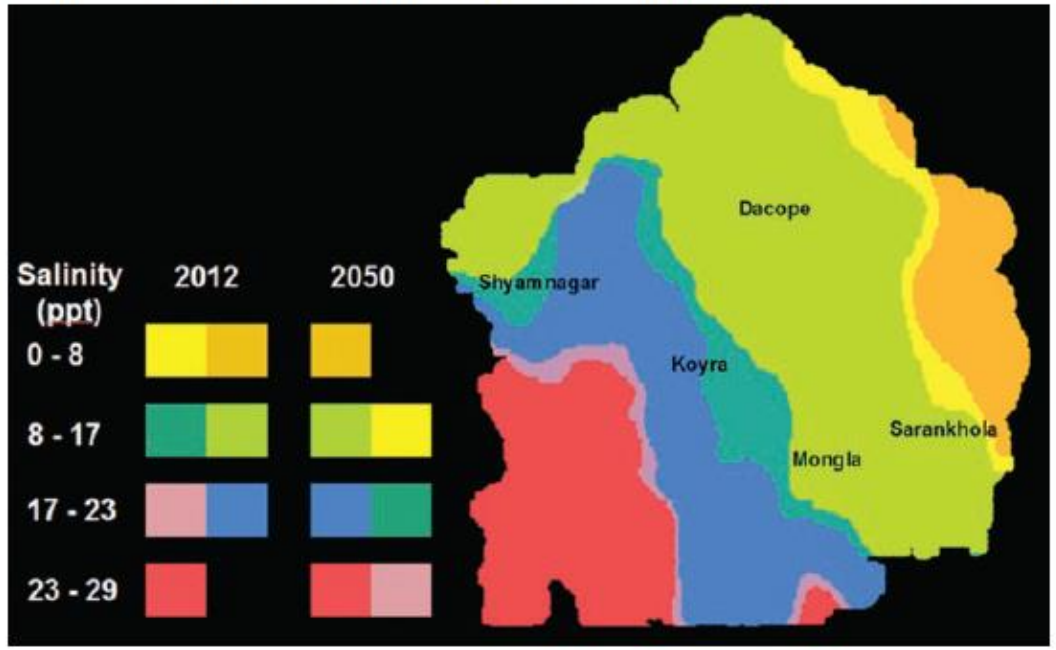




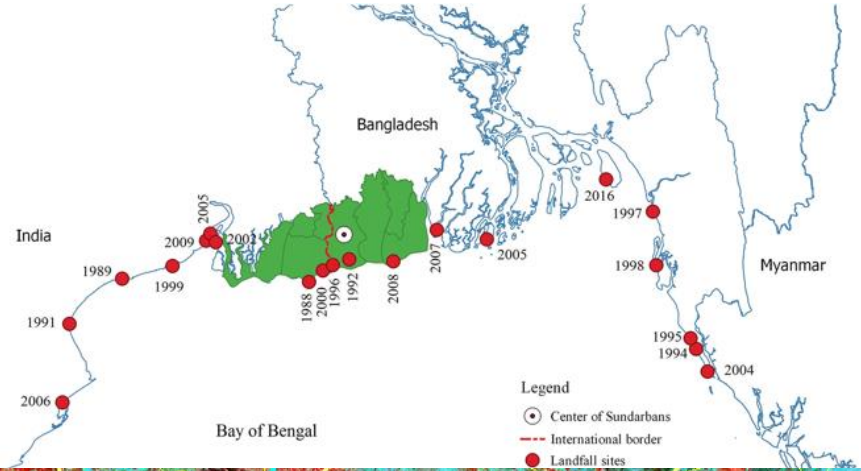


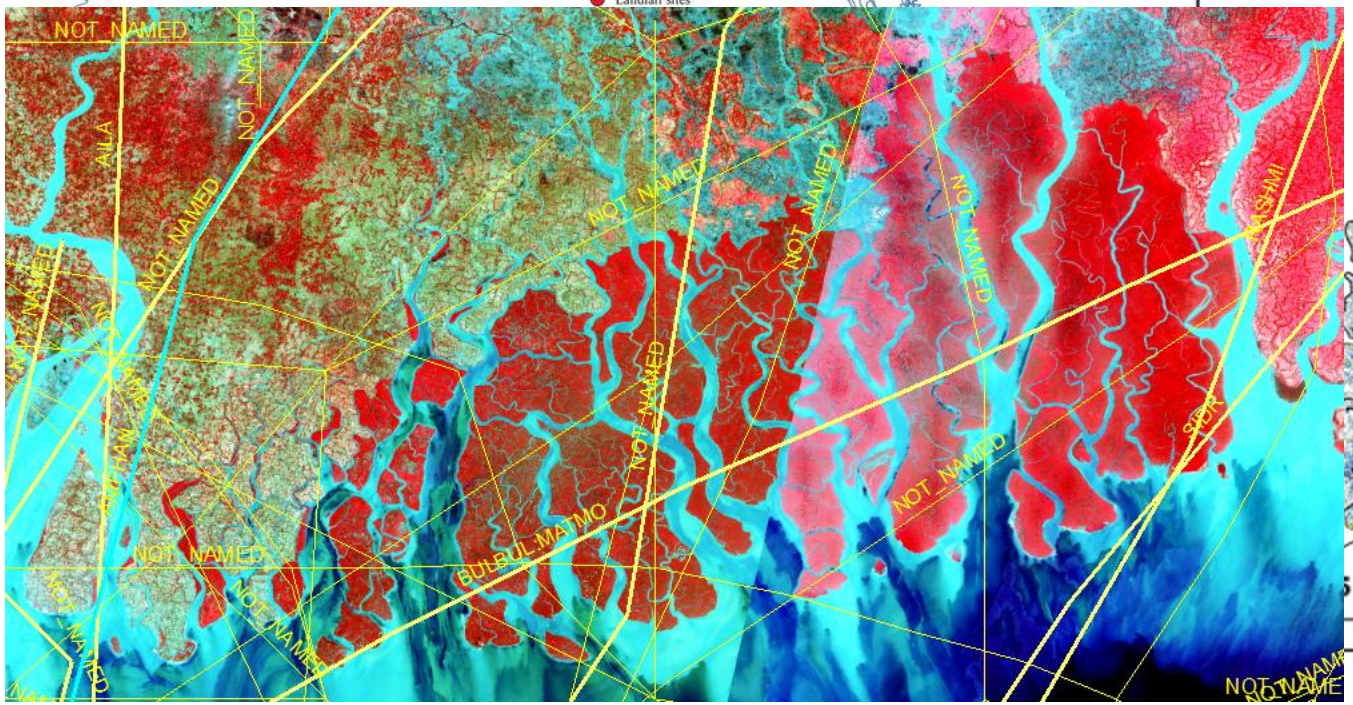
Predicted rise in water salinization in the Bangladesh Sundarbans

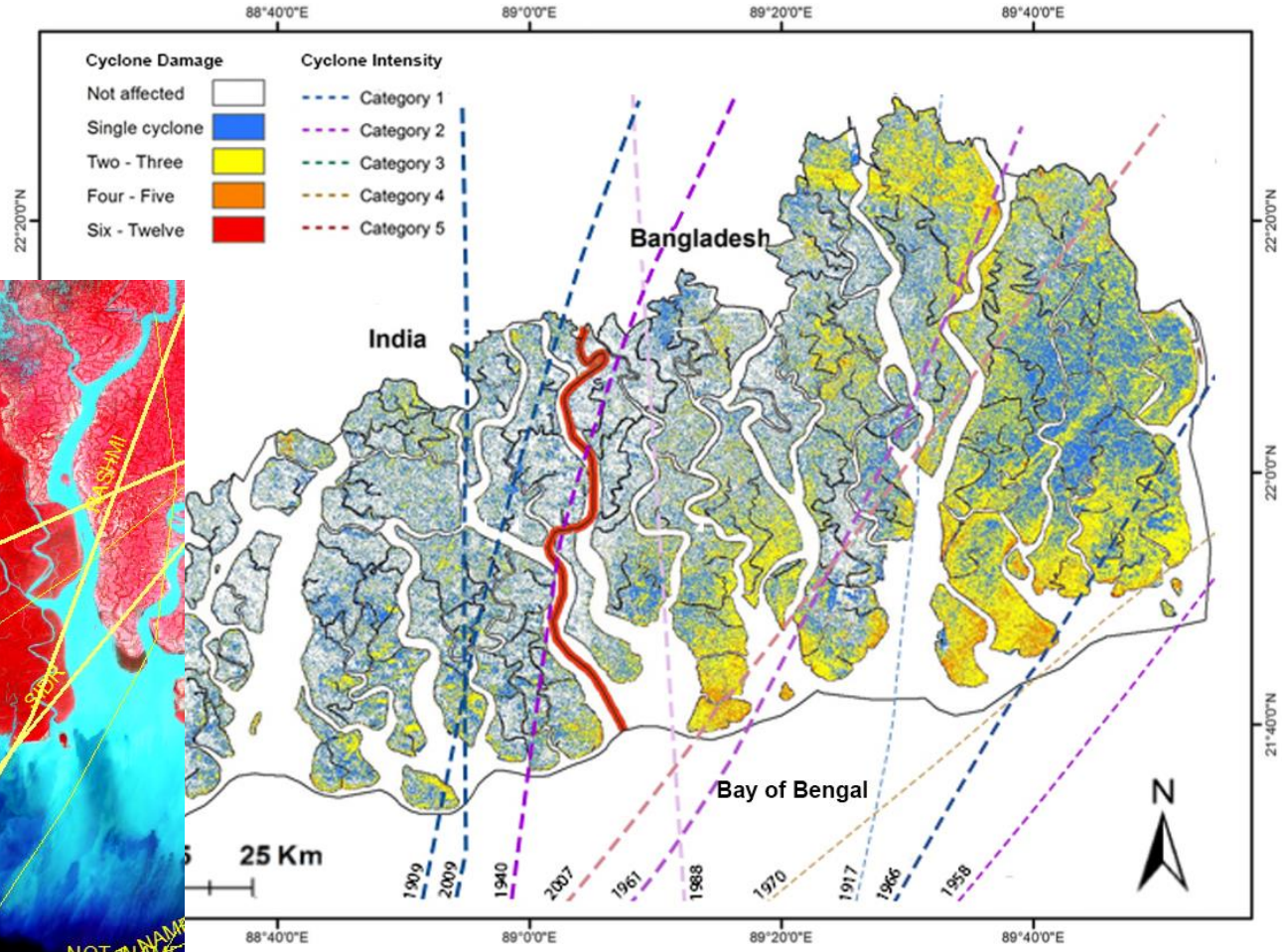


Source: Dasgupta, Sobhan, and Wheeler 2017.
Note: ppt = parts per 1,000.

Cyclones in the Sundarbans







Major changes social-ecological system over the past years

- Greater conservation focus that leads to restricted access and use of forest resources by local villagers;
- Salinity increase in parts of Sundarbans;
- Tourist and fishing ban in several months (4-6 months) ;
- Increase in human-tiger encounters/conflict.

Sea-level rise and salinity impacts on Sundarbans flora and fauna

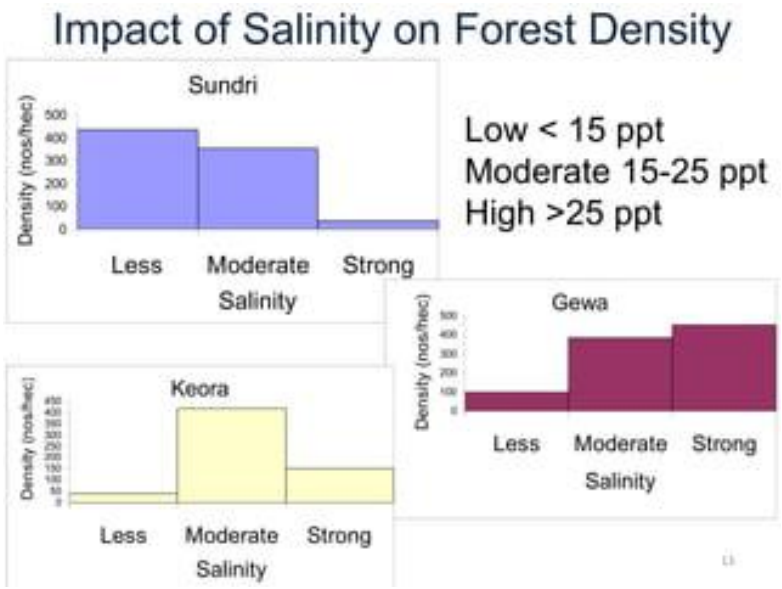
- Reduction of suitable habitats for Bengal tigers;
- Vegetation changes and top-dying of Sundri;

Flora:

- Sundri (*Heritiera fomes*)
- Keora (*Excoecaria agallocha*)
- Goran (*Ceriops decandra*)

Flora:

- Bengal tiger
- Rhesus macaque,
- Spotted deer



Research question

What are the interacting effects of changes in key flora and fauna in Sundrabans and how they will influence local life and livelihoods?

Other challenges around Sundarbans

- Damming in upstream (Farakka Barrage),
- Large infrastructure development (port, power plant, etc.);
- Salinity intrusion in agricultural land;
- Scarcity of drinking water.

Any question ?

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