

Climate Proofing Coastal Cities



– Challenges and Way Forward

Any development can be an opportunity to redesign the city considering present and future climate challenges



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The Climate Challenges over Mumbai/Maharashtra



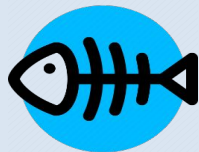
1. Sea Level Rise
3 cm/decade
Future: 5 cm/decade



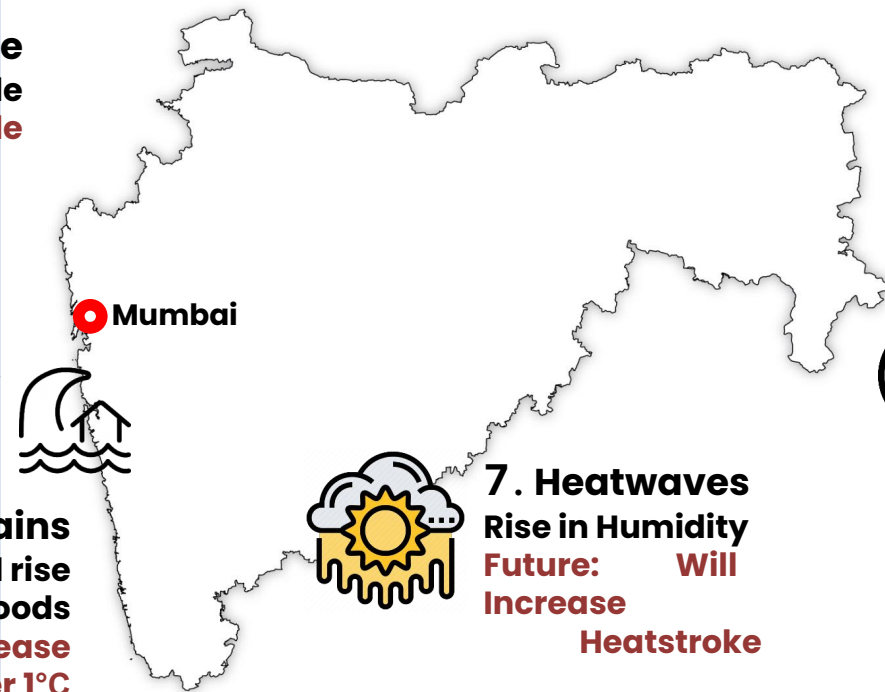
2. Cyclone
Frequency: 50% ↑
Duration: 80% ↑
Future: Extremely Severe Cyclone will increase



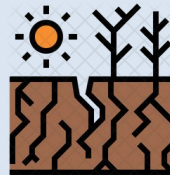
3. Extreme Rains
3-fold rise
Landslides and Floods
Future: 7-10% increase per 1°C



4. Fisheries and Marine Ecosystem Decline
Future: Further Decline



5. Drying
>10% Decline in Average Rainfall
Future: Not Clear



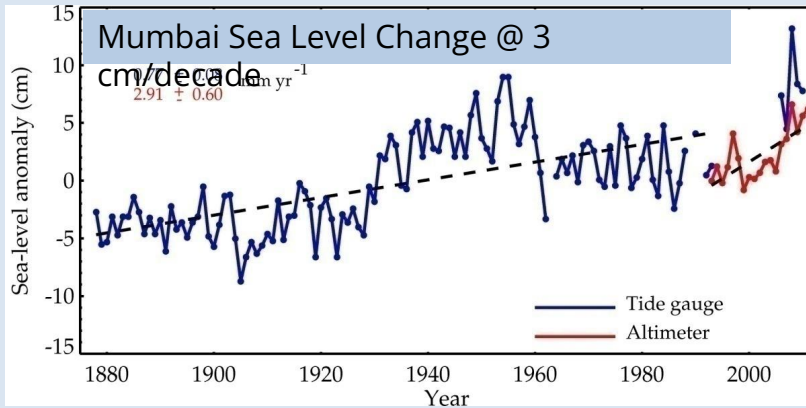
6. Water Scarcity Salinity Intrusion
Future: Will Increase

7. Heatwaves
Rise in Humidity
Future: Will Increase
Heatstroke

Way forward:

1. Localized impacts, localized solutions
2. Identify hotspots and bottlenecks
3. Tailored adaptation

How much land will the sea take?



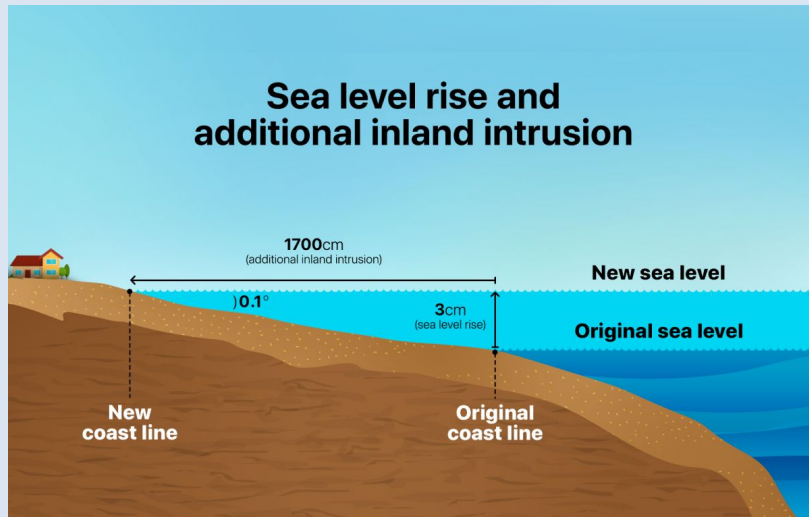
A 3 cm rise for a slope of 0.1° will take away 17 meters of land per decade

Will Mumbai submerge anytime soon?

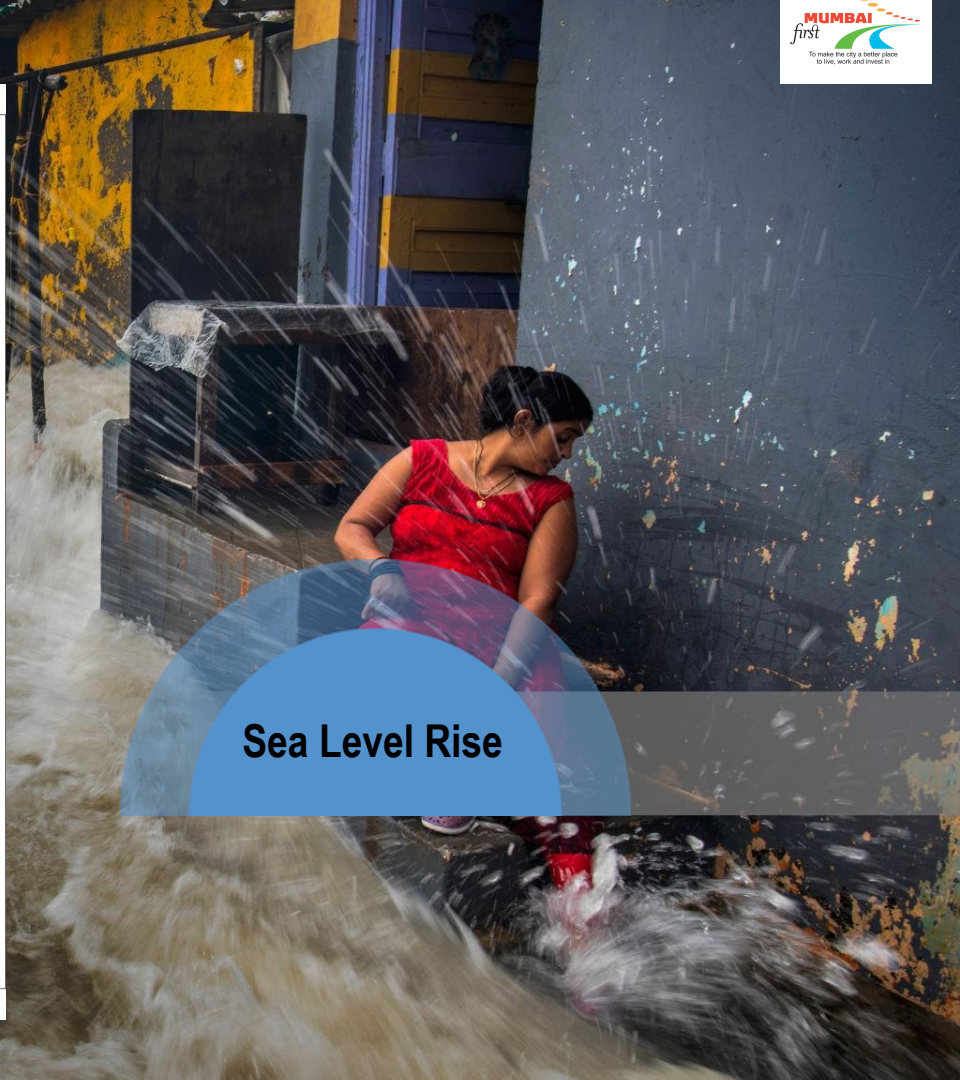
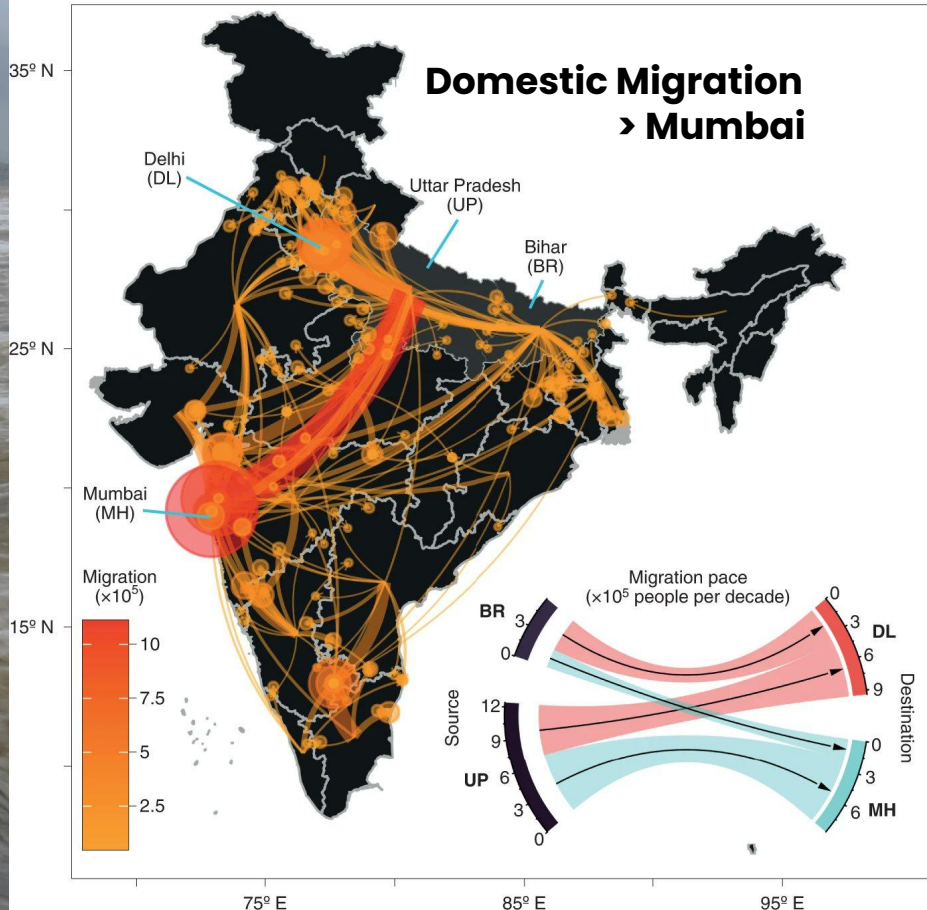
No, but prolonged floods will happen due to **Compound Floods**

Compound Floods?

Sea level rise, storm surges from cyclones, heavy rainfall, and a flooded river can overlap and damage a city and its outlying regions



Net migration (2011)



Sea Level Rise

Climate Change is not the only Culprit

The floodplain gives room for the river to fill, sink in, and move



Once this space is encroached, largescale floods occur



We need to bring back our Rivers, Floodplains, and Mangroves



We need to Disaster Proof our Coastal Cities



● MAJOR CITIES AT HIGHEST RISK
 ● MAJOR CITIES ALSO AT RISK

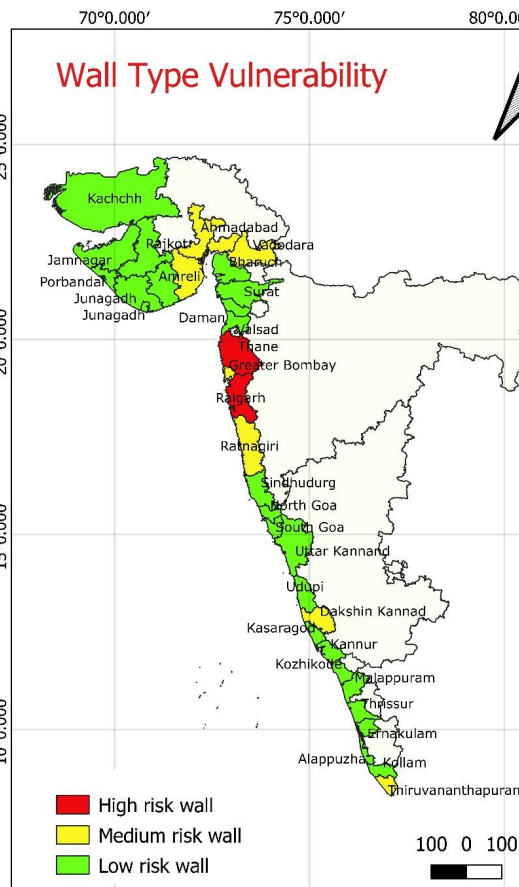
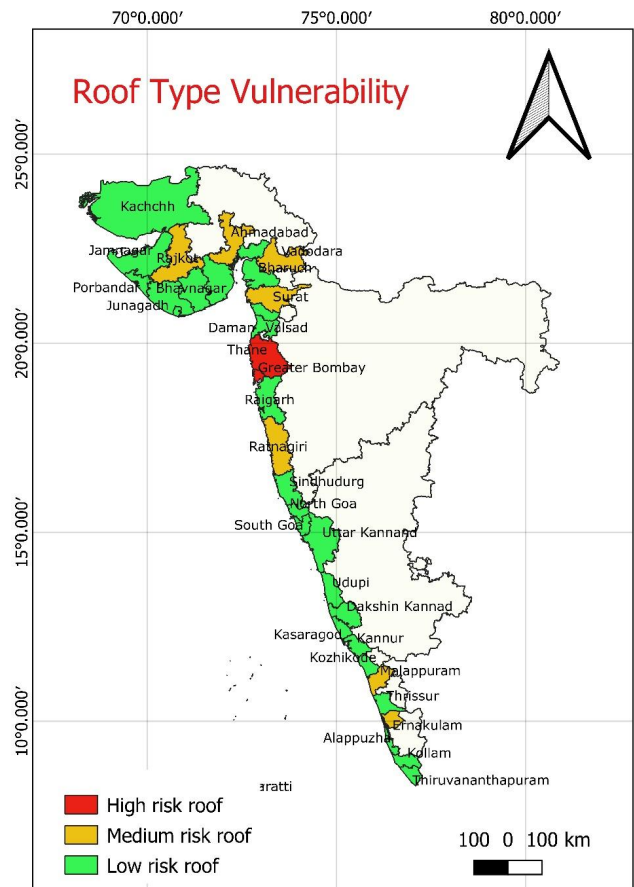
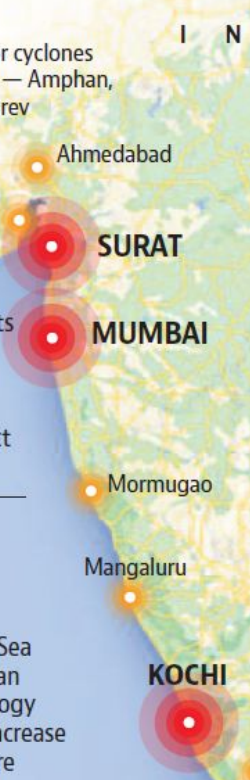
4 major cyclones
 There were four major cyclones in India in 2020 alone — Amphan, Nisarga, Nivar and Burev

June 2020:

Mumbai was hit by Nisarga, its first cyclone in over 70 years. In May 2021, Cyclone Tauktae became the first extremely severe cyclonic storm to affect Mumbai in 130 years

52% increase

As the waters of the Arabian Sea warm, researchers at the Indian Institute of Tropical Meteorology (IITM) have observed a 52% increase in the number of cyclones here



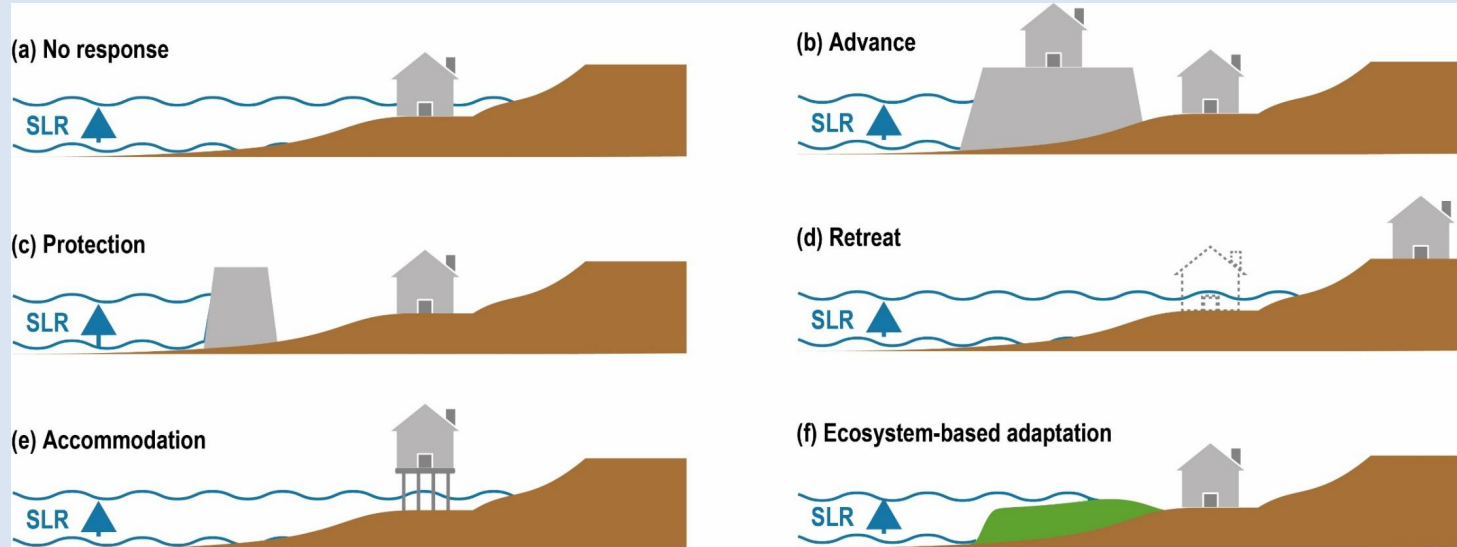
Climate Proofing our Coastline



Mumbai is growing fast

Population in **2020: 20** Million (Global Warming: **1°C**)

Population in **2050: 40** Million (Global Warming: **2°C**)



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Way forward:

- 1. Ecosystem-based elevated adaptation**
- 2. Consider future challenges, not just present**
- 3. Urban design / Architecture**

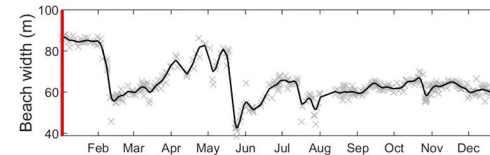
Involve the Community



Scientists, governments and communities should work together

Community involvement can help in monitoring and protecting coastal cities and use their knowledge for decision-making

Date: 2020/01/02 Time: 08:37 Contributor: gnarf Tide level: -0.12m AHD



Beach width
86.4 metres



Climate Ready Mumbai?



Use the city's 2070 flood maps, target infrastructure along most vulnerable flood pathways



Benefits

- Elevated landscapes
- Flood resilient buildings
- Enhanced waterfront parks
- Protected biodiversity
- Tourism, recreation
- Revitalized connections to waterfront

Climate is Changing



— So must Mumbai



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Redesign for

- **Sea Level Rise and Floods**
- **Cyclonic Winds**
- **Sustainable Water Management**
- **Extreme Temperatures**
- **Ecosystem based Adaptation**

