



# Impact Assessment and Model Simulation to Urban Extreme Weather Vulnerabilities to Advance Climate Adaptation

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Asian Network on  
Climate Science and Technology  
(ANCAST)



## KARACHI: Unplanned urbanization destroying environment:

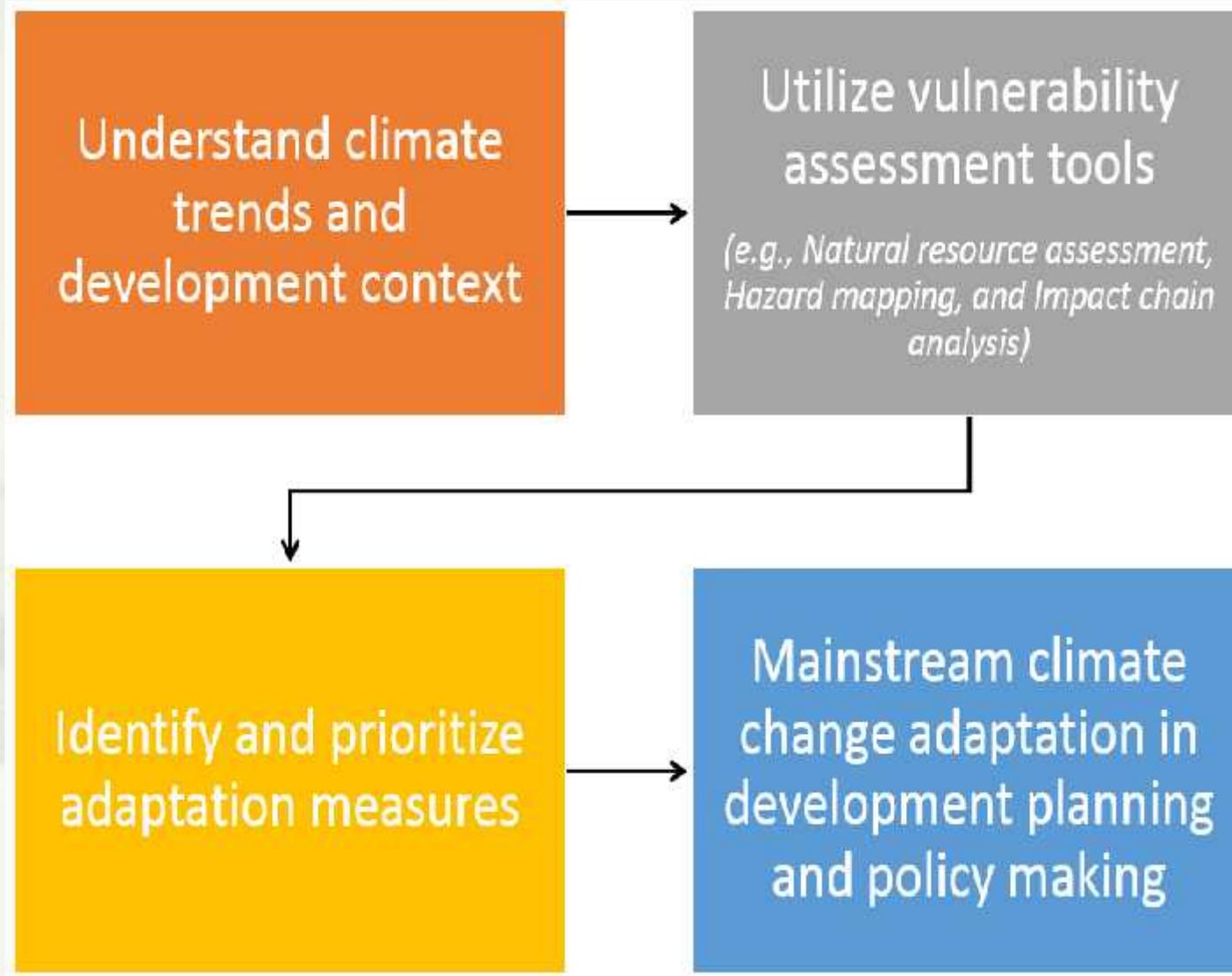


- Karachi is the largest city in Pakistan
- 16.22 million population
- 7<sup>th</sup> largest metropolitan city in the world
- 50 % of population lives in informal settlements

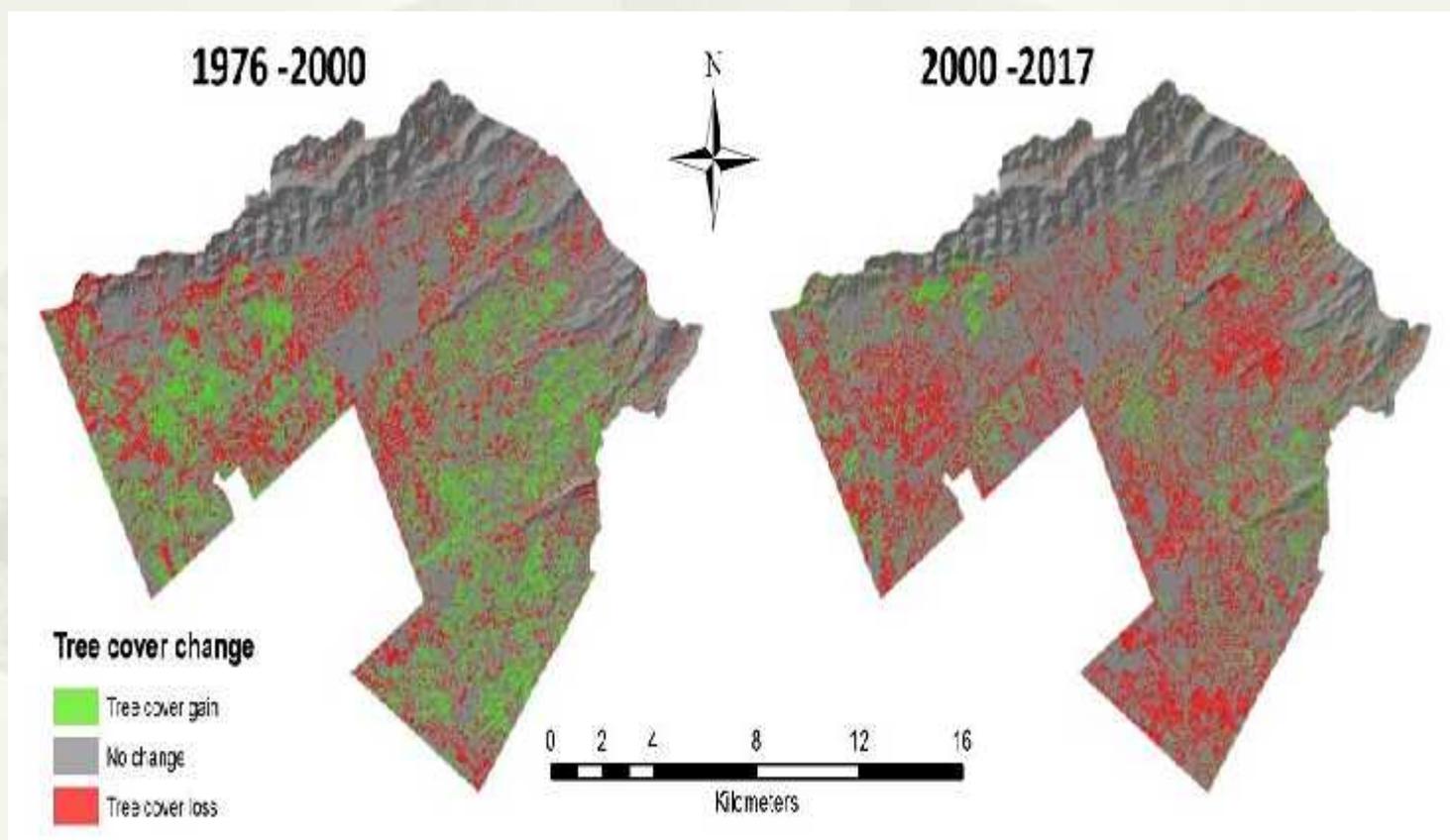
- Mangrove Forests spread 350-km long, 129,000 hectares
- 129-km long the city coast.
- Mangroves being destroyed in the name of development; urbanization



# Assessment Framework



## Impact assessment of MF deforestation and degradation on climatic conditions of Karachi in last 17-years.



# Pakistan sets April world temperature record

*Highest monthly reading ever, reported in Sindh province.*

8 May 2018



An April global record temperature has been set in the city of Nawabshah, Pakistan. A maximum of 50.2 degrees Celsius (122.3 degrees Fahrenheit) was reported on Monday.

It was subsequently confirmed by the Pakistan Meteorological Department as the highest temperature recorded in the country in April.

Records extend back as far as the 1930s. (The

## MORE ON WEATHER

[Dominican Republic hit by an 'easterly wave'](#)

Today

[Cleanup follows deadly flooding in Ivory Coast's Abidjan](#)

7 days ago

[May 2018 was the world's 'fourth-warmest' May on](#)

## Heat Waves (HV) Met-data

43-49 °C (2015)

44-47 °C (2016)

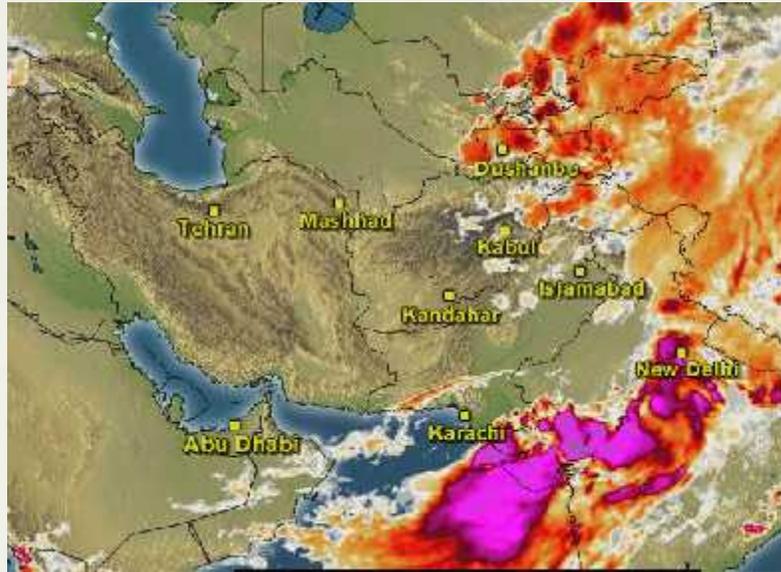
42-45 °C (2017)

46-50.2 °C (2018)

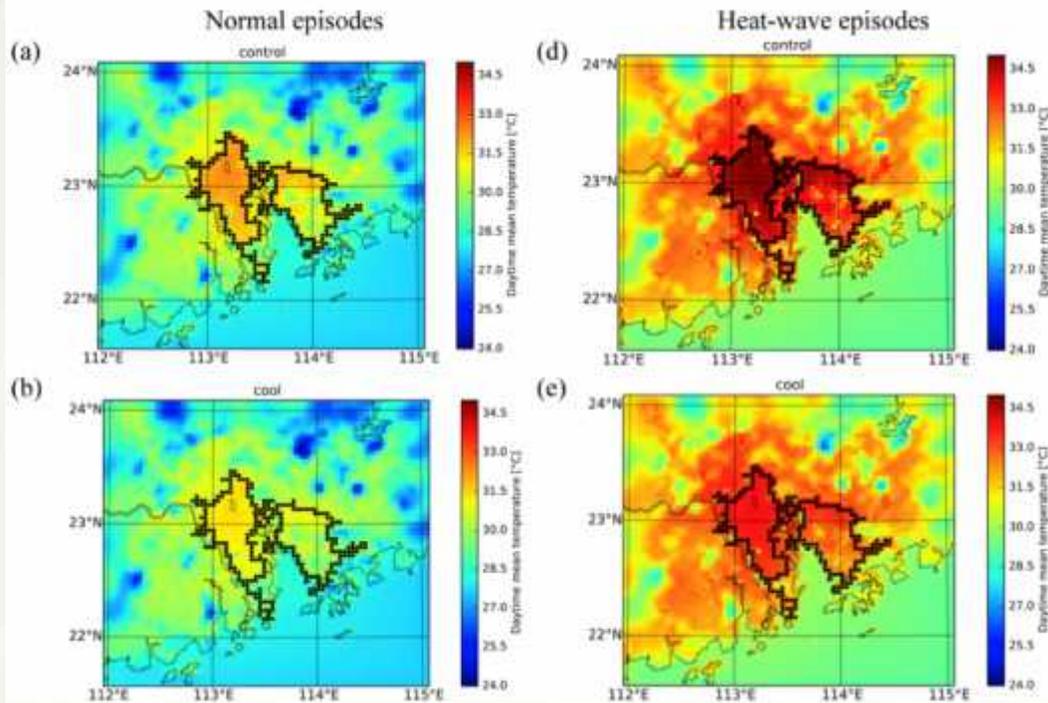
*Pakistan Meteorology Department (PMD)*

[Nawabshah](#) recorded the highest temperature of **50.2 °C** in [April](#) 2018 which is the highest temperature to ever be recorded on [Earth](#)





## Heat Waves; When a city transforms into a furnace

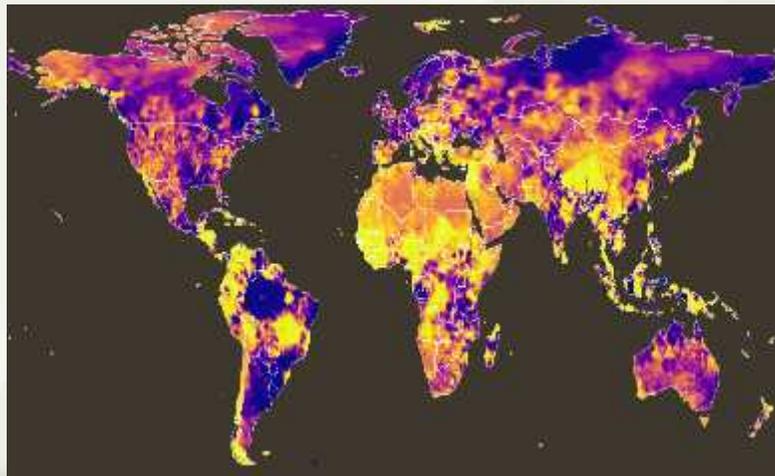


**Heat Wave Alert**  
 Another heatwave spell is likely to prevail over Karachi and surrounding area from Tuesday, 29-05-2018 to 31-05-2018. Maximum temperature is expected to remain in the range of 41-44 °C during the period. Wind blowing from west to northwest direction and become southwest during this period.

Karachi		3 – Days Forecast		
		29 <sup>th</sup> May, 2018		
Weather Elements	Day 1 (29 <sup>th</sup> May)	Day 2 (30 <sup>th</sup> May)	Day 3 (31 <sup>st</sup> May)	
Weather	Hot Very Hot	Hot Very Hot	Hot Very Hot	
Maximum Temperature (°C)	41 – 43 °C	42 – 44 °C	42 – 44 °C	
Minimum Temperature (°C)	28.0 °C	32 – 34 °C	32 – 34 °C	
Humidity Morning (%)	60 – 70 %	40 – 50 %	50 – 60 %	
Humidity Evening (%)	30 – 40 %	20 – 30 %	20 – 30 %	
Wind Direction	Westerly/Northwesterly becoming southwesterly	Westerly/Northwesterly becoming southwesterly	West Southwesterly	

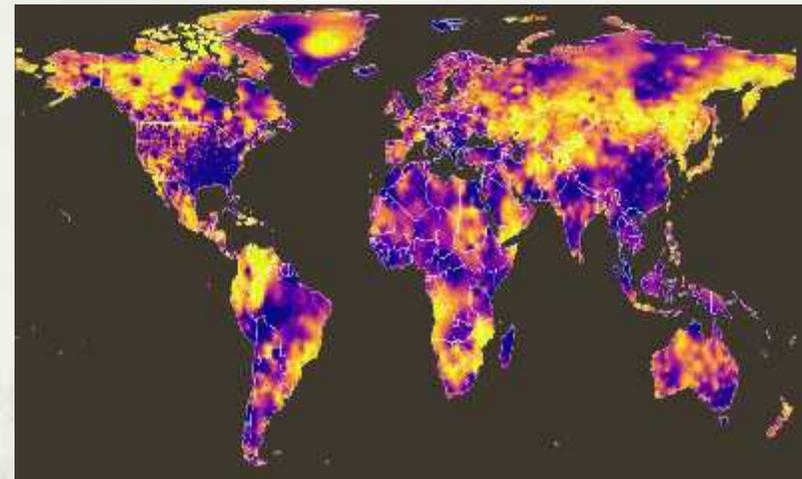
# Estimation of combined impacts of experienced climate change

## Kestrel-5400 Heat Stress Tracker



Increase  
Decrease

Trend in total annual precipitation (deciles) for the period 1901-2000



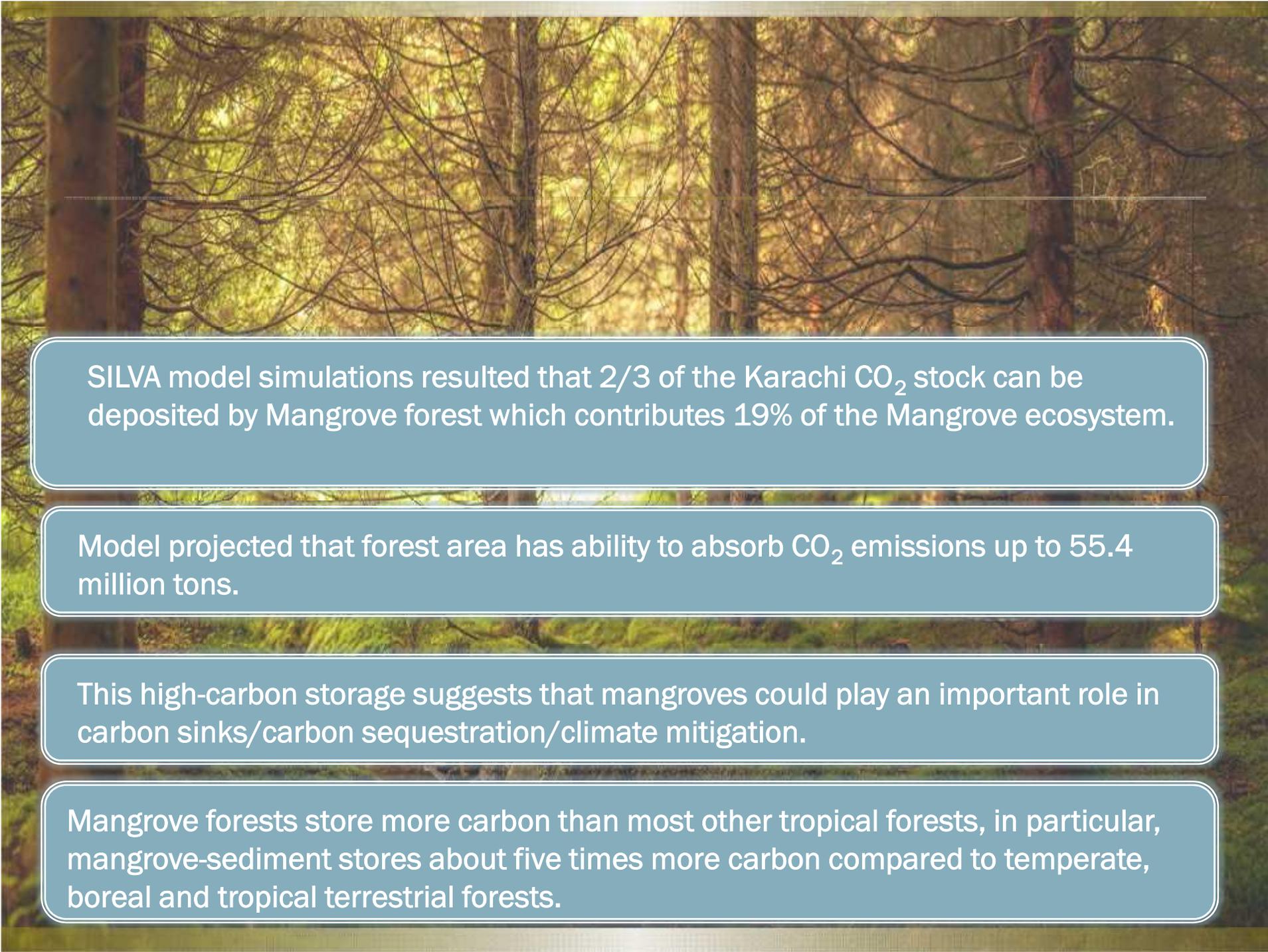
Increase  
Decrease

Trend in mean annual surface air temperature (deciles) for the period 1901-2000

# UR-SCAPE: A Sharing Data Platform for the shared-risk Assessment ?



Ur-scape is an interactive tool that has capability to visualize information for decision making support, including spatial planning.

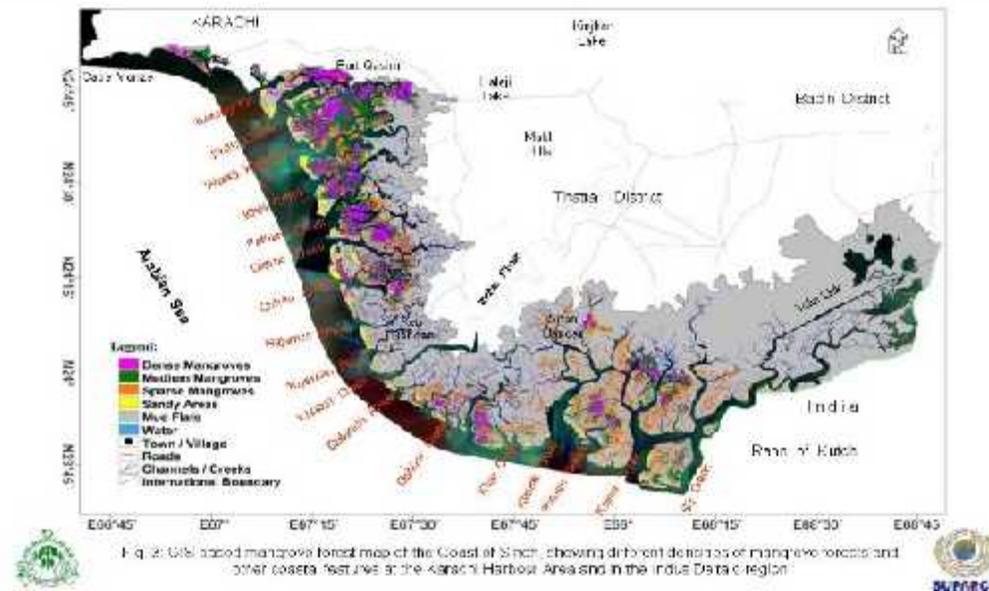


SILVA model simulations resulted that 2/3 of the Karachi CO<sub>2</sub> stock can be deposited by Mangrove forest which contributes 19% of the Mangrove ecosystem.

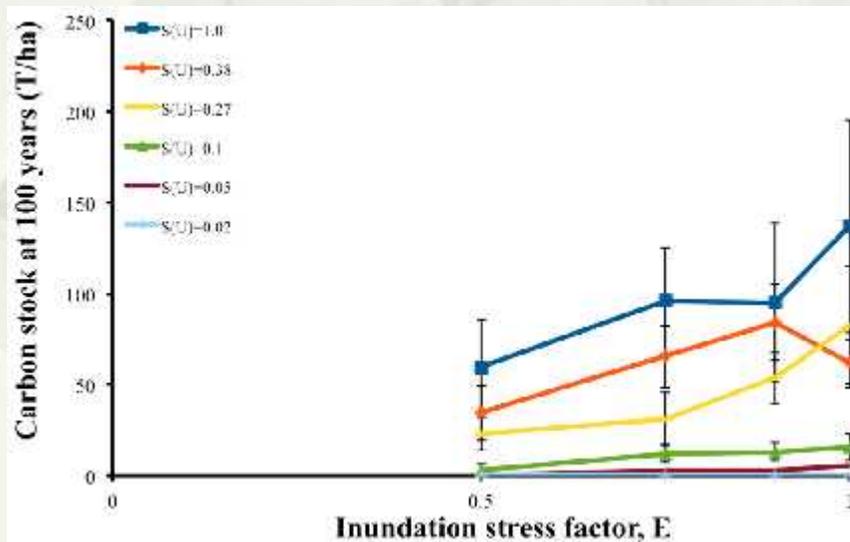
Model projected that forest area has ability to absorb CO<sub>2</sub> emissions up to 55.4 million tons.

This high-carbon storage suggests that mangroves could play an important role in carbon sinks/carbon sequestration/climate mitigation.

Mangrove forests store more carbon than most other tropical forests, in particular, mangrove-sediment stores about five times more carbon compared to temperate, boreal and tropical terrestrial forests.



Model simulations demonstrated that rehabilitation of 30 mangrove trees per 100m<sup>2</sup> might be able to reduce the maximum flow of a Heat stress, tsunami, CO<sub>2</sub>, AQI by more than 90%.



Models projected that Mangrove forest area has ability to absorb 55.4 million tons emissions of CO<sub>2</sub> by Karachi.

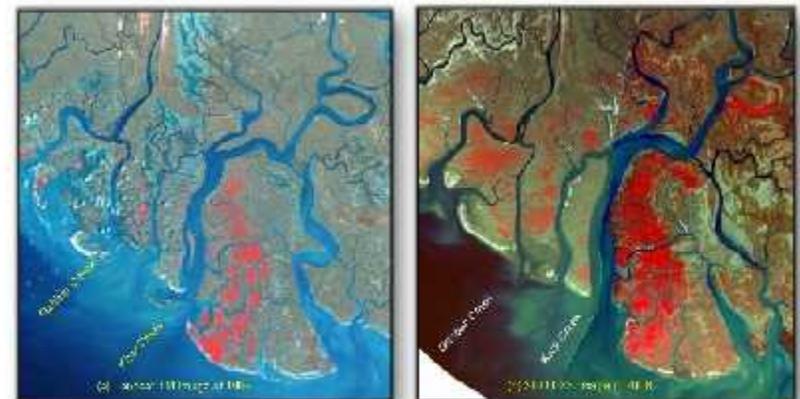


Fig. 12: Mangrove deforestation in mangrove forest area and carbon stock loss due to deforestation near the mouth of Indus River.

- \* Rehabilitation and reforestation of Mangroves **forest** need to do on emergency bases with application of advance meteorological forecasting system.
- \* Advancement of **meteorological forecasting** of Monsoon cycle and establishment of Early Warning System to **Climate Disasters**.
- \* Capacity building of individuals and communities to **respond** to the heat stress during heat-waves by raising heat-health awareness campaigns in the both countries.
- \* Green spaces may be increased by tree plantation in the city on **emergency** basis.
- \* **Adapting** white or reflective materials to build houses, roofs, pavements, and roads of the city.
- \* Cool Centre's.

**Challenges:**

Framing climate change as a **development issue**

