Living with Droughts in the Transboundary Indus Basin

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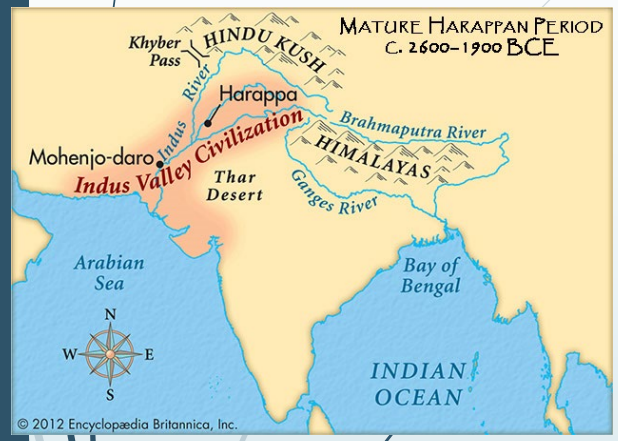
Drought- a slow onset but long lasting disaster

- Highly complex and less understood phenomena as compared to other weather and climate extremes
- Propagates slowly but with long-lasting and devastating effects
- Well recognized that climate change has caused the frequency and severity of drought events to increase in many regions around the globe
- May propagate as

Meteorological » hydrological » agricultural

History of Droughts in the Indus Valley



https://www.thebetterindia.com/137899/iit-kharagpur-indus-valley-civilisation/

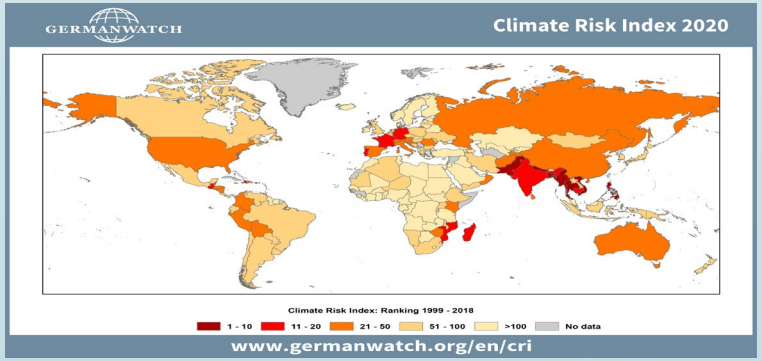
- **The collapse of the Indus Valley Civilization: the Centuries-long Drought**
  - Lake sediment isotope analysis reveals massive disruption in the monsoon cycle, causing a drought, for almost 02 centuries (Dixit et al., 2014)/ 09 centuries (Dutt et al 2018), the IVC faced a irreversible collapse.
- Droughts in Balochistan and Sindh have been a cause of long-term migration (Ashraf, Routray, and Saeed 2014).
- Prominent drought events observed in Pakistan in early 1970s, mid 1980s (Adnan et al., 2017;Young et al., 2019; Xie et al., 2013)
- The famous drought of 1998-99 to 2002, the worst in the history of the country
- Prolonged drought in Sindh of 2014–17, about 1,000 children died and 22,000 hospitalized with drought-related diseases in the Tharparkar district alone (ACAPS 2016)

Pakistan's Climate Case

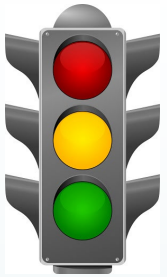
- Super **Flood** (2010)
- **Heat waves** (e.g.Karachi in 2015)
- **Droughts** in Sindh and Balochistan

…is all about water

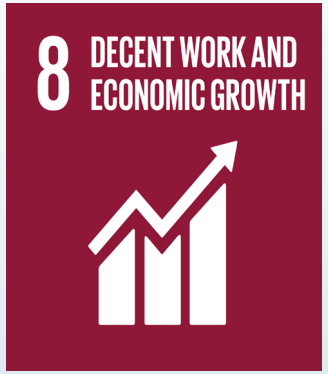
Which puts Pakistan consistently among the top 10 in the list of **countries most affected by Climate Change**

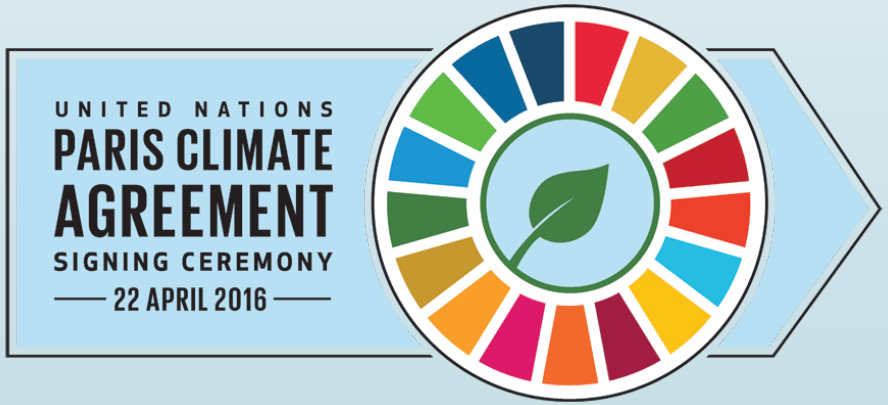


Pakistan's Climate Agenda



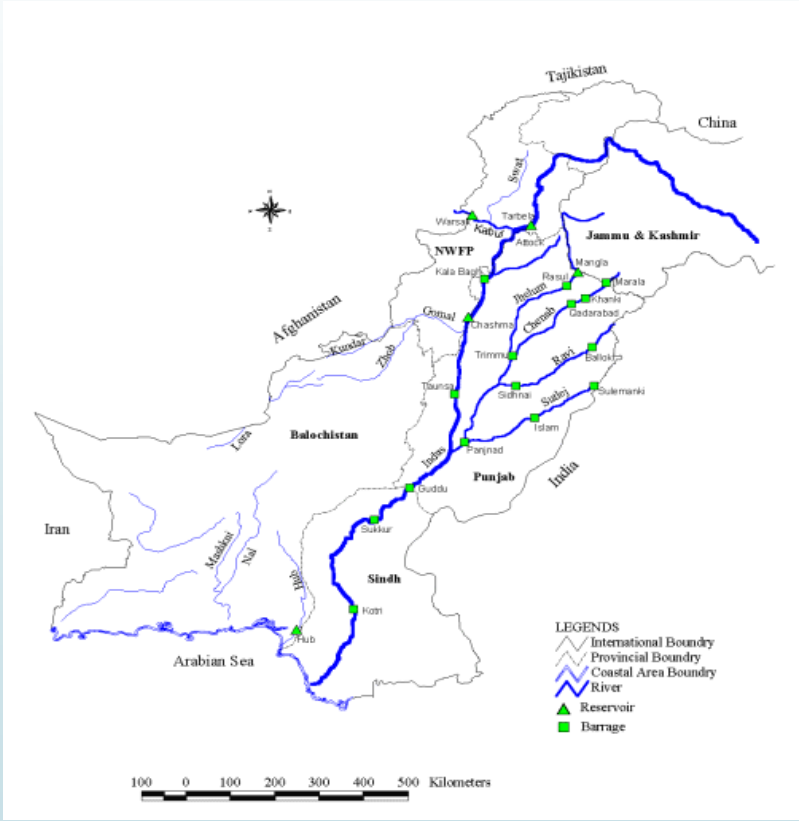
- Safety and wellbeing of the people
- Sustainable economic growth
- Fulfilling international commitments





Proactive approach -only solution to surviving droughts

- Effective drought monitoring, prediction and early warning systems are crucial for water use in a climate affected world.
- In Pakistan, surface water flows originate from the transboundary Upper Indus sub-catchments of Chenab, Jhelum, Indus and Kabul rivers.
- Impact of droughts in these catchments is strongly felt by downstream users
- This study aims to explore the relationship between meteorological and hydrological droughts in the Upper Indus catchments of Pakistan using the Standard Precipitation and Evaporation Index (SPEI) and the Standard Streamflow Index (SSI).

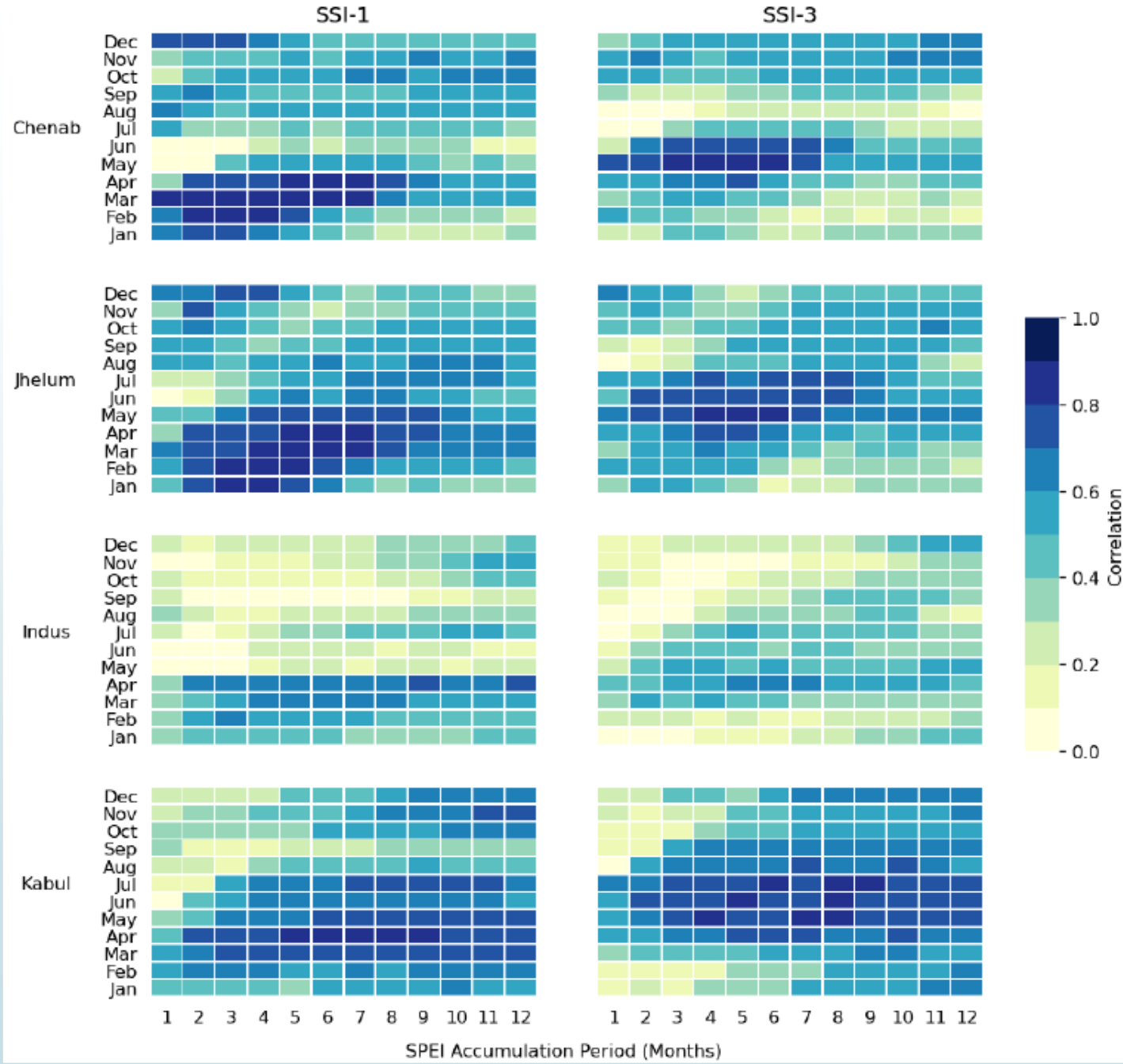


Predicting Hydrological Drought by Efficiently Detecting Meteorological Drought in Advance*.....

- Seasonal cross-correlations and lagged cross-correlations between SSI and SPEI
- Strong cross-correlations between SPEI and SSI for Chenab, Jhelum and Kabul catchments in early Kharif months (April to June)
- Hydrological drought events are cross-correlated across the four basins
- These can be used in operational drought monitoring and forecasting systems, reservoir planning and operations in drought conditions
- The study provides new insights for improvement of existing DEWS

*Akhtar, T., Mushtaq, H., and **Hashmi, M. Z.-R. (2020)**. Drought monitoring and prediction in climate vulnerable Pakistan: Integrating hydrologic and meteorologic perspectives, Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2020-297, in review, 2020.

Monthly cross-correlations between SSI and SPEI.



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Conclusions and Recommendations

- Indus Basin has a history of severe droughts and is still prone to more intense and more frequent events in this climate emergency times
- **Efficient drought monitoring and prediction** with improved DEWS is **the only option** the already water stressed Himalayan countries are left with
- Considering the trans-boundary nature of the river basins in the Himalayan countries-including Pakistan, **enhanced scientific cooperation through knowledge sharing, technology transfer and jointly run early warning systems** is a prerequisite, for the success of any effort **to safeguard lives and ensure sustainable economic growth in the region**