

Updates on Development of Pakistan Drought Monitoring System (PakDMS)

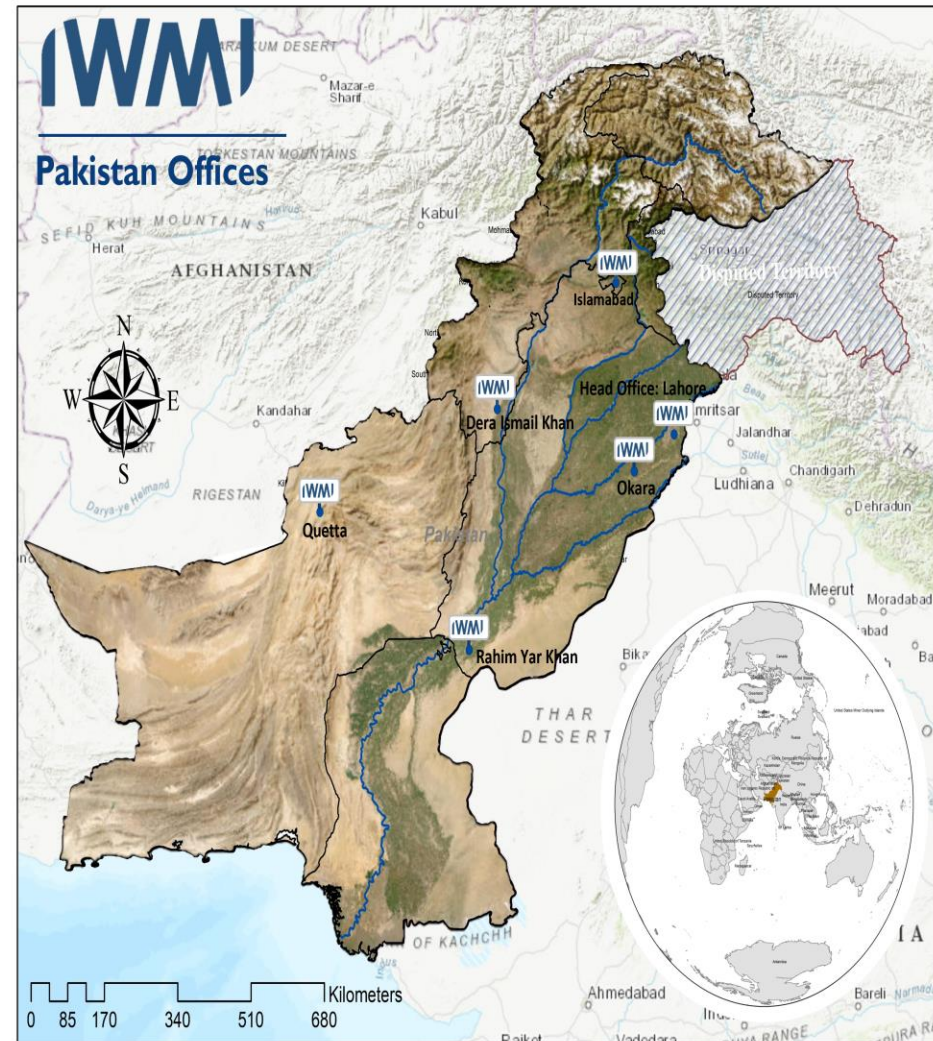
WRAP Programme Component 1 Climate
Resilient Solutions for Improving Water
Governance (CRS-IWaG)

February 21, 2024

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International Researcher IWMI

IWMI Footprint in Pakistan

- Strong on-ground presence since 1984 across sub-national, provincial, and federal scales with field offices
- Diverse group of team members having expertise in natural resource management, agriculture/irrigation engineering, economics, RS GIS, social sciences
- Well connected with all stakeholders i.e., donors/federal ministries/ provincial departments/ academia/NGOs





South Asia Water Security Initiative Demonstration Project for Pakistan

Project Portfolio



Water Management for Enhanced Productivity (WMFEP)



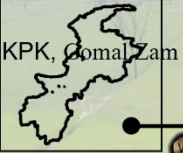
NEXUS Gains Pakistan



Capacity Building of On-Farm Water Management, Agriculture Department, Government of Balochistan

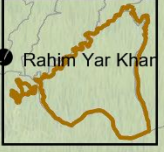


Technical Assistance for the Revival of Balochistan Water Resources Programme



Water Resources Accountability in Pakistan (WRAP)

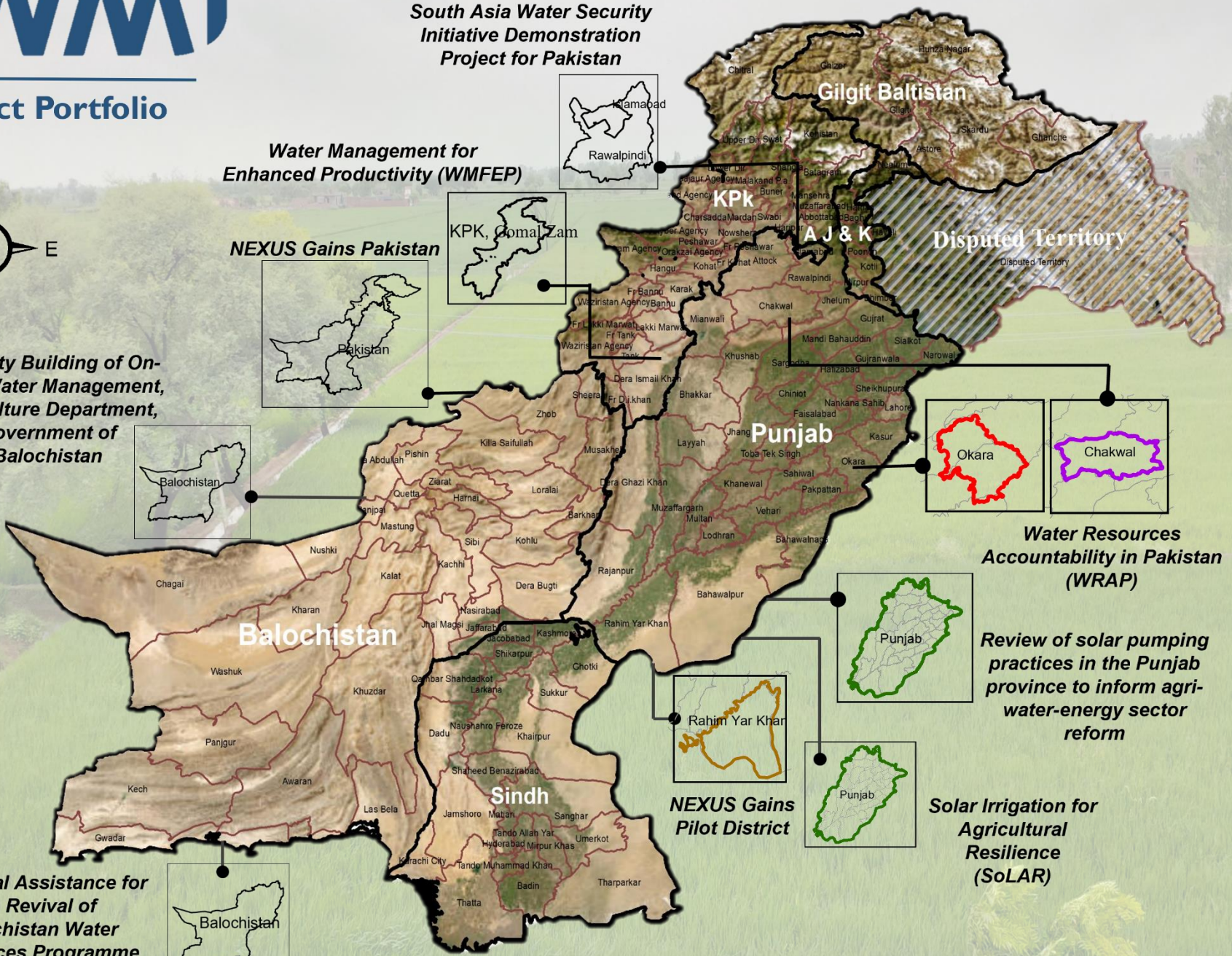
Review of solar pumping practices in the Punjab province to inform agri-water-energy sector reform



NEXUS Gains Pilot District



Solar Irrigation for Agricultural Resilience (SoLAR)



WRAP Programme Component 1: CRS-IWaG Overview

Component 1 (Federal Level): Improving water governance in the Indus Basin to support the implementation of national policies (water and climate change).

Component 2 (Punjab Level): Better 'use' of water within Punjab province and how it is shared around priority 'usage' areas to support the implementation of Punjab Water Act.

Component 3 (Cross-cutting): Dissemination of key findings, capacity development activities of key government institutions, working with Punjab Government to up-scale technical interventions supported through WRAP.

Comp. 2 and 3 will be implemented directly in Punjab. For Comp. 1, the success stories from Punjab will be showcased at the federal level to upscale & to show links in implementing climate/water policies.

Climatic Catastrophe – Growing Challenge



Impacts of Droughts in Pakistan

- Crop losses and reduced agricultural productivity
- Food insecurity and malnutrition
- Water scarcity for drinking, sanitation, and hygiene
- Livestock losses and decline in livelihoods
- Internal migration and displacement
- Increased poverty and social unrest



The Road Ahead: Building Resilience to Droughts



Investing in climate-smart agriculture



Integrated water resource management



Strengthening early warning systems

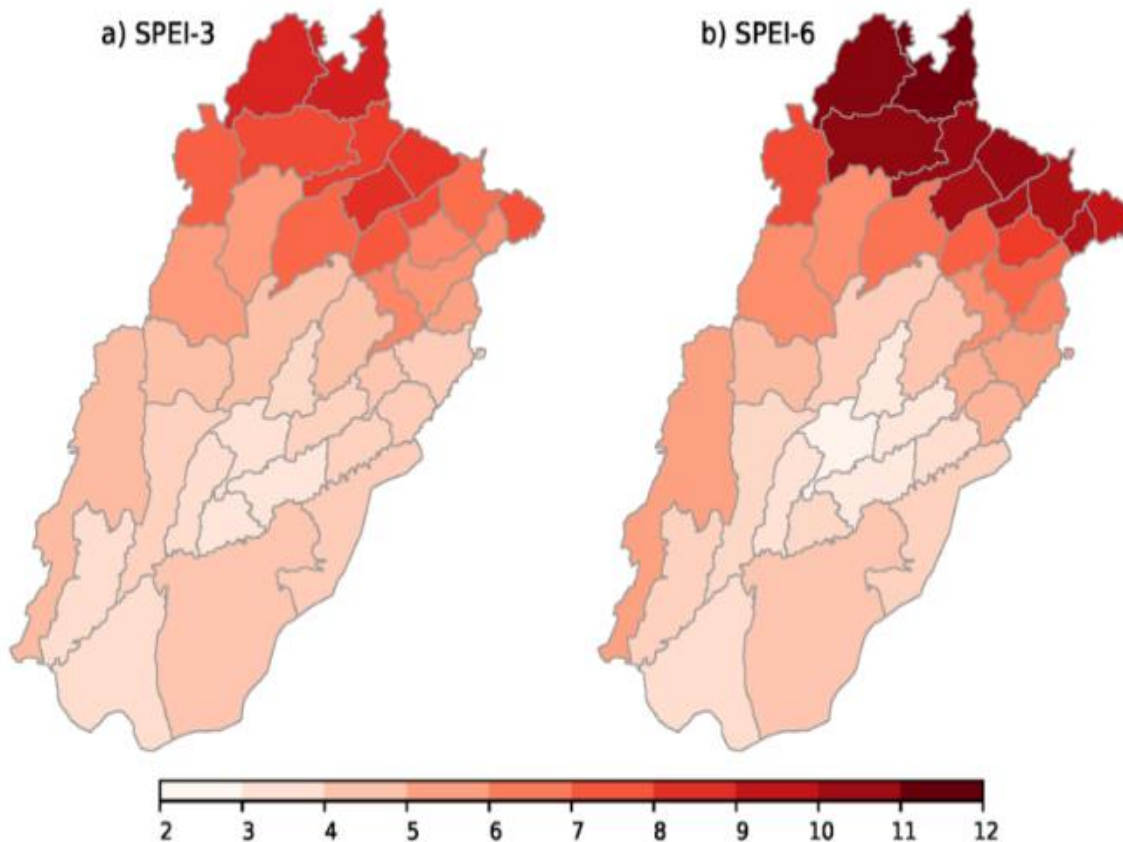


Promoting community-based adaptation strategies



International cooperation and knowledge sharing

Frequency of Severe Droughts



Average frequency of **Severe** droughts (drought months per decade) for the period 1971-2021 based on

a) 3-month SPEI index (SPEI-3) and

b) 6-month SPEI index (SPEI-6).

Higher negative values (dark red color) highlight area with highest number of severe drought months per decade

Literature

| Title | Author | Year of Publication |
|---|----------------|---------------------|
| Spatio-temporal risk analysis of agriculture and meteorological droughts in rainfed Potohar, Pakistan, using remote sensing and geospatial techniques | Goheer et al., | 2023 |
| Assessing drought and its impacts on wheat yield using remotely sensed observations in rainfed Potohar region of Pakistan | Ijaz et al., | 2023 |
| Analysis of Production and economic losses of cash crops under variable droughts: A case study from Punjab province of Pakistan | Rahman et al., | 2023 |

All these studies are done for some specific years. There is no platform available that provides us with continuous real-time data. Therefore, we have to develop a Drought Warning System

Pakistan

| | | |
|--|----------------|------|
| Assessment of drought conditions using HJ-1A/1B data: a case study of Potohar region, Pakistan | Aziz et al., | 2017 |
| Identification of Drought Events from Multi years Temporal SPOT NDVI Data for Potohar region in Pakistan | Akhtar et al., | 2014 |

IWMI's South Asia Drought Monitoring System

IWMI has developed South Asia Drought Monitoring System (SADMS).

https://dmsdemo.iwmi.org/drought-monitor?key=drought-monitor

IWMI International Water Management Institute

SADMS South Asia Drought Monitoring System

Drought Management Tool

Sign In

Home Weather Forecast Drought Management Contingency Plan Public API More

Select Module: Drought Monitor

Select Region: India

Select State:

Select Indicators: Mandatory, Drought, SPI (GPM), SPI (CHIRPS), Dry Spell, Water Resources

Drought Management

The tool allows the users to monitor past and current drought frequency and severity and to determine the drought conditions to promote proactive drought management measures. Drought decision support tool offers triggers using pre-defined conditions for drought alert to determine drought conditions and support in contingency plan. Start using Drought Monitoring >

Drought Prediction

Drought Monitor

DDS

Other Indices

Development of Early Drought Warning System for a Pilot District

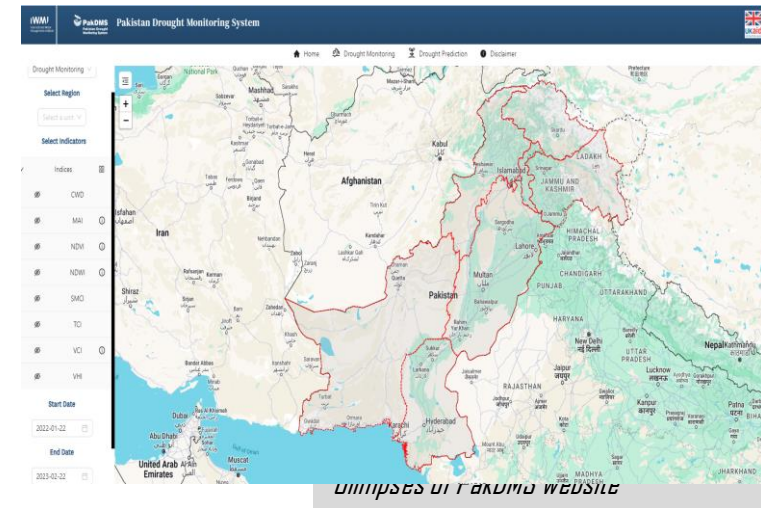
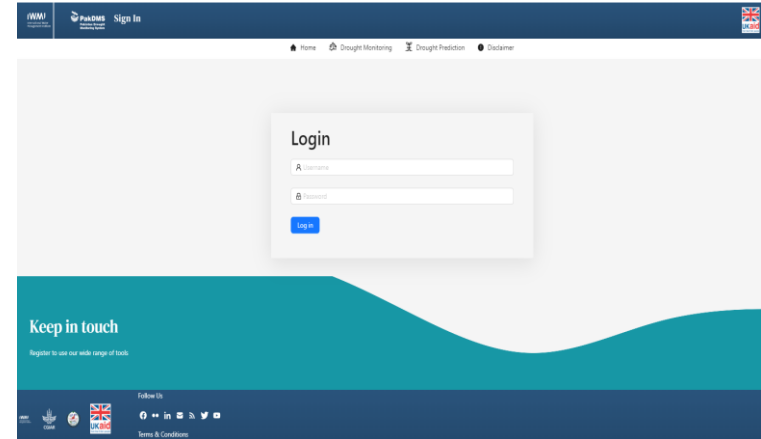
Memorandum of Understanding (MoU) with:

- a) Pakistan Meteorological Department (PMD)
 - b) National Disaster Risk Management Fund (NDRMF)
 - c) Barani Agriculture Research Institute (BARI)
- to formalize the relationship and ownership of the Pakistan Drought Monitoring System (PakDMS)

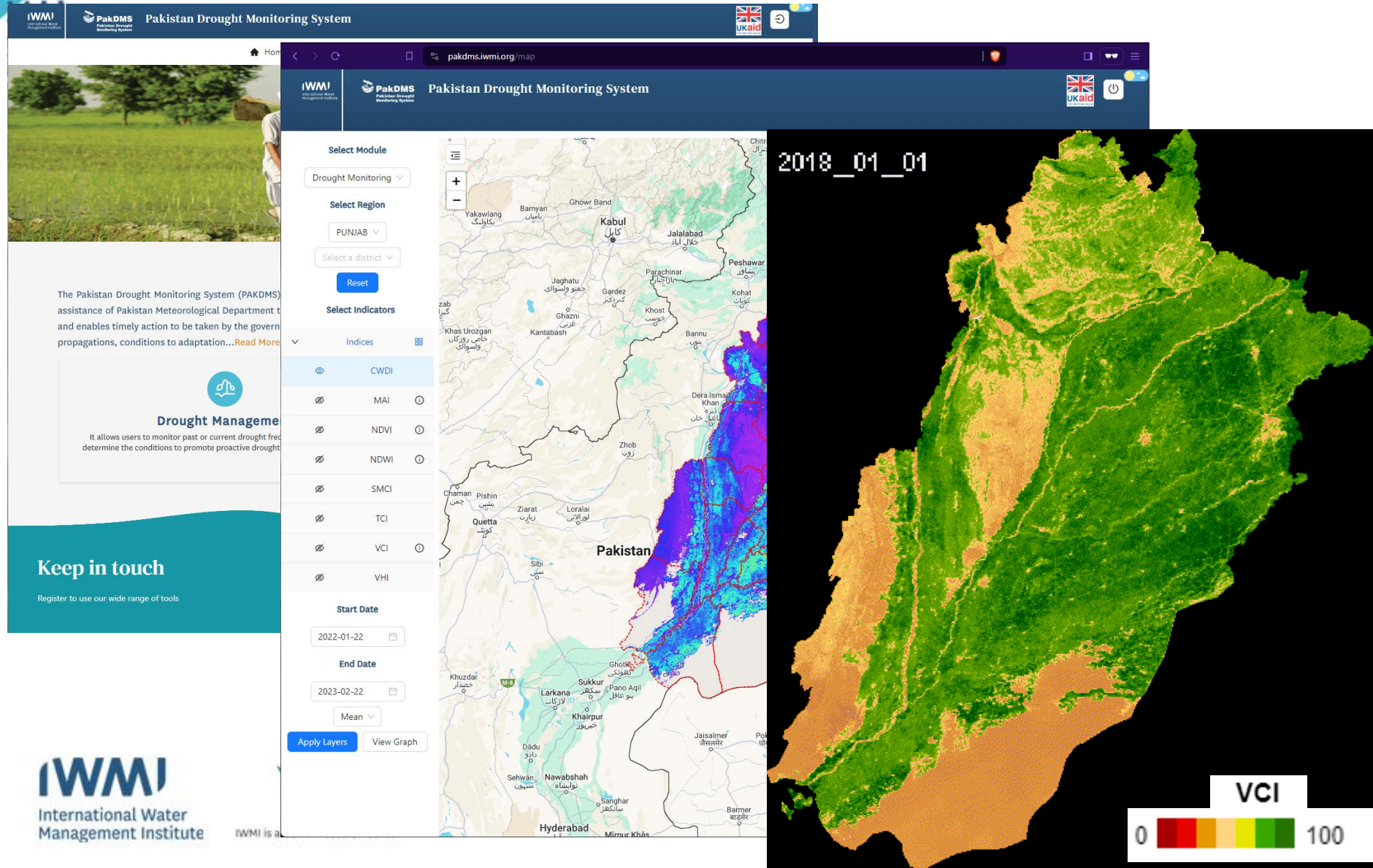


Development of Early Drought Warning System (PakDMS) for a Pilot District

- Frontend of PakDMS developed on the theme of South Asia Drought Monitoring System (SADMS) including user login and hierarchal access control.
- Realtime calculation of drought indices (**NDVI, NDWI, CWI, TCI, IDSI, VCI, VHI, SPI CHIRPS, SPI GPM, Dry GPM, Dry Spell, Extreme Rainfall, Rainfall Anomaly**)

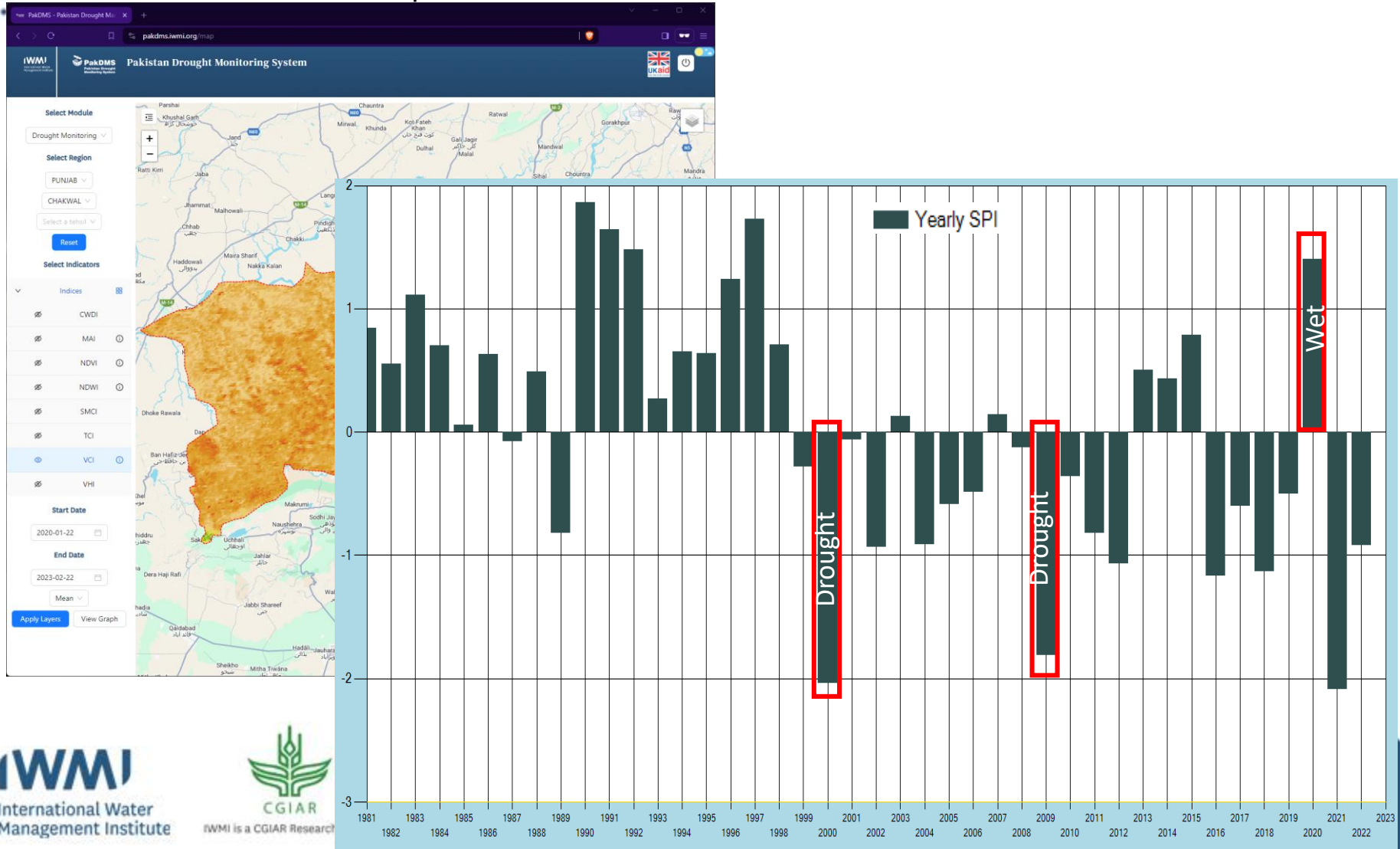


Development of Early Drought Warning System (PakDMS) for a Pilot District



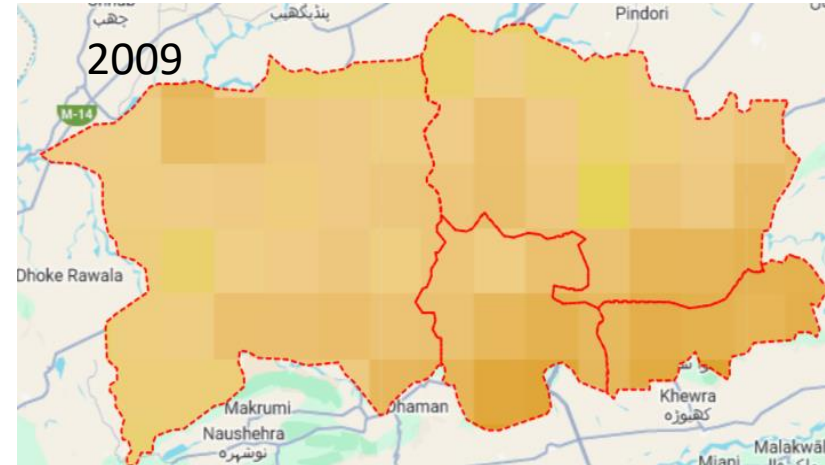
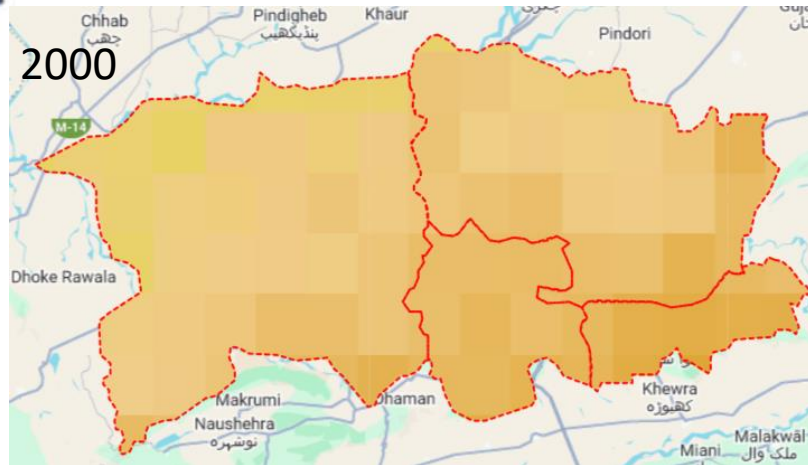
Development of Early Drought Warning System (PakDMS) for a Pilot District

Standardized Precipitation Index (SPI) based on PMD-Data (1981-2023) for Chakwal



Development of Early Drought Warning System (PakDMS) for a Pilot District

Soil Moisture Concentration Index (SMCI)

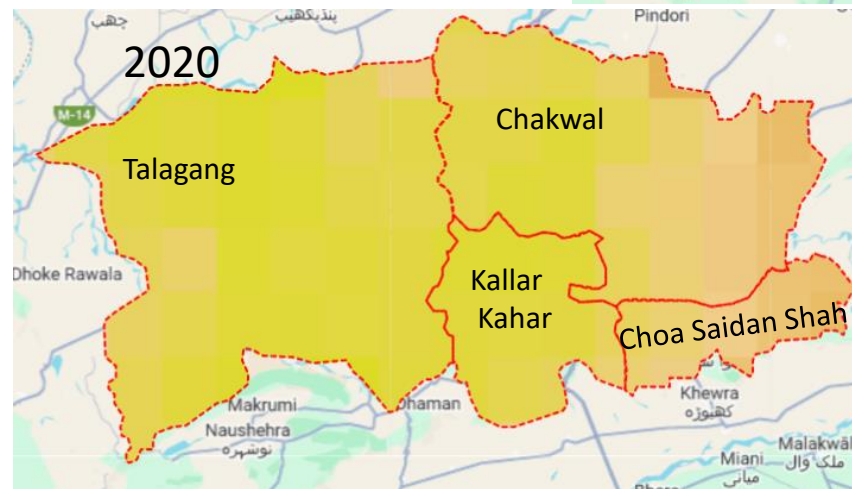


SMCI (%)

2020-01-1 to 2020-12-31

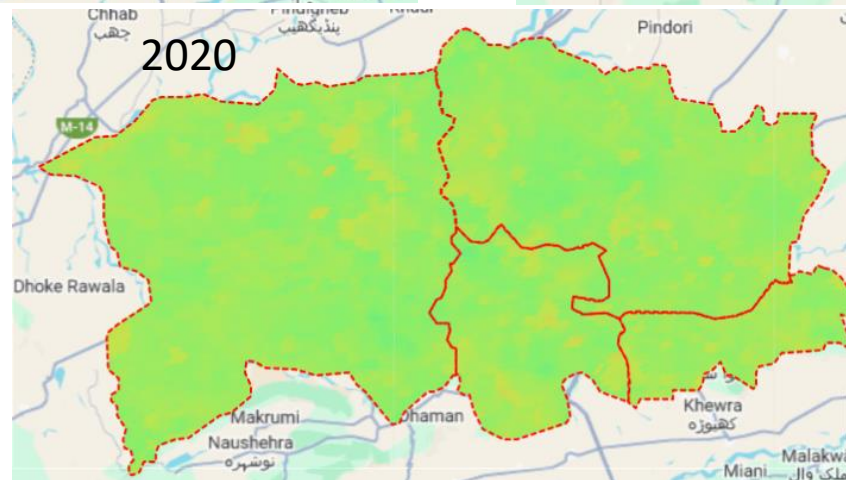
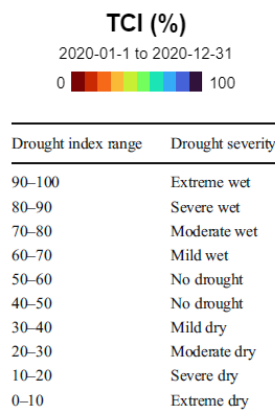
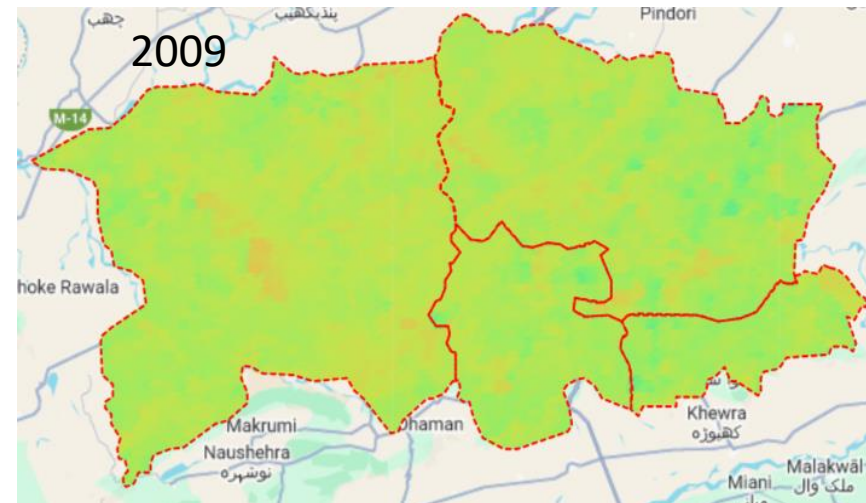
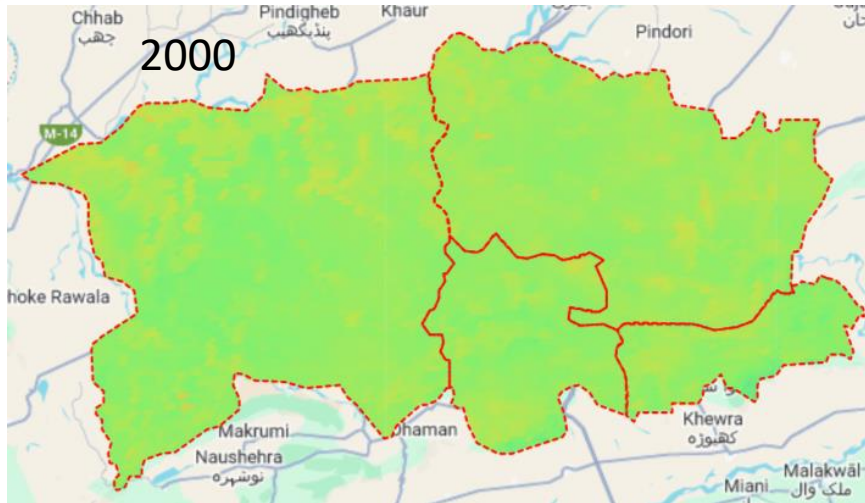
0 100

| Drought index range | Drought severity |
|---------------------|------------------|
| 90-100 | Extreme wet |
| 80-90 | Severe wet |
| 70-80 | Moderate wet |
| 60-70 | Mild wet |
| 50-60 | No drought |
| 40-50 | No drought |
| 30-40 | Mild dry |
| 20-30 | Moderate dry |
| 10-20 | Severe dry |
| 0-10 | Extreme dry |



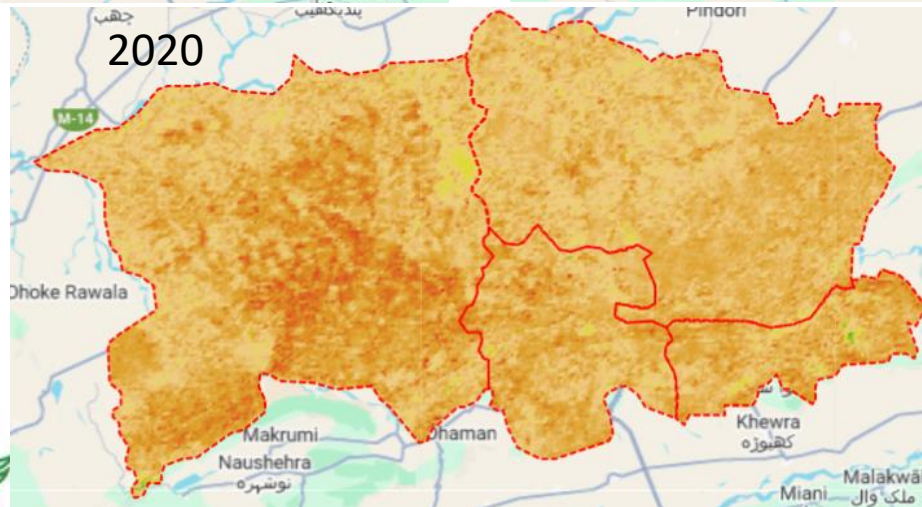
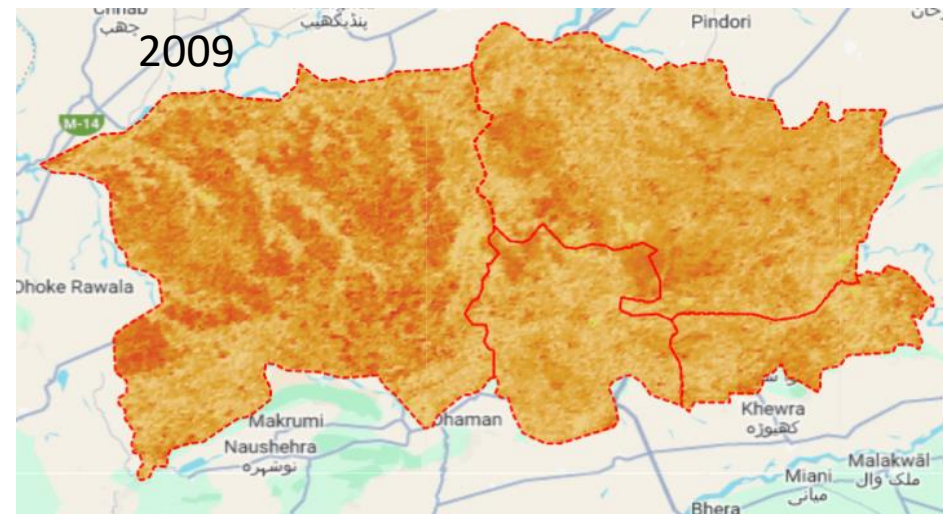
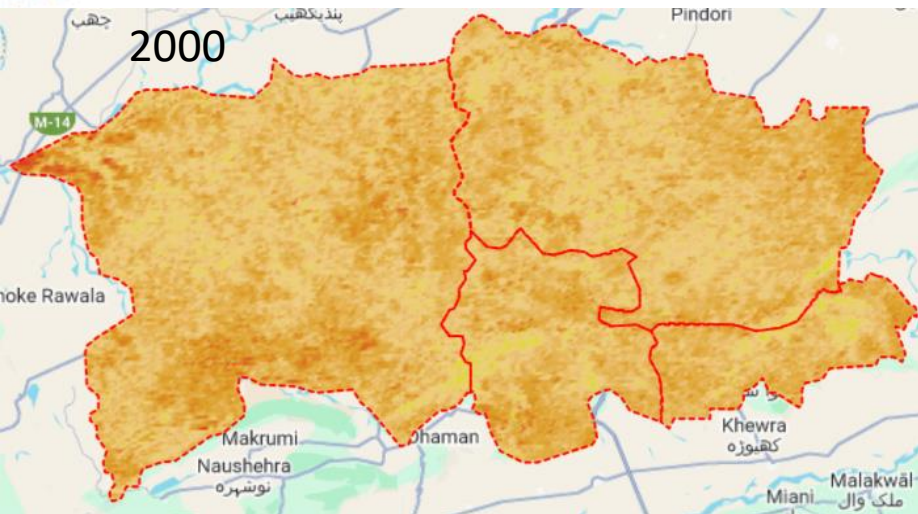
Development of Early Drought Warning System (PakDMS) for a Pilot District

Temperature Concentration Index (TCI)



Development of Early Drought Warning System (EDWS) for a Pilot District

Vegetation Condition Index (VCI)



VCI (%)

2020-01-1 to 2020-12-31

0 100

| Drought index range | Drought severity |
|---------------------|------------------|
| 90–100 | Extreme wet |
| 80–90 | Severe wet |
| 70–80 | Moderate wet |
| 60–70 | Mild wet |
| 50–60 | No drought |
| 40–50 | No drought |
| 30–40 | Mild dry |
| 20–30 | Moderate dry |
| 10–20 | Severe dry |
| 0–10 | Extreme dry |



CGIAR

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Conclusion

- Droughts are a complex challenge, but not an insurmountable one
- Collaborative efforts involving government, communities, and stakeholders are key
- By investing in solutions and building resilience, Pakistan can mitigate the impacts of droughts and ensure water security for its future.





International Water
Management Institute



CGIAR

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Thank You

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Food · Climate · Growth

