International Water Management Institute

WaPOR

Tool Series

Drought Monitoring: Pakistan

The challenge

The Pakistan Meteorological Department (PMD) is responsible for drought monitoring and alerts, and distributing PDF-format drought reports to various government agencies and citizens. The current system relies on static data with no real-time visualizations, hindering timely analysis and decision-making. Additionally, failure to integrate various data sources prevents comprehensive drought assessments, while low user engagement further reduces effectiveness.

The solution

The Pakistan Drought Management System (PakDMS) enhances existing monitoring by using high-resolution Water Productivity through Open access of Remotely sensed derived data (WaPOR), and other data to create dynamic visualizations of drought conditions (Figure 1). This allows PakDMS to offer a more accessible interface for greater user engagement. The tool produces key drought indicators – including precipitation (P), soil moisture, vegetation and temperature – analyzing drought conditions across Balochistan, Sindh and Gilgit Baltistan provinces.

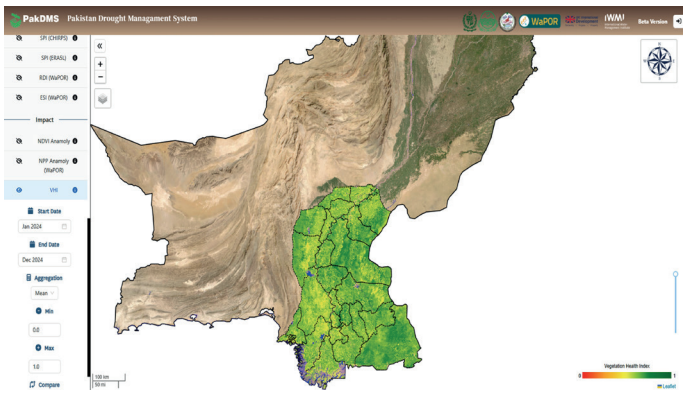

Figure 1: The Pakistan Drought Monitoring System (PakDMS) dashboard.

Key technical features

PakDMS uses Level 2 WaPOR datasets at 100 m resolution – including actual evapotranspiration and interception (AETI), reference evapotranspiration (RET), precipitation (P), root-zone soil moisture and net primary production (NPP) – that are generated every 10 days. These are integrated with satellite products, such as the Moderate Resolution Imaging Spectroradiometer (MODIS), the Climate Hazards Group InfraRed Precipitation with Station data (CHIRPS), and Soil Moisture Active Passive (SMAP). Reanalysis datasets are also utilized, including the fifth-generation European Centre for Medium-Range Weather Forecasts (ECMWF) atmospheric reanalysis of the global climate (ERA5), the Global Land Data Assimilation System (GLDAS) and other high-resolution sources to track spatiotemporal drought patterns. The tool also evaluates agricultural impacts through NPP and soil moisture data. Maps and time-series graphs allow users to analyze trends and make informed decisions for effective drought response. The tool is available in English.

Current use and main users

PakDMS was launched in February 2025. The beta version is currently being tested by PMD and other key stakeholders. The tool's main users are government agencies – PMD and the National Disaster Risk Management Fund (NDRMF) – researchers and academics, farmers and agricultural experts.

Key stakeholders and beneficiaries

Key stakeholders include policy- and decision-makers (PMD, ministries of Climate Change, Water Resources, National Food Security and Research), disaster management authorities (National Disaster Management Authority [NDMA], Provincial Disasters Management Authorities [PDMAs], NDRMF), and international organizations (Food and Agriculture Organization of the United Nations [FAO], United Nations Development Programme and other partners supporting climate resilience initiatives). The main beneficiaries are government agencies (NDMA, PDMAs and water resource managers), farmers, rural communities and the general public. The tool is hosted by PMD.

The co-creation process

The co-creation process included multiple meetings with PMD, NDRMF and Provincial Agriculture Departments. Thanks to co-creation workshops, local context was incorporated and stakeholder feedback helped refine the tool's functionalities, including the integration of a drought forecast module. PMD and NDRMF staff also participated in a two-day on-the-job training to familiarize themselves with the tool and ensure optimal use.

Key outcomes and impacts

PakDMS enables timely drought detection and trend monitoring, while its forecast module improves risk management. Its impact assessment module evaluates socioeconomic and environmental effects to guide mitigation strategies. Overall, the tool enhances decision-making, optimizes resource management and reduces vulnerabilities, strengthening resilience and supporting sustainable water use and food security in drought-prone regions.

Sustainability and continuous updating

The tool was co-created with PMD and is managed by its National Drought Monitoring Centre. Regular feedback, capacity building initiatives and integration with evolving datasets and technologies support ongoing improvements, ensuring long-term effectiveness of the tool.

Scaling potential

The tool's modular design, integration with diverse datasets, and regional adaptability make it highly scalable. With stakeholder collaboration and continuous enhancements, it can be expanded across national and regional levels, enabling data-driven drought monitoring, early warning, and proactive water resources management.

The WaPOR portal

The publicly accessible Water Productivity through Open access of Remotely sensed derived data (WaPOR) portal of the Food and Agriculture Organization of the United Nations (FAO) supports agricultural water productivity monitoring at continental, national and basin scales. With new information produced every 10 days, the portal helps users make informed policy and investment decisions.

Authors

Dr. Muhammad Cheema, Deputy Country Representative - Pakistan & Researcher - Water Resources Management, International Water Management Institute (IWMI), Lahore, Pakistan (m.cheema@cgiar.org)
Dr. Shahzada Adnan, Deputy Director, Pakistan Meteorological Department (PMD), Islamabad, Pakistan (shaz.adnan@gmail.com)
Dr. Muhammad Zohaib, National Researcher – Remote Sensing and Geographic Information System (GIS), IWMI, Lahore, Pakistan (m.zohaib@cgiar.org)
Dr. Petra Schmitter, Research Group Leader – Climate Mitigation & Adaptation Pathways, IWMI, Colombo, Sri Lanka (p.schmitter@cgiar.org)
Dr. Moctar Dembélé, Researcher – Spatial Hydrologist, IWMI, Accra, Ghana (moctar.dembele@cgiar.org)

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International Water Management Institute (IWMI)

Headquarters
127 Sunil Mawatha, Pelawatte, Battaramulla, Sri Lanka

Mailing address:
P. O. Box 2075, Colombo, Sri Lanka
Tel: +94 11 2880000
Fax: +94 11 2786854
Email: iwmi@cgiar.org
www.iwmi.org

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