

GOVERNMENT OF PAKISTAN
PAKISTAN METEOROLOGICAL DEPARTMENT



*Quarterly Drought Bulletin
of Pakistan
July-September 2025*



National Drought Monitoring and Early Warning Centre

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URL: <https://ndmc.pmd.gov.pk/new/>

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1. Introduction

Pakistan's latitudinal range contributes to significant variability in rainfall across different seasons. The country's climate exhibits a spectrum from arid to hyper-arid in its lower southern regions, while the northern half ranges from semi-arid to humid. Certain areas experience persistent dry conditions, rendering them vulnerable to drought throughout the year. Prolonged absence of precipitation can exacerbate these conditions, leading to widespread drought impacts. Historically, all provinces of Pakistan have grappled with significant drought events.

Apart from other natural disasters such as floods, cyclones, and earthquakes, drought sometimes get gradual onset with prolonged duration and sometime as a result of heat waves emerge as flash drought. Its impacts are often less immediately noticeable but can span across vast geographical areas, impacting a larger population than other environmental hazards.

The Pakistan Meteorological Department (PMD) established the National Drought Monitoring and Early Warning Centre (NDMC) in 2004-05, following the severe drought of 1999-2001. The primary objective of NDMC is to proactively monitor drought conditions nationwide and issue timely advisories.

The NDMC operates a central office in Islamabad, complemented by four Regional Drought Monitoring Centers (RDMCs) in Lahore, Karachi, Peshawar, and Quetta. These RDMCs serve as central hubs for gathering, consolidating, and analyzing drought-related data from all regions of the country. To strengthen monitoring capabilities, Automatic Weather Stations (AWS) have been strategically installed, particularly in drought-prone areas. The maintenance and regular acquisition of data from the remote regions of the country have always posed a significant challenge.

The National Drought Monitoring Centre (NDMC) also operates an extensive network of Ordinary Rain Gauges (ORGs) distributed across the country. This network ensures comprehensive spatial coverage, particularly in drought-prone and vulnerable districts across all four provinces. The data collected through these ORGs play a vital role in monitoring precipitation trends, validating satellite-based rainfall estimates, and supporting the assessment of drought intensity and spatial extent. The spatial distribution of these rain gauges is illustrated in Figure-1.

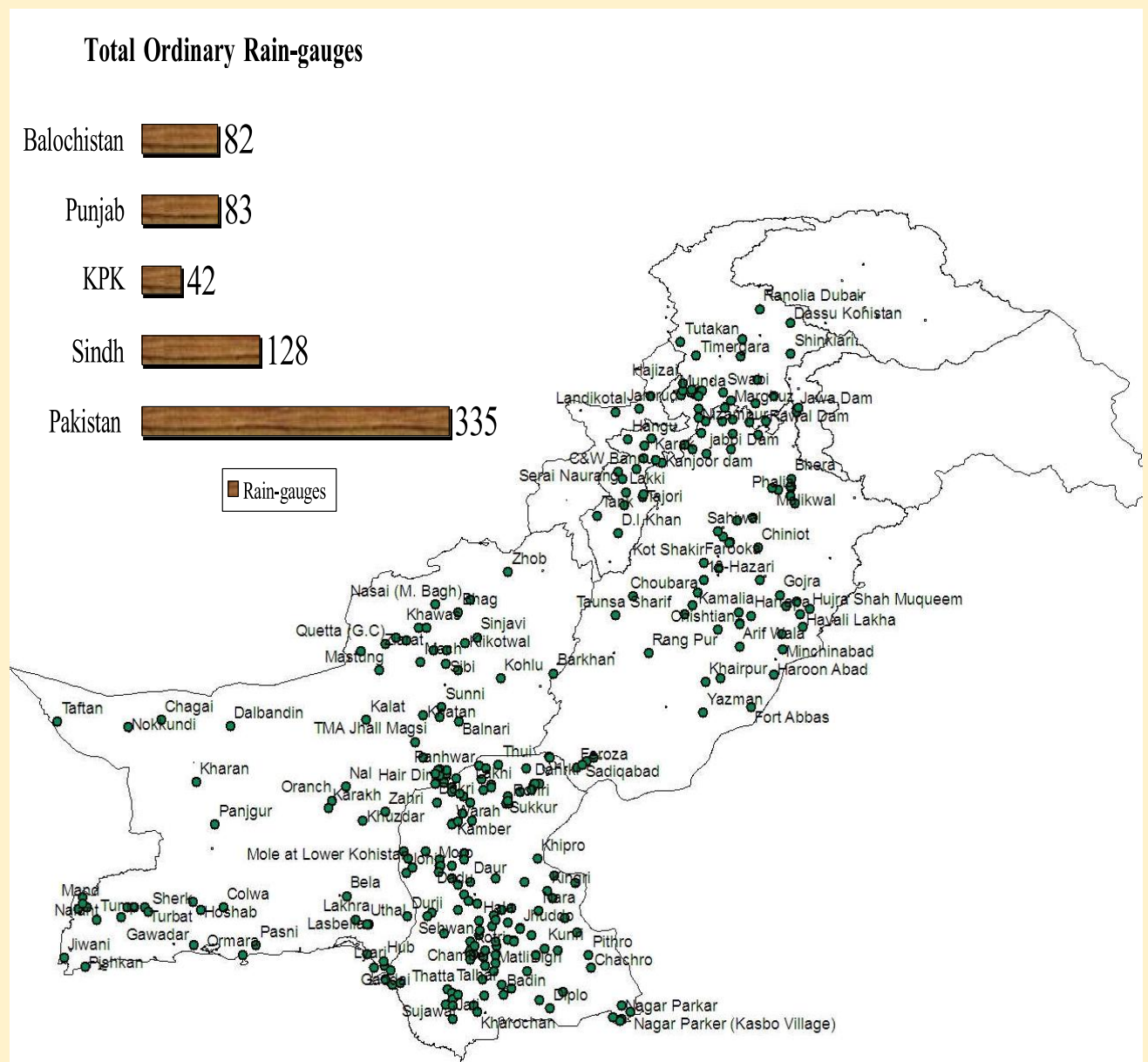


Figure-1: Rain-gauges network of Pakistan by NDMC

2. Historical Background

The tropical monsoon climate of the Indian subcontinent is characterized by pronounced variability in rainfall intensity and spatial distribution. The regional and temporal shifts in atmospheric circulation patterns associated with the monsoon form an integral part of the region's climatology. Two primary rainfall systems dominate the weather patterns: the Southeast or Summer Monsoon (occurring from late June to September), and the Winter Monsoon or Westerlies prevailing from December to the end of March.

Pakistan, being favorably located within this region, receives substantial rainfall during the summer months from the Southwest (SW) monsoon and in winter due to western disturbances. The summer monsoon contributes 65% of the annual rainfall in Pakistan from July to September (Waqas and Athar, 2019; Ullah et al., 2021b; Abbas et al., 2022). Monsoon rainfall exhibits significant spatial and temporal variability. Droughts in Pakistan primarily result from deficiencies in rainfall associated with the southwest monsoon and seasonal droughts occur due to winter rainfall deficits. Furthermore, El Niño and La Niña events have a significant correlation with the strength and variability of monsoon activity in Pakistan.

Pakistan has witnessed several drought episodes affecting various provinces. The Punjab province experienced severe droughts in 1899, 1920, and 1935. North west of Khyber Pakhtunkhwa (KP) experienced worst droughts in 1902 and 1951, while Sindh faced major droughts in 1871, 1881, 1899, 1931, 1947, and 1999. Among the most severe nationwide droughts was the 1999–2002 event that affected large parts of the country, including Balochistan, Sindh, Punjab, and KP. These droughts around the year 2000-2001 had significantly affected agricultural yield. Major crops experienced a decline of nearly 10% in growth, contributing to an overall negative growth rate of 2.6% for the agricultural sector. The water shortage in Pakistan persisted in 2001–2002, reaching levels of up to 51% below normal supplies, worsening from the 40% deficit in the previous year (Shahid Ahmad, et al 2020).

Climate change has altered rainfall patterns, causing greater variability between wet and dry periods. This has led to increased precipitation during wet spells and reduced rainfall during dry phases. As a result, prolonged dry conditions often trigger droughts, whereas intense rainfall events contribute to flooding of various types, including flash floods, urban floods, coastal floods, and riverine floods

3. Rainfall Distribution (July-September) 2025

During the third quarter of 2025 (July-September), Pakistan experienced above-normal precipitation overall. In July, rainfall remained above normal with an overall departure of 23% across the country. In addition, during the month of August, there was above-normal rainfall with a 44% positive departure in GB and 11% across Pakistan. However, in September, rainfall distribution became more uneven. Sindh experienced significantly above normal rainfall with 317% positive departure, whereas GB, KPK and AJK recorded below normal rainfall with departures of -22%, -18%, -34%, respectively.



Figure-2: Percentage area weighted departure of rainfall during (July-September) 2025

The cumulative quarterly rainfall analysis indicates that Pakistan received above-average rainfall during the third quarter of 2025. This overall surplus reflects the combined effect of enhanced monsoon activity, particularly during July and September, when several regions recorded substantial positive rainfall departures. The area-weighted rainfall analysis, illustrated in Figure 2, provides a comprehensive overview of the spatial distribution of rainfall anomalies across the country.

The Spatial distribution of rainfall during the third quarter (July-September) is illustrated in Figure 3. During this period, wide spread heavy rainfall spells were observed throughout the country, the most significant rainfall occurred in central and upper parts of KPK, upper Punjab, Potohar region, Kashmir and southwestern parts of Sindh.

The above normal rainfall was observed across most parts of the country during July-September. However, regional variations were evident. Western Balochistan, most parts of KPK, GB, Southern Punjab and some parts of eastern Sindh experienced below normal rainfall. In contrast, northeastern Punjab, Islamabad division, southeastern Balochistan and most parts of Sindh received above normal rainfall during the quarter. This spatial variability highlights the complex interplay between monsoon dynamics and local topography influencing rainfall distribution across Pakistan.

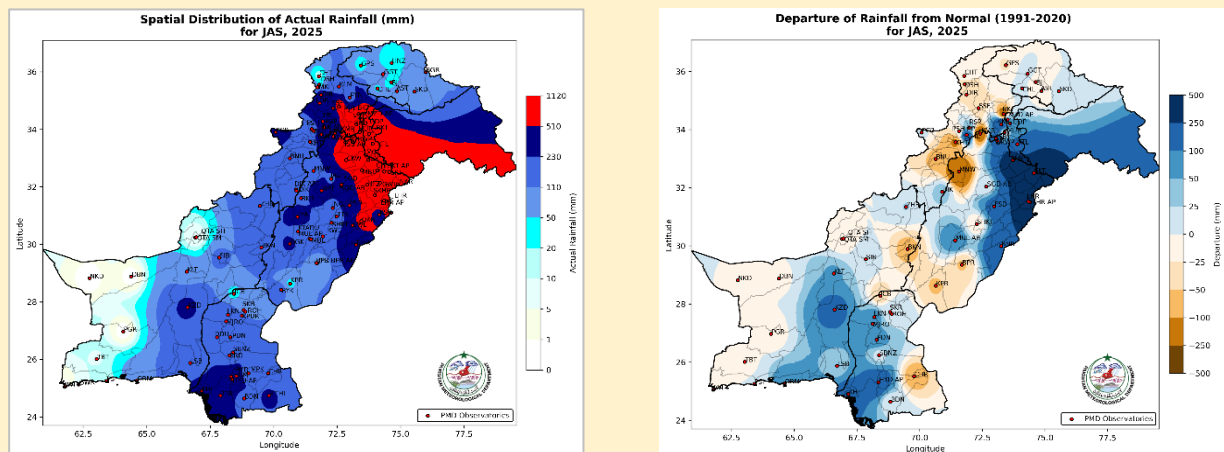


Figure-3: Spatial distribution and departure of rainfall during (July-September) 2025 in Pakistan

3.1 PMD Stations with highest rainfall (mm) (July-September) 2025

Table-1: Chief amount of rainfall recorded across Pakistan for JAS, 2025					
Sr.No.	Station	Rainfall(mm)	Sr.No.	Station	Rainfall(mm)
1	Sialkot Cantt	1118.5	11	Mangla	738.4
2	Jhelum	1011.0	12	Murree	735.4
3	Islamabad, ZP	927.8	13	Islamabad AP	735.1
4	Lahore, AP	896.9	14	Kotli	708.4
5	Sialkot AP	868.0	15	Malamjabba	703.0
6	Narowal	864.2	16	Muzaffarabad AP	696.7
7	Lahore, City	836.8	17	Muzaffarabad City	690.3
8	Kakul	832.0	18	Mandibahauddin	669.6
9	Sheikhupura	820.1	19	Gujrat	661.6
10	Chaklala AB	808.6	20	Gujranwala	627.3

The maximum length of dry days spell calculated as Consecutive Dry Days (CDD) is shown in Figure 4. The highest CDD values were recorded in western Balochistan, particularly in Jiwani (253 days), Dalbandin (214 days) and Nokkundi (202 days). The duration of these dry spells provides a clear indication of the prevailing drought conditions in the affected regions and helps in assessing the intensity and persistence of dryness across the country.

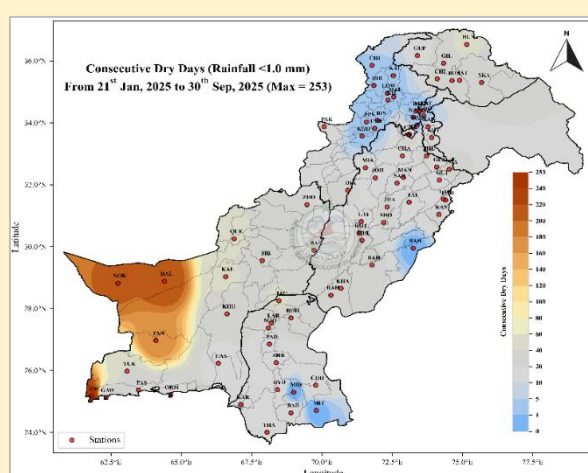


Figure-4: Maximum length of dry spell up to September 2025 in Pakistan

4. Drought Products

4.1 Cumulative Precipitation Anomaly (CPA)

The Cumulative Precipitation Anomaly (CPA) was computed from 1st June, 2025 onward for each month. The CPA maps for July, August and September 2025 are shown below in Figure 6. Notably, some parts of eastern and northeastern Punjab, AJK, eastern KPK, western Sindh, eastern GB and parts of Balochistan received above normal rainfall, exhibiting positive anomalies of up to 500mm.

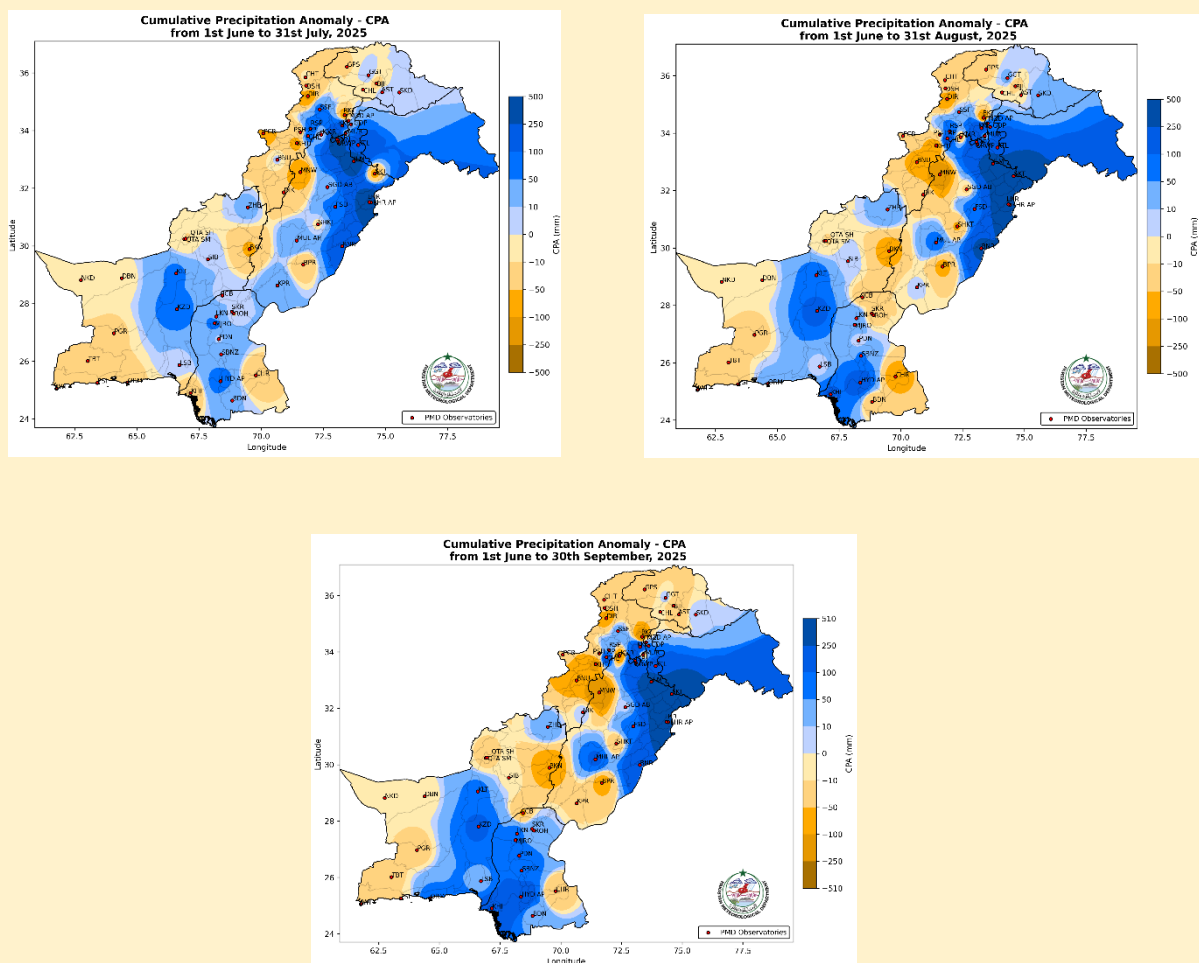


Figure-6: Cumulative precipitation anomaly during (July-September 2025) in Pakistan

4.2 Soil Moisture Anomaly (SMA)

It was observed that the amount of rainfall varied significantly across different regions of the country, leading to varying soil moisture conditions as illustrated in Figure 7. Increased rainfall improved soil moisture conditions in most areas, particularly in Sindh, eastern Punjab, and large parts of KP. However, below normal soil moisture was recorded in some parts of KP including Chilas, Dir, and Drosh as well as in western Baluchistan.

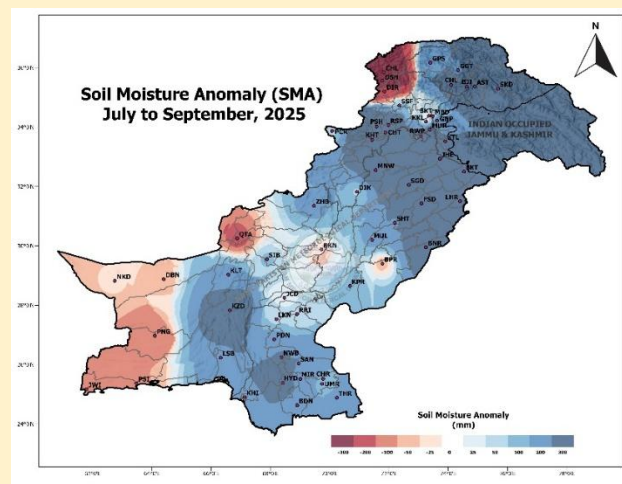


Figure-7: Soil moisture anomaly values (July-September,2025)

4.3 Water Level of Reservoirs

Pakistan has two major water reservoirs of Tarbela and Mangla, play a crucial role in meeting the country's irrigation, power generation, and domestic water needs. The dead level of Tarbela is 1402 feet with maximum conservation level of 1550 feet, while Mangla has a dead level of 1050 feet with a maximum conservation level of 1242 feet. The monsoon rains, along with seasonal snow melt are the key contributors influencing the rise and fall of these reservoir levels. Additionally, small dams across various parts of the country also reached satisfactory storage levels that will help to boost the agriculture activities and ultimately contribute to improving socio-economic conditions nationwide. The water storage levels at both Tarbela and Mangla reservoirs in the month of September were above average with Tarbela showing considerably higher level, reflecting the combined impact of monsoon rainfall and glacial melt as illustrated in Figure 8.

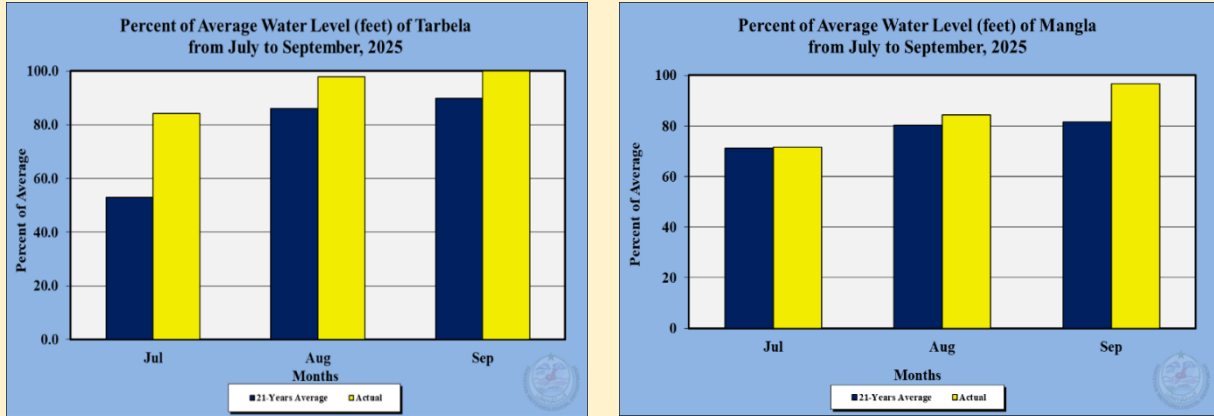


Figure-8: Percentage of water levels at Mangla and Tarbela Dams during July-September,2025

4.4 District-wise impact of drought

Currently, mild drought conditions are prevailing across western Baluchistan, while moderate drought conditions are observed in Turbat.

5. Kharif season forecast of Mangla and Tarbela Dams (2025)

The predicted water availability forecast in Million Acre Feet (MAF) forecast for the two major reservoirs, Tarbela and Mangla during the Kharif season (April-Sept) is illustrated in Figure 9.

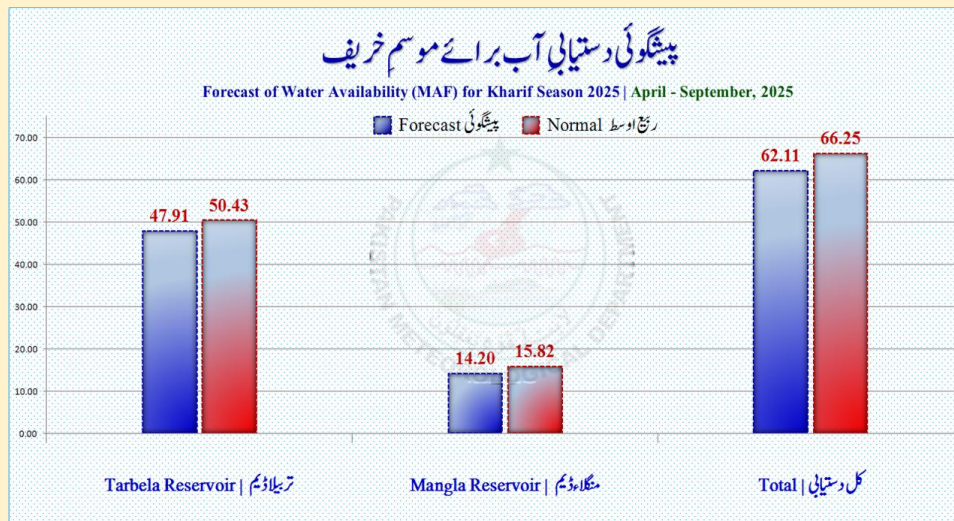


Figure-9: Kharif season forecast of Mangla and Tarbela dams

6. Drought Monitor

The drought monitor map (Figure 5) for September 2025 illustrates the spatial variation in drought severity across different regions of the country, derived using multiple drought monitoring indices, the Standardized Precipitation Index (SPI), Consecutive Dry Days (CDD), and the Standardized Precipitation Evapotranspiration Index (SPEI).

The SPI reflects short- to long-term precipitation anomalies and helps identify meteorological drought conditions, while the SPEI incorporates both precipitation and temperature to assess the balance between water availability and atmospheric demand. The CDD index, on the other hand, represents the maximum number of consecutive dry days during a period, providing insight into the persistence and intensity of dry spells.

Based on these indices, the spatial drought assessment indicates that moderate drought conditions, depicted in orange color, are prevailing in the Turbat region. Mild drought conditions, shown in pale yellow, are spread across western Balochistan, reflecting prolonged dry periods and reduced rainfall. Regions not affected by drought are classified as “Normal”, represented in white color, signifying adequate rainfall and soil moisture conditions.

The moderate drought conditions are depicted in orange color are observed in Turbat. Mild Drought conditions, represented in pale yellow are prevalent across western Baluchistan. Regions not affected by drought are marked as "Normal" and are indicated in white color.

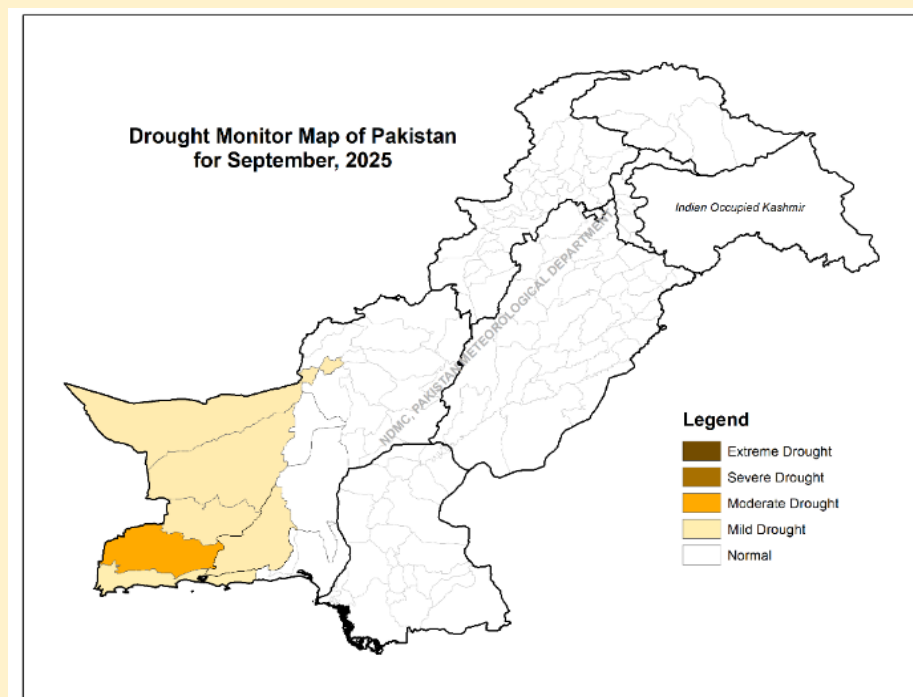


Figure-5: Drought Monitor for the month of September 2025

Recommendations

Natural disasters cannot be completely prevented. Each past event provides valuable lessons for improved planning, management, and the adoption of precautionary measures to minimize future impacts. The following recommendations are proposed to better cope with floods and droughts in Pakistan.

- Pakistan's existing water storage capacity is significantly lower than the normal rainfall received in the region. Therefore, it is necessary to construct additional large and small dams or water storage facilities particularly in catchment and low-lying areas, to effectively conserve rainwater during the rainy season.
- The conservation of water resources will play a crucial role in ensuring food security by meeting the demands of crops during periods of droughts and water scarcity in the country.
- Integrated water resource management strategies should be adopted to promote efficient utilization of available water through modern irrigation techniques, rainwater harvesting, and groundwater recharge initiatives.
- The national Drought Monitoring Center (NDMC) is continuously monitoring drought situation over the country while strengthening its technical and operational capacity to enhance accuracy and efficiency. It also focuses on improving real time drought information dissemination to stakeholders and general public. The NDMC regularly issues drought information bulletins on a weekly, fortnightly, monthly and Quarterly basis.
- Over all, normal conditions prevail in most parts of the country, except for western Balochistan, where mild to moderate drought conditions persist during this quarter. For more information regarding the current drought situation in Pakistan, please visit the NDMC official website: <http://www.ndmc.pmd.gov.pk/index.htm>.

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