Pakistan Meteorological Department

Drought Bulletin of Pakistan

April-June 2021

National Drought Monitoring Centre

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Drought Bulletin

April – June, 2021

This bulletin is regularly published on Quarterly basis under the guidance of Dr. AzmatHayat Khan, Chief Meteorologist, National Drought Monitoring Centre(NDMC), Islamabad.

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Quarterly Drought Bulletin

April – June, 2021

By

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1. Introduction

Pakistan has a long latitudinal extent and the rainfall variability during different seasons is considerably high. The climate of the country in its lower southern half is arid and hyper-arid while the northern half of country lies between semi arid to very humid. Some regions of the country in each seasons, remain drastically dry and area always vulnerable to drought. If subsequent seasons fail to generate significant precipitation, the drought conditions then are sure to take the vulnerable regions in the grip. All the provinces of Pakistan have a history of facing major droughts in the past.

Drought differs from other natural disaster (e.g. flood, tropical cyclones, tornadoes and earthquakes etc) in the sense that the effects of drought often accumulate slowly over a considerable period of time and may linger for years even after the termination of the event. Because of this drought is often referred to as a "Creeping Phenomena". Drought impacts are less obvious and are spread over large geographical areas than are the damages that results from other natural hazards. Consequently drought affects more people than any other environmental hazard.

Unfortunately, no organizations dealing with the drought issues exist in Pakistan and the responses to drought for the distressed economic and social sector, whenever such situation arose, were taken on emergency and on adhoc basis. It is thus inevitable need of the time and Pakistan Meteorological Department (PMD) took an initiative to establish National Drought/Environment monitoring and Early Warning Centre (NDMC) in 2004-05 after the worst drought during 1999-2001 in Pakistan. The main objective is to monitor drought situation in the country and issue advisory before time. Its national centre is in Islamabad while four Regional Drought Monitoring Centers (RDMC's) are in Lahore, Karachi, Peshawar and Quetta. These four RDMC's cover those regions which come under their jurisdiction. These centers serve as a hub for the monitoring,

collection, consolidation and analysis of drought related data from all the possible sources in the country. In order to strengthen the network, 50 Automatic weather stations (AWS) have been installed in different regions, particularly the drought prone areas of the country. The data of eleven meteorological parameters i.e. air temperature, humidity, wind speed, wind direction, dew point, sea level pressure, station level pressure, solar radiations, soil moisture at standard depths (5, 10, 20, 50 ,100)cm and snow level are transmitted through satellite and GPRS technology after 3 hours. So, it has now become easy to access the data of remote areas of the country. NDMC has installed 335 Ordinary Rainguages at districts level in four provinces as shown in figure-1.

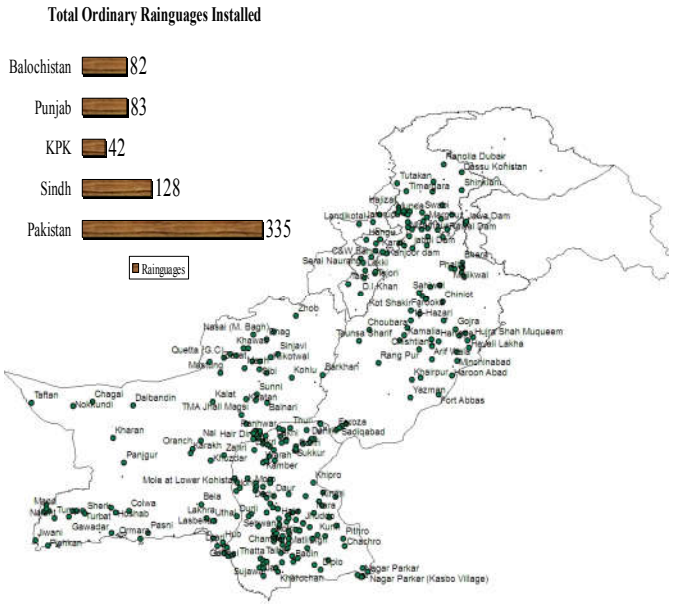


Figure-1 Rain-gauges Network of Pakistan by NDMC

NDMC is monitoring the water level situation of small dams also in Barani areas of the country. NDMC using different indices like Standardized Precipitation Index (SPI), Normalized difference Vegetation Index (NDVI), Cumulative Precipitation Anomaly (CPA), Rainfall Anomaly Index (RAI), Percent of normal, Probability of occurrence, Percentage departure and soil moisture analysis etc to monitor drought. NDMC issues fortnightly drought bulletin of the country. Negotiations are underway with NGO‘s and National Disaster Management Authority (NDMA) for utilization of drought advisories / bulletin to end users.

2. Historical Background

The Indian sub-continent is predominantly characterized by a tropical monsoon climate and entire regime is distinguished mainly by the differences in rainfall both in quantity and distribution. The most important feature is the regional and temporal alteration of atmospheric flow patterns associated with monsoon. There are two rainfall systems operating in the region (a) Southwest or Summer monsoon and (b) Northeast or the Winter monsoon.

Fortunately Pakistan also falls in this region which receive heavy amount of rainfall in summer due to SW monsoon and in winter due to western disturbances. The summer monsoon accounts for 70 to 80% of the annual rainfall over major parts of South Asia (IMD, 2009). In Pakistan, summer monsoon accounts 60 to 70% of the annual rainfall during July to September (Chaudhry, 1992). There is a large variability in the monsoon rainfall on both space and time scales.

Droughts in Pakistan region are mainly due to failures of rains from southwest monsoon. Also there seems to be some association between El Nino and La Nina events and weak monsoons. Pakistan frequently experiences droughts in southern parts of country. The study conducted at National Drought Monitoring Centre (NDMC) of PMD revealed that the province of Sindh and Balochistan are the more vulnerable to drought. The long term data analysis of past sixty years (1951-2010) different intensity (mild to extreme) of drought were experienced in the country i.e. 31 in Sindh,23 in Balochistan,22 in Punjab and 18 in Khyber Pakhtunkhwa. The longest episode of drought was experienced during 1999-2002.The Punjab province experienced the worst droughts in 1899, 1920 and 1935,1969,1987-88, 2000-01, Khyber Pakhtunkhwa (KPK) experienced the worst droughts in 1902 and 1951-1952,1970-71,1987-88,1999-2001, Sindh had its worst droughts in 1871, 1881,1899,1931,1947,1951-52,1958,1966,1969,1972-74, 1987-88, 1999-2001, 2003-04 and 2018 while Balochistan had 1952,1963-64, 1965, 1968, 1970-71, 1983-84, 1987-88, 1999-2002,2004,2006 and 2018. Over more than hundred year's period between 1871-1988, 11 out of 21 drought years were El Nino years. Due to climate change, some years we receive more rains in wet spell and in dry spell we receive less rain. Due to less rain we have drought and heavy rain we have floods (flash flood, urban flood, costal flood and river flood).

3. Rainfall Distribution (April–June) 2021

During the second quarter of the year (April-June) 2021, Slightlynormal (-10.57%) precipitation was observed over Pakistan. During the quarter high temporal and spatial variabilityin

precipitation was observed. Normally May and June are the hottest months in the country,whereas northern areas and south western parts received very less amount of rainfall. However, some convection rainfall lessened the moisture stress in the country along with some gusty winds. The evaporation rate remained very high during this quarter. But during this quarter, amount of rainfall was normal to slightly belownormal as predicted by the Pakistan Meteorological department in seasonal forecast. During Apirl2021, normal (-31.5%) received in Pakistan. It was very much below normal(-47.2%) in Punjab,Gilgit-Baltistan and Azad Jammu Kashmir (-35.0%), Balochistan (-28.0%), Khyber Pakhtunkhwa, (-22.6%) and Sindh (-13.9%). Normal to near normal (3.5%) rainfall was received in country during May, 2021. It was well above normal in Punjab (57.7%) andBalochistan(41.9%), whereasit well below normal in Gilgit-Baltistan and Azad Jammu and Kashmir (-73.5%),Sindh(-31.3%) and Khyber Pakhtunkhwa (-5.0%)

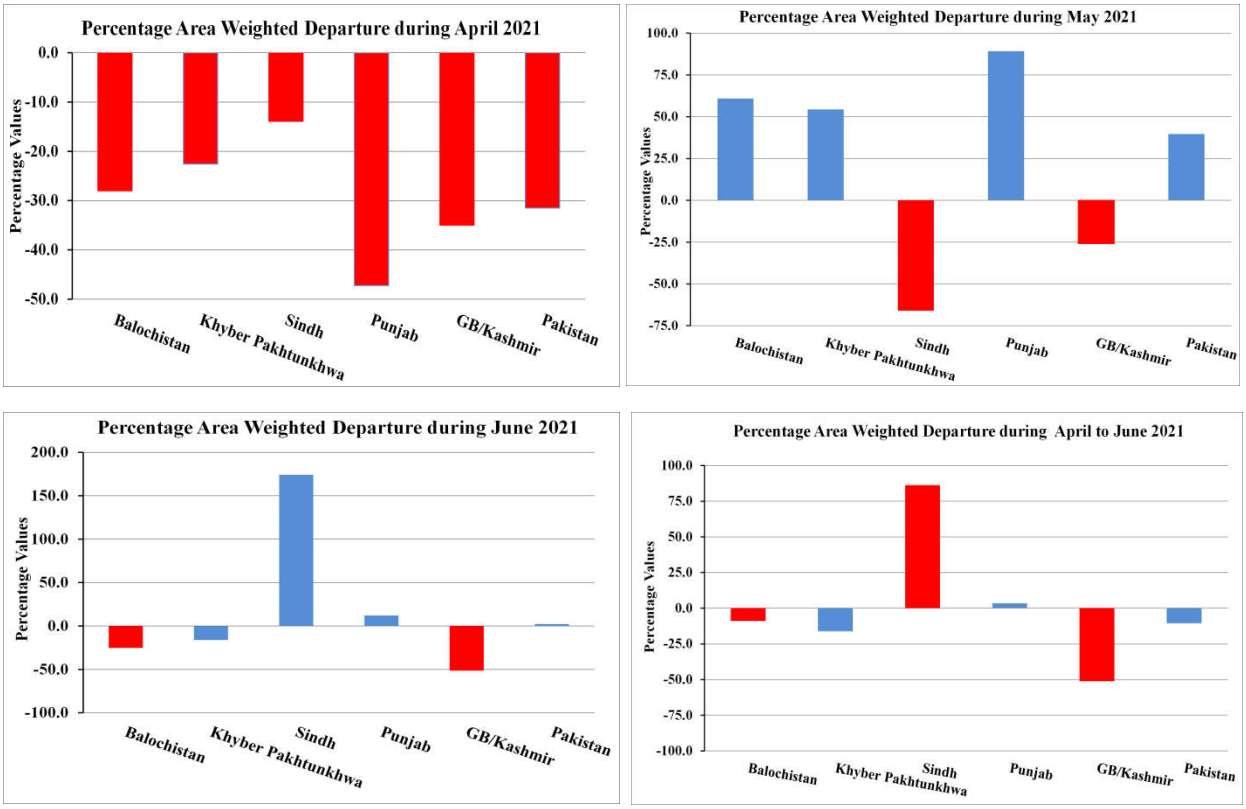


Figure-2 percentage departure of rainfall during (April-June) 2021

During June2021, amount of rainfall wasslightlyabovenormal (2.2%) in country. However, therainfall was very much near normal in the province of Sindh (174.1%) whereas it was slightly above normal in Punjab (12.1%). However, the rainfall was well below normal inGilgit-Baltistan

and Azad Jammu and Kashmir (-51.4%) followed by in Balochistan (-25.2%) and Khyber Pakhtunkhwa (-16.2%). The figure-2 shows the percentage area weighed departure rainfall occurred during (April-June) 2021 for whole region of Pakistan in which the country receivedslightly below normal (-10.6%) rainfall during this quarter. Viewing the rainfall distribution on province basis, highly above-normal rainfall was received over Sindh (86.3%), whereas it was near to normal in Punjab (3.4%). The rainfall was well blow normalGilgit-Baltistan and Azad Jammu and Kashmir (-51.1%), Khyber Pakhtunkhwa (-16.1%) followed byBalochistan (-8.9%) as shown in figure-2. Indian Ocean Dipole (IOD) is in neutral phase whereasneutral El-Nino conditions are also neutral. Spatial distribution of monthly and quarterlyrainfall is shown below in figure-3.

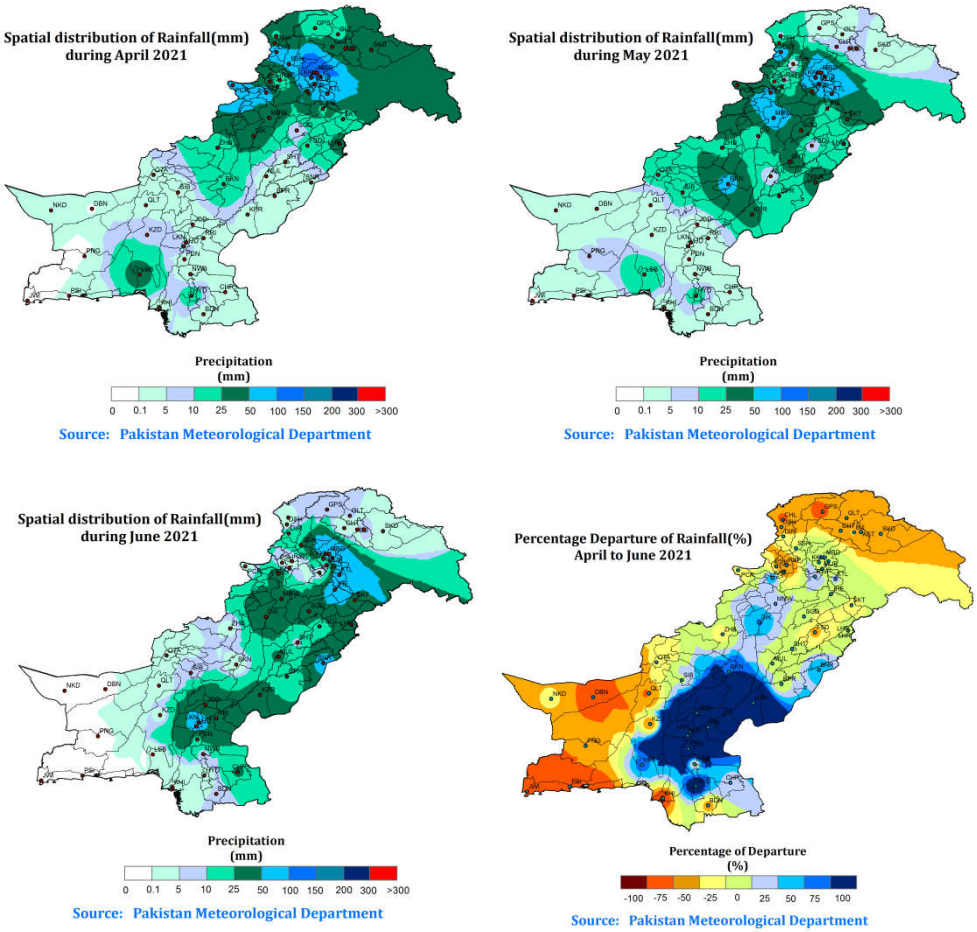


Figure-3 spatial distribution of rainfall during (April-June) 2021 of Pakistan

- **Maximum length of dry Spell**

The dry spell is defined as when the amount of rainfall is less than 1.0mm over an area.

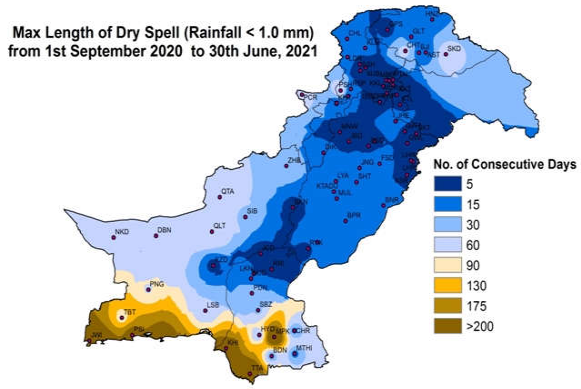


Figure-3b spatial distribution of maximum length of dry spell

- **Monthly Highest Rainfall**

i. April, 2021

April-2021 Rainfall					
Sr.No.	Station	Rainfall(mm)	Sr.No.	Station	Rainfall(mm)
1	Chakothi	161.9	11	Tandali	106.4
2	Haraman	155	12	Brarkot	106
3	Balakot	152	13	Kalam	93.8
4	BandiAbbaspur	143.9	14	Kakul	87.8
5	Kalam	134.6	15	G.Dopatta	85.6
6	Rawalakot	130.02	16	ChattarKalas	81.4
7	Pattan	127.2	17	Kohat	79.02
8	Muzaffarabad Airport	126.6	18	Murree	75
9	Besham	118.3	19	Kotli	75
10	Malamjabba	116	20	Parachinar	71

ii. May 2021

May-2021 Rainfall					
Sr.No.	Station	Rainfall(mm)	Sr.No.	Station	Rainfall(mm)
1	Rawalakot	157.4	11	Garhi Dupatta	72.8
2	Bandi Abbaspur	146.6	12	Chattar Kalas	70.3
3	Malam Jabba	141.0	13	Mianwali Airbase	70.0
4	Chakothi	133.5	14	Kohat Airbase	70.0
5	Saidu Sharif	110.0	15	Panjera	69.8
6	Buner	104.0	16	Kakul	62.7
7	Murree	97.0	17	Brarkot	60.8
8	Tandali	88.5	18	Balakot	60.0
9	Dir	85.6	19	Fort Munro	60.0
10	Hajira	82.2	20	Kotli	58.6

iii. June, 2021

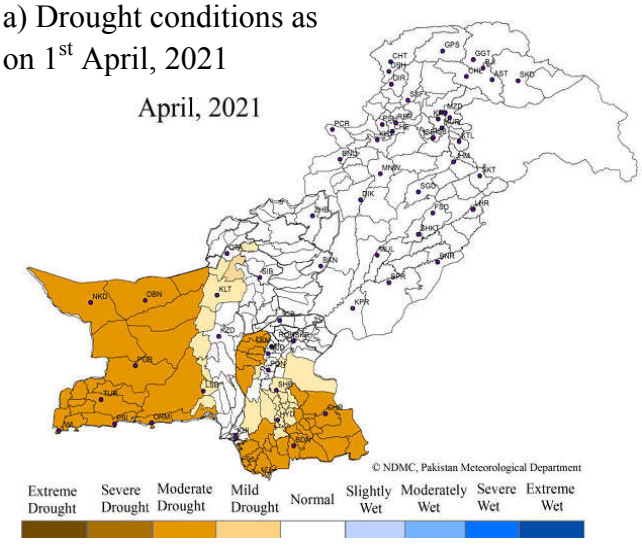
June-2021 Rainfall					
S. No.	**Stations**	**Rainfall (mm)**	**S. No.**	**Stations**	**Rainfall (mm)**
1	Bandi Abbaspur	198.4	11	Barkhan	101.0
2	Chattar Kalas	143.4	12	Barnala	93.0
3	Chaklala (Airbase)	138.6	13	Narowal	91.3
4	Rawalakot	128.8	14	Balakot	91.0
5	Chakothi	125.5	15	Mangla	90.8
6	Kakul	123.0	16	Panjera	90.3
7	Islamabad (Z/P)	122.7	17	Haraman	82.0
8	Murree	112.0	18	Hajira	80.2
9	Mangla	105.7	19	Garhi Dupatta	75.3
10	Fort Munro	104.6	20	Muzaffarabad (A/P)	73.4

4. Drought products

i. Standardized Precipitation Index (SPI)

The Standardized Precipitation Index (SPI) was developed for the purpose of defining and monitoring drought (McKee *et al*., 1993). The SPI calculation for any location is based on a series of accumulated precipitation for a fixed time scale of interest (i.e. 1, 3, 6, 9, 12, months). Positive SPI values indicate greater than median precipitation, and negative values indicate less than median precipitation. Because the SPI is normalized, wetter and drier climates can be represented in the same way, and wet periods can also be monitored using the SPI. Here we are including one month and seasonal maps show the drought conditions of the monsoon season in the country.

a) Drought conditions as on 1st April, 2021



a) Drought conditions as on 30th June, 2021

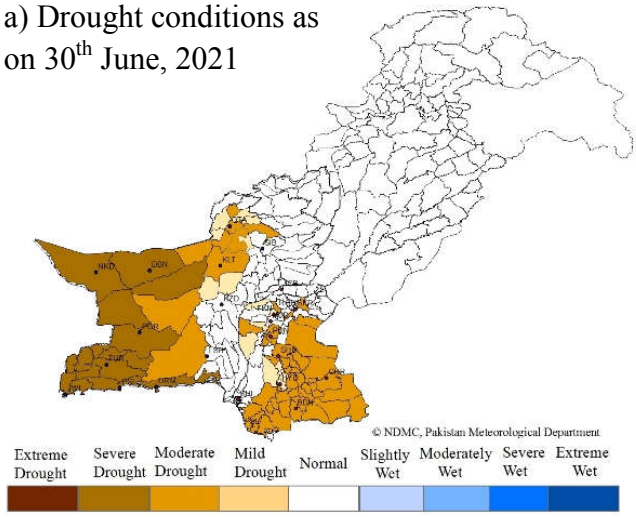


Figure-4 Drought conditions of Pakistan

Due to deficient rainfall, mild to moderate drought conditions emerged in lower Sindh,whereas the moderate to severe drought was experienced in southern half of Balochistan especially the south western areas of Balochistan. Moreover, appreciable amounts of rainfall has been recorded over agricultural plains of the country, therefore the water requirement is satisfactory.

ii. Cumulative Precipitation Anomaly (CPA)

Westerly rain bearing systems remained active over Pakistan with the decreasing frequency of occurrence as compared to the peak winter months. The northern parts of the country will be

mainly influenced by these weather systems and frequency of precipitation days would be greater in these areas as compared to other parts of the country. Some precipitation associated with thunderstorm/ hailstorm is also expected due to local weather developments in the northern parts.

During April to June 2021, it was observed that Cumulative Precipitation Anomaly was negative e in southern west Balochistan, southern Sindh and upper KP regions. Even the day time temperature and evapotranspiration were higher as compare to the previous quarter yet the conditions are satisfactory, however moisture stress has been observed especially in lower and central regions of the country. While the barani areas of KPK and Gilgit Baltistan were also under moisture stress.

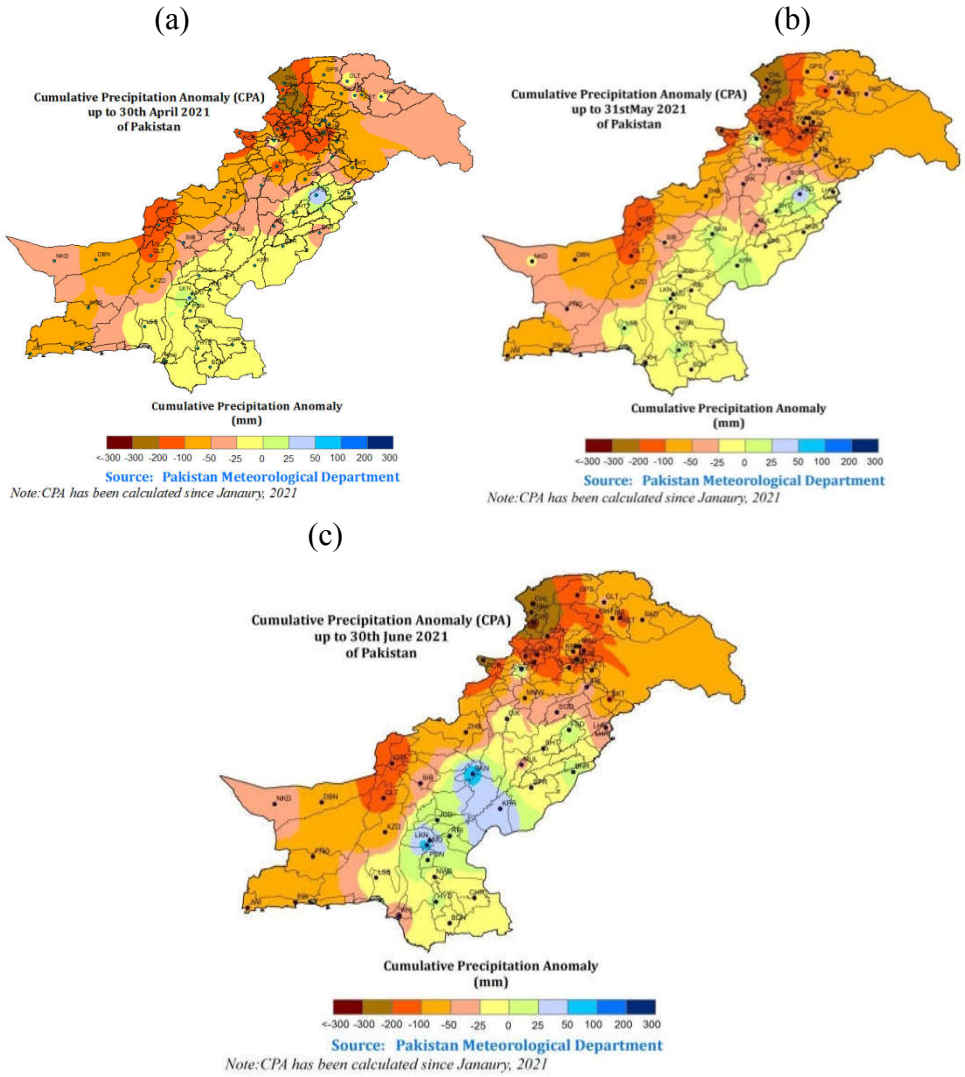


Figure-5 Cumulative precipitation anomaly during (April-June) 2021 of Pakistan

iii. Soil Moisture Anomaly (SMA)

Significant moisture stress was observed in most of the drought prones areas of the country. The central and western regions of Balochistan have shown some stress due to low amount of rainfall and prevailing drought conditons in these areas (figure-6). However, the soil moisture conditions in rest of the country is satisfactory. It was predicted that rainfall will be below normal in April-June 2021 due to which soil moisture stress may be increased especially in the southern parts of the country. It is predicted that the normal to near normal monsoon rainfall 2021 is expected in the country especially in the northeastern and south eastern parts.

(a) (b)

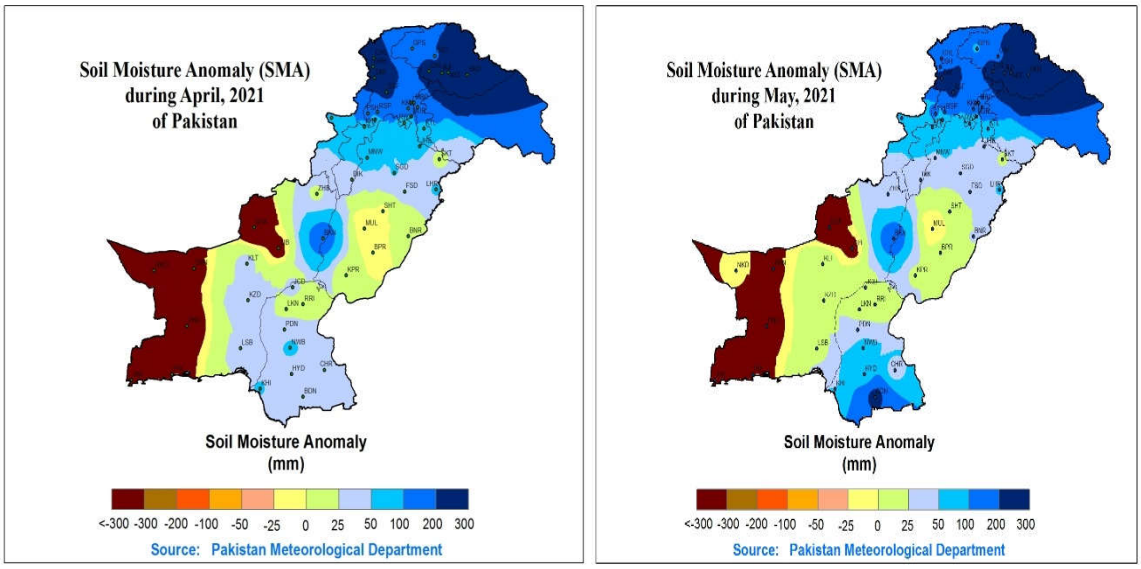


Figure-6 soil moisture anomaly during (April-May) 2021of Pakistan

iv. Water Level of Reservoirs

Pakistan has two main reservoirs of water in the form of dams i.e. Tarbela and Mangla. The dead level of Tarbela is 1378feet while maximum conservation level is 1550feet whereas Mangla has dead level of 1040feet and maximum conservation level of 1242 feet. Pre-monsoon rains, along with the snow melting play an important role to water levels of dams. In addition, small dams in various parts of the country were also filled that would help boost agriculture and improve socio-economic activities in the country. The water level (%) of Mangla dam is below than the average value especially May and June. However, the dams situation will be increased and significantly

improved due to incursion of monsoon season during July. Percentage of average water level during April to June 2021 was calculated for both dams are shown below in figure -7.

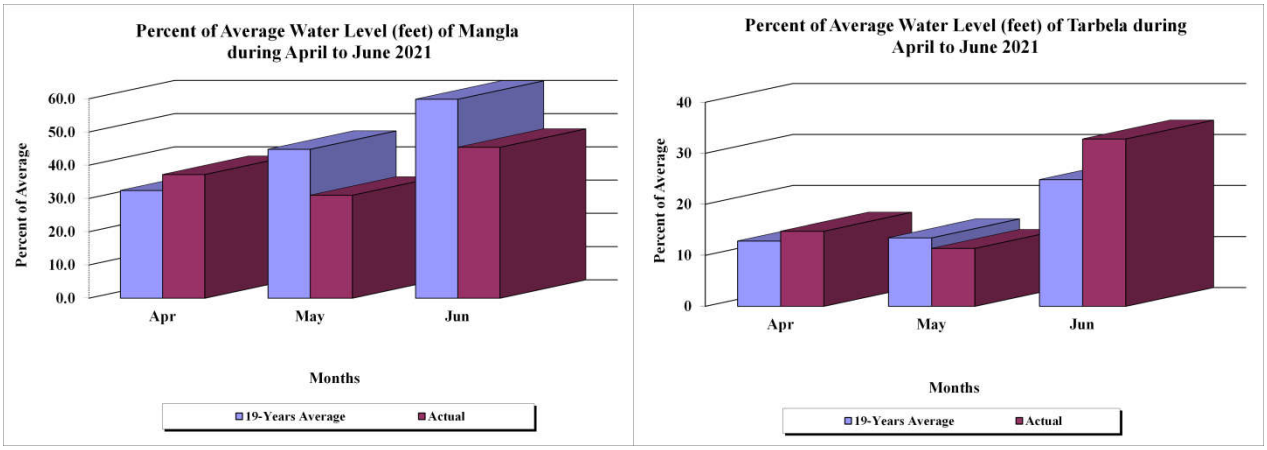


Figure-7 percent of water level of Tarbela and Mangla during (April-June) 2021

5. Agriculture

Agriculture is main livelihood of about 70% population of the country. Due to direct relationship between agriculture and water scarcity/drought, drought mapping data is of vital importance. Efforts are being made to inform farmers of drought information in a timely fashion for better utilization of data.

5.1 Crop Condition:April-2021

The rabi season at the end of April, was half way through in Punjab, Upper Sindh, Balochistan and Southern KP.The harvesting observed in most parts of these areas by mid-May. The harvesting in Peshawar valley and northern areas generally extends upto June and beyond.

- **Wheat Crop**

Wheat crop condition was satisfactory in irrigated areas. However, in rainfed areas less rains during early season of crop growth caused stress to wheat crop. Wheat harvesting operations were started in most parts of Punjab and Sindh. In Khyber Pakhtunkhwa, the harvesting starts by start of May in southern parts and continues up to June in the northern parts. Following were key features of wheat crop:

Key Factors for Wheat 2020-21

Positive Factors: a) Timely sowing of wheat crop due to early termination of Kharif crops particularly cotton. b) Better irrigation water supply in areas of Indus Command, Khyber Pakhtunkhwa and Balochistan. c) Increase in area sown under wheat crop. d) Significant increase in Minimum Support Price (MSP) of wheat.

Negative Factors: a) Less rains during early crop season especially in rainfed areas. b) Shortage of irrigation water supply in some areas of Chenab – Mangla. Command and Sindh during November to January. c) Decrease in DAP off-take during October-November. d) Higher prices of DAP than last year. e) Hailstorm / rains in Multan division during third week of March causing. damage to wheat production on limited scale.

- **Maize crop**

Two crops of Maize are grown in Pakistan viz. autumn crop during June to August and spring crop during February to March. Spring maize was at silking stage during April in major growing districts of Punjab. These districts include Sahiwal, Okara, Pakpattan, Chiniot, Sialkot and Kasur. The crop is gaining popularity in adjoining districts of Khanewal, Vehari, Multan and Jhang. The abundant rainfall during early period proved highly beneficial for the crop. The crop will be harvested in June.

5.2 Crop Situation: May, 2021

The spring maize crop is at cobbing stage after completing tasseling and silking stages and would be harvested in early June. The February-March sown sugarcane crop is at suckering stage and the September sown crop is at prime stage of rapid growth. Early sown cotton in Punjab and Sindh is at flowering stage. However major sowing of the cotton area was carried during April-May in Sindh. The large areas of cotton were sown during May and the operation will continue further during early June. The major activity during early May was harvesting of wheat crop.

- **Spring Maize Crop**

Spring maize crop is mainly grown in Punjab. There are two cropping seasons of maize crop viz. autumn and spring. The crop is irrigated in Central Punjab and generally sown under upland system in other areas. Spring maize is generally confined to Central Punjab/PindDadan Khan

Tehsil of Jhelum on the right bank of the river. This crop is sown in February-March and harvested up-to June. The main growing districts include Okara, Pakpattan, Sahiwal, Faisalabad, Chiniot, Kasur, Jhelum and others. The crop completed tasseling and silking stages in April-Early May. The crop was at grain filling and maturity stage toward the end of May.Crop is at grain formation stage and will be harvested in early June.

- **Cotton Crop**

Cotton crop is at sowing and flowering stage depending upon sowing time, area and varietal characteristics. Late wheat harvesting particularly in southern Punjab, has caused one to two weeks delay in cotton sowing operations from the normal time frame.The optimal sowing time for cotton inSindh is form April to Mid-May while in Punjab, it is from May to mid of June.The field information indicate that about8-10 percent of the cotton crop is sownearly during the months of February andMarch in both these provinces. Howeverthe farmers draw out the sowing time lineson either side, both early and late tomatch the thinly spread irrigation watersupply.The sowing of early cotton starts in February in Punjab. This situation has been corroborated to combat the attack of cotton leaf curl virus. The main crop is sown in March-May in Sindh and May-June in Punjab.

Textile industry is the top most export industry of the country with cotton being the raw material. Government is making all out efforts to support export industries to sustain economy of the country. These efforts will only be fruitful if raw material is indigenous particularly the cotton for textile industry. Due to substandard inputs particularly the seed and pesticides, cotton production is badly affected in last few years which discouraged cotton growers not to sow cotton crop. As a result, cotton area and production is gradually decreasing from last few years.

- **Sugarcane Crop**

Sugarcane crop is at vegetative growth stage. Crop growth is generally satisfactory. Crop yield is expected to be better than lastyear mainly due to better irrigation water supplies as compared to last year.In Sindh, 75 percent of sugarcane crop area was sown in September 2018 while the rest of the area was sown during February and March 2021. In most parts of Punjab and KP sugarcane wassown during February and March, 2021. Crop is at healthy growth stage in most parts of the country due to sufficient water availability.

- **Rice Crop**

Nursery sowing operations were in progress after 20th May particularly for IRRI varieties. In the start of current Kharif season (April-May), water availability is less than last year. This may increases the use of ground water increasing cost of production to meet crop water requirement. Coarse rice transplantation is in progress. IRRI and Basmati varieties however were at nursery sowing stage after 10thMay andnormally transplanted during June / July.The rice crop is still at nurserystage in most parts of the country. By endof May, Basmati rice in North eastern regionof Punjab was at nursery plantationstage and are required to be sown after 20th May by a legislation aiming at breaking life cycle of rice borer by eliminating the host plants.

5.3 Crop Situation: June, 2021

The growth of Kharif seasoncrops i.e sugarcane and cottonare progressing during themonth of June. Sugarcanecrop is at early growth stage. The cottoncrop is at boll formation stage in Sindhand in some limited areas of Punjab,where crop was sown during February &March. The Cotton crop in major areasof Punjab is however at flowering stage. Farmers in Khanewal and Vehari substituted part of the area by planting spring maize crop and in Muzaffargarh, the short duration Mungbean crop was sown in areas stretching along the River Chenab to assure resilience in any likelihood of flooding

Kharif Crops

- **Maize Crop**

Spring maize crop is mainly grown in Punjab. There are two cropping seasons of maize viz. autumn and spring. The crop is irrigated in Central Punjab and generally sown under upland system in other areas. The main growing districts include Okara, Pakpattan, Sahiwal, Faisalabad, Chiniot, Kasur and Jhelum. This crop is sown in February-March and harvested by June. Harvesting of spring maize in Sahiwal division took place during June and almost completed except the late sown maize during April, which will be harvested in first decade of July.

- **Cotton Crop**

Cotton crop is a perennial plant with an indeterminate growth habit which has no distinct stage between vegetative and itsreproductive stage. This characteristic makes cotton picking a multi-stage picking phenomenon. It has a very dynamic growthresponse to environment and management. Site-specific management strategies need to be taken into consideration to

optimizeyields. Furthermore, management strategies should be flexible to allow for changing environmental conditions. Cotton has oneof complex insect pest and disease problem in main growing areas of Punjab and Sindh. Most common are CLCV, bollworms,dusky cotton bug, whitefly thrips, armyworm, jassids and others. Cotton in Sindh is promising this year and has reached the blooming stage. A few Ginning factories have started operation bymid of June based on small scale cotton picking. It is expected that cotton production will be on higher side, if crop acreage andcrop growth is not affected by rains/river floods later in the season.

5 District wise impact of drought

1st Drought Alert: 2nd April 2021

The country overall received below normal **(-41.5%)** rainfall during (Oct-20 to Mar-21). The main thrust was in Balochistan **(-74.5%)** andSindh **(-77.3%)** while it remained above normal during November throughout the country. The west to the south-west districts of Balochistan are winter (Dec-Mar) rainfall dominant and do not receive rainfall during April to November. Due to deficient of pre-winter and winter rainfall, a moderate drought like condition has emerged in the southern parts of Balochistan and Sindh. The moderate drought is prevailing in districts of Balochistan (**Chagi, Gawadar, Harnai, Kech, Kharan, Mastung, Nushki, Pishin, Panjgur and Washuk)** and Sindh **(Badin, Qambar Shahdadkot, Mirpur Khas, Umerkot, Sanghar, Tharparkar, Thatta and Sajwal)**. The climatological normal shows that the Sindh province remains dry during October to May, and moderate drought prevailed during these months.

2nd Drought Alert: 3rd June 2021

The country overall received below normal **(-36.1%)** rainfall during (Oct-20 to May-21). The main thrust was in Sindh **(-64.5%)** and Balochistan **(-59.5%)** and while it remained above normal during November throughout the country. The drought affected districts are enlisted below;

S.No.	Sindh		Balochistan	
	Severe	**Moderate**	**Severe**	**Moderate**
1	Badin	Dadu	Chagi	Harnai
2	Mirpur Khas	Khairpur	Gawadar	Mastung
3	Umerkot	Karachi	Kharan	Nushki
4	Sanghar	Larkana	Kech	Pishin,
5	Tharparkar	Neushero Feroz	Panjgur	Kalat
6	Thatta	Shaheed Benazirabad	Washuk	Quetta
7	Sajawal	Sukkur		

6 Government reactions to drought

Due to below normal rainfall, drought conditions have emerged in the southern half of the country especially in Sindh and Balochistan Province. The water availability in major reservoirs is not sufficient due to below normal snowfall in the catchments areas, water situation in the dams is not satisfactory. The provincial government as well as UN-WFP and other agencies have already started interverntion in the drought prone districts of Sindh and Balochistan.

Keeping in view the climatology and current seasonal forecast of PMD for these areas, drought conditions may further exacerbate and affect the agriculture and live stocks. It is advised to all stakeholders to take pre-emptive measures for disaster prone districts. Farmers/agriculturists are advised to keep themselves updated from PMD website http://www.pmd.gov.pk.

7 Kharif season forecast of Mangla and Tarbela Dams (2021)

The predicted water availability forecast (MAF) forecast in two big reservoirs i.e. Tarbela and Mangle during Kharif season (April-September) 2021 is shown in figure 8.

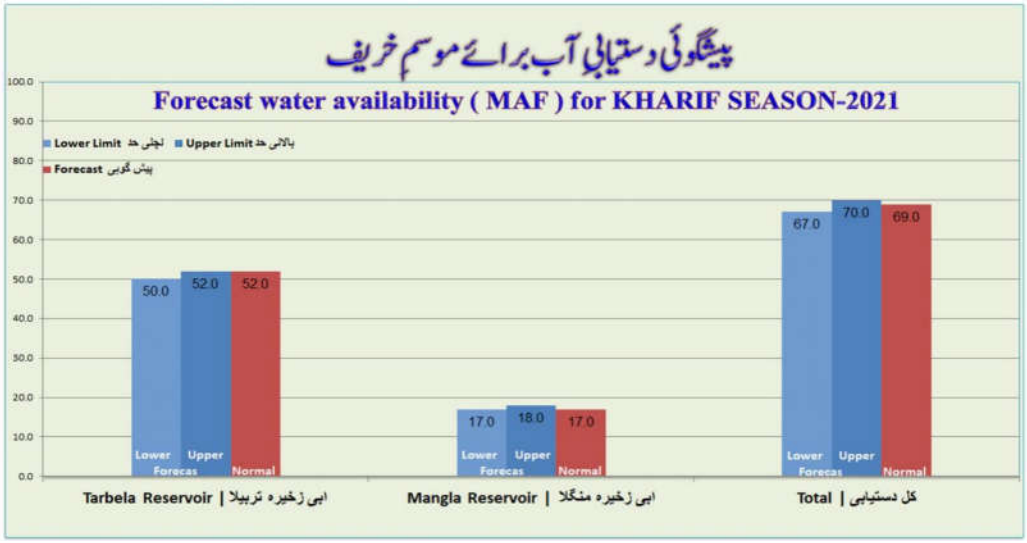


Figure 8: Forecasted water volume (MAF) for Kharif Season 2021 in Tarbela and Mangla dams.

8 Recommendations

Natural disaster could not be stopped. Each disaster gives us a lesson to do better planning, management and taking some precautionary measures to minimize its impacts in future. Following are some recommendations to cope with the floods and droughts in Pakistan

- Pakistan dam's water storage capacity is much less than the neighbouring countries like India. Therefore it is the need of the hour to build large and small dams to manage the floods and storage of the water.

- The stored water will protect food security especially fulfill the water requirements of crops during drought period in the country.

- The water will also be helpful in generating hydropower electricity which is essential requirement of country and reduce the unemployment in the country.

9 Acknowledgement

National Drought Monitoring Centre, Pakistan Meteorological Department, Islamabad acknowledges SUPARCO and district office agricultural departments for sharing the information.

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