Drought in Iran, Afghanistan, Turkmenistan, Uzbekistan, Pakistan - May 2021 - JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) - 27/05/2021



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Executive summary

- A large region across Central and Western Asia is under drought conditions, including most
 of Iran, parts of Afghanistan, Uzbekistan, Pakistan and Turkmenistan, with impacts of
 different severity depending on the area and local magnitude of the event. In general, safe
 and sufficient water supply, agriculture and electrical power are at stake, while food
 security and households' income are also at risk in the most vulnerable areas (e.g.
 Afghanistan, south-west Pakistan).
- The drought originates primarily from below average precipitation during the winter 2020/2021 and the following spring, further fuelled by higher-than-average temperatures during the same period. Ground waters are already strained by frequent droughts and unsustainable abstraction, thus offering little buffering against prolonged dry meteorological conditions.
- According to the long-term records, the whole area receives no meaningful precipitation between June and October, with very limited variability around this figure. Therefore, accumulated deficit up until May 2021 will persist to the end of the year, entailing a possible worsening and propagation of drought impacts everywhere in the region, during the incoming months.

Risk of drought impact for agriculture (RDrI-Agri)

The RDrI-Agri indicator shows the risk of having impacts from a drought, by taking into account the exposure and socio-economic vulnerability of the area, with particular focus to the agricultural impacts.

Drought risk is detected at different levels over a large area, covering most of Iran and parts of Turkmenistan, Afghanistan and Uzbekistan. Drought conditions extend westward over Iraq

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and Syria too¹, as well as in western Pakistan. Figure 1 shows the indicator at the beginning of May, with the risk at its highest and unmitigated by later May rainfall. Risk emerged early in 2021, after scant winter precipitation (Figure 2). The bordering zone of Iran, Afghanistan and Turkmenistan shows the highest risk, as a combination of bio-physical drought conditions and vulnerability of the population exposed.

Turkmenistan and Uzbekistan are not affected by food insecurity, but a significant part of their population is employed in agriculture, and thus affected directly by climate woes.². Most of agricultural land there benefits from irrigation systems, which is fundamental for the viability of crops in a naturally dry climate. However, water resources are strained in both countries, with water quality and security primary issues. Livestock on rangelands are chronically exposed to drought, forcing farmers to move constantly and widely in search of sufficient animal feed. South-east Turkmenistan (Mari region) is the most populated and amongst those most at risk, with about 1,5 million people living within a medium to high drought risk area.

Decades of conflicts have made Afghanistan one of the most vulnerable countries in the world with respect to any hazards, including drought³. The lack of coping capacity of rural population makes humanitarian aid necessary for any climatic downturns. The north-west areas are for the most semi-arid or arid and rely heavily on melted snow flowing from the mountains for the majority of their water resources. Indeed, Afghanistan is rich of water in the east, but only a fraction of the resource is accessible to farmers in the west, where most people rely on subsistence farming and animal husbandry. Under current conditions, more than three million Afghans are exposed to high risk of impact from drought, but many more to a lesser degree across the whole country (10 to 16 millions).

The Iranian climate is mostly arid or semi-arid and is heavily affected by depleting water resources, as a consequence of growth in demand, salinization, ground waters overexploitation and increasing drought frequency⁴. The country, where groundwater is the main water source, has a long-standing issue with the inefficiency of its water distribution network, particularly in the agricultural sector. Despite not suffering from food insecurity, Iran faces paramount challenges in safeguarding sustainable water access at every dry spell and in the long-term. All sectors relying on water are exposed, from agriculture to power production and public water supply. Currently, from 2 to 20 million people are under high to medium risk of impacts

Global Drought Observatory: http://edo.jrc.ec.europa.eu/gdo

¹ https://edo.jrc.ec.europa.eu/documents/news/GDODroughtNews202104_Syria_Iraq.pdf

² A detailed analysis of drought issues in Central Asian countries is available from FAO at http://www.fao.org/documents/card/en/c/d2da11f3-4d0c-4f30-ab8d-fe6a0cd348ab/

³ https://drmkc.jrc.ec.europa.eu/inform-index/Portals/0/InfoRM/CountryProfiles/AFG.pdf

⁴ Cfr. Ashraf, S., Nazemi, A. & AghaKouchak, A. Anthropogenic drought dominates groundwater depletion in Iran. *Sci Rep* **11**, 9135 (2021). https://doi.org/10.1038/s41598-021-88522-y and Ashraf, S., AghaKouchak, A., Nazemi, A. *et al.* Compounding effects of human activities and climatic changes on surface water availability in Iran. *Climatic Change* **152**, 379–391 (2019). https://doi.org/10.1007/s10584-018-2336-6

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from drought. On top of poor precipitation during the 2020-2021 winter, warm temperatures have caused more snow to melt, thus reducing the water storage that becomes available later during the drier months (i.e. late spring and summer).

The Pakistani region of Balochistan is facing drought conditions as well, a naturally dry area (<200 mm/year rainfall) sparsely populated, whose inhabitants rely on livestock and are constantly exposed to food and water insecurity. In fact, conditions are such that a single poor rainfall season may jeopardize households' income and access to food and safe water.

Central and western Asian countries in general face risk of conflicts because of water, due to its scarcity and the transboundary nature of the most important rivers.

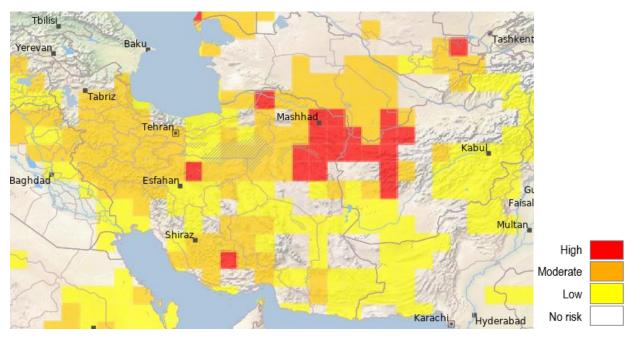


Figure 1: Risk of drought impact for agriculture (RDrI-Agri), from 1st of May until 11th May 2021.

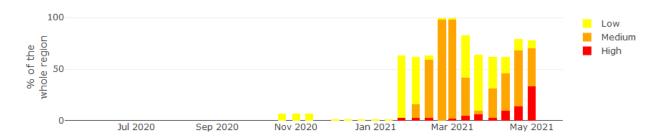


Figure 2: Risk of drought impact (RDrI-Agri), evolution over time in Khorasan (Iran).

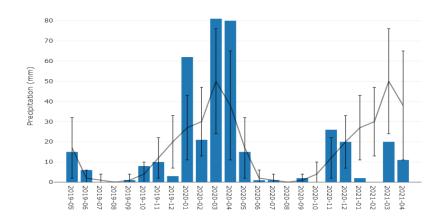
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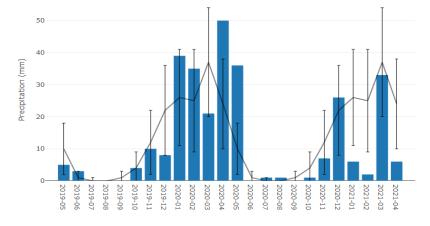
Precipitation

Precipitation includes total monthly of both rainfall and snow. The precipitation patterns differ across the large area under analysis (Figure 3). However, in the long-term data, almost everywhere a clear annual peak can be identified between December and April, as opposed to a summer low. This unimodal pattern is useful to characterize the deficit and its potential duration into the drier months. With the exceptions of south-west Iran and eastern Afghanistan, the climate is dry or arid over the whole region and displays strong fluctuations around the average from year to year.

After a normal or even wet autumn (November and December 2020), scant precipitation followed from January to April 2021, reaching less than half of the normal overall, with some months not recording any meaningful precipitation at all. The cumulative deficit since September 2020 is about 50% of the average over the country corners between Iran, Turkmenistan and Afghanistan (Figure 3a, 3b), 70% for south-western Iran (Shiraz area, Figure 3c), 60% over western Pakistan (Balochistan, Figure 3d). Similar records are found for other areas (see SPI section below).



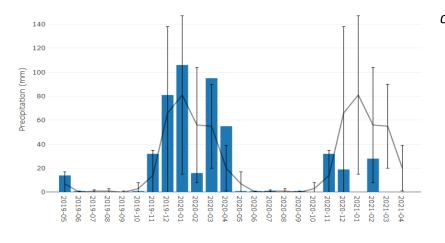
a) Western Iran (Khorasan, 60.1 E, 35.5 N)



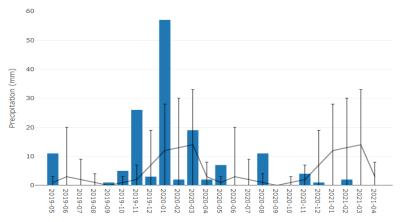
b) South-east Turkmenistan (63.3 E, 37.5 N)

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c) Shiraz (Iran, 53.3 E, 29.3N)



d) Balochistan (Pakistan, 63.2 E, 28.6 N)

Figure 3: Monthly total precipitation in four selected locations, with the long-term monthly averages (1981-2010) and standard deviation.

Standardized Precipitation Index (SPI)

The SPI indicator is used to monitor the occurrence of meteorological drought. The lower (i.e. more negative) the SPI, the more intense is the drought.

Figure 4 shows SPI at different time intervals. On top-left, the areas with the strongest deficit over the whole year (SPI-12), falling almost entirely within Iran, plus fringes of Turkmenistan and south-west of Afghan capital Kabul. These regions are of particular concern, since it is likely that the deficit will extend for at least another semester with consequences on both surface and ground waters.

SPI from November 2020 to April 2021 (SPI-6, figure 4, top-right) is the most significant to analyze the main driver of current drought, encompassing all the key months for precipitation over the whole area under analysis. The deficit is relevant across a wide belt ranging from the

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Persian Gulf up to central Asia. Despite the different amounts of precipitation at the two extremes, the pattern is similar, as well as the underperforming streak of precipitation month after month.

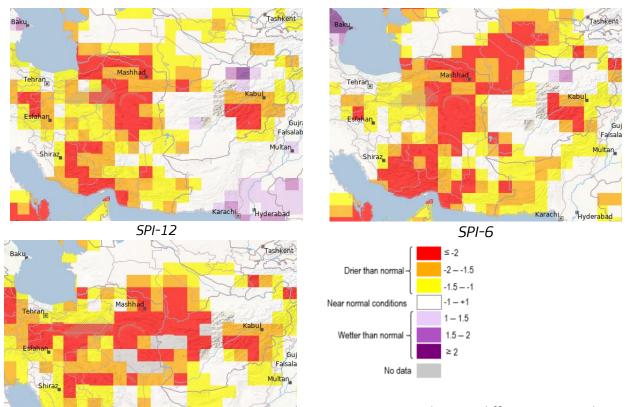


Figure 4: SPI values at different accumulation periods for April 2021.

Finally, SPI at 3 months (SPI-3, figure 4, bottom-left), highlights where precipitation failed in recent months: Iran, western Afghanistan and southern Turkmenistan. It is worth noting that water supply in these areas is supported by rivers flowing from the Hindu-Kush range at the centre and east of Afghanistan, where the peak of precipitation is slightly later and where snow plays a key role in water reserves replenishment and downstream flow. The eastern half of Iran seems particularly affected by short-term meteorological drought, reaching rare values of minus 3 and lower.

Hyderabad

Overall, it is striking the similarity of the three maps, despite the different periods, suggesting that the extremely scarce precipitation at the beginning 2021 dragged the longer period SPI down with it. Indeed, none of the time series for the locations analysed display long-lasting

SPI-3

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anomalies for the previous months (e.g. figure 5). Western Afghanistan is different, as the deficit did not affect the precipitation balance from the previous year.

Since December 2020, western Pakistan recorded below average rainfall too, despite its already naturally arid climate and low expectations for rainfall. The wide inter-annual fluctuations around the average partly hide a potential condition of higher severity on the ground.

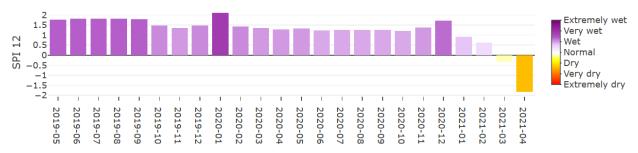


Figure 5: SPI for a cumulative period of 12 months in Khorasan (Iran, coordinates: 35.4 N, 60.6 E).

The period from June to October is extremely dry in the whole area, hence the mid-range forecast of precipitation anomaly do not provide useful information to understand the development of the drought. However, accumulated precipitation deficits up until May 2021 will persist throughout the summer and until October at least. In addition to the high temperatures typical of the period, conditions on the ground may worsen and turn into a full-scale hydrological drought.

fAPAR anomaly

The fraction of Absorbed Photosynthetically Active Radiation (fAPAR) represents the fraction of the solar energy absorbed by leaves. fAPAR anomalies, specifically the negative deviations from the long-term average over the same period, are a good indicator of drought impacts on vegetation. fAPAR negative anomalies emerged at the beginning of March 2021 in the south of Turkmenistan and Uzbekistan and became significant in mid-March (Figure 6, top). Normal or positive conditions still prevailed elsewhere. In mid-May 2021, marked fAPAR anomaly was detected in western Afghanistan and north-east Iran, while extending up to Uzbekistan at a milder magnitude (Figure 6, bottom).

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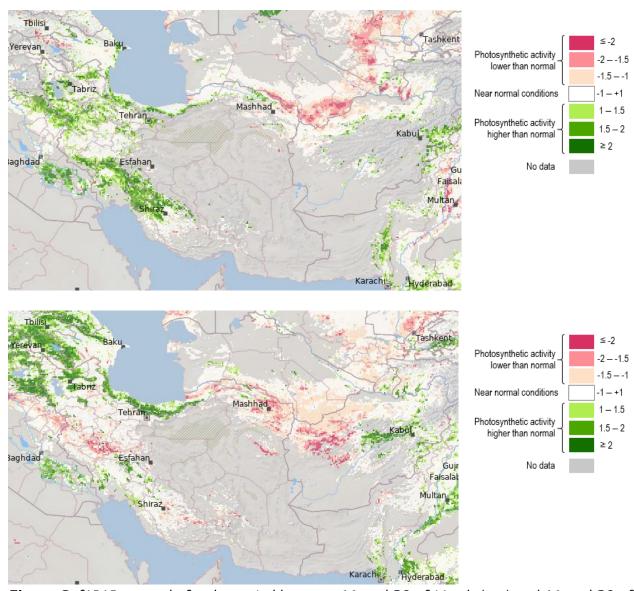


Figure 6: fAPAR anomaly for the period between 11 and 20 of March (top) and 11 and 20 of May 2021 (bottom).

In the map, the surrounding grey areas host primarily rangelands with sparse vegetation, for which it is not possible to trace reliably the photosynthetic activity. While classified as no-data, these areas may hide similar stress conditions for the existing vegetation, often important for livestock grazing. Despite below-average precipitation in recent times, the west of Iran displays positive anomalies, albeit receding from the peak of February into normal conditions, but not entering the range of negative anomaly yet. A similar evolution is observed south of Kabul, Afghanistan. This may be due to higher than average temperatures that favoured

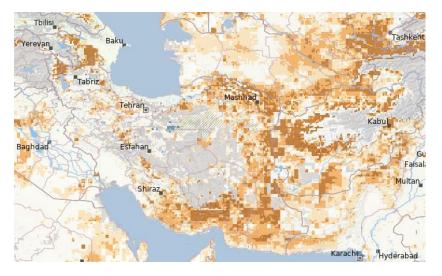
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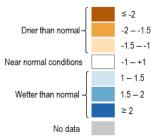


earlier vegetation growth in the area⁵. Further data are needed to determine correctly whether the current trajectory is turning into widespread vegetation stress.

Soil moisture anomaly

The aim of this indicator is to provide an assessment of the top soil water content, which is a direct measure of drought conditions, specifically the difficulty for plants to extract water from the soil. According to Figure 7, widespread and strong negative anomalies developed during February 2021, eased during March and worsened again during April and May. The south-east of Turkmenistan and Uzbekistan did not benefit from any meaningful rebound during March. In stark contrast with fAPAR anomaly, current soil moisture is much drier than normal in western Iran, while it appears relatively normal in the east. Almost near-normal conditions are found in the south of Iran and neighbouring Pakistan (Balochistan), with the prominent exception of Shiraz region (south-west Iran), where dryness is persisting. In Afghanistan, negative soil moisture conditions are present north of the Helmand river, crossing the centre of the country, with a patchy pattern. The latter is much more limited than the strong and large anomalies detected earlier in the west. In general, it seems that March precipitation benefitted soil moisture very rapidly across the bordering zone between Iran and Afghanistan. Whether such improvement is enough to deflect severe drought for the months ahead will be clearer by early June, at beginning of the dry summer.





⁵ https://climate.copernicus.eu/surface-air-temperature-february-2021

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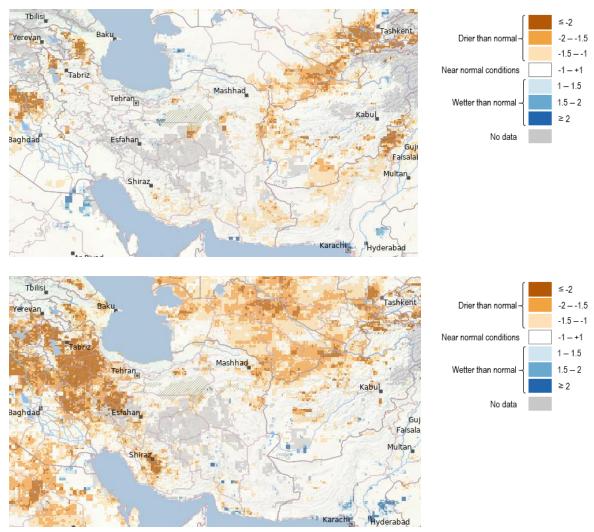


Figure 7: Soil moisture anomaly in early February 2021 (top), end of March (middle), early May (bottom).

Regarding groundwater, measured with the Total Water Storage (TWS) indicator, as of February 2021 it stood well below the average from the reference period, in all the areas currently affected by drought (Figure 8). This suggests a longer-term problem with the lack of precipitation, further reducing the chances of quick recovery after any drought or dry spell.

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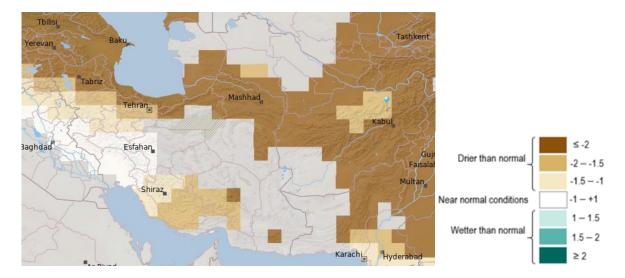


Figure 8: GRACE Total Water Storage (TWS) Anomaly during February 2021 (reference period: 2002-2017).

Reported impacts

Drought is affecting agriculture production in North-western **Afghanistan**⁶ ⁷, confirming a situation foreseen earlier in the season⁸ ⁹. According to the same sources, the severity of impacts of depends on irrigation facilities and is expected to affect mainly spring and summer crops, to be sown in May. Nevertheless, the north-west provinces present impacts on winter cereals too.

A generalized increase of grain prices compared to the previous year and the average of years 2018-2019 was reported in April¹⁰, particularly in Maimana, the reference market for the drought-affected provinces of north-west Afghanistan.

The shortage of animal feed induced by drought drives up its price, a critical situation for farmers that risk losing their livestock and income without compensations. Humanitarian help is therefore needed, and international aid was already dispatched to prevent food insecurity for hundreds of thousands citizens¹¹.

According to the latest IPC report 12 published in April, nearly 11 million people in Afghanistan (~29% of the population) are experiencing high levels of acute food insecurity (IPC Phase 3 or

⁶ https://mars.jrc.ec.europa.eu/asap/country.php?cntry=1

⁷ https://paihwok.com/2021/05/14/drought-affects-samangan-livestock-farmers/

⁸ https://reliefweb.int/disaster/dr-2021-000022-afg

⁹ https://media.ifrc.org/ifrc/press-release/afghanistan-13-million-lack-food-as-drought-crisis-bites/

¹⁰ https://fews.net/central-asia/afghanistan/price-bulletin/april-2021

¹¹ https://reliefweb.int/report/afghanistan/un-humanitarian-emergency-funding-support-fao-preventing-livestock-losses

¹² http://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC_Afghanistan_AcuteFoodInsec_2021MarchNov_report.pdf

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above) due to conflict, COVID-19, high food prices and rampant unemployment, between March and May 2021 (the lean season in most parts of the country). This includes around 7.8 million people in Crisis (IPC Phase 3) and 3.2 million people in Emergency (IPC Phase 4). The drought is likely to impact water available for irrigation of first and second crops in 2021, limiting food availability compared to average years.

Impact of drought in **Turkmenistan** widespread underperforming yield in winter cereals¹³. A similar situation is depicted also for **Uzbekistan** and in particular for its western provinces, where the impact of drought is coupled to that of a cold wave lasted from mid November 2020 to the first dekad of January 2021¹⁴.

In **Iran**, unfavourable conditions for agriculture are currently observed¹⁵. The crisis Management Organization proposed 3.2 trillion rials (about 623 million €) to finance credit to compensate for the drought damages and for water shortage management, with a priority given to the supply of fresh water in urban areas¹⁶. The Iranian Red Crescent Society (IRCS) launched a water donation national campaign, to collect funds to ease water stress in Sistan-Baluchestan, South Khorasan, Kerman, and Hormozgan provinces, financing both structural water supply interventions (e.g. desalination, rehabilitation of ancient qanat systems, improvement of wells and water quality, filtering and sanitation of reservoirs) and health services¹⁷. The drought is intensifying the rate of depletion of Iran's groundwater reserves, mainly in highly irrigated and populated regions in northwest, west and northeast of the country, where water demand drastically exceeds natural renewable water supply. Reportedly, water shortages are affecting livelihoods through both the lack of water and power blackouts¹⁸. The situation is exacerbated by the additional pressure from the international sanctions on Iran and by the impact of COVID-19 pandemic on the economy of Iran.

In **Pakistan**, the drought-affected regions of western Balochistan did not improve since April, continuing a long-lasting dry spell. Farmers were advised to irrigate the fields for the Kharif crops to prevent the forecasted lack of rain¹⁹. Balochistan, together with Sindh, is the province in Pakistan with the highest prevalence of food insecurity, malnutrition and poverty. The primary source of income of 85% of the population in Balochistan is agriculture. In 2020, the population faced multiple shocks including high food prices, locust outbreaks and heavy monsoon rains/flooding, all exacerbated by the impacts of the COVID-19 pandemic. Around 26

¹³ https://mars.jrc.ec.europa.eu/asap/country.php?cntry=250

¹⁴ https://mars.jrc.ec.europa.eu/asap/country.php?cntry=261

¹⁵ Communication from Relief International through DG-ECHO country desk

¹⁶ https://www.tehrantimes.com/news/460785/Some-766m-proposed-to-drought-management-projects

¹⁷ https://www.tehrantimes.com/news/461053/National-campaign-to-ease-water-stress-in-4-provinces

¹⁸ https://iranintl.com/en/iran/iran-facing-summer-water-shortages-power-cuts

¹⁹ https://ndmc.pmd.gov.pk/new/assets/bulletins/1620116658.pdf

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percent of the rural population analysed in these two provinces are estimated to be facing high levels of acute food insecurity (IPC Phase 3 or above) in the current period of March to June 2021, corresponding to the end of the lean season and the beginning of the harvest season. At least 5 percent of the population analysed is in Phase 4 20 21 .

Concerning other countries in the wider area, not covered by this report but partly affected by the same drought event, a summary of impacts is reported below.

In **Kyrgyzstan**, drought affects hydropower production, with consequences also on neighbour countries²². The president of **Tajikistan** mentioned drought as affecting the country and negative impacts on crop production, horticulture and animal husbandry in the speech on the results of the country's economic and social development in the first quarter of 2021²³. However, so far no drought impact has been reported for Tajikistan by others²⁴. Weather conditions have been overall favourable, resulting in average vegetation conditions in most croplands. Livestock conditions are good and no disease outbreak have been reported²⁵. Currently, the COVID-19 pandemic, and not weather, is the main driver for food insecurity in Tajikistan, in relation to increasing prices of food commodities²⁶.

²⁰ http://www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1154292/

²¹

 $http://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC_Pakistan_Balochistan_Acute_Food_Insecurity_2021MarSept_Report.pdf$

²² http://inozpress.kg/en/rfe-rl-kyrgyzstans-hydropower-problems-causing-concern-in-neighboring-nations/

²³ https://khovar.tj/rus/2021/04/vystuplenie-prezidenta-respubliki-tadzhikistan-uvazhaemogo-emomali-rahmona-na-zasedanii-pravitelstva-po-itogam-ekonomicheskogo-i-sotsialnogo-razvitiya-strany-v-pervom-kvartale-2021-goda/

²⁴ Communication from DG-ECHO country desk

²⁵ http://www.fao.org/documents/card/fr/c/cb3847en/ and http://www.fao.org/giews/countrybrief/country,jsp?code=TJK

²⁶ https://reliefweb.int/sites/reliefweb.int/files/resources/WFP-0000127425.pdf

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