

GDO Analytical Report

Drought in Mozambique and neighbouring countries July 2020

JRC Global Drought Observatory (GDO), 16 July 2020



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Executive Summary

- At the beginning of the dry season, northern Mozambique, surroundings of Lake Malawi and western Madagascar show a marked precipitation deficit, cumulated primarily in the second half of the wet season (February-April). The strong seasonality of rainfall now entails a sequence of three to four months without rain.
- No major impacts were reported in relation to this specific event, mostly thanks to the late onset of drought in the agricultural season, but mild to severe food insecurity affects endemically the countries involved, and severe natural disasters are frequent in that part of Africa. Indeed, 2019 saw a historical cyclone (Idai) and a dry spell, so even minor events may cause distress during the current recovery stage.
- The outlook at six months shows a very wet start of the next rainy season (October/November), but no significant precipitation is forecasted until then.

Risk of drought impact for agriculture (RDri-Agri)

The indicator RDri-Agri shows the risk of having impacts from a drought, by considering the exposure and socio-economic vulnerability of the area, with focus to the agricultural impacts (Figure 1).

Mozambique is one of the African countries most exposed to climate risks, ranging from floods and intense tropical cyclones to droughts. In addition, the vulnerability of population is very high, due to poverty and lack of coping capacity at scale¹. Drought hits more frequently the centre and south of the country, but the high rainfall seasonality is common to the north and exposes it to severe droughts too. Neighboring Malawi and Zimbabwe experience similar climatic extremes and population vulnerability. Both countries had socio-

¹ https://drmkc.jrc.ec.europa.eu/inform-index/Portals/0/InfoRM/2019/Country_Profiles/MOZ.pdf

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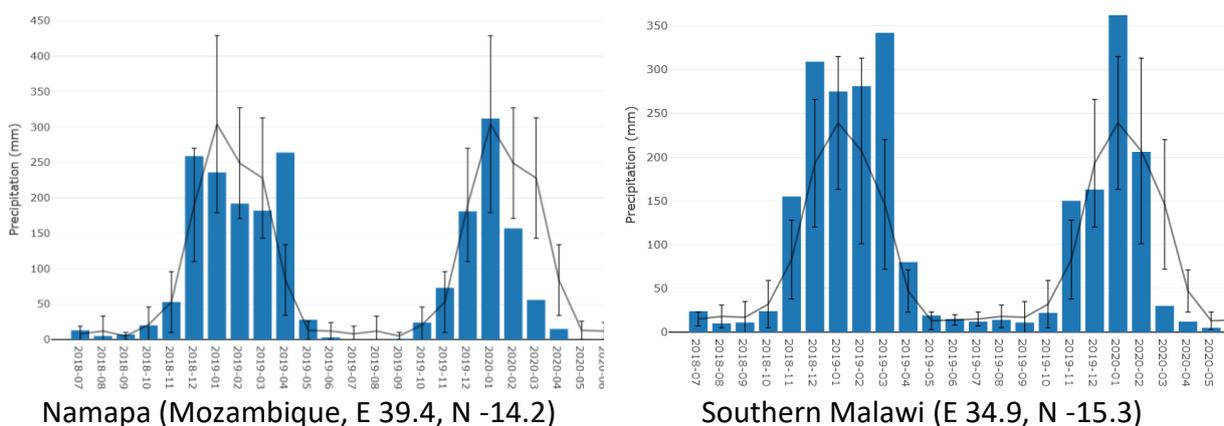


economic downturns in 2019 and 2020 and, like Mozambique and Madagascar, were hit in 2019 by the tropical cyclones Idai and Kenneth. The former had historic proportions and a devastating impact on population, infrastructures and built-up areas. Even though Zimbabwe and western Madagascar currently display low to no risk of drought impact, the events of 2019 and 2020 (COVID pandemic) add potential for a worsening of the situation.



Precipitation

Long-term precipitation patterns are quite similar across selected regions of Figure 2, but actual precipitation differed in the first half of 2020. In general, northern Mozambique, Malawi and western Madagascar show a normal or very wet first half of the rainy season 2019/2020, abruptly dropping below average in the second half. Zimbabwe, on the contrary, saw wide fluctuations from month to month, but the first half was much drier than the second overall.



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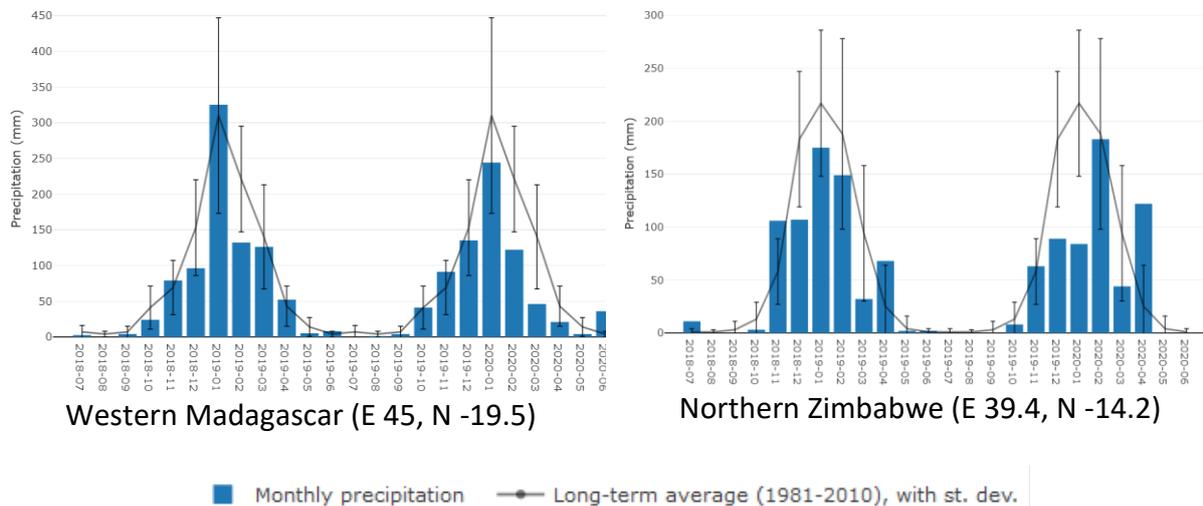


Figure 2: Monthly precipitation from July 2018 to June 2020 in selected representative locations. Bars show observed monthly precipitation (mm). Lines show the long-term monthly average with one standard deviation.

Figure 3 shows the rainfall percentile for cumulative March-April-May at the individual weather stations, compared to the reference period 1961-1990. The whole wider region, well beyond the areas under analysis, received less rainfall than they used to in the past.

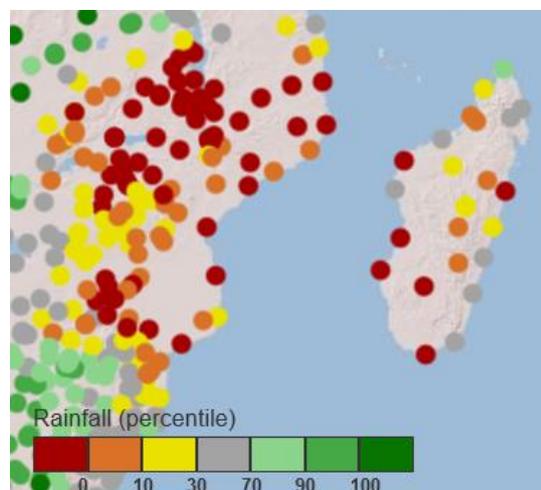


Figure 3: percentile cumulative rainfall for trimerster March-May 2020, compared to reference period 1961-1990.

(source:

<http://csc.sadc.int/en/climate/watch/watch-tool-monthly>)

Standardized Precipitation Index (SPI)

The SPI measures precipitation anomalies based on long-term records, aggregated at different time-scales, such as 1 month (SPI-1), 3 months (SPI-3) or 12 months (SPI-12). The lower (more negative) the SPI, the more intense the drought. Different aggregation periods indicate different types of droughts, with related impacts. For instance, the SPI-3 may signal agricultural drought, while low values of SPI-12 may reflect a decrease of river and groundwater levels.

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The SPI-3 (Figure 4, top-left) best illustrates the areas where the second half of the wet season underperformed: the whole of Mozambique, especially the north, Malawi and western Madagascar. Zimbabwe faced drought issues for at least one year, before receiving abundant precipitation in March and April and relieving from the dry conditions developed during the first half of the season.

The SPI-12 in June 2020 shows a situation of milder and more localized deficits, mainly due to the normal or abundant precipitation experienced in the first half of the wet season and before. Accordingly, only the geographic extremes of Mozambique show relevant deficits (Nampula, Inhambane, Manica). Southern Malawi does not display precipitation deficits during the same period.

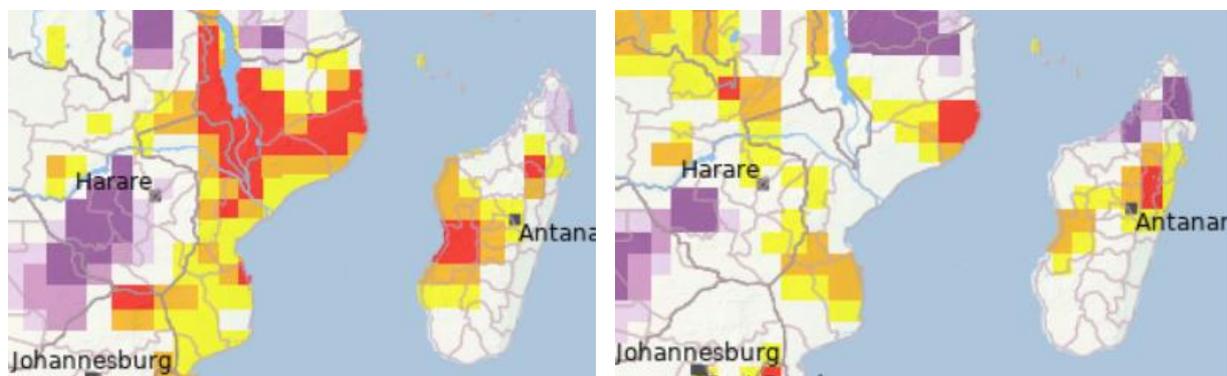
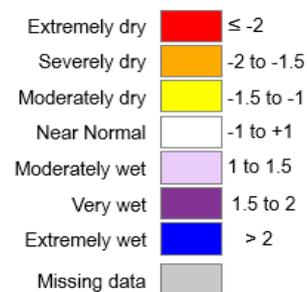


Figure 4: Standardized Precipitation Index (SPI), showing the precipitation anomalies with respect to the long-term climatological average. Left: SPI-3, May 2020 (March to May cumulative). Right: SPI-12, July 2019 to June 2020.



Temperatures

High temperatures increase the evapotranspiration rate of water from the land, while increasing water demand for consumption in urbanized areas, thus contributing substantially to drought severity, even in the absence of relevant rainfall deficits.

Figure 5 shows how temperatures were predominantly higher than average over Africa during June 2020. Mozambique and Malawi both recorded about 2 degrees above the average temperature. Note that June marks the start of winter season in the southern hemisphere, therefore temperature extremes may affect natural ecosystems rather than crops.

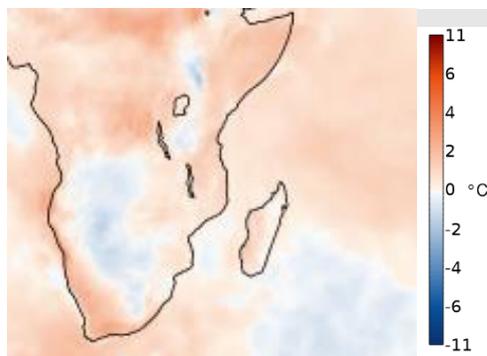


Figure 5: Surface air temperature anomaly for June 2020, relative to the June average for the period 1981-2010, over southern and eastern Africa (Data: ERA5. Reference period: 1981-2010. Credit: C3S/ECMWF).

Soil Moisture Anomaly (SMA)

This indicator provides an assessment of the top-soil water content, which is a direct measure of drought conditions, specifically indicating the difficulty for plants to extract water from the soil.

During the three months from April to June 2020, the soil moisture anomaly constantly stood negative in wide areas ranging from Zambia to Madagascar (Figure 6, left). As of early July, the situation slightly improved, but anomalies persisted in Nampula (Mozambique), western coast of Madagascar and northern Zimbabwe (Figure 6, right). While Mozambique and Madagascar low soil moisture levels may be explained by the recent rainfall deficits, those of Zimbabwe (and Zambia) have roots in the longer term, but mostly in the second half of 2019. It is worth noting the time series for Nampula (Figure 6, bottom left), where a long sequence of wetter than average soils turns into a negative anomaly, testifying the stark drop in soil moisture.

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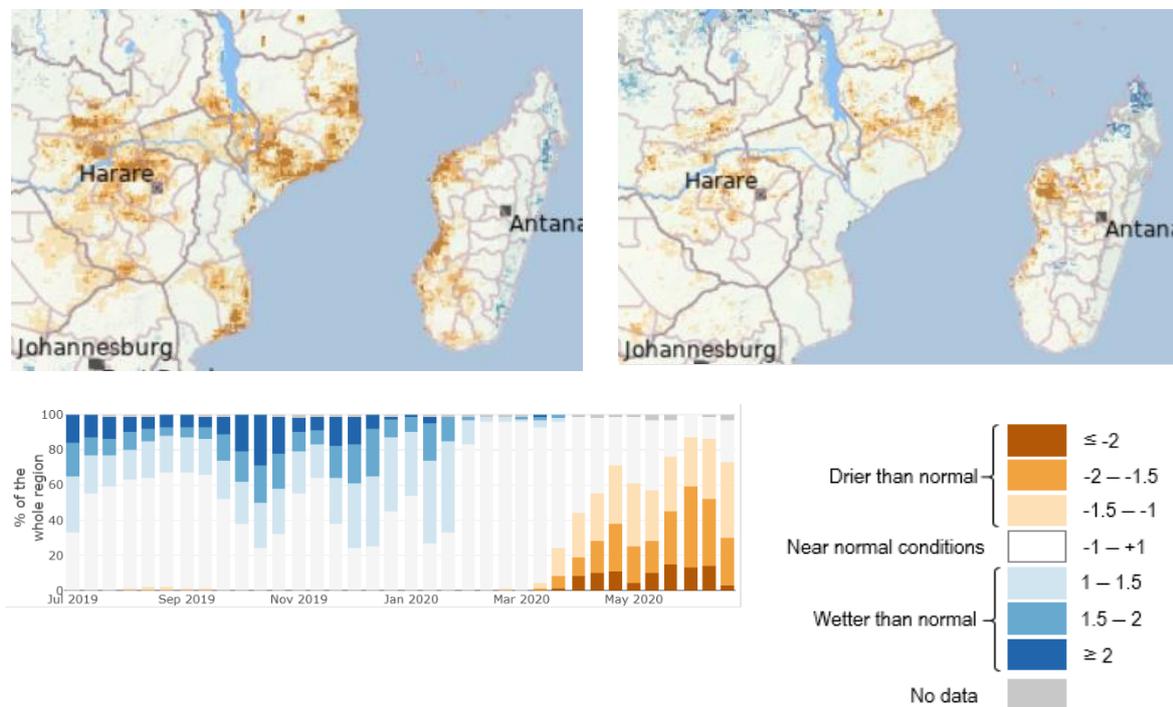


Figure 6: Soil moisture anomaly (SMA) during April (top-left) and 10th June to 10th July (top-right). The bar chart on lower left shows the SMA in percentage of Nampula (Mozambique).

Regarding groundwater, measured with the Total Water Storage (TWS) indicator at April 2020, northern Mozambique and Malawi were under normal conditions, while Zimbabwe and southern Mozambique stood well under average compared to the normal (figure 7).

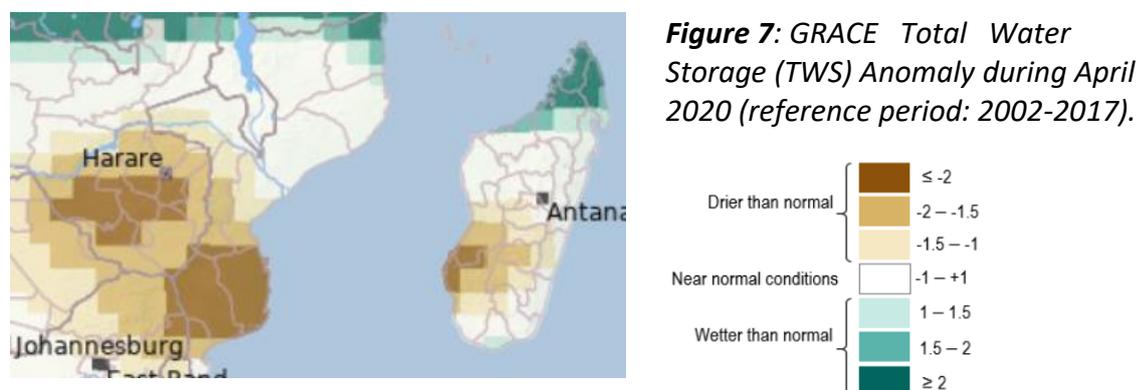


Figure 7: GRACE Total Water Storage (TWS) Anomaly during April 2020 (reference period: 2002-2017).

Vegetation Productivity (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.

At the end of June, the anomaly was particularly intense in Nampula (north Mozambique) and western Madagascar (Figure 8). However, a negative tendency is detected over most of the wider region, including southern Malawi, Zimbabwe, Madagascar and beyond. The current stage, displaying anomalous decline in photosynthetic activity, can't be related to a sharp decline in crops condition, as it coincides with the harvest period or later. Rather, it suggests stress on forest and rangelands.

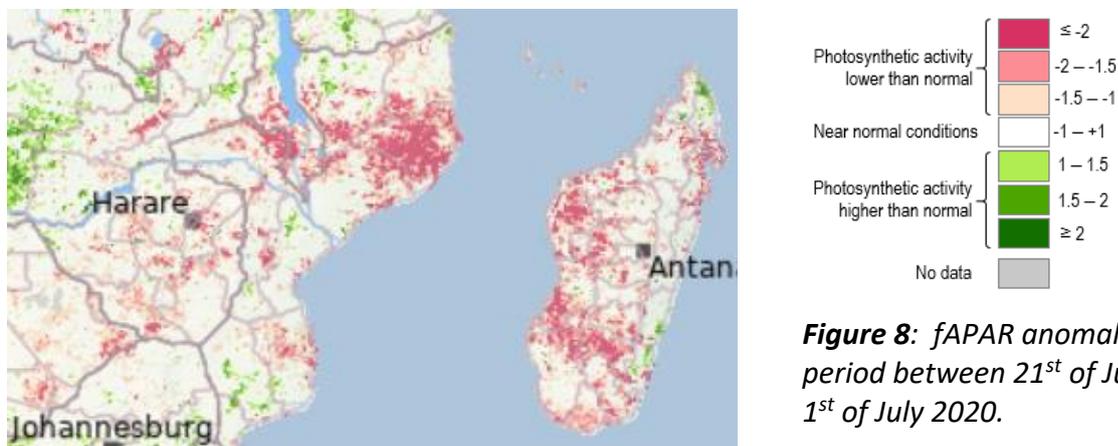


Figure 8: fAPAR anomaly for the period between 21st of June and 1st of July 2020.

SPI outlook

The forecasts of SPI are based on the ECMWF probabilistic seasonal model of precipitation (S5), and the map shows warnings only where the forecast is relatively robust.

The outlook at six months projects an extremely wet start of the next rainy season over this part of Africa (Figure 9, left), but no significant precipitation is forecasted until September (Figure 9, right), which are usually almost completely dry. The extreme north-east of Mozambique and most of Madagascar will receive even less than the usual small amount typical of the period. In general, the current deficit will persist until October when the first significant rainfall is expected.

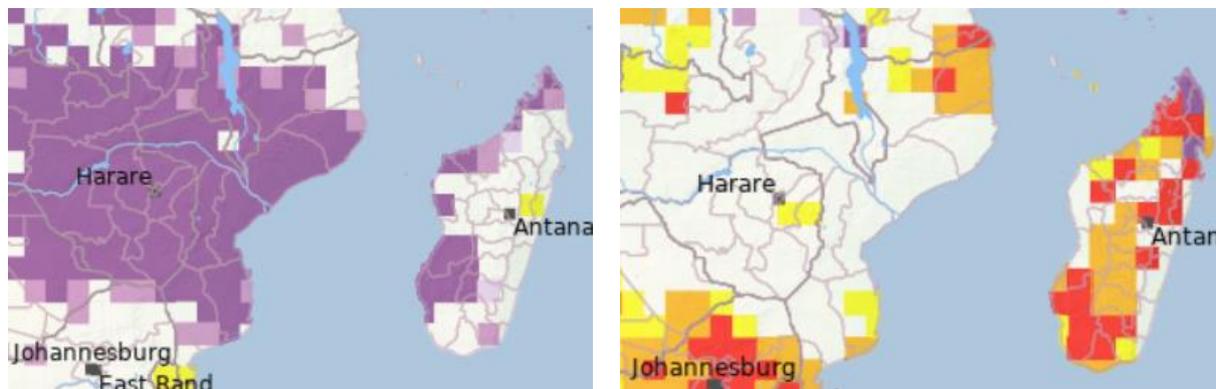
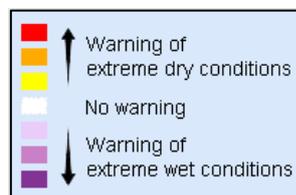


Figure 9: SPI forecast for July to December 2020 (SPI-6, left) and July to September (SPI-3, right), based on ECMWF S5 ensemble forecasts.



Reported impacts

During the last five years the countries affected by the current dry spell had to face severe droughts induced by the strong El Niño of 2016 and devastating floods and winds later in 2019, due to landfall of tropical cyclones Idai and Kenneth during the same season, plus a further dry spell later in the year (Zimbabwe). Although the regions analyzed in this document were not affected entirely by the events of 2019, the respective countries have not fully recovered. No major impacts were reported in relation to this specific event, mostly thanks to the late onset of drought in the agricultural season. Nevertheless, the conditions are not favorable: “maize production in Zimbabwe is expected to be 30% below the 5-year average, an output reflecting the challenging economic situation and the poor weather conditions that affected planting operations and crop development. Localised production shortfalls are expected in southern Mozambique and southern Madagascar”². Prices of staple food are stable thus far³. The National Meteorological Office of Mozambique recommended for preparatory and mitigation actions in front of a drier than usual trimester ahead⁴. In Zimbabwe, despite the abundant rainfall, water supply and food security issues were reported in mid-June⁵ ⁶. Hence, vulnerability is high and minor events may be of serious concern.

² <https://mars.jrc.ec.europa.eu/asap/> (Release of 02/07/2020)

³ <https://reliefweb.int/report/mozambique/mozambique-price-bulletin-june-2020>

⁴ <https://www.inam.gov.mz/index.php/pt/produtos-e-servicos/interpretacao-da-previsao-sazonal>

⁵ <https://www.zimbabwesituation.com/news/families-sleep-in-water-lines-as-drought-grips-byo/>

⁶ <https://bulawayo24.com/news/national/187021>

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Natural reserves and reservoirs, such as Lake Chivero supplying Harare with water and a major wildlife sanctuary, are subject to a long lasting sequence of period of below normal precipitation (figure 10), threatening its capacity to supply water as already happened in the recent past⁷.

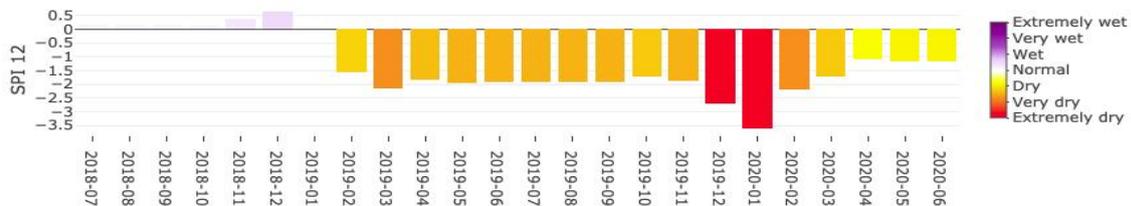


Figure 10: time-series of SPI 12 for Lake Chivero (coordinates: E 30.7, N -17.5)

⁷ <https://www.sundaymail.co.zw/lake-chiveros-slow-foretold-death>

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