

# GDO Analytical Report

## Drought in Western Cape Province – January 2018

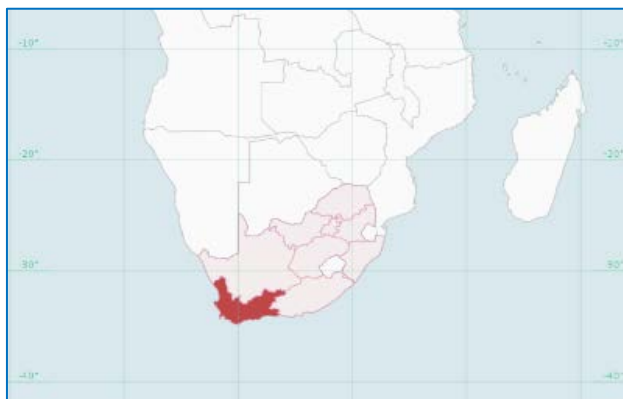
JRC Global Drought Observatory (GDO) and ERCC Analytical Team

Date of report 24-01-2018



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### Executive Summary

- Western Cape Province in South Africa is going through a severe drought, affecting in particular the highly populated urban area of Cape Town and its water supply.
- The current drought is the effect of a sustained below-average monthly rainfall series since 2015, which intensified in the last wet season (April to September 2017). The very exceptional nature of this event is highlighted by GDOs long-term indicators of precipitation anomalies (e.g. SPI-48).
- Cape Town’s water supply is in critical emergency, water for any use has been restricted through water cuts and rationing. The day of “zero-water” has been established as 12 April 2018 by Cape Town water authorities<sup>1</sup>. Saldanha and Stellenbosch municipalities are facing a similar level of emergency for water supply.
- Very little precipitation may be expected before April.

<sup>1</sup> <http://resource.capetown.gov.za/documentcentre/Documents/City%20research%20reports%20and%20review/damlevels.pdf>



### Description of Affected Area

South Africa's Western Cape Province is located at the southernmost part of the continent, over an area of more than a million square kilometres. The region has a set of mountain ranges running parallel to the coastline, which give rise to its varied climatic gradients and vegetation patterns. In general, climate is a mild Mediterranean type on the coasts (wet winter and dry summer), shifting to semi-arid and continental towards the interior and past the mountains. Vegetation is mostly made of scrubland, here called fynbos, a very typical and fire prone vegetation type. Agriculture is a growing sector in the region, which hosts renowned vineyards. Western Cape includes one of the country's capitals, Cape Town, also one of the main urban areas. General data are shown below.

#### Western Cape<sup>2</sup>

Population, estimate (2017)	6,510,300
GDP per capita (current US\$) (2016)	6201.88
Population density (per km <sup>2</sup> of land area)	45

While much of the southern African continent has been recovering, following heavy summer rains, from a drought caused by El Nino, Cape Town in Western Cape is still gripped by its worst drought in a century, having had very low rainfall for the last three years. The drought is reportedly having severe impacts on the population, with water supplies to Cape Town's residents due to be cut off on 12 April 2018 unless there is a drastic reduction in water consumption, while the water level of the Theewaterskloof dam (the largest in the Western Cape water supply system, holding 41% of the water storage capacity available to Cape Town) is critically low<sup>3</sup>.

### Likelihood of Drought Impact (LDI)

The LDI indicates the likelihood of having impacts from a drought, by taking into account the exposure and socio-economic vulnerability of the area (Figure 1).

Remarkably, almost none of the region is shown under risk, with a clear drop from the high levels of the last winter. This is because the LDI takes into consideration the overall precipitation in the past three months, which has been about normal during that time in the region. So, while LDI flags rising and short-term droughts, in this instance it does not highlight the long-term aspect of the drought.

<sup>2</sup> [https://en.wikipedia.org/wiki/Economy\\_of\\_the\\_Western\\_Cape](https://en.wikipedia.org/wiki/Economy_of_the_Western_Cape)

<sup>3</sup> <https://www.theguardian.com/world/2018/jan/24/cape-town-to-run-out-of-water-by-12-april-amid-worst-drought-in-a-century>

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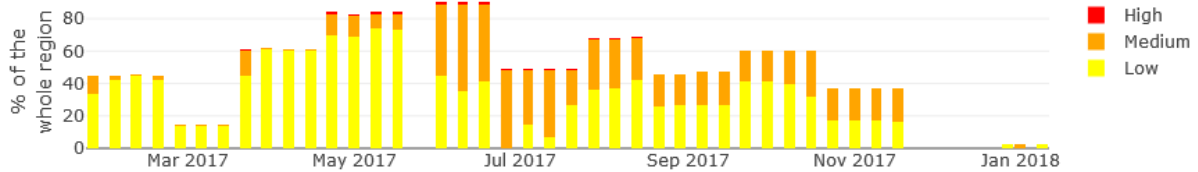


Figure 1 - Likelihood of drought impact (LDI), evolution over time in Western Cape (South Africa).

## Precipitation Analysis

Precipitation includes total monthly of both rainfall and snow. Figure 2 shows the monthly precipitation pattern near Cape Town since January 2015: only one fifth of the months reached or exceeded the expected average, with the wettest period looking narrower than normal. As a result, in the past three years, the area received only 65% of the expected precipitation overall (Figure 3). During 2017 the figure went down to 60% and considering the last cold season, between April and September 2017, further down to 55% compared to the long-term measurements. July in particular, being the wettest month, received barely half its normal precipitation.

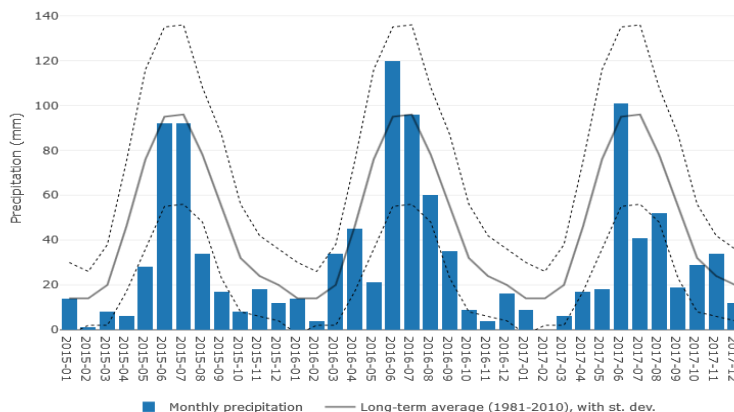


Figure 2 - Monthly total precipitation (blue bars) near Atlantis (Western Cape, South Africa, coordinates: N-33.57422, E18.62183). The solid line represents the long-term monthly average (1981-2010); the dotted lines are plus/minus one standard deviation.

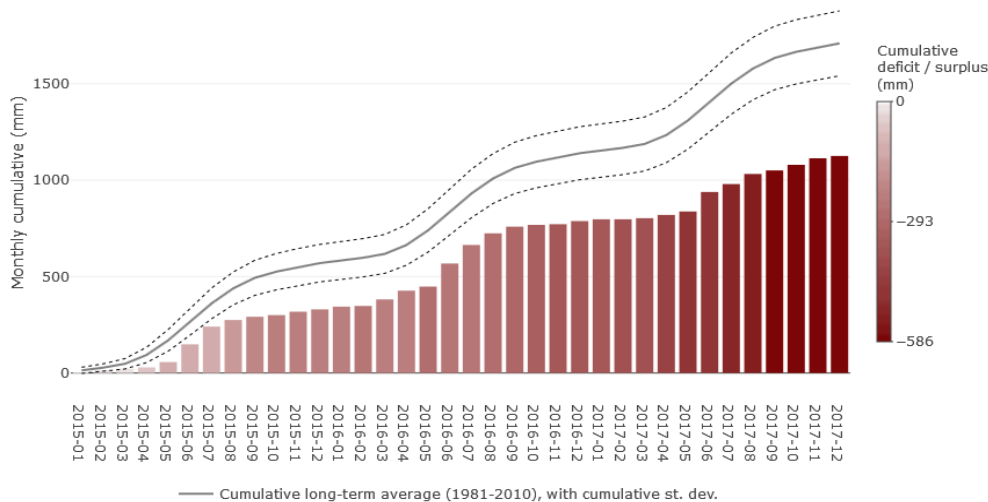


Figure 3 - Cumulative precipitation over a period of 3 years near Atlantis (Western Cape, South Africa, coordinates: N-33.57422, E18.62183). The bar colors indicate the cumulative deficit (red gradient) or surplus (blue gradient) compared to the cumulated monthly long-term average (solid line), for the same time span and location.

## Standardized Precipitation Index (SPI)

The SPI is an index used to monitor the occurrence of meteorological drought. The lower the SPI, the more intense is the drought (Figure 4). Note that different accumulation periods are shown (3, 9, 24 and 48 months). As mentioned, precipitation in the last quarter of 2017 has been roughly within normal, so the 3-months SPI does not fall too far from normal fluctuations during the last few months, suggesting a mild drought at the most. However, the SPI 9-months from Figure 4 shows the serious lack of precipitation during late 2016 and 2017, with SPI values dropping to the threshold of minus three. In relation to impacts, more concerning are the long-term SPIs, which go past the “extreme drought” value. This entails a constant under-supply of water to reservoirs since at least 2015 (Table 1 and Figure 8), which explains the current crisis of water provisioning in Cape Town. The 24-months’ time series shows the starting point for the drought, with precipitation of 2015 dragging the SPI to very negative values. The 48-months SPI reaches the rare value of SPI minus four, a level of truly exceptional drought.

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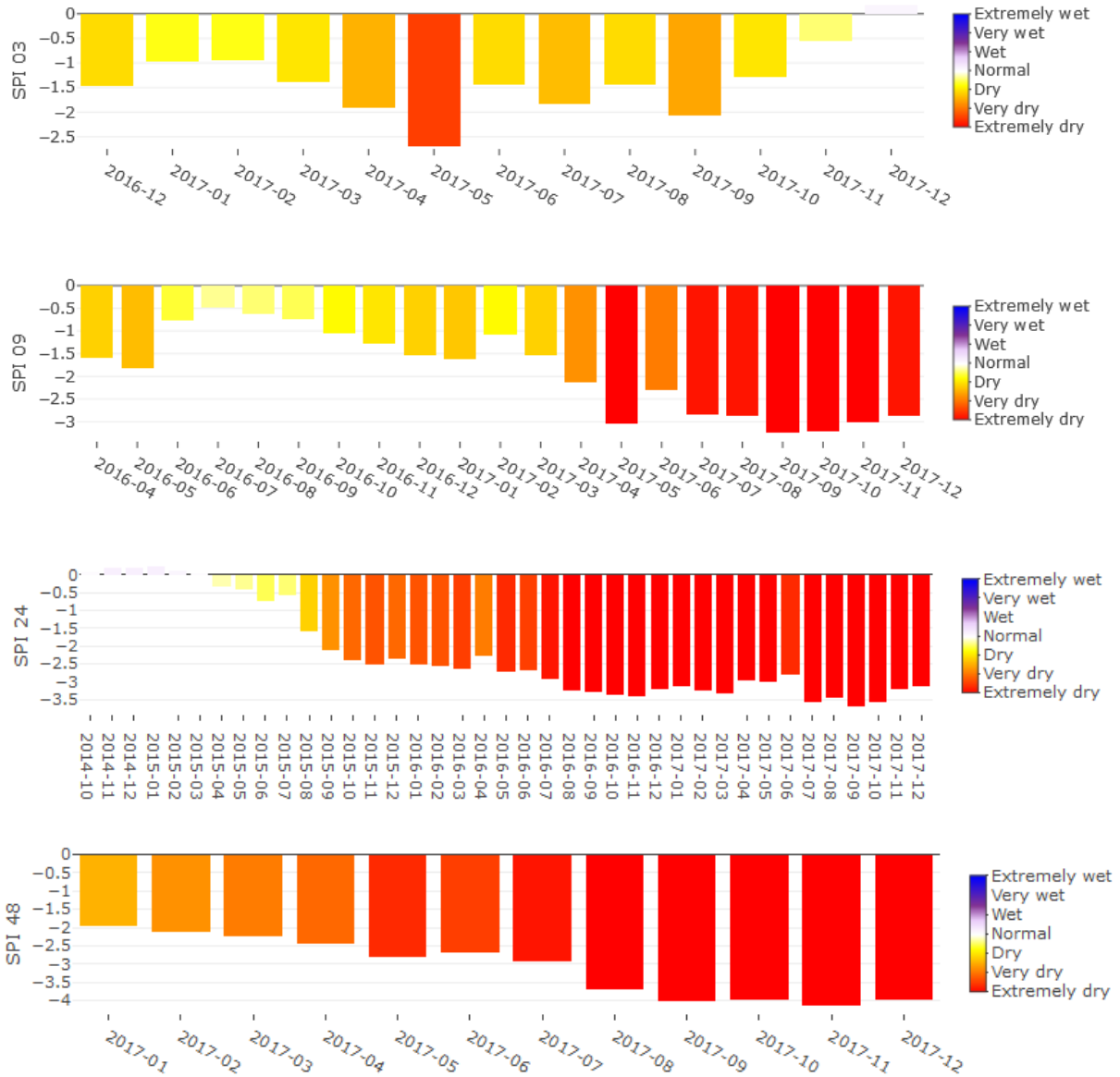


Figure 4 - SPI for a cumulative period of 3, 9, 24 and 48 months near Atlantis (Western Cape, South Africa, coordinates: N-33.57422, E18.62183 ).

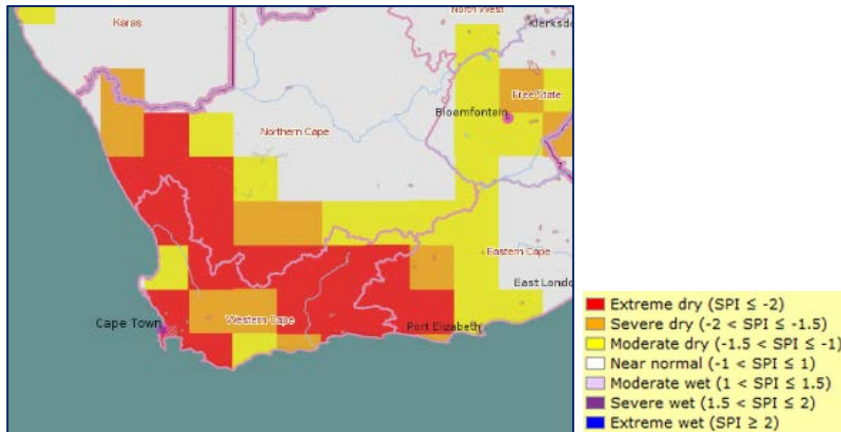


Figure 5 - SPI for a cumulative period of 24 months over Western Cape, December 2017.

### fAPAR and Soil Moisture 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 (Figure 6). As expected from the recent precipitation pattern across Western Cape, vegetation greenness is affected by drought, showing negative anomalies in the very circumscribed region of Western Cape, especially around and North of the capital.

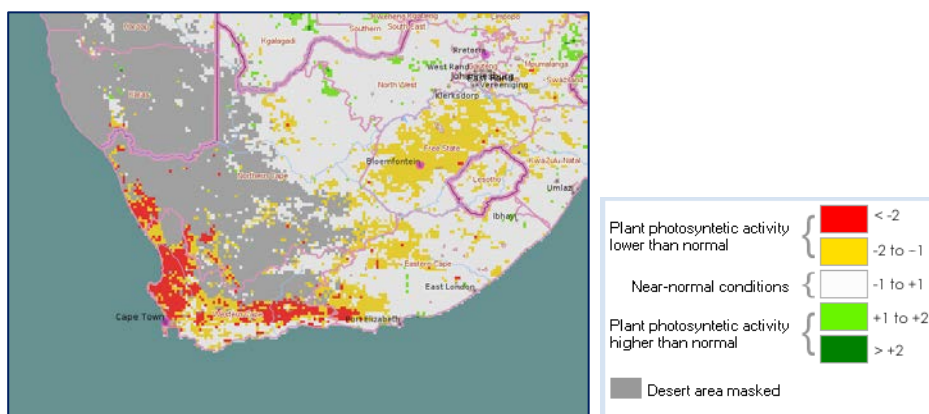


Figure 6 - fAPAR anomaly in Western Cape (South Africa) for the period 01-01-2018 to 10-01-2018.

Concerning soil moisture, a situation of severe drought is detected from September 2017 onwards (Figure 7), in particular on the westernmost part of the Province.

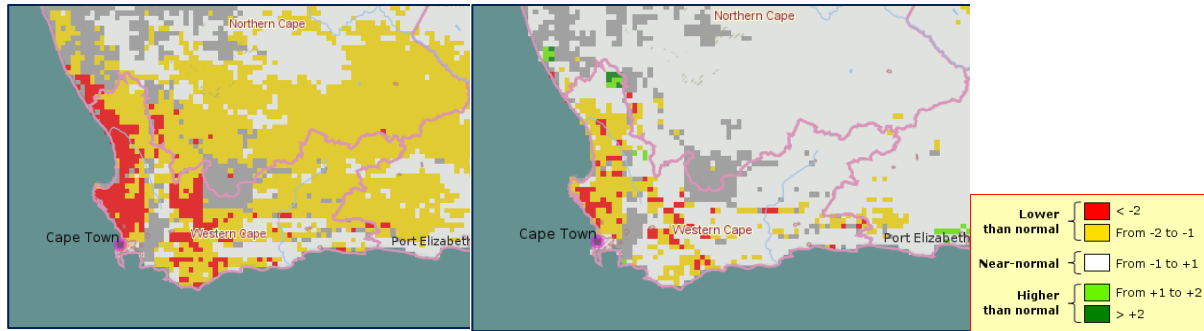


Figure 7 – Soil moisture anomaly in Western Cape Province in September 2017 (left) and in December 2017 (right).

## Maps and Tables of the Western Cape Drought (various sources)



Figure 8 - Location of dams in Western Cape<sup>4</sup>.

<sup>4</sup> From: <https://www.westerncape.gov.za/general-publication/latest-western-cape-dam-levels>

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Table 1 – Current Dam Water Levels in Western Cape, 24/1/2018. Units of volume are megaliters (MI)<sup>5</sup>.

Major dams	Storage	
	MI Capacity	% 24/1/2018
Berg River	130 010	54.8
Steenbras Lower	33 517	45.1
Steenbras Upper	31 767	86.0
Theewaterskloof	480 188	13.9
Voëlvlei	164 095	18.5
Wemmershoek	58 644	52.4
<b>Total Stored MI</b>	<u>898 221</u>	<u>241 358</u>
<b>% Storage</b>	100.0	26.9

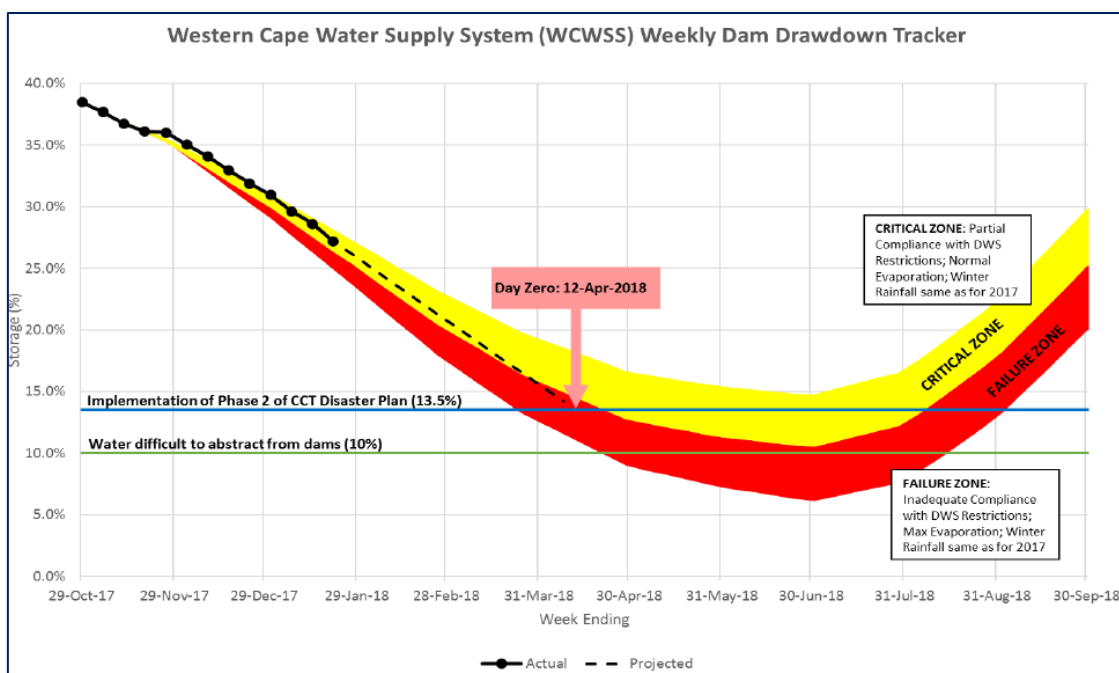


Figure 9: Projection of overall dam levels in Western Cape, as % of total capacity<sup>6</sup>.

<sup>5</sup> From: <https://www.westerncape.gov.za/general-publication/latest-western-cape-dam-levels>

<sup>6</sup> From: <http://resource.capetown.gov.za/documentcentre/Documents/City%20research%20reports%20and%20review/damlevels.pdf>



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### Media Coverage

- The Guardian. 24 January 2018. “Cape Town told to cut water use or face losing supply by 12 April”. <https://www.theguardian.com/world/2018/jan/24/cape-town-to-run-out-of-water-by-12-april-amid-worst-drought-in-a-century>
- City of Cape Town. 22 January 2018. “Weekly Water Dashboard Report”. <http://resource.capetown.gov.za/documentcentre/Documents/City%20research%20reports%20and%20review/damlevels.pdf>
- GroundUp (Cape Town news agency). 22 January 2018. “How severe is the drought? An analysis of the latest data”. <https://www.groundup.org.za/article/how-severe-drought-detailed-look-data/>
- Eyewitness News. 20 January 2018. “Spike in grape prices inevitable amid drought”. <http://ewn.co.za/2018/01/20/economist-spike-in-grape-prices-inevitable-amid-drought>
- BBC News. 18 January 2018. “South Africa: Cape Town slashes water use amid drought”. <http://www.bbc.com/news/world-africa-42731084>
- Western Cape Government. 2018. “Latest Western Cape dam levels”. <https://www.westerncape.gov.za/general-publication/latest-western-cape-dam-levels>

### Information Sources

- Joint Research Centre (European Commission): Global Drought Observatory (GDO) - <http://edo.jrc.ec.europa.eu/gdo/>
- Global Precipitation Climatology Centre (GPCC) - [http://gpcc.dwd.de/pub/data/gpcc/PDF/GPCC\\_intro\\_products\\_v2011.pdf](http://gpcc.dwd.de/pub/data/gpcc/PDF/GPCC_intro_products_v2011.pdf)
- Cape Town city Council <http://www.capetown.gov.za/>

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