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The Watchman

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NATURAL RESOURCES AND ENGINEERING
Soil, Climate and Water

CONTENTS:

agriculture
Department:
Agriculture
REPUBLIC OF SOUTH AFRICA

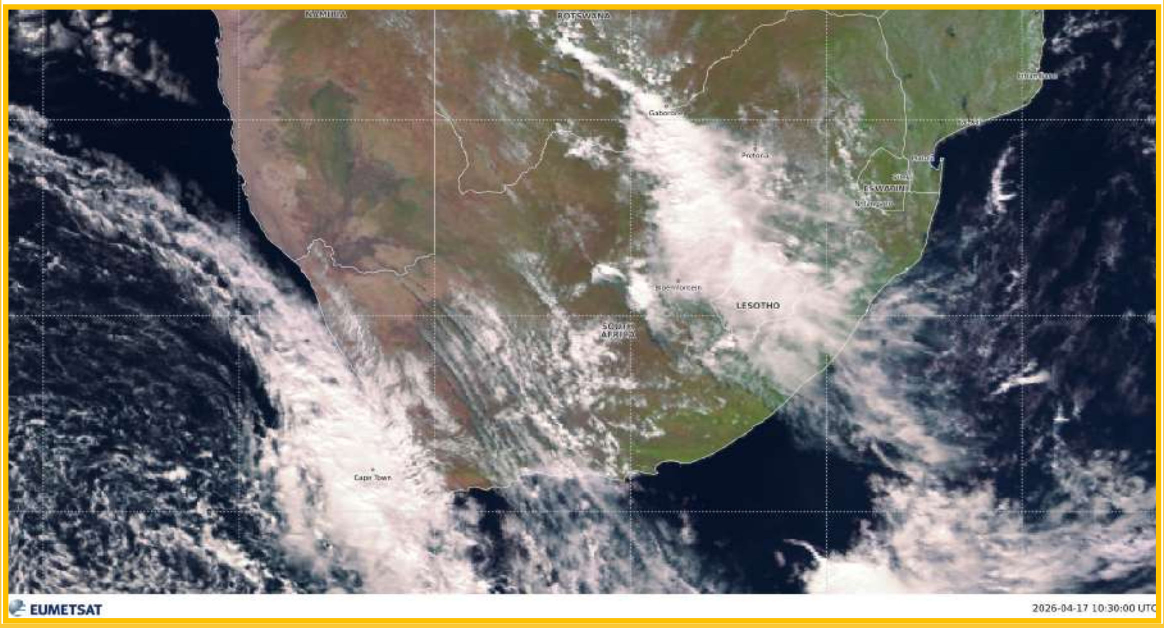
South African Weather Service

262nd Edition

Image of the Month

Onset of winter-like frontal activity over South Africa in autumn

The month of April was marked by the passage of frontal systems, consistent with the seasonal transition from a summer largely influenced by a weak to moderate La Niña towards autumn. Frontal activity became more frequent as cold fronts associated with the westerly circulation moved across the country. A well-defined cold front was observed on 17 April 2026 (see satellite image below). As it approached, cloud bands extended from the southwest coast across the Western Cape into parts of the interior, indicating the arrival of cooler, moisture-bearing air. This system, along with subsequent fronts, brought cool, windy and wet conditions to the southwest, with rainfall extending into parts of the central and eastern interior, including the Free State, Gauteng and KwaZulu-Natal. Behind these systems, temperatures dropped across much of the country, particularly in higher-lying areas. These conditions contributed to some late-season soil moisture, while also slowing the drying of summer crops in areas approaching harvest. The decrease in minimum temperatures further increased the likelihood of early frost in exposed inland regions such as the Free State. Thus, continued monitoring of frontal systems and localized weather forecasts is recommended for agricultural planning, especially for harvest timing, frost risk management, and livestock protection.



The Agricultural Research Council - Natural Resources and Engineering (ARC-NRE) Soil, Climate and Water campus collected the data, generated the products and compiled the information contained in this newsletter, as part of the Coarse Resolution Imagery Database (CRID) project that was funded by the Department of Agriculture and Department of Science and Technology at its inception and is currently funded by the Department of Agriculture (DoA).

Overview:

March 2026 showed a gradual transition from the peak summer rainfall season toward early autumn conditions. Rainfall activity remained widespread across much of the summer rainfall region; however, the distribution showed a noticeable shift toward the northern and eastern parts of the country compared to February, when the central interior was more dominant. A notable feature during the first week of March was the presence of moist tropical air extending southwards over the interior, developing into a trough to enhance thunderstorm activity across parts of the Highveld, western Bushveld and central interior, resulting in several days of scattered to widespread showers and thunderstorms. The highest monthly totals recorded were concentrated over the northeastern summer rainfall region, particularly across Limpopo, the Lowveld of Mpumalanga and parts of northeastern KwaZulu-Natal. Areas surrounding Musina, Polokwane and Mbombela recorded totals generally between 150 and 300 mm, with a few isolated places exceeding this range. Some areas received more than 125% of their normal March rainfall, while others exceeded 200%. In contrast, parts of the eastern coastline and southeastern interior, including parts of coastal KZN and the Eastern Cape, recorded below-normal rainfall, with some locations receiving less than 50% of their normal March totals despite measurable rainfall. The lowest totals were observed over the far western interior and parts of the winter rainfall region, including areas near Springbok, Calvinia and parts of the western Cape. Monthly totals in these areas were generally below 25 mm, with some places receiving less than 10 mm. This pattern is broadly consistent with climatology as March often remains relatively dry in these regions before the onset of their main rainfall season later in autumn and winter.

1. Rainfall

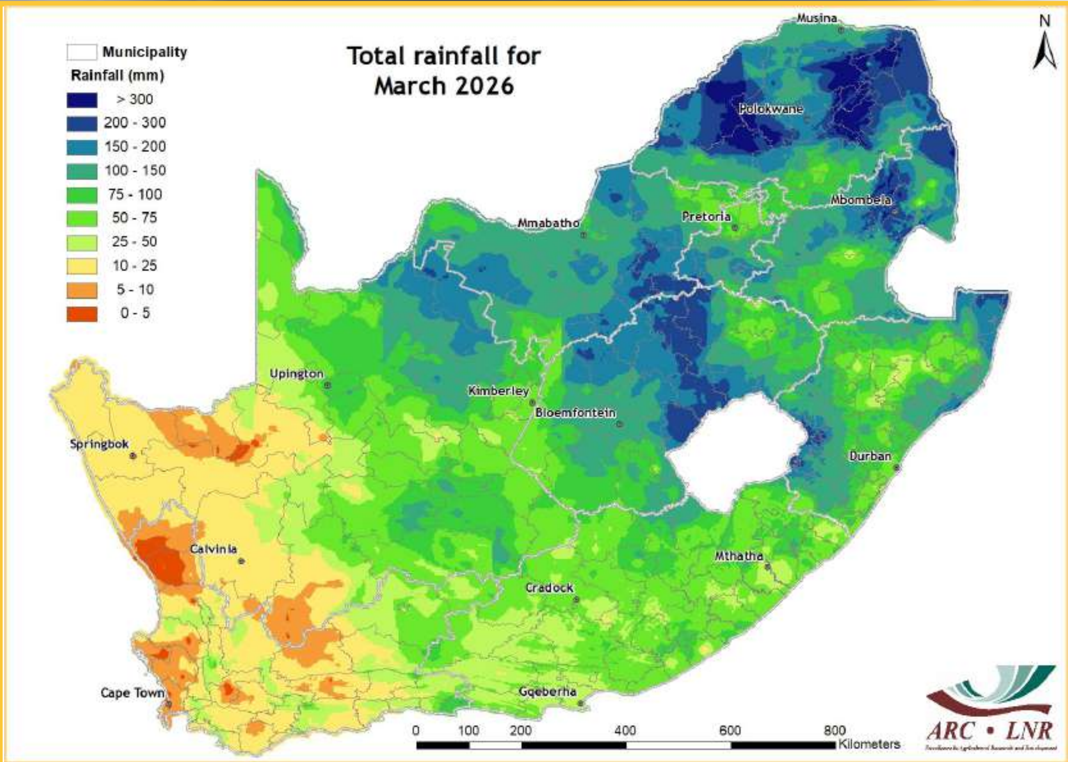


Figure 1

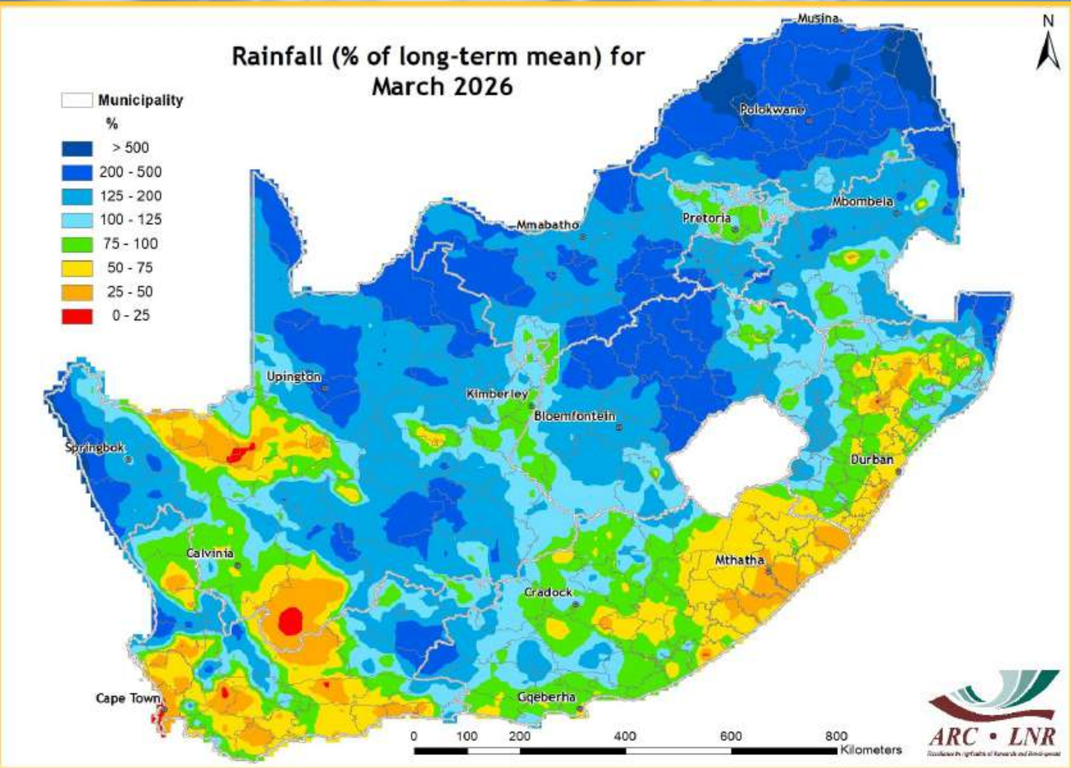


Figure 2

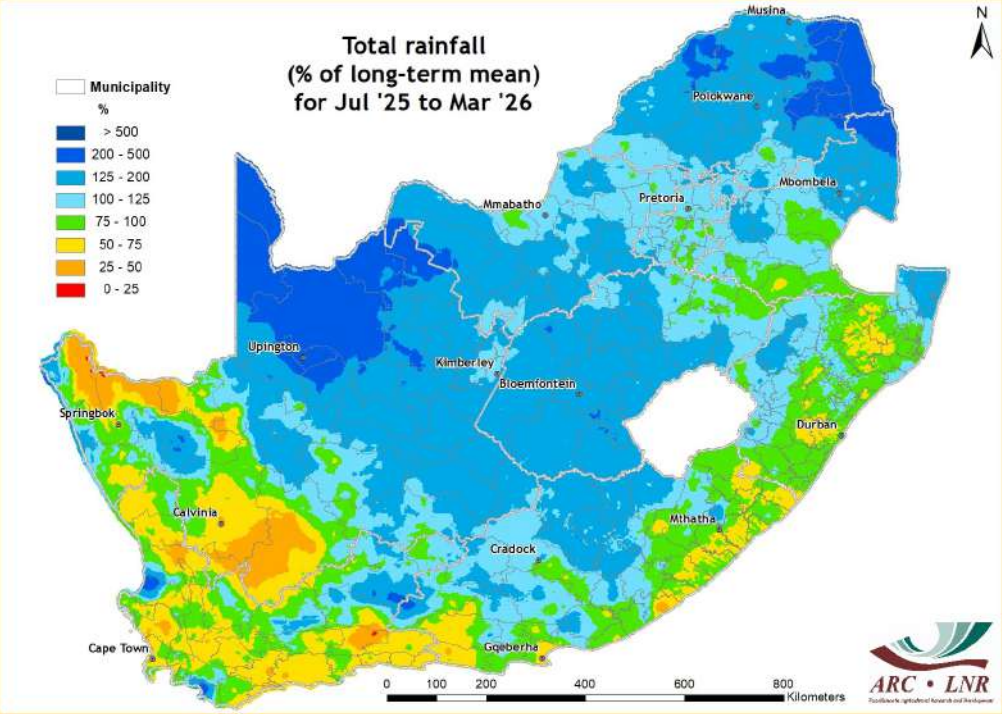


Figure 3

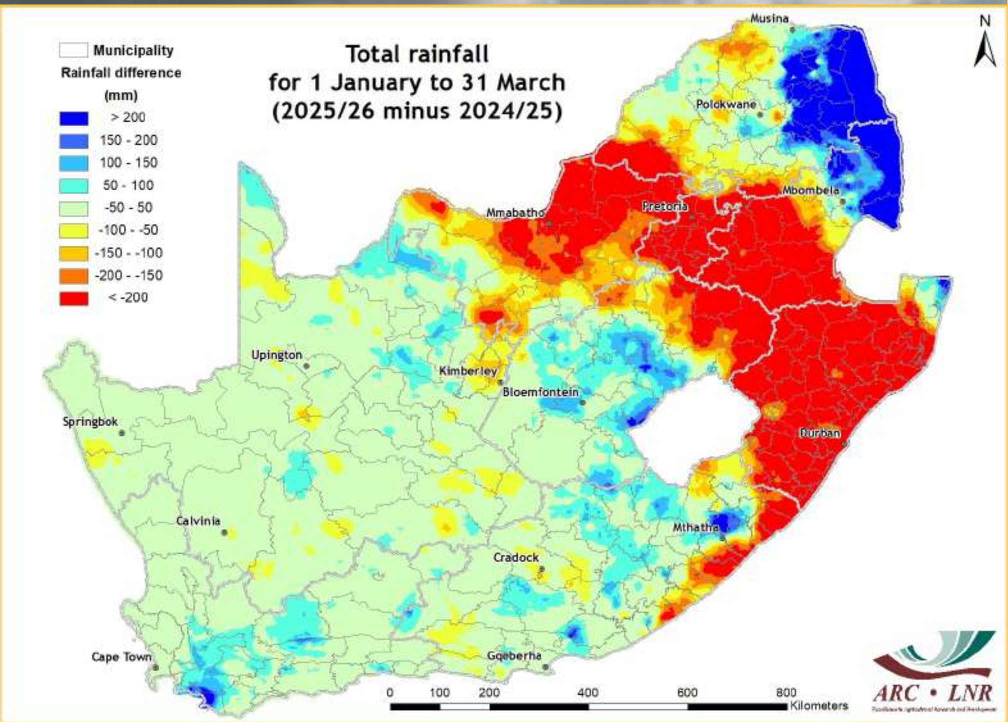


Figure 4

Figure 1:
Large areas of Limpopo, the Mpumalanga Lowveld and northeastern KwaZulu-Natal received rainfall totals between 150 and 300 mm in March 2026, with isolated areas exceeding 300 mm. Much of the central interior, including parts of the Free State, North West, Gauteng and eastern Northern Cape, recorded totals of 75-150 mm. In contrast, the far western interior and sections of the winter rainfall region, including areas near Springbok and Calvinia, received the lowest totals, generally below 25 mm.

Figure 2:
Rainfall in March was somewhat above normal across much of the northern, central and western interior, including parts of Limpopo, North West, Free State, Northern Cape and the Karoo, where totals frequently exceeded 125% of the long-term mean and isolated areas exceeded 200%. Near-normal conditions were observed across portions of the Highveld and central interior. While below-normal rainfall occurred along parts of the eastern and southeastern regions, including parts of KwaZulu-Natal and the Eastern Cape coast, some areas received less than 50% of their normal March rainfall.

Figure 3:
The period from July 2025 to March 2026 recorded near- to above-normal rainfall for the central to northern interior. Areas that recorded below-normal conditions include parts of the Cape provinces and isolated areas along the eastern coastline.

Figure 4:
The first 3 months of 2025/26 were notably drier than the same period in the previous season (2024/25) across much of the eastern half of South Africa, with rainfall deficits exceeding -200 mm over KZN, Mpumalanga, Gauteng and adjacent areas. In contrast, the far northeastern parts of Limpopo and Mpumalanga recorded substantial surpluses, locally exceeding 200 mm, while much of the western interior remained near normal.

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2. Standardized Precipitation Index

Standardized Precipitation Index

The Standardized Precipitation Index (SPI - McKee *et al.*, 1993) was developed to monitor the occurrence of droughts from rainfall data. The index quantifies precipitation deficits on different time scales and therefore also drought severity. It provides an indication of rainfall conditions per quaternary catchment (in this case) based on the historical distribution of rainfall.

REFERENCE:

McKee TB, Doesken NJ and Kliest J (1993) The relationship of drought frequency and duration to time scales. In: Proceedings of the 8th Conference on Applied Climatology, 17-22 January, Anaheim, CA. American Meteorological Society: Boston, MA; 179-184.

The SPI maps revealing short-term (6-month), medium-term (12-month) and long-term (24- and 36-month) drought conditions ending in March 2026 are shown in Figures 5-8. The short-term SPI map reveals that the eastern and northeastern regions, including parts of Limpopo and Mpumalanga, were observed to be predominantly wetter than normal, with conditions ranging from moderately wet to extremely wet in several areas. Central regions showed mostly near-normal to mildly wet conditions, although localized variability was evident. In contrast, the western and southwestern regions, particularly the Western Cape and parts of the Northern Cape, were characterized by predominantly dry conditions. These areas exhibited a gradient from mild to severe drought, with pockets of extreme drought observed along the southwestern coastal region. The medium-term SPI map shows a similar pattern, with more pronounced conditions over the central parts and drier conditions in the southwestern regions. The long-term maps show widespread near-normal to wet conditions.

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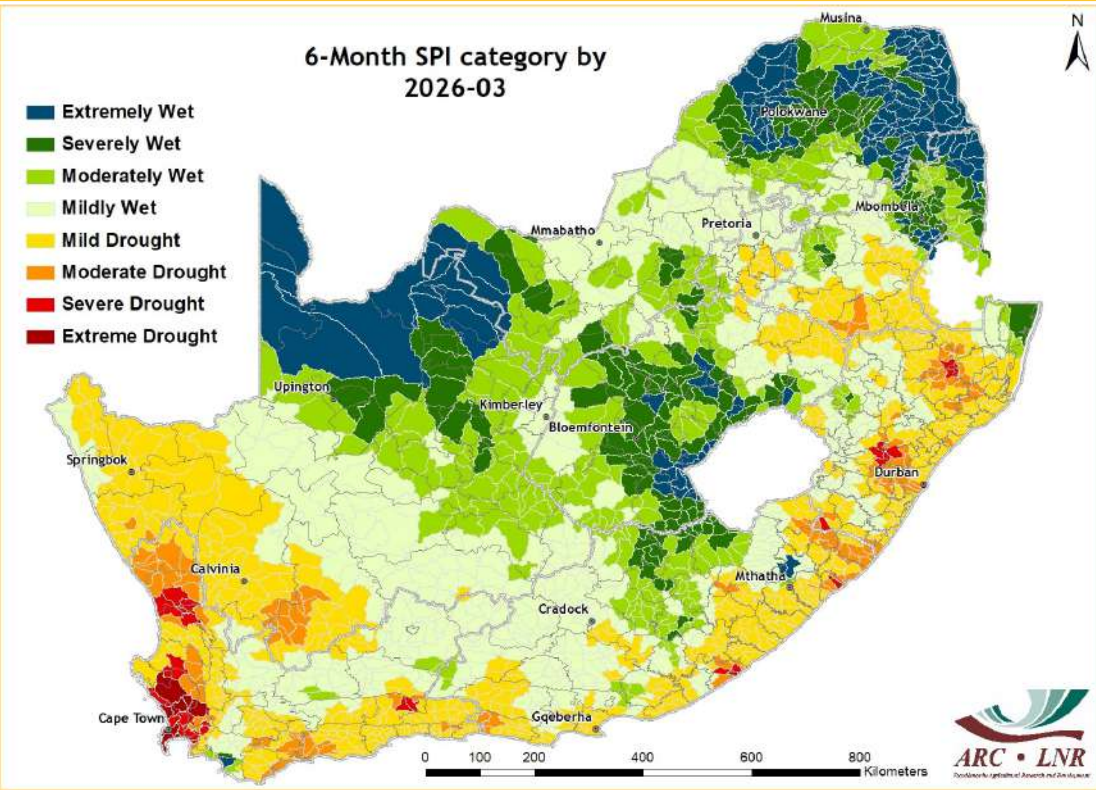

Figure 5

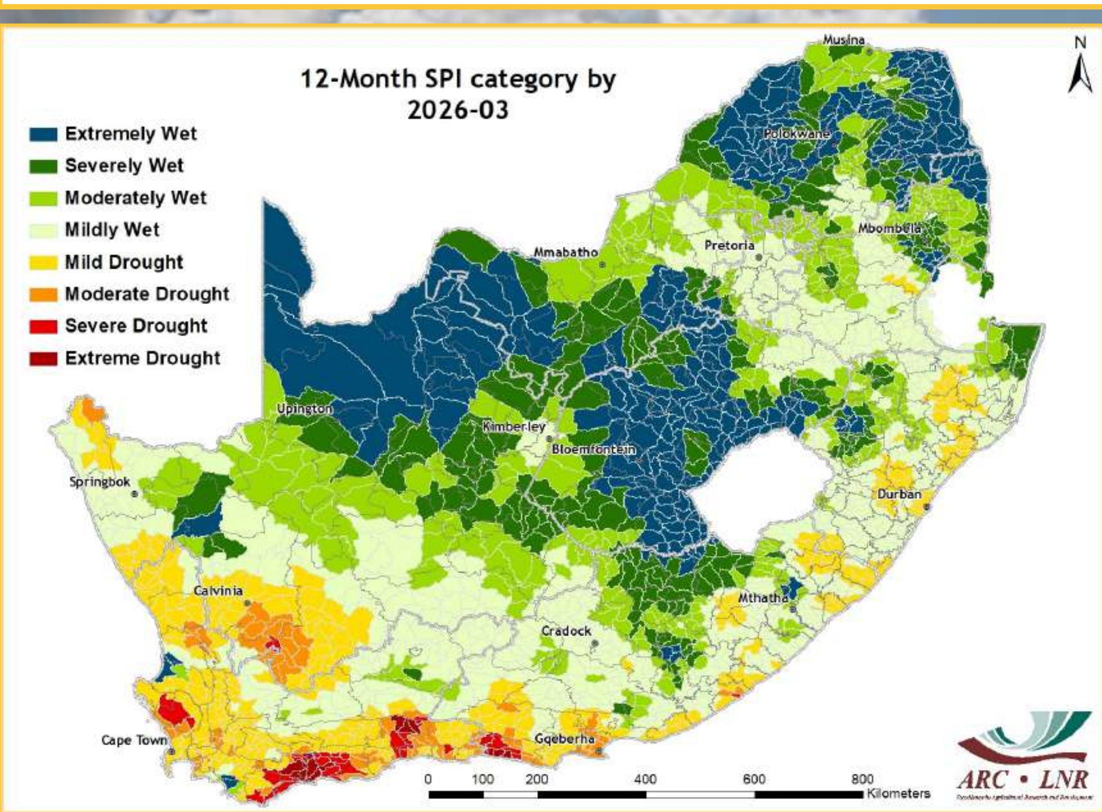

Figure 6

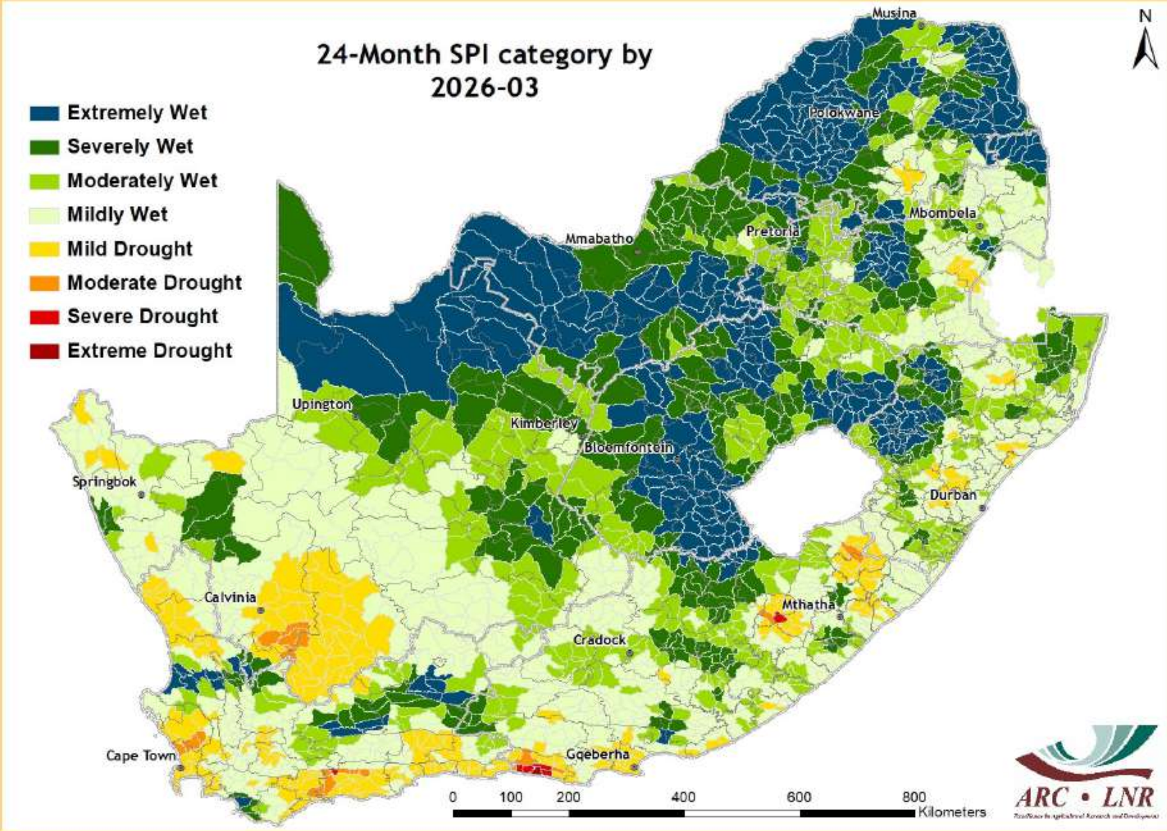

Figure 7

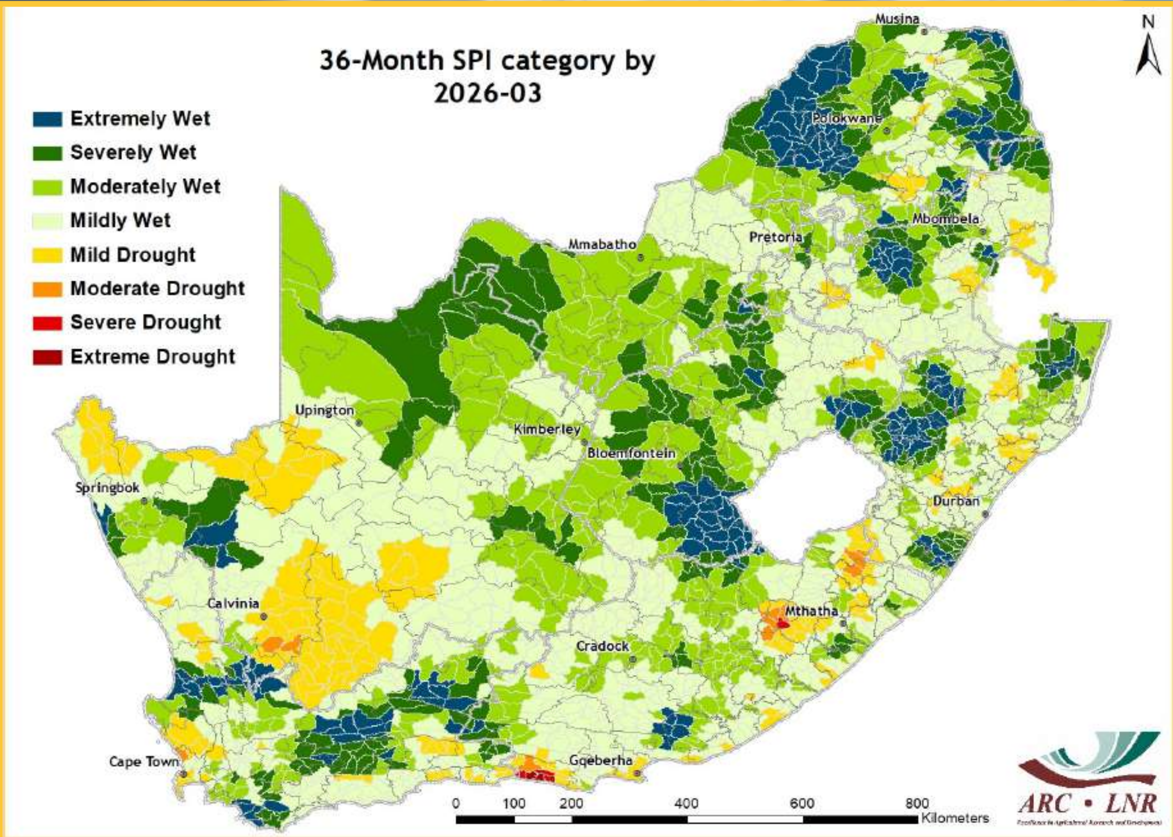

Figure 8

3. Rainfall Deciles

Deciles are used to express the ranking of rainfall for a specific period in terms of the historical time series. In the map, a value of 5 represents the median value for the time series. A value of 1 refers to the rainfall being as low or lower than experienced in the driest 10% of a particular month historically (even possibly the lowest on record for some areas), while a value of 10 represents rainfall as high as the value recorded only in the wettest 10% of the same period in the past (or even the highest on record). It therefore adds a measure of significance to the rainfall deviation.

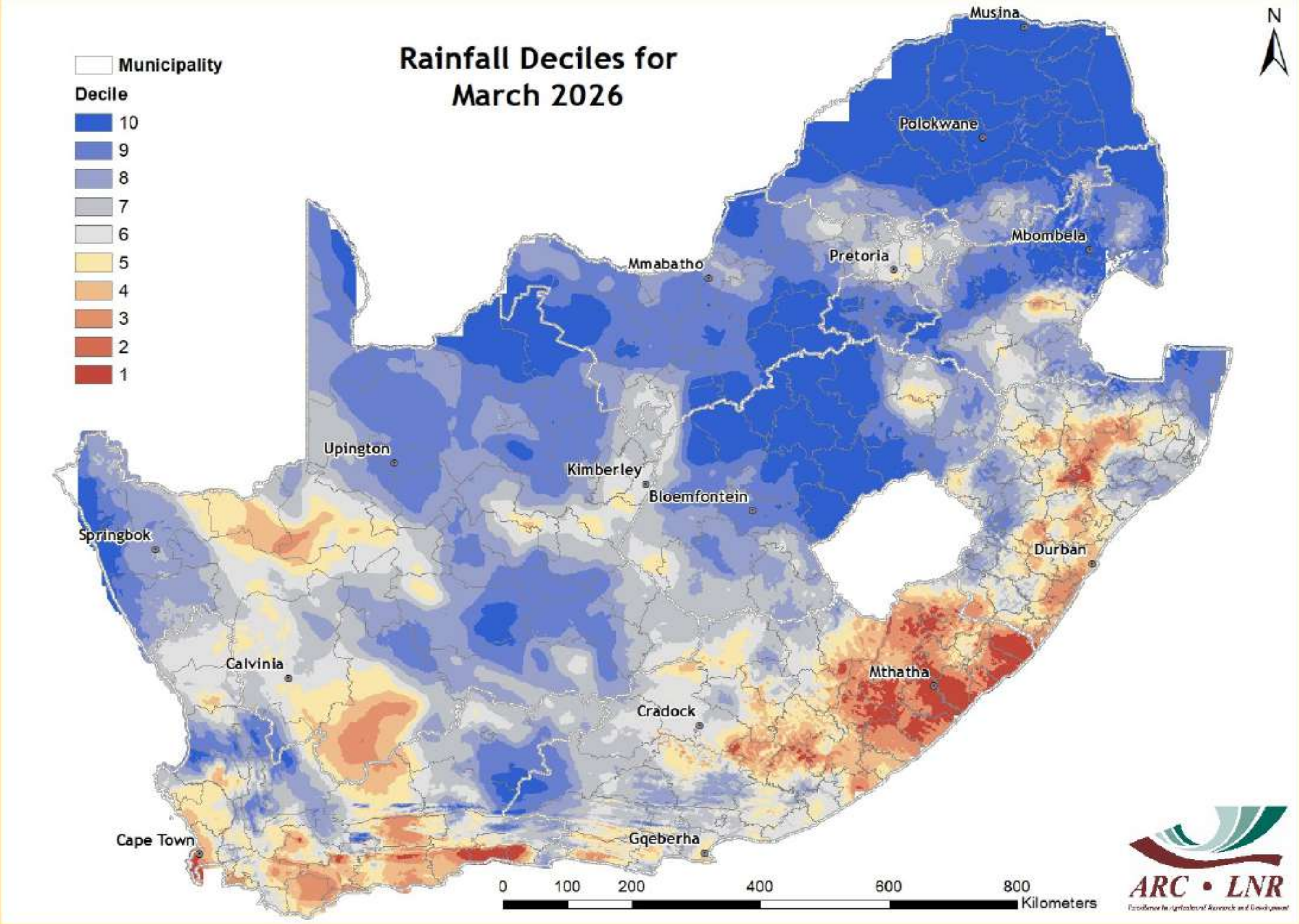

Figure 9

Figure 9:
During March 2026, greater parts of the country recorded rainfall totals that compared well with historically wetter March months. However, parts of the eastern coastline and southwestern interior, including parts of the winter and all-year rainfall regions, remained dry.

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4. Vegetation Conditions

Vegetation Mapping

The Normalized Difference Vegetation Index (NDVI) is computed from the equation:

$NDVI=(IR-R)/(IR+R)$

where:
IR = Infrared reflectance &
R = Red band

NDVI images describe the vegetation activity. A decadal NDVI image shows the highest possible "greenness" values that have been measured during a 10-day period.

Vegetated areas will generally yield high values because of their relatively high near infrared reflectance and low visible reflectance. For better interpretation and understanding of the NDVI images, a temporal image difference approach for change detection is used.

The Standardized Difference Vegetation Index (SDVI) is the standardized anomaly (according to the specific time of the year) of the NDVI.

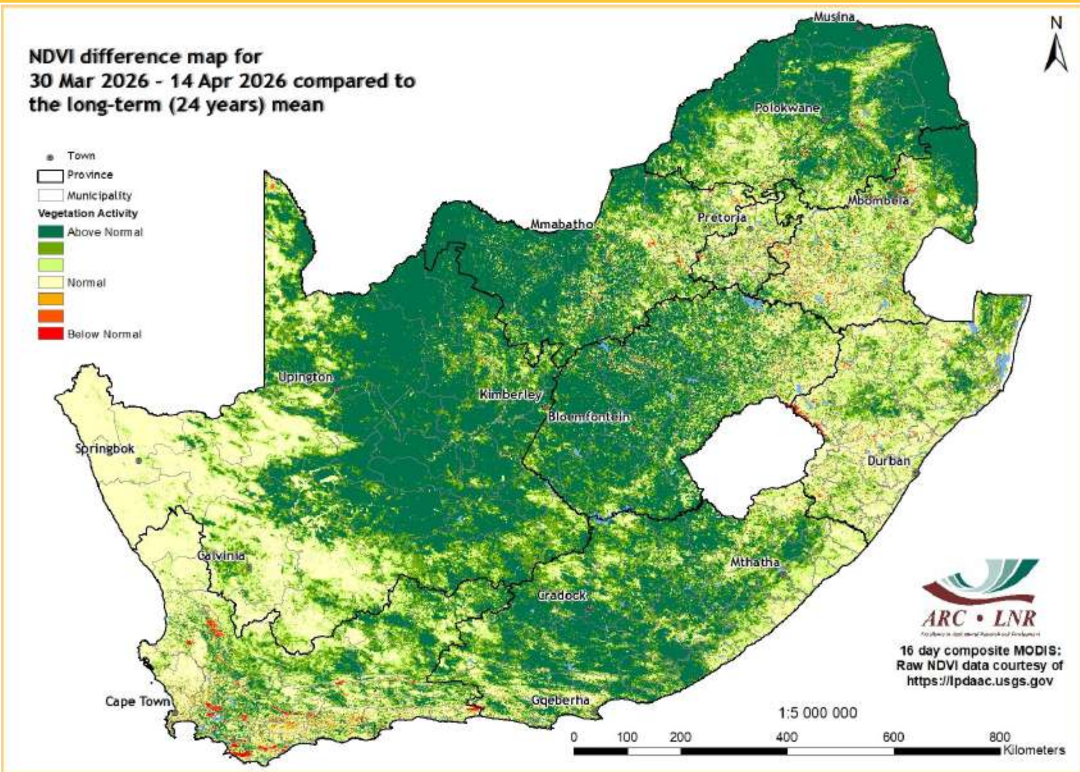

Figure 10

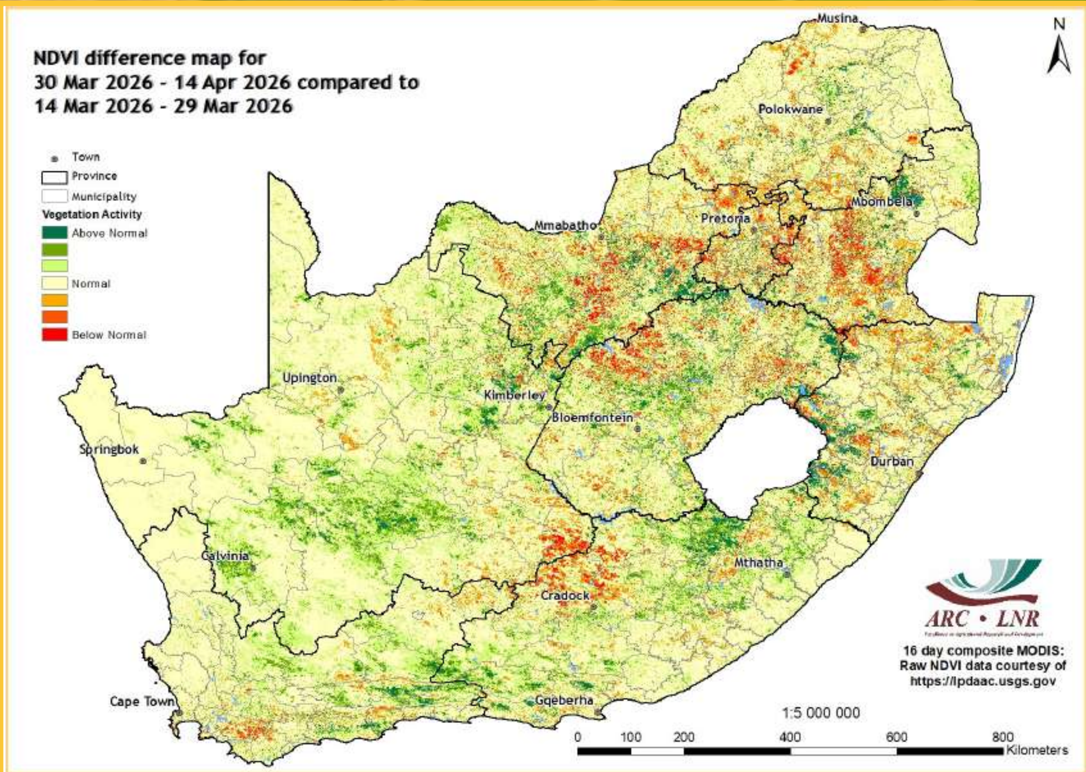

Figure 11

Figure 10:
Compared to the historical averaged vegetation conditions, the 16-day NDVI map for March 2026 shows that above-normal conditions occurred in the central interior and far northern parts of the country, with patches of below-normal activity observed in some isolated areas.

Figure 11:
The 16-day NDVI difference map for March 2026 compared to the preceding 16-day period shows that the country experienced mainly normal vegetation conditions, with patches of both below-normal and above-normal activity in isolated areas.

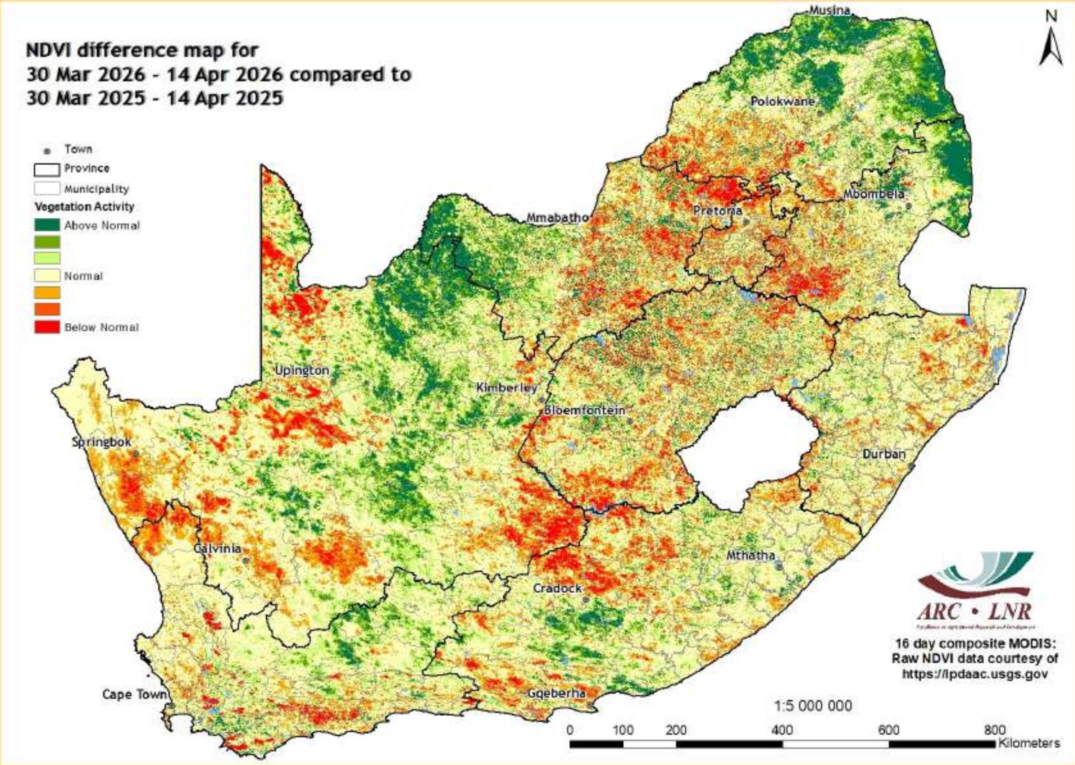

Figure 12

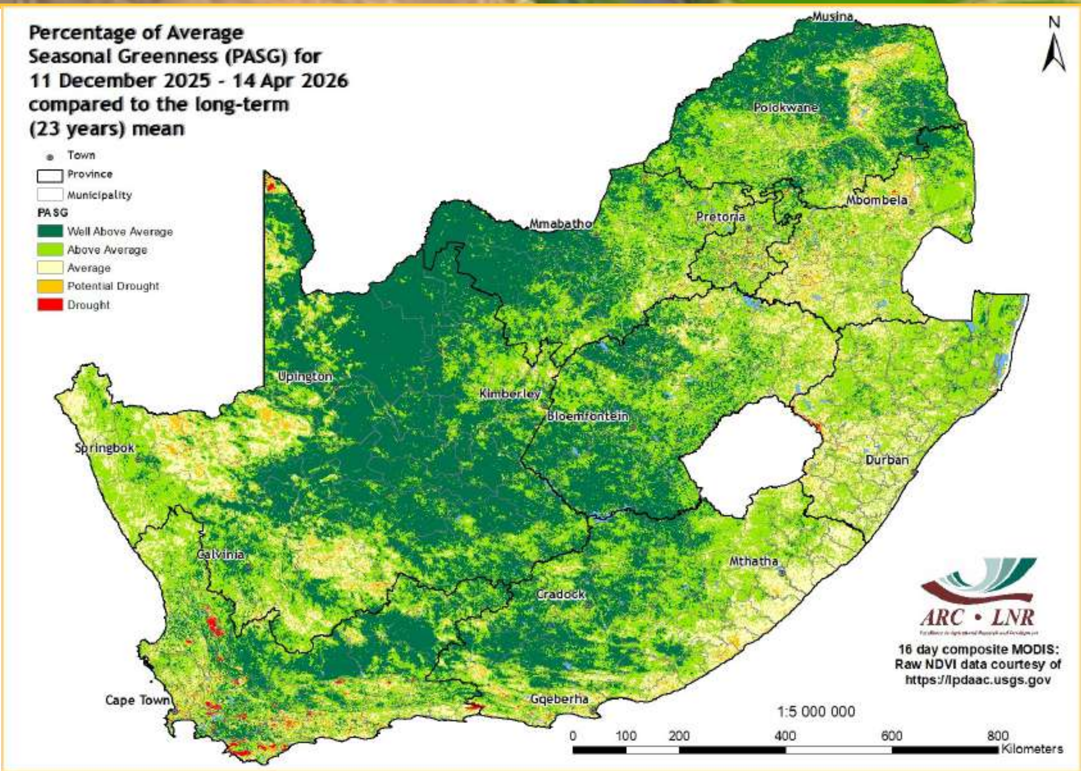

Figure 13

Vegetation Mapping
(continued from p. 7)

Interpretation of map legend

NDVI-based values range between 0 and 1. These values are incorporated in the legend of the difference maps, ranging from -1 (lower vegetation activity) to 1 (higher vegetation activity) with 0 indicating normal/the same vegetation activity or no significant difference between the images.

Cumulative NDVI maps:

Two cumulative NDVI datasets have been created for drought monitoring purposes:

Winter: January to December
Summer: July to June

Figure 12:
The 16-day NDVI difference map for March 2026 compared to the same period last year shows that the country experienced a mix of vegetation activity. The central parts experienced mainly above-normal conditions, whilst patches of below-normal activity occurred in the far northern and the western parts of the country.

Figure 13:
The Percentage of Average Seasonal Greenness (PASG) map for the past 4 months shows that the northern and central parts the country continue to experience above-normal vegetation conditions, while a few isolated areas, particularly along the southern coastline, experienced potential drought.

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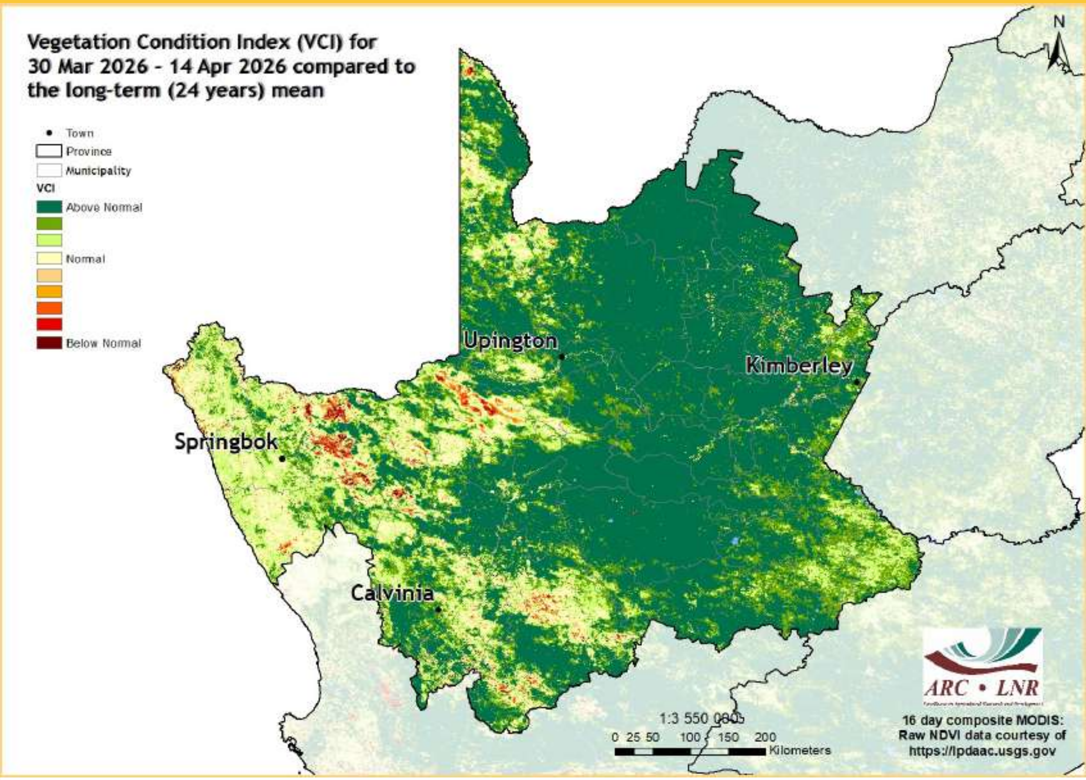
5. Vegetation Condition Index

Vegetation Condition Index (VCI)

The VCI is an indicator of the vigour of the vegetation cover as a function of the NDVI minimum and maximum encountered for a specific pixel and for a specific period, calculated over many years.

The VCI normalizes the NDVI according to its changeability over many years and results in a consistent index for various land cover types. It is an effort to split the short-term weather-related signal from the long-term climatological signal as reflected by the vegetation. The VCI is a better indicator of water stress than the NDVI.



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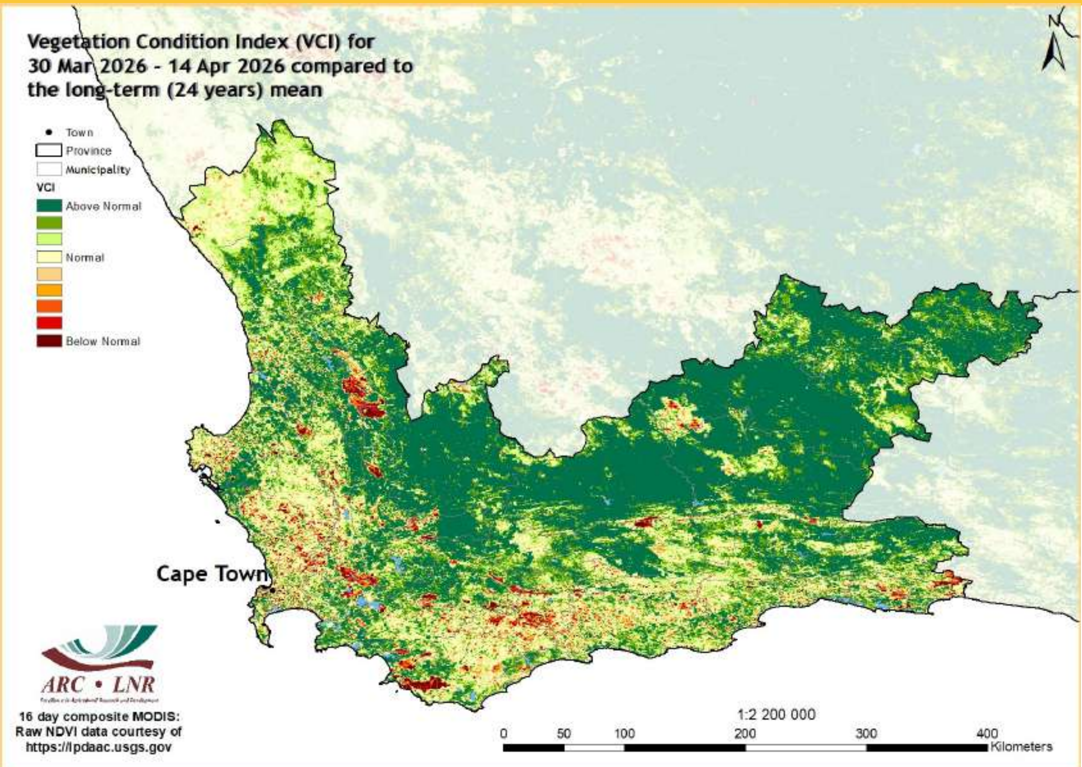

Figure 15

Figure 14:
The 16-day VCI map for March 2026 shows that the eastern half of the Northern Cape experienced mainly above-normal vegetation conditions, while patches of below-normal activity were observed in the far western parts of the province.

Figure 15:
The 16-day VCI map for March 2026 shows that the inland parts of the Western Cape experienced mainly above-normal vegetation conditions, while patches of below-normal activity were observed particularly in the coastal parts of the province.

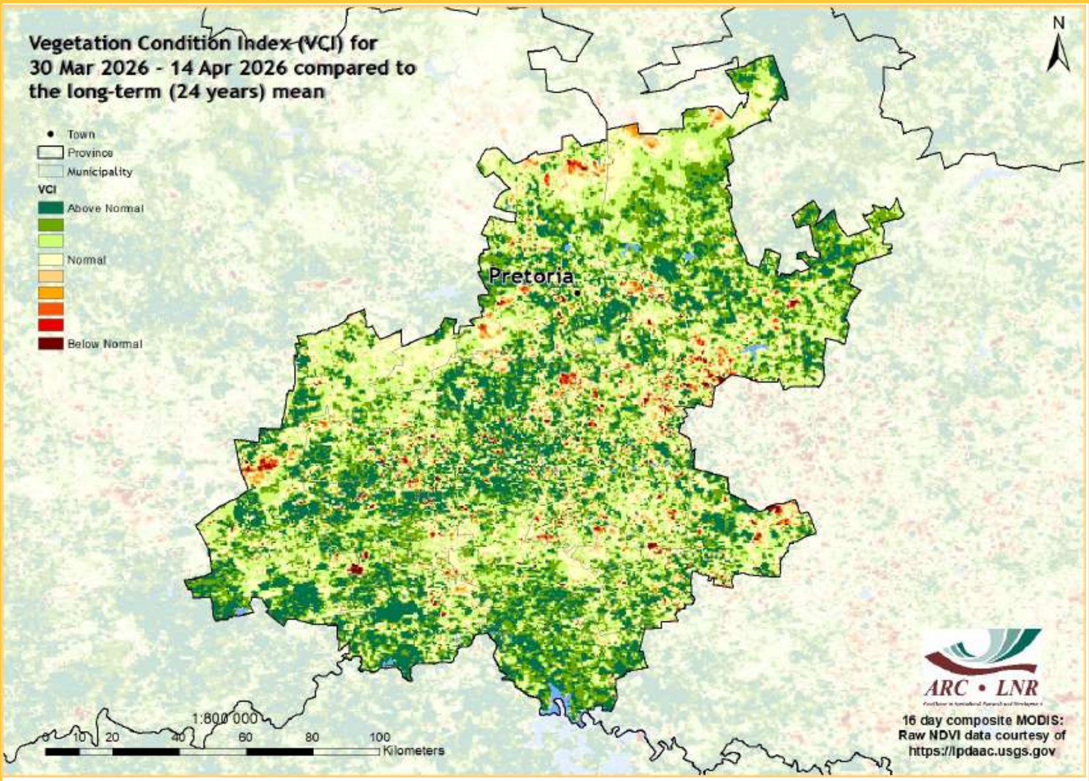

Figure 16

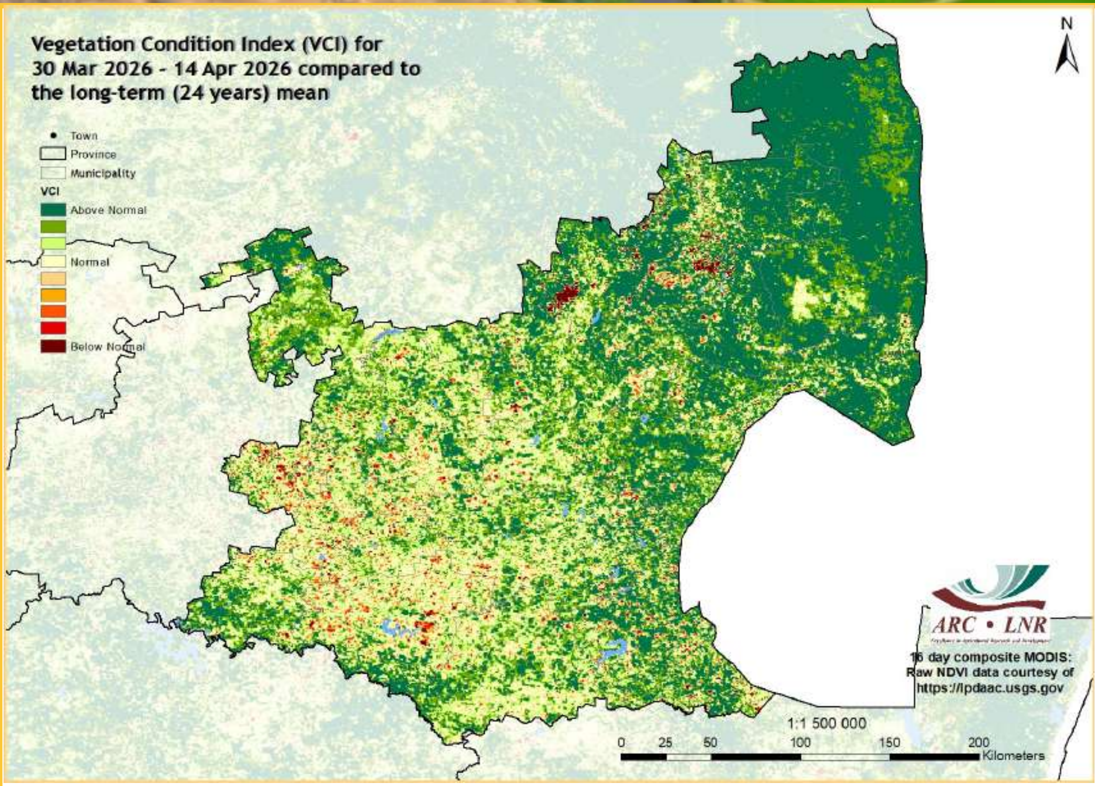

Figure 17

Figure 16:
The 16-day VCI map for March 2026 shows that Gauteng experienced a mix of vegetation conditions with many parts of the province experiencing mainly above-normal activity.

Figure 17:
The 16-day VCI map for March 2026 shows that most of Mpumalanga experienced a mix of below- and above-normal vegetation conditions, with patches of below-normal activity mainly confined to the western parts of the province while the eastern half experienced mainly above-normal conditions.

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6. Vegetation Conditions & Rainfall

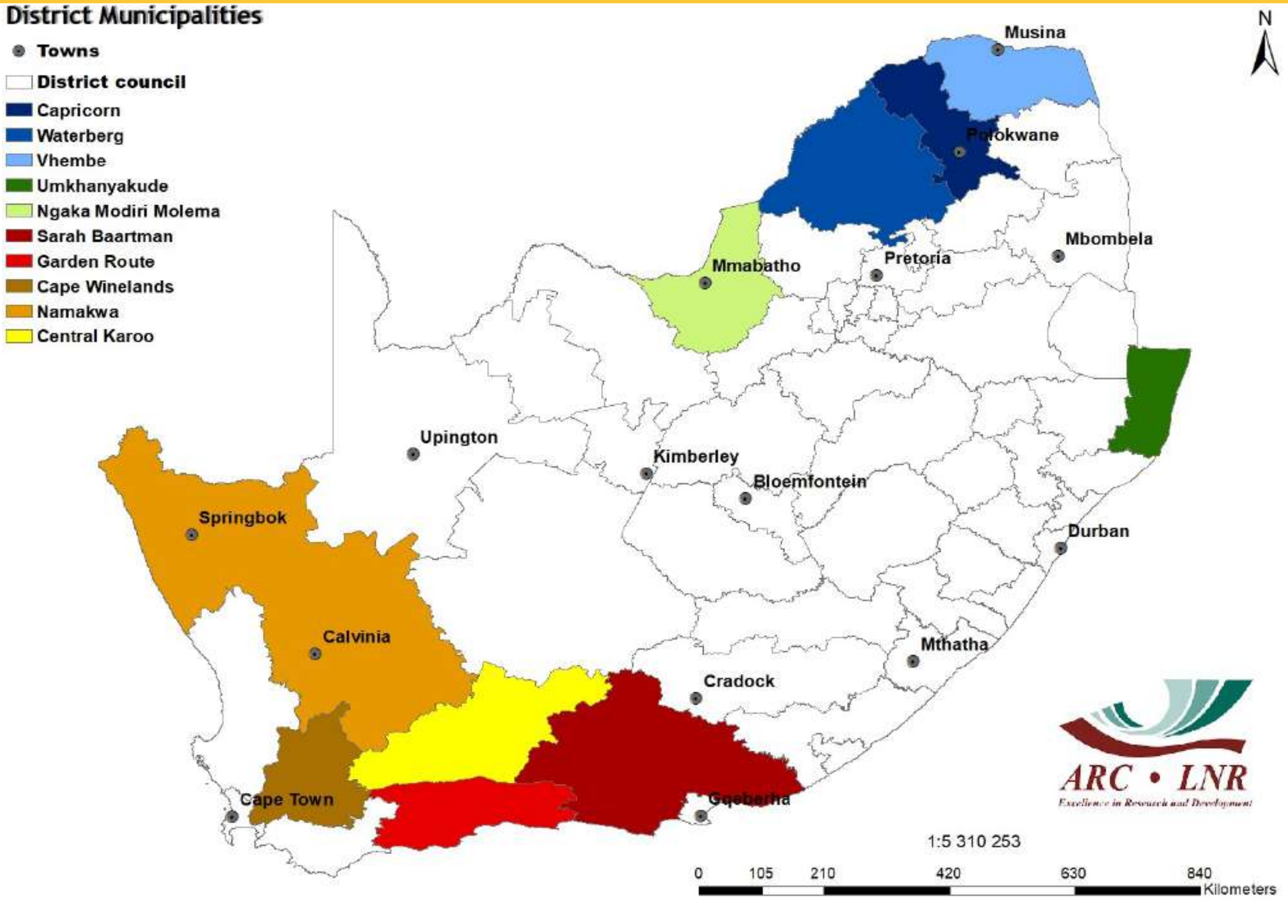

Figure 18

Rainfall and NDVI Graphs

Figure 18:
Orientation map showing the areas of interest for March 2026. The district colour matches the border of the corresponding graph.

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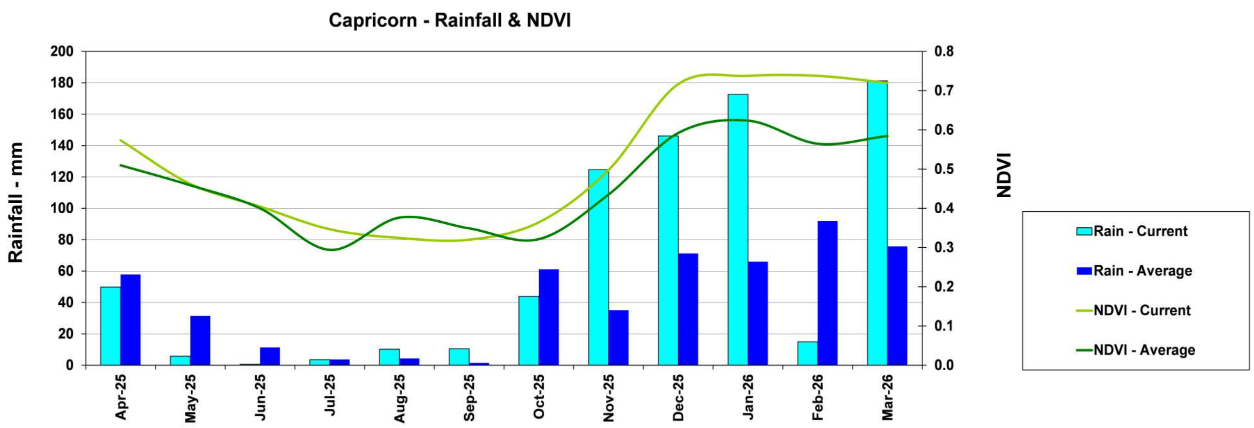
Figures 19-23:
Indicate areas with higher cumulative vegetation activity for the last year.

Figures 24-28:
Indicate areas with lower cumulative vegetation activity for the last year.



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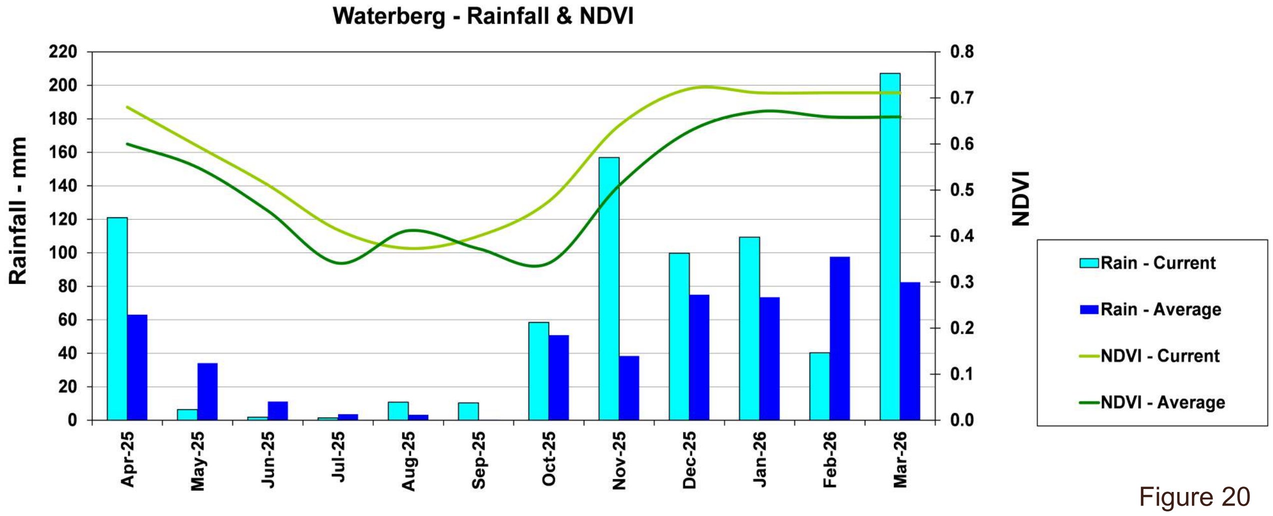

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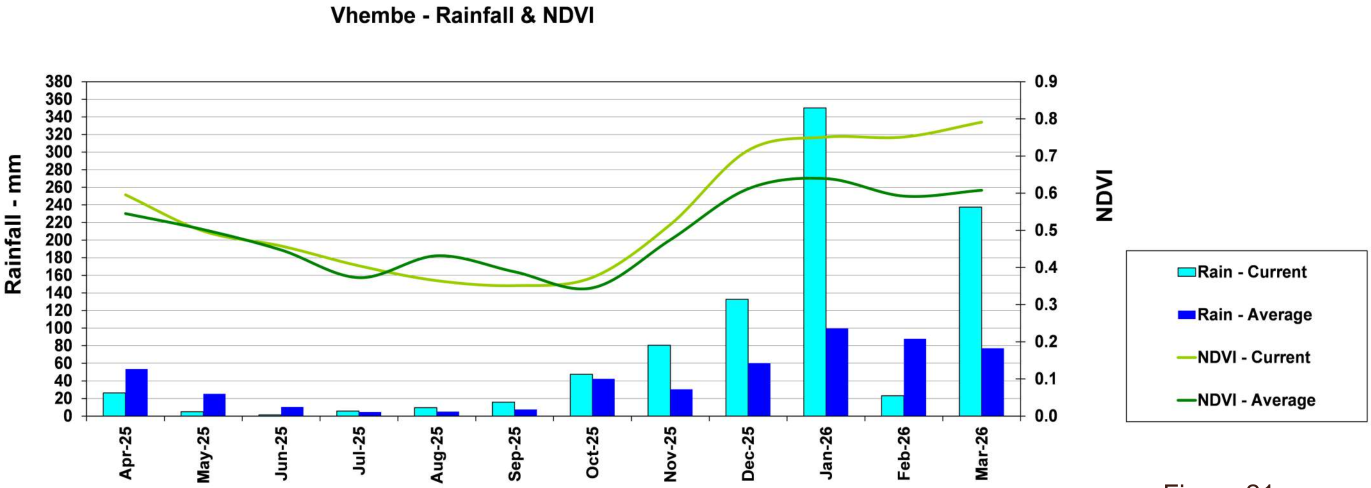

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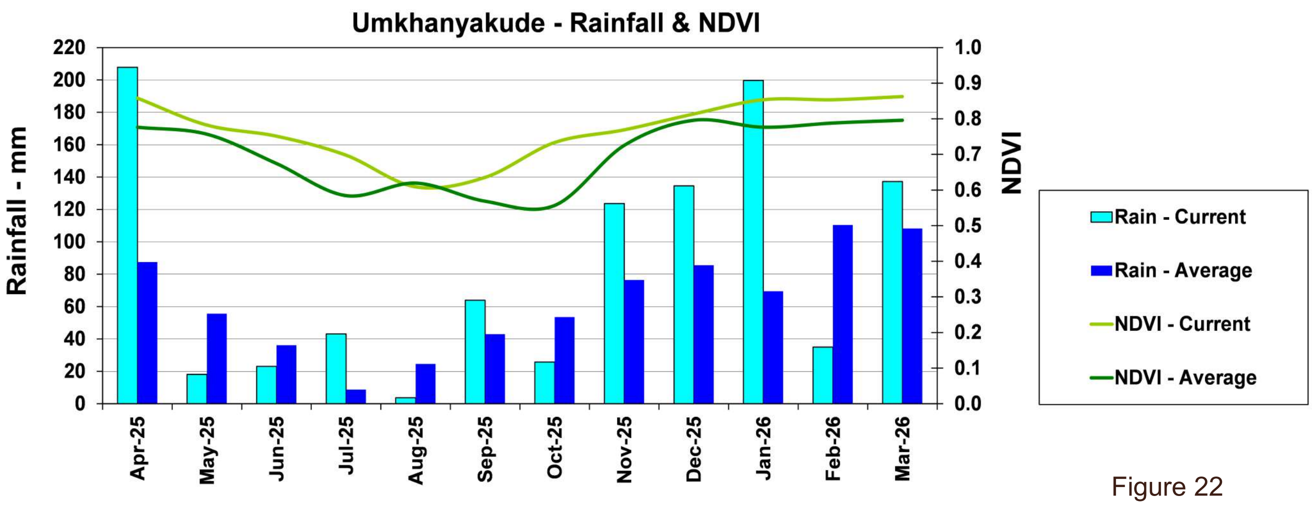

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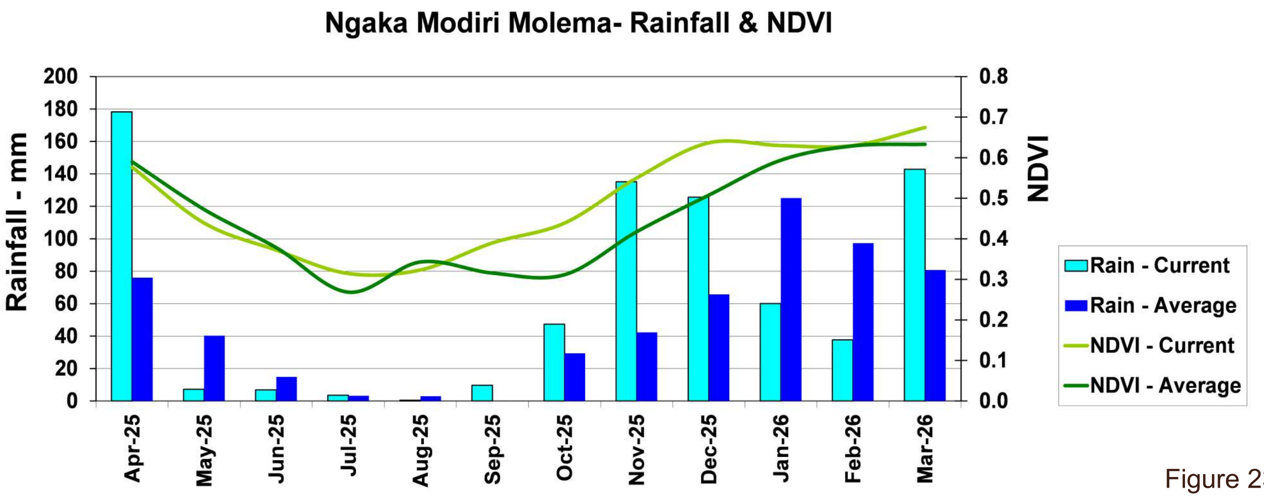

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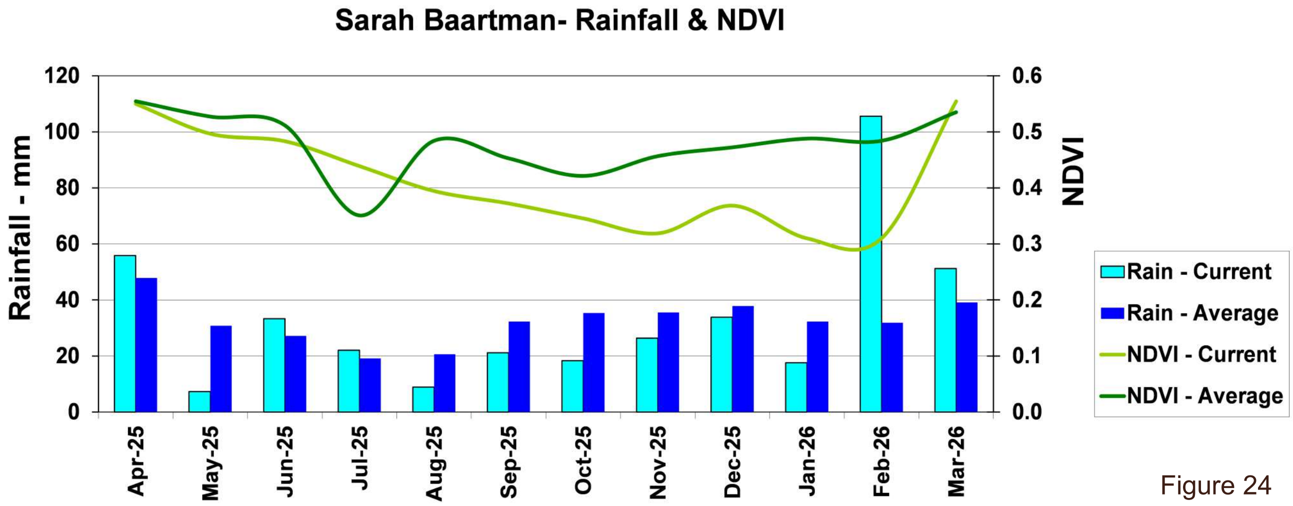

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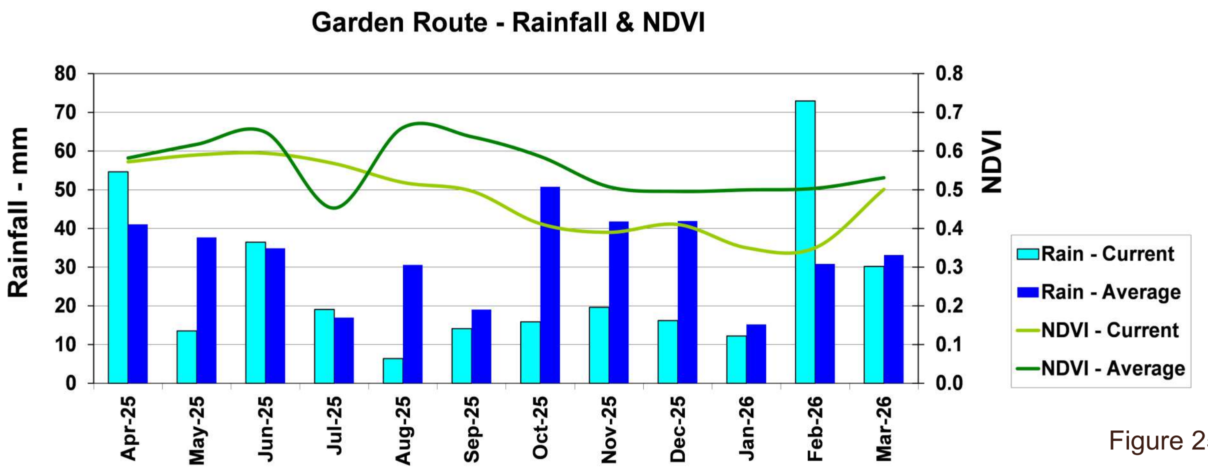

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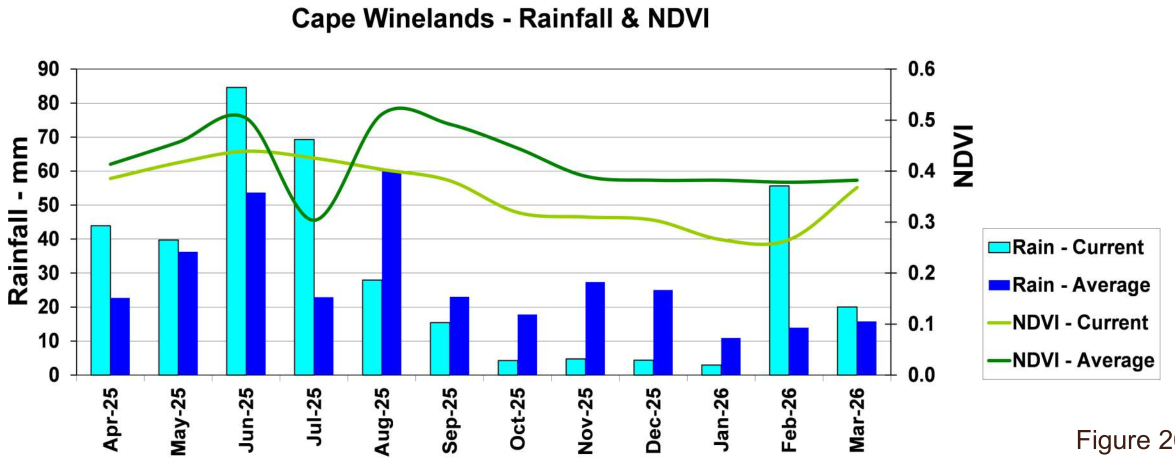

Figure 26

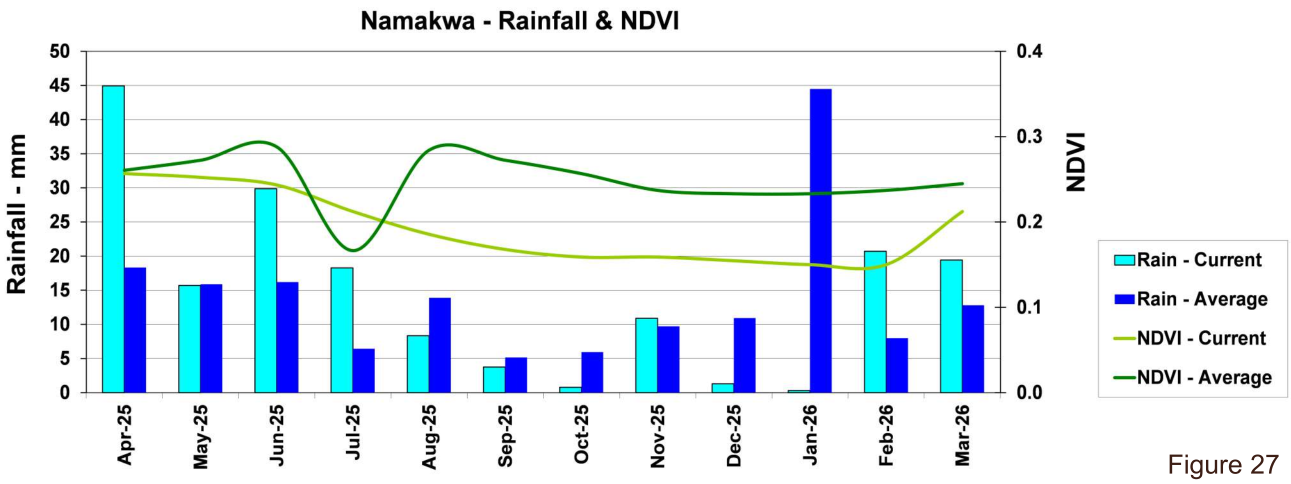

Figure 27

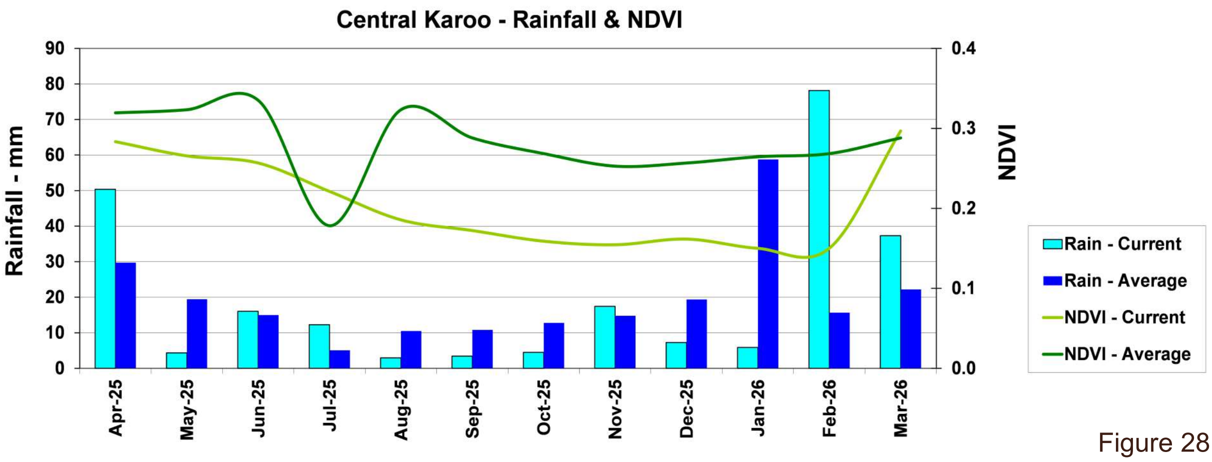

Figure 28

7. Fire Watch

Active Fires *(Provided when data is available)*

Forest and vegetation fires have temperatures in the range of 500 K (Kelvin) to 1000 K. According to Wien's Displacement Law, the peak emission of radiance for blackbody surfaces of such temperatures is at around 4 μm. For an ambient temperature of 290 K, the peak of radiance emission is located at approximately 11 μm. Active fire detection algorithms from remote sensing use this behaviour to detect "hot spot" fires.

Figure 29:
The graph shows the total number of active fires detected from 26 February to 29 March 2026 per province. Fire activity was higher in the Free State and Northern Cape compared to the long-term average.

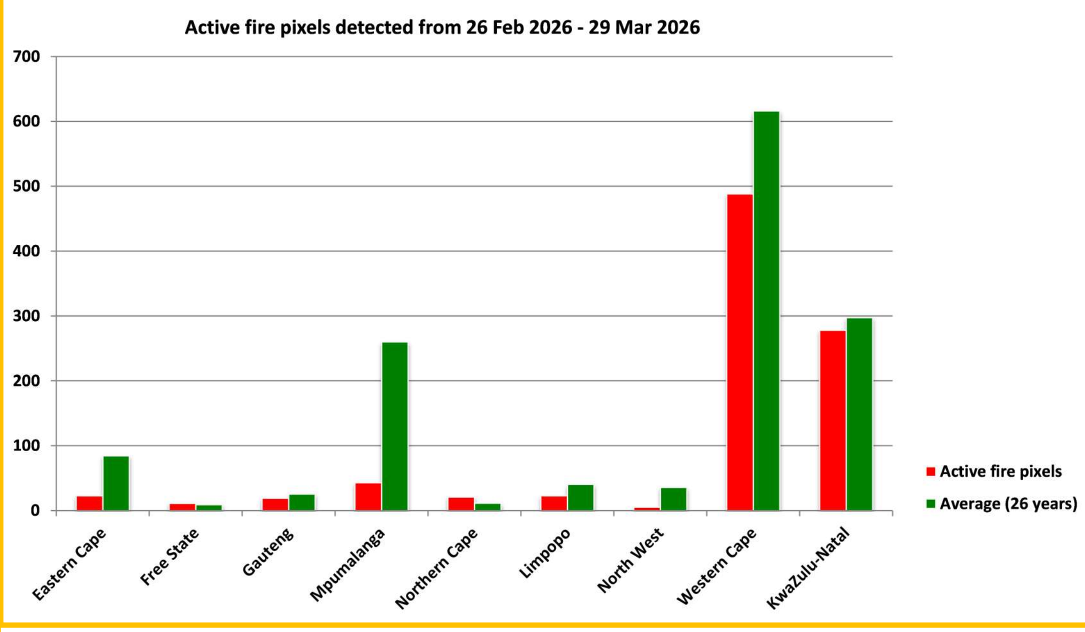

Figure 29

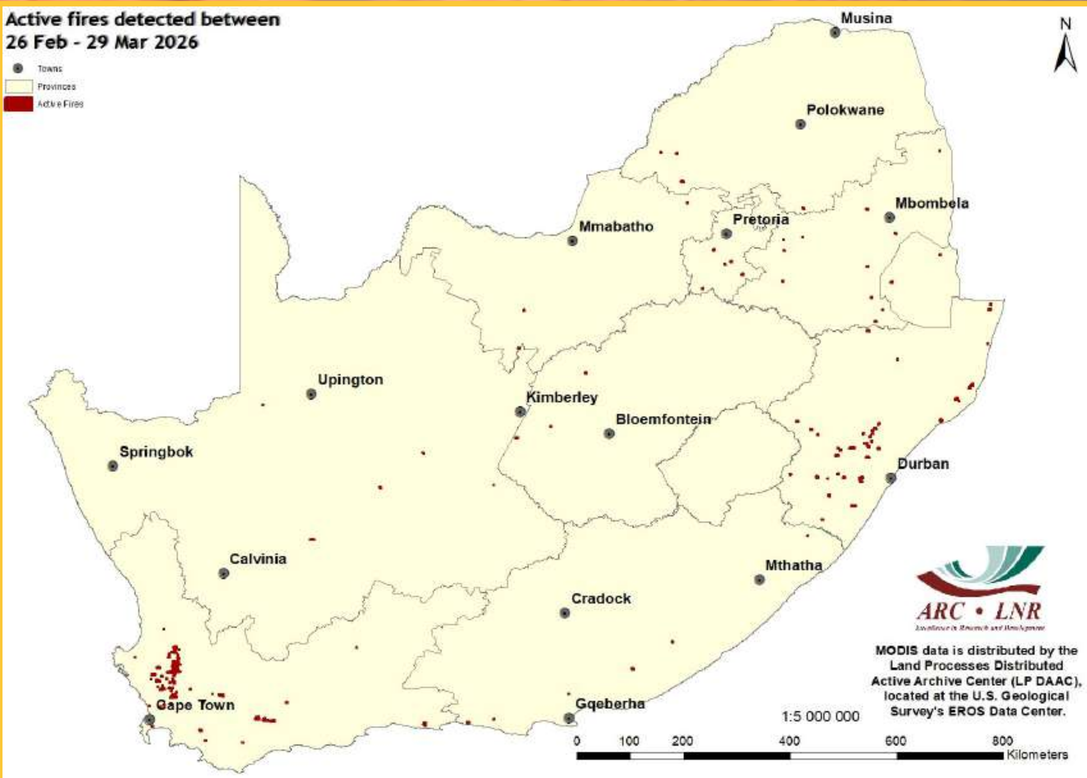

Figure 30

Figure 30:
The map shows the location of active fires detected between 26 February and 29 March 2026.

Active Fires *(Provided when data is available)*

Forest and vegetation fires have temperatures in the range of 500 K (Kelvin) to 1000 K. According to Wien's Displacement Law, the peak emission of radiance for blackbody surfaces of such temperatures is at around 4 μm. For an ambient temperature of 290 K, the peak of radiance emission is located at approximately 11 μm. Active fire detection algorithms from remote sensing use this behaviour to detect "hot spot" fires.

Figure 31:
The graph shows the total number of active fires detected from 1 January to 29 March 2026 per province. Fire activity was higher in the Eastern Cape compared to the long-term average.

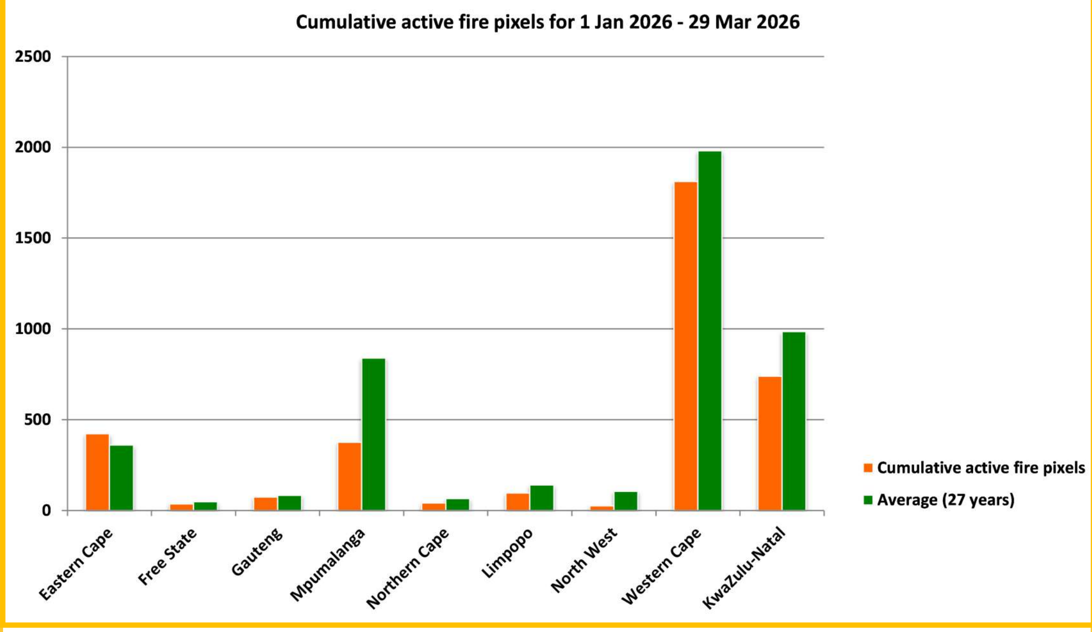

Figure 31

Figure 32:
The map shows the location of active fires detected between 1 January and 29 March 2026.

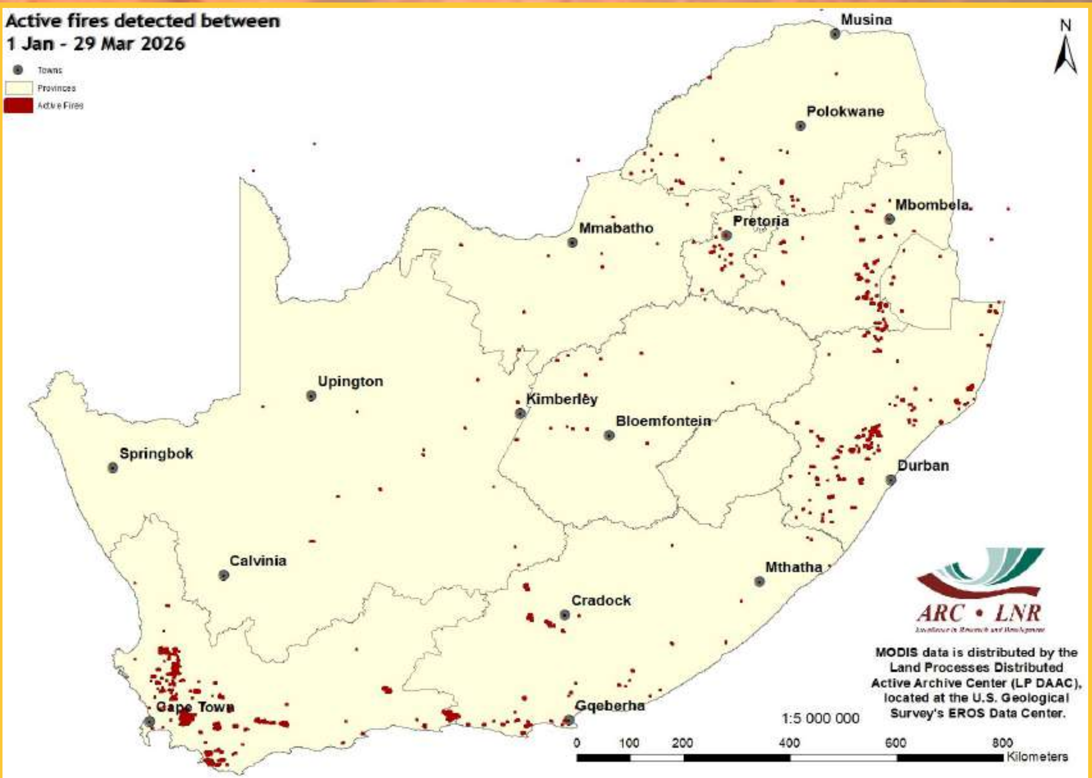

Figure 32

Questions/Comments:
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8. Surface Water Resources

Countrywide surface water areas (SWAs) are mapped on a monthly basis by GeoTerraImage using Sentinel-2 satellite imagery from the start of its availability at the end of 2015.

Figure 33 represents a comparison between the area of water available now and the maximum area of surface water recorded in the last 9 years. This 9-year historical window represents the operational period of the satellite from which the water information has been generated. In this map, any value less than 100 represents water catchments within which the current month's total surface water is less than the maximum extent recorded for the same area since the end of 2015.

Figure 34 represents a comparison between the area of surface water now and for the same month last year. In this map, any value less than 100 represents water catchments within which the current month's total surface water is less than that recorded in the same water catchment, in the same month, last year.

The long-term map for March 2026 shows a marked improvement in water distribution patterns to that recorded in the previous month in both winter and summer rainfall regions. Winter rainfall catchments are still lower than summer rainfall areas, but show an improvement on the previous February long-term conditions.

The comparison between March 2026 and March 2025 also shows significant improvements in many catchments in the central and northwestern parts of the country, although decreases are noticeable across KwaZulu-Natal and most of the northern border regions.

The SWA maps are derived from the monthly data generated and available through GeoTerraImage's 'Msanzi Amanzi' web information service: https://www.water-southafrica.co.za

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Maximum surface water area for March 2026 expressed as a % of historic maximum, per Tertiary catchment.

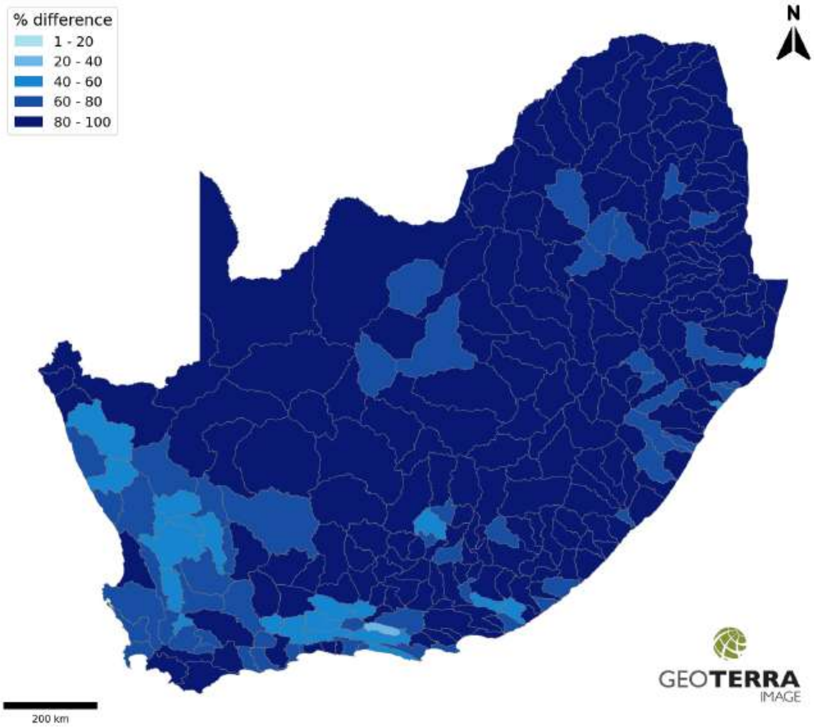

Figure 33

Maximum surface water area for March 2026 expressed as a % of March 2025 maximum, per Tertiary catchment.

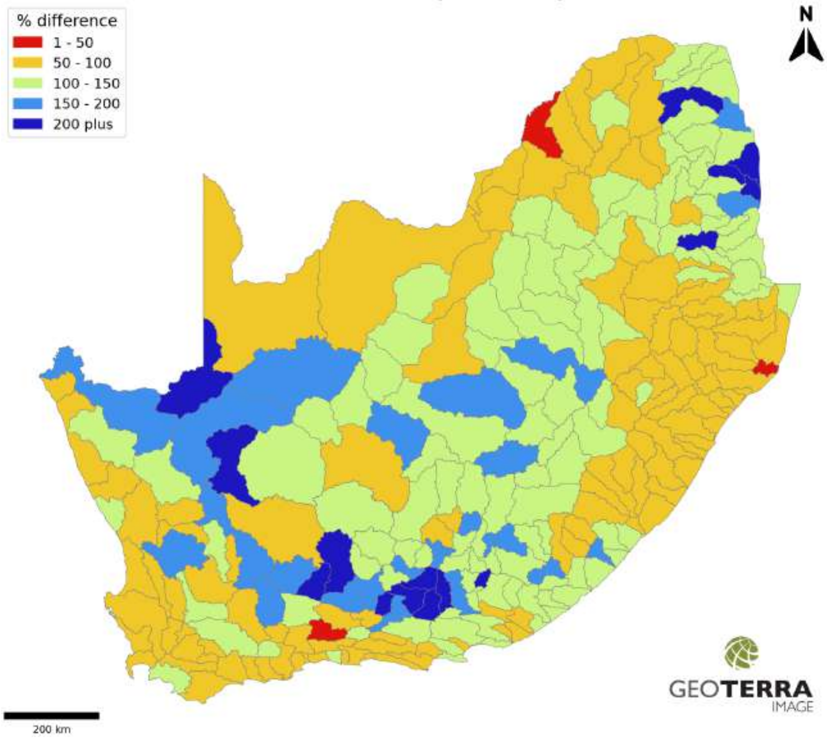

Figure 34

GEOTERRA IMAGE
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ARC - NATURAL RESOURCES AND ENGINEERING

SOIL, CLIMATE AND WATER

Agrometeorology

The programme uses weather and climate information for agricultural planning and the enhancement of crop and livestock production systems. The impact of climate variability and change in the agricultural sector is investigated. Due to the increasing pressure to reduce greenhouse gas emissions globally, climate change mitigation is also an important facet of our activities. The Weather Station Network and Climate Database are maintained as a national asset for the benefit of the agriculture sector.

Activities

Agrometeorology and Crop Modelling

- Assessing climate risk for an area in relation to a particular crop
- Agroclimatological analysis of the suitability for crop production at a particular location
- Development of early warning systems for climate hazards (e.g. drought, floods)
- Agrometeorological forecasting and advisory services
- Crop modelling to assess the impact of weather conditions and climate on agriculture
- Conducting crop yield forecasting exercises, hydrological modelling, hydrometeorology and biometereology studies

Climate Change Adaptation and Mitigation

- Conducting research on possible impact of projected climate change on agricultural activities, potential, greenhouse gas emissions from various land use, climate change, mitigation and adaptation strategies for agriculture
- Developing greenhouse gas inventories at farm and national levels
- Conducting research on climate change mitigation and adaptation strategies for agriculture
- Promoting low-carbon technologies

Climate Monitoring, Products and Services

- Developing and maintaining a network of over 500 weather stations distributed all over the country
- Archiving historical and current weather data of good quality with some datasets dating back to 1900
- Developing weather/climate products and services together with stakeholders and clients to meet their specific requirements
- Disseminating weather/climate data, products and services via multiple platforms

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ARC • LNR

ARC - NATURAL RESOURCES AND ENGINEERING

SOIL, CLIMATE AND WATER

GeoInformatics

The programme focuses on applied Geographical Information Systems (GIS) and provides leadership in GIS products, solutions and decision support systems for agriculture and natural resources management. The Coarse Resolution Satellite Image Archive and Information Database is maintained as a national asset.

Activities

Digital/Smart Agriculture/Drone Platform - Applications

- Yield & production estimation
- Insurance index
- Mapping crop types
- Monitoring growth stages
- Weed/invasive sp. mapping
- Water requirement
- Smart & digital agriculture
- Disease/pests

Applications in Natural Resources/National Assets

- Early warnings
- National & Provincial advisories
- Crop suitability changes
- Crop statistics
- Crop stress
- Spatially explicit information dissemination systems, e.g. Umlindi newsletter

Applications in Rangelands, Livestock and Wildlife

- Early warnings
- National & Provincial advisories
- Rangeland suitability
- Rangeland dynamics
- Rangeland stresses
- Spatially explicit information dissemination systems, e.g. Umlindi newsletter

Contact Person: *Dr George Chirima*
Tel: 012 310 2672 • E-mail: chirimaj@arc.agric.za

ARC-Natural Resources and Engineering
Soil, Climate and Water Campus
600 Belvedere Street, Arcadia, 0083
Private Bag X79, Pretoria 0001
Tel: 012 310 2500 • Fax: 012 323 1157
Website: www.arc.agric.za

For more information contact:
Adri Laas - Public Relations Officer
E-mail: adril@arc.agric.za

ARC - NATURAL RESOURCES AND ENGINEERING

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SOIL, CLIMATE AND WATER

Analytical Laboratory

The unit focuses on the various procedures to analyze and determine the properties of soil, water and associated materials, mainly for agricultural purposes. The laboratory operates a range of equipment and participates in various quality control schemes, both local and international. The water analysis for anions is SANAS-accredited and other accreditations are underway.

Analyses and Services

Soil Physical Analysis

- Texture (sand, silt and clay content)
- Water-holding capacity
- Soil moisture content
- Bulk density
- Shrink-swell capacity

Soil Chemical Analysis

- pH
- Exchangeable and extractable cations
- Acidity
- Soil Organic Carbon
- Nitrogen content and C/N ratio
- Phosphorus
- Micronutrients

Soil Fertility

- Analysis package for farmers & gardeners
- Fertilizer recommendations for specific crops

Water Analysis

- pH, EC, anions, cations
- Water quality

ICP Scan

- Semi-quantitative scan for a range of elements (Li, Be, Ti, V, Cr, Mn, Co, Ni, Cu, Zn, As, Se, Rb, Sr, Mo, Cd, Sn, Sb, Te, Cs, Ba, La, W, Pt, Hg, Tl, Pb, Bi, U), can be done on soil, water and plant

Plant Material Analysis

For example: leaves, roots, growth media, etc. – drying, milling, pH, EC, C, N, nutrients and toxic elements

Special Sample Analysis

- For example: sludges, compost, fertilizers – composition and other properties
- Elemental analysis of animal tissue (e.g. hair, bones, liver, muscle, milk)

For more information or to obtain prices or quotation, contact the <u>Laboratory Manager:</u> *Ms. Zanele Hlam*
Tel: 012 310 2531 • E-mail: HlamZ@arc.agric.za

In order to assist clients who wish to send samples to ARC, the courier costs can be borne by ARC for analysis packages of R10 000 or more.

Contact the Laboratory Manager for details.

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SOIL, CLIMATE AND WATER

Microbiology and Environmental Biotechnology Laboratory

The Microbiology and Environmental Biotechnology Research Group forms part of the Soil Science Programme at ARC-SCW. The research group utilizes both fundamental as well as applied microbiology and biotechnology approaches to address soil, climate and water related problems in a sustainable and eco-friendly manner.

Analyses and Services

Renewable energy generation

- Gas Chromatography analysis of biogas - methane and carbon dioxide content measurements

Nanotechnology

- UV-Visible spectrophotometer analysis for colloidal nanoparticle synthesis

Phytochemical extraction

- Hotplate extraction of phytochemicals
- Soxhlet extraction of phytochemicals
- Microwave-assisted extraction of phytochemicals

Community-Level Physiological Profiling (CLPP)

- Microbial functional analysis using Biolog 31C plates

For information on microbiological analyses contact

Dr Ashira Roopnarain

Tel: 012 310 2650 • E-mail: RoopnarainA@arc.agric.za

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The Coarse Resolution Imagery Database (CRID)

NOAA AVHRR

ARC-NRE has an archive of daily NOAA AVHRR data dating from 1985 to 2004. This database includes all 5 bands as well as the Normalized Difference Vegetation Index (NDVI), Active Fire and Land Surface Temperature (LST) images. The NOAA data are used, for example, for crop production and grazing capacity estimation.

MODIS

MODIS data is distributed by the Land Processes Distributed Active Archive Center (LP DAAC), located at the U.S. Geological Survey's EROS Data Center. The MODIS sensor is more advanced than NOAA with regard to its high spatial (250 m^2 to 1 km^2) and spectral resolution. ARC-NRE has an archive of MODIS (version 4 and 5) data.

- MODIS v4 from 2000 to 2006
- MODIS v5 from 2000 to present

Datasets include:

- MOD09 (Surface Reflectance)
- MOD11 (Land Surface Temperature)
- MOD13 (Vegetation Products)
- MOD14 (Active Fire)
- MOD15 (Leaf Area Index & Fraction of Photosynthetically Active Radiation
- MOD17 (Gross Primary Productivity)
- MCD43 (Albedo & Nadir Reflectance)
- MCD45 (Burn Scar)

Coverage for version 5 includes South Africa, Namibia, Botswana, Zimbabwe and Mozambique.
More information:
http://modis.gsfc.nasa.gov

VGT4AFRICA and GEOSUCCESS

SPOT NDVI data is provided courtesy of the VEGETATION Programme and the VGT4AFRICA project. The European Commission jointly developed the VEGETATION Programme. The VGT4AFRICA project disseminates VEGETATION products in Africa through GEONETCast.

ARC-NRE has an archive of VEGETATION data dating from 1998 to the present. Other products distributed through VGT4AFRICA and GEOSUCCESS include Net Primary Productivity, Normalized Difference Wetness Index and Dry Matter Productivity data.

Meteosat Second Generation (MSG)

ARC-NRE has an operational MSG receiving station. Data from April 2005 to the present have been archived. MSG produces data with a 15-minute temporal resolution for the entire African continent. Over South Africa the spatial resolution of the data is in the order of 3 km. ARC-NRE investigated the potential for the development of products for application in agriculture. NDVI, LST and cloud cover products were some of the initial products derived from the MSG SEVIRI data. Other products derived from MSG used weather station data, including air temperature, humidity and solar radiation.

Rainfall maps

- Combined inputs from 450 automatic weather stations from the ARC-NRE Soil, Climate and Water weather station network, 270 automatic rainfall recording stations from the South African Weather Service (SAWS), satellite rainfall estimates from the Famine Early Warning System Network: **http://earlywarning.usgs.gov** and long-term average climate surfaces developed at the ARC-NRE.

Solar Radiation and Evapotranspiration maps

- Combined inputs from 450 automatic weather stations from the ARC-NRE Soil, Climate and Water weather station network.
- Data from the METEOSAT Second Generation (MSG) 3 satellite via GEONETCAST: **http://www.eumetsat.int/website/home/Data/DataDelivery/EUMETCast/GEONETCast/index.html**.

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NATURAL RESOURCES AND ENGINEERING
Soil, Climate and Water

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The operational Coarse Resolution Imagery Database (CRID) project of ARC-NRE is funded by the Department of Agriculture (DoA). Development of the monitoring system was made possible at its inception through LEAD funding from the Department of Science and Technology.

For further information please contact:
Reneilwe Maake – 012 310 2533, MaakeR@arc.agric.za

To subscribe to the newsletter, please click on the following link:
https://forms.office.com/r/YhBLkxXXp7

What does Umlindi mean?
UMLINDI is the Zulu word for "the watchman".