



Images of the Month

NATURAL RESOURCES AND ENGINEERING
Soil, Climate and Water

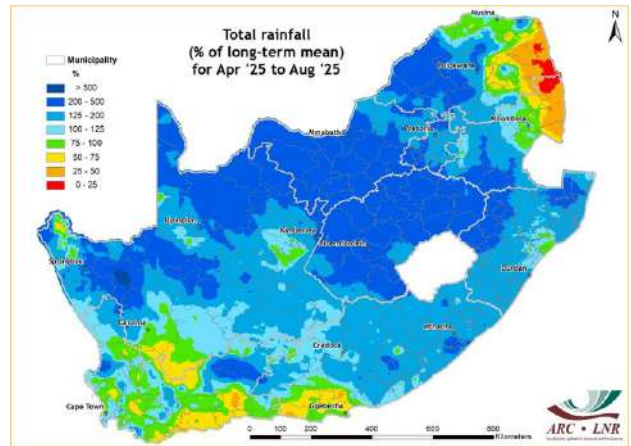
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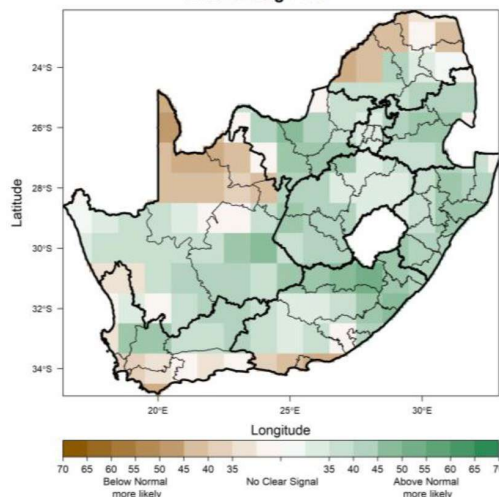
Rainfall outlook towards the onset of summer

The total rainfall map for April to August 2025 generally shows above-normal rainfall across much of the country compared to the long-term mean, with particularly strong positive anomalies over large parts of the interior, while drier pockets were mostly confined to the far northeast. Although parts of the summer rainfall region experienced dry weather during winter, as is climatologically expected, the rainfall received since April has contributed to sustaining residual soil moisture into spring.

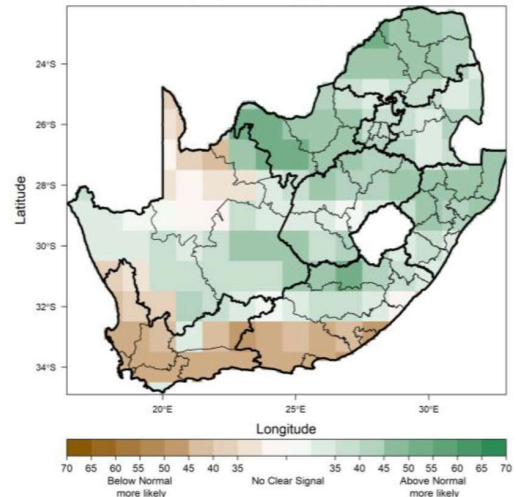
According to the South African Weather Service, the El Niño-Southern Oscillation (ENSO) is currently in a neutral state and is predicted to weaken, with probabilities favouring the development of a weak La Niña during the summer months. Moreover, the rainfall forecast shown below indicates the probability of above-normal rainfall for greater parts of the interior, with below-normal conditions expected for parts of Limpopo and the Northern Cape during September-October-November. Although agricultural implications may vary by location, for the upcoming planting period this generally indicates favourable conditions for land preparation and crop establishment across the maize belt and summer cropping region. Farmers should, however, remain vigilant for the possibility of localized flooding. In areas experiencing below-normal conditions, it is advisable to begin preparations where feasible so that planting can commence promptly once rainfall conditions become favourable.



Expected Precipitation Conditions for SON 2025
Issued: Aug 2025



Expected Precipitation Conditions for OND 2025
Issued: Aug 2025



Overview:

August 2025 was marked by generally wet conditions in parts of the country, with both the winter and summer rainfall regions receiving rain. In the winter rainfall region, particularly over the southwestern parts around Cape Town, several cold fronts brought moderate to heavy showers. Rainfall totals ranged between 25 and 150 mm, indicating near- to below-normal conditions, particularly in the eastern areas around Calvinia. However, these rains were important for sustaining winter crop and pasture growth as the season drew to a close. Along the southern coastal belt, which typically receives rainfall all year round, totals were largely below 25 mm for the month.

It was further observed that unseasonal rainfall occurred in the summer rainfall region during August. While much of the interior and northeast remained cool and relatively dry, with the central and northwestern interior, including parts of the Northern Cape, North West, western Free State, Gauteng, as well as parts of Limpopo and Mpumalanga, recording less than 25 mm (0-25% of their normal rainfall), isolated showers were observed in a belt stretching from central Limpopo through Mpumalanga and the eastern Free State to the central region of the Eastern Cape. These systems produced localized above-normal totals of 100-200% of the long-term mean, and in some high-lying areas even included light snow. Although scattered, these early rains were significant as they marked the first rains of the season, supporting land preparation and contributing to soil moisture recharge ahead of the summer planting period.

1. Rainfall

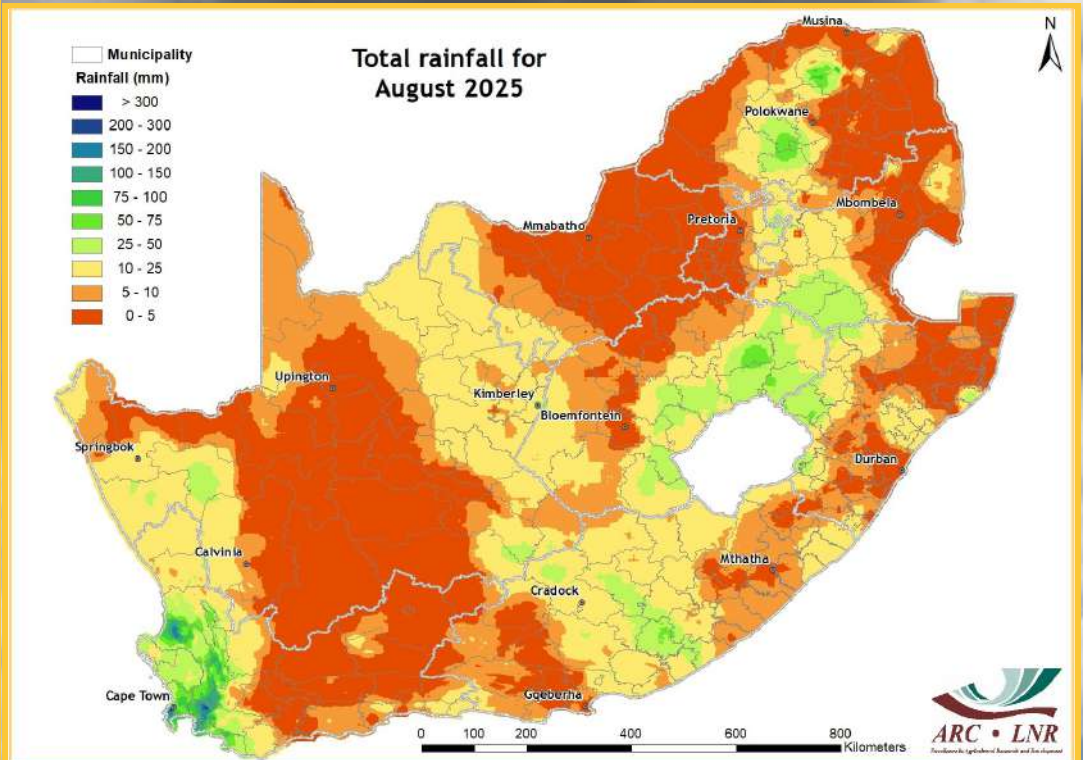


Figure 1

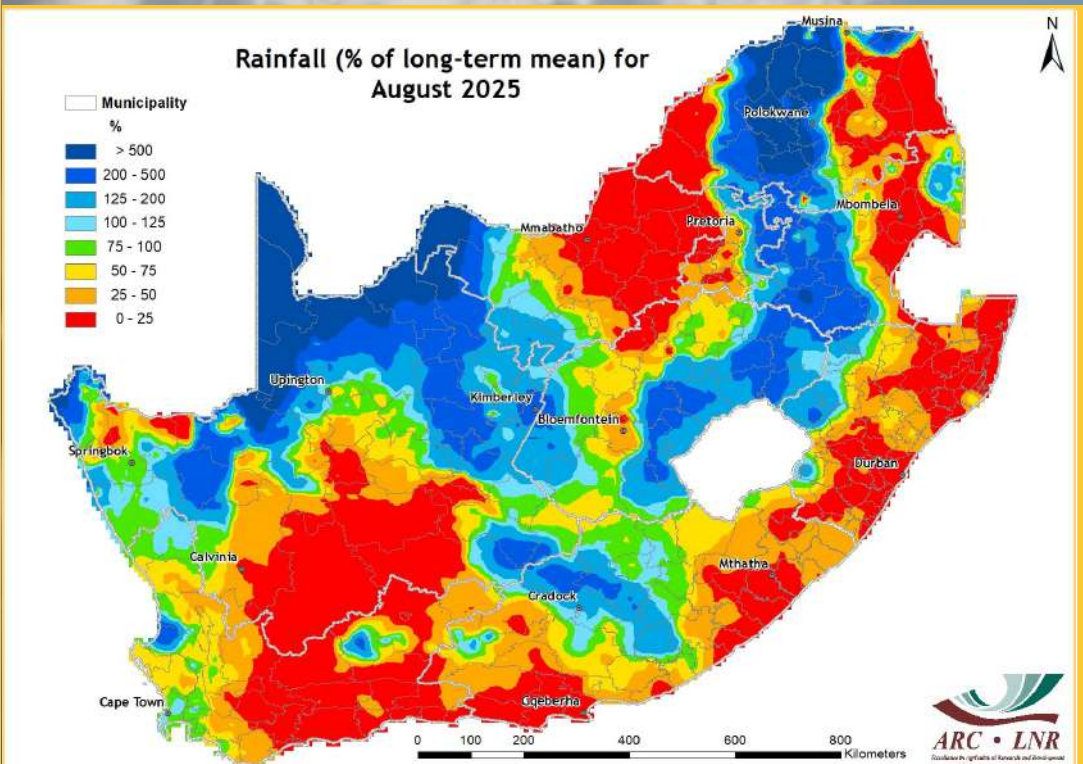


Figure 2

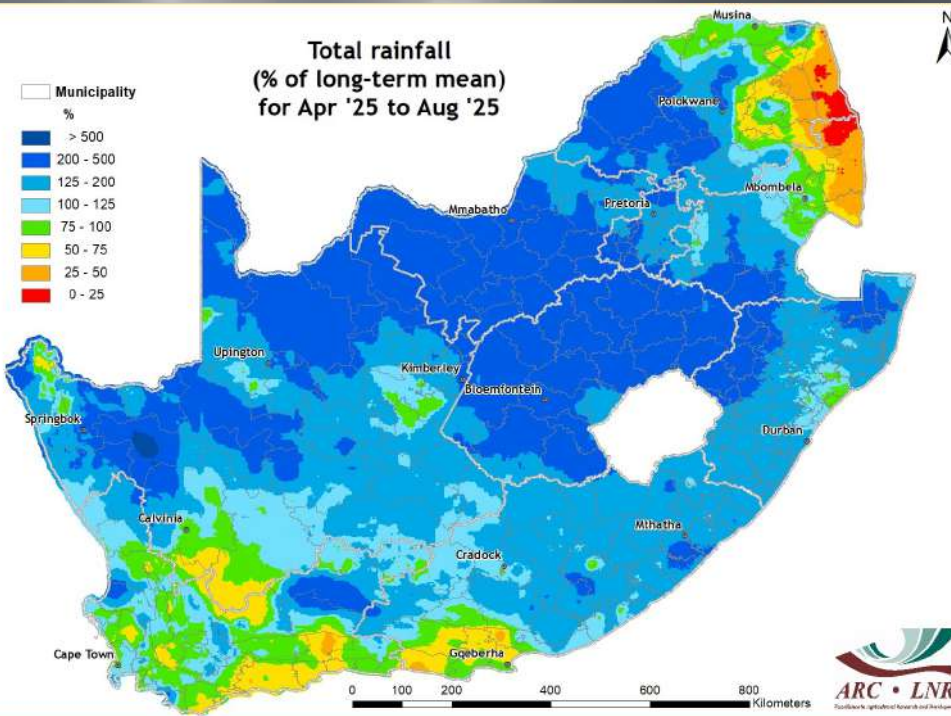


Figure 3

Figure 1:

Rainfall totals for August 2025 indicate that the winter rainfall region received between 25 and 150 mm, while parts of the summer rainfall region experienced unseasonal showers, ranging from less than 25 mm in most places to more than 75 mm in a few localized areas.

Figure 2:

Rainfall in large parts of the north-east, eastern coastal belt and the Karoo remained below normal in August. Meanwhile, areas in the central and northwestern interior recorded above-normal rainfall, in places exceeding 150% of the long-term average.

Figure 3:

The period from April to August 2025 generally experienced above-normal rainfall over most parts of the country, except for some areas in north-eastern Limpopo and Mpumalanga which recorded below-normal conditions.

Figure 4:

From June to August 2025, overall rainfall accumulation was similar to the same 3-month period last year, except in parts of the Western Cape, which received below-average rainfall, and parts of the Eastern Cape, KwaZulu-Natal and adjacent Free State, which recorded above-average rainfall.

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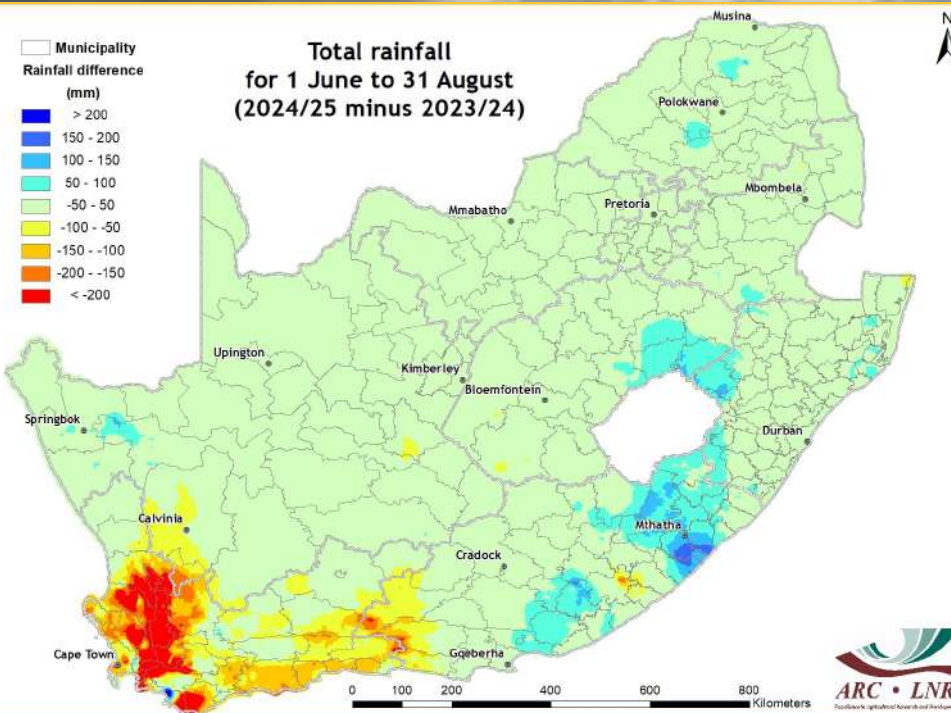


Figure 4

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 August 2025 are shown in Figures 5-8. The short-term SPI map indicates widespread wet conditions across most of the country, with extremely wet conditions dominating the interior, including the North West and adjacent parts of Limpopo, extending through Gauteng, Mpumalanga, the eastern Free State and KwaZulu-Natal. In contrast, moderate drought persists in the eastern parts of Mpumalanga in the Kruger National Park. These dry conditions are not visible on the medium-term SPI map but the wet conditions remain evident. The long-term maps reveal widespread near-normal to wet conditions, with mild drought confined to isolated areas of the Northern Cape, Limpopo and Mpumalanga.

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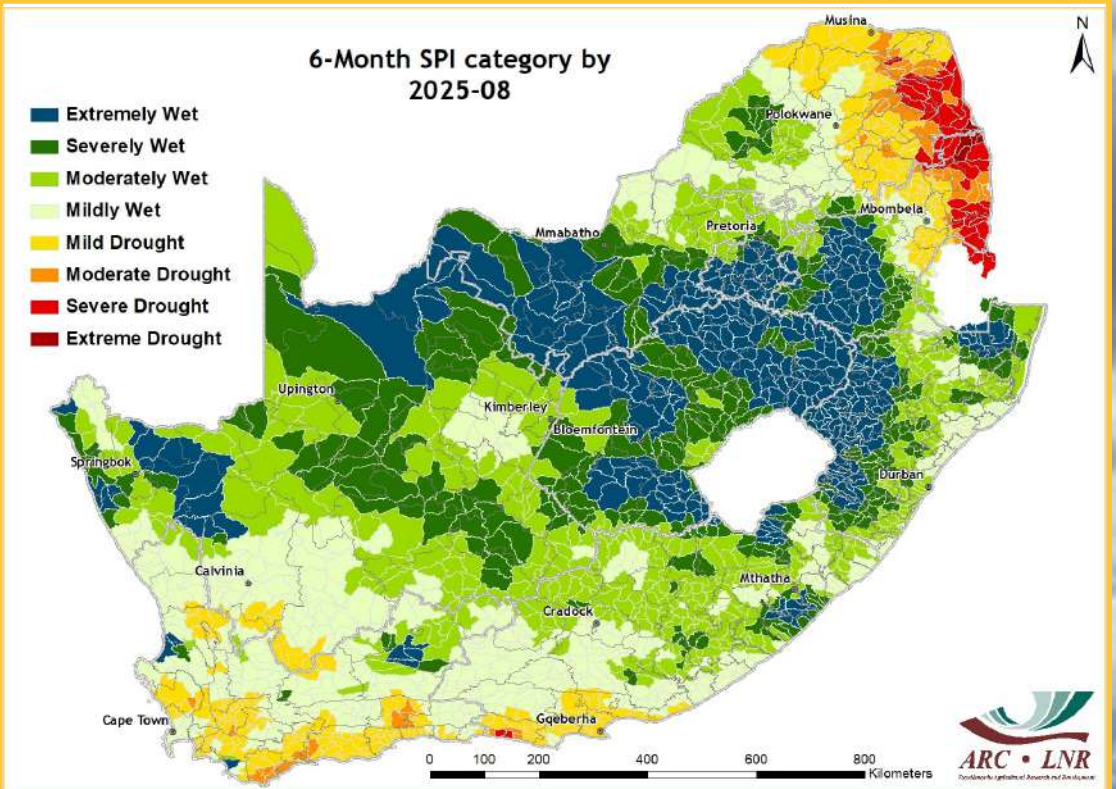


Figure 5

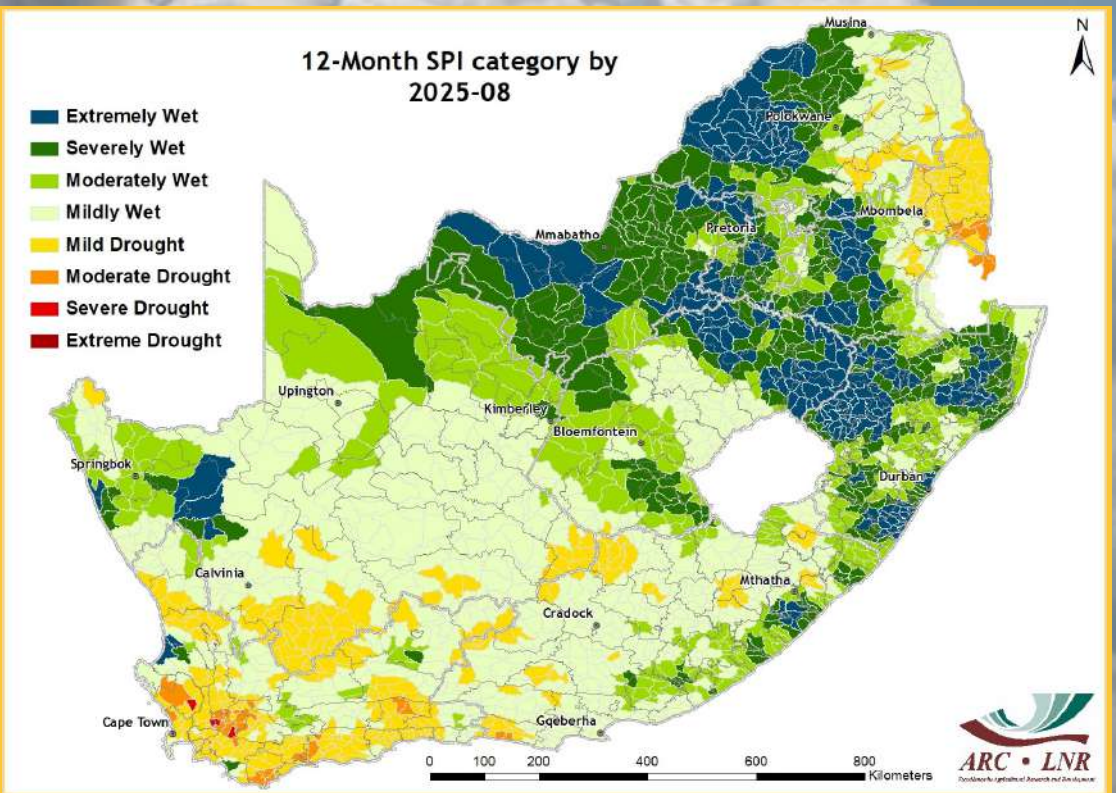


Figure 6

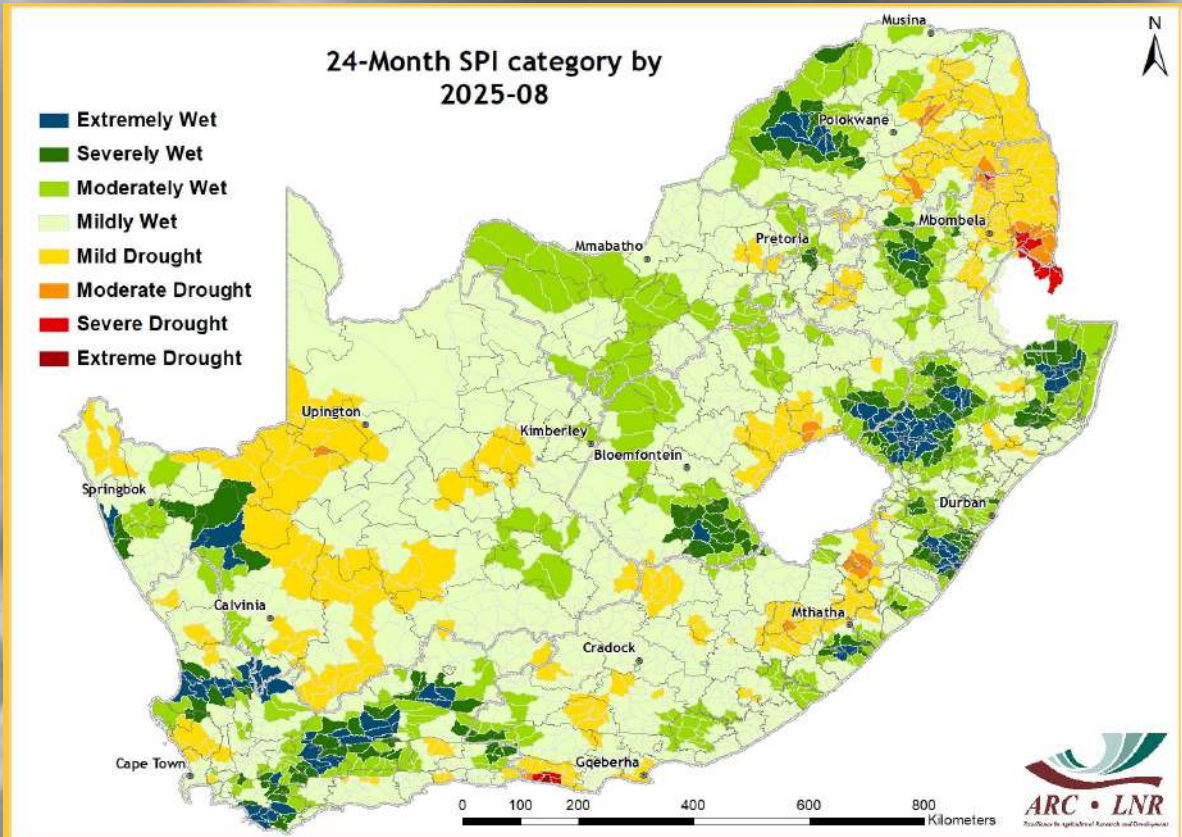


Figure 7

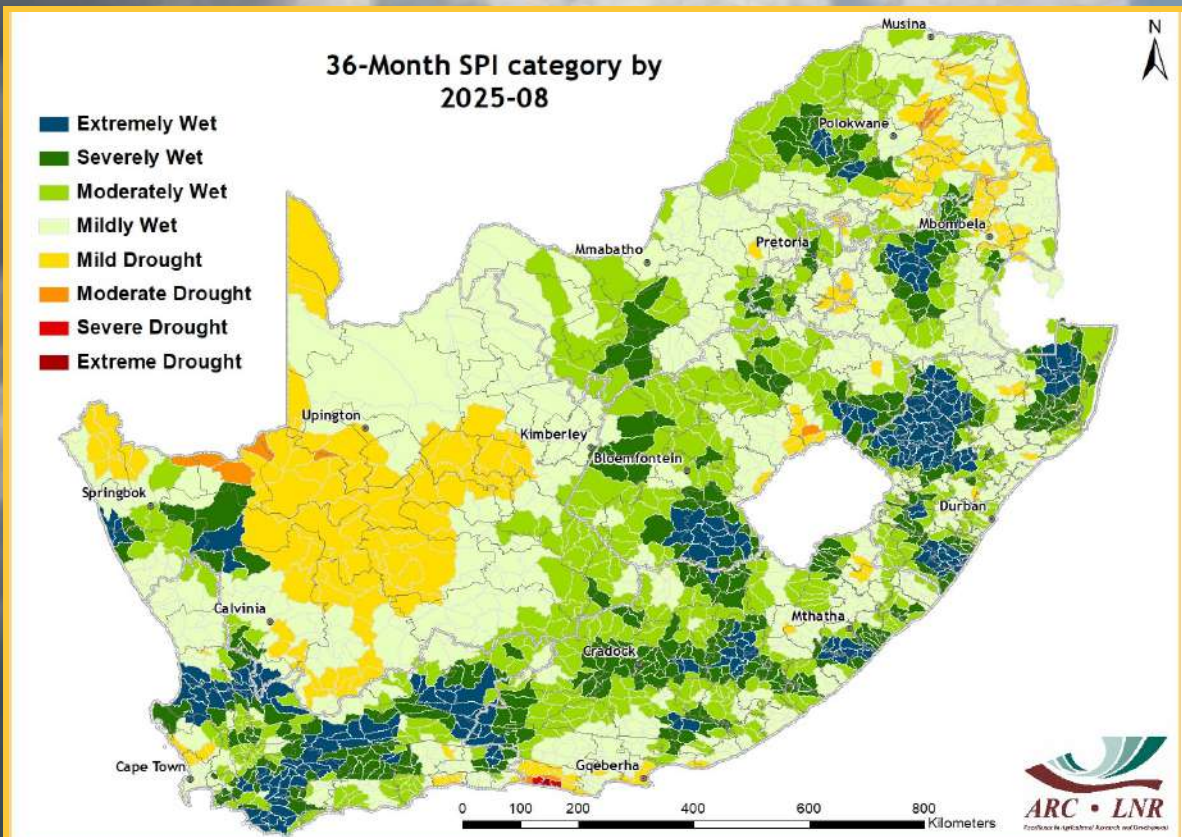


Figure 8

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.

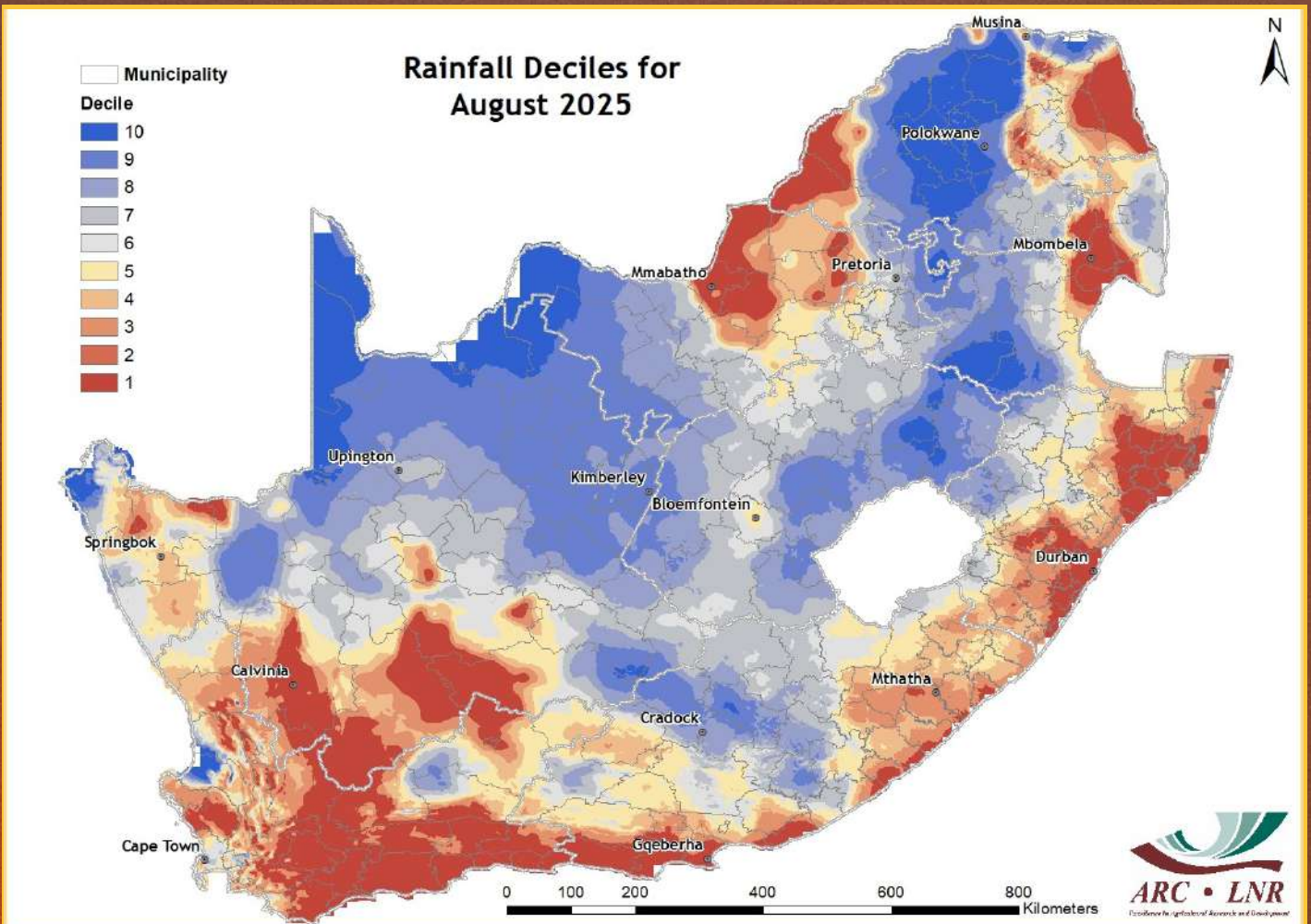


Figure 9

Figure 9:

In August 2025, much of the interior received rainfall totals comparable to historically wetter August months. In contrast, the southwestern region and parts of the eastern coast, extending into the Lowveld of Mpumalanga and Limpopo, remained dry.

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Vegetation Mapping

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

$$NDVI = \frac{(IR - R)}{(IR + R)}$$

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.

4. Vegetation Conditions

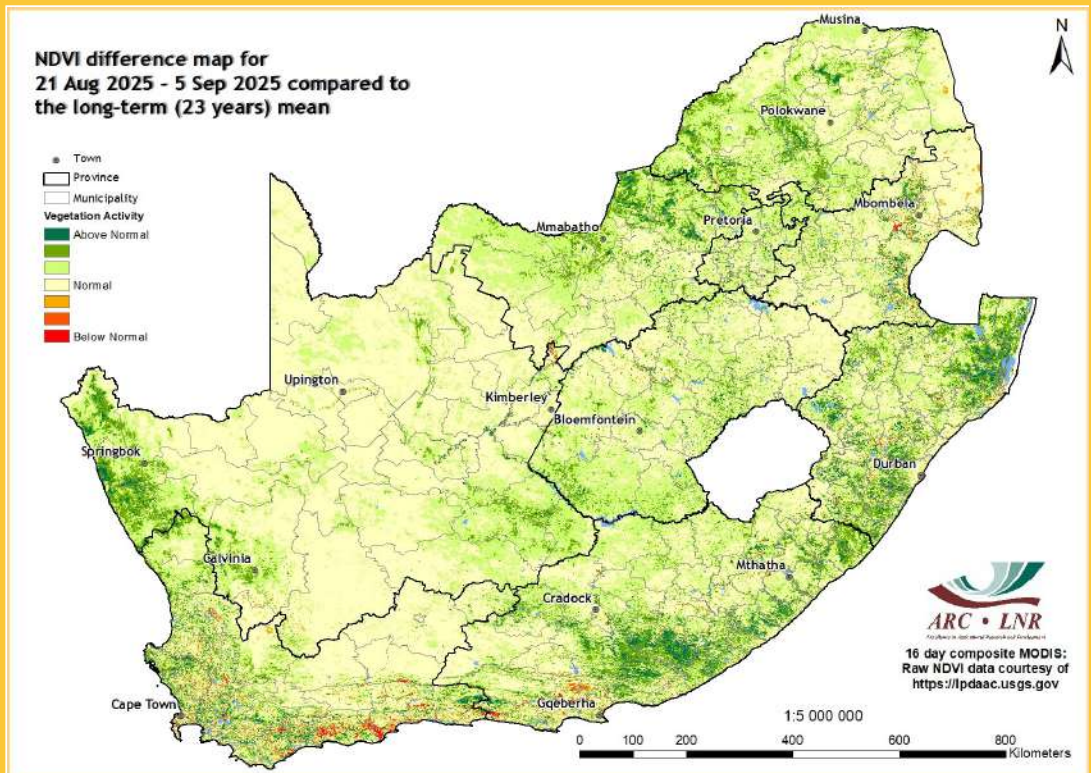


Figure 10

Figure 10:

Compared to the historical averaged vegetation conditions, the 16-day NDVI map for August 2025 shows that above-normal conditions persist in many parts of the country, with patches of below-normal vegetation activity in isolated areas.

Figure 11:

The 16-day NDVI difference map for August 2025 compared to the preceding 16-day period shows that many parts of the country experienced normal to below-normal vegetation conditions, with above-normal activity in isolated areas.

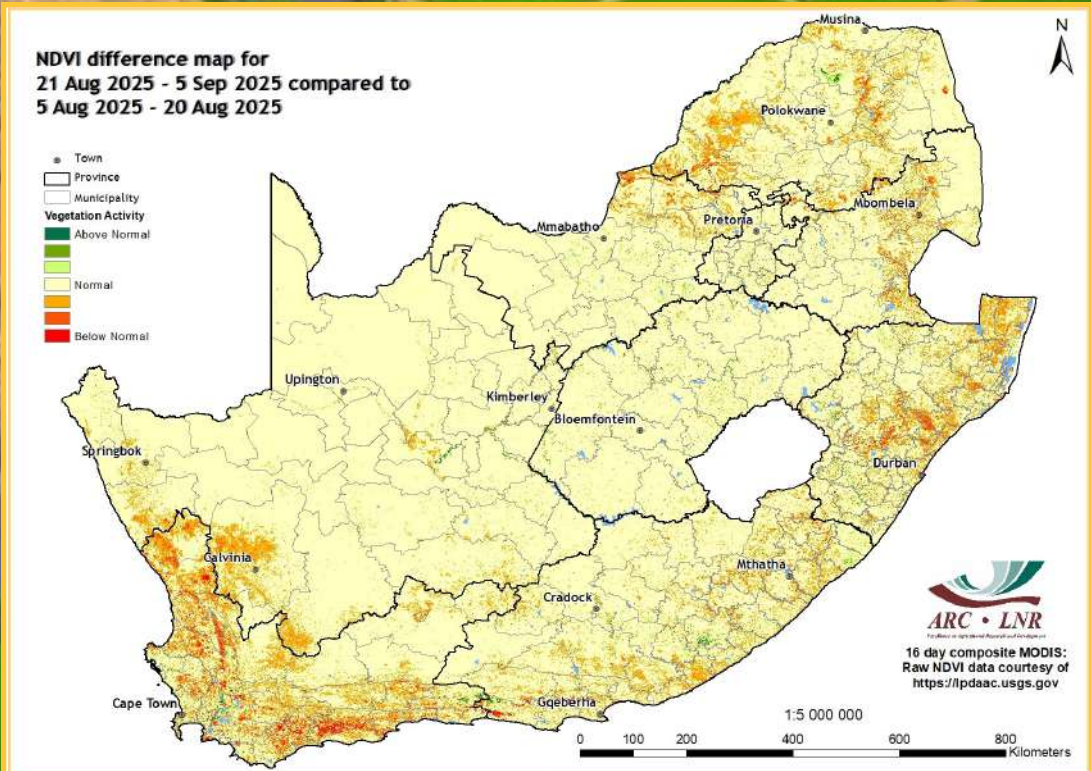


Figure 11

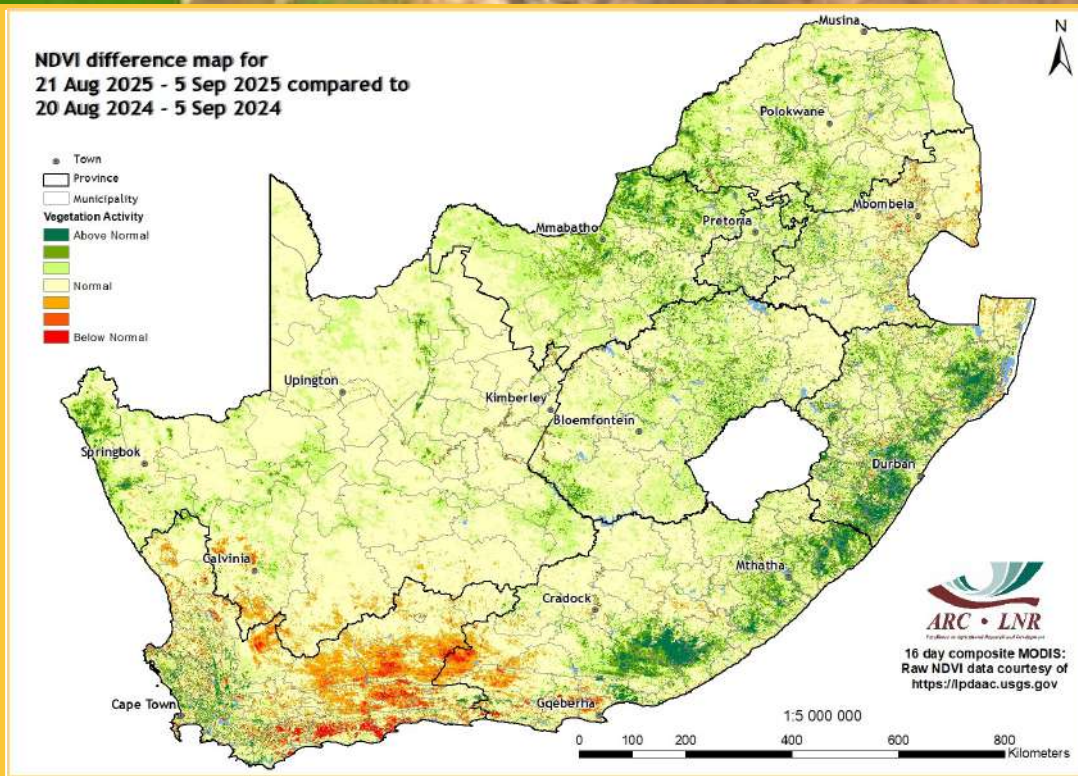


Figure 12

**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

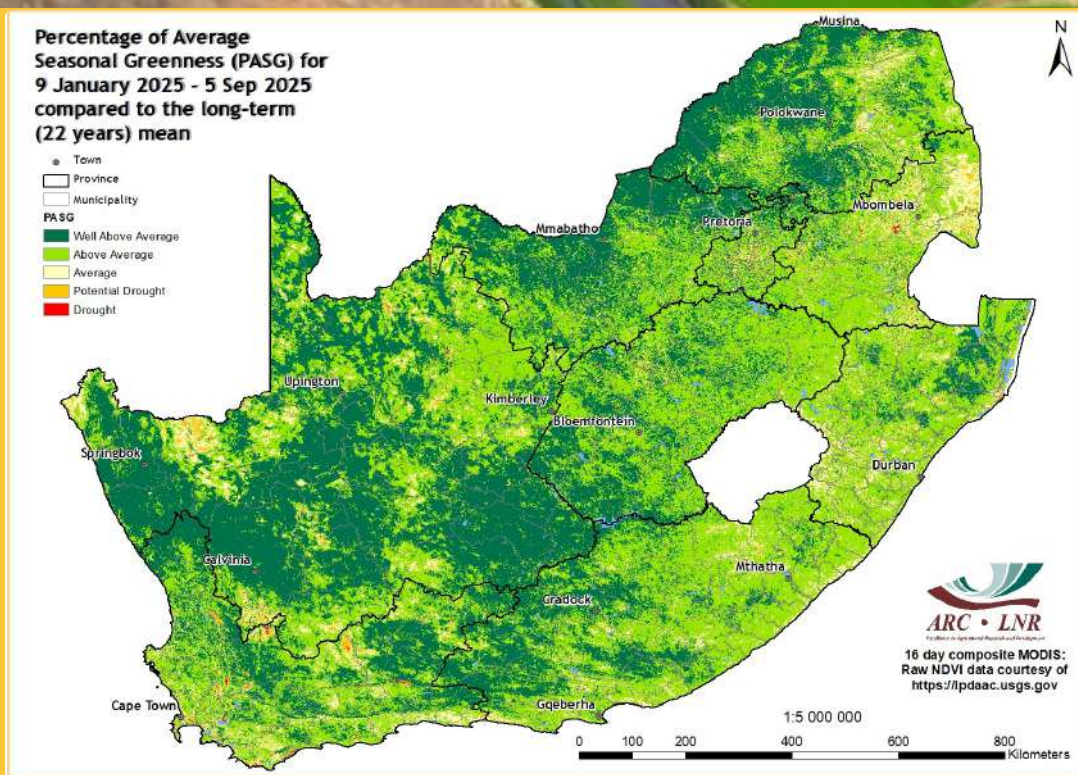


Figure 13

Figure 12:

The 16-day NDVI difference map for August 2025 compared to the same period last year shows that many parts of the country experienced a mix of normal to above-normal vegetation conditions, with patches of below-normal activity in eastern Mpumalanga and the southern interior.

Figure 13:

The Percentage of Average Seasonal Greenness (PASG) map for the past 8 months shows that many parts of the country continue to experience above-average vegetation conditions, with the exception of a few isolated areas that are experiencing 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.

Vegetation Condition Index (VCI) for 21 Aug 2025 - 5 Sep 2025 compared to the long-term (23 years) mean

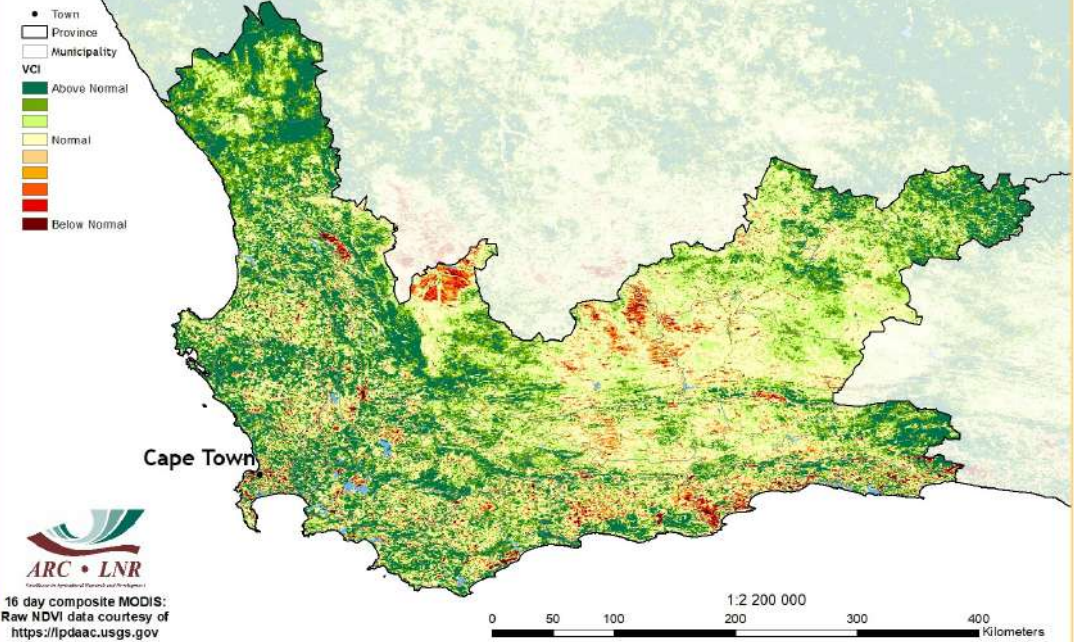


Figure 14

Figure 14:

The 16-day VCI map for August 2025 shows that the eastern half of the Western Cape experienced mainly below-normal activity while the western half showed improved vegetation conditions.

Figure 15:

The 16-day VCI map for August 2025 shows that much of Mpumalanga experienced improved vegetation conditions, except for the far eastern parts which continue to experience poor vegetation activity.

Vegetation Condition Index (VCI) for 21 Aug 2025 - 5 Sep 2025 compared to the long-term (23 years) mean

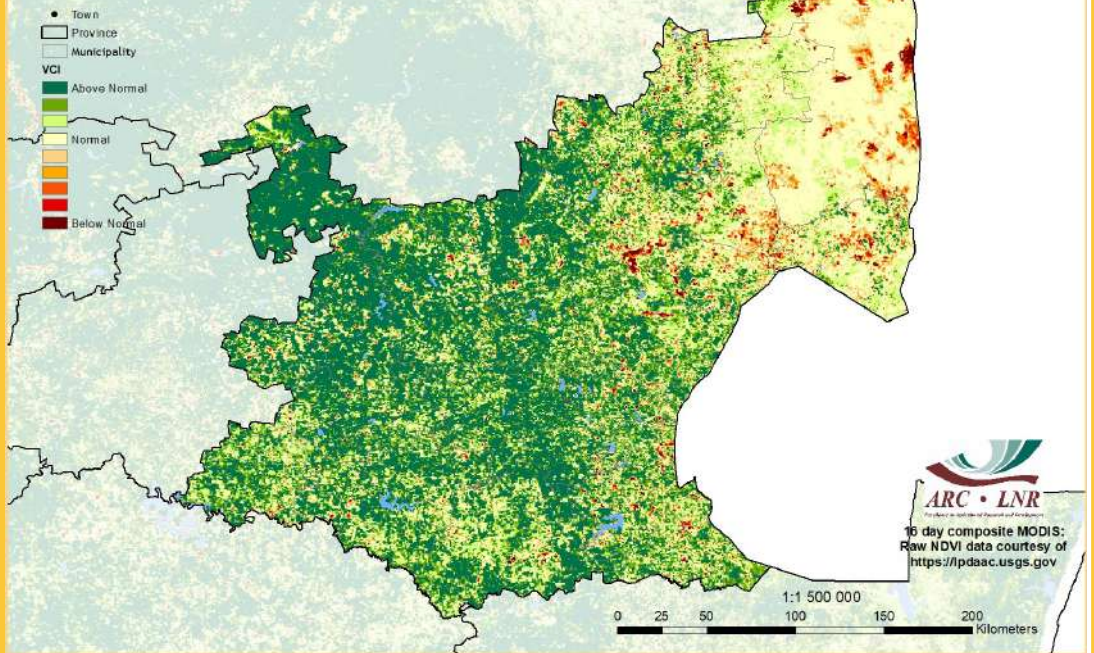


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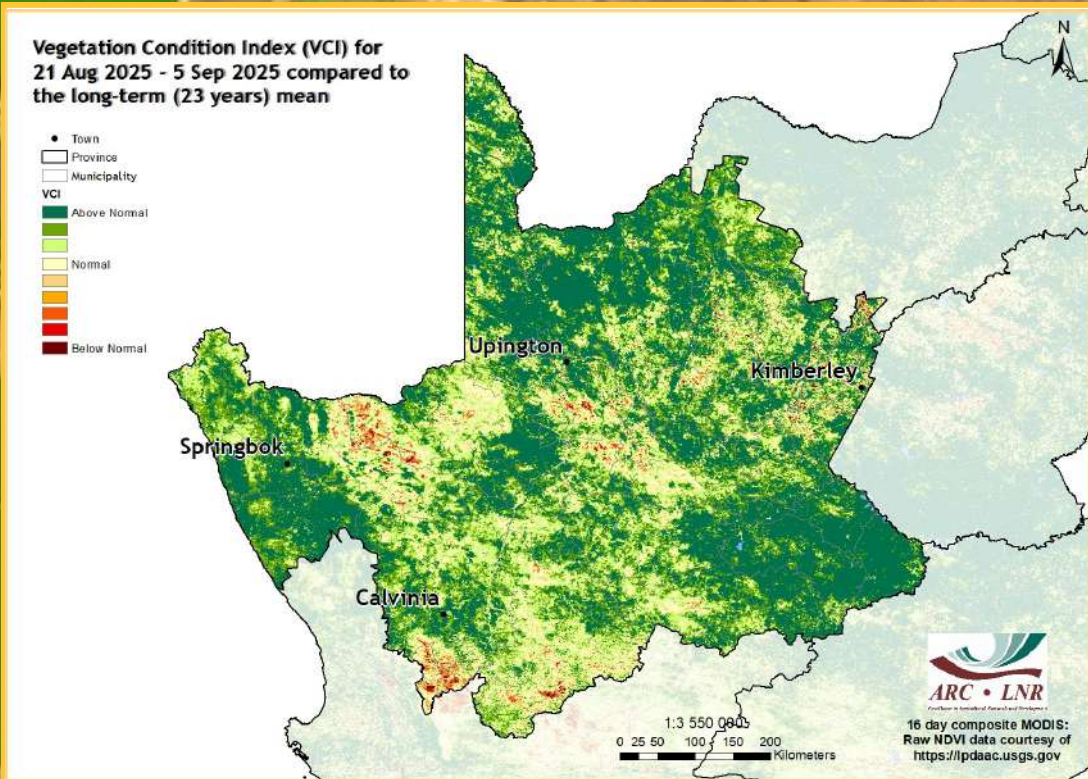


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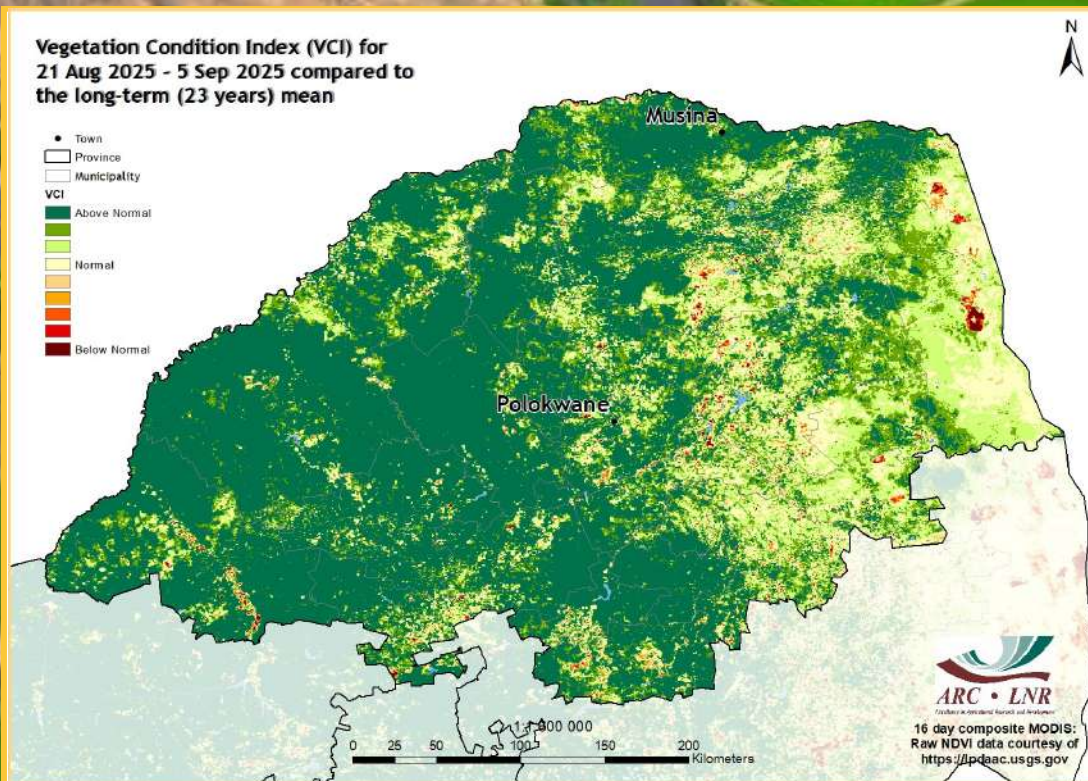


Figure 17

Figure 16: The 16-day VCI map for August 2025 shows improved vegetation conditions in most parts of the Northern Cape with patches of below-normal activity in isolated areas.

Figure 17: The 16-day VCI map for August 2025 shows that many parts of Limpopo experienced improved vegetation conditions with patches of poor vegetation activity mainly in the eastern parts.

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6. Vegetation Conditions & Rainfall

District Municipalities

- Towns
- District council
- Capricorn
- Umkhanyakude
- Waterberg
- Vhembe
- Ugu
- City of Johannesburg
- ZF Mgcawu
- Pixley ka Seme
- Namakwa
- Central Karoo

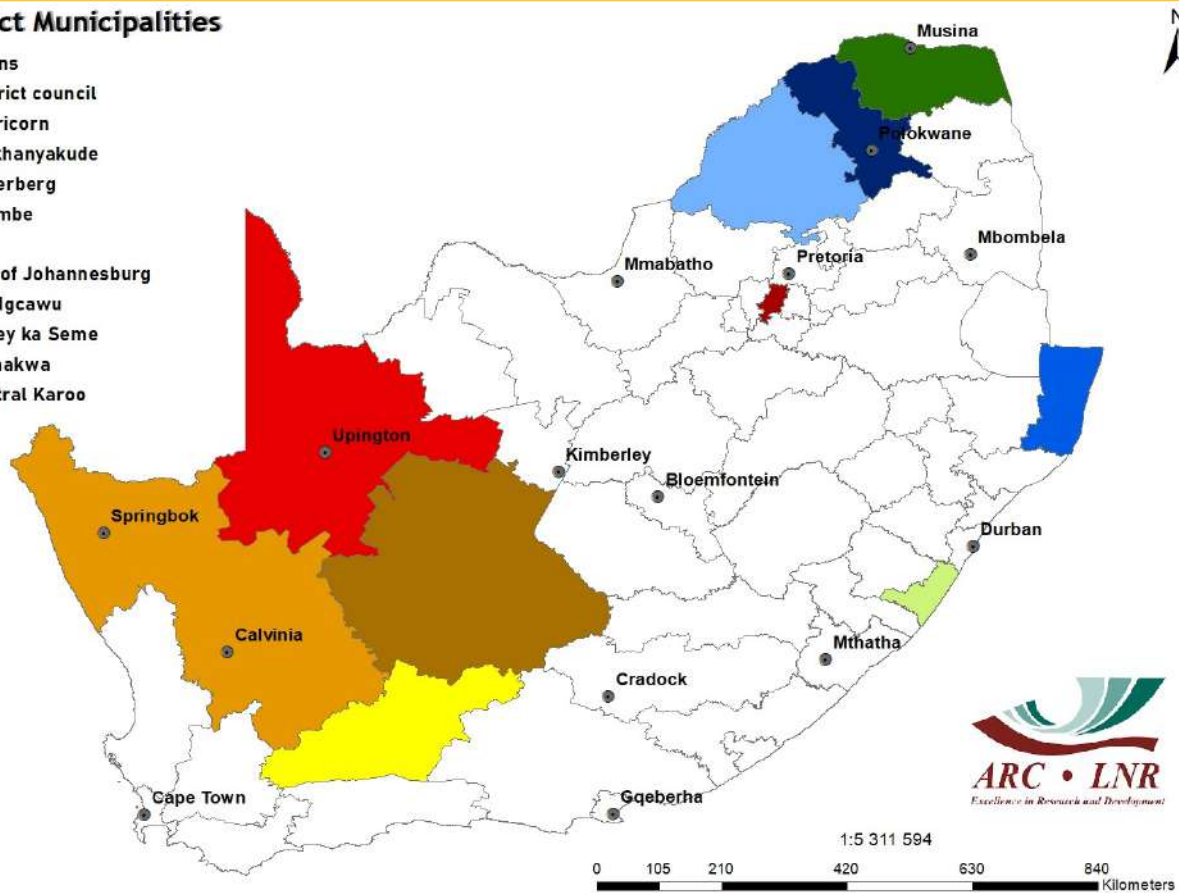


Figure 18

Rainfall and NDVI Graphs

Figure 18: Orientation map showing the areas of interest for August 2025. 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.

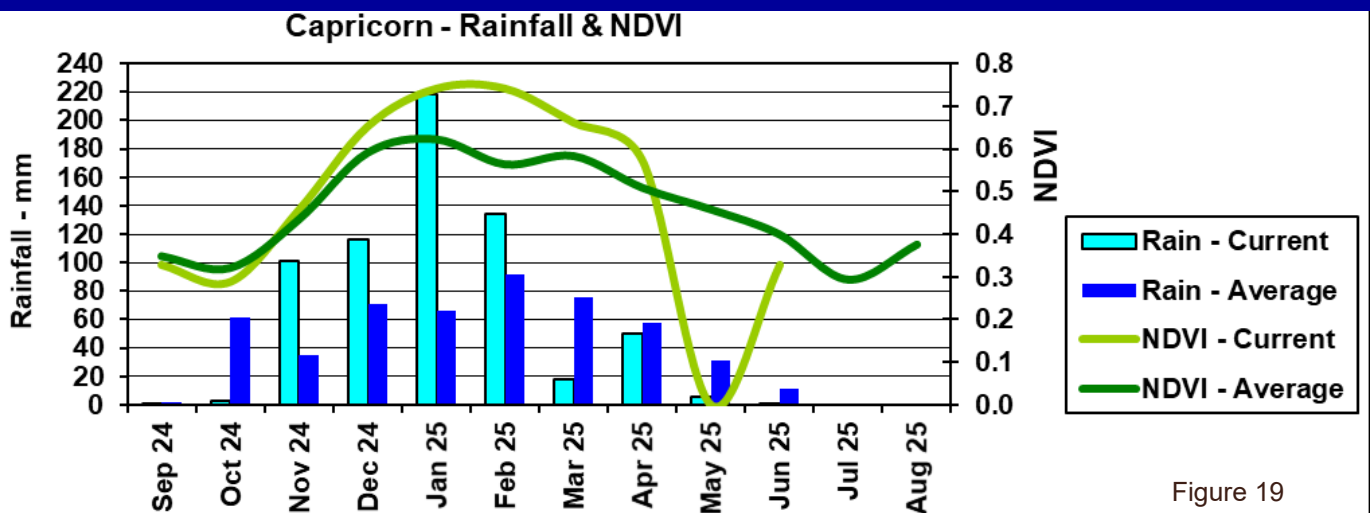


Figure 19

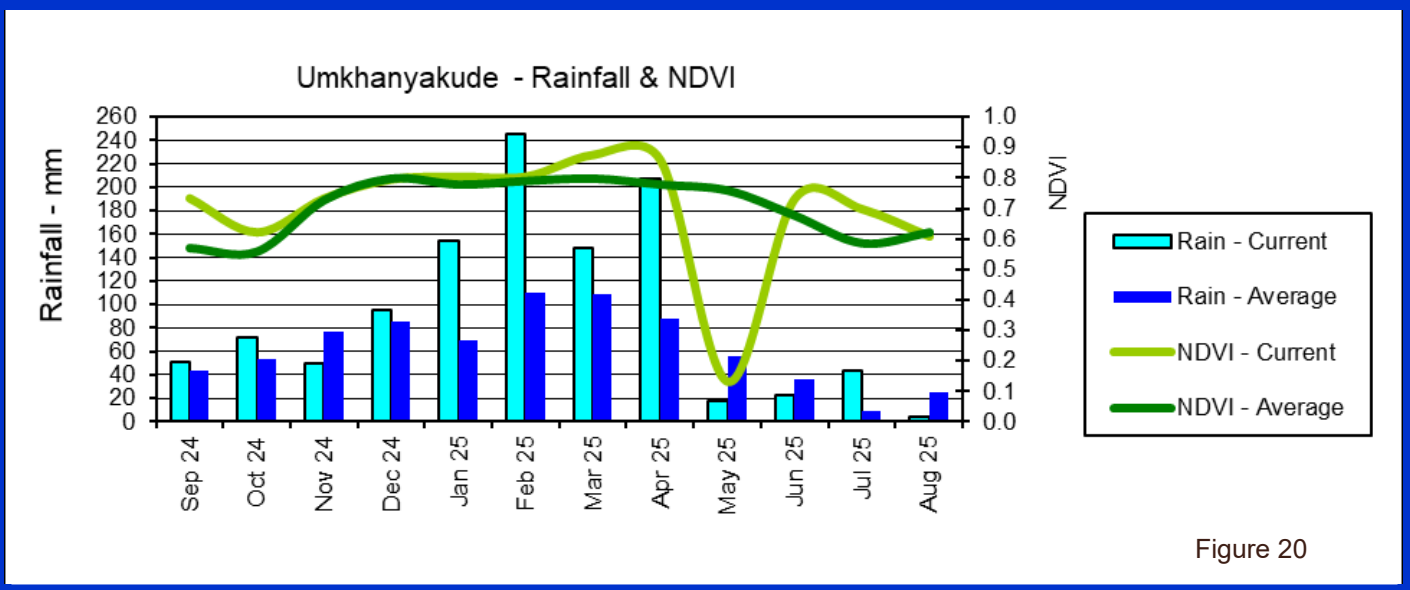


Figure 20

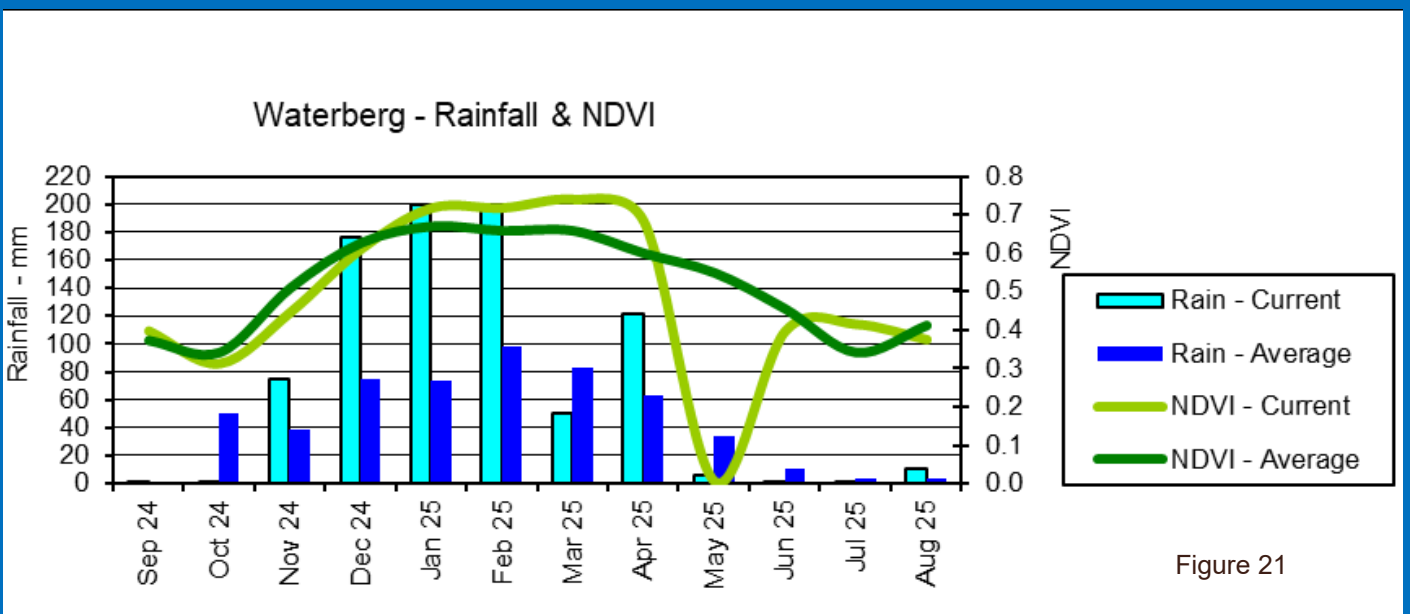


Figure 21

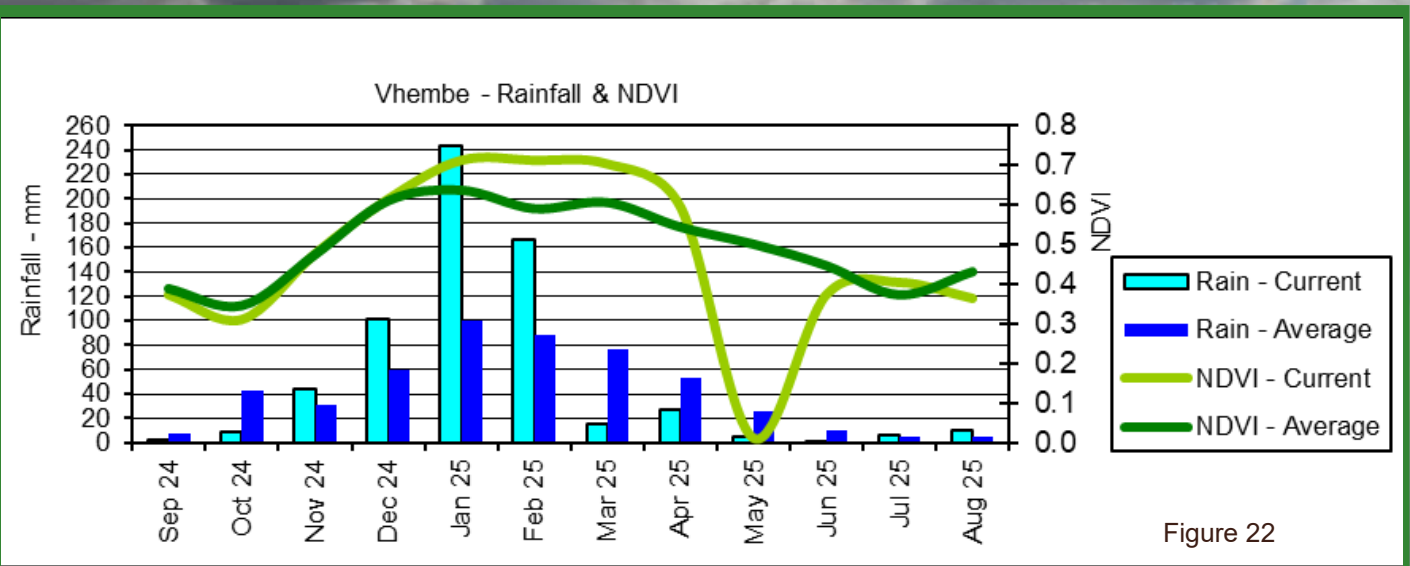


Figure 22

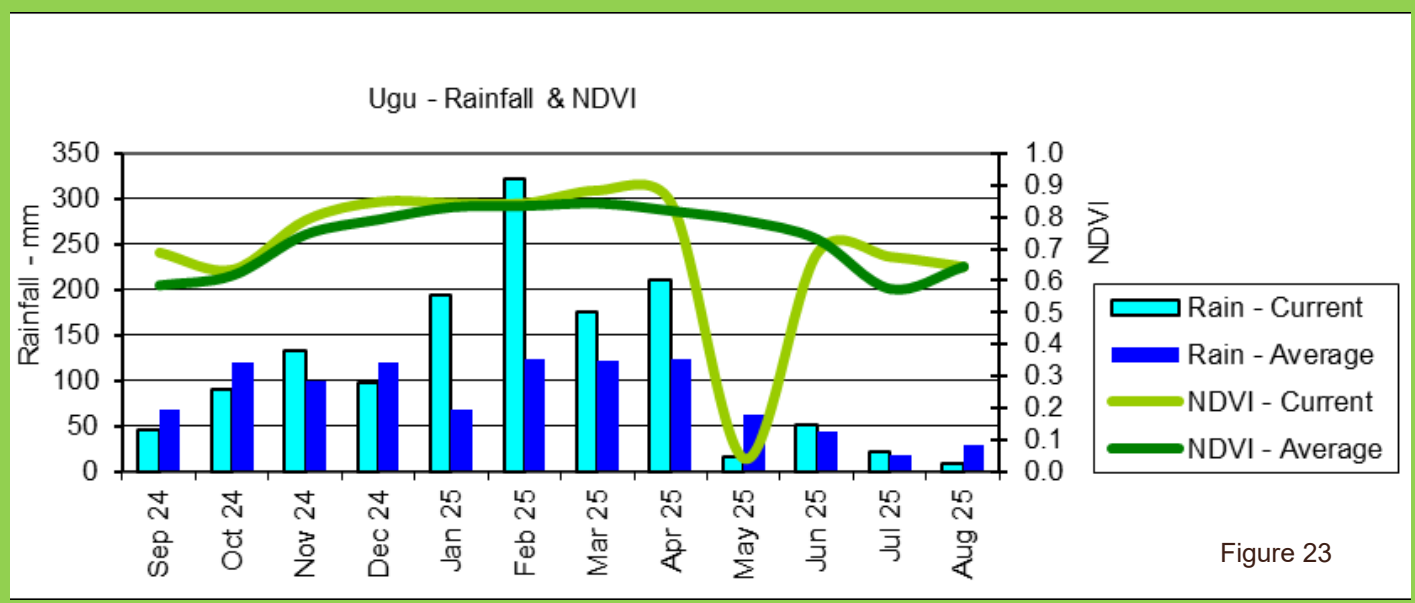


Figure 23

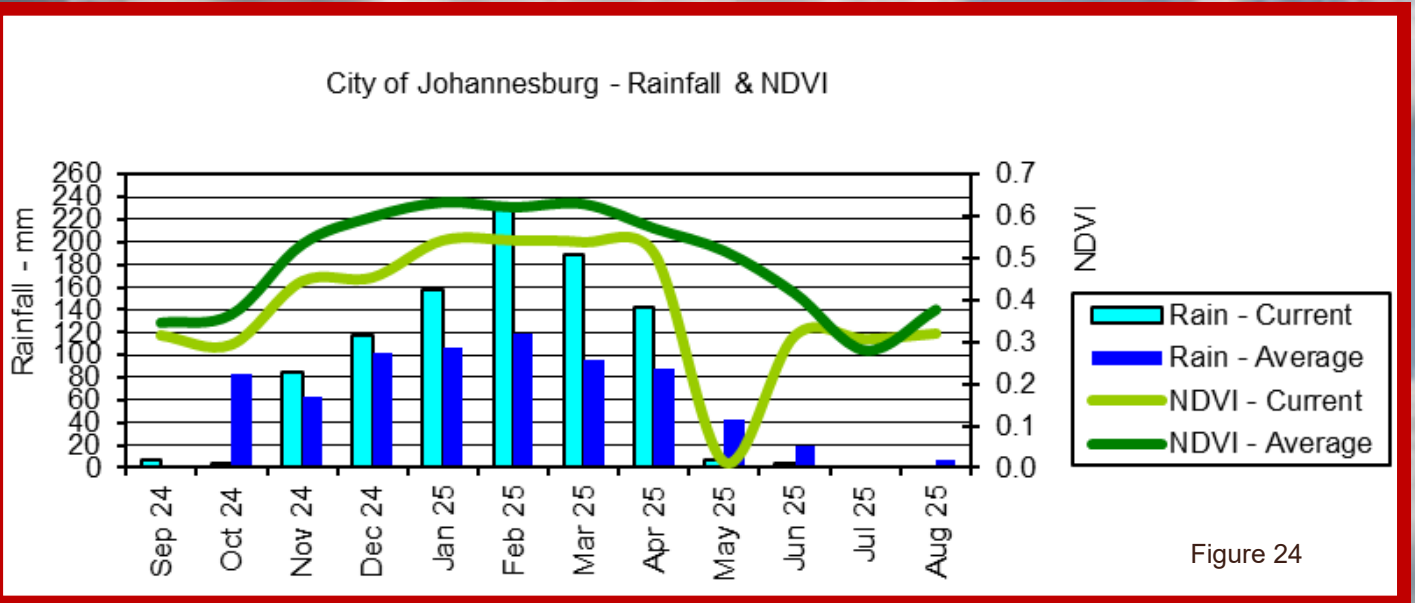


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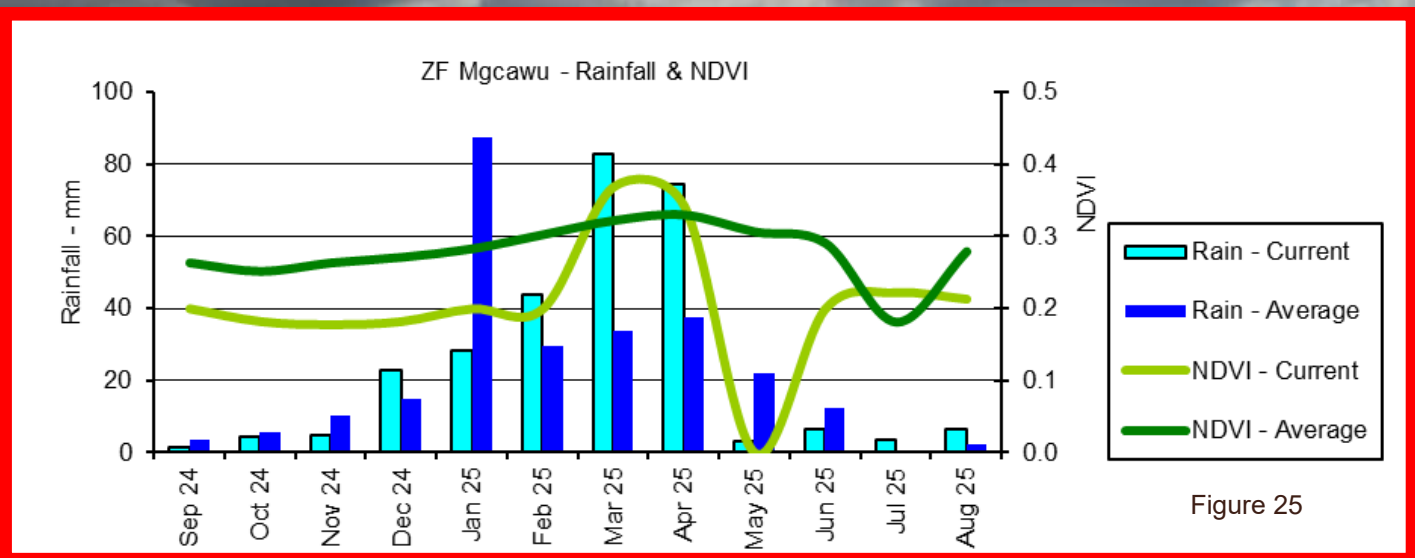


Figure 25

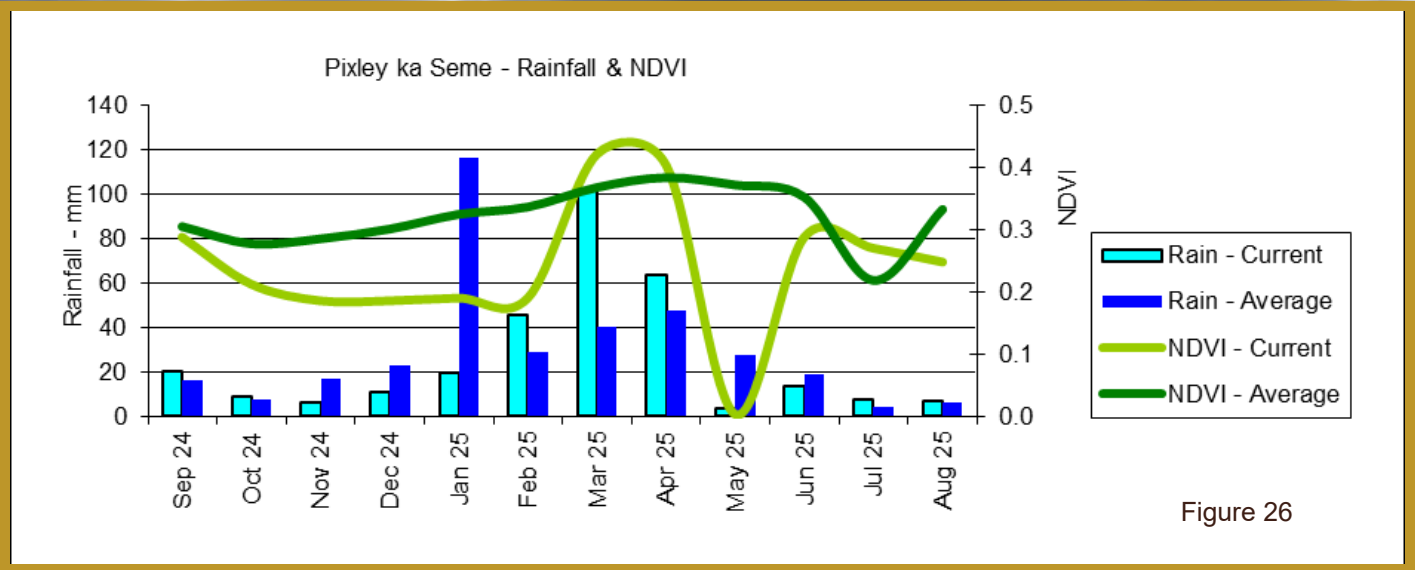


Figure 26

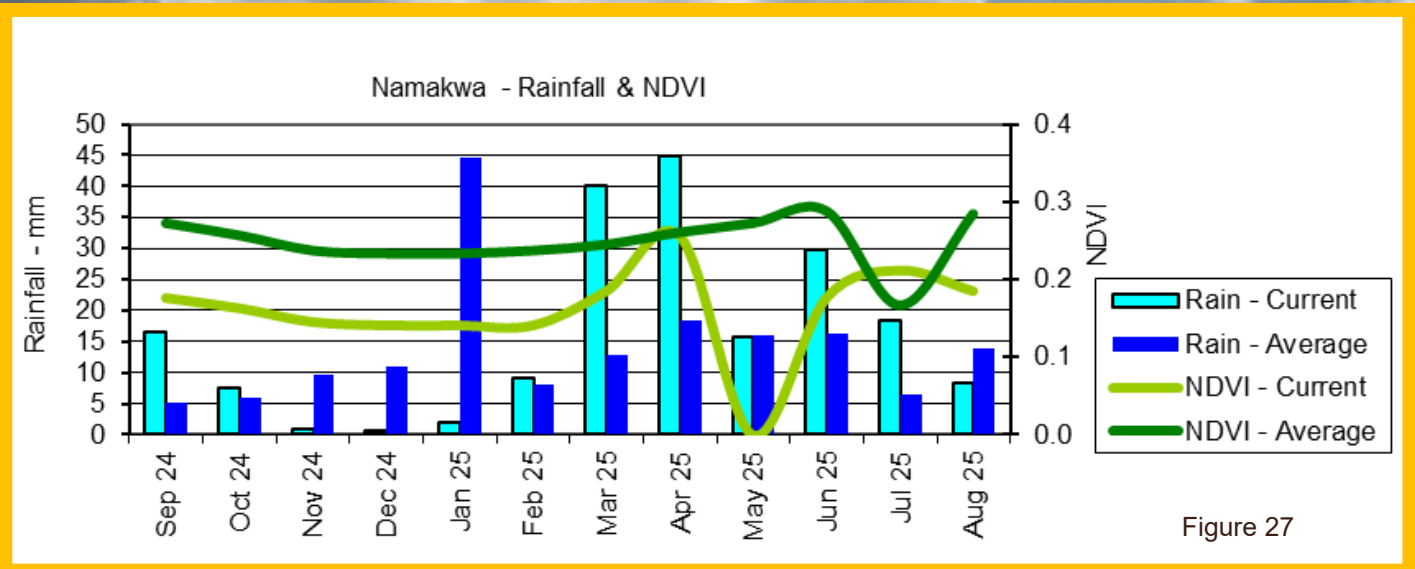


Figure 27

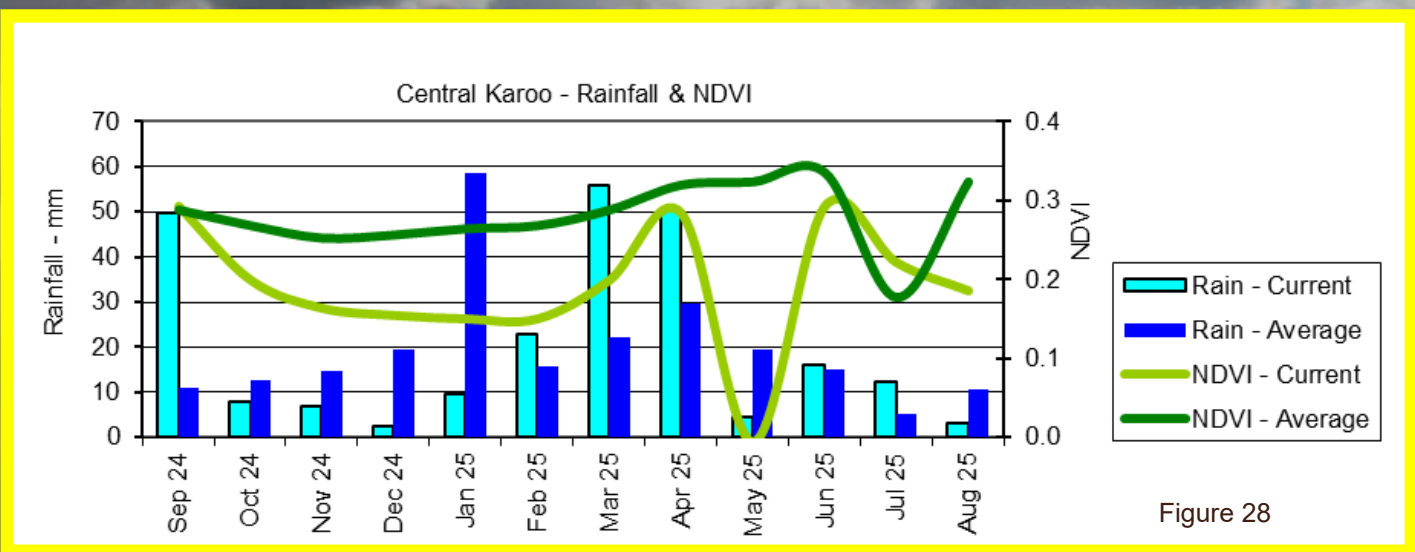


Figure 28

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 28 July to 28 August 2025 per province. Fire activity remains lower in all provinces compared to the long-term average.

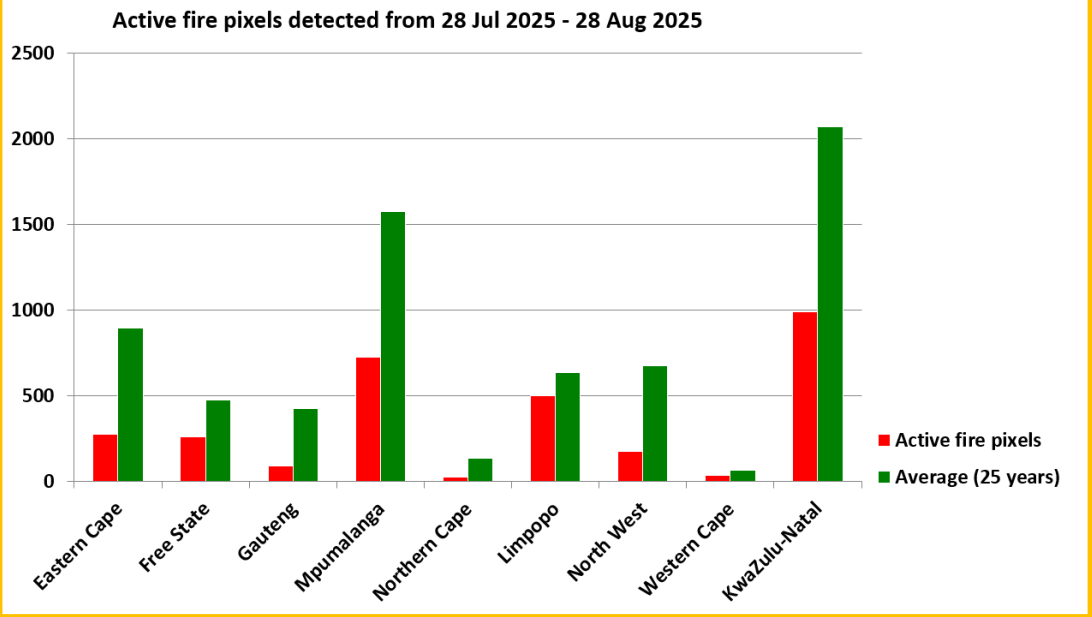


Figure 29

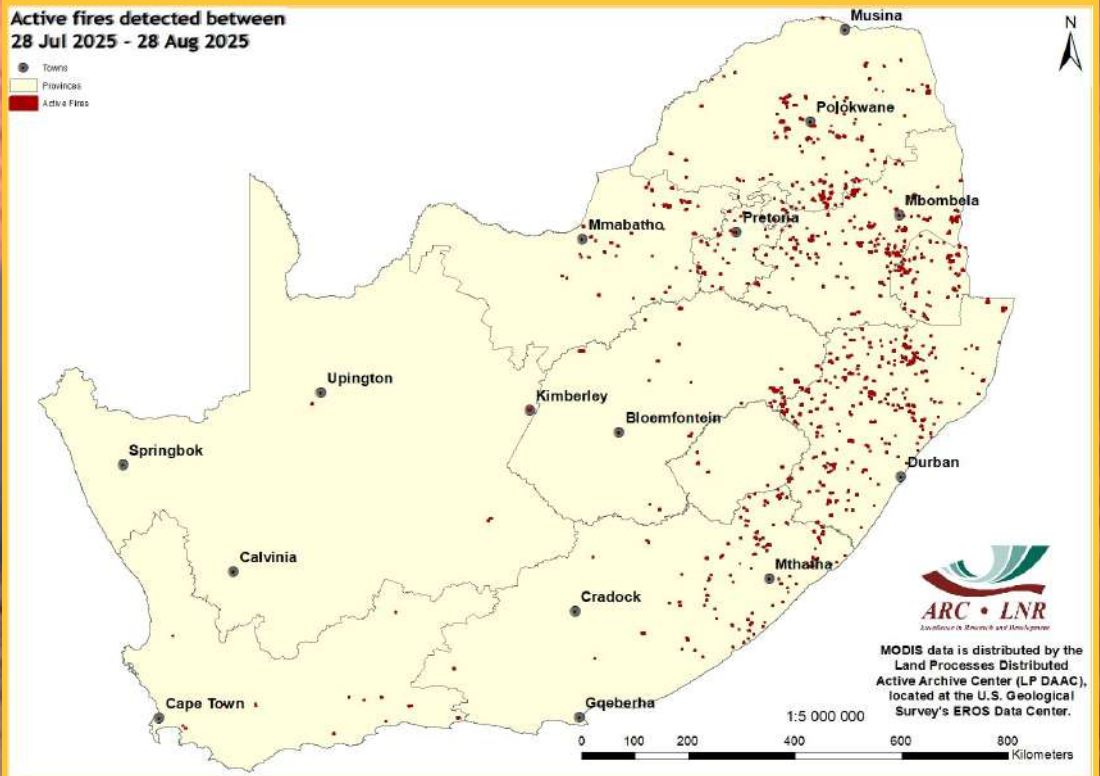


Figure 30:

The map shows the location of active fires detected between 28 July and 28 August 2025.

Figure 30

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 28 August 2025 per province. Fire activity remains lower in all provinces compared to the long-term average.

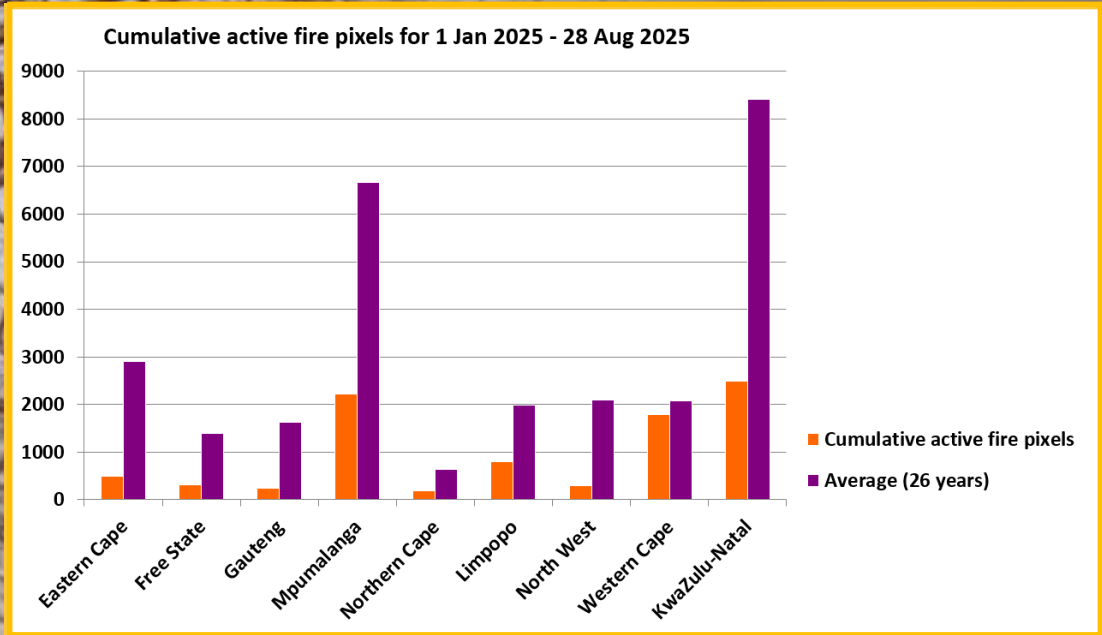


Figure 31

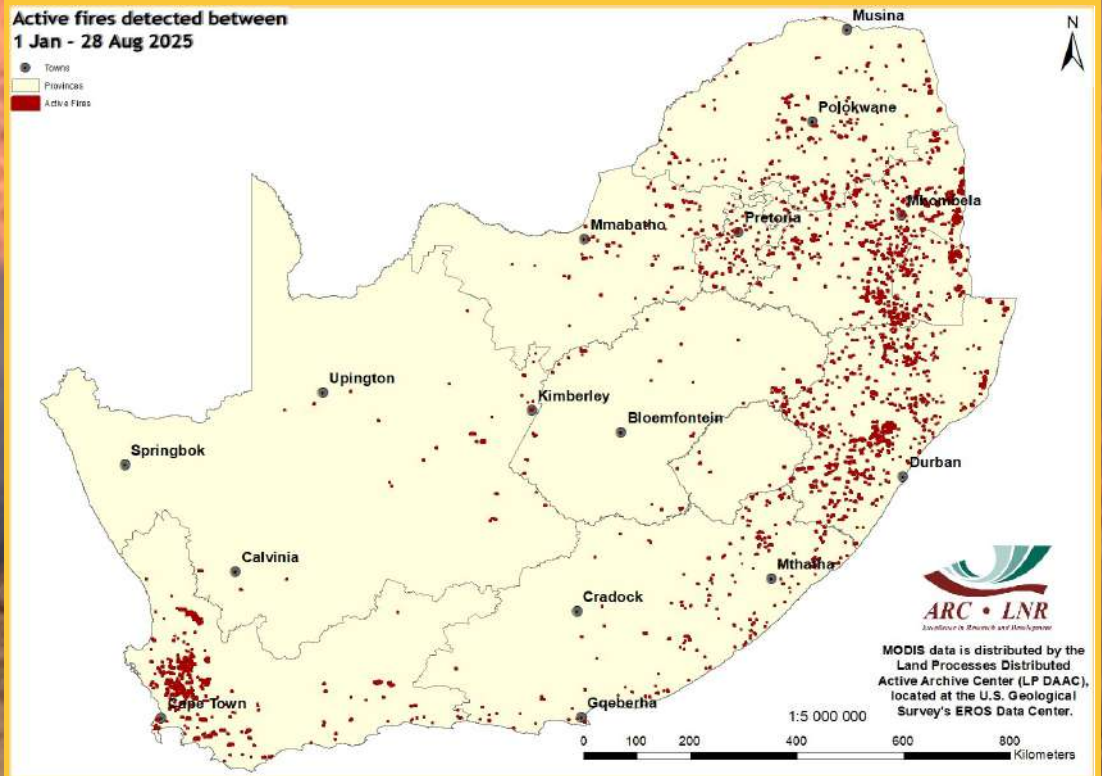


Figure 32

Figure 32:

The map shows the location of active fires detected between 1 January and 28 August 2025.

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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.

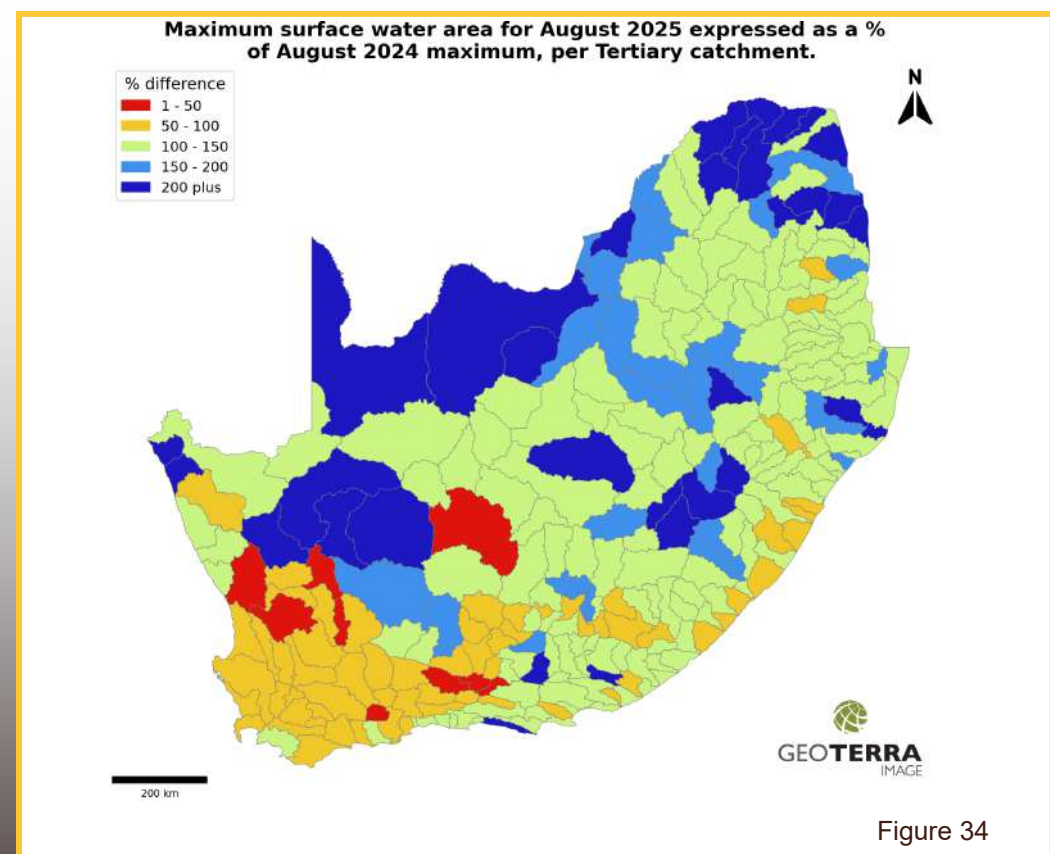
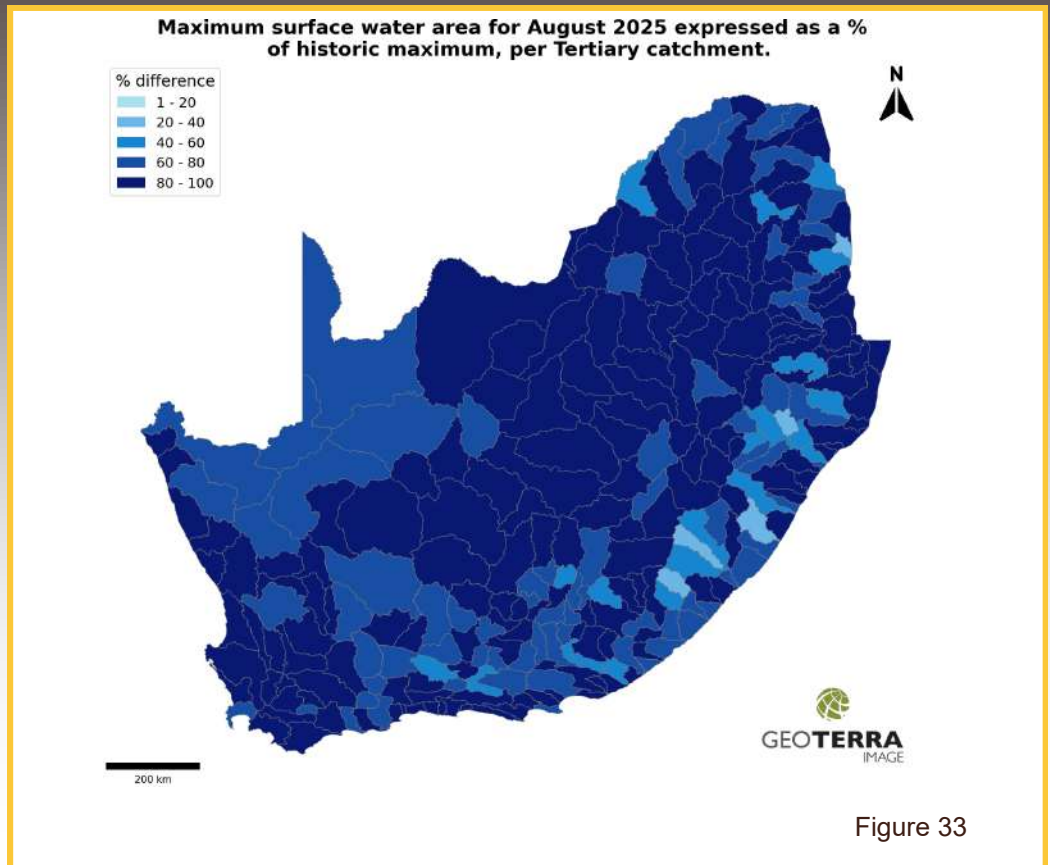
Figure 34 represents a comparison between the area of surface water now and for the same month last year. In this map, any value less than 100 represents water catchments within which the current month's total surface water is less than that recorded in the same water catchment, in the same month, last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

The long-term map for August 2025 shows a near identical spatial pattern to the previous 2 months and continues to illustrate high water levels across almost the entire country. Most inland catchments are at levels of 80-100%, with a scattering of similar or lower levels across mainly the coastal provinces.

The comparison between August 2025 and August 2024 also shows a near identical pattern to that observed in the previous 2 months. Normal to high water levels are evident across the central and northern borders of the country, compared to lower levels in the southwest and southern coastal regions. Catchment areas across the northern parts of the Northern Cape, North West and Limpopo provinces continue to show the highest water improvement levels.

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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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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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



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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 Laboratory Manager: 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.

**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: adri@arc.agric.za



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 m² to 1 km²) 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>

VG4AFRICA 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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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".*

DISCLAIMER:

The ARC-NRE and its collaborators have obtained data from sources believed to be reliable and have made every reasonable effort to ensure accuracy of the data. The ARC-NRE and its collaborators cannot assume responsibility for errors and omissions in the data nor in the documentation accompanying them. The ARC-NRE and its collaborators will not be held responsible for any consequence from the use or misuse of the data by any organization or individual.