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The Watchman

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NATURAL RESOURCES AND ENGINEERING
Soil, Climate and Water

CONTENTS:

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Department: Agriculture
REPUBLIC OF SOUTH AFRICA

South African Weather Service

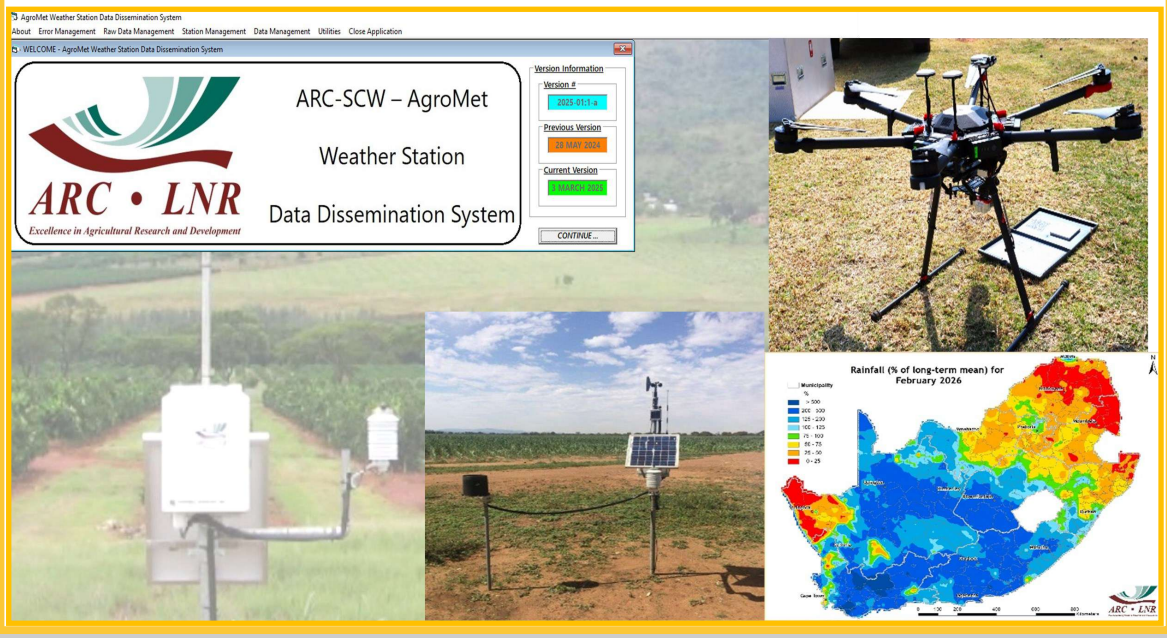
261st Edition

Image of the Month

Observing Today, Protecting Tomorrow', as the World celebrates World Meteorological Day 2026

World Meteorological Day is commemorated annually on 23 March to mark the establishment of the World Meteorological Organization in 1950. Each year, the global meteorological community observes the day under a specific theme to highlight key issues related to weather, climate, and water. In 2026, the theme "Observing Today, Protecting Tomorrow" underscores the critical role of meteorological and environmental observations in understanding climate variability and supporting informed decision-making. In South Africa, where agriculture remains highly sensitive to climate variability and extremes such as droughts, floods, and heatwaves, reliable observations are essential for monitoring conditions and reducing risk.

The Agricultural Research Council commemorated the day through a seminar and outreach activities, while also reflecting on its growing contribution to climate observations. From humble beginnings with a single agrometeorological station established on 1 January 1941, the ARC's network has expanded significantly to include over 600 automatic weather stations across the country (see Figure below). This growth has been complemented by the integration of satellite data and the use of modern technologies such as drones, enhancing the precision and spatial coverage of observations. Through these advancements, the ARC continues to strengthen its role in generating reliable climate information and supporting resilient agricultural systems in a changing climate.



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).

1. Rainfall

Overview:

Climatologically, February represents a latter part of the peak rainfall season over South Africa's summer rainfall region, typically associated with convective thunderstorms over the central and eastern interior. Observations for February 2026 showed that rainfall remained largely within the summer rainfall region but a shift in spatial distribution and intensity compared to the extreme conditions observed in January was observed. While the northeastern parts of the country continued to experience residual wet conditions early in the month, rainfall became more pronounced over the central interior, particularly across the Northern Cape, North West, Gauteng, Free State, Mpumalanga, extending eastwards into the Eastern Cape and KwaZulu-Natal. Areas that recorded the highest totals generally ranged from >150 to >300 mm.

At the start of the month, catchments in the northeastern interior, including Limpopo and Mpumalanga, remained hydrologically responsive due to saturated soils and elevated river levels following the persistent rainfall events of January. Consequently, even moderate rainfall during early February contributed to continued localised flooding and a slow recession of water levels in low-lying areas. As the month progressed, rainfall activity became more episodic, characterised by scattered thunderstorms across the central and eastern interior, with intermittent dry spells between events. Distribution during February was notably widespread, with most stations across the country recording measurable precipitation. Above-normal rainfall was recorded across much of the central to western interior, including the Karoo and adjacent areas of the Western Cape, indicating short-term relief from the dry conditions experienced in preceding months. However, parts of the far western winter rainfall region, including areas near Springbok, as well as parts of the northeastern summer rainfall region, recorded below-normal rainfall, with totals generally less than 50% of the long-term normal.

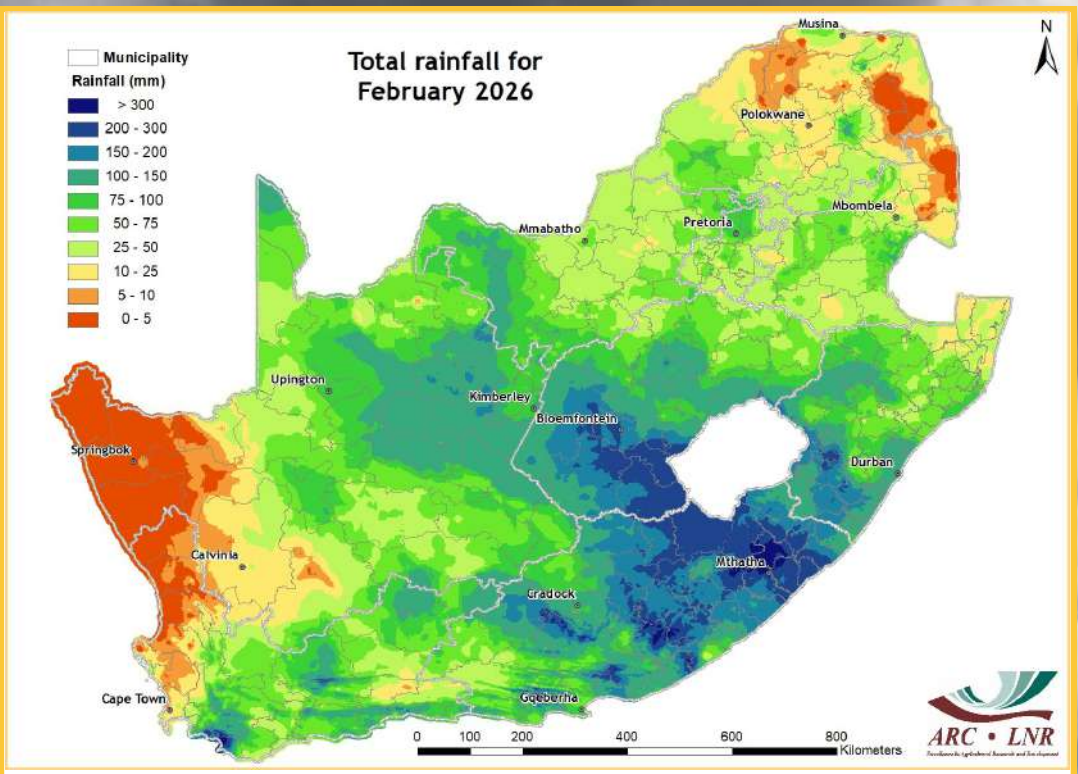


Figure 1

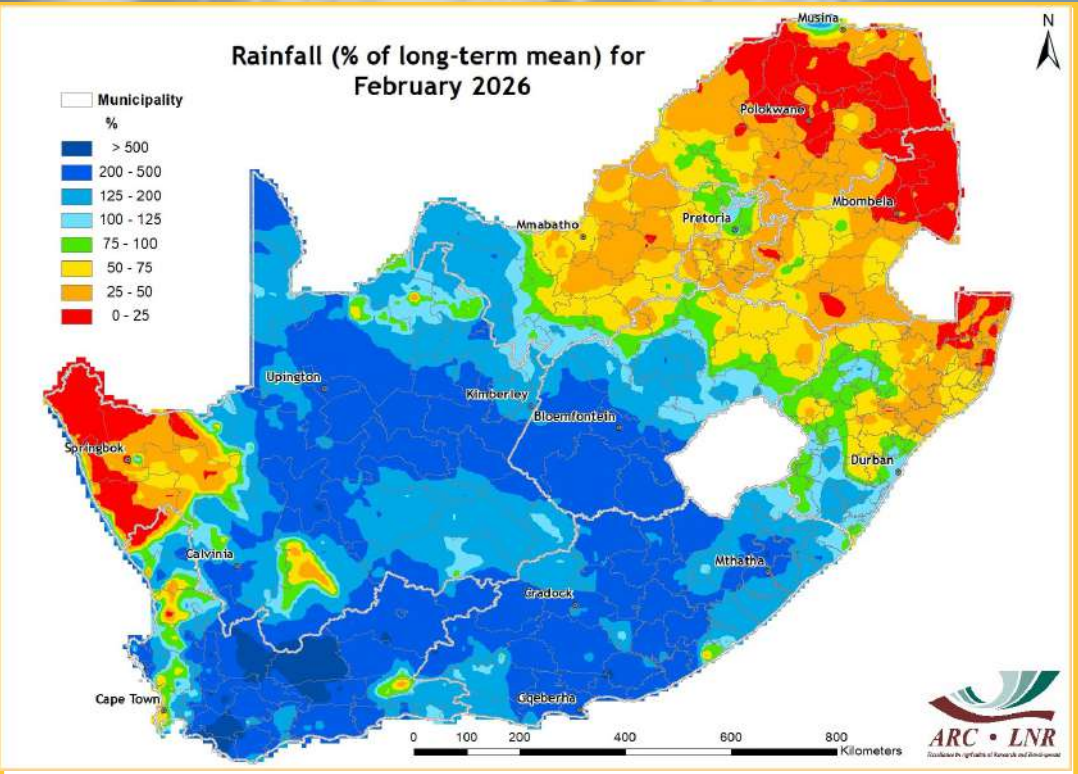


Figure 2

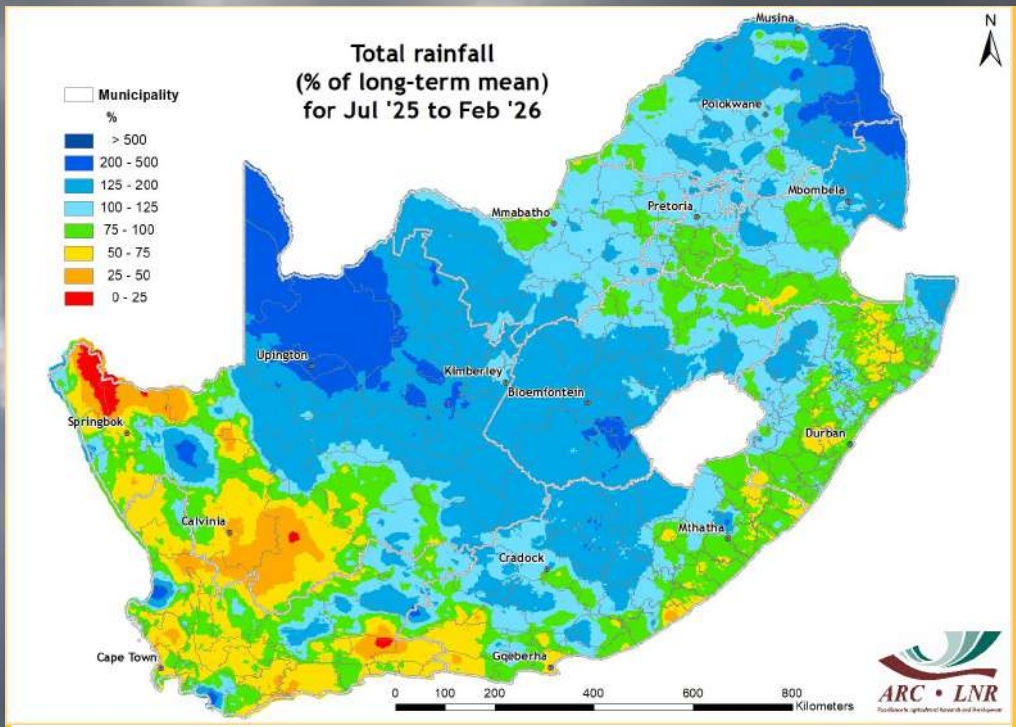


Figure 3

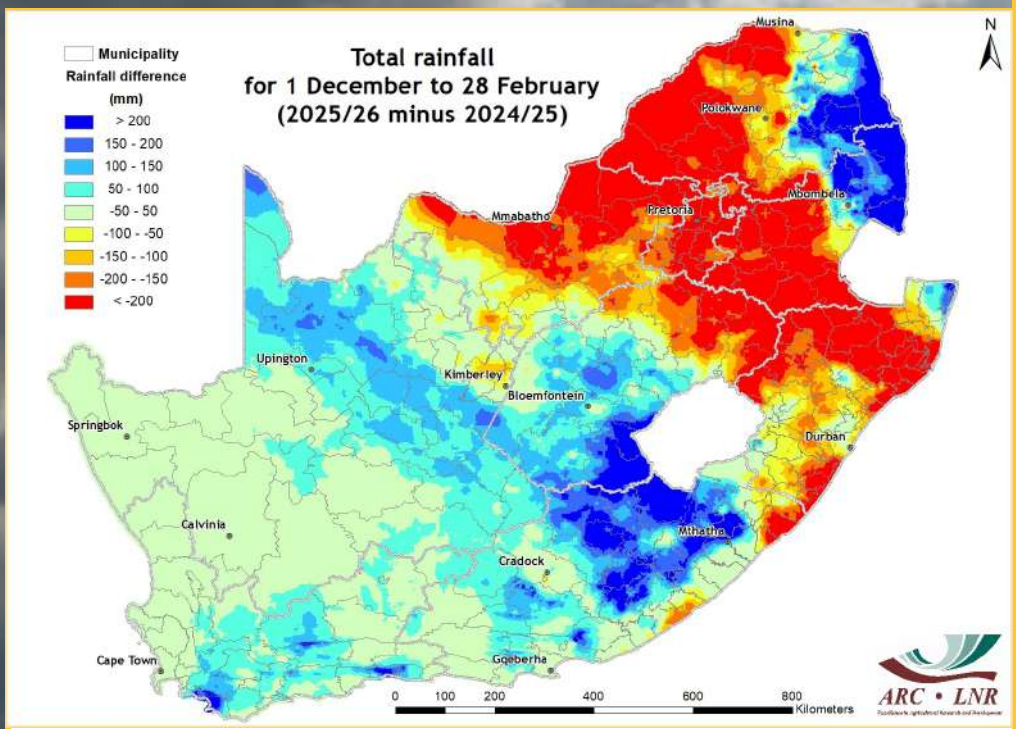


Figure 4

Figure 1:
Rainfall during February 2026 was widespread across much of the country, with the highest totals concentrated over the central interior, including the Free State, extending eastwards into the Eastern Cape and KwaZulu-Natal, where monthly totals generally exceeded 200 mm. Much of the interior recorded moderate to high rainfall, while lower totals (generally below 50 mm) were observed over the far western regions.

Figure 2:
Relative to the long-term February climatology, rainfall was above normal across large parts of the central to western interior. Near- to above-normal conditions were also observed across parts of the eastern interior. In contrast, below-normal rainfall occurred over the far western winter rainfall region, and parts of the northeastern summer rainfall region.

Figure 3:
The period July 2025 to February 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.

Figure 4:
The period December 2025 to February 2026 was wetter than the corresponding period of the previous season (2024/25) in most parts of the central interior, and the far northeastern parts of Limpopo and Mpumalanga. However, parts of the adjacent interior, moving towards the eastern coastline, recorded notably lower totals, with deficits ranging from 150 mm to more than 200 mm during these 3 months.

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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 in February 2026 are shown in Figures 5-8. The short-term SPI map reveals wet conditions across the Northern Cape, Free State, parts of the Eastern Cape, Limpopo and Mpumalanga, with moderate to extreme drought observed in the winter rainfall region. The medium-term map shows wet conditions over greater parts of the country, with more pronounced conditions over the central parts, and drier conditions in the south-western regions. Long-term maps show widespread near-normal to wet conditions.

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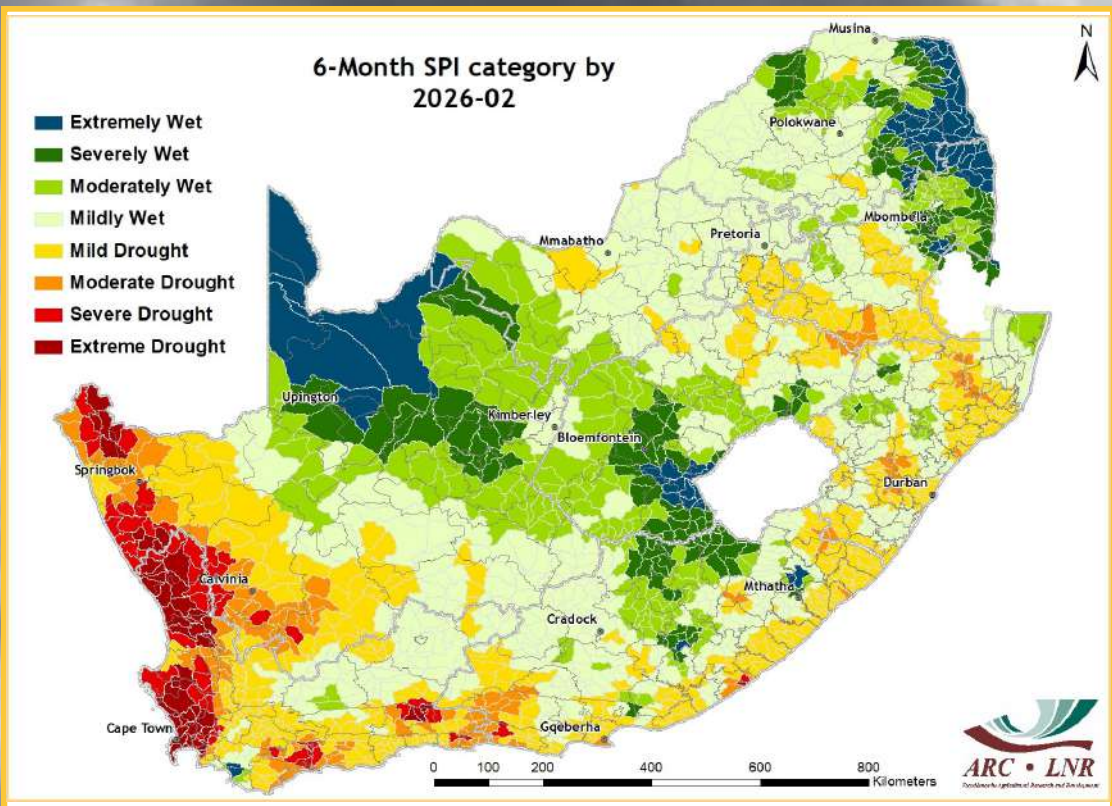

Figure 5

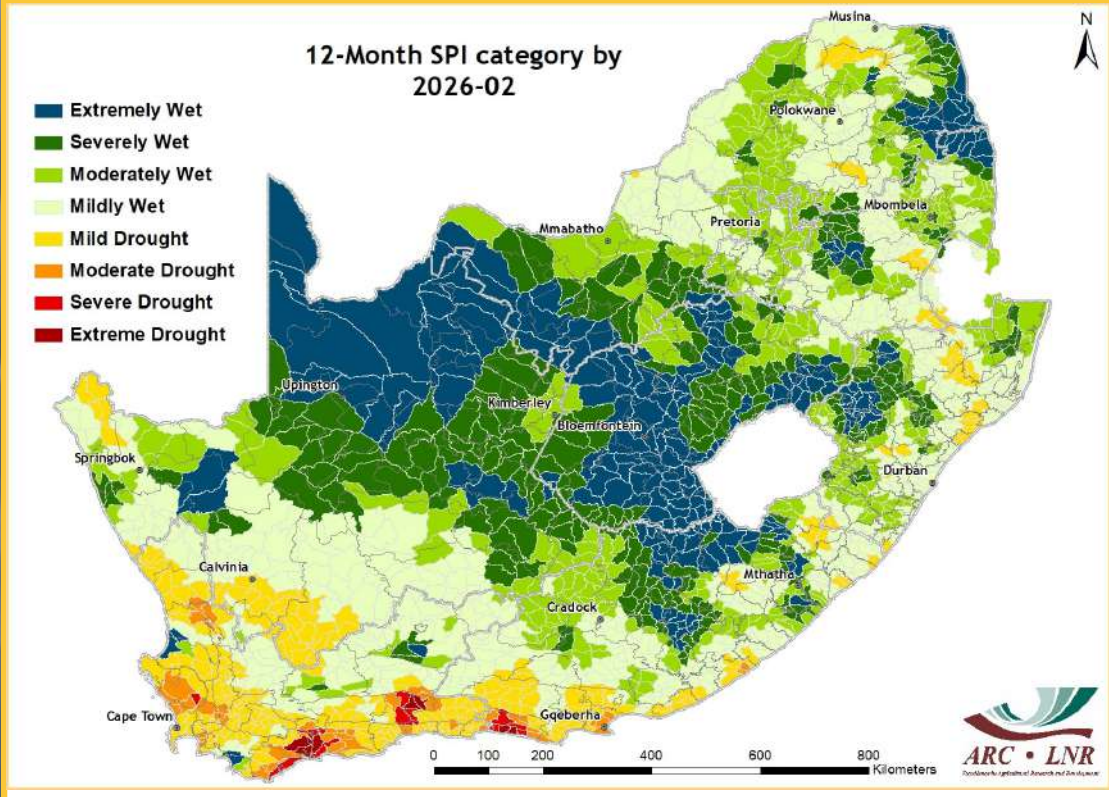

Figure 6

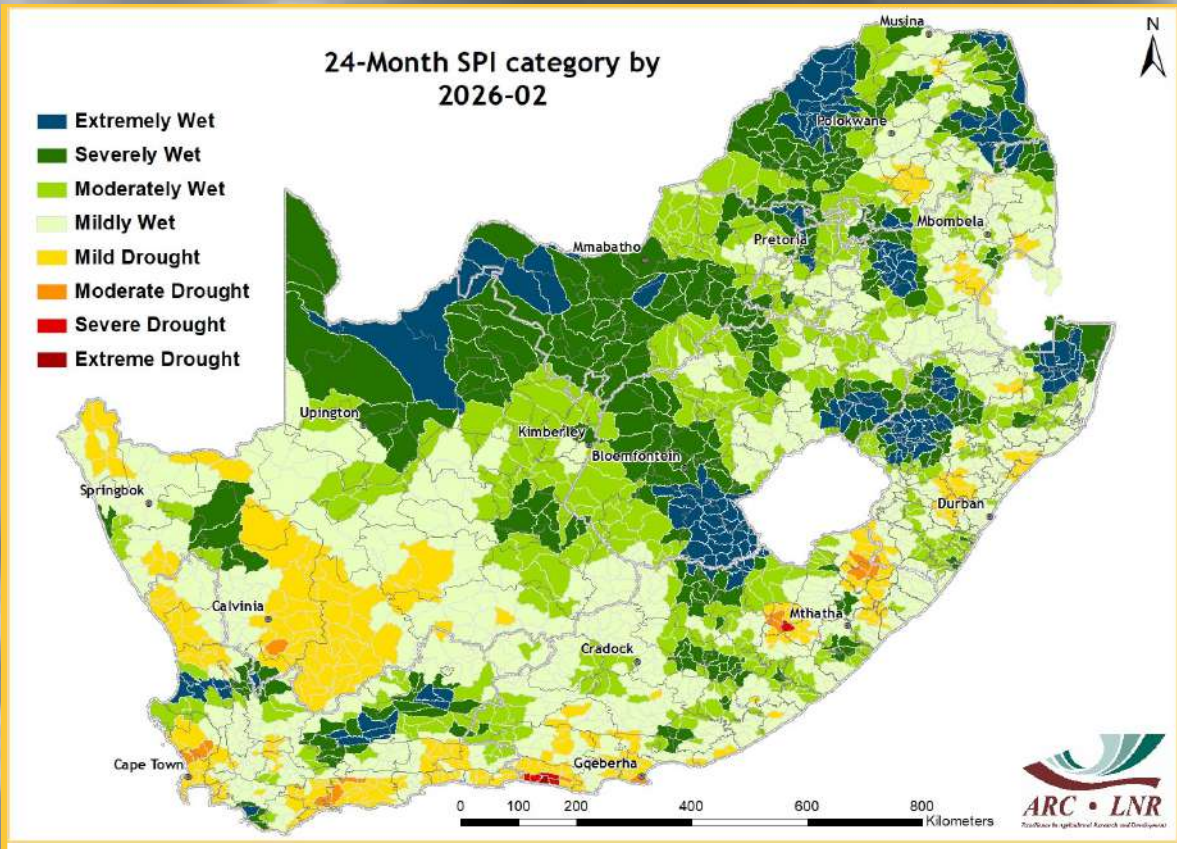

Figure 7

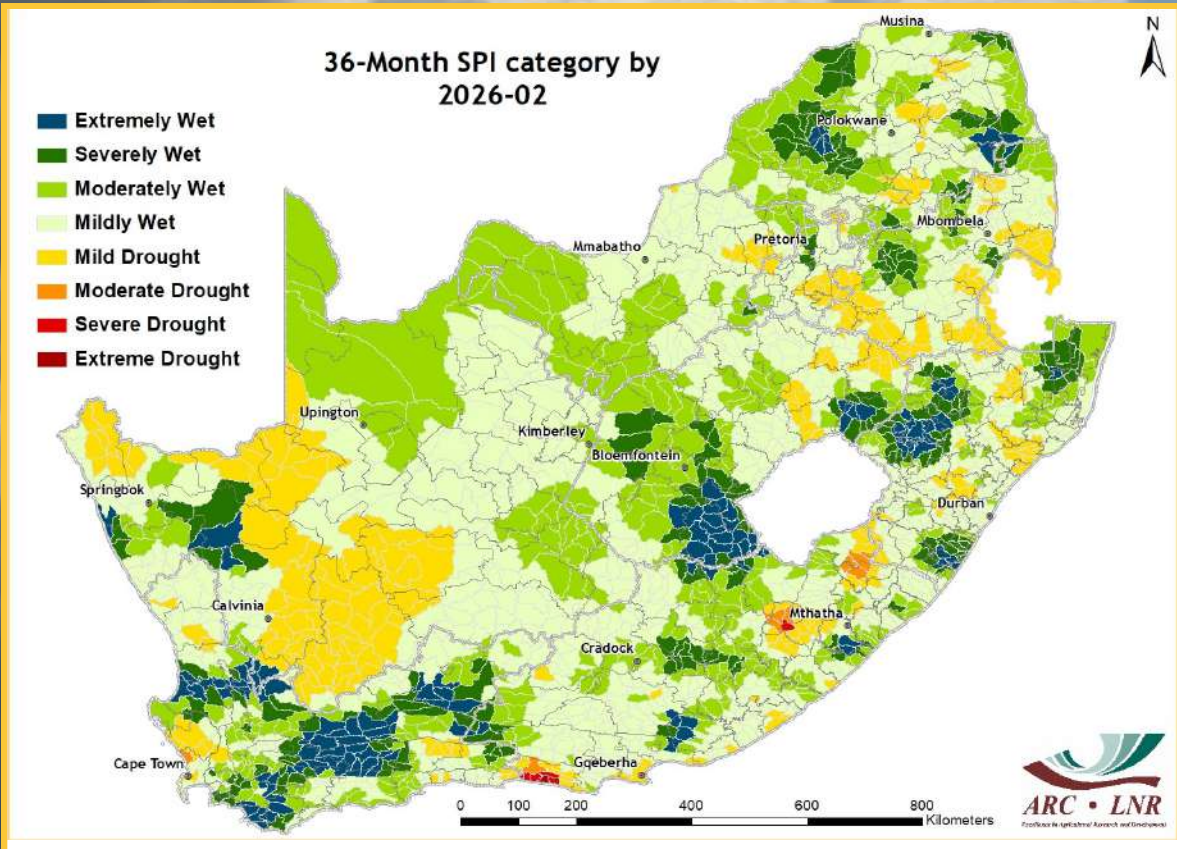

Figure 8

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.

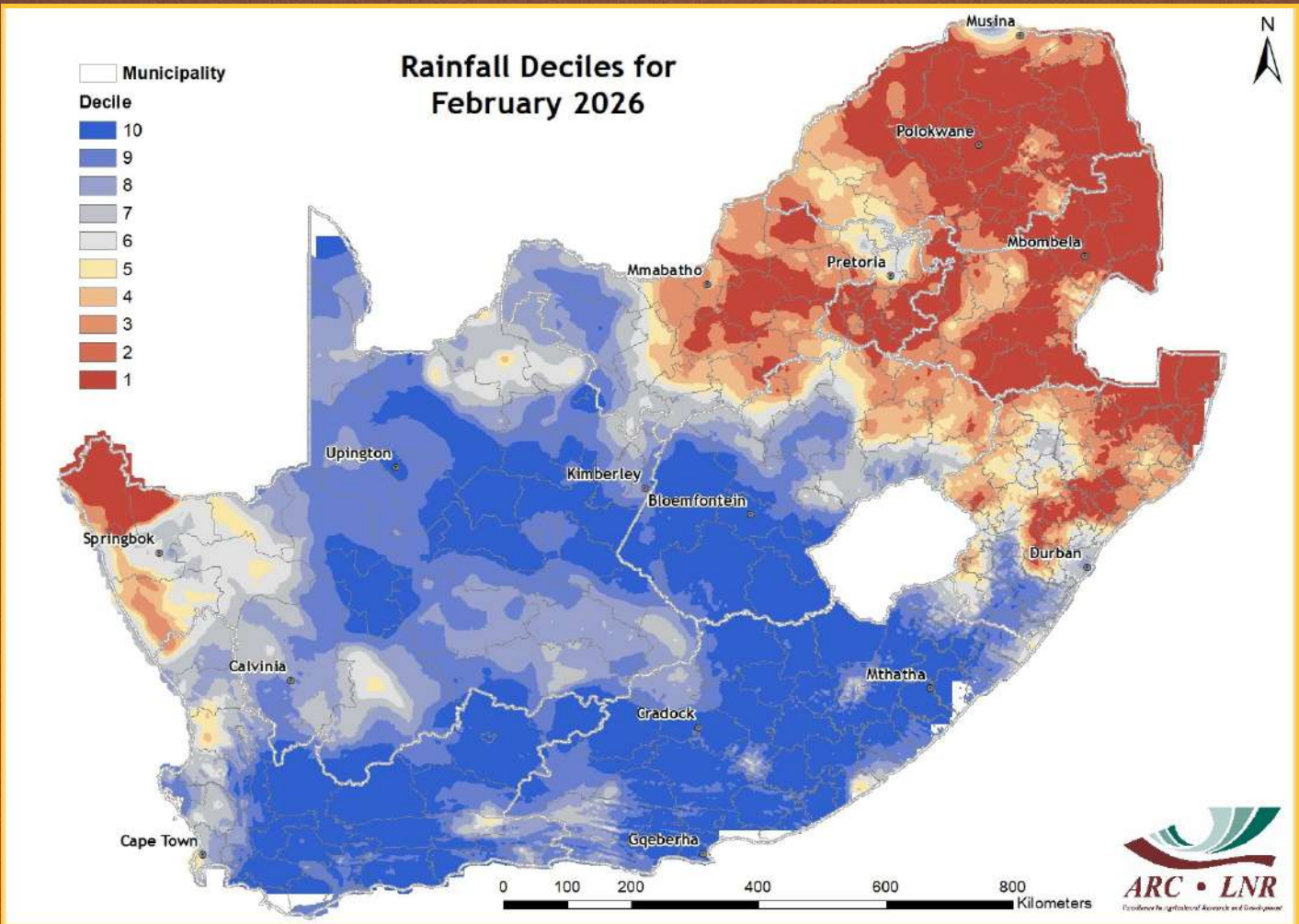

Figure 9

Figure 9:
The western half of the country, and parts of the central interior, recorded rainfall that compared well with the historical wetter February totals. The northeastern parts and the far western parts were drier than normal.

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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.

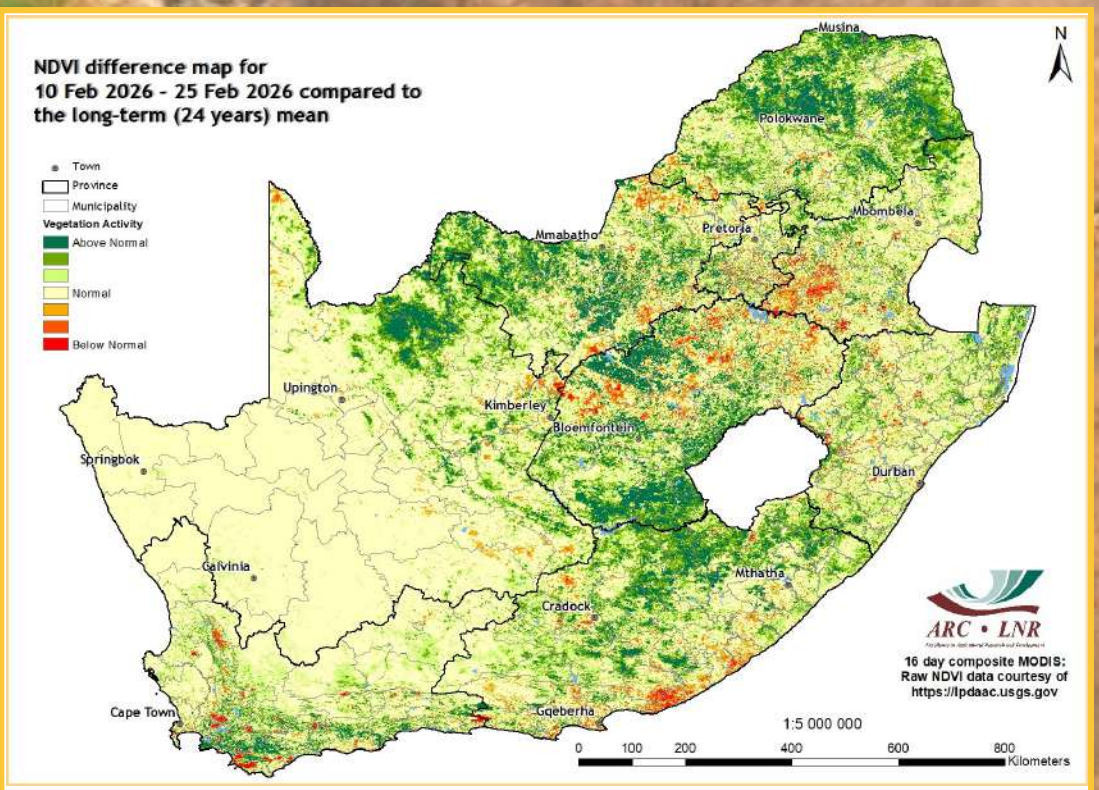

Figure 10

Figure 10:
Compared to the historical averaged vegetation conditions, the 16-day NDVI map for February 2026 shows that above-normal conditions persist in the eastern half of the country, while the western half experienced mostly normal vegetation. Patches of below-normal activity were observed in isolated areas of the country.

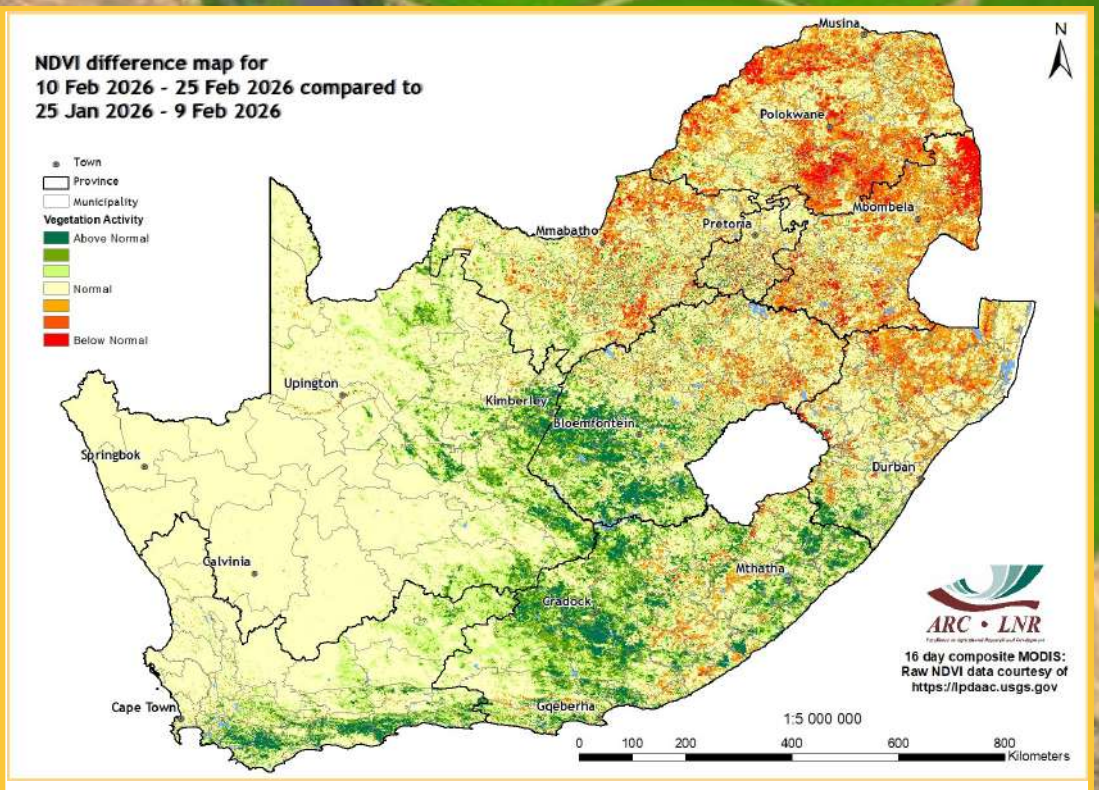

Figure 11

Figure 11:
The 16-day NDVI difference map for February 2026 compared to the preceding 16-day period shows that the northern parts of the country experienced poor vegetation while the western half experienced mainly normal conditions. Patches of above-normal, activity were observed in the central and coastal parts.

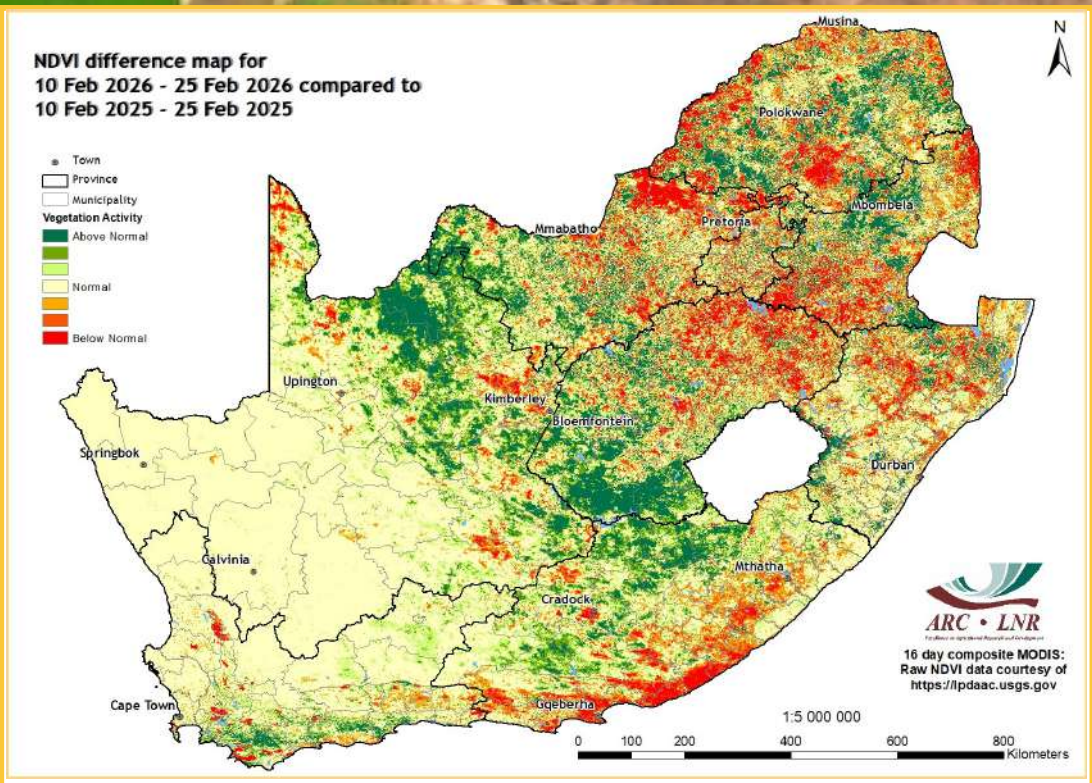

Figure 12

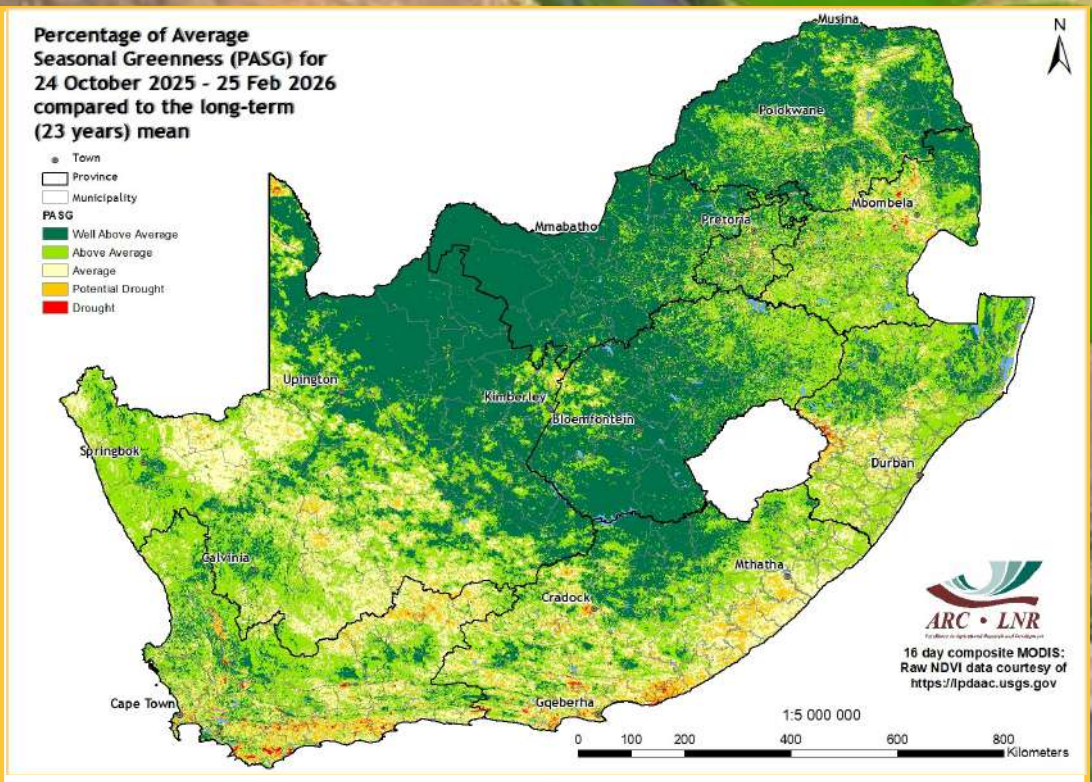

Figure 13

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 February 2026 compared to the same period last year shows that the country experienced a mix of vegetation activity, particularly the norther parts experienced below-normal activity, with patched of above-normal while the western half experienced central mainly normal conditions.. The interior parts of the country continued to experience above-normal vegetation conditions.

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-average vegetation conditions, while a few isolated areas, particularly the southern coastal areas 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.

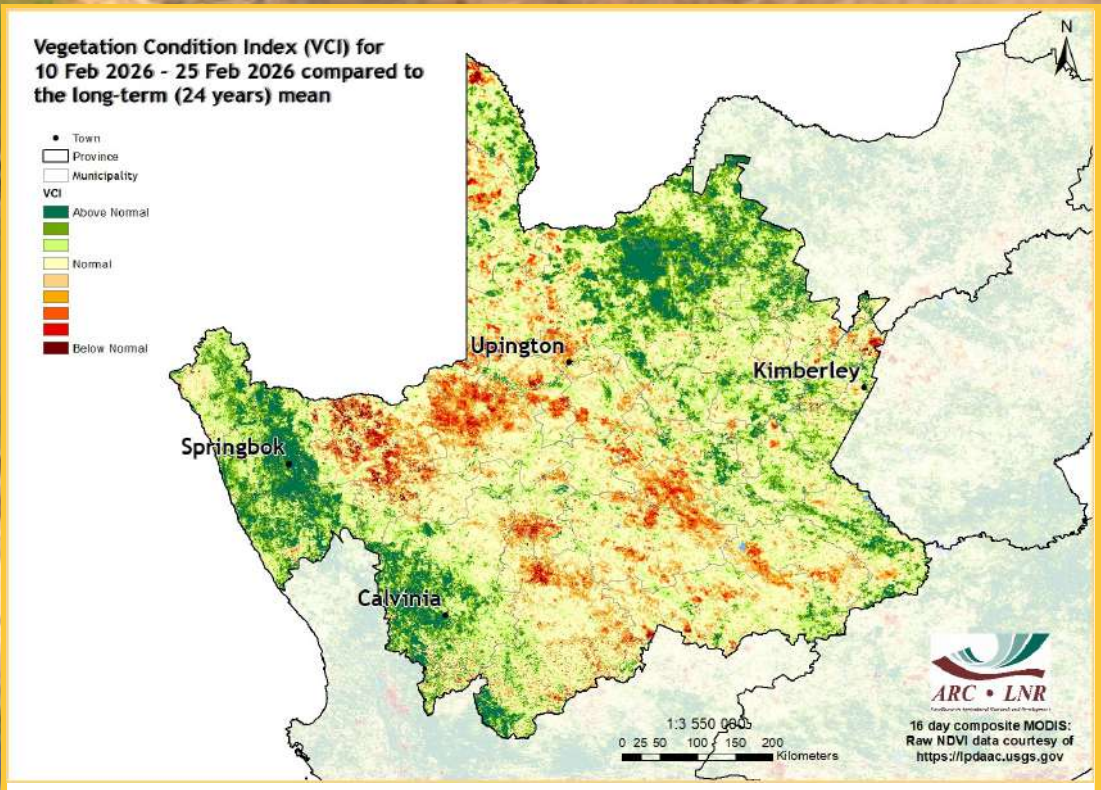


Figure 14

Figure 14:
The 16-day VCI map for February shows that the centran interior of the Northern Cape experienced mainly below-normal vegetation activity with patches of above-normal vegetation activity in isolated areas.

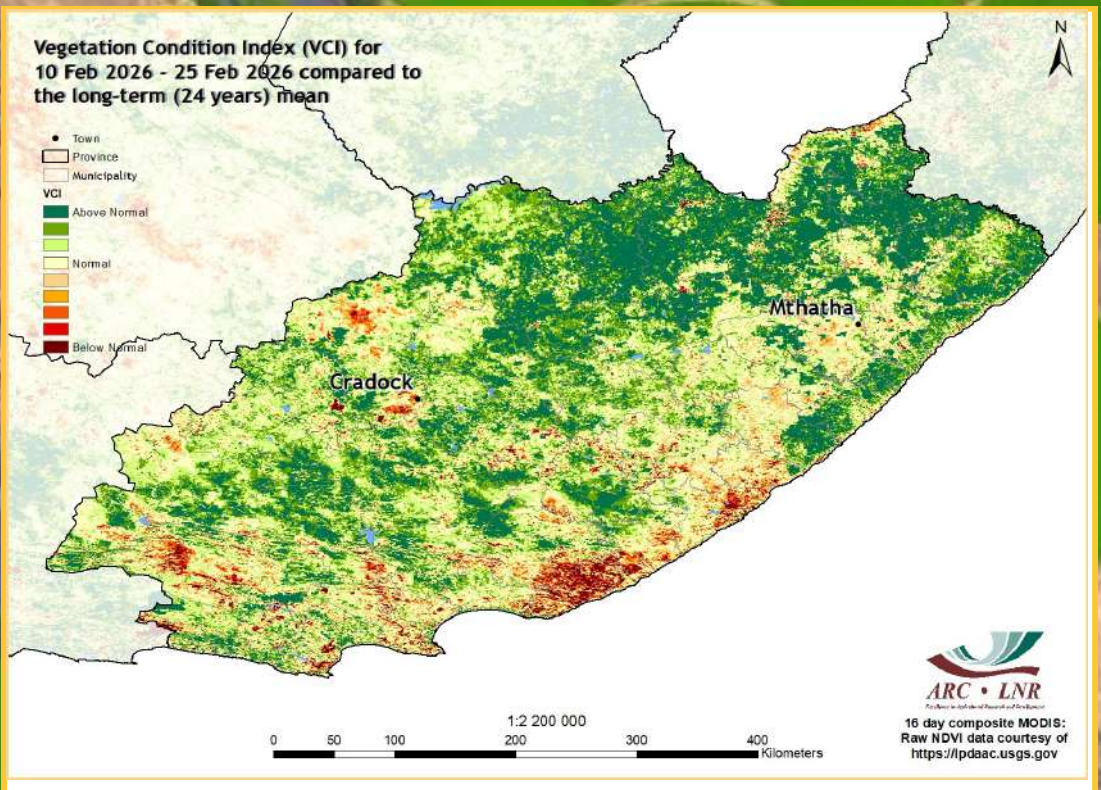
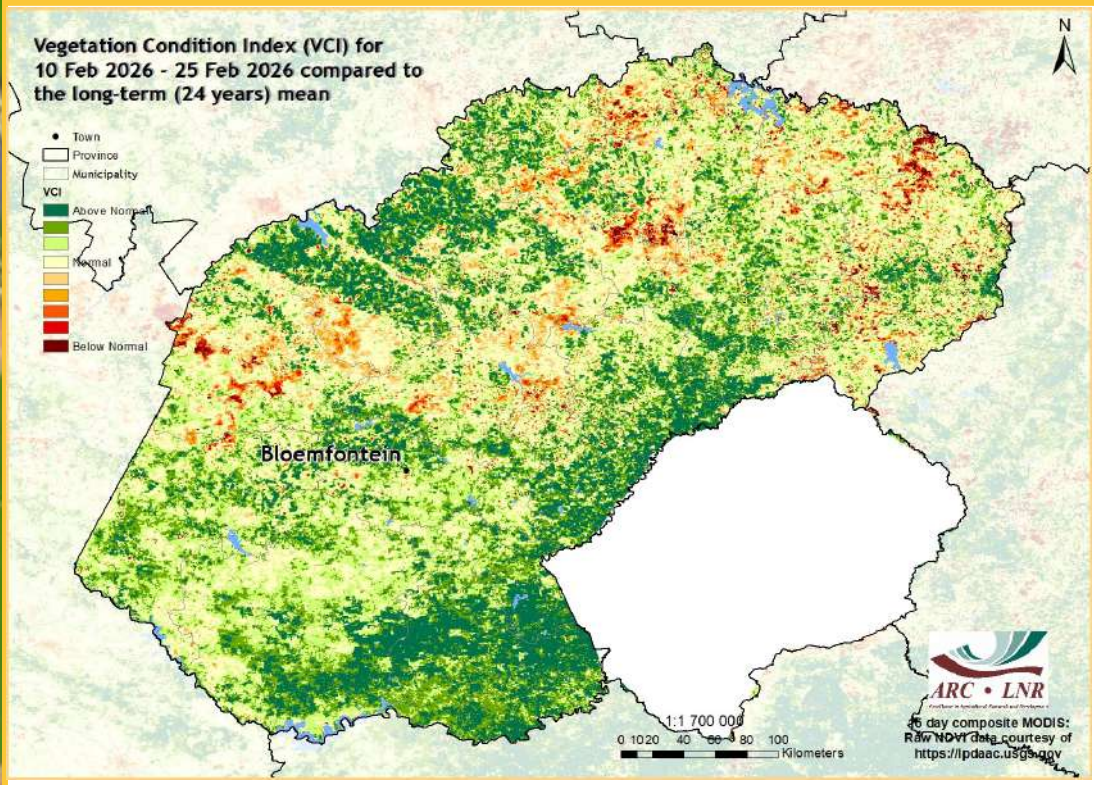


Figure 15

Figure 15:
The 16-day VCI map for February shows that the Eastern Cape experienced improved vegetation conditions with patches of below-normal vegetation activity in isolated areas.



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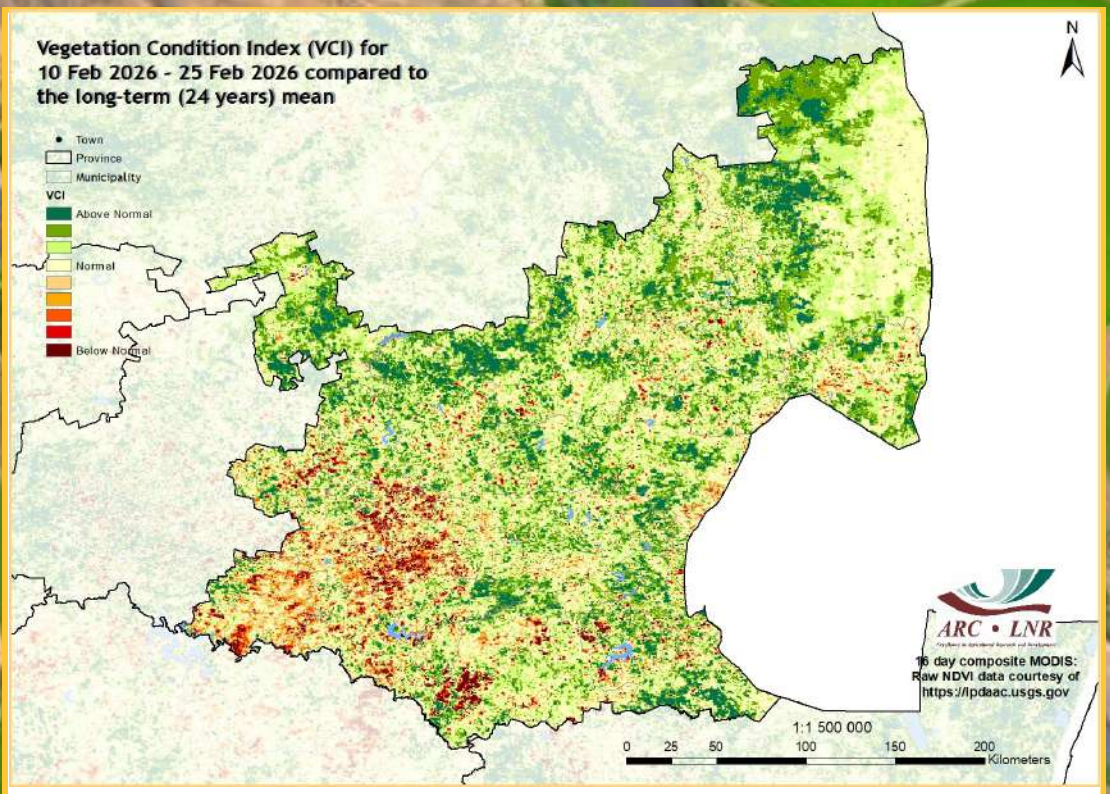

Figure 17

Figure 16:
The 16-day VCI map for February 2026 shows improved vegetation conditions persist mainly in the southern half of the Free State with patches of below-normal activity in northern half the province.

Figure 17:
The 16-day VCI map for February 2026 shows that most of Mpumalanga experienced mix of below- and above-normal vegetation activity with patches of below-normal activity mainly confined to the south western parts of the province.

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6. Vegetation Conditions & Rainfall

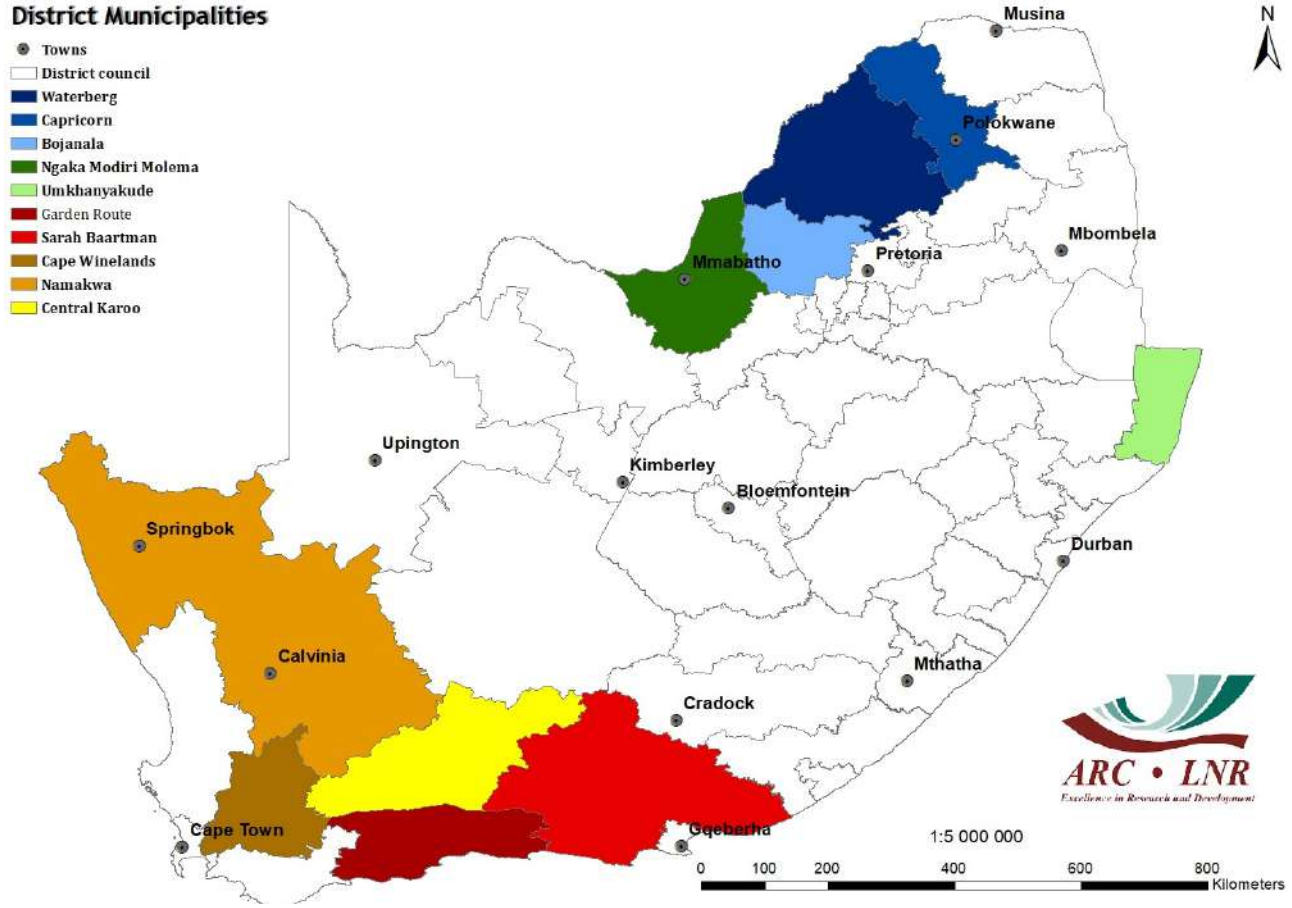

Figure 18

Rainfall and NDVI Graphs

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

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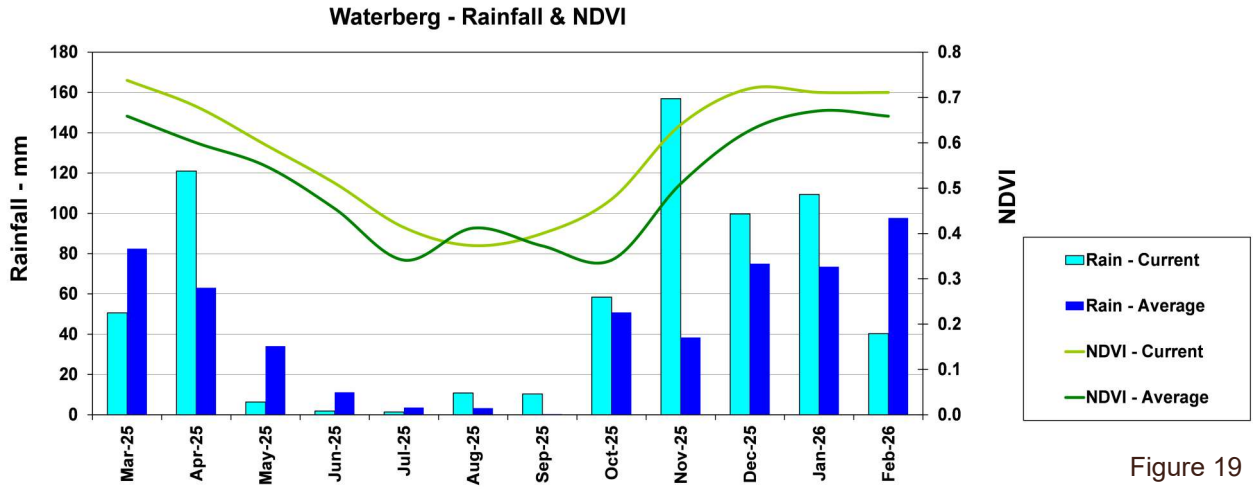
Figures 19-23:
Indicate areas with higher cumulative vegetation activity for the last year.

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



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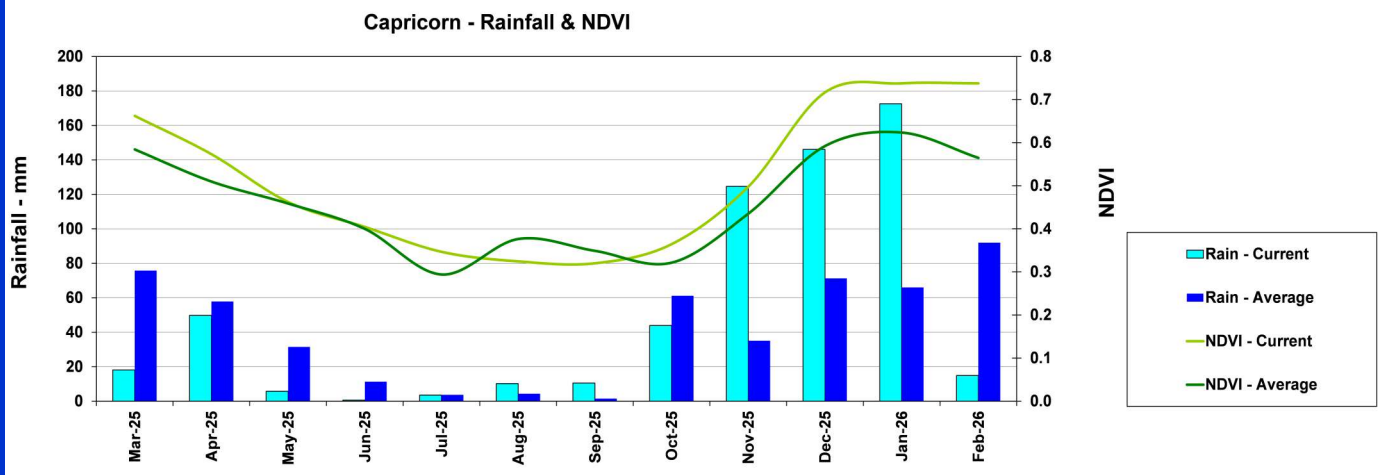

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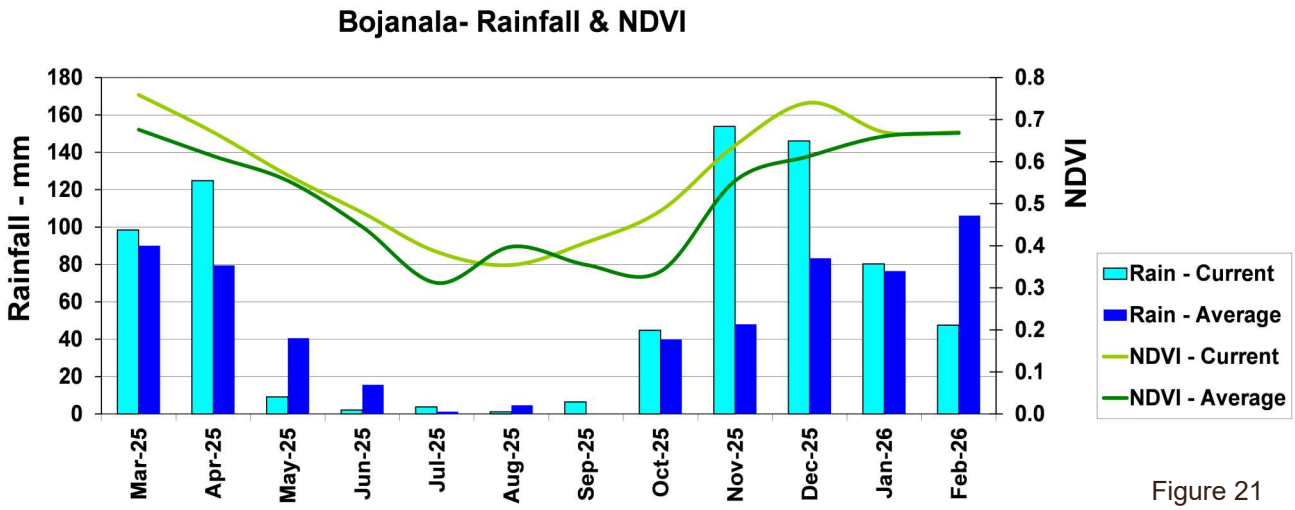

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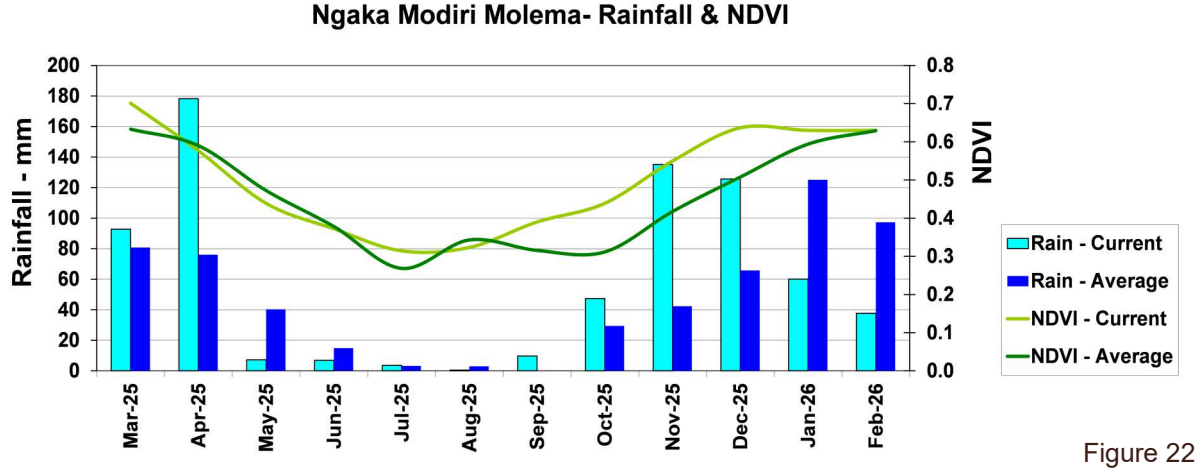

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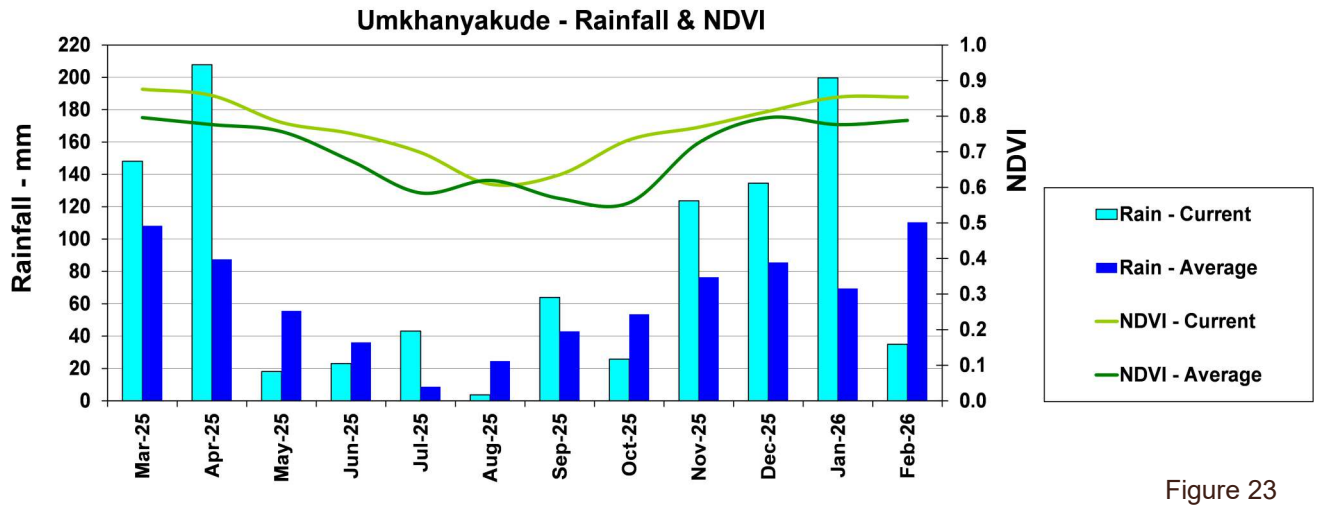

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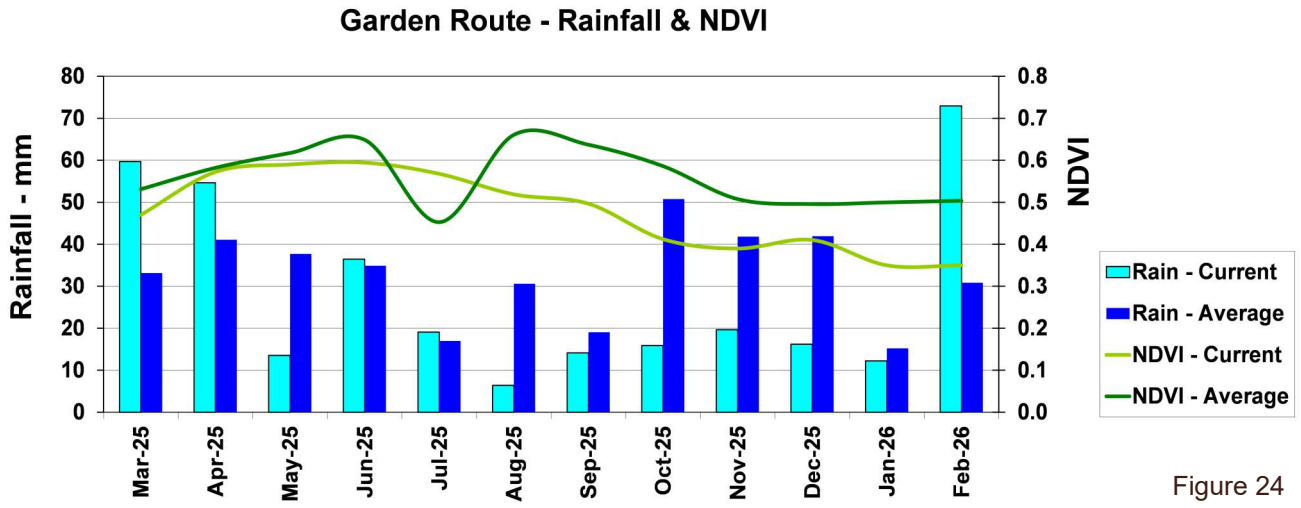

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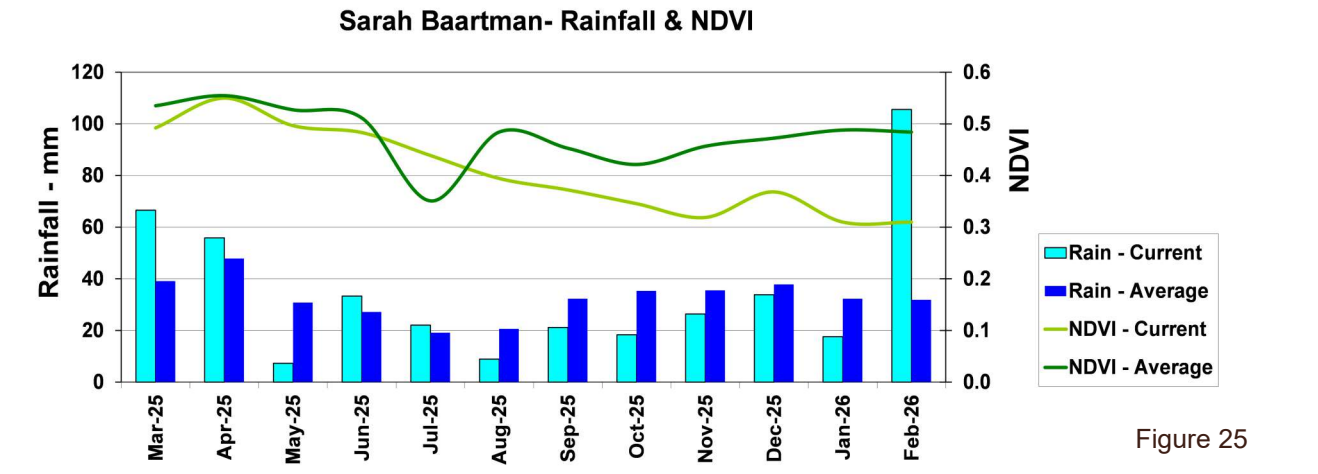

Figure 25

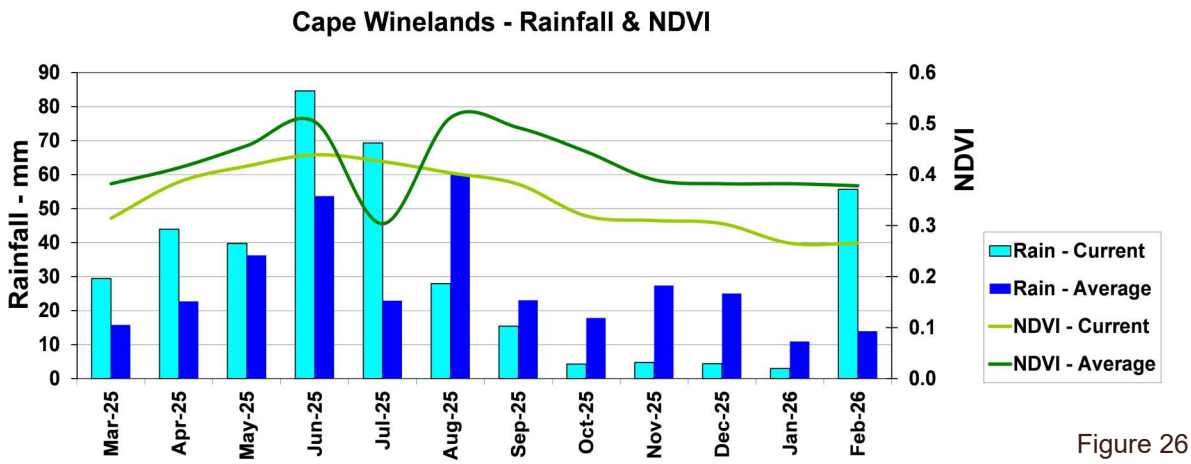

Figure 26

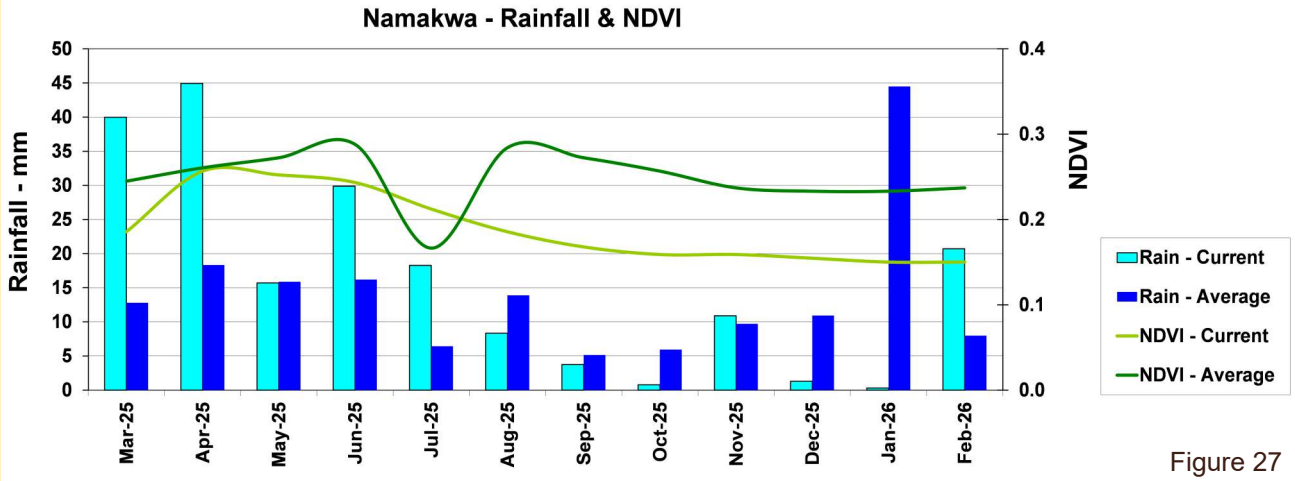

Figure 27

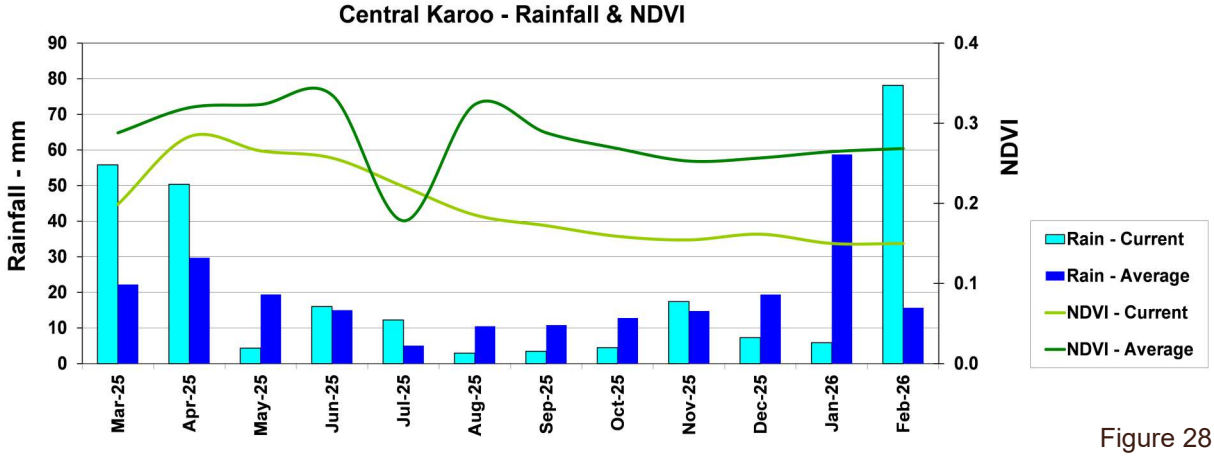

Figure 28

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 2 February and 25 February 2026.per province. Fire activity was higher in Mpumalanga and Limpopo compared to the long-term average.

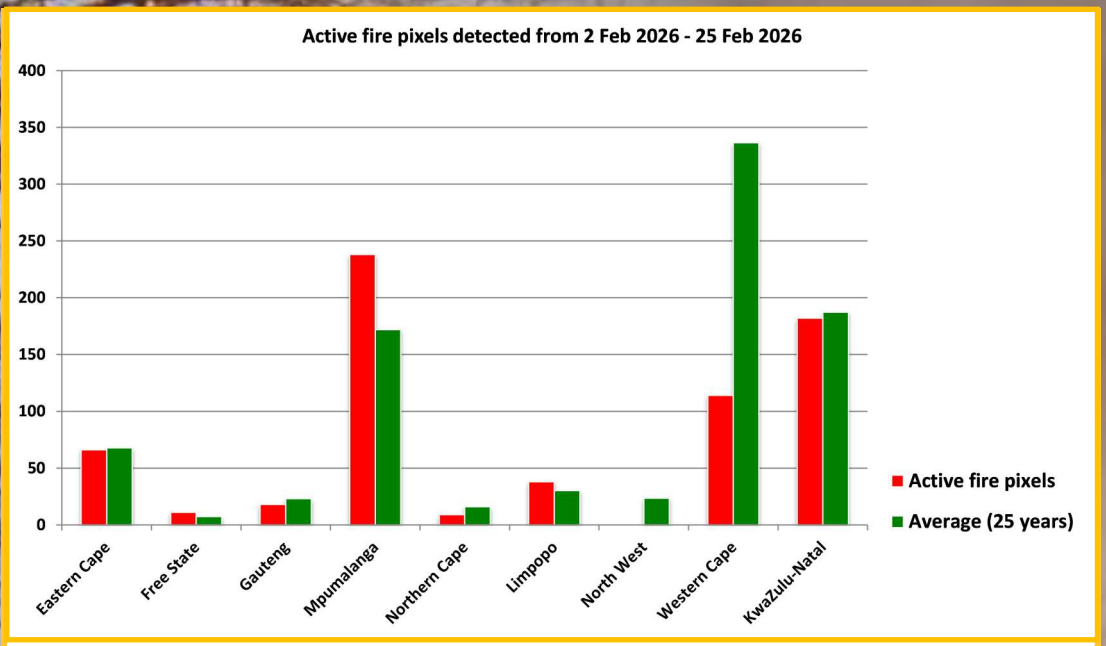

Figure 29

Figure 30:
The map shows the location of active fires detected between 2 February and 25 February 2026.

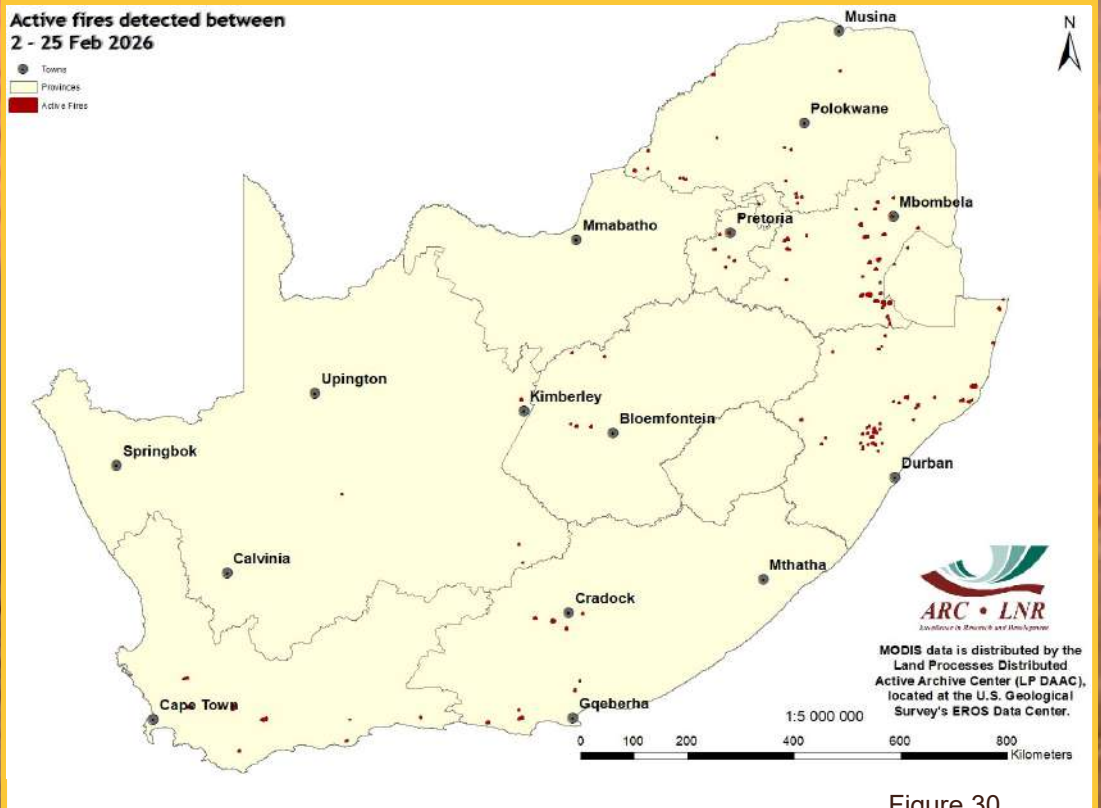

Figure 30

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 25 February 2026 per province. Fire activity was higher in the Eastern and Western Cape provinces compared to the long-term average.

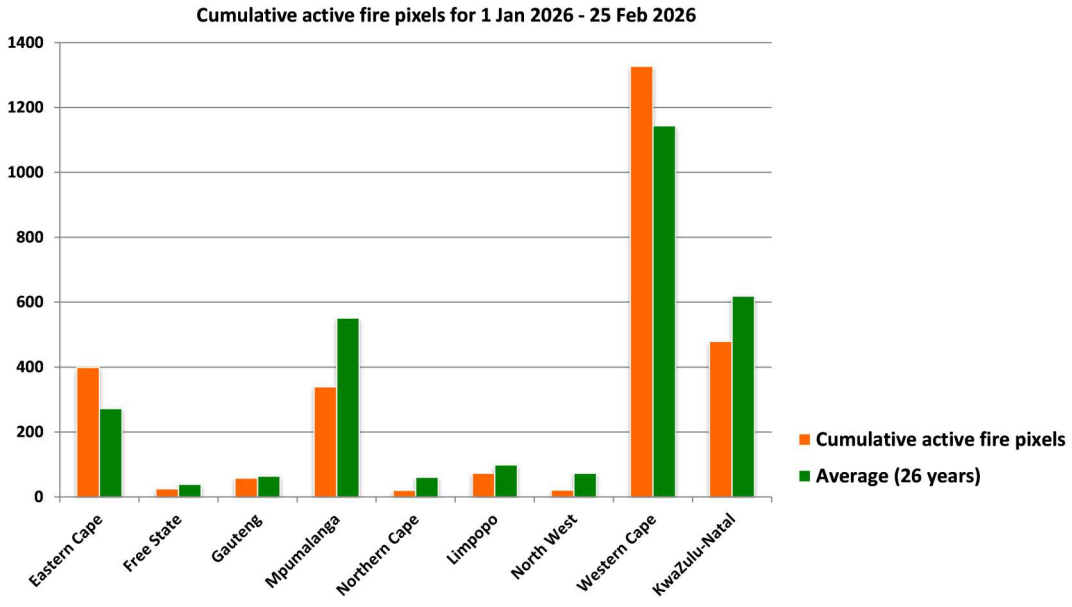

Figure 31

Figure 32:
The map shows the location of active fires detected between 1 January to 25 February 2026.

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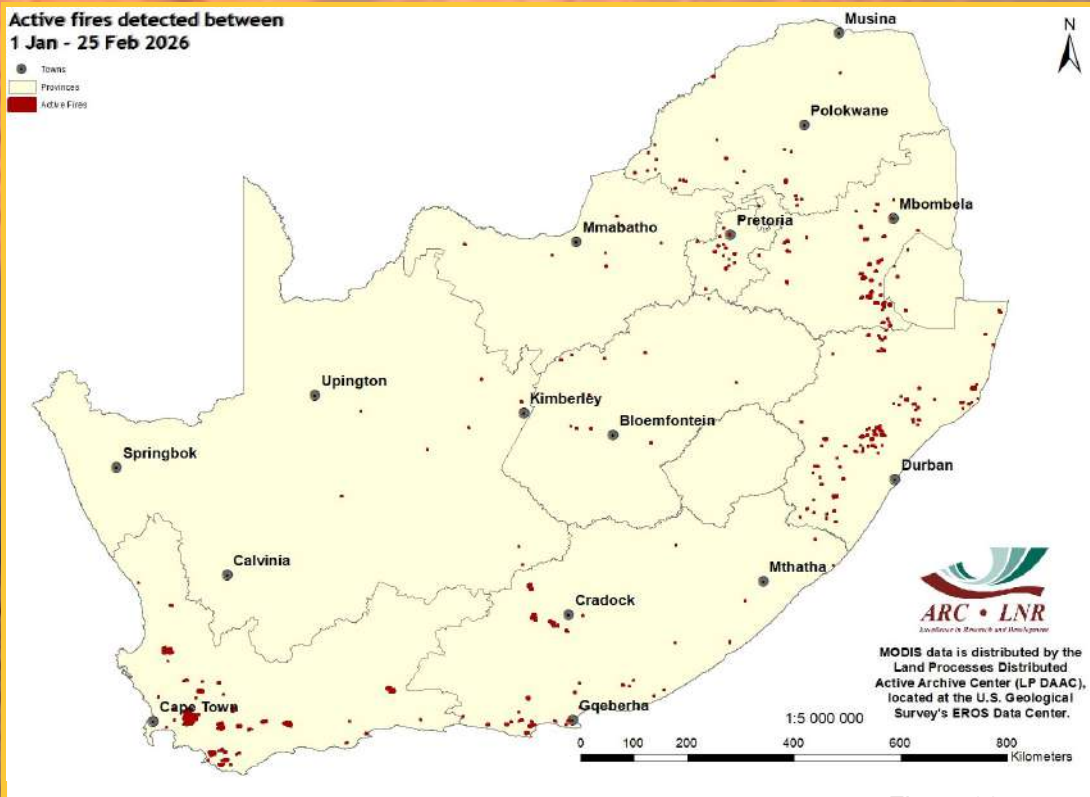

Figure 32

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 February 2026 shows a near identical water distribution pattern to that recorded for December 2025 and January 2026. Generally, this represents an ongoing increase in water levels across most of the summer rainfall areas, compared to the previous November 2025 long-term patterns, with most areas exhibiting an 80 – 100%. Although the North West and adjacent areas of the Northen Cape are starting to show reduced levels in February compared to January long-term differences. In comparison, winter rainfall continue to exhibit typically more extensive and lower water levels, especially in the karoo regions, compared to November 2025 conditions.

The comparison February 2026 and the same month in 2025 are now showing significantly different water distribution patterns than in January 2026, with nearly all the country, and especially the Northen Cape and Mpumalanga lowveld regions, having significantly lower water levels, compared to January 2025 annual comparison.

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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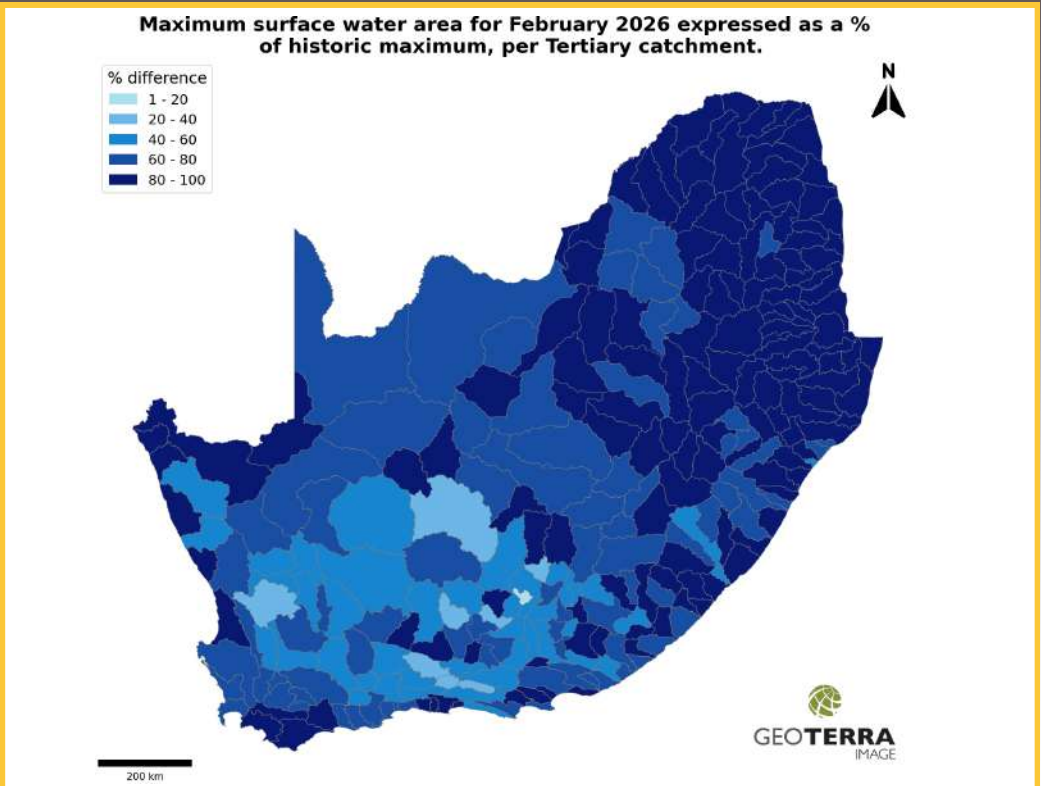

Figure 33

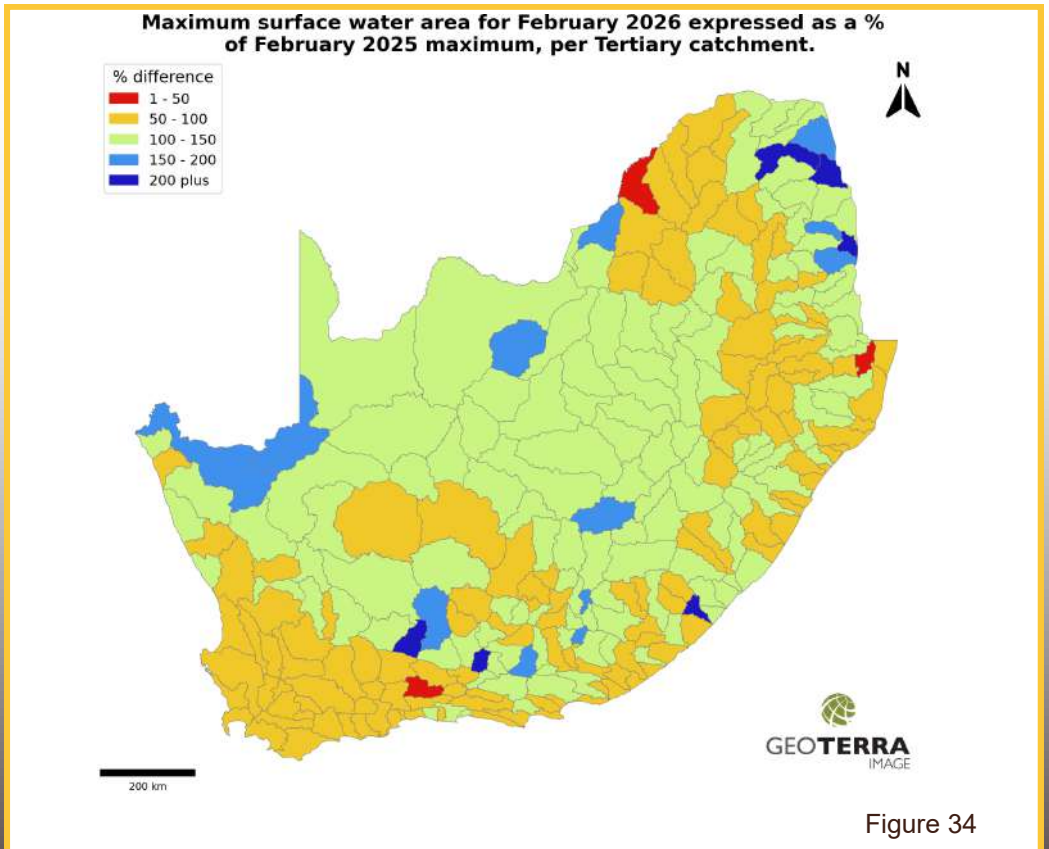

Figure 34

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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

Contact Person: *Dr Mokhele Moeletsi*
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For more information contact:
Adri Laas - Public Relations Officer
E-mail: adril@arc.agric.za

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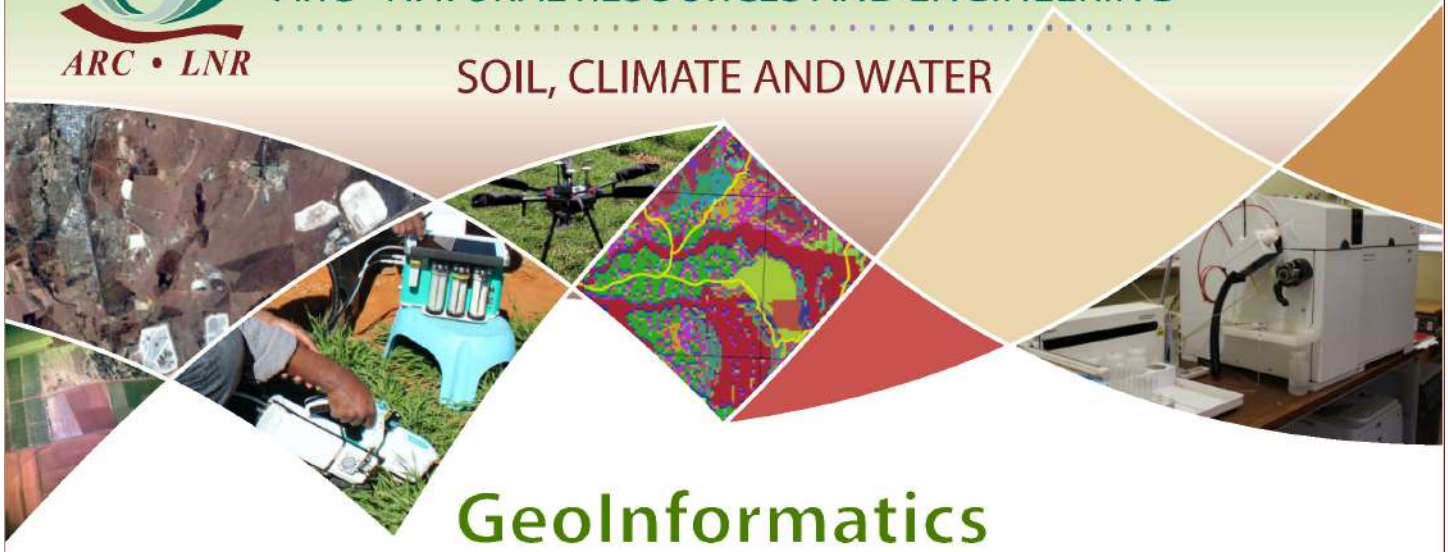
SOIL, CLIMATE AND WATER



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

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

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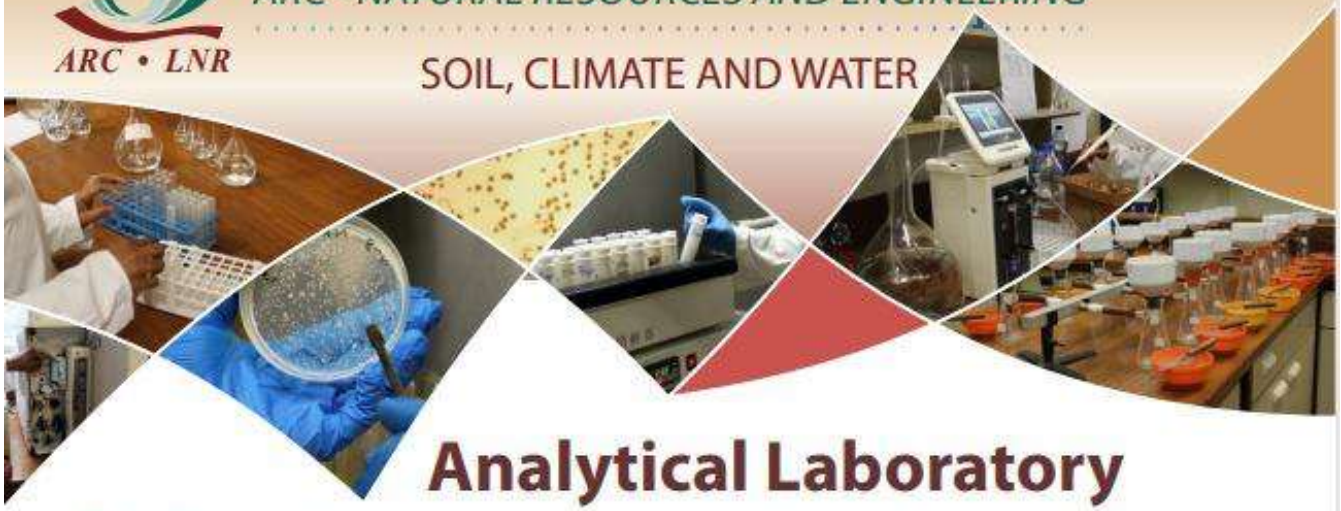

Analytical Laboratory

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.

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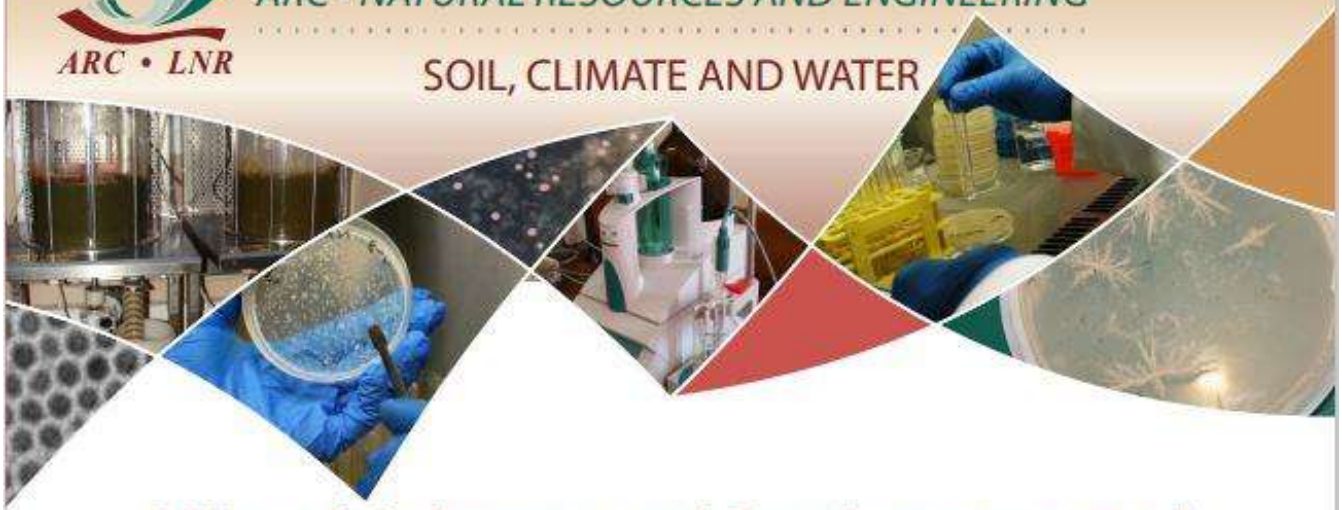

Microbiology and Environmental Biotechnology Laboratory

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

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.

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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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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".