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REPUBLIC OF SOUTH AFRICA

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The Watchman

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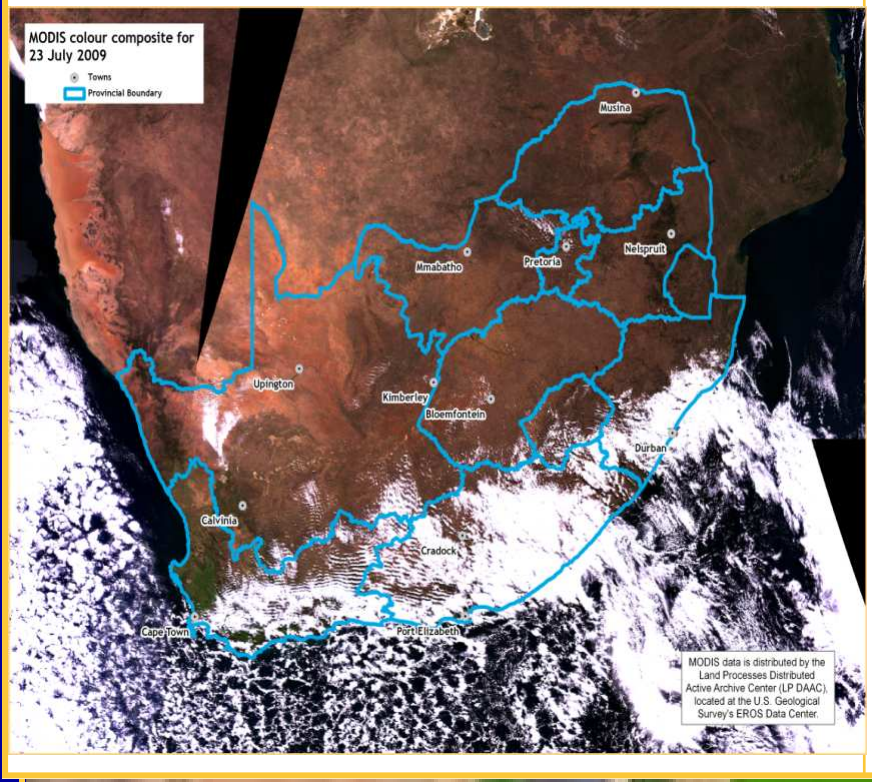
INSTITUTE FOR SOIL, CLIMATE AND WATER

- Latest vegetation conditions as deduced from SPOT VEGETATION
- Rainfall for July 2009

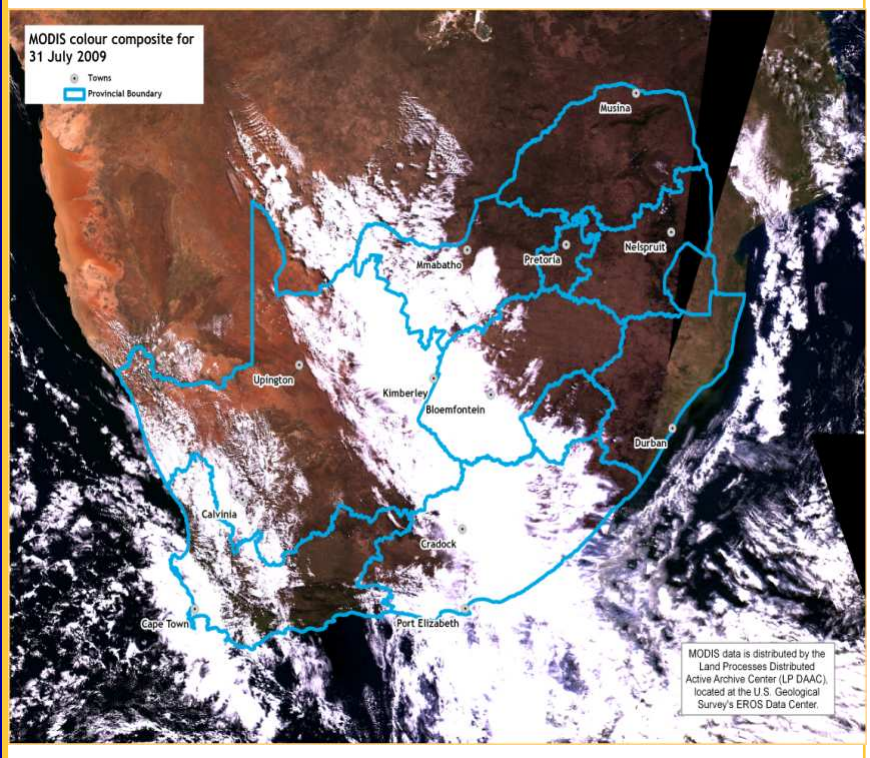
CONTENTS:

ARC • LNR
Excellence in Research and Development

Images of the Month



During July 2009, temperatures over the country were sometimes far below normal with cold fronts moving through and high pressure systems located behind them causing a flow of cold air over the country from the west or south. The image of the 23rd July shows the situation when a cold front that had moved from the west over the southern parts of the country was located over the southeastern parts of the country and a strong high pressure system was ridging behind it. A strong flow from the south resulted in very low temperatures with frost over large parts of the interior. The broken cloud to the south is an indication that the air moving from that direction is cold. There is also a wave-like cloud pattern visible over the southern parts of the country due to the effect of the mountains on the air flow from the south.



After widespread rain over the interior during June, very little rain fell over that region during July. By the very end of the month, however, a deep cut-off low pressure system developed over the western parts of the country causing a cloud band over the central interior resulting in widespread rain over the central parts, moving eastward with the passage of the low pressure system. Also visible on the picture is a cloud mass over the Western Cape, associated with a surface cold front and responsible for widespread rain over the winter rainfall area. This was one of several fronts that moved over the Western Cape during the month. The strongest front responsible for most of the rain over the winter rainfall area caused widespread rain and flooding on the 12th of July.

1. Vegetation Conditions

Vegetation Mapping

The Normalised 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.

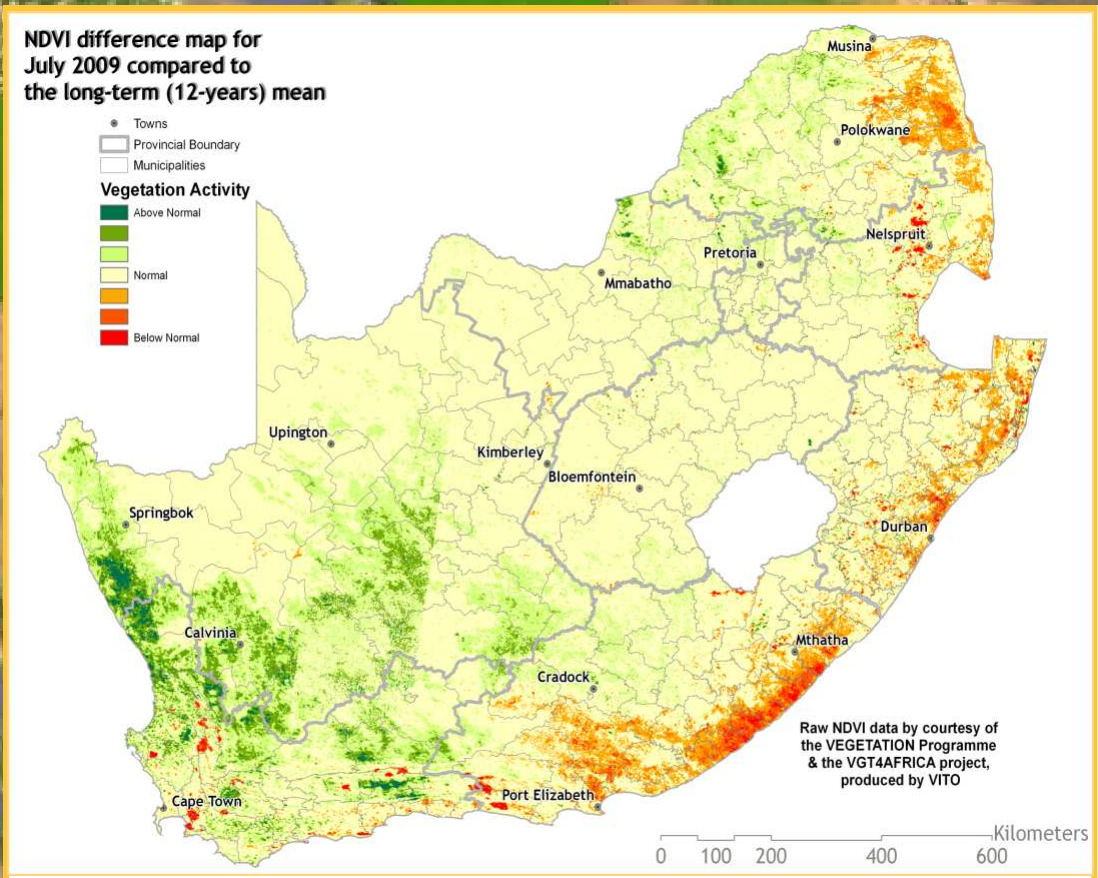


Figure 1

Figure 1:
Vegetation conditions for July 2009 were normal throughout most of the country. However, lower vegetation activity can be seen in the Eastern Cape and eastern Limpopo (see also Figures 14-18). Higher vegetation activity can be seen in the Western Cape and along the west coast.

Figure 2:
Vegetation activity for July 2009 is much lower in the summer rainfall region than in June 2008. Large parts of Limpopo received good rain in May, June and July, and this is reflected in the higher vegetation activity in the province. Higher vegetation activity can also be seen in the Western Cape. Vegetation activity along the east coast and in the central region of the country (Kimberley) shows much lower vegetation activity in 2009 compared to 2008.

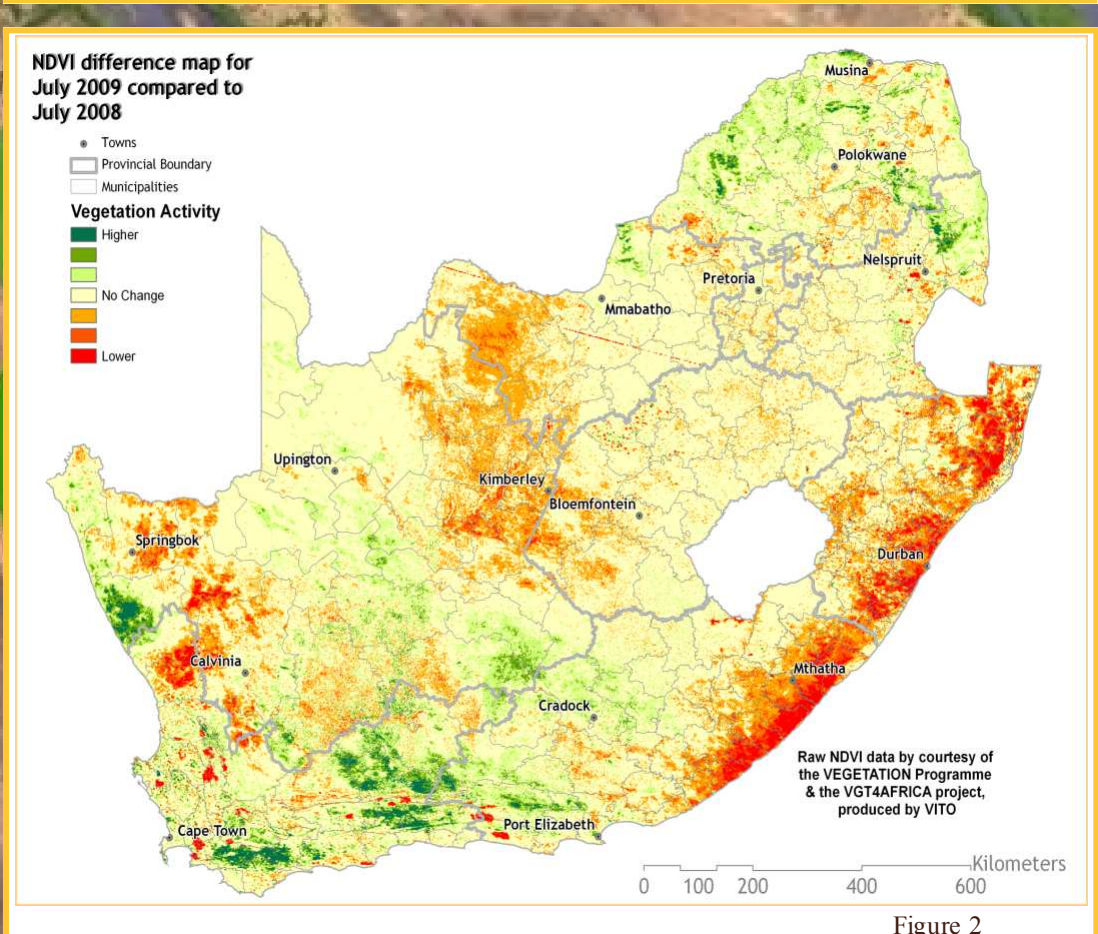


Figure 2

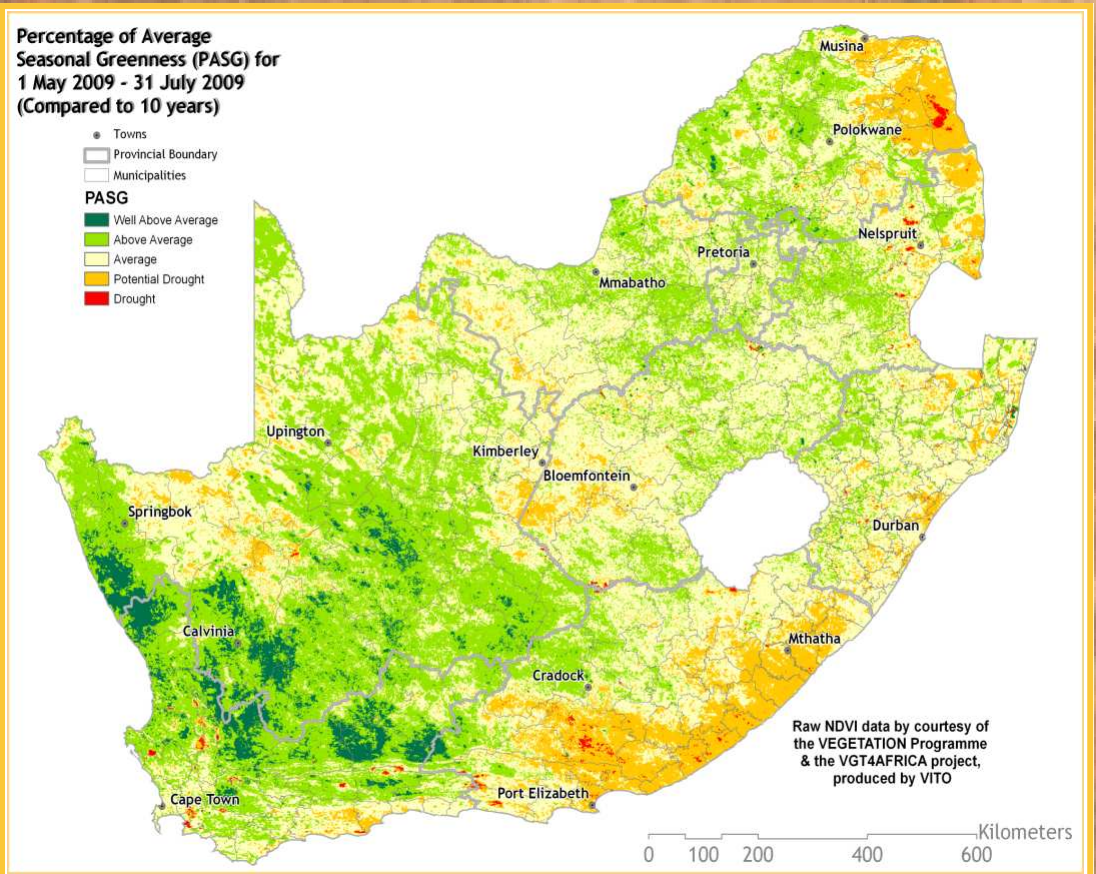


Figure 3

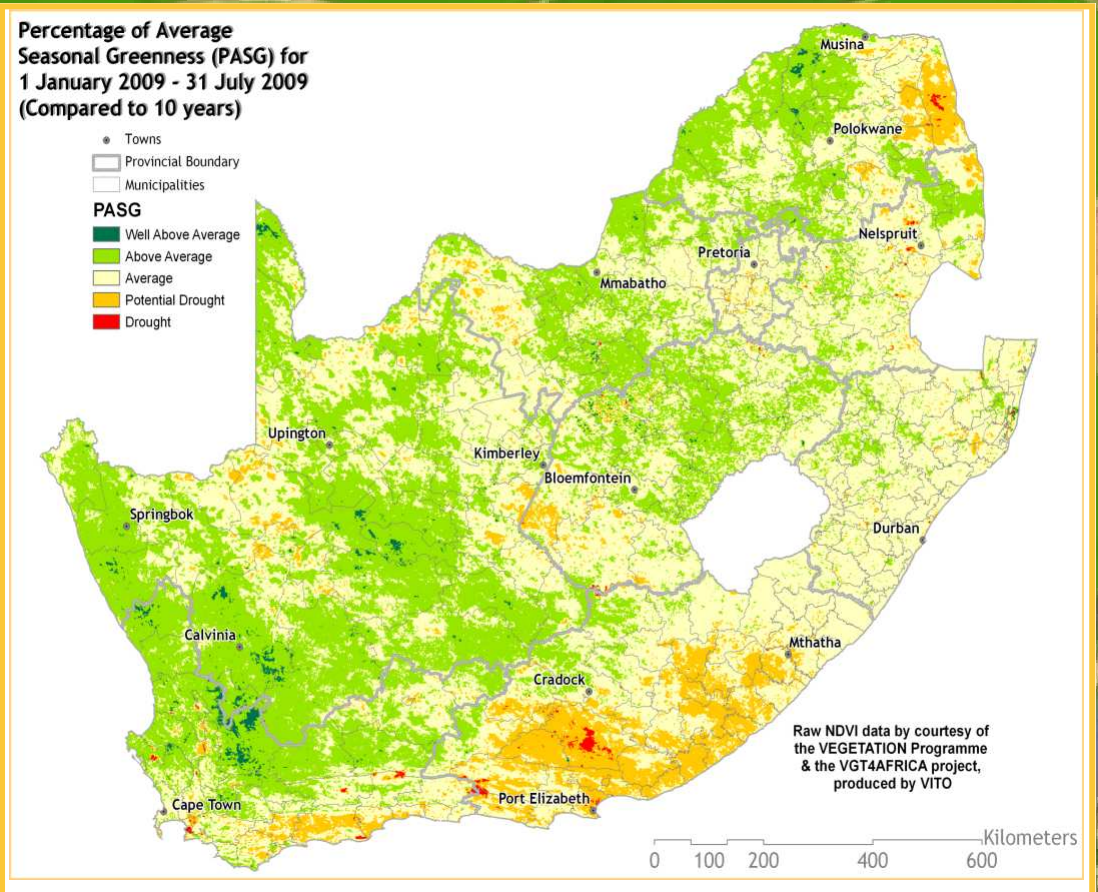


Figure 4

Vegetation Mapping cont.... *(from p. 2)*

Interpretation of map legend

NDVI 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 3:
The PASG map for May to July 2009 shows normal to higher vegetation conditions over the western half of South Africa (see also Figures 10-12). Areas of concern, with lower vegetation conditions, include large parts of eastern Limpopo (Figure 17), and the Eastern Cape (Figures 14-16 & 18).

Figure 4:
The PASG map for the 2009 season shows normal to above-normal vegetation conditions throughout South Africa. The eastern half of the country had a much drier year with lower vegetation activity dominating the Eastern Cape as well as the eastern region of Limpopo.

Questions/Comments:
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2. Rainfall

Overview:

July 2009 was characterized by normal to above-normal rainfall over the winter rainfall area while the interior was mostly dry, in contrast to June when above-normal rain occurred over most of the interior. It was also somewhat colder than average for July over large parts of the interior. The month commenced with an onshore flow over the northeastern parts. With the development of a weak upper air low pressure area over the central and eastern parts, light showers occurred over many areas in the northeast by the 5th.

Very little rain occurred over the country during the first ten days of the month. By the 11th, an upper air trough caused some showers over the central and southeastern parts. A cold front associated with the upper air system caused widespread rain over the southwestern parts of the country from the 11th. With further development of the upper air system to the west and further associated cold fronts moving over the southwestern parts, the period between the 11th and 15th was one of the wettest during this season over the winter rainfall area with localized flooding in places. After this episode, more fronts moved over the southern parts of the country, with the Atlantic Ocean high pressure system causing an inflow of cold air from the south over most of the country. Precipitation associated with these systems was confined to the southern, southeastern and far eastern parts but cold conditions occurred over most of the interior due to the air flow from the south.

By the end of the month an upper air low pressure system developed over the western parts causing a cloud band to develop over the central parts, responsible for the first significant rain over the central interior in about a month. As the system moved eastwards in early August, the area of precipitation also spread eastward over the interior. The month ended with a cold front making its way over the winter rainfall area on the 31st.

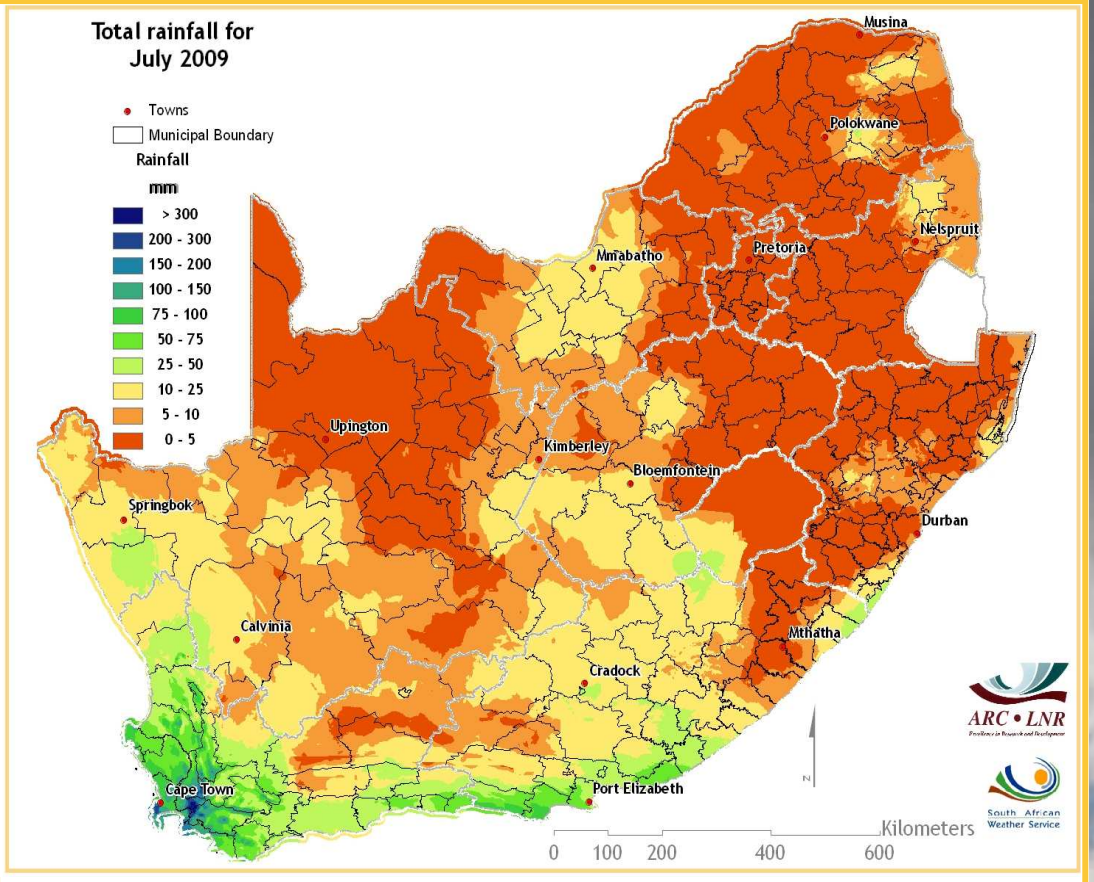
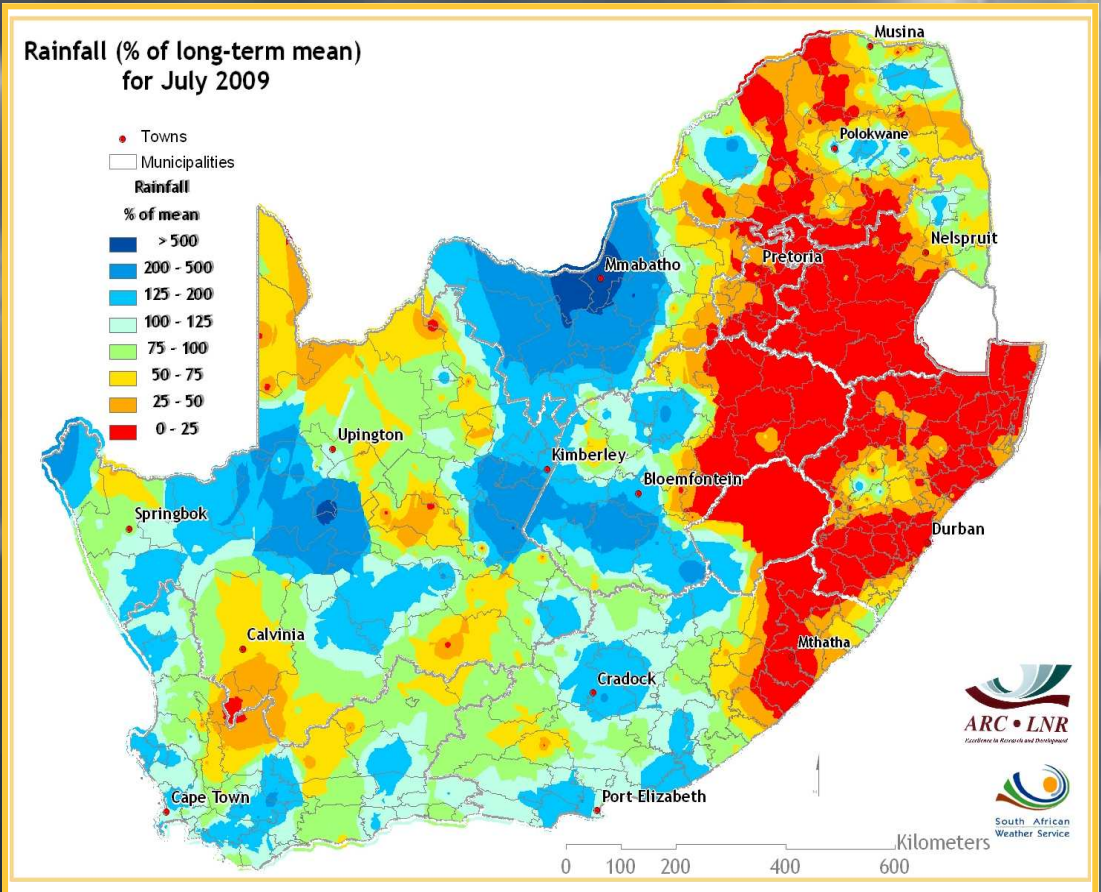


Figure 5



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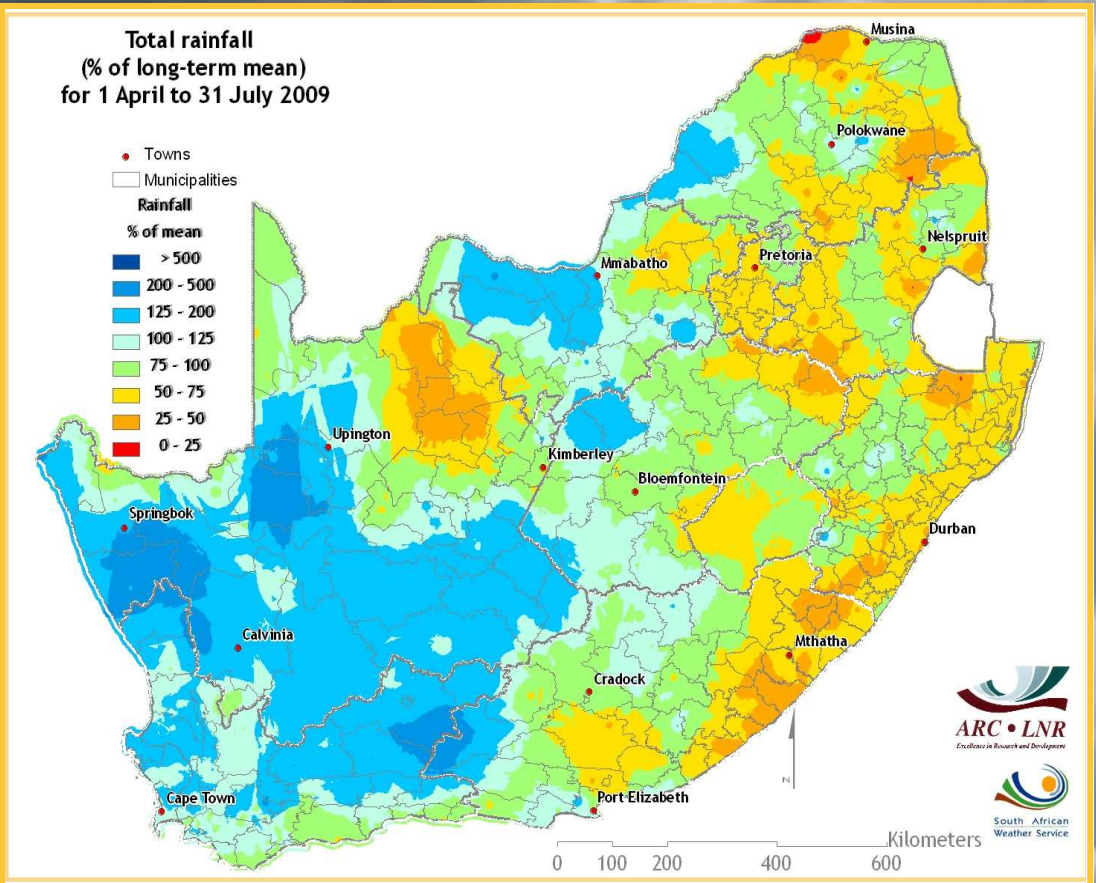

Figure 7

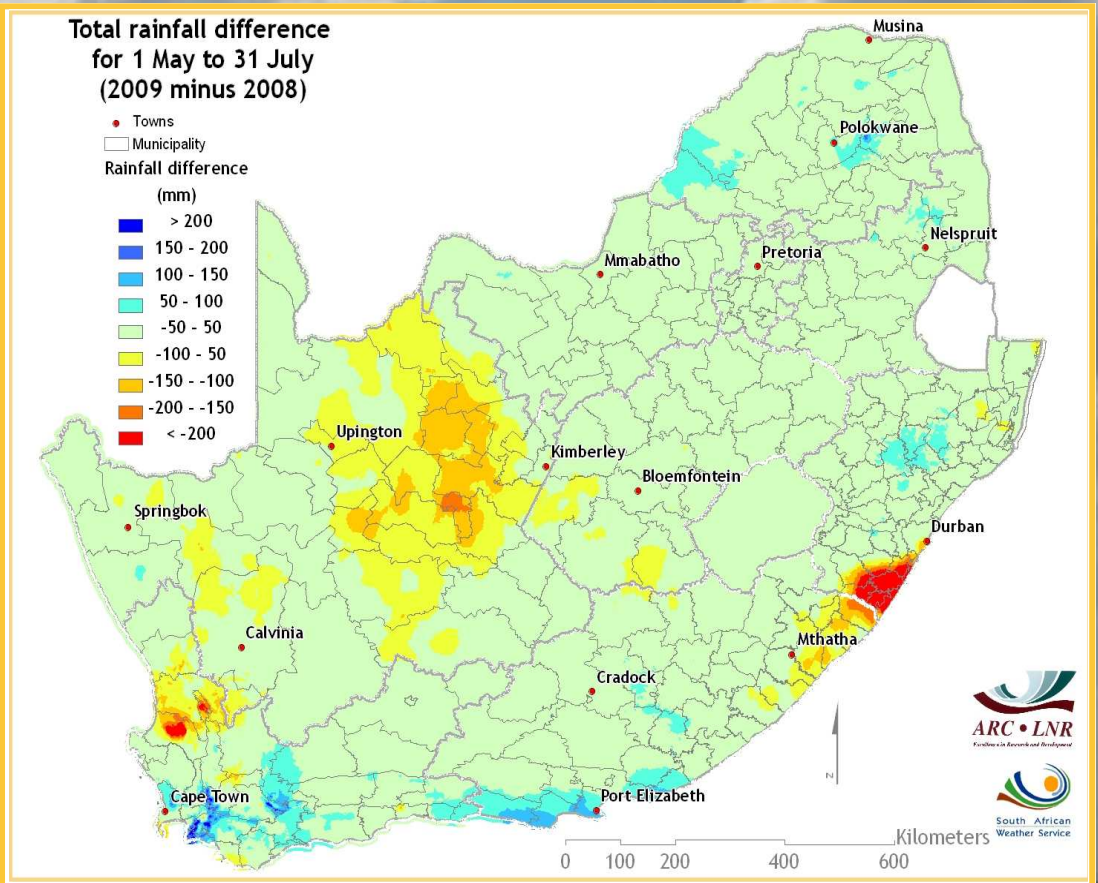

Figure 8

Figures 5 & 6:
While most of the winter rainfall area and southern parts of the country received more than 25 mm of rain during July, the northern and eastern interior were mostly dry. The southwestern parts of the winter rainfall area as well as the coastal areas to the west of Port Elizabeth received more then 75 mm of rain. Compared to the long-term average, most of the winter rainfall area received normal to above-normal rainfall while certain areas over the central and western parts of the interior also received above-normal rain.

Figure 7:
During the period April to July 2009, most of the western two thirds of the country including the winter rainfall area received normal to above-normal rainfall while the eastern parts received less rain than the long-term average.

Figure 8:
More rain occurred during May to July this year over the southern coastal areas and adjacent interior than during last year while large parts of the western and central interior received less rain during this year than last year for the same period.

Questions/Comments:
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3. Vegetation Conditions & Rainfall

NDVI and Rainfall Graphs

Figure 9:
Orientation map showing the areas of interest for July 2009. The district colour matches the border of the corresponding graph.

Questions/Comments:
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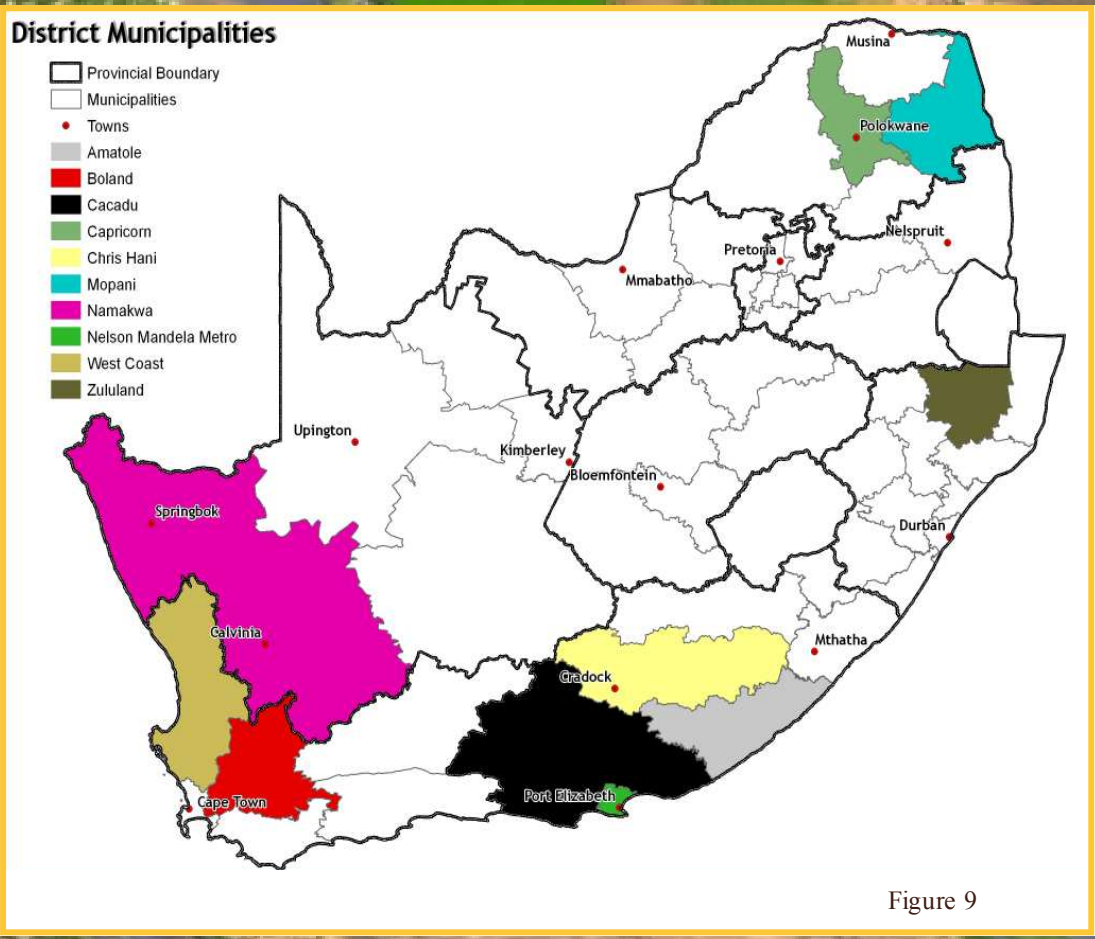


Figure 9

Figures 10-13:
Indicate areas with higher cumulative vegetation activity for the last year.

Figures 14-19:
Indicate areas with lower cumulative vegetation activity for the last year.

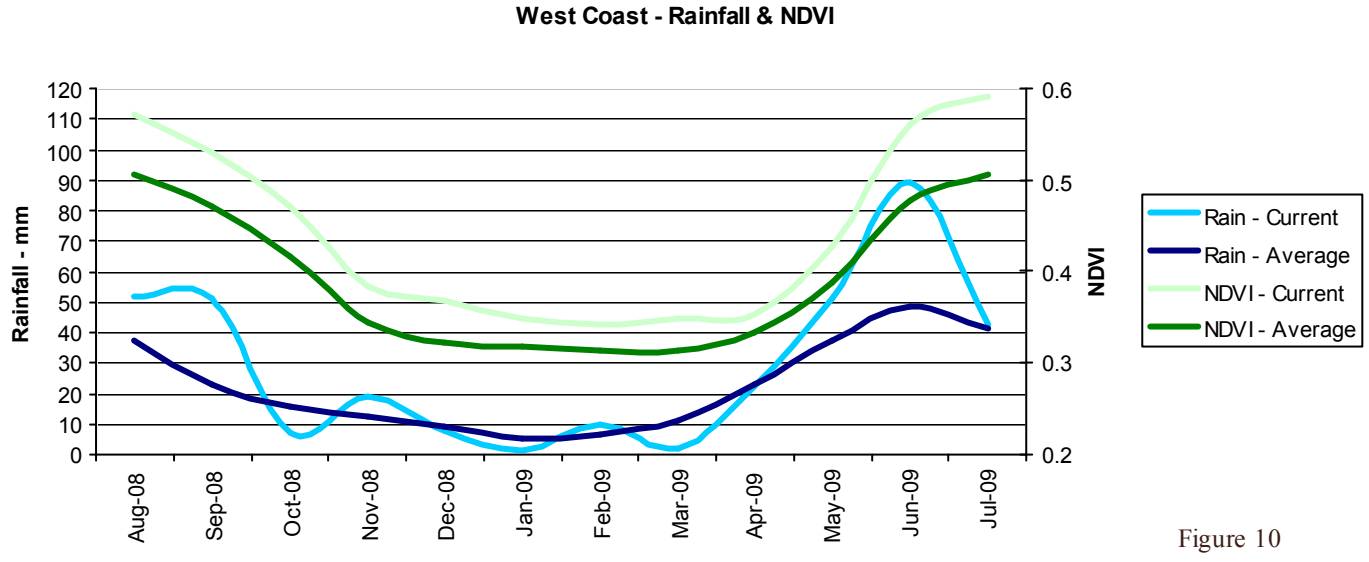


Figure 10

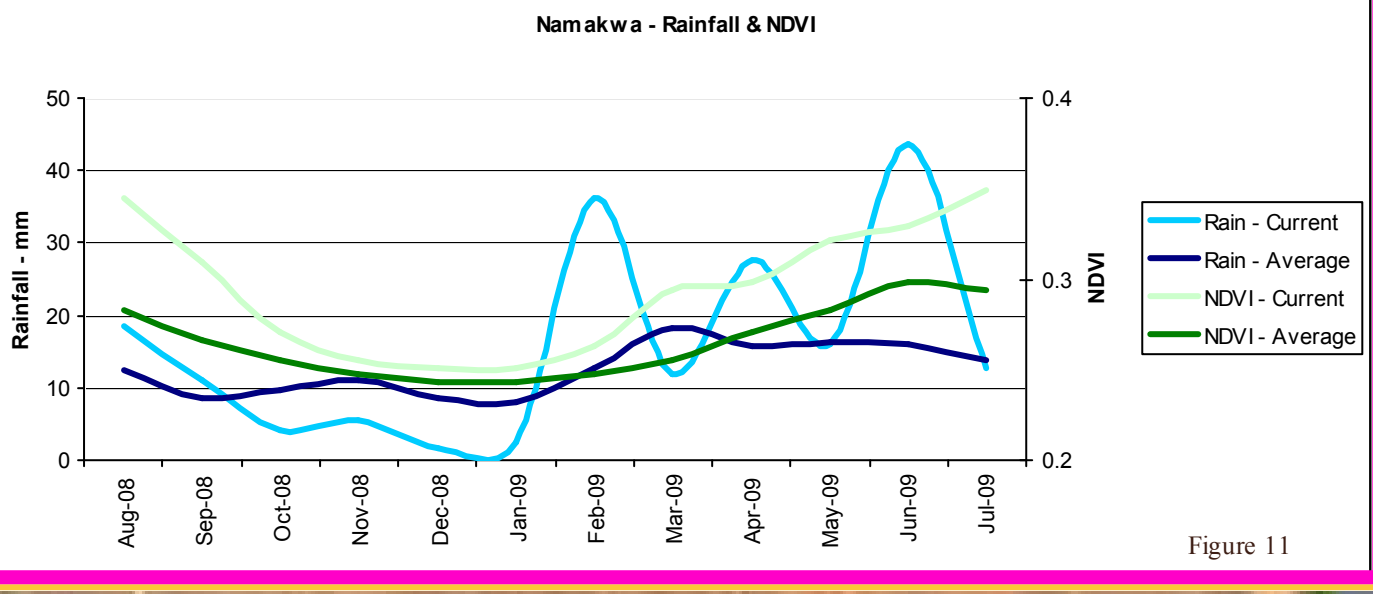


Figure 11

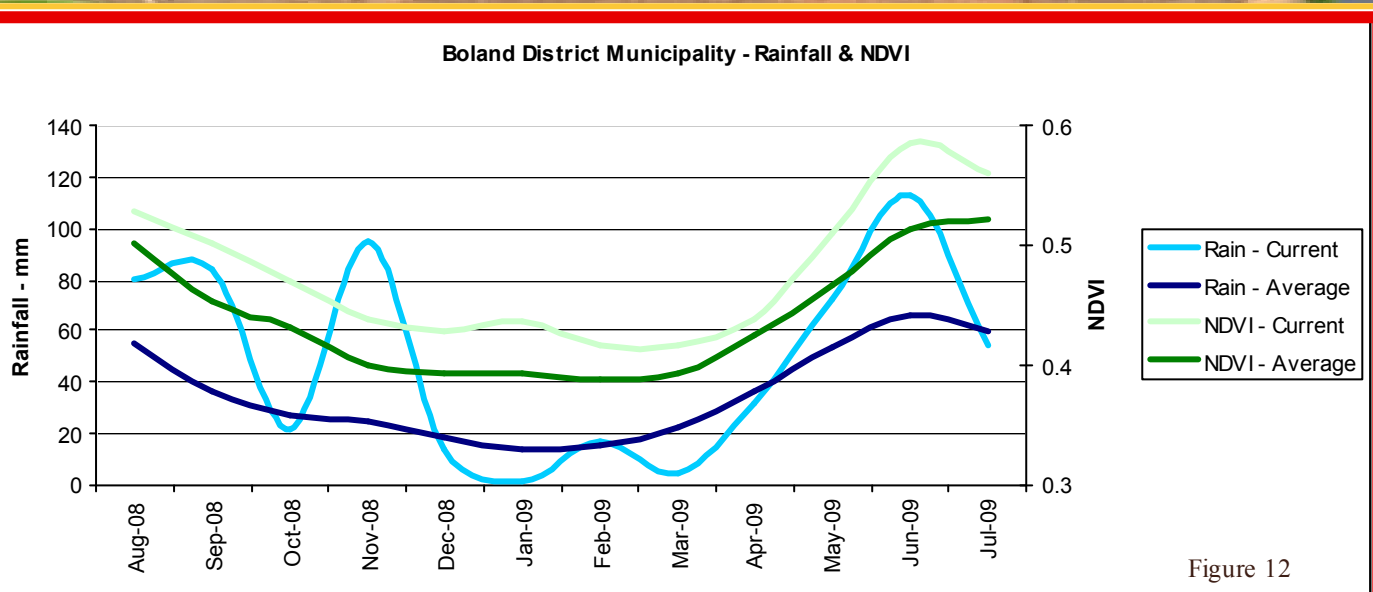
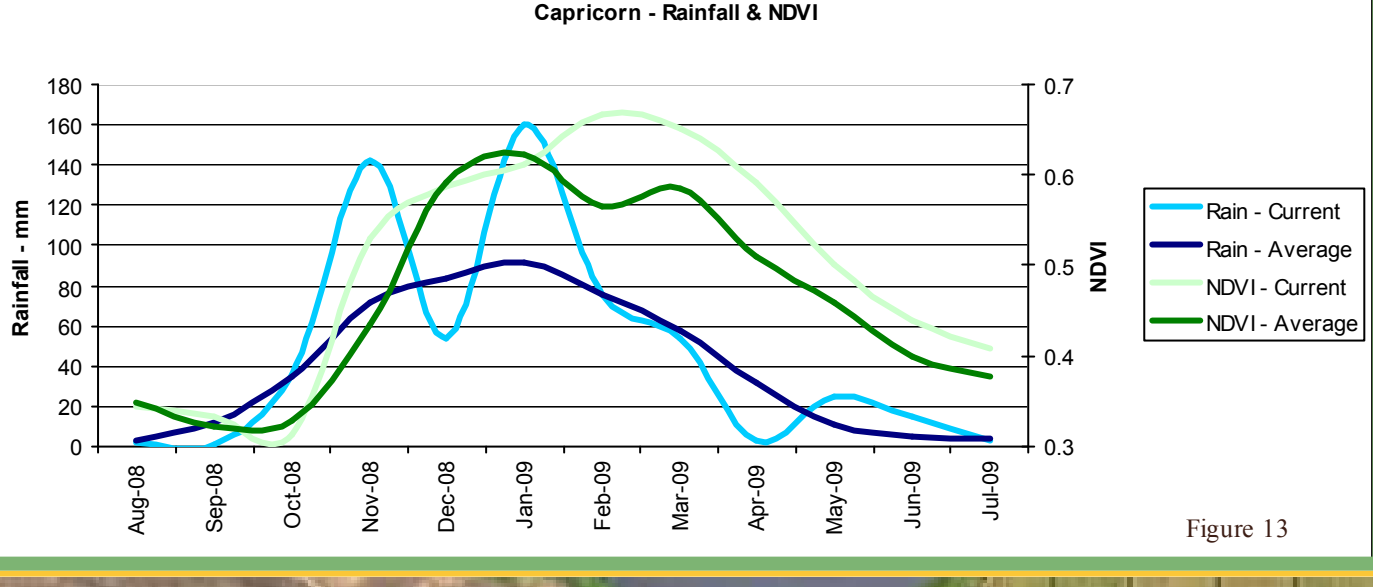


Figure 12



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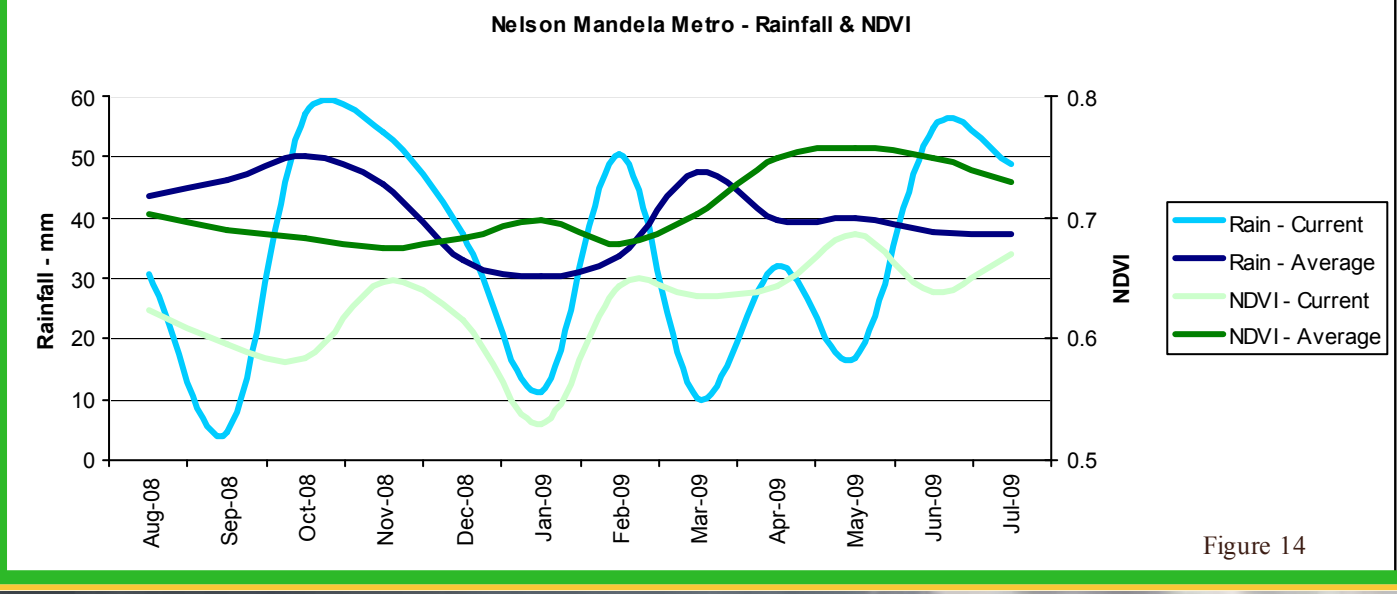

Figure 14

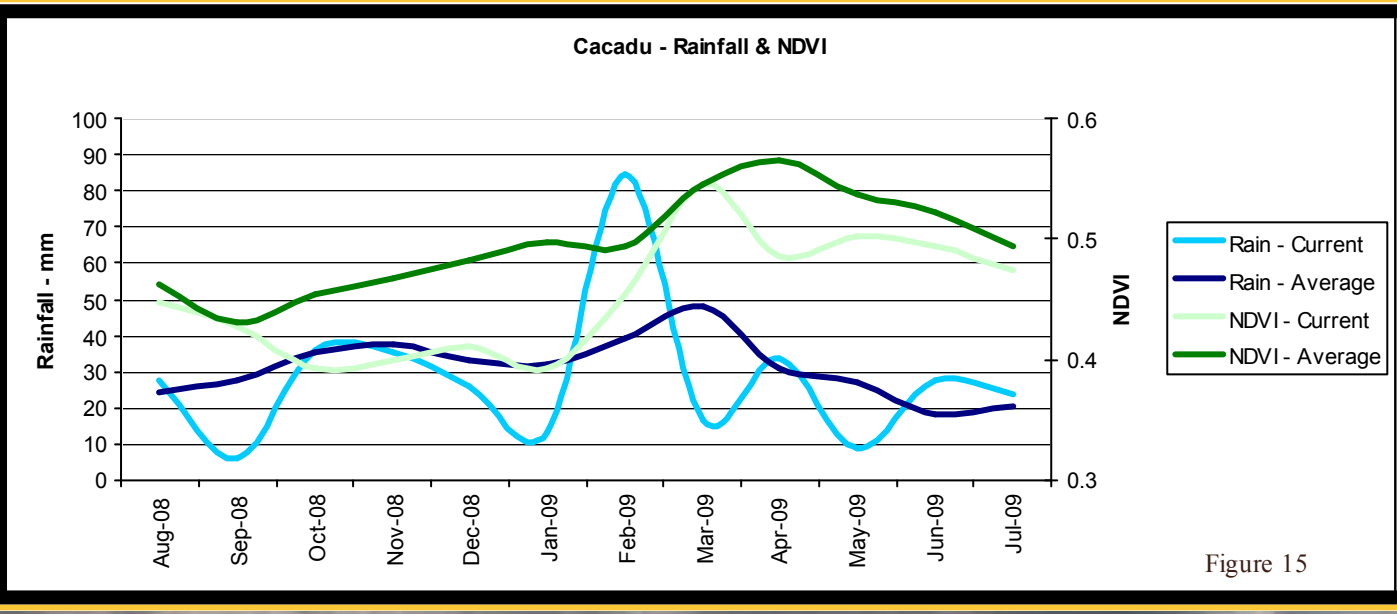

Figure 15

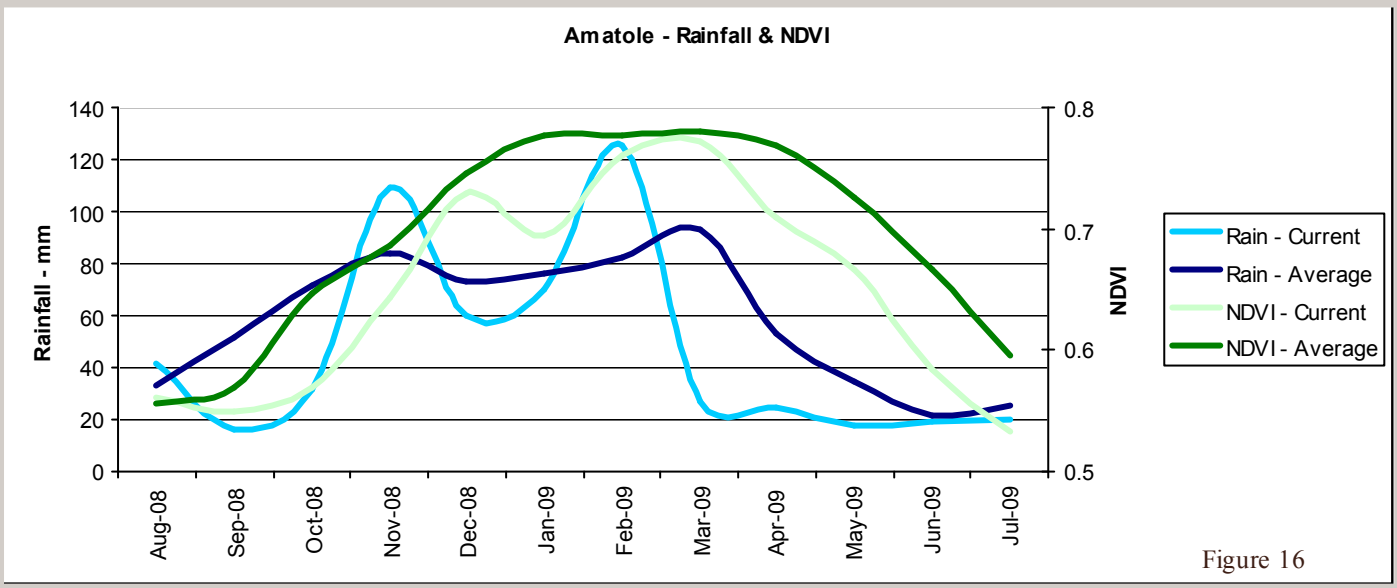

Figure 16

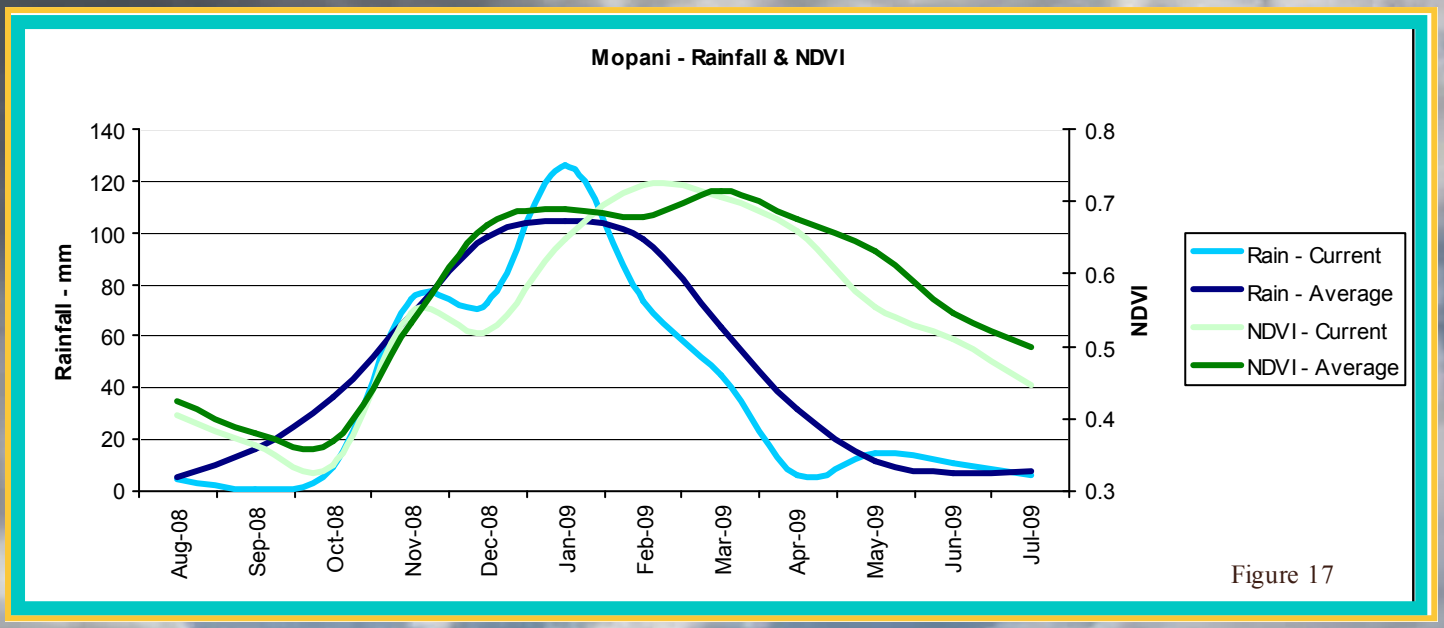

Figure 17

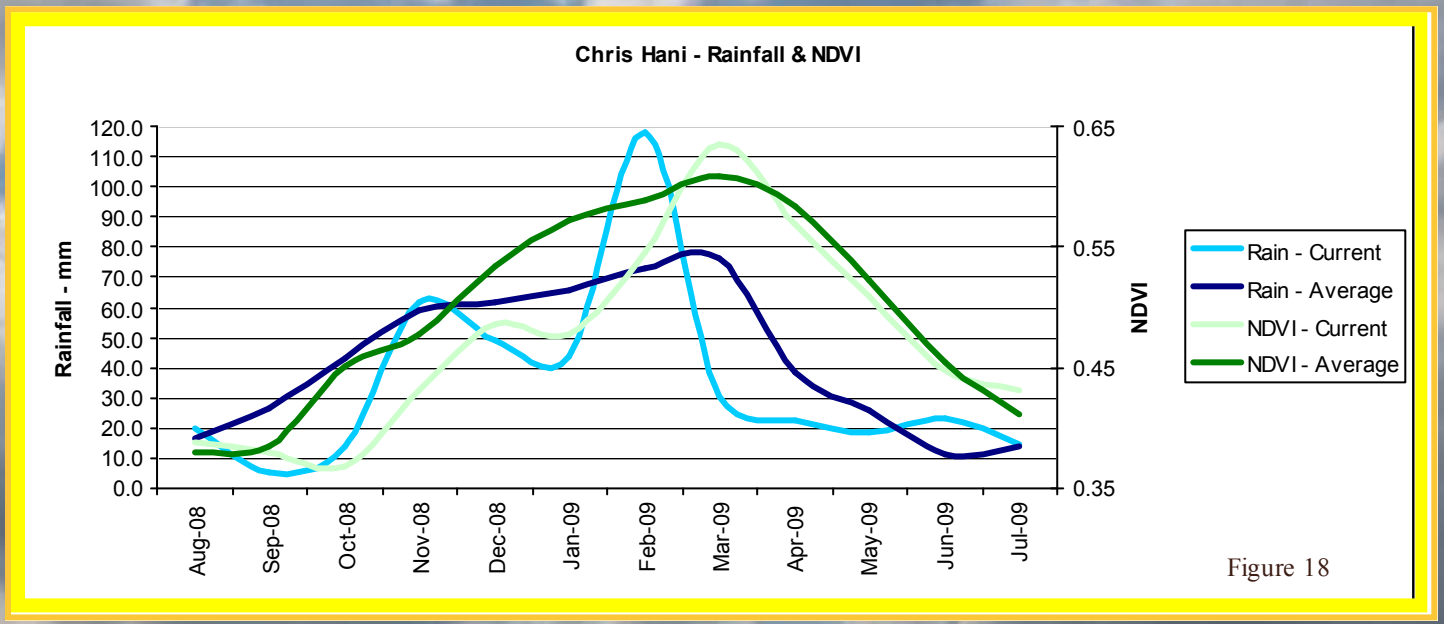

Figure 18

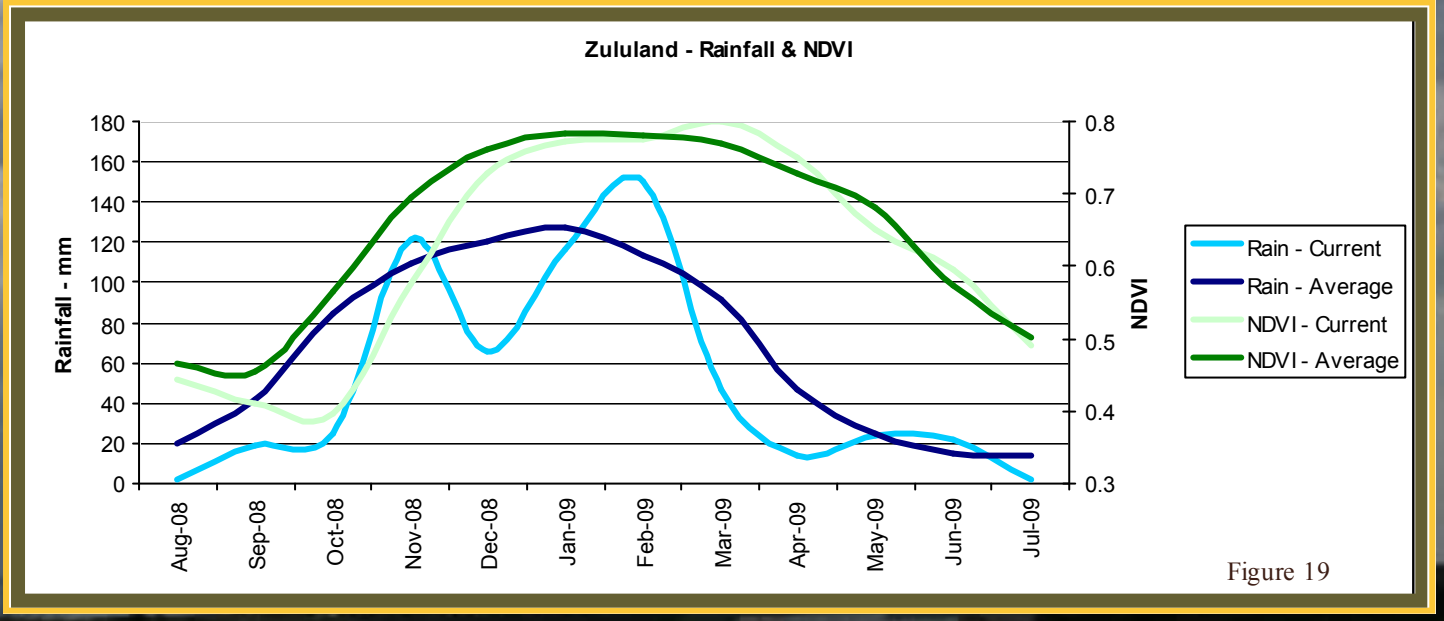

Figure 19

4. Fire Watch

Active Fires

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 20
The map shows the location of active fires detected from 1 January 2009 to 30 June 2009.

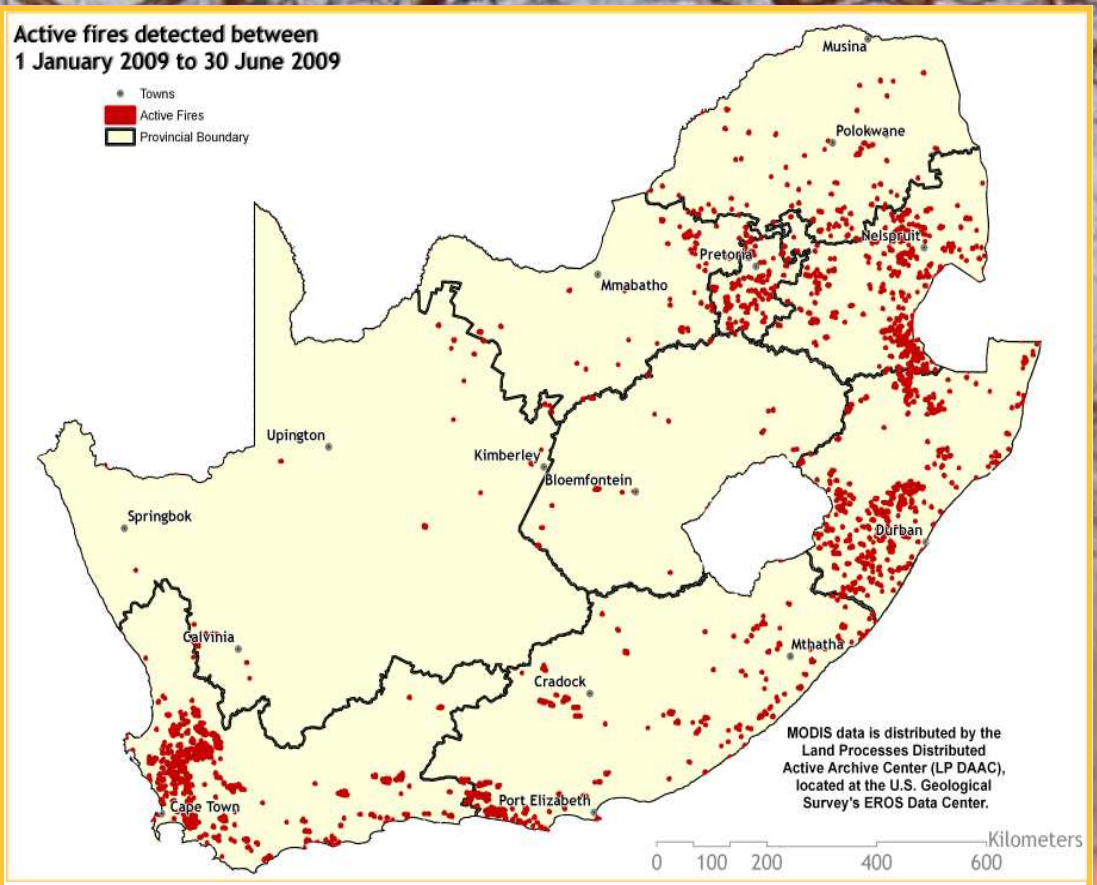

Figure 20

Burn Scars
Burnt areas are characterized by deposits of charcoal and ash, removal of vegetation, and alteration of the vegetation structure. The MODIS algorithm to map burned areas takes advantage of these spectral, temporal, and structural changes. The algorithm detects the approximate date of burning at 500 m by locating the occurrence of rapid changes in daily surface reflectance time series data.

Source: *MODIS Burned Area Users Guide*

Figure 21
The map shows burnt areas detected from 1 January 2009 to 30 June 2009.

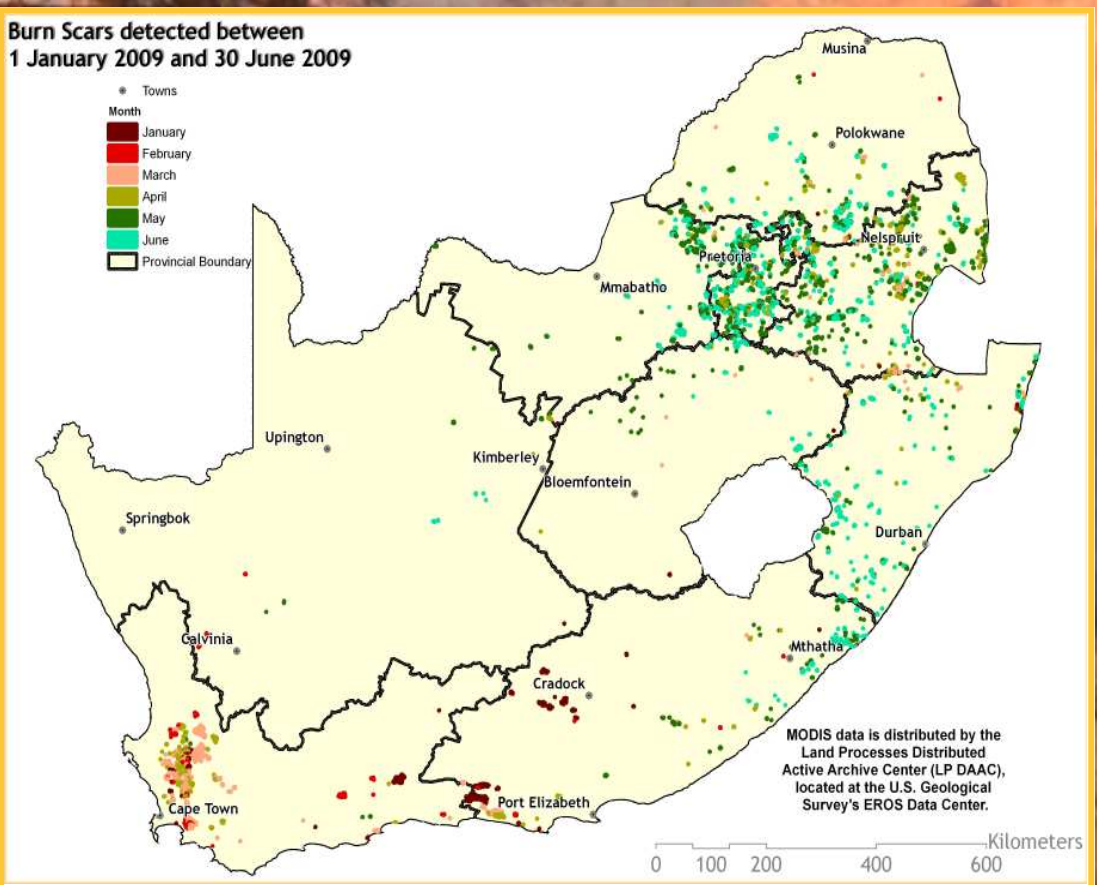

Figure 21

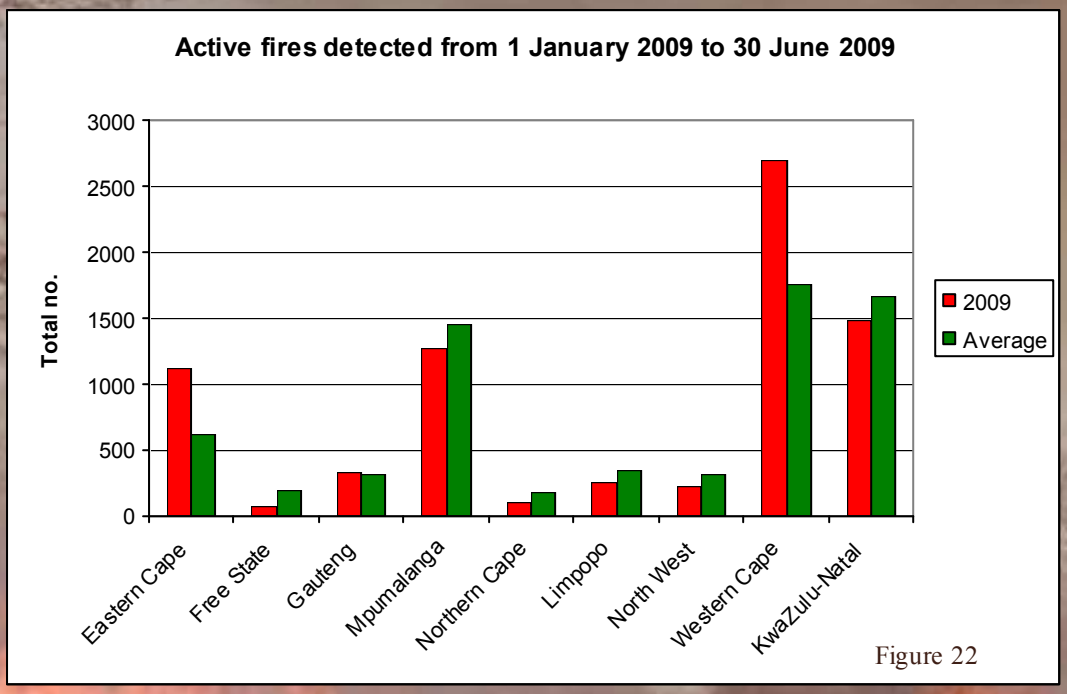

Figure 22

Figure 22
The fire activity was higher in the Western and Eastern Cape provinces this year compared to the average for the same period for the last 10 years.

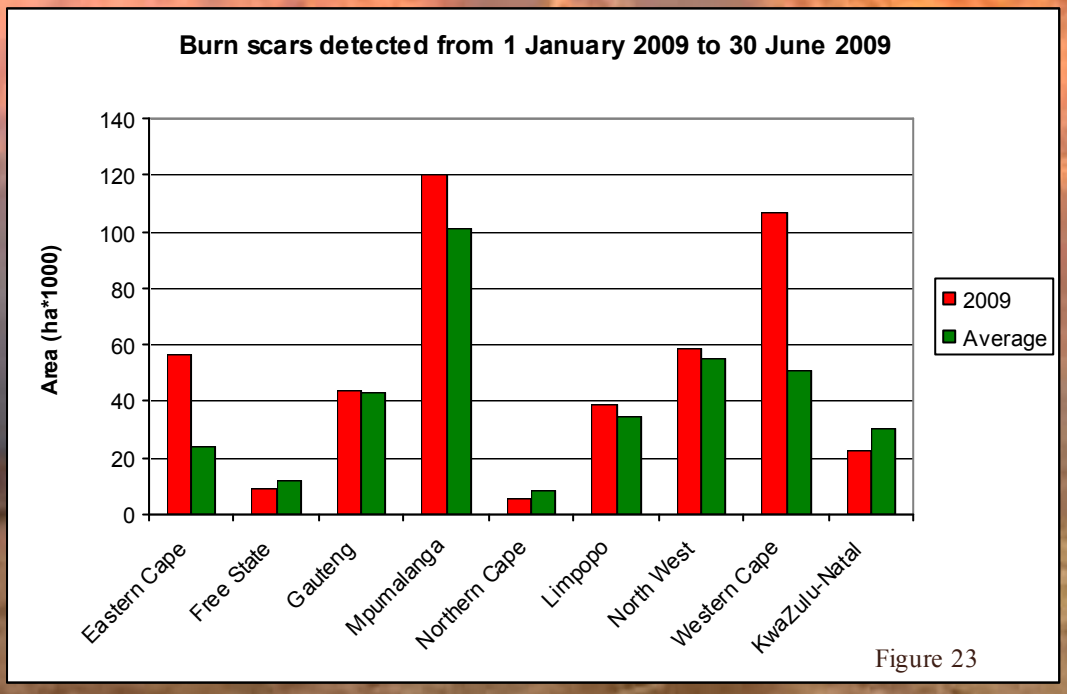

Figure 23

Figure 23
The area affected by fires is larger in the Eastern Cape, Mpumalanga, Limpopo, North West and Western Cape provinces compared to the average for the same period for the last 10 years.

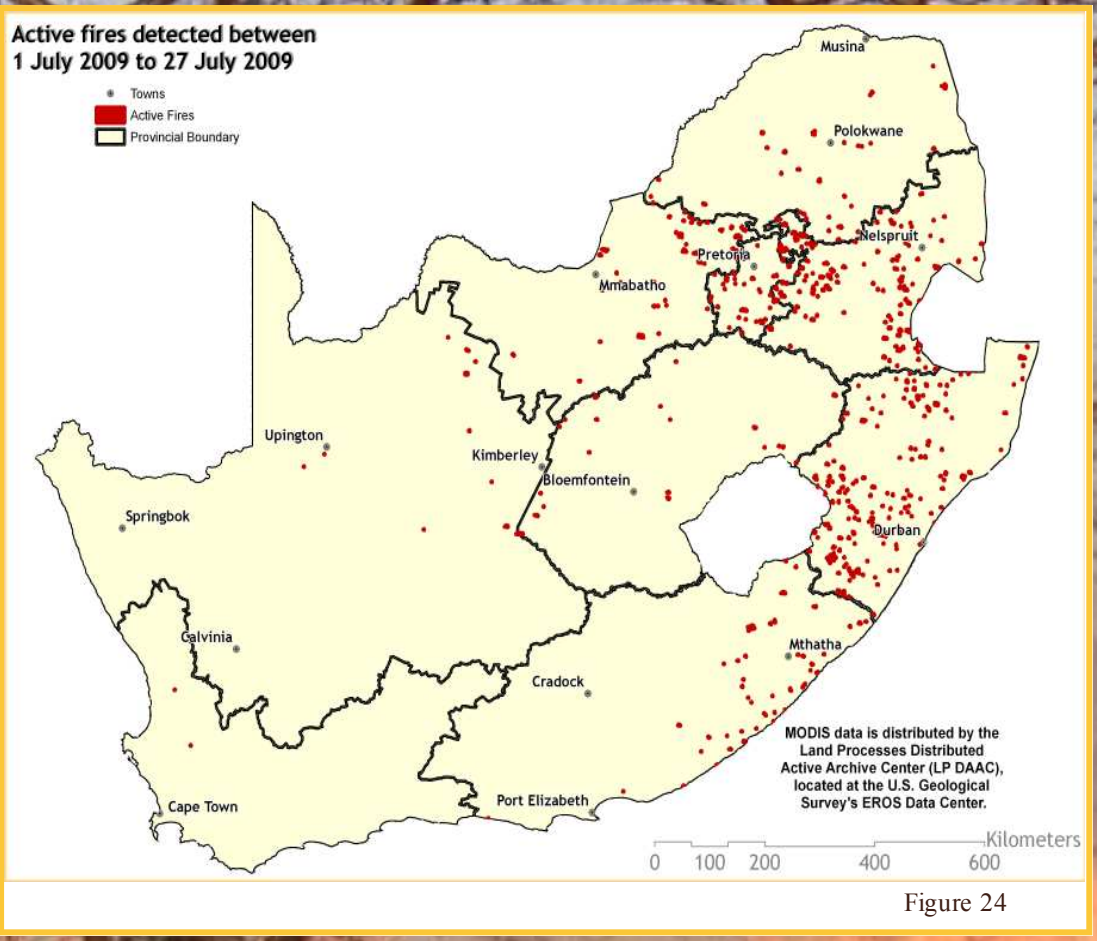

Figure 24

Figure 24
The map shows active fires detected between 1-27 July 2009.

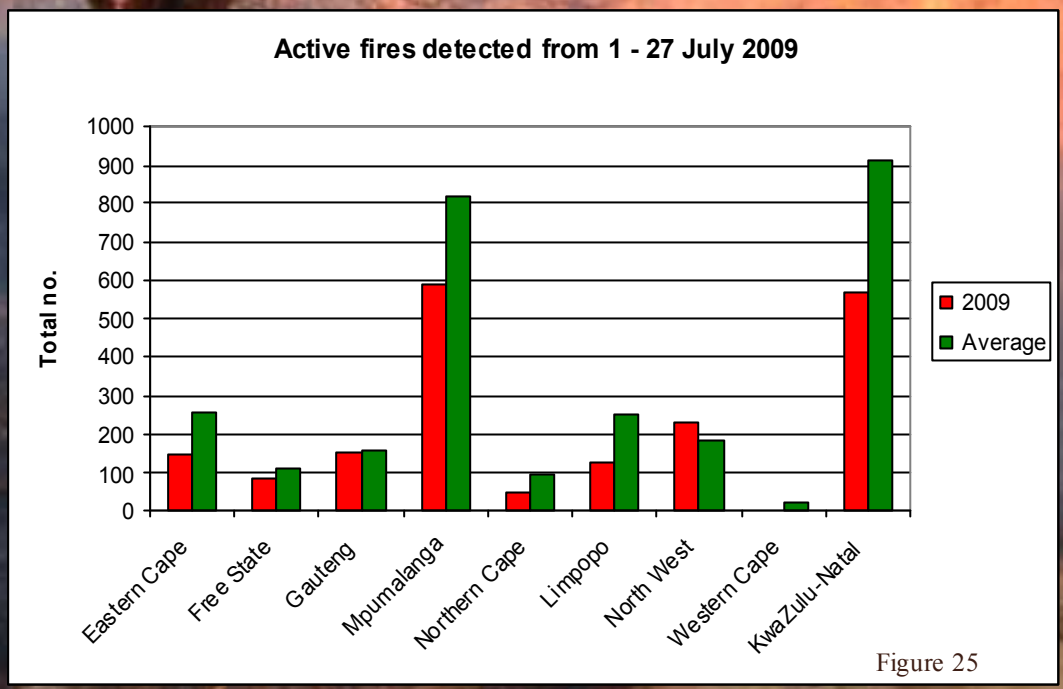

Figure 25

Figure 25
The graph shows the total number of active fires detected between 1-27 July 2009 per province. The North West Province shows a slight increase in fire activity compared to the average for the same period for the last 10 years.

Questions/Comments:
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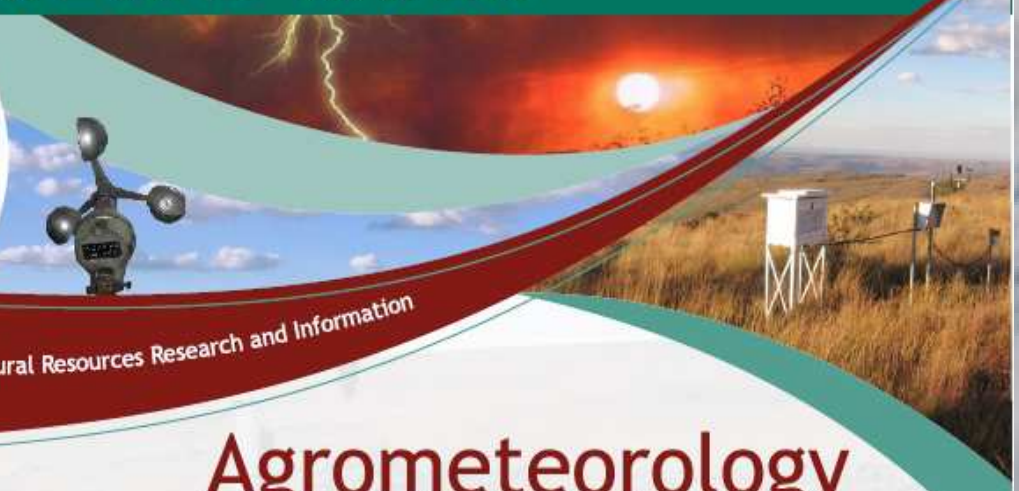

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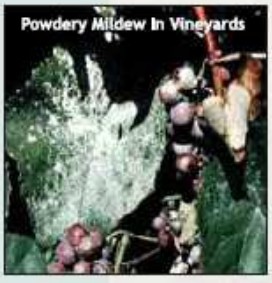
The AgroMet Division of ARC-ISCW conducts and implements research in the field of Agrometeorology and Climatology to promote sustainable utilization of the region's climate, soil and water resources.

Since 1940, ARC-ISCW AgroMet has installed a countrywide network of weather stations aimed at satisfying the climatological requirements of Agriculture in particular. This network has grown to the stage where there are now 110 mechanical weather stations and 455 automatic weather stations.

Since 1940, ARC-ISCW AgroMet has collected all the available climate information from its own climate monitoring network as well as from other organizations such as the South African Weather Service. This collection has now grown to ± 10 000 data points in the climate databank.

ARC-ISCW AgroMet is involved in the following activities:

- **Climate Monitoring (Weather Station Network), Data Management and Dissemination**
  - *Sending out reports, including Disease Warnings, Indices and Daily Data Reports*
  - *Disease warnings include: Powdery Mildew and Downy Mildew warnings*
  - *Indices calculated are: Evapotranspiration, Chill Units, Heat Units and other Temperature Thresholds*
  - *Elements include: Rainfall, Air Temperature, Sunshine Duration, Solar Radiation, Relative Humidity, Evaporation, Wind Speed and Wind Direction*
- **Climate Analysis for Agricultural Purposes**
- **Crop Micro- and Meso-Climate Monitoring**
- **Crop-Climate Matching**
  - *Crop Suitability Surfaces*
- **Crop Growth Modeling**
- **Developing new Climatic Related Early Warning Systems**
- **Spatial Interpolation of Climate Elements**
  - *Long-term Climate Surfaces*
  - *Climate Monitoring*
- **Climate Classification according the Köppen Climate Zones**



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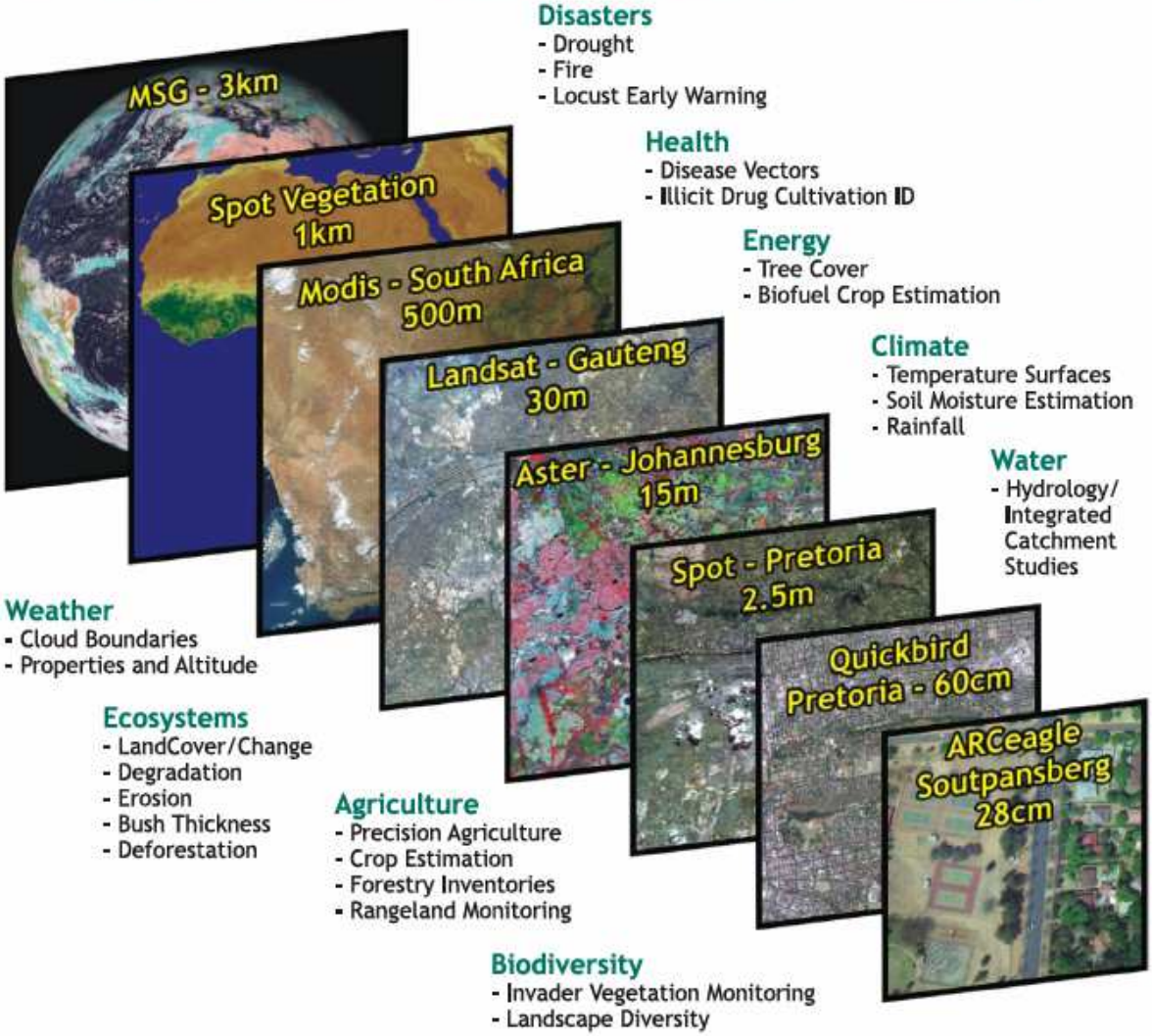

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The Coarse Resolution Imagery Database (CRID)

NOAA AVHRR

The ARC-ISCW has an archive of daily NOAA AVHRR data dating from 1985 to 2004. This database includes all 5 bands as well as the Normalised 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. The ARC-ISCW 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-ISCW has an archive of VEGETATION data dating from 1998 to the present. Other products distributed through VGT4AFRICA and GEOSUCCESS include Net Primary Productivity, Normalised Difference Wetness Index and Dry Matter Productivity data.

Meteosat Second Generation (MSG)

The ARC-ISCW 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. The ARC-ISCW 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.

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The operational Coarse Resolution Imagery Database (CRID) project of ARC-ISCW is funded by the National Department of Agriculture, Forestry and Fisheries . Development of the monitoring system was made possible through LEAD funding from the Department of Science and Technology.

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

http://www.agis.agric.za