Cooperative Governance
Traditional Affairs

DROUGHT HAZARD QUANTIFICATION FOR DISASTER MANAGEMENT PLANNING

DECHLAN PILLAY
NDMC

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Stakeholder Workshop on
Earth observation-based information products for drought risk on a national basis

PRESENTATION OVERVIEW

1. INTRODUCTION
2. A PORTFOLIO OF HAZARD PRODUCTS FOR THE NDMC
3. DROUGHT HAZARD DROUGHT RISK
4. DROUGHT HAZARD VS RISK PROFILE
5. DROUGHT DECLARATION AND THE SUPPORT
6. CONCLUSIONS

1. INTRODUCTION

- South Africa is a drought prone country
- After several wet years, SA began experiencing drought conditions during 2012 and 2013 over the North West Province serving as a reminder of major droughts that had occurred during the past.
- In 2013, the North West Province has been declared drought stricken under the Disaster Management Act and relief interventions included: financial assistance and relief to farmers.
- The Disaster Management Act stresses the shift from a re-active disaster management approach to a pro-active one, with a view to minimize the impact of disaster events to the lowest possible level. As part of the shift towards a pro-active approach, the susceptibility regionally to drought needs to be assessed.

2. A PORTFOLIO OF HAZARD PRODUCTS

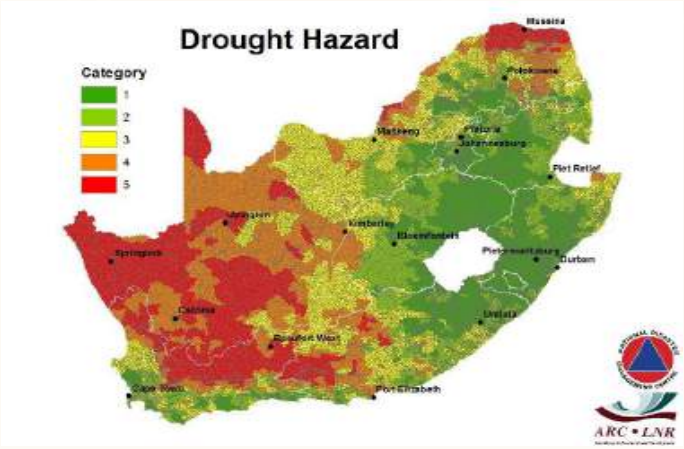
- The NDMC undertook to completed a portfolio of hazards products beginning with the quantification of drought.
- Prior to this, risk products existing studies or the spatial derivatives from historical studies.
- There was a need to quantify the hazards that were prevalent in the region
- Several studies were commissioned from 2013 and includes the following:
  - **Drought Hazard:** ARC and the NDMC
  - **Windstorm:** SAWS and the NDMC
  - **Snowfall:** CSIR and the NDMC

3. HAZARD QUANTIFICATION

- Rainfall data, available since 1920, provides a valuable historical data archive that can be explored to understand historical climate variability and hence also the occurrence of droughts. Monthly rainfall GIS surfaces are produced from the historical rainfall data over the period 1920-2013.
- The rainfall surfaces are produced as follows:
  - Rainfall data from between 1200 and 3000 mechanical and automatic stations are extracted
  - The long-term average rainfall for a specific month is used as a trend surface for interpolation
  - Rainfall at a specific point is expressed as a percentage of the underlying rainfall trend surface
  - The rainfall percentage values for a specific ten-day period are interpolated using the inverse distance weight method.

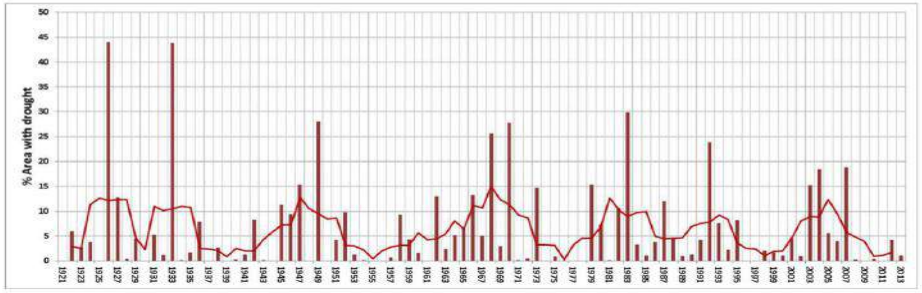
4. HAZARD QUANTIFICATION METHODOLOGY

- The method results in a monthly rainfall surface that is true to the points where rainfall is recorded, but follows the climatology resulting from the influence of factors such as topography or distance from the ocean.
- The rainfall surfaces from 2003 onward are created through a combination of the abovementioned method and satellite rainfall estimates to supplement rainfall data over the South African plateau.



Severe drought:

6-month SPI— March



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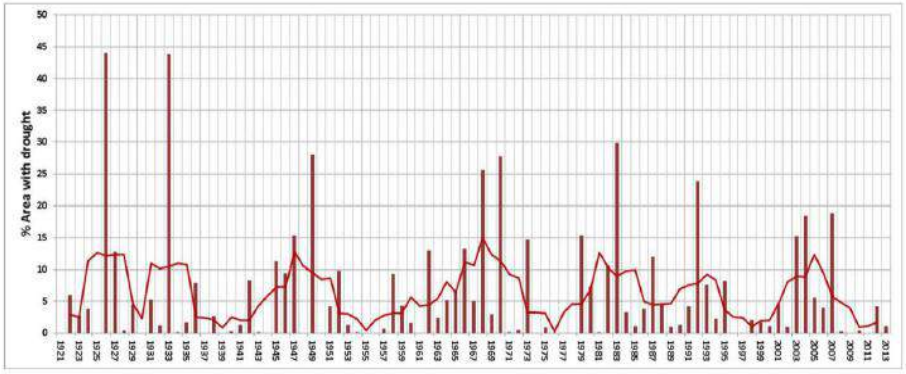
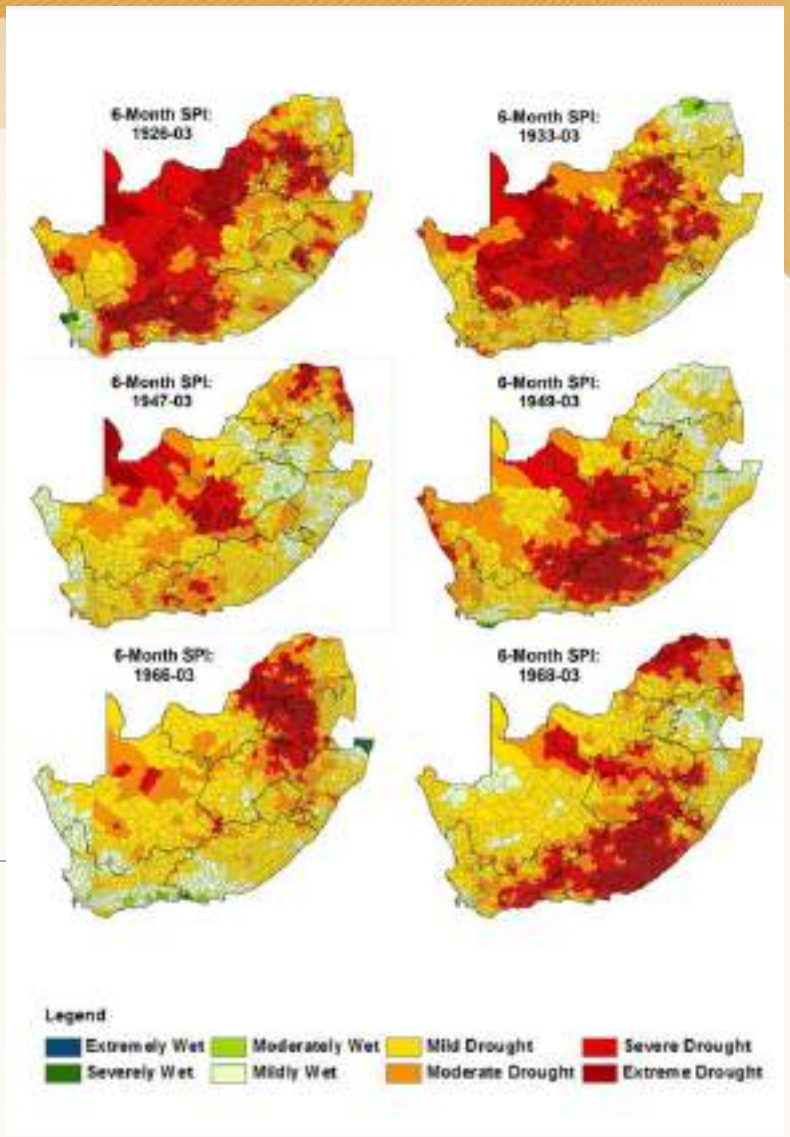
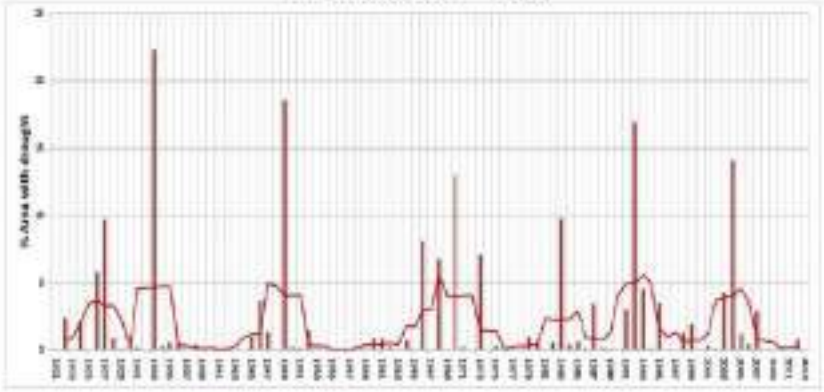




Extreme drought:

12-month SPI— June



Severe drought:

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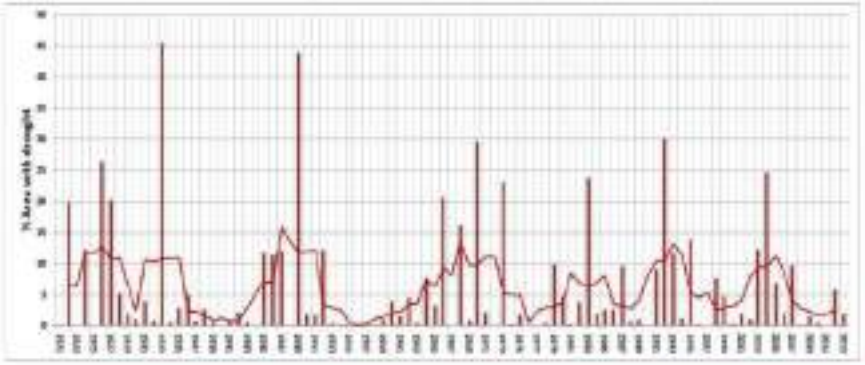
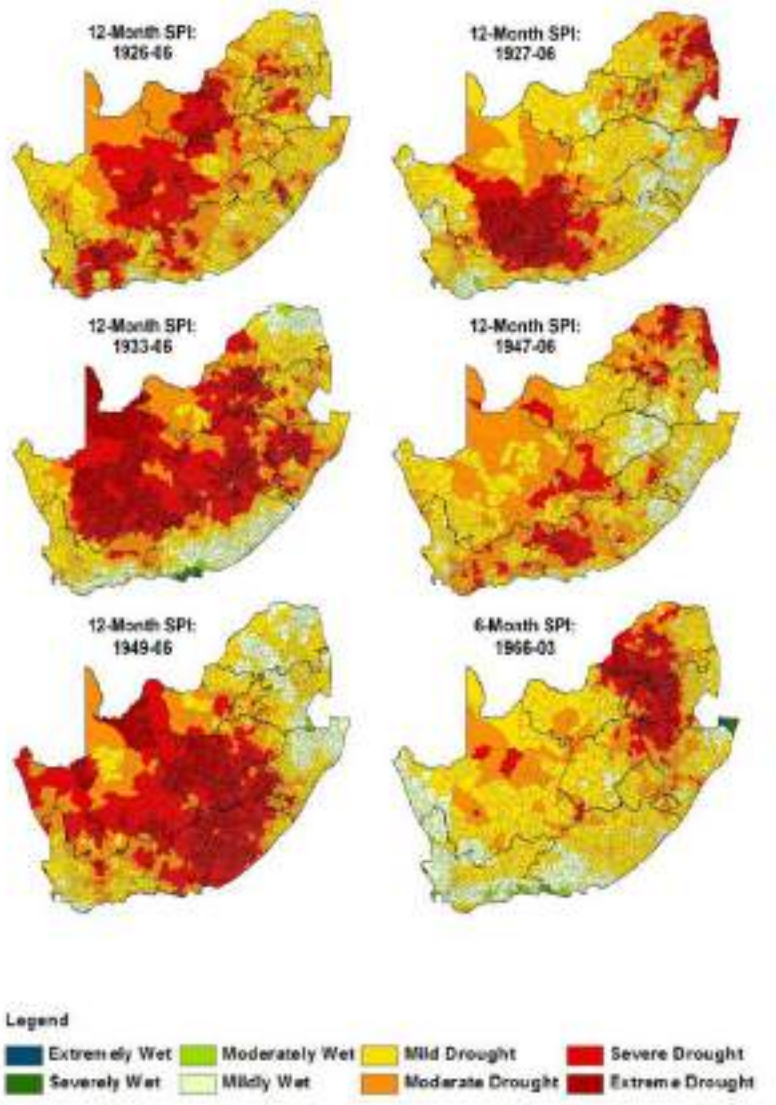
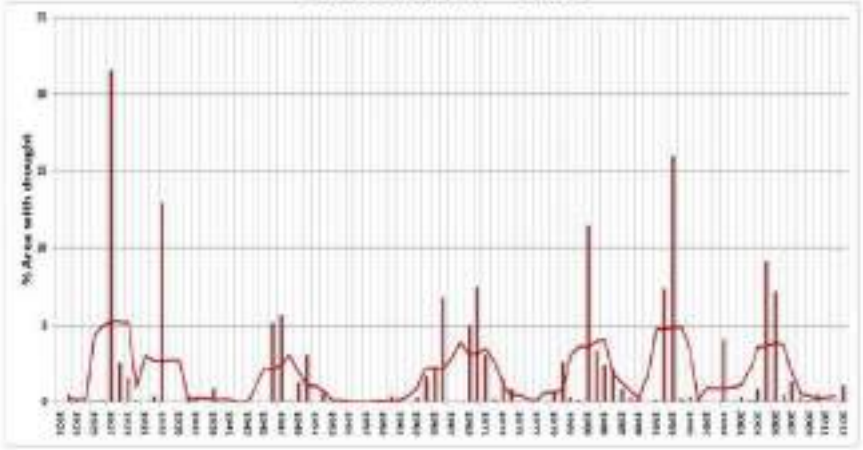




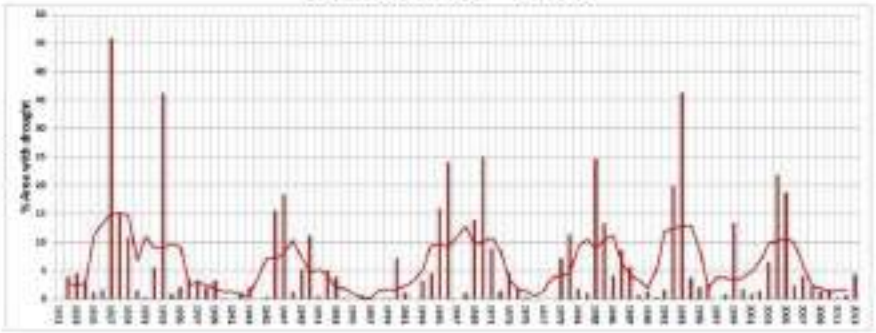
Extreme drought:

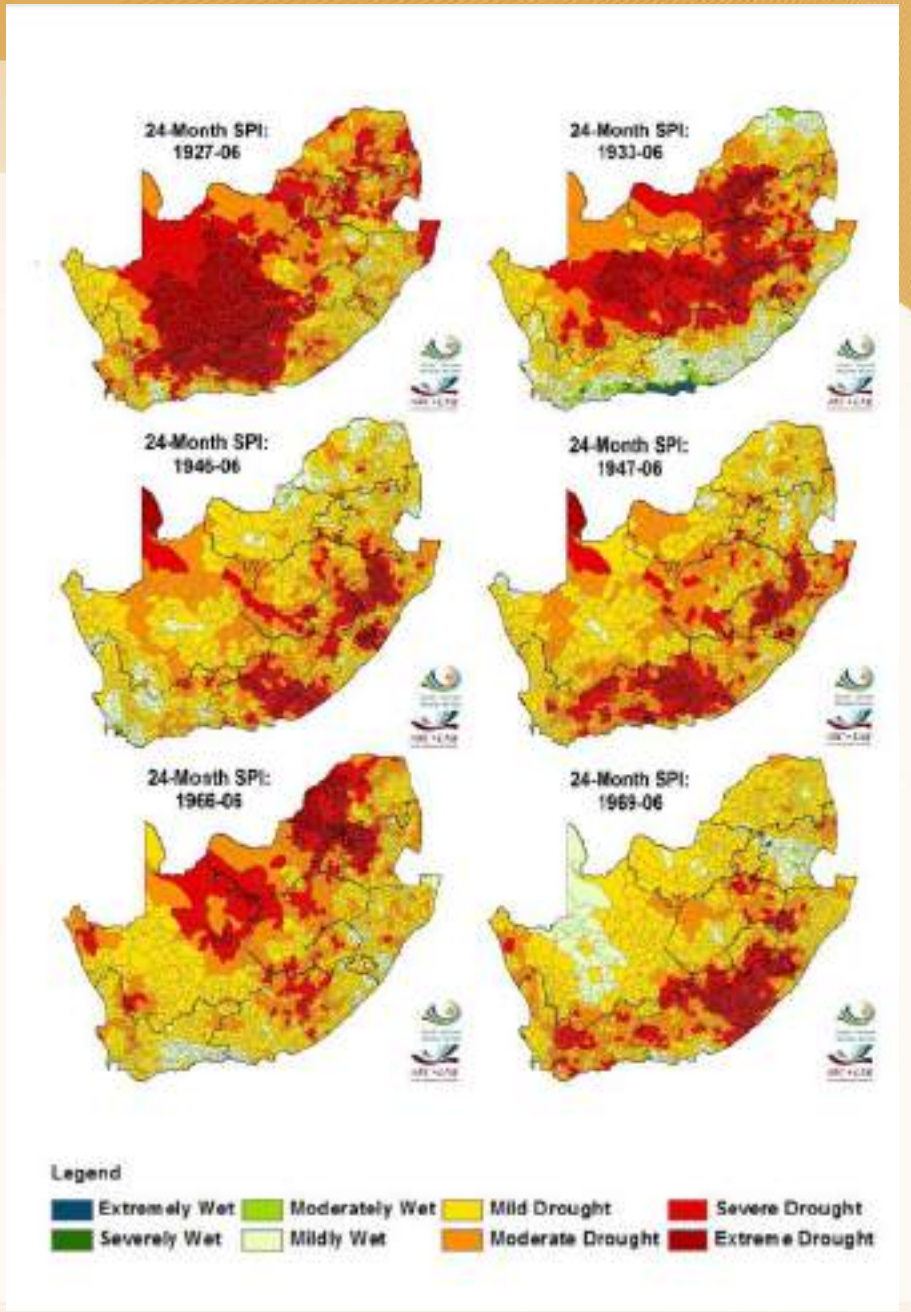
24-month SPI— June



Severe drought:

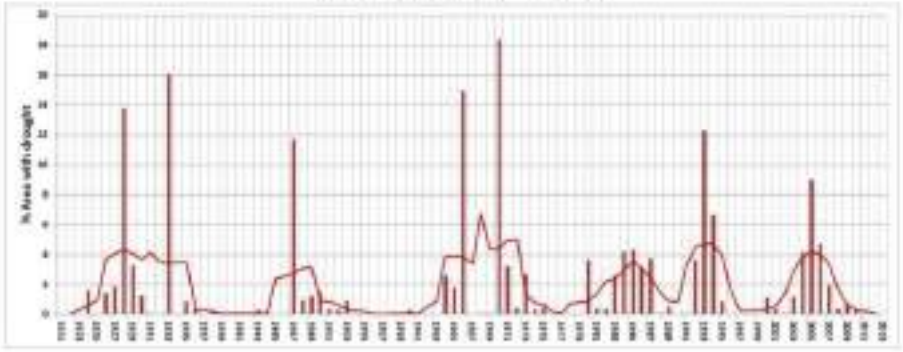
24-month SPI— June





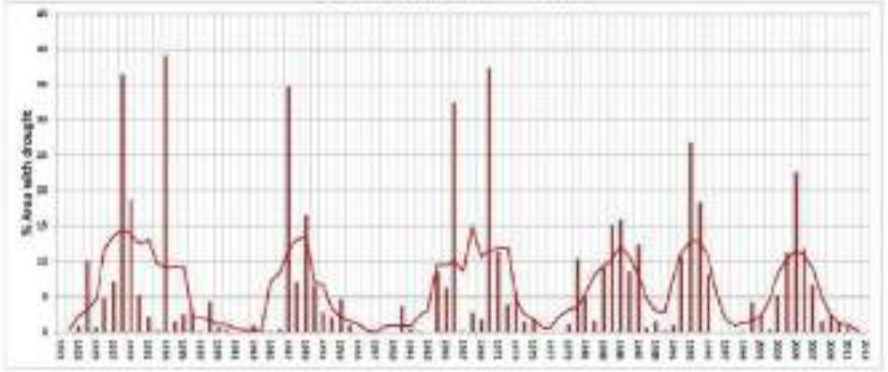
Extreme drought:

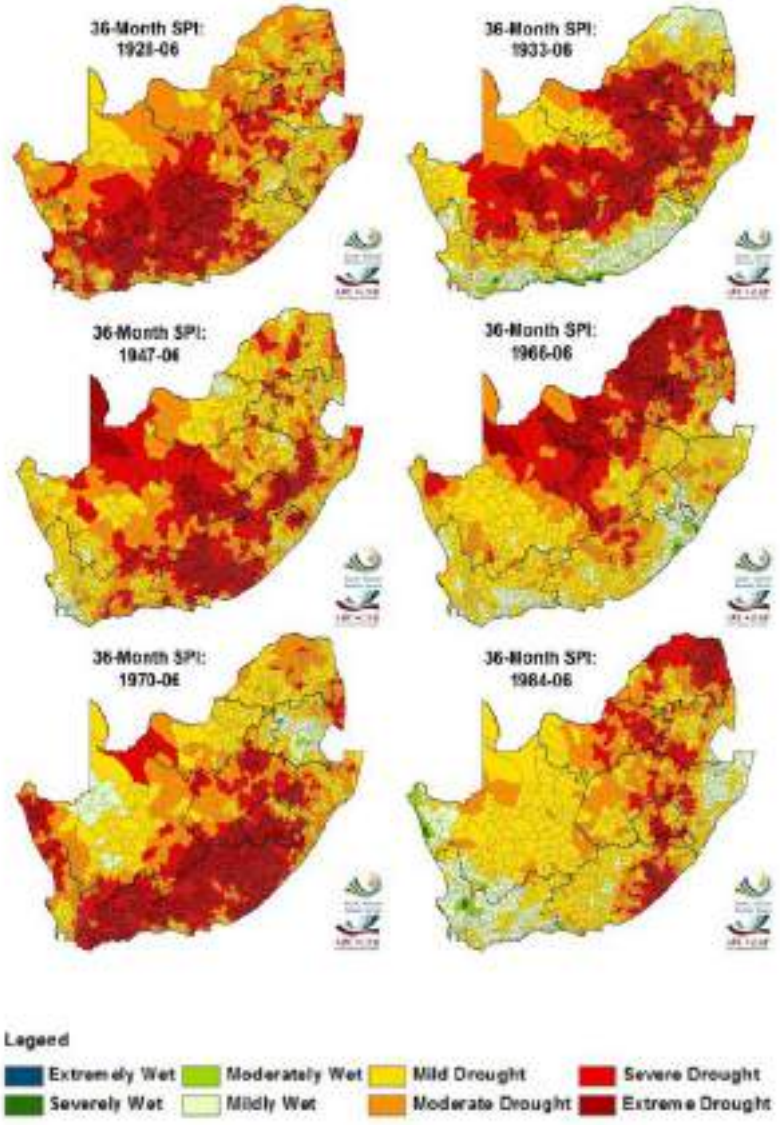
36-month SPI— June



Severe drought:

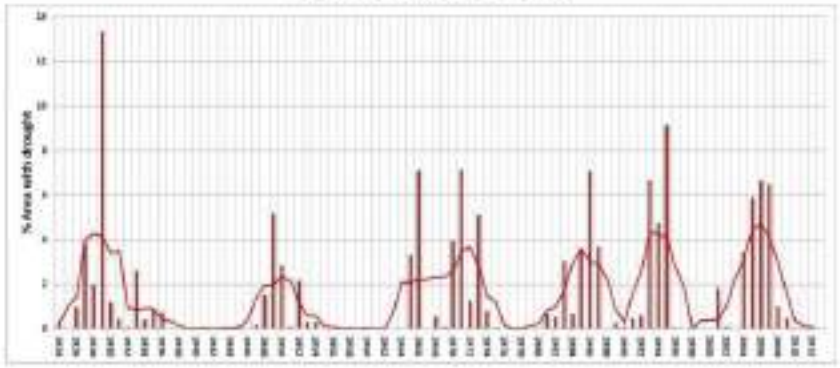
36-month SPI— June





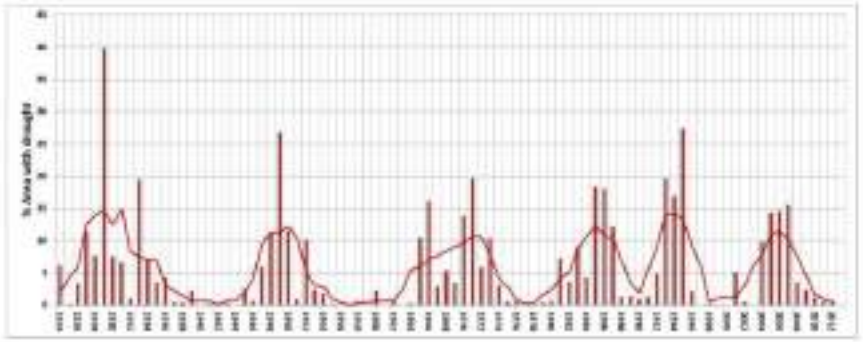
Extreme drought:

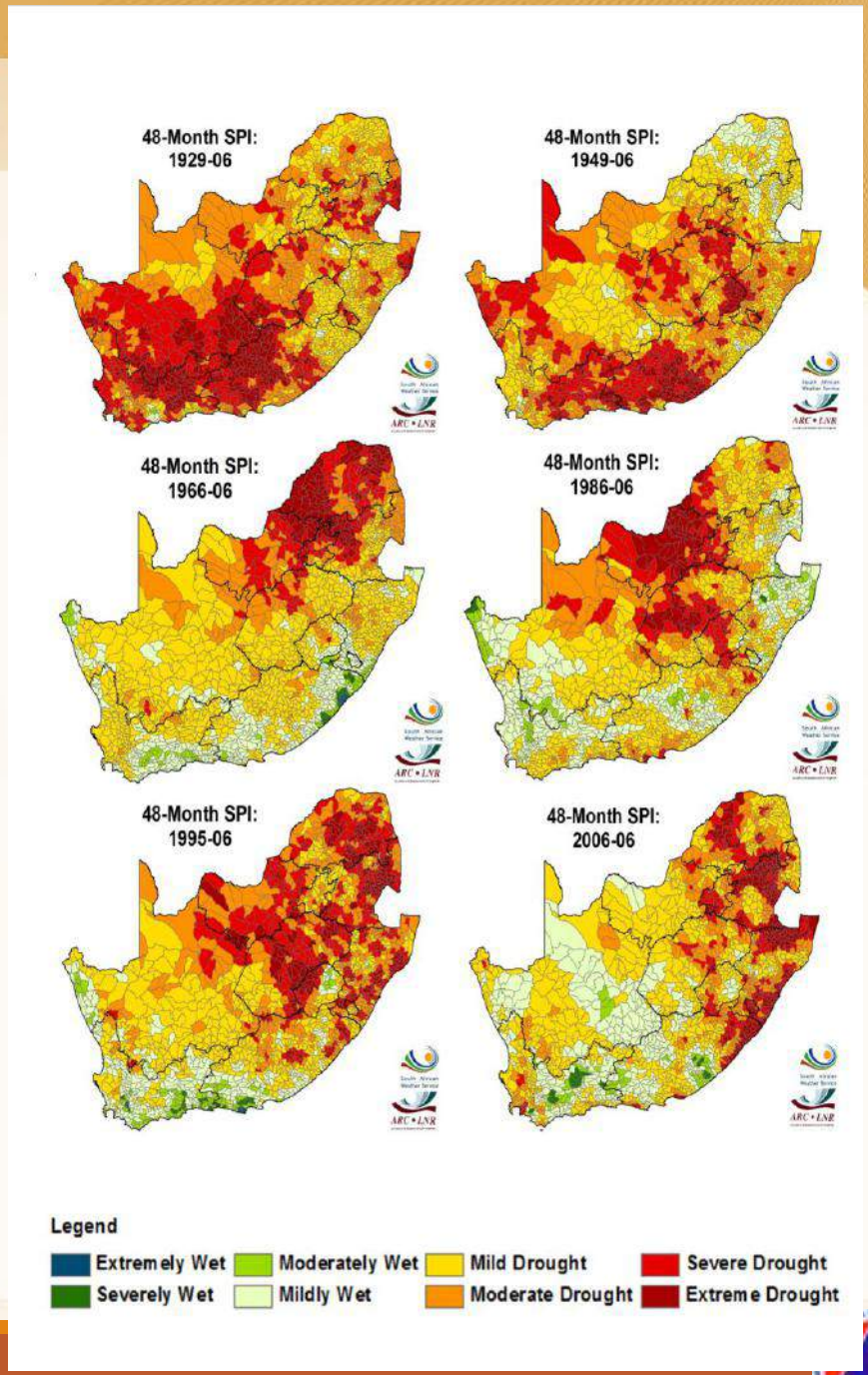
48-month SPI— June



Severe drought:

48-month SPI— June





5. TOWARDS A RISK PRODUCT..

Considering the time series of the largest droughts at various time scales as represented by Fig. 1 to 15, the follow main characteristics surface:

There is a decadal-scale variation noticeable in the occurrence of droughts, as can be expected from the existence of rainfall cycles of similar periodicity over the summer rainfall area.

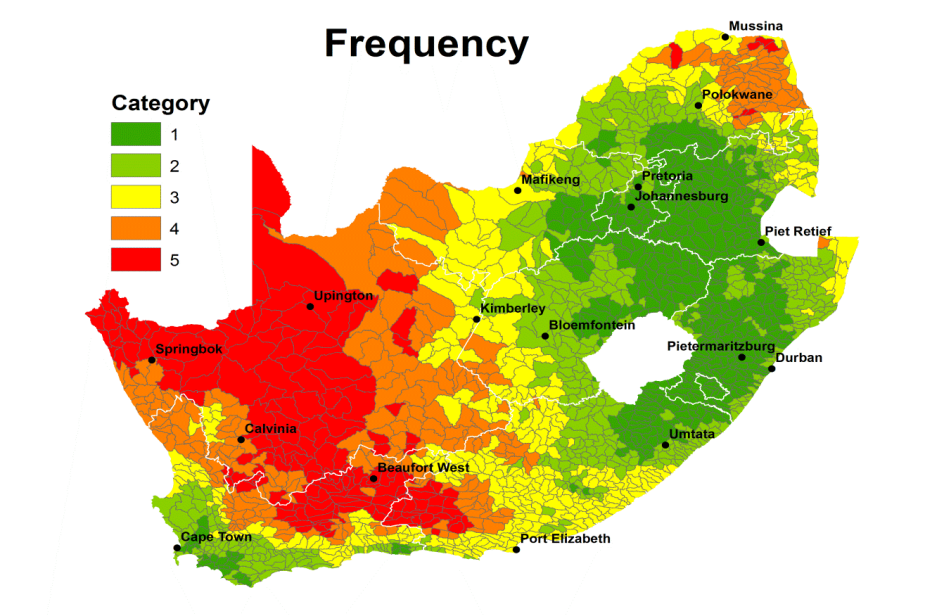
Dry periods are concentrated approximately within the following periods:

- **1925-1933**
- **1946-1952**
- **1965-1973**
- **1983-1994**
- **2003-2007**

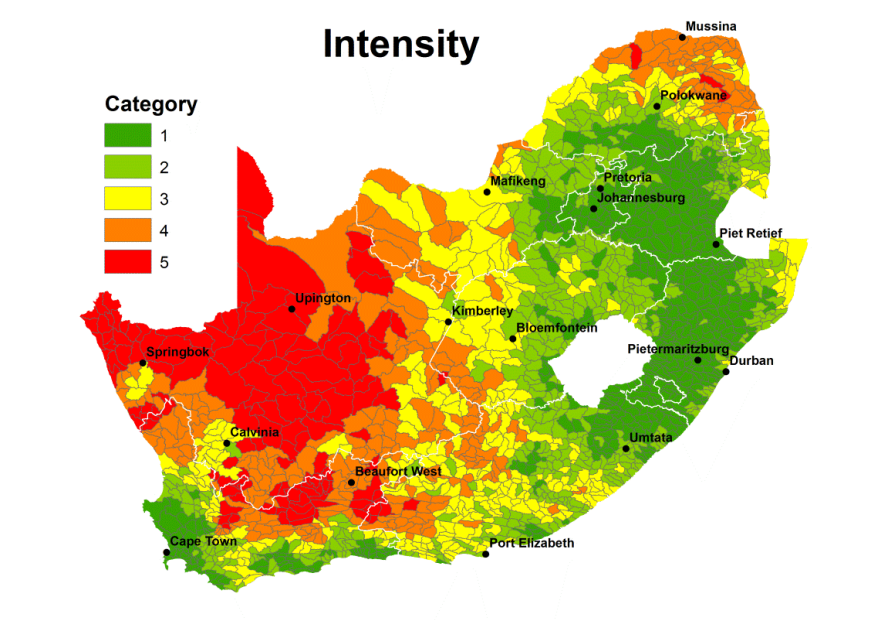
Droughts at longer time scales (towards 24 up to 48 months) occur not only as a result of a multi-year period of lower rainfall, but consist of short term (6-monthly) extreme drought events, occurring in relative close proximity in time

- Rainfall time series per quaternary catchment analyzed for following characteristics:
  - **Frequency of drought occurrence**
  - **Intensity of dry periods**
  - **Duration of dry periods**
  - **Regularity of dry periods**
- Results are categorized into 5 categories
  - Catchment values per characteristic are ranked
  - Subdivided to obtain 5 groups covering equal spatial extent across South Africa

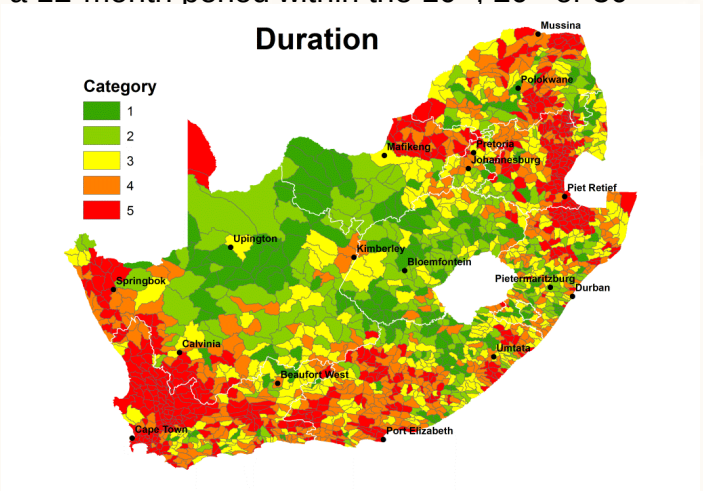
- **Frequency of droughts (1 = low, 5 = high):**
  - The number of times during the historical time series where the rainfall remained below 50% and 75% during
    - 6-month main rainfall season
    - 12-month period
    - 24-month period



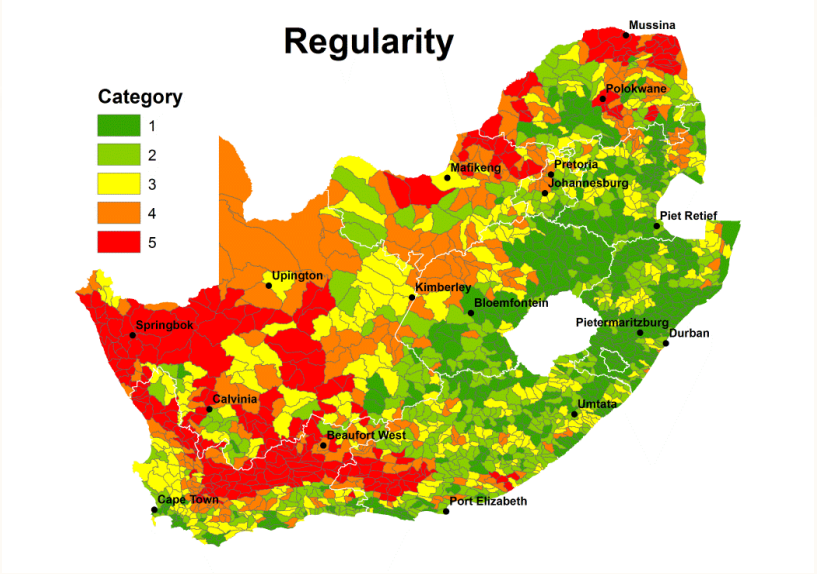
- **Intensity of droughts (1 = low, 5 = high):**
  - Focusing on the behavior of the lower part of the rainfall time series per catchment
  - Change (%) in rainfall between the median values over the time series and the lower percentiles (10th and 20th percentile)
    - 6-month main rainfall season
    - 12-month period
    - 24-month period



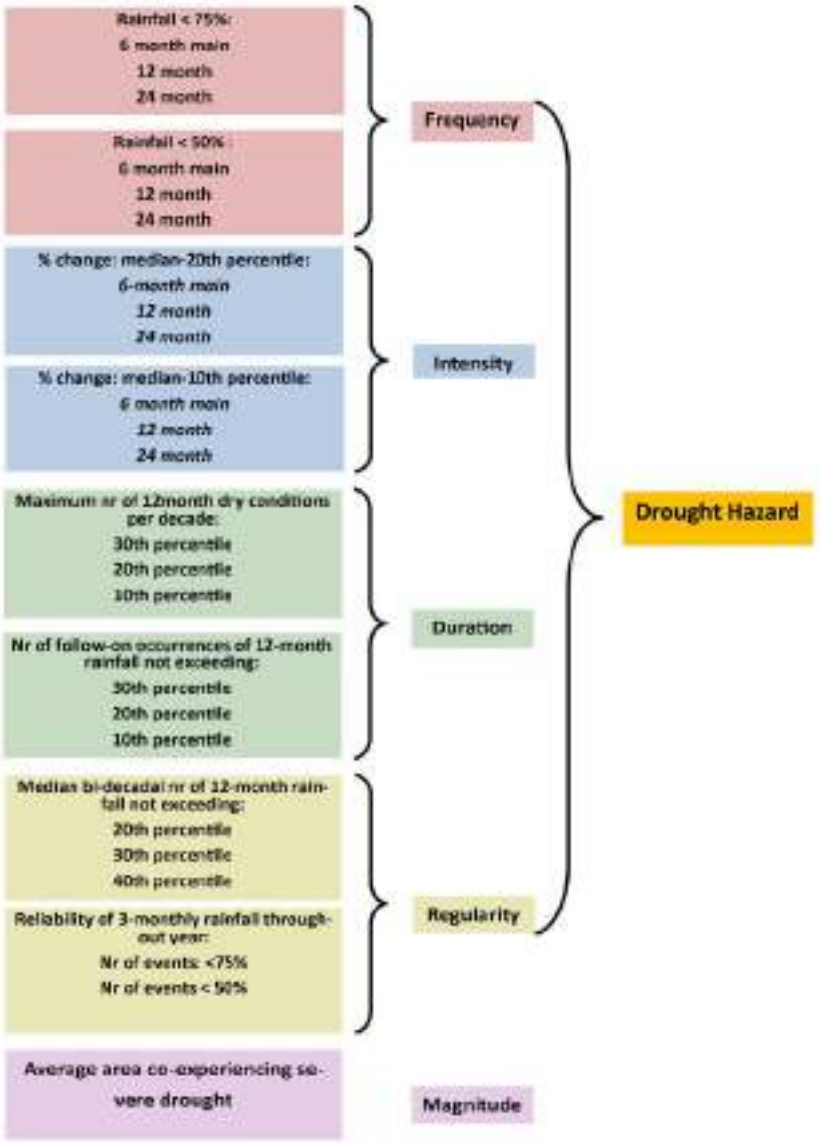
- **Duration of droughts (1 = low, 5 = high):**
  - Focusing on the tendency for drought periods to be prolonged, continuous
  - Potential for drought to occur numerous times within a limited number of years, or the tendency for dry years to occur concurrently
    - maximum number of relatively dry years (10th, 20th and 30th percentile) within a decade over the 94-year period
    - number of times within the time series where rainfall within a 12-month period within the 10th, 20th or 30th percentile is followed by a similar deficient rainfall value
    - 12-month periods



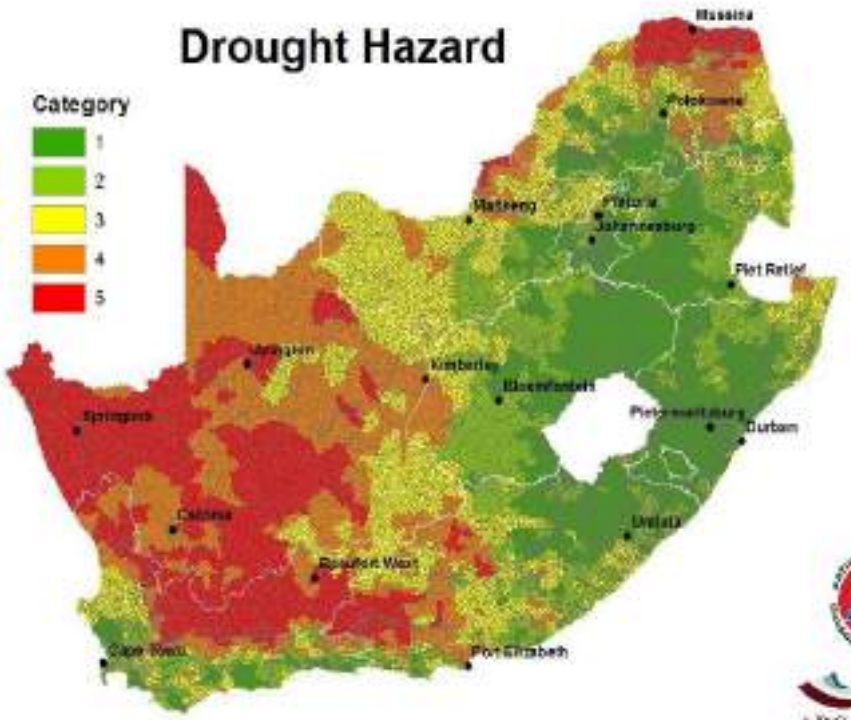
- **Regularity of droughts (1 = low, 5 = high):**
  - Focusing on how regularly throughout the time series a certain area will experience dry years
  - 2 main input values:
    - 1) a moving 20-year window is used and the median occurrence over the time series of the 12-month 20th, 30th and 40th percentile rainfall per 20-year period is calculated
    - 2) Frequency of rainfall not exceeding 50% or 75% for:
  - October-December (early summer)
  - January-March (late summer)
  - April-June (early winter)
  - July-September (late winter)



- **All input values are given equal weights and combined**
- **Resulting map is again categorized to obtain 5 classes equal in spatial extent**
- **Results per quaternary catchment is summarized to mesozone polygon**

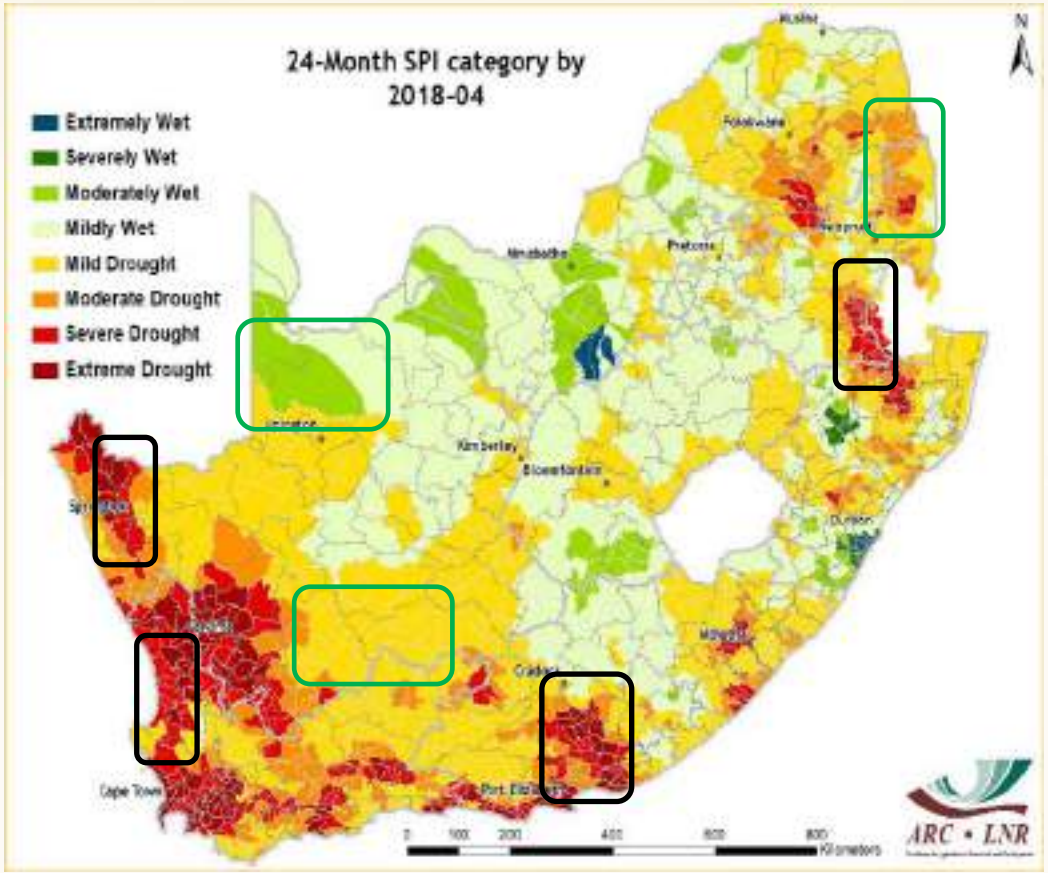


- Results form a summary of the most extensive droughts at various time scales have been provided.
- overview of the potential for drought in the South African context. Time series analysis has yielded further insight into the recurrence of multi-year periods.

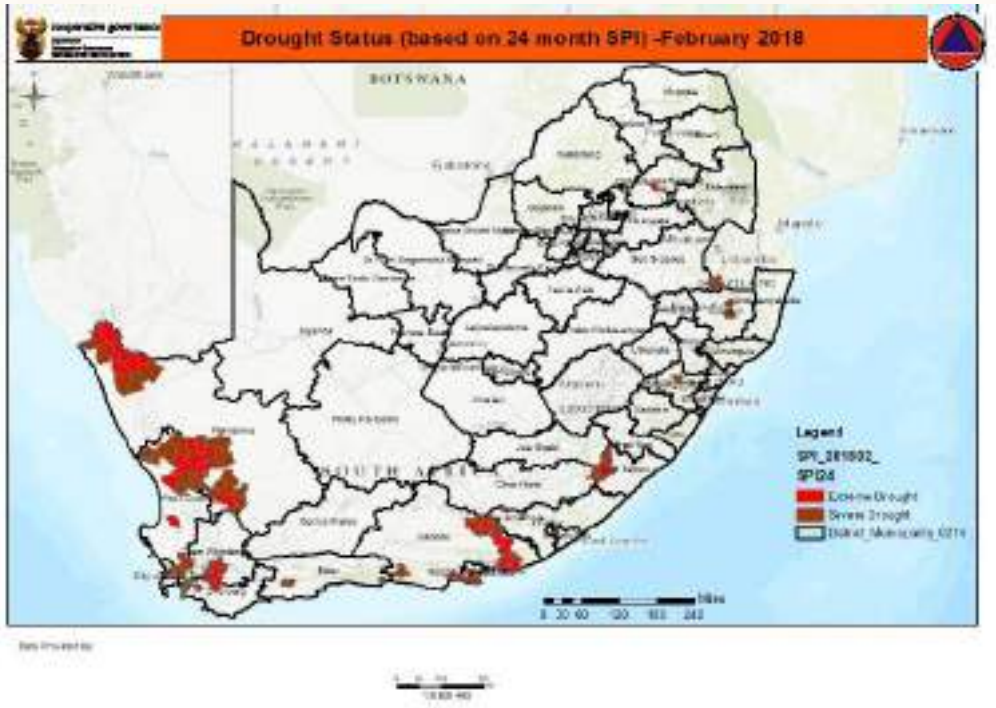


cooperative governance

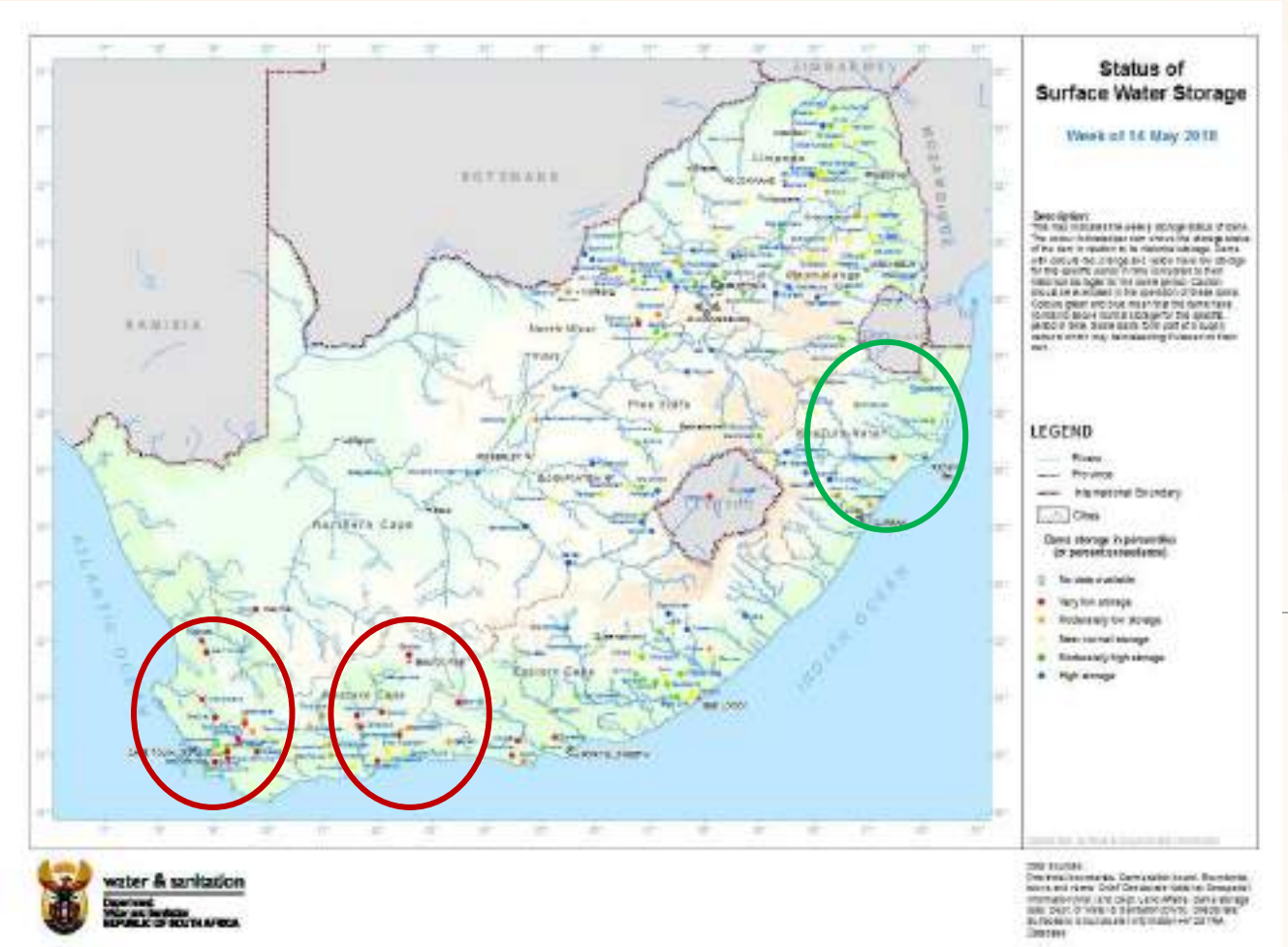
6. INFORMATION SUPPORT: PRE AND POST DROUGHT DECLARATION



Back to Basic Priority Areas



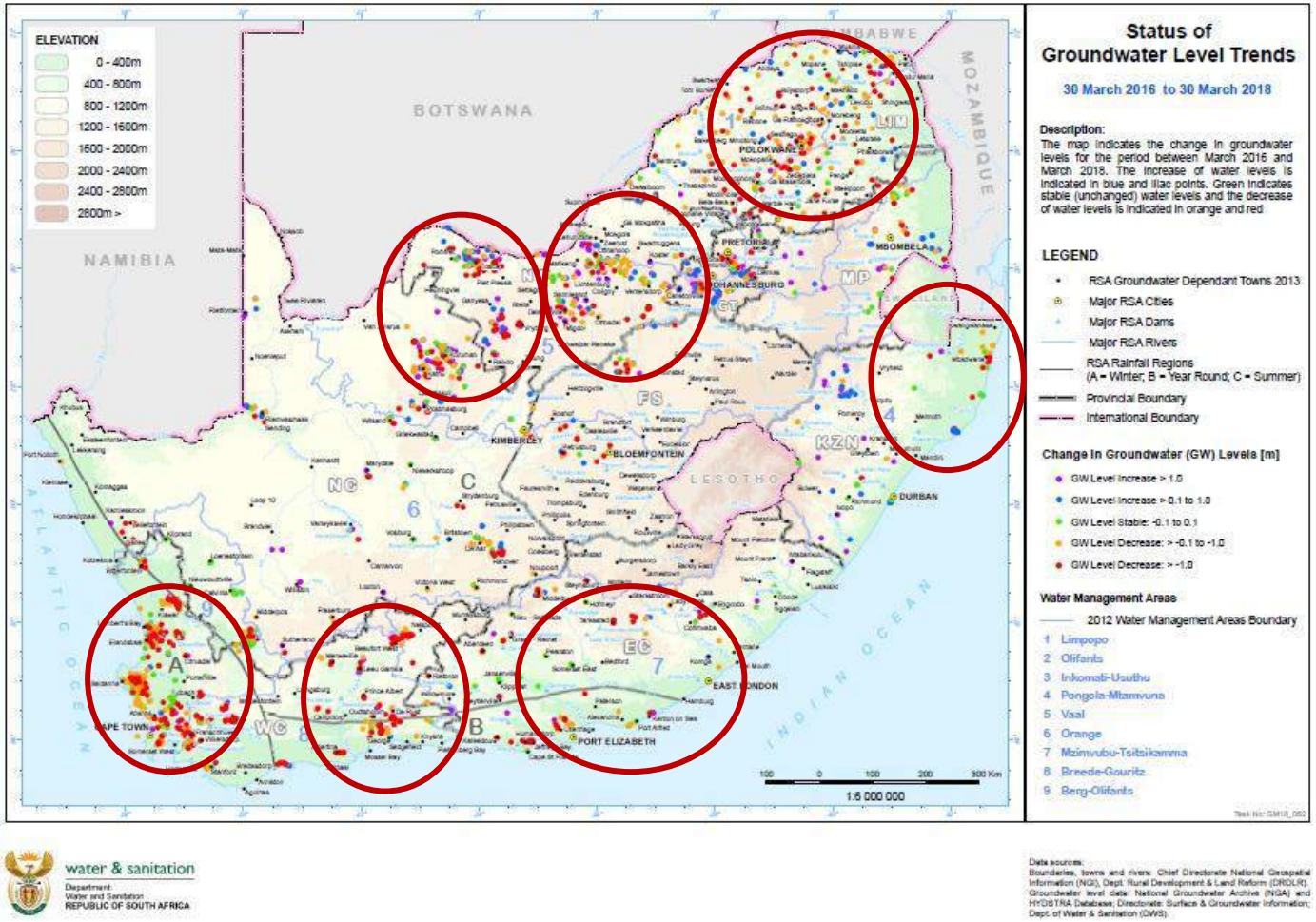
SPI and Surface Water Indicators



Groundwater Status – March 2018

Groundwater Resources continue to be under pressure over large areas of the country.

Farmers have expressed concerns over the inadequate recharge.



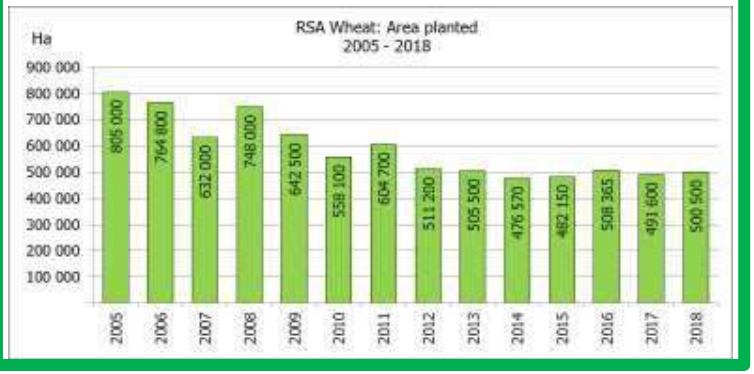
Maize production

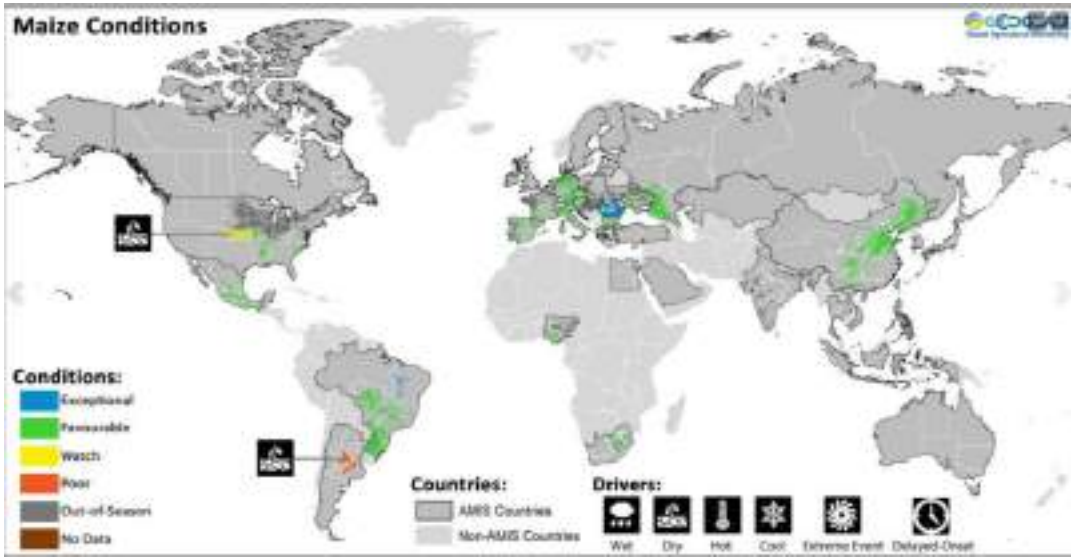
The latest official estimates from the National Crop Estimates Committee places the maize production figure in the upper quartile compared to production during the last decade, indicating a favourable production season in 2017/18.

According to the global crop monitor, maize in SA experiences favourable conditions. This is also noted over most production areas globally.

The area estimate for winter wheat planted is similar to the values for the last 6 years.

Wheat production





Work Stream	Outcome
1. Weather analysis and forecasting LEAD: SAWS SUPPORTING: NDMC	• Recent rainfall observations and analysis thereof • Latest short term weather forecasts • Latest seasonal forecasts, including the status of main climate drivers (e.g., ENSO)
1. Water Status and projections LEAD: DWS SUPPORTING: NDMC	• Current dams levels • Ground water monitoring • Spatial information related to water resources that will be applicable to both drought risk and water related early warnings matters
1. Agricultural impact, vegetation tracking and measurements. LEAD: ARC SUPPORTING: CSIR	• Crop estimation and forecasting • Regional crop estimation and impact analysis • Alien vegetation monitoring • Vegetation indices such as the VCI and PASG • Information supplied to and gathered at the monthly crop estimates meeting and GEOGLAM crop forum
1. Drought Risk hazard measurement and analysis LEAD: NDMC SUPPORTING: CSIR	• Standardized Precipitation Index evaluation • Historical analysis and modelling • Spatial analysis of related drought risk products
1. Socio- economic impact analysis LEAD: NDMC SUPPORTING: MULTI SECTOR	• Social economic indicators • Impact analysis and modelling
1. Drought related Interventions LEAD: NDMC SUPPORTING: MULTI SECTOR	• Drought specific Interventions


Thank You!