

# Rain For Africa (R4A)

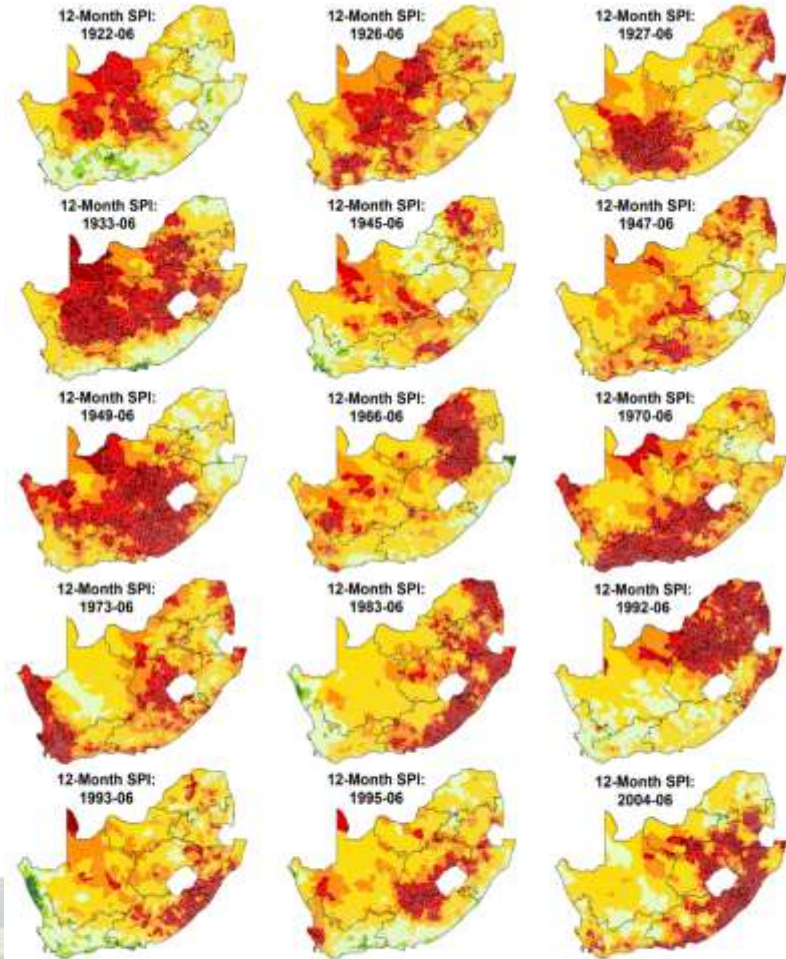
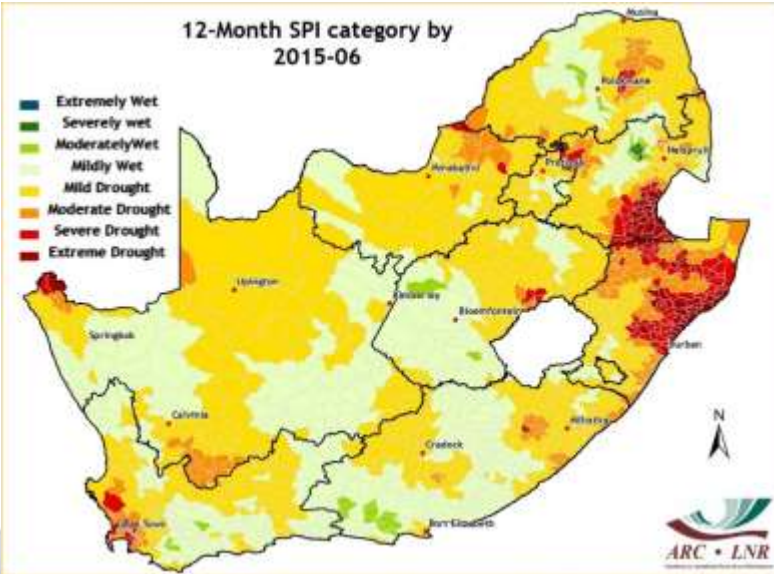
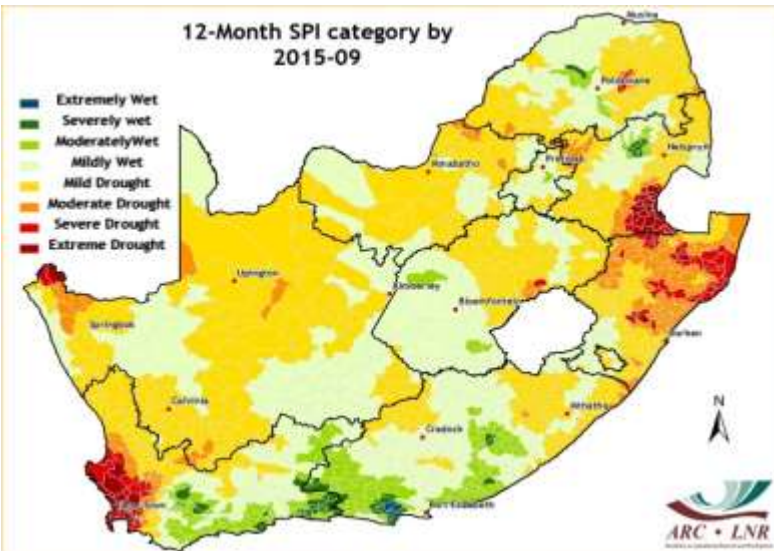
The benefits of weather information for 125000 South African Small  
Holder Farmers



**Dr Jasper Rees & Dr Johan Malherbe**  
**19 November 2015**  
**House of the Future : El Nino Seminar**

# Drought In South Africa – A brief recent history

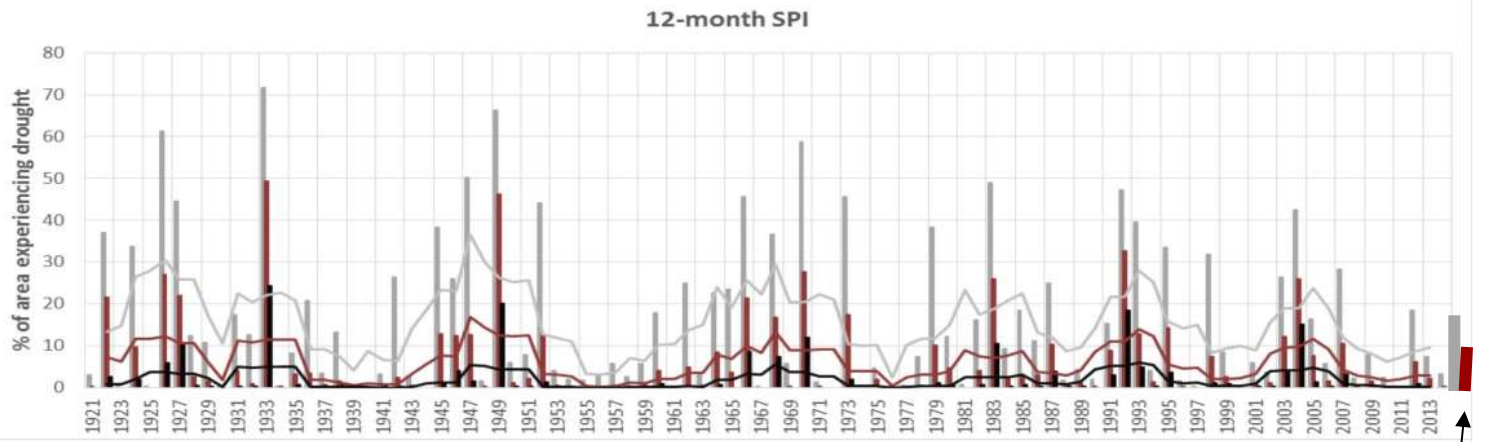
## Current Conditions compared



# Drought In South Africa – A brief recent history

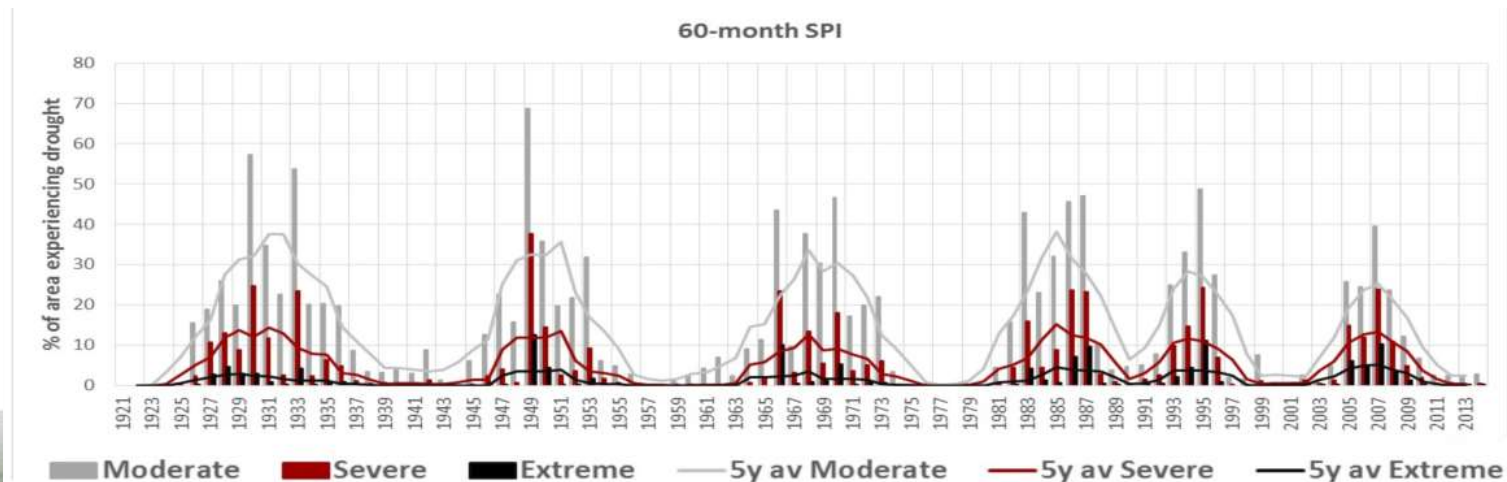
## Current Conditions compared

Drought Extent  
according to  
Standard  
Precipitation  
Index (SPI)  
(% of summer  
rainfall region  
experiencing  
drought)



2014/15

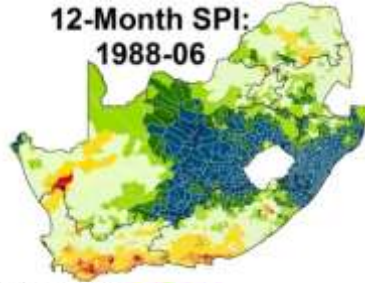
**+ - 9 years  
wet/dry**



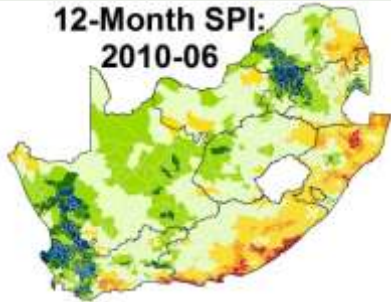
# ENSO and Agriculture

- Total rainfall during JFM was below normal
  - Higher than in 1992, 2007 and other ENSO Warm years

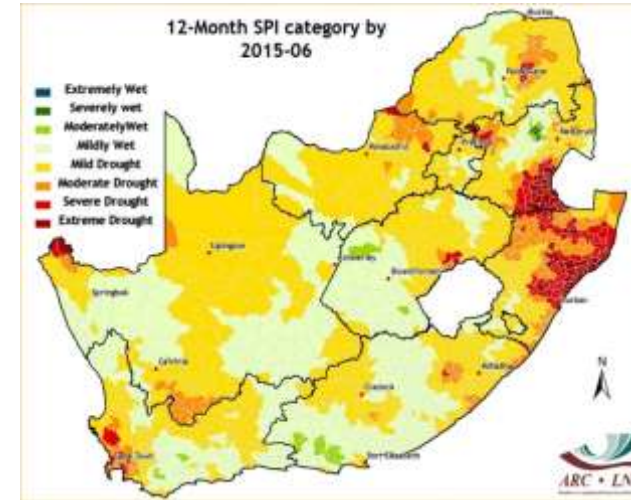
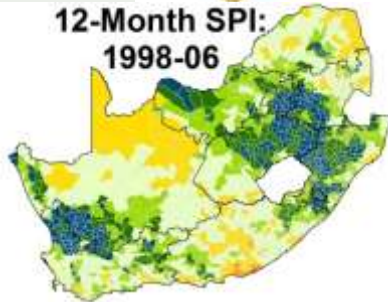
12-Month SPI:  
1988-06



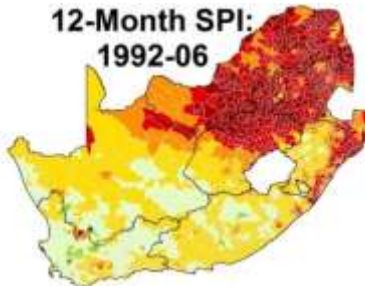
12-Month SPI:  
2010-06



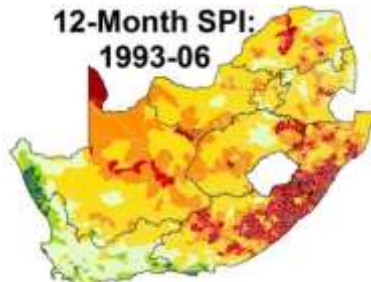
12-Month SPI:  
1998-06



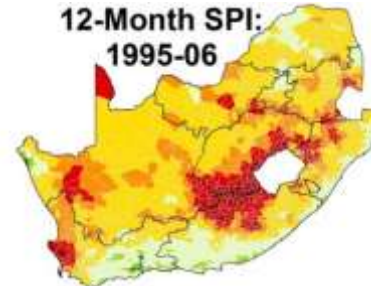
12-Month SPI:  
1992-06



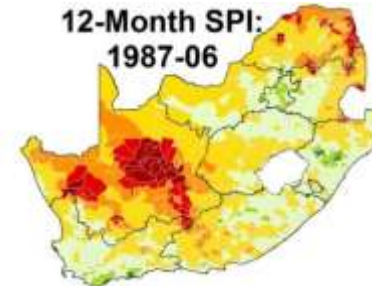
12-Month SPI:  
1993-06



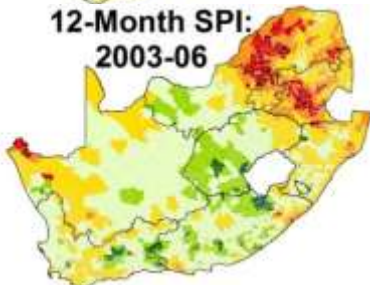
12-Month SPI:  
1995-06



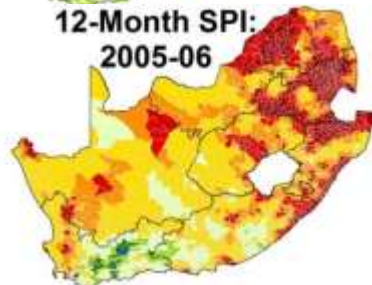
12-Month SPI:  
1987-06



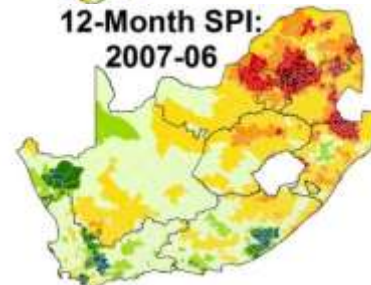
12-Month SPI:  
2003-06



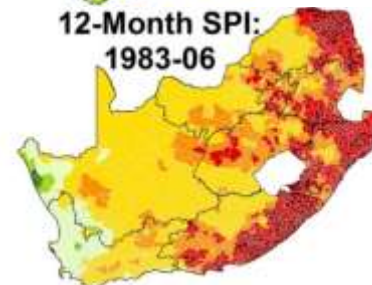
12-Month SPI:  
2005-06



12-Month SPI:  
2007-06



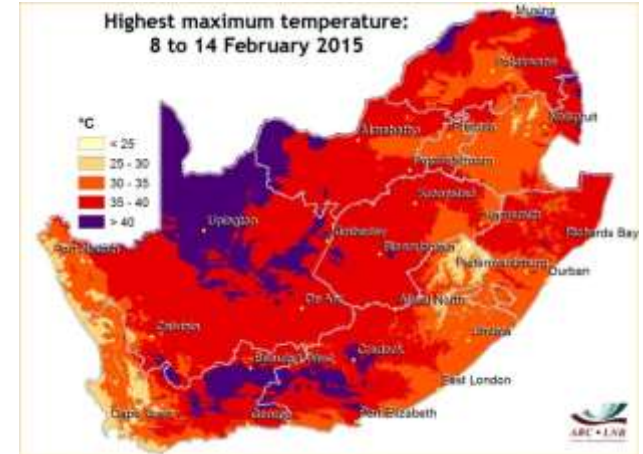
12-Month SPI:  
1983-06



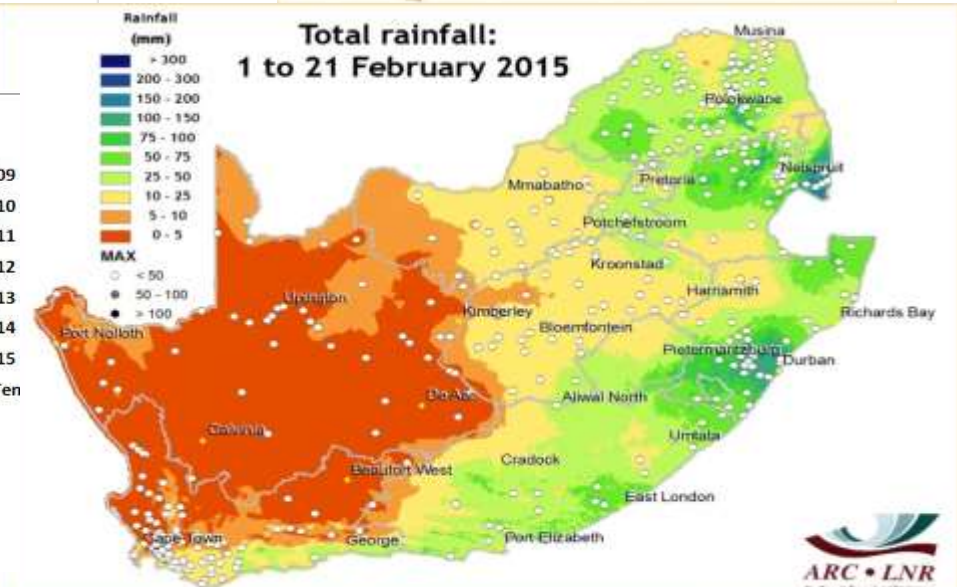
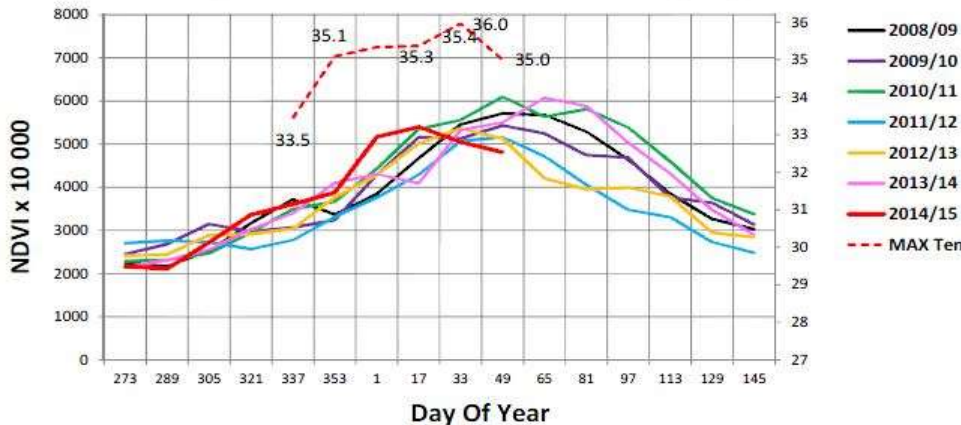
# ENSO and Agriculture

- Even though total summer rainfall during 2014/15 was near normal over most of the summer rainfall region, conditions during February had a particularly negative impact on maize.
- An intense hot and dry spell by early to mid-February resulted in large negative impacts on the summer maize crop due to the critical part of the growing season during which it occurred.

Extreme conditions during part of the 2014/15 summer highlighted the importance of information regarding intraseasonal variation to the maize industry, including individual farmers.



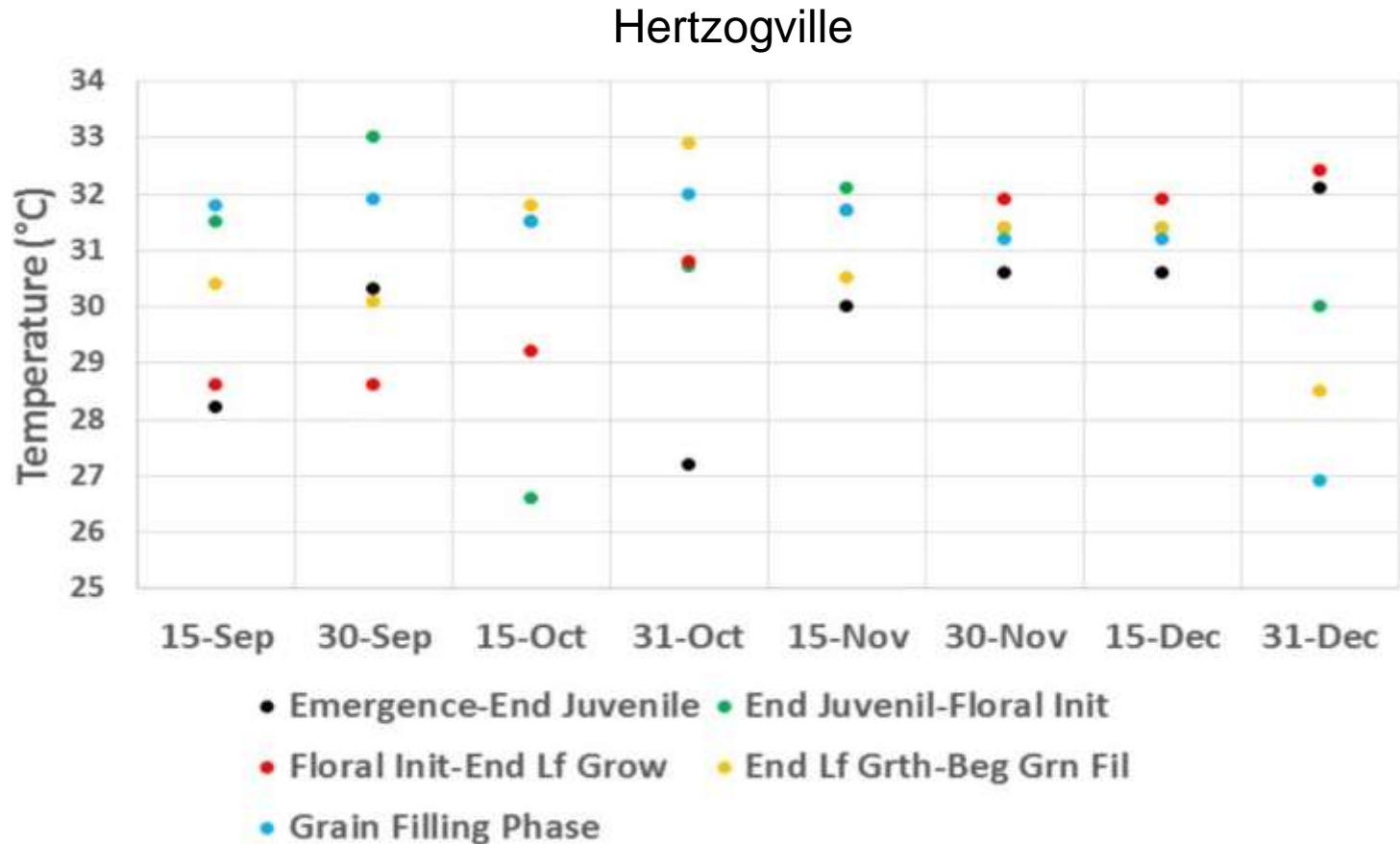
**Average NDVI for Maize Areas of Ventersburg Magisterial District**



# ENSO and Agriculture

Extreme conditions during part of the 2014/15 summer highlighted the importance of information regarding intraseasonal variation to the maize industry, including individual farmers.

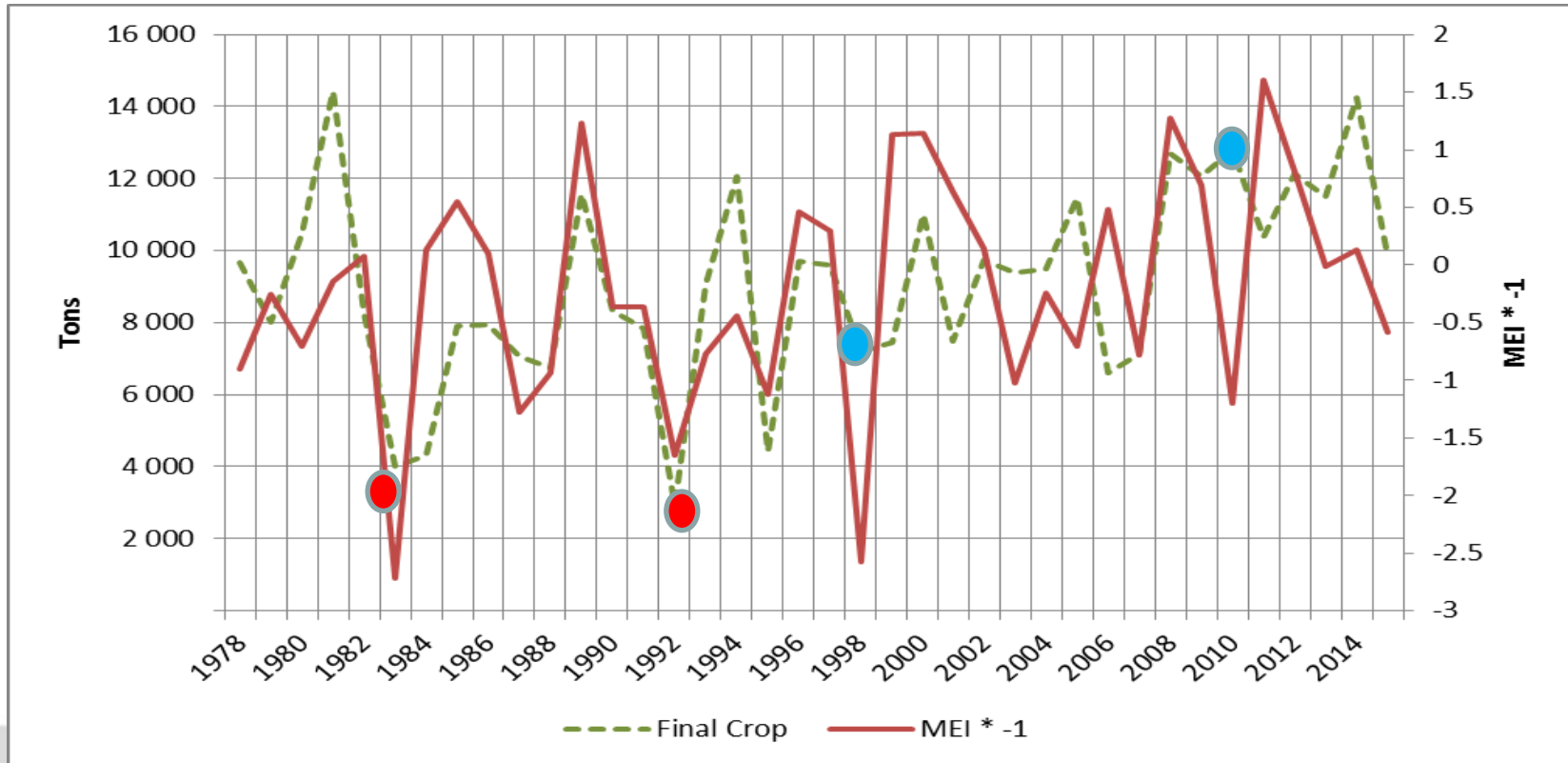
*Average maximum temperature during various growth stages of maize as simulated for maize at Hertzogville during the 2014/15 summer, for 8 plant dates as indicated*



# El Niño and Maize yields since 1978

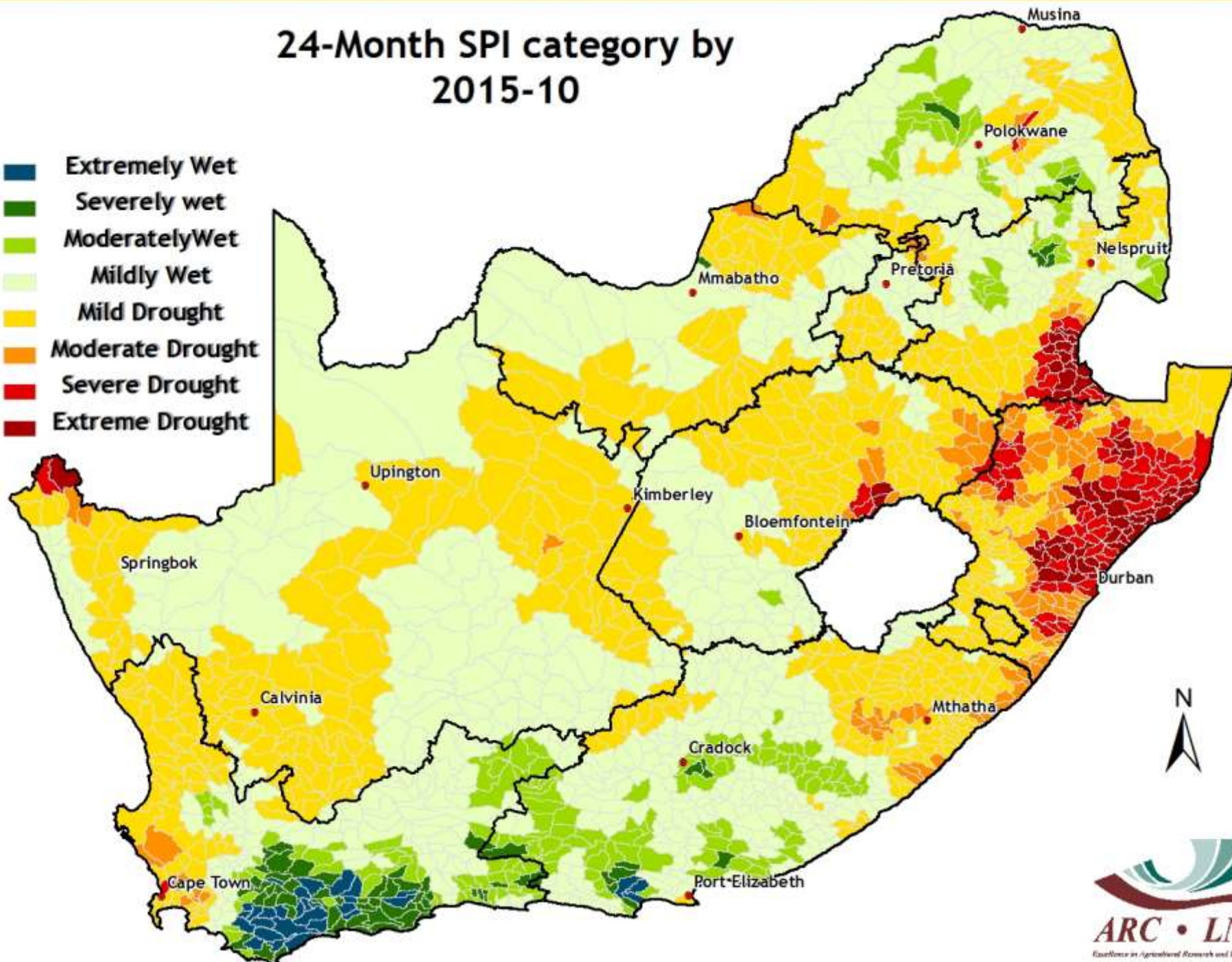
- SA Rainfall – El Niño relationship well known – usually drier during January-March (JFM) during El Niño years
- Seasonal forecasts predict drier conditions by late summer – advice to maize farmers will be to plant early and be conservative in strategy – to avoid/minimize the effect of adverse conditions towards late summer
  - This would translate, for dryland maize farmers, to use the earliest date within the normal planting window, following the first significant rain. This window in the east is from September to November – and in the west – from October to December.
- **Large uncertainty – local effects on maize crop related to El Niño**
- **Intra-seasonal variability/extremes play an important role**

**This graph shows historical maize yields (green broken line) since 1978. Stronger El Niños usually coincided with low yields (see red dots for 1983 and 1992) However, some strong El Niños have seen good maize yields (blue dots – 1998 and 2010). The red line shows the El Niño index (MEI = Multivariate ENSO Index). Stronger El Niños are represented by negative values.**



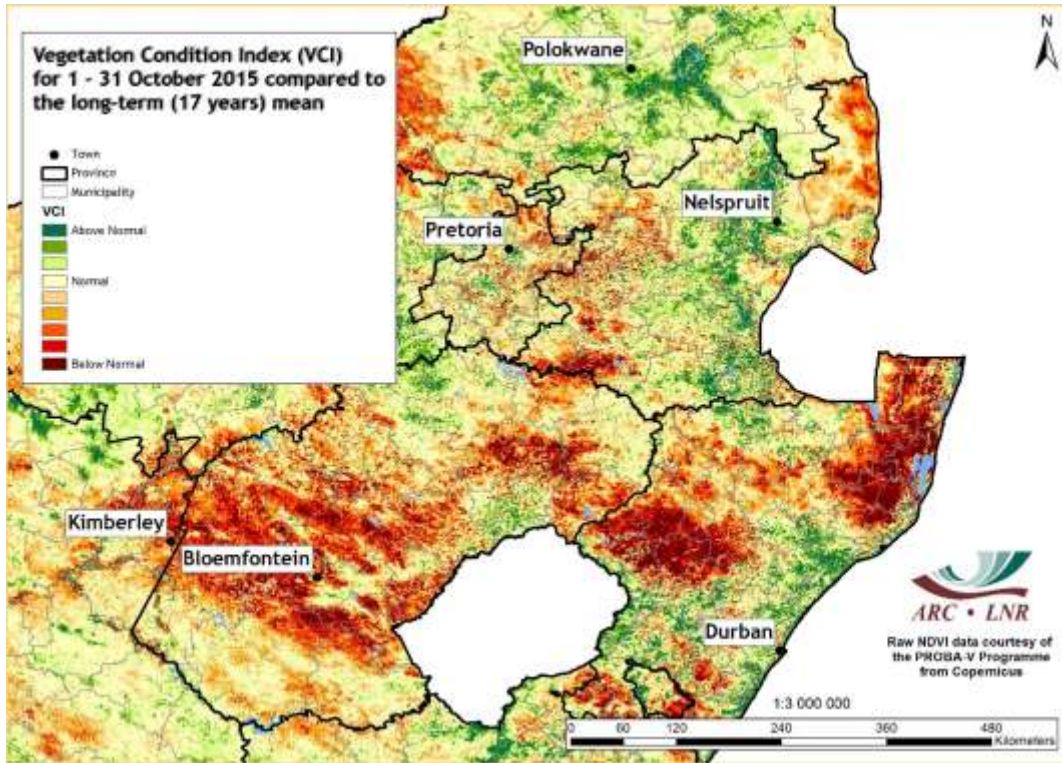
# 24-Month SPI category by 2015-10

- Extremely Wet
- Severely wet
- Moderately Wet
- Mildly Wet
- Mild Drought
- Moderate Drought
- Severe Drought
- Extreme Drought





# Current KZN situation



# Current KZN situation

- An estimated 40 000 cows have already died in KwaZulu-Natal because of the drought
- A further 800 000 may have to be killed in the province
- More than 500 000 people in the eastern province of KwaZulu-Natal are facing severe hunger and are at risk of disease as the drought continues - World Vision, a Christian humanitarian organisation
- Sugercane: 2016 season plantings of the grain to the smallest since 2011 because of poor rains in the main growing regions - Crop Estimates Committee

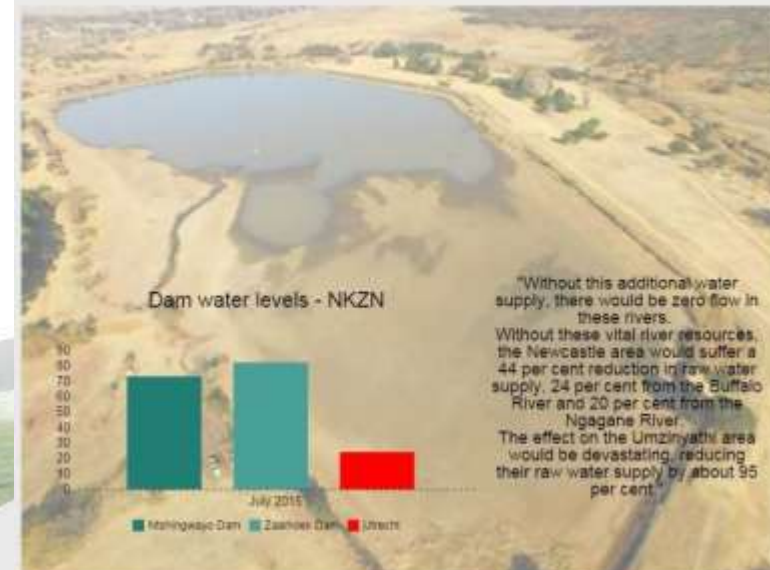
- *Business Day* , 16 November 2015

- *Newcastle Advertiser* , 16 July 2015

## Newcastle Municipality addresses the state of our water

The severity of the prevailing drought in KwaZulu-Natal has finally hit home for the residents of Newcastle.

July 16, 2015



# Current KZN situation

- Hluhluwe,
- Hluhluwe Umfolosi



Photos: Garret Muller (DARD KZN)



# Current KZN situation

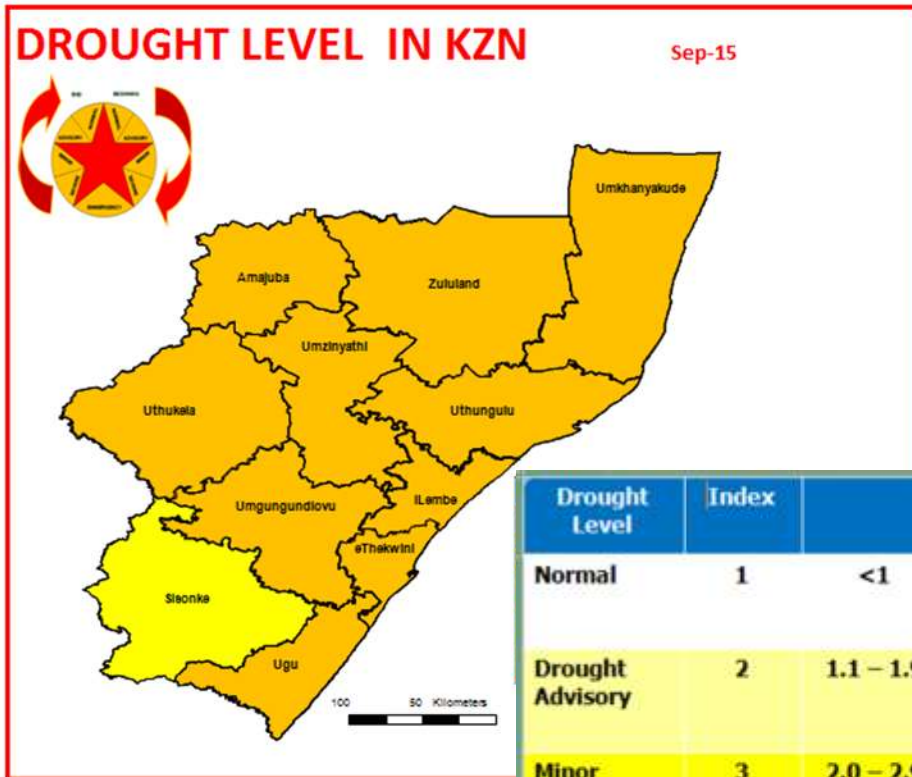
- Empangeni
- Nkandla



Photos: Garret Muller (DARD KZN)



# Current KZN situation



Drought Level	Index	Description	Objective	Target	
Normal	1	<1	Sufficient water to meet human and ecosystem needs	Normal	Ongoing reductions in community water wastage
Drought Advisory	2	1.1 – 1.9	1 <sup>st</sup> indications of a potential water supply problem	Voluntary conservation	Minimum 10% reduction
Minor Drought	3	2.0 – 2.9	Potentially serious ecosystem or socioeconomic impacts	Voluntary conservation and restrictions	Minimum additional 20% reduction
Severe Drought	4	3.0 – 3.9	Water supply insufficient to meet socio-economic and ecosystem needs	Voluntary conservation, restrictions and regulatory response	Maximum reduction of use
Emergency Drought	5	>4.0	Loss of Supply - loss of a community's potable or fire fighting supply	Emergency response	Ensure health and safety



# Current KZN situation

## IMPACT: WATER SOURCES

- ◉ Farm dam levels for livestock watering and irrigation in all districts remain at critically low levels.
- ◉ Provincial dams are still down 16% on last year's levels, and remain at their lowest levels in 13 years.
- ◉ Levels are still dropping on average 1% per week
- ◉ Soil Moisture across the province remains very low to date, however with the rainfall received, there appears to be a positive trend in the coastal areas in particular.



# Current KZN situation



agriculture  
& rural development  
Department  
agriculture  
& rural development  
PROVINCE OF KWAZULU-NATAL



## ADVICE

- The drought situation is becoming worse.
- Managing the drought is not the sole responsibility of the government.
- As the provincial motto for disaster management states "It is every bodies business":
- Thus it is crucial that the affected (communities/Farmers) do their best to reduce the impact on their family and their farming enterprises.
- This will require of the farmer to apply conservation agriculture, farming with nature and not against it.

TOGETHER WE HAVE MADE KZN A BETTER PROVINCE TO LIVE IN.

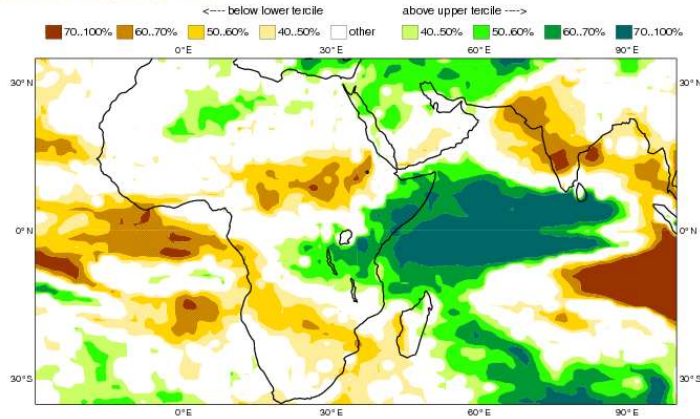


# El Niño / -impacts were predicted

- Seasonal forecasts very sensitive to ENSO
- Conditions be mid-2015 already dry in the east

ECMWF Seasonal Forecast  
 Prob(most likely category of precipitation)  
 Forecast start reference is 01/07/15  
 Ensemble size = 51, climate size = 450

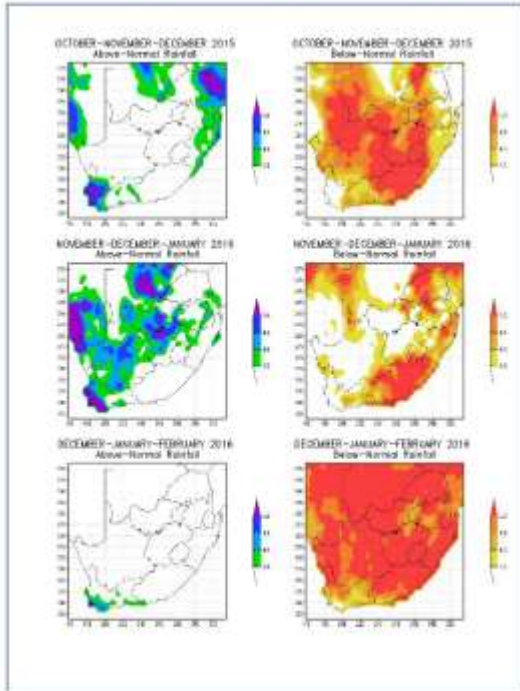
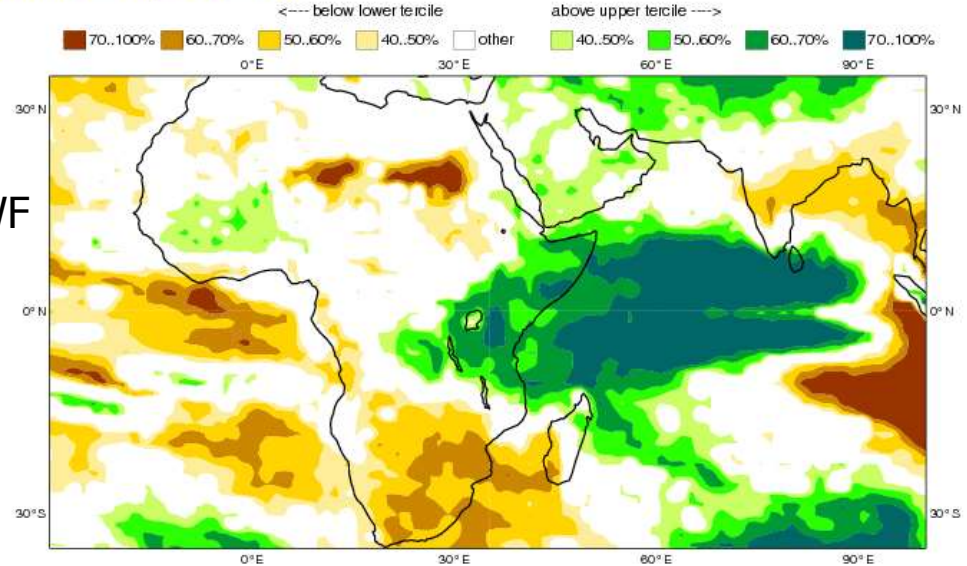
System 4  
 SON 2015



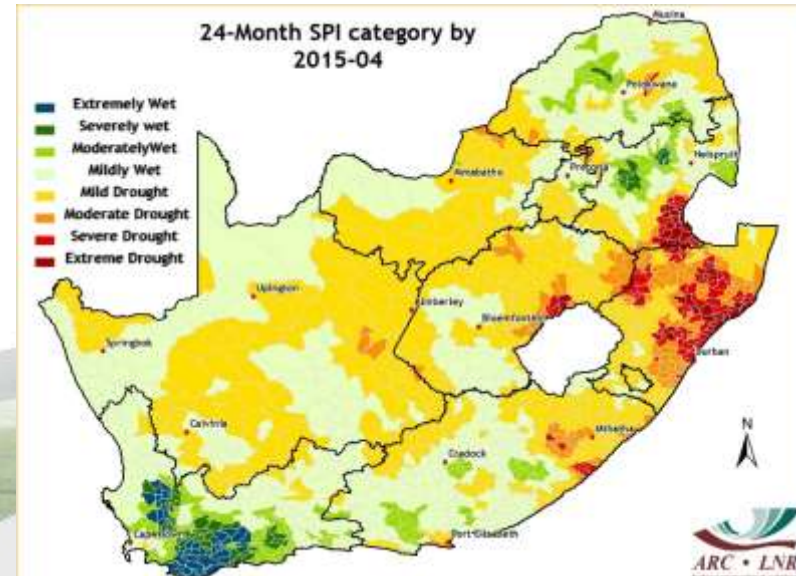
ECMWF Seasonal Forecast  
 Prob(most likely category of precipitation)  
 Forecast start reference is 01/07/15  
 Ensemble size = 51, climate size = 450

System 4  
 OND 2015

ECMWF



SAWS





# El Niño / -impacts were predicted



agriculture,  
forestry & fisheries

Department:  
Agriculture, Forestry and Fisheries  
REPUBLIC OF SOUTH AFRICA

**National Agro-meteorological Committee (NAC) Advisory on the  
2015/16 summer season  
Statement from Climate Change and Disaster Management  
01 DAFF 2015**

01 October 2015

- Rainfall- below normal
- Severe drought in some districts
- Maize/Grass running low
- Farmers not ready to plant maize – drought
- Livestock: Fair in commercial areas; poor in communal areas
- Mortalities of livestock in all districts
- Major dams – levels decrease to 61%

Media Release  
The National Agro-meteorological Committee (NAC) has issued a statement on the 2015/16 summer season. The statement predicts a generally dry and hot summer with below normal rainfall and above normal temperatures. The statement also predicts a severe drought in some districts. The statement is available on the DAFF website at [www.daff.gov.za](http://www.daff.gov.za). The statement is also available on the DAFF website at [www.daff.gov.za](http://www.daff.gov.za). The statement is also available on the DAFF website at [www.daff.gov.za](http://www.daff.gov.za). The statement is also available on the DAFF website at [www.daff.gov.za](http://www.daff.gov.za).

In summation, below normal rainfall and above normal temperatures are anticipated throughout the summer season over most areas. Farmers are encouraged to continually check updates i.e. seasonal forecasts and utilize 7 day weather forecasts for short term planning.

With the above forecast in mind, the following strategies are recommended:

## VI. SUGGESTED STRATEGIES

With the seasonal forecast for dry and hot conditions, together with little moisture available, farmers are advised to be conservative in their planting i.e. planting density/cultivar/area being planted.

### A. Rain-fed crop production Soil choice

- Choose suitable soil type.
  - Suitable soil and land use management practices that would control wind and water

<p>DAFF, Directorate: Climate Change and Disaster Management Private Bag X93 Pretoria 0001 Tel: 012 309 5722/23; Fax: 012 309 5878 Email: <a href="mailto:MitteA@daff.gov.za">MitteA@daff.gov.za</a></p>  <p>agriculture, forestry &amp; fisheries Department: Agriculture, Forestry and Fisheries REPUBLIC OF SOUTH AFRICA</p>	<p>SAWS: Private Bag X097 Pretoria 0001 Tel: +27 (0) 12 367 6000 Fax: +27 (0) 12 367 6200 <a href="http://www.weathersa.co.za">http://www.weathersa.co.za</a></p>  <p>South African Weather Service</p>	<p>ARC: Institute for Soil, Climate and Water Private Bag X79 Pretoria 0001 Tel: 012 310 2500 Fax: 012 323 1157 Email: <a href="mailto:iscwinfo@arc.agric.za">iscwinfo@arc.agric.za</a> <a href="http://www.arc.agric.za">http://www.arc.agric.za</a></p>  <p>ARC • LNR Excellence in Research and Development</p>
--	--	---

**Disclaimer:** The Department of Agriculture, Forestry and Fisheries (DAFF) accepts no responsibility for any application, use or interpretation of the information contained in this advisory and disclaims all liability for direct, indirect or consequential damages resulting

# Early Response to *early warning* message

- Constrained by resistance to change
- Adaptation is possible
  - Response farming
  - Climate smart Farming
  - Water harvesting technologies
  - Cultivar choices
  - Crop type choice
  - Early Livestock reductions



# Challenge: THE MESSAGE

Did we Hear, Understand and Respond

- Parable of the Sower- message fall on stones, hard ground, soft soil
- *“Extreme Events’ Watch”* Centre for Agriculture ???
- Forecasts & Early Warning are there
- Centre needs to **advocate seriousness** of message.



# 2015: Did the message propagate & was it “heard”?

- Probably not!
- Thus the Crisis
- Lessons Learnt
  - Were Meteorologists **confident** in issuing warning
  - Were Communication channel to executive decision-makers **open and used**.
  - Was “Packaging of message” for all relevant role players (**politicians .....Farmers**) attempted.



Thank you



# Rain for Africa (R4A): Background

Dr Jasper Rees –  
Group Executive: ARC-NRE

The R4A project was submitted under the 2<sup>nd</sup> call for proposals to:  
**Geodata for Agriculture and Water (G4AW)**

## 1. G4AW first call



4 approved proposals – insurance and finance support

### Africa

- Mali& Uganda
- 2 x Ethiopia
- Indonesia



# R4A supported by G4AW



## 2. G4AW second call - projects were supported by a 60% grant

33 applications & 10 approved proposals – various agricultural applications & support,

### Middle East (4 proposals)

- Bangladesh (3), Vietnam (1)

### Africa (6 proposals)

- Kenya, Uganda, Burkina Faso, Mali, Kenya & Tanzania, South Africa,



# R4A supported by G4AW



## 3. What is different in R4A vs other projects?

R4A envisages to combine:

- Insurance & finance support;
- App for Agricultural applications & support;
- Weather data & models
- Private & commercial partnerships



# Partners 1

## 1. ARC

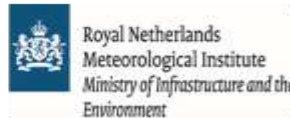
Weather Station Network & Agricultural expertise

## 2. Hydrologic:

HydroNET platform, develop Apps

## 3. SAWS:

Weather forecast , Radar & weather station network





# Partners 2

## 4. Mobile Water Management:

MyRainGauge smartphone application

## 5. Water Impact:

Weather forecast application

## 6. KNMI:

Training & Support for SAWS forecasts



# Partners 3

## 7. Waterschap Groot Salland:

Dutch South African Cooperation expertise  
(CMA's)

## 8. WineJob:

Disease forecast App

## 9. eLeaf:

Satellite & Derived data (e.g. Et )



# The Problem

## The Message is clear!

Chain between **Data & Information** and **Decision Support & Action** is broken

### Data & Information

- Lack of Scientific Capacity???
- Research Resources,???

### Decision Support & Action

- Farmers / Extension services
- Resistance to change?
- Stick to traditional
  - planting dates, cultivars, spacing



# The Problem

## The Message is clear! cont.

Chain between **Data & Information** and **Decision Support & Action** is broken

- Decision Support & Action
  - Lack of drought resistant cultivar seed stocks
  - Lack of adaptive information / advice
  - Decision makers
    - Not Committed
    - Not prepared take a unpopular decision (cost & political implications, previous experience of inaccurate forecasts?)



# Innovative Solutions

NB: Government to take responsibility & initiate warnings, alerts etc. based on seasonal outlook in order for.....?

- Seed/Plant material producers/breeders
  - ready with drought resistant material
  - Stockpile seeds for severe events (Previous year's)
- Drought aid before drought manifests
  - subsidize drought resistant seed/planting material
  - Based on Early Warning / Seasonal Outlook



# R4A : The Solution

- The R4A-consortium brings along .....:
  - Data
  - Agricultural Information
  - Decision support systems & knowledge
  - Weather data and forecasts
  - Strong partnership
  - Proven technology (MyRain Gauge)
  - Proven App's

And.....We take action



## R4A vision

“Compose the **best available** historical, actual and forecasted **weather data** and make it **easily accessible via applications** for each food producer, weather services, added value provider and other potential clients in South Africa, at an affordable price.”

Picture of user and cell phone



# Aim

- To integrate weather data with expert agricultural knowledge
- Reach 125.000 small holder farmers
  - 10% increase income
  - 10% decrease in input resources
- Provide sophisticated Apps to Commercial farmers (as an income stream for sustainability)
- Scale-up into southern Africa





# Mobile usage

## Current:

- South Africa is well in the lead with 133%. That means that the majority of people have more than one mobile phone. Smartphone penetration, on the other hand, is only at 47%.

<http://www.htxt.co.za/2014/10/23/south-africas-mobile-penetration-is-133/>

- By comparison, 81,9% of South African households used only cellular phones.
- Households in historically rural provinces such as Mpumalanga (90,6%) and Limpopo (92,6%) were very reliant on the more accessible cellular telephones than landlines.

Stats SA 2013

## In 3 years time?"



# Mobile usage cont.

## In 3 years time?"

- By the end of 2014, it is forecast that there will be more than **635m** mobile subscriptions in sub-Saharan Africa. This is predicted to rise, to about **930m** by late 2019, when it is estimated that three in four mobile subscriptions will be internet inclusive.
- The sub-Saharan African countries with the most mobile subscriptions are Nigeria, **South Africa**, Kenya, the Democratic Republic of the Congo and Ghana.  
<http://www.theguardian.com/world/2014/jun/05/internet-use-mobile-phones-africa-predicted-increase-20-fold>
- This relates to 31,7% in 5 years and approximately 19% in 3 years



# R4A's Approach (Geodata - Mobile Devices)

- Space Technology & Mobile Devices
  - GPS, Satellite maps etc. makes it possible to integrate these into Apps
- Why:
  - Mobile usage in SA is on the rise
  - Modern Technology & Communication are available to integrate
    - Earth Observations
    - Other GEOdata (satellite, point data, maps, GPS, agriculture, social, etc.)



# Apps

- Umlindi Watch (in development)
- Plant date
- Irrigation
- Spraying
- Disease forecast for wine industry (final testing with 10 farmers)
- MyRain Gauge - Crowd sourcing (App developed – adjust to SHF)



# MyRain Gauge

The MyRain Gauge App, once acquired can assist in taking rainfall readings at any point

- Easy to use
- Off-the-shelf rain gauge
- Auto updates data on databank
- Used to accumulate credits from SHF
- Auto-validates data with neighboring readings



# Umlindi Watch App

The screenshot shows the main menu of the Umlindi Watch app. The title bar is green with the text "Umlindi Watch" and a hamburger menu icon on the left. Below the title bar is a blue header with the word "Reports". A list of report categories follows: "Rainfall" with a cloud icon, "Precipitation Index", "Water Balance" with a water drop icon, "Soil Moisture" with a hand holding a plant icon, and "Fire Watch" with a flame icon. Below this is a "Settings" section with a gear icon and a toggle switch for "My Location" which is currently turned "ON". At the bottom, there are logos for the Department of Agriculture, Forestry and Fisheries, the South African Weather Service, and the Agricultural Meteorological Service of South Africa (AMESD).

This screenshot displays the "Rainfall" section of the app. The title bar is green with "Umlindi Watch" and "Rainfall". Below the title bar is a blue header with the word "Rainfall". The main content area shows a map of South Africa for the month of "October 2015". To the left of the map is a color-coded legend for rainfall amounts in millimeters: > 300 (dark blue), 200 - 300 (blue), 150 - 200 (light blue), 100 - 150 (green), 75 - 100 (yellow-green), 50 - 75 (yellow), 25 - 50 (orange), 10 - 25 (light orange), 5 - 10 (red), and 0 - 5 (dark red). The map shows that most of South Africa received between 5 and 25 mm of rainfall in October 2015. Navigation arrows are visible above the map, and zoom in (+) and zoom out (-) icons are on the right. Logos for the Department of Agriculture, Forestry and Fisheries, the South African Weather Service, and AMESD are at the bottom.

This screenshot shows a detailed view of the "Rainfall" section for "Gauteng - Pretoria". The title bar is green with "Umlindi Watch" and "Rainfall". Below the title bar is a blue header with the word "Rainfall". The main content area features a line graph titled "Rainfall Jan-15 - Oct-15". The x-axis represents time from January 15 to October 15, 2015, with markers every two weeks. The y-axis represents rainfall in millimeters, ranging from 0 to 30. The graph shows a fluctuating trend: starting at approximately 25 mm in Jan 15, dropping to 20 mm in Feb 15, reaching a low of 10 mm in Mar 15, rising to 25 mm in Apr 15, dropping to 10 mm in May 15, reaching a low of 5 mm in Jun 15, rising to 20 mm in Jul 15, and ending at 25 mm in Oct 15. Logos for the Department of Agriculture, Forestry and Fisheries, the South African Weather Service, and AMESD are at the bottom.

# Uniqueness



Packaged product



Crowd Sourcing

Data:

Rain + Social+ Yield +  
SHF-finance + Resource  
usage



= Credit Voucher for SHF



updated info



AgriAssist App



Agriculture:	Bank / Insurance:	Social:
AgriAssist-App	Secure invest	Forms baseline
	Monitor farmer	measure 10% Impact
	Mitigate risk	

# Sustainability Business

## Sophisticated Apps – e.g.

(User subscription)

- Disease report (already tested)
- Irrigation scheduling
- Sowing Assist
- Spraying Assist

## Public good app – e.g.

(Government subsidised / financed)

- Umlindi Drought Monitor
- Extension-Assist App?
- Etc.



**Thank You**

