Climate-SMART agriculture – the future of agriculture in southern Africa

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Context



- Emerging challenges in the Agri-sector
- Opportunities
- □ CLIMATE SMART Agriculture as the desired

Technology intervention

□ Examples

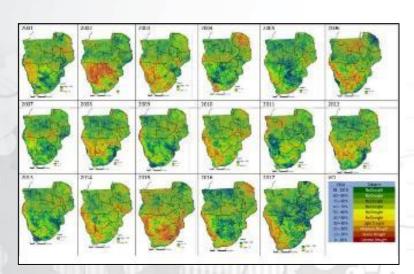


Emerging challenges in the Agri-sector



Climate change and variability leading to increased frequency of

extreme events e.g. droughts



December Legend

Value	Category		
90 - 100 %	No Drought		
80 – 90 %	No Drought		
70 – 80 %	No Drought		
60 – 70 %	No Drought		
50 - 60 %	No Drought		
40 - 50 %	No Drought		
30 - 40 %	Light Drought		
20 - 30 %	Moderate Drought		
10 - 20 %	Severe Drought		
0-10 %	Extreme Drought		

- Drought severity –December: 2001-2017

 Variable impact on the vegetated landscape



The 2015/16 El Niño event brought the worst drought since 1904

2016/02/15



PRETORIA NEWS







2016/02/04

AVE: 13315.39 (ZAR)



LOW PS INT. The insufficient water reason see that to the about tell burger stores and dringlet are entired in the

December driest in 15 years

DOUBLE WHAMMY: EL NINO. PLUS GLOBAL WARMING

-+ CSIR orientists paint ghastly picture year in Africa - ever.

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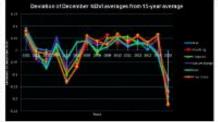
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current drought in South Africa Free State and North West provinces as

drought in South Airtox. The index shows a 15-year average of registion greeness for the North West, Gusting, Free State, Limpopo, Meanustrage and Reviews News pro-

The CSLR's State of the art sorth obsert that there was up to a 60 percent doors notion becomes given event the extent one in negitation greensess in Decem-and severity of the current drought in the 2015 in some period the Proc State. six of the nine provinces, showing the and North West, regions, Cho.

SA was severely affected by an ETNIthe most affected by the nurrent incorrespondent father salfor 2015 and (hough). beginning of 2016. This has placed a "December 2015 has been recorded strade on water supplies and agricultaas the datest December to South Alice of production in the country. This co-in 15 years, "said CBIR remote sensing ones often the CSIR's principle researappendixt. Dr. Moses Cho. Cho has used der, Prof. Fronce is Rage beechte mati-renate sensing technologies that reveal on of severe temperature increases late. an index of regulation greensess to inci-one the estern and magnitude of the tropical Mirlos have meen by more than being the global rate over the last five debetween 4 = 6 °C and 3 = 5 °C over the subtropics and tropics respectively b the end of this century are projected, in others, rescaling that there has been a. Icount to the present day climate under severe decrease to way belong recoons. Toy intogeton. Engilthreth's warning December 2010 was talor ned by downsomed regions. The smellin imagery derived shows and global climate models.



Deviation of December NOVI oversper

Satellite images of SA point to severity of drought

TONY CARNIE

SATELLITE images from the US space agency and measurements of vegetation "greenness" in South Affrica have confirmed the severity of one of the worst droughts in sev-

By analysing satellite images from Nasa - in combination with data on the level of chlorophyll in

few months. In some areas of KwaZulu-Nata

the Free State and North West, plant greenness has dropped by as much as 60% compared with average conditions over the past 15 years.

plants and grops - local scientists specialist at the CSIR in Protoria, have measured a severe decrease in said analysis of the chlorophyll greening "vegetation greenness" over levels in plants across the country large parts of the country in the past - showed that last December was the driest December in at least 15 years.

Chlorophyll is the green pagment in plants that is crucial to the process of photosynthesis, allowing plants to absorb sunlight and convert solar energy which is used to build starch

to make comparisons for the past 15 years or so because no suitable satellite imagery had been available before that for determining plant greenness levels.

The CSIR's vegetation preenness index revealed that the Free State and North West had been hardest hit by the drought. Cho said high Dr Moses Cho, a remote sensing and other food nutrients in the plant. chlorophyll levels in plants served as past five decades.

Cho said it had only been possible an indicator of the health and vigous of plants, and the relative greenness of the landscape could be calculated accurately because chlorophyll also absorbed the red and near-red light wavelengths from the sun.

AVE: 5816.68 (ZAR)

Dr François Engelbrecht, also at the CSIR, said recently that temper atures over Africa had risen by more

POTCHEESTROOM HERALD

2016/02/11

The extent and magnitude of the

AVE: 4104.17 (ZAR)

SATRILLETS images from the a ma modes meter to measure the

US space agricy Non and managements of vegetation one of the worst droughts in sensori decades.

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'Green meter scientist' maps drought severity

PRAJECT THIRST

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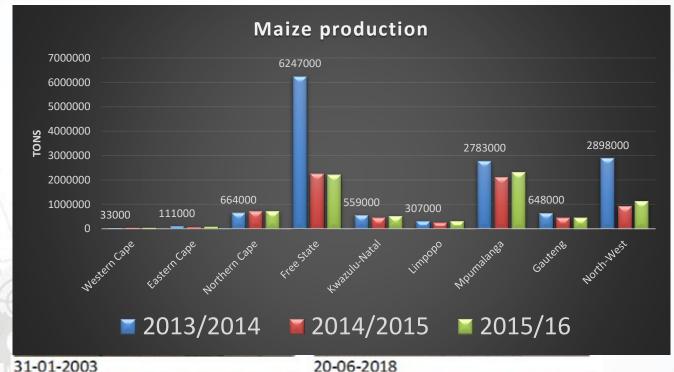
Impacts of climate variability on food production



 Decline in food production



Farm
 abandonment
 and bush
 encroachment











Opportunities

Karl Gotte

ANNIVERSARY

Innovative water-saving strategies

amid drought conditions



Standard Bank

By the Standard Bank of South Africa Ltd

inesses need to apply nditions persist. While realised the risks of an ongoing drought and are implementing water strategies into their planning, many have not yet adopted sufficient strategies, according to Standard Bank. South Africa has been severely affected by an El Niño effect drought in the latter half of 2015 and the beginning of 2016, which has placed strain on water supplies and agricultural production in the

Local and global crisis

"With weather patterns set to remain increasingly unpredictable, commercial businesses should adopt water efficiency. plans. While many have, for example. applied renewable solutions such as solar, purchased a generator or at least implemented energy efficiencies, both energy and water efficiency solutions need to be combined going forward," says Karl Götte, head of Standard Bank commercial. banking. He says only approximately 20% of companies are likely to have adequate plans in place for managing water

The World Economic Forum's (WEF) Global Risks 2015 report states that decision-makers will be forced to make tough choices regarding allocations of water in the future, and even though all of the risks are well known, governments and businesses often remain "woefully underprepared". Global water requirements. are projected to exceed sustainable water

supplies by 40% by 2030.

Götte says a basic usage plan should be the initial point of departure. Peaks: and troughs can then be tracked, and alternative solutions with regards to renewable sources of water can be used to prevent major productivity disruptions. According to him, it is possible to reduce demand from municipal water supplies by up to 50% if a plan is implemented properly.

Conservation guidelines

"As an example, Standard Bank's Rosebank building conserves water by using waterefficient fittings such as dual flush toilets. low-flow showerheads and tap arrators. For external use, high groundwater which infiltrates the basement is captured and in combination with rainwater harvested from the roofs - is used for irrigating the gardens. Combining energy-efficient but. water-inefficient evaporative cooling systems with air-cooled chiller systems. which are water-efficient, also saves a substantial amount of water. There is a lot of room to improve," he says.

Simply reducing levels of wastage can result in significant savings, and highly innovative solutions are already being found by companies willing to think strategically. For instance, China is the world's largest potato producer. However, as their population increases and more production takes place, strain was being placed on the water system of an already

"So innovations were applied across the industry, and among other solutions found, the water saved by using drip instead of

centre pivot irrigation have amounted to 40%," says Gotte.

"Multinationals such as PepsiCo noticed the danger signs and are taking significant action. As a result of their manufacturing process being water intensive and one of their raw materials, namely potatoes, comprising of 80% water, they have started capturing and recycling their own water to use in their operations"he says.

The road ahead

The Council for Scientific and Industrial. Research (CSR) in South Africa says. temperatures over central tropical Africa have risen by more than twice the global rate over the last five decades. Moreover. further warming of between 4 to 6 and 3 to 5°C over the subtropics and tropics respectively, are projected to occur by the end of this century. December 2015 has been recorded as the driest December in South Africa in 15 years.

These challenges also present an opportunity for entrepreneurs. "Similar to the establishment of the solar industry. there is a business case to diversify and create a new industry to provide more water-saving solutions." The knock-oneffects for businesses will be enormous if solutions are not found. "Businesses can close down if they don't have water," he says. According to Götte, companies need to work in pertnership with sector and commercial specialists to begin the process of change.

> Visit www.standardbank.co.za/ standardbank/Business for more

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Climate SMART Agriculture – A much needed Technology Intervention



The Big Question

- How do we sustain productivity and profitability amidst the climate challenge?
- Climate-SMART agriculture appears to be answer



Climate-SMART agriculture



As defined by the World Bank:

Climate-smart agriculture (CSA) is an integrated approach to managing landscapes — cropland, livestock, forests and fisheries - that address the interlinked challenges of food security and climate change.



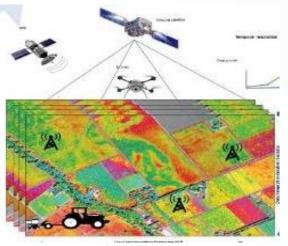
At the CSIR – We are crafting a precision agriculture system as part of the Climate-SMART agri system



- Precision agriculture
 - Observing
 - Measuring
 - Responding



Goal: to foster early detection of crop stress, weed & pest, and rapid response to optimise <u>yields</u>, <u>profits</u>
 while mitigating negative enviro. impacts



Level of actionable data from the PA system

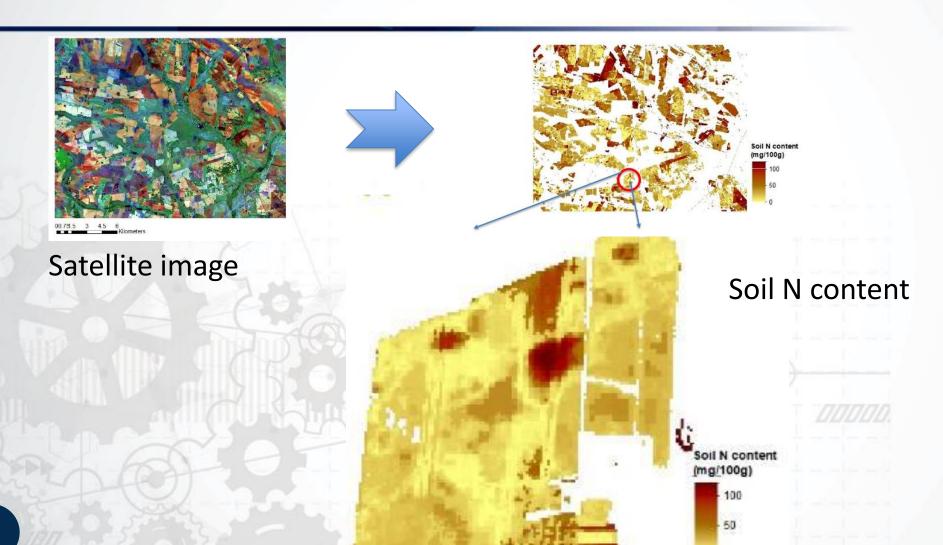


Levels of earth observation products (data) for precision agriculture.

Level 1	Level 2	Level 3	Level 4
 Processed satellite or drone data: Atmospherically corrected images Vegetation indices i.e. indicators of crop health. Regional vegetative drought severity levels Regional climate data (e.g. rainfall and temperature) 	 Soil and crop variables: Soil moisture and nutrient maps Growth stages Crop cover & biomass maps Crop nutrient (N) & water use maps Weed infestation maps Pest or disease detection Yield forecasts 	 Temporal and spatial anomaly detection: Soil moisture and nutrient stress levels Biomass growth deficiencies Crop nutrient & water use deficiencies Weed, pest infestation levels Performance benchmarking 	 Management recommendations: Planting e.g. timing and planting density Fertiliser application (time, place and rate) Irrigation application Disease, pest and weed management

The process





Climate-SMART agriculture would need several capabilities



1. Big data

- Skills in collection and archiving of large volumes of data
- -Drones and a network of field sensors
- Drone piloting skills
- -Climate modelling capabilities

2. Big data analytics

- Skills in algorithm development e.g. Al, machine and deep learning algorithms to uncover patterns, anomalies and trends

3. <u>Automation</u>

- Automated data processing platform to generate PA information (Table below) in near realtime
- Cloud computing infrastructure
- Coding (JAVA and Python) and software development

4. <u>Data Delivery</u> <u>systems –</u> IOT

- Platform to convey PA information to users e.g. Web delivery services
- desktop and mobile apps

5. <u>Data</u> <u>Commercialisation</u>

- Market assessment
- Business plan development
- Marketing

