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

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science & innovation
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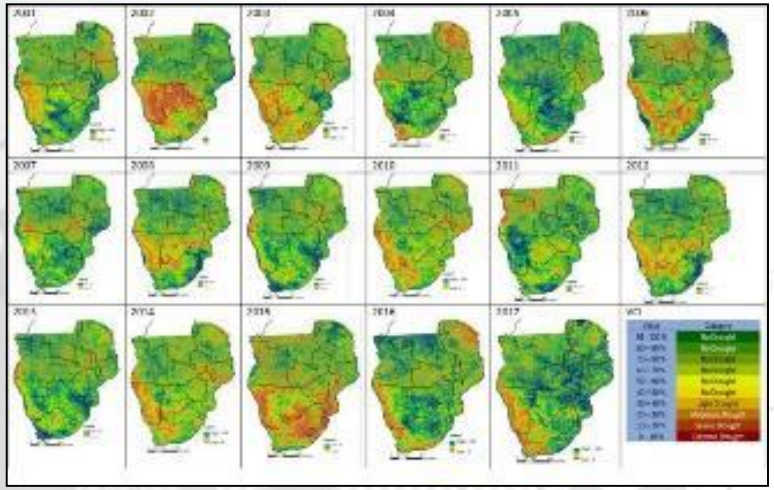
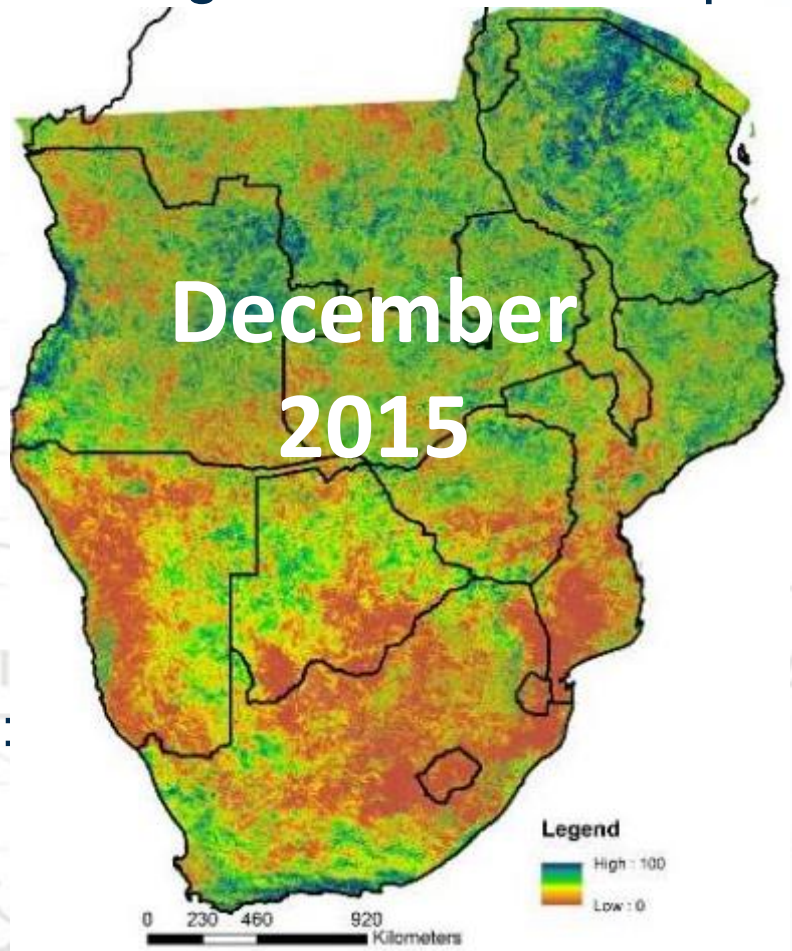
Context

- 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**





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

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

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THE CITIZEN 2016/02/04 Page: 10

AVE: 12315.39 (ZAR)

December driest in 15 years

DOUBLE WHAMMY: EL NINO, PLUS GLOBAL WARMING

CSIR scientists paint ghastly picture of possibly hottest year in Africa – ever.

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PRETORIA NEWS 2016/02/15 Page: 3

AVE: 5816.68 (ZAR)

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 Africa have confirmed the severity of one of the worst droughts in several decades.

By analysing satellite images from Nasa – in combination with data on the level of chlorophyll in plants and crops – local scientists have measured a severe decrease in average "vegetation greenness" over large parts of the country in the past few months.

In some areas of KwaZulu-Natal, the Free State and North West, plant greenness has dropped by as much as 60% compared with average conditions over the past 15 years.

Dr Moses Cho, a remote sensing specialist at the CSIR in Pretoria, said analysis of the chlorophyll levels in plants across the country showed that last December was the driest December in at least 15 years.

Chlorophyll is the green pigment 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 and other food nutrients in the plant.

Cho said it had only been possible 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 greenness index revealed that the Free State and North West had been hardest hit by the drought. Cho said high chlorophyll levels in plants served as an indicator of the health and vigour 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.

Dr Francois Engelbrecht, also at the CSIR, said recently that temperatures over Africa had risen by more than twice the global rate over the past five decades.

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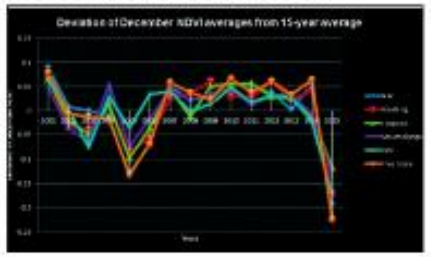
POTCHEFSTROOM HERALD 2016/02/11 Page: 11

AVE: 4104.17 (ZAR)

The extent and magnitude of the current drought in South Africa



Deviation of December NDVI averages.

'Green meter scientist' maps drought severity

PROJECT THIRST OUR WATER

75 YEAR ANNIVERSARY

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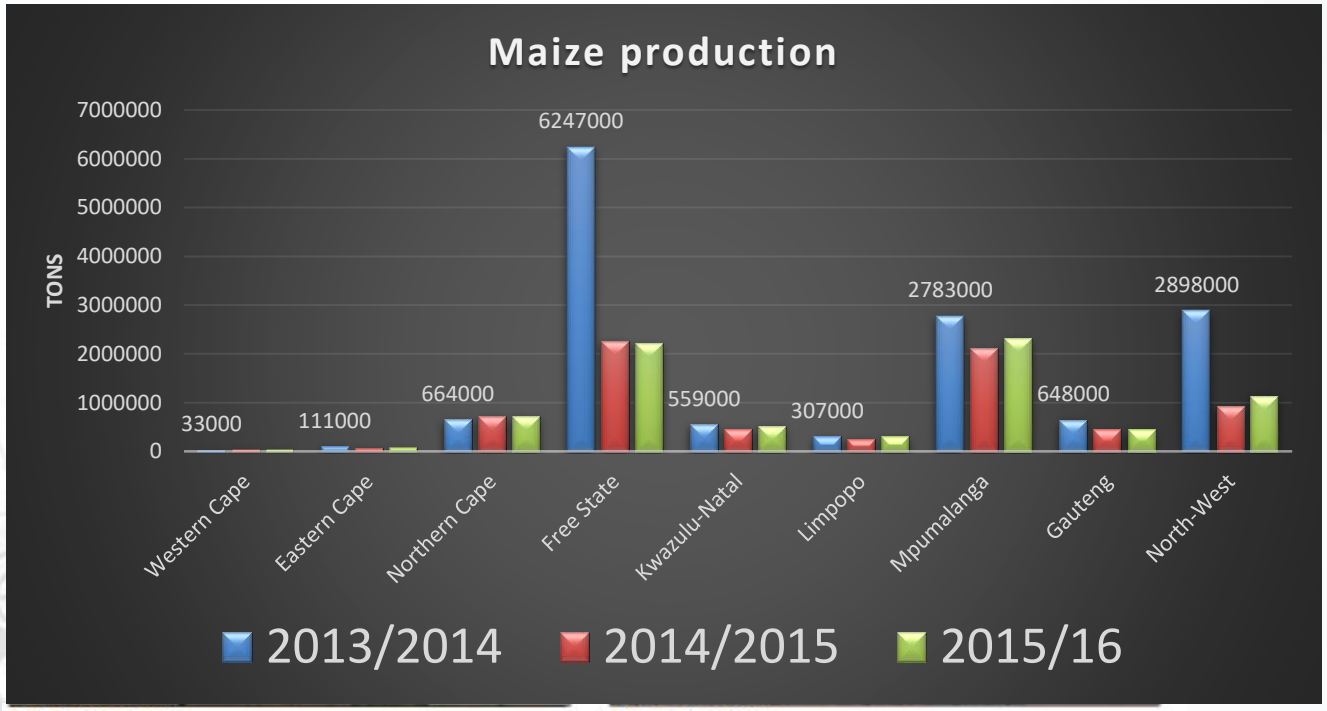
Impacts of climate variability on food production

- Decline in food production

- Farm abandonment and bush encroachment



Opportunities

Karl Gotte

Innovative water-saving strategies amid drought conditions

Standard Bank

By the Standard Bank of South Africa Ltd

Karl Götte

Businesses need to apply innovative water-saving strategies as drought conditions persist. While some companies have 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 country.

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 shortages.

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 water-efficient fittings such as dual-flush toilets, low-flow showerheads and tap aerators. 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 arid country.

"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 Götte.

"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 (CSIR) 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-on effects 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 partnership with sector and commercial specialists to begin the process of change.

Visit *www.standardbank.co.za/standardbank/Business* for more information.

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Climate SMART Agriculture – A much needed Technology Intervention

The Big Question

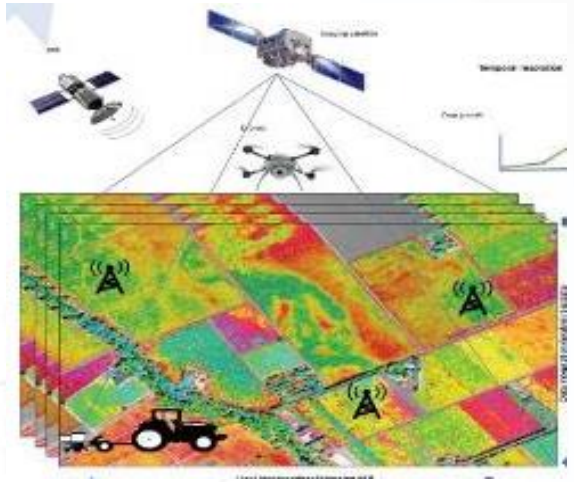
- How do we sustain productivity and profitability amidst the climate challenge?
- Climate-SMART agriculture appears to be answer

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

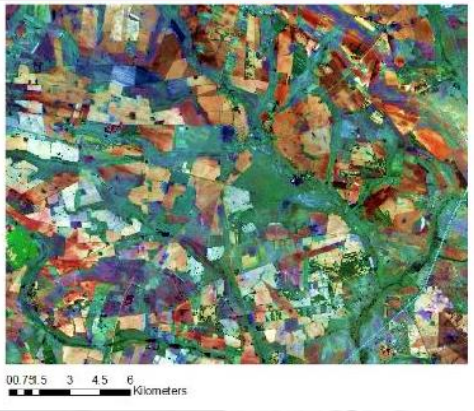
  To within field and between field differences in crop growth or rangeland condition
- Goal: to foster early detection of crop stress, weed & pest, and rapid response to optimise yields, profits while mitigating negative enviro. impacts

Level of actionable data from the PA system

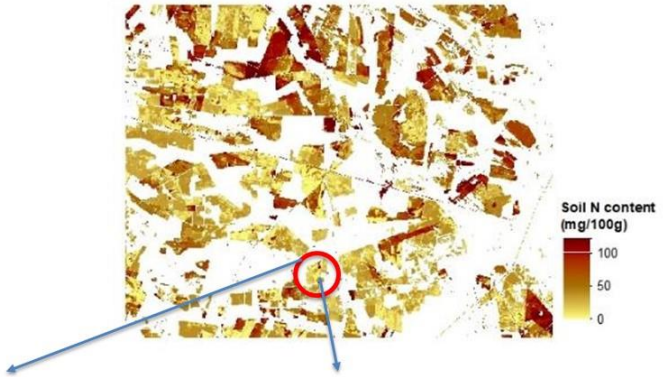
Levels of earth observation products (data) for precision agriculture.

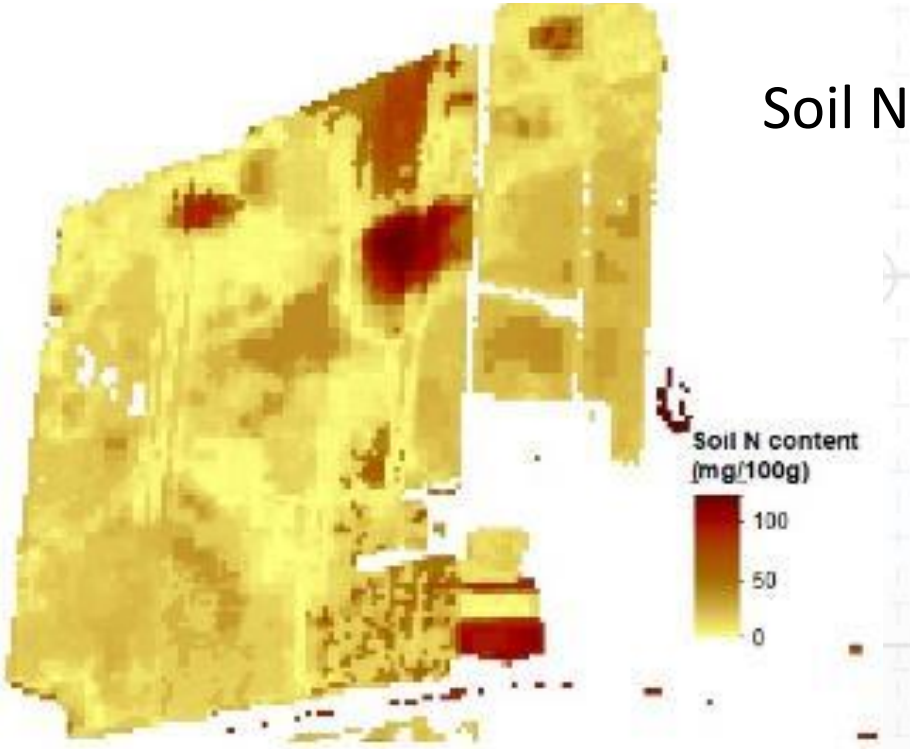
Level 1	Level 2	Level 3	Level 4
Processed satellite or drone data: • Atmospherically corrected images • Vegetation indices i.e. indicators of crop health. • Regional vegetative drought severity levels • Regional climate data (e.g. rainfall and temperature)	**Soil and crop variables:** • Soil moisture 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



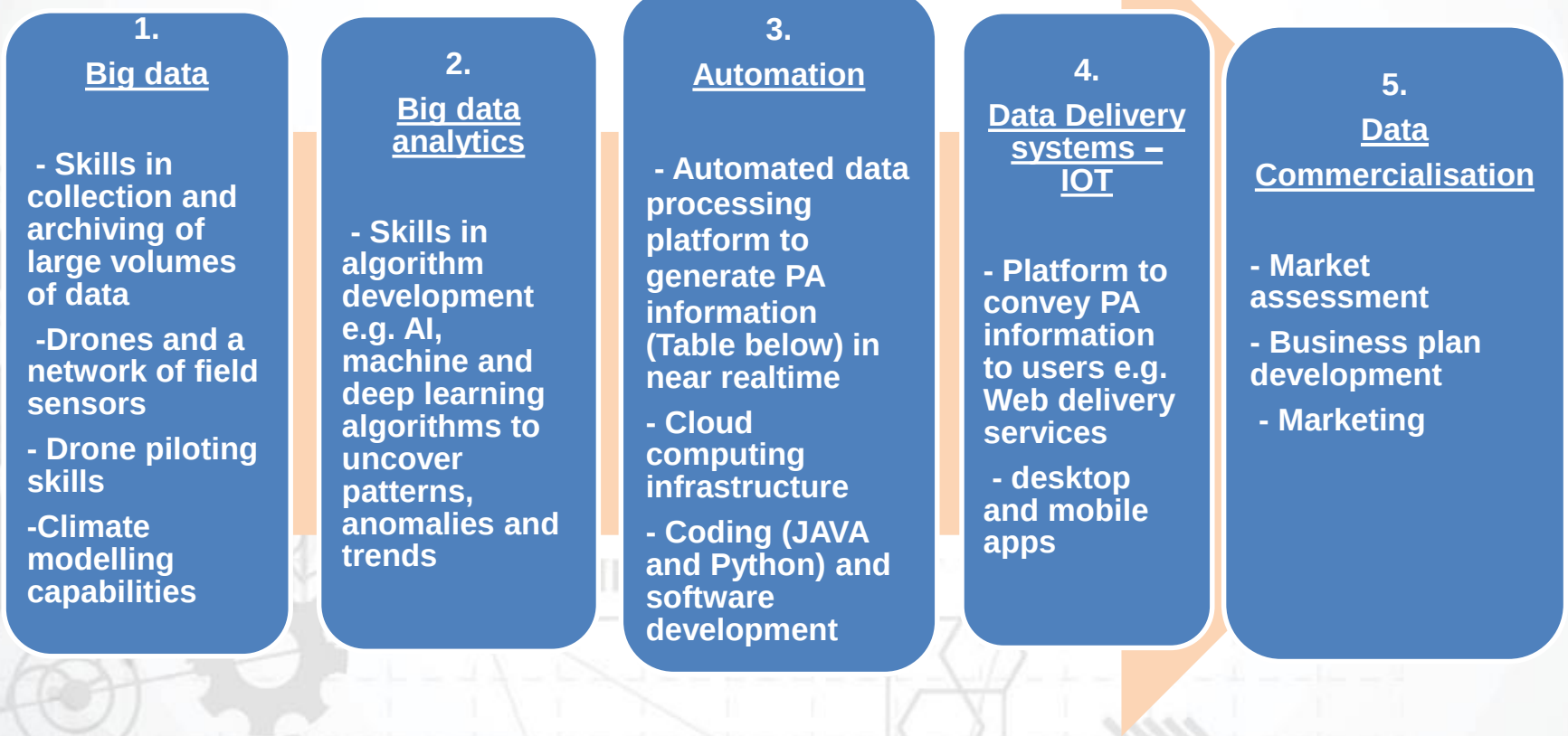
Satellite image





Soil N content

Climate-SMART agriculture would need several capabilities



Let’s act now to safeguard a more secured world for future generations.