Towards a more Integrated Agricultural Production monitoring in South Africa

JECAM - RESEARCH
Agricultural Research Council

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Two systems in South Africa

**PREMISE:**

\[ \text{YIELD} = \text{AREA PLANTED} \times \text{YIELD PER HECTARE} \]
SA - LARGELY GOOD FOR LARGE-SCALE

Aircraft

Statistical Geographic Sampling Frame

PICES Team

Satellite imagery
GAPS - Area planted for smallholder farmers

- SA population growing - BUT commercial Agric. sector NOT
- Food security becoming a challenge
- Area planted for smallholder farmers NOT known
- Climate variability - less frequent and more intense rain events, [increasing small farmers’ vulnerability]
- Smallholders provide bulk of food and economic activities in rural SA
- “Smallholder agriculture has been identified as the vehicle through which the goals of poverty reduction and rural development can be achieved.”
PICES- Gaps

- 1st understand the system, location of farms and spatial distribution, then, monitoring crops → YEILDS
- For small scale, PICES field boundary maps do not represent single fields. Rather, it delineates plots of lands where small scale farming activity is present which makes pre-locating crop samples difficult.
Research on Smallholders, 2016

- Collaboration with UCL and the Agricultural Research Council (ARC).
- Timmermans, Alice
- Romain van Baalen
- Zinhle Mashaba

Completed MScs

New studies 2018:
- Zinhle- (PhD –SAR/Sent-1 data on maize yields)
- Wonga - (PhD-insurance products)
- [Siphokazi] – MSc-Assessing the ability of Sentinel-2 Multispectral Instrument (MSI) to estimate soybean grain yields

CIRAD Collaboration
- Audrey Jovilot  Researcher CIRAD Mapping small fields

RESEARCH THEME:
The adequateness of Sentinel products to map smallholder parcels (area under production, improve predictions of yields, ID mixed cropping issues)
Findings: 1\textsuperscript{st} Smallholder farm typology

- Three main different types:
  - small scale subsistence farmers
  - Small scale collective farmers and
  - Small scale commercial
Results- Small scale commercial farming

- Small scale commercial- more productive compared to the other two categories
- Fields are far bigger & more homogeneous compared to the other two categories
- Represent a mere 10% of the total farmers on study area
Findings - issues on area

- Mapping of smallholder fields remains challenging:
  - The term ‘smallholder’ isn’t rigorously defined
  - The small size of the fields
  - High degree of heterogeneity within these fields, and lack of clarity in field boundaries make it challenging to differentiate between cultivated areas, abandoned fields, and natural vegetation
Yields predictions

- Flowering storage: best period to make yield predictions for maize
- Accuracy around 55%
- Within 10 days of emergence date [good for cropping calendar]
Results Yields

• The 55% accuracy for maize grain yield prediction can be improved using a combination of satellite indices and meteorological data (1-2tomes/ha)
  – (planting density & days, weeds, fertilizers issues)

• The grain filling stage is the most important stage of maize because excess rainfall or wet day during this stage can severely deteriorate the yield quality of maize

• The best predictions using NDVI and SAVI

• Wheat (flowering stage) is the best

• Prediction around 75-85% accurate (0.4 tones/ha)

• Planting date reliable within 10 days
Mixed cropping still A CHALLENGE: Varying diversities censed for the maize crop type class. Crop association with maize and soybean. Low density maize with groundnuts.
Special Focus Small scale commercial farming

- Farming benefits from a well developed road infrastructure and proximity to more developed markets
- Dedicated infrastructure to clean and store goods
- Land typically belongs to a landowner
Conclusions

• While the results presented during phase 1 aren’t conclusive for evaluating the general performance of Sen2Agri for mapping smallholders systems on a larger scale, they set a baseline for future studies.
• Emergence date is close enough, within 10 days
• Yields 55-82% reliability -a little bit more research is require
• Mixed cropping is still a challenge
• Small farmer sizes remain another challenge
PLAN 2019

- Extend Sent 2/JECAM work throughout SA (different climatic zones)
- Improve yield modelling
- More work on mixed cropping systems
Thank you