STARS — Project Overview

High-level Meeting AgriSense-STARS project in Uganda

Kampala, September 3rd, 2015

Rolf A. de By
Project synopsis

Spatial information is revolutionizing agriculture in high-income countries but not in low-income countries. Here, important adoption barriers exist: heterogeneity.

**STARS**: coordinated effort to

- learn,
- identify opportunities, constraints & risks,
- test hypotheses

around potential **exploitation of high-resolution RS technology in production systems and livelihoods of smallholders.**
Project facts

- Five partners: ITC, University of Maryland, ICRISAT, CIMMYT, CSIRO
- 26 months = 1 or 2 crop seasons per region
- Supported by DigitalGlobe & RapidEye data & knowledge contracts
- Started June 1, 2014 will run to July 31, 2016
- Various subgrants/-contracts: Uni Sokoine, ESIPPS, ...
- Links with other initiatives:
  Cereal Systems for South Asia (CSISA),
  Drylands Systems CGIAR Research Program,
  VitalSigns,
  African Soil Information Service,
  International Potato Center (CIP),
  National Food Security Department Tanzania
Objectives

• Better understand why RS has not been taken up for SHA, and which investments are required to unlock potential.

• Demand-driven experimental use cases where currently poor information is the norm, and where RS-based workflows can help improve.

• Match private sector partners (satellite data/spatial analysis) with public sector actors and public good objectives.
Main hypotheses

We think we can

• *monitor crop growth* within the small farms of sub-Saharan Africa and Southern Asia, *using time-series remote sensing*.

If achievable, this will

• allow *improved outlooks for crop yields* throughout the season, *informing policy-makers*, and
• ensure more effective evidence-based advisory services at the farm scale, *informing farmers and agro-business*.
Three facets

Stakeholder: information products that inform & transform agricultural processes

Business: sustainable models of realization

Technology: ground-based, airborne, and spaceborne monitoring throughout the crop season
Challenges

Heterogeneity in

• Crops and crop varieties
• Crop systems
• Soils and nutrient content
• Climatic conditions
• Farm field practices and consistency
  – Farm field boundaries
  – Tillage and planting system
  – Rain-fed vs irrigated fields
  – Use of fertilizers
  – Use of mechanization
High dimensionality of problem space
Compared to high-income ag

- Smallholder farming in Africa/Asia is a data-poor context; there are many facets of the production systems that we do not know.
- Tanzania 2008 maize bumper crop
- Much ground truthing required

- Build an infoconomy with the farmer as active partner?
Where we work

Stakeholder approaches:
bottom-up
top-down
mid-level
STARS Data collection

Satellite data

DigitalGlobe
- Biweekly, WorldView-2 & -3
- 8-spectral band, 2m resolution

RapidEye/Blackbridge
- Biweekly, 5-spectral band, 5m resolution

Challenges
- Cloud cover
- Off-nadir angle
- Pre-processing
- Analytical processing
- (Licenses)

WorldView-2 image of the Mali study site, growing season May-November 2014
STARS Data collection

**UAV data**

*eBee*

- GR+NIR 12 Mp Canon camera, 3.5cm resolution (5cm vertical)
- GRRe+NIR 4-band 1.2Mp multiSPEC camera, 10cm resolution

*Geo X-8000 Octocopter*

- Tetracam miniMCA 5/6-band 1.3Mp, 10cm resolution
- RGB Sony NEX-7 24 MP, 2cm resolution
- OPTRIS PI 400 thermal camera, 1.1 Mp, 15 cm resolution

**Challenges**

- Hw robustness, stitching, calibration
• The amazing proposition by UMD in STARS for East Africa
UNIVERSITY OF TWENTE.

DR. IR. R.A. (ROLF) DE BY
Associate Professor
Department of Geo-Information Processing
Faculty of Geo-Information Science and Earth Observation

P  +31(0)53 4874 553  E  r.a.deby@utwente.nl
M  +31(0)6  4604 2254  I  www.utwente.nl/en
F  +31(0)53 4874 335  I  www.itc.nl

P.O. Box 217
7500 AE Enschede
The Netherlands

Building ITC
Hengelosestraat 99
7514 AE Enschede
Public good outcomes

• Landscaping study — CSIRO & partners
  Aim to understand
  – the decision-making environment for key stakeholders
  – the pathways for agricultural development that are likely to emerge
  – the nature of the infrastructure systems needed for delivering the right information to the right stakeholders at the right time.

• Crop Spectrotemporal Signature Library
  – Spectral info for crops followed over time
  – Accompanying farm field data

• Image analysis algorithm repository
  – Data ingestion workflows
  – Analytical workflows
Soil conditions

Dry soil

Wet soil
Plant health
Species determination

Spectral reflectance values of select leaves

- Pine
- Juniper
- Dead leaf
Crop Spectrotemporal Signature Library

UAV/Formosat-2 crop spectral profile,
MSc thesis Caroline Gevaert (EOS/ITC)
Lund University, 2014