Sentinel-2: WFP Use Cases

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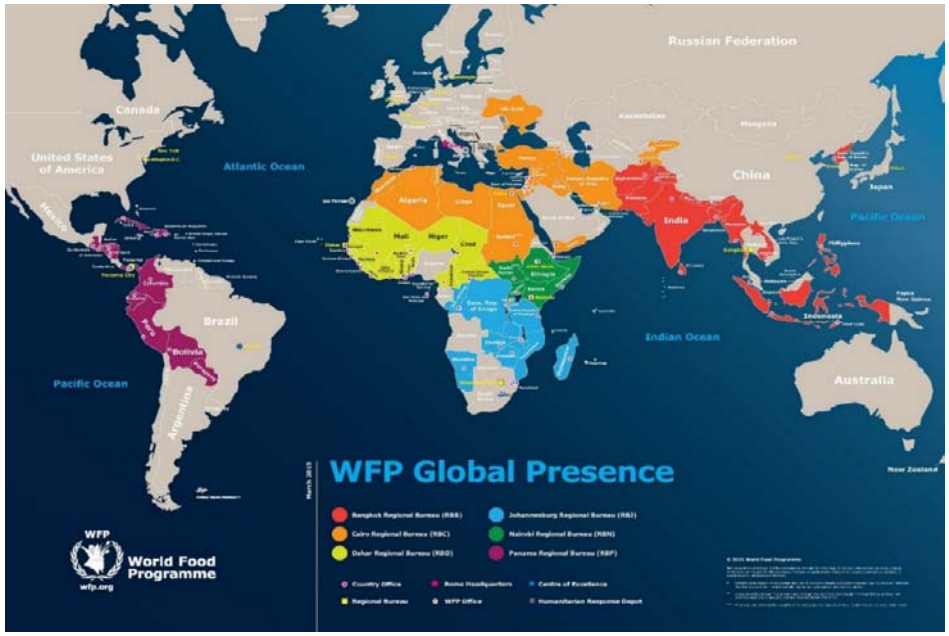
Sentinel-2 WFP Use Cases

WFP Overview

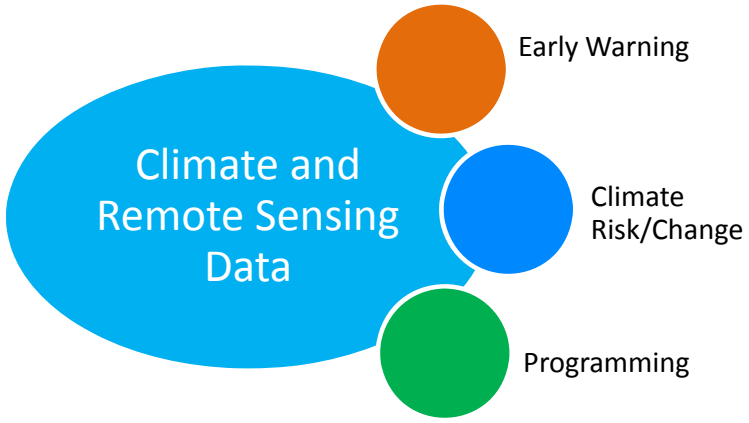
The **World Food Programme** provides humanitarian assistance in 80 countries:

75 million beneficiaries (2013)

5.1m MT requirements (USD5.7bn)



Earth Observation Data is in current use at the Analysis and Trends (VAM) and Emergency Services



Most usage has been focused on medium-low resolution data, but finer resolution data is a growing area of work

Sentinel-2 opens new areas of analysis and presents significant challenges

What is Sentinel-2 and What is Special About it?

Sentinel-2: a land monitoring two satellite constellation providing high resolution high frequency optical imagery. 20 year availability.

Global coverage of the Earth's land surface every 5 days.

State-of-the-art MSI (Multispectral Imager) instrument, providing high resolution optical imagery. All data are for free to everyone.

- Two identical satellites
- 10m spatial resolution
- 13 spectral channels
- 5 day Global coverage
- Data is free and open

Sentinel-2 for Hot Spot Analysis

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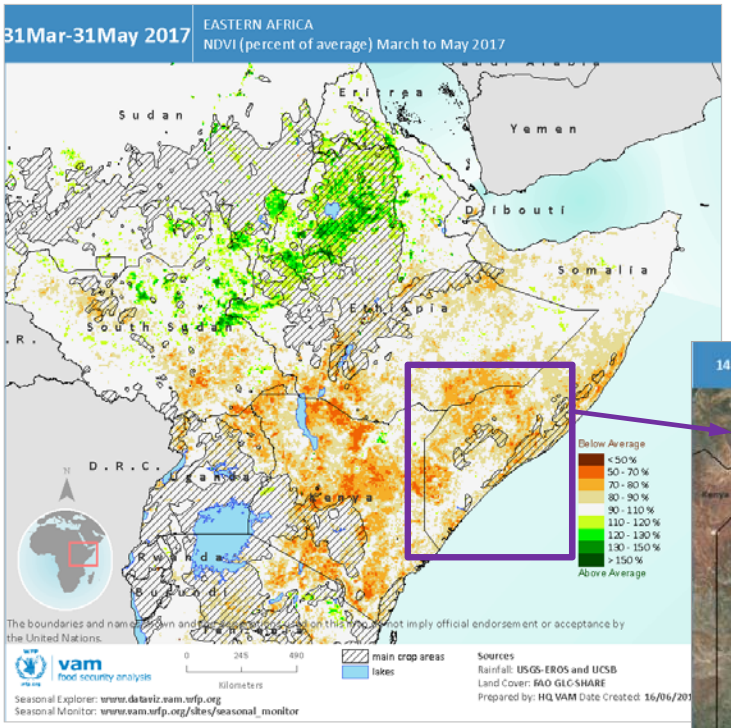
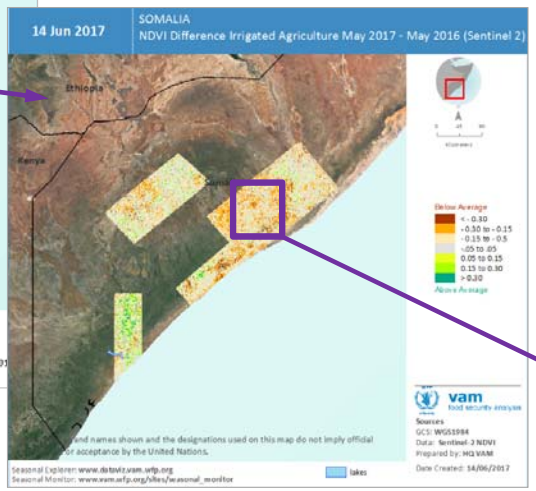
Sentinel-2 WFP Use Cases

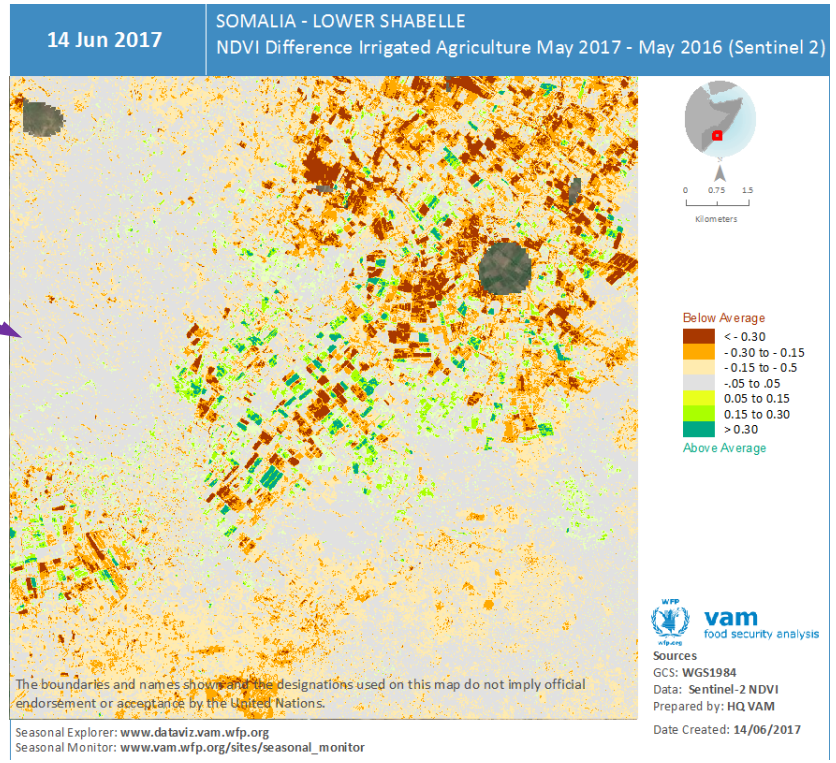
Hot Spot Analysis





Regional Scale:

Diagnostics and Identification



Zoom in AOI, identify scale of problem, nature of area affected

Crop Type Mapping Experiments:
Karamoja (Eastern Uganda), South Sudan

Crop Type Mapping in Challenging Humanitarian Terrain

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Cropland / Crop Type Mapping in Food Insecure

WFP Motivation and Interest

Major interest is in crop type (and status) mapping in food insecure regions, in particular those with restricted or difficult access.

South Sudan, NE Nigeria, Somalia, Syria

Other countries where deficient agricultural statistics systems deliver poor quality or no information.

Results can clarify major information gaps faced by FAO-WFP CFSAMs, basis for humanitarian intervention plans.

Other applications are concerned with land cover changes associated with some classes of WFP interventions:

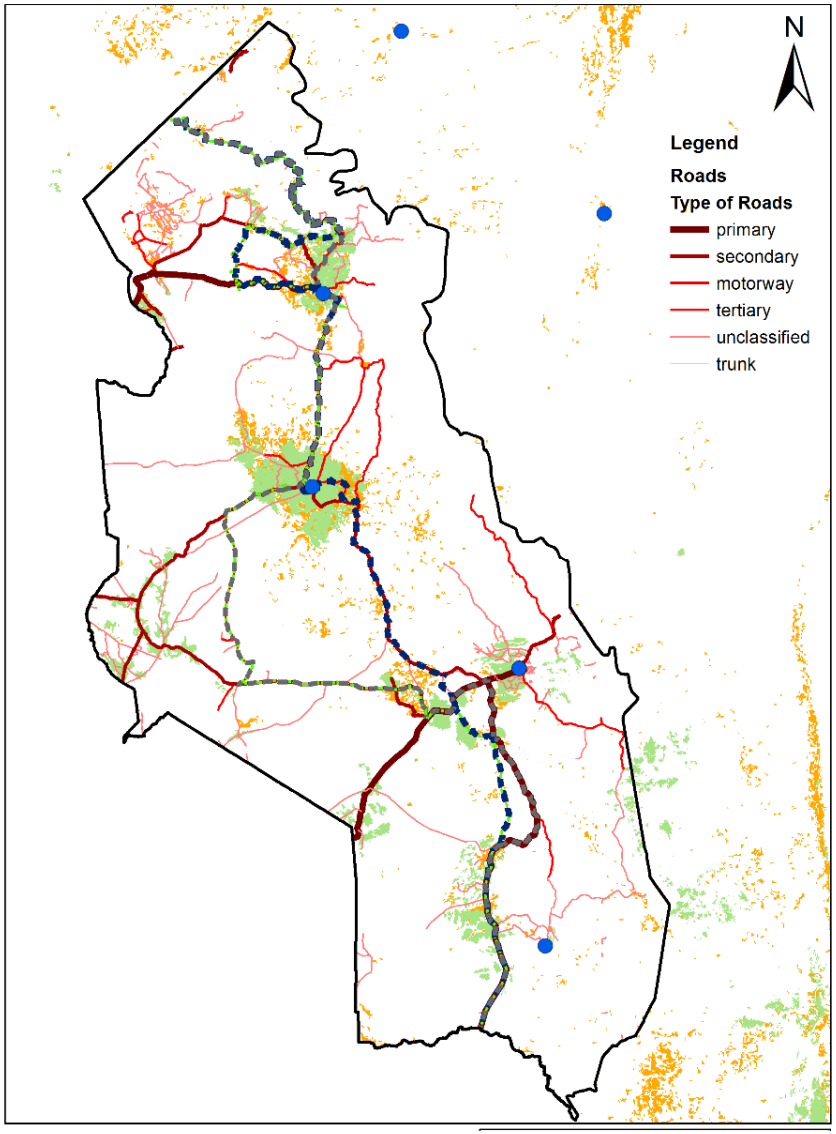
FFA – building of community assets: dams, roads, soil conservation, afforestation.

AIMS pilot project under planned expansion to WFP scale.

Improvements in Weather index insurance, sp NDVI based livestock insurance schemes.

Hot spot analysis of early warning patterns

Karamoja Sentinel-2 Experiment



Karamoja: First Testing Ground

Dedicated Team: WFP CO+HQ and UC Louvain

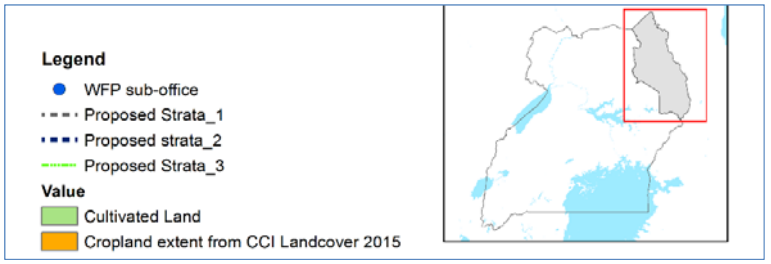
Smartphone data collection tool development and testing

Assessment of CO support capacity

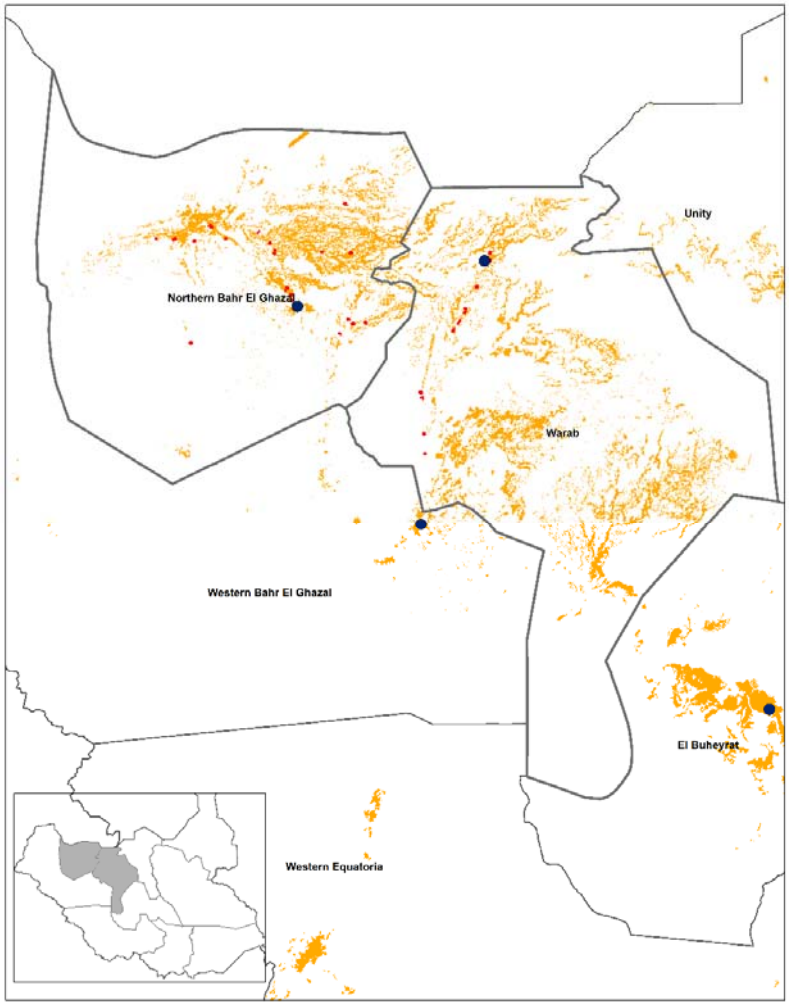
Significant crop variety, 5-6 main types, strong variability in crop development stage.

Large expansion in crop area in past 10 years, increasing commercial farming

Moderate logistical challenges, no security issues



South Sudan Sentinel-2 Experiment



South Sudan: North Bahr-el-Ghazal and Warrap

Integrate Data Collection in existing FAO-GoSS regular field assessments, adding WFP support.

Significant movement challenges, including security clearances and no-go areas, two vehicle travel.

Heavy WFP presence, 13 sub-offices.

Poor mobile coverage.

Sorghum and groundnut dominance, uniform crop cycle

Changes in crop area: groundnut expansion. Elsewhere strong conflict impacts (land abandonment)

General Approach

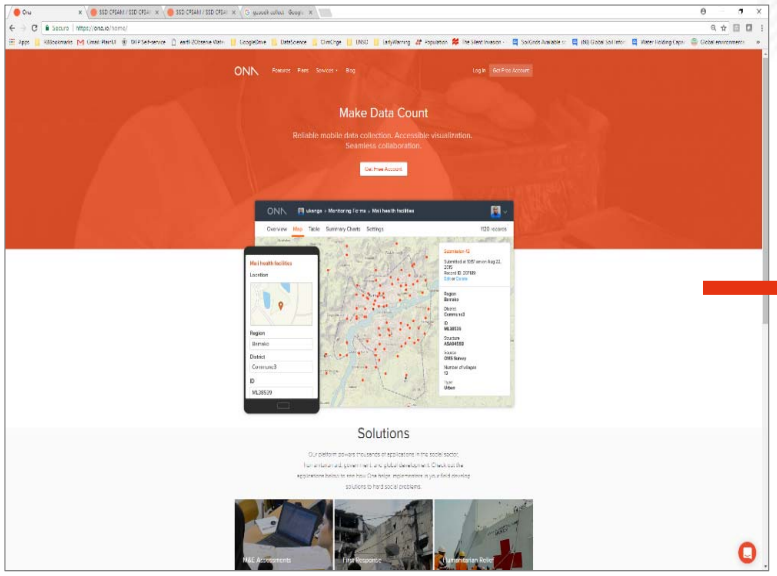
GeoODK Collect

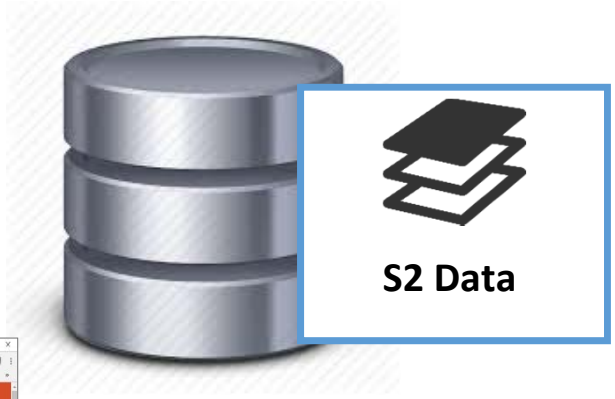
Field Data Collection

Low cost sub-EUR90 smartphones

ONA Platform

Assimilation, Quality Control, Conversion





Sen2Agri at EODC

Field data uploaded and assimilated to EODC for integration with S2 imagery

Field Work Practicalities

Crop type data collected using JECAM compatible guidelines complemented by Univ Catholique Louvain Geomatics in the context of the Sen2Agri project.

Basic minimum information set required:

- **ID**
- **Crop / No Crop**
- **Crop Type**
- **Crop/LC Class**
- **Irrigation**

30-50 samples per strata and crop type.

Non cropland data also needs to be collected, whether in field or by photo-interpretation.

Two tools developed: Field and Transect.

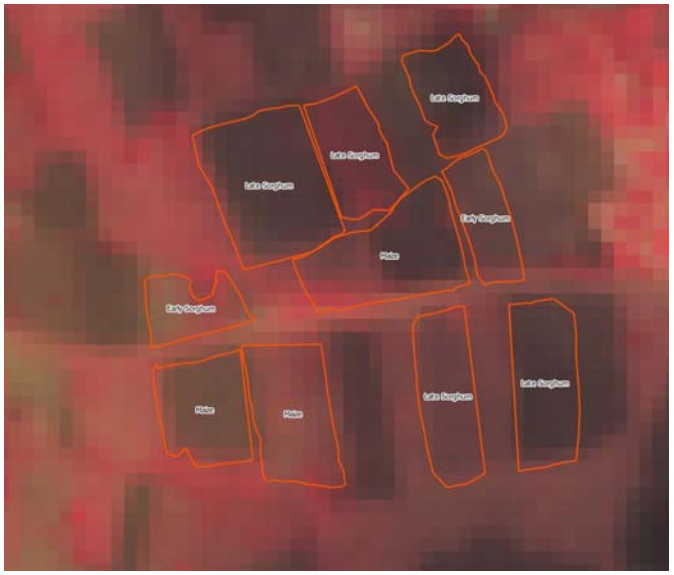
- **Field** – capture of crop field perimeter outline or in-field point location (for large fields)
- **Transect** – large fields along roadside

Additional data collected to ease interpretation and quality control:

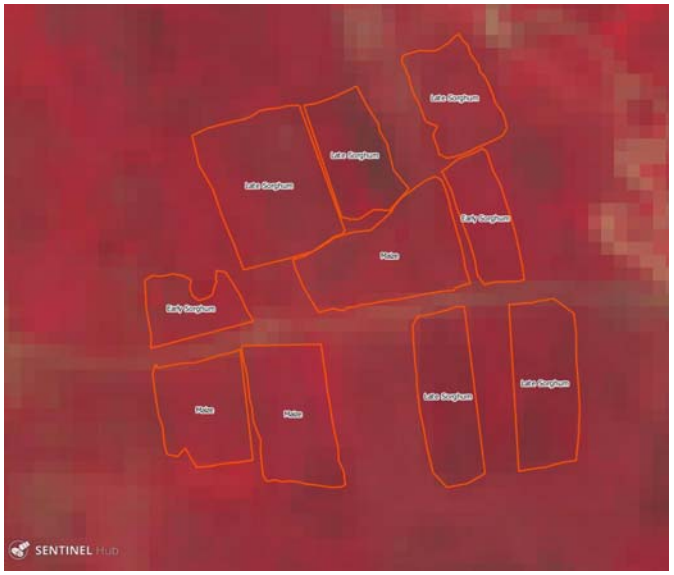
- **Development stage**
- **Crop planted previous season**
- **Planting and Harvest date**
- **Free comments (crop status, flood, weeds, trees)**

Karamoja Sentinel-2 Experiment

Field samples in Karamoja (Google Earth).



Field samples in Karamoja S2 early May 2017



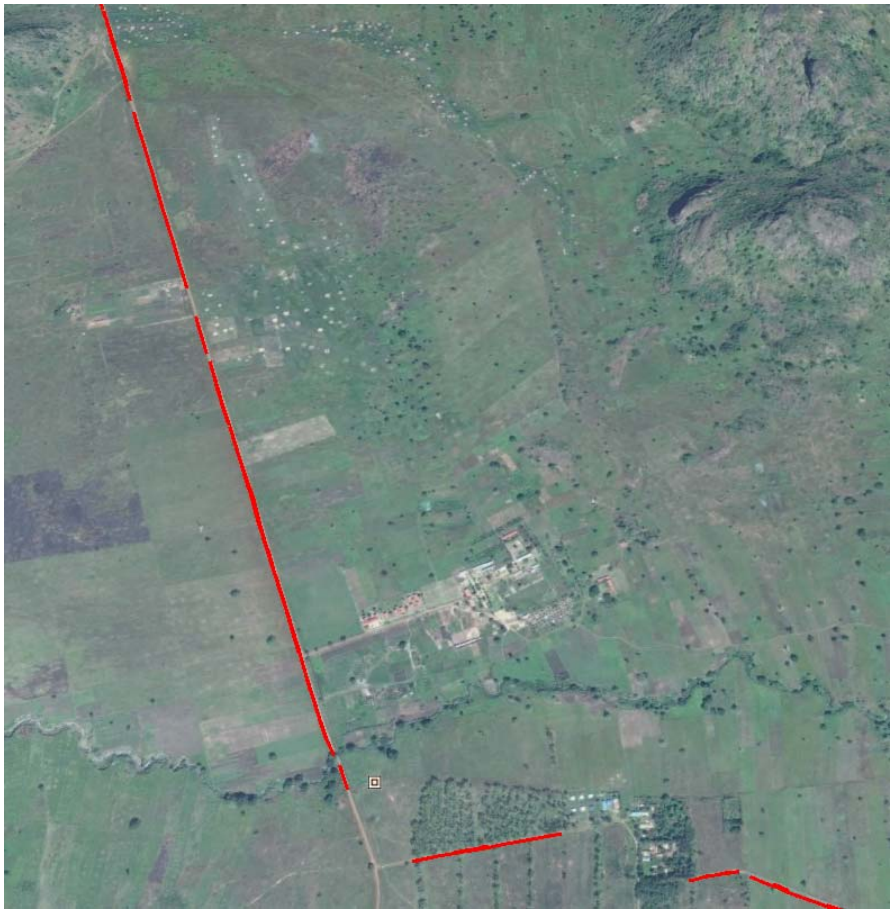
Field samples in Karamoja S2 early July 2017

Karamoja Sentinel-2 Experiment

Transect samples in Karamoja (Google Earth).

Large roadside uniform fields allow capture from moving vehicle

Very fast, lots of samples, but…



… back in the office, digitize the field as seen on S2 or GEarth

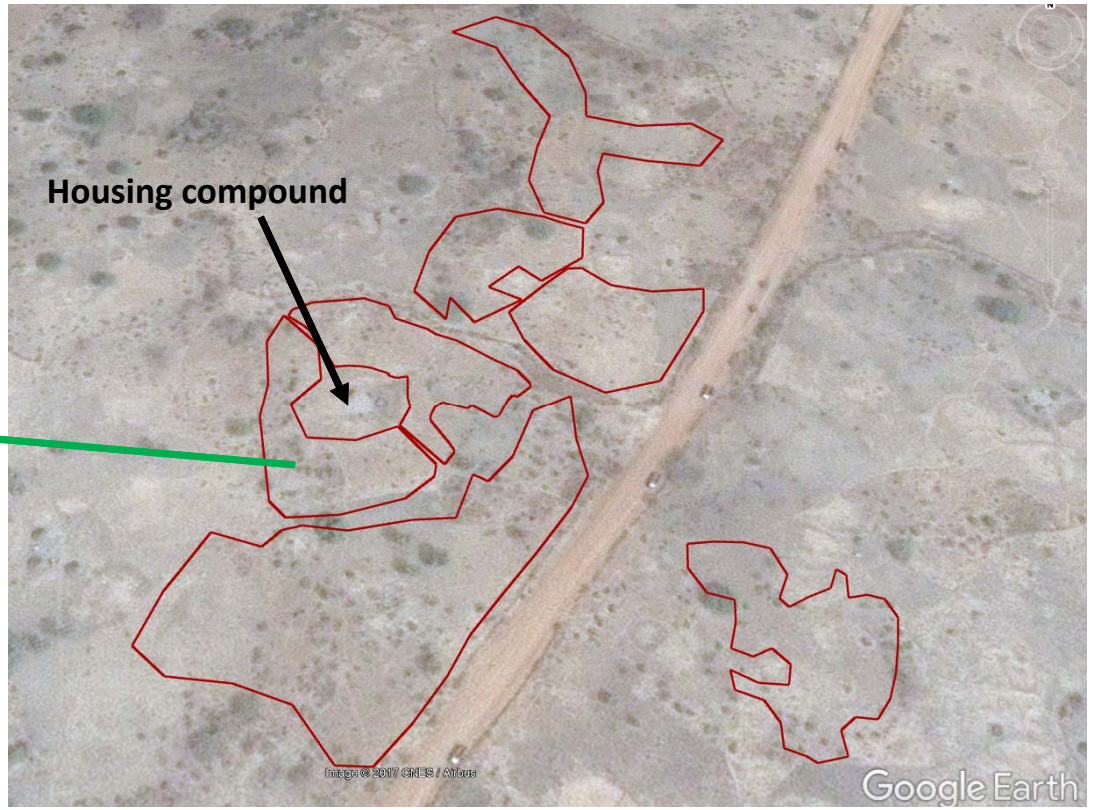
South Sudan Sentinel-2 Experiment

No transect samples in South Sudan, polygon or partial-polygon only.

Few large roadside fields.

Field	Value
FID	148
Shape	Polygon
RESP_id	20094238
SurveyDate	26/09/2017
Pic	n/a
crop	1
irrigation	2
CrpSyst	1
CT_main	42
CODE	Groundnut
_Dvlp_st_L	N/A
_yesno	1
_PlntngD	30
_PlntngM	6
_HrvstDy	30
_HrvstMn	9
_Comment	Good groundnuts farm

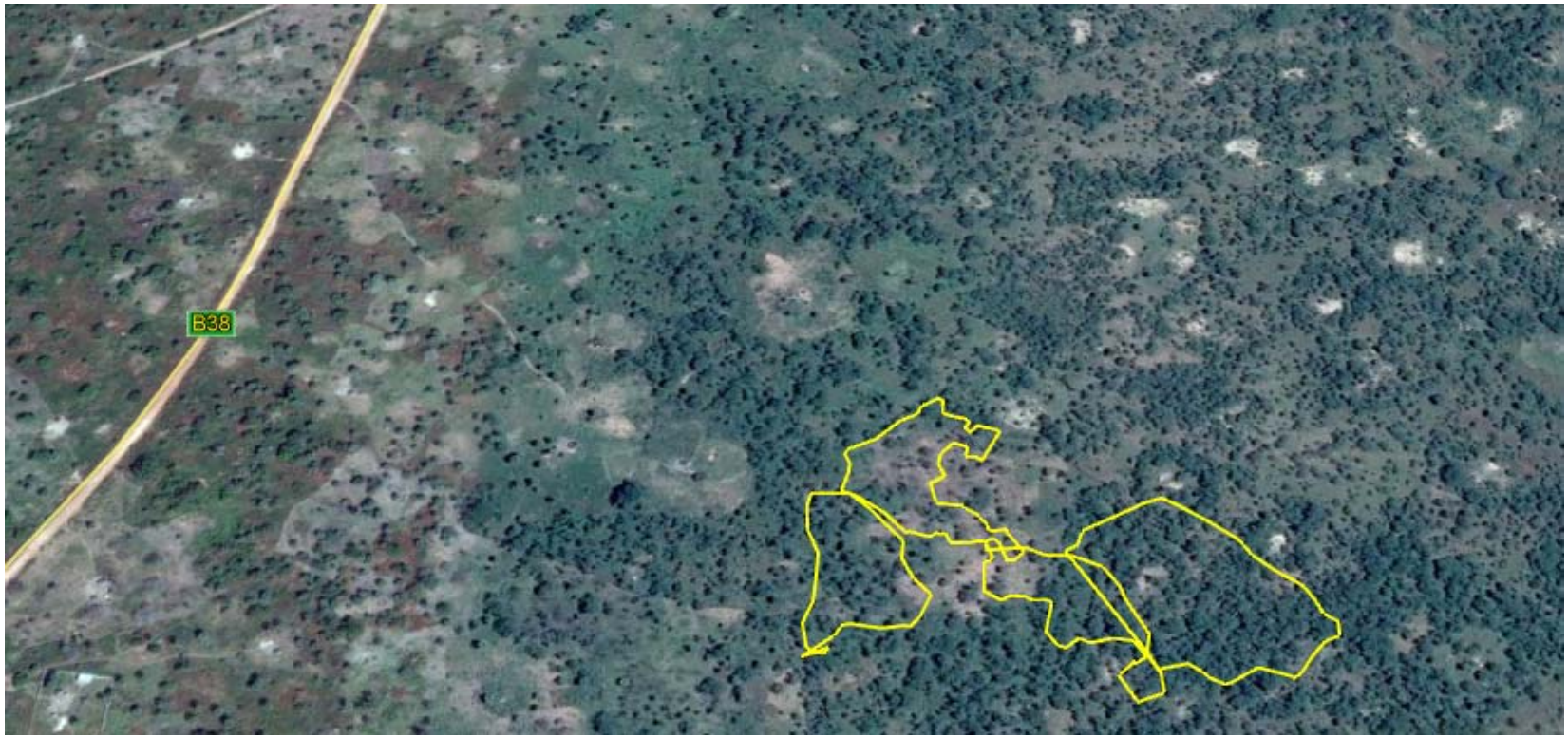
Identified 1 feature



Groundnut farms. Marial Bai, Warrap State

South Sudan Sentinel-2 Experiment

Recent changes in land cover from agricultural expansion



Groundnut farms samples – still under bush/forest in Google Earth images.

Kuajok, Warrap State

Karamoja Field Results:

883 total crop samples of which 644 transects

148 non-crop samples, of which 134 transects

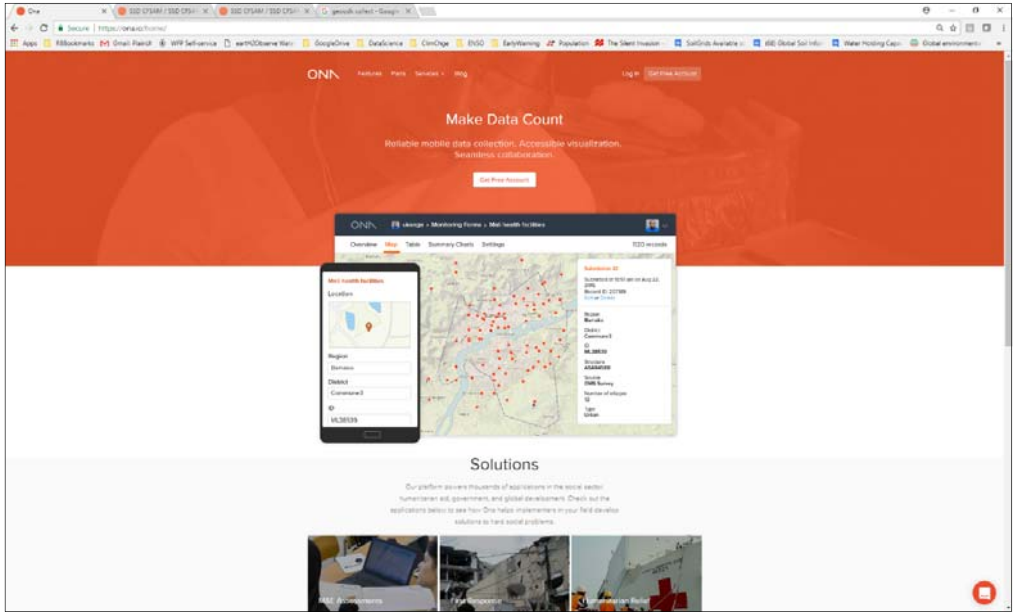
63% sorghum, 20% maize, 7% all others (sunflower, groundnut and beans)

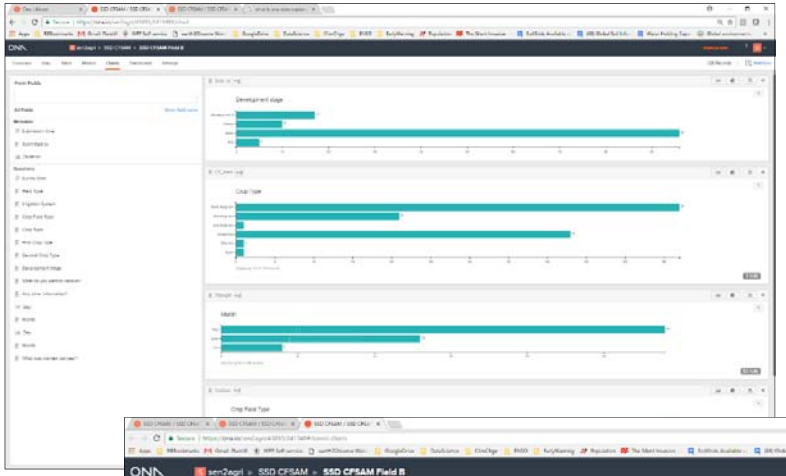
South Sudan (NBeG, WS) Field Results:

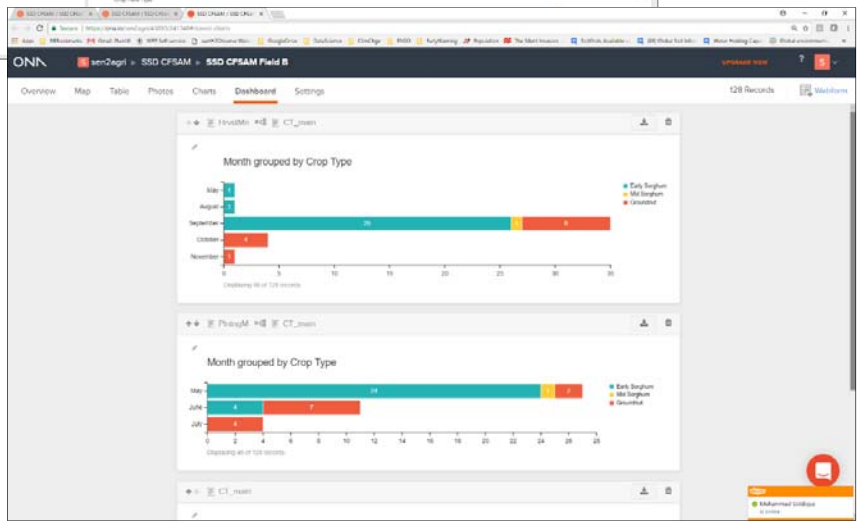
270 total crop samples of which 116 partial polygons

72% sorghum, 22% groundnut, 6% all others (maize, rice and sesame)

WFP Sentinel-2 Experiment







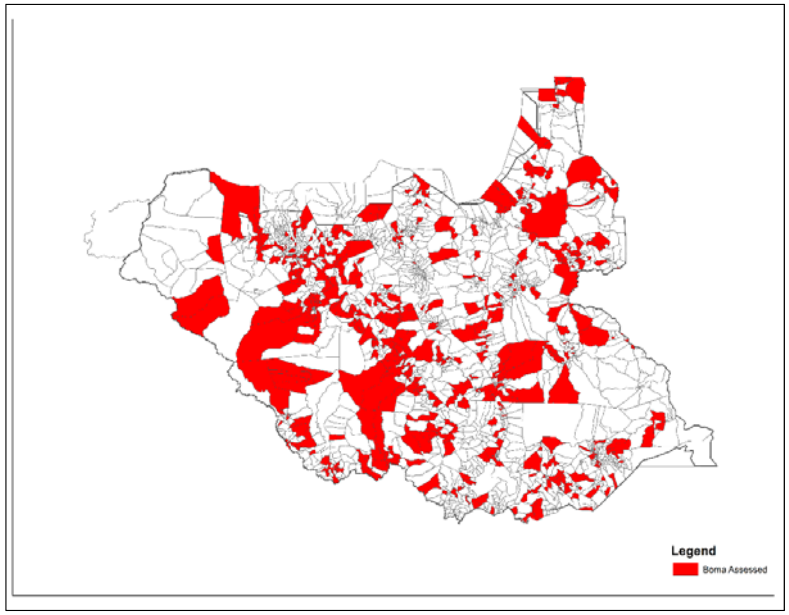
ONA platform for field data management, quality control, query and conversion to shape files and other outputs.

South Sudan Sentinel-2 Experiment

South Sudan Plan:

3 FAO-GoSS Teams trained, 9 smartphones.

Field missions will continue until December – plan is to continue data collection throughout.



Integration of crop type data collection in WFP teams collecting household data across the country in mid November (FSNMS).

400+ villages visited, data collection to take place as households are interviewed.

Potential to capture several hundred samples

Relevant Operational Questions

Crop Type Mapping in Challenging Humanitarian Terrain

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South Sudan Sentinel-2 Experiment

Treating no-access areas

Will data collected in areas with similar crop type variety, practices and climate be usable in non-sampled areas?

Will data from a previous season be usable in a following season?

Other Requirements

Extent of army worm infestation of maize crop

Abandoned agricultural land due to conflict and insecurity

Usage of S1 data

Help in discrimination of crop types?

Identification of surface changes post-harvest

With Thanks:

WFP Uganda Country Office, Kotido and Nakapiripit Sub-Offices

WFP South Sudan Country Office, Aweil and Wunrok Sub-Offices

FAO South Sudan Office

South Sudan Ministry of Agriculture

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