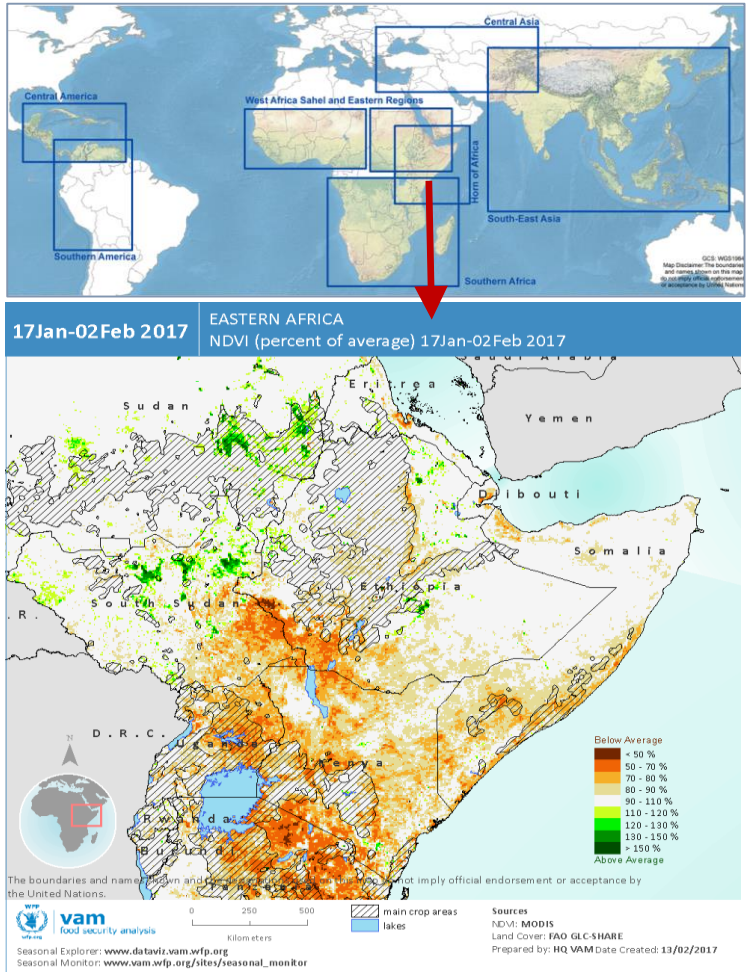
Eye in the Sky

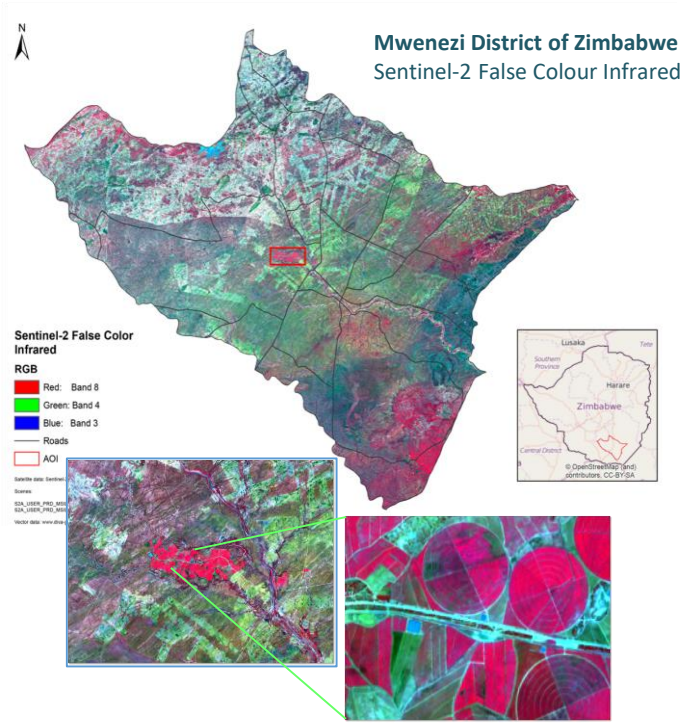
Why is VAM using satellite imagery?

EO in WFP – Resolutions/Scales

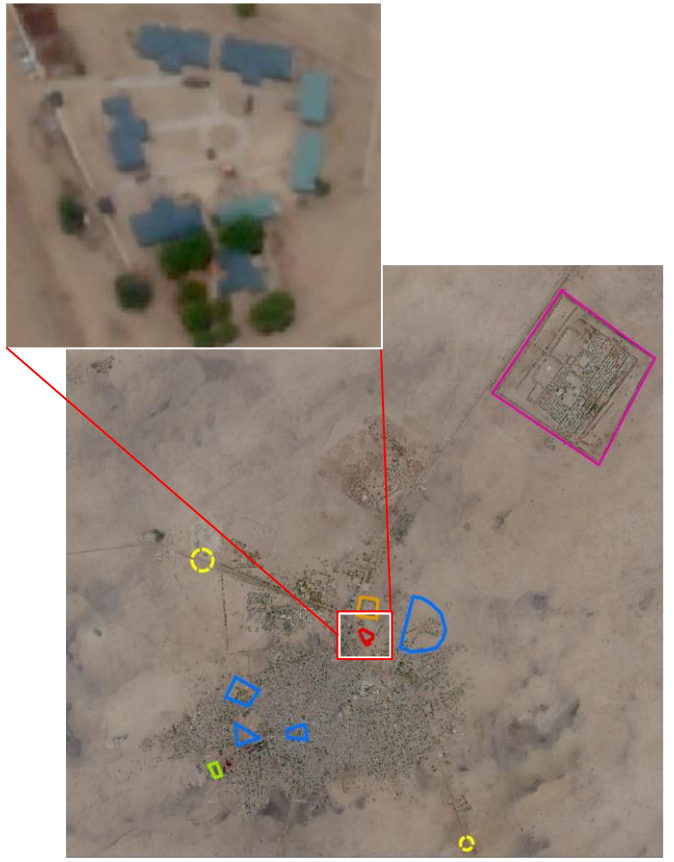
LOW RESOLUTION GLOBAL MONITORING



HIGH RESOLUTION AGRO-MONITORING, FLOODS, HOT SPOTS, LAND COVER



VERY HIGH RESOLUTION CAMPS, ASSETS MONITORING



EO in WFP – Sources

EO in WFP – Main Applications

1 - Seasonal Monitoring

2 - Climate and Vegetation TS Analysis

3 - EO Supports to Project Phases

4 - Mapping Population Displacement with VHR images

5 - Asset Impact Monitoring System

6 - Cropland/Crop Type Mapping in Food Insecure Areas

WHY?

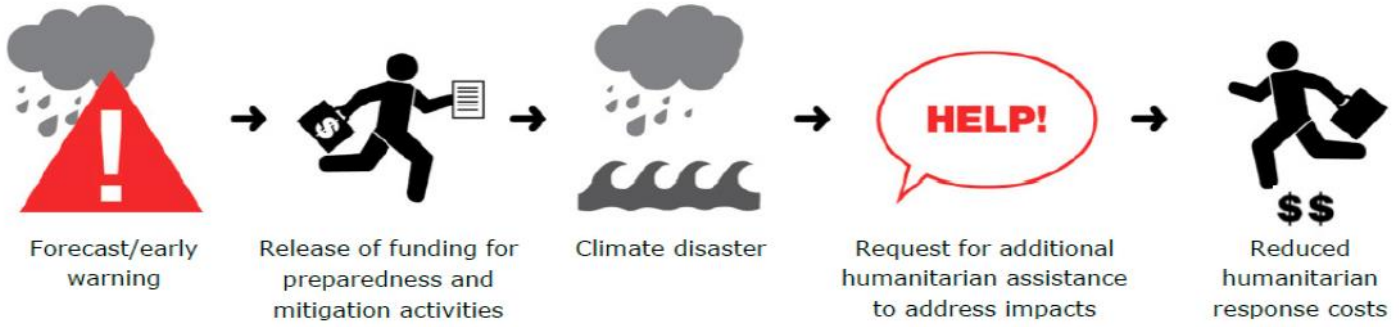
1 - Seasonal Monitoring

WHY?

Climate shocks are a **major driver** of food insecurity in the world and cause the majority of WFP beneficiaries

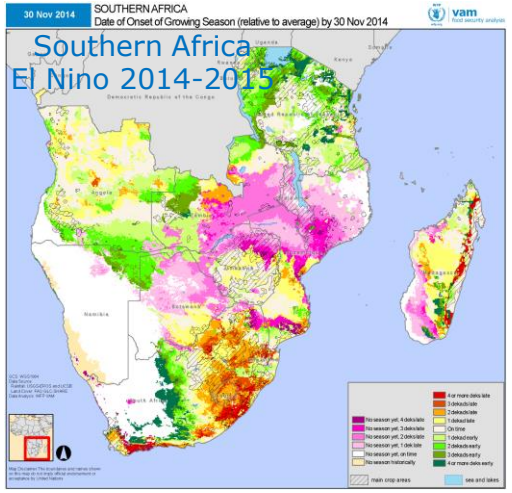
- 50% of WFP operations responding to climate causes
- 80% of the food insecure live in disaster exposed areas
- 20% of malnutrition cases have drought as their root cause

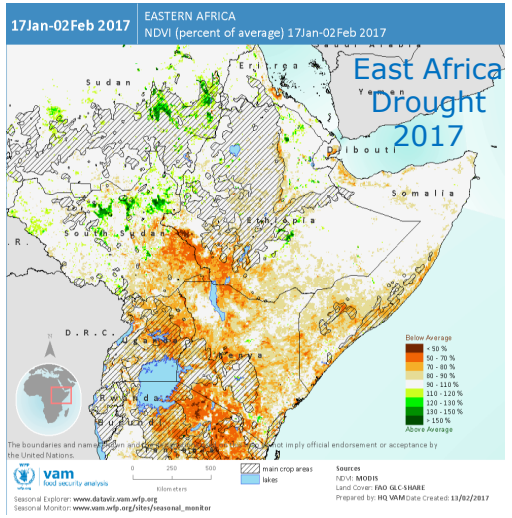
Preparedness and **early response** to a disaster and the building of people's **resilience** **save** both **lives** and **money**

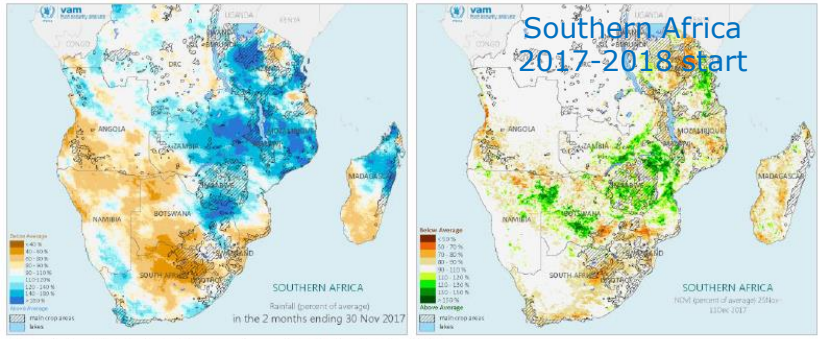


1 - Seasonal Monitoring / Seasonal Explorer

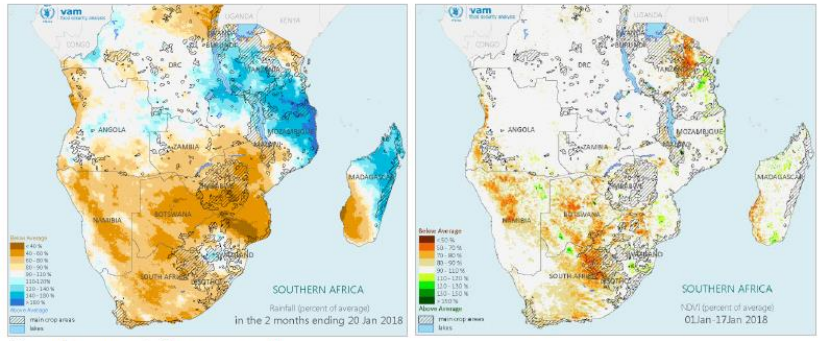
Tracking Growing Season Conditions Across WFP Regions







October – November: Dryness from Angola to South Africa



December onwards: Dryness spreads

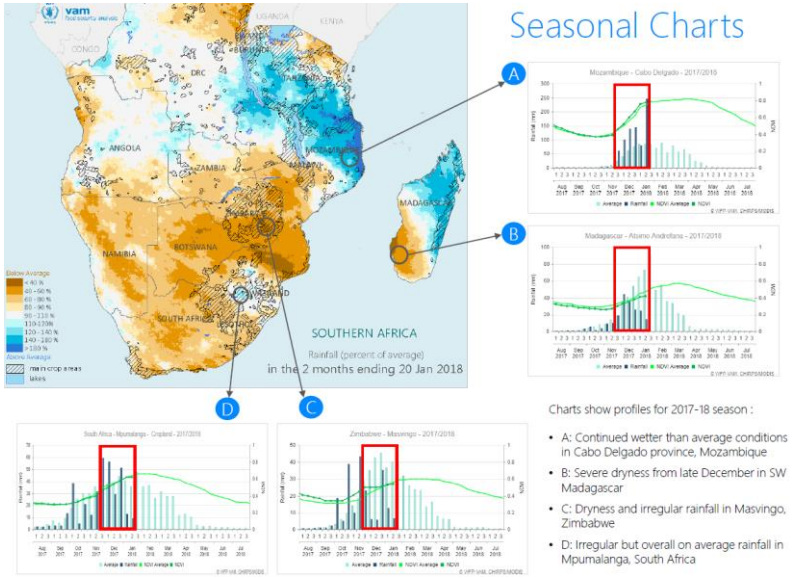
Planned for 2018:

- Air Temperature
- LST
- Moisture Index

About 20 products/10 days are produced…

…supporting the seasonal monitoring

Here just few examples

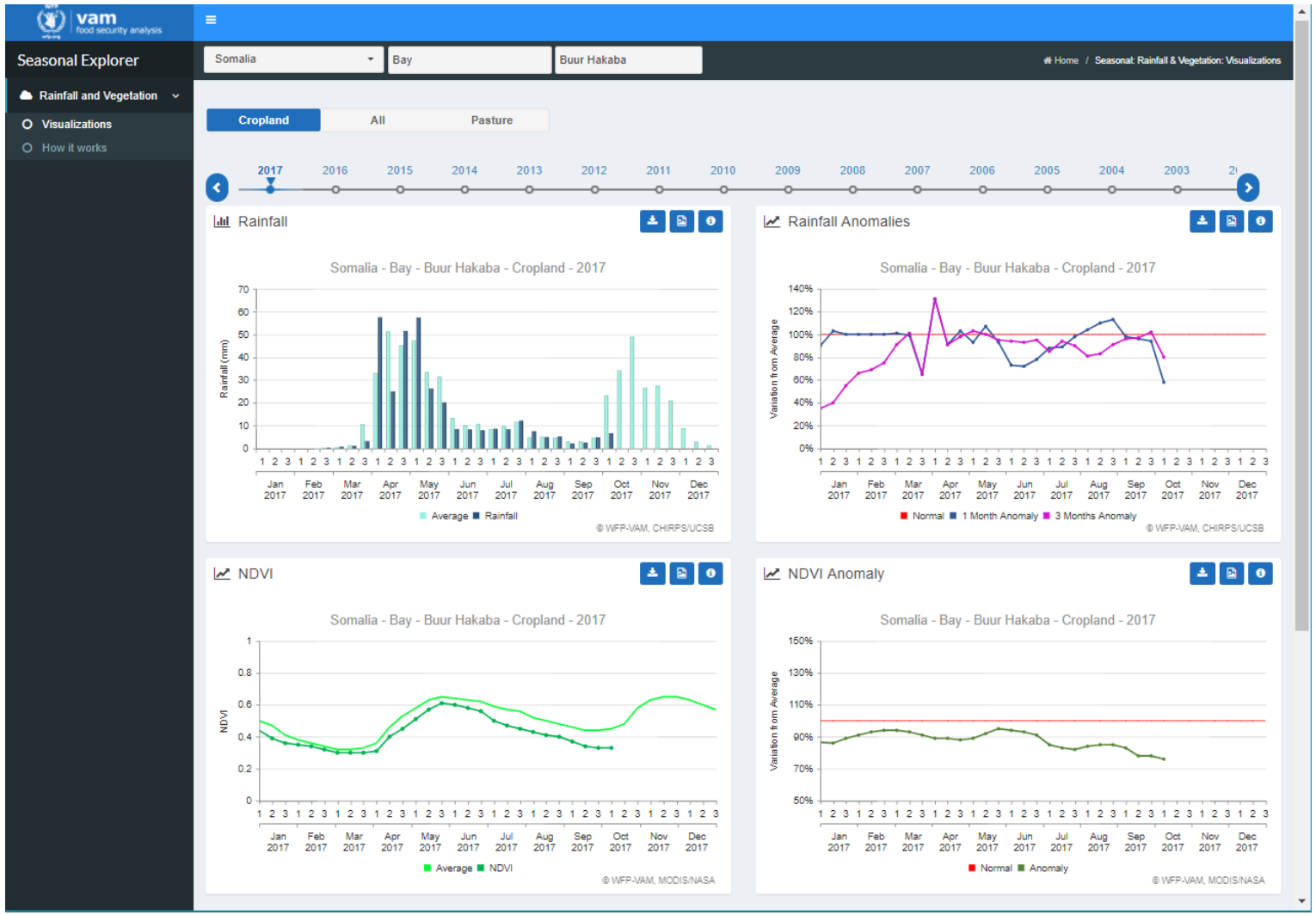


Charts show profiles for 2017-18 season :

- A: Continued wetter than average conditions in Cabo Delgado province, Mozambique
- B: Severe dryness from late December in SW Madagascar
- C: Dryness and irregular rainfall in Masvingo, Zimbabwe
- D: Irregular but overall on average rainfall in Mpumalanga, South Africa

SOURCES
http://vam.wfp.org/sites/seasonal_monitor/

1 - Seasonal Monitoring / Seasonal Explorer

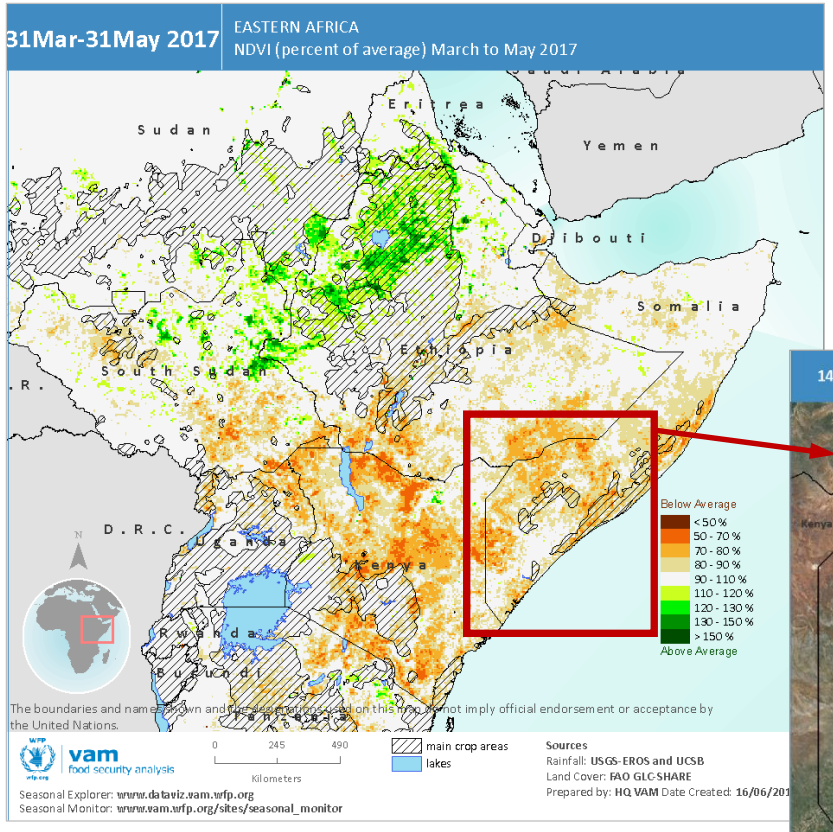


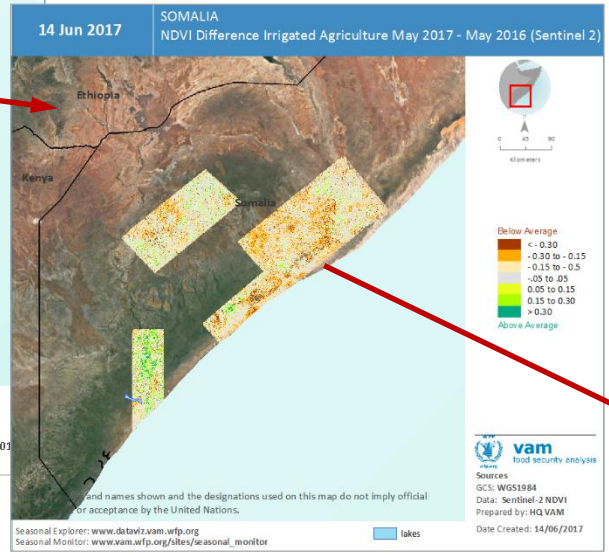
WHY?

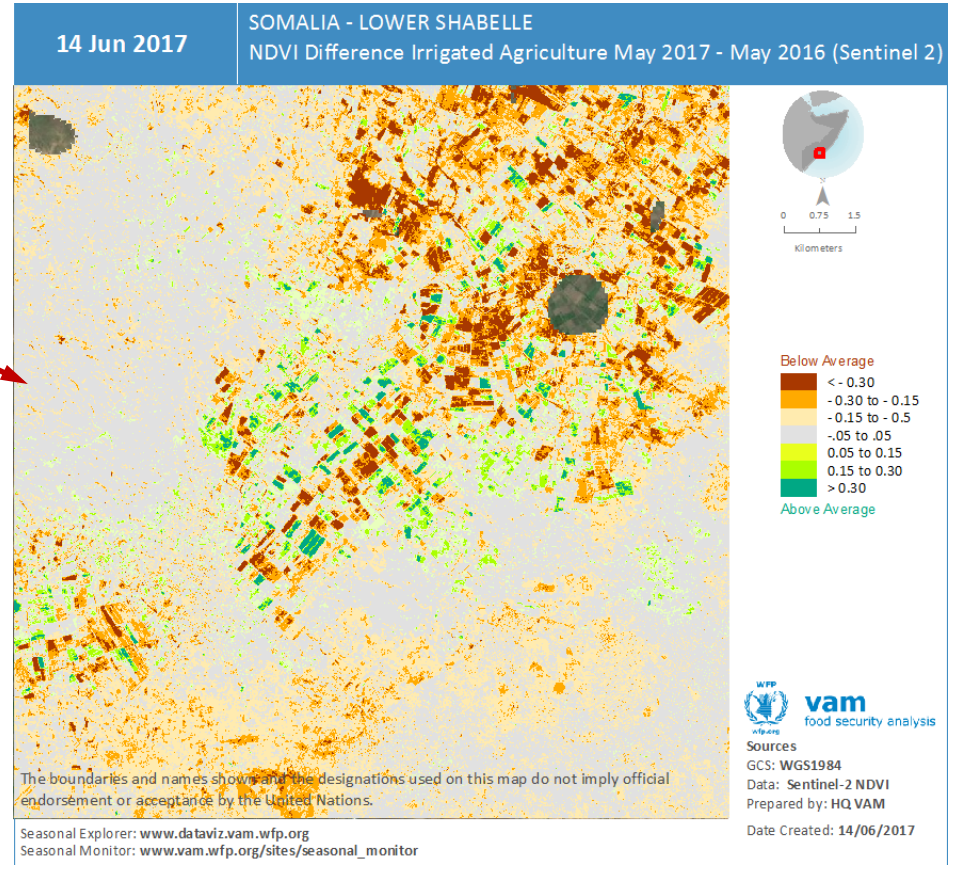
Reply to a **need** expressed by WFP COs and RBs to have seasonal charts (aggregated by administrative level and land cover type) **easily available and in near real time**

SOURCES
http://dataviz.vam.wfp.org/

.....Hot Spot Analysis by HR images







Regional Scale:

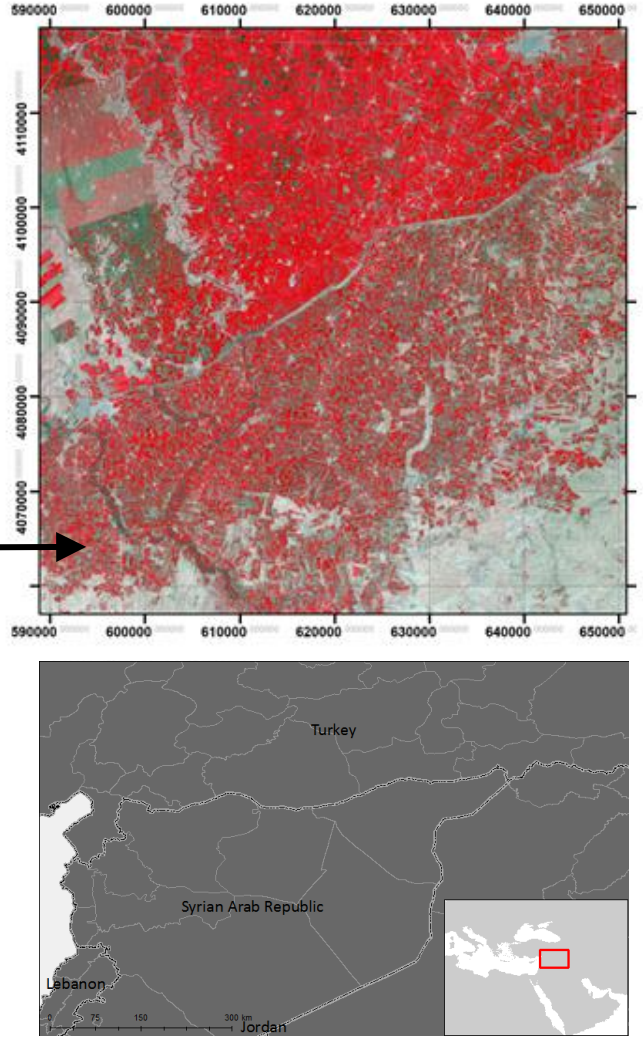
Diagnostics and Identification

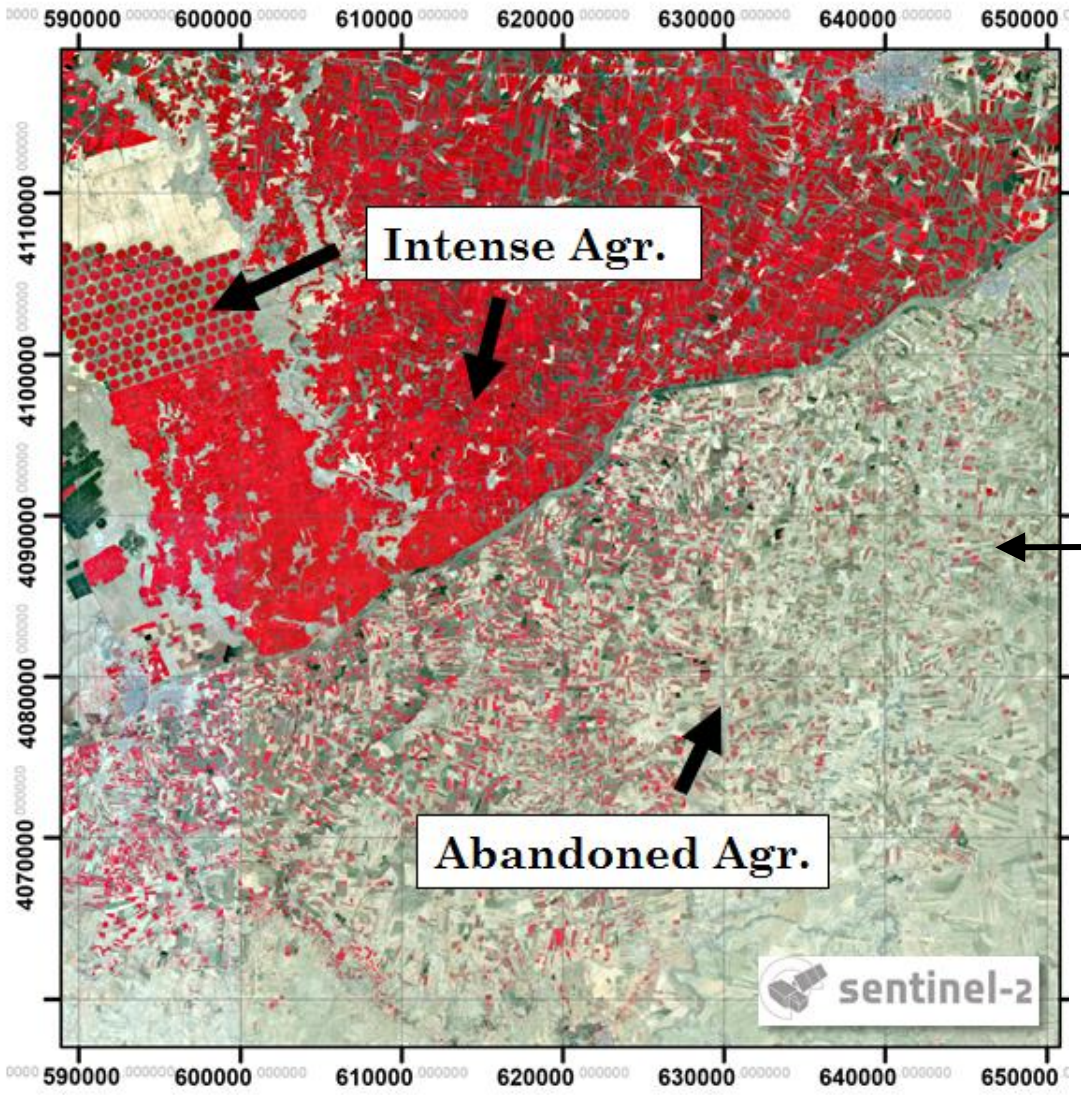
Zoom in ROI:

Identify scale of problem, nature of area affected

.....Hot Spot Analysis by HR images

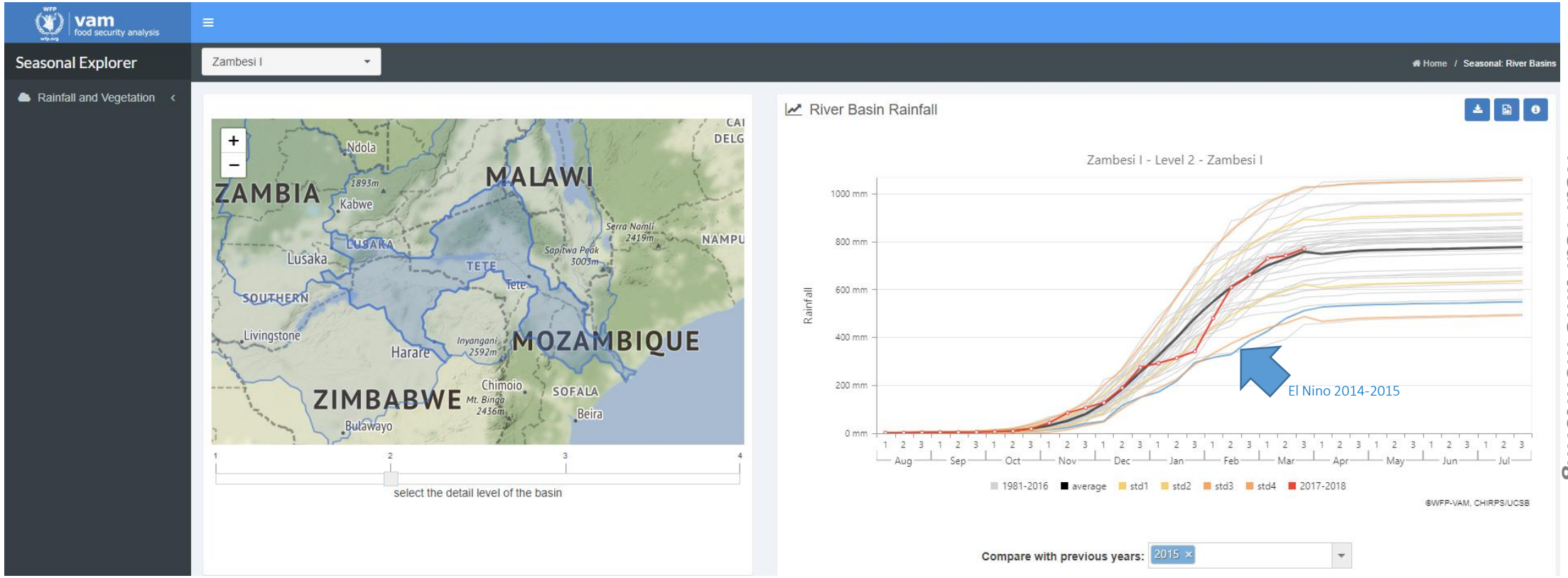
Before conflict (March 2011)





April 2016

1 - Seasonal Monitoring - River Basins Rainfall



Near real time monitoring

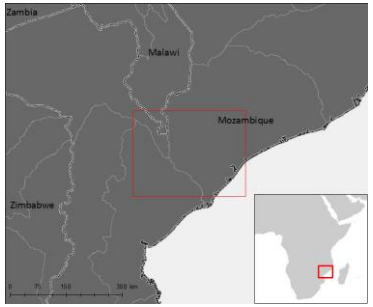
WHY?

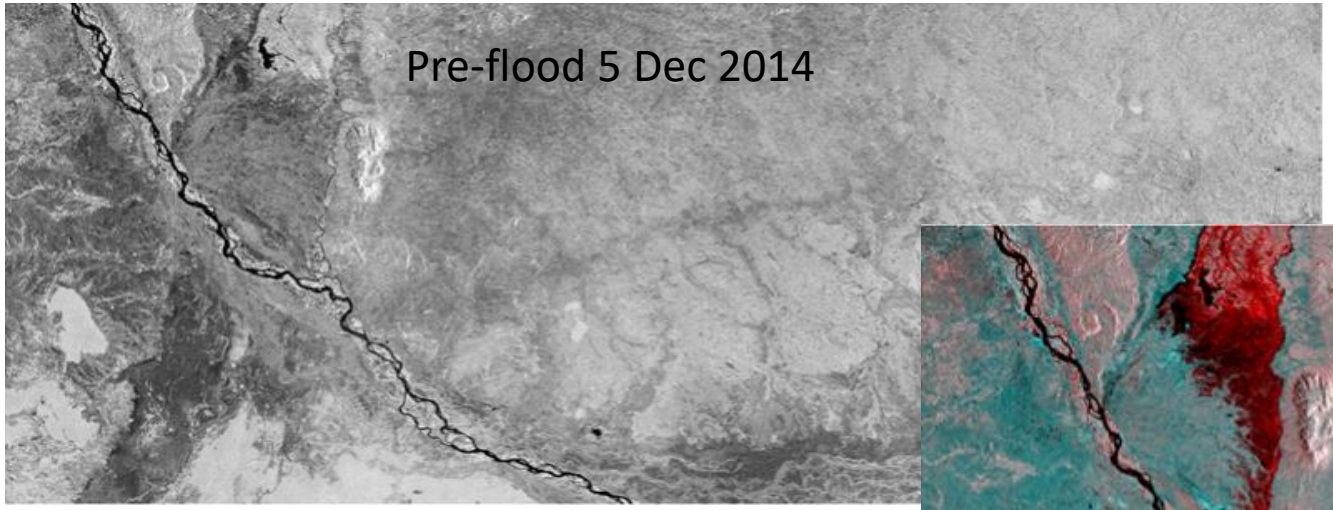
Can support **predicting** large scale catastrophic floods and start **preparing** HR/VHR satellite acquisition and baseline preparation (previous significant events). Can be also useful for drought and low river flow detection. Less useful for flash floods and smaller scale river flooding

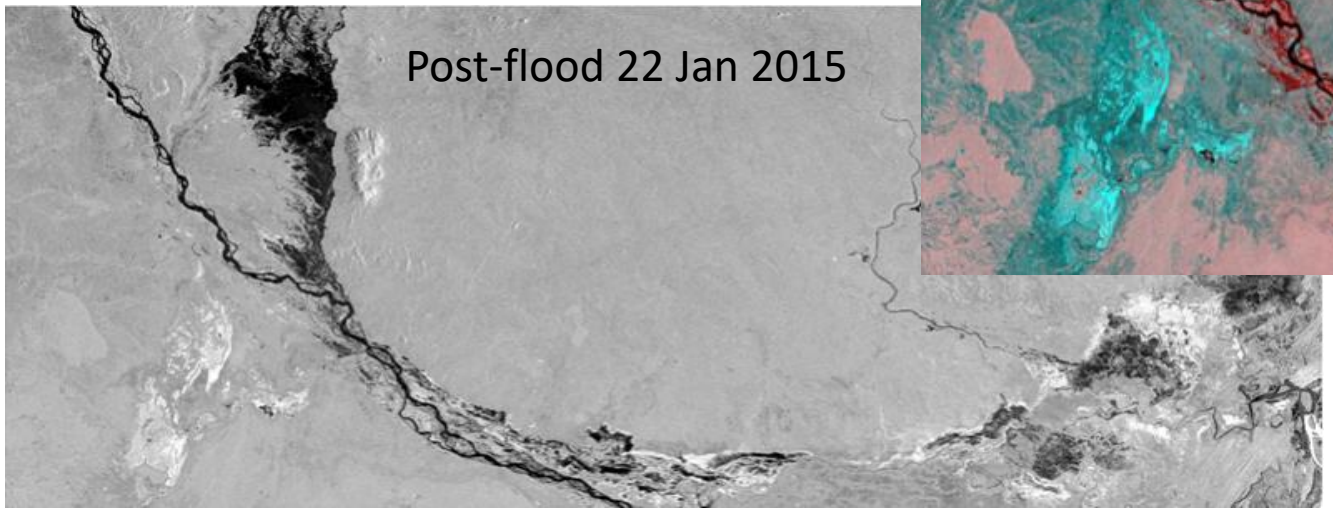
Note that if the basin rainfall is very high compared with the historical record, it doesn't necessarily follow that there will be floods within the basin or downstream from it. Other factors need to be taken into consideration. However, it can be useful to raise the alarm level or flag a potentially serious situation.

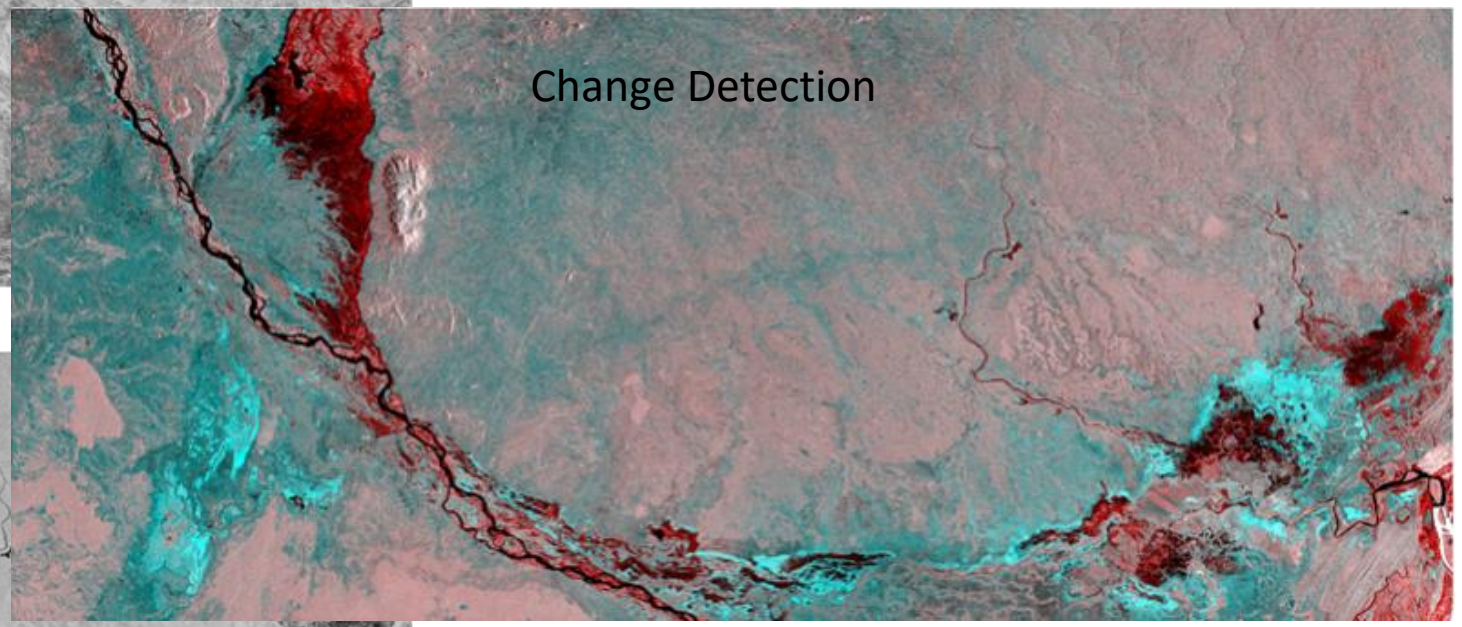
.....Flood Detection by HR images

Sentinel-1A - Malawi and Mozambique Flooding Dec 2014 to Jan 2015





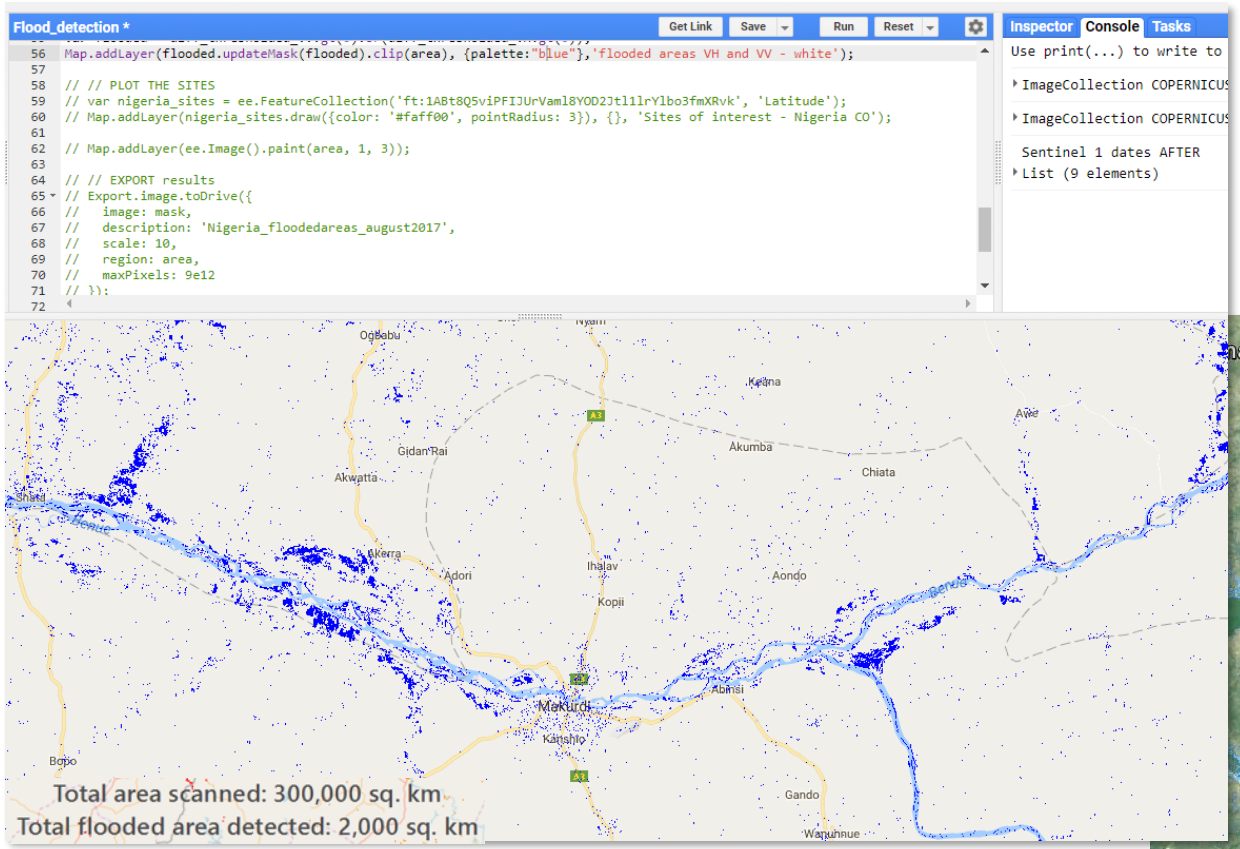




Red areas: decrease in backscatter (flooding)
Cyan areas: increase in backscatter (flooded vegetation)

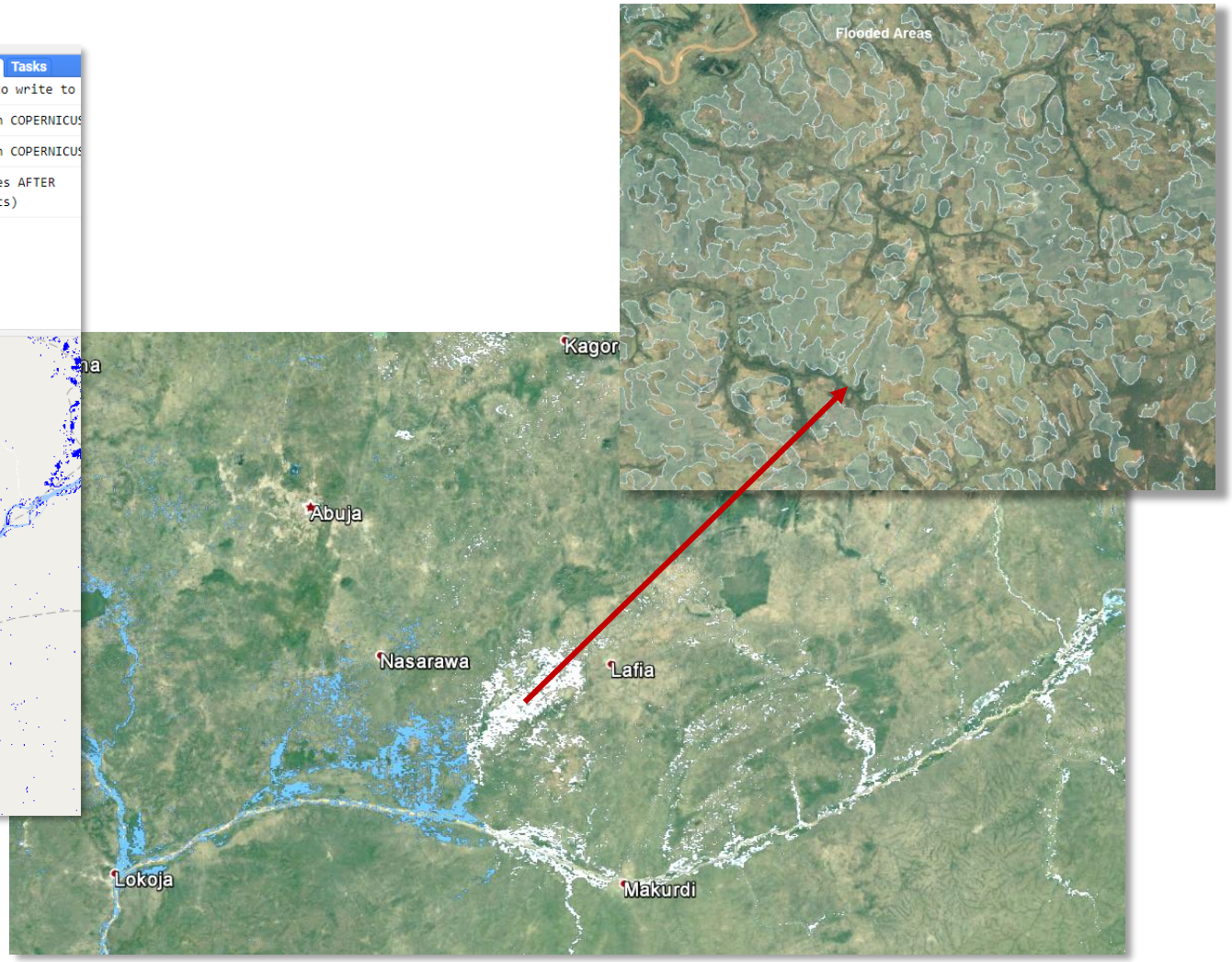
.....Flood Detection by HR images

Sentinel-1A – Nigeria Flooding Aug 2017



Model run in Google Earth Engine

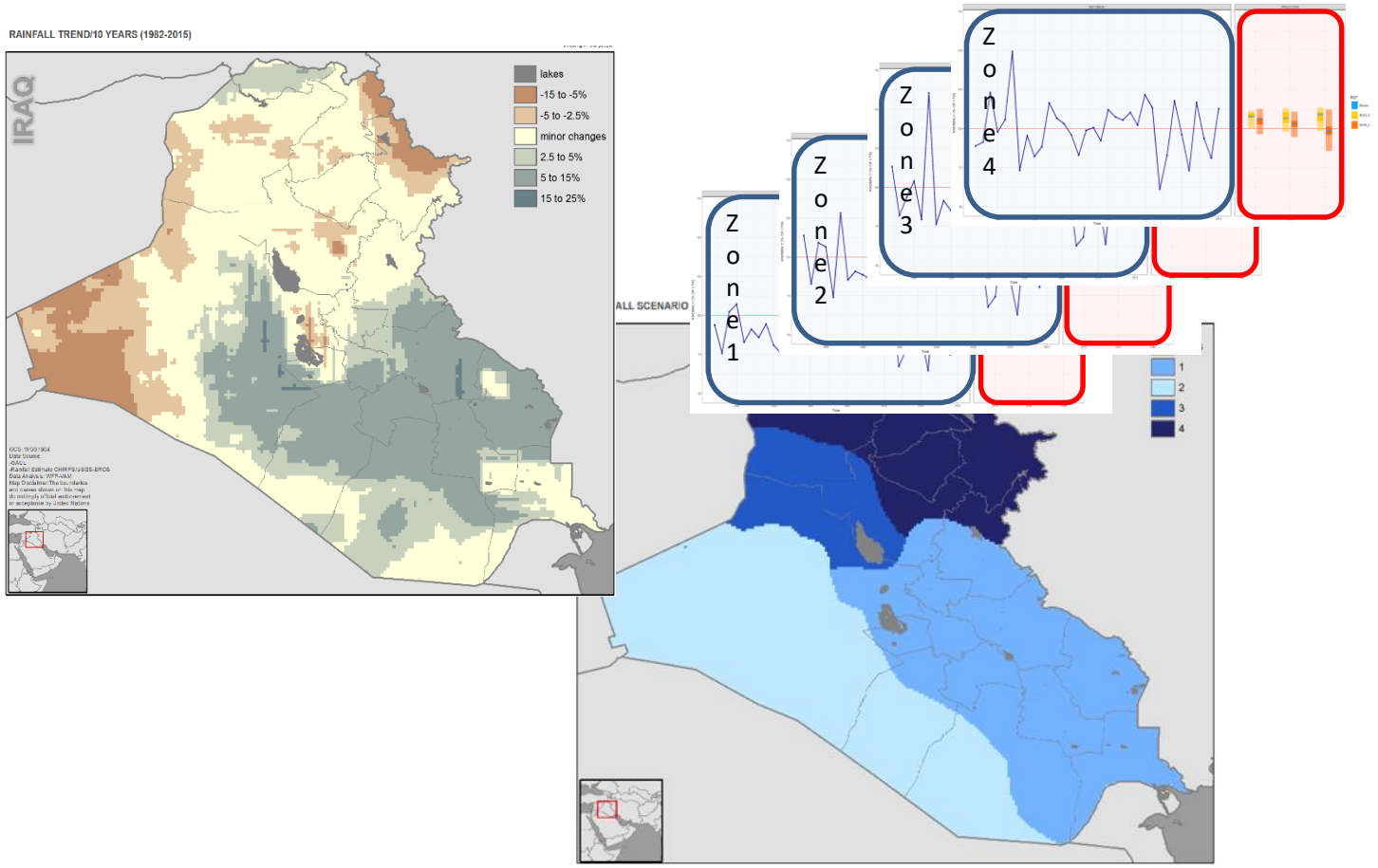
Data: SAR data from Sentinel-1



Outputs in map, shp and kmz format made available to Country Offices

2 - Climate and Vegetation TS Analysis

WHY? **Climate change** will disproportionately affect the most **food-insecure** people around the world, most of whom live in fragile areas prone to climate hazards, **increasing the risk** of food insecurity and the breakdown of food systems

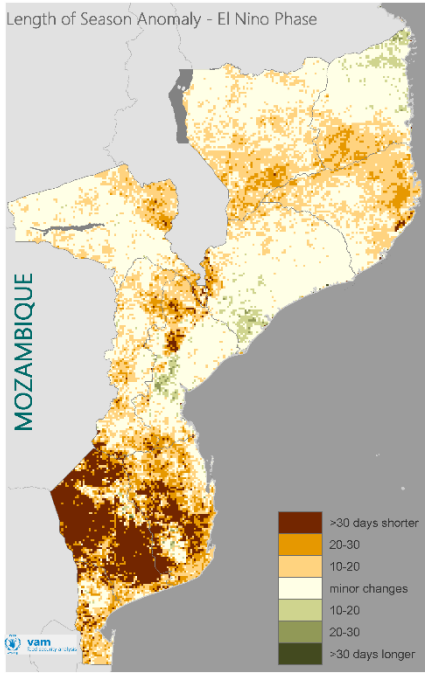


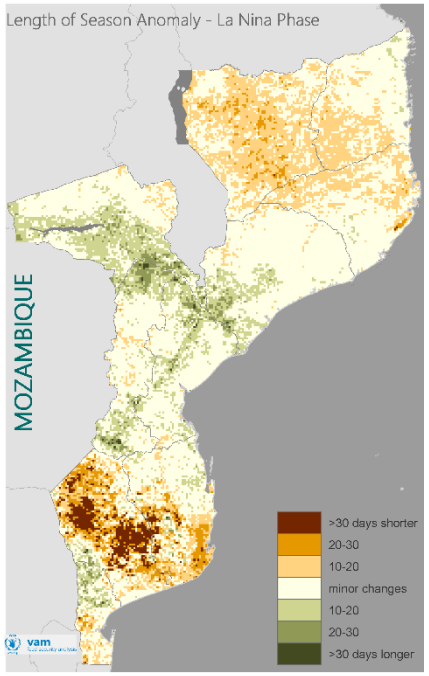
Understand the past and present climate and the main tendencies and then combine these findings with the available future climate projections in order to provide information **supporting** the identification of priority areas of intervention and appropriate long term programme **strategies** and climate adaptation **practices**

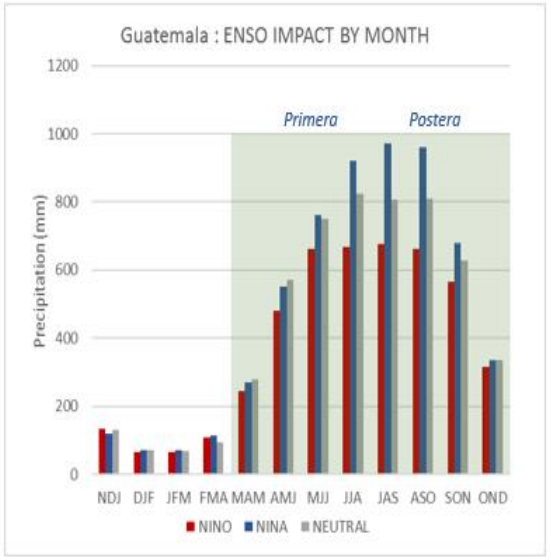
2 - Climate and Vegetation TS Analysis

Analyse and understand **ENSO impacts** by studying its **past** effects.

By knowing the type of impact we may better **anticipate** these hazards and **prepare** for them.

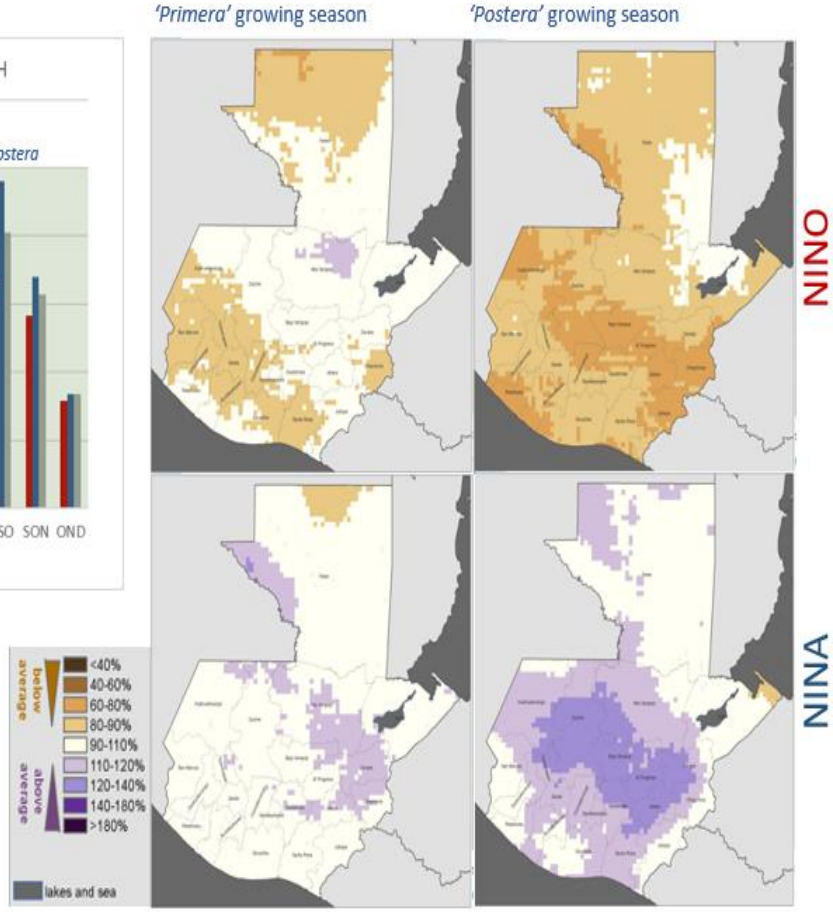






Plot: ENSO impact at National level. Same plots are available by Region and District level

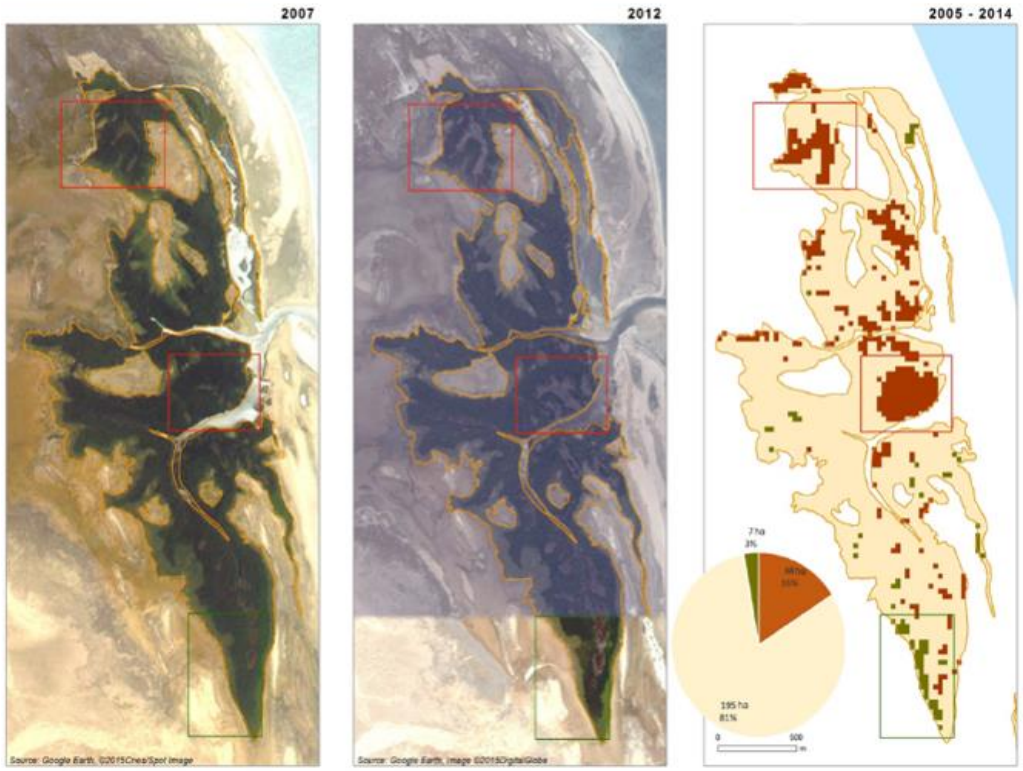
Highlighted area in the plot represents the growing seasons



3 - EO Supports to Project Phases

WHY? Reply to the **increasing demand** of information and evidences in the project phases

A) EO supporting project area **targeting**



B) EO supporting project **impact** evaluation

To analyse different pattern of change from before to after the treatment compared with similar areas not treated by the project

The methodology applied is derived from the "Before/After Control/Impact 'BACI' contrast"

The BACI analysis provides two important statistics: the significance level (P-value) of the BACI effect test and the BACI contrast

Perimeter name	Zone	BACI index (contrast)	Relative contrast %	P-value	Before and After Time-frame
[redacted]	full area	**-0.0052**	-0.73	0.0080061	2011-13vs2014-16
[redacted]	medium fields	**-0.0155**	-2.16	0.0002820	2011-13vs2014-16
[redacted]	small fields	**-0.0067**	-0.89	0.2066130	2011-13vs2014-16
[redacted]	full area	0.0024	0.34	0.0000150	2011-13vs2014-16
[redacted]	large fields	**-0.035**	-4.9	0.0892510	2011-13vs2014-16
[redacted]	medium fields	0.0203	2.89	0.0000470	2011-13vs2014-16
[redacted]	small fields	0.0036	0.48	0.0004710	2011-13vs2014-16
[redacted]	full area	0.0216	2.98	0.0001090	2012-14vs2015-16
[redacted]	small fields	-0.0031	-0.41	0.0058530	2012-14vs2015-16
[redacted]	full area	0.0065	0.85	0.2082250	2012-14vs2015-16
[redacted]	small fields	**-0.0113**	-1.45	0.0001110	2012-14vs2015-16
[redacted]	full area	0.0043	0.61	0.0145280	2013-15vs2016
[redacted]	medium fields	0.0595	9.24	0.3925540	2013-15vs2016
[redacted]	small fields	**-0.0044**	-0.63	0.0140050	2013-15vs2016

Negative BACI contrasts (in bold)
Green background is used to highlight negative BACI contrasts that are significant at the 0.05 P-value
Light green background is used to highlight negative BACI contrasts that are very close to significant 0.05 P-value
Grey background indicates a non-significant/no BACI effect

4 - Mapping Population Displacement with VHR images

Very high-resolution and high-frequency satellite imagery (VHR) is routinely acquired and analysed to monitor **conflict-affected** populations within WFP Level-3 emergencies to observe population displacement and the creation of post-displacement settlements.

Active in **5 countries*** for a total of **21** areas of interest

* Syria, Iraq, South Sudan, Nigeria, Bangladesh-Myanmar

WHY?

Improve the quality of information available about remote and inaccessible areas and enable WFP to be better **informed** of and to validate changes on the ground without the risk and investment of the time and resources required for a field visit

Multi-temporal monitoring providing information on rapidly-evolving situations

Assesses the **environmental impact**, land cover change and land degradation in areas surrounding refugee/IDP camps

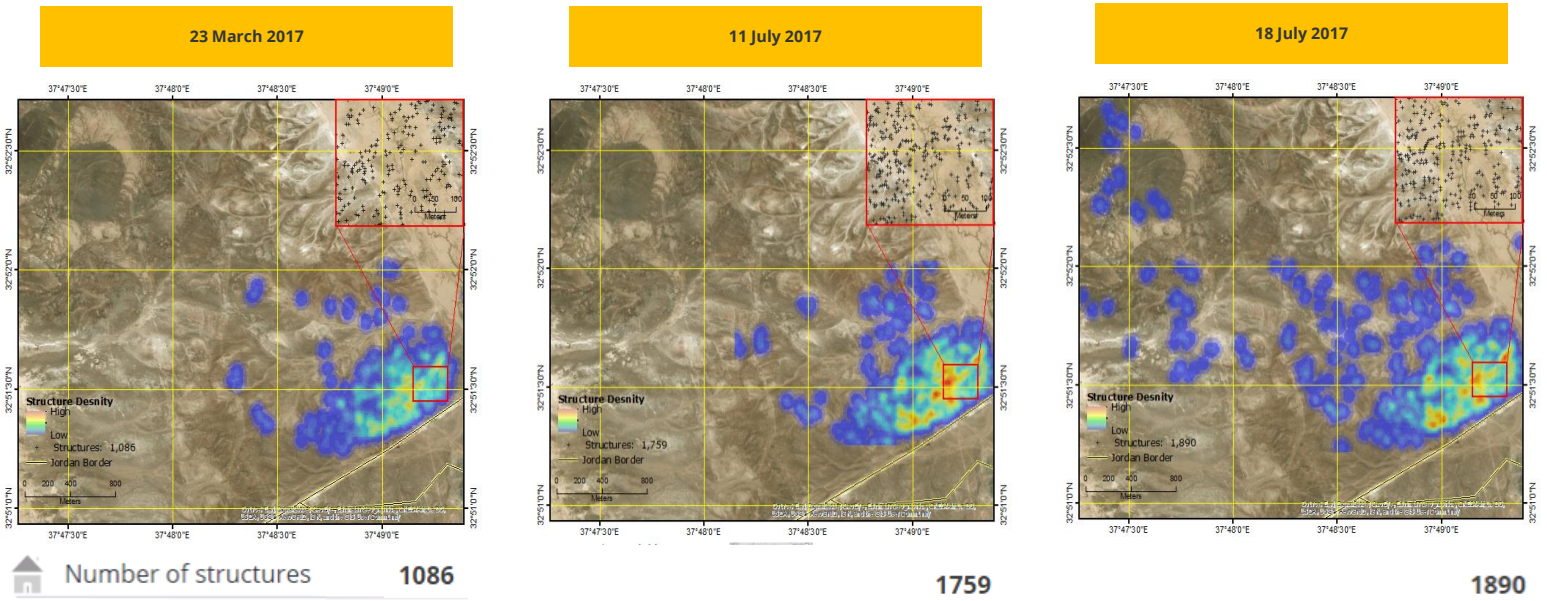
Derive rough **population** estimates

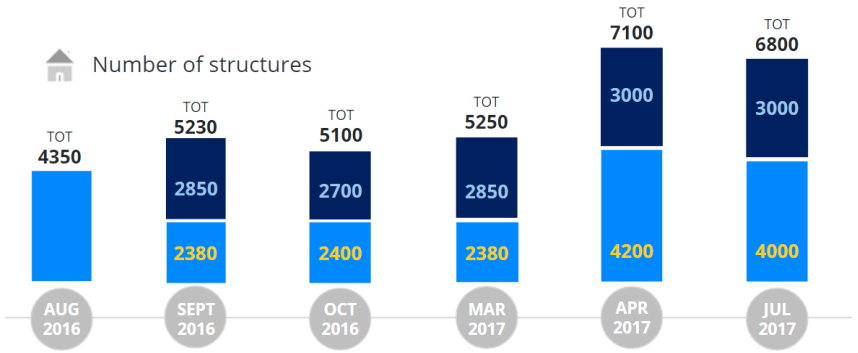
4 - Mapping Population Displacement with VHR images

Identify the number of **structures** and derive a rough population estimate.

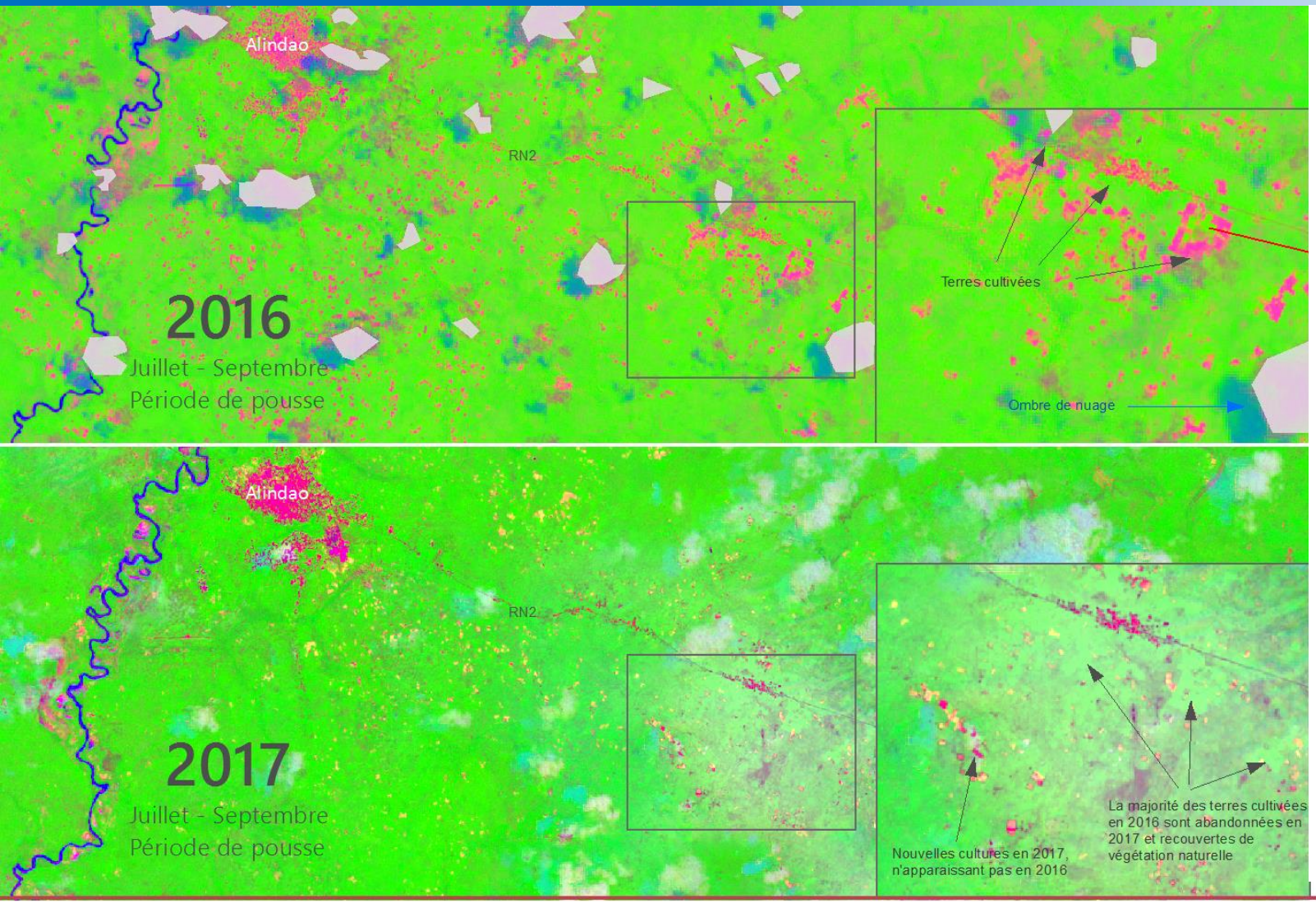
Understand the distribution and **density** of structures to answer where are people concentrating.

Monitor the **expansion** of camps





4 - Mapping Population Displacement with VHR images



Environmental/ Agric.Activities impact

i.e. land cover change and land degradation in areas surrounding refugee/IDP camps

Example:
Farmland Abandonment

Créé le: **5 Decembre 2017**
www.wfp.org
Préparé par: **HQ VAM**

Légende

- Eau
- Nuage
- Végétation
- Terre cultivée
- Terre abandonnée
- Construction

Source de l'image:
Sentinel-2
ESA/COPERNICUS

WFP
wfp.org

5 - Asset Impact Monitoring System

World Food Programme
wfp.org

WHY?

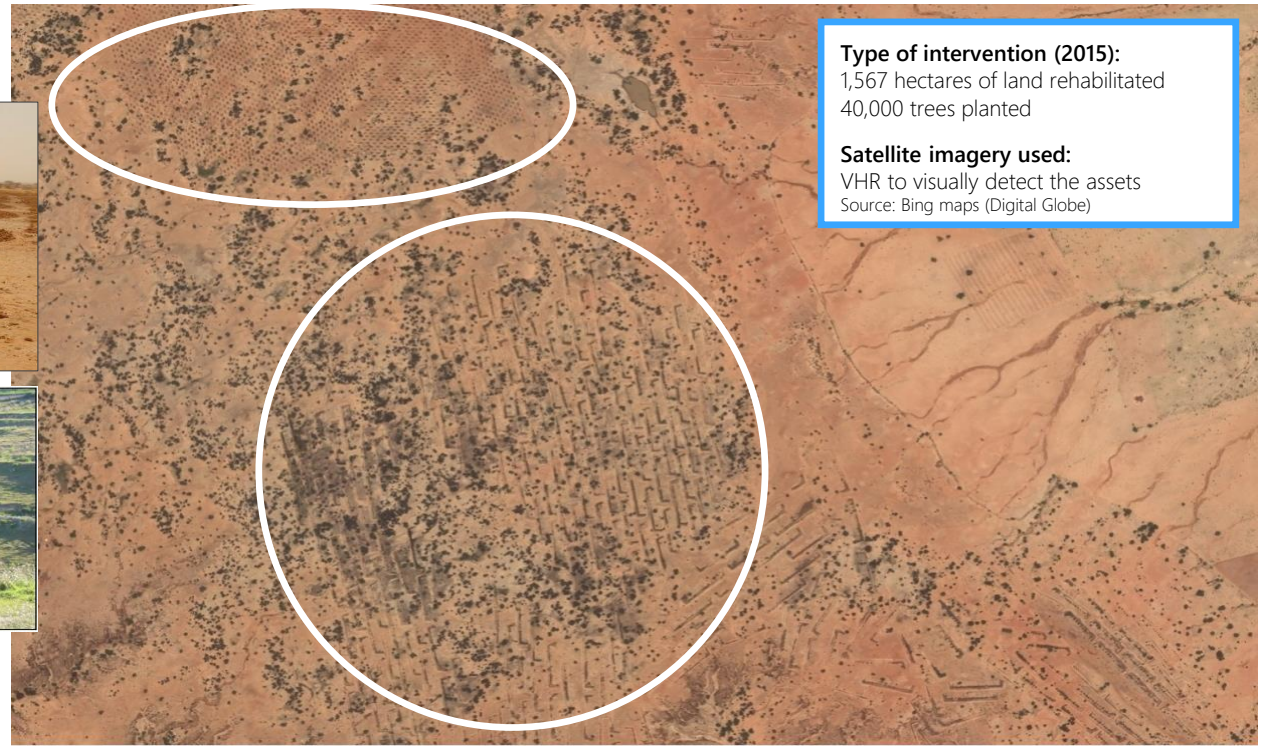
- monitor physical **changes** linked to FFA programmes
- quantifying regenerative **impact** on the local environment over time
- identifying examples to **advocate** for positive impact of FFA programmes
- areas with **access constrains**

Detection of the assets built in Niger

The ground work – building half moons to conserve water before planting
Photo credit: WFP/Rein Skullerud/Niger

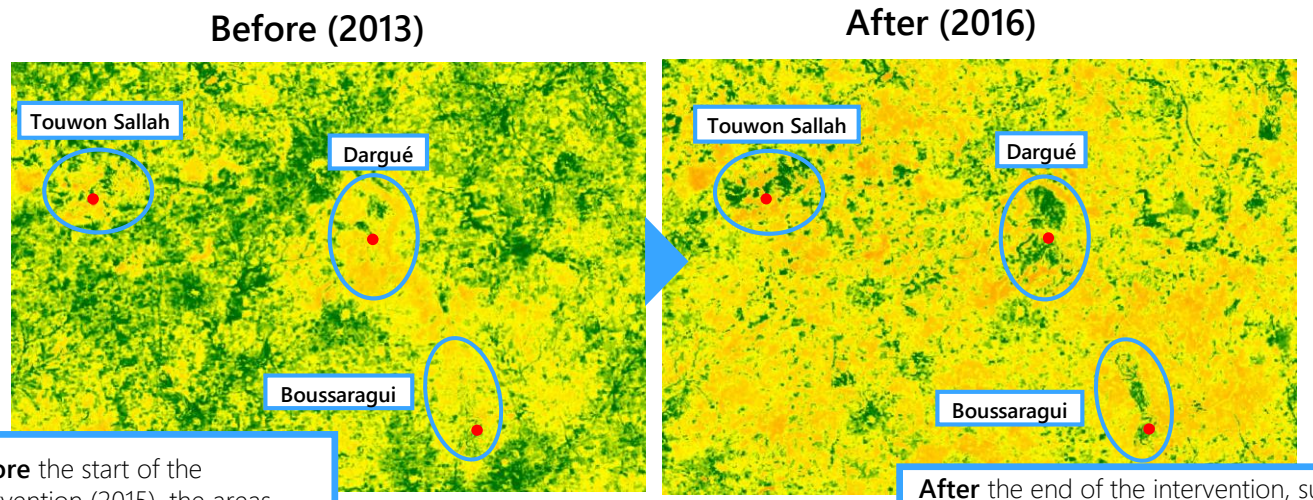
Large half moons

Soil bunds



5 - Asset Impact Monitoring System

Detection of impacts during ‘shock’ years



Before the start of the intervention (2015), the areas where FFA was implemented were mostly **not vegetated**, as it can be seen here in 2013 - a good year in terms of climatic conditions.

After the end of the intervention, such as in 2016, despite **dry conditions** during the growing season, those same areas are the ones with the **healthiest vegetation** while the surrounding area has suffered from vegetation loss.

Satellite imagery used: : Landsat-8 max-NDVI composites over the growing season (August-September)

5 - Asset Impact Monitoring System

Detection of the assets built

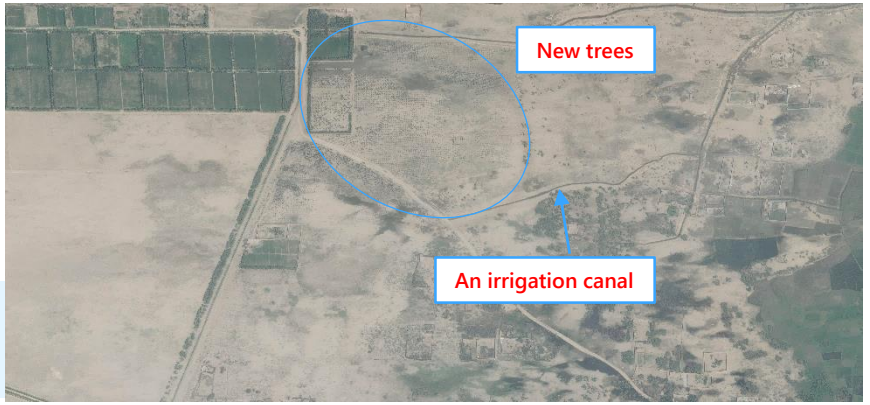
Type of intervention (Sept2013-Nov2015):
1,000,000 trees planted

Satellite imagery used: VHR to visually detect the assets
Source: Digital Globe

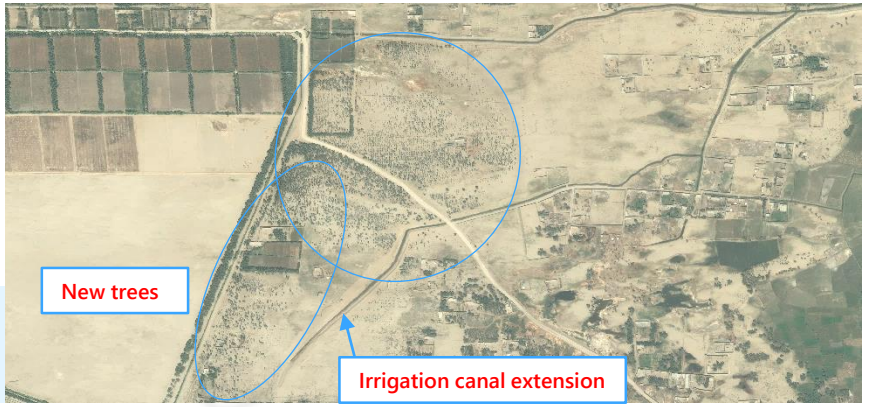
- **Before** the start of the intervention, no asset could be detected
- **During** the tree plantation operation, new patterns of vegetation can be detected
- **After** the end of the intervention, additional trees are visible in the southern part, covering an area of about **35 Ha.**

Before
20 Aug 2012

During
3 April 2015



After
27 April 2017



6 - Cropland/Crop Type Mapping in Food Insecure Areas

WFP World Food Programme wfp.org

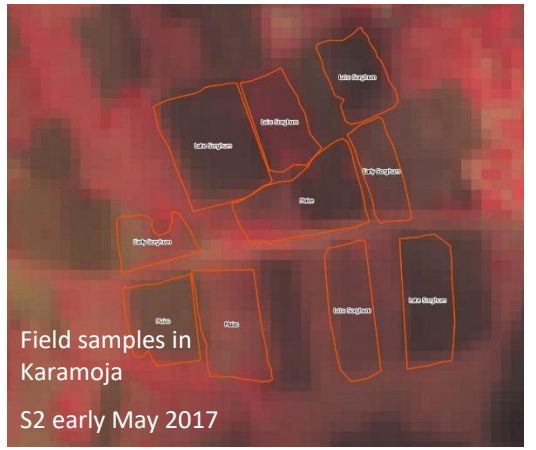
WHY?

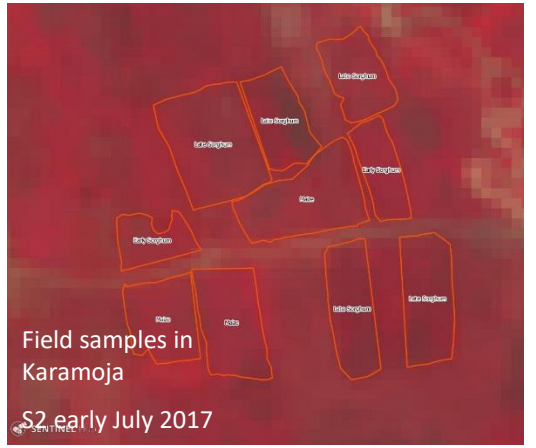
Major interest is in crop type and status mapping in **food insecure regions**, in particular those with restricted or **difficult access.**

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**

Field samples in Karamoja (Google Earth).

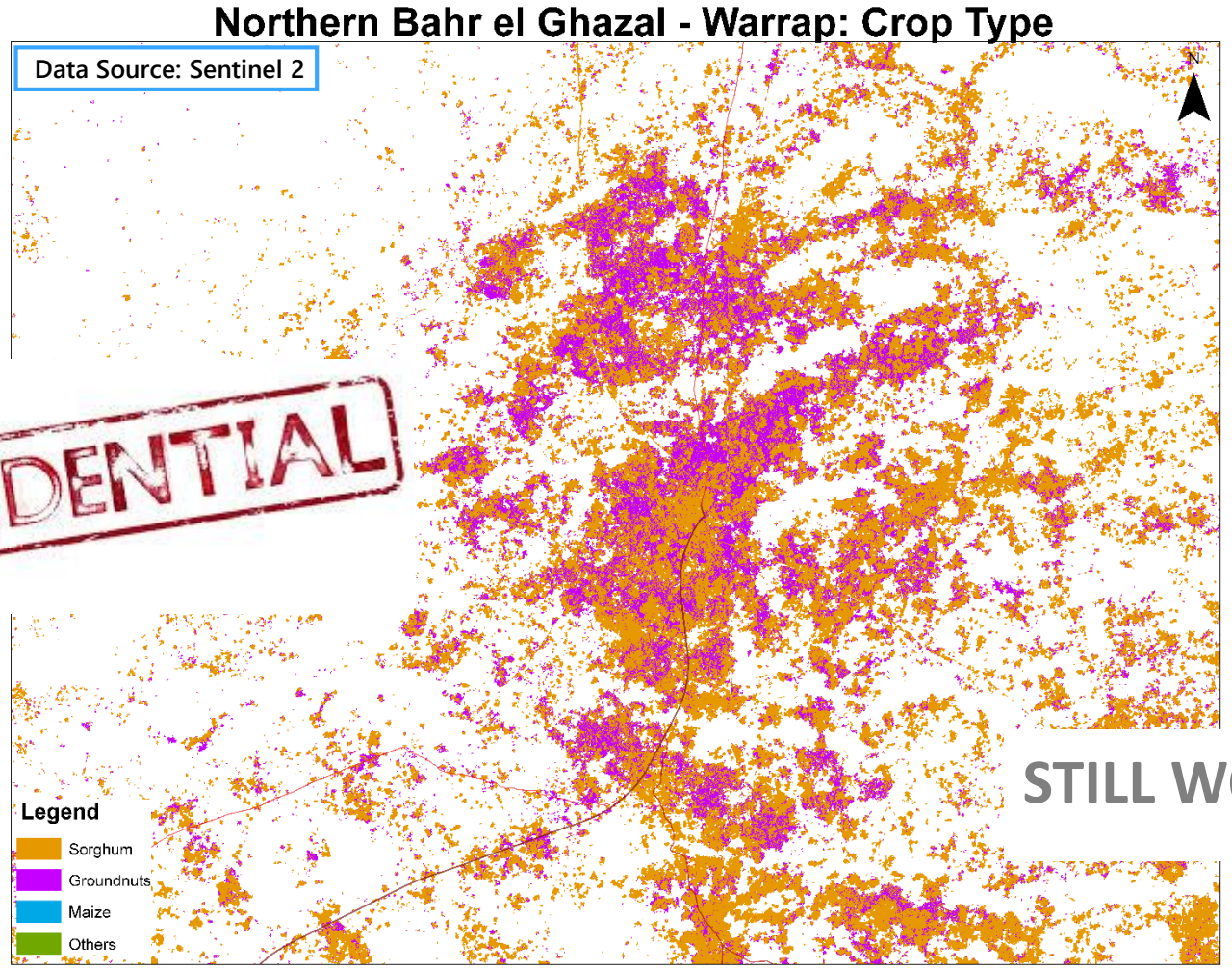




>1000 samples/pilot

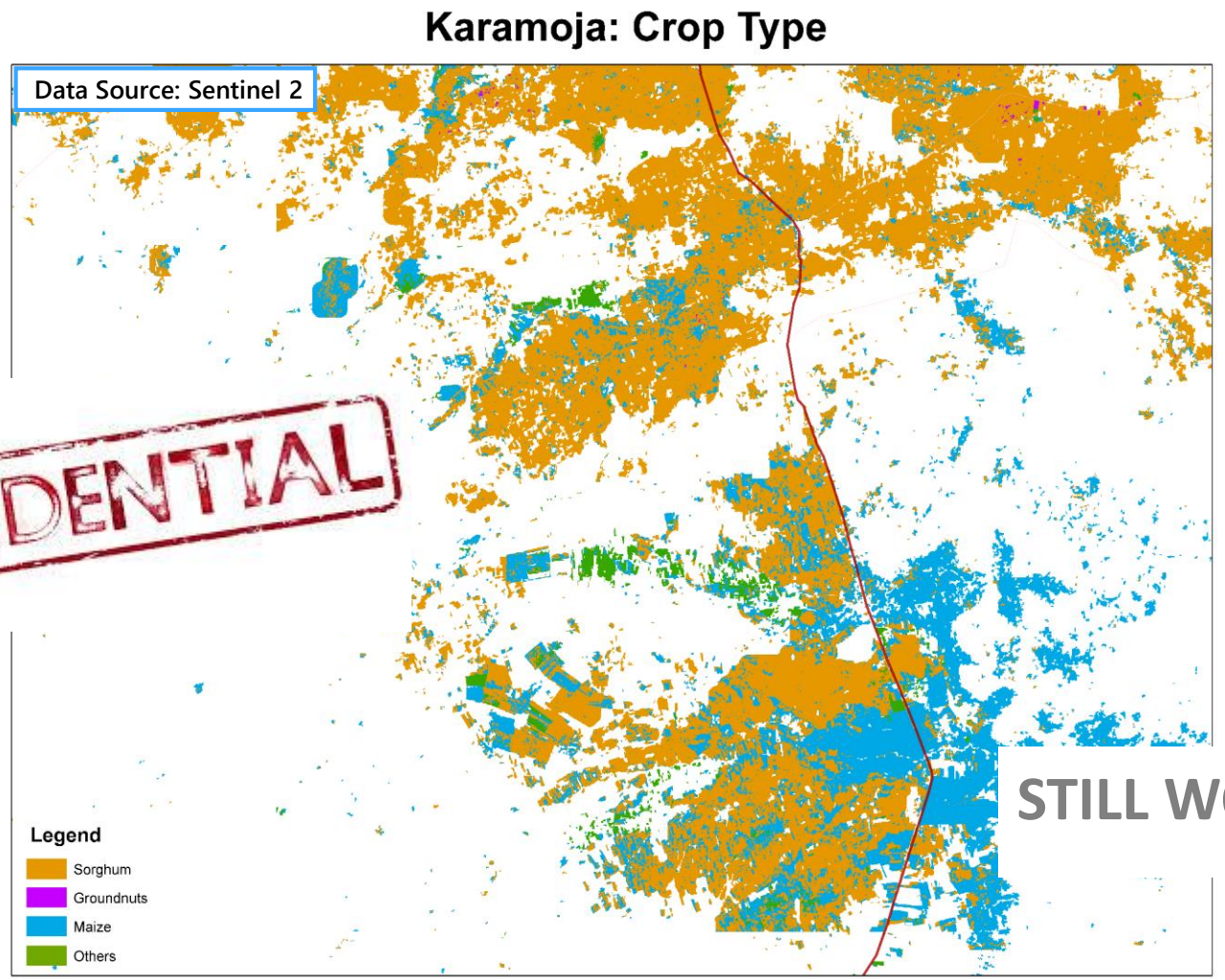
In **collaboration** with ESA (Sen2Agri), UC Louvain and EODC

6 - Cropland/Crop Type Mapping in Food Insecure Areas



STILL WORKING ON IT

6 - Cropland/Crop Type Mapping in Food Insecure Areas



CONFIDENTIAL

STILL WORKING ON IT