The European Commission's science and knowledge service

Joint Research Centre

Earth Observation contribution to agriculture and food security policy

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European Commission

Structure

- JRC – Food security Unit
- EO data for agric. and FS monitoring and new opportunities
- Examples of recent use of EO for policy support in Europe and Africa
    - Common agricultural policy
    - Early warning systems and risk management
    - Land governance (mainly large scale invesments monitoring)
- Research applications and training
- Conclusions

The Joint Research Centre

- In-house science service of the European Commission
- Independent, evidence-based scientific and technical support for EU policies
- 3000 staff Almost 75% are scientists and researchers, 1 370 publications in 2014

European Commission

JRC Food Security Unit (former MARS)

Using crop growth models the JRC provides timely yield forecasts for Europe and neighbouring countries to the European Commission

To help manage farmers aid, the JRC supports the implementation of the Integrated Administration and Control System (IACS).

JRC multidisciplinary approach to food security:

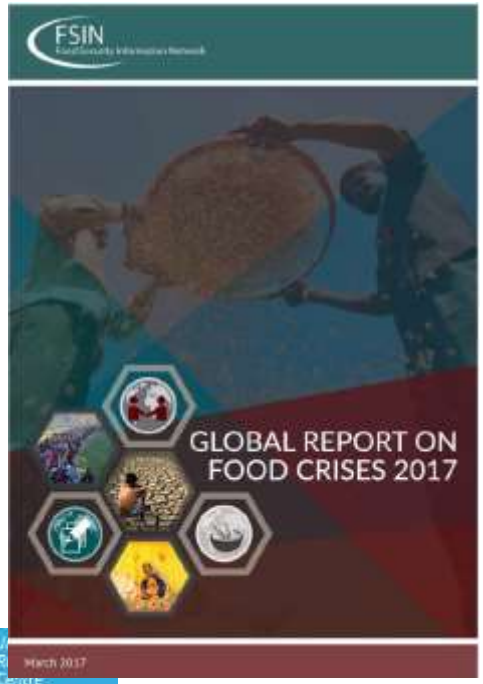
Monitoring and assessments in collaboration with international partners + research (including nutrition)

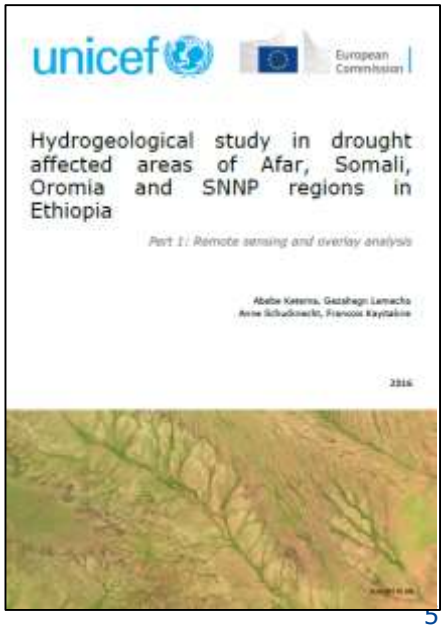
European Commission

Technical and scientific Support to agriculture and FNS

Support EU institutions and partner countries in the formulation and implementation of policies and programs in the sustainable agriculture and food and nutrition security areas through the provision of demand-driven technical and scientific advice.

Examples of recent products for DEVCO and Delegations:





Contribution to UN state of food security 2018 report

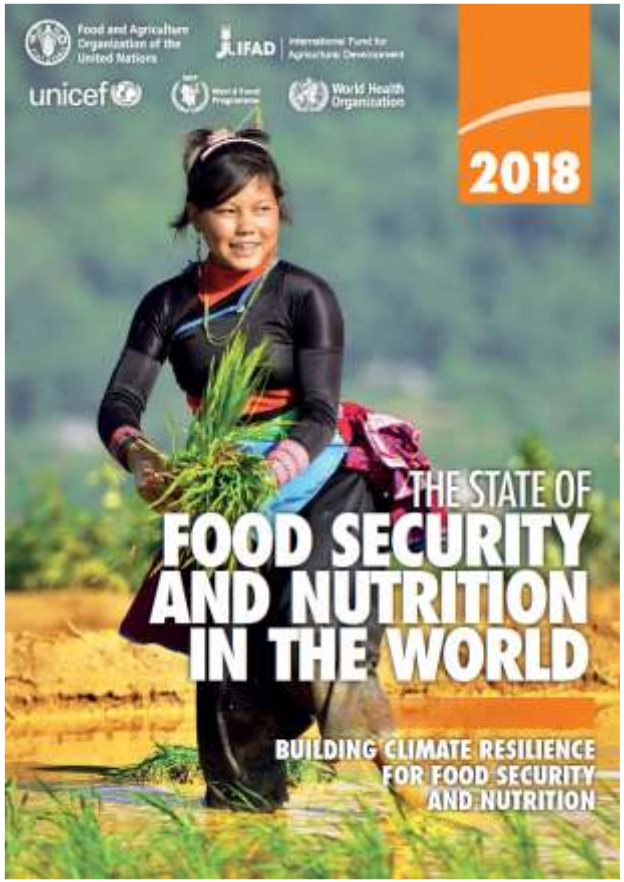


FIGURE 19
DECREASED GROWING SEASON LENGTH AND YEAR OF LOWEST CUMULATIVE ANNUAL VEGETATION BIOMASS OVER CROPLAND AND RANGELAND AREAS IN AFRICA, 2004–2016

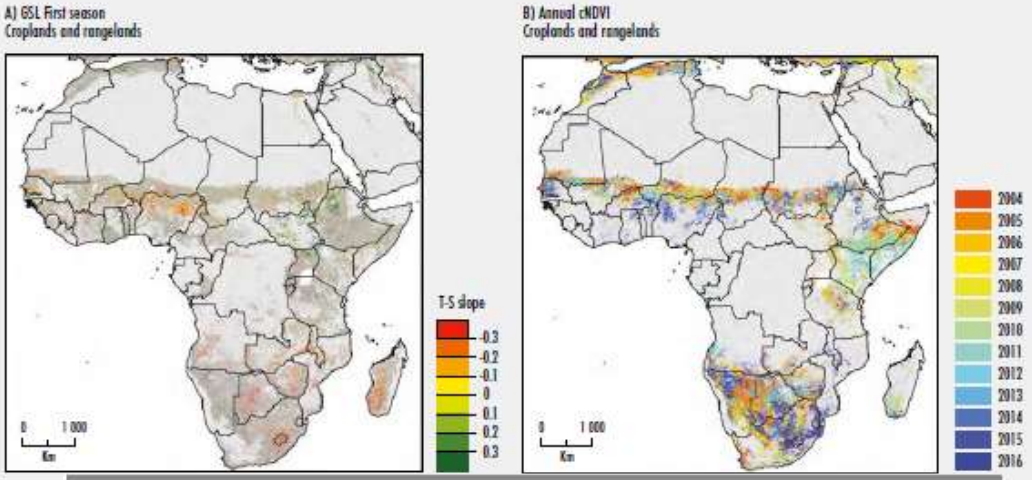
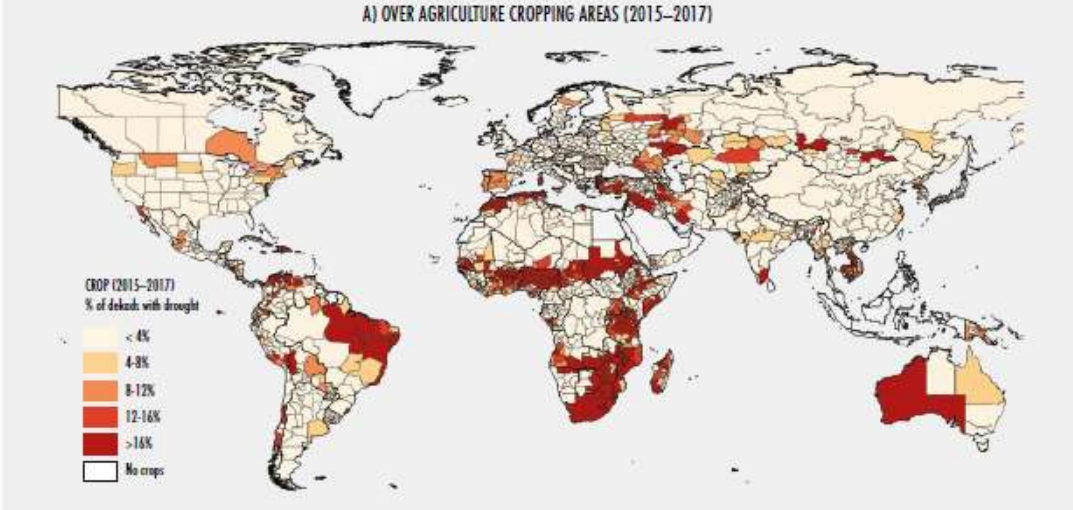


FIGURE 21
FREQUENCY OF AGRICULTURAL DROUGHT CONDITIONS DURING THE EL NIÑO OF 2015–2017 COMPARED TO THE 2004–2017 AVERAGE



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Using satellite images for agricultural monitoring

Applications in relation to spatial resolution and temporal frequency

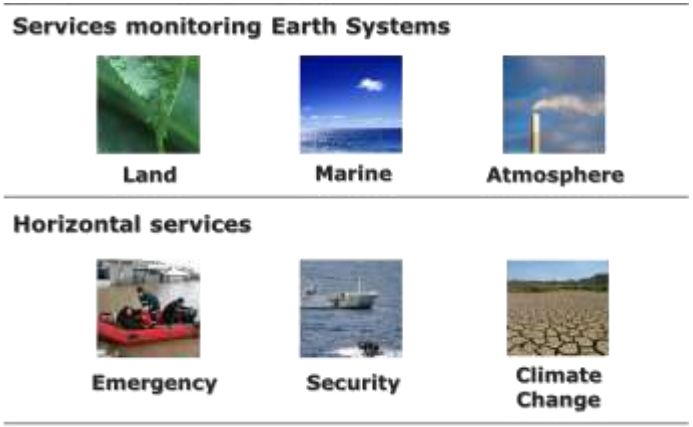
Resolution	Revisit	Application	Limits
300 m – 1 km low	Daily	Global crop production trends, drought monitoring, pastoral biomass productivity	Not crop specific, difficult to separate area and phenology
10-30 m high	Weekly	Crop area, crop type, phenology, crop diversity/rotation, land use change	Requires massive data processing
0.5-5 m very high	On demand	Area measurement, detailed measures, precision farming, impact assessment	Costly, on sample basis only
5 – 50 cm Aerial photos	On demand	Land tenure, cadastral applications	High costs

Free & open

Commercial, but plenty of choice

COPERNICUS

European Commission



Examples of products in land service:

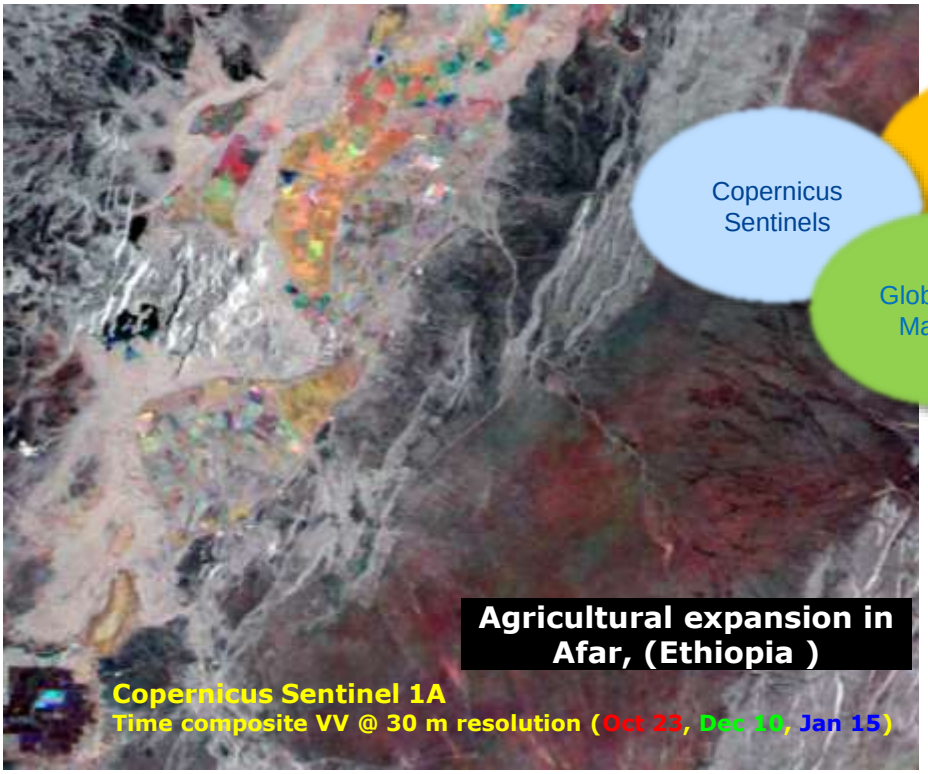
- Urban atlas, tree cover density, EU DEM, CORINE land cover…

http://land.copernicus.eu/

Copernicus
Europe's eyes on Earth

Joint Research Centre

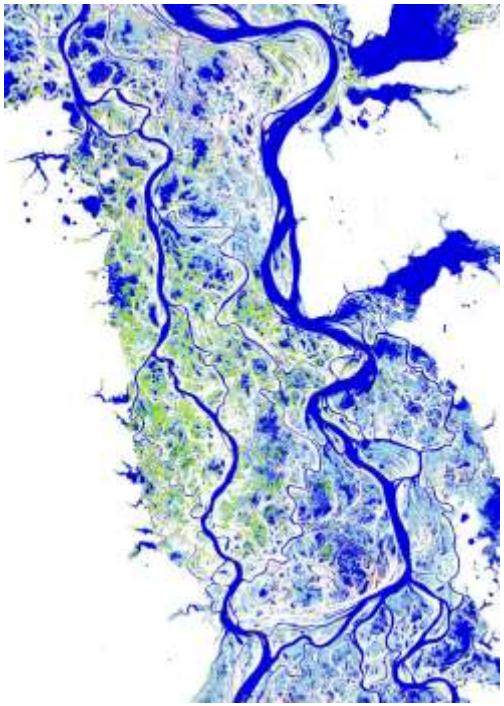
New opportunities in the 10 m resolution domain



- Free and open data of COPERNICUS (Sentinel sensors), 3- 10 days revisit capacity, 10 m spatial resolution range
- Towards global crop mapping, area and yield at high resolution – requires big data approach!
- CAP 2020: discussion on technical needs for monitoring implementation of greener policy with larger national differentiation.

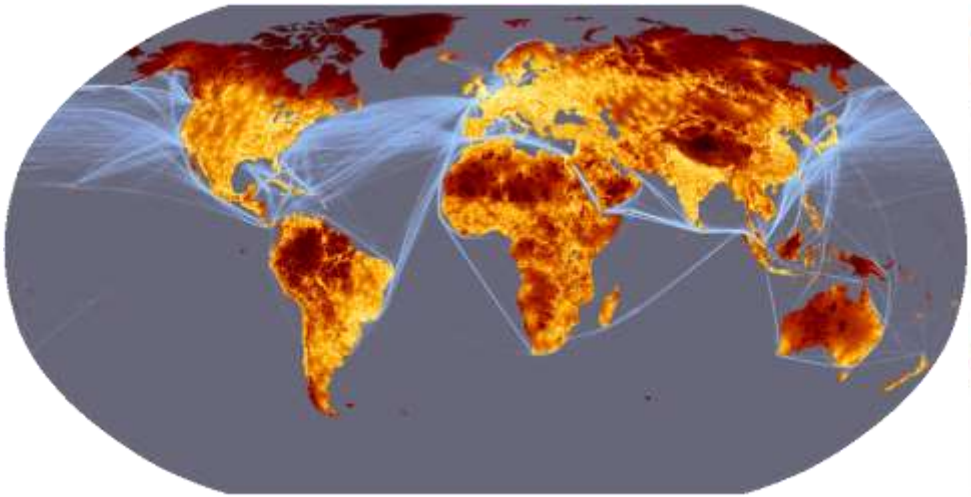
FROM CONTROL TO MONITORING

Recent global JRC research products

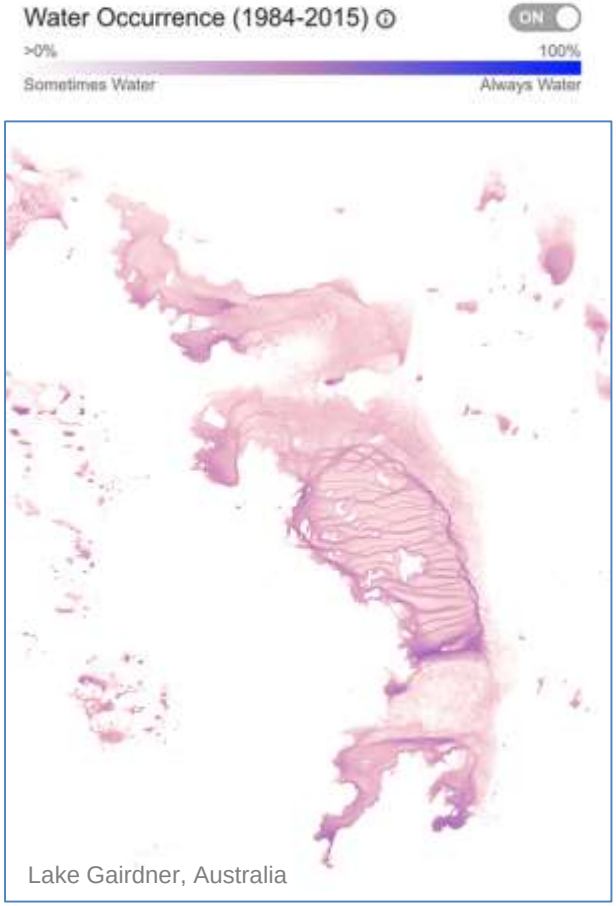


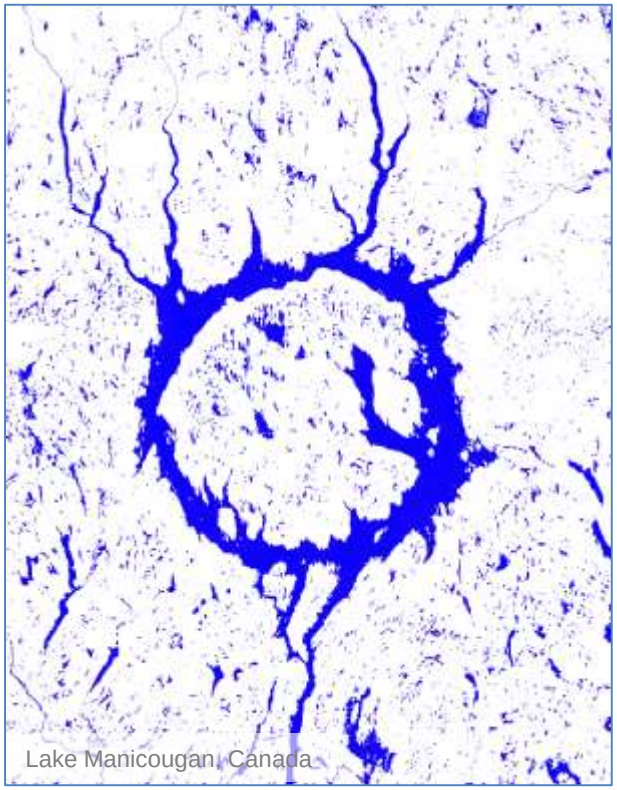
Global water explorer
Global human settlements layer
Global map of accessibility
Global desertification atlas

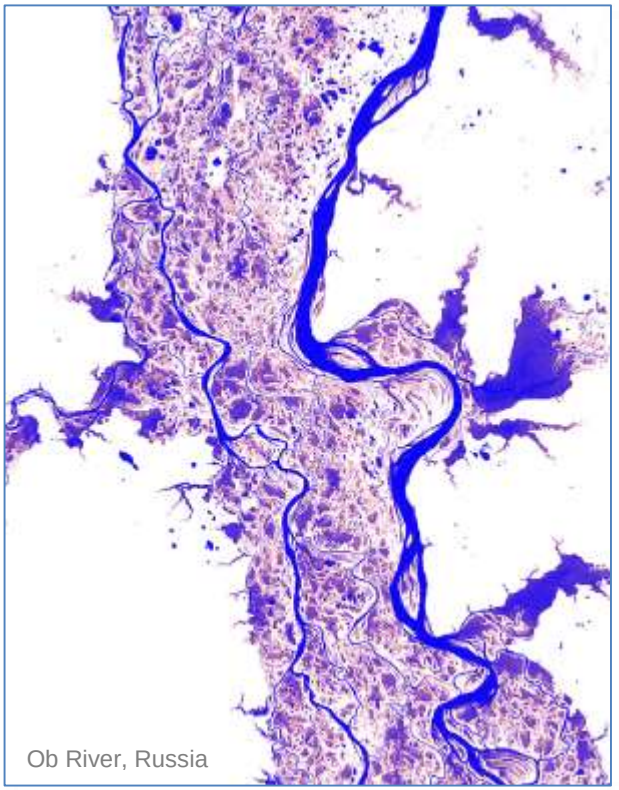
exploring big data appraoches, cloud processing, machine learning…



SDG 6.6.1 Change in the extent of water-related ecosystems over time





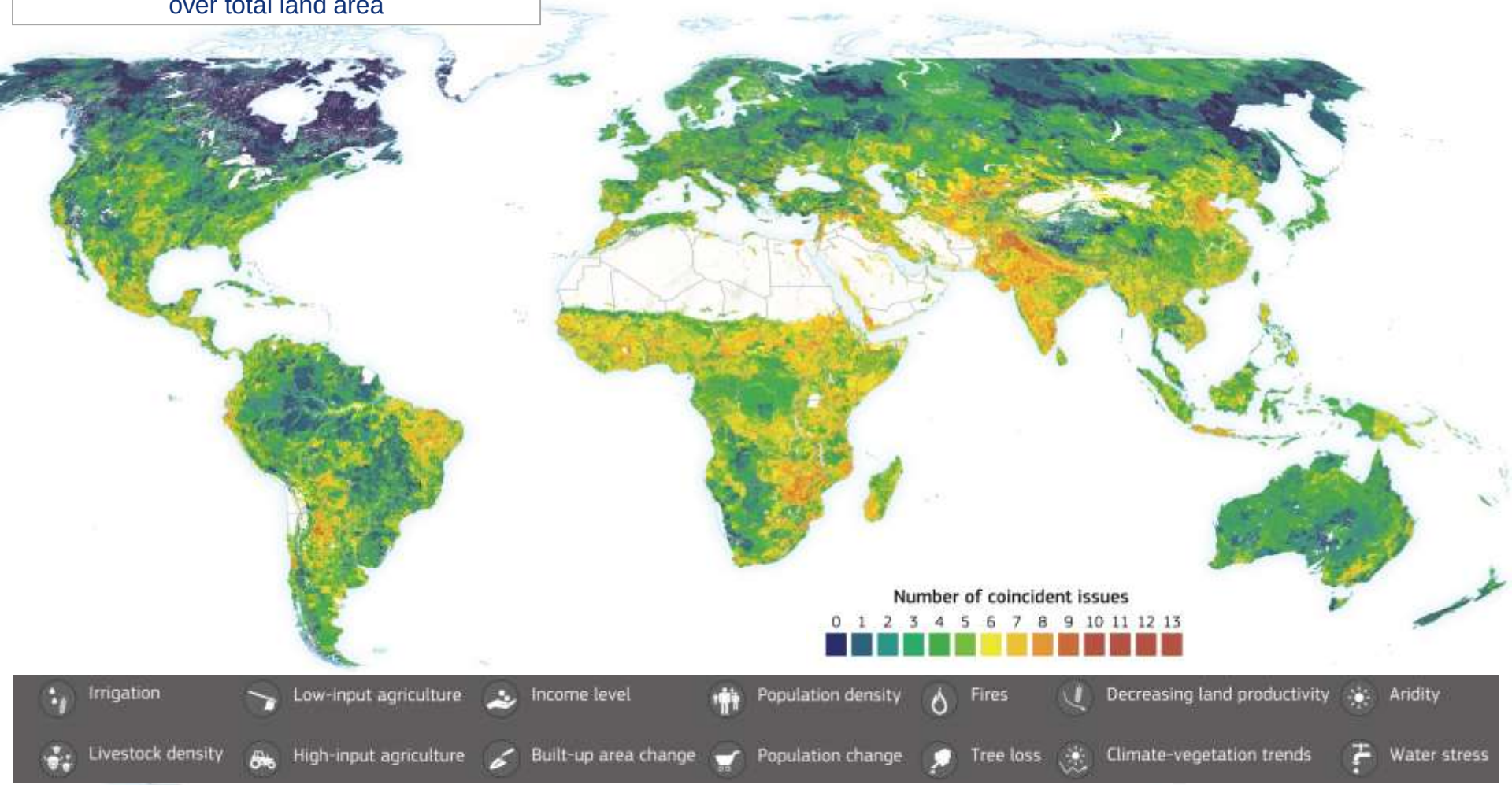


Global Surface Water Explorer https://global-surface-water.appspot.com/

European Commission

SDG 15.3.1 Proportion of land degraded over total land area

Source: JRC from World Atlas of Desertification, 3rd Edition, JRC/UNEP



European Commission

Source, JRC

Building infrastructure

Assembly, delivery and installation of 186 installations in Africa/EU

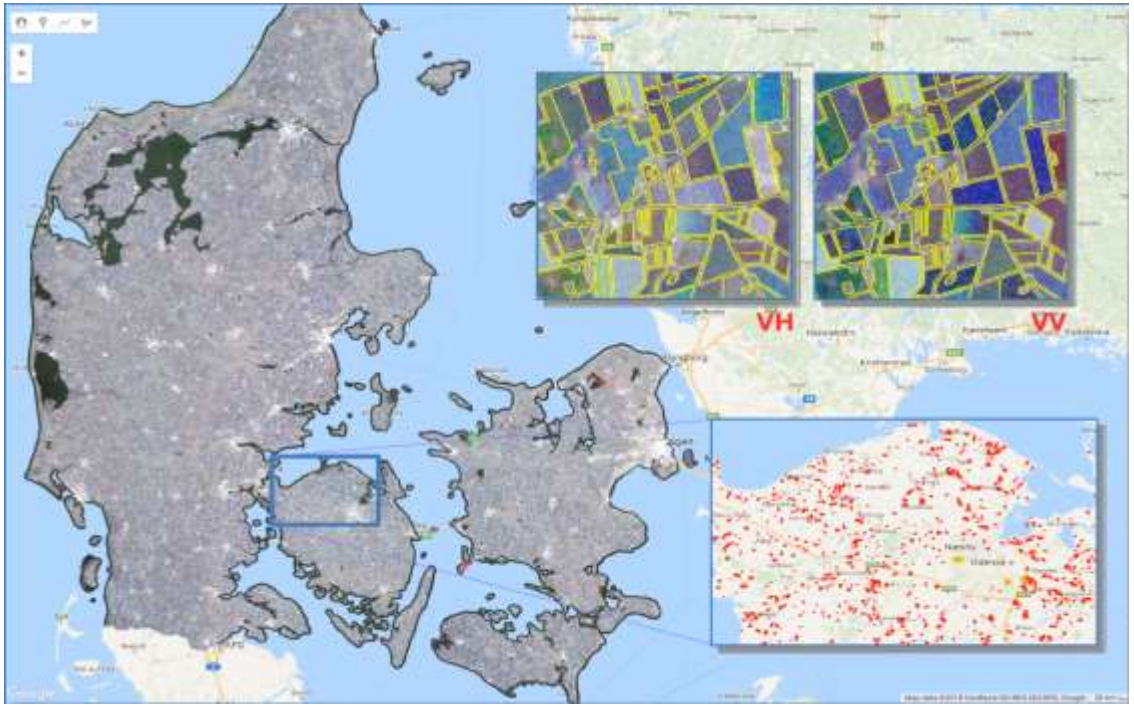
Training and capacity building (data, tools and know-how, transferrable IT skills)

Diverse applications throughout Africa (agriculture, rangeland, marine, river navigation, fires...) and direct links to policy implementers

European Commission

The future of the CAP

- Currently ongoing discussion on post 2020 CAP reform (towards: **more flexible, simpler, greener, fairer, cheaper…**)
- Some points with strong JRC contribution:
  - Move from area based approach to peformance based
  - Move from control to monitoring, based on new satellite data and big data approaches
  - Continue and expand crop conditions monitoring and yield forecasts (better market transparency…)



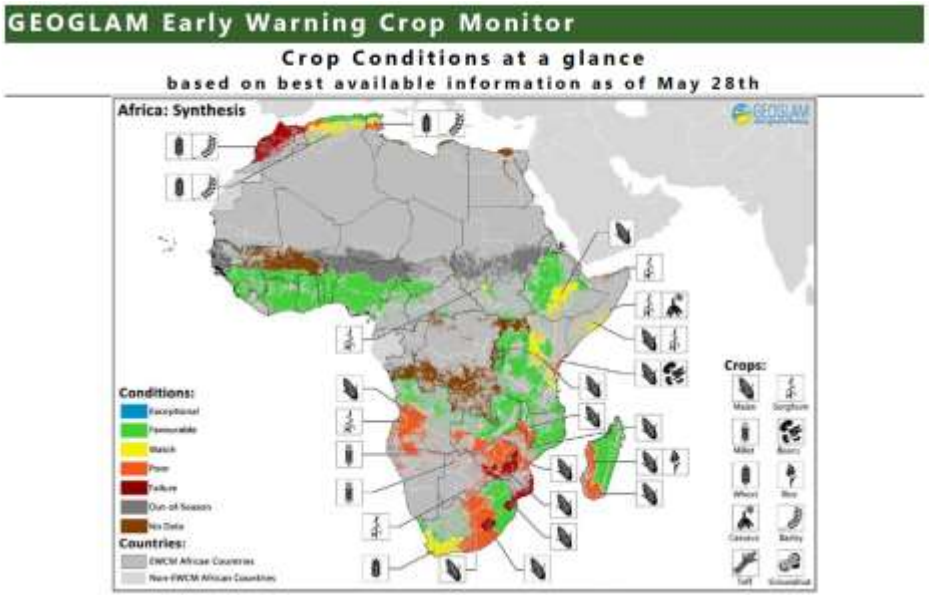
European Commission

Early warning: consolidated multi-agency information

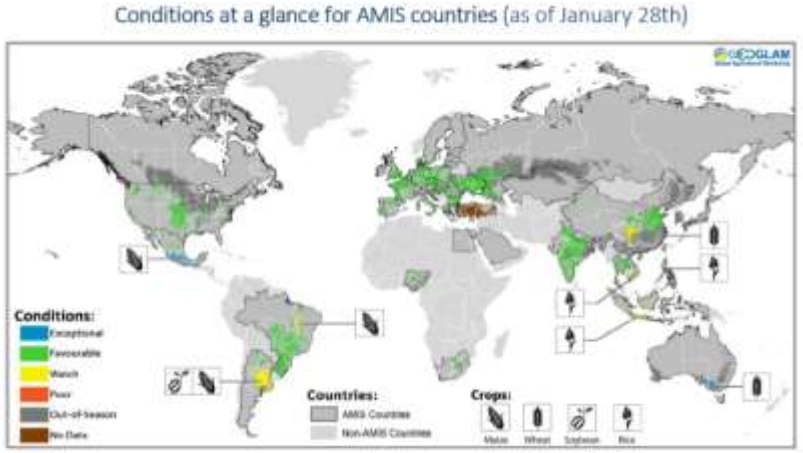
Effort towards multi-agency early warning systems such as the Crop monitor for Early Warning of GEOGLAM (a G20 initiative)

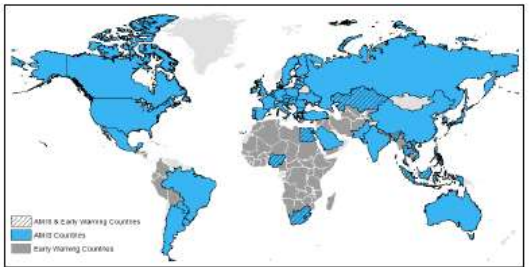
Other partners include: WFP, FEWSNET, FAO, University of Maryland etc...

For food insecure countries



For main producing countries





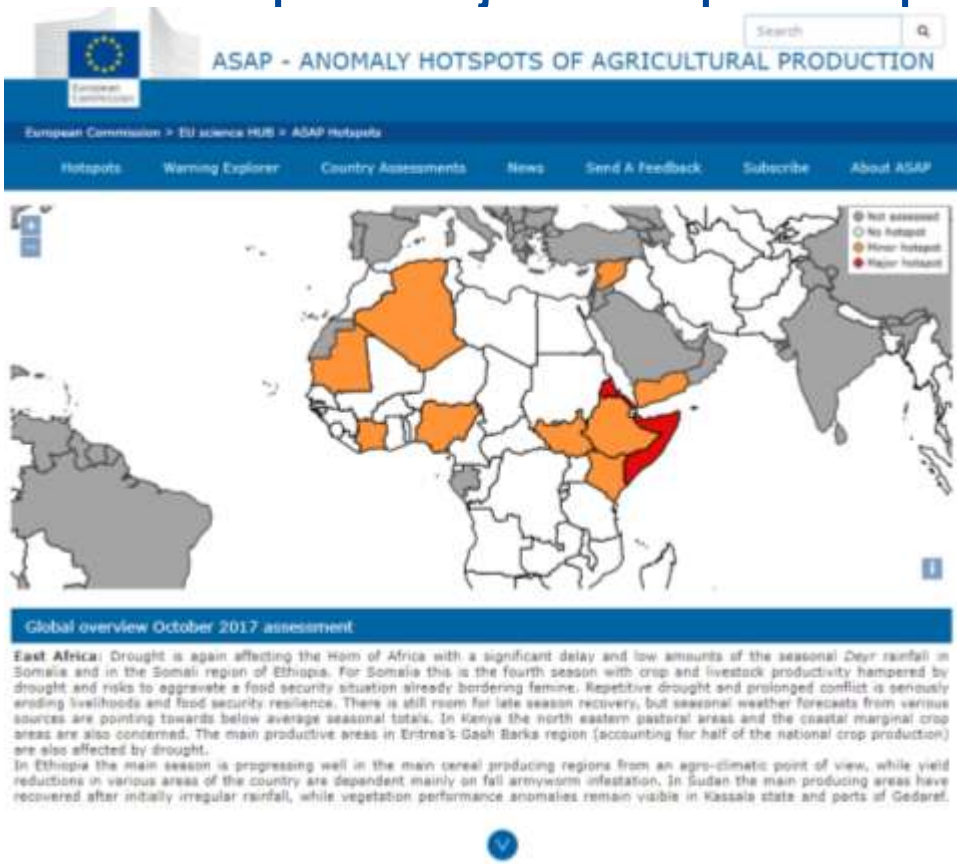
ASAP - Anomaly hot Spots of Agricultural Production

Online Early Warning Decision Support System providing timely warnings and short narratives for countries affected by anomalies of agricultural production (to non-remote sensing experts)

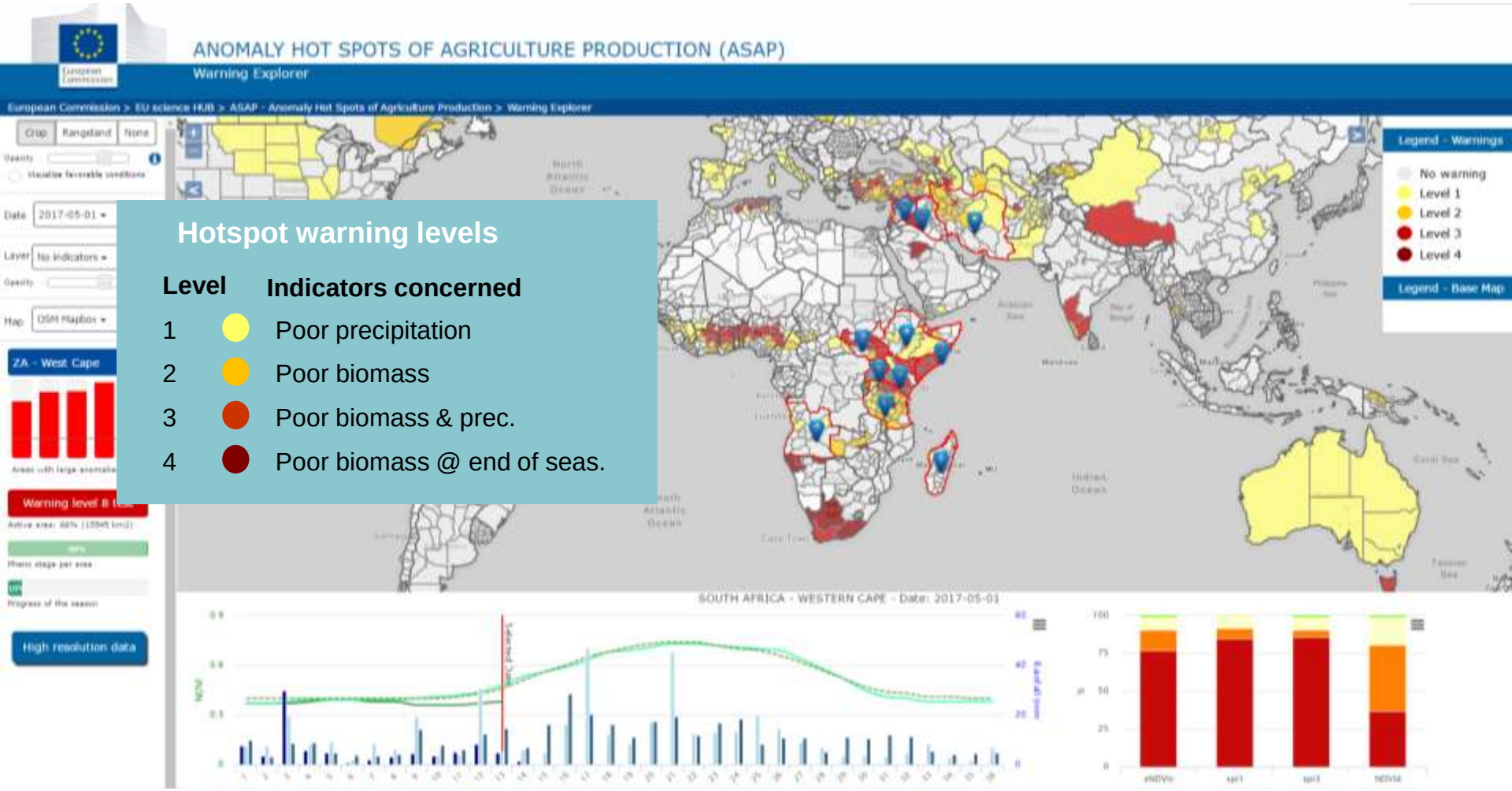
Users

- DG DevCo, EU delegations, agric. and FS analysts
- Agriculture and food security analysts in general
- Launched on 8th of June 2017 at the European Development days in Brussels
- Helps JRC to contribute to:
  - Food security assessments
  - IPC analysis
  - GEOGLAM products
  - Global report on food crises

https://mars.jrc.ec.europa.eu/asap/



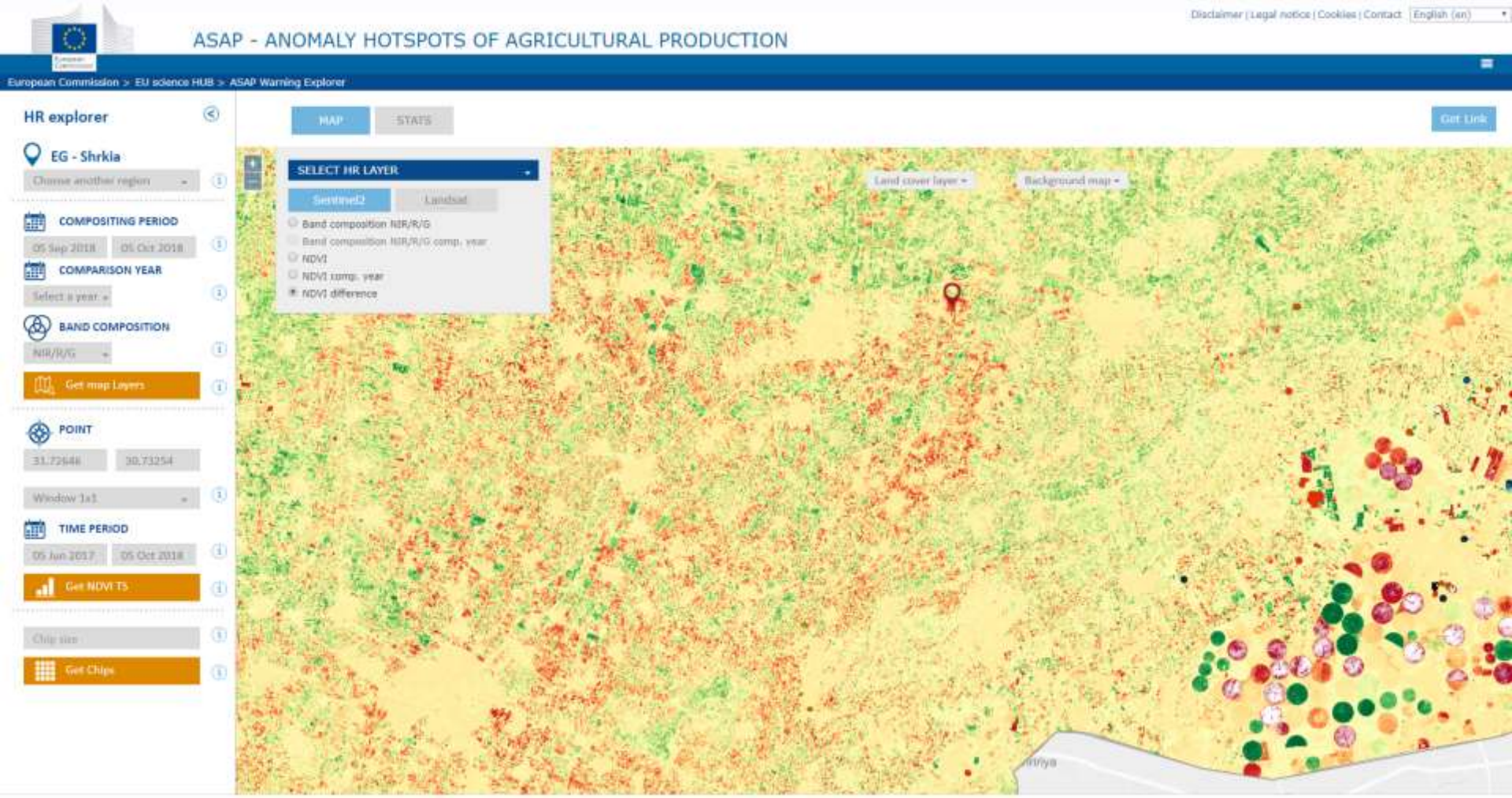
The ASAP Warning Explorer



Hotspot warning levels

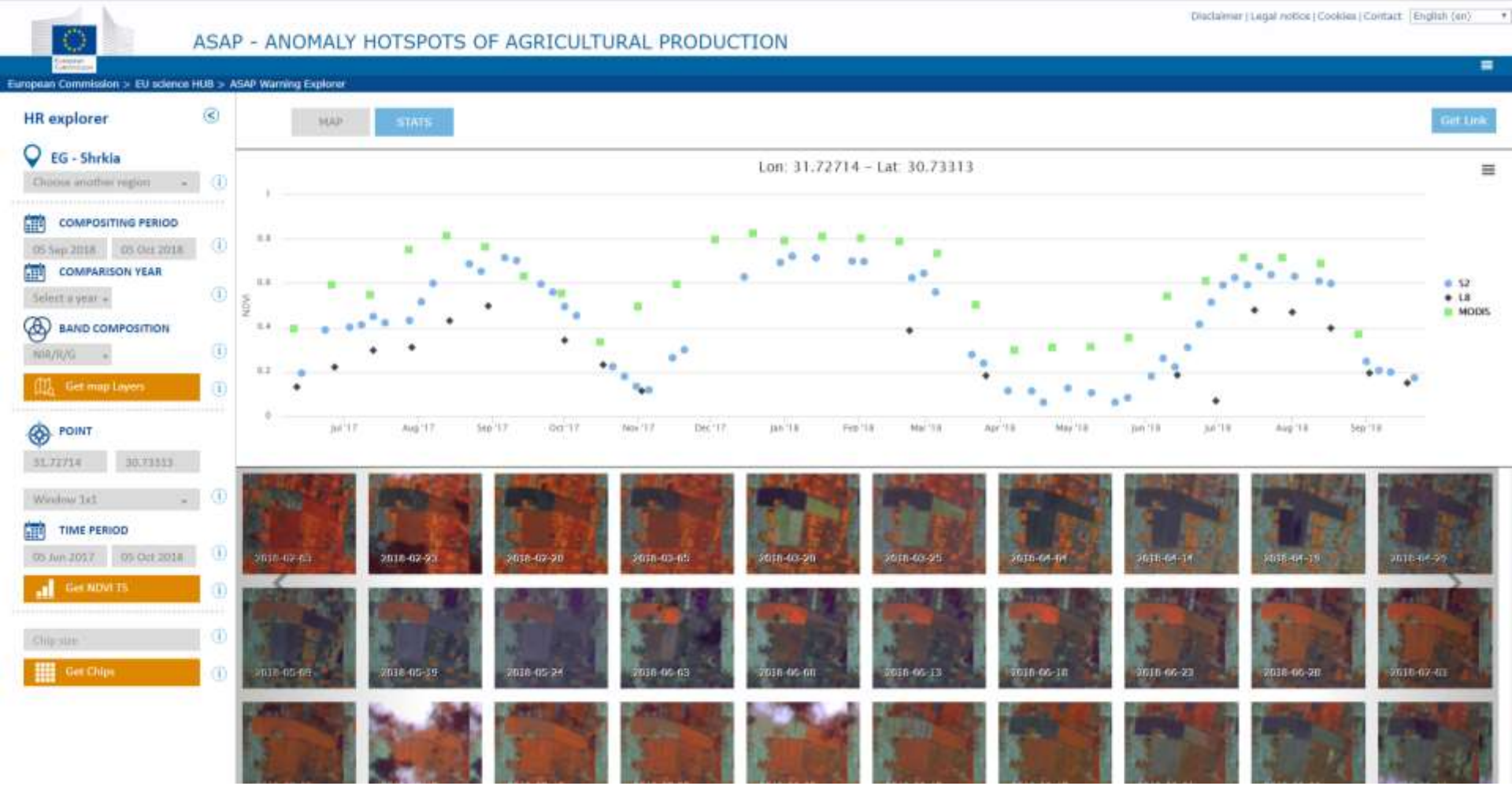
Level	Indicators concerned
1	Poor precipitation
2	Poor biomass
3	Poor biomass & prec.
4	Poor biomass @ end of seas.

ASAP HR viewer: zooming to the field level

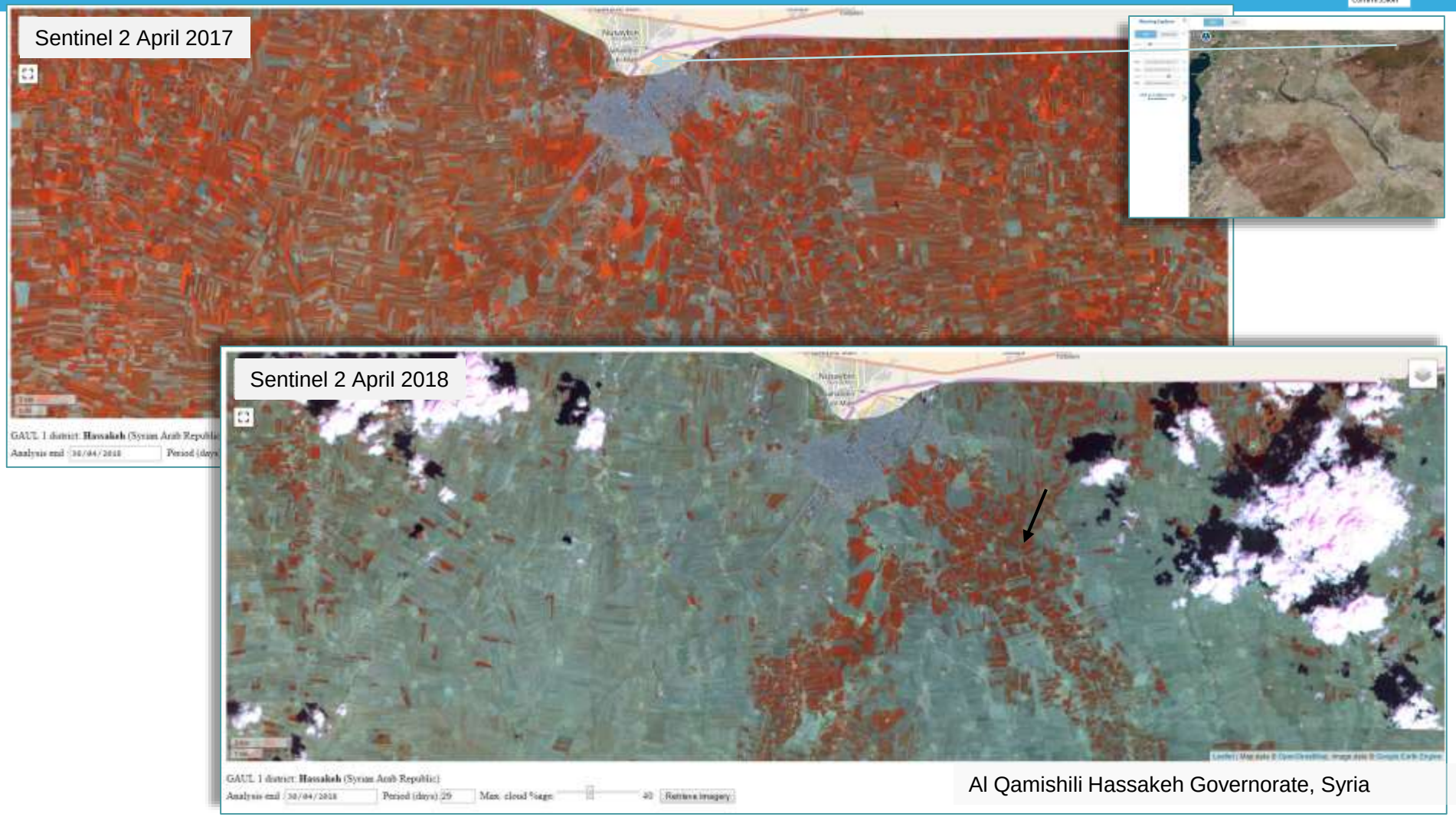


- High resolution imagery from Sentinel and Landsat sensors allows zooming in to field level (example of Shkria region)
- The NDVI difference between Oct.2018 and Oct. 2017 SENTINEL2 imagery shows many fields with lower performance in 2018

ASAP HR viewer: zooming to the field level



- The time series profile function compares SENTINEL2, Landsat8 and MODIS NDVI profiles at field level (approx.) and confirms that for this field, the 2018 Summer season (peak on the right) is shorter and has lower performance than in 2017 (peak on the left)
- The chip viewer provides a false color image for this field every 5 days (allows checking crop conditions, planting, harvesting, but also image quality or water on the field...)



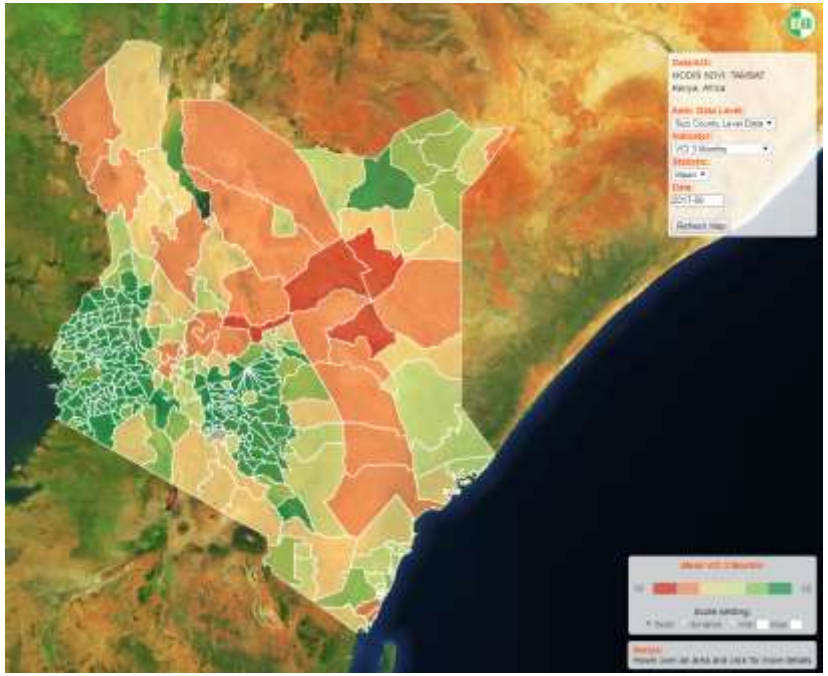
Al Qamishili Hassakeh Governorate, Syria

Crop area reduction 2017 - 2018

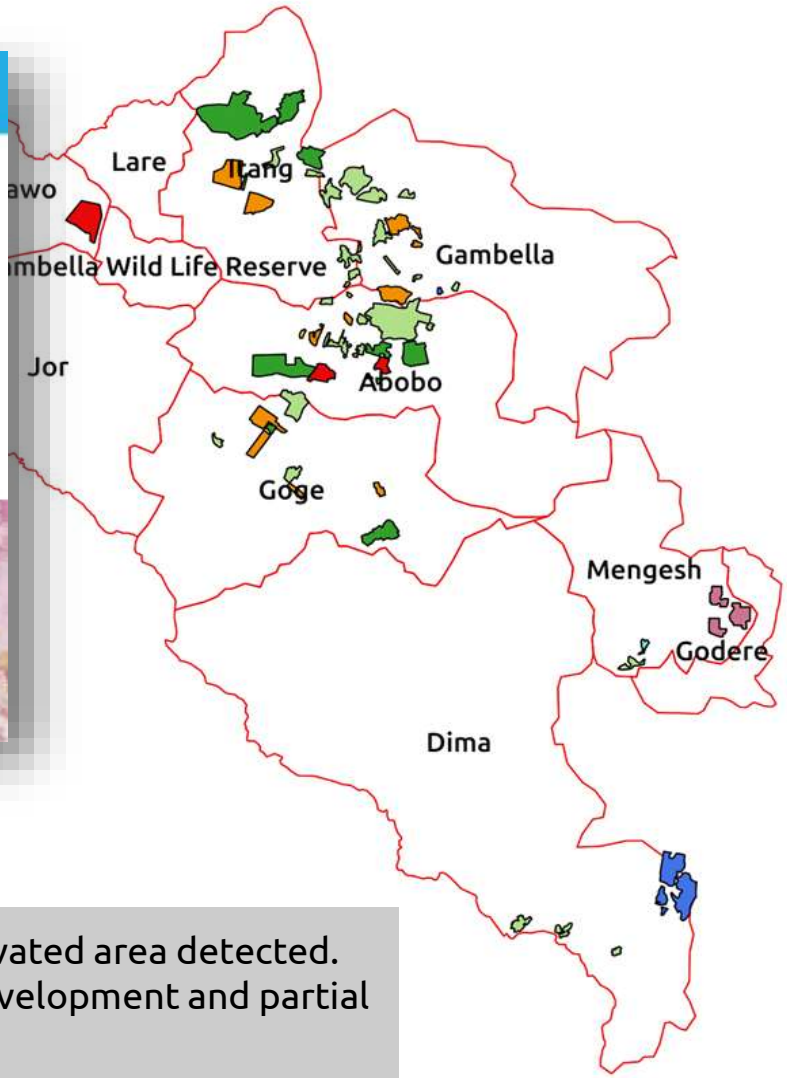
Risk management in drought prone areas

NATIONAL DROUGHT MANAGEMENT AUTHORITY (NDMA)

- About 74% of the contingency funds disbursed (ca. 8 Mio. Euro) in 2016/2017 was used to mitigate against drought effects on livestock assets
- Interviewed pastoralists felt that the 2016/2017 drought was managed better than any other previous drought.
- The 2016/2017 drought was more severe in terms of rain scarcity (four failed or below normal rain seasons). But basically no livestock losses (as opposed to 2009 and 2011)



Monitoring Large Scale Land Investments



Legend

Detected Agriculture

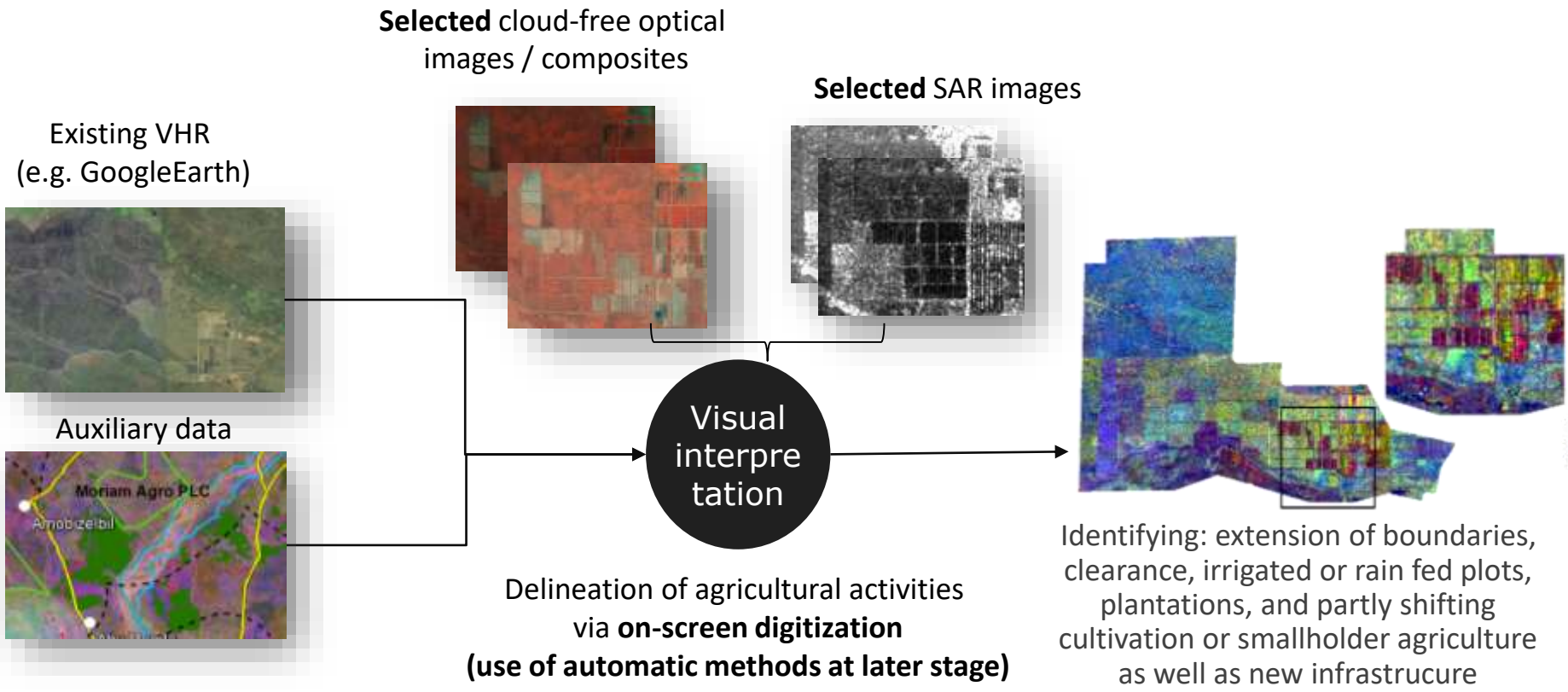
- clearance only
- intensive (irrigated)
- intensive (rainfed)
- partial (irrigated)
- partial (rainfed)
- plantation
- shifting cultivation
- smallholder
- Gambella Woredas

25 0 25 50 75 10

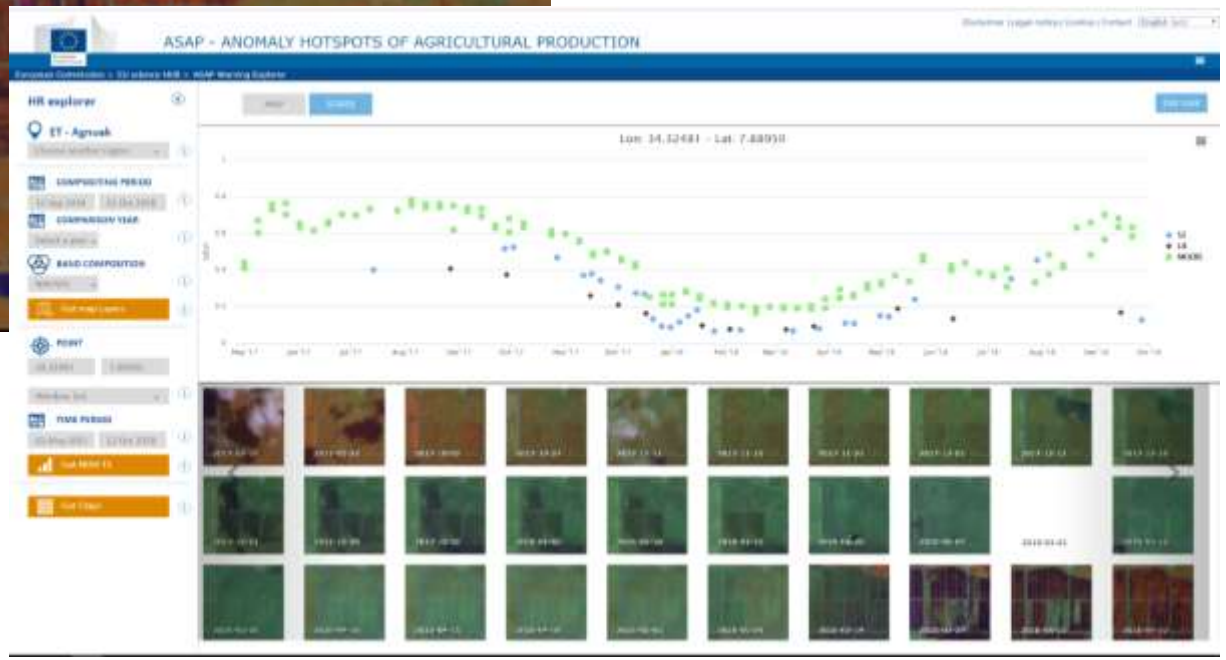
~110,000 ha of cultivated area detected. Includes ongoing development and partial cultivation

Developing a basic tool for comprehensive monitoring

Collaboration between GIZ, EU, JRC in developing a tool for Ethiopian Authorities for monitoring large scale land investments with EO data



ASAP HR viewer: fit for other purposes



- Example of Large Scale Land Acquisition (LSLA) monitoring in Ethiopia
- High resolution spatial and temporal information allows land use change monitoring: in this case transition from rain-fed to irrigated agriculture in 2018

Support to the LANDMATRIX

Objectives:

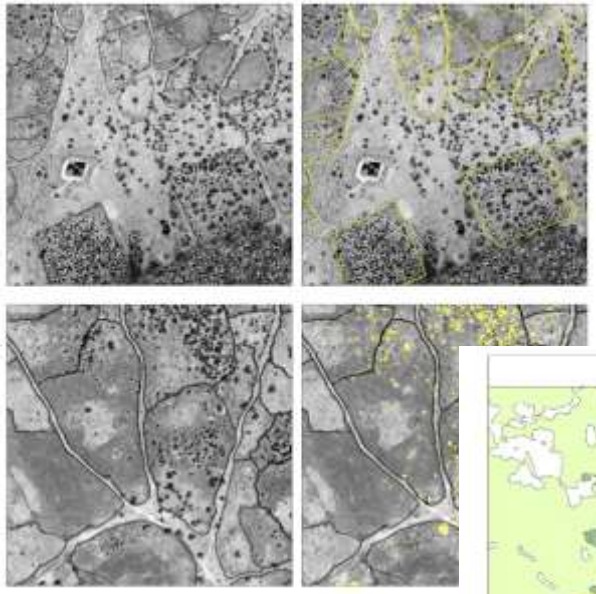
- Improve georefencing of land transactions included in the LM database
- Detect and map new or unreported large-scale land conversions
- Training on remote sensing/mapping techniques (e.g. as support to National Land Observatories)

A workshop on Earth Observation support to the LANDMATRIX took place from 8-10 October 2018

Pastoral land governance – mapping pastoral enclosures

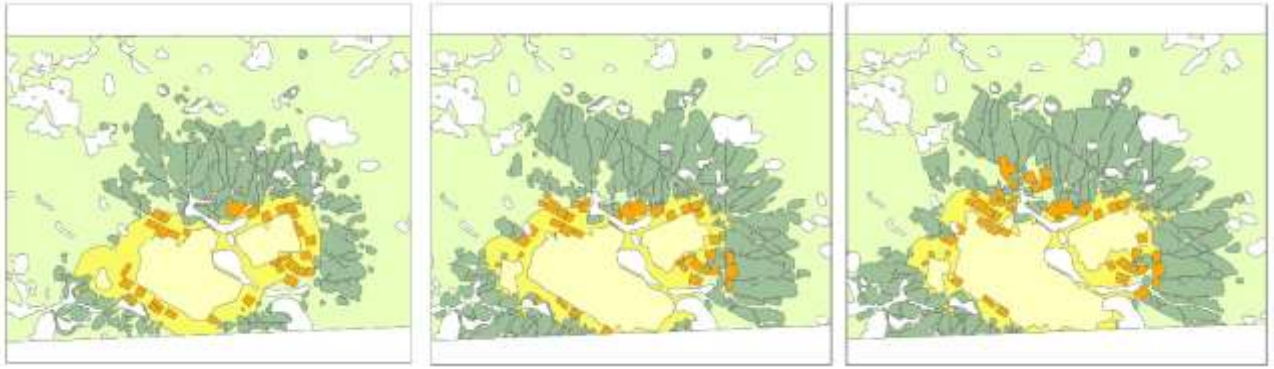
Pastoral enclosures are typical for many rangeland areas in East Africa with increasing pressure on natural resources and sedentarization

Objective: mapping enclosures and their changes over time for understanding main governance and management dynamics as well as long term dynamics



Delimitation on VHR images

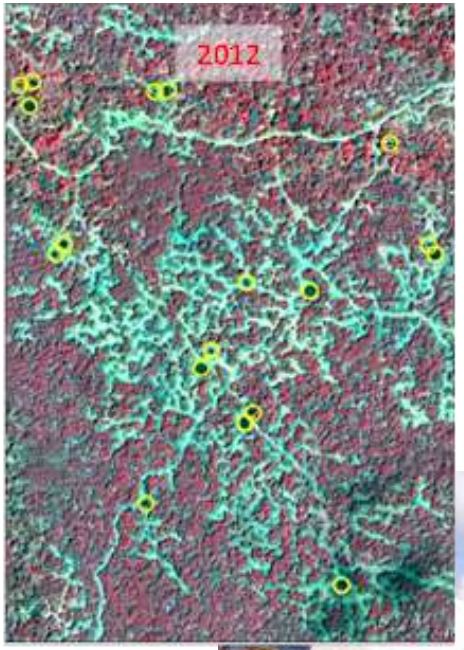
Change analysis on VHR and Sentinel



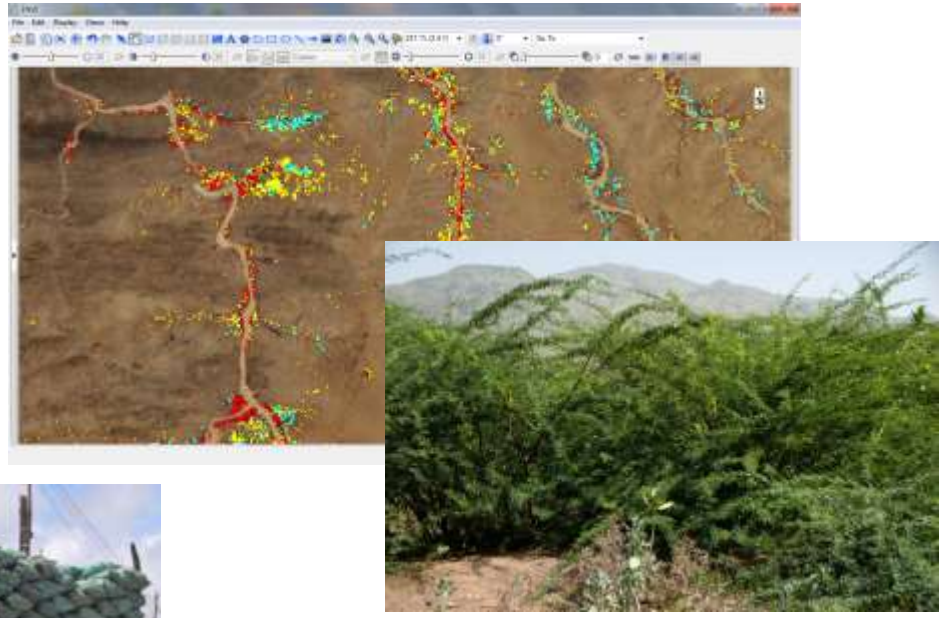
2006 2010 2013

Environmental research activities related to food security

Monitoring factors of land degradation: charcoal production, invasive species....



Source: *Rembold et. al 2013, Mapping charcoal driven forest degradation during the main period of Al Shabaab control in Southern Somalia, Energy for Sust. Development.*

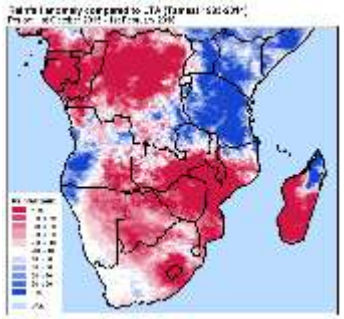


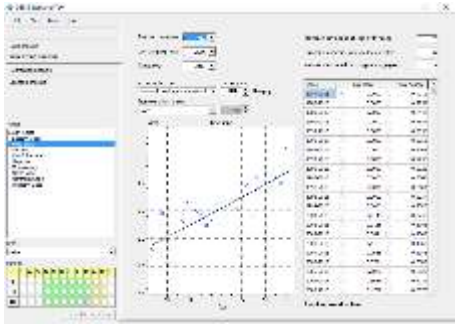
Source: *Rembold et. al 2015,* Mapping areas invaded by Prosopis Juliflora in Somaliland on Landsat 8 imagery

Training with EO based agricultural monitoring tools

JRC provides training in EO crop monitoring with 3 main tools and in coordination with MESA/GMES&AFRICA, FAO and WMO:

- **E-Learning Course** – Understanding the basis of crop monitoring with remote sensing (produced with FAO)
- **SPIRITS** – Free software for monitoring vegetation condition and produce crop bulletins (produced with VITO)
- **CST** – Statistical tool for yield forecasting (produced with Alterra and SIGMA project)
- Training in the use of Sentinel data for agricultural monitoring (in combination with GEE)





Conclusions

- Earth Observation increasingly relevant for agricultural monitoring, early warning, risk management project monitoring etc...
- Applications rapidly adapting to new user needs thanks to:
  - Increasing data availability and quality, common use of cloud processing tools, improved access to reference information
- JRC is interested it:
  - Scientific and technical collaboration, contribution to food security relevant international networks and reports (SOFI, Global network against food crises, IPC, LANDMATRIX etc…)
  - Development of applications for policy support
  - Contribution to international research frameworks (eg. GEOGLAM)
  - Support to knowledge transfer and capacity building

Thank you!

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