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ENVIRONMENTAL ENGINEERING

SPACE-BASED RDI PROJECTS IN SUPPORT OF DROUGHT EFFECTS MITIGATION

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► DIANA – DETECTION AND INTEGRATED ASSESSMENT OF NON-AUTHORISED WATER ABSTRUCTIONS USING EO

Co-coordinated by:



AgriSat
Iberia, s.l.



The project has received funding from the European Union's Horizon 2020 Leadership in Enabling and Industrial Technologies - Space programme under grant agreement No 730109



DETECTION AND INTEGRATED ASSESSMENT OF NON-AUTHORISED WATER ABSTRACTIONS USING EO

IRRIGATION → Main use of water in the EU (agriculture)

Problem → Non-authorized water (over-) Abstractions

Scarcity of water resources and drought that is becoming a frequent phenomenon

Traditional time-consuming and costly field inspections



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DIANA: EO-based commercial service platform

DETECTION AND INTEGRATED ASSESSMENT OF NON-AUTHORISED WATER ABSTRACTIONS USING EO



Non-authorized water abstraction detection and monitoring



Seasonal drought forecasting and monitoring



Support for monitoring the WFD



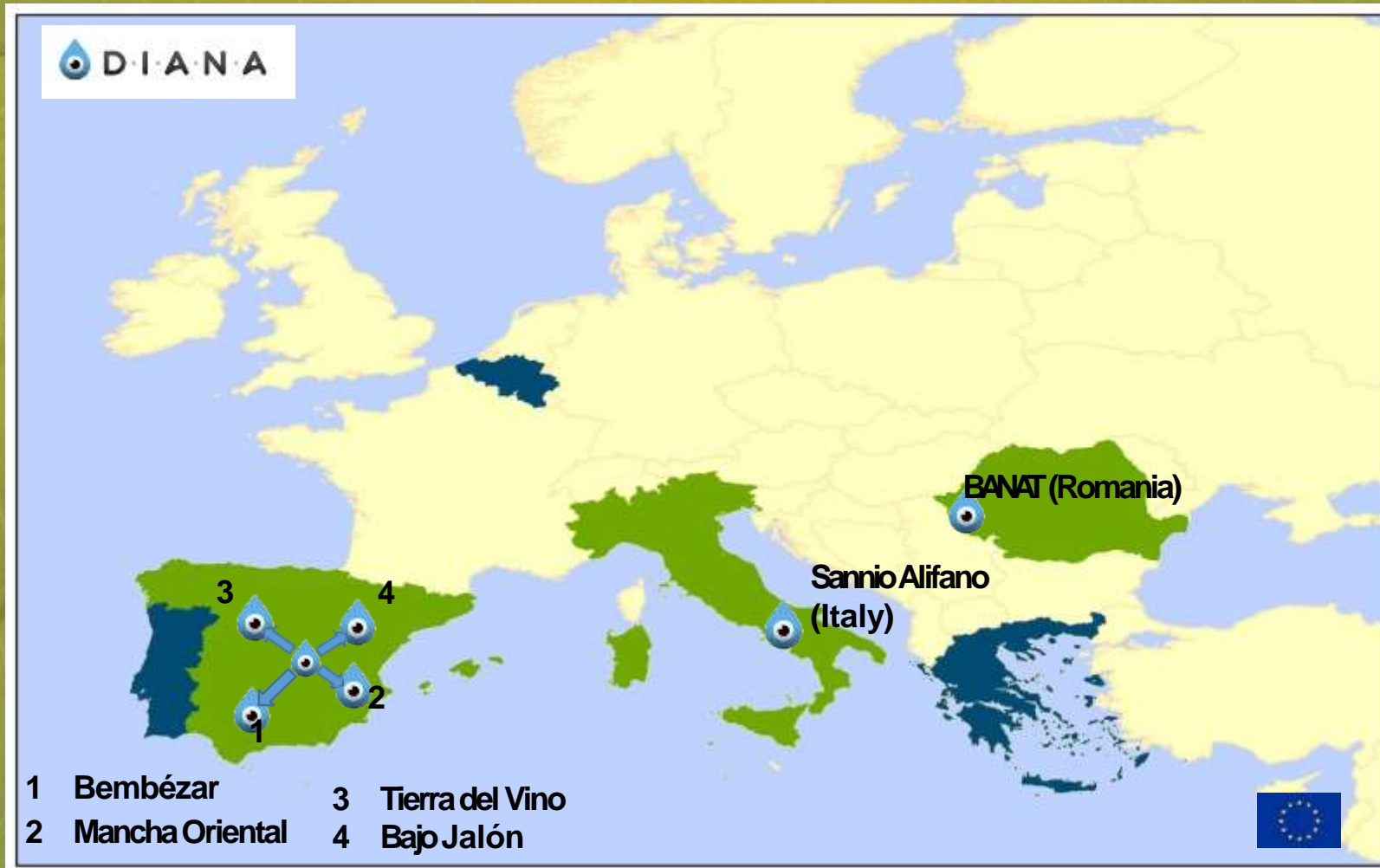
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Pilot areas

DETECTION AND INTEGRATED ASSESMENT OF NON-AUTHORISED WATER ABSTRACTIONS USING EO





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Pilot areas - Romania

DETECTION AND INTEGRATED ASSESSMENT OF NON-AUTHORISED WATER ABSTRACTIONS USING EO

**LOCATION: WESTERN PART OF THE
COUNTRY:**

- infrastructure for irrigations: 80 gauging
stations and 351 observation wells;

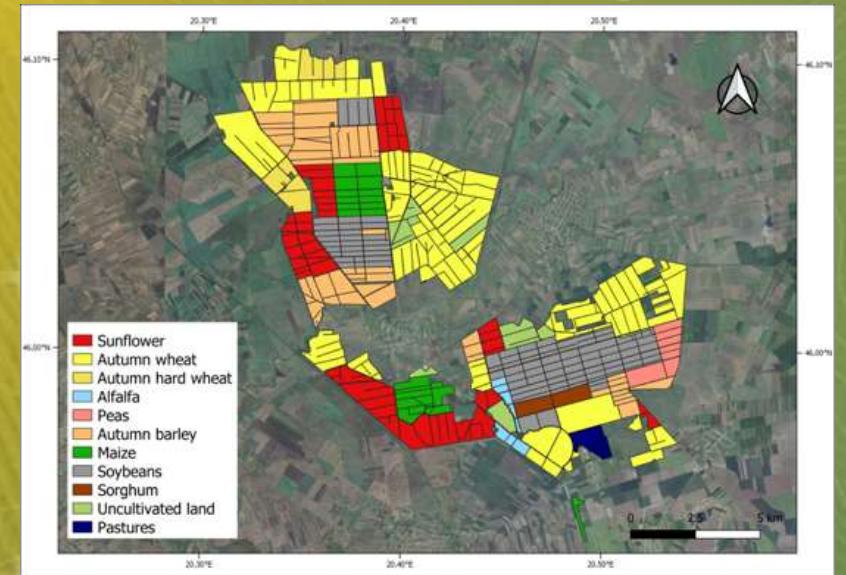
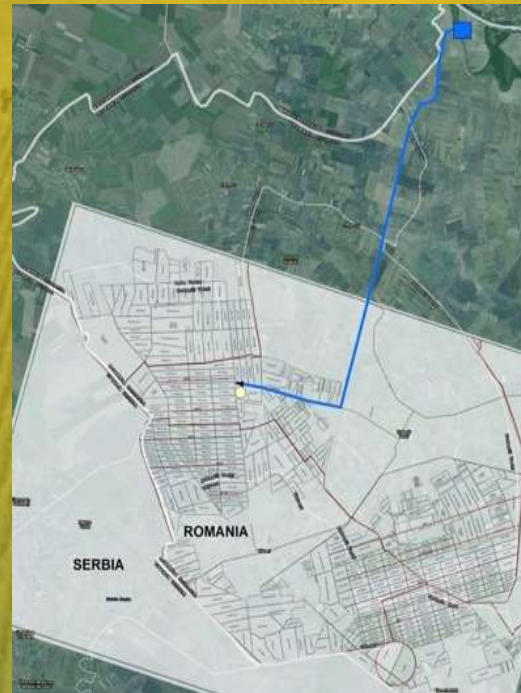
Sannicolau Mare – Dudestii Vechi Pilot Area

Farm: EMILIANA WEST ROM

- over 12.000 ha of irrigable land

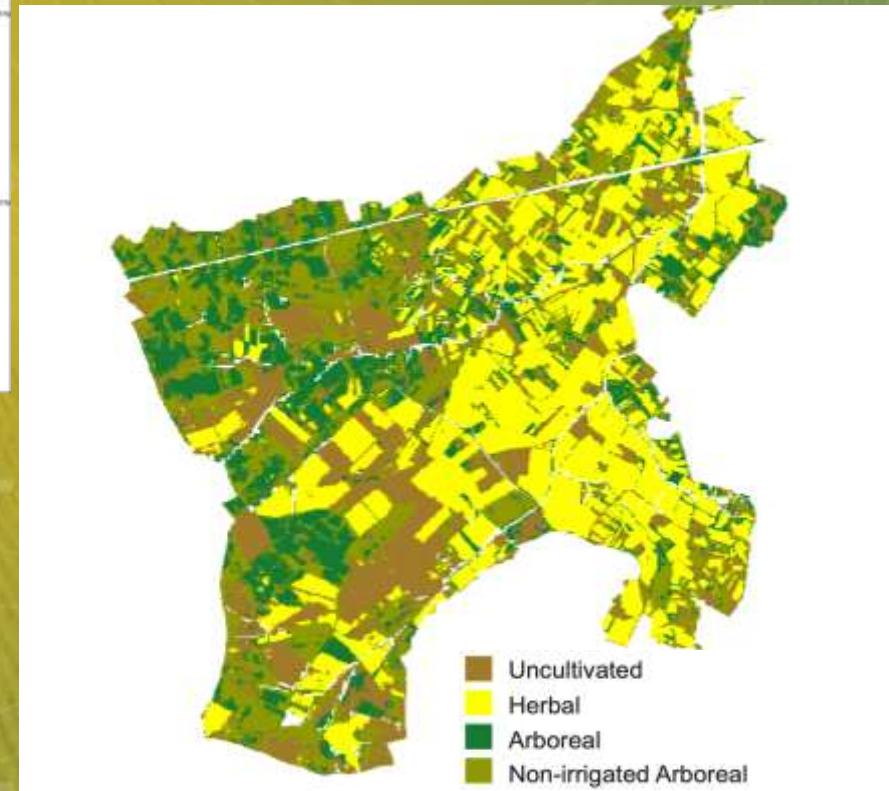
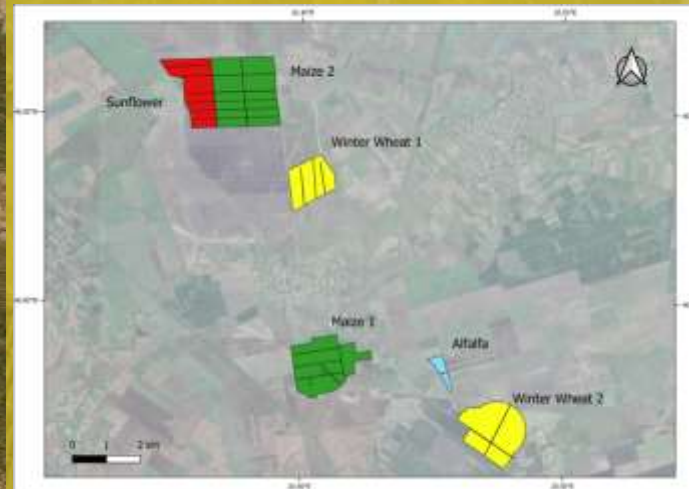
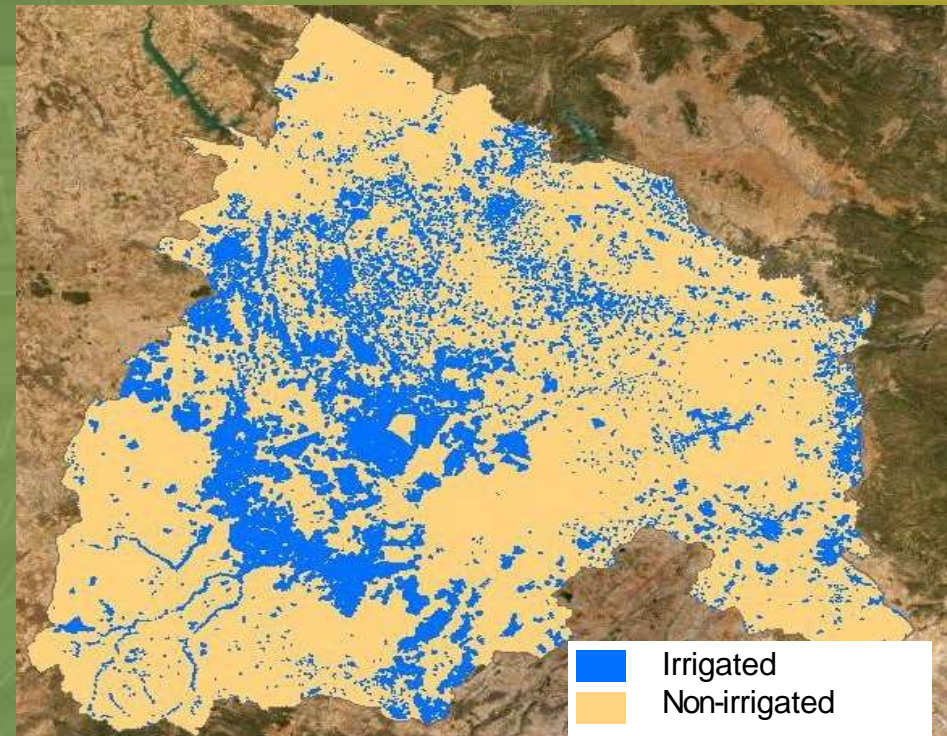
- Main crops

- wheat
- soybean
- rapeseed
- sunflower
- maize





Water Abstractions Monitoring



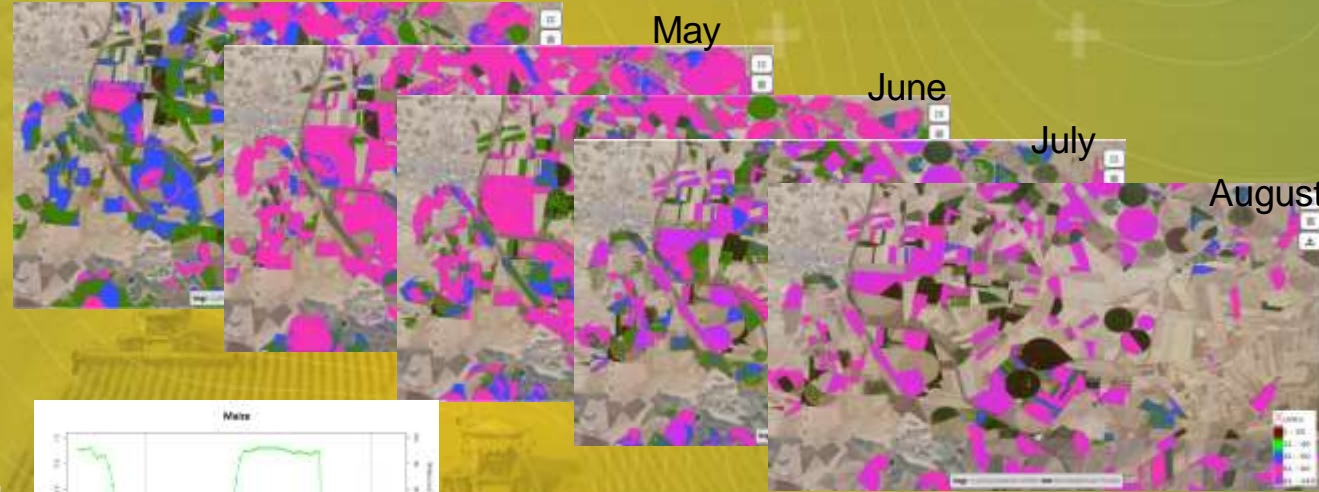
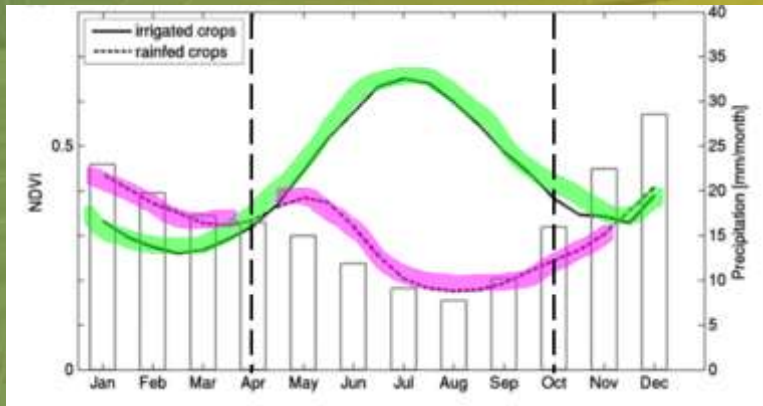
Maps of Irrigated Areas



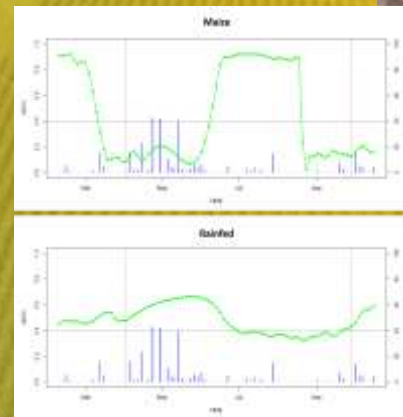
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Water Abstractions Monitoring

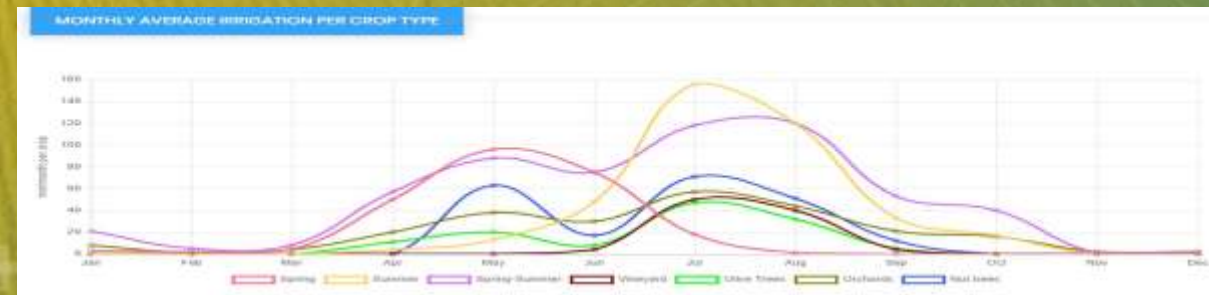


TEMPORARY SCALE
Monthly → Annual



Maps of Consumed
Volumes

MONTHLY AVERAGE IRRIGATION PER CROP TYPE

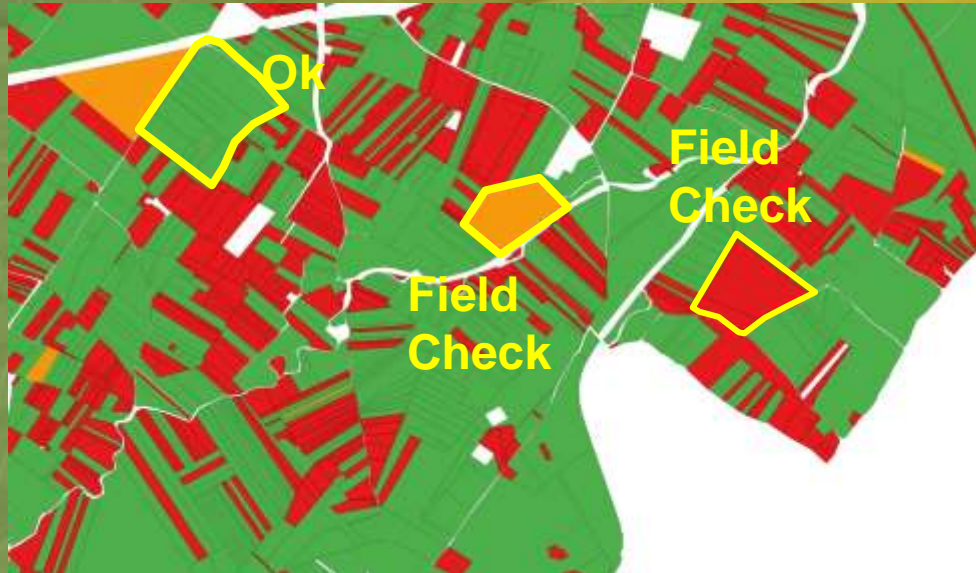




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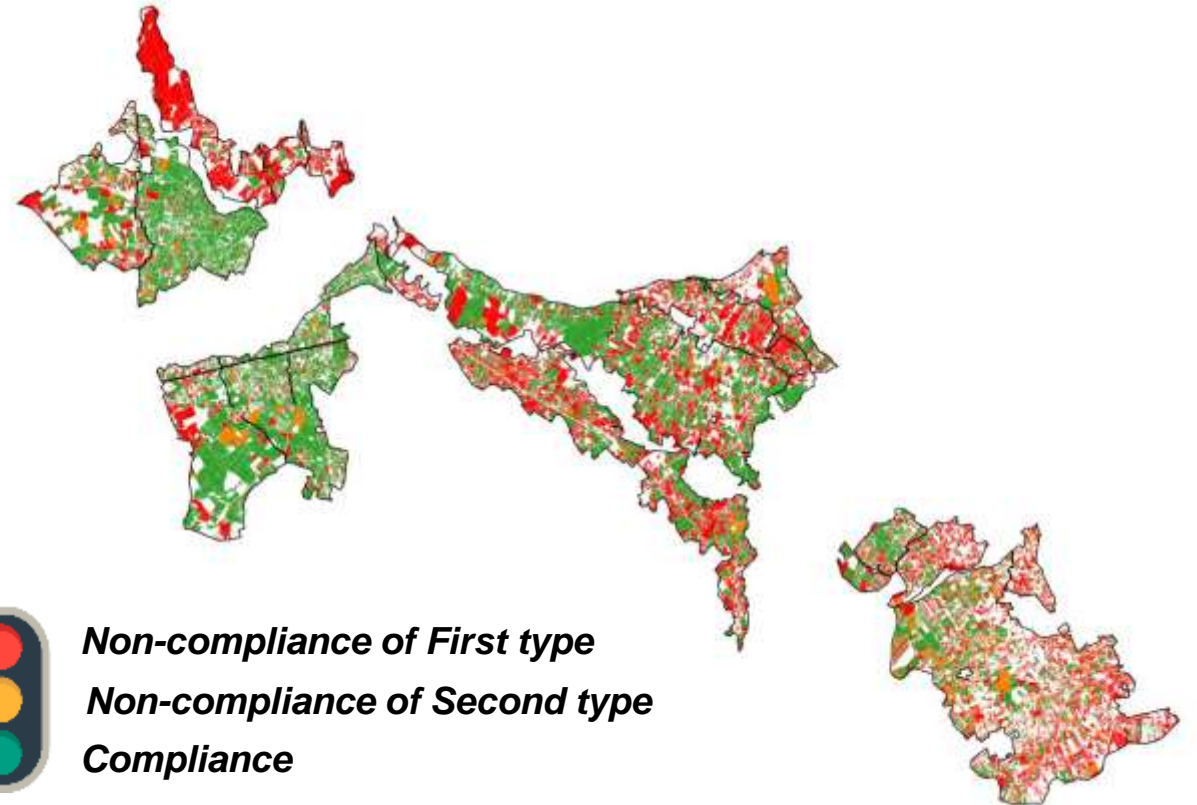
Water Abstractions Monitoring



RED: areas without water right

YELLOW: areas exceeding the water volume assigned

GREEN: match between layers



Merging Irrigated Areas with Water Rights

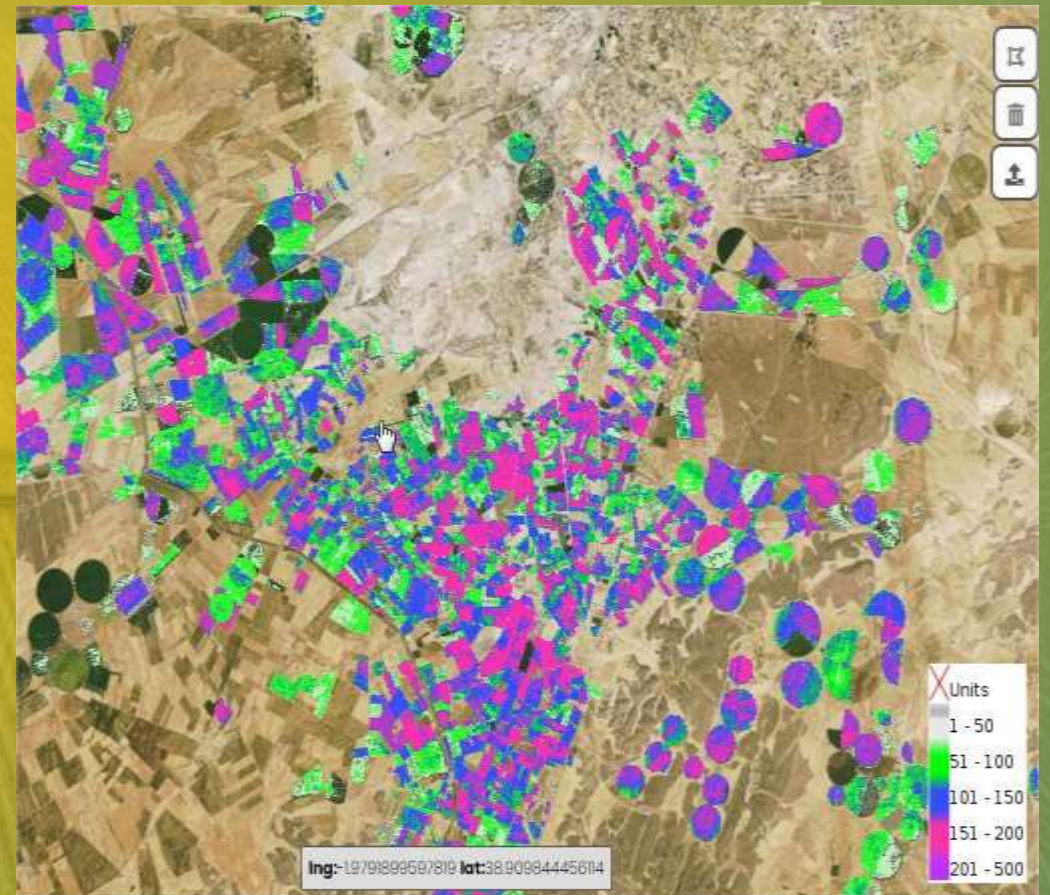
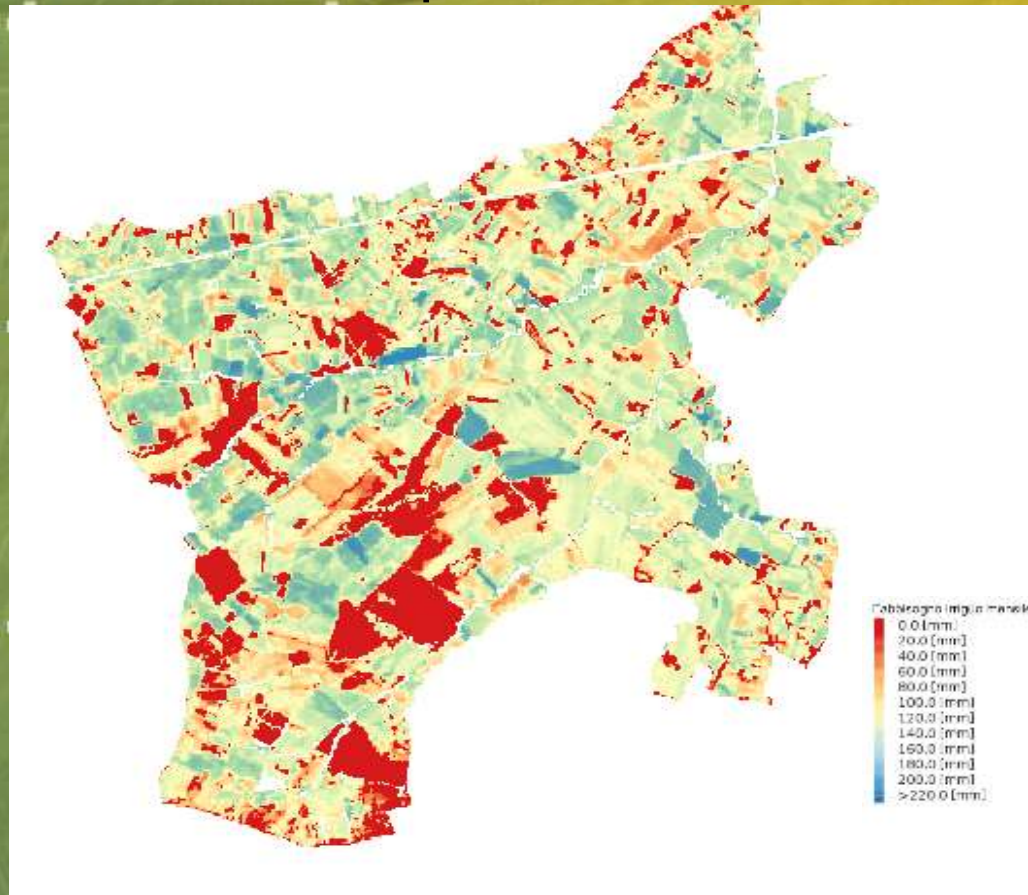


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Irrigation Water Requirements



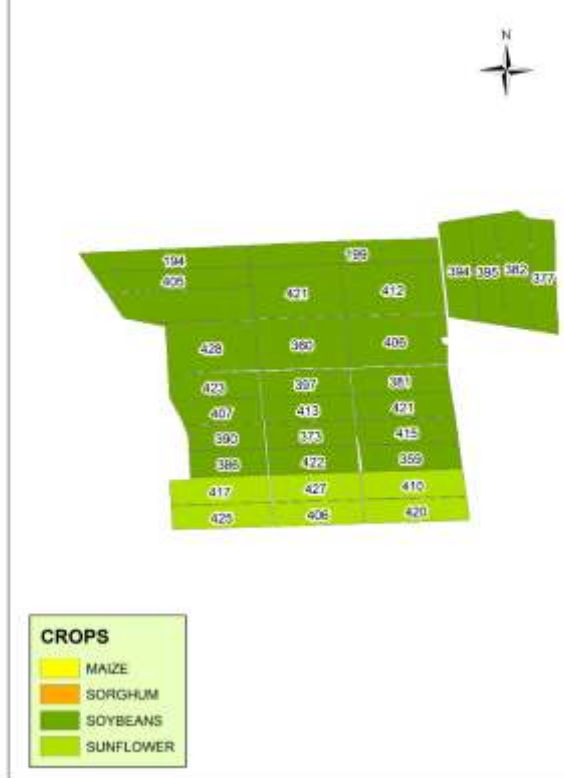
Water Abstractions Monitoring



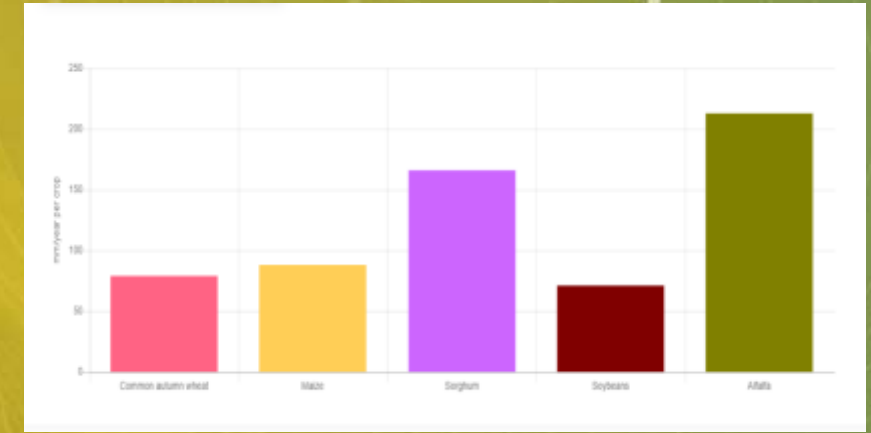
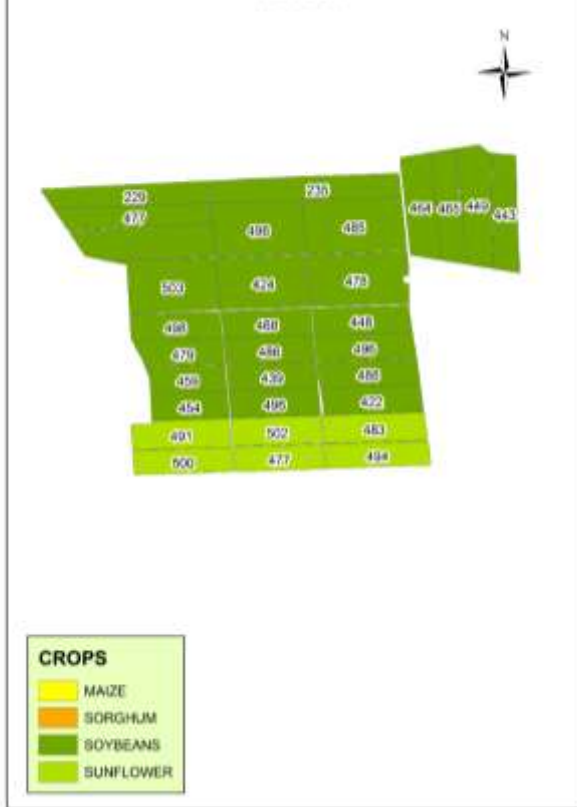


DETECTION AND INTEGRATED ASSESSMENT OF NON-AUTHORISED WATER ABSTRACTIONS USING EO

AVERAGE OF NET IRRIGATION WATER REQUIREMENTS PER PLOT



AVERAGE OF GROSS IRRIGATION WATER REQUIREMENTS PER PLOT





Water Abstractions service

DIANA Platform



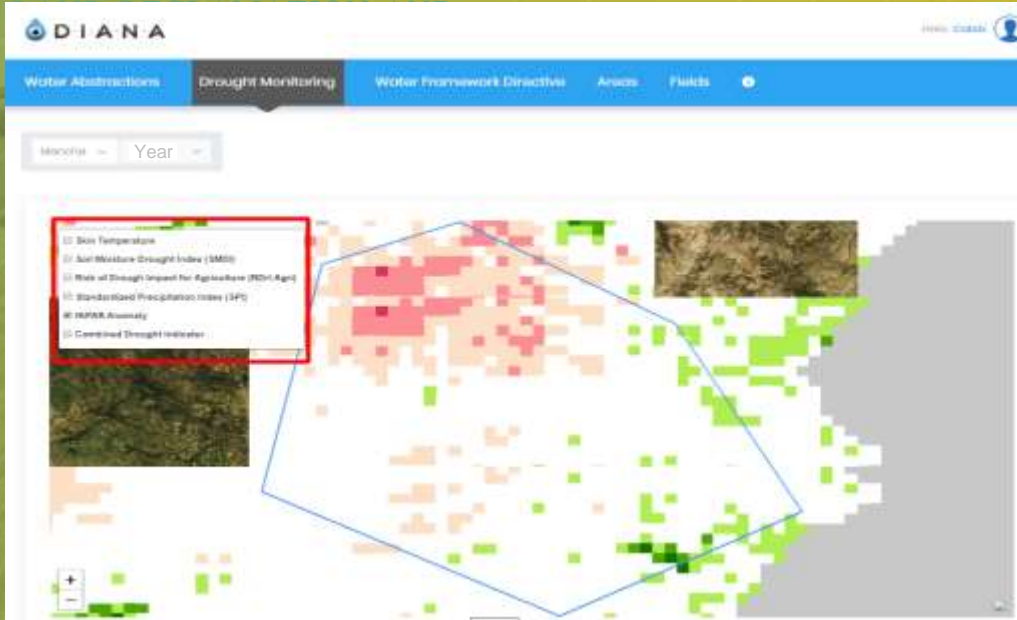
AVAILABLE LAYERS:

- Crop classification
- Irrigated and Non-irrigated Areas
- Crop Evapotranspiration (Etc)
- Net Irrigated Water Requirements (NIWR)
- Gross Irrigated Water Requirements (GIWR)





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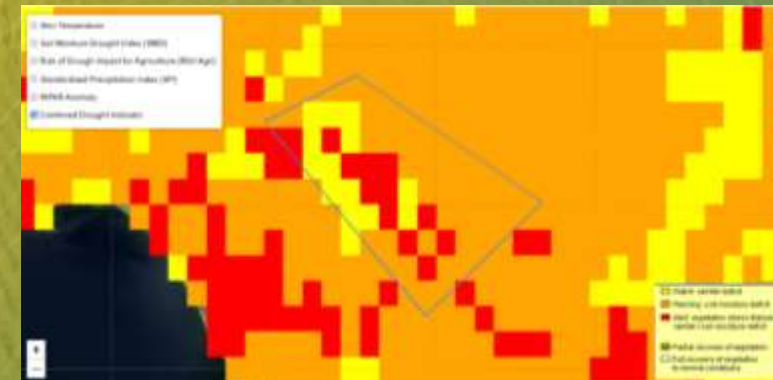


Drought monitoring service

DIANA Platform

AVAILABLE LAYERS:

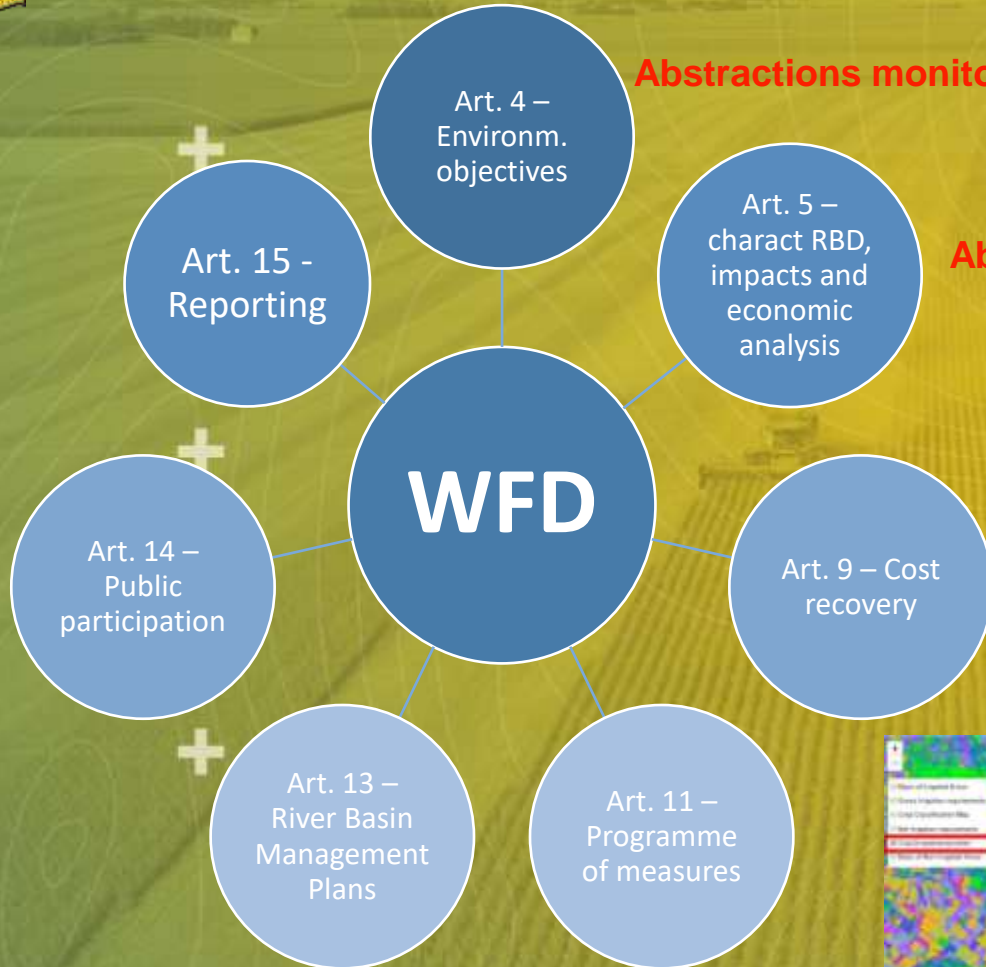
- Skin Temperature
- Soil Moisture Drought Index (SMDI)
- Risk of Drought Impact for Agriculture (Rdri-Agri)
- Standardized Precipitation Index (SPi)
- fAPAR Anomaly
- Combined Drought Indicator





Water Framework Directive

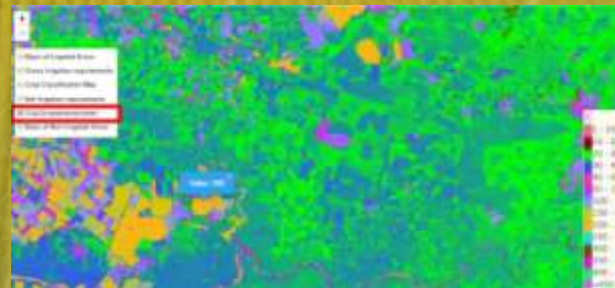
DIANA Platform



Abstractions monitoring

Abstractions monitoring

Crop water requirements / consumption / abstractions mapping



Crop water requirements / consumption / abstractions mapping

Update of abstractions registry

AVAILABLE LAYERS:

- Maps of Irrigated Areas
- Gross irrigation requirements
- Crop classification map
- Net irrigation requirements
- Crop evapotranspiration
- Maps of Non-irrigated Areas



DETECTION AND INTEGRATED ASSESSMENT OF NON-AUTHORISED WATER ABSTRACTIONS USING EO

OVERALL ACHIEVEMENTS

The technology applied to derive DIANA products from Earth Observation was mature enough to be transferred to operational applications.

The processing chains have been consolidated and implemented in the different pilot areas.

DIANA products exploit the full potentiality of COPERNICUS in terms of spatial, spectral and temporal resolution.

The validation has evidence that the accuracy of the operational products is very satisfactory and it fulfils the requirements from final users for their specific usage.

River basin planning & management

Main tasks to which DIANA is useful

- Detect and estimate authorized, non-authorized and over-abstraction
- Timely estimate of irrigation water demand from the plot scale to River Basin District
- Water allocation among uses
- Meet reporting requirements
- Identify areas affected by drought, or with high drought risk to provide a solid basis for early intervention -- real time management of water allocations and use in cases of drought



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TOMOGRAPHIC C-BAND SAR INFRASTRUCTURE FOR EARTH OBSERVATION APPLICATIONS





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► **T-SAR** - Campaign Support for Sentinel-1 Companion Satellite (CS) –
System Studies - CampaignS1_T-SAR

Financed by: European Space Agency (ESA)



Contractor: Terrasigna SRL (RO)



Sub-contractor: University of Agronomic Sciences and
Veterinary Medicine of Bucharest (RO)



Period: since 2019

Main objective: development of a ground-based pilot system for radar measurements performed on agricultural crops, in order to verify the feasibility of applying satellite radar techniques in this field.



Context

- the **Sentinel-1** mission within the **EU's Copernicus program** has traded tomographic capabilities and spatial resolution in exchange for complete coverage of Europe;
- the current **Sentinel-1** data is not suitable for mapping certain biophysical parameters of vegetation;





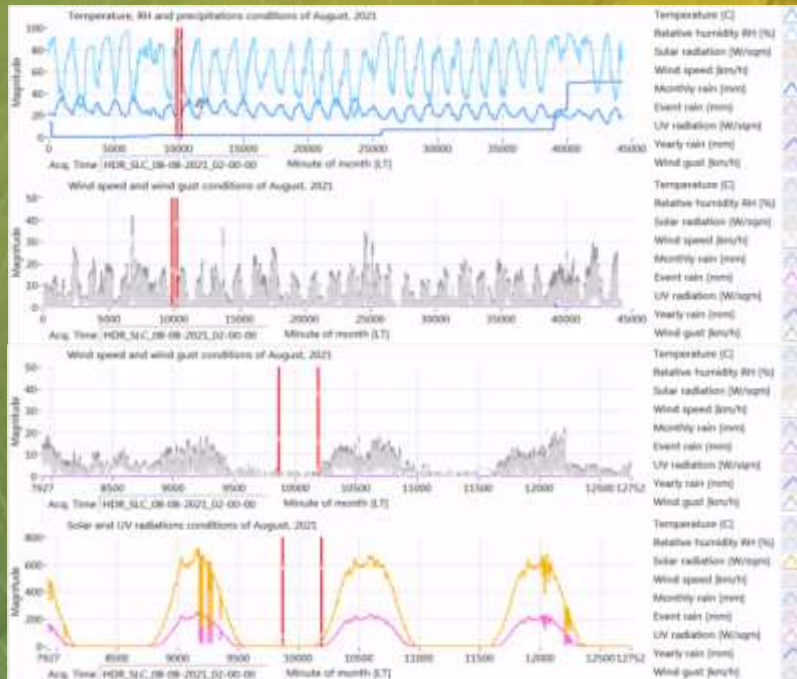
The radar installation at Moara Domneasca Didactic Farm reproduces, on the ground, the space measurement technique and geometry that the European Space Agency is considering for the launch of a future satellite mission





The system

- is using radar technology (microwaves)
- is providing 3D radar imagery (holography)
- is designed to provide information about:
 - crop phenology
 - growth stage
 - relative water content of plants
 - relative soil moisture

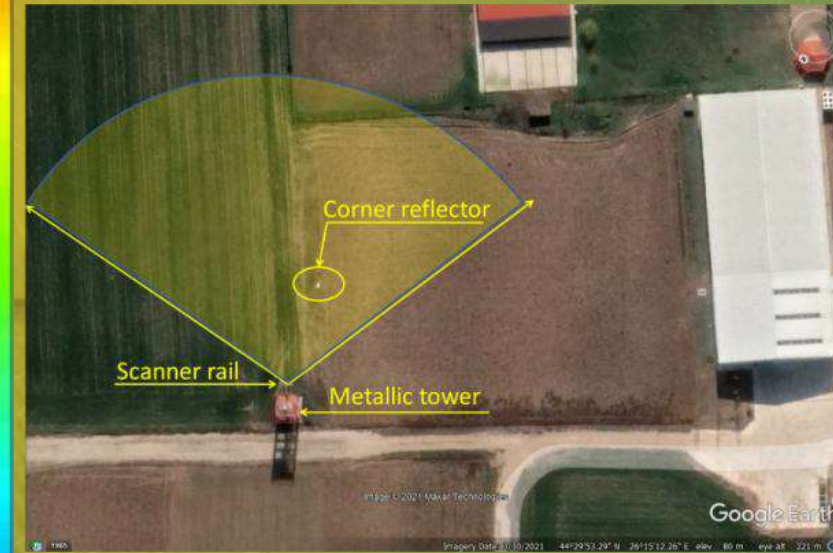
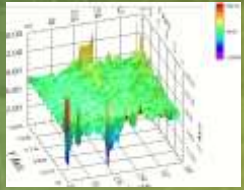
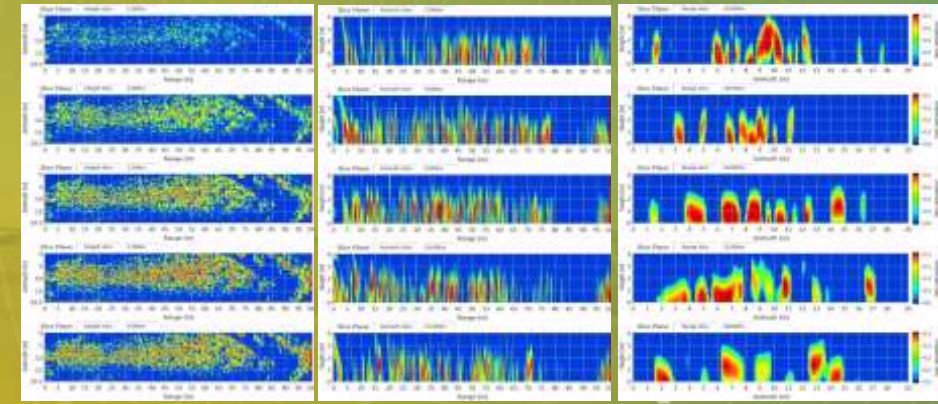
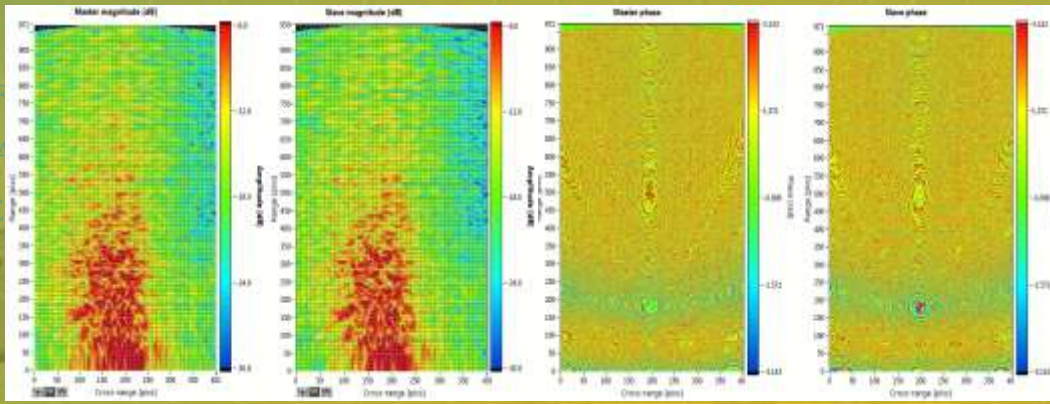


System characteristics

- Automatic scanning (programmable)
- Internet connection
- Video recordings
- Correlation of radar information with:
 - meteorological data / conditions
 - chromatic analysis
 - ground measurements (local sensors)
 - complementary data regarding crop parameters



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View of the test site



Next steps – starting 2023

- investigations over a full growth period and for a lower range resolution, corresponding to Sentinel-1 transmitted bandwidth;
- calibration of the 3D images by installing small reflectors at different heights
- acquisitions sessions after freezing, rainy and **drought** periods, in order to validate the expected responses in these cases;
- ancillary sensors network - sensors for leaf-wetness (optical), soil moisture (at different depths) and NDVI (for VWC, biomass, crop phenology & LAI) shall be installed in the field for real-time measurements;
- irrigation system – **irrigated and non-irrigated plots for radar measurements**



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Thank you!

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