EARTH OBSERVATION FOR SMART FARMING AND CAP PERFORMANCE

How time-series measurement of vegetation indices supports the provision of smart farming and agricultural monitoring services for Greek farmers and policymakers.

The challenge

Greek farmers are facing a series of challenges that affect their crop yield. For example, plant defensive systems are lowered due to climate change, making them more susceptible to pest attacks. Nevertheless, farmers continue to make decisions for their farms based on their intuition, or acquired ancestral knowledge, using traditional non-sustainable practices that drain the natural resources and affect the environment.

In this context, gaiasense has arisen as a Smart Farming (SF) platform that provides data-driven environmentally friendly advisory services on fertilisation, irrigation and pest management, minimising the use of inputs (i.e. water, fertilisers and pesticides), according to the mandates of the Common Agricultural Policy (CAP). Multiple data sources, such as the Internet of Things (IoT) sensors, farm logs, and satellite imagery, are used to generate reliable advice and support the decision-making process of the farmer.

The space based solution

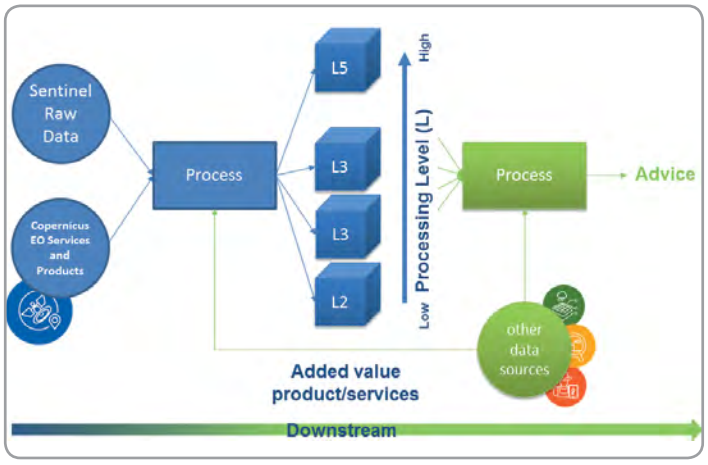
Gaiasense uses remote sensing methods to process and upgrade one of the main data inputs that of Copernicus raw data and services hosted on hubs. The downstream workflow aims to output high value-added products and services that may be then fused with the remaining data sources of gaiasense to generate the advice. As an example, solar radiation and IoT measurements are combined to estimate the reference evapotranspiration that is needed in the irrigation advice.

In practice, the pipeline of the platform incorporates three core modules operating independently, which in turn search for new Sentinel-2 imagery, download them and perform the required processing for optical satellite images (i.e., atmospheric correction and cloud masking). As a result, the initial data are upgraded to higher-level products, such as NDVI or LAI vegetation indices that are valuable for SF.

The platform automatically assigns the extracted information to the agricultural parcels or the management units belonging to the gaiasense database. Furthermore, meteorological data from the IoT telemetry stations enrich the information context. The farmer is also able to correlate the spatiotemporal conditions of his parcels with those of a larger user-defined Area of Interest (AOI).

Benefits to Citizens

Gaiasense provides EO-based monitoring services that allow farmers to understand their crops growth and vitality, and enhance their farm management with evidence for specific action. In parallel, the extracted vegetation indices provide valuable information



The downstream workflow of gaiasense produces a high value data chain leveraging EO Copernicus data and services.

Thematic Area: AGRICULTURE, FOOD, FORESTRY AND FISHERIES

Region of Application: CENTRAL GREECE, CENTRAL MACEDONIA

Sentinel mission used: S2

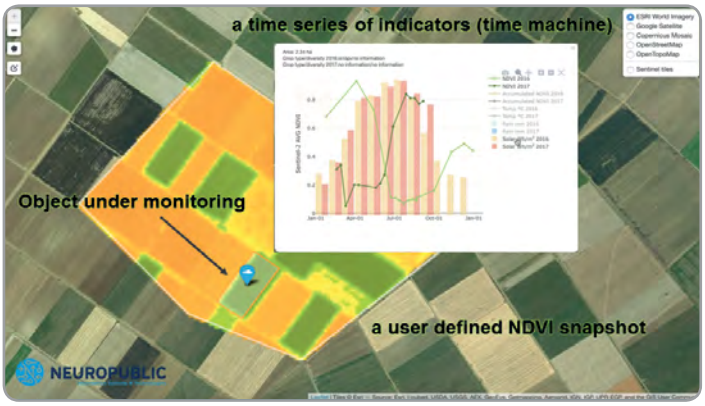
Copernicus Service used: –

Usage Maturity Level: 3

regarding the intrafield variability conditions of the parcel (time-series of image snapshots). The gaiasense-guided actions in the field reduce the consumption of natural resources and protect the environment by minimising the use of chemicals.

These services also introduce spatial analytics intelligence for CAP performance and efficiency management, which is valuable for policymakers. EO-based stream values enable crop growth analysis and crop type profiling, revealing trends and helping regional, national and EU policymakers to understand "where we are, what direction we are heading in and how far we are from where we want to be", supporting the CAP and Food Security policies.

After two years of applying the SF services, results have shown that it is possible to increase production by an average of 10% and decrease the consumption of water, fertilisers and pesticides by an average of 19%.



A demo view depicting fields in Central Macedonia. The end user can monitor parcels through time, either by using interactive graphs of indicators, or image snapshots.
Credit :Contains modified Copernicus Sentinel data [2016, 2017]

> "Gaiasense helps the producers of our regions to reduce the use of agrochemicals, leading to the production of safer food."
>
> ***Mr. Kostas Apostolopoulos,***
> ***Vice-Governor of Rural Economy of the Central Greece Region***
> ***Mr. Theofanis Papas,***
> ***Vice-Governors of Rural Economy of the Central Macedonia Region***

Outlook to the future

Agricultural monitoring and SF require a large amount of data from several sources in order to be accurate. In the future, we plan to incorporate more Sentinel missions into the workflow in order to examine data from more wavelengths and acquire the shortest revisit time that will enhance the quality of the given advice. Crop growth models and probabilistic weather forecasts powered by satellite data are another appealing extension for gaiasense.

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ABOUT COPERNICUS4REGIONS

This Copernicus User Story is extracted from the publication "**The Ever Growing use of Copernicus across Europe's Regions: a selection of 99 user stories by local and regional authorities**", 2018, Edited by NEREUS, the European Space Agency and the European Commission.
The model cases focus on local and regional authorities who successfully applied Copernicus data in 8 major public policy domains.
The views expressed in the Copernicus User Stories are those of the Authors and can in no way be taken to reflect the official opinion of the European Space Agency or of the European Commission.
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