Green Biomass and Yield estimation
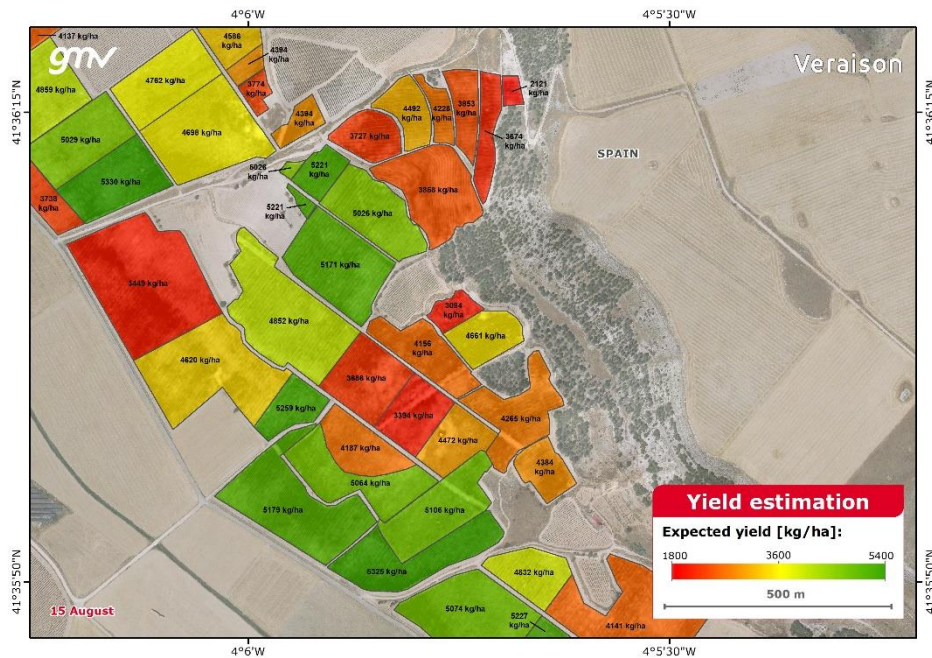

Yield estimation map in Spain using Sentinel-2 (Source: GMV).

Product Category

■ Land Use   □ Natural Disaster   □ Coast Management   □ Earth's Surface Motion

□ Land Cover   □ Climate Change   □ Marine

Financial Domain(s)

■ **Investment management**   ■ **Risk analysis**   ■ **Insurance management**   ■ **Green finance**

User requirements

UN9: Understanding stock levels and monitoring supply chains.
UN18: Need to monitor crop productivity.
UN29: Need to accurately measure the planted area for crops.
UN38: Need for trustworthy time series of reliable data on assets.

Description

Green biomass is a crucial parameter for various applications and a key input for yield estimation. Multiple methods exist to calculate green biomass using satellite imagery. One approach relies on LSP metrics, which discussed briefly earlier. Green biomass is determined at the peak and end of the season using the Leaf Area Index (LAI) rather than NDVI due to LAI's correlation with the leaf's life stage. Yield estimation is a complex indicator and can be achieved using machine learning algorithms that are trained with EO data (such as vegetation indices like FAPAR), climate data (temperature and precipitation), crop type and acreage maps, LSP metrics, biomass, and ground truth yield samples. By integrating these data sources, accurate yield predictions can be obtained, aiding in effective agricultural planning and management.

Spatial Coverage Target

Individual farm level

Data Throughput

Rapid tasking   □ High   ■ Low
Data availability   □ High   ■ Low

Product specifications

Product specifications	
Main processing steps	Green biomass can be computed using optical and/or SAR imagery through various algorithms, which may involve the use of vegetation and soil indicators. Alternatively, commercially available products like Planet Biomass Proxy can be utilized to estimate green biomass. Subsequently, the green biomass data is combined with other EO data, such as vegetation indices like FAPAR, climate data (temperature and precipitation), crop type and acreage maps, LSP metrics, and ground truth yield samples. These combined datasets are then used to train machine learning models for accurate yield estimation.
Input data sources	Optical: Sentinel-2, VHR based on the availability like Pleiades 1A/1B & NEO, WorldView2&3, and SPOT6/7 Radar: Sentinel-1 Reanalysis products: ERA5 land Supporting data: crop type and acreage maps, LSP metrics, and ground truth yield samples.
Accessibility	Sentinel-1&2: freely and publicly available from ESA. Optical VHR imagery: commercially available on demand from EO service providers. ERA5 land: freely and publicly available from ECMWF
Spatial resolution	Sentinel-2: 10 m Optical VHR: ≤ 1 m Sentinel-1: 20 m ERA5 land: 0.1°
Frequency (Temporal resolution)	Sentinel-2: 6 days Optical VHR: Sub-daily to Daily Sentinel-1: 6 days ERA5 land: Hourly
Latency	< 1 Day
Geographical scale coverage	Globally
Delivery / output format	Data type: Raster File format: GeoTIFF. NetCDF
Accuracies	Thematic accuracy: 80-90% Spatial accuracy: 1.5-2 pixels of input data
Constraints and limitations	■ The lack of local in-situ data ■ Cloud presence ■ The accuracy of Biomass and Yield estimation relies on the accuracies of their inputs like crop type and acreage maps, LSP metrics, and climate data. ■ Machine learning model uncertainty
User's level of knowledge and skills to extract information and perform further analysis on the EO products.	Skills: Essential Knowledge: Essential
Similar Products	**Planet Biomass Proxy** (link) Spatial resolution: 10 m Frequency (Temporal resolution): Daily Latency: 1 Day Geographical scale coverage: Globally with gaps over some major agricultural areas of the world, due to the discontinuity of Sentinel-1B in December 2021 Delivery / output format: GeoTIFF, NetCDF (Raster), CSV (Time series) Accuracies: 80-90% Accessibility: Commercially available from Planet