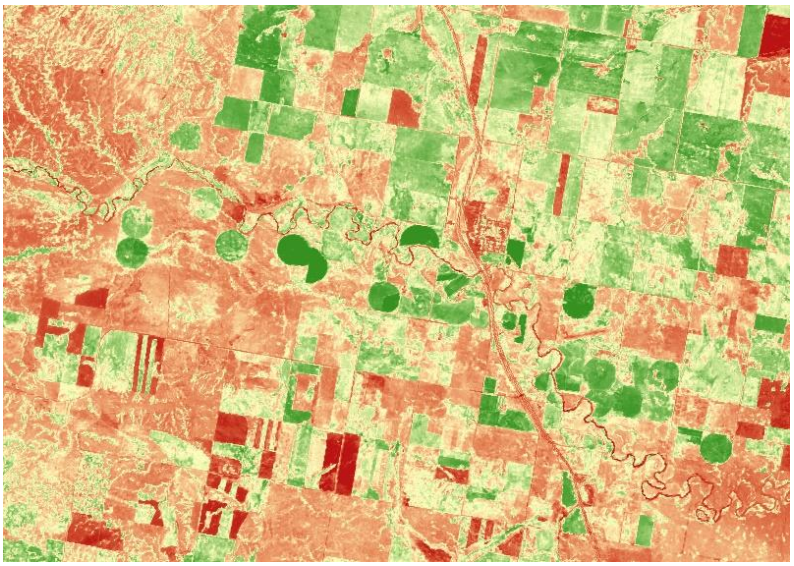
EO-FIN

Crop Health (Diseases and Pests detection)



Sentinel-2 NDVI image of land along the Milk River in Alberta (Source: USGS).

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

UN30: Need for monitoring with accurate measurements of the growth and health of trees.
UN37: Projection of risk to portfolio assets into the future.
UN55: Detecting crop damage at the level of individual farms/fields.

Description

Crop health monitoring with EO involves analysing the distinctive energy absorption and reflection patterns of healthy and stressed plants. Stressed plants exhibit reduced energy reflection in the near-infrared (NIR) spectrum compared to healthy plants. This enables NIR to identify stressed plants, often before visible signs of stress are noticeable to farmers. Additionally, various vegetation indices like NDVI, NDWI, EVI, LAI, and FAPAR, derived from the relative reflectance of visible, NIR, and SWIR light, can be utilized to monitor stressed vegetation. These indices capture altered reflectance patterns caused by factors such as water stress, nutrient deficiencies, pests, diseases, or extreme temperatures. However, multispectral sensors used for these indicators lack the ability to differentiate specific disease types due to limited spectral discrimination. The use of hyperspectral sensors overcomes this limitation but introduces challenges such as spectral complexity and interpretation, data volume and processing requirements, coarse spatial resolution, and data pre-processing challenges.

Spatial Coverage Target

Individual farm level

Data Throughput

Rapid tasking	☐ High	■ Low
Data availability	☐ High	■ Low

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Product specifications	
Main processing steps	The crop health monitoring process begins with the acquisition of optical satellite imagery that includes near-infrared (NIR) bands, and sometimes short-wave infrared (SWIR) bands, as well as SAR imagery to provide consistent monitoring, regardless of weather conditions. Both optical and SAR imagery should be with appropriate spatial resolution for the target monitoring area. Subsequently, the process entails computing various vegetation indices, utilizing thresholding or classification methods to classify health conditions, examining temporal changes to identify variations, and finally visualizing the outcomes through thematic maps.
Input data sources	Optical: Sentinel-2, VHR based on the availability like Pleiades 1A/1B & NEO, WorldView2&3, and SPOT6/7 Radar: Sentinel-1 Supporting data: N.A
Accessibility	Sentinel-1&2: freely and publicly available from ESA. Optical VHR imagery: commercially available on demand from EO service providers.
Spatial resolution	Sentinel-2: 10 m Optical VHR: ≤ 1 m Sentinel-1: 20 m
Frequency (Temporal resolution)	Sentinel-2: 6 days Optical VHR: Sub-daily to Daily Sentinel-1: 6 days
Latency	< 1 Day
Geographical scale coverage	Globally
Delivery/ output format	Data type: Raster File format: GeoTIFF
Accuracies	Thematic accuracy: 80-90% Spatial accuracy: 1.5-2 pixels of input data
Constraints and limitations	■ Cloud presence ■ Challenges in fields with mixed land cover (multiple crops, bare soil, vegetation). ■ Lacking the ability to differentiate specific disease types due to limited spectral discrimination.
User's level of knowledge and skills to extract information and perform further analysis on the EO products.	Skills: Essential Knowledge: Essential