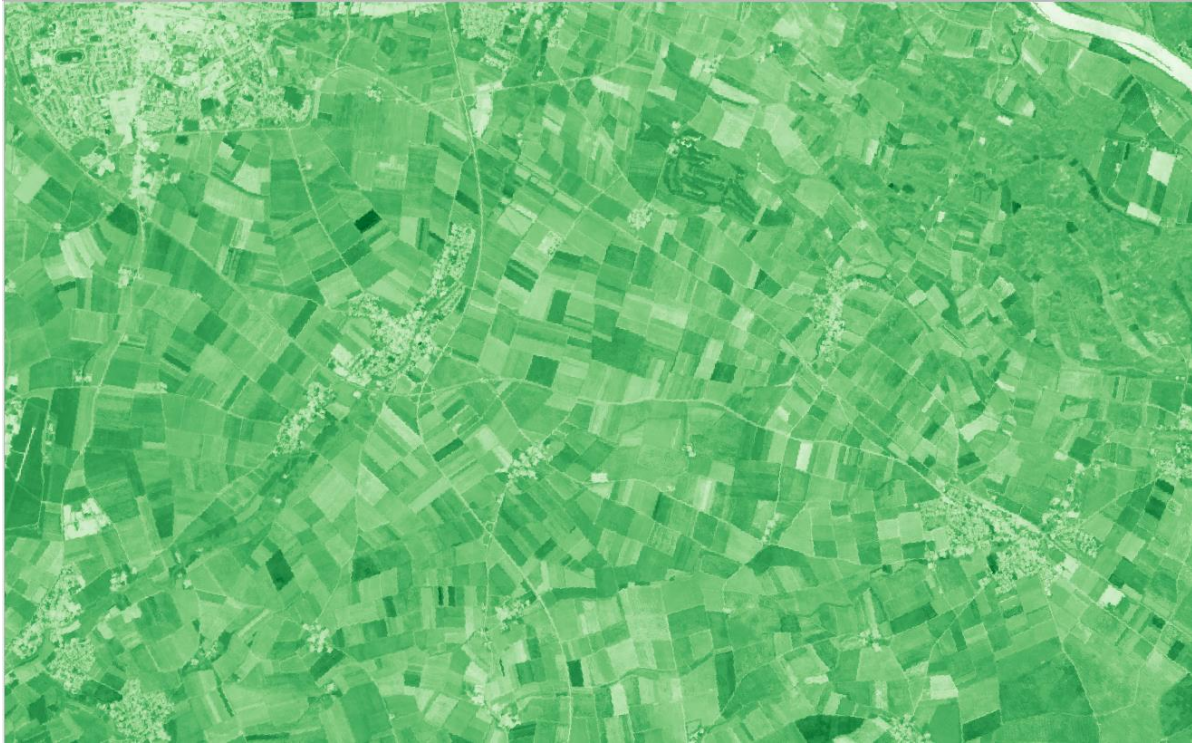

VEGETATION INDICES: LAI, NDVI



NDVI (Source: Sentinel-2)

CATEGORY

Product Development Product Sales Underwriting Loss Adjustment Claims Handling

DESCRIPTION

Different vegetation indices serve as input for various applications and services of remote sensing-based analysis and products/services, such as the Normalized Difference Vegetation Index (NDVI), Leaf Area Index (LAI), Enhanced Vegetation Index (EVI) or Fraction of Absorbed Photosynthetically Active Radiation (FAPAR). They are derived from satellite images using different bands. Consistent long time series are available on various spatial levels.

The Normalized Difference Vegetation Index (NDVI) is an indicator of the greenness of the biomass. It is widely used for ecosystem as well as vegetation monitoring. Depending on how the plant reflects light at certain frequencies the NDVI indicates the state of plant health.

The Leaf Area Index (LAI) characterized the plant canopies. It is defined as half the total area of green elements of the canopy per unit ground area. The LAI quantifies the thickness of the vegetation cover.

Vegetation indices are widely applied in insurance industry for product development, underwriting and loss adjustment purposes.

PRODUCT SPECIFICATIONS

Main processing steps	The NDVI is calculated by normalizing the spectral reflectance that are measured in the near infrared (green leaf scattering) and red (chlorophyll absorption) wavebands of satellite imagery.
Input data sources	<u>Optical</u> : Sentinel-2, MODIS, PROBA-V <u>Radar</u> : n.a. <u>Supporting data</u> : n.a.

Spatial resolution and coverage	<p><u>Spatial resolution</u>: >10m</p> <p><u>Coverage</u>: global</p> <p><u>Availability</u>: globally available</p>
Accuracy / constraints	<p><u>Thematic accuracy</u>: n.a. as indices are calculated directly on the basis of raw measurements</p> <p><u>Spatial accuracy</u>: Absolute geolocation is constantly monitored for S2A and S2B; the long-term performance is close to 11 m at 95% for both satellites. For the geolocation accuracy for PROBA-V satellites please refer to http://proba-v.vgt.vito.be/en/quality/platform-status-information/geolocation-accuracy.</p>
Limitations	Atmospheric effects and clouds can affect the calculations and may lead to misinterpretation.
Frequency / timeliness	<p><u>Frequency</u>: various time steps and historic archive</p> <p><u>Timeliness</u>: near real-time</p>
Delivery / output format	<p><u>Data type</u>: GIS-ready data formats; Raster</p> <p><u>File format</u>: GeoTIFF</p>
Accessibility	<p>Products with higher resolution are commercially available on demand from EO service providers.</p> <p>The Copernicus Global Land Service has been providing operationally global products of biophysical parameters such as NDVI, FAPAR, fcover, ... from Proba-V satellite imagery. This service will switch to Sentinel 3 data (from Q2 2020 onwards) to ensure data continuity for its users. These data provide both long historical archives (1999 – today), which could be used for historical analyses and near real time monitoring at medium resolution scale. https://land.copernicus.eu/global/</p>

CHALLENGES ADDRESSED – USE CASE(S)

Product Development:

- Market analysis
- Index insurance: Toolbox for indices
- Index insurance: Risk / crop modelling (Correlation of EO data with in-situ data)
- Index insurance: Relation between weather events and impact on crop productivity
- Index insurance: Functionalities of plants, chemical reactions, early stress detection
- Index insurance: Parcel/Field and regional yield statistics
- Index insurance: Platform for crop health products
- Elaboration of crop profile: Field crops, vegetables, horticulture, greenhouses
- Information on crop rotation
- Information on crop (seasonal) calendar
- Information on forest health and production at different temporal scales (realtime monitoring, historical development)
- Identification of specific stresses and vegetation problems and their underlying causes
- Forestry: Infrastructure & management
- High accuracy of crop-specific yield for smaller crop parcels
- Risk exposure (product design and customer communication)

Product Sales:

- Client outreach
- High accuracy of crop-specific yield for smaller crop parcels (penetration)
- Pre-contractual consulting (show-case risk exposure)
- Greater acceptance of index covers by farmers

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- Regular market penetration review
 - Risk alerts

Underwriting:

- Seasonal portfolio monitoring
- Online platforms or easy-to-use interfaces integrating various data sources (e.g. vegetation stress, field boundary changes, comparison, etc.)
- Risk / crop zoning
- Actual crop health (vegetation)
- Global/Regional production trends (e.g. monitoring specific crop acreages of surrounding regions/countries)
- Procure better reinsurance terms/capacity from enhanced insurance practice
- Trustful historical data agro-insurance indemnity pay-outs
- Identification of farmer's production practice (technology, infrastructure, property, machinery, etc.)
- Identification of vegetation stages (identify most sensitive stages when crop is the most vulnerable to a risk, e.g. flowering stage)
- Crop calendar and practices
- Regular assessment of risk pricing and product rating

Loss Adjustment:

- High accuracy of crop-specific yield for smaller crop / land parcels
- Regularly updated consistent long-time series of reliable data for index insurance
- Benchmark physical field observations against yield loss detection (e.g. product calibration)
- Risk-mapping against crop's vegetation stages
- Increase credibility of loss adjustment (e.g. show EO data/visualization to support loss adjustment communication to farmer)
- Enhance field survey (better precision with EO data support)
- Detect crop damage at field level
- Assess crop damage at field level
- Distinct field heterogeneity with crop damage
- Obtain information on pasture biomass

Claims Handling:

- Identification of actual damage size (tons (volume) / ha (area) / price (yield value))
 - Quality control assessment of claims before pay-out
 - Fraud detection
 - Obtaining timely, reliable and consistent data to speed-up the indemnity pay-outs
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