CLMS NCP:
Bio-geophysical parameters

Vegetation Indices

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Vaia Storm in Italy

Between 27 and 30 October 2018, a large storm named «Vaia» afflicted the North of Italy, especially the west Alps, with strong winds beyond 200 km/h that caused the loss of more than 8 million m^3 of trees.

Source: Google Earth Pro
“Panchià, Trento, Italy.”
Imagery from 2019

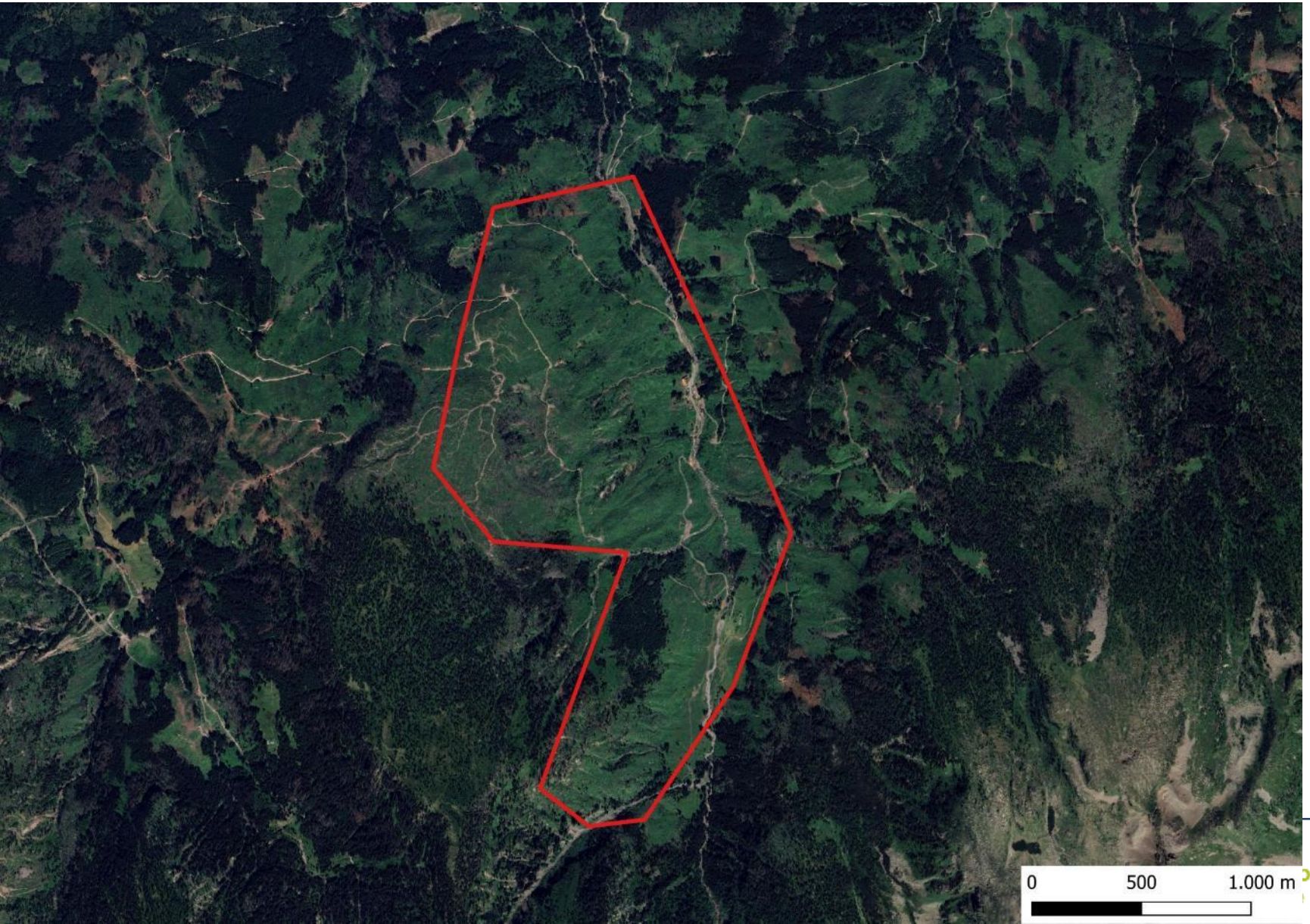
Vaia Storm in Italy

Normalized Difference Vegetazion Index (NDVI) can be useful to monitor before and after the storm event, and to assess the loss of vegetation, as well as the growth.

Copernicus offered NDVI products at 10m resolution (based on Sentinel-2) which are now discontinued.
Currently, the NDVI products at 300m resolution (every 10 days) are available.

NDVI ranges from -1 (absence of vegetation) to 1 (presence of vegetation).

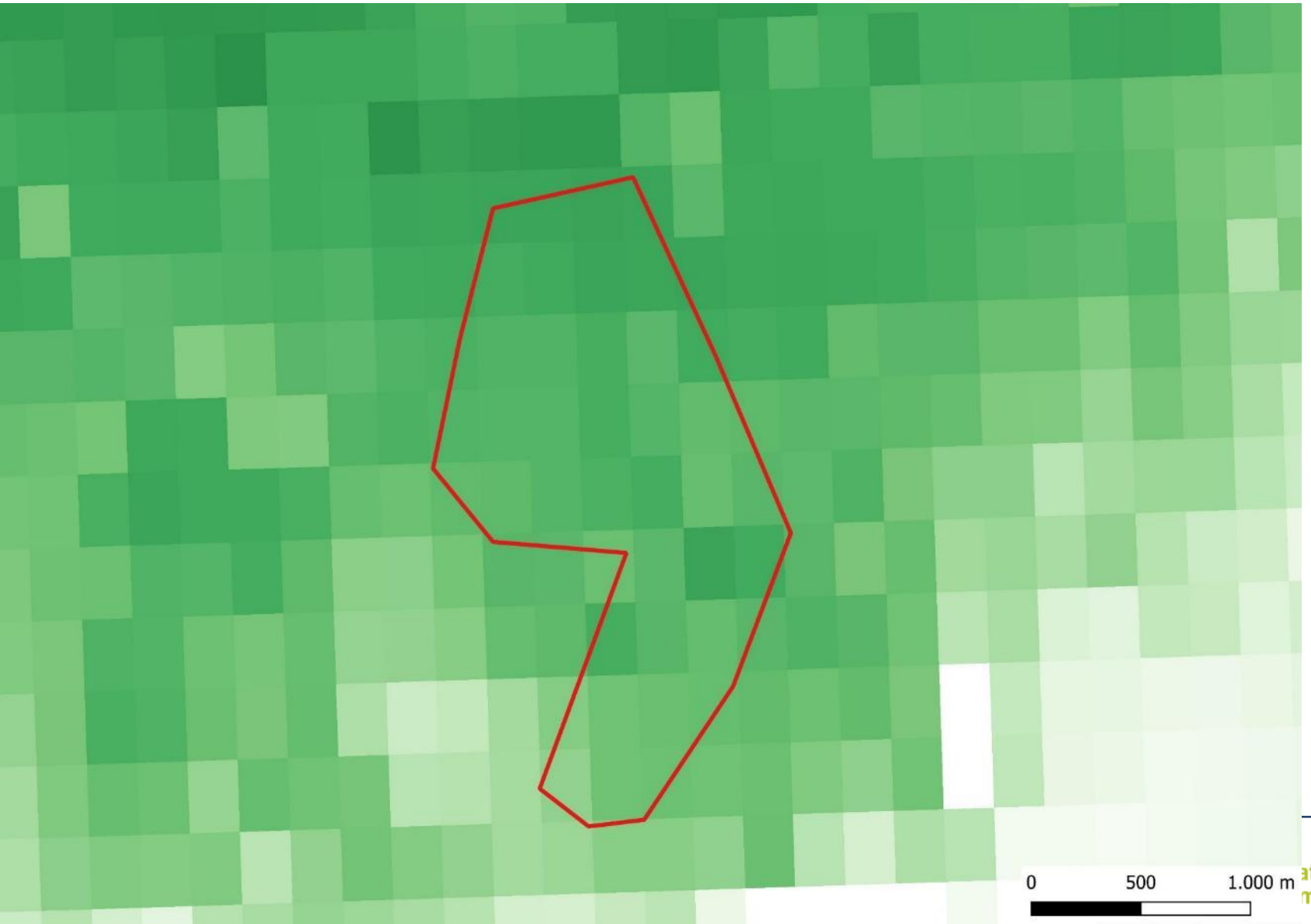
Imagery 2019



The red polygon highlights an area affected by the Vaia storm.

Source: Google Earth Pro
“Panchià, Trento, Italy.”
Imagery from 2019

NDVI 2018



In 2018 (before the storm) the area presents high values of NDVI.

NDVI

Source:
Copernicus NDVI (300 m), global, 10-daily – version 3

European Environment Agency

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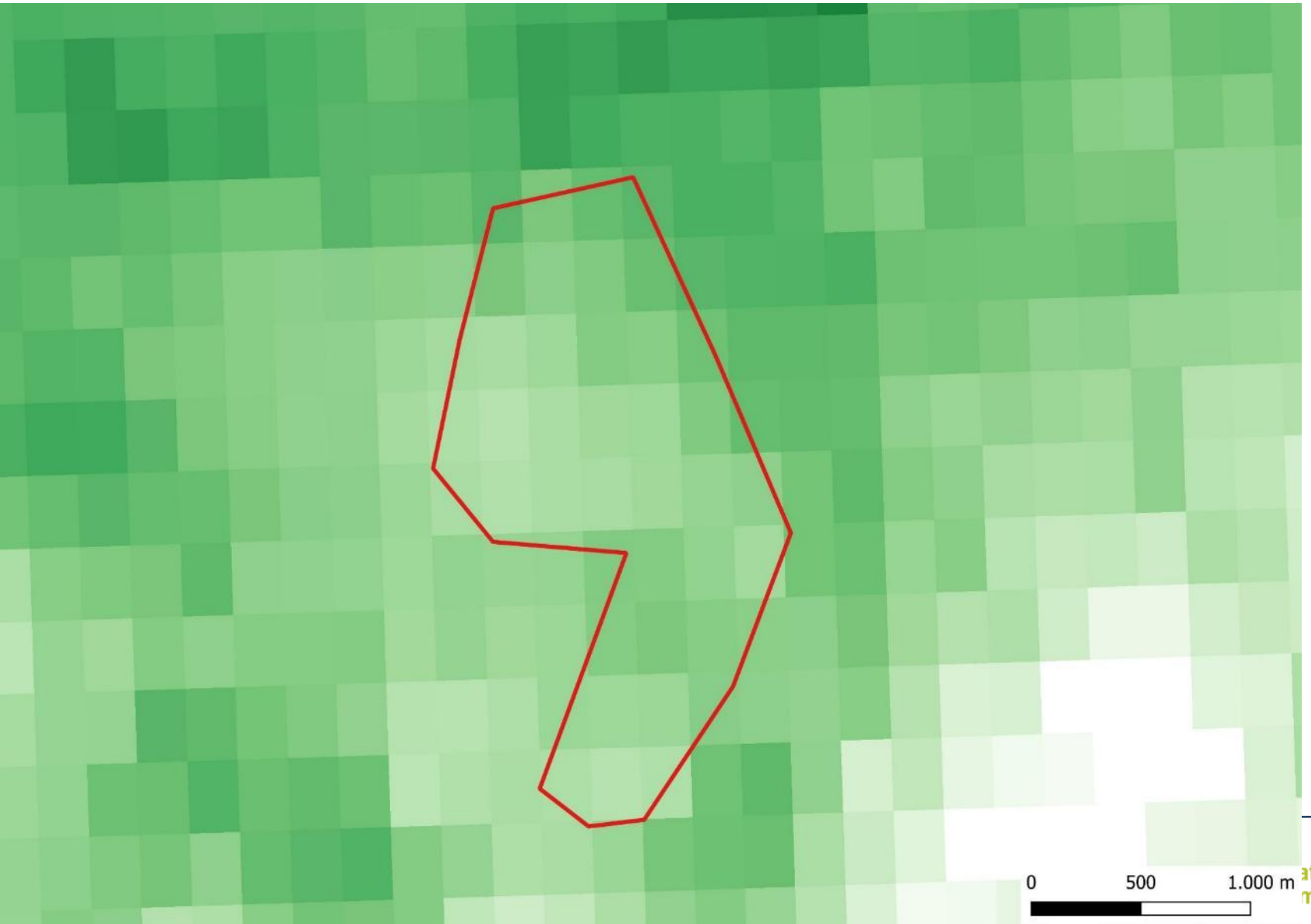
NDVI 2020



In 2020 (after the storm) the area shows lower values of NDVI, indicating the loss of tree cover.

NDVI

Source:
Copernicus NDVI (300 m), global, 10-daily – version 3

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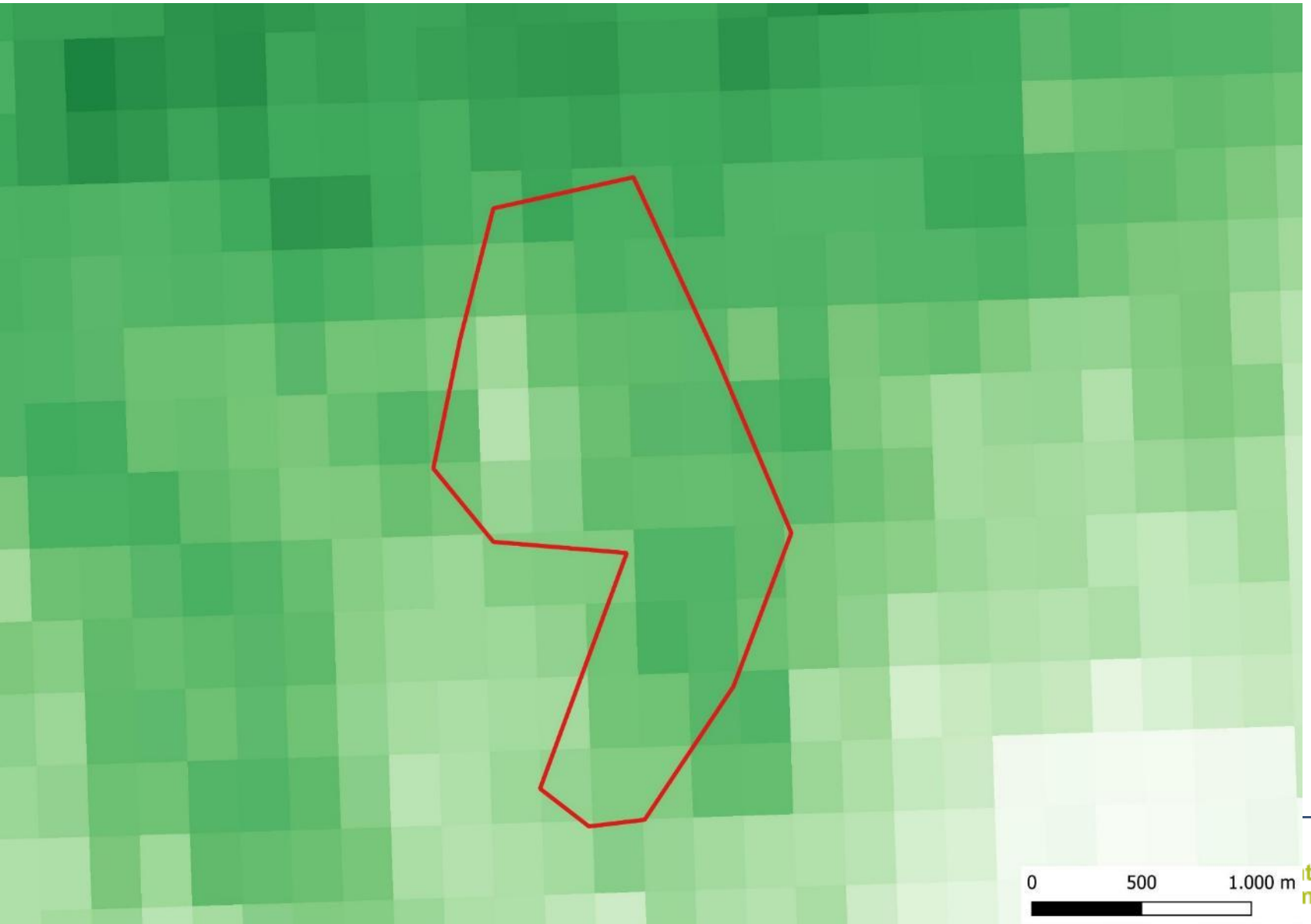
NDVI 2024



In 2024 (6 years after the storm) the area presents high values of NDVI, indicating the growth of vegetation (mainly grass cover).

NDVI

Source:
Copernicus NDVI (300 m), global, 10-daily – version 3

European Environment Agency

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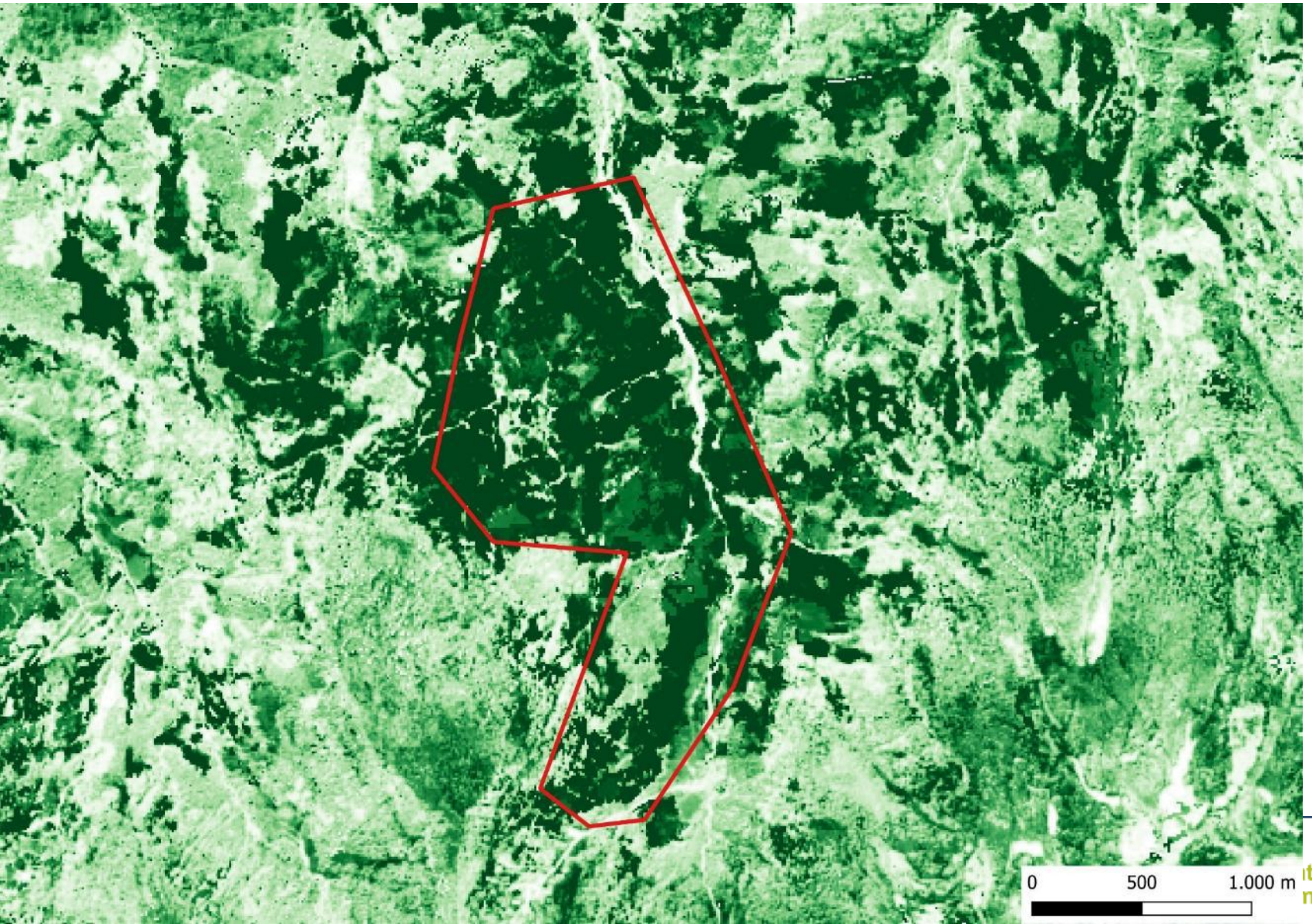
Plant Phenology Index (PPI)

The spatial resolution is a fundamental characteristics for vegetation monitoring.

The Plant Phenology Index (PPI) is calculated from Sentinel-2 images at 10m resolution, and Copernicus provides the maximum PPI value of the year at pixel level. Therefore, it can be useful to compare annual variations of vegetation.

Plant Phenology Index (PPI) 2024



In 2024 (6 years after the storm) the area shows high values of PPI (season maximum). The spatial resolution of 10m allows for a better visualization of vegetated areas where grass cover has increased.

Source:
Copernicus PPI Season Maximum (10 m), yearly

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Considerations about monitoring the effects of Vaia storm

The Vaia storm affected several areas in the North of Italy, causing widespread tree fall.

Following the storm, vegetation indices did not fully capture the extent of vegetation loss, as the trees that had fallen to the ground retained their green foliage.

Moreover, spatial resolution is fundamental to detect these kind of phenomena, because coarse resolution cause mixed pixels (the pixel area covers multiple land cover classes) that limit change detection at the local scale. Therefore, the availability of 10m images such as Copernicus Sentinel-2 is fundamental for vegetation monitoring.

Vegetation Phenology and Productivity Parameters

Vegetation indices are useful for agriculture monitoring, in particular vegetation phenology that is the seasonal life cycle of plants (leaf emergence, flowering, fruiting, autumn leaf fall, and winter dormancy), which is strongly influenced by climate.

The Start-of-Season (SoS) Date identifies when vegetation begins to grow, derived from satellite-detected signals such as early greening.

The End-of-Season (EoS) Date marks when growth stops, typically due to cooling temperatures or drought, and corresponds to reduced photosynthetic activity.

Copernicus provides SoS and EoS Date products based on the Plant Phenology Index at 10m resolution.

Vegetation Phenology and Productivity Parameters

Copernicus data support crop identification, agricultural planning, ecosystem monitoring, and climate-change analysis.

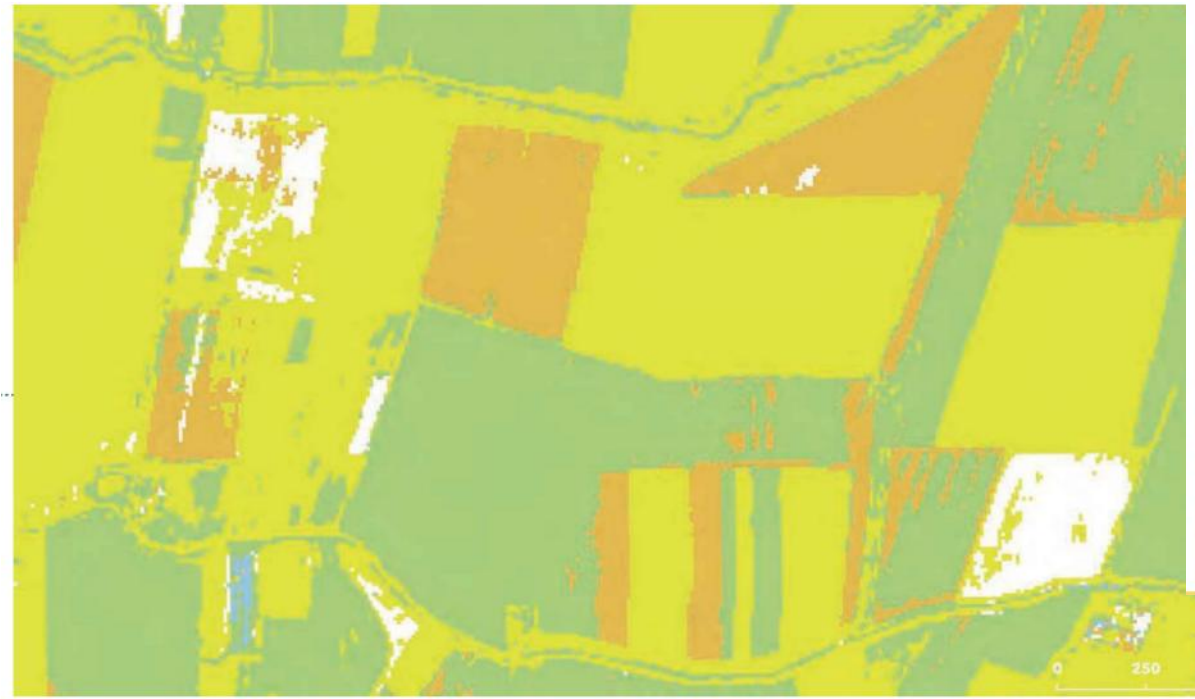
In this case we monitored SoS and EoS dates across fields of an agricultural area in the Po Valley (Vighizzolo d'Este, Padua, Italy).

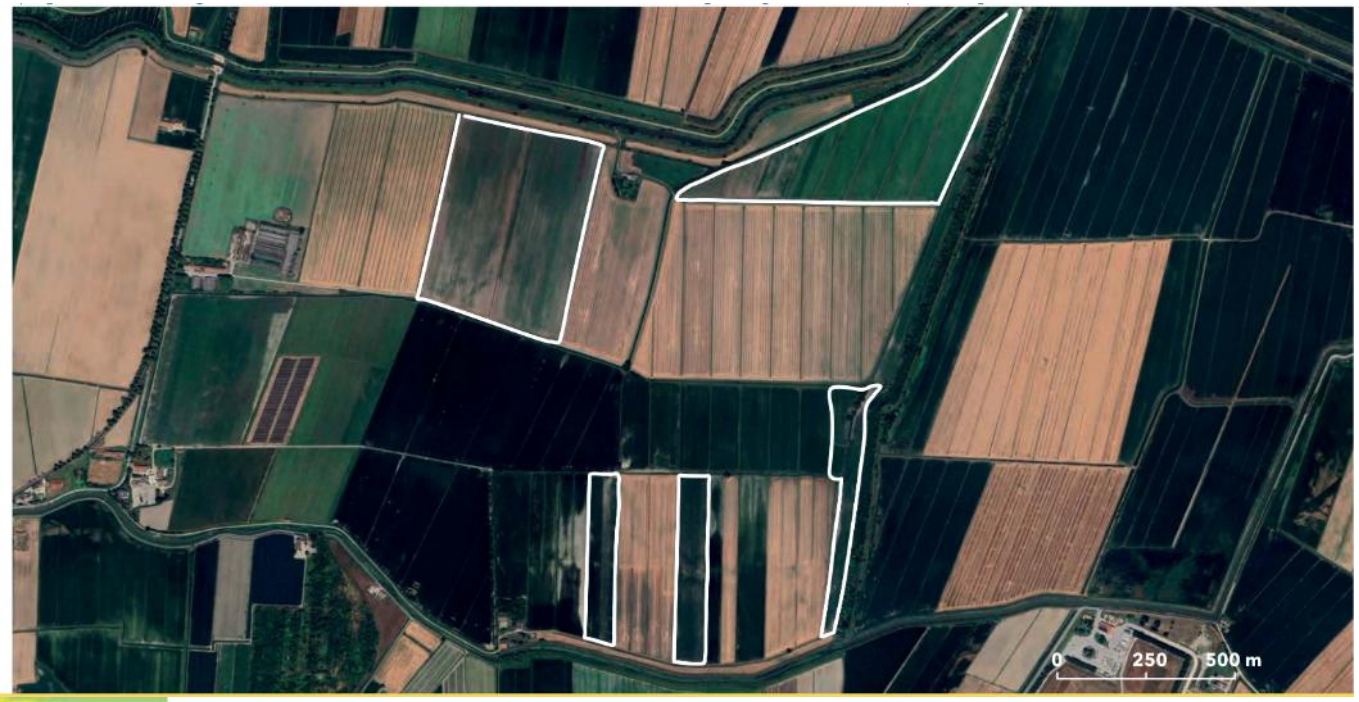
In addition, Copernicus provides the Total Productivity (sum of all daily Plant Phenology Index values between the SoS and EoS dates) at 10m spatial resolution.

Start-of-Season 2023

Source:
Copernicus Start-of-Season (10 m), yearly

Start-of-Season 2023



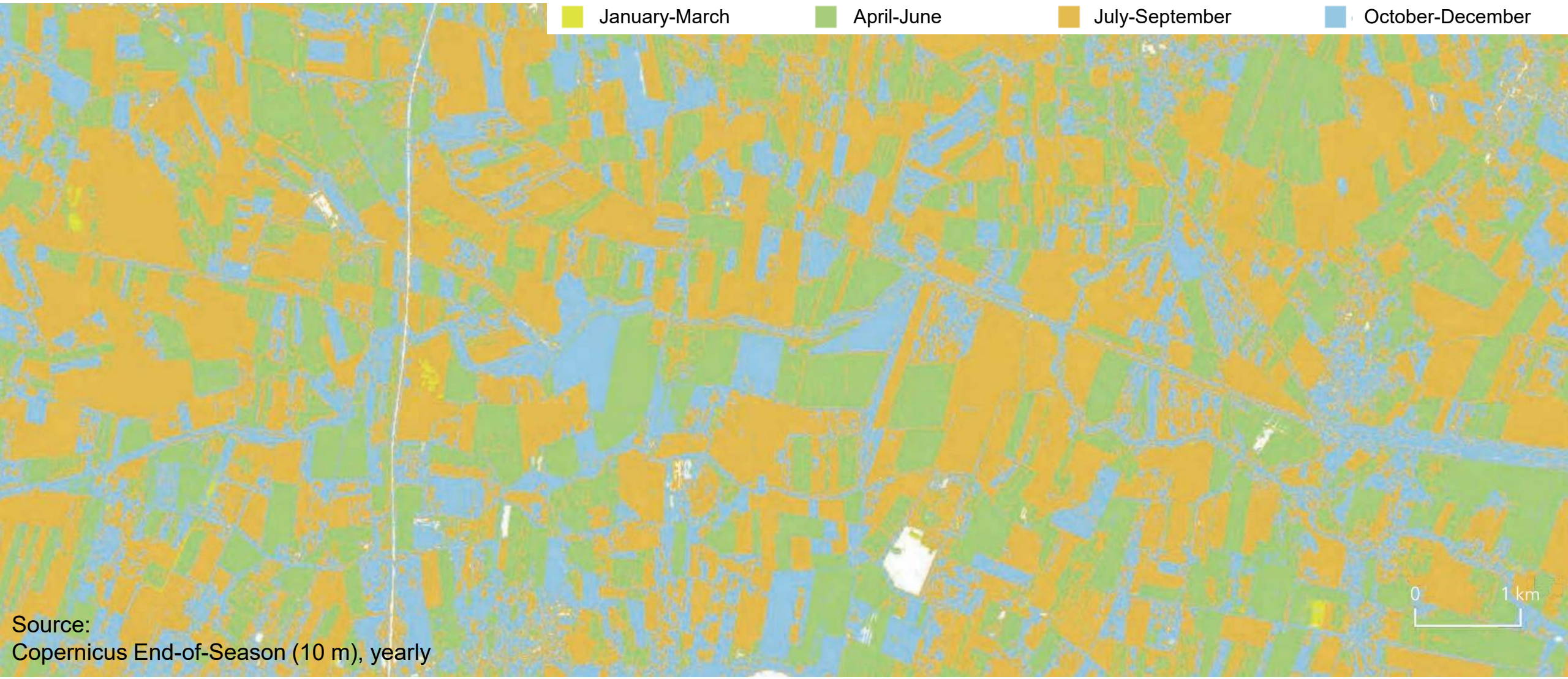


Source: Airbus image acquired on 20/07/2023 from Google Earth Pro

January-March April-June July-September October-December

Source: Copernicus Start-of-Season (10 m), yearly

End-of-Season 2023



Source:
Copernicus End-of-Season (10 m), yearly

Copernicus Europe's eyes on Earth
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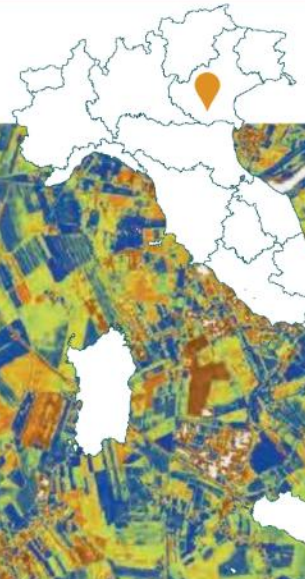
Total Productivity 2023



Source:
Copernicus Total Productivity (10 m), yearly

PPI/day
0,5 300

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