Remote environmental monitoring and data collection, 16 November 2023

Training of Experts to Assess Soils Damaged due to Hostilities

Iryna Babanina | Anna McKean

Conflict and Environment Observatory - www.ceobs.org

For the next hour…….

1. Brief introduction to CEOBS
2. Methods for remote data collection and analysis

2a. Social Media Analysis

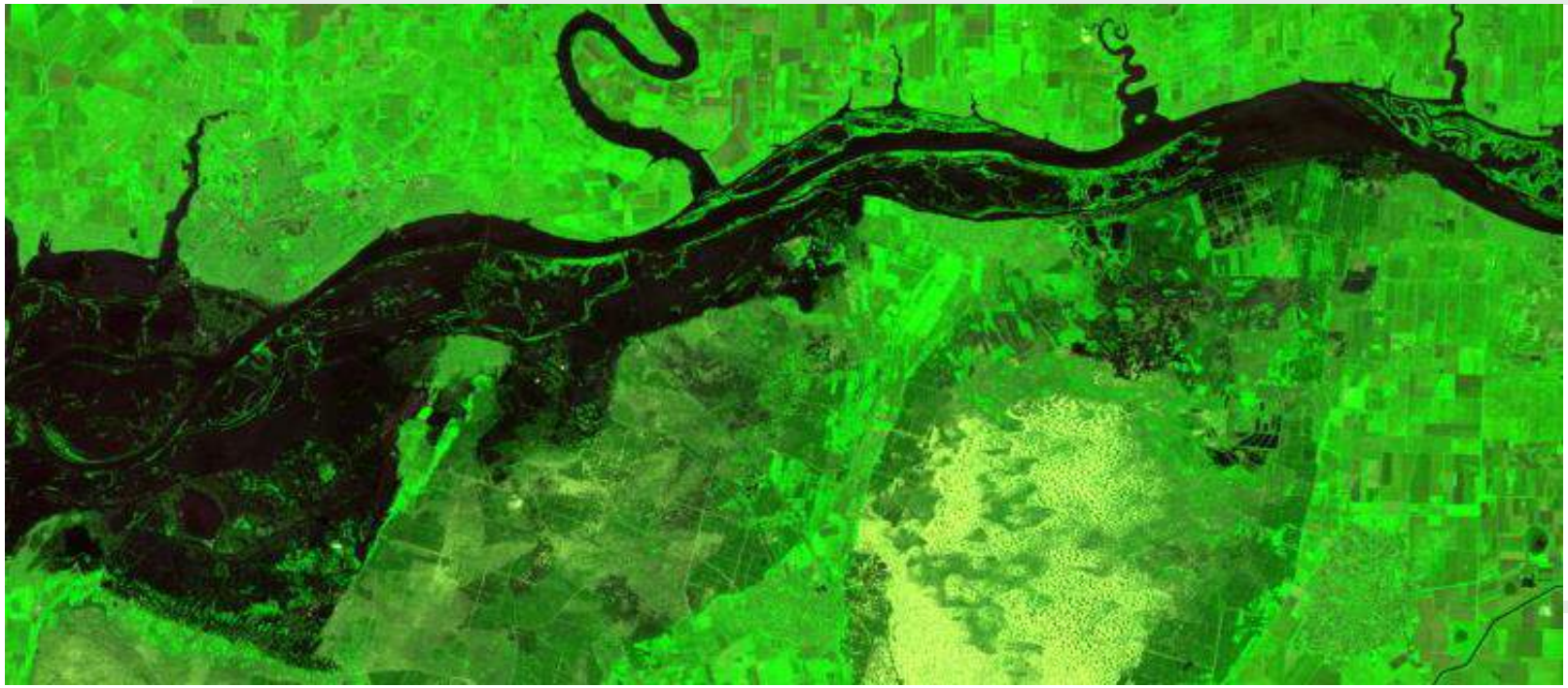
2b. Satellite image analysis

3. Q/A

Conflict and Environment Observatory

CEOBS is a UK charity working to increase the protection of people and ecosystems from the impact of armed conflicts and military activities

www.ceobs.org, Hebden Bridge, West Yorkshire



Why do we collect environmental data?

Protection of the environment in relation to armed conflicts

Joint civil society submission to the Secretary General of the International Law Commission following First Reading

May 2021

AL-HAQ

AMNESTY INTERNATIONAL

Conflict and Environment Observatory

GENEVA WATER HUB

IHRC
INTERNATIONAL HUMAN RIGHTS CLINIC
HARVARD LAW SCHOOL

https://ceobs.org/perac-principles-frequently-asked-questions/


MineWolf
SYSTEMS
MineWolf

CONFLICT AND ENVIRONMENT OBSERVATORY

Projects in Ukraine

- Incidents database (1270)
- UNEP Ukraine project – training personnel of State Environmental Inspectorate
- NPA project ‘Protecting the environment in armed conflict in Ukraine,’
- GROMADA Erasmus+ project ‘European universities supporting legal and community capacities for Ukraine’s environmental recovery’
- OSCE report


Within Ukraine's Borders

Outside Ukraine's Borders

Energy Policy

Food security

Military spending and GHG emissions

Industrial attacks in Russia

Distraction from global environmental and climate governance

Forest fires in Russia

CONFLICT AND ENVIRONMENT OBSERVATORY

Top level review

- We are witnessing a **high intensity international armed conflict in a highly industrialised country**.
- We have already seen a great deal of damage to military, industrial, energy and commercial sites, and civilian infrastructure, which has the potential to harm the environment.
- Much of Ukraine's industrial and military infrastructure is located within or in close proximity to urban areas, which suffer the impacts from direct hits, and also from intense indiscriminate bombardment by Russia.
- This has created a heightened risk of serious air, water and soil pollution, and in certain places environmental emergencies associated with environmentally hazardous infrastructure.


Credit: SES of Ukraine

Foam production plant
Kyiv | 3rd March


Credit: UkraineNow

Chemical Industry
Rubhizne | 10th April


Credit: truexanewsua

Fuel Storage
Odesa | 4th April


Credit: Planet Labs

Logistics warehouses
Brovary | 22nd March


Credit: SES of Ukraine

Thermal Power Plant
Okhtyrka | 10th March


Credit: Sentinel Hub. Contains modified Copernicus data (2022)

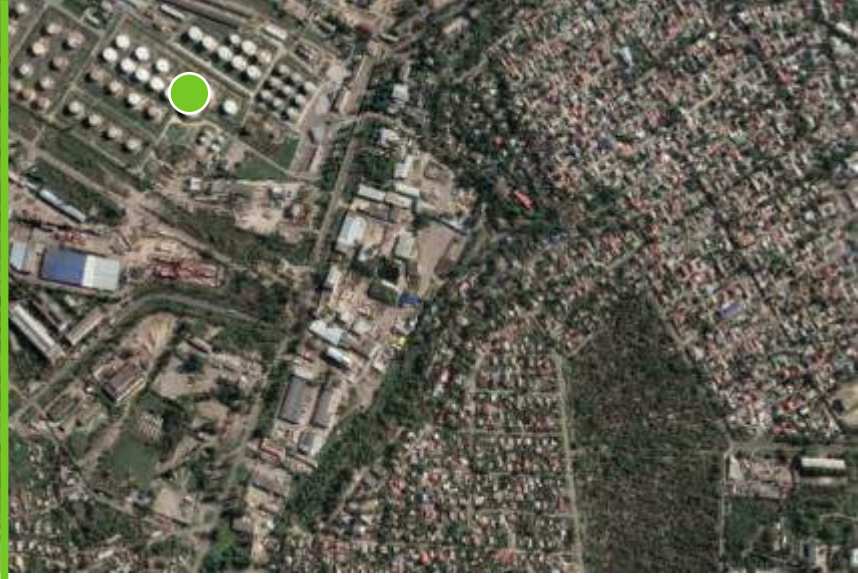
Food Factory
Chernihiv | 23rd March

Foam production plant

Kyiv, Location

Chemical Industry

Rubhizne | 10th April

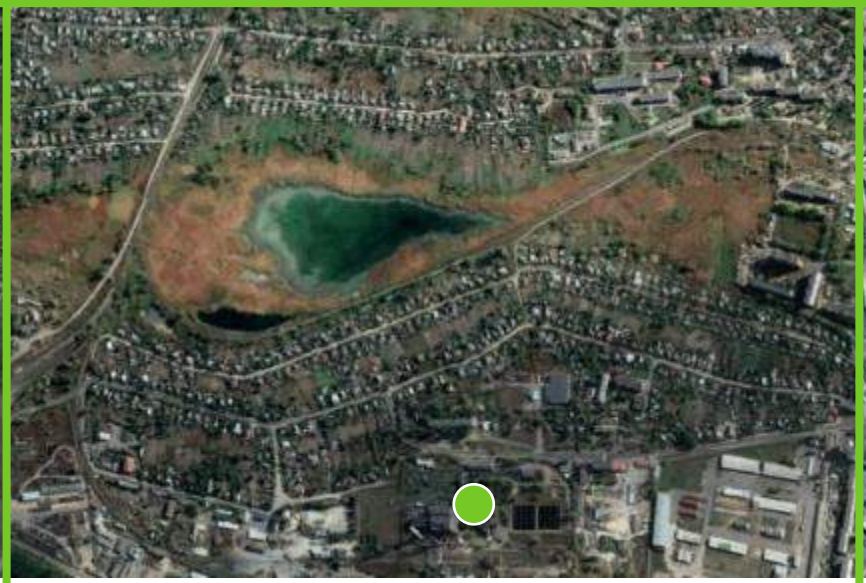


Fuel Storage

Odesa | 4th April

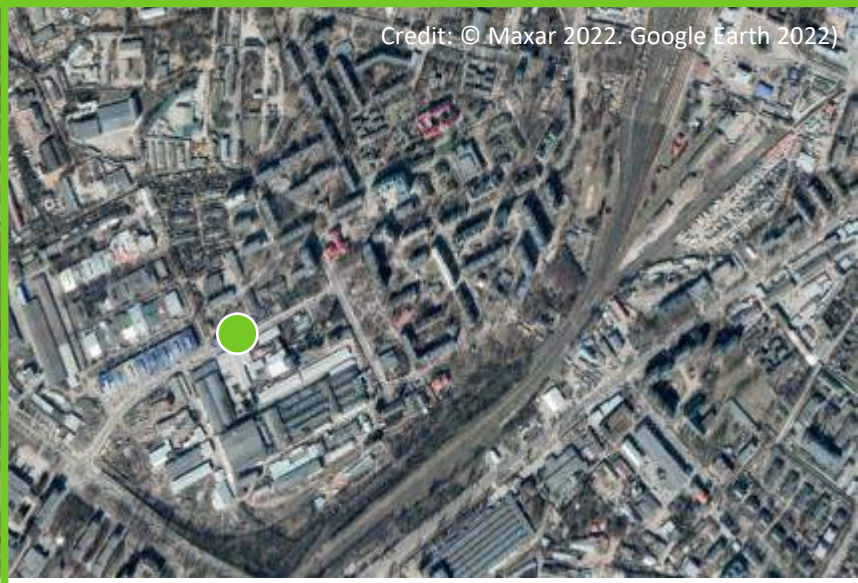
Logistics warehouses

Brovary | 22nd March



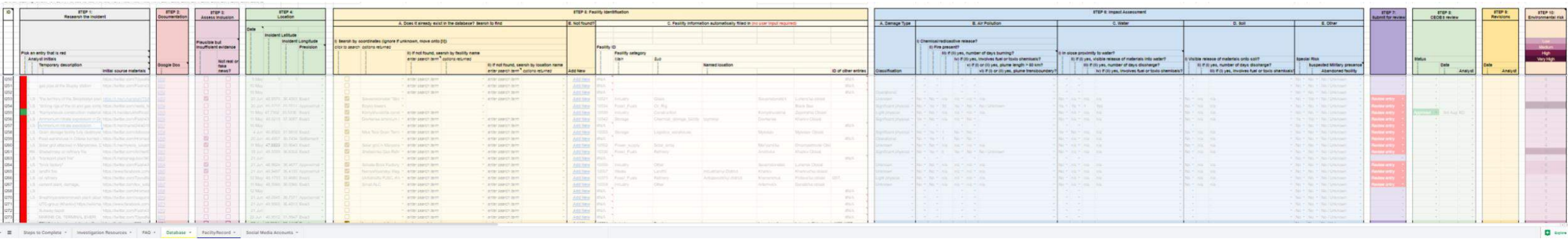
Thermal Power Plant

Okhtyrka | 10th March



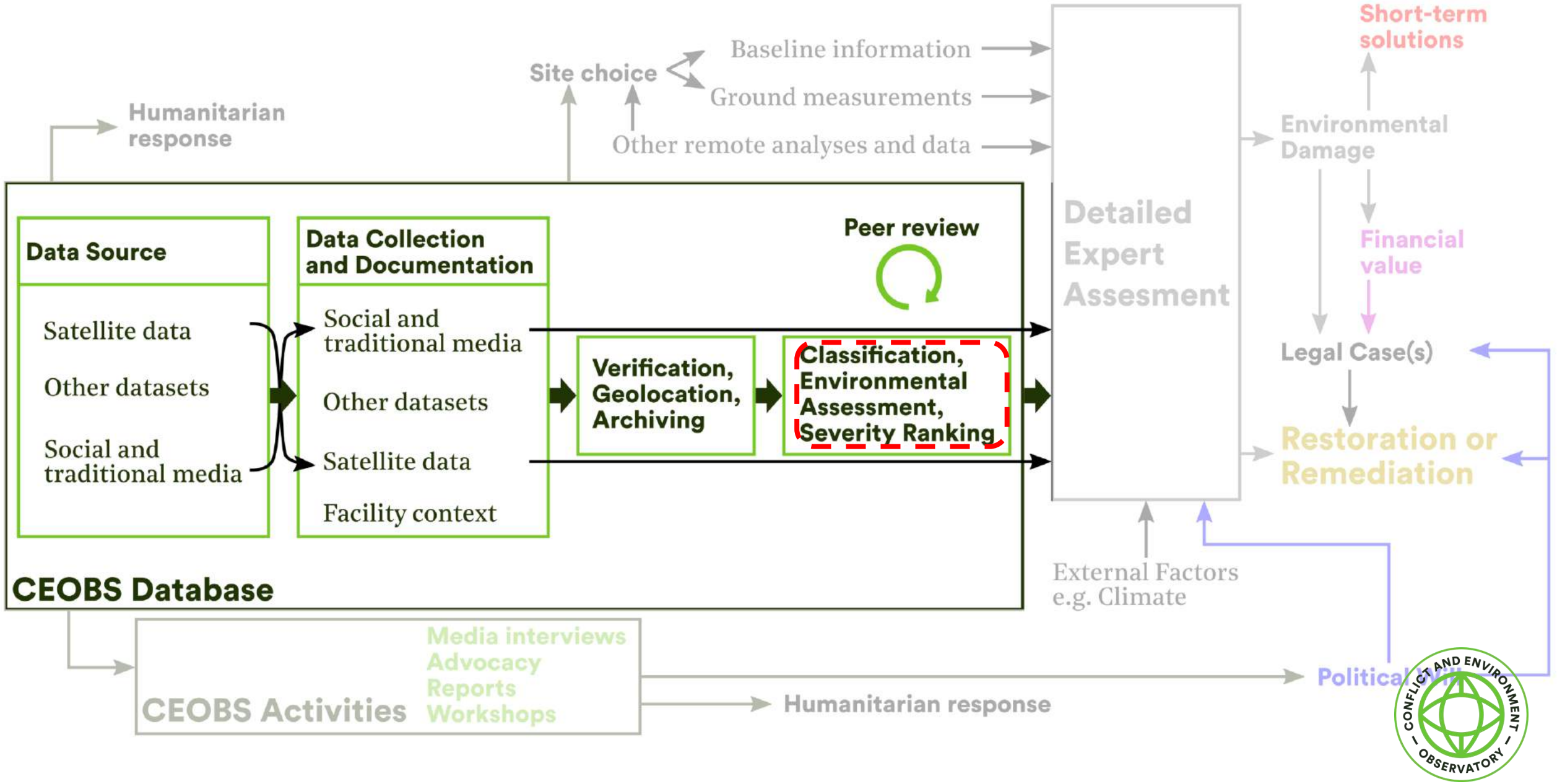
Food Factory

Chernihiv | 23rd March



CEOBS incidents database

- Not publicly open (1270 incidents)
- Incidents peer-reviewed
- User guide, help videos, FAQ’s produced
- Mostly within google suite – some external coding required

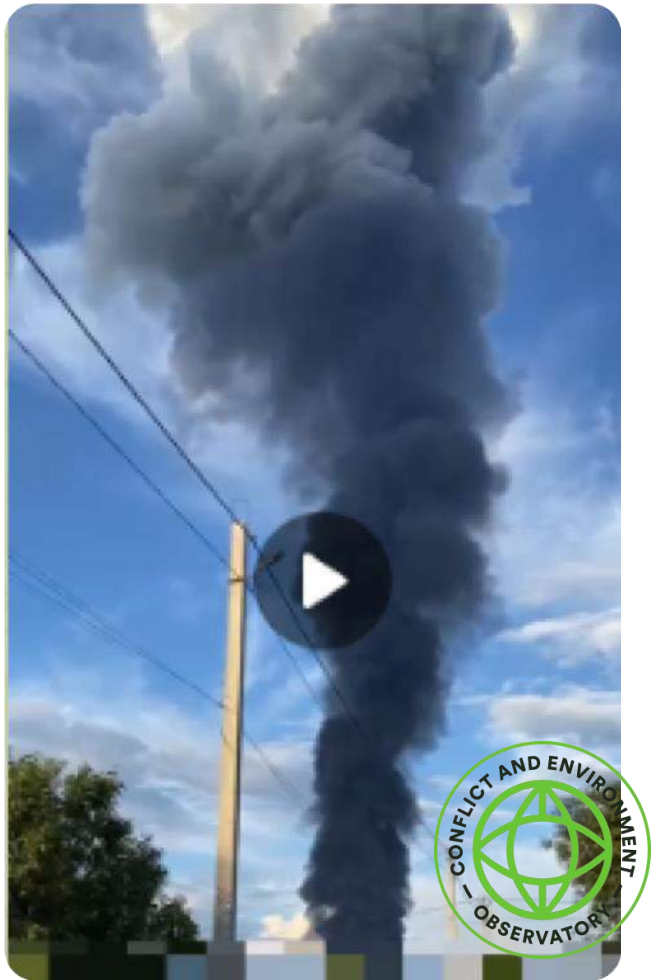

Humanitarian response
Site choice
Baseline information
Ground measurements
Other remote analyses and data
Short-term solutions
Environmental Damage
Financial value
Legal Case(s)
Restoration or Remediation
Detailed Expert Assesment
Peer review
Data Source
Satellite data
Other datasets
Social and traditional media
Data Collection and Documentation
Social and traditional media
Other datasets
Satellite data
Facility context
Verification, Geolocation, Archiving
Classification, Environmental Assessment, Severity Ranking
CEOBS Database
External Factors e.g. Climate
CEOBS Activities
Media interviews
Advocacy
Reports
Workshops
Humanitarian response
Political will
CONFLICT AND ENVIRONMENT OBSERVATORY

Examle: Identifying damage and harm from satellite imagery

Brief Description: Fire at mini refinery over multiple days

Location: Hubynykha, Dnipropetrovsk Oblast, 48.8155, 35.2825

Date of Incident: 18 June 2022



Google maps (48.8155, 35.2825)

Social media information

-Telegram channels, Twitter aggregator accounts, Facebook, Vkontakte, Linkedin, TikTok etc…

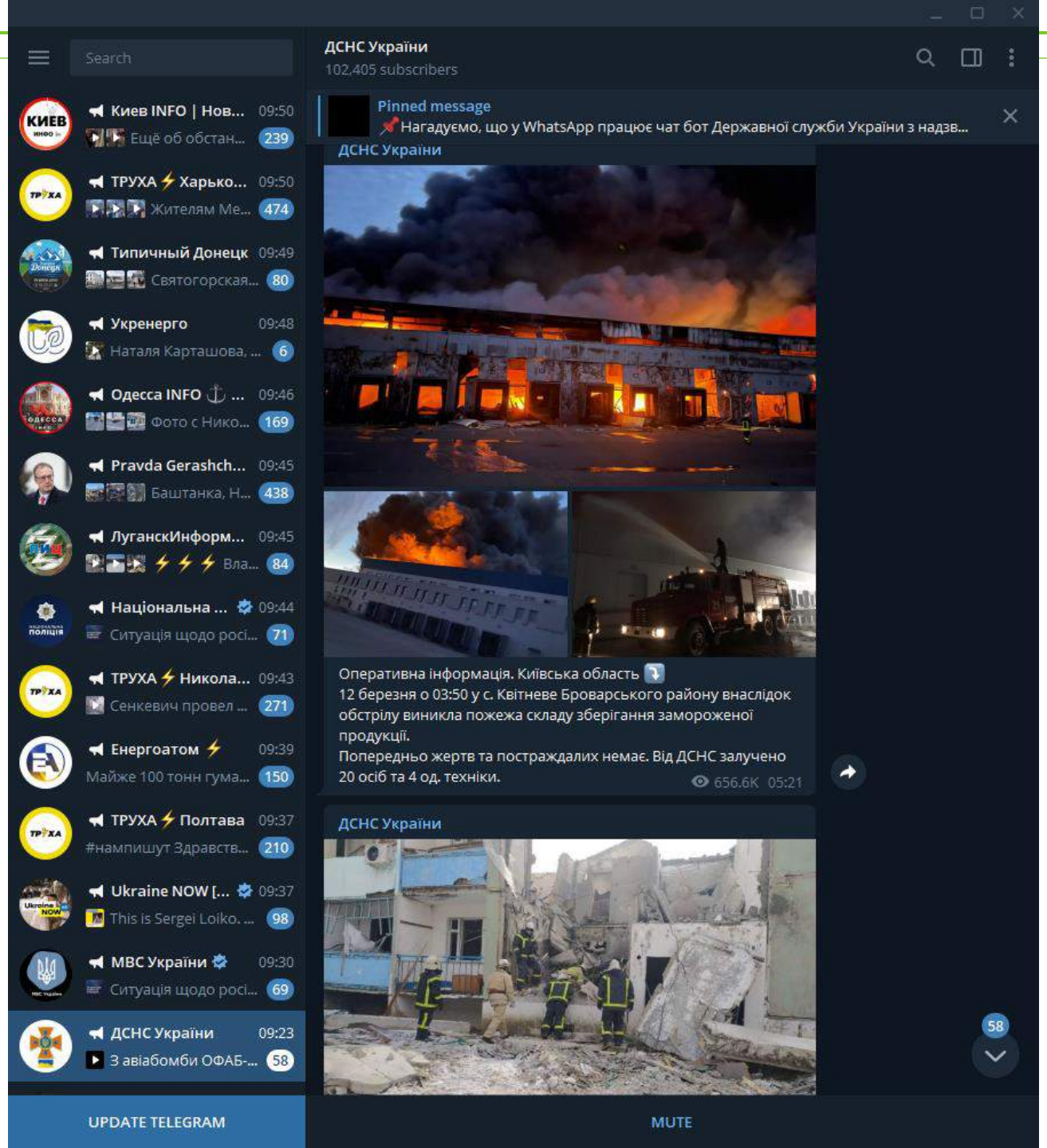
-From both Ukrainian and Russian sources

-National level and city or regional level channels

-Government spokespeople and departments, domestic civil society

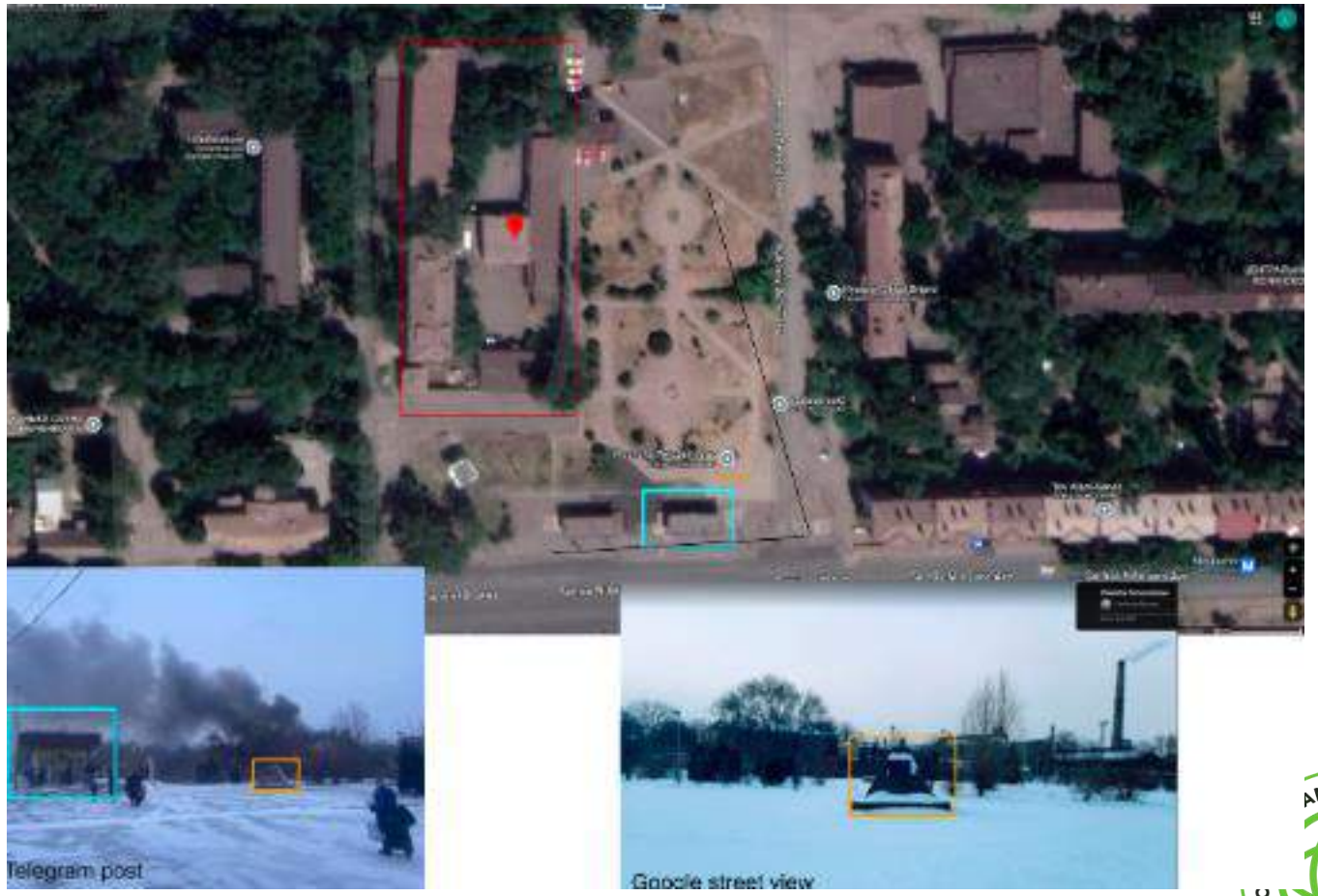
-Twitter - (Губиниха OR Hubynukha OR Dnipro) until:2022-06-19 since:2022-07-18

-Google Image search, Google lens – Images, video



Mapping, Satellite, Street View and Location-Based Information (1)

- Google Maps
- Google Earth Pro
- Yandex
- Satellites Pro
- Big maps
- Open Street Maps
- Wikimapia
- Dual Maps
- Map Carta



Satellite Data

- Open sources satellite imagery and data: **Sentinel-2** and **Sentinel-3, Landsat, MODIS, SEVIRI** – of differing resolution, frequency, and speed of availability
- Augmented by higher-resolution commercial imagery: **Planet Explorer, Maxar, Satellogic**
- Open source satellite data: **Fire hotspots (FIRMS), Radar products** (Sentinel-1 e.g. for oil spills), air pollution (**Sentinel 5P**), **altimetry for water levels**
- **DamageUA westite, Ukraine Observer**

Large fire at the oil depot in Kalynivka, near Kyiv, 24th March 2022
Visible in very high resolution satellite imagery. Imagery (C) Maxar 2022.

Graphic produced by the Conflict and Environment Observatory.


©Maxar, Google Earth
0.3 m resolution
20 April 2019
25 m

Planet Labs – After, 8 August 2022


Blackened Cropland
Biogas bags
Large Storage Tanks
Debris
Earthworks
Destroyed Building
Crater
Small Storage Tanks
Earthworks
Planet SkySat imagery
0.5 m resolution
8 August (50 days later)

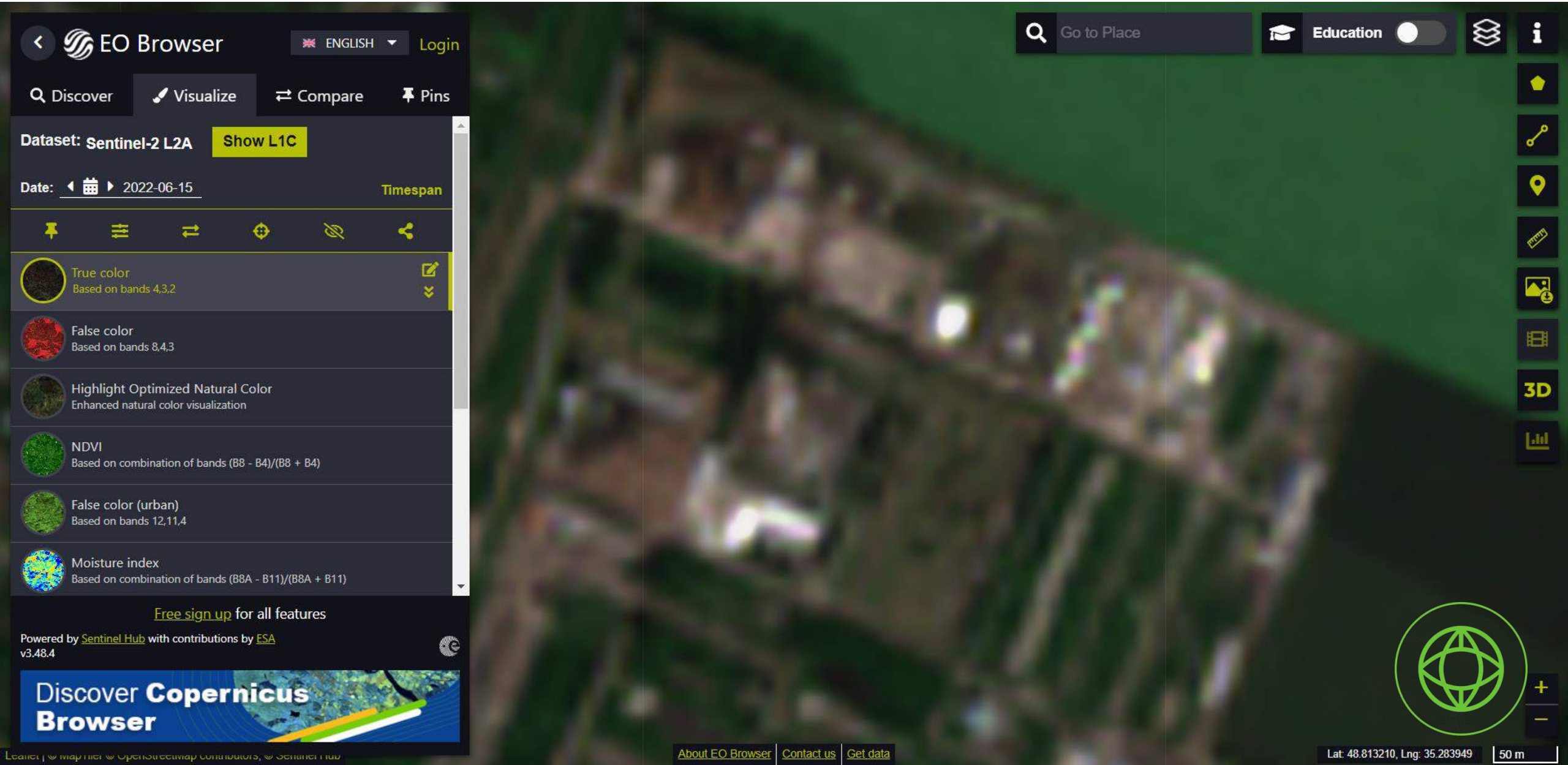
Sentinel-2 basic features

Sentinel-2 uses multispectral imagery with 13 bands, the combinations of which are used to better understand specific features of the imagery to explore vegetation, agriculture, geological characteristics.

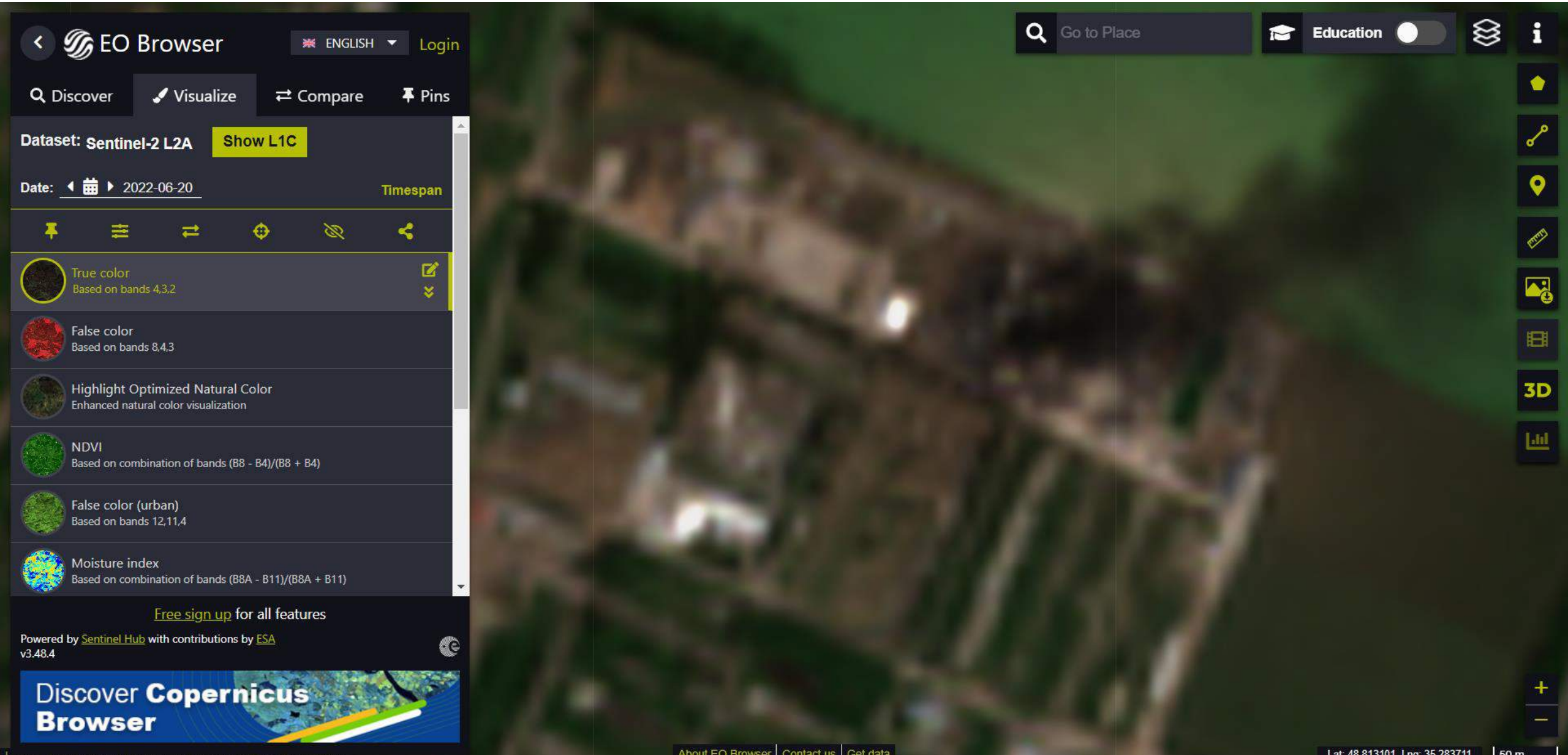
Band	Resolution	Central Wavelength	Description
B1	60 m	443 nm	Ultra Blue (Coastal and Aerosol)
B2	10 m	490 nm	Blue
B3	10 m	560 nm	Green
B4	10 m	665 nm	Red
B5	20 m	705 nm	Visible and Near Infrared (VNIR)
B6	20 m	740 nm	Visible and Near Infrared (VNIR)

B7	20 m	783 nm	Visible and Near Infrared (VNIR)
B8	10 m	842 nm	Visible and Near Infrared (VNIR)
B8a	20 m	865 nm	Visible and Near Infrared (VNIR)
B9	60 m	940 nm	Short Wave Infrared (SWIR)
B10	60 m	1375 nm	Short Wave Infrared (SWIR)
B11	20 m	1610 nm	Short Wave Infrared (SWIR)
B12	20 m	2190 nm	Short Wave Infrared (SWIR)

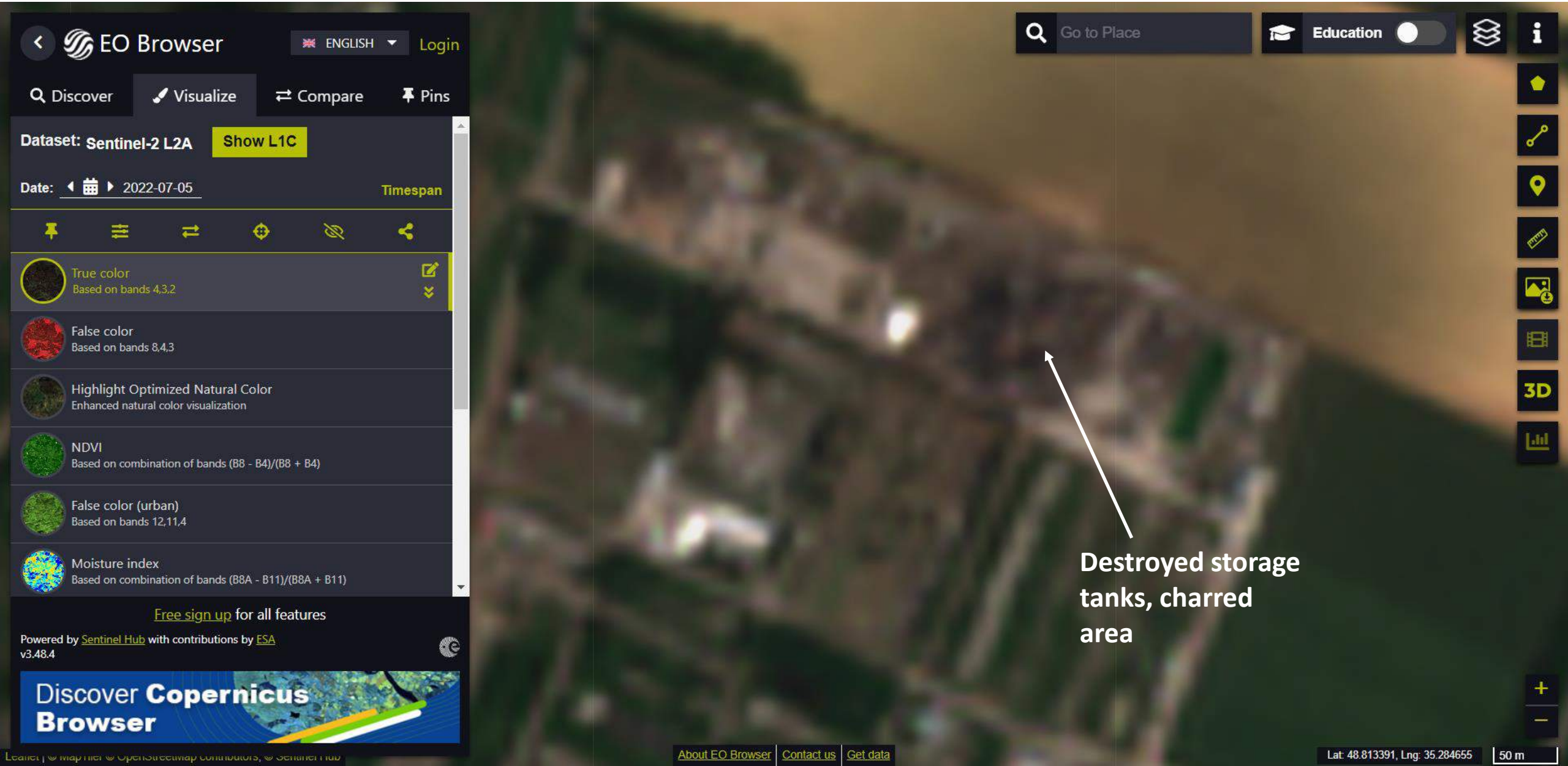
Sentinel-2 – true color imagery
Before, 16 June 2022 – closeup of the affected area



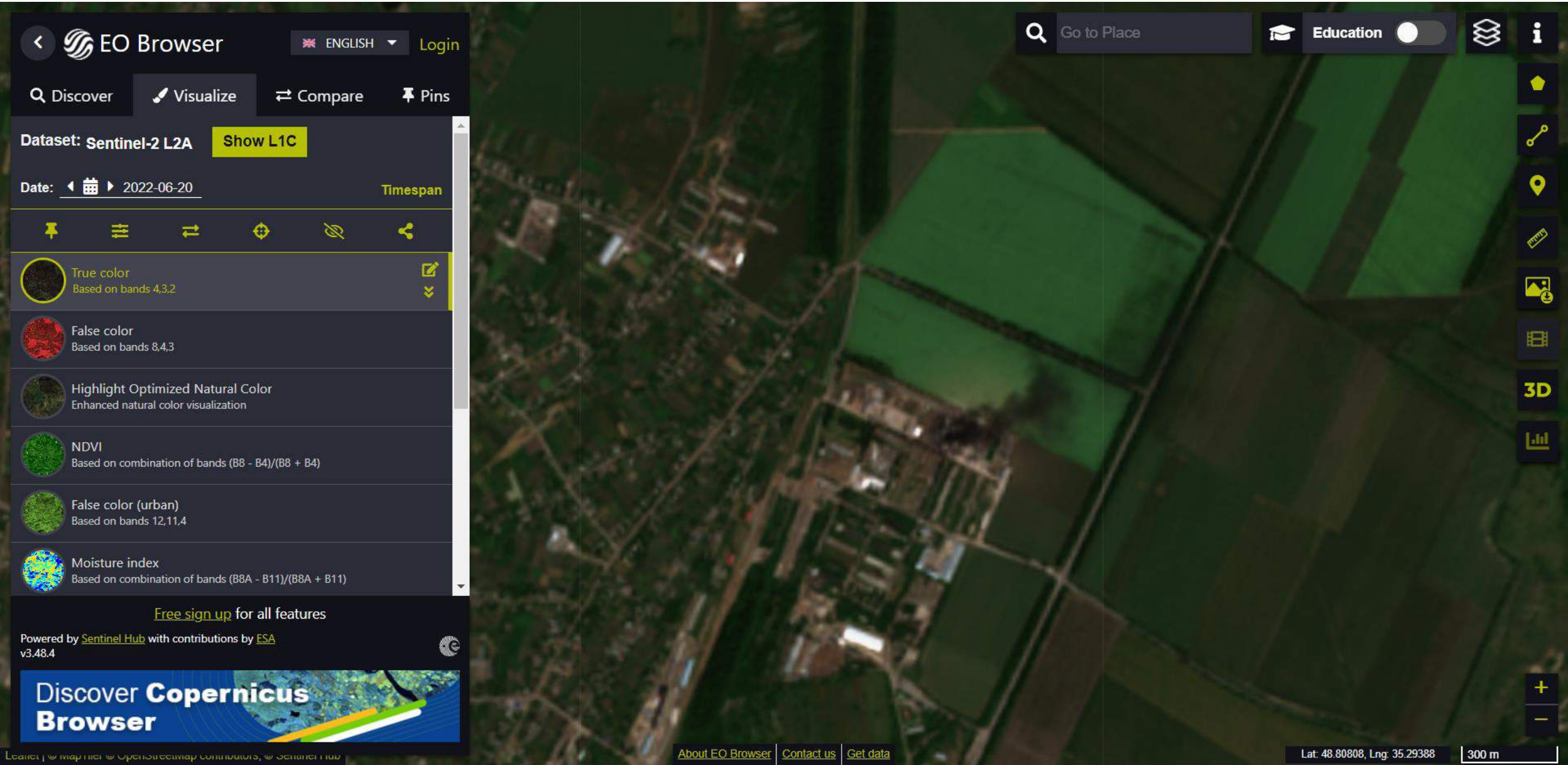
Sentinel-2 – true color imagery
During, 20 June 2022 – closeup of the affected area



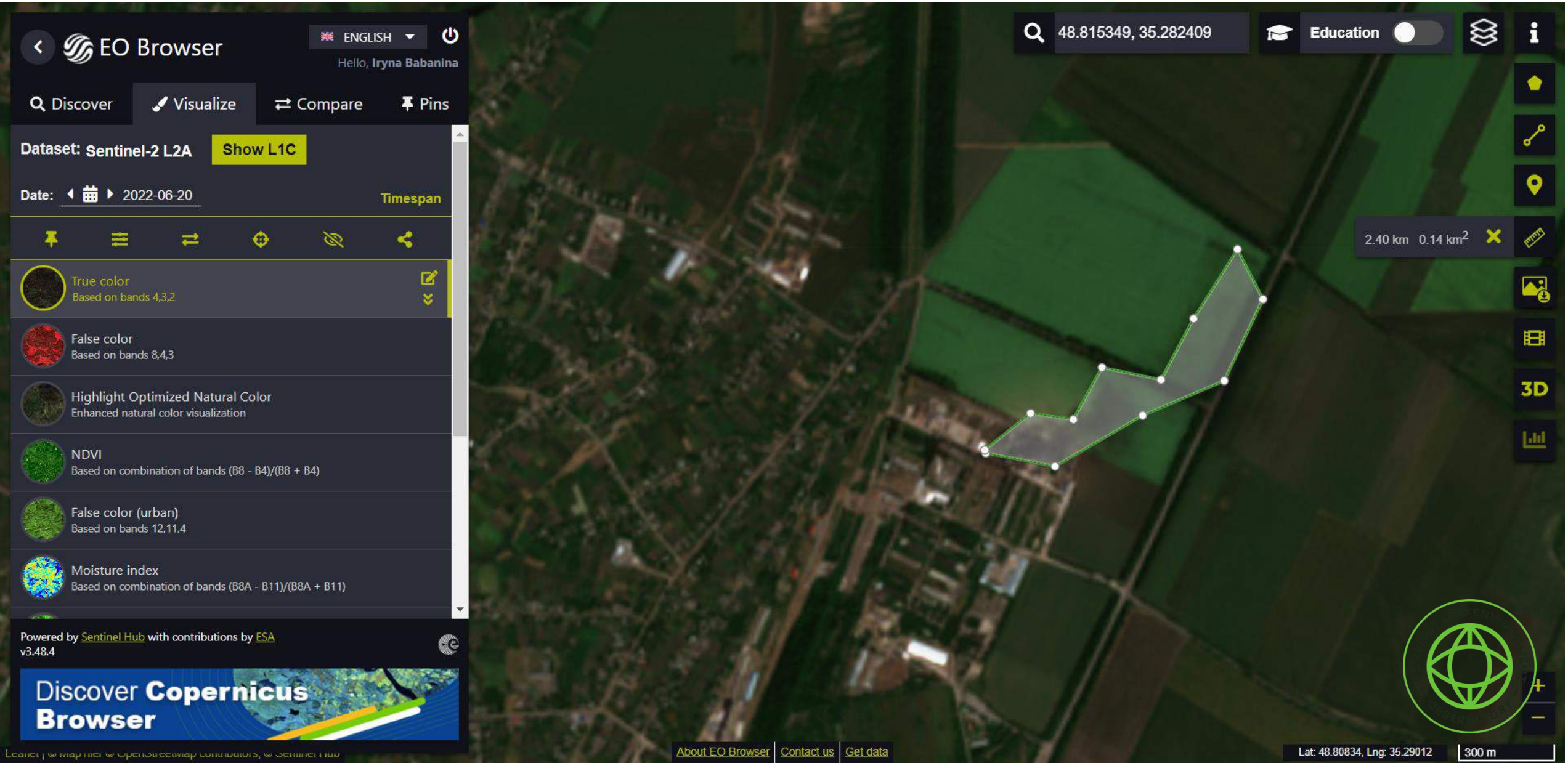
Sentinel-2 – true color imagery
After, 5 July 2022 – closeup of the affected area



Sentinel-2 – measuring the smoke plume length and potential area of pollution transfer to assess soils which may be affected by airborne pollution



Smoke plume area



Sentinel-2 – using false color combinations

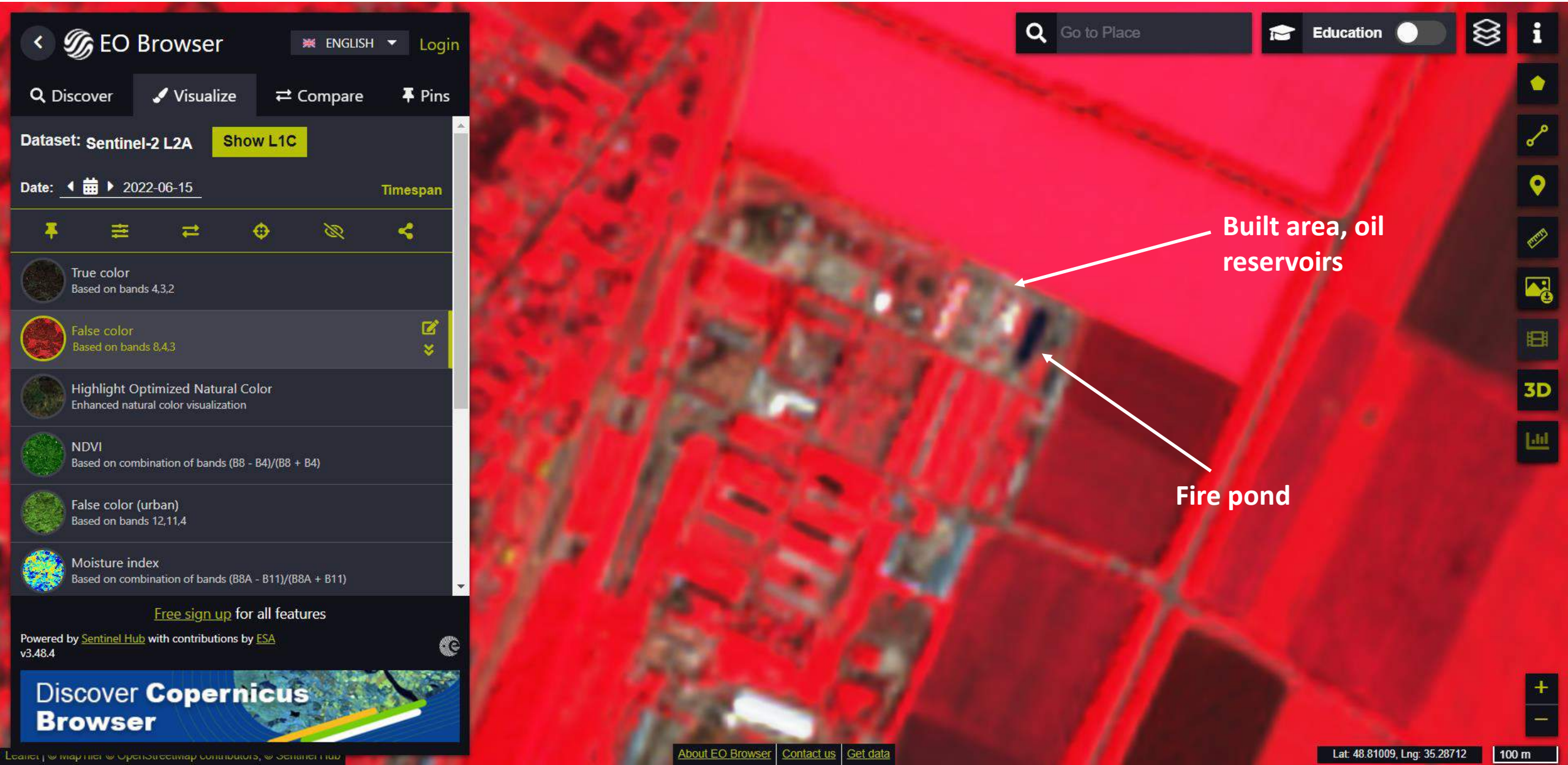
- False color image based on bands B8 (visible and near infrared, 842 nm wavelength), B4 (red, 665 nm) and B3 (green, 560 nm) is meant to emphasize healthy and unhealthy vegetation.

- By using the near-infrared (B8) band, it's especially good at reflecting chlorophyll. This is why in a color infrared image, denser vegetation is red.

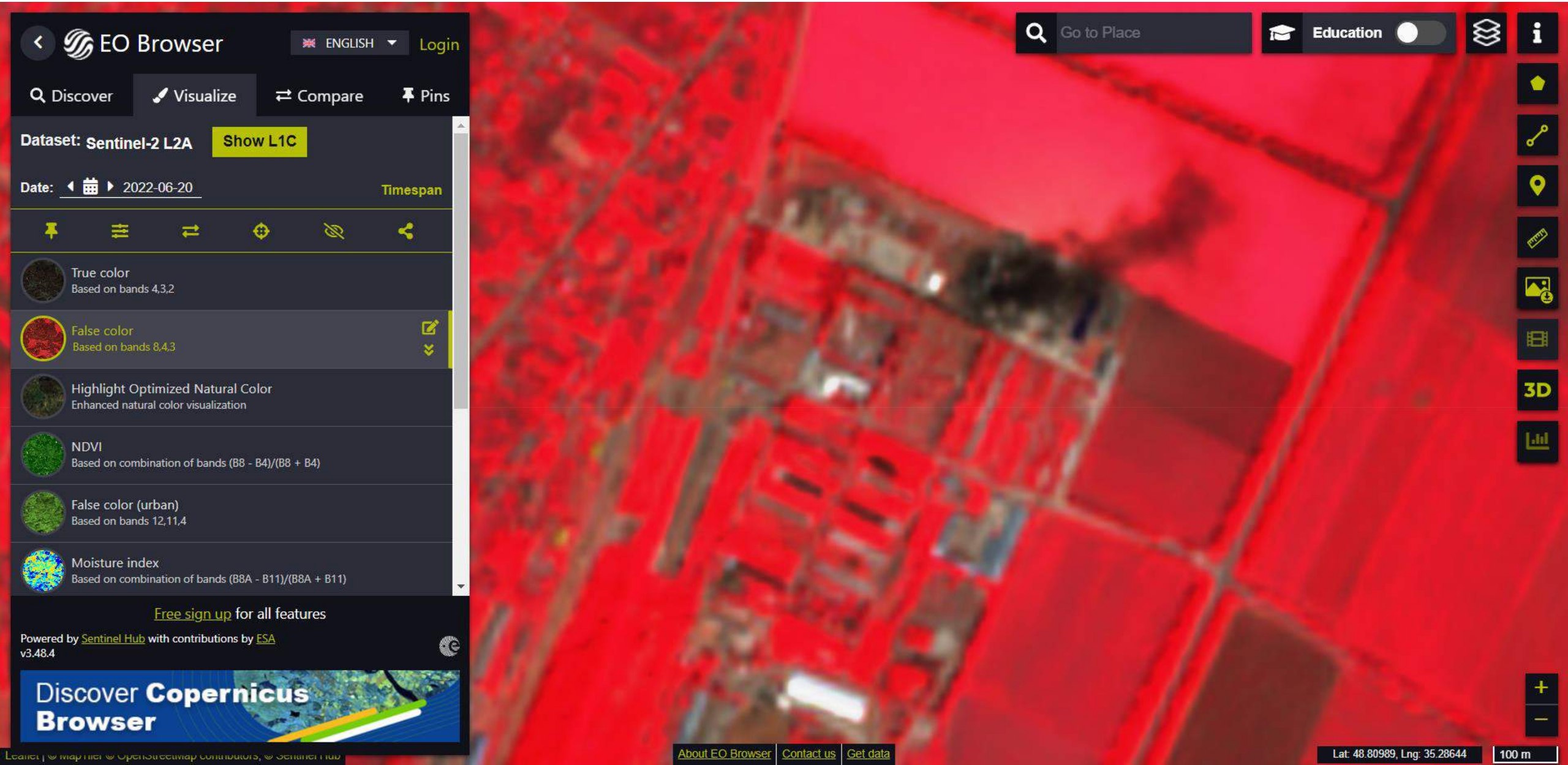
- Built areas appear grey or white. False colors combination also helps identify destroyed buildings - makes the shapes of the structures stand out from the vegetation-covered background.

- Water appears dark.

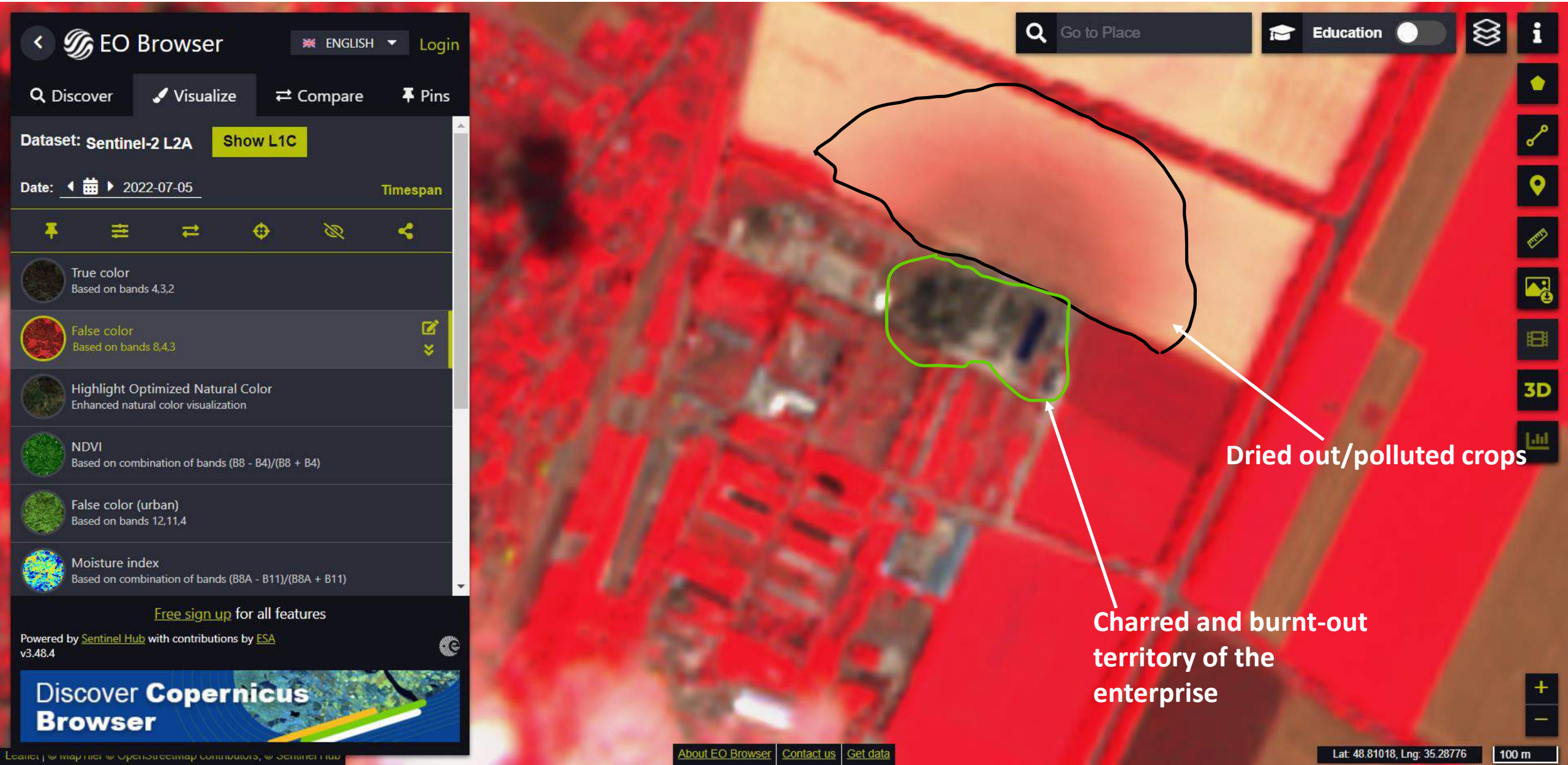
False colors - before, 15 June 2022



False colors - during, 20 June 2022



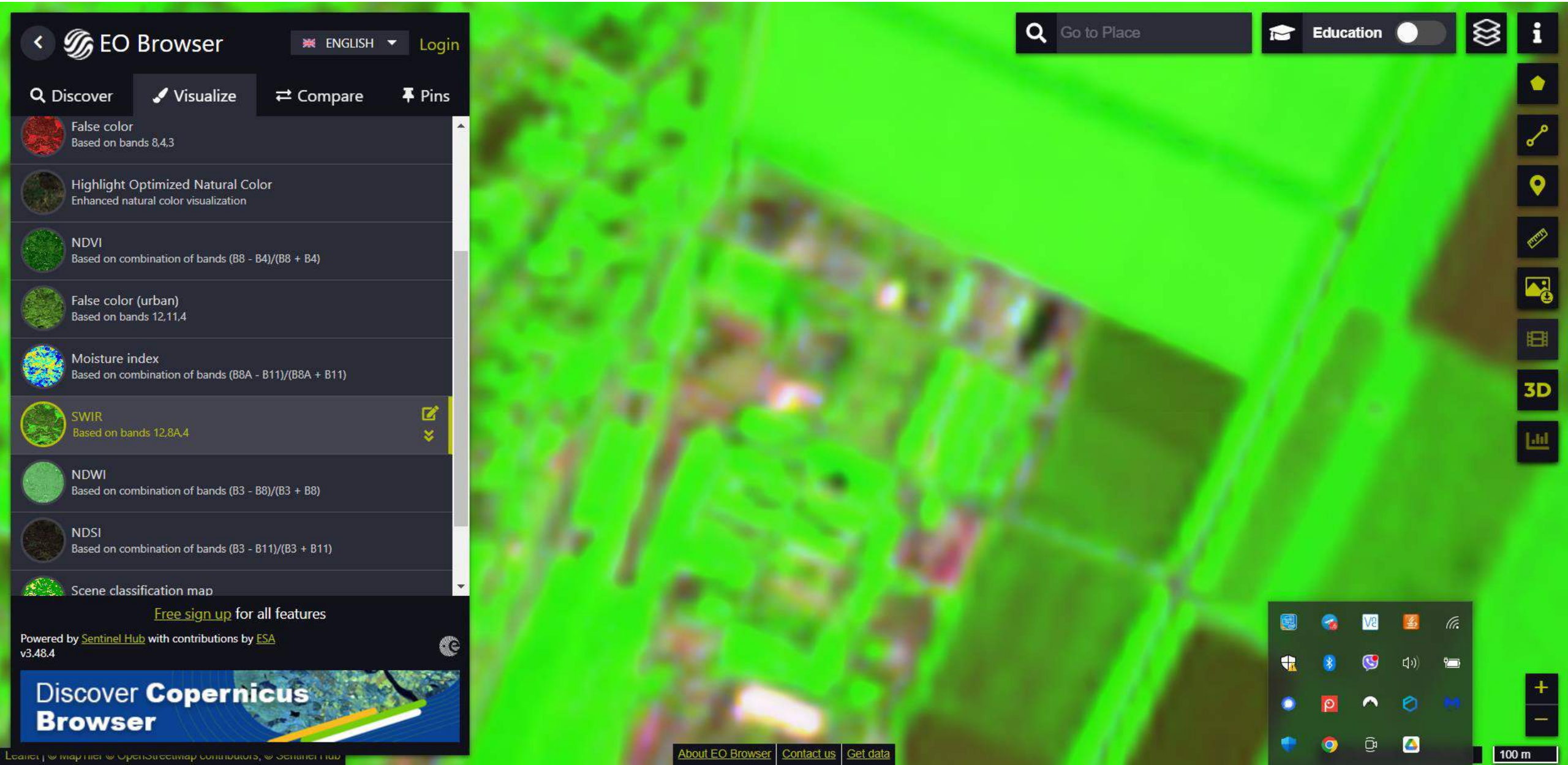
False colors - after, 5 July 2022



Sentinel-2 – using SWIR (short-wave infrared)

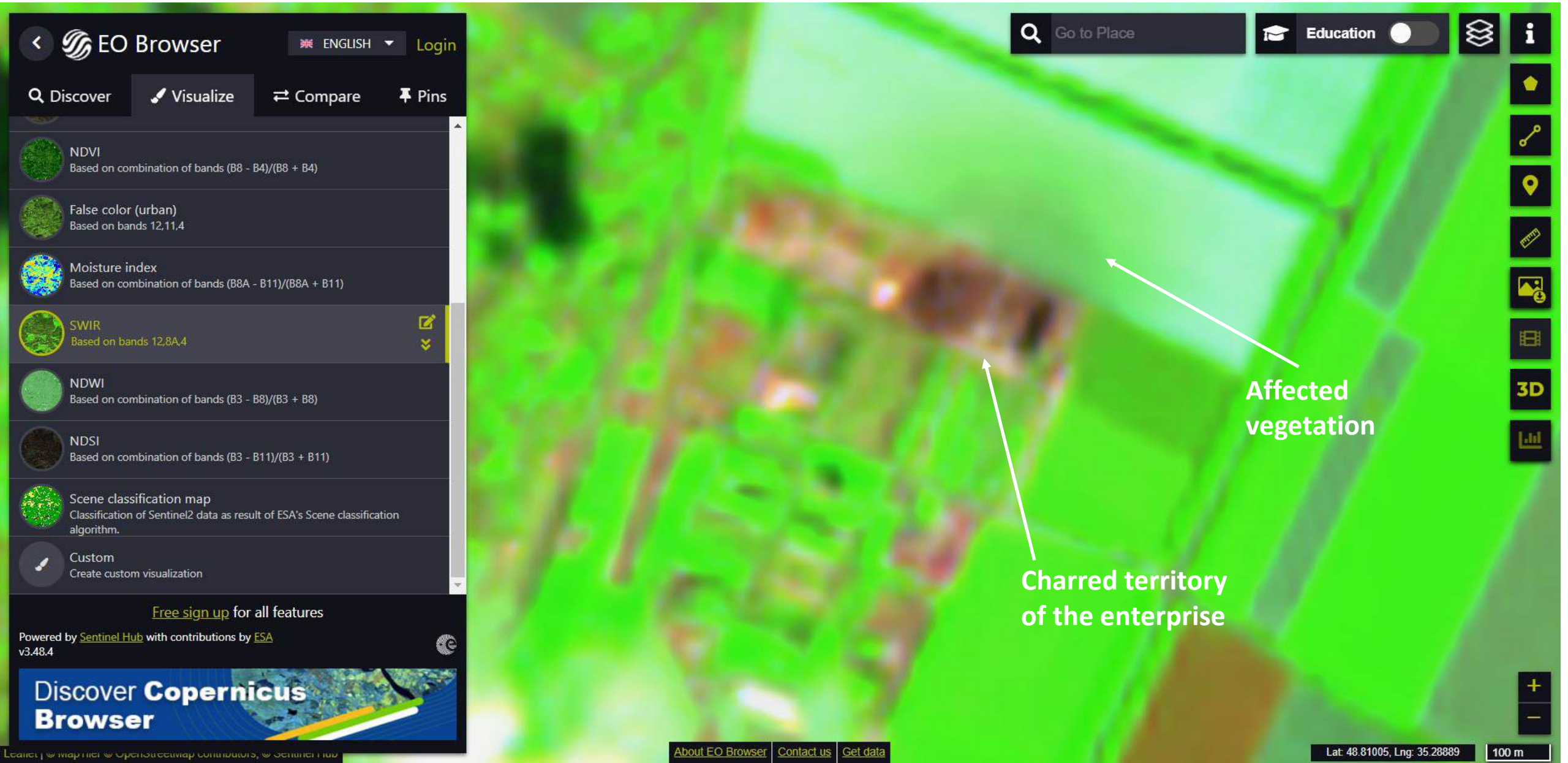
- The short-wave infrared band combination uses SWIR (B12 band, 2190 nm), NIR (B8A, 865 nm), and red (B4, 665 nm).
- This composite shows vegetation in various shades of green. In general, darker shades of green indicate denser vegetation.
- Brown is indicative of bare soil and built-up areas.
- This combination also shows active fires and smoldering (thermal anomalies).

SWIR - before, 15 June 2022



SWIR - during, 20 June 2022

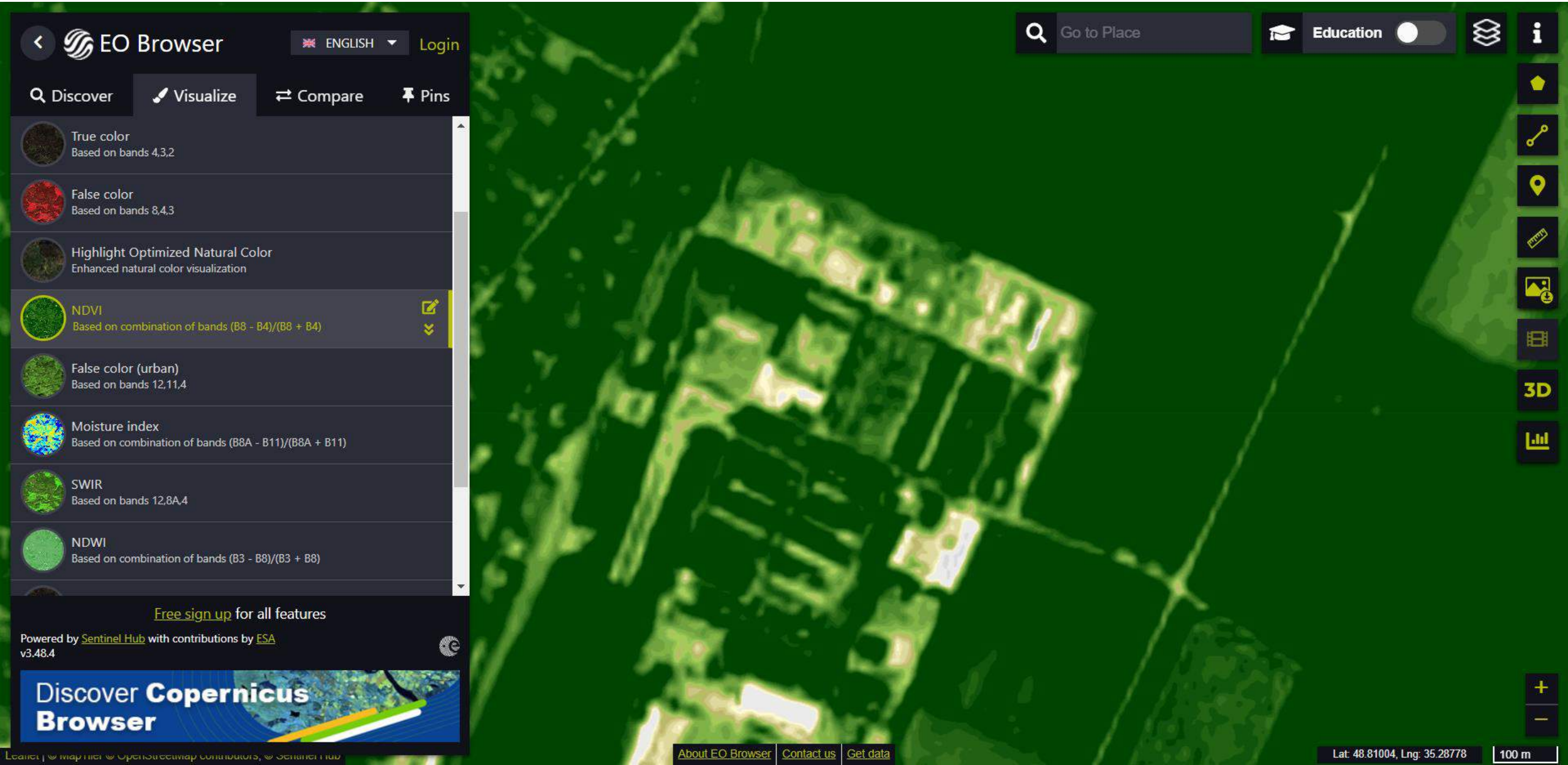
SWIR - after, 5 July 2022



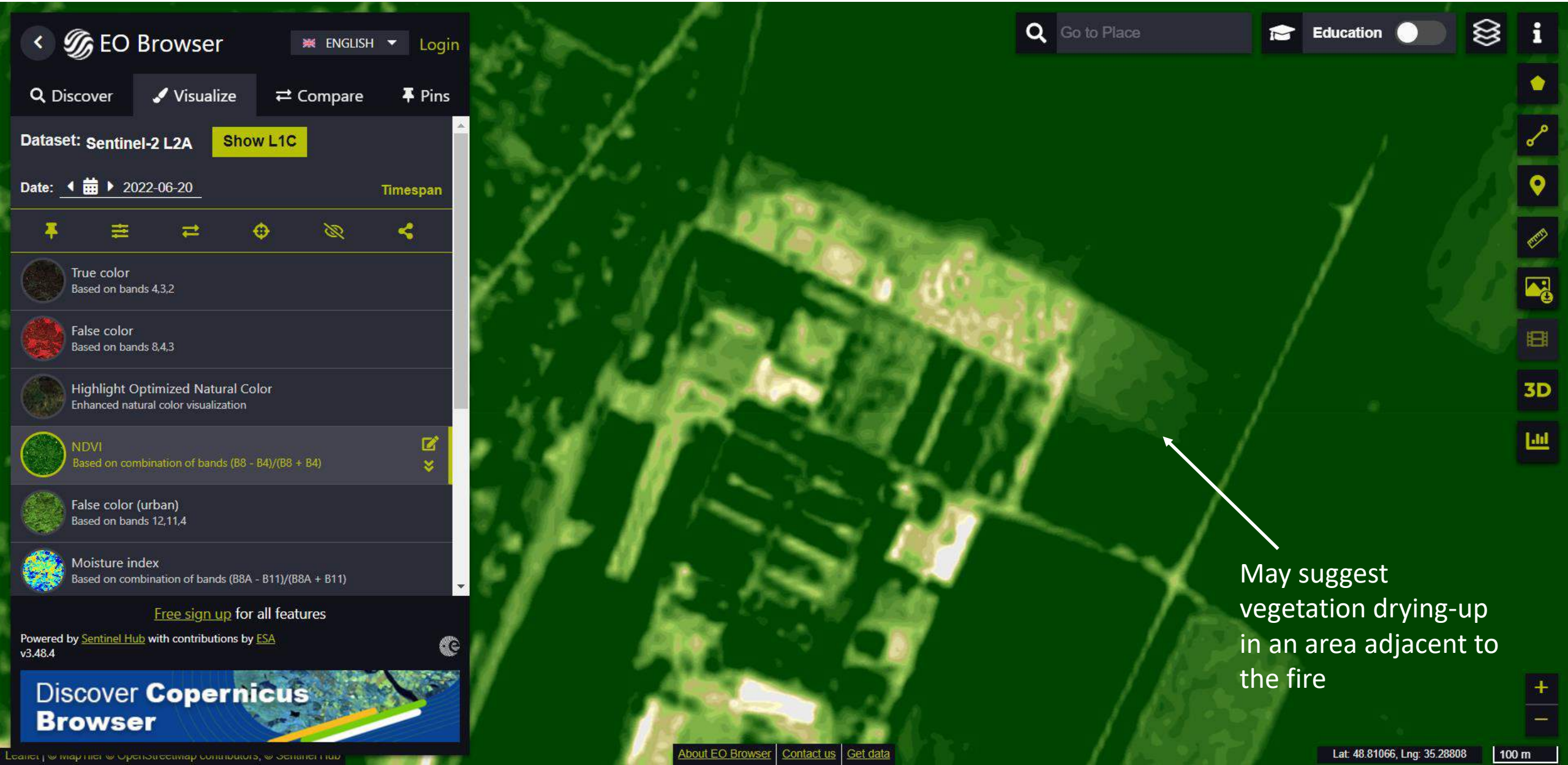
Sentinel-2 – using NDVI (Normalized Difference Vegetation Index)

- NDVI uses near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs), to quantify the amount of vegetation.
- The formula for the normalized difference vegetation index is (B8-B4)/(B8+B4).
- High values suggest dense vegetation cover, low or negative values indicate urban and water features.
- May also be used to distinguish between built and green areas in darker images.

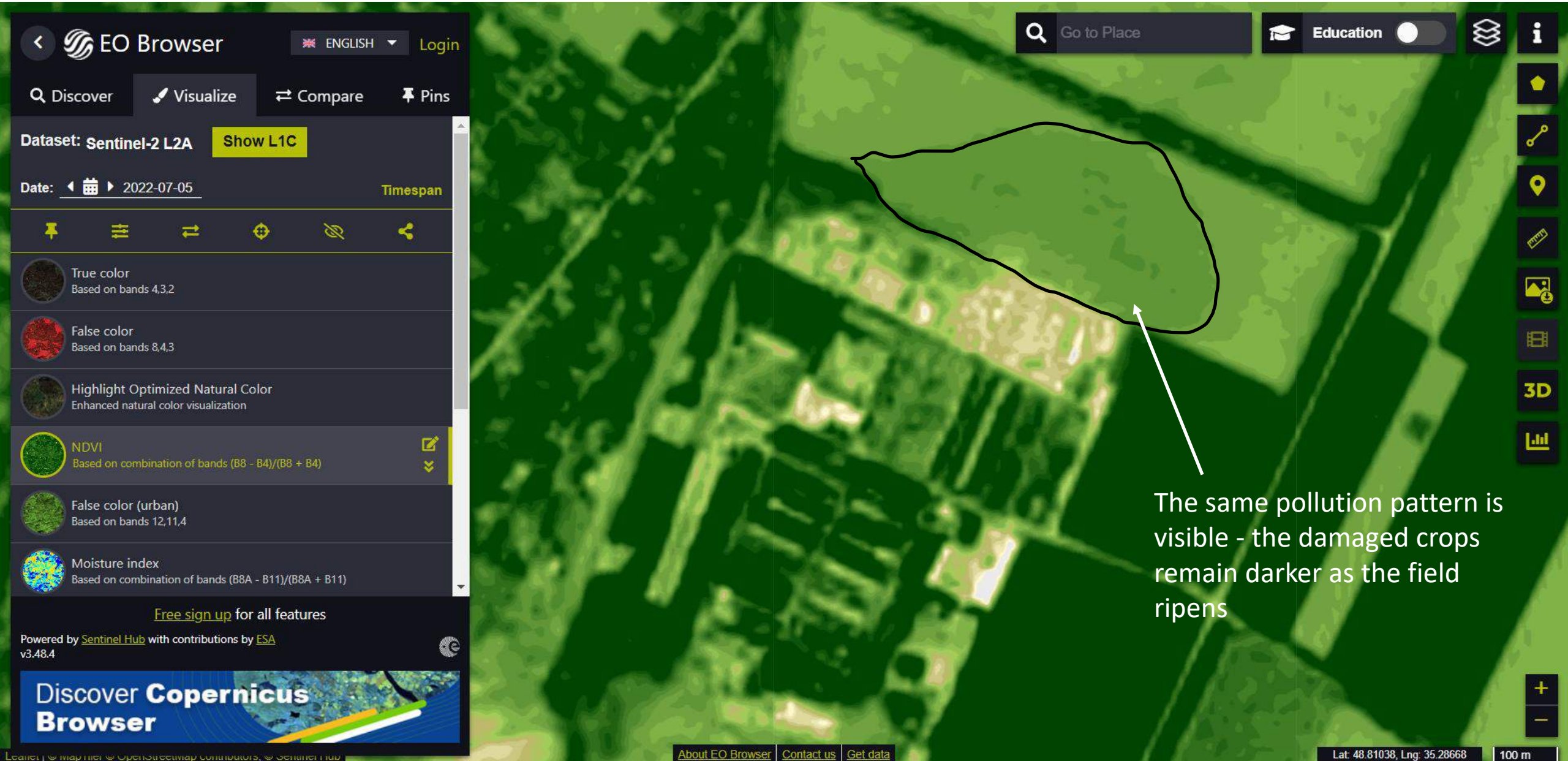
NDVI - before, 15 June 2022



NDVI - during, 20 June 2022



NDVI - after, 5 July 2022



FIRMS – Fire Information for Resource Management System

The Fire Information for Resource Management System (FIRMS) distributes near-realtime active fire data from the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard the Aqua and Terra satellites, and the Visible Infrared Imaging Radiometer Suite (VIIRS) aboard S-NPP and NOAA 20. Globally these data are available within 3 hours of satellite observation, but for the US and Canada active fire detections are available in real-time.

Fire Map:
https://firms.modaps.eosdis.nasa.gov/map

Fire Map mirror website:
https://firms2.modaps.eosdis.nasa.gov/map

FIRMS

Location

Measuring tool

Information layers

FIRMS

Modes:

- Basic mode – daily information
- Advanced mode – updated every few hours

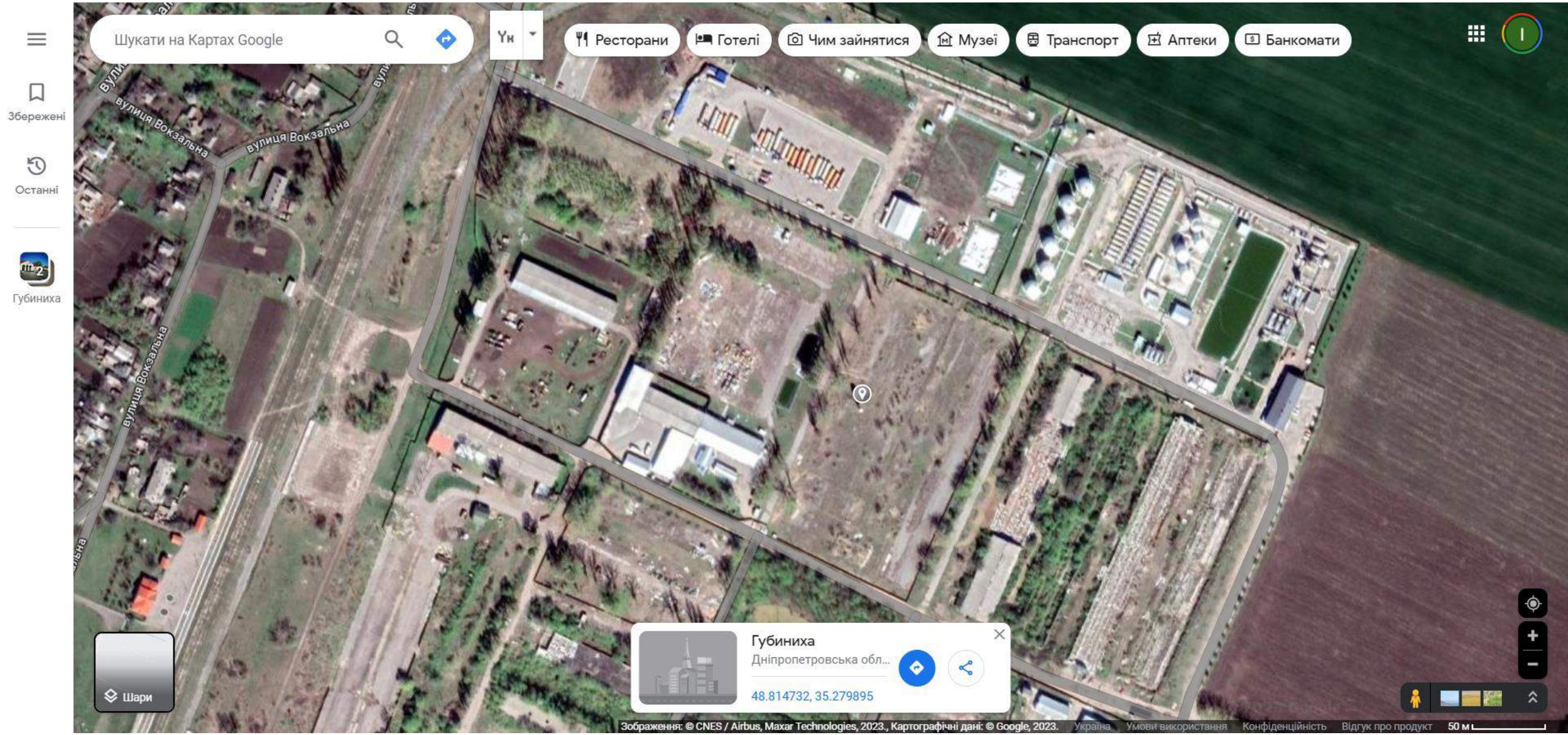
Layers:

- The Coastlines/Borders/Roads layer is a reference layer that displays global coastlines, country borders, first order administrative boundaries and major roads.

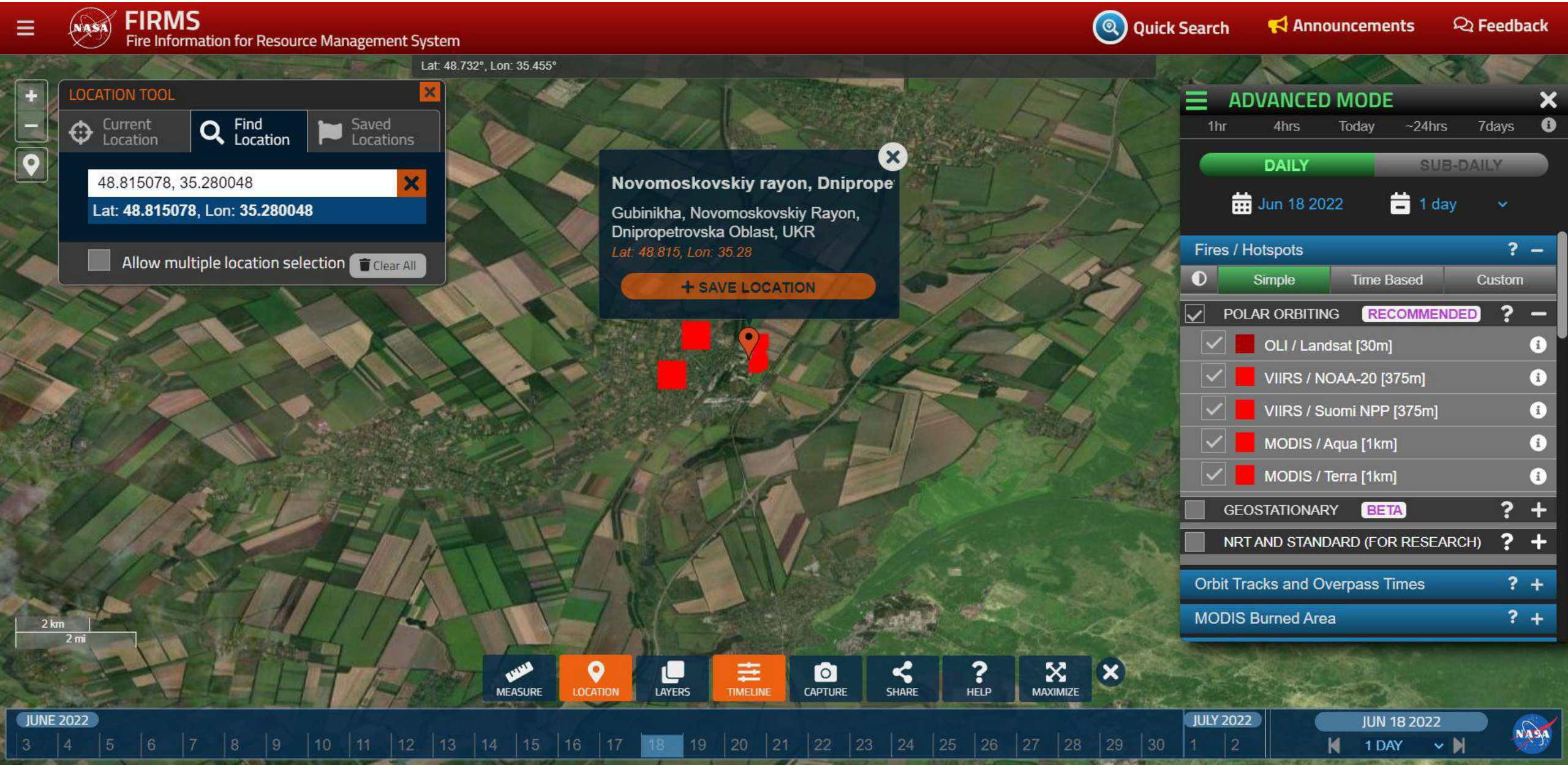
- Human Built-up And Settlement Extent layer is from the Global Human Built-up And Settlement Extent (HBASE) Dataset from Landsat.

- Protected Areas and European Regional Pas - these layers are from the World Database on Protected Areas (WDPA) (August 2023), the most comprehensive global database of marine and terrestrial protected areas.

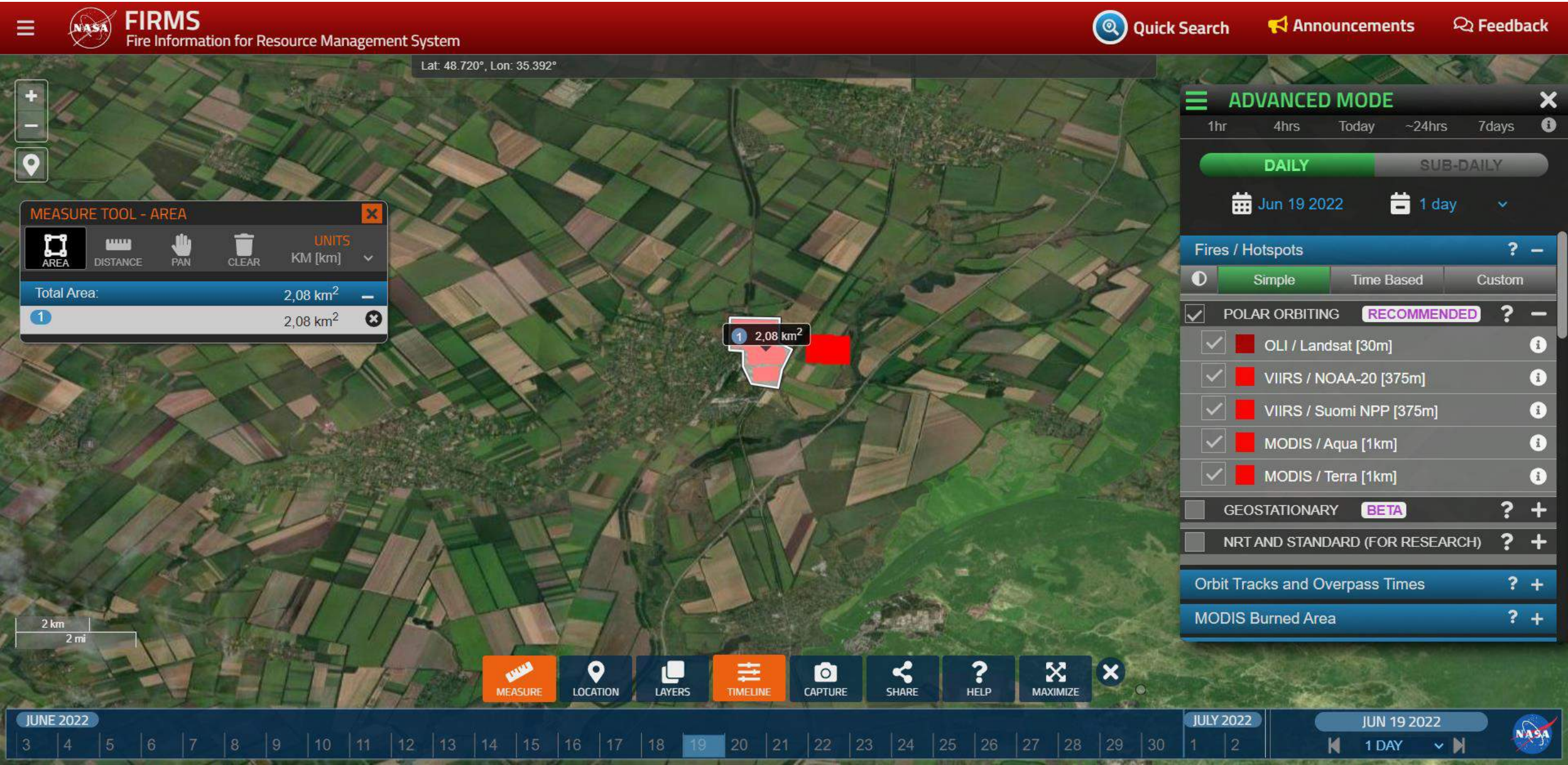
Hubynykha on Google Maps



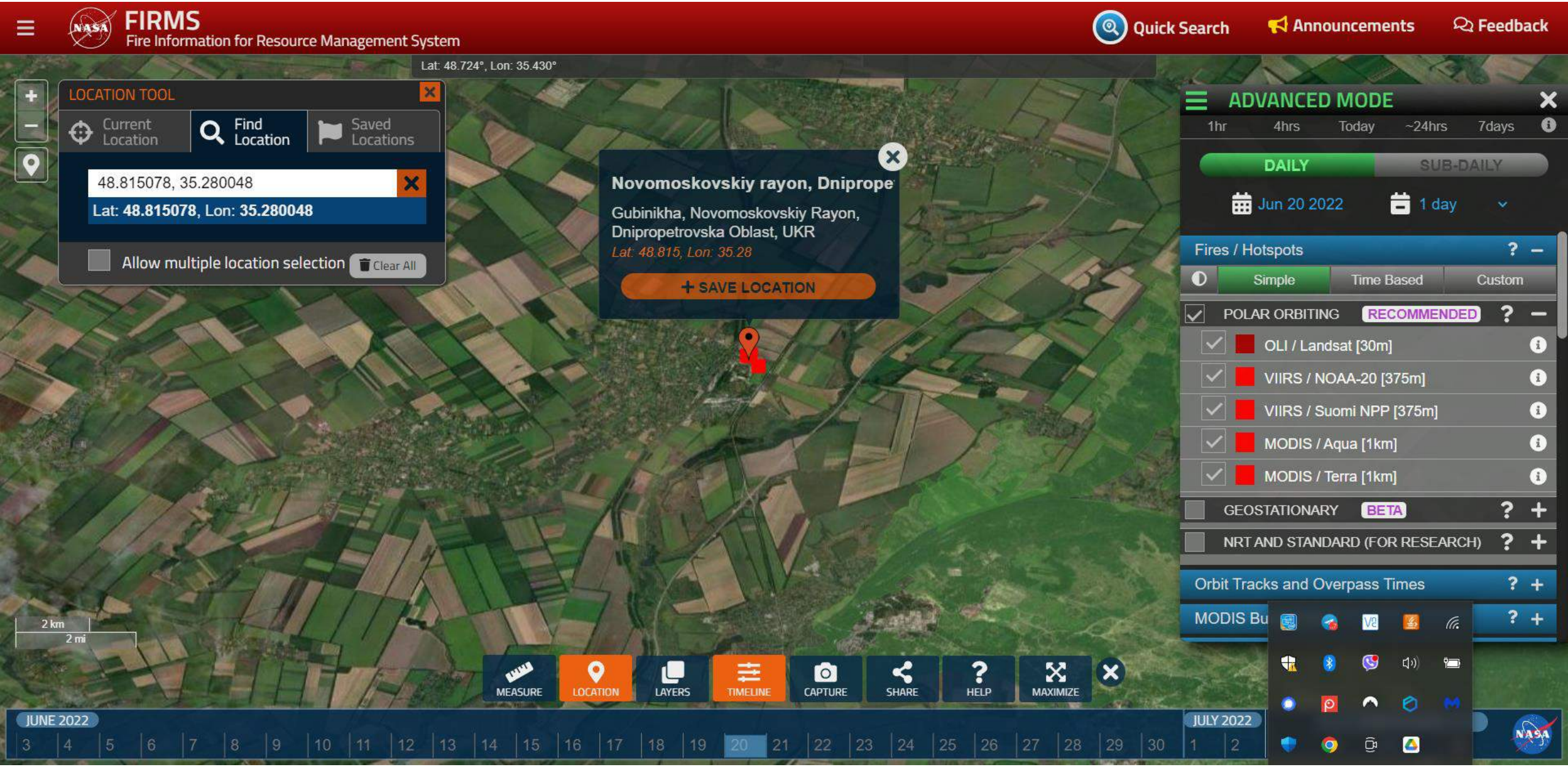
FIRMS data on 18 June 2022



FIRMS data on 19 June 2022



FIRMS data on 20 June 2022



Ukraine conflict environmental briefing: Water

Explosive weapons use and the environmental consequences: Mapping environmental incidents in Ukraine

The Ukraine conflict's legacy of environmental damage and pollutants

Monitoring the monitors studying the Ukraine conflict's environmental impact

Exploring environmental governance in eastern Ukraine

Environmental trends in the Ukraine conflict, 10 days in

Ukraine conflict environmental briefing: Industry

Ukraine invasion: rapid overview of environmental issues

UNEA-2 passes most significant UN resolution on conflict and the environment since 1992

Are abandoned mines flooding in Ukraine's Donbas region?

Sustainable recovery? First sustain interest in Ukraine's environment

Legal accountability for environmental destruction in Ukraine

Ukraine conflict environmental brief: Nuclear and radiation risks

Conflict and Environment Observatory

CEOBS is a UK charity working to increase the protection of people and ecosystems from the impact of armed conflicts and military activities.

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