

Global Wildfire Information System

User Guide to GWIS applications

Version 1.2, June 2024



Welcome to GWIS

The Global Wildfire Information System (GWIS) is a joint initiative of the GEO and the Copernicus Work Programs. In the [GEO GWIS work program for the years 2023-2025](#), GWIS aims at bringing together existing information sources at regional and national levels in order to provide a comprehensive view and evaluation of fire regimes and fire effects at global level; the fires mapped in GWIS may include fires set intentionally for the purpose of vegetation management. Additionally, GWIS provides tools to support operational wildfire management from national to global scales.

GWIS builds on the ongoing activities of the European Forest Fire Information System (EFFIS), the Global Terrestrial Observing System (GTOS) Global Observation of Forest Cover- Global Observation of Land Dynamics (GOCF-GOLD) Fire Implementation Team (GOCF Fire IT), and the associated Regional Networks, complementing existing activities that are on-going around the world with respect to wildfire information gathering. The development of GWIS is supported by the partner organizations and space agencies, while its main funding is provided by the European Commission. Support to GWIS was provided by NASA through its [GEO-GWIS activities in the ROSES program](#).

Currently, GWIS is made of five applications:

[Visit the brand-new](#)

[Current Statistics Portal](#)

Events

Upcoming

Recent

[6th Meeting of the Expert Group Forest Fires in LAC \(EGFF LAC\) - 21-24 May 2024](#)

[6th GWIS and GOCF-GOLD Fire IT meeting, 14-15 November 2023 Montreal, Canada](#)

GWIS Applications



Current Situation Viewer

Provides fire danger forecast up to 10 days in advance, 1 day lightning forecast and near-real time information on active fires...

[Read more >](#)



Current Statistics Portal

Statistics are provided at national level and for regions of interest, such as the 'Brazilian Legal Amazon' and the Arctic Monitoring and Assessment Program (AMAP).

[Read more >](#)



Country Profile

Provides historical overviews of fire regimes at country and sub-country level for the period 2002-2019.

[Read more >](#)



Long-term fire weather forecast

Monthly and seasonal forecast of temperature and rainfall anomalies that are expected to prevail over the world.

[Read more >](#)

Data & Services

Provides access to the data used in the GWIS applications. Data from the Current Situation Viewer are provided from the WMS.

[Read more >](#)

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GWIS presentation

The Global Wildfire Information System (GWIS) aims at bringing together existing information sources at regional and national level in order to provide a comprehensive view and evaluation of fire regimes and fire effects at global level and to provide tools to support operational wildfire management from national to global scales.

The worldwide information on wildfires can be accessed through the GWIS viewer at: <https://gwis.jrc.ec.europa.eu/>

Current Situation Viewer


The current situation enables the user to view and query map layers, with the most up to date information on the current fire season worldwide. This includes current date meteorological fire danger maps (and forecast up to 9 days), maps of hot spots (daily updated), fire perimeters and fire emissions. Moreover, lightning forecast and fuel map are available.

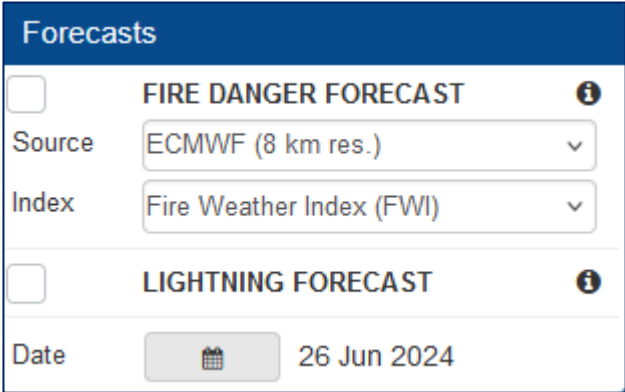


Overview of the Current Situation Viewer.

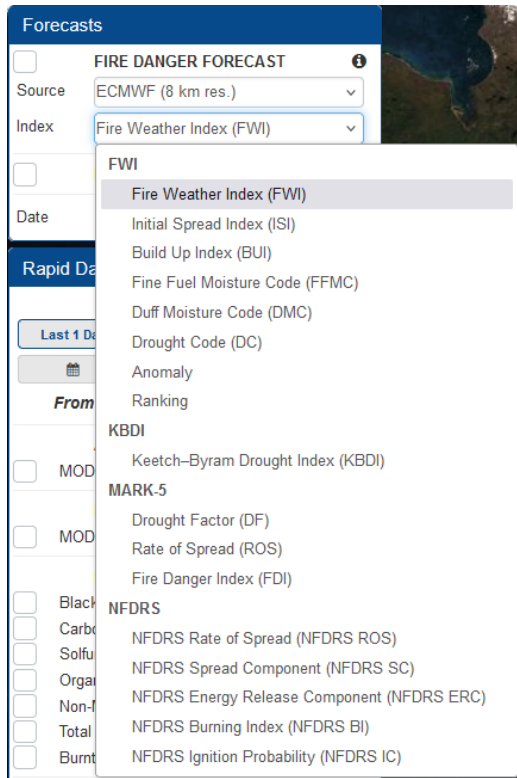
Layer controls

On the left of the map are 4 windows containing map options/analysis tools, described below. In all cases clicking on the info button (i) opens a new screen containing detailed information as presented in **Additional information** session on this guide.

MAP OPTIONS	Details
	<p>Adds or removes Country Boundaries, Human Settlement Layer, Protected Areas Layer or CCI Landcover layer.</p> <p>Click to add (default: off).</p>

FORECASTS	Details
	<p>Display Fire Danger information (Click to add - default: off).</p> <p><u>Choose source:</u> ECMWF (default), ECMWF Probabilistic.</p> <p><u>Choose Index:</u> indexes change according to the model selected (see below for details).</p> <p>Display Lightning Forecast (Click to add - default: off).</p> <p><u>Choose date:</u> today (default), 9 days forecast.</p>

FORECASTS – continuation

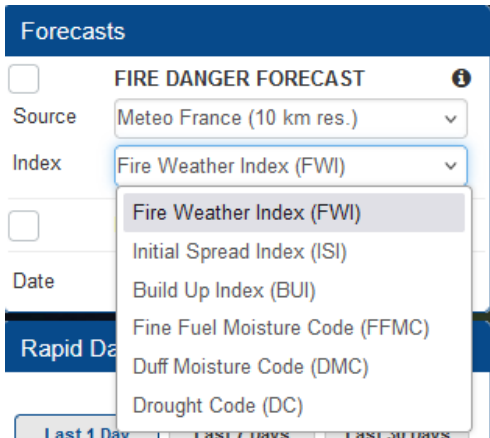


Details

Source: ECMWF (8 km res.)

Available index list:

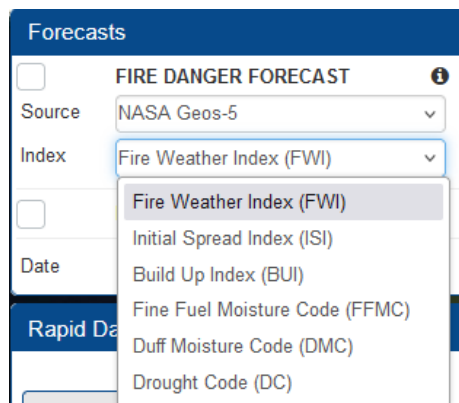
- FWI
 - Fire Weather Index (FWI) - *default*
 - Initial Spread Index (ISI)
 - Build up Index (BUI)
 - Fine Fuel Moisture Code (FFMC)
 - Duff Moisture Code (DMC)
 - Drought Code (DC)
 - Anomaly
 - Ranking
- KBDI
 - Keetch-Byram drought index (KBDI)
- Mark-5
 - Drought factor (DF)
 - Rate of spread (ROS)
 - Fire danger index (FDI)
- NFDRS
 - Rate of spread (NFDRS ROS)
 - Spread component (NFDRS SC)
 - Energy release component (NFDRS ERC)
 - Burning index (NFDRS BI)
 - Ignition probability (NFDRS IC)



Source: Meteo France (10 km res)

Available index list:

- Fire Weather Index (FWI) - *default*
- Initial Spread Index (ISI)
- Build up Index (BUI)
- Fine Fuel Moisture Code (FFMC)
- Duff Moisture Code (DMC)
- Drought Code (DC)



Source: NASA Geos-5

Available index list:

- Fire Weather Index (FWI) - *default*
- Initial Spread Index (ISI)
- Build up Index (BUI)
- Fine Fuel Moisture Code (FFMC)
- Duff Moisture Code (DMC)
- Drought Code (DC)

RAPID DAMAGE ASSESSMENT

Rapid Damage Assessment

Select a date-range

From: 25 Jun 2024 **To:** 26 Jun 2024

ACTIVE FIRES ⓘ

MODIS VIIRS

BURNT AREAS ⓘ

MODIS & VIIRS NRT

FIRE EMISSIONS ⓘ

Black Carbon Methane
 Carbon Dioxide Carbon Monoxide
 Sulfur Dioxide Nitrogen Oxides
 Organic Carbon Particulate Matter
 Non-Methane Hydro-Carbon
 Total Carbon in Aerosols
 Burnt Carbon

FUELS ⓘ

Details

Displays active fires, burnt area, fire emissions and fuels information (Click to add - default: off).

Select date-range: allows the selection of pre-calculated or custom ranges.

Active fires: display active fires from MODIS, VIIRS or both together.










Burnt areas: display Burnt areas from MODIS & VIIRS NRT (instead of or together with active fires).

Fire Emissions: can be displayed for a selection of fire emissions.

Fuels: display Global fuel map.

Map Tools

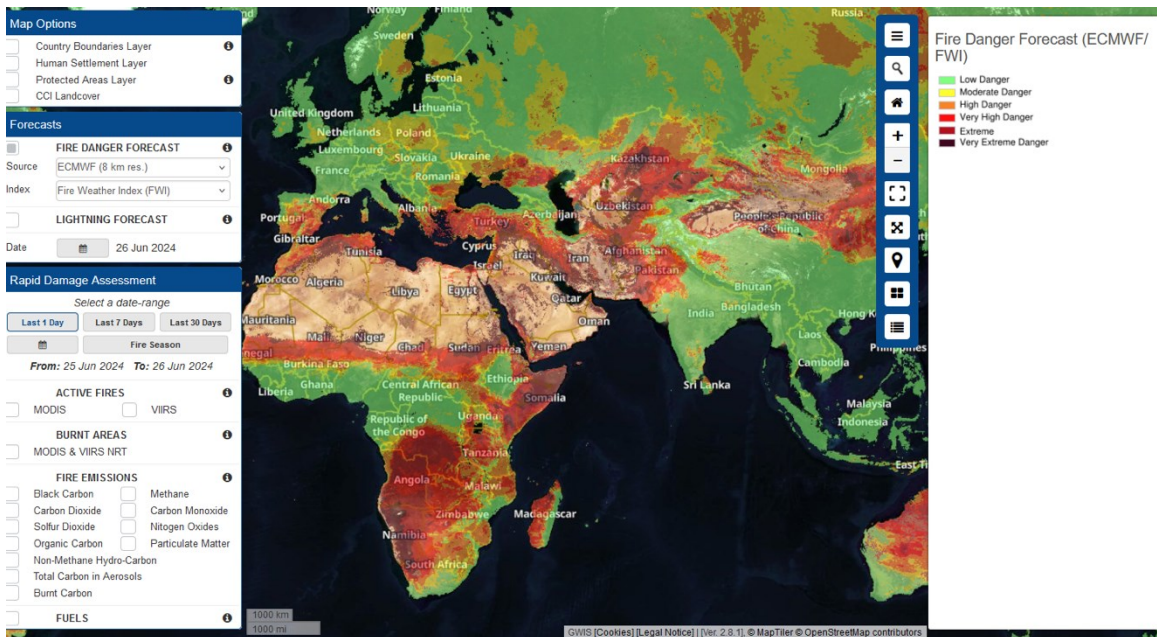
A set of map tools are on the right side of the map image. The following table explains how the tools work.

Tool	Icon	Details
Open/close layers sidebar		Shows or hides the options bars on the left of the screen. Click once to hide, click again to show.
Search		Opens a box to search for place names.
Reset map		Returns the map to the original extent covering Europe.
Zoom in/out		Click to increase or decrease resolution. The same effect can also be obtained using the roller button on the mouse.
Zoom to specific area		Click and use the mouse to highlight a specific area for the zoom.
Full screen		Click to put map on whole screen. Click again to restore to previous view.
Show me where I am		Click to zoom in on current location (may not work if permission has not been granted to the browser to find location).
Switch base layer		<ul style="list-style-type: none"> •Country Boundaries •Satellite Hybrid (Default layer) •Topographic + water bodies •Streets
Show legend		Opens a box on the screen with the legends for all the layers that are currently displayed.

Working with the “Current Situation Viewer”

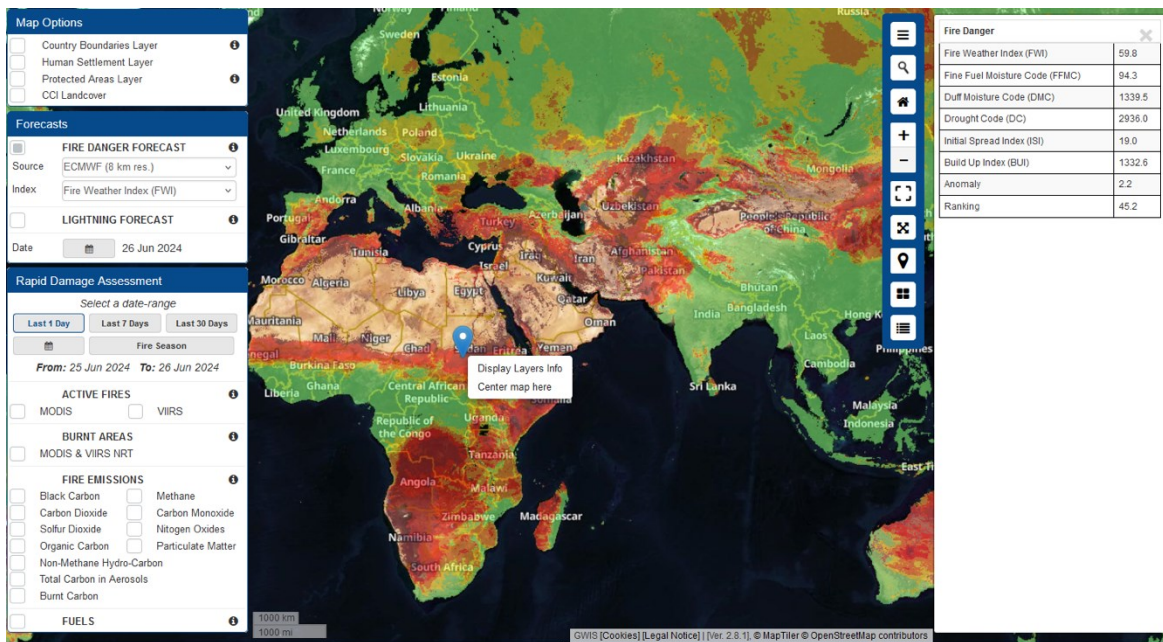
Fire Danger Forecast

Click in the small box (upper left) of the FORECASTS menu to display the Fire Danger Forecast (according to the “source”, “index” and “date” selected) and on Map tools to show legend.



Display of Fire Danger Forecast.

The right button of the mouse on the map allows the user to display information on fire danger for a single location as follows:



Display Layers info shows fire danger indices (according to the source selected) for the location.

Lightning Forecast

Click in the small box (lower left) of the FORECASTS menu to display Lightning Forecast and on Map tools to show the legend.









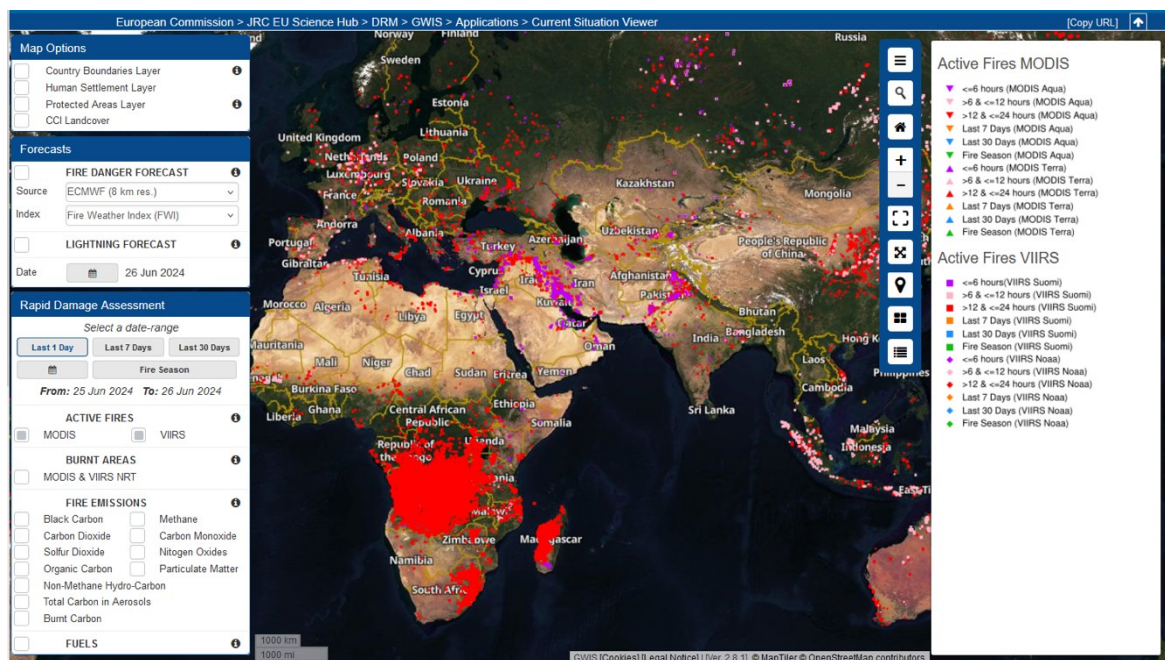
Display of Lightning Forecast.

Rapid Damage Assessment

Active Fires Information

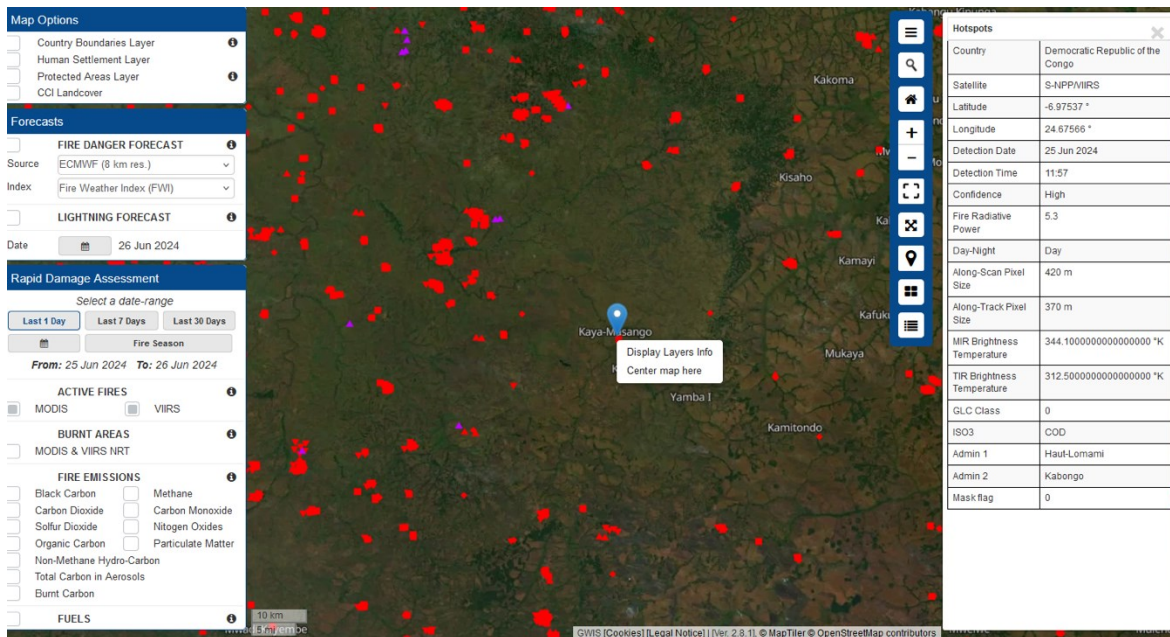
For displaying active fires information, first select the date-range then click on MODIS, VIIRS or both to display active fires. MODIS fires are displayed as circles, while VIIRS fires are displayed as inverted triangles ▽. Active fires are colour-coded according to the period in which they were recorded by the satellite sensor into the following groups:

	Purple	<=6 hours
	Pink	>6 and <=12 hours
	Red	>12 and <=24 hours
	Orange	Last 7 days
	Blue	Last 30 days
	Green	Season

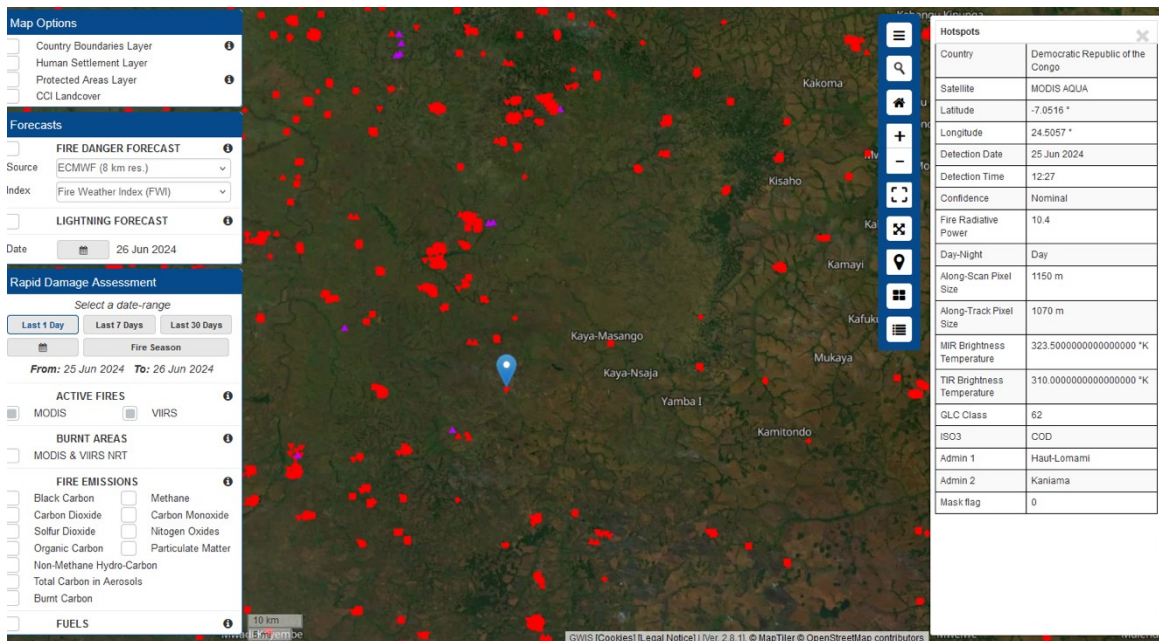


Display of active fires (from MODIS and VIIRS) in the “current situation viewer”.

The right button of the mouse placed on the selected active fire allows the user to display layer information (such as hotspots detection date and time or land cover) and centre the map. By clicking on the place marker that appears it is also possible to display Lat/long position.



Displaying layer information on Modis active fires.

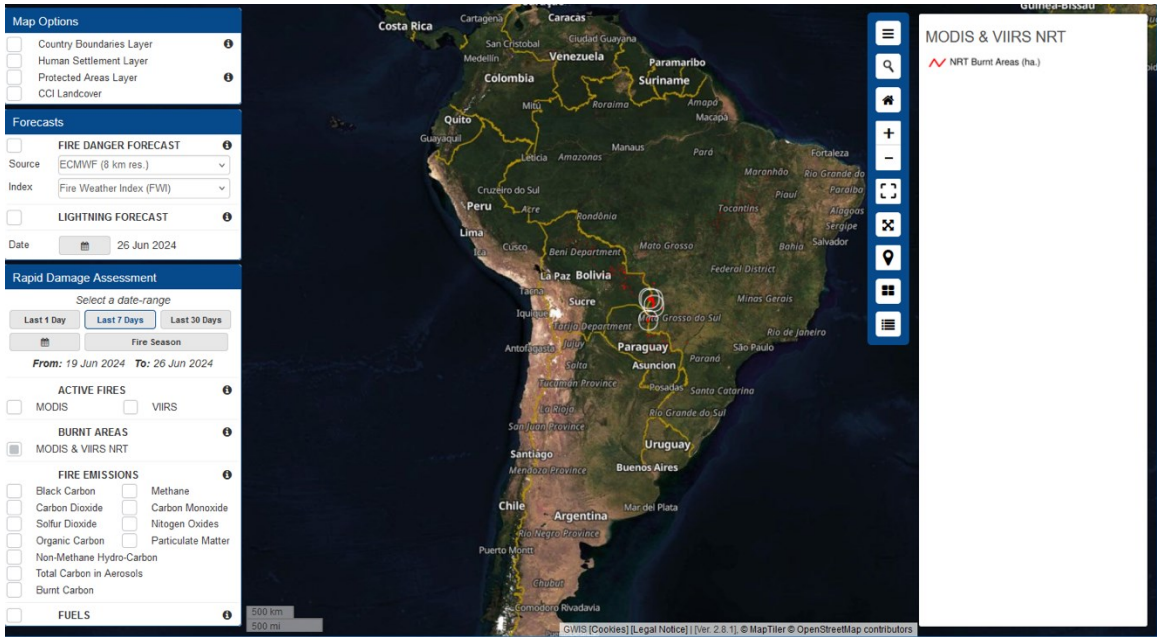


Displaying layer information on VIIRS active fires.

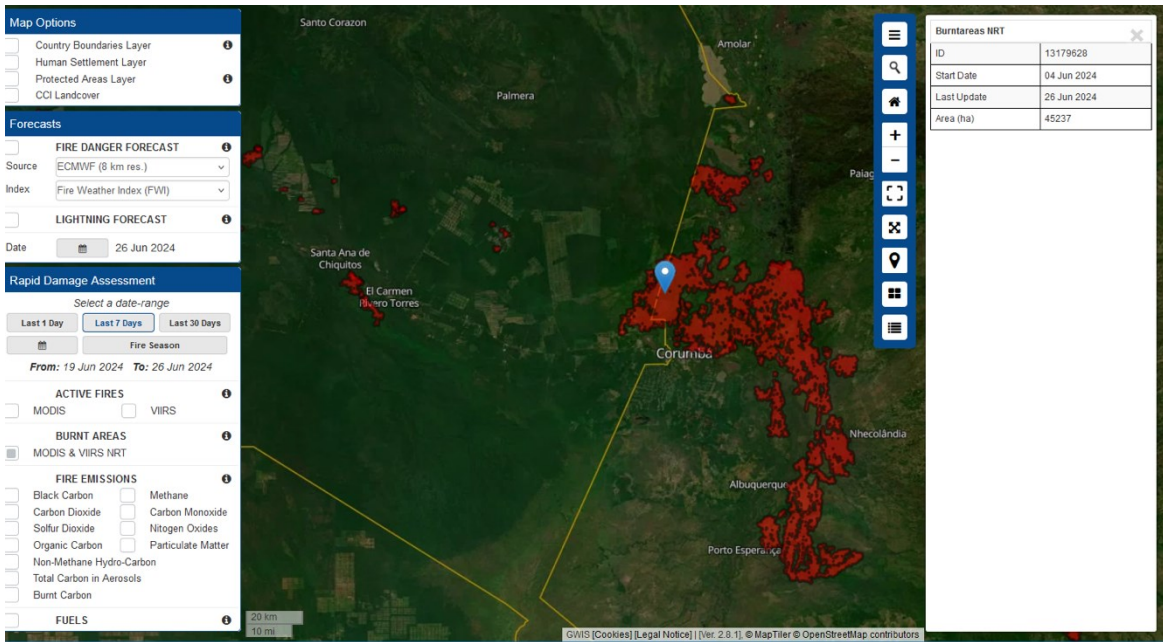
Burnt Area Information

Burnt area information in GWIS is available from MODIS & VIIRS NRT, based on MODIS and VIIRS hotspots (near real time).

For displaying burnt area information, first select a date range, then click on MODIS & VIIRS NRT to display burnt areas. The user has to zoom-in to visualize burnt area perimeters, then Right-click to display layer information on burnt areas (being implemented).



Burnt areas from MODIS & VIIRS NRT - overview. Circles signify the presence of burnt areas over 10000 ha.

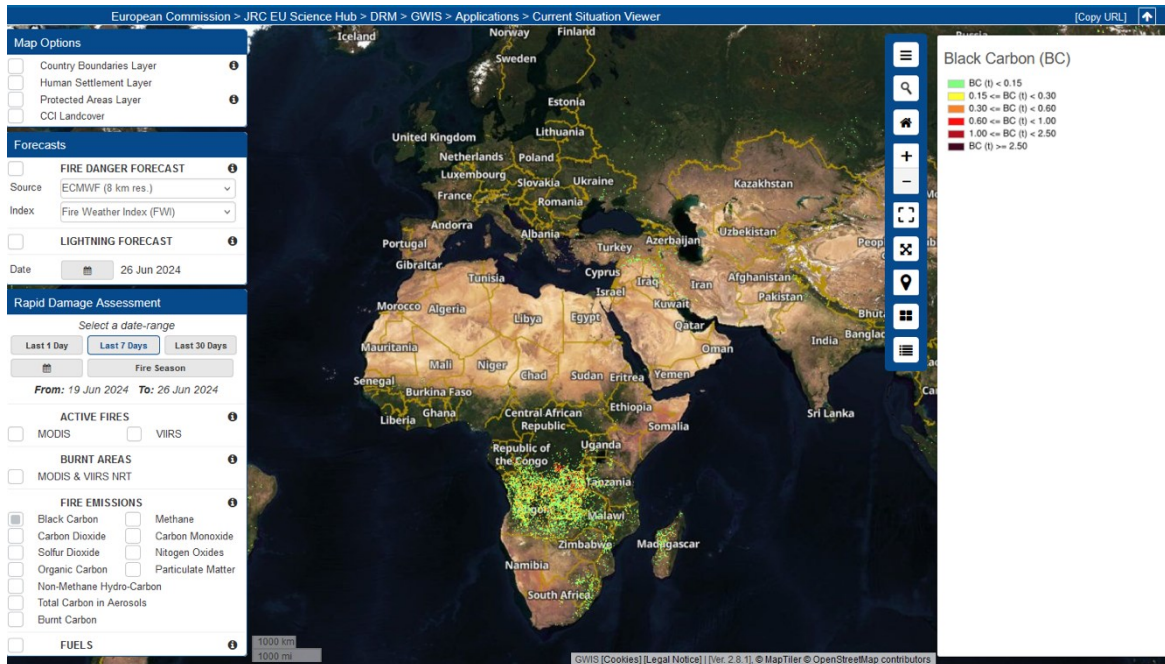


Zoom-in to visualize burnt area perimeters and display layer information.

Fire emissions

In GWIS, the following fire emissions are available: black carbon, carbon dioxide, sulphur dioxide, organic carbon, methane, carbon monoxide, nitrogen oxides, particulate matter, non-methane hydro-carbon, total carbon in aerosols and burnt carbon.

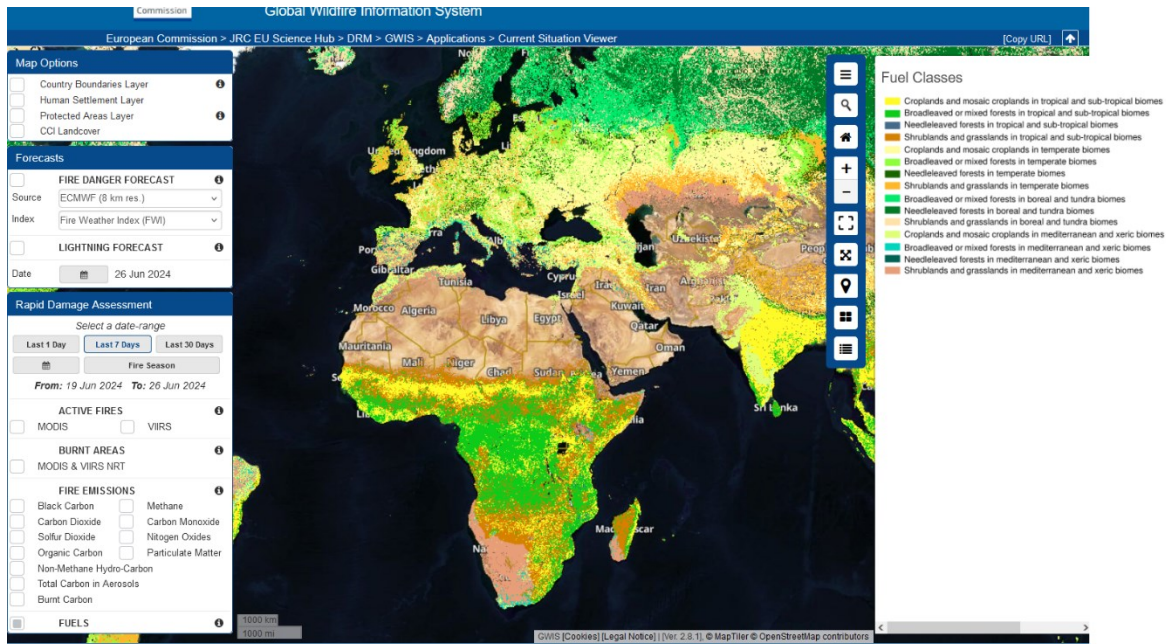
First select a date range and then click on the fire emission of interest for displaying and on Map tools (Show legend) for displaying the legend.



Fire emission example for Black carbon.

Fuels

Click on Fuels to display [Global fuel map](#) and on map tools to display legend.



Displaying Global fuel map.

GWIS Statistics Portal

Here statistics are provided at national level and also for several groups of countries:

- Africa
- the Americas
- Asia
- Europe
- Oceania

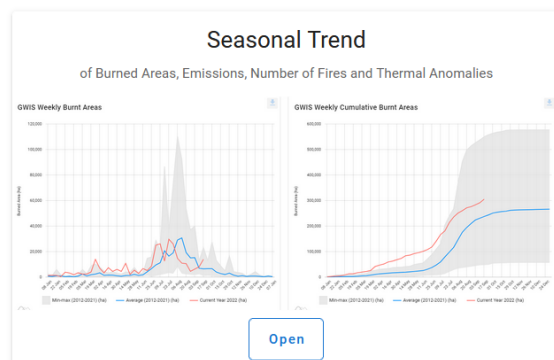
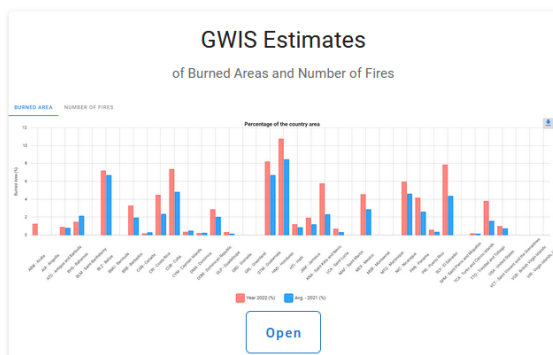
In addition a number of Areas of Interest may be selected:

- the European Union
- Latin America and the Caribbean (LAC)
- Middle East and North Africa (MENA)
- North America
- South America

The GWIS methodology for the identification of events and assessment of burnt areas is based on the spatial-temporal clustering of thermal anomalies detected by MODIS and VIIRS. Additional information on the identification of fire events in GWIS is available at: <https://gwis.jrc.ec.europa.eu/about-gwis/technical-background/burnt-areas>

The fires mapped in GWIS may also include fires set intentionally for the purpose of vegetation management.

There are two parts to the Portal: GWIS estimates and the Seasonal trend.

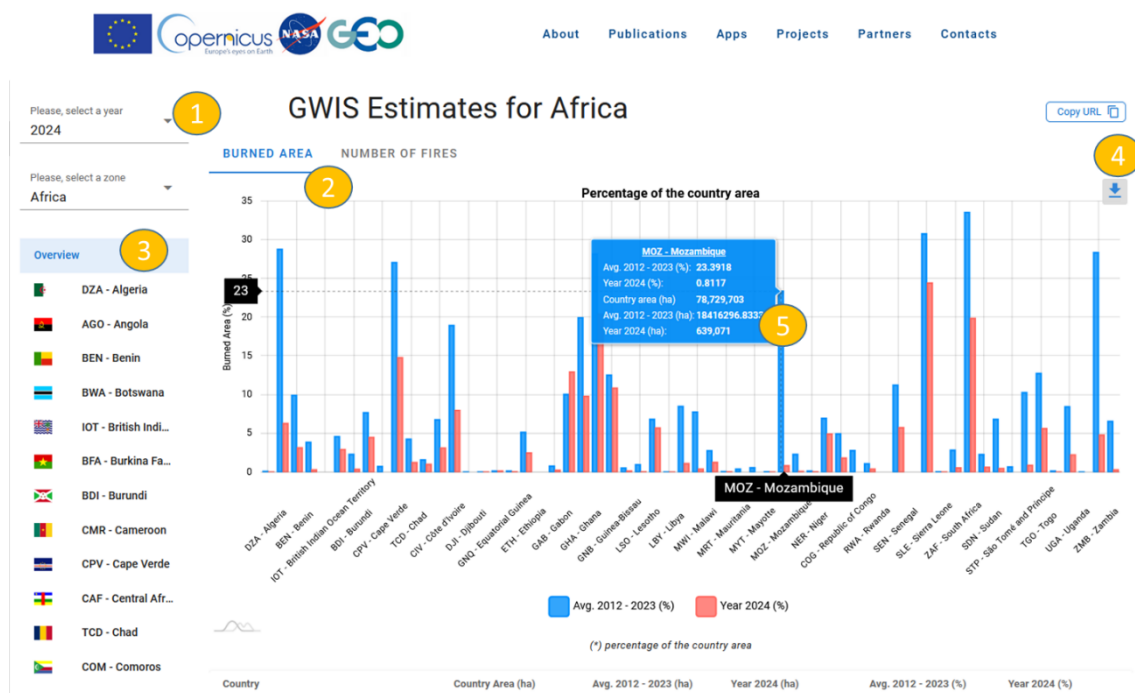


GWIS Estimates

In this section the user can display the burnt area or numbers of mapped fires for a single year from 2012 (default is the current fire season). The countries are grouped by region and displayed in alphabetical order in the graph. The values displayed on the graph are provided in table format below the graph.

In each case the statistics can be displayed for the entire region of interest, or for any of the individual countries in the group.

1. Select individual year of interest.
2. Choose Burned area or number of fires.
3. Choose a zone or region of interest and either the overview or an individual country.
4. Download the results or copy the url.
5. Hover the mouse over individual points to get their statistics.



View of GWIS estimates per Country: burnt area.

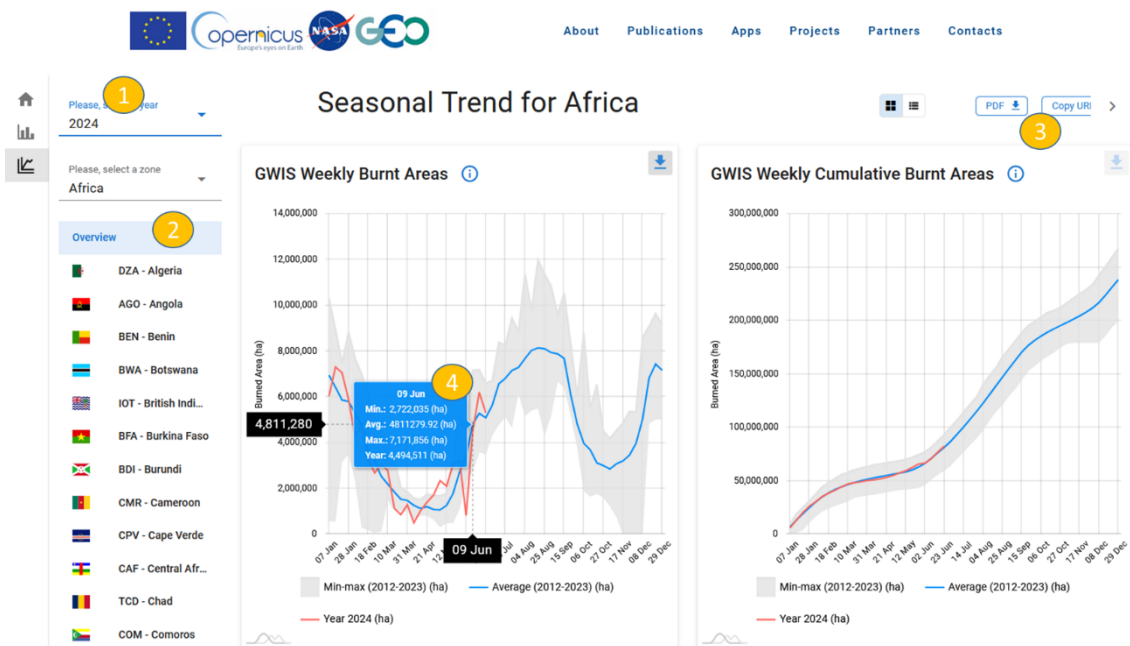
Seasonal Trend

In this section the user can display the weekly burnt areas burnt area for a single year from 2012 (default is the current fire season) compared with the min, max and average statistics for the period 2012-2023.

There are two charts: the first displays the weekly statistics for the period of interest and the second shows the same information as a cumulative chart.

In each case the statistics can be displayed for the entire region of interest, or for any of the individual countries in the group.

1. Select individual year of interest.
2. Choose a zone or region of interest and either the overview or an individual country.
3. Download the results or copy the url.
4. Hover the mouse over individual points to get their statistics.



GWIS seasonal trend example.

Additional information

Fire Danger Forecast

The fire danger forecast module of GWIS provides forecast maps from 1 to 9 days of fire danger levels. Numerical weather predictions are used to compute the [Fire Weather Index \(FWI\)](#) (Van Wagner and Pickett, 1985). In 2019, due to the interest of countries to compare the performance of the FWI with other relevant fire danger indices, the Australian [McArthur Forest Fire Danger Index](#) (MARK-5), the [Keetch-Byram Drought Index \(KBDI\)](#) and the [National Fire Danger Rating System](#) (NFDRS) have been made available through GWIS.

GWIS operates using meteorological forecast data received daily from the European Centre for Medium-Range Weather Forecast (ECMWF).

Fire danger is mapped in 6 classes (very low, low, medium, high, very high and extreme) with a spatial resolution of about 8 km (ECMWF data). At the moment, the fire danger classes are the same for all countries and maps show a harmonized view of the spatial distribution of fire danger level.

However, given the different climatic conditions at the global level, GWIS publishes two indicators that provide information on the local/temporal variability of the FWI values as compared to a historical time series of approximately 30 years. Those products are the ranking, which provides percentiles of occurrence of the values, and the anomaly, computed as a standard deviation from the historical mean values. These indices are available in the "index" pull-down menu.

The following are the FWI values used as thresholds of the fire danger classes in the map:

Fire Danger Classes	FWI	FFMC	DMC	DC	ISI	BUI
Low	< 11.2	< 82.7	< 15.7	< 256.1	< 3.2	< 24.2
Moderate	11.2 - 21.3	82.7 - 86.1	15.7 - 27.9	256.1 - 334.1	3.2 - 5.0	24.2 - 40.7
High	21.3 - 38.0	86.1 - 89.2	27.9 - 53.1	334.1 - 450.6	5.0 - 7.5	40.7 - 73.3
Very High	38.0 - 50.0	89.2 - 93.0	53.1 - 83.6	450.6 - 600.0	7.5 - 13.4	73.3 - 133.1
Extreme	50.0 - 70.0	93.0 - 96.0	83.6 - 160.7	600.0 - 749.4	13.4 - 26.8	133.1 - 193.1
Very Extreme	> 70.0	> 96.0	> 160.7	> 749.4	> 26.8	> 193.1

A data-transformation model of the FWI is also used to provide a measure of fire control difficulty: the Daily Severity Rating (DSR: Van Wagner, C.E., Pickett, T.L., 1985). Its average of daily estimates over a week is called Weekly Severity Rating (WSR).

References

Van Wagner, C.E., Pickett, T.L., 1985. **Equations and FORTRAN program for the Canadian Forest Fire Weather Index System**. *Forestry Technical Report*. Canadian Forestry Service, Ottawa, Canada. <https://purl.org/INRMM-MID/c-14026112>

Copernicus Emergency Management Service, 2019. **Fire danger indices historical data from the Copernicus Emergency Management Service**. In: *Copernicus Climate Change Service (C3S) Climate Data Store (CDS)*. <https://doi.org/10.24381/cds.0e89c522>

ⓘ Lightning Forecast

<https://www.ecmwf.int/en/about/media-centre/news/2018/how-predict-lightning>

ⓘ Active Fire

Active fires are located on the basis of the so-called thermal anomalies produced by them. The algorithms compare the temperature of a potential fire with the temperature of the land cover around it; if the difference in temperature is above a given threshold, the potential fire is confirmed as an active fire or "hot spot."

GWIS uses the active fire detections provided by the NASA FIRMS ([Fire Information for Resource Management System](#)).

MODIS Active fires

The MODIS sensor, on board of the TERRA and ACQUA satellites, identifies areas on the ground that distinctly hotter than their surroundings and flags them as active fires. The difference in temperature between the areas that are actively burning with respect to neighbor areas allows the identification and mapping of active fires. The spatial resolution of the active fire detection pixel from MODIS is 1 km.

Additional information on the MODIS active fire product is available at <https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms/c6-mcd14dl>

VIIRS Active fires

The VIIRS (Visible Infrared Imaging Radiometer Suite) on board of the NASA/NOAA Suomi National Polar-orbiting Partnership (SNPP) uses similar algorithms to those used by MODIS to detect active fires. The VIIRS active fire products complements the MODIS active fire detection and provides an improved spatial resolution, as compared to MODIS. The spatial resolution of the active fire detection pixel for VIIRS is 375 m. Additionally, VIIRS is able to detect smaller fires and can help delineate perimeters of ongoing large fires.

Additional information on VIIRS active fire products can be found at <https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms/viirs-i-band-active-fire-data> and <https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms/v1-vnp14imgt>

The mapping of active fires is performed to provide a synoptic view of current fires worldwide and as a means to help the subsequent mapping of burnt fire perimeters. Information on active fires is normally updated daily and made available in GWIS within 1 day the acquisition of the MODIS/VIIRS images.

When interpreting the hotspots displayed in the following must be considered:

- Hotspot location on the map is only accurate within the spatial accuracy of the sensor
- Some fires may be small or obscured by smoke or cloud and remain undetected
- The satellites also detect other heat sources (not all hotspots are fires)

📄 Burnt Areas

Burnt Areas (MODIS)

Burnt area information is based on the MODIS burned area product (MCD64A1) which provides burning and quality information on a per-pixel basis (more details may be accessed at <https://modis-land.gsfc.nasa.gov/burn.html>). The source information is based on MODIS Collection 6 combining imagery from Terra and Aqua, along with thermal anomalies.

This dataset is not near real time as fire events require approximately two month be available (see temporal granularity of the source product https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table/mcd64a1_v006). Initial and final dates of the fires are subject to an uncertainty of few days.

Currently, GWIS displays data from 2001 to February 2018.

📄 Fire emissions

Emissions from forest fires in GWIS are provided by the Copernicus Atmosphere Monitoring Service (CAMS) operated by the European Centre for Medium-Range Weather Forecast (ECMWF). A selection of fire emissions species is presented in GWIS to allow compatibility with the emissions estimates of those species provided in the European Forest Fire Information System (EFFIS).

Further information on fire emissions presented in GWIS is available at <https://atmosphere.copernicus.eu/sites/default/files/2018-05/CAMS%20%20Global%20Fire%20Assimilation%20System%20%28GFAS%29%20data%20documentation.pdf>

📄 Fuels

Global Fuel Map

Fuel classes aggregated from Pettinari et al. 2016 (<https://www.biogeosciences.net/13/2061/2016/bg-13-2061-2016.html>)

Reference

[Pettinari, M Lucrecia \(2015\)](#): Global Fuelbed Dataset. *Department of Geology, Geography and Environment, University of Alcala, Spain*, doi:[10.1594/PANGAEA.849808](https://doi.org/10.1594/PANGAEA.849808)

📄 Analysis Tools

This section refers to the information on burnt areas provided in the "Analysis Tools" of the Global Wildfire Information System (GWIS).

Burnt area information in the "Analysis Tools" is derived from the MODIS burned area product (MCD64A1) (more details may be accessed at <https://modis-land.gsfc.nasa.gov/burn.html>). This information is based on MODIS Collection 6, which combines imagery from Terra and Aqua, along with thermal anomalies. Such data provide burnt date estimates per pixel at the global scale. The MODIS dataset is not near real time, as mapped fire events require more than one month be available (see temporal granularity of the source

product https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table/mcd64a1_v006). Initial and final dates of the fires are subject to an uncertainty of few days.

It is important to note that GWIS uses MCD64A1 as a source to create a fire-event based database. The post-processing aggregates in time and space the burnt pixels identifying individual fires, extracting the fire evolution and computing a final area. Then, each fire event is tagged with a unique numerical identifier and the initial and final fire date of the event. The final perimeter of the fire event retains the daily evolution of the fire and all the details of the burnt areas included in it for the entire duration of the fire (Artes-Vivancos et al., 2018 (in preparation)).

Country, region and global statistics in the "Analysis Tools" are based on these data. Therefore, statistics may differ from other data derived directly from the MCD64A1 product. Currently, GWIS provides statistics from 2001 to 2017.

Data and services

On **DATA AND SERVICES** application, the user can download:

- **Active Fires** (MODIS and VIIRS): Last 1-day layer, Last 7 days layer Last 30 days layer Fire Season layer;
- **Burned Area** (MODIS and MODIS & VIIRS NRT): Last 1-day layer, Last 7 days layer Last 30 days layer Fire Season layer;
- **Fire Emissions** (Last 7 days layer): Black Carbon, Methane, Carbon Dioxide, Carbon Monoxide, Sulfur Dioxide, Nitrogen Oxides, Organic Carbon, Particulate Matter, Non-Methane Hydro-Carbon, Total Carbon in Aerosols;
- **Fuels** (Last 7 days layer);
- **Fire Danger Forecast** (1-day forecast) - Fire Weather Index (FWI), Initial Spread Index (ISI), Build Up Index (BUI), Fine Fuel Moisture Code (FFMC), Duff Moisture Code (DMC), Drought Code (DC), Anomaly, Ranking;
- **Lightning Forecast** (1-day forecast);
- Human Settlement Layer;
- ECMWF – Fire Danger Forecast Reanalysis.