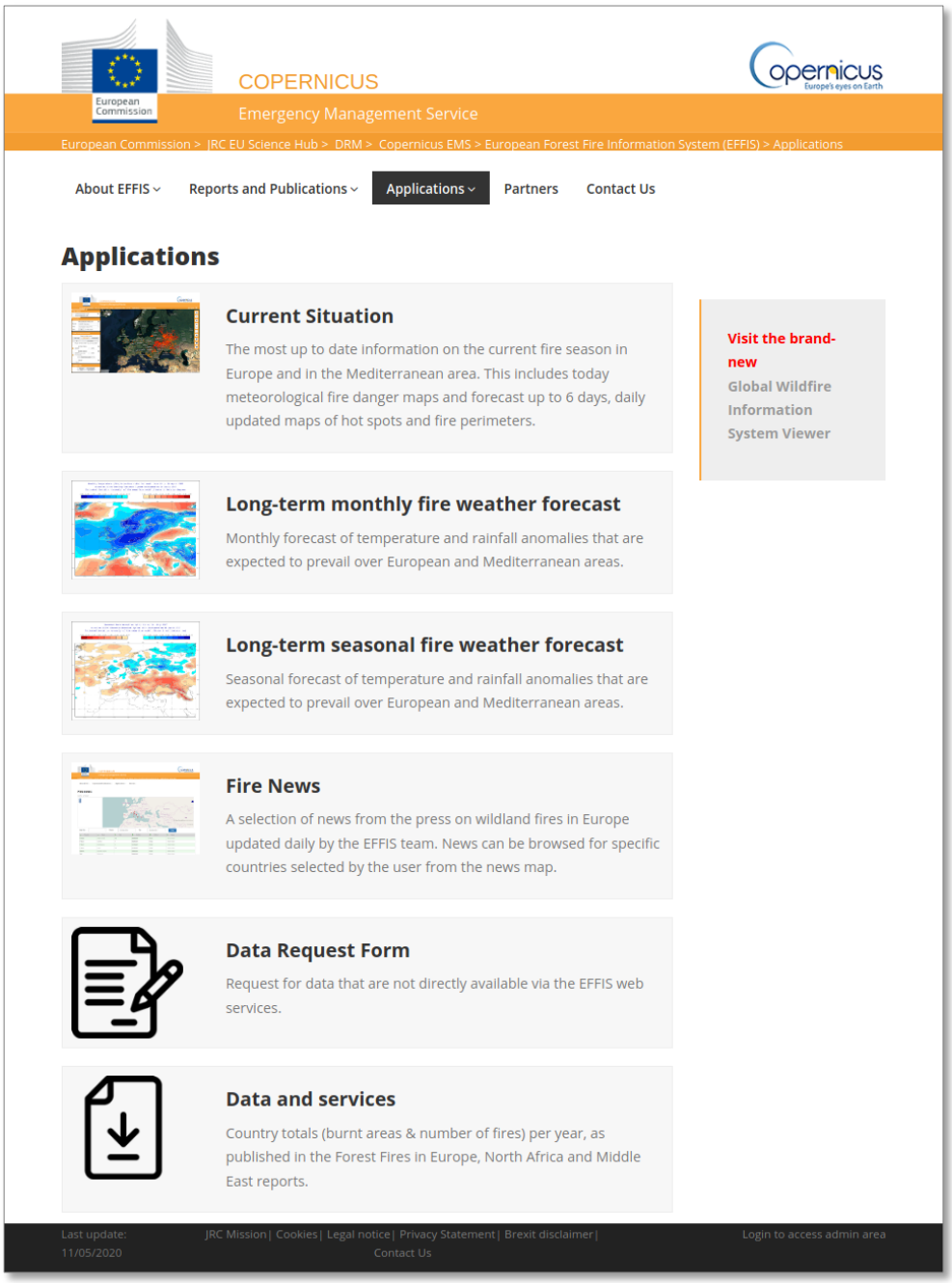
The European Forest Fire Information System

User Guide to EFFIS applications

Version 2.5.x, June 2020

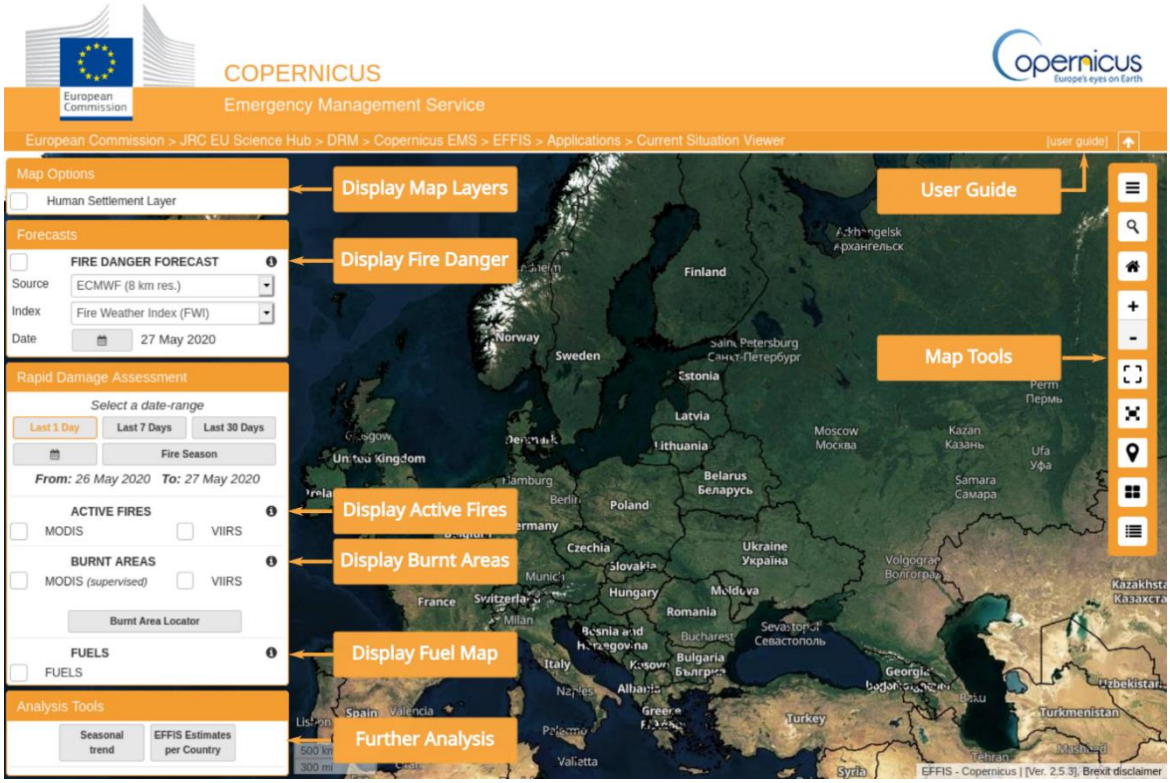


Contents

Current Situation Application

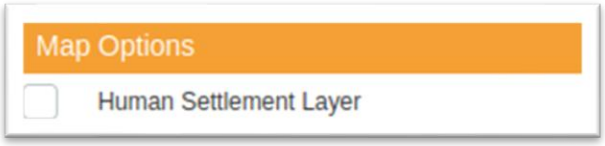
The current situation enables the user to view and query map layers, with the most up to date information on the current fire season in Europe and in the Mediterranean area. This includes current date meteorological fire danger maps and forecast up to 9 days, daily updated maps of hot spots and fire perimeters. The application can also be used to view the situation in past years.

Overview

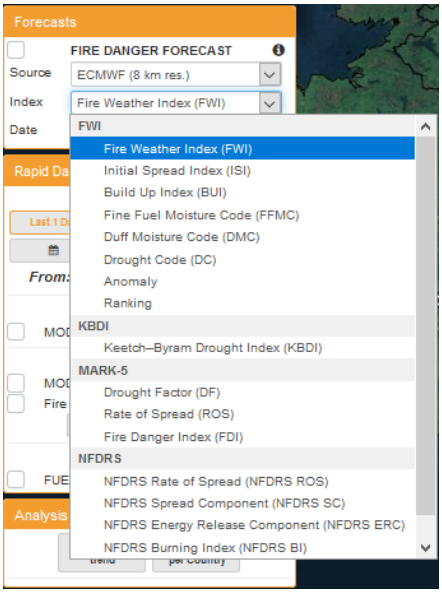
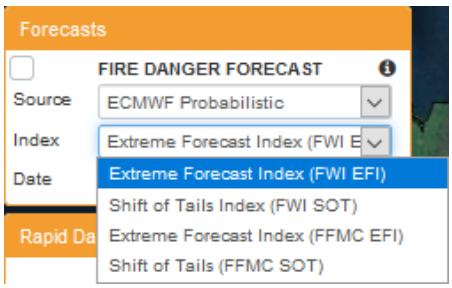
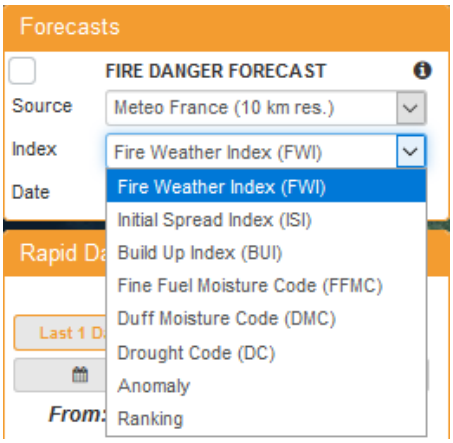


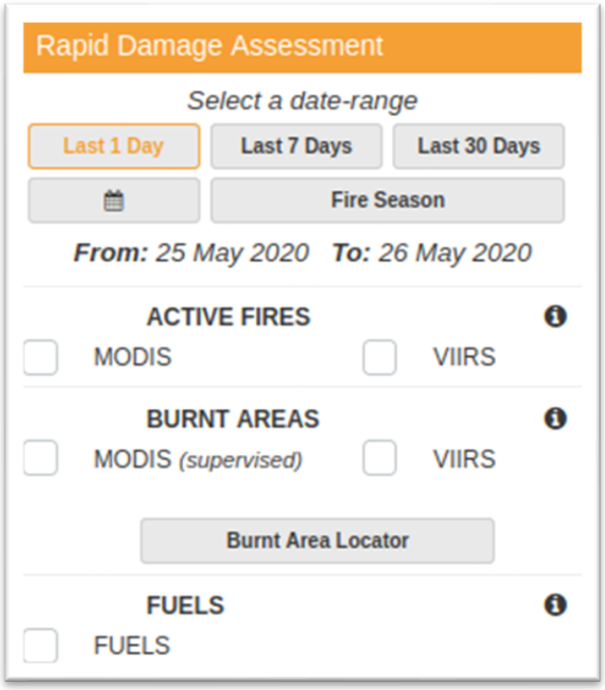
Layer controls

On the left of the map are 4 windows containing map options/analysis tools. In all cases clicking on the info button ℹ opens a new screen containing detailed information. (See **Additional information** session on this guide for full text of information on fire danger forecast, active fires, burnt areas and fuels).

MAP OPTIONS	**Details**
	Adds or removes Human Settlement Layer. Click to add (default: off).

FORECASTS	**Details**
	**Display Fire Danger information** (Click to add - default: off). Choose source: ECMWF (default), ECMWF Probabilistic or Meteo France. Choose Index: indexes change according to the model selected (see below). Choose date: today (default). The number of forecast days change with the model: 9 days for ECMWF, 3 days for ECMWF Probabilistic and 3 days for Meteo France.

FORECASTS – continuation	Details
	**Source: ECMWF (8 km res.)** <u>Available index list</u>**:** 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 (standard deviation with respect to a 30-year average) Ranking (percentile vs historical 30 years values) 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: ECMWF Probabilistic** <u>Available index list</u>**:** Extreme Forecast Index (FWI EFI) - *default* Shift of Tails Index (FWI SOT) Extreme Forecast Index (FFMC EFI) Shift of Tails (FFMC SOT)
	**Source: Meteo France** <u>Available index list</u>**:** 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

RAPID DAMAGE ASSESSMENT	Details
	**Displays active fires, burnt area 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 or both. (instead of or together with active fires). Burnt area locator: this tool allows accessing specific fire events by country and province. Fuels: displays EFFIS fuel map.

ANALYSIS TOOLS	Details
	**Seasonal trend** and **EFFIS Estimates per Country** open up new windows with EFFIS Statistics. The **Seasonal trend** compares the values of burnt areas (or number of fires) on a given date of current year, with the average values of burnt areas (or number of fires) in the period 2008-2019. **EFFIS Estimates per Country** provides information on the yearly trends of forest fires and burnt areas in a country (or region) from 2008 to 2019. It also provides a comparison of the values of the current year with the average values of the period 2008-2019.

Map Tools

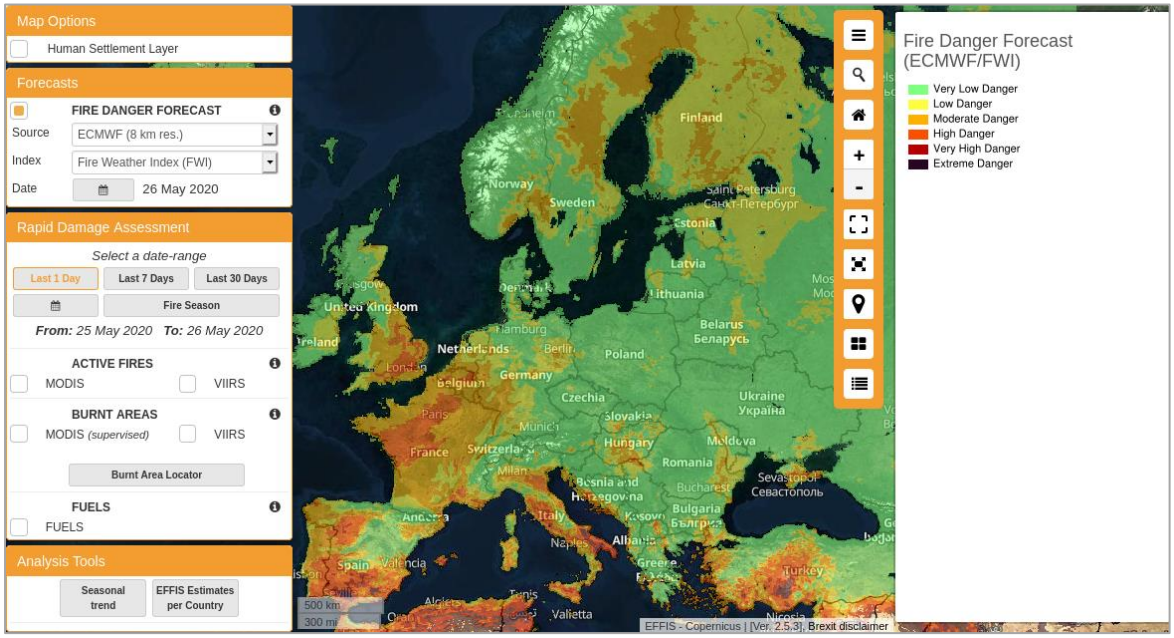
A set of map tools are on the right side of the map image. The following table explains how the tools work.

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		Accepting cookies, the user will be able to select among the following base layers: •Country Boundaries •Satellite Hybrid (Default layer) •Topographic + water bodies •Open Streets Map without accepting, only "country boundaries" and "OSM EU version" will be available.
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"

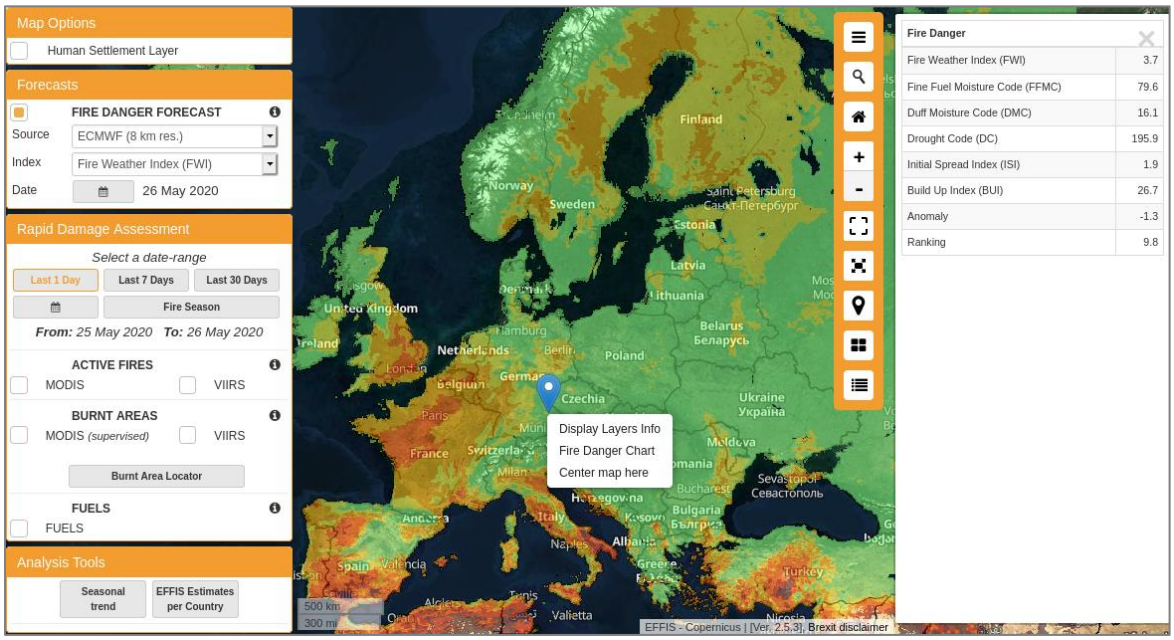
Fire Danger Forecast

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.

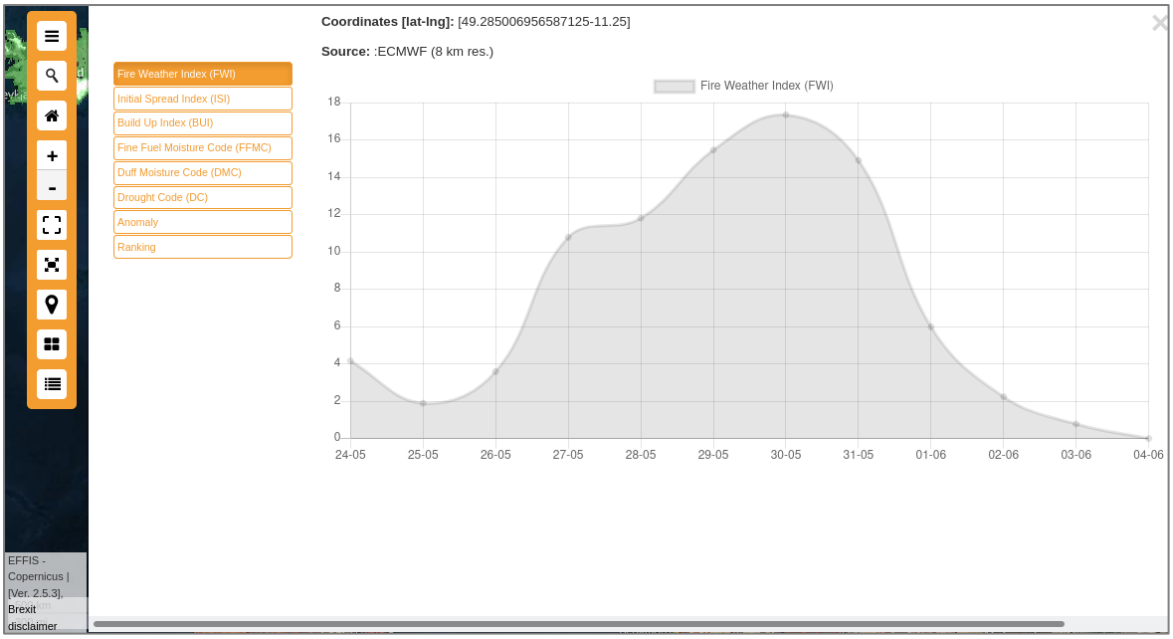


Display of Fire Danger Forecast.

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

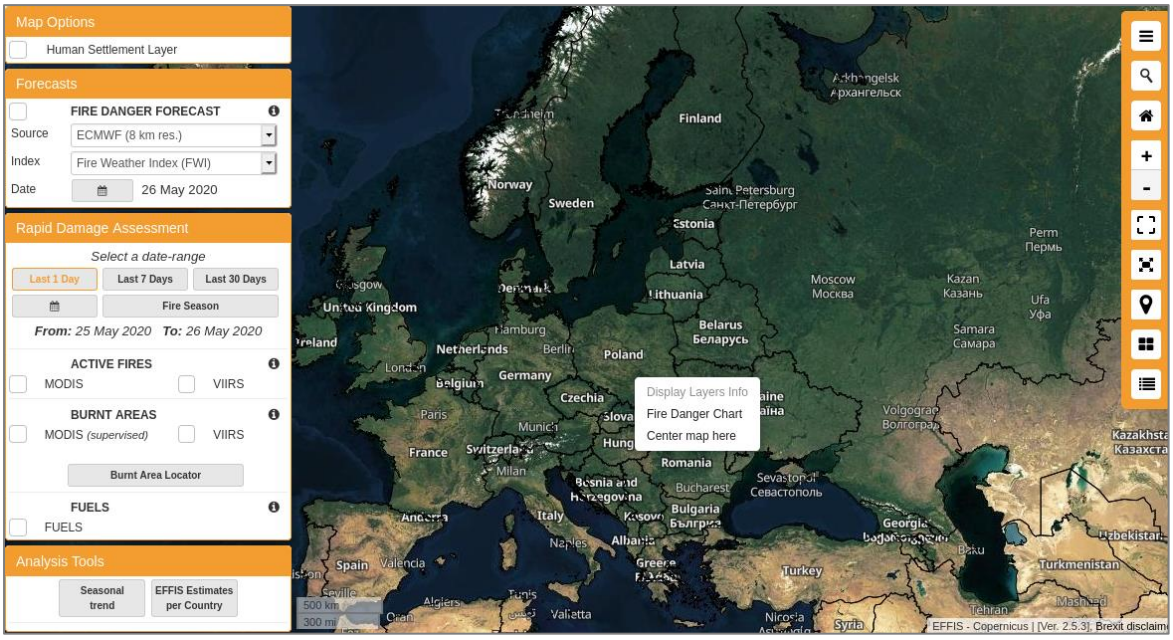


"Display Layers info" displays fire danger indices for the location according to the source selected.



"Fire danger chart" displays fire danger information according to the model selected and the default index for a period from 2 days before the current date to the last forecast day (the index can be changed from the list on left side).

Fire danger charts can also be displayed without selecting the fire danger layer by right-clicking anywhere on the map. In this case, the option "display layers info" is not active and the default source for the Fire Danger chart will be ECMWF (8 km res).

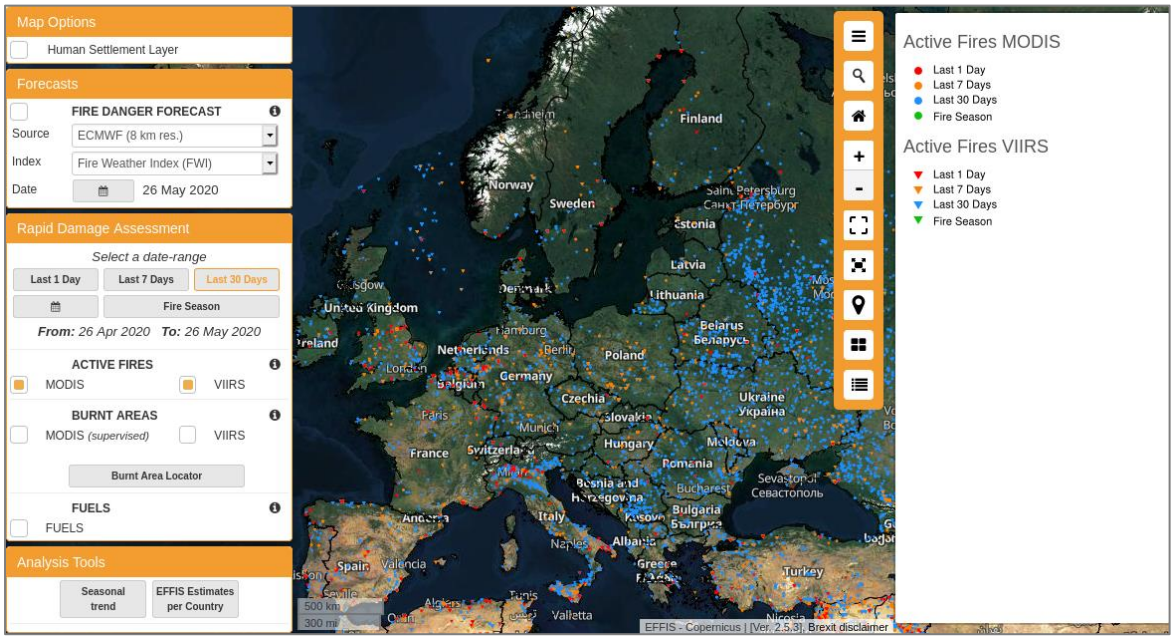


Displaying fire danger chart for any location directly on the map.

Rapid Damage Assessment

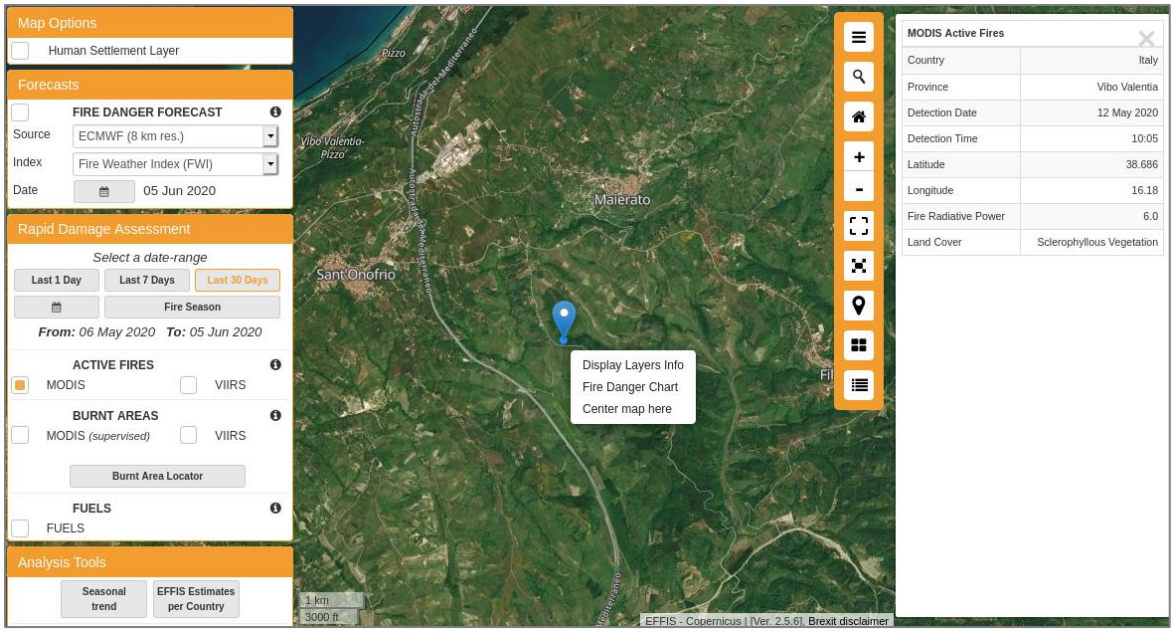
Active Fires Information

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: green (older than 90 days), blue (last 90 days), orange (last 7 days) and red (last 24 hours).

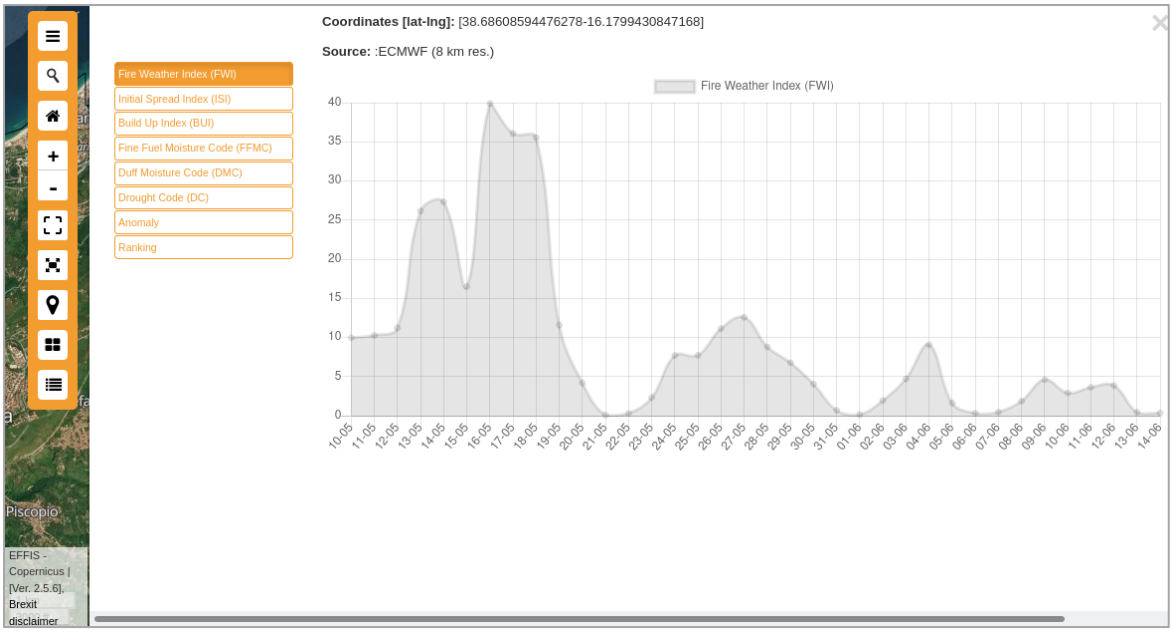


Information on active fires in the "current situation viewer".

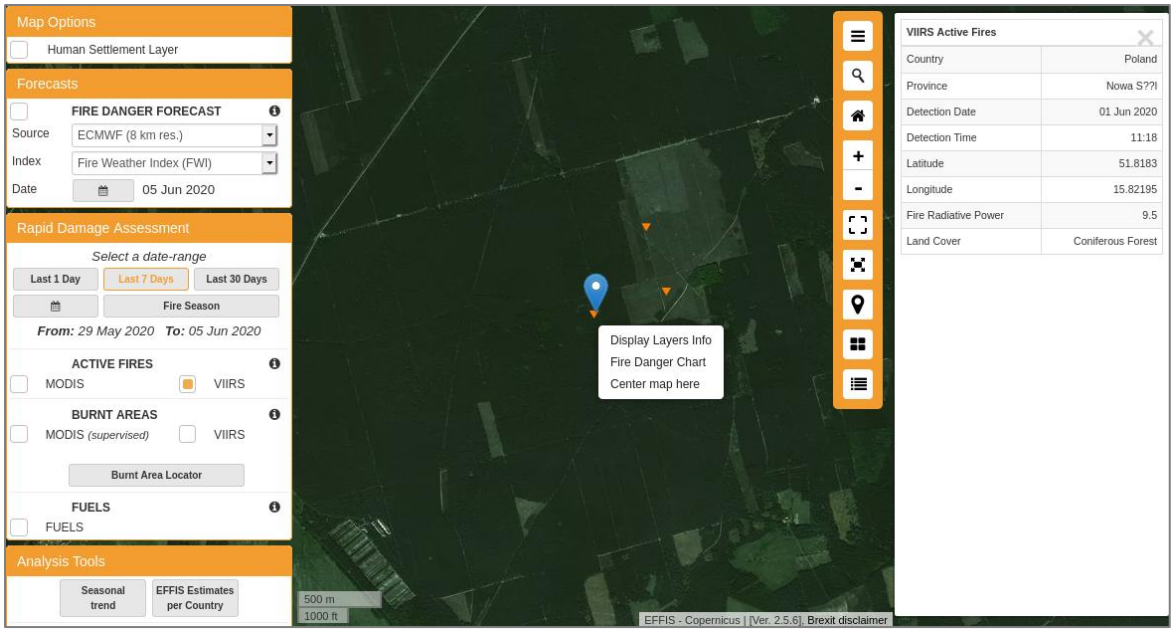
The right button of the mouse placed on the selected active fire allows the user to display layer information (such as hotspots detection date and time), display fire danger charts and centre the map. By clicking on the place marker that appears it is also possible to display Lat/long position.



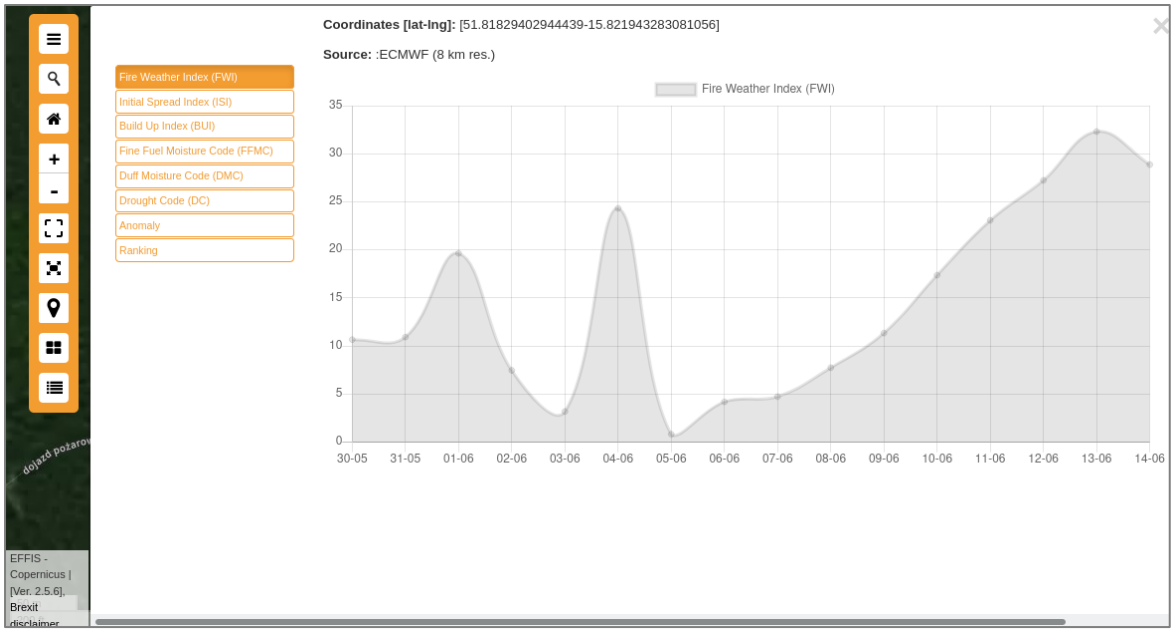
Display layer information on Modis active fires.



"Fire danger chart" on MODIS hotspot location from 2 days before the detection date to the current date plus the forecast days.



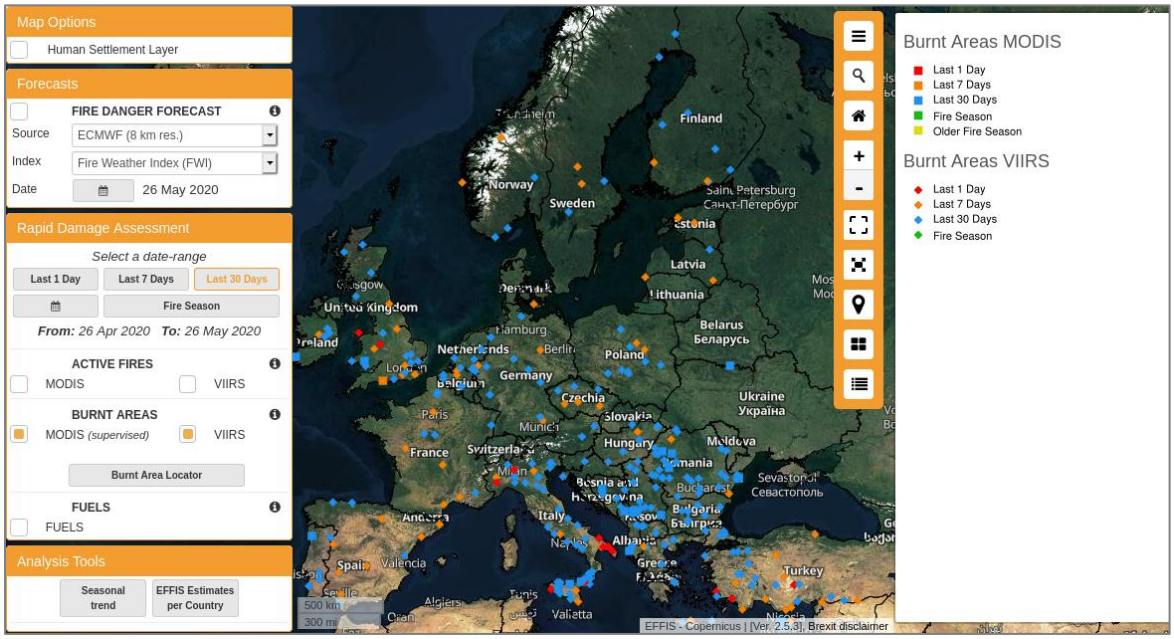
Display layer information on VIIRS active fires.



"Fire danger chart" on VIIRS hotspot location for a period from 2 days before the detection date to the current date plus the forecast days.

Burnt Area Information

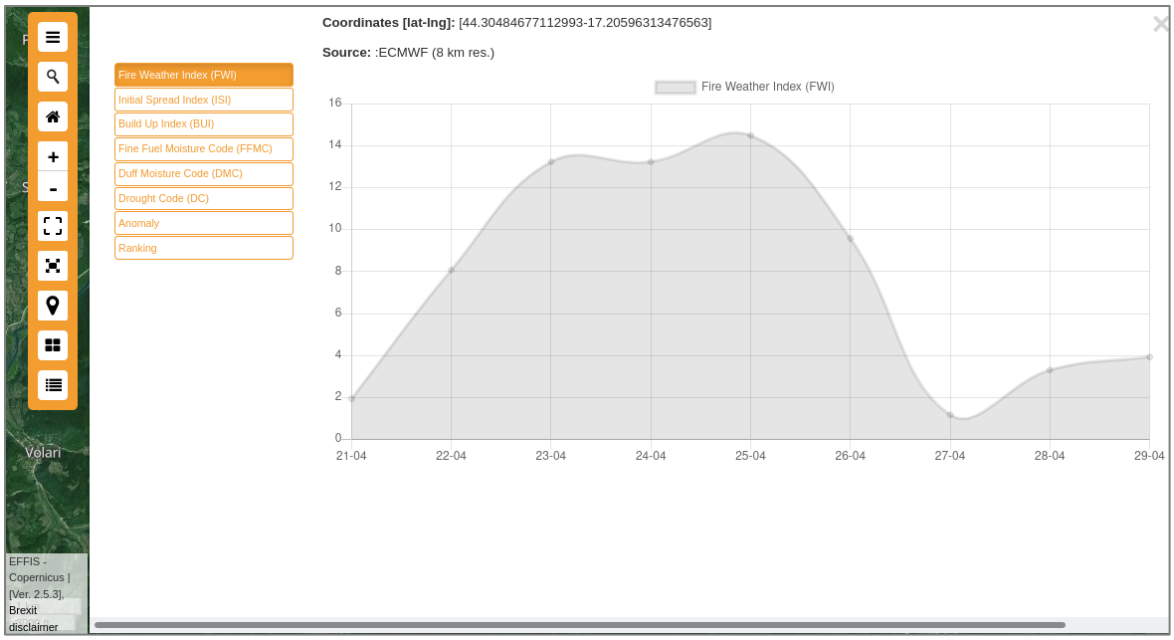
First, select a range of days for which the burnt area information will be displayed. Then click on MODIS, VIIRS or both to display burnt areas. Burnt areas are color-coded according to the period in which they were recorded by the satellite sensor into: green (older than 90 days), blue (last 90 days), orange (last 7 days) and red (last 24 hours).



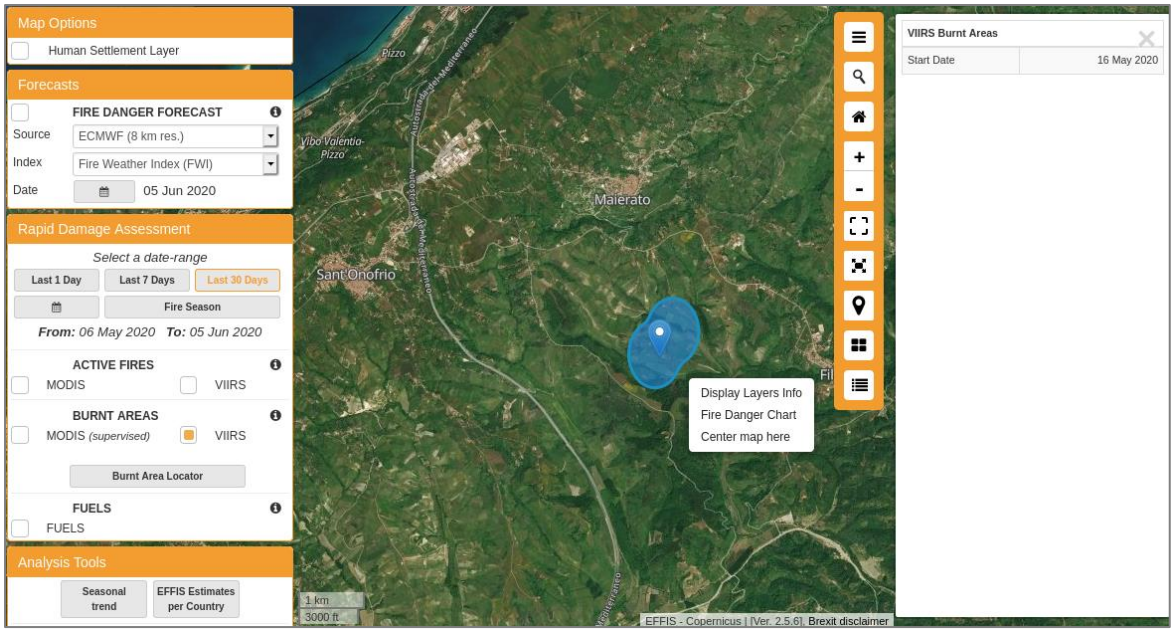
Overview of burnt areas from MODIS and VIIRS color-coded according to the period of acquisition.

The user has to zoom-in to visualize burnt area perimeters (MODIS or VIIRS). Then, Right-click to display layer information on burnt areas or fire danger charts. Detailed information on burnt areas is available for those perimeters mapped with MODIS data and is being implemented for those from VIIRS.

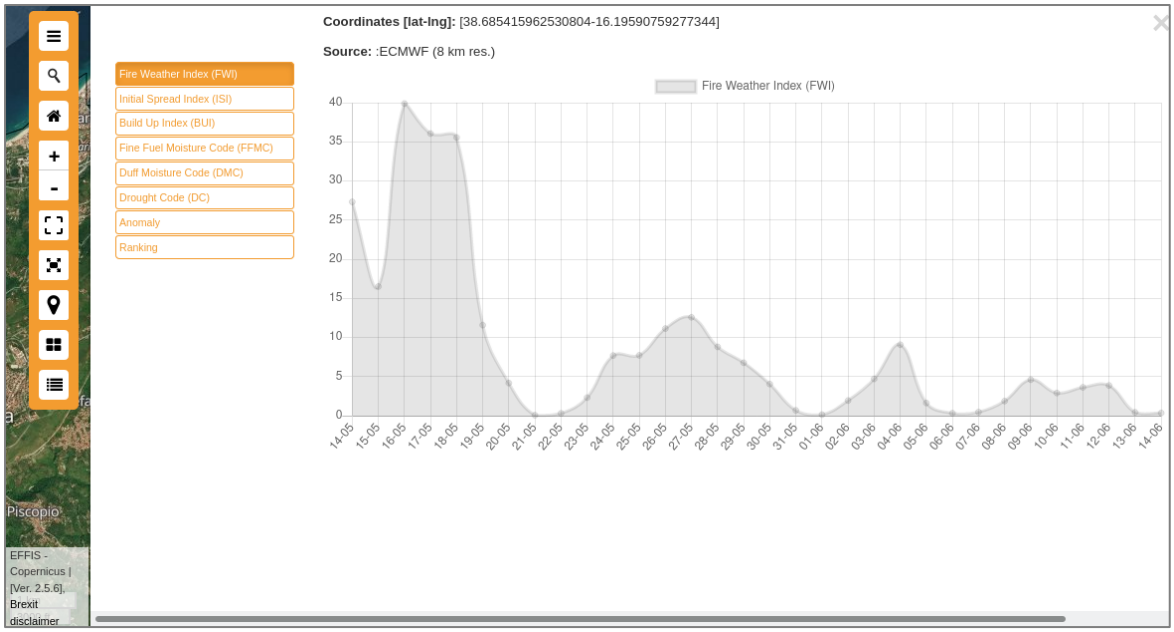
MODIS burnt area detailed layer information.



"Fire Danger Chart" on MODIS burnt area location displays fire danger information from 2 days before the start date to 2 days after the last fire date.



VIIRS burnt area layer information (being implemented).



"Fire danger chart" on VIIRS burnt area location displays fire danger information from 2 days before the start date to the current date plus the forecast days.

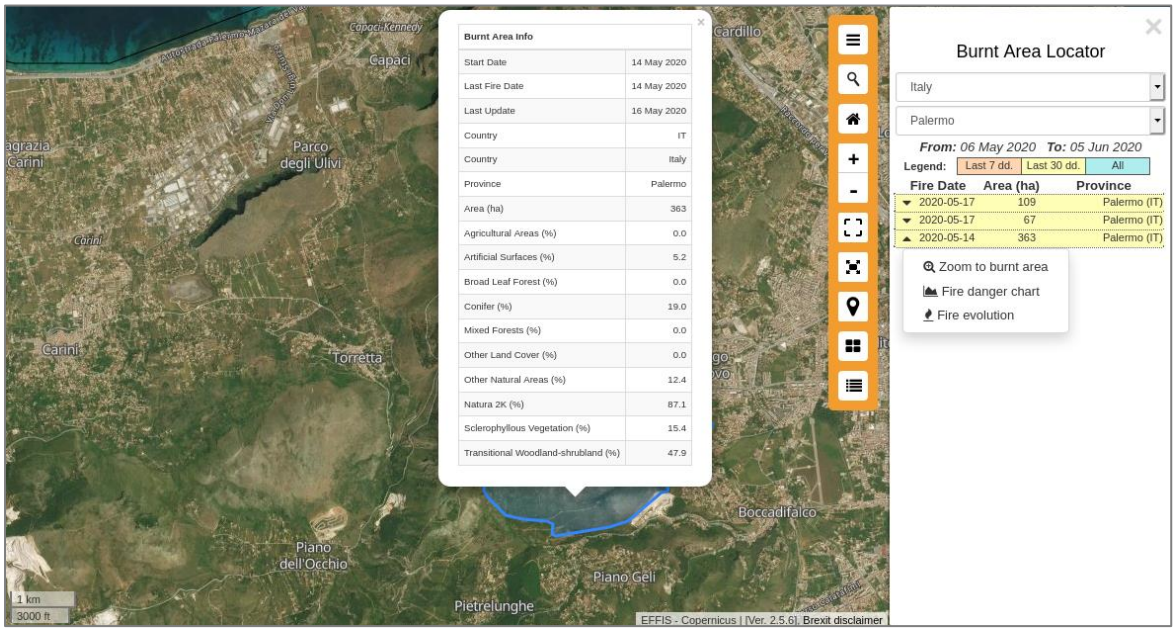
Please note that on Burnt areas layer info, the Start Date refers to first date recorded of active fire presence detection, the Last Fire Date is the last date recorded of active fire presence detection and Last Update refers to the date of the burnt area perimeter's last detection and validation.

Burnt Area Locator

The **Burnt Area Locator** tool at the "Rapid Damage Assessment" menu allows the user to choose a country and a province to see the details of the fires that have been recorded there over the current season. The date-range must be selected prior to clicking on Burnt Area locator.

After selecting the country and province of interest, a list of fires will show. Fires are colour coded depending on how recently they occurred. This tool displays perimeters mapped with MODIS data only. By clicking on the arrow on the left of the fire list, the user can retrieve 3 types of information on the single fire:

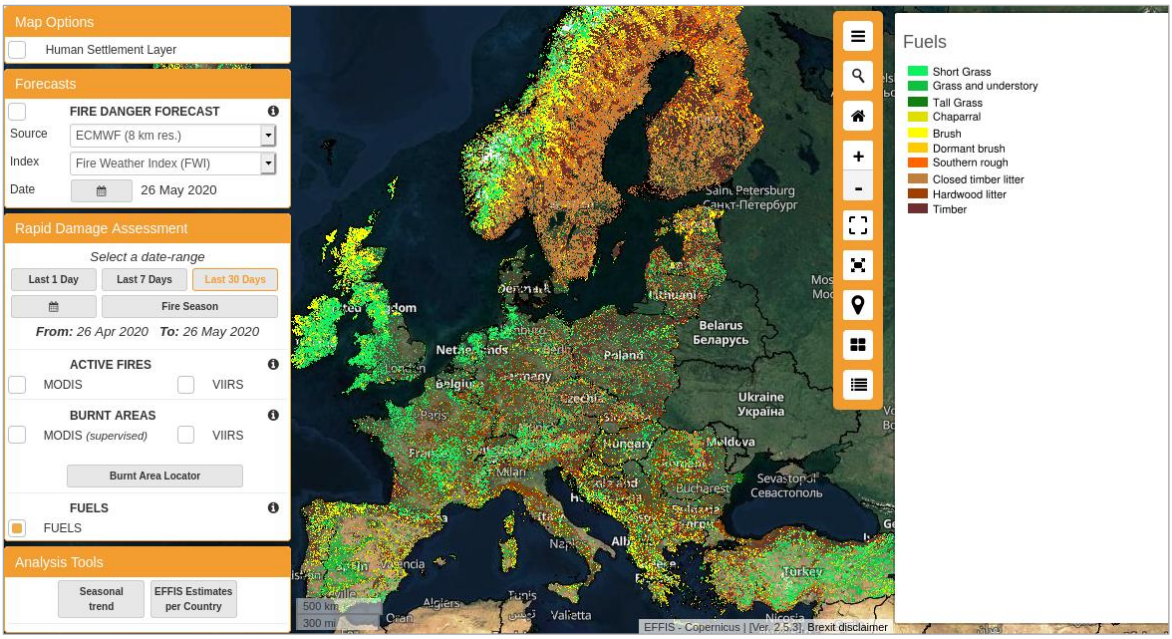
- **Zoom to burnt area** and click on the polygon to display Burnt Area Information;
- Display **Fire danger chart** at the fire location (date-range will be from 2 days before the fire start date to 2 days after the last fire date);
- Display **Fire evolution** of the burnt area (when available).



Example of Information that can be retrieve per single fire on Burnt area locator tool.

Fuels

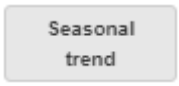
Display EFFIS fuel map, as depicted below.



EFFIS fuel map.

Analysis Tools

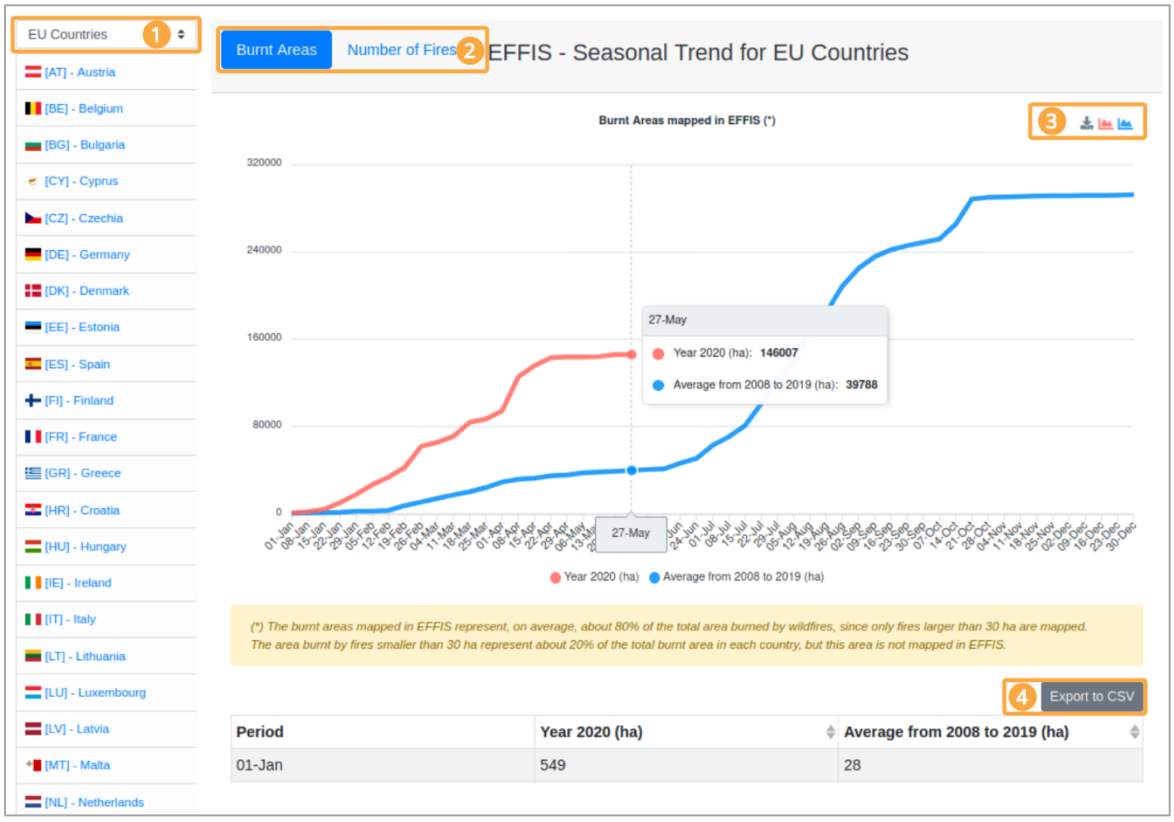
Seasonal Trend

The 

tool opens a window showing the current season's cumulative burnt areas or number of fires mapped in EFFIS against the long-term average **2008-2019** (see example for Burnt Areas below). Please note that the fires mapped in EFFIS are those of approximately 30 ha or larger. Data are available for total EU, European non-EU, Middle East and North Africa (MENA) and individual countries. The weekly data displayed on the graph are provided below the graph in table format.

On the graph the user can:

- Select region or country of interest (1)
- Select variable: burnt area or number of fires (2)
- Download chart (SVG, PNG, CSV) or switch Chart type (3)
- Export to CSV (4)



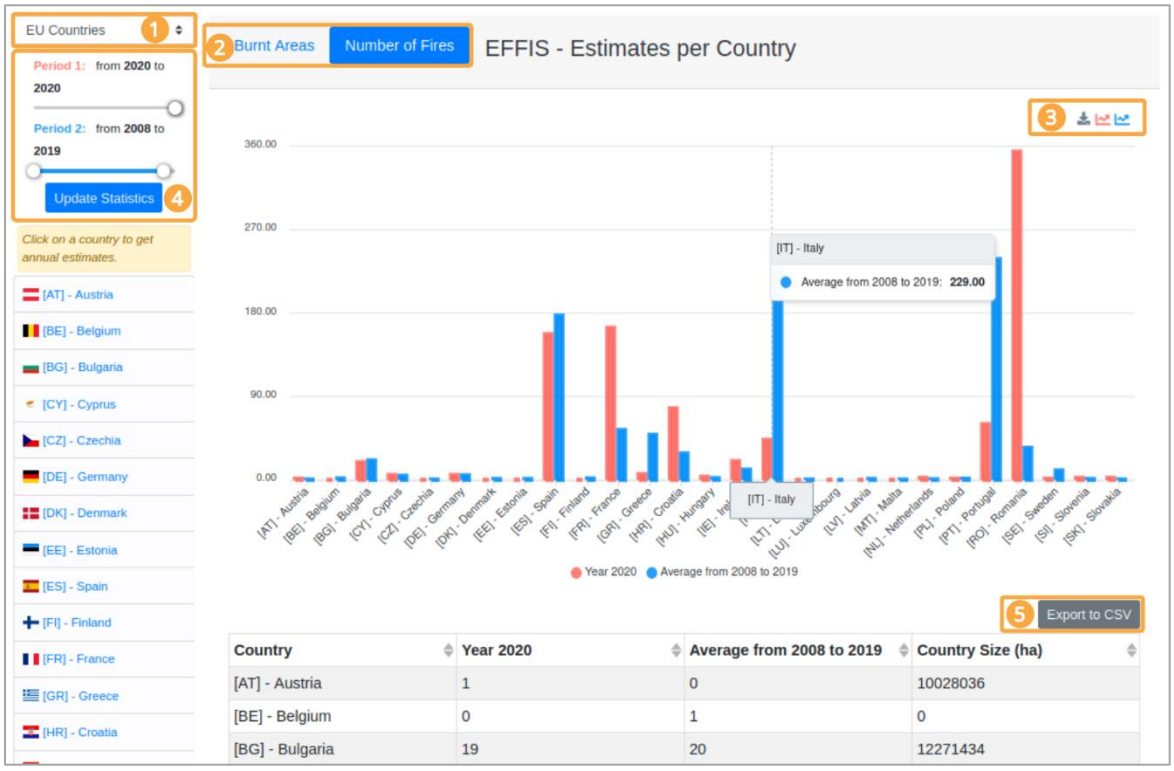
EFFIS Seasonal trend for EU Countries - Burnt Areas mapped in EFFIS.

EFFIS Estimates per country

The EFFIS Estimates per Countries tool displays the cumulative number of fires mapped in EFFIS or burnt areas for two periods, which can be defined by the user. For instance, Period 1 is showing current year (2020) and Period 2 the 2008-2019 average for each of the countries covered. 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. The last column of the table provides the country size (ha).

On the graph the user can:

- Select region of interest (1)
- Select variable: burnt area or number of fires (2)
- Download chart (SVG, PNG, CSV) or switch Chart type (3)
- Select the Periods of analysis and Update Statistics (4)
- Export to CSV (5)



EFFIS estimates per country – number of fires.

Additionally, the user can visualise annual estimates for single countries by selecting the country of interest from the countries list on the left side. For returning to the EU estimates graph (default) click on the EFFIS Estimate icon on the upper left corner.

Additional information

Fire Danger Forecast

In 2007, after a test phase of 5 years during which different national fire danger indices were implemented in EFFIS, the EFFIS network adopted the Canadian Forest Fire Weather Index (FWI) System as the method to assess the fire danger level in a harmonized way throughout Europe. However, given the different climatic conditions in Europe, EFFIS publishes two indicators that provide information on the local/temporal variability of the FWI compared to a historical series of approximately 30 years. These indicators are the **ranking**, which provides percentiles of occurrence of the values, and the **anomaly**, computed as a standard deviation from the 30-year historical mean values. These indices are available in the pull down menu of the fire danger section.

Currently, the fire danger forecast module of EFFIS provides access to fire danger indices using numerical weather forecast from two deterministic models i.e. ECMWF (8 km) and MeteoFrance (10 km), and one probabilistic model, the ECMWF Probabilistic model, at 18 km spatial resolution. You can select the model in the pull-down menu of the EFFIS "current situation viewer."

ECMWF and MeteoFrance deterministic models

FWI is computed from the ECMWF model (8 km), which provides 1 to 9 days forecasts, and from the MeteoFrance model (10 km), which provides up to 3 days forecasts. The Fire Weather Index is mapped in 6 classes (very low, low, medium, high, very high and extreme). The fire danger classes are the same for all countries and maps show a harmonized picture of the spatial distribution of fire danger level throughout Europe, Middle East and North Africa. The values for the FWI and its sub-components are provided below.

Fire Danger Classes	FWI	FFMC	DMC	DC	ISI	BUI
Very Low	FWI < 5.2	FFMC < 82.7	DMC < 15.7	DC < 256.1	ISI < 3.2	BUI < 24.2
Low	5.2 >= FWI < 11.2	82.7 >= FFMC < 86.1	15.7 >= DMC < 27.9	256.1 >= DC < 334.1	3.2 <= ISI < 5.0	24.2 <= BUI < 40.7
Moderate	11.2 >= FWI < 21.3	86.1 >= FFMC < 89.2	27.9 >= DMC < 53.1	334.1 >= DC < 450.6	5.0 <= ISI < 7.5	40.7 <= BUI < 73.3
High	21.3 >= FWI < 38.0	89.2 >= FFMC < 93.0	53.1 >= DMC < 140.7	450.6 >= DC < 749.4	7.5 <= ISI < 13.4	73.3 <= BUI < 178.1
Very High	38.0 >= FWI < 50.0	FFMC>=93.0	DMC>=140.7	DC>=749.4	ISI>=13.4	BUI>=178.1
Extreme	FWI >=50.0					

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 the EFFIS Fire Danger Forecast module. Information on these indices, which are all computed from numerical weather predictions of the ECMWF deterministic model, is available at the links provided in this paragraph.

ECMWF Probabilistic model

The **ECMWF Probabilistic model** provides four fire danger indices: (1) FWI Extreme Forecast Index (FWI EFI), (2) FWI Shift of Tails (FWI SOT), (3) Fine Fuel Moisture Content Extreme Forecast Index (FFMC EFI) and (4) Fine Fuel Moisture Content Shift of Tails (FFMC SOT).

The EFI is calculated by computing the difference between the climate model of the last 20 years for a given day and an 11-model ensamble forecast for that day, using 5 start dates in different years. This larger window brings the benefit of better defining the climatology tails - i.e. the more extreme values - which is important for a consistent computation of EFI and SOT. The Shift of Tails index complements the EFI by providing information about how extreme an event could potentially be. Specifically, SOT for FWI compares the tails of the distributions for the climate model and the ensemble using the 90th and 99th (upper tail) percentiles. Positive SOT values indicate that at least 10% of the ensemble is forecasting an extreme event above what observed in the climate. A high value of SOT shows how extreme the top 10% ENS results are. Additional information on EFI and SOT computed at ECMWF is available at this link.

The maps of forecasted fire danger level can be consulted through the web mapping interface of EFFIS and are also emailed daily to the users.

Additional information on the map viewer tool downloading the User Guide to the EFFIS Current Situation.

Active Fire Detection

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."

EFFIS uses the active fire detection provided by the NASA FIRMS (Fire Information for Resource Management System).

MODIS Active fires

The MODIS sensor, on board the TERRA and ACQUA satellites, identifies areas on the ground that are 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 neighbouring areas allows active fires to be identified and mapped. 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/what-is-new-collection-6-modis-active-fire-data.

VIIRS Active fires

The VIIRS (Visible Infrared Imaging Radiomer Suite) on board 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 delinate 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

The mapping of active fires is performed to provide a synoptic view of current fires in Europe and as a means to help the subsequent mapping of burnt fire perimeters. Information on active fires is normally updated 6 times daily and made available in EFFIS within 2-3 hours of the acquisition of the MODIS/VIIRS images.

When interpreting the hotspots displayed in the map, 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)

To minimize false alarms and filter out active fires not qualified as wildfires (e.g. agricultural burnings), the system only displays a filtered subset of the hotspots detected by FIRMS. To this end a knowledge based algorithm is applied that takes into account the extent of surrounding land cover categories, the distance to urban areas and artificial surfaces, the confidence level of the hotspot.

With the identify feature tool, key information attached to each active fire is provided, such as geographic coordinates, administrative district (commune and province) and the main land cover category affected.

Fire News

Another source for identification of active fires is built through **firenews**: the news items are selected from a large set of RSS feeds published by various forest fires related sites, and from news feeds filtered out with appropriate keywords. Items from selected feeds are then geolocated and published on the EFFIS web site, in the FireNews section.

Burnt Areas

Rapid Damage Assessment

The Rapid Damage Assessment (RDA) module of EFFIS was initially implemented in 2003 to map burned areas during the fire season, by analyzing MODIS daily images at 250 m spatial resolution. For the monitoring of burned areas during the summer, daily images from the MODIS instruments on board of TERRA and AQUA satellites are acquired and processed few hours after the acquisition. The EFFIS Rapid Damage Assessment provides the daily update of the perimeters of burnt areas in Europe for fires of about 30 ha or larger, twice every day.

Since the year 2016, the RDA incorporates the mapping of active fires and burnt areas from the VIIRS Sensor, onboard the NASA/NOAA Suomi National Polar-orbiting Partnership (SNPP), which allows the update of burnt areas maps one more time, every day.

MODIS Burnt Areas

This process involves the delineation of the extent of forest fire events based on the semi-automatic classification of MODIS satellite imagery using ancillary spatial datasets. Testing on the use of MODIS data for mapping burnt areas in Europe was performed between the years 2000 and 2002, and the first map of burnt areas using

this imagery was obtained in 2003. Until then maps of fire perimeters (burnt areas) were obtained only at the end of the fire campaign, i.e. end of September/October. After 2003 the processing chain was further automated to process MODIS data in near-real time. Daily, two full image mosaics the European territory are processed in EFFIS to derive burnt area maps.

Fires are mapped using a semi-automatic procedure. Fires are first mapped on the basis of an unsupervised procedure that uses a combination of band thresholds and ancillary information from the CORINE Land Cover, the active-fire detection product, and the news application, which are described ahead. Fires that are mapped by the unsupervised procedure are visually verified and corrected through visual interpretation of the MODIS images.

IMPORTANT NOTE - For any use of the EFFIS Burnt Area product the conditions listed below must be taken into consideration:

- The product is derived from the daily processing of MODIS satellite imagery at 250 m ground spatial resolution.
- The perimeters of the burned scars in the represent areas burned by fires as detected from MODIS satellite imagery. Therefore, no distinction is made between wildland fires, environmental burnings or prescribed fires.
- Burnt scars of approximately 30 hectares in size are mapped, although the product may also include the perimeters of burned areas of smaller dimension.
- Small burnt or un-burnt areas below the spatial resolution of the MODIS imagery are not mapped; these may include small unburned islands inside the burnt area perimeter.
- The Burnt Area product is updated up two times every day. The perimeter of burnt areas due to different fires happening between two sequential updates may be merged into a single perimeter.
- The dates reported as Start date and Last update may not correspond to the date of ignition and extinction of the fire.
- The EFFIS burnt area product is intended to provide estimates of burnt areas at European level. Caution should be taken when comparing this product to other data that may have been produced using different methodologies and scopes.
- Although the burnt area perimeters are overlayed on the Google imagery, it must be noted that the original EFFIS product is produced at 250 m spatial resolution, not at the resolution of the underlying Google images.

Although only a fraction of the total number of fires is mapped, the area burned by fires of this size represents about 75% to 80% of the total area burned in EU. Modelling historical fire data from the EFFIS European fire database, equations have been set up for the different countries, which make it possible to predict the total area burned with good accuracy; that is, the total burnt area in a country is obtained as a function of the area burned by fires larger than 30 ha.

In order to obtain the statistics of the burnt area by land cover type, the data from the CORINE Land Cover database are used. Therefore, the mapped burned areas are overlaid to land cover maps, allowing an assessment of damage to be made that is harmonized for all the European Countries.

The burnt area mapping in the RDA is based on the identification of active large fires from the MODIS, the expansion of the burnt areas from these initial points on the basis of region-growing algorithms, and the refinement of the final perimeter of the fire through visual interpretation of the images. The process is aided by the systematic collection of fire news from a variety of media. An alternative to the current

methodology is being developed. This method is based on abrupt post-fire vegetation change detected from MODIS daily time series. Once implemented, this method will allow for a better and less user-dependent classification of the burned areas.

VIIRS Burnt Areas

Data from the VIIRS VIIRS (Visible Infrared Imaging Radiometer Suite) on board the NASA/NOAA Suomi National Polar-orbiting Partnership (SNPP) are also used for the mapping of burnt areas in EFFIS. The perimeters of the fires derived from VIIRS are generated using algorithms that derive polygons on the basis of the active fires retrieved from this sensor. Accordingly, the fire perimeters are directly derived from the coordinates of active fires, which permits near-real time processing, even in light cloudy or smoke situations.

These fire perimeters are thus produced just after the pass of the satellite and the acquisition of the data, without the need to perform the classification of the satellite imagery. Since the procedure is automatic and based on delineating polygons, the fire perimeters may have sharper shapes than those produced from the classification of MODIS imagery (above section). For the spatial resolution of the fire perimeters, it must be noted that the nominal spatial resolution of VIIRS is 375 m.

VIIRS derived data on burnt areas are not yet used in EFFIS to compute burnt area statistics; they are only displayed in the EFFIS "current situation viewer."

Fuels

The EFFIS fuel map was derived in the context of JRC Contract Number 384347 on the "Development of a European Fuel Map." Although the original map contained 42 vegetation complexes, these were assigned to the 13 categories of the NFFL or fire behavior models (Anderson, 1982). The last 3 categories of the NFFL models are not used in the European Fuel Map.

The EFFIS fuel map can be downloaded at:

https://effis.jrc.ec.europa.eu/applications/data-and-services/

If the EFFIS fuel map is used, we suggest the following way to cite it:

- European Forest Fire Information System (EFFIS) - European Fuel Map, 2017, based on JRC Contract Number 384347 on the "Development of a European Fuel Map", European Commission.

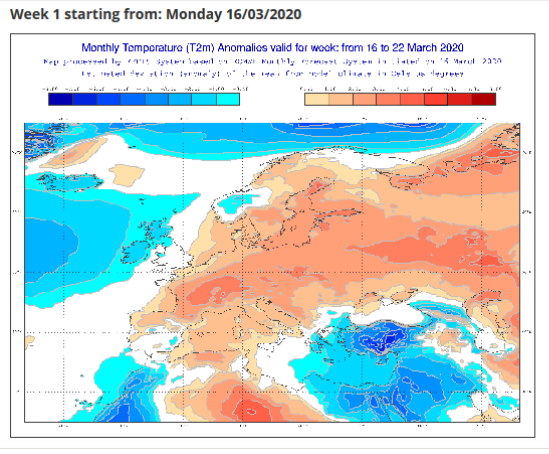
Long-term monthly fire weather forecast

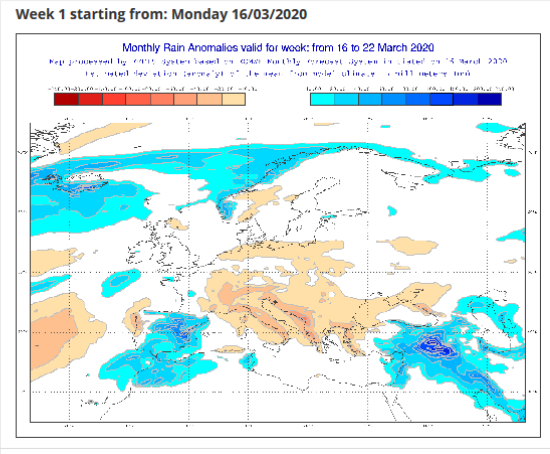
Long-term monthly forecast of temperature and rainfall anomalies

This page shows temperature and rainfall anomalies that are expected to prevail over European and Mediterranean areas during the next 2 weeks. This service started in April 2014; these weekly anomalies shown will be updated every week during the fire season. Normally in the beginning of each week a forecast for the next 2 weeks will be made available.

The maps are produced by the JRC's EFFIS Team based on data from the ECMWF (European Centre for Medium-Range Weather Forecasts) Monthly Forecast System (MFS). MFS anomalies of temperature and rainfall are estimated from the mean deviation of the monthly forecast from the model climate. The maps highlight the areas which are expected to be colder/warmer and dryer/wetter (than normal) over Europe and Mediterranean countries, with an obvious linkage to potentially higher forest fire danger.

Additional details on monthly forecasting can be found below, while detailed technical illustration of the Monthly Forecast System MFS can be consulted on the related pages of the ECMWF web site (https://www.ecmwf.int/en/forecasts/datasets/set-vi).





Clicking on any of the images will open it in a new window. Click to have a zoomed-in view and click again to restore the image to the smaller size.

Monthly forecast – additional information

Two ensemble forecasting systems are currently operational at ECMWF: (1) the EPS (Ensemble Prediction System) for medium-range weather forecasting and (2) the seasonal forecasting (Seasonal Forecast System, so-called: S5). The EPS produces weather forecasts out to 15 days, whereas seasonal forecasting (S5) produces forecasts out to 7 months.

The two systems have different physical bases. Medium-range weather forecasting (EPS) is essentially mostly driven by the atmospheric initial state and a complex assimilation system provides the best initial states. Seasonal forecasting (S54), on the other hand, is justified by the long predictability of the oceanic circulation (of the order of several months) and by the fact that the variability in tropical SSTs has a significant

global impact on the atmospheric circulation. The oceanic circulation is a major source of predictability in the seasonal scale, the ECMWF seasonal forecasting system is based on coupled ocean-atmosphere integrations. Seasonal forecasting is also an initial value problem, but with much of the information contained in the initial state of the ocean.

It becomes obvious that between EPS and S5 there exists a certain gap. The main goal of the extended range forecast is to fill the gap between these systems. Twice a week ECMWF produces forecasts for the time range 15 to 46 days. The time range 15 to 46 days is probably still short enough that the atmosphere retains some memory of its initial state and it may be long enough that the ocean variability has an impact on the atmospheric circulation. Therefore, the extended range forecast has been built as a continuation of the medium-range VAREPS (VAriable Resolution EPS)

Furthermore, an important source of predictability over Europe in the 15-46 day range is believed to originate from the Madden Julian Oscillation (MJO). The MJO is a 40-50 day tropical oscillation. Several works suggest that the ocean-atmosphere coupling has a significant impact upon the speed of propagation of an MJO event in the Indian Ocean and western North Pacific. The use of a coupled system helps to capture some aspects of the MJO variability.

Long-term seasonal fire weather forecast

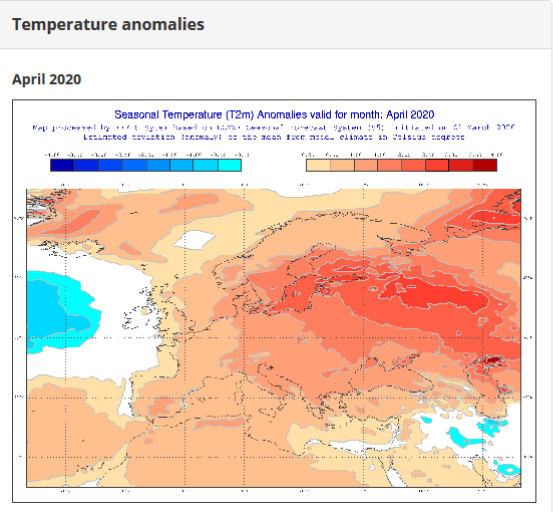
Long-term seasonal forecast of temperature and rainfall anomalies

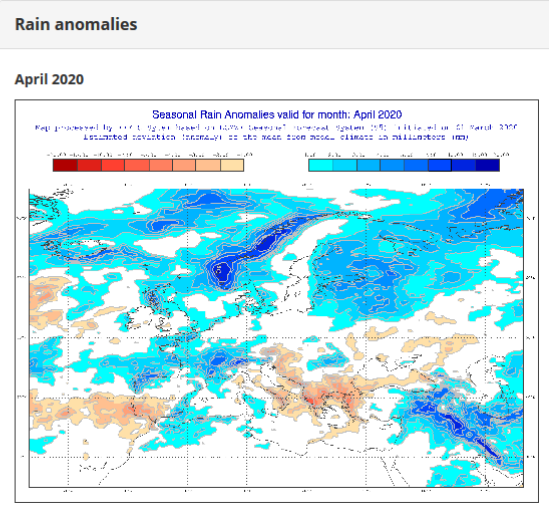
This page shows temperature and rainfall anomalies that are expected to prevail over European and Mediterranean areas during the next 7 months. This service started in June 2013; the set of 7 months shown will be updated monthly during the fire season. Normally within the first week of each month a forecast for the next 2 months will be made available.

The maps are produced by the JRC's EFFIS Team based on data from the ECMWF (European Centre for Medium-Range Weather Forecasts) Seasonal Forecasting System named S5 (System 5). S5 anomalies of temperature and rainfall are estimated from the mean deviation of the seasonal forecast from the model climate. The maps highlight the areas which are expected to be colder/warmer and dryer/wetter (than normal) over Europe and Mediterranean countries, with an obvious linkage to potentially higher forest fire danger.

Please take into account that the longer the forecast horizon, the less accurate the forecast will be.

Additional details on seasonal forecasting can be found below, while detailed technical illustration of the Seasonal Forecast System S5 can be consulted on the related pages of the ECMWF web site https://www.ecmwf.int/en/forecasts/datasets/set-vi).





Clicking on any of the images will give a zoomed-in view. Click again to restore the image to the smaller size.

Seasonal forecast – additional information

Seasonal forecasting attempts to provide useful information about the "climate" that can be expected in the coming months. The seasonal forecast is not a weather forecast: weather can be considered as a snapshot of continually changing atmospheric conditions, whereas climate is better considered as the statistical summary of the weather events occurring in a given season.

Despite the chaotic nature of the atmosphere, long term predictions are possible to some degree thanks to a number of components which themselves show variations on long time scales (seasons and years) and, to a certain extent, are predictable. The most important of these components is the ENSO (El Nino Southern Oscillation) cycle, which refers to the coherent, large-scale fluctuation of ocean temperatures, rainfall, atmospheric circulation, vertical motion and air pressure across the tropical Pacific. El Niño episodes (also called Pacific warm episodes) and La Niña episodes (also called Pacific cold episodes) represent opposite extremes of the ENSO cycle. The ENSO cycle is the largest known source of year-to-year climate variability.

Changes in Pacific sea surface temperature (SST) are not the only cause of predictable changes in the weather patterns. There are other causes of seasonal climate variability. Unusually warm or cold sea surface temperatures in the tropical Atlantic or Indian Ocean can cause major shifts in seasonal climate in nearby continents.

In addition to the tropical oceans, other factors that may influence seasonal climate are snow cover and soil wetness. All these factors affecting the atmospheric circulation constitute the basis of long-term predictions.

Overall, seasonal forecasting is justified by the long predictability of the oceanic circulation (of the order of several months) and by the fact that the variability in tropical SSTs has a significant global impact on the atmospheric circulation.

Seasonal forecasts provide a range of possible climate changes that are likely to occur in the season ahead. It is important to bear in mind that, because of the chaotic nature of the atmospheric circulation, it is not possible to predict the daily weather variations

at a specific location months in advance. It is not even possible to predict exactly the average weather, such as the average temperature for a given month.

The European Centre for Medium-Range Weather Forecasts (ECMWF) Seasonal Forecasting System (S5) is based on a global model which, since the oceanic circulation is a major source of predictability in the seasonal scale, is based on coupled ocean-atmosphere integrations.

The S5 has a surface grid with 28 km spacing representing large scale weather patterns. Local weather and climate is much influenced by features too small to be included in the relatively low-resolution model (hills, coastlines, land surface properties). Thus, trying to read off local values from the maps could be very misleading.

The seasonal forecasts consist of a 51-member ensemble. The ensemble is constructed by combining the 5-member ensemble ocean analysis with SST perturbations and the activation of stochastic physics. The forecasts have an initial date of the 1st of each month, and run for 7 months.

Every seasonal forecast model suffers from bias - i.e., the climate of the model forecasts differs to a greater or lesser extent from the observed climate. Since shifts in predicted seasonal climate are often small, this bias needs to be taken into account, and must be estimated from a previous set of model integrations. Forecast monthly mean anomalies (of temperature and rain) are calculated relative to a climate mean formed from the appropriate 1981-2016 re-forecasts. The set of re-forecasts (otherwise known as hindcasts or back integrations) are made starting on the 1st of every month for the years 1981-2016. They are identical to the real-time forecasts in every way, except that the ensemble size is only 25 rather than 51.

Fire News Application

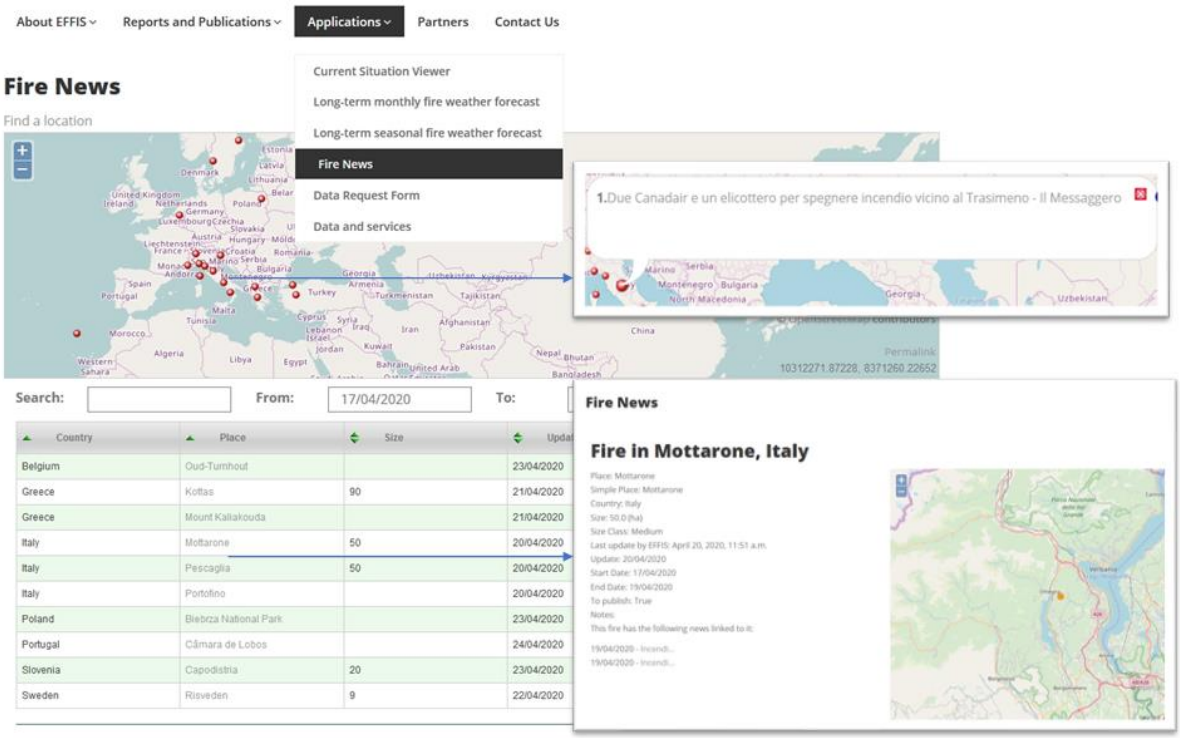
The purpose of this application is to display geo-located news items about forest fires from a number of sources. News items are added to the map daily by team members during the fire season. The resulting list can be sorted by any of the displayed variables and filtered by date, size class or country.

[**N.B.** It is important to note that not all fires are displayed here: only those with an identifiable location. Fires are not always reported individually in the press, as the amount written about them depends on other current world events].

- Click on a point on the map to give a link to the original news item associated with that point.

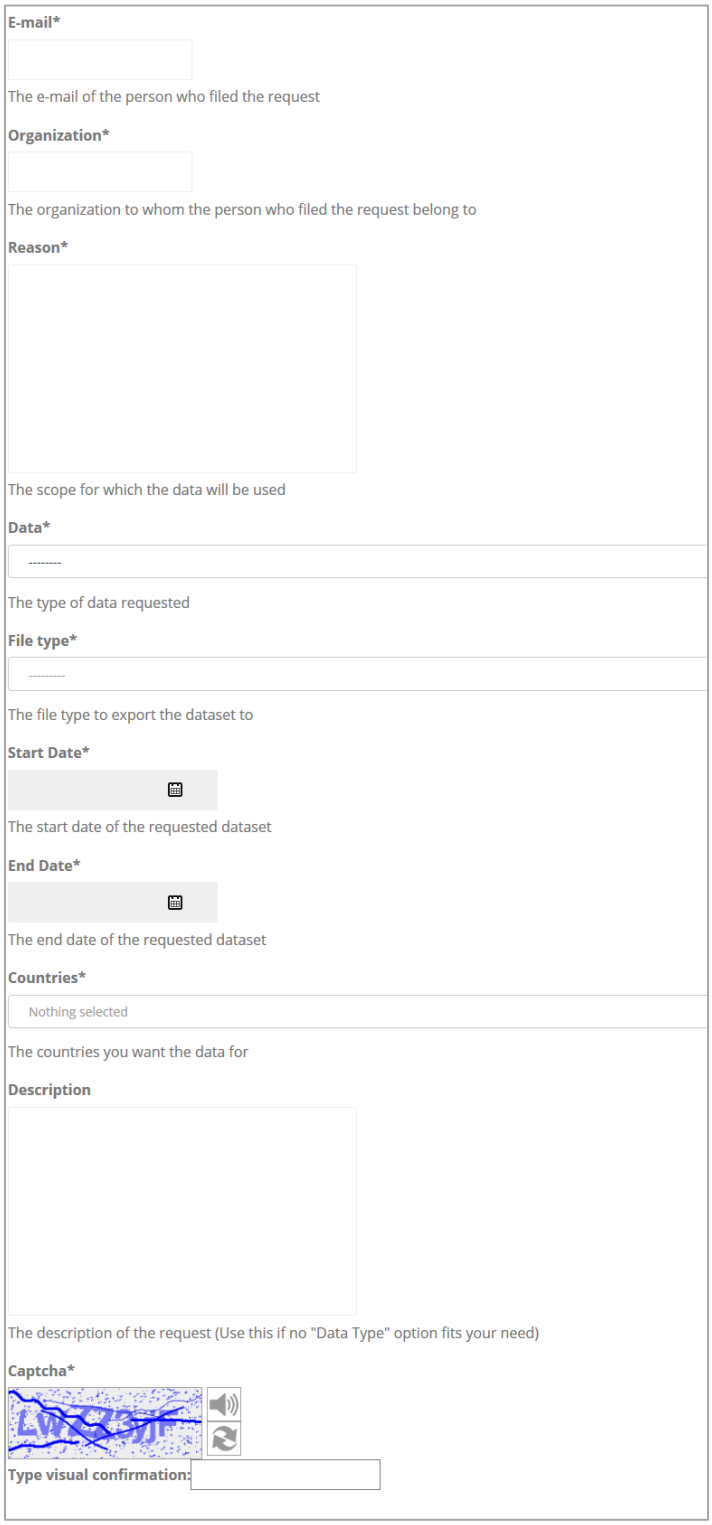
- Click on the name in the list for a table with details of the fire and a close-up of the map.

By default, the display shows fires occurring in the last week, but the From and To boxes can be used to select other time periods – even for past years. The Search box allows the user to narrow down the display from among the total selected in the date filters.



Data Request Form

This application is made available for specific requests of data from EFFIS that are not directly available via the EFFIS web services. Please, fill in the required information so that your request can be processed. The data will be delivered to the email address provided in the application as soon as possible.



Data and services

The user can download different datasets directly from https://effis.jrc.ec.europa.eu/applications/data-and-services/.

These datasets include active fires data (MODIS and VIIRS), burnt areas (MODIS and VIIRS), Fire severity, Fuel, EFFIS Fuel Map, and Fire Danger Forecast (1-day forecast) - different indexes (either from ECMWF or Meteo France).

Additionally, it is also possible to download data from the EFFIS database (e.g. country totals -burnt areas and number of fires- in .csv format), and data from the European Fire Database (country totals (burnt areas & number of fires) per year), as published in the Forest Fires in Europe, North Africa and Middle East reports .

For any request of data which is not available through the EFFIS Web services (e.g. historic data, extracts of the fire database, or raw burned area perimeters), the user can send a request via the **Data Request Form** button (click to access the form).