Exercise 2: The Global Wildfire Information System (GWIS)

Objectives

- Understand how to use the GWIS Current Situation Viewer
- Learn how to compare various fire danger indices
- Learn how to conduct an assessment of active fires in comparison with fire emissions
- Learn how to use the GWIS system for monitoring global wildfire patterns and specific fire events

Overview of Topics

- Explore GWIS functions
- Examine various fire danger indices
- Conduct a rapid fire assessment on an example fire

Tools Needed

- Web browser with internet connection

Introduction

For this exercise we will explore the Global Wildfire Information System (GWIS) website. GWIS is a joint initiative of the Group on Earth Observations (GEO) and the Copernicus Work Program that is supported by NASA's Applied Sciences Program. GEO is a global network of government and academic institutions, private businesses, data providers, and experts that aim to create innovative solutions to solve global challenges, particularly those related to environmental management. Copernicus is the European Union's Earth Observation Programme that provides both satellite and in-situ environmental data.

GWIS is used operationally by the Emergency Response Coordinating Centre (ERCC) of the European Commission. The ERCC coordinates disaster relief worldwide on behave of the European Commission. GWIS provides data for the Fire Danger Forecast a day in advance, which is provided to incident managers.

GWIS aims to provide a comprehensive view of fire effects and fire regimes at a global level. The GWIS Current Situation Viewer provides data on fire danger forecasts, actively burning fires, and fire emissions.

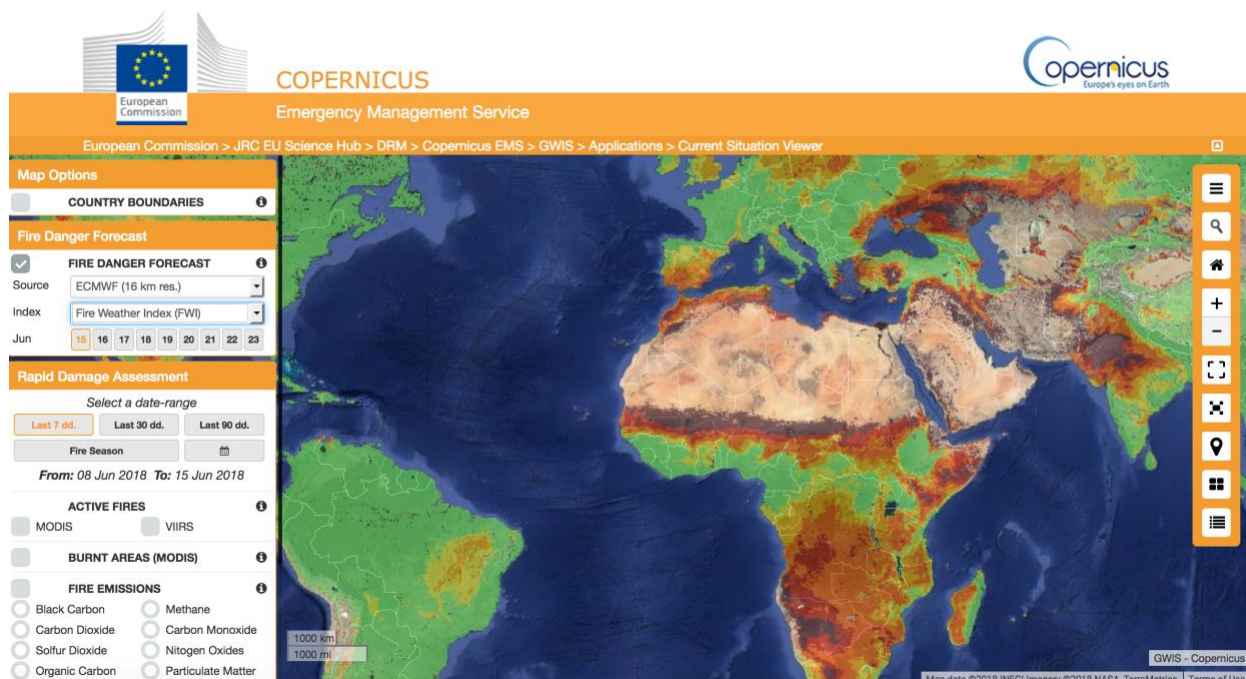## Part 1: Exploring the GWIS Current Situation Viewer

1. Go to the Global Wildfire Information System (GWIS) website here:
   http://gwis.jrc.ec.europa.eu/

2. Click on **Current Situation Viewer** on the right side of the page under **Applications**.

3. Let's first explore the viewer functions on the right side.

a. The **Open/close layers sidebar** function will turn on or off the layer options on the left hand side of the viewer.

b. The **Search** function allows the user to input a location and be taken directly to that region on the map.

c. The **Home** function will return the zoom level to the standard (the one pictured above).

d. The plus and minus signs will allow you to zoom in and out. You can also do this with your mouse.

e. The **Zoom to specific area** function allows the user to draw a rectangle on the map to zoom to that region.

f. The **Full Screen** function will display the map at full screen.

g. The **Show me where I am** function will point the user to where they are currently located in the world.

h. The **Switch Base Layer** function will allow the user to select from a different GoogleMap or OpenMap layer.

i. The **Show Legend** function displays the **Fire Danger Forecast** levels on the right. These are the colors represented in the standard map function, and range from Very Low Danger to Extreme Danger.

Fire Danger Forecast (ECMWF/FWI)

- Very Low Danger
- Low Danger
- Moderate Danger
- High Danger
- Very High Danger
- Extreme Danger

4. Now let's examine the data layers on the left side. To turn on the country boundaries click on **COUNTRY BOUNDARIES** under **Map Options**.

5. Click on the **information** 🛈 icon in the **Fire Danger Forecast** section. This will open a new tab in your browser that provides the details about the forecast. The
forecast uses the Fire Weather Index (FWI), which is based off numerical weather predictions from 1 to 10 days. Fire danger is mapped in six classes.

| Fire Danger Classes	FWI ranges (upper bound excluded)
Very low	< 5.2
Low	5.2 - 11.2
Moderate	11.2 - 21.3
High	21.3 - 38.0
Very high	38.0 - 50.0
Extreme	>= 50.0

6. Go back to the viewer and take a look at the other indices available for mapping fire danger. The Canadian Wildland Fire Information System website has more information on many of these indices:
http://cwfis.cfs.nrcan.gc.ca/background/summary/fwi
    a. The **Initial Spread Index (ISI)** is a numeric rating of the expected rate of fire spread. It combines the effects of wind and the FFMC on rate of spread without the influence of variable quantities of fuel.
    b. The **Build Up Index (BUI)** is a numeric rating of the total amount of fuel available for combustion. It combines the Duff Moisture Code (DMC) and the Drought Code (DC).
    c. The **Fine Fuel Moisture Code (FFMC)** is a numeric rating of the moisture content of litter and other cured fine fuels. This code is an indicator of the relative ease of ignition and the flammability of fine fuel.
    d. The **Duff Moisture Code (DMC)** is a numeric rating of the average moisture content of loosely compacted organic layers of moderate depth.
    e. The **Drought Code (DC)** is a numeric rating of the average moisture content of deep, compact organic layers. This code is a useful indicator of seasonal drought effects on forest fuels and the amount of smoldering in deep duff layers and large logs.
    f. The **Ranking** categorized the Fire Danger Forecast in terms of the regions that are at highest risk for wildfires, with rankings of 50-100.
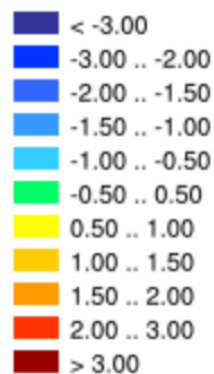
Fire Danger Forecast (ECMWF/Ranking)

Color	Range
	<= 50
	50 .. 75
	75 .. 85
	85 .. 90
	90 .. 95
	95 .. 98
	98 .. 100
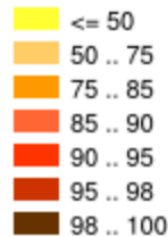
g. The **Anomaly** shows the deviation from normal fire danger globally, with negative anomalies indicating less than normal fire danger and positive values indicating higher than normal fire danger.

Fire Danger Forecast (ECMWF/Anomaly)

Color	Range
	< -3.00
	-3.00 .. -2.00
	-2.00 .. -1.50
	-1.50 .. -1.00
	-1.00 .. -0.50
	-0.50 .. 0.50
	0.50 .. 1.00
	1.00 .. 1.50
	1.50 .. 2.00
	2.00 .. 3.00
	> 3.00

7. Notice the date selections along the bottom portion of the **Fire Danger Forecast Panel**, where you can view model predictions up to 8 days in advance.

The **Rapid Damage Assessment** panel allows you analyze near real-time data such as actively burning fires, burnt areas, and aerosols information.

8. For the **Date Range** you can select the last 7, 30, or 90 days, select the fire season, or a specific date range.

9. **Active Fires** are available via MODIS and VIIRS. Click on the **information** ⓘ icon under **Active Fires** and read the overview description about these data.

10. The **Burnt Areas** are calculated using MODIS data. Click on the **information**

    ⓘ icon next to **BURNT AREAS (MODIS)** and read the overview description about these data.

11. The Fire Emissions panel provides data on a variety of aerosols like carbon dioxide and particulate matter. Click on the **information** ⓘ icon next to **FIRE EMISSIONS** and read the overview description about these data. You can also visit this website for more detailed information: http://www.gmes-atmosphere.eu/about/project_structure/input_data/d_fire/

12. The **FUELS** panel provide an image of the first global fuel map, containing the inputs for the Fuel Characteristic Classification System (FCCS). This is based on satellite products and fuel databases. Click on the **information** ⓘ icon next to **FUELS** and you will be directed to a website that has a link to the paper that this layer was based on.

Part 2: Examining Fire Danger

1. In the GWIS viewer, set the map to the original extent using the **Reset Map** icon.
2. Turn off all layers, and turn on the **COUNTRY BOUNDARIES** and **FIRE DANGER FORECAST** layers.
3. Each day GWIS has a different range of dates for fire forecasts, with a lead time of up to 8-days in advance. Select any day you would like, and choose the **Fire Weather Index (FWI)** as the **Source**.
4. Move your mouse around the globe.
   a. What are the regions of the world that are at highest risk for wildfires?
5. Zoom into the southwestern United States. This is a region experiencing extreme drought, and is also prone to wildfires. Recently, parts of Colorado have been experiencing wildfires.
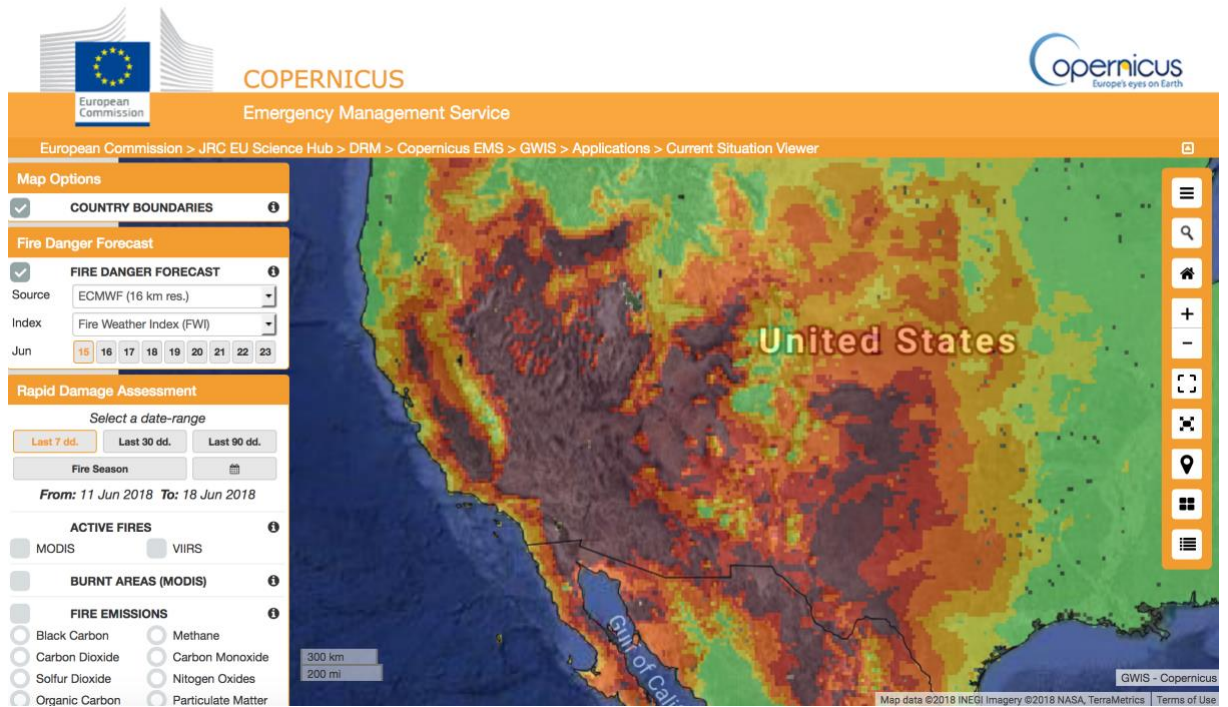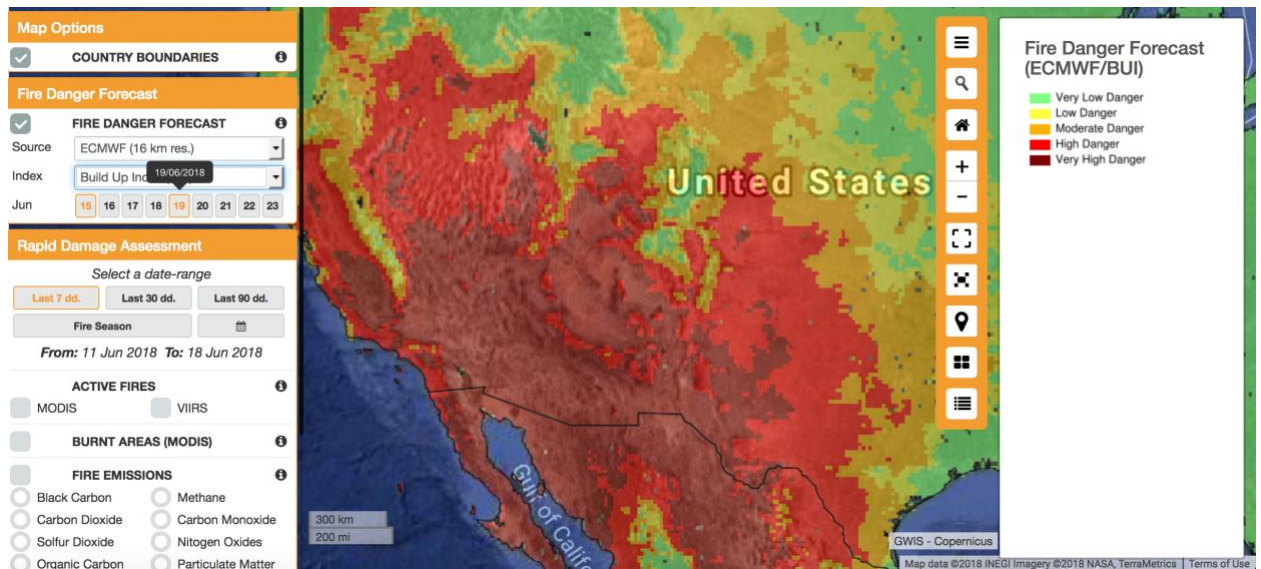
6. Click on the **Show Legend** icon. Now toggle the map view between the **FWI** and the **BUI**.

   a. What differences do you notice between these two indices? Why do you think the BUI fire danger is less severe in some regions?
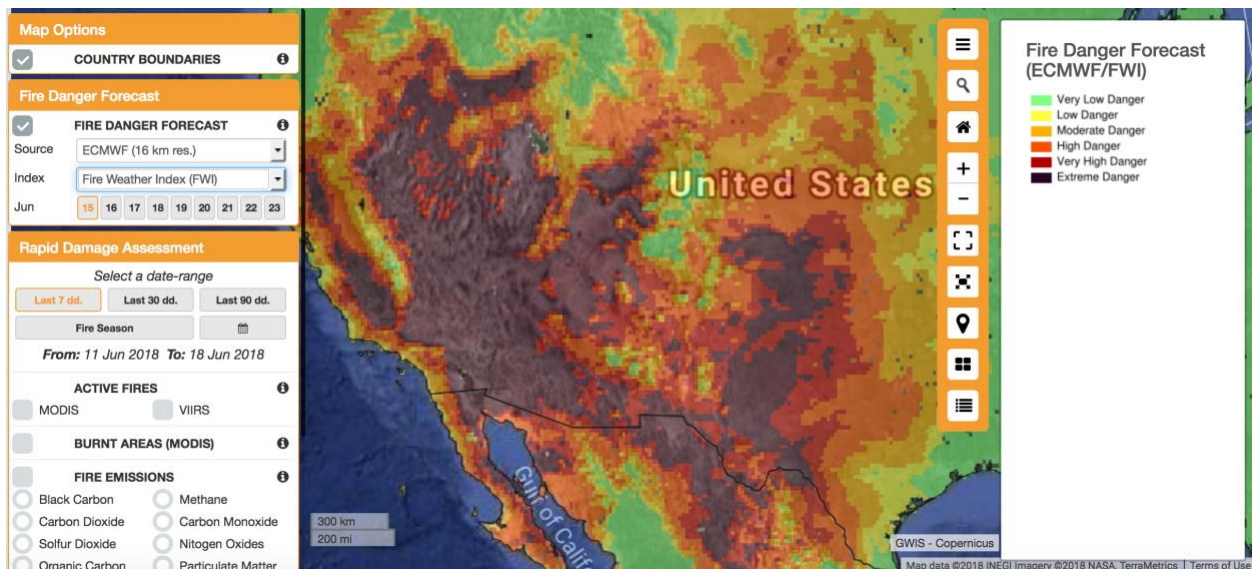
7. In the drop down menu next to **Index**, turn on the **Fire Danger Ranking** layer and notice that much of the region is in the highest ranked category (98-100). Fire managers in this region can be expected to be on high alert for active fires this summer.

8. With the **Fire Danger Ranking** category still turned on, zoom back out to the full extent of the global map. You can use the **Reset Map** icon to do this.
    a. What other part of the world appears to be at high risk for fire?

9. Zoom into Finland, and notice that the southern region of the country is also at high risk for wildfires. Note, that due to the rapidly changing conditions, at the time you complete this exercise, some of these patterns will be different than the images and categories outlined below.
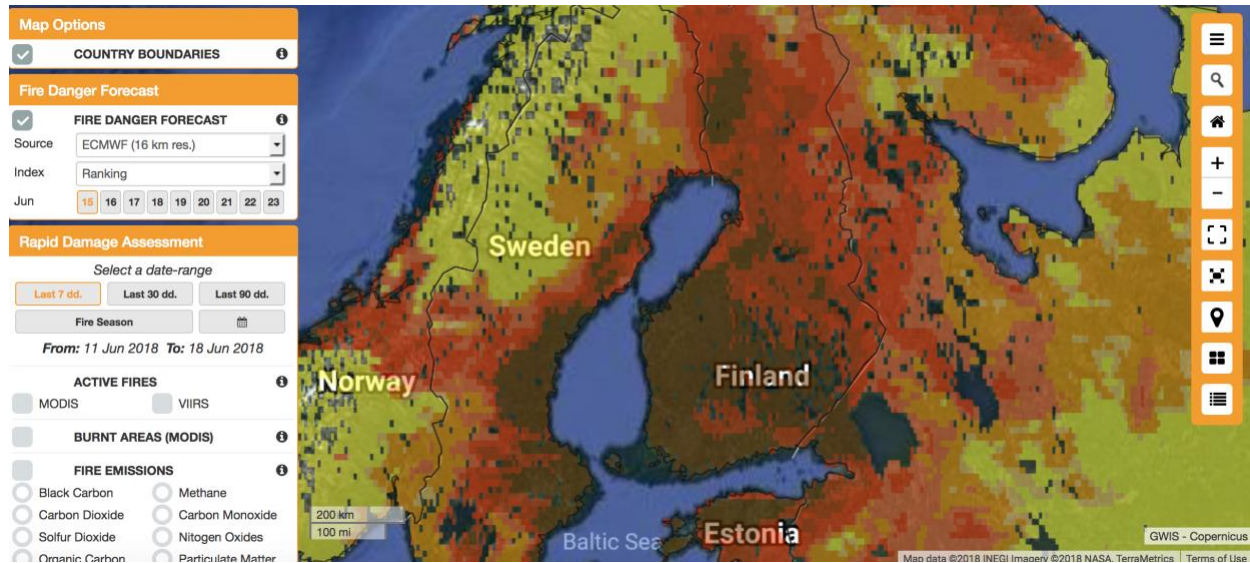
10. Under the **Rapid Damage Assessment** panel, turn on the **MODIS** and **VIIRS ACTIVE FIRES** buttons.
11. Select the Last 30 dd. date range.
    a. Do you see any actives fires in this region?

Finland just experienced the warmest May in over 30 years, coupled with a considerable dry spell, and the risk for fires is particularly high. While there may not be many fires yet in this region, the risk is currently high.

Feel free to explore other regions of interest that appear to have a high fire risk, such as central Africa or northwestern Australia.
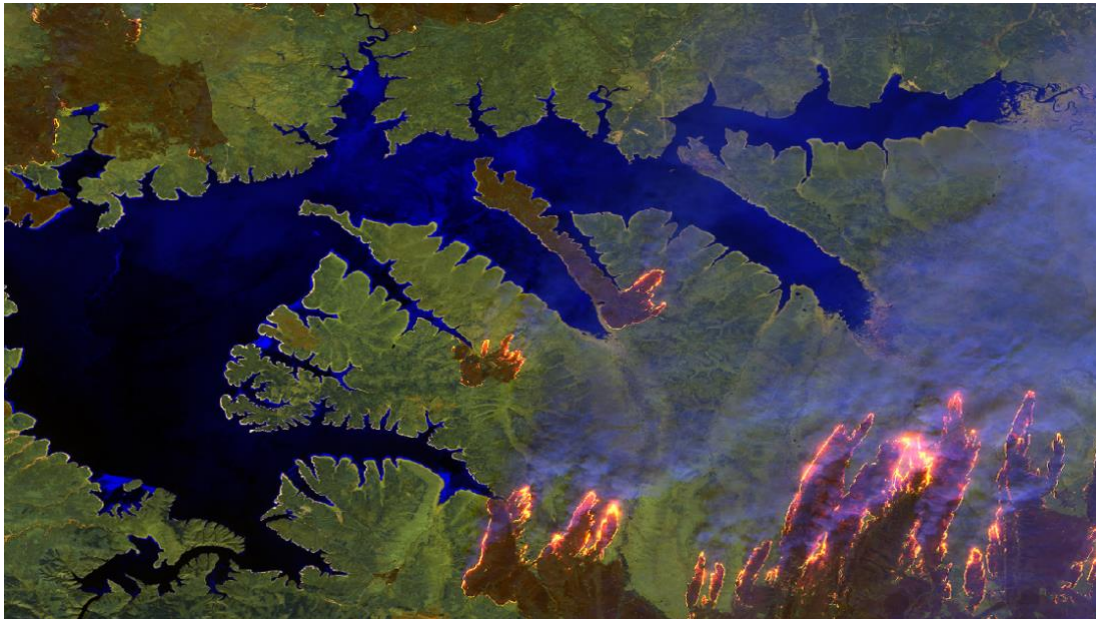
Part 3: Rapid Fire Assessment Example

Let's use GWIS now to examine a particular set of fires burning in Siberia. Dry, warm weather in the region sparked wildfires in the countryside in early May 2018. NASA and ESA satellites imaged and analyzed these fires. On May 9th, a fire blazed near Komsomolsk-on-Amur, a city in Russia with over 260,000 people. Below is an image taken from the Sentinel-2 satellite on May 9, 2018.

Here is an article about this fire and image:
https://sentinels.copernicus.eu/web/sentinel/news/-/article/copernicus-sentinels-work-together-to-monitor-wildfires


1. In the GWIS viewer, set the map to the original extent using the **Reset Map** icon.
2. Turn off the **Danger Forecast** layer.
3. Turn on the **Country Boundaries** layer.

4. Click on the **Select a custom date range** 📅 icon under the **Rapid Damage Assessment** panel.
   a. Select April 26th, 2018 as the start date and May 25th, 2018 as the end date.
5. Turn on the **MODIS** and **VIIRS** Active Fires layers.
6. Turn on the **FIRE EMISSIONS** and the **Particulate Matter** buttons.
7. Scroll over to the southeastern portion of Russia (see map below) and zoom into the region with the clustering of blue and red dots.
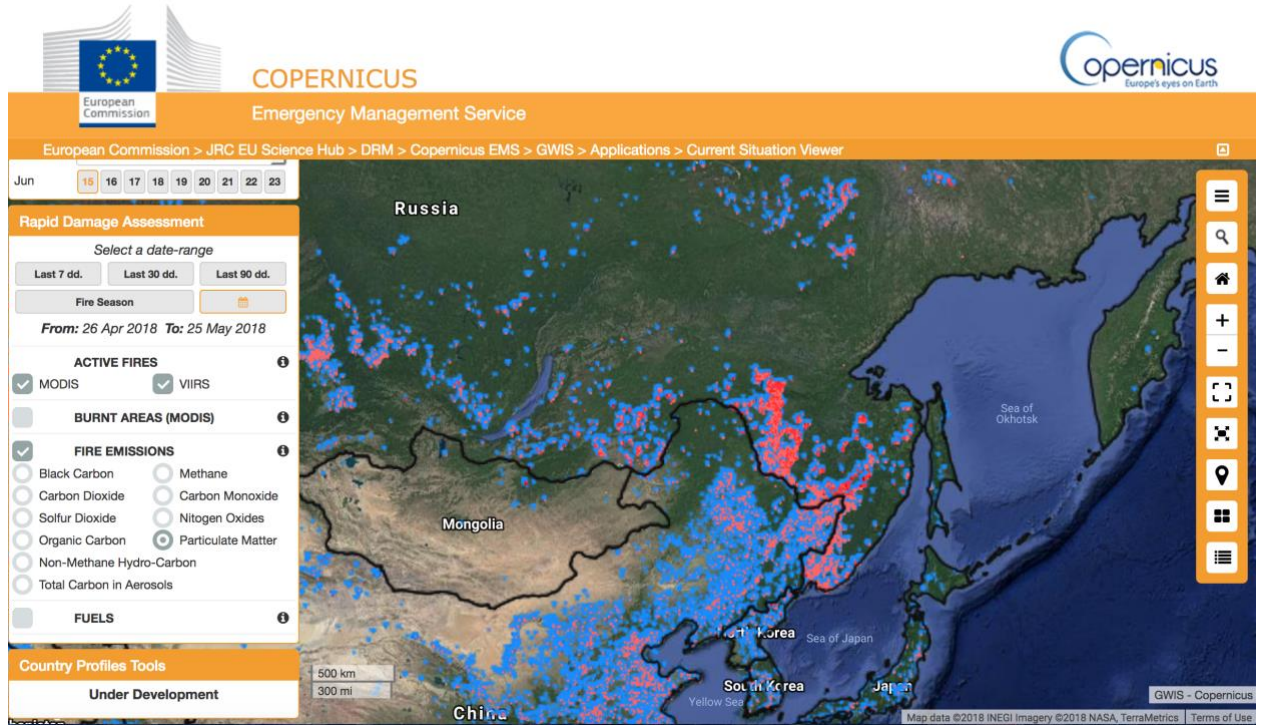
8. Zoom in a bit farther and turn on the legend by clicking on the **Show Legend** icon on the bottom right of the page.
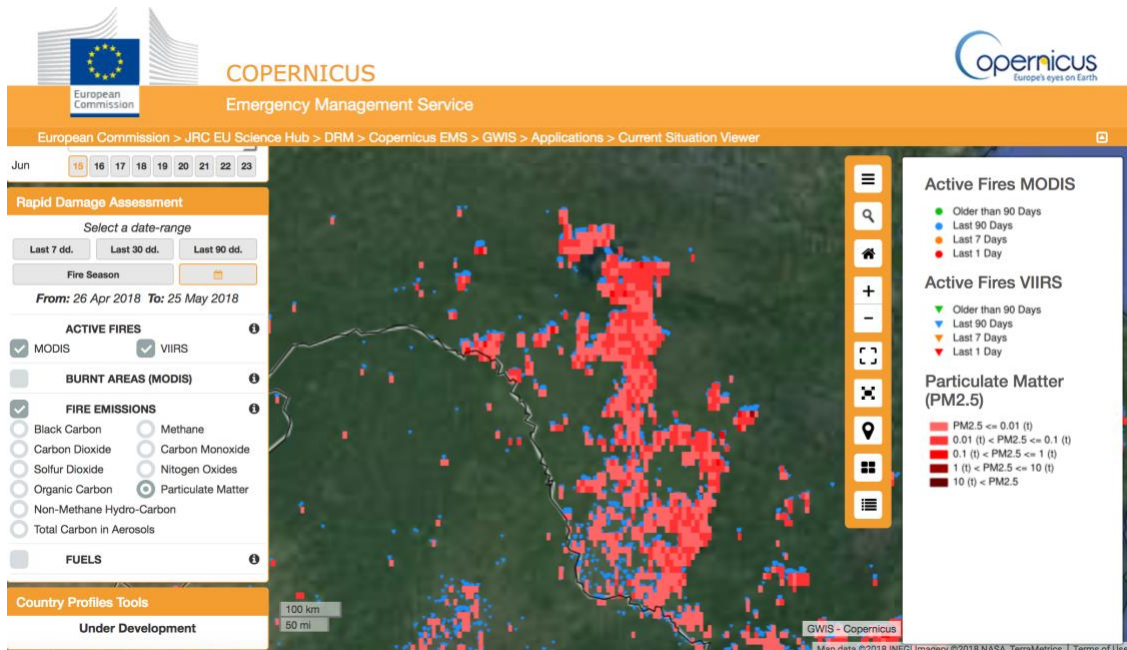
Now you can see levels of $PM_{2.5}$ that are elevated and overlapping active fires identified by MODIS and VIIRS.

9. Click on some of the other options in the **FIRE EMISSIONS** panel. Examine the differences between different types of pollutants.
10. Turn on the **FUELS** layer.
    a. What types of vegetation are predominant in this region?
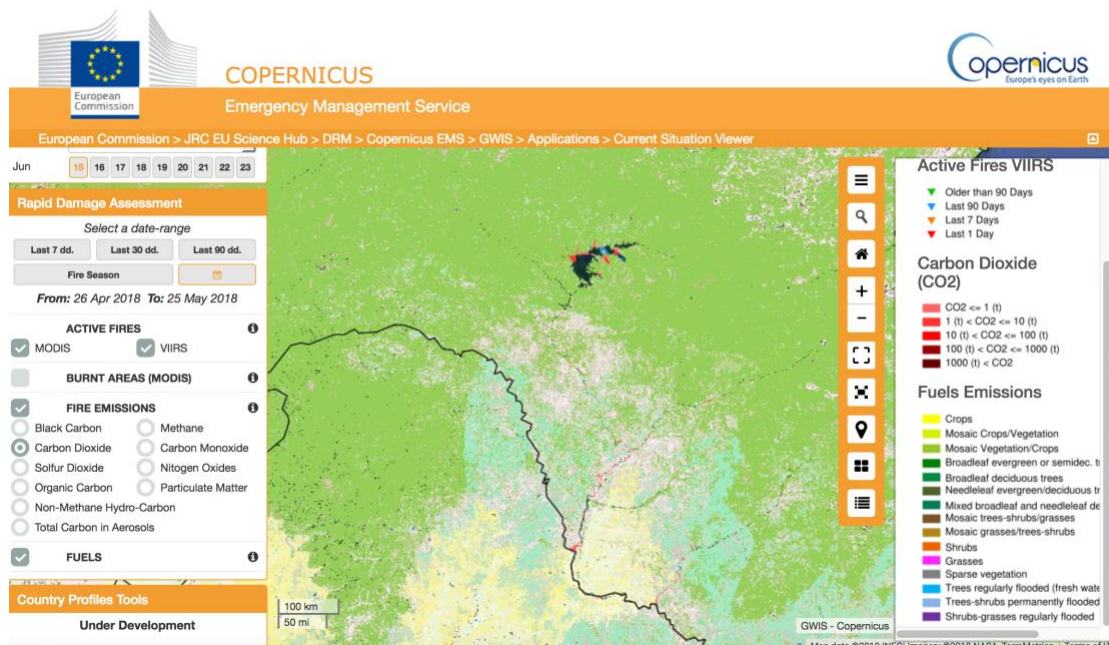
Conclusion

GWIS allows users to visualize fire danger, actively burning fires, and fire emissions. These types of data assist in the visualization of fire properties and can provide an overview of an active fire area and emissions. As a first approach, GWIS provides insight on where to examine active fires and what other types of information you might need to monitor fires on the ground. In this exercise you:
1. explored GWIS functions
2. examined various fire danger indices
3. conducted a rapid fire assessment on an example fire from Siberia

Additional Online Resources

- The Group on Earth Observations (GEO):
  http://www.earthobservations.org/geoss_wp.php
- Copernicus Emergency Management System:
  http://www.earthobservations.org/geoss_wp.php
- The European Forest Fire Information System (EFFIS):
  http://effis.jrc.ec.europa.eu/
- The Global Terrestrial Observing System (GTOS) Global Observation of Forest Cover- Global Observation of Land Dynamics (GOFC-GOLD) Fire Implementation Team (GOFC-Fire IT):http://gofc-fire.umd.edu/