EDO Analytical Report

Drought in Europe – August 2019

JRC European Drought Observatory (EDO), 08 August 2019

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Executive Summary

- Several regions spanning from north-east to western Europe are experiencing drought conditions, but particularly Lithuania, central Poland, Czech Republic, Germany, central France, and central Spain.
- The drought results from a combination of drivers, with different weight depending on location: the long-tail influence of the 2018 drought, the heatwaves of June/July 2019 and below-average precipitation in spring 2019.
- Crop damages were reported primarily from Lithuania, Poland and Czech Republic.
- River levels are lower than normal in central Europe, hampering waterways for the second year in a row.
- After the heatwave of July, the drought intensified in central Europe and moved towards western Europe, notably France and Spain.
- The 1 and 3-months rainfall outlooks for August and August to October predict average conditions for central Europe and above average for northern and western Europe, plus northern Italy.

Combined Drought Indicator (CDI)

EDO Combined Drought Indicator (CDI) is based on the analysis of precipitation, soil moisture and the fraction of Absorbed Photosynthetically Active Radiation (fAPAR), to identify areas that are at potential risk to suffer drought, areas where drought manifests through a significant soil moisture deficit, and areas where vegetation is already affected by drought conditions. Areas in the process of recovery to normal conditions after a drought episode are also shown.

Figure 1 (top) pictures the CDI during mid-July, when the drier conditions became manifest for all indicators, over north-eastern Europe and Poland in particular, with other patches of dryness scattered across Europe too (eastern Alpine regions, central and northern Germany, central France). The drought moved westwards in the third dekad of July (Figure 1, bottom), while worsening in Finland and Scandinavia. The recover from previous drought conditions in the Baltic countries, Denmark, northeastern Germany, Poland, Belarus, and eastern Alpine

regions are in contrast with the expansion of drought in Czech Republic, central Germany, France and Iberian Peninsula. The drivers are multiple and have different importance depending on location: the long-tail influence of the 2018 drought, the heatwaves of June/July 2019 and below-average precipitation in spring 2019.

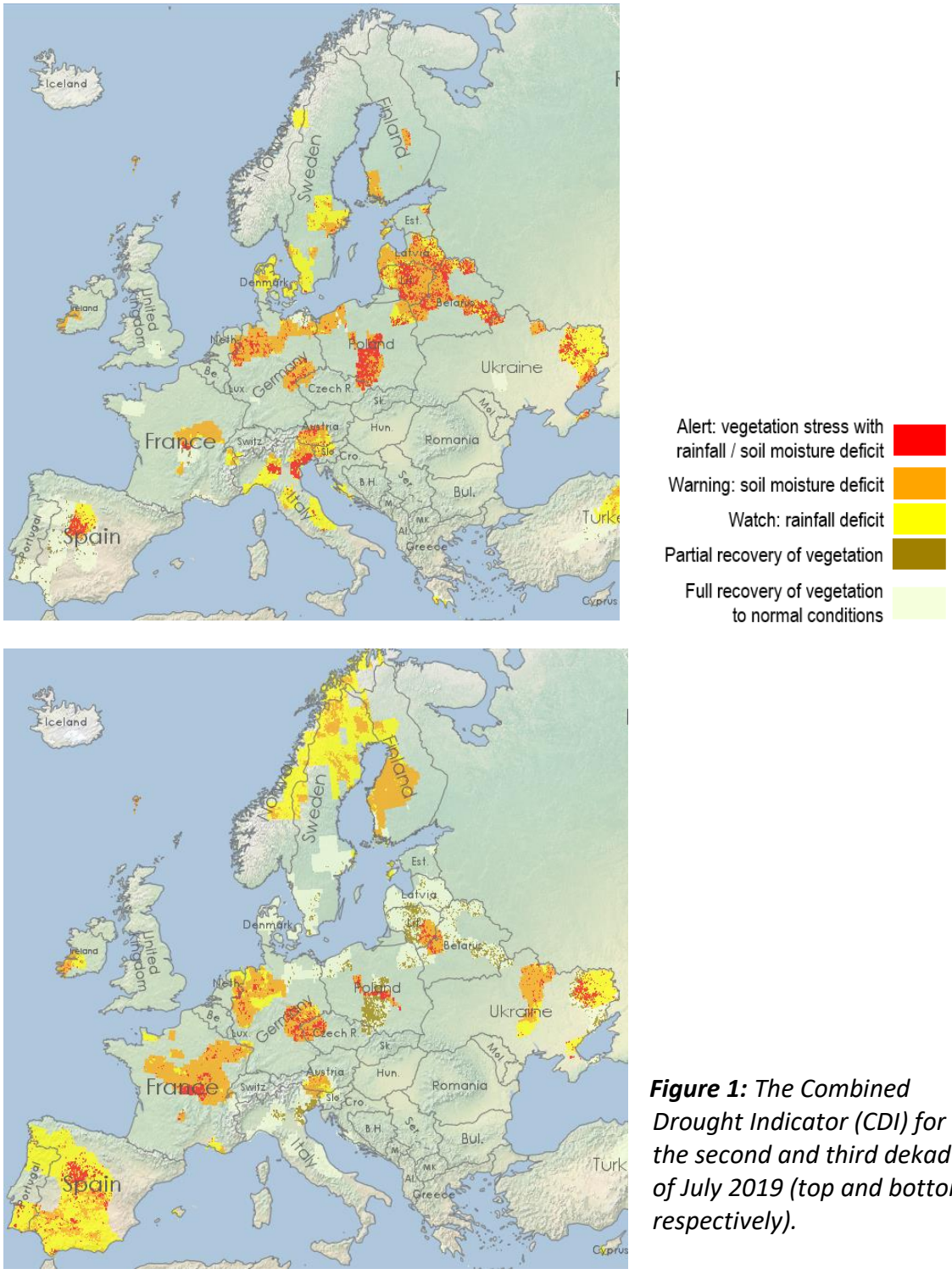


Figure 1: *The Combined Drought Indicator (CDI) for the second and third dekad of July 2019 (top and bottom respectively).*

Precipitation and Standardized Precipitation Index (SPI)

Figure 2 shows the monthly precipitation totals for selected locations across affected areas. Over a time-span of 18 months, a large belt running from eastern Baltic through France received a grand total of 75-85% of the long-term average precipitation. This figure includes the deficit cumulated during summer and fall 2018 and the surplus of following December and January. Within-month variability is fairly marked over the whole area.

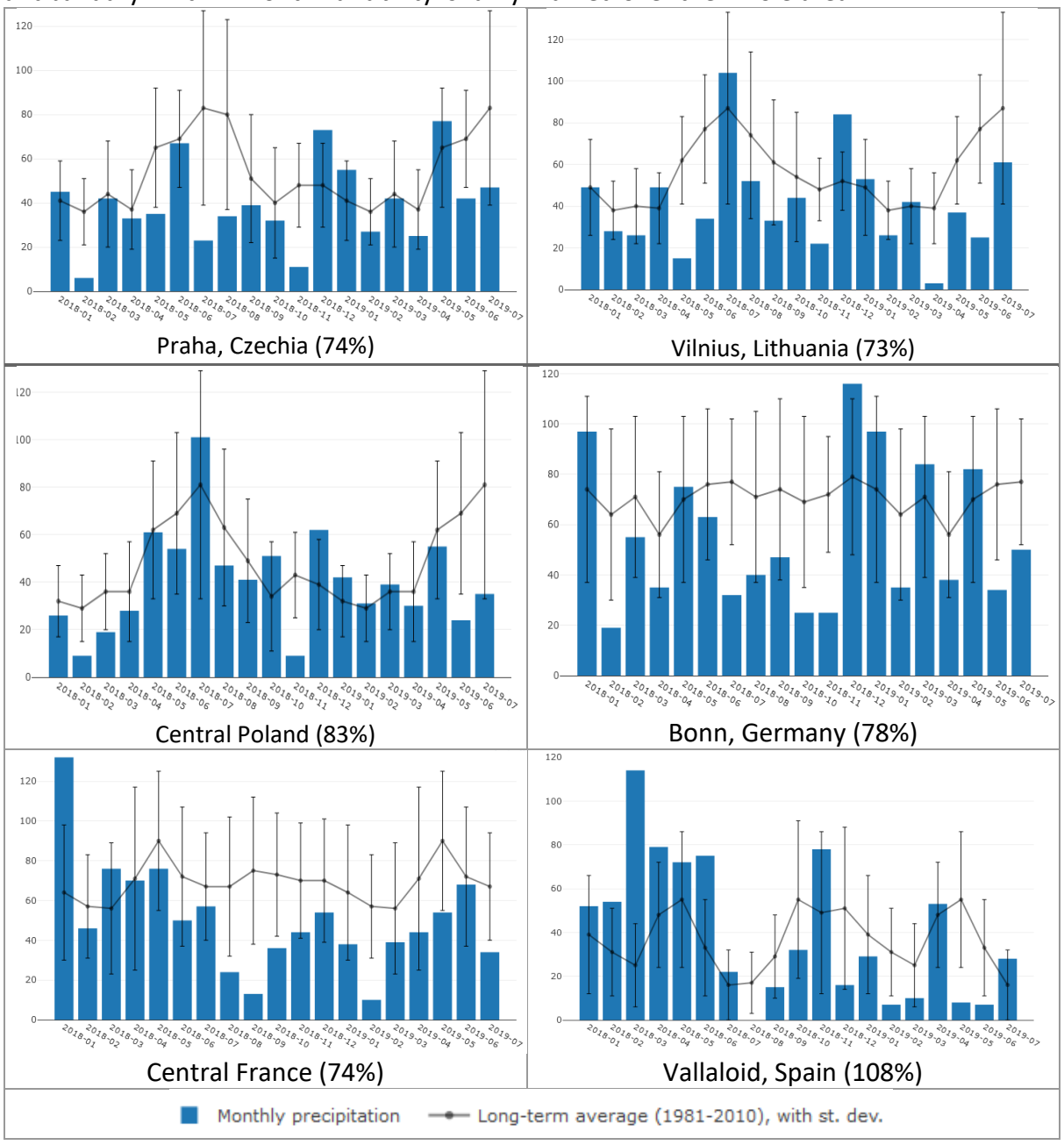
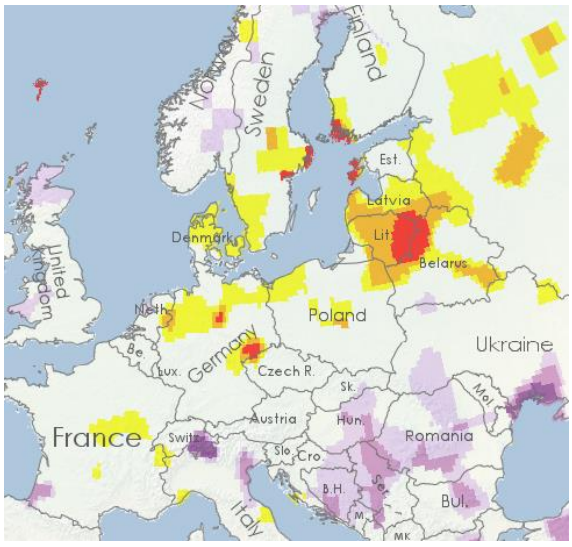


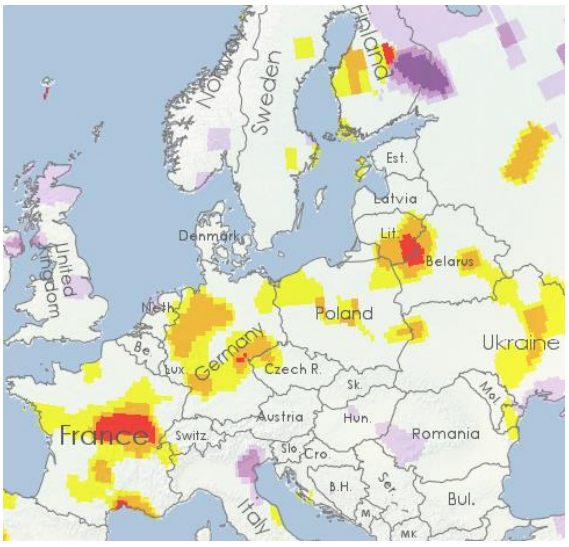
Figure 2: *Monthly precipitation from January 2018 to July 2019 in selected representative locations. Percentage of total precipitation compared to the climatological average of the same 18 months interval are shown within brackets. Bars show observed monthly precipitation (mm). Lines show the long-term monthly average with one standard deviation.*

The SPI measures precipitation anomalies based on the long-term records. The lower (more negative) the SPI, the more intense is the drought.

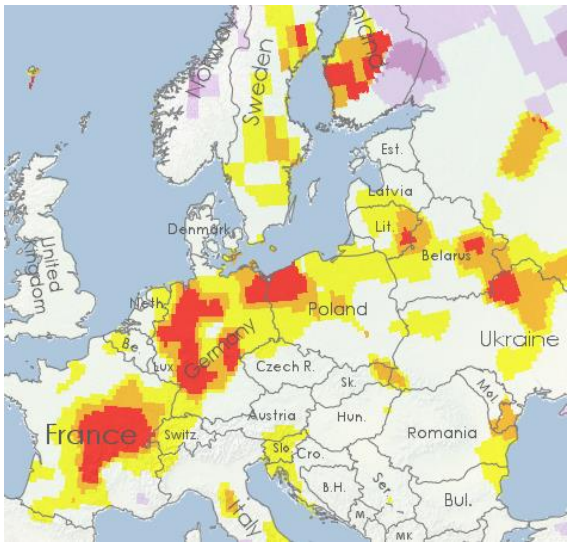
Looking at different time scale SPI provides good insights about the current event (figure 3). Over eastern Baltic countries, the trimester April to June 2019 was particularly dry, thus explaining the drought issues reported from Lithuania during the same period (SPI-3). Elsewhere, weather was mostly normal or only mildly drier than normal. The SPI does not account for temperature extremes, which played a key role in increasing water losses during the same period. Analysing SPI-6, thus spring and the latest growing season, shows a meteorological drought of mild to intermediate severity for all regions except for central France and Lithuania/Belarus, where it is still very intense. The Iberian peninsula (not shown) recorded significantly low SPI values at both the 3 and 6 months cumulative intervals. Finally, the SPI-12 explains the current hydrological drought in central Europe, which is not grasped by the short-term precipitation patterns. In fact, the 12 months interval incorporates most of the 2018 drought event with its remarkable cumulated deficit, which depleted ground waters and did not recover yet fully. Consequently, even a mild rainfall deficit like during the last few months added to the long lasting effects of the 2018 severe drought.



SPI-3 at June 2019 (April to June cumulative)



SPI-6 at July 2019 (6 months cumulative)



SPI-12 at July 2019 (12 months cumulative)

Extremely dry	≤ -2
Severely dry	-2 to -1.5
Moderately dry	-1.5 to -1
Near Normal	-1 to +1
Moderately wet	1 to 1.5
Very wet	1.5 to 2
Extremely wet	> 2
Missing data	

Figure 3: *Standardized Precipitation Index (SPI), showing the precipitation anomalies with respect to the long-term climatological average.*

Temperatures

High temperatures increase massively the evaporation rate of water from the ground, and cause much higher water demand for consumption. Therefore, heatwaves contribute substantially to drought severity, even in absence of relevant rainfall deficits.

At least two main heatwaves unfolded over Europe between June and July, with different timing and extension over different regions (Figure 4). A first short temperature anomaly showed up on north-east Europe, followed by a second heatwave further south, shortly afterwards. Both events hit Poland and Lithuania. The latter experienced a brief temperature anomaly around the 20th of May too. Then, central and western Europe suffered a stronger heatwave at the end of June and again at the end of July. Overall, temperature extremes contributed to enhance markedly water deficits in soils.

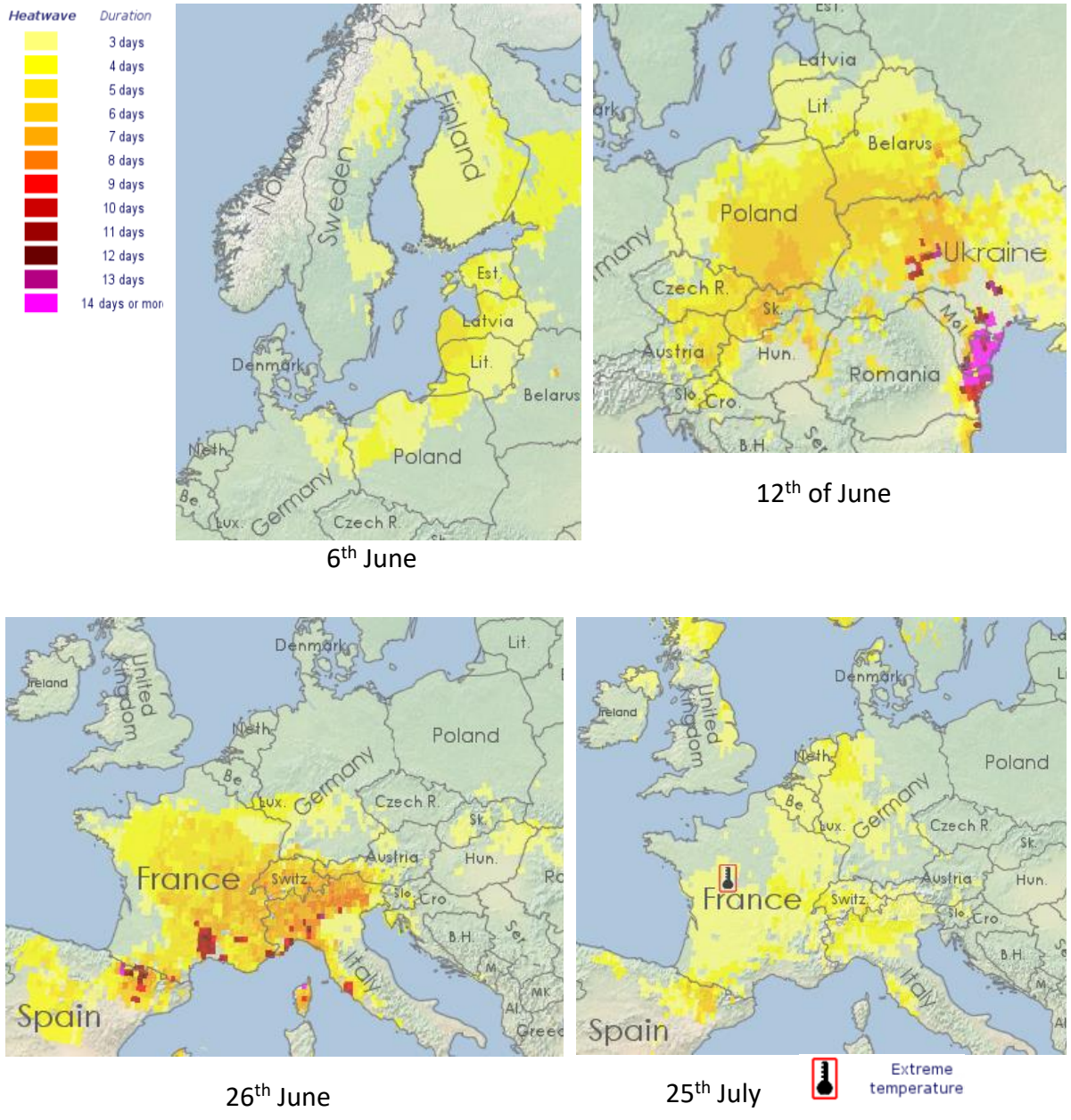
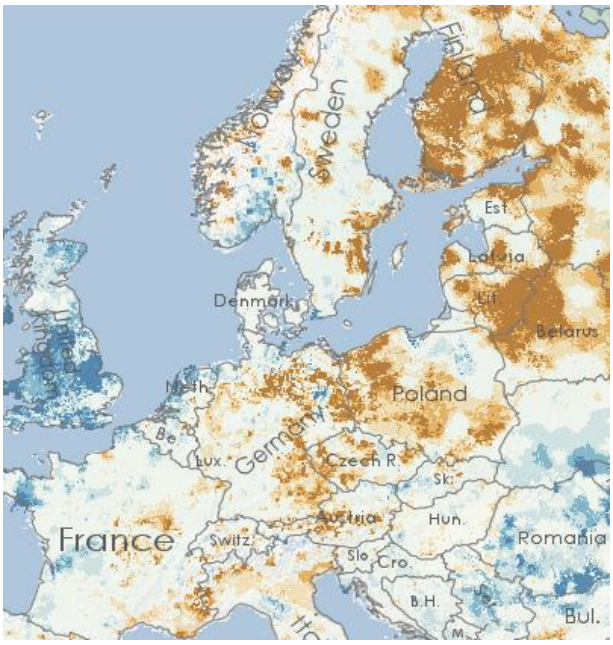


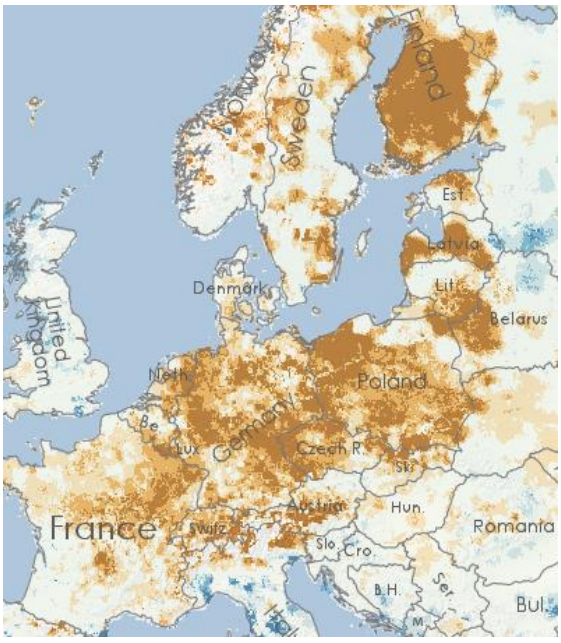
Figure 4: *The sequence of images shows the peak of successive heatwaves across Europe at different dates.*

Soil Moisture Anomaly (SMA)

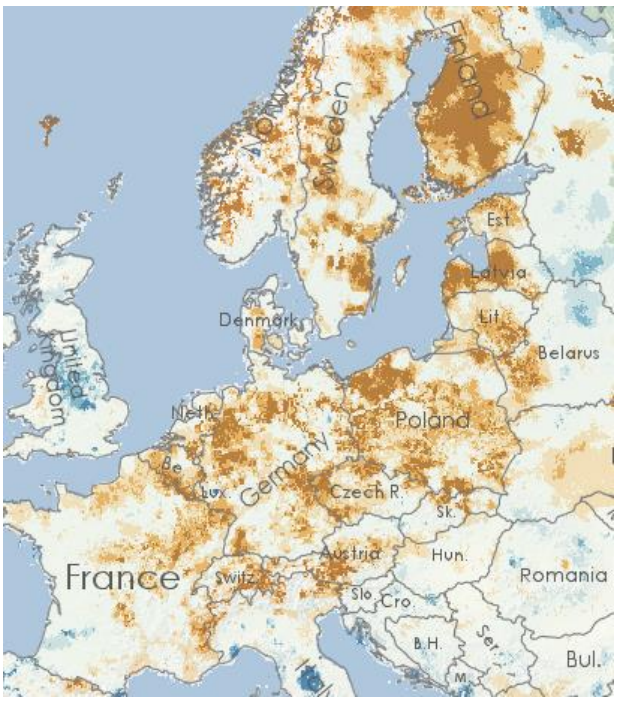
The aim of this indicator is to provide an assessment of the top soil water content, which is a direct measure of drought conditions, specifically indicating the difficulty for plants to extract water from the soil.



SMA, 11th to 20th of June 2019



SMA, 21st to 31st of July 2019



SMA, forecast to 11th August 2019

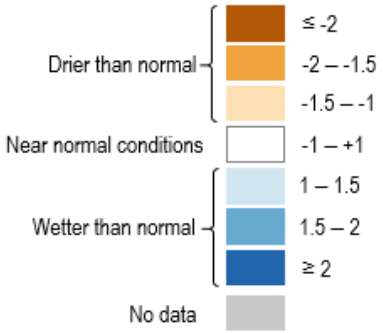
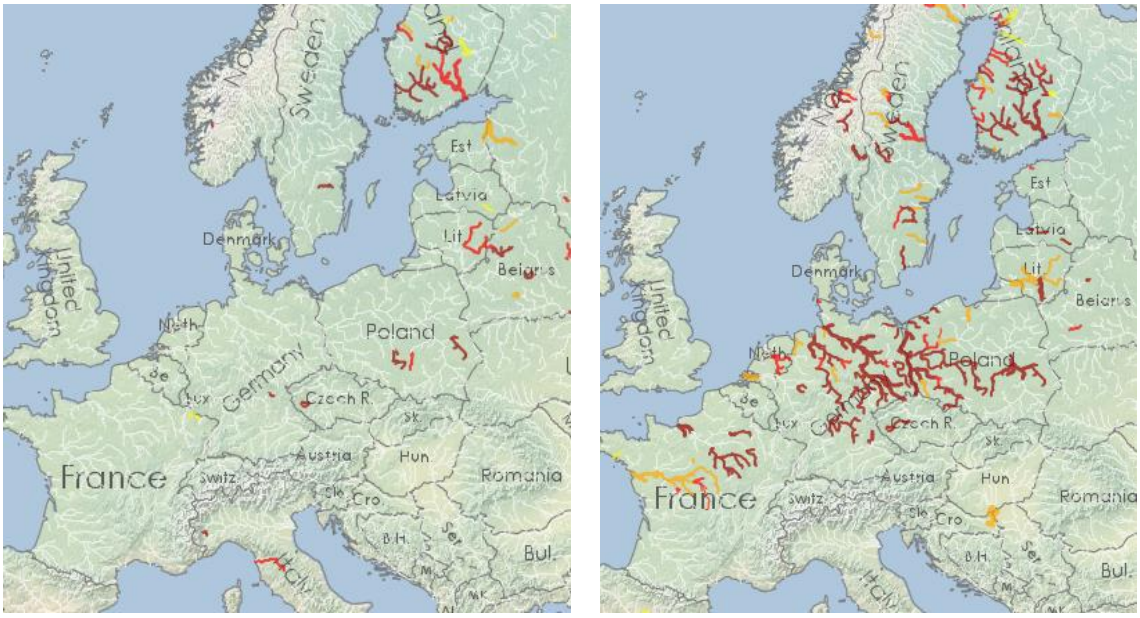


Figure 5: *Soil moisture anomaly (SMA) in central and northern Europe.*

In mid-June north-east Europe showed a situation of strong soil moisture anomaly already, while still patchy over central Europe (Figure 5, top left). At the end of July, most of central Europe was experiencing soil moisture deficits (Figure 5, top right). Forecast to the first third of August show the anomaly easing overall, but still widespread over all of the affected areas (Figure 5, bottom left).

Low Flow Index

The Low Flow Index is an indicator of hydrological drought reflecting the total water deficit of the river discharge, when the latter drops below a minimum threshold.
River flows dropped remarkably between June and July in central Europe, from a consistent situation of seasonal normality to widespread deficit anomaly (Figure 6). This is due, at least in part, to the strong heatwave of June, while for eastern Europe its effect seems negligible. Finland recorded low flows since mid May.
Particularly affected rivers are the Loire, Weser, Meuse, Elbe, Oder, plus significant sections of Seine, Vistula and Niemen, and several other tributaries. The Rhine, despite some alarming news, at the last third of July was still within average for the period level[1]. Note that low river levels are common across Europe during the summer and may not show up as anomalies, despite small flows. Ground water stock plays a key role in hydrological drought, the current situation links to the water gap following the 2018 drought over central Europe.



11th to 21st of June 2019 *21st to 31st of July 2019*

Figure 6: *Low-Flow Index (LFI). The colors from yellow to red indicate increasing hazard of hydrological drought.*

Vegetation Productivity (fAPAR) Anomaly

The fraction of Absorbed Photosynthetically Active Radiation (fAPAR) represents the fraction of the solar energy absorbed by leaves. fAPAR anomalies, specifically the negative deviations from the long term average over the same period, are a good indicator of drought impacts on vegetation.

[1] See also: https://www.bafg.de/EN/06_Info_Service/01_WaterLevels/waterlevels_node.html

Figure 7 pictures widespread vegetation stress over the whole of central and eastern Europe, with darker hotspots in several places, but most notably Poland, Lithuania, Czech Republic.

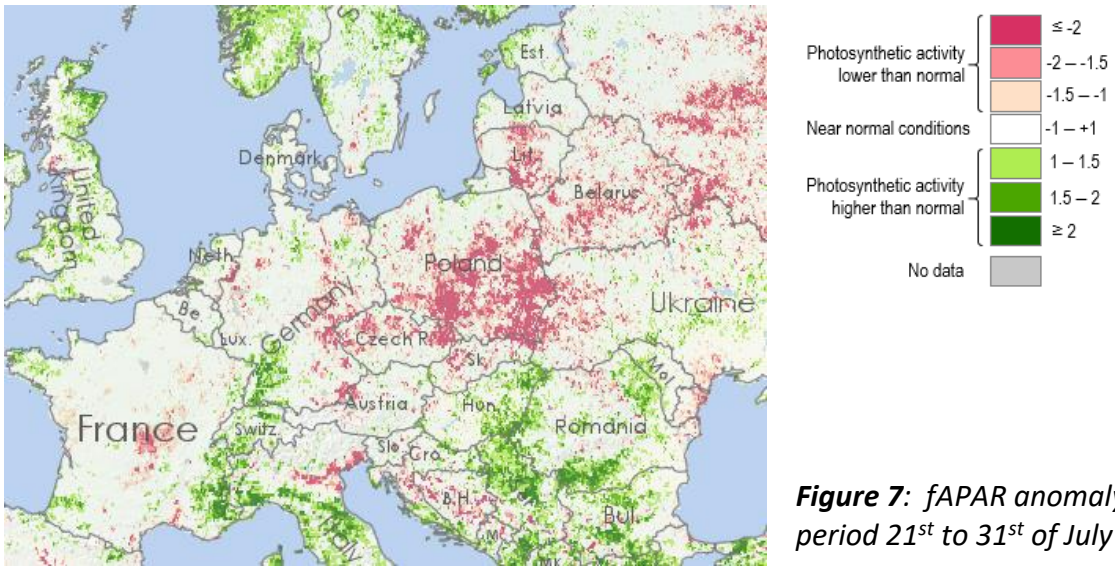


***Figure 7**: fAPAR anomaly for the period 21st to 31st of July 2019.*

Reported impacts

Concerning agriculture, for crop-specific information and yield forecasts, please refer to the latest JRC MARS bulletins from July 2019 [2] [3]. The European Commission has stepped in to give support to European farmers[4].

Low water levels affecting waterways in central Europe are causing significant disruptions to logistics[5], with significant business cases at stake[6]. The heatwave forces more electricity demand while supply shrinks due to reduced operation of water dependent power plants, thus pushing up prices[7].

The Ministry of Agriculture of Lithuania agreed to support farmers against drought[8]. Despite a slight increase in total grain production related to wider cropped area, yields are expected to be significantly lower than in 2018[9]. Prices for livestock forage were reported on the rise, due to lower hay yields[10].

[2] https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-mars-bulletin-vol27-no7.pdf
[3] https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-mars-bulletin-vol27-no7_pastures_update.pdf
[4] https://europa.eu/rapid/press-release_IP-19-4729_en.htm
[5] https://www.insurancejournal.com/news/international/2019/07/24/533767.htm
[6] https://www.reuters.com/article/us-basf-results-rhine/basf-says-it-has-prepared-for-any-repeat-of-low-rhine-water-levels-idUSKCN1S90LZ
[7] https://www.bloomberg.com/news/articles/2019-07-24/paris-is-scorching-in-historic-drought-as-heatwave-fries-europe
[8] http://udiena.lt/kaimas/item/13126-nuo-sausros-nukenteje-zemdirbiai-sulauks-lengvatu
[9] https://www.laei.lt/?mt=aktualijos&naujiena=503
[10] https://www.delfi.lt/agro/kaimo-portretas/sausra-ir-kainos-pjauna-lietuvos-karves.d?id=81757227

In Poland, the rivers are running dry[11] and agricultural drought is confirmed over most of the country[12]. Restrictions are in place to optimize water usage and there is potential for water shortages[13]. The government is preparing measures to support farmers, after a first assessment of losses indicating about 20% of crops affected[14] [15].

In France, authorities declared water supply emergency in several departments across the centre and introduced tight restrictions to water use[16]. Impacts on agriculture are reported[17] and government is providing aid to farmers[18]. There are claims for damages to buildings as well[19]. Until July, energy production was not directly affected by drought, despite concerns[20], but rather by the heat[21]. Losses in agriculture are reported from Belgium too[22].

Forest fire risks are at the peak in several European countries, due to high temperatures and low moisture[23].

[11] http://www.pogodynka.pl/polska/hydro
[12] http://www.iung.pulawy.pl/index.php?option=com_content&view=article&id=2361:msr7
[13] https://plus.gloswielkopolski.pl/susza-w-wielkopolsce-w-sierpniu-moze-zabraknac-wody-w-naszych-kranach-ogloszono-stan-zagrozenia-hydrogeologicznego/ar/c1-14308817
[14] https://www.money.pl/gospodarka/susza-w-polsce-resort-rolnictwa-szykuje-specjalna-pomoc-6407837223024257a.html
[15] https://niezalezna.pl/282191-susza-w-polsce-trwa-szacowanie-strat
[16] http://propluvia.developpement-durable.gouv.fr/propluvia/faces/index.jsp
[17] https://actualite.lachainemeteo.com/actualite-meteo/2019-07-31/secheresse-2019-situation-inquietante-malgre-les-dernieres-pluies-51672
[18] http://www.leparisien.fr/economie/secheresse-le-ministre-de-l-agriculture-annonce-1-milliard-d-euros-d-avance-de-tresorerie-21-07-2019-8121180.php
[19] https://www.francebleu.fr/infos/climat-environnement/apres-deux-etes-de-secheresse-en-berry-les-maisons-se-fissurent-de-plus-en-plus-1564476376
[20] https://www.lejdd.fr/Societe/climat-les-centrales-nucleaires-menacees-par-la-penurie-deau-3907393
[21] https://www.lemonde.fr/energies/article/2019/07/22/canicule-edf-doit-mettre-a-l-arret-deux-reacteurs-nucleaires_5492251_1653054.html
[22] https://www.sudinfo.be/id133554/article/2019-08-01/la-secheresse-fait-des-ravages-dans-les-cultures-les-pertes-sont-parfois
[23] https://effis.jrc.ec.europa.eu/static/effis_current_situation/public/index.html

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Information sources

- European Drought Observatory (EDO) - European Commission, Joint Research Centre
- Global Drought Observatory (GDO) - European Commission, Joint Research Centre
- Media News (European Media Monitor and other sources)

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