EDO Analytical Report

Drought in Europe – June 2020

JRC European Drought Observatory (EDO), 17 June 2020

Table of Contents

Executive Summary

- Some regions of Europe are facing a robust dry spell, following poor rainfall during April and May 2020. Particularly affected are central and northwestern European countries (i.e. Germany, Belgium, the Netherlands, Ireland and most of the UK). Earlier in the spring, drier than usual conditions were already experienced across central and eastern Europe as well as in Italy. Relatively warm temperatures, but not exceptional, were recorded across northwestern Europe.
- The current drought marks the third consecutive year of unexpectedly dry conditions across Europe.
- The precipitation outlook is positive or neutral both for June and for the June-August trimester. If forecasts are confirmed, the drought should ease or end in most affected regions.
- Some rivers levels are lower than normal, particularly the lower Danube, Warta and tributaries of Elbe.
- As of mid-June 2020, impacts were mild overall, with slightly reduced crop yields in central and eastern Europe, while several local authorities ordered prevention measures. Indeed exceptional precipitation during February in northwestern Europe allowed reservoirs to fill to full capacity, and more generally mitigated against the evolution towards a full-scale agricultural or hydrological drought at the end of the spring.

Combined Drought Indicator (CDI)

EDO's Combined Drought Indicator (CDI) is based on the analysis of precipitation, soil moisture and the fraction of Absorbed Photosynthetically Active Radiation (fAPAR). When combined they 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 highlighted.

The CDI from the end of May 2020 reveals the remarkable extent of the dry spell (Figure 1) and for a few core regions, namely: Ireland and the UK, Belgium, the Netherlands and Germany, north-west Balkans and Scandinavia. More peripheral affected areas are located in central Italy, eastern France, Poland, Belarus and Greece. Recovery from drier conditions is detected in parts Romania, Moldavia and north-west Ukraine.

Western and central Europe suffered from droughts in 2018 and 2019, with significant crop damage, water supply restrictions and industrial slow-down due to low river levels. Therefore, the current event marks the third consecutive year of widespread significantly dry conditions over the continent.

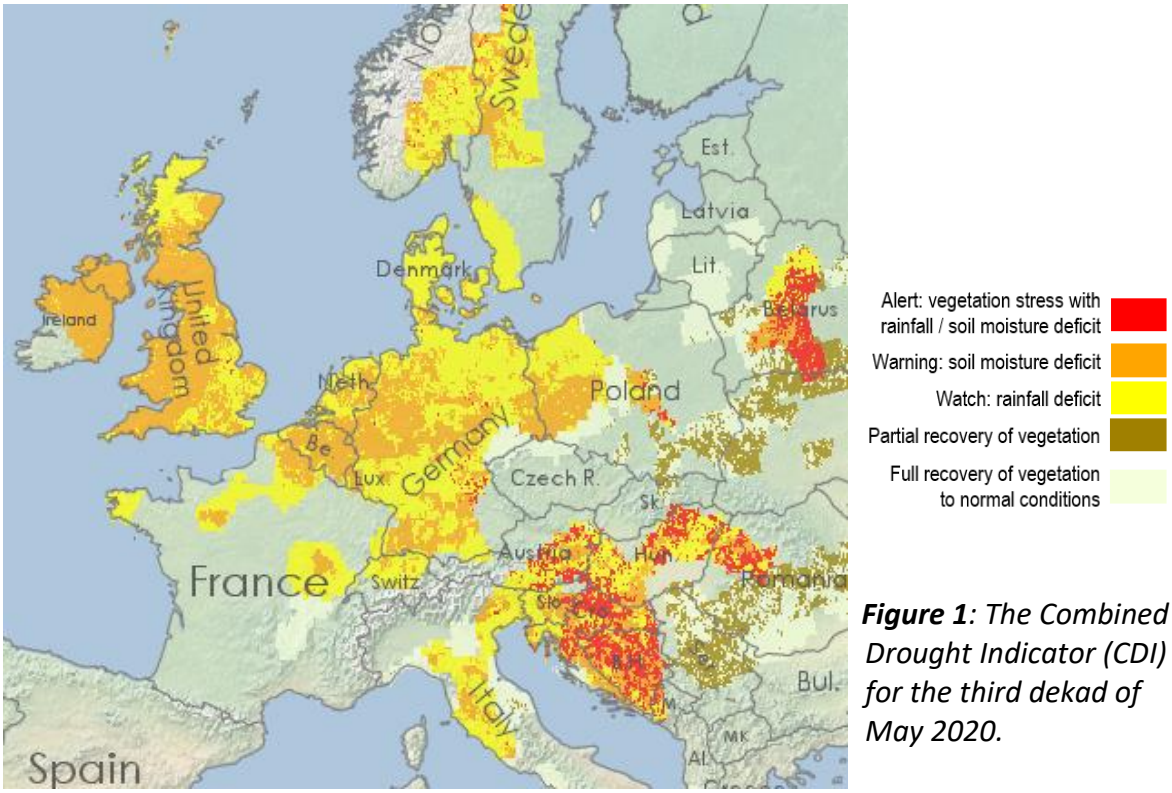


***Figure 1**: The Combined Drought Indicator (CDI) for the third dekad of May 2020.*

Precipitation

Figure 2 shows the monthly precipitation totals for selected locations across affected areas. The first half of 2020 showed two opposite extremes of wet and dry conditions in northwestern Europe (Figure 2, top left and top-right). After a couple of relatively dry months, February recorded as much as twice the average rainfall from the long-term observations (1981-2010) and well beyond the inter-annual variability. In spring, an atmospheric high-pressure system then settled over northwestern and central Europe, bringing far drier than normal conditions for April and May. Due to such a close succession of extremes, the totals accumulated in the longer term do not diverge from the average and do not suggest the occurrence of significant rainfall deficits. In central and eastern Europe precipitation patterns were less unbalanced, recording for both February and May closer to average amounts (e.g.

Figure 2, bottom-right). Germany displays a very wet February, but also a longer sequence of below-average months, resulting in an accumulated precipitation deficit over the last two years (Figure 2, bottom-left, last 18 months only).

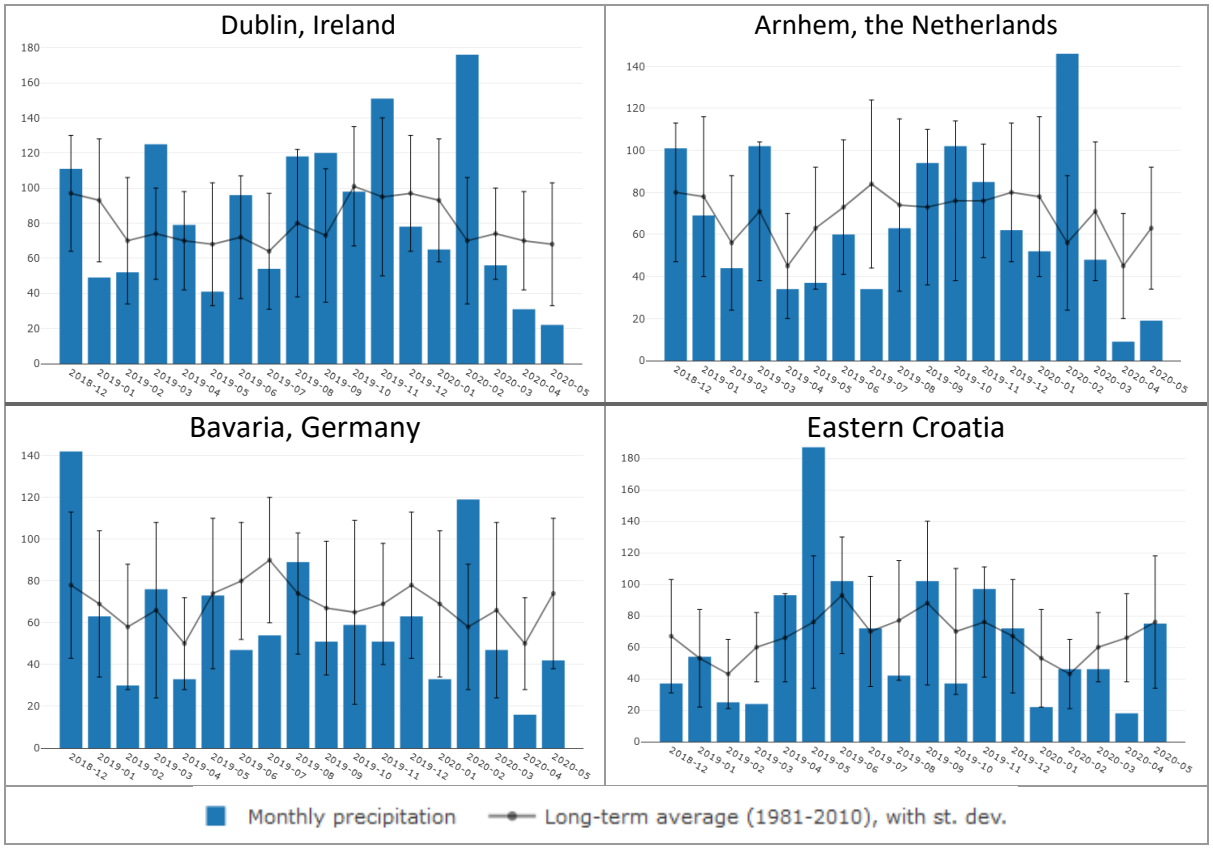


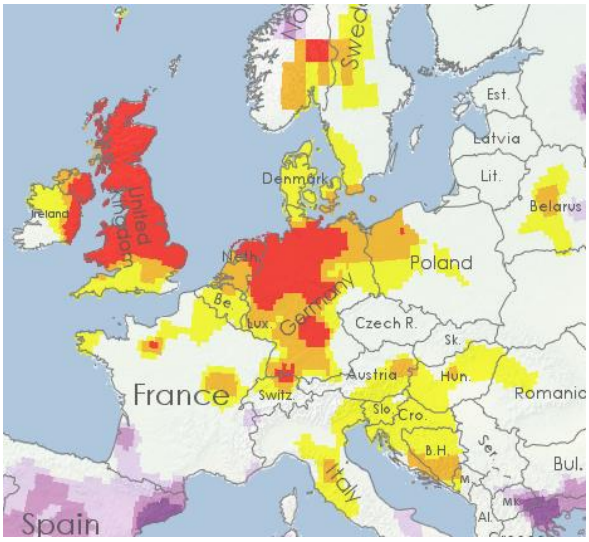
Figure 2: *Monthly precipitation from December 2018 to May 2020 in selected representative locations. Bars show observed monthly precipitation (mm). Lines show the long-term monthly average with one standard deviation.*

Standardized Precipitation Index (SPI)

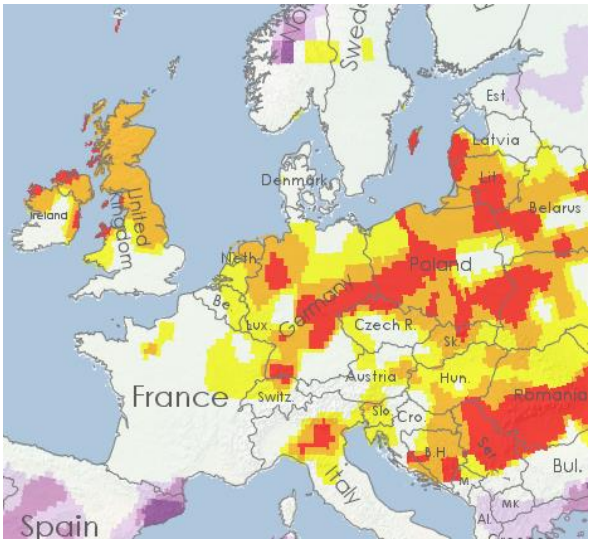
The SPI measures precipitation anomalies based on long-term records, aggregated at different time-scales. The lower (more negative) the SPI, the more intense the drought.

The short term SPI (at time-scale of one and three months) provides the best insight on the current dry spell. The precipitation anomaly from March to May (SPI-3) is extremely low over eastern Ireland, most of the UK, the Netherlands and central to northern Germany (Figure 3, top left). Milder dryness shows up in central Italy and the western Balkan Peninsula. The rainfall deficit built up during April and May only. March was normal everywhere (except Scotland) and February was much wetter than usual in all of the above-mentioned regions (Figure 3, bottom left). Indeed SPI at longer term (e.g. 6 or 9 months, not shown) does not highlight negative anomalies, with winter rainfall compensating for the dry spring.

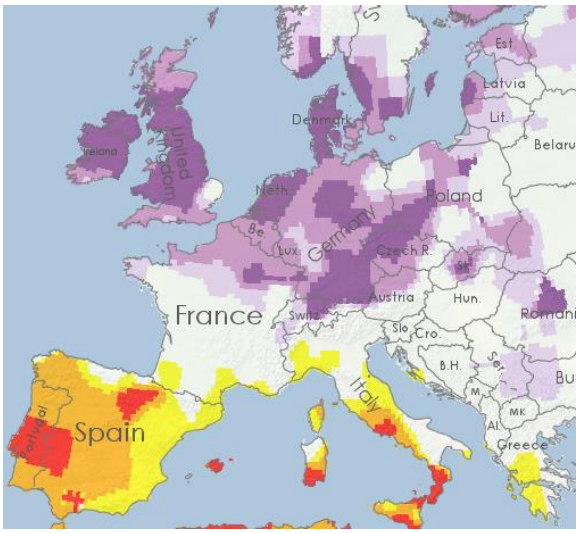
Central and eastern Europe recorded a widespread lack of rainfall in April (Figure 3, top right), less so during May. Southern Europe experienced a remarkably dry February (Figure 3, bottom left), which was later compensated by abundant rainfall over the Iberian Peninsula, while Italy did not fully recover (Figure 3, top-left).



SPI-3, May 2020 (March to May cumulative)



SPI-1, precipitation anomaly for April 2020



SPI-1, precipitation anomaly for February 2020

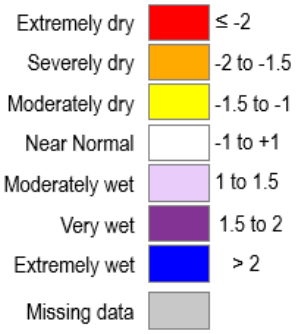


Figure 3: *Standardized Precipitation Index (SPI), showing the precipitation anomalies with respect to the long-term climatological average.*

Temperatures

High temperatures increase massively the evapotranspiration rate of water from the land, and cause much higher water demand for consumption, thus contributing substantially to drought severity, even in the absence of relevant rainfall deficits.

In May 2020, higher than normal temperatures persisted over Ireland, Wales, England and northern France, including a minor heatwave that developed in early April in some of those

areas (Figure 4, left), but were not exceptional, lasting from three to four days. However, eastern Ireland and most of the UK had the sunniest (and driest) May since 1929, and the sunniest spring overall, close to the top records even compared to summer[1] [2] [3]. On the contrary, central and eastern Europe had a rather cold weather during May. Southeastern Europe (Albania, North Macedonia, Greece, Cyprus, Turkey) went through a heatwave in mid-May (Figure 4, right), but the event was not followed by anomalous dry conditions.

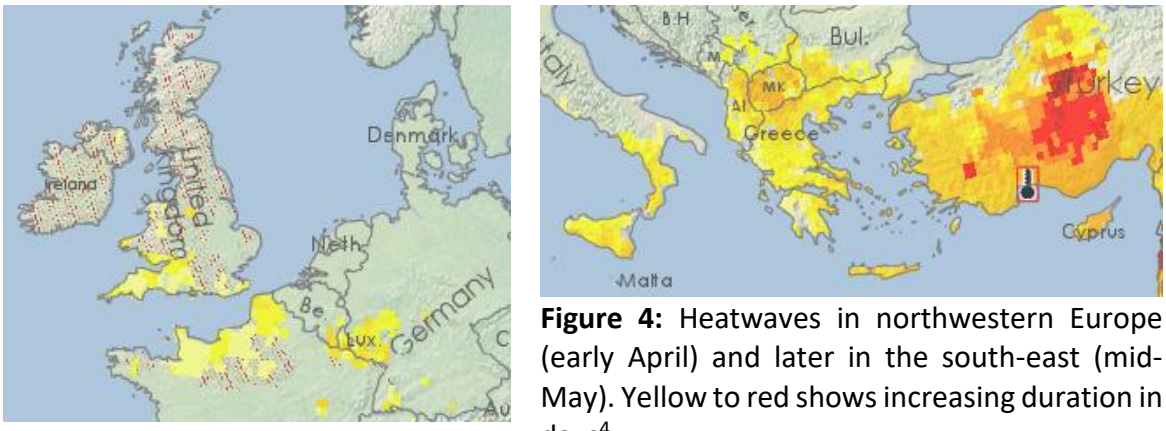


Figure 4: Heatwaves in northwestern Europe (early April) and later in the south-east (mid-May). Yellow to red shows increasing duration in days[4].

Soil Moisture Anomaly (SMA)

EDO's SMA indicator provides 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.

After dropping to the driest category across eastern Europe at the end of April 2020, the SMA recovered partly, thanks to May precipitation. On the contrary, soil moisture stands consistently at very low levels in central and north-west Europe, when looking at the 30-days period, from 10th of May until 10th of June (Figure 5, left).

The forecast of soil moisture to the last days of June shows a widespread improvement and even full recovery over several regions, in agreement with the abundant precipitation forecasted for June (Figure 5, right).

[1] https://climate.copernicus.eu/surface-air-temperature-may-2020
[2] https://cli.fusio.net/cli/bulletin/data/2020/14/sum_142020.pdf
[3] https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2020/2020-spring-and-may-stats
[4] https://edo.jrc.ec.europa.eu/documents/factsheets/factsheet_heatColdWaveIndex.pdf

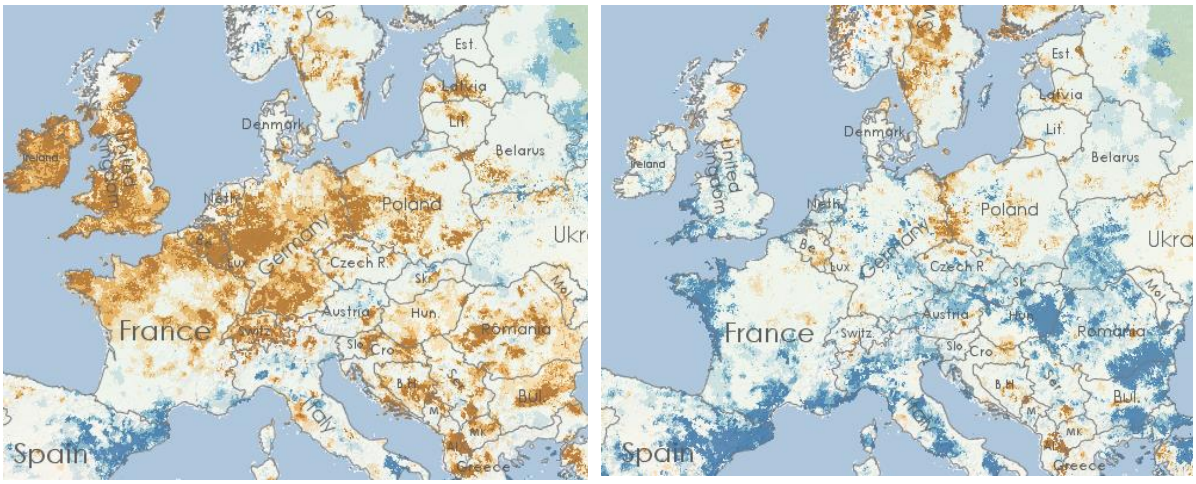


Figure 5: *Soil moisture anomaly (SMA) between 10th of May to 10th of June (left) and forecast up to 24th of June 2020 (right).*

Low Flow Index (LFI)

EDO's LFI indicator of hydrological drought reflects the total water deficit of the river discharge, when the latter drops below a threshold.

The situation improved since late April and early May 2020, when low flow anomalies were widespread across central and eastern Europe (Figure 6, left). In early June, river levels persist below normal for the season in the lower Danube basin and the western Black Sea, as well as river Warta (Poland) and eastern tributaries of Elbe (Figure 6, right).

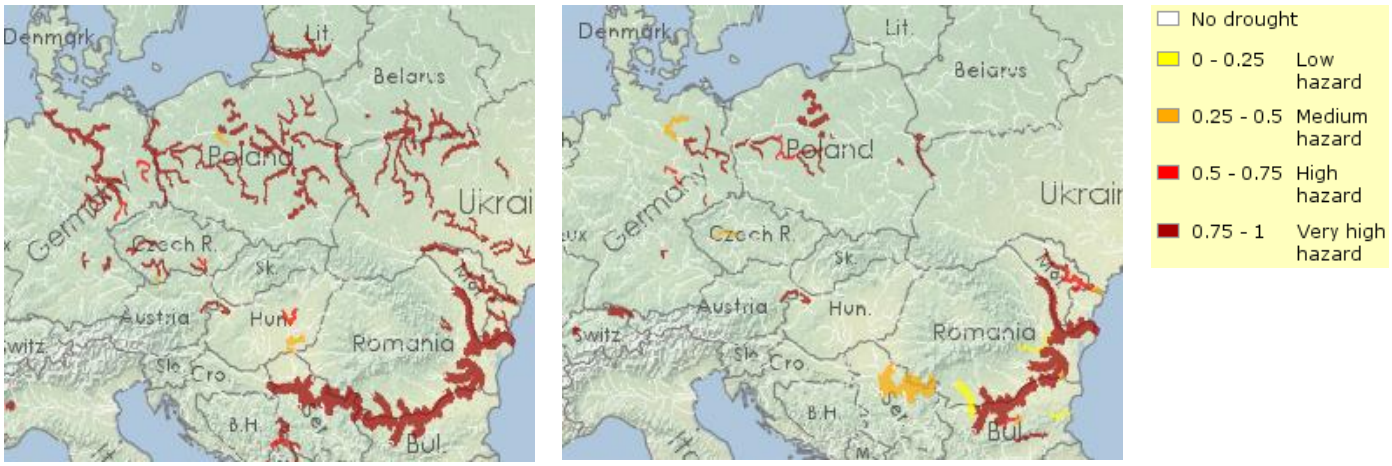


Figure 6: *Low-Flow Index (LFI), first ten days of May (left) and first ten days of June 2020 (right). Thicker lines indicate bigger rivers.*

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.

Figure 7 pictures widespread vegetation stress over fringes of central Europe and a large belt encompassing the Balkans Peninsula up to Russia. The relative greenness of the European north-west appears to defy the ongoing dry spell. Still, it more realistically displays a shift ahead in the growing season, thanks to slightly warmer and wetter weather early on, now already fading away.

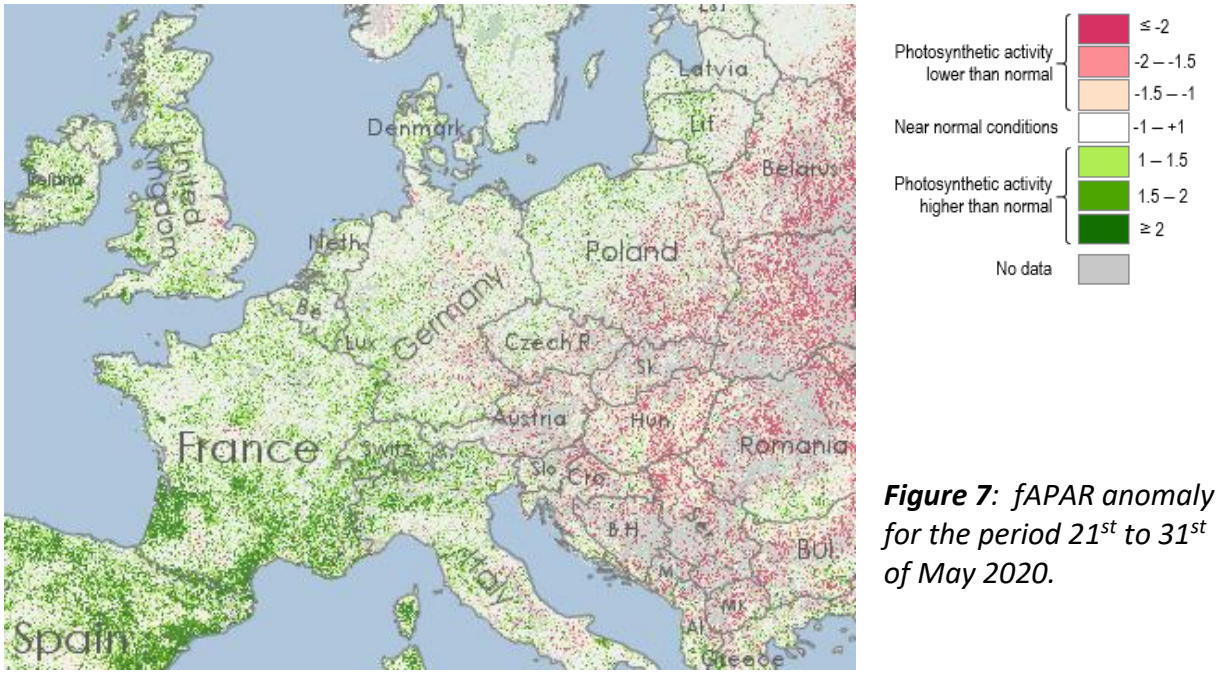


***Figure 7**: fAPAR anomaly for the period 21st to 31st of May 2020.*

SPI outlook

The forecasts of SPI are based on the ECMWF probabilistic seasonal model of precipitation (S5), and the map shows warnings only where the forecast is relatively robust.

No negative precipitation anomalies are forecasted anywhere in Europe for the overall trimester June-August, excepted small parts of Ireland and Italy (Figure 8, right). Instead, abundant precipitation for the period is expected across Europe. Among the countries currently affected by the dry spell, June is forecasted drier than normal solely in Ireland (Figure 8, left). In conclusion, the meteorological dry spell is not expected to intensify any further during the summer and to end at least in central Europe, Italy and southern Scandinavia.

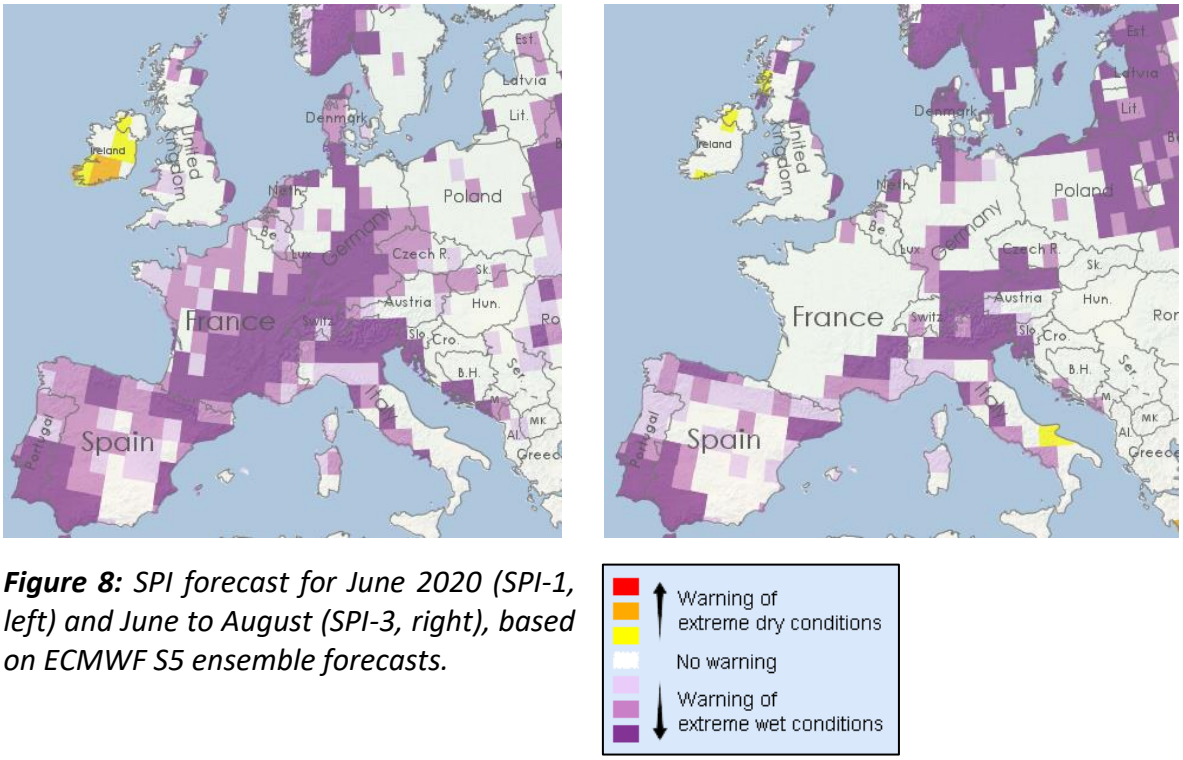


Figure 8: *SPI forecast for June 2020 (SPI-1, left) and June to August (SPI-3, right), based on ECMWF S5 ensemble forecasts.*

Reported impacts

Ireland introduced a hosepipe ban to save water[5] and similar policies are being discussed in the UK[6]. However, water supply is not at risk, as reservoirs were filled up during the previous extremely wet February, and restrictions are mostly precautionary[7].

Concerning agriculture, for crop-specific information and yield forecasts, please refer to the latest JRC MARS bulletins from June 2020[8]. As it reports, there are slightly lower expectations for winter crops in northern France, southern parts of the United Kingdom, Ireland, the Benelux countries, northern and western Germany and western Poland. Winter crops were negatively impacted by the dry conditions in the sensitive stages around flowering or in early grain filling. In eastern Romania and south-eastern Ukraine, drought conditions are still present and winter crops entered the grain filling phase much earlier than usual and under very poor conditions. The Minister of agriculture of Romania gathered claims for over a million hectares of crops affected by the dry spell since April and is preparing relief packages for farmers, but the actual extent of crops affected is yet to be confirmed[9] [10]. In the Netherlands and Belgium there are concerns for agriculture activities without access to river

[5] https://www.irishtimes.com/news/environment/six-week-hosepipe-ban-to-come-into-force-from-tuesday-1.4273066
[6] https://hosepipeban.org.uk/2020/05/29/fears-of-summer-2020-hosepipe-ban/
[7] https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2020/2020-spring-and-may-stats
[8] https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-mars-bulletin-vol28-no6.pdf
[9] https://www.economica.net/adrian-oros-suprafa-a-agricola-afectata-de-seceta-este-1-165-000-de-hectare_185979.html
[10] https://www.economica.net/seceta-extrema-tabara-asas-pierderea-medie-a-productiei-pe-tara-la-culturile-de-toamna-peste-30prc-la-pomii-fructiferi-timpurii-pana-la-70prc_185565.html

waters, despite recent rainfall[11], in particular in the sandy soils in the east and the south of the Netherlands and the north of Belgium[12]. Ecosystem damage was reported due to soil compaction leading to lack of access to food for various protected birds.

No systemic transportation issues, nor industrial water supply interruptions were reported from European rivers. The lower Danube level is currently raising towards its long-term average of mid-June[13] [14]. The Rhine experienced a decrease in flow during May, but it is fully navigable as of mid-June, and water supply is not at risk[15] [16].

[11] https://www.boerderij.nl/Home/Nieuws/2020/6/Problemen-door-droogte-nemen-toe-596159E/
[12] https://waterberichtgeving.rws.nl/LCW/droogtedossier/droogtemonitoren-2020
[13] http://www.inhga.ro/diagnoza_si_prognoza_dunare
[14] http://www.hydroinfo.hu/en/hidelo/hidelo_graf_duna.html
[15] https://www.nieuweoogst.nl/nieuws/2020/06/10/enige-verlichting-maar-droogte-nog-niet-voorbi
[16] https://www.1limburg.nl/droogte-houdt-aan-neerslagtekort-loopt-verder-op

Drought in Europe – June 2020

JRC European Drought Observatory (EDO), 17 June 2020

***Distribution**: For use by the ERCC and related partners, and publicly available for download at EDO website: https://edo.jrc.ec.europa.eu/gdo/php/index.php?id=2050*

***Authors**:*

JOINT RESEARCH CENTRE, Directorate E: Space Security & Migration, Disaster Risk Management Unit

DROUGHT TEAM
Barbosa P.[i] *(Team Leader)*
Masante D.[ii] *(Lead Author)*
Arias Muñoz C.[iii]
Cammalleri C.[i]
De Jager A.[i]
Magni D.[ii]
Mazzeschi M.[iv]
McCormick N.[i]
Naumann G.[i]
Spinoni J.[i]
Vogt J.[i]

[i] Joint Research Centre (JRC) of European Commission
[ii] Arcadia SIT, Vigevano, Italy
[iii] Arhs Development, Milan, Italy
[iv] UniSystems, Luxembourg