

# EDO Analytical Report

## Drought in Central-Northern Europe – July 2018

JRC European Drought Observatory (EDO) and ERCC Analytical Team  
17/07/2018



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### Executive summary

- A relatively short but intense dry spell has affected central and northern Europe since May 2018.
- A combination of little precipitation and sustained above-average temperatures (including heat waves), due to persistent anticyclone conditions, is responsible for the event.
- Concerns are mainly for agricultural production (primarily cereals and hay), while water supply disruptions or restrictions are reported locally. Enhanced fire hazard is broadly reported as well.
- No significant rain is expected until at least mid-July, nor are temperatures forecast to return at normal during the same month.

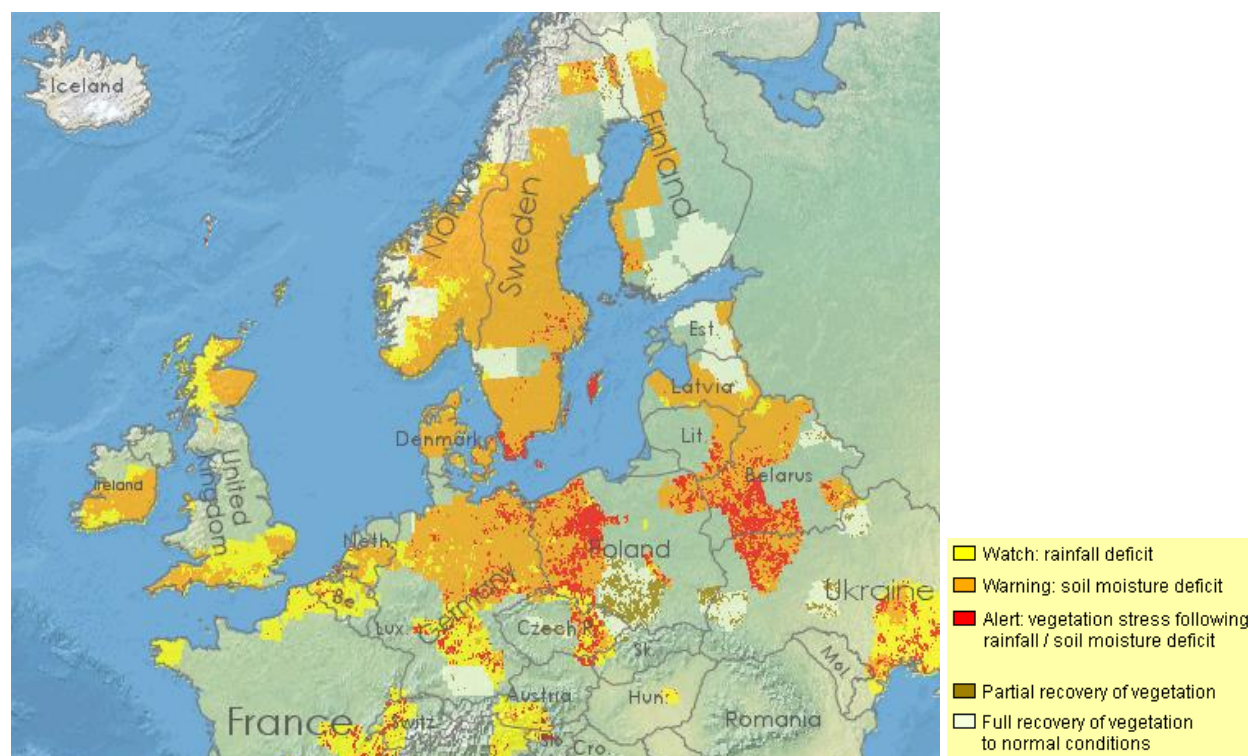
### EDO analysis: Combined Drought Indicator (CDI)

EDO's Combined Drought Indicator (CDI) is based on Standardized Precipitation Index (SPI), soil moisture and the fraction of Absorbed Photosynthetically Active Radiation (fAPAR), to identify areas that are at potential risk to suffer agricultural drought, areas where vegetation is already affected by drought conditions, and areas in the process of recovery to normal conditions after a drought episode. Under the current conditions, the areas affected by drought are widespread across most of central and northern Europe (Figure 1). Specifically, the CDI indicates a high deficit in soil moisture across Scandinavia, Latvia, the Netherlands, northern half of Germany, Scotland and most of Ireland. Western Belarus, western Poland and part of Czech Republic experience an even stronger deficit that is noticeable not just from moisture levels but also vegetation stress.

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**Figure 1:** The Combined Drought Indicator (CDI), from 21<sup>st</sup> to 30<sup>th</sup> June 2018.

### EDO analysis: Precipitation and Standardized Precipitation Index (SPI)

The meteorological variable precipitation includes monthly totals of both rainfall and snow. The SPI indicator monitors the occurrence of meteorological drought. The lower (more negative) the SPI, the more intense is the drought.

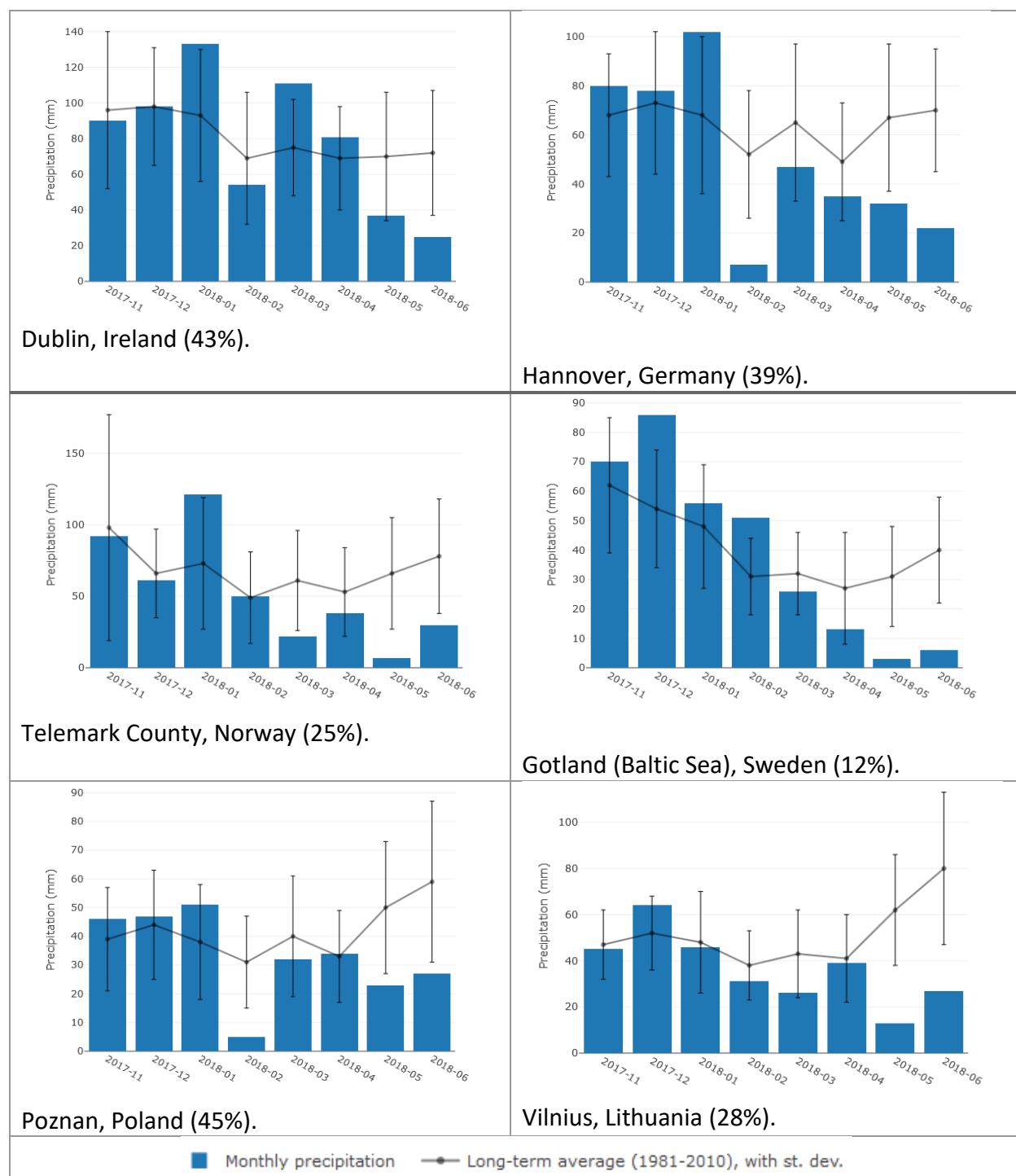
A persistent condition of high pressure (anticyclone) is responsible for the prolonged sunny and dry weather over most of central and northern Europe, from west to east. Rainfall has been consistently below normal during May and June (Figure 2), even considering normal fluctuations, with several regions experiencing poor precipitation also in the preceding months.

Figures 3 and 4 show the SPI situation in June across central and northern Europe. In north-west Europe, the high pressure led to very little precipitation in June, except in Scotland, where there was less rain than usual already in May. The previous months have been at or above average, therefore mid- and long-term SPI do not highlight the current dry spell (Figure 3). However with the one-month SPI (SPI-1) for June - which measures single-month precipitation anomalies - large portions of Ireland and areas on both sides of the English Channel stand out clearly, as a consequence of rainfall at about one third of average for that month (Figure 4).

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**Figure 2:** Monthly precipitation in selected locations. Rainfall percentage compared to the May and June expected average, is shown in parentheses. Bars show monthly observed precipitation (mm), lines show long-term monthly average with standard deviation. Source: EDO.

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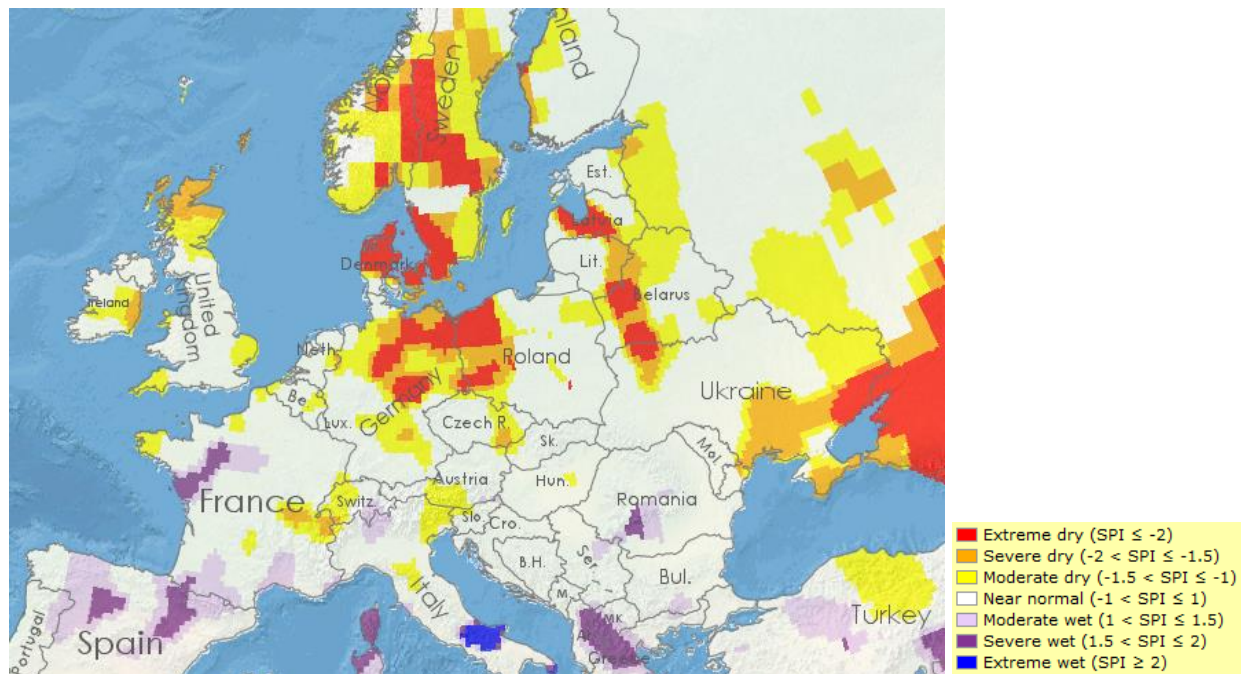
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In Scandinavia, the drought has developed over a slightly longer time-span, from March 2018 onwards. March and May have seen particularly little precipitation, a dryness which is well captured by the three-month SPI (SPI-3) in Figure 3.

On the south-eastern coast of the Baltic Sea and further to central Belarus, both May and June were much drier than normal, although some local fluctuations can be observed. A similar pattern of precipitation, and consequently SPI, in late spring have characterized central Europe (Germany and Czech Republic).



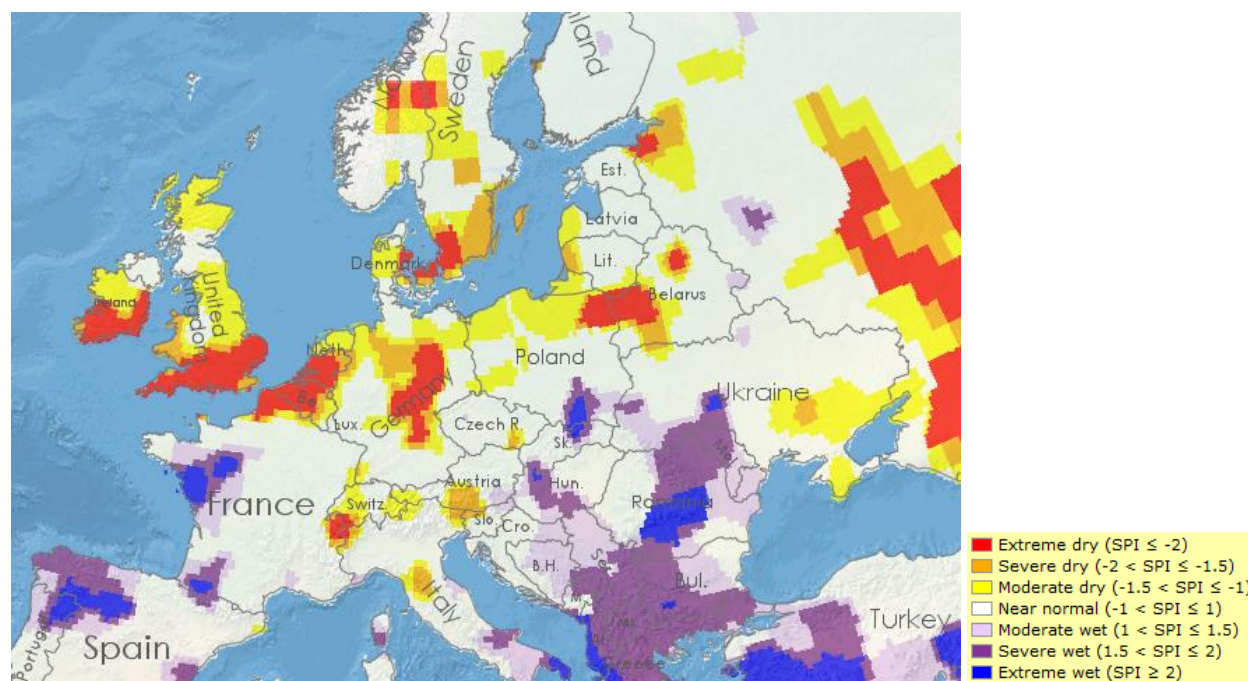
**Figure 3:** SPI for a cumulative period of 3 months (April-June 2018).



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**Figure 4:** SPI for a cumulative period of 1 month (i.e. June 2018 anomaly).

### EDO analysis: Temperature

High temperatures massively increase the rate of evaporation of water from the ground, and cause much higher water demand for consumption. Therefore, heatwaves contribute substantially to drought severity, even in absence of strong rainfall deficits. This is the case for Ireland and Great Britain, where temperatures persisted well above average throughout May and June, with a similar prospect until mid-July at least.

Scandinavia was struck by an enduring heat wave in late May (Figure 5). Southern Norway experienced the warmest May since records began, dating back to 1900<sup>1</sup>, as well as all of Denmark. In both countries the anomalous temperatures persisted in June, and peaked again in early July.

Central and northern Poland also experienced the warmest May in decades, followed by above average temperatures in June, as did most of the northern half of Germany.

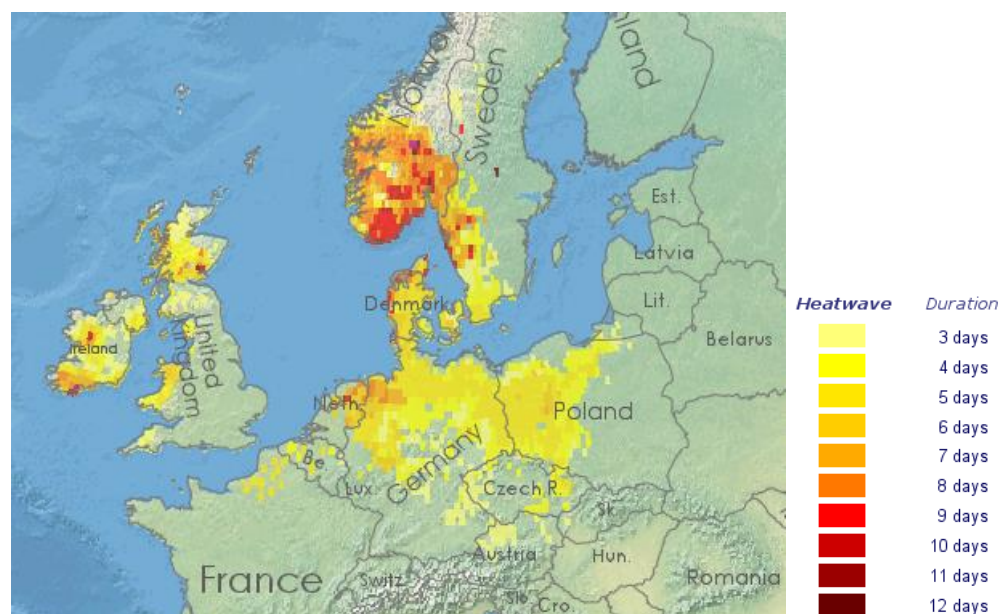
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<sup>1</sup> [https://www.met.no/vaer-og-klima/maanedens-vaer-vs-klima/\\_/attachment/download/f2267506-ef83-444a-b1d0-e0213d117343:9f9941cc5e829f19b34721cb559057f88d8bf47f/MET-info-05-2018.pdf](https://www.met.no/vaer-og-klima/maanedens-vaer-vs-klima/_/attachment/download/f2267506-ef83-444a-b1d0-e0213d117343:9f9941cc5e829f19b34721cb559057f88d8bf47f/MET-info-05-2018.pdf)

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**Figure 5:** Climatological heat wave during second half of May 2018, as of 31<sup>st</sup> May 2018. The heatwave is defined by the number of consecutive days with temperatures above the 95 percentile threshold.

### EDO analysis: Soil Moisture Anomaly (SMA)

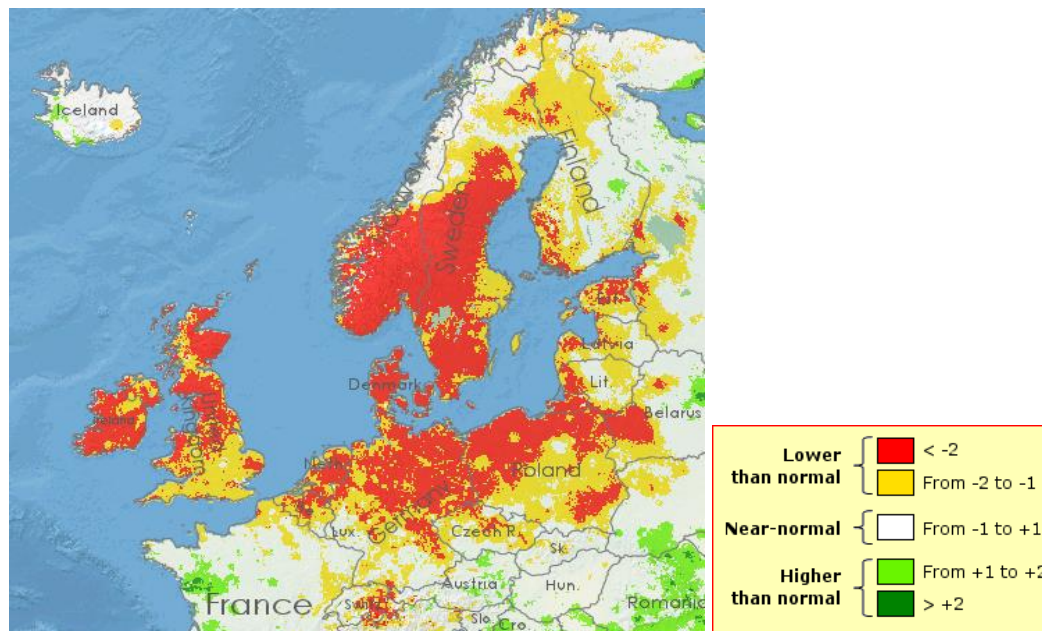
The Soil Moisture Anomaly (SMA) indicator provides an assessment of the top soil water content, which is a direct measure of drought conditions, specifically the difficulty for plants to extract water from the soil.

Figure 6 shows an extensive and severe anomaly on both sides of the Baltic Sea and North Sea, also including Ireland. The heat, sometimes combined with strong winds, quickly depleted the soil moisture through evaporation. These values are very consistent with the news of drought and its impacts reported by the media for the geographical domain of interest. Projections after mid-July (Figure 7) suggest a strong recovery to the south and east of the Baltic Sea, and little or no improvement at all elsewhere.

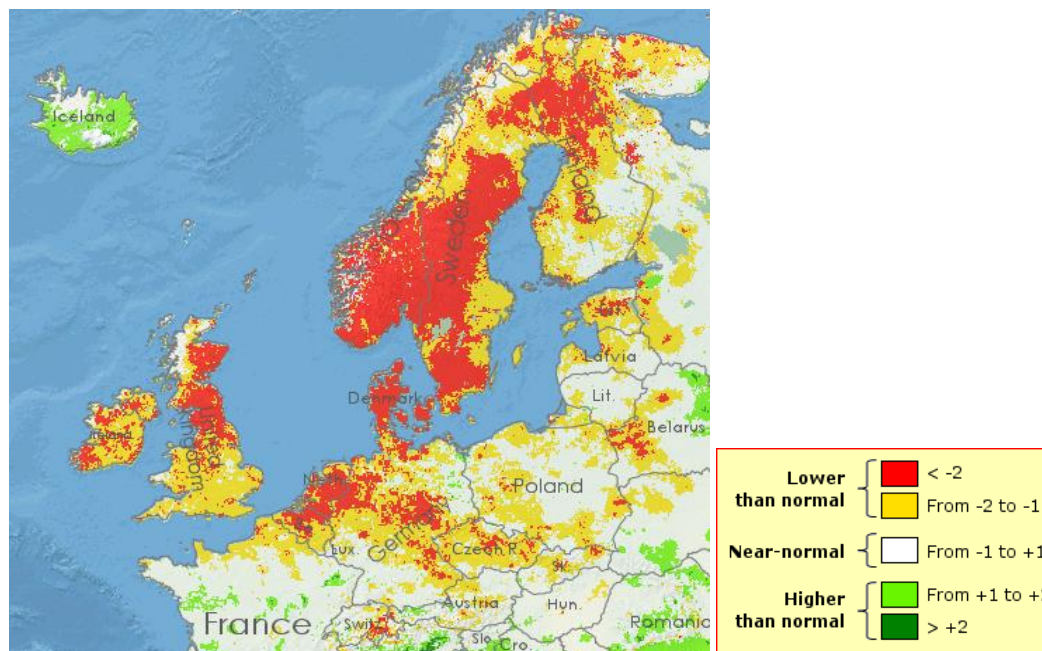
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**Figure 6:** Soil Moisture Anomaly in central and northern Europe, on 10 July 2018.



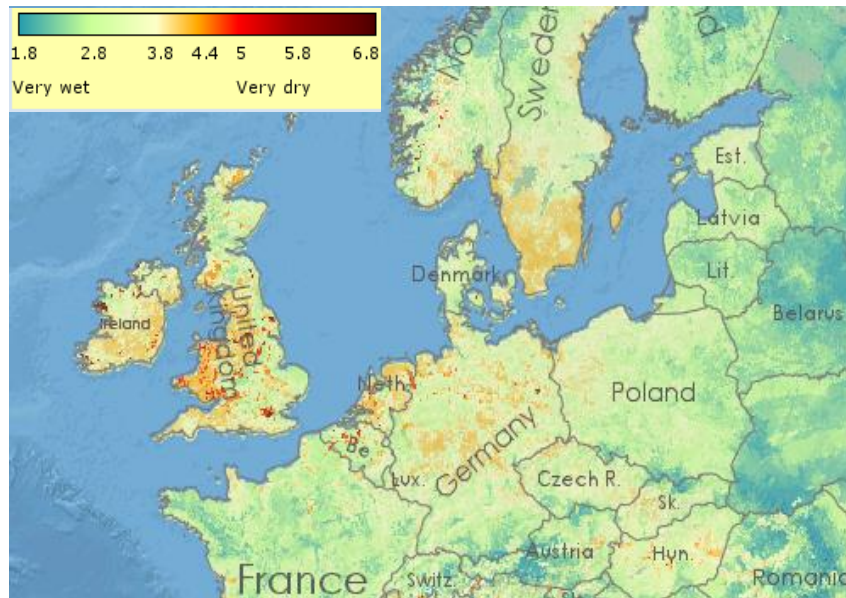
**Figure 7:** Soil Moisture Anomaly in central and northern Europe, projected to 19 July 2018.



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**Figure 8:** Soil moisture levels in central and northern Europe, on 10 July 2018.

### EDO analysis: Low Flow Index (LFI)

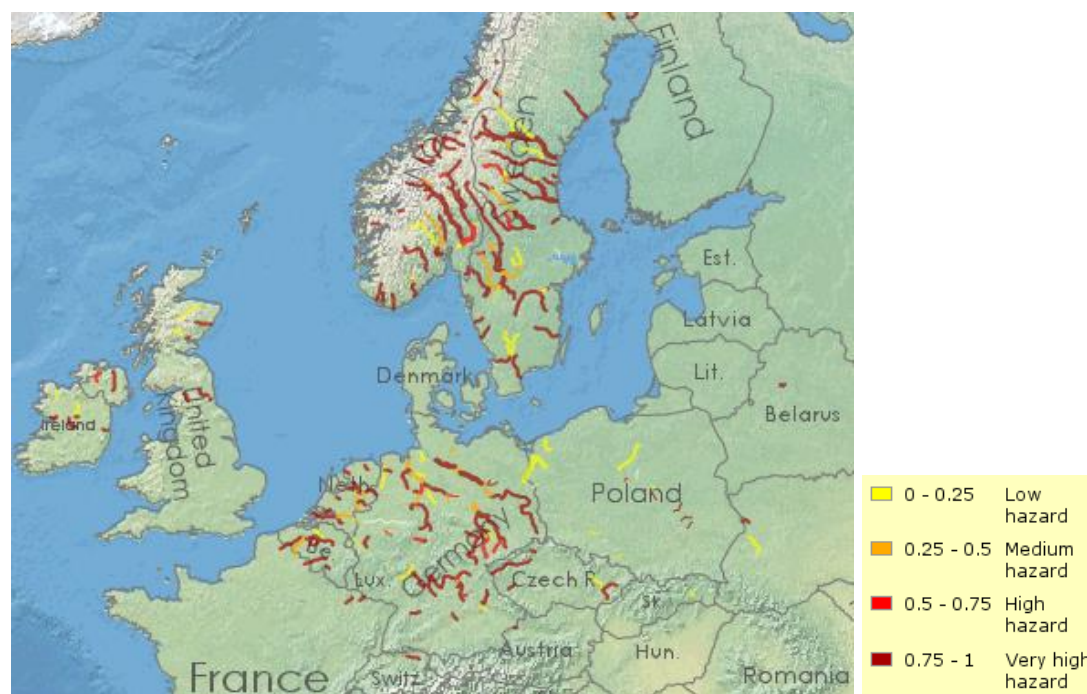
The Low Flow Index is an indicator of hydrological drought, and is based on the total water deficit of the river discharge, when the latter drops below a threshold. Currently the index shows a pattern of low flows across central Europe and the Scandinavian peninsula (Figure 9), extending from events that were rather limited earlier in June. The index is highest for those rivers which have both their source and course lying within the drought-affected areas, whereas it is closer to normal if the source is located outside affected areas. The water levels may further decrease due to the typical delay between a meteorological and hydrological drought.



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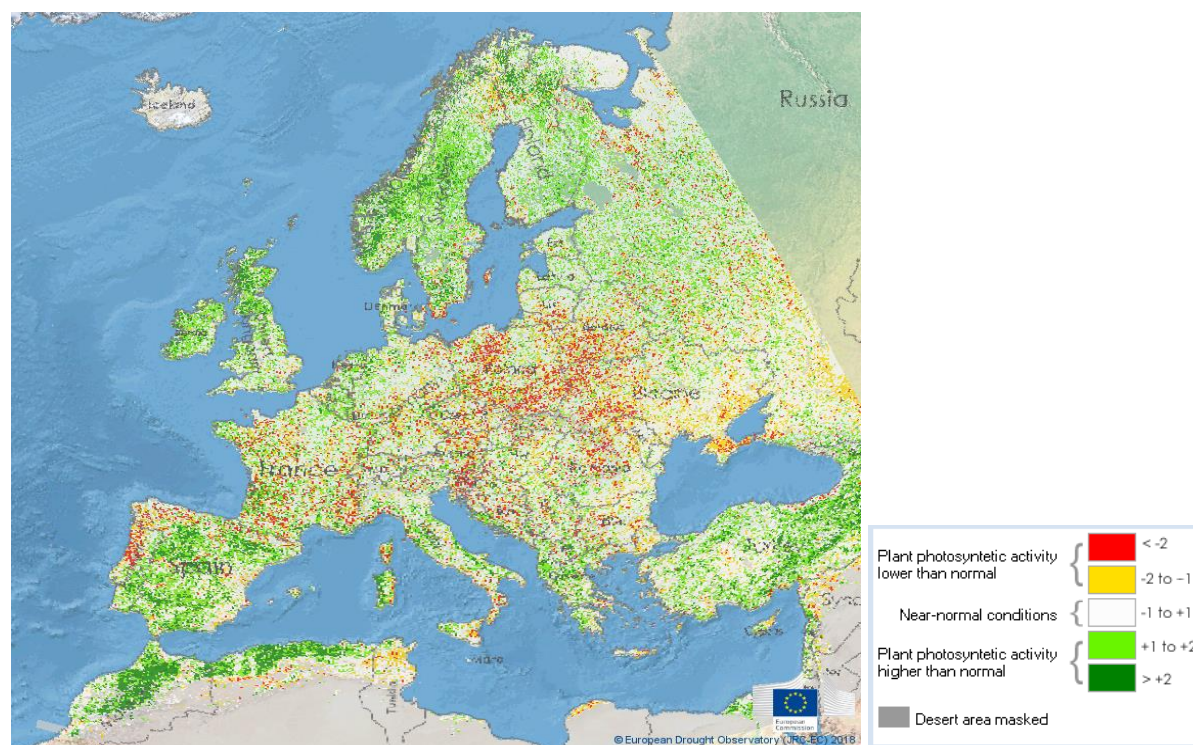


**Figure 9:** Low-Flow Index (LFI), between 1<sup>st</sup> and 10<sup>th</sup> July 2018.

### EDO analysis: Vegetation Productivity (fAPAR) Anomaly

The satellite-measured fraction of Absorbed Photosynthetically Active Radiation (fAPAR) represents the fraction of the sun's energy that is absorbed by leaves. fAPAR anomalies, specifically negative deviations from the long term average, are a good indicator of drought impacts on vegetation (Figure 10).

A negative fAPAR anomaly is particularly evident and consistent in central-eastern Europe, while elsewhere the pattern is less consistent and shows less agreement with current low levels of soil moisture. This discrepancy may be explained by the phenological stage of vegetation. A shift from the long-term average of the start of the growing season might overstate the indicator in one direction or the other. Specifically, in north-west Europe the season started later than usual due to the cold spell in late winter and early spring 2018 (March/April in Scandinavia, February/March in UK and Ireland). Then, the water stress of the current season may be masked by fAPAR values in line with the more advanced stage of the usual vegetation cycle, i.e. the browning stage.



**Figure 10:** fAPAR anomaly for the period 21-30 June 2018.

### Reported impacts of current drought

In all affected countries, the main concerns are related to an enhanced fire hazard and crop yield reductions, particularly cereals in the Baltic area and islands across the English Channel (mainly wheat), and fruit / horticulture in continental Europe. Farmers associations from several countries have raised common concerns about the 2018 harvest season<sup>2</sup>.

In Ireland, both water supply and crops are causes for concern. In the Dublin area, as well as in Northern Ireland, water restrictions such as hosepipe bans have been enforced<sup>3 4</sup>. In both areas, farmers are predicting significant yield reductions<sup>5 6</sup>. In Great Britain, no issues are envisaged for

<sup>2</sup> <https://www.pressandjournal.co.uk/fp/business/farming/1513785/eu-farmers-unions-call-for-help-over-drought/>

<sup>3</sup> <https://www.rte.ie/news/weather/2018/0629/974079-weather-ireland/>

<sup>4</sup> <https://www.niwater.com/major-incident.aspx>

<sup>5</sup> <https://www.independent.ie/business/farming/tillage/yield-expectations-are-low-in-some-crops-tillage-expert-details-options-for-farmers-as-drought-hits-sector-37079213.html>

<sup>6</sup> <https://www.belfasttelegraph.co.uk/news/northern-ireland/northern-ireland-farmers-hoping-for-rain-as-heatwave-threatens-to-destroy-crops-37077783.html>

water supply, as abundant spring precipitation replenished reservoirs to full capacity<sup>7</sup>. However, there are concerns for rainfed pasturelands and crops in Scotland<sup>8</sup>.

In Norway, water restrictions were imposed around Oslo<sup>9</sup> and electricity prices are expected to rise, due to the high dependency on hydropower<sup>10</sup>. In Denmark, open-air fires have been banned since May to reduce fire hazard, while in July water restrictions were enforced for irrigation<sup>11</sup>, as the national drought indicator by the Meteorological Institute went off-scale<sup>12</sup>. Tax relief for farmers are being considered, as some sources claim damages up to about 600 million euros<sup>13</sup>. Sweden is facing a high fire hazard, with ongoing fires due to the dry and hot weather<sup>14</sup>. Also, Swedish wheat export may shrink due to an estimated harvest reduction up to 20 percent of the five-year average<sup>15</sup>.

On the south and east side of the Baltic Sea, the reported impacts concerned primarily agriculture. Lithuania's government declared a state of emergency for agriculture, due to the ongoing drought, estimating losses at one third of the expected harvest<sup>16</sup>. In Latvia the current drought was acknowledged officially as a natural disaster of a national scale<sup>17</sup>. In Poland, grain production was damaged, although exact quantifications of losses are not available to date. Some estimates put the losses between 5-25% compared to 2017 harvest<sup>18 19</sup>. In Germany, the farmers association lowered the grain harvest expectations to 20 percent less compared to the last five-year average<sup>20</sup>. Similar percentages of yield loss were suggested for Czech Republic<sup>21</sup>. Farmers in Belgium and the Netherlands have had minor losses, thanks to irrigation, but the dry spell was as strong as in the rest of central and northern Europe and prices are predicted to rise<sup>22</sup>.

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<sup>7</sup> <https://www.ft.com/content/a0dd8ba6-8044-11e8-8e67-1e1a0846c475>

<sup>8</sup> <https://www.bbc.com/news/uk-scotland-44708074>

<sup>9</sup> <http://www.newsenglish.no/2018/05/28/oslo-suddenly-faces-a-water-shortage/>

<sup>10</sup> <https://www.reuters.com/article/us-norway-power-prices/warmest-may-since-1900-to-cost-norwegians-2-34-billion-more-for-power-this-year-idUSKBN1K0257>

<sup>11</sup> <https://www.b.dk/nationalt/offentligt-vandingsforbud-indfoert-i-toerkeplagede-koebenhavn>

<sup>12</sup> <https://www.dmi.dk/nyheder/arkiv/nyheder-2018/juli/ekstremt-hoejt-toerkeniveau-fortsætter/>

<sup>13</sup> <https://www.thelocal.dk/20180705/denmark-considers-political-relief-for-drought-hit-farmers>

<sup>14</sup> <https://www.thelocal.se/20180702/sweden-hit-by-a-wave-of-forest-fires>

<sup>15</sup> <https://www.reuters.com/article/us-europe-grains-harvest/eu-baltic-sea-region-wheat-crops-suffer-from-drought-idUSKBN1JB1WA>

<sup>16</sup> [https://www.baltictimes.com/lithuanian\\_govt\\_declares\\_nationwide\\_state\\_of\\_emergency\\_over\\_drought/](https://www.baltictimes.com/lithuanian_govt_declares_nationwide_state_of_emergency_over_drought/)

<sup>17</sup> <https://eng.lsm.lv/article/politics/politics/latvian-officials-choose-natural-disaster-over-state-of-emergency.a283426/>

<sup>18</sup> <http://www.businessinsider.com/r-eu-baltic-sea-region-wheat-crops-suffer-from-drought-2018-6?IR=T>

<sup>19</sup> <https://sivpost.com/the-drought-destroyed-in-poland-a-quarter-of-the-grain-harvest/3596/>

<sup>20</sup> <https://www.agweb.com/article/german-farmers-expect-poor-harvest-amid-drought-record-heat/>

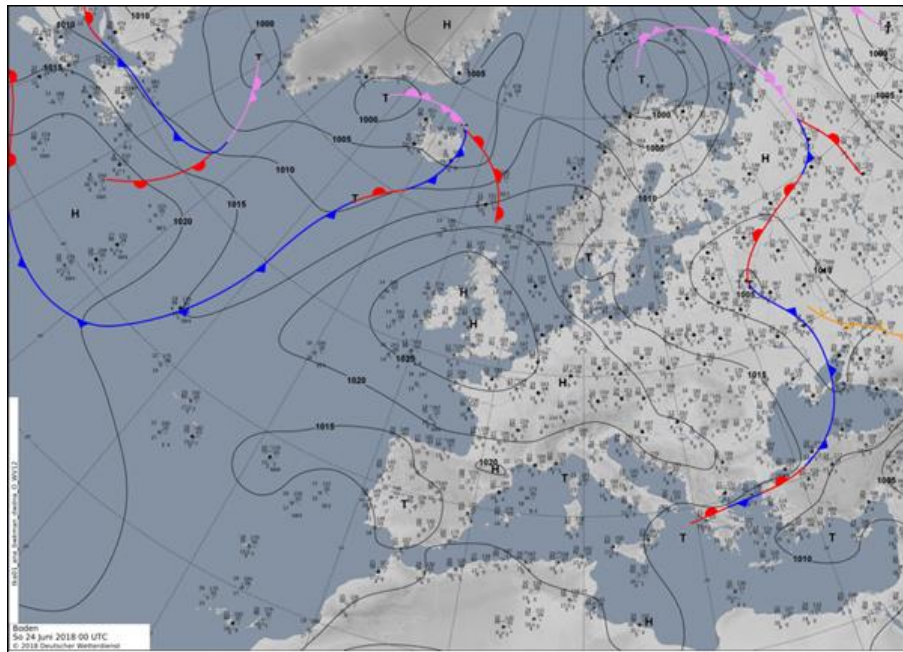
<sup>21</sup> <http://www.intersucho.cz/en/?map=3&from=2018-06-13&to=2018-07-11&current=2018-07-05>

<sup>22</sup> <http://www.freshplaza.com/article/197769/Northern-Europe-dry,-Southern-Europe-hit-by-hail>

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**Figure 11:** High pressure system on 24 June 2018. Source <https://www.met.ie/recent-warm-weather-report-up-to-6th-july-2018>

### Information sources

- European Drought Observatory (EDO) - European Commission, Joint Research Centre
- Global Drought Observatory (GDO) - European Commission, Joint Research Centre
- Met Éireann - Irish Meteorological Service
- Intersucho ([www.intersucho.cz/en/](http://www.intersucho.cz/en/))



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**Authors:** Masante D., Barbosa P., McCormick N. (DG JRC, European Commission)

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