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Drought in Europe July 2024

GDO Analytical Report

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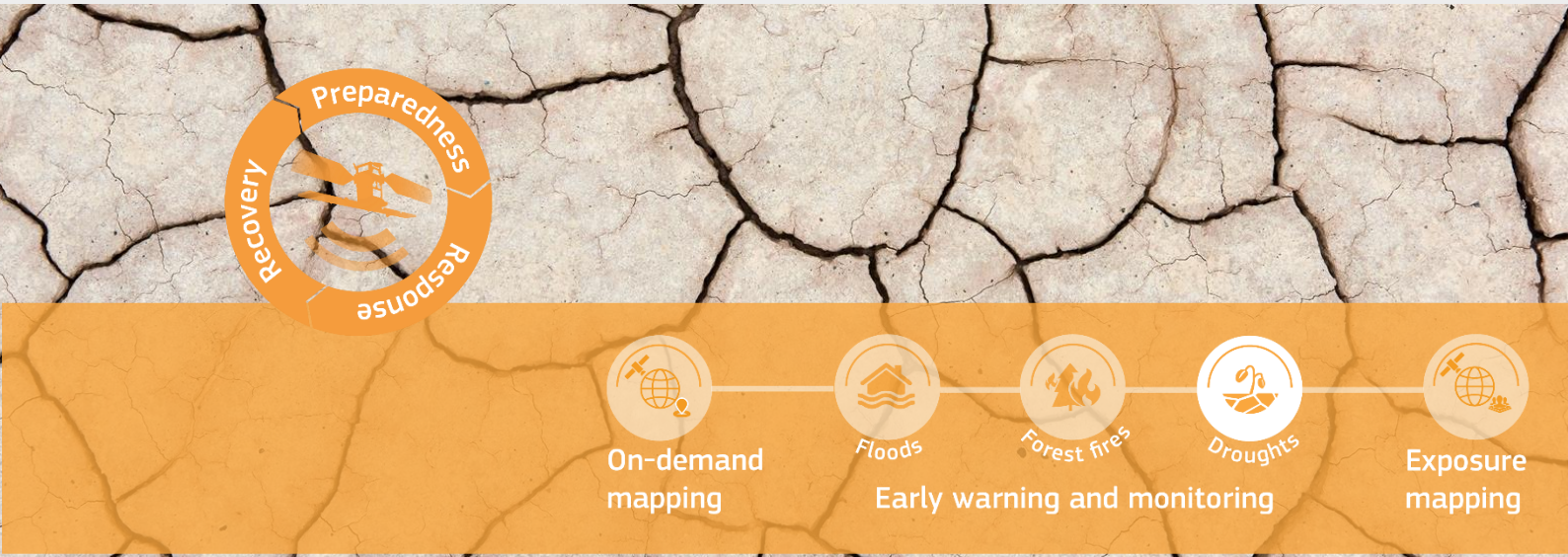
Copernicus Europe's eyes on Earth

Emergency Management Service

2024



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Drought in Europe - July 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) – GDO/EDO data up to 18/07/2024

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Abstract

- After severe and prolonged droughts that affected northern Africa during the last 6 years and Europe for over 2 years, drought conditions are back again in large parts of Europe, particularly in the Mediterranean region, eastern Europe and the Baltic countries.
- Recent above-average temperatures and heatwaves in Scandinavia, Baltic, and the eastern Mediterranean regions exacerbated the effect of the prolonged lack of precipitation.
- Above-average temperatures have directly affected soil moisture and vegetation growth, with severe impacts in northern Africa, coastal regions of Spain, and most of the Mediterranean islands.
- Wildfire danger varies from high to extreme over most of southern and eastern Europe as well as in northern Africa.
- Seasonal forecasts point to a warmer and slightly drier than average summer 2024, compared with long-term records, particularly in southern Europe.

Combined Drought Indicator (CDI)

After the extremely hot and dry conditions in 2022 and 2023, warm and dry conditions are again affecting many regions in Europe during the spring and summer of 2024.
Most of the Mediterranean region is yet to recover from the previous years' droughts, reporting severe impacts on crops and vegetation growth. In eastern Europe, a widespread severe drought is quickly developing since the late spring of 2024.

In terms of availability of water resources, the most critical conditions are in southern and south-eastern Europe.

The Combined Drought Indicator (CDI)[1] for early July 2024 (Fig. 1)[2] shows warning drought conditions in eastern Spain, most of southern and central-eastern Italy, most of Romania, Poland, southern Baltic region, most of Greece, most of the Balkans, western Cyprus, Malta, several Mediterranean islands, and wide regions in Türkiye. Watch conditions are identified in the southern Iberian Peninsula and regions in eastern Europe due to a recent precipitation deficit.
Recovery conditions are observed sparsely in central-eastern Europe and Scandinavia due to recent precipitation that contributed to alleviate some of the potential impacts from drought.

Several areas of Scandinavia, most of the United Kingdom, Ireland, the central and the north-eastern Iberian Peninsula, most of France, Benelux, Germany, most of Hungary, Switzerland, Austria, Czechia, and Slovakia show recovery or near-normal conditions. Over-wet conditions in areas such as north-eastern France, Benelux, southern Germany, and northern Italy lead to impacts on crop conditions.
Large areas in the Mediterranean region, particularly in central and southern Italy, north-western Spain, Greece, and central-western Türkiye, are currently under alert drought conditions and already show impacts on

[1] For more details on the CDI, and the other GDO and EDO indicators of drought-related information used in the report, see the Appendix at the end of the document.

[2] Note that the results of the CDI computation are affected by a few data quality issues related to the meteorological forcing (precipitation data from ground weather stations) of the hydrological model used to produce the soil moisture component of the CDI. This is particularly relevant in northern Italy (e.g. the Po river basin). The indicators will be reprocessed as soon as possible but the process of data correction and re-run of the model will take several weeks. As drought conditions detected in the affected regions should not be considered reliable, the CDI data has been post-processed by filtering out any detected drought for the pixels where SPI-3 is above 1.0 (corresponding to wetter than normal conditions over the last months).

vegetation growth. Prolonged alert drought conditions and significant impacts on vegetation growth have been identified in northern Morocco, Algeria, and Tunisia. Alert conditions are progressively and intensively affecting eastern Europe as well, particularly Ukraine, Romania, and Southern Russia. In the Rostov Oblast a drought emergency has been declared.

The evolution of the CDI (Fig. 2)[2] shows stable and dry conditions over the Mediterranean regions and eastern Europe since late May 2024. Warning conditions, connected to dry soil moisture, were detected over most of southern and eastern Europe in late May 2024 and remained stable except for partial and local recovery in some spots in eastern Europe. Alert conditions with impact on vegetation and crops have been hitting Mediterranean in the last few years and have expanded in eastern Europe reaching the maximum extent in late June 2024. In Scandinavia and north-eastern Europe, the alternance between watch and recovery conditions is due to discontinue and inhomogeneous precipitation patterns leading to short and local meteorological droughts. Central and western Europe are under wetter-than-average conditions.

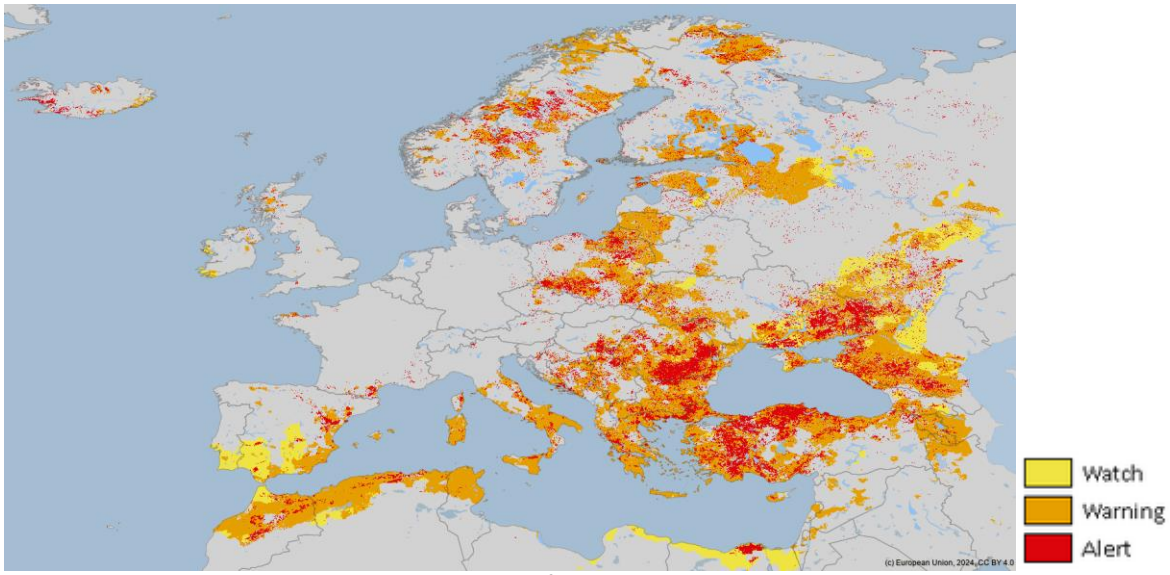

Figure 1: The Combined Drought Indicator (CDI)[2], based on a combination of indicators of precipitation, soil moisture, and vegetation conditions, for early July 2024.[1]

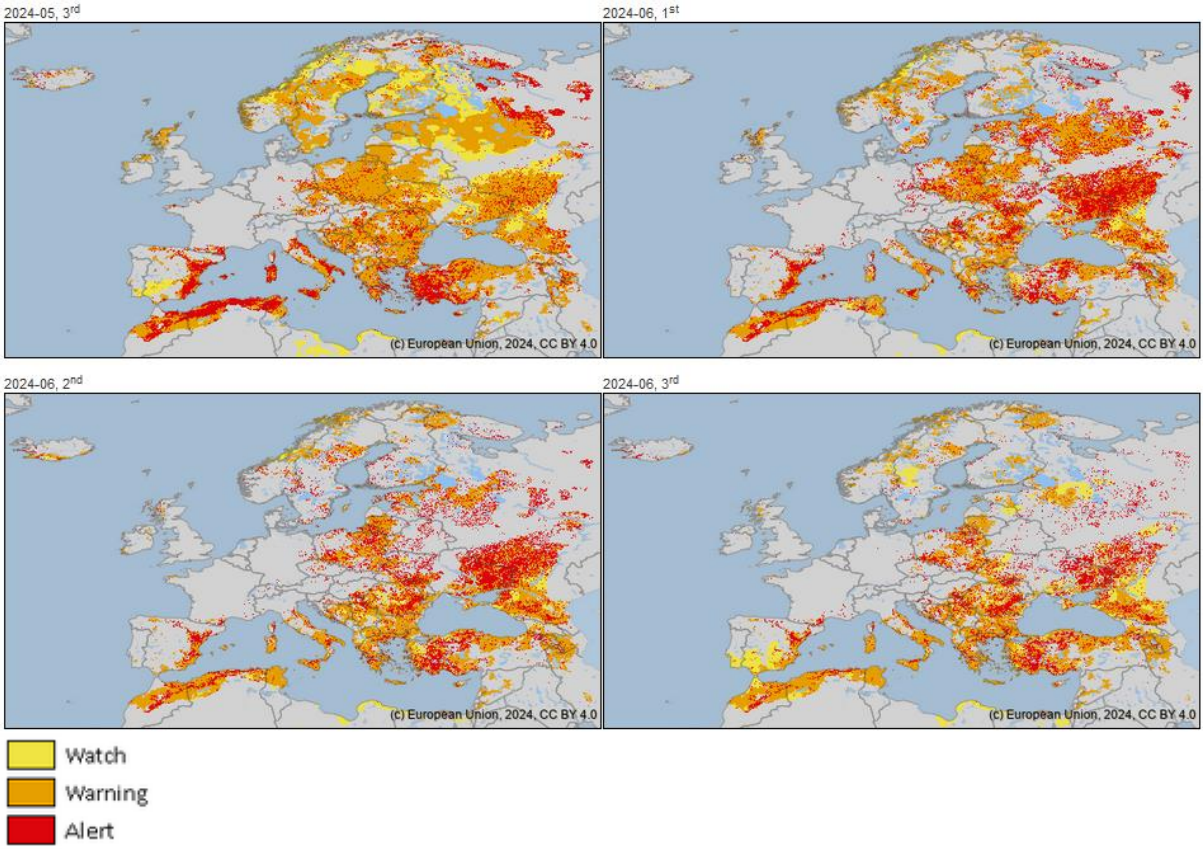

Figure 2: The Combined Drought Indicator (CDI)[2], based on a combination of indicators of precipitation, soil moisture, and vegetation conditions, from late May to late June 2024.[1]

Standardized Precipitation Index (SPI)

In early July 2024, SPI-3 (i.e. SPI computed for an accumulation period of 3 months)[3] shows normal or wetter than normal conditions over most of central Europe including mainly France, Germany, the Netherlands, Belgium, Denmark, Switzerland, northern Italy, and western Austria. Dry anomalies are detected along most coastal regions of the Mediterranean, northern Türkiye, central Romania, eastern Ukraine, and south-western Russia. (Fig. 3).

Similar and stable precipitation anomaly patterns have been observed since late May 2024 determining the exacerbation of the prolonged and severe drought in the Mediterranean and the quick onset and worsening of meteorological drought conditions in the eastern European regions (Fig. 4).

[3] For more details on the SPI, and the other GDO and EDO indicators of drought-related information used in this report, see the Appendix at the end of the document.

Drought in Europe - July 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) – GDO/EDO data up to 18/07/2024

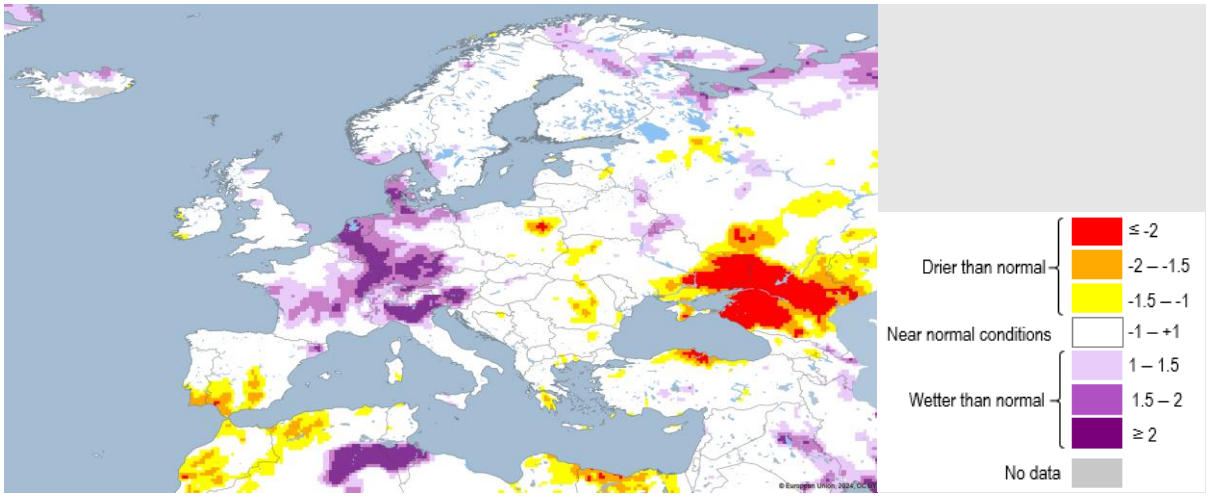

Figure 3: Standardized Precipitation Index (SPI-3), for the 3-month accumulation period ending in early July 2024.[3]

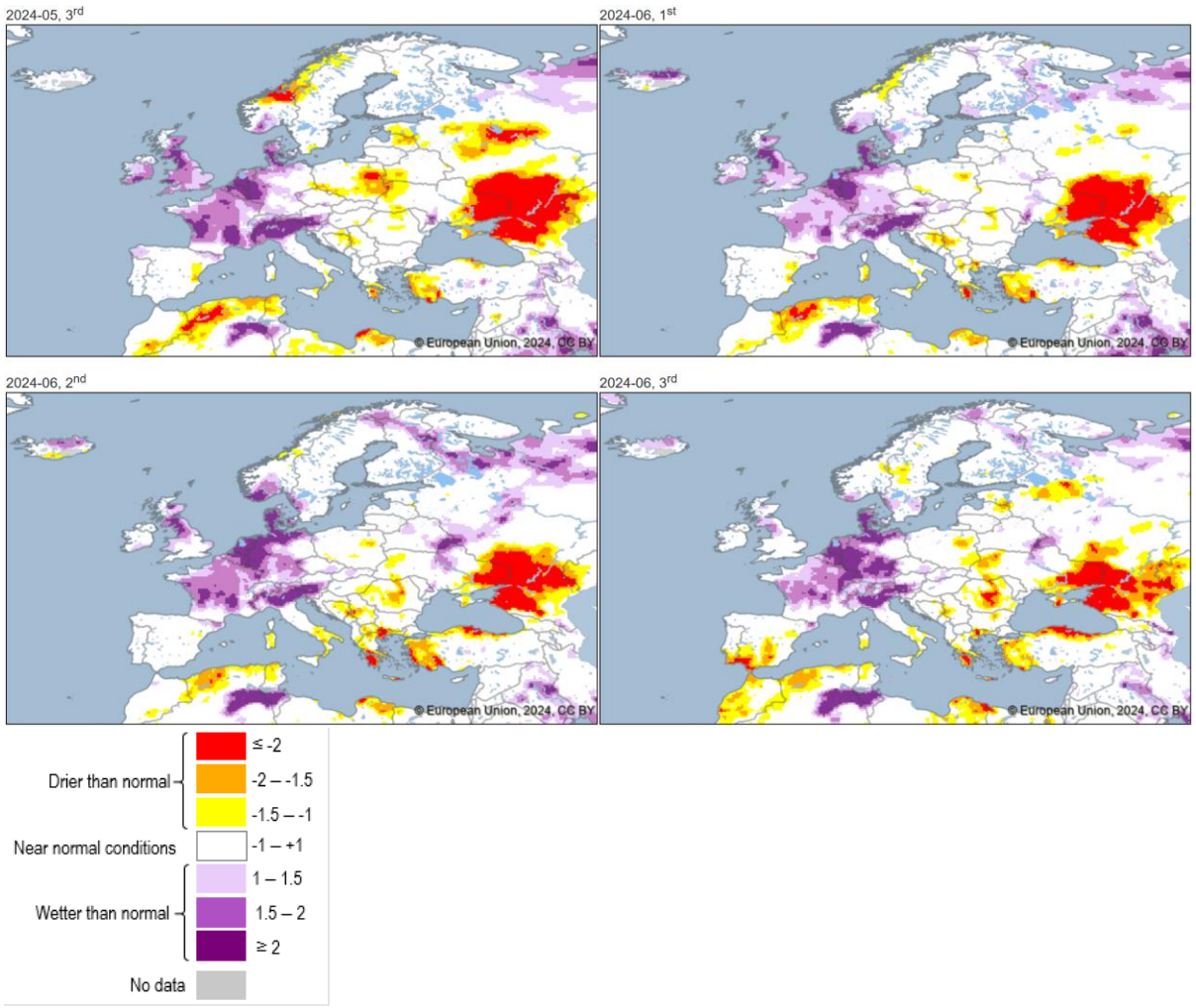

Figure 4: Standardized Precipitation Index (SPI-3) for the 3-month accumulation period from late May to late June 2024.[3]

Temperature

During spring and the beginning of summer 2024, most of Europe experienced above-average temperatures. In May 2024 (Fig. 5a), positive temperature anomalies affected mostly the southern parts of the Mediterranean region, with anomalies above 1.5 °C, as well as Scandinavia and the Baltic Sea regions with anomalies above 2.5 °C. While the northern Iberian Peninsula, central and southern France, the Alps, northern Italy, and south-eastern Europe were mostly experiencing a wetter and cooler May. In June 2024 (Fig. 5b), warm positive anomalies were observed over almost the entire eastern Europe and were exacerbating in central-southern and eastern Mediterranean regions, with very large areas experiencing anomalies above 2.5 °C. These temperatures anomalies recorded in June 2024 have resulted in the warmest than any previous June at the global scale, and the average European temperature was over 1.5 °C the 1991-2020 average for June, according to the Copernicus Climate Change Service.[4]

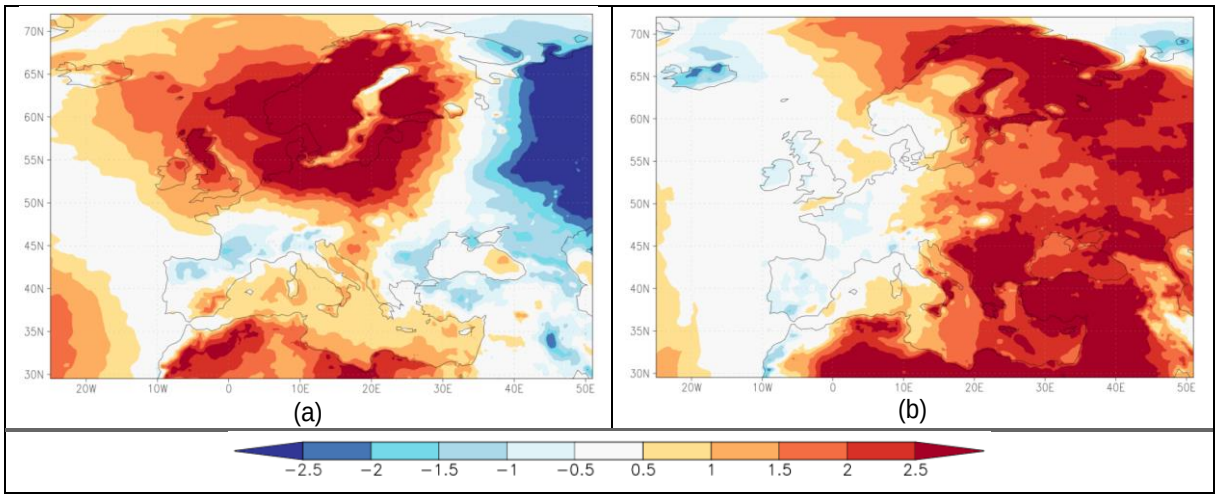

Figure 5: Average temperature anomalies (ERA5, baseline 1991-2020) in 2024, computed for (a) May and (b) June. Source: The KNMI Climate Explorer.[5]

A sequence of heatwave events also hit Scandinavia, the Baltic, eastern Europe, and the eastern Mediterranean regions. Record-breaking intense heatwave events, with a duration longer than two weeks, have been observed over Finland, Estonia, Ukraine, Romania, Moldova, Bulgaria, the Balkans, Greece, Cyprus and south-western Türkiye (Fig 6b). Indeed, south-western Türkiye and Cyprus have been hit throughout June by a particularly intense and long-lasting heatwave event (Fig. 6a). As shown by the Heat and Cold Wave Index (HCWI)[6], other regions that have been affected by relatively intense and long-lasting heatwave events are northern Bulgaria, Romania, Moldova, western Ukraine, Albania, northern Libya, and southern Finland (Fig. 6a).

[4] https://climate.copernicus.eu/climate-bulletins
[5] The KNMI Climate Explorer: https://climexp.knmi.nl
[6] For more details on the Heat and Cold Wave Index (HCWI), and the other GDO and EDO indicators of drought-related information used in this report, see the Appendix at the end of the document.

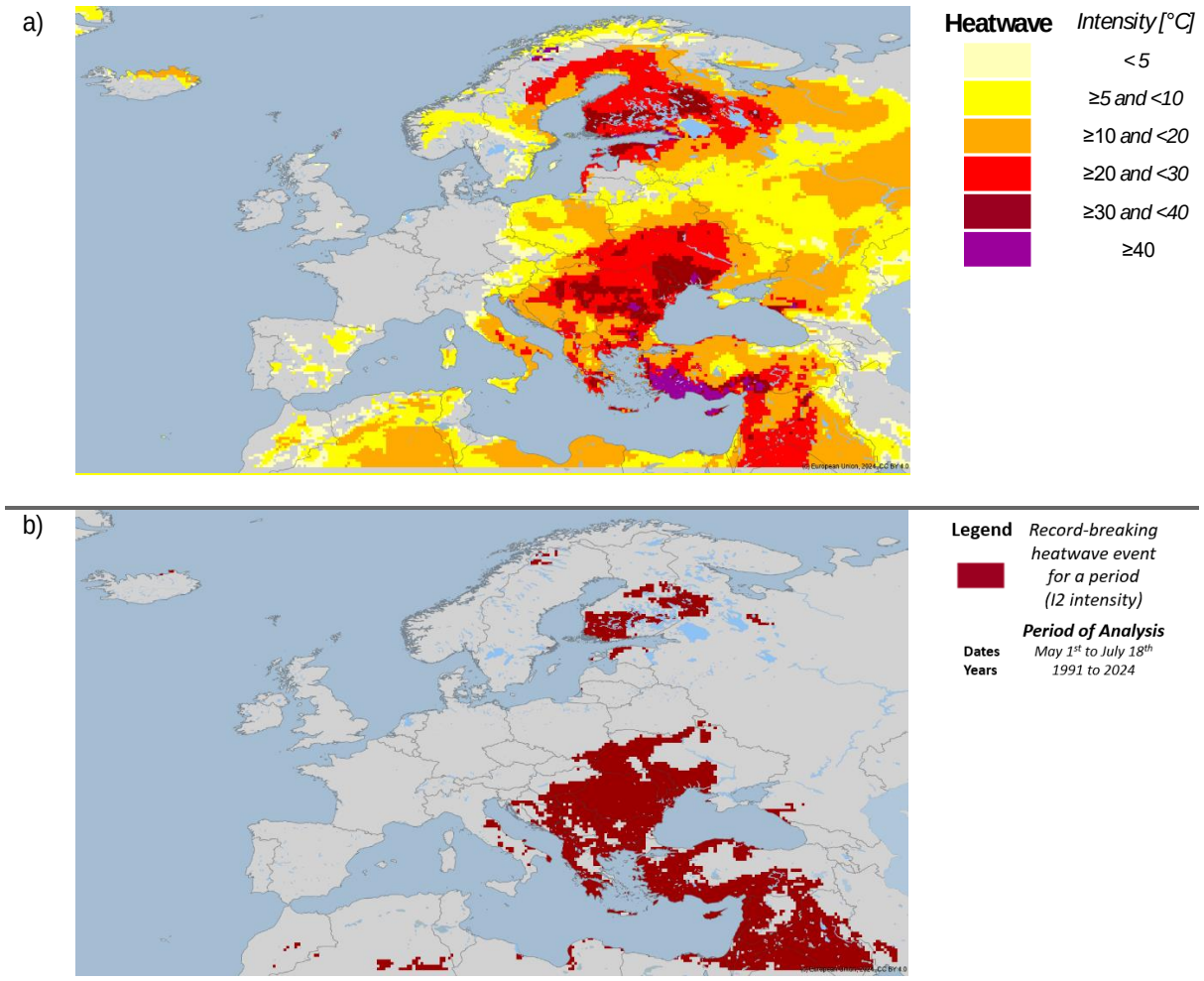

Figure 6: Heat and Cold Wave Index (HCWI, I2 intensity indicator based on ERA5 baseline 1991-2020, Lavaysse et al., 2018)[6]. Panel a) shows the maximum intensity (in °C) of heatwave events between May 1st and July 18th of 2024 in Europe, using a yellow-to-purple colour scheme to represent increasing values. Panel b) shows the areas identified as record-breaking heatwaves in 2024 when considering the maximum total intensity (I2 intensity metric) of heatwave events between the dates May 1st and July 18th for all years during the period 1991 to 2024.

Soil moisture

In early July 2024, the Soil Moisture Index Anomaly[7] shows negative anomalies over most of the Mediterranean region, particularly in northern Africa, the southern and eastern Iberian Peninsula, the Mediterranean islands, southern Italy, Greece, and western Türkiye, indicating dryer than usual soil condition in these regions (Fig. 7)[8]. The dryer-than-usual conditions are a continuation of the severe droughts that had hit Europe in the previous two years, due to a combination of low precipitation and high temperatures. The drier than normal soil moisture pattern is consistent with the precipitation deficit of the previous months, as shown by the SPI-3 (see Fig. 3 and Fig. 4). Additionally, coherently with the precipitation patterns, wide regions in eastern Europe, and particularly northern Türkiye, Bulgaria, Romania, south-eastern Ukraine, south-western Russia, and the eastern Baltic Sea regions are under dryer-than-usual conditions. Some of the regions with the strongest negative precipitation anomalies were also affected by high temperatures, which accelerated water loss from the soil due to increased evapotranspiration. Some areas show a Soil Moisture Anomaly below -2, corresponding to a very strong negative anomaly and being the driest class for this indicator.

Figure 8 shows the evolution of the Soil Moisture Anomaly in late spring and early summer of 2024.[8] Mediterranean regions, particularly northern Africa, the southern and eastern Iberian Peninsula, the Mediterranean islands, most of southern Italy, Greece and central-western Türkiye show persistent dry conditions, never fully recovered since the last previous years. Eastern Europe shows a slow reduction of the dry anomaly extent thanks to some scattered precipitation which partially contributed to local temporary recovery of soil moisture.

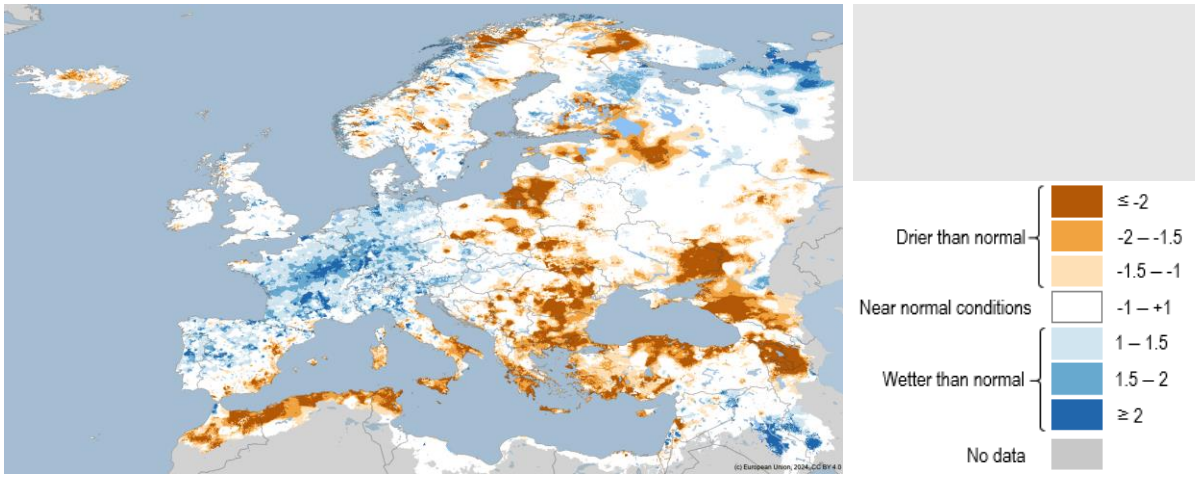

Figure 7: Soil Moisture Index Anomaly for early July 2024.[7, 8]

[7] For more details on the Soil Moisture Anomaly indicator, and the other GDO and EDO indicators of drought-related information used in this report, see the Appendix at the end of the document.

[8] The wide and uniform dry anomaly in Poland, particularly in late May 2024, could be likely attributed to the mentioned issue in the forcing data of the hydrological model that affected soil moisture output. These data are being re-evaluated and subsequently the indicators will be reprocessed. Drought conditions detected in these regions should not be considered reliable.

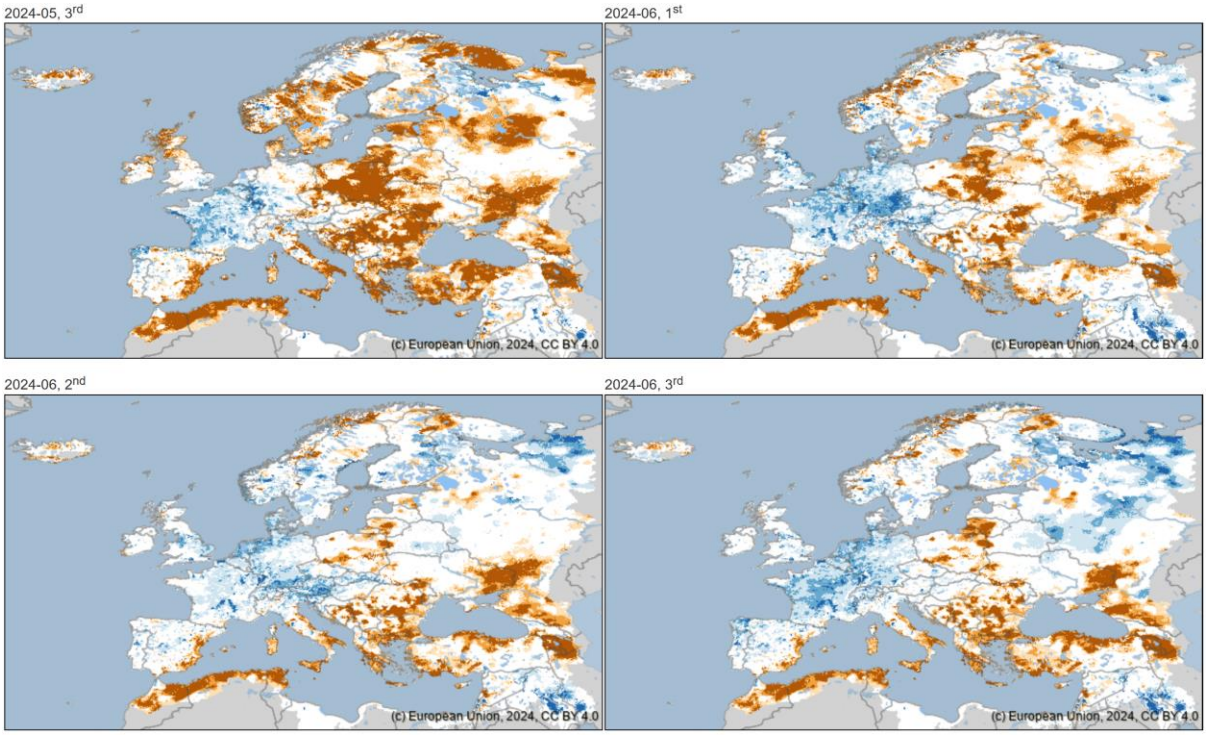

Figure 8: Soil Moisture Index Anomaly from late May to late June 2024.[7, 8]

Vegetation

In early July 2024, the satellite-derived fAPAR (fraction of Photosynthetically Active Radiation) anomaly indicator[9] shows vegetation stress over the Mediterranean region, central and eastern Europe, and central and eastern Scandinavia. Note that not all these critical conditions are connected to drought. Mediterranean regions, particularly northern Africa, southern Italy, the eastern Iberian Peninsula, southern Greece, and wester Türkiye are severely affected by drought with impacts on crops and vegetation growth. (Fig. 9). In the western Alps and the surrounding areas, in contrast, the vegetation development anomaly may be linked with over-wet conditions, late vegetative growth and delayed sowing.

The evolution of the fAPAR anomaly from late May 2024 to late June 2024 (Fig. 10) indicates stable vegetation stress conditions affecting mainly northern Africa, the south-eastern Iberian Peninsula, southern Italy and Greece, the Mediterranean islands, and western Türkiye. In north-eastern and eastern Europe vegetation conditions improved and the negative fAPAR anomaly has been reducing with values close to normal conditions except for eastern Ukraine and central-Eastern Romania.

Dedicated information on the agricultural yield forecast for Europe are provided in the JRC MARS Bulletins[10].

[9] For more details on the satellite-derived Fraction of Absorbed Photosynthetically Active Radiation (fAPAR) anomaly indicator, and the other GDO and EDO indicators of drought-related information used in the report, see the Appendix at the end of the document.
[10] https://joint-research-centre.ec.europa.eu/monitoring-agricultural-resources-mars/jrc-mars-bulletin_en

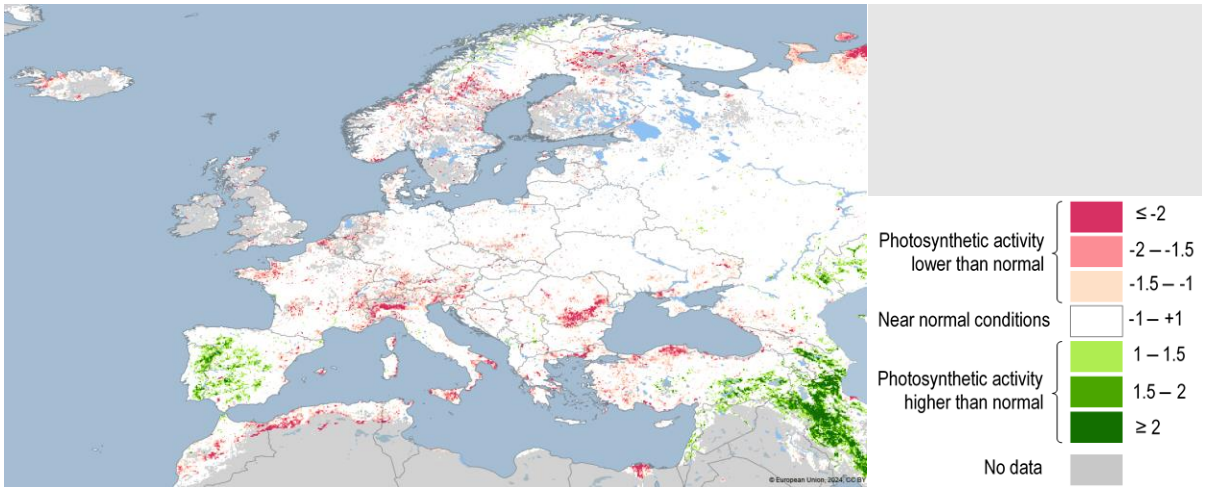

Figure 9: Satellite-derived fAPAR anomaly indicator (measuring photosynthetic activity of vegetation), for early July 2024.[9]

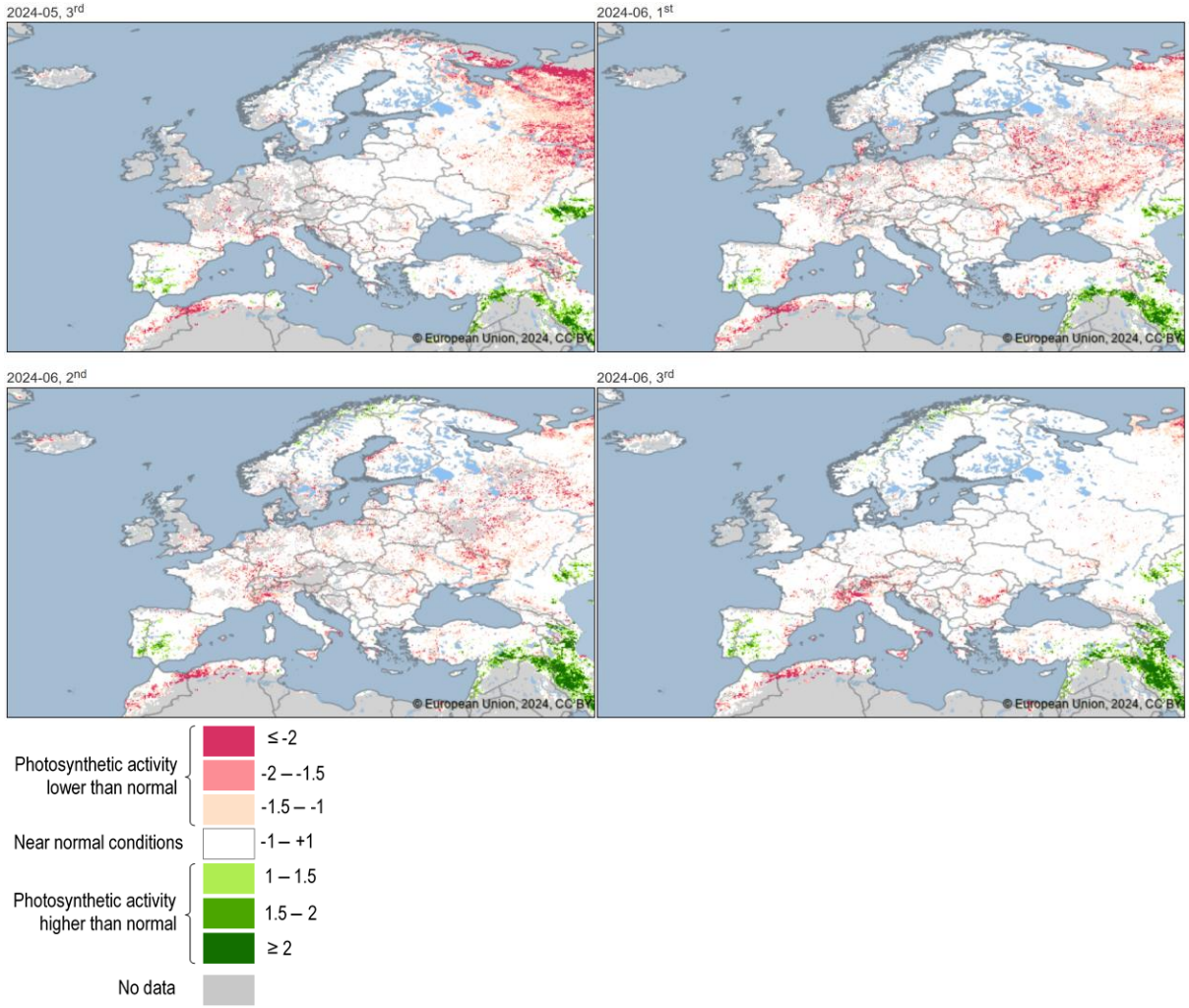

Figure 10: Satellite-derived fAPAR anomaly indicator (measuring photosynthetic activity of vegetation), from late May to late June 2024. [9]

Large-scale atmospheric conditions

The atmospheric condition in May was marked by a prominent centre of anomalous anticyclonic circulation over the UK and the Scandinavian Peninsula (Figure 11, left). This circulation pattern explains the higher-than-average temperatures observed in the region, as shown in Figure 5a. Conversely, cyclonic conditions over France, northern Spain and north-western Italy, led to cold temperature anomalies and wetter than normal conditions in these areas.

June displayed a dipole of geopotential anomalies, with cyclonic conditions over the UK and Norway, and anticyclonic conditions centred in south-eastern Europe, extending over Russia and Finland (Fig. 11, right). The cyclonic conditions moderated the warm temperature anomalies from the previous month in the UK and the southern part of the Scandinavian Peninsula. Meanwhile, anticyclonic anomalies in the eastern Mediterranean and Baltic regions raised temperatures, as shown in Figure 5b. The heatwaves experienced are likely a response to this large-scale circulation pattern.

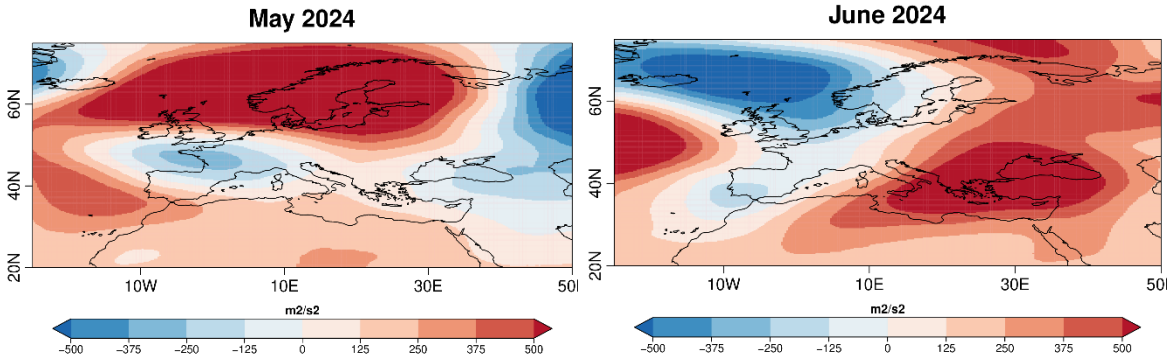

Figure 11: 500 hPa geopotential (m^2/s^2) anomalies for May (left) and June (right) 2024 (data source: ERA5, baseline 1991-2020, retrieved from KNMI Climate Explorer).

Fire danger

Fire danger, or wildfire hazard, has been triggered by the elevated temperature anomalies and surface dryness, combined with the availability of fuel (dry litter and wood). The CEMS European Forest Fire Information System (EFFIS) provides mapping services of the fire danger, forecast all over Europe[11]. Up to 16 July 2024, EFFIS shows high to extreme fire danger in most of the Mediterranean regions and Eastern Europe (Fig. 12).

[11] The European Forest Fire Information System of CEMS: https://effis.jrc.ec.europa.eu/

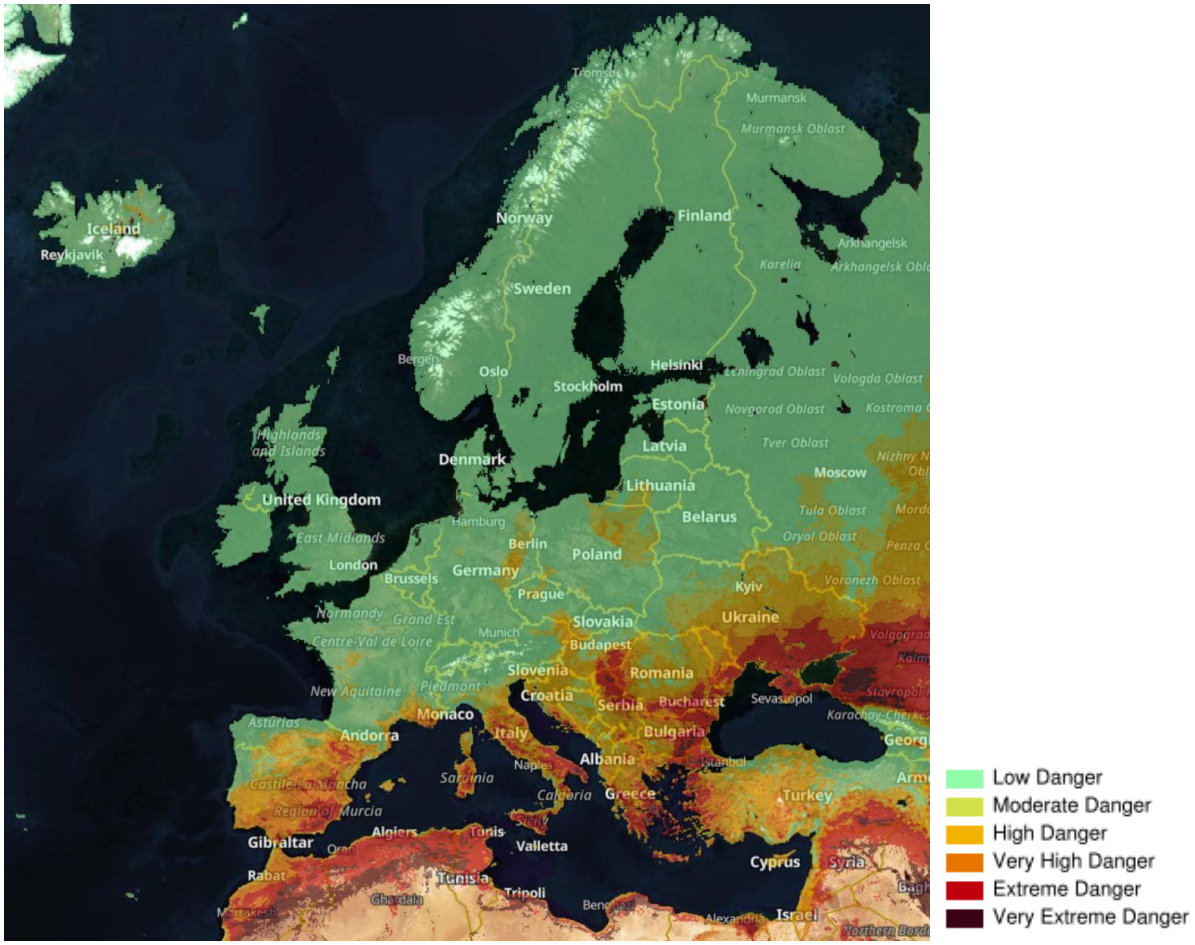

Figure 12: Fire danger expressed by the Fire Weather Index up to 16 July 2024. Data source: European Forest Fire Information System (EFFIS).[11]

Seasonal forecast

From July to September 2024, as shown in Figure 13, drier than normal conditions (compared with the 1981-2016 baseline) are predicted over the Iberian Peninsula, southern France, central-northern Italy, Slovenia, Croatia, Hungary, Slovakia, eastern Europe, southern Russia, and northern Africa. Close to average or slightly wetter than average conditions are predicted for northern Europe.

Based on the Copernicus Climate Change Service (C3S) seasonal forecasts[12] (not shown here), warmer than usual conditions are likely to occur in Europe up to October 2024, with larger positive anomalies in southern Europe and the Mediterranean region. Precipitation forecasts are close to average for central and northern Europe, and mostly slightly drier than average for southern Europe and the Mediterranean region with the greatest anomalies in the Iberian Peninsula and in northern Africa. Some variability between the models is present.

As shown in Figure 14, most south-eastern Europe and northern Africa is expected to be affected by very low flow conditions in July-August 2024, with high probability of low flow in Morocco, Algeria, Tunisia,

[12] https://climate.copernicus.eu/seasonal-forecasts

Mediterranean islands, Albania, south-western Greece, southern Türkiye, and most of northern Africa. In the regions highlighted in Figure 14, the prolonged lack of precipitation and warmer than average temperatures are potentially affecting river flows, with direct impacts on agriculture, ecosystems and energy production. Water resource management should be planned cautiously, to limit impacts and to identify actions to be taken.

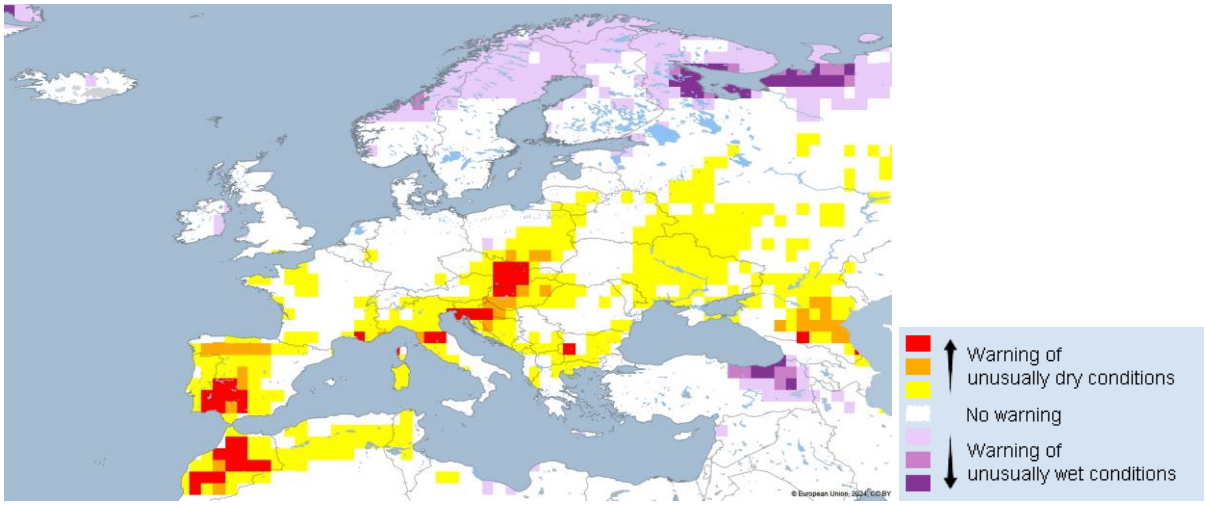

Figure 13: Indicator for Forecasting Unusually Wet and Dry Conditions, for July to September 2024 (based on ECMWF SEAS5).[13]

[13] For more details on the Indicator for Forecasting Unusually Wet and Dry Conditions, and the other GDO and EDO indicators of drought-related information used in the report, see the Appendix at the end of the document.

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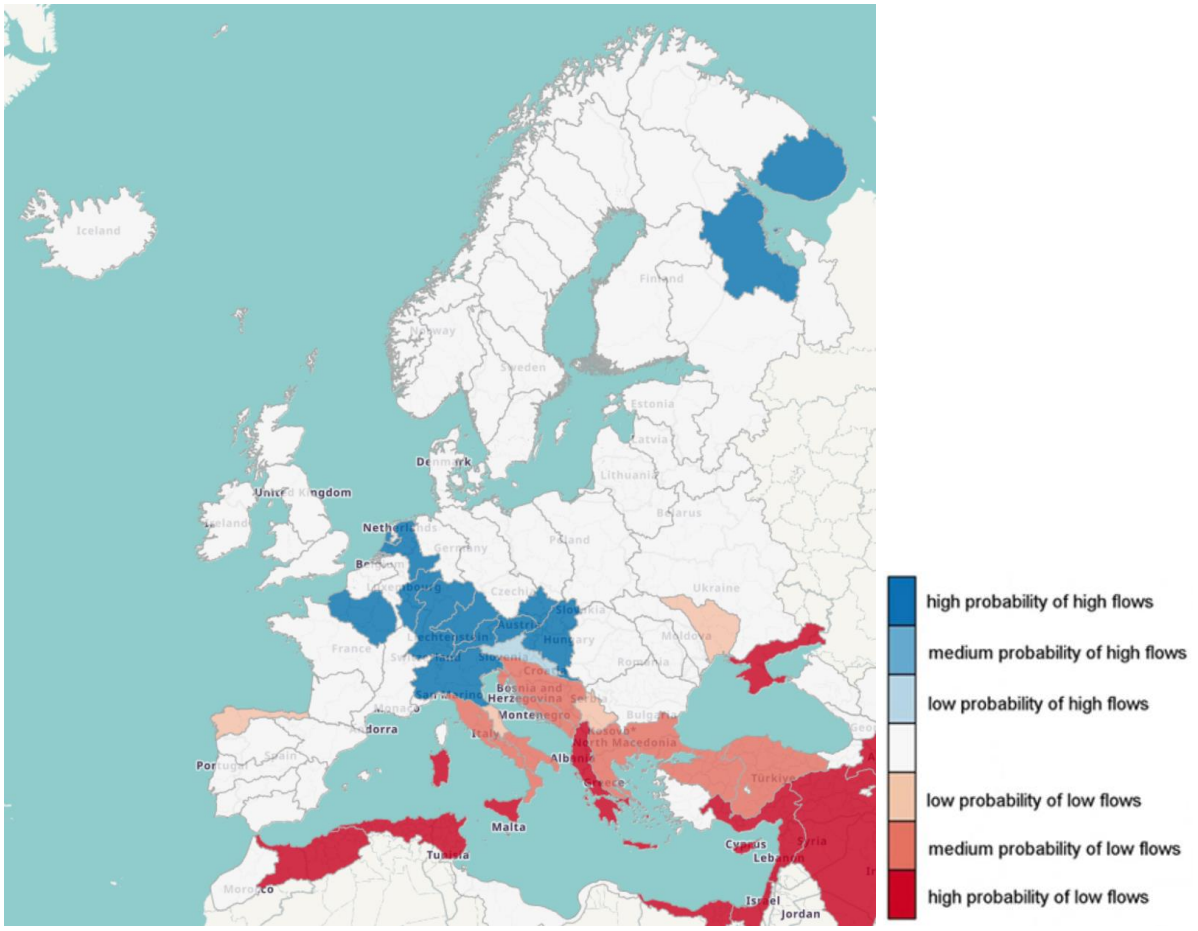

Figure 14: Probability of river flow anomalies for 8 weeks (July - August 2024). The high and low probability thresholds refer to the 90th and 10th percentiles of the simulated discharge from a 31-year model climatology run (1992 - 2022).[14] (See also Technical Note below).

Technical note:

- *The regions displayed in Fig. 14 were created by merging several basins together, respecting hydro-climatic boundaries. This allows large-scale variability in weather to be captured, and forecast information to be summarized. The map in Fig. 14 shows the forecast river flow anomaly per region over 8 weeks. The probability of a low and high flow anomaly is indicated by red and blue, respectively. The intensity of the colour represents the highest forecasted probability of falling below the low threshold, or exceeding the high threshold, within the forecast horizon.*
- *The analysis results shown in Fig. 14 are based on the LISFLOOD hydrological model outputs driven by 51 ensemble members of the ECMWF SEAS5 seasonal forecast. More information on LISFLOOD: De Roo et al., 2000. "Physically based river basin modelling within a GIS: the LISFLOOD model". Hydrological Processes, 14, 1981–1992. Additional and updated information: Open Source Lisflood (https://ec-jrc.github.io/lisflood/)*

[14] Source: The CEMS European Flood Awareness System (EFAS): https://www.efas.eu

Reported impacts

The European JRC MARS Bulletin - Crop Monitoring in Europe, of June 2024[15] reported that water excess in Benelux, western Germany, north-eastern France, and northern Italy affected crop growth and delayed crop sowing. Southern Germany has experienced floods, while eastern Germany, south-western Poland, and north-eastern Poland face soil moisture depletion but no crop damage. Hungary, Romania, Ukraine, and Russia are estimated to have yield reductions for winter crops due to water deficit. Spain has positive overall yield expectations but heatwaves worsen winter crops in the east. As for rice in Europe, despite sowing delays, favourable conditions characterised the start of the season.

In Sicily (Italy), the accumulated rainfall over the last 12 months (from late June) dropped to a regional average of 414 mm against a long-term average of more than 700 mm (2002-2023).[16] Reservoirs are below the alert level. According to the Authority of the Hydrographic District of Sicily, the cumulative volume of the reservoirs on 1 June 2024 was 45% less than the one on 1 June 2023.[17] About 25% of the municipalities in Sicily have issued functional ordinances to save drinking water.[18] In late June 2024, the District Water Observatory confirmed that the water severity status is high for the entire district of Sicily.[19]
About 25% of the agricultural production in Sicily has been lost due to drought. According to Confcooperative and Fedagripesca, citrus fruits, wheat, and vineyards are the most affected crops. The estimated damage amounts to 2.7 billion euros, with the drought affecting half of the available territory. The greatest impact will be on citrus fruits, which account for 60% of national production. The wheat harvest has been reduced by 11% this year. The Sicilian region has allocated 90 million euros to reactivate three desalination plants that have been abandoned for years.[20]
Animals are drinking mud as lakes dry up and wheat and fodder harvests are decimated in Sicily. The situation is devastating farmers and ranchers across the region and will soon impact the wider community. Many farmers are forced to slaughter their animals due to lack of food and water. Lake Pergusa, Sicily's only natural lake, has dried up completely, while other artificial lakes have been reduced to puddles and mud.[21] On May 6th, the Council of Ministers declared a national state of emergency for drought in Sicily for a period of 12 months, initially allocating €20 million.

The heatwave in Cyprus led to the death of at least two elderly people, while Türkiye is battling wildfires as temperatures soared above 40 °C[22].
In Athens, Greece, the Greek Ministry of Culture and Sports ordered on the 17th and the 18th of July the closure of the Acropolis archaeological site between the hours from 12:00 to 17:00 so to avoid the exposure of individuals to dangerously high temperatures[23].
In Albania, the government has rescheduled working hours for civil servants so to avoid exposure to extreme hot temperatures[24].

[15] https://publications.jrc.ec.europa.eu/repository/handle/JRC136662
[16] https://terra.regione.sicilia.it/in-sicilia-piogge-scarse-anche-a-giugno-la-siccita-continua-a-mettere-a-dura-prova-le-risorse-idriche/
[17] https://www.regione.sicilia.it/istituzioni/regione/strutture-regionali/presidenza-regione/autorita-bacino-distretto-idrografico-sicilia
[18] https://www.regione.sicilia.it/istituzioni/regione/strutture-regionali/presidenza-regione/autorita-bacino-distretto-idrografico-sicilia/stato-emergenza-crisi-idrica
[19] https://www.regione.sicilia.it/istituzioni/regione/strutture-regionali/presidenza-regione/autorita-bacino-distretto-idrografico-sicilia/osservatorio-distrettuale-permanente-sugli-utilizzi-idrici
[20] https://www.corriere.it/economia/aziende/24_luglio_02/siccita-in-sicilia-danni-all-agricoltura-per-2-7-miliardi-imprese-piegate-dalla-crisi-climatica-il-governo-intervenga-487aff14-eb02-4540-9b26-0470eaadaxlk.shtml?refresh_ce
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[22] Euronews. "Death toll rises as heatwaves hit Cyprus, Greece and Türkiye: Will this be Europe's hottest summer?". Available at: https://www.euronews.com/green/2024/06/17/death-toll-rises-as-heatwaves-hit-cyprus-greece-and-turkiye-will-this-be-europes-hottest-s. Accessed on the 18th of July 2024.
[23] Greek Ministry of Culture and Sports. "Ephorate of Antiquities of the City of Athens - Administrative Information – Open hours". Available at: http://odysseus.culture.gr/h/3/eh355.jsp?obj_id=2384. Accessed on the 18th of July 2024.
[24] DW. "Europe: Scorching heatwave bakes Greece, Balkan region". Available at: https://www.dw.com/en/europe-scorching-heatwave-bakes-greece-balkan-region/a-69692137. Accessed on the 18th of July 2024

Hungary economy is severely affected by the heat impacts. In July yield projections have been lowered by 14% for maize and 9% for sunflower compared to the data estimated in June. These impacts are due to a compound effect of higher than usual temperatures and lack of precipitation.[25]

[25] https://168.hu/itthon/a-hoseg-katasztrofalis-hatasai-aranyarban-lehet-a-buza-iden-279698

Appendix: GDO and EDO indicators of drought-related information[26]

The Combined Drought Indicator (CDI) of the European Drought Observatory (EDO) is used to identify areas that may be affected by agricultural drought. The CDI is derived by combining the Standardized Precipitation Index (SPI), the Soil Moisture Index Anomaly (SMA), and the fAPAR anomaly. Areas are classified according to three primary drought classes: (1) "Watch", indicating less than normal precipitation; (2) "Warning", indicating that also soil moisture is in deficit; (3) "Alert", indicating that also vegetation shows signs of stress. Three additional classes – i.e. "Recovery", "Temporary Soil Moisture Recovery" and "Temporary Vegetation Recovery" – identify the stages of drought recovery processes in terms of impacts on soil moisture and vegetation.

The Standardized Precipitation Index (SPI) provides information on the intensity and duration of the precipitation deficit (or surplus). SPI is used to monitor the occurrence of drought. The lower (i.e., more negative) the SPI, the more intense is the drought. SPI can be computed for different accumulation periods: the 3-month period is often used to evaluate agricultural drought and the 12-month (or even 24-month) period for hydrological drought, when rivers fall dry and groundwater tables lower.

The Heat and Cold Wave Index (HCWI) is used to detect and monitor periods of extreme-temperature anomalies (i.e., heat and cold waves) that can have strong impacts on human activities, health and ecosystem services such as sprouting of crops. It is based on the persistence for at least three consecutive days of events with both daily minimum and maximum temperatures (Tmin and Tmax) above the 90th percentile daily threshold (for heat waves) or below the 10th percentile daily threshold (for cold waves). For each location, the daily threshold values for Tmin and Tmax are derived from a 30-year climatological baseline period (1991-2020), using the GloFAS/ERA5 derived temperature data.

Lack of precipitation induces a reduction of soil water content. The Soil Moisture Index Anomaly provides an assessment of the deviations from normal conditions of root zone water content. It is a direct measure of drought associated with the difficulty of plants in extracting water from the soil.

The satellite-based fraction of Absorbed Photosynthetically Active Radiation (fAPAR) monitors the fraction of solar energy absorbed by leaves. It is a measure of vegetation health and growth. Negative fAPAR anomalies with respect to the long-term average are associated with negative impacts on vegetation.

The Indicator for Forecasting Unusually Wet and Dry Conditions provides early risk information for Europe. It is computed from forecasted SPI-1, SPI-3, and SPI-6 derived from the ECMWF seasonal forecast system SEAS5.

[26] For more details on the GDO and EDO indicators: https://edo.jrc.ec.europa.eu/factsheets

Glossary of terms and acronyms

▪ *CDI: Combined Drought Indicator*	▪ *GDO: Global Drought Observatory*
▪ *CEMS: Copernicus Emergency Management Service*	▪ *GloFAS: Global Flood Awareness System*
▪ *EC: European Commission*	▪ *HCWI: Heat and Cold Wave Index*
▪ *ECMWF: European Centre for Medium-Range Weather Forecasts*	▪ *JRC: Joint Research Centre*
▪ *EDO: European Drought Observatory*	▪ *KNMI: Royal Netherlands Meteorological Institute*
▪ *EFFIS: European Forest Fire Information System*	▪ *MARS: Monitoring Agricultural Resources*
▪ *ERA5: ECMWF Reanalysis v5*	▪ *SMA: Soil Moisture Anomaly*
▪ *ERCC: European Emergency Response Coordination Centre*	▪ *SPI: Standardized Precipitation Index*
▪ *EU: European Union*	▪ *SWE: Snow Water Equivalent*
▪ *fAPAR: Fraction of Absorbed Photosynthetically Active Radiation*	▪ *VIIRS: Visible Infrared Imaging Radiometer Suite*

GDO and EDO indicators versioning

The GDO and EDO indicators appear in this report with the following versions:

GDO, EDO indicator	*Version*
▪ *Combined Drought Indicator (CDI)*	*v.4.0.0*
▪ *Soil Moisture Index (SMI) Anomaly (SMA)*	*v.3.0.0*
▪ *fAPAR (fraction of Absorbed Photosynthetically Active Radiation) Anomaly (VIIRS)*	*v.3.0.0*
▪ *Indicator for Forecasting Unusually Wet and Dry Conditions*	*v .1.1.0*
▪ *Standardized Precipitation Index (SPI) (ERA5)*	*v.2.0.0*
▪ *Heat and Cold Wave Index (HCWI) Intensity I2*	*v.1.0.0*

Check https://edo.jrc.ec.europa.eu/download for more details on GDO and EDO indicator versions.

Distribution

For use by the ERCC and related partners, and publicly available for download at https://joint-research-centre.ec.europa.eu/european-and-global-drought-observatories/drought-reports_en

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