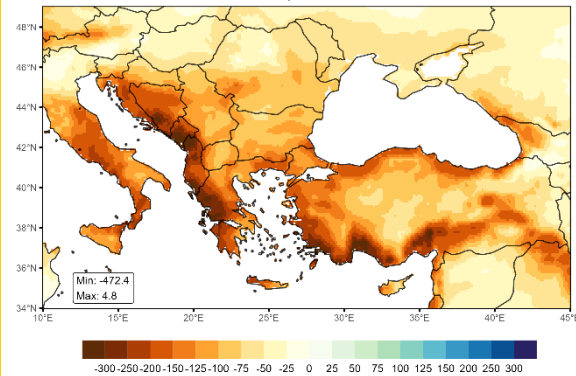


# DROUGHT MONITORING BULLETIN

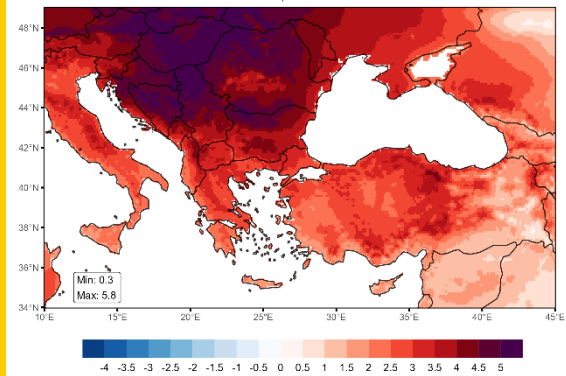
Overview from January to December 2024

## HOTSPOT

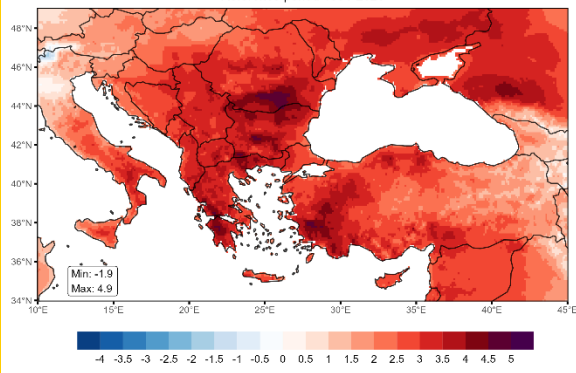
**Anomaly of 3-monthly precipitation (mm), February 2024**  
Reference period 1991-2020



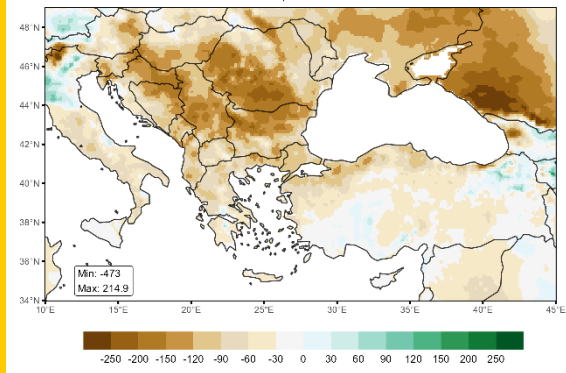
**Anomaly of 2-monthly mean temperature (°C), March 2024**  
Reference period 1991-2020



**Anomaly of 2-monthly mean temperature (°C), July 2024**  
Reference period 1991-2020



**Anomaly of 3-monthly water balance (mm), August 2024**  
Reference period 1991-2020



It was a **dry beginning of the year** across the region, January and February each brought between 50 and 150 mm less precipitation than usual for this time of year, more prominently along southern and southwestern part of the region. Spring months saw varying weather conditions across the region, as along southern areas and central Balkan Peninsula noticeable winter lack of rain persisted **into April**, while over the region's north-east **summer drought** set on with precipitation deficit in May already. Between June and August, unusually dry as well as warm weather conditions moved from over southern and eastern part of the region in June, to central and northern part of Balkan Peninsula in July and August, while Turkey and much of Greece experienced wetter than normal conditions in second half of summer. September high rainfall rate across the entire region ended drought conditions also in central and eastern Balkan Peninsula. It was drier than normal again in **late autumn**: Turkey and southeastern half of Balkan Peninsula recorded very dry October, while November and December were drier than normal in the north-west and along the north.

In terms of air temperature, monthly means reveal nearly all months of the year were warmer than usual across the region, the only exception were colder-than-normal May over much of Turkey and eastern Balkan Peninsula, October in northeastern Turkey, and November in much of the region. Most outstanding in **air temperature** sense were **February-April** and **June-August periods** when individual months were among the warmest of the record (>95<sup>th</sup> percentile) over most of the region.

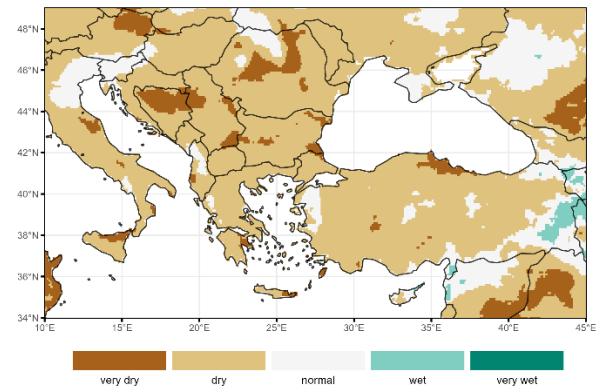
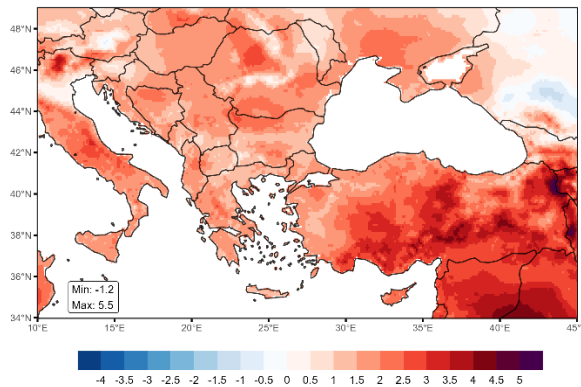
## AIR TEMPERATURE AND SURFACE WATER BALANCE

Figures in this section present monthly **mean air temperature anomalies** and monthly accumulated **surface water balance in percentile classes** from **January to December 2024**, as compared to the 1991–2020 long-term averages.

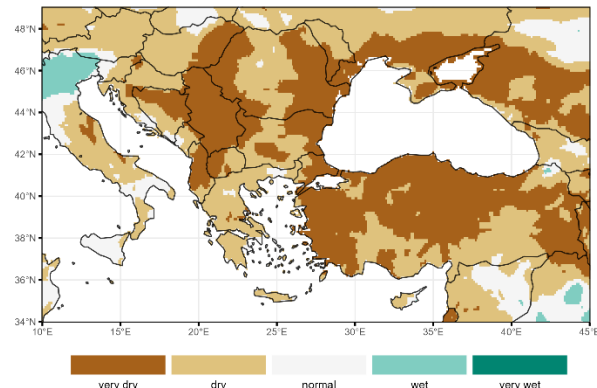
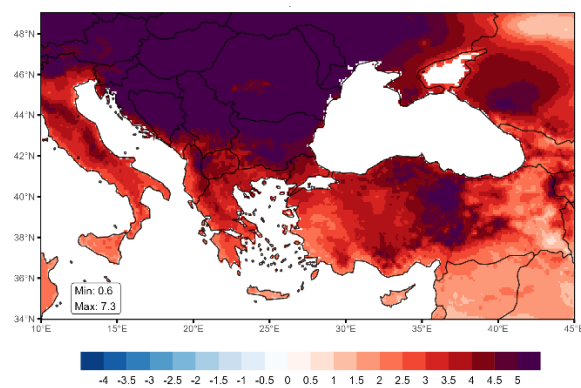
MEAN AIR TEMPERATURE  
ANOMALY [°C]

SURFACE WATER BALANCE  
[percentile classes]

### JANUARY 2024



### FEBRUARY 2024



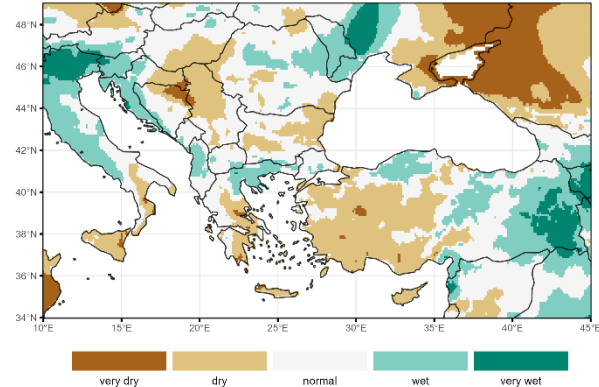
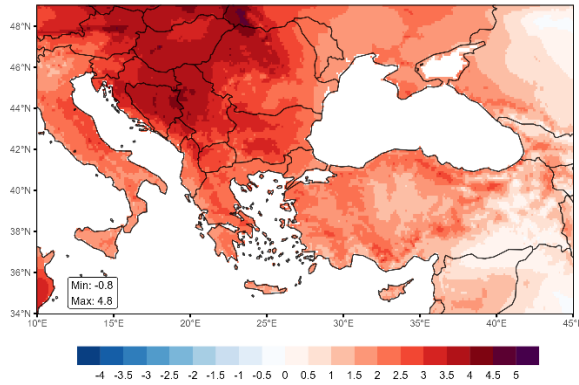
Compared to the long-term average, **January** was drier than expected across the entire region except for far southeastern Turkey. It brought up to 75 mm less precipitation than usual, to Montenegro and along southwestern and southern Turkey up to 125 mm less. It was also unusually warm, exceeding the monthly average for 1.5–2.5 °C across Balkan Peninsula and northwestern Turkey, and for 2.5–4.5 °C across southeastern half of Turkey. Thus, surface water balance deficit prevailed in January across the region, with higher deficit concentrated about southern half of Balkan Peninsula and the Aegean area.

Drier and warmer than normal weather conditions intensified throughout **February**. Monthly mean air temperature ended up 5–7 °C above the long-term average across the entire northern half of Balkan Peninsula including Bulgaria and over central Turkey, while in Albania, Greece and the rest of Turkey February was on average 2.5–4.5 °C warmer than normal, altogether being one of the warmest February months of the long-term record. Along came additional precipitation deficit, as much of the region received up to 75 mm less precipitation than normal also in February, and a greater stretch of the area than in January experienced precipitation deficit of 100 up to 150 mm, from northern Adriatic Croatia to Albania and western Greece, and along much of the coastal Turkey. Thus, dry to very dry surface water balance conditions prevailed across the entire region in February, set by the noticeable precipitation deficit and even slightly higher than normal evapotranspiration amount.

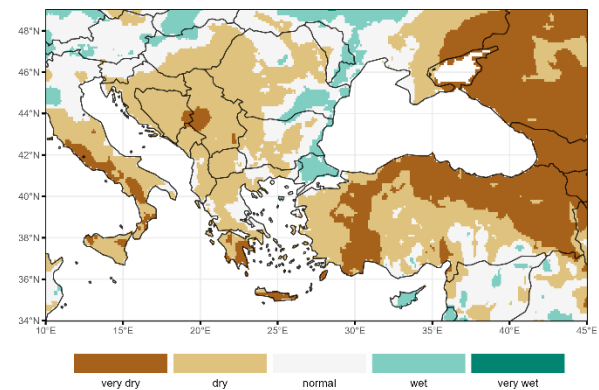
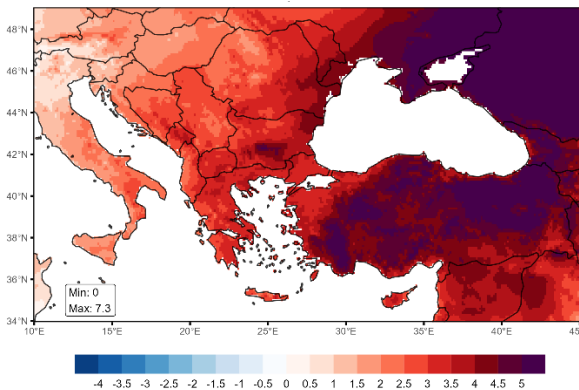
MEAN AIR TEMPERATURE  
ANOMALY [°C]

SURFACE WATER BALANCE  
[percentile classes]

MARCH 2024



APRIL 2024



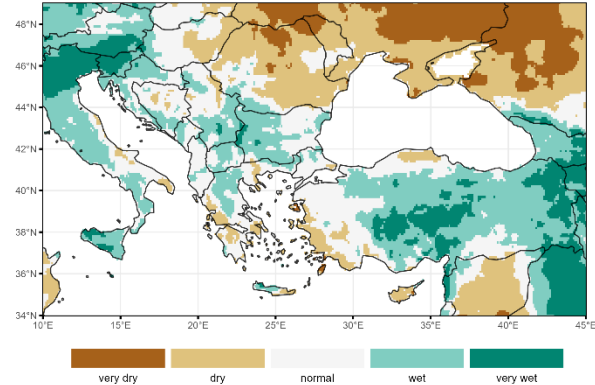
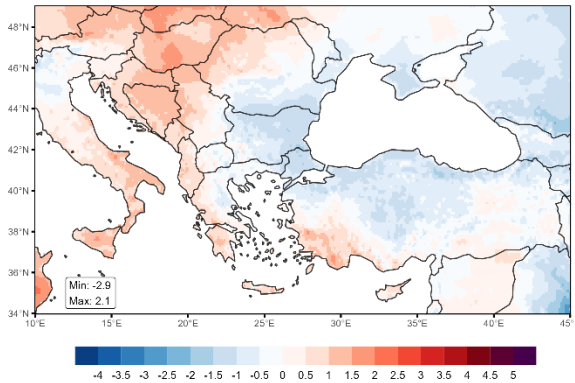
**March** continued with warmer-than-normal air temperatures. Monthly mean exceeded the average for up to 2.5 °C across Turkey, and across Balkan Peninsula it stood 2.5–4.5 °C higher than normal, most prominently over its central-northern area, where March too was one of the warmest of the long-term records. Precipitation conditions varied across the region that month: it was a wet month for scattered localized areas across northern Adriatic and over Turkey's south-east, bringing between 75 and 150 mm more precipitation than usual, southern Moldova and a belt between southern Croatia and northeastern Greece also recorded precipitation surplus of up to 75 mm; on the other hand, precipitation continued to come short of its usual monthly level across southern Turkey, eastern half of Greece and across central Serbia. These parts of the region continued to experience drier than normal surface water balance conditions, with March bringing up to 60 mm of additional deficit.

**April** also classified among the warmest of the long-term records (>95<sup>th</sup> percentile) across the entire region except for Hungary, Slovenia and most of Croatia. Monthly air temperature mean was in these countries up to 2.5 °C above the average, indicating unusually warm April, while elsewhere across the region the usual monthly mean was exceeded for 3.5–5 °C, locally across central and northeastern Turkey for up to 7 °C. Normal to wet precipitation conditions continued over Slovenia and northern Hungary and along a wide belt from Moldova to eastern Bulgaria, however, the rest of the region again received less than normal amount of precipitation. Across central-western part of Balkan Peninsula, over Greece and Turkey, April accumulated between 30 and 90 mm of surface water balance deficit, across eastern Turkey between up to 150 mm. April was in these parts of the region the fifth month in a row recording monthly surface water balance deficit, starting in December 2023.

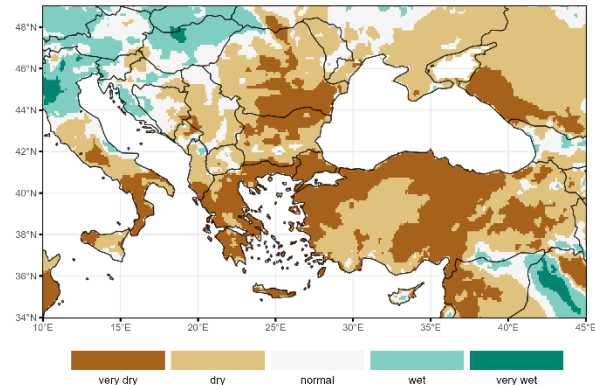
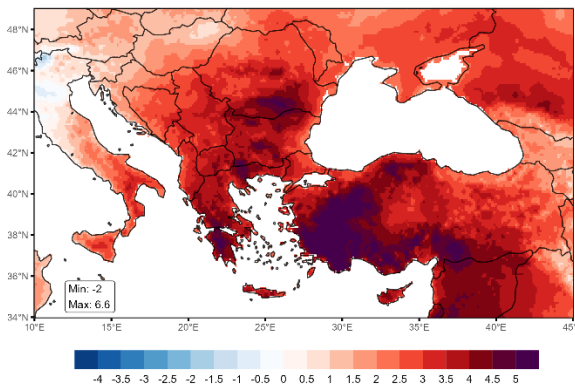
MEAN AIR TEMPERATURE  
ANOMALY [°C]

SURFACE WATER BALANCE  
[percentile classes]

MAY 2024



JUNE 2024



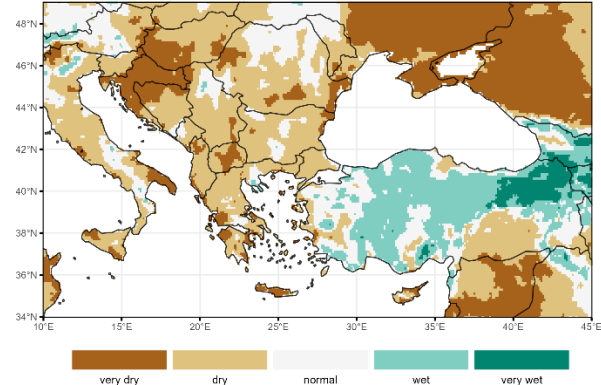
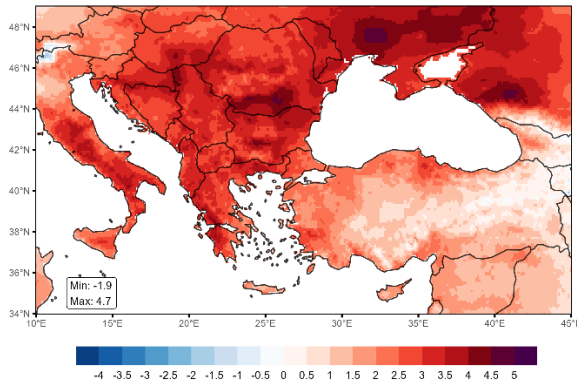
Mean air temperature was in **May** closer to the normal across the region than in earlier months of 2024, and ranged mostly within 2 °C from the long-term average: over a wider Black Sea area, from southern Moldova across Bulgaria and over the entire northern half of Turkey, May was on average up to 1.5 °C colder than usual, while over Turkey's far south-west, southwestern Greece, Albania and in northwestern Balkan Peninsula from coastal Croatia to northwestern Romania May was not more than 2 °C warmer than normal. Most of the region was in May experiencing normal to wet surface water balance conditions, locally in Slovenia and central Turkey considerable precipitation surplus caused very wet conditions. However, lack of rain returned to Moldova and Romania and contributed to between 30 and 90 mm of monthly surface water balance deficit.

In **June**, less than normal amount of rain prevailed across most of the region again, with deficit more prominent over southern half of Romania and Bulgaria to northeastern Greece and across the entire northern belt of Turkey. Only the north-west, from Bosnia and Herzegovina over Slovenia to Hungary, received more or less normal amount of rain, locally in northern Hungary surplus reached up to 100 mm. Dry conditions across the region were further aggravated by unusually high air temperatures, which too were less severe across Croatia, Slovenia and Hungary with monthly anomalies of up to 2 °C, but elsewhere across Balkan Peninsula and Turkey they were at least 3 °C above the long-term average, classifying also June among the warmest June months of the local long-term record. Especially high were air temperatures over southern Romania, Bulgaria, Greece and much of southwestern half of Turkey where June mean was between 4–6.5 °C higher than normal. Consequent increased evapotranspiration along with precipitation deficit caused severely to extremely dry conditions across the region except for its north-west, with up to 90 mm of monthly surface water balance deficit, in central Romania, northern Bulgaria and across northern Turkey up to 120 mm.

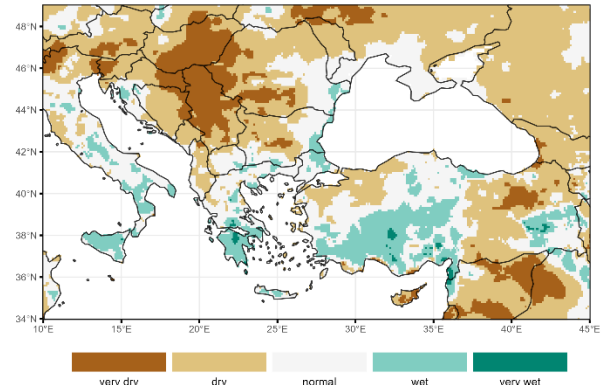
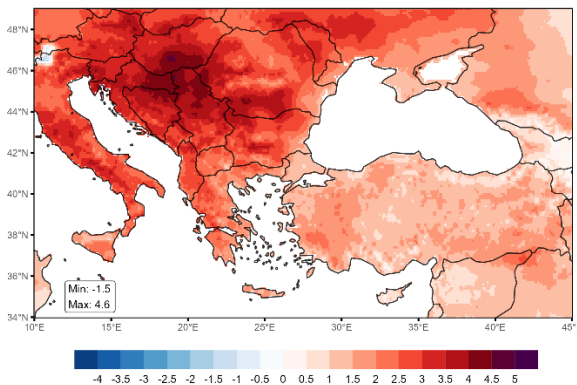
MEAN AIR TEMPERATURE  
ANOMALY [°C]

SURFACE WATER BALANCE  
[percentile classes]

JULY 2024



AUGUST 2024



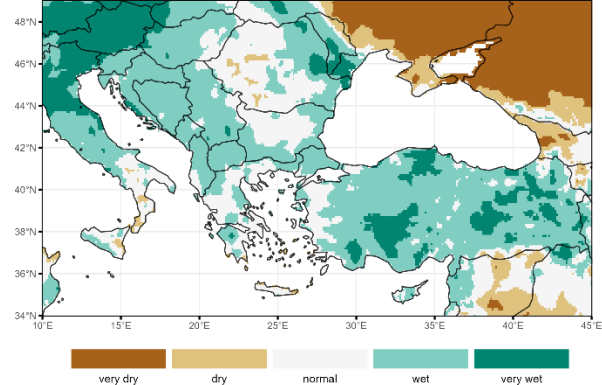
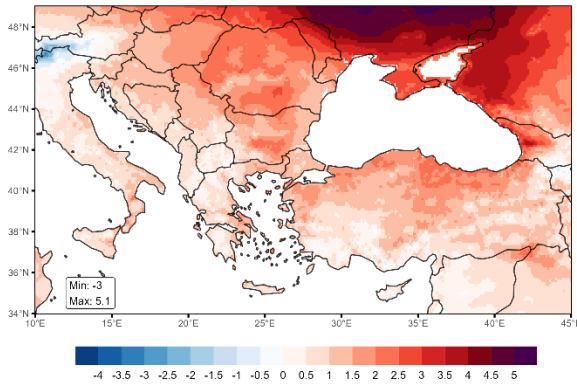
Over Balkan Peninsula, unusually dry and warm conditions persisted throughout **July**. Monthly mean over Slovenia and Aegean Greece was up to 2.5 °C above the long-term usual, and even higher, up to 4.5 °C, over the rest of the Balkan Peninsula, classifying also July among the warmest of the long-term records, with the highest anomalies present over northern Serbia and southern Romania. Unusually high air temperatures contributed to additional loss of water due to evapotranspiration, which was up to 45 mm higher compared to July normal. Unusually warm and rainless conditions resulted in dry to very dry surface water balance conditions over Balkan Peninsula with monthly accumulated deficit of 30–90 mm, locally over continental Croatia up to 120 mm. Over Turkey, air temperatures generally returned to normal in July except for wider coastal areas where they were still 2–3 °C warmer than normal. Dry conditions also eased in July as most of Turkey recorded normal to wet conditions, with monthly surface water balance surplus of up to 60, locally in the north-east up to 120 mm.

In **August**, weather conditions across much of the region remained similar to those in July. Across Turkey, Greece, North Macedonia and along western coastal area of the Black Sea it was 1.5–3 °C warmer than usual while precipitation levels were at least normal, across much of these areas even higher than usual for this time of the year, altogether resulting in average levels of surface water balance or with localised surplus of up to 120 mm. Meanwhile, unusually high air temperatures along with drier than normal weather conditions continued across the wider central-northern Balkan Peninsula and kept on intensifying existing drought conditions. Air temperatures were on average 3–4.5 °C higher than usual, classifying also August among the warmest 5 % of local records and creating favourable conditions for up to 30 mm higher evaporation than normal for August. Along with noticeable lack of rain detected also in August, much of this part of the region especially central Pannonian Basin recorded additional 60–120 mm of surface water balance deficit this August.

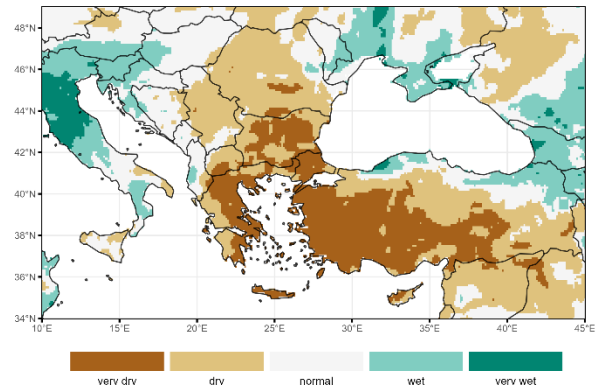
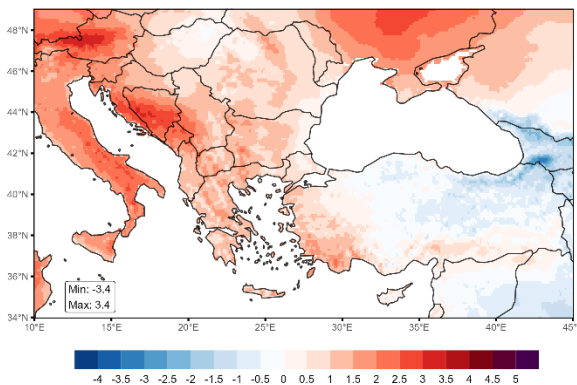
MEAN AIR TEMPERATURE  
ANOMALY [°C]

SURFACE WATER BALANCE  
[percentile classes]

SEPTEMBER 2024



OCTOBER 2024



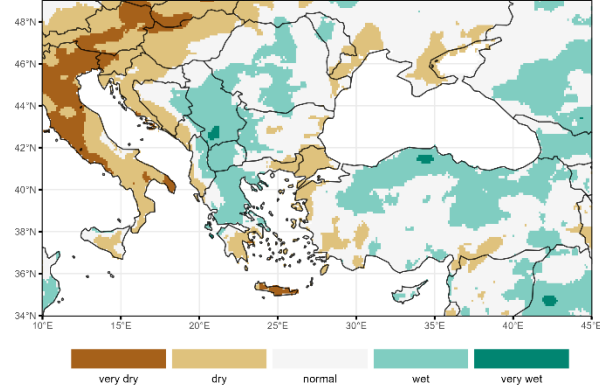
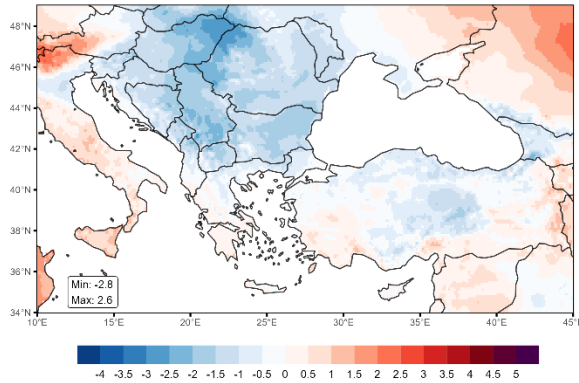
It was only after the normal to high precipitation levels in **September** that drought conditions ceased also across northern half of Balkan Peninsula, and no part of the region recorded noticeable monthly lack of rain. It was last in March 2024 and November 2023 that monthly precipitation levels suggested no considerable precipitation deficit across much of the region or was limited to localised areas. Although air temperatures remained warmer than normal on average, the anomalies from the usual were much less than in previous months and rarely exceeded 2.5 °C, only over Moldova they stood 2.5–4 °C above the long-term average, while across southwestern half of Balkan Peninsula and southern half of Turkey they were not more than 1.5 °C above September mean. Normal to above-average precipitation amount across the region resulted in monthly surface water balance surplus of mostly up to 60 mm, in northwestern Balkan Peninsula, along the Adriatic Sea, over Romania-Moldova border area and along northern Turkey, monthly surface water balance surplus ranged between 120 and 200 mm.

In **October**, air temperatures remained warmer than normal across Balkan Peninsula and western Turkey, exceeding the average for 1–2 °C, in Montenegro, Bosnia and Herzegovina and continental Croatia for 2–3.5 °C, making it one of the warmest October months of the record, while on the other hand it was up to 2 °C colder for this time of the year in central and eastern Turkey. Normal to high rainfall rate continued over northwestern Balkan Peninsula, Moldova and across northern and northeastern Turkey, while to the rest of the region October brought considerable rainfall deficit, especially to Greece and western Turkey where this October ranked among the driest of the long-term records. Surface water balance levels conditions therefore very dry across southern and western Turkey, Greece and Bulgaria, with monthly deficit of up to 60 mm, over Aegean Sea area up to 120 mm. Deficit of up to 60 mm was recorded also across central Balkan Peninsula from Romania to North Macedonia, while other parts recorded surplus of mainly up to 60 mm, locally in Slovenia and along northern Turkey up to 180 mm.

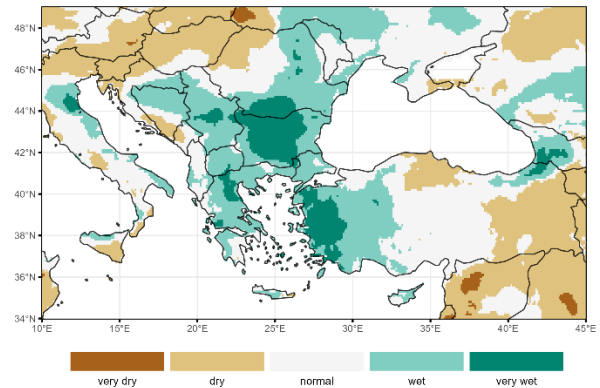
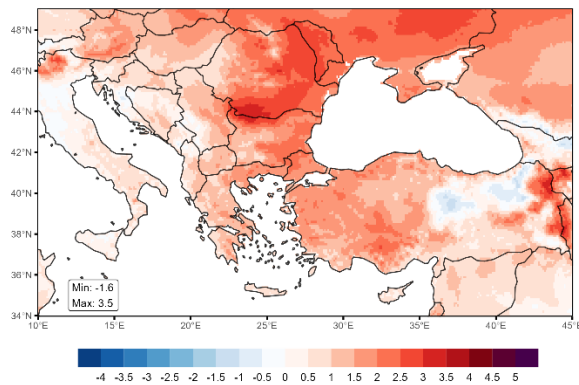
MEAN AIR TEMPERATURE  
ANOMALY [°C]

SURFACE WATER BALANCE  
[percentile classes]

NOVEMBER 2024



DECEMBER 2024



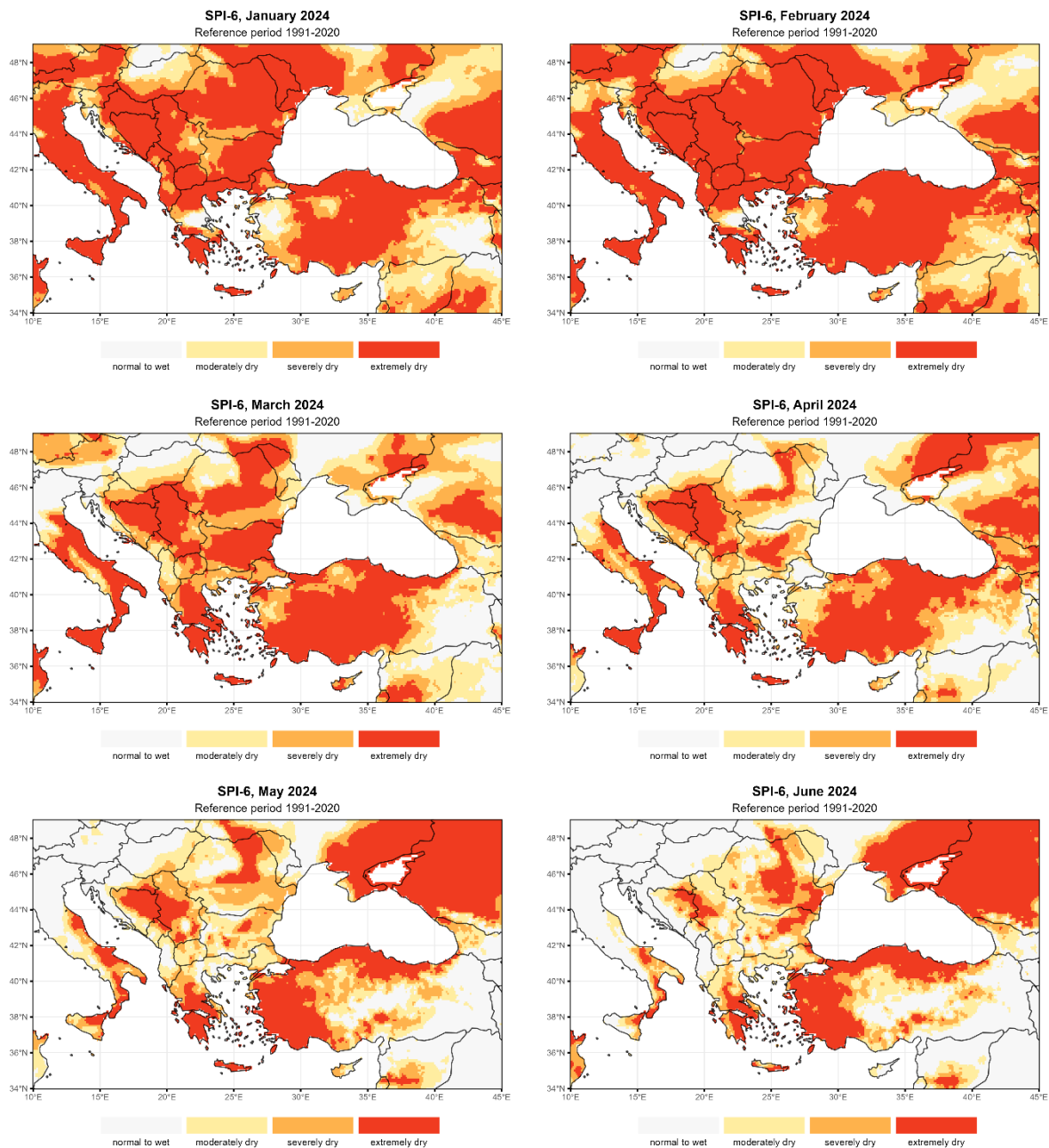
With **November** came much colder than normal air temperatures to the region, only across western and eastern thirds of Turkey and much of Greece November mean stood about the average but not more than 1.5 °C above it. The rest of the region was embraced in air temperatures on average up to 2 °C colder than usual, in southern Serbia and over wider Hungary-Romania border area up to 3 °C colder. Over the Aegean Sea and Bosphorus area precipitation deficit continued throughout November, altogether resulting in additional monthly surface water balance deficit of up to 60 mm. Considerably dry was November also over the far north-west, from northern Hungary to southern Albania and especially along the Adriatic Sea, where lack of rain attributed to up to 90 mm of monthly surface water balance deficit, locally in Slovenia, Bosnia and Herzegovina and Montenegro between 150 and 200 mm. Elsewhere in the region, normal to wet surface water balance conditions prevailed in November, with surplus of 30–90 mm present mostly in central-southern Balkan Peninsula and along northern Turkey.

Warmer-than-usual air temperatures returned across much of the region in **December**. With the exception of the western parts, from Slovenia to southwestern Serbia, and northeastern quarter of Turkey where December mean air temperature stood within 1.5 °C from the average in either extreme, December was across the rest of the region on average up to 2.5 °C warmer than usual, across northeastern part of Balkan Peninsula from Moldova to southwestern Romania up to 3 °C. Precipitation deficit continued in northern Romania, Slovenia, along the Adriatic Sea and across most of the eastern half of Turkey, altogether resulting in up to 90 mm of monthly surface water balance deficit, over the western Alps and southern Adriatic Sea area surface water balance was up to 125 mm lower than usual for December. Elsewhere and especially over the Aegean area, December high precipitation level resulted in considerable monthly surface water balance surplus, mostly between 25 and 100 mm, locally in western and northern Greece and far western Turkey up to 200 mm.

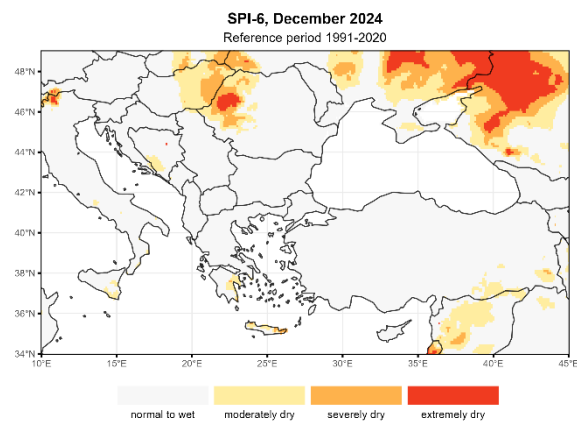
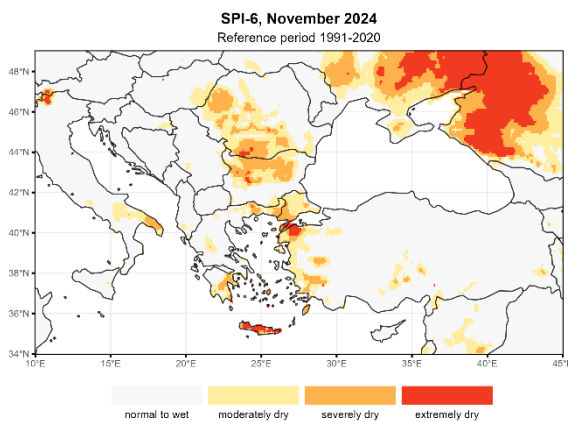
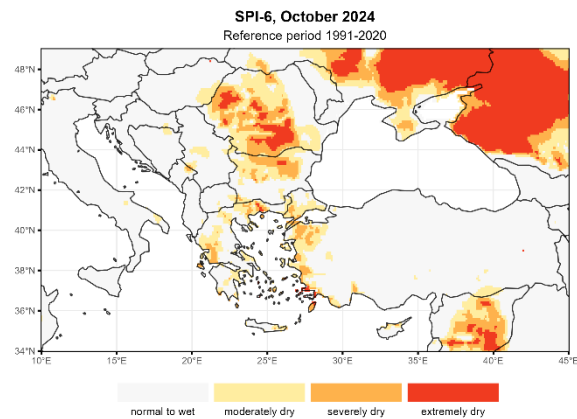
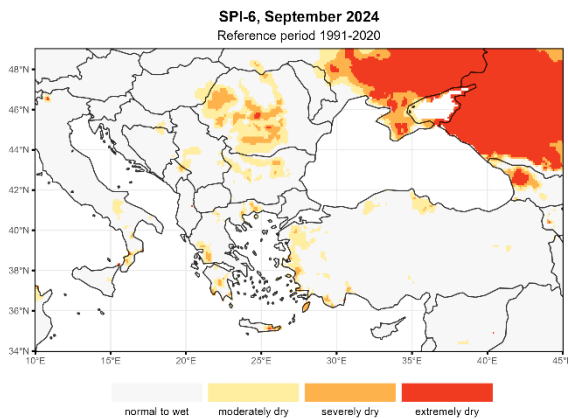
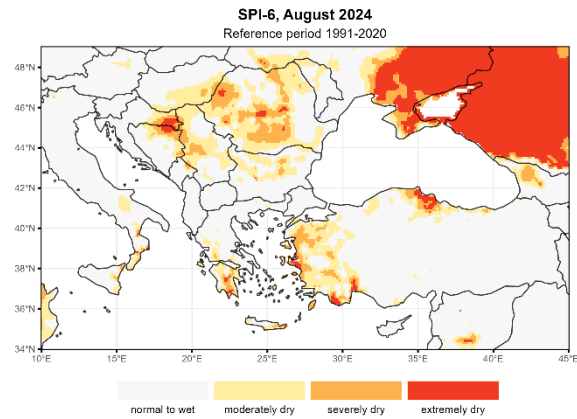
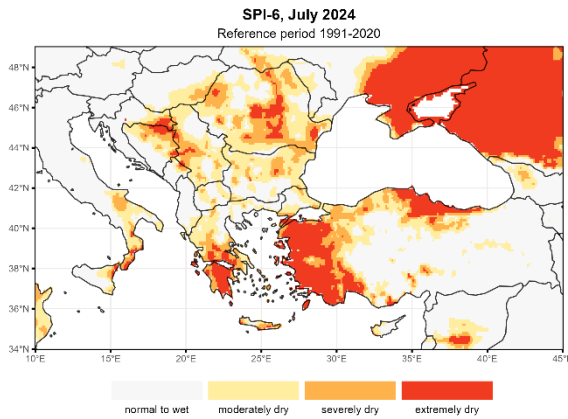
## STANDARDIZED PRECIPITATION INDEX

Drought situation with regard to precipitation accumulation is presented by **Standardized Precipitation Index (SPI)**. The SPI calculation is based on distribution of precipitation over a longer time period (in this bulletin long-term average 1991–2020 is used). SPI can be calculated at various time scales which reflect impact of drought on water availability. The long-term precipitation record is fit to probability distribution which is then normalised so that the mean SPI for any place and time period is zero. SPI values above zero indicate wetter periods while values below zero indicate periods drier than normal. Only the dry part of the extreme anomalies is presented on the maps below.

SPI maps for one and three months throughout 2024, which can be used for indication of meteorological and agricultural drought respectively, have already been published in individual monthly bulletins. Maps below show **6-monthly SPI throughout 2024**, which give indications about hydrological conditions throughout the year.







SPI6 for **early 2024 winter months** shows extensive spread of severe to extreme hydrological drought across the region in terms of 6-monthly precipitation accumulations. They developed on the base of severe to extreme precipitation deficit recorded across most of the region from August 2023 to October 2023, to a lesser degree in December 2023 and January 2024, and to extreme level again in February 2024. Of the observed period between August and February, it was only in November that region recorded average precipitation amount, with no considerable surplus to make up for the past deficit.

**Spring months** were generally favourable in precipitation sense, except for April across parts of western Turkey and its northeastern half, and May in northern Romania. As a result, severity and geographical extent of hydrological drought across the region began to lessen throughout spring months but nevertheless remained extreme over northern Romania, much of Serbia, Bosnia and Herzegovina, southern half of Greece and western and northern Turkey, mostly on the account of extremely dry October 2023 and February 2024,

with surrounding areas still under moderate to severe 6-monthly precipitation deficit.

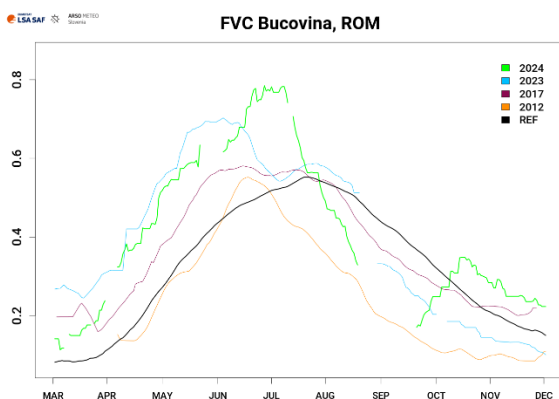
Only in June did the areas under extreme hydrological drought continue to experience considerable lack of rain, then throughout the rest of **summer** average to wet precipitation conditions spread across southern half of the region and contributed to rapid cease of hydrological drought across Greece and Turkey, only across limited areas in southern Greece and western and in parts northern Turkey they remained moderate to severe. In July and August, precipitation was scarce across northwestern and central-eastern Balkan Peninsula respectively, thus lessening of existing hydrological drought was throughout summer in central part of Balkan Peninsula slower than in the south, although it lost most of its extreme intensity by the end of summer, thus remaining present in moderate to severe in intensity.

Noticeably wetter than normal **September** over the entire region contributed to nearly complete cease of hydrological drought across the region, with only Romania still recording moderate to severe 6-monthly precipitation deficit although even in this country the geographical extent shrunk by the end of September compared to its extent in August. September level of severity and geographical extent of 6-monthly precipitation deficit indicating unfavourable hydrological conditions was the smallest of the entire year 2024. In **autumn**, noticeably drier than normal October and locally also November revived severe to extreme level of hydrological drought in parts of southwestern half of Romania, Bulgaria and wider Aegean area, but which mostly lessened in scope and intensity again before the end of the year.

## REMOTE SENSING – FRACTION OF VEGETATION COVER

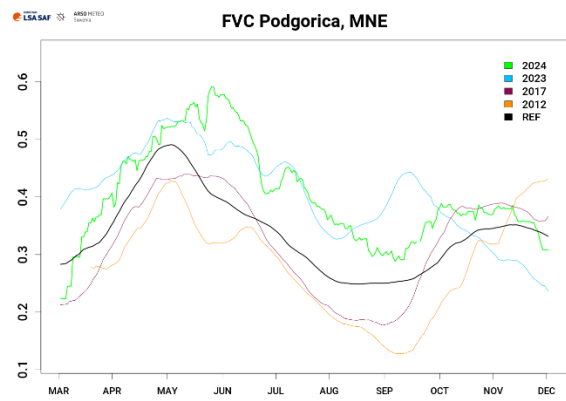
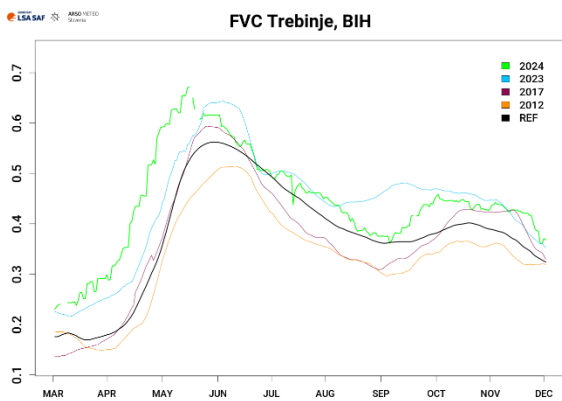
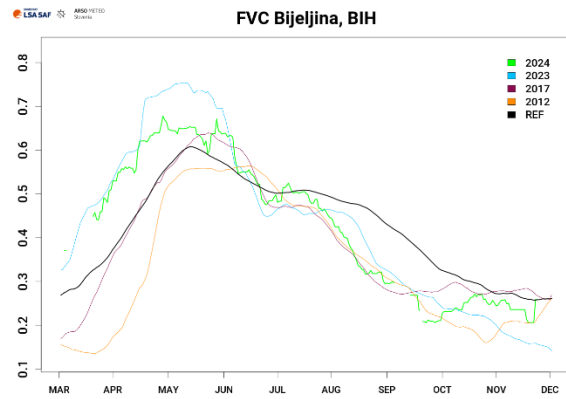
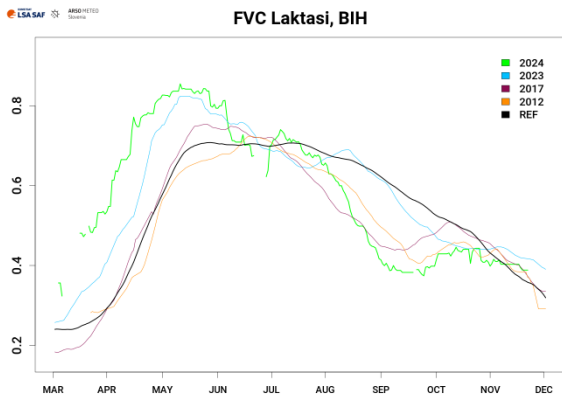
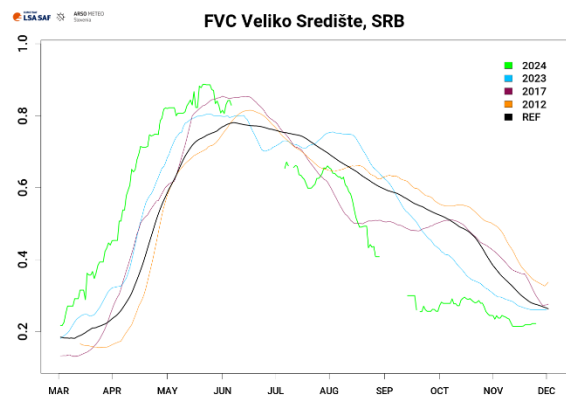
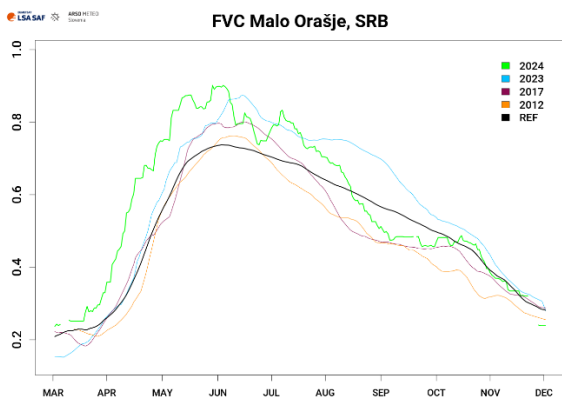
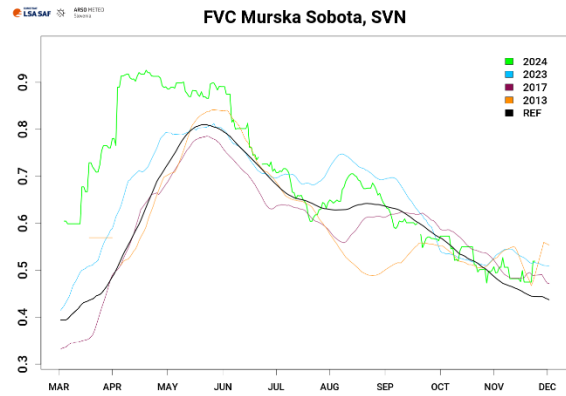
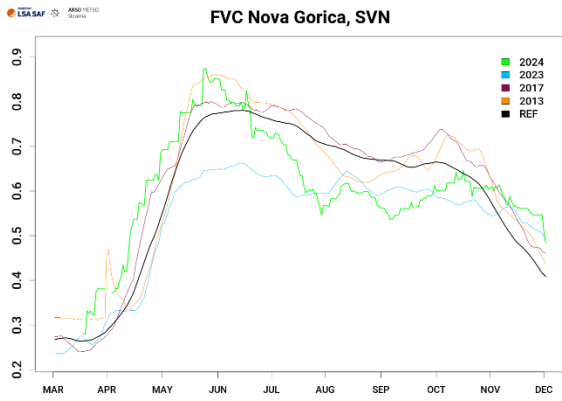
***Fraction of vegetation cover (FVC)** is a vegetation index based on multi-channel remote sensing measurements. FVC shows fraction of the total pixel area that is covered by green vegetation, which is relevant for applications in agriculture, forestry, environmental management and land use. Values vary according to the vegetation stage and to the damage suffered by the vegetation, among others due to possible natural disasters including drought. FVC values are lower at the beginning of the growth season, the highest at the full seasonal vegetation development, then FVC slowly drops with vegetation senescence. Line shape depends on sort of the vegetation. Index deviation from the long-term average (reference line) in combination with meteorological deviations has proved useful for drought monitoring.*

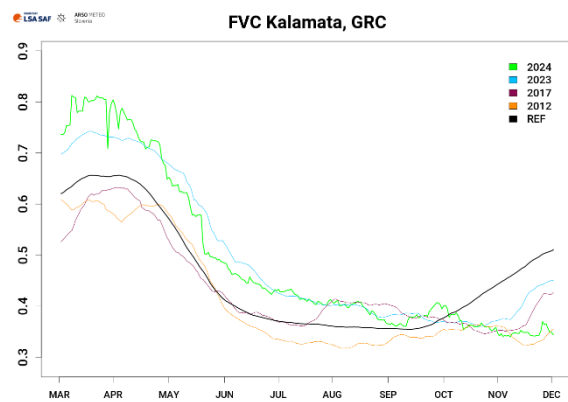
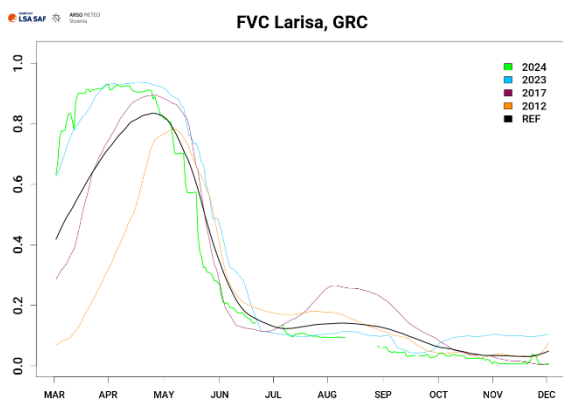
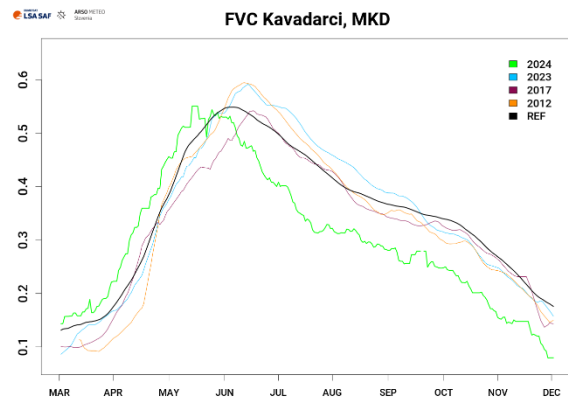
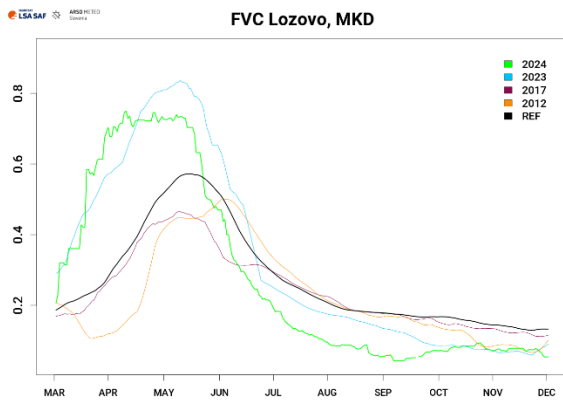
Graphs below present **vegetation development** from **March to December 2024** at 13 locations across southeastern Europe, as indicated by FVC index. FVC values for year 2023 are presented as green line. Graphs also include reference line (2004–2023) in black, and lines in light blue (year 2023), magenta (year 2017) and orange (year 2012, or 2013 for Slovenia) for comparison. Possible missing values or their sharp decline can be a result of prolonged cloudy weather, extreme weather events, snow blanket or changes to product by the product provider.



*Graphs of FVC at the following locations  
(from top left to bottom right):*

*Romania – Bucovina;  
Slovenia – Nova Gorica, Murska Sobota;  
Serbia – Malo Orasje, Veliko Srediste;  
Bosnia and Herzegovina – Laktasi, Bijeljina, Trebinje;  
Montenegro – Podgorica;  
North Macedonia – Lozovo, Kavadarci;  
Greece – Larisa, Kalamata.*





## DROUGHT IMPACT REPORTS

### CROATIA

Favourable distribution of precipitation during spring months in most regions enabled a good start to the growing season, and due to heat the growing season began 14 days earlier. The **maize** held up well until mid-July when it seemed the yield would be at its maximum, but the heatwave in second half of July accelerated senescence and decimated the crop. Depending on the soil type at individual locations, the yield reduction was between 40 and 80 %, not only on maize but also on **other crops grown without irrigation**.

Along the Adriatic Sea, the **olives** held up well for most of the month due to the available water reserves during spring, but drought in the second half of July led to curled leaves and shriveled fruits and a questionable harvest. Drought in the Neretva valley had a negative effect on the crops of **watermelons, citrus fruits and other vegetables**.

The amount of rainfall in August, averaging around 40 mm in lowland areas and around 20 mm along the Adriatic coast, was insufficient to alleviate the effects of heat stress on plants, which was present almost the entire month. The drought in most regions during August caused significant damage to the agricultural sector, and without irrigation, it was very difficult to maintain optimal yields. In Slavonia region, eastern Croatia crops like **rapeseed, soybeans, sugar beets, and corn** suffered the most. Yields decreased locally by more than 80 %, and **natural disasters were declared** due to drought. Along the Adriatic, **olive trees** shrivelled and were suffering from heat stress due to high day and night air temperatures.

Extracted from:

[https://meteo.hr/klima.php?section=klima\\_pracenje&param=spi&el=prspi](https://meteo.hr/klima.php?section=klima_pracenje&param=spi&el=prspi)

[https://meteo.hr/klima.php?section=klima\\_pracenje&param=ocjena](https://meteo.hr/klima.php?section=klima_pracenje&param=ocjena)

[https://meteo.hr/proizvodi.php?section=publikacije&param=publikacije\\_publicacije\\_dhmz&el=bilteni](https://meteo.hr/proizvodi.php?section=publikacije&param=publikacije_publicacije_dhmz&el=bilteni) (preliminary report; publication is in preparation)

[https://meteo.hr/klima.php?section=klima\\_pracenje&param=spi&el=karte\\_suse&Week=231012](https://meteo.hr/klima.php?section=klima_pracenje&param=spi&el=karte_suse&Week=231012)

[https://meteo.hr/klima.php?section=klima\\_pracenje&param=spi&el=karte\\_suse](https://meteo.hr/klima.php?section=klima_pracenje&param=spi&el=karte_suse)

## SERBIA

Extremely high temperatures and drought this year caused severe hardship for farmers in Serbia. The yields of all agricultural goods were somewhat reduced or poor in quality, fewer goods made to the market and their **prices** generally went up. Yields of nearly all main agricultural crops and vegetables were in generally reduced on average up to 50 %. Mostly affected stood **corn and soybean** while the consequences of the drought in fruit growing are different - cherries and apricots suffered less from the drought, which is not the case with **apples, pears and vine**.<sup>[1, 2, 3]</sup> The producers from Sumadija, central Serbia estimated that the biggest damage from the two-month drought, when not a drop of rain fell in most villages in July and August, was suffered by corn and soybean, to about 50 %, as well as **sunflower**, which had a drop in yield by about 40 %. The damages to corn crop further concern livestock breeders, as **corn for cattle feed** has also failed this year.<sup>[4]</sup> Pepper yield was also up to 50 % reduced, due to high spring air temperatures in addition to summer drought and heat. Pepper sprouting was difficult, many didn't even produce seedlings and some plants in hot spring temperatures rejected the fruit, thus first flowers appeared only in July. According to agro-economists, the crop of **all basic vegetable crops** - potatoes, peppers, tomatoes, cucumbers and onions - has failed.<sup>[5]</sup> The **grapes** ripened earlier in Zeljin area, central Serbia, with early varieties picked at the beginning of August already, but due to extremely high temperatures and prolonged drought, yields are on average 30 % lower although it secured the quality of the remaining fruit.<sup>[6]</sup> The dry season did not favour the **walnut** crop across northern Serbia, and in high air temperatures quite some walnuts did not pollinate. Therefore, in some orchards the yield is expected to drop by more than 40 %.<sup>[7]</sup> Dry soil due to drought **prevented sowing** of the oilseed rape during its optimal period at the end of August or in early September but has instead been postponed for about a month while some producers did not even purchase seeds in fear conditions for timely soil preparation will not be met.<sup>[8]</sup>

All **fruits** ripened earlier due to high temperatures and lack of rainfall. Fruit trees obtained autumn colour of the leaves in mid-August already. Peaches and plums were in Srem, northern Serbia by mid-August already collected. In Cacak region, central Serbia pear harvest was due to lack of rain mostly affected in quality, thus most of pears will end up in processing.<sup>[9, 10, 11]</sup> Drought caused earlier **grape** harvest. In Idos, northern Serbia, most of the vineyards were harvested before the end of August already. Drought increased sugar levels in grapes but reduced quantity.<sup>[12, 13]</sup> In Pirot, southeastern Serbia, this year's **honey** yields were several times lower than previous years. Beekeepers had an average of 2–3 kg of honey per hive, compared to 10–20 kg in previous years, in a good year even up to 50 kg. According to local beekeepers, reasons lie in rainy spring when bees could not collect nectar during the blooming of the acacia, and in extremely hot and dry summer which further reduced the availability of food and water for the bees, as well as their survival conditions.<sup>[14]</sup> **Calls for protests** arose due to farmers' dissatisfaction with response from the governing bodies to difficult farming situation.<sup>[15]</sup>

Scorching air temperatures and almost no rainfall over the summer months made several kilometres of natural area spanning across **Mount Cer appeared yellow and withered**. Similar scenes could also be seen on other mountains such as Kosmaj, Divcibari etc.<sup>[16]</sup> Extreme heat wave and lasting drought affected almost all parts of Serbia, causing **fires, drought and water shortages** across much of the country. Many populated or natural areas experienced water supply problems or even completely **dried up local springs**. Thus, drinking water needed to be delivered with army, civil protection or water supply vehicles to supply for the basic daily needs, but in some places even that the minimum was difficult to be met.<sup>[17, 18, 19, 20]</sup> In municipalities of Lucani and Guca, western Serbia, several villages and towns did not have water supply during nighttime hours. A decision was made to impose much higher water prices for household water consumption over a **set daily water limit**.<sup>[21]</sup> Due to excessively high air temperatures and prolonged lack

of rain, 20 villages of Sjenica municipality, western Serbia were left without water for over 2 months. Many water sources on Pester plateau where cattle normally graze, dried up, leading to **livestock death**.<sup>[22, 23, 24]</sup> High temperatures and low water level caused **en-masse death of fish** in Dzerekarska River, southwestern Serbia to the extent of ecological disaster.<sup>[25, 26]</sup> In September, some sections of **Kamenica River** near Cacak, central Serbia almost completely dried up.<sup>[27]</sup> Very low water level was recorded also on the **Danube River** in eastern Serbia, which revealed the wrecks of German military ships near Negotin.<sup>[28]</sup> In early September, long-term drought left the water level of Serbia's cleanest **river Gradac** at its biological minimum near Valjevo, northwestern Serbia. The riverbed has been low in some places for a long time, but in early September also the river's main source dried up.<sup>[29]</sup> By mid-September, the Ibar River in southwestern Serbia dried up at several sections and caused a fish kill to the extent of **ecological disaster**. Its water level at the source was in June similar to that normal at the end of August or the beginning of September, when the water level is at its lowest. Low water level was due to lack of snow precipitation in the last two winter seasons, prolonged drought this summer as well as high temperatures, due to which all tributaries in the upper section of Ibar were at an extreme minimum, which at one point caused the river to dry up completely over a lengthy section from the village of Bac in eastern Montenegro to Lake Gazivoda in southwestern Serbia.<sup>[30]</sup>

In mid-August, **state of emergency** was declared for territories of Sjenica and Gornji Milanovac, western Serbia due lasting drought and high air temperatures that caused problems in the water supply to the population as well as to feed livestock.<sup>[31, 32, 33, 34]</sup> Although restrictive measures on water consumption in municipality of Topola, central Serbia were introduced in mid-July due to severe drought, further worsening of hydrological conditions led to the state of emergency being declared in mid-August for part of its territory, mostly several rural settlements, as there was no capacity for even restrictive supply to rural settlements without jeopardizing the minimum supply of urban settlements with priority institutions such as kindergartens, schools, health center and the like.<sup>[35, 36, 37]</sup> Later in August, a state of emergency was declared on the territory of Nova Varos Municipality, western Serbia, where bad hydrological conditions led to the drying up of almost all springs and the water supply problems were critical for both urban and rural areas.<sup>[38, 39]</sup>

In mid-August, due to low water level of Sava River in the Sabac sector, northwestern Serbia, islets appeared, and the river could practically no longer be used for **navigation**, according to the representatives from Vode Vojvodina. The situation was problematic also on the Banat watercourses, northeastern Serbia, encompassing smaller rivers coming from the territory of Romania, where there was no improvement observed in water levels for several days.<sup>[40]</sup>

[1] <https://vreme.com/ekonomija/posledice-suse-paradajz-zelen-kukuruz-i-krompir-izgoreli/>

[2] <https://www.euronews.rs/biznis/agrobiznis/136915/problemi-ratara-vocara-i-povrtara-zbog-suse-se-suocavaju-sa-smanjenjem-roda-za-u-proseku-50-odsto-vest>

[3] <https://moravainfo.rs/ocekuje-se-rast-cena-voca-povrca-i-zimnice/>

[4] <https://www.glassumadije.rs/lbar-presusio-ekoloska-katastrofa-koja-nas-mora-probuditi/>

[5] <https://novaekonomija.rs/vesti-iz-zemlje/letnja-susa-prepolovila-rod-paprake-tegle-ajvara-poskupela-na-preko-1-000-dinara>

[6] <https://biznis.rs/vesti/srbija/grozdje-sazrelo-ranije-ali-susa-obra-30-odsto-prinosa/>

[7] <https://www.rts.rs/vesti/srbija-danas/5541598/kako-su-mraz-a-zatim-i-susa-uticali-na-proizvodnju-oraha-.html>

[8] <https://biznis.rs/u-fokusu/susa-pomerila-setvu-uljane-repice-za-kraj-septembra/>

[9] <https://rtvnp.rs/2024/08/17/vrucina-i-susa-omlatile-oko-150-000-tona-voca-u-srbiji/173148>

[10] <https://www.euronews.rs/biznis/agrobiznis/134928/vocari-se-zale-kisa-nije-padala-vise-od-40-dana-to-je-uticalo-na-kvalitet-kruske-vest>

[11] <https://www.mojnovisad.com/vesti/toplotni-talas-i-vocarstvo-ranije-sazrevanje-voca-i-uticaj-na-domacu-proizvodnju-id63864.html>

[12] <https://www.dnevnik.rs/ekonomija/poljoprivreda/susret-proizvodaca-u-idosu-obrase-se-vinogradi-zbog-suse-ranije-nego-inace>

[13] <https://www.politika.rs/sr/clanak/629203/Berba-grozda-u-nasoj-zemlji-drasticno-poranila>

[14] <https://www.pirotskevesti.rs/losa-godina-za-pcelare-prinosi-znatno-manji-od-uobicajenog-proseka/>

[15] <https://n1info.rs/biznis/naps-ako-vlada-ne-ispuni-zah-teve-za-pomoc-spremn-smo-na-protest/>

[16] <https://www.blic.rs/vesti/drustvo/jezive-posledice-suse-u-dve-fotografije-ovako-je-nasa-planina-izgledala-u-junu-a-da/9r97rm8>

[17] <https://www.telegraf.rs/vesti/srbija/3954095-problem-sa-vodosnabdevanjem-u-topoli-na-terenu-18-tankova-za-vodu-mestanima-je-to-jedini-spas>

[18] <https://www.blic.rs/vesti/drustvo/alarmanтно-stanje-u-topoli-ogromni-problemi-sa-vodom-restrikcije-neminovne-a-eto-sva/3r2hmfh>

[19] <https://www.slobodnaevropa.org/a/pozari-suse-nestacije-vode-srbija/33081710.html>

[20] <https://www.dnevnik.rs/drustvo/u-susi-pomaze-kako-ko-moze-dok-se-zaseoci-kod-bajine-baste-muce-bez-vode-oni-koji-mogu>

[21] <https://www.kurir.rs/vesti/srbija/4428037/sve-manje-vode-za-normalno-snabdevanje-u-lucanima>

[22] <https://www.novosti.rs/srbija/vesti/1399660/vanredna-situacija-opstini-sjenica-zadesila-katastrofalna-susa-dvadesetak-sela-bez-vode-vec-dva->

meseca-foto

[23] <https://www.telegraf.rs/vesti/srbija/3947937-zivotinja-umrla-na-livadi-od-zedji-ovo-je-najtuznija-slika-sa-pestera-susa-napravila-katastrofu>

[24] <https://sandzakpress.net/vlast-ne-nesposbna-da-obezbijedi-vodu-susa-uzima-danak-pocelo-uginuce-stoke-u-sjenici/>

[25] <https://www.sandzakhaber.net/ekoloska-katastrofa-na-pesteru-pomor-ribe-u-reci-djerekara-visoke-temeprature-i-nizak-vodostaj-prete-biljnom-i-zivotinjskom-svetu/>

[26] <https://www.kurir.rs/vesti/drustvo/4427289/masovni-pomor-ribe-na-pesteru-zbog-suse>

[27] <https://indeksonline.rs/2024/09/alarmanтно-stanje-i-na-ovoj-srpskoj-reci-presusila-kamenica-kod-cacka-mestani-ne-pamte-susu-poput-ove/>

[28] <https://www.b92.net/zivot/aktuelno/58323/kod-negotina-ispivali-nacisticki-vilenjaci-pad-nivoa-dunava-otkrio-ratne-tajne-foto/vest>

[29] <https://www.telegraf.rs/vesti/srbija/3961672-alarmanтно-stanje-u-valjevu-ekoloska-katastrofa-na-pomolu-presusuje-najcistija-reka-u-srbiji>

[30] <https://www.glassumadije.rs/ibar-presusio-ekoloska-katastrofa-koja-nas-mora-probuditi/>

<https://www.rina.rs/item/21361-/>

[31] [https://www.rtv.rs/sr\\_lat/drustvo/zbog-vrucine-i-suse-proglasena-vanredna-situacija-na-teritoriji-opstine-sjenica\\_1561470.html](https://www.rtv.rs/sr_lat/drustvo/zbog-vrucine-i-suse-proglasena-vanredna-situacija-na-teritoriji-opstine-sjenica_1561470.html)

[32] <https://www.alo.rs/vesti/drustvo/942433/u-sjenici-proglasena-vanredna-situacija/vest>

[33] <https://www.rina.rs/item/21084-/>

[34] <https://vreme.com/razno/susa-uzima-danak-pocela-uginuca-stoke-u-sjenici-vanredno-i-u-gornjem-milanovcu/>

[35] <https://www.telegraf.rs/vesti/srbija/3948627-proglasena-vanredna-situacija-u-topoli-susa-i-udarila-i-na-sedam-sela-u-kojima-je-stanje-kriticno>

[36] <https://vreme.com/drustvo/susa-katastrofa-u-srpskoj-toskani/>

[37] <https://www.telegraf.rs/vesti/srbija/3954095-problem-sa-vodosnabdevanjem-u-topoli-na-terenu-18-tankova-za-vodu-mestanima-je-to-jedini-spas>

[38] <https://www.rina.rs/item/21141-/>

[39] <https://zoomue.rs/susa-pravi-probleme-u-novoj-varosi/>

[40] [https://www.rtv.rs/sr\\_lat/drustvo/susa-ugrozila-plovidbu-rekama-kod-sapca-vrebaju-sprudovi-dunav-se-bolje-drzi%E2%80%A6\\_1562563.html](https://www.rtv.rs/sr_lat/drustvo/susa-ugrozila-plovidbu-rekama-kod-sapca-vrebaju-sprudovi-dunav-se-bolje-drzi%E2%80%A6_1562563.html)

## MOLDOVA

In mid-July, the Ministry of Environment called for rational use of water resources after **hydrological warning** was issued by the State Hydrometeorological Service, following monitoring of the state and evolution of meteorological and hydrological conditions across the country. The most affected across the country were the Botna, Vilia, Draghiște and Cubolta rivers. The Prut River downstream of the Costești-Stanca reservoir and the Raut River with its tributaries were also affected. Low water levels were recorded also in the Cainari, Ciulucul de Mijloc and Ciulucul Mic rivers. <sup>[1]</sup> One of the tourist attractions in the Republic of Moldova, the Saharna **waterfall** in the Rezina district, central-eastern Moldova stopped due to drought. And the flow of the Tipova waterfall from the same district also decreased considerably. <sup>[2]</sup>

In mid-July, the Forța Fermierilor Association called on all state institutions to facilitate the urgent establishment of the National Commission for Exceptional Situations and to declare a State of Emergency in **agriculture** at the country level. To their knowledge, thousands of agricultural enterprises together with tens or hundreds of thousands of jobs they hold were in danger of ending bankrupt and liquidated. Dry weather along with record temperatures across the country created record damage throughout all of Moldova. Most of the farmers were affected regardless of the agricultural technology applied to growing crops, including those with ecological technology, as some regions have been faced with severe drought for 3 consecutive years. <sup>[3]</sup> Preliminary data of Ministry of Agriculture and Food Industry showed **corn plantations** in southern Moldova were affected by drought by 70–100%, and **sunflower plantations** by 60–80%. Such high damage to the crops came as a result of both pedological and atmospheric drought, excessively high temperatures and low humidity, as well as frequent nighttime temperatures above 25 °C. <sup>[4]</sup> Generally, crops in the central-eastern area of the country did better compared to that in the south of the country. <sup>[5]</sup> **Apple** producers expected about 15 % less fruit than last year, stating drought and deforestation of orchards as the main causes. <sup>[6]</sup> Drought considerably affected the quantity and quality of **grapes**. The total grape harvest in 2024 was expected to be 20–35 % lower than last year, and due to unusually high temperatures the harvest began 20–30 days earlier, starting in first days of August already. <sup>[7]</sup> Drought-affected **tobacco** farmers were asking for help from the authorities, since of the approximately 400 ha cultivated with tobacco, two thirds were affected by the drought. <sup>[8]</sup> The Commission for Exceptional Situations has allocated 100 million lei from the **Government Intervention Fund** for farmers affected by drought. <sup>[9]</sup>

[1] <https://unimedia.info/ro/news/406b8f23ac4c3a02/moldovenii-indemnati-sa-consume-rational-apa-seceta-si-canicula-au-stors-raurile-din-tara.html>

[2] [https://www.ipn.md/ro/cascadele-de-la-saharna-si-tipova-afectate-de-seceta-7967\\_1106755.html](https://www.ipn.md/ro/cascadele-de-la-saharna-si-tipova-afectate-de-seceta-7967_1106755.html)

[3] <https://unimedia.info/ro/news/ac8f29e68c9a0989/record-de-pagube-in-agricultura-din-cauza-secetei-extreme-fermierii-in-disperare-cer-instituirea->

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[5] [https://www.ipn.md/ro/in-centrul-tarii-porumbul-si-floarea-soarelui-s-au-7966\\_1106254.html](https://www.ipn.md/ro/in-centrul-tarii-porumbul-si-floarea-soarelui-s-au-7966_1106254.html)

[6] <https://www.ziarulnational.md/mai-putine-mere-recoltate-in-acest-an-in-r-moldova-seceta-si-defrisarea-livezilor-printre-principalele-cauze/>

[7] [https://www.ipn.md/ro/recolta-de-struguri-va-fi-cu-20-35-mai-7966\\_1106907.html](https://www.ipn.md/ro/recolta-de-struguri-va-fi-cu-20-35-mai-7966_1106907.html)

[8] [https://www.ipn.md/ro/producatorii-de-tutun-afectati-de-seceta-cer-ajutorul-autoritatilor-7966\\_1106309.html](https://www.ipn.md/ro/producatorii-de-tutun-afectati-de-seceta-cer-ajutorul-autoritatilor-7966_1106309.html)

[9] [https://www.ipn.md/ro/cse-a-alocat-100-de-milioane-de-lei-pentru-7966\\_1106993.html](https://www.ipn.md/ro/cse-a-alocat-100-de-milioane-de-lei-pentru-7966_1106993.html)

## ROMANIA

Intense drought and heatwave conditions this year severely affected **agricultural crops** in Romania. According to farmers' estimates, the degree of damage ranged between 70 and 100 %. As a result of such losses, the **prices** of basic food products such as sunflower oil, corn and potatoes rose considerably, affecting the purchasing power of consumers. <sup>[1, 2, 3]</sup> According to the County Agricultural Directorate's final analysis, damage to **spring crops** in Olt County, southern Romania were observed on one third of the arable lands. Sunflower crops were affected on more than two thirds of the cultivated area, and complete calamity was present on about 10 % of the cultivated area. <sup>[4]</sup> In Arad County, western Romania around 40,000 ha were affected by drought, which presents 12 % of the county's arable surface. The most affected was its western part, mostly in Nadlac, Pecica or Sintin, where the surfaces were affected in proportions of up to 70-80 %. <sup>[5]</sup> In Prahova County, southern Romania, of more than 4,600 ha sown with autumn crops, a degree of damage was determined between 71 % and 100 %, with the most affected crops being corn and sunflower, these being also the principal crops of Prahova County. <sup>[6]</sup> In Buzau County, southeastern Romania, almost the entire **corn** production was affected by drought, even on irrigated plots, and the lands cultivated with **wheat** were affected to a considerable extent. The areas of Balta Alba, Boldu, Valcelele, Ghergheasa and several others were completely affected, with no corn successfully produced. As for sunflower, the yields were on average more than 50 % lower. <sup>[7]</sup> In general, farmers recorded also poor production of **cabbage** due to drought, as most of the crop was compromised. <sup>[8]</sup> The **sugar beet** crop was also among the affected crops due to drought. The heat wave and the lack of rain even led to the halving of production. <sup>[9]</sup> Ostrovit wine and table **grape** producing company, located in southeaster Romania reported that due to hot and dry summer, followed by heavy rains, their production was reduced by approximately 20-30% in comparison to the last year, although the quality was not expected to be affected. <sup>[10]</sup> Extreme heat affected also **tobacco crops**. In Dolj, southern Romania, the plants did not reach a quarter of the height they normally would by this time in season, and on some surfaces, they completely stopped growing. Similar situation was experienced also by farmers who replanted it three times in an attempt to save production. <sup>[11]</sup> The decrease in soil moisture affected also livestock breeders. **Donkey milk production** dropped by 57 % this year after pastures were scorched and the quality of the available grass decreased. <sup>[12]</sup> According to the owner of the first truffle plantation in Romania that obtained the accredited mountain product certificate, from Archita, central Romania **truffles** were becoming increasingly rare, both in the forest and in plantations, with production decreasing by about 40 % in the face of the excessive drought of the last two years. <sup>[13]</sup>

In the view of extreme weather conditions affecting agricultural production in the past year, the Romanian government adopted **emergency ordinances** as a solution to support agricultural producers, which evolves around financial compensation for production losses and the legal suspension of the repayment of current and outstanding debts. According to their estimates, more than 2.5 million ha of agricultural land was affected by drought, and the eligibility for compensations applies to more than 230,000 farmers whose crops of wheat, barley, rapeseed, corn, peas, sunflowers, soybeans, vines, fruit trees were affected by drought from September 2023 to August 2024. <sup>[14, 15, 16]</sup> According to the estimates of the Pro Agro National Federation, severe drought in Romania affected approximately 2.5 mio ha of agricultural crops, represented in about 40 % of wheat, corn, rape and sunflower crops, with **major economic damage** that could reach 1.8 billion euros. With such high losses recorded in Romania, one of the EU's main corn and sunflower producers, the **EU-level corn production** is expected to fall. <sup>[17, 18]</sup>



Hot and dry weather conditions caused **hydrological drought** across Romania. Drought and lack of rain this summer contributed to the drastic drop in **Danube River** water level along the entire course of the river. In Bazias, southeastern Romania where Danube enters the country, flow rate in mid-August was almost half its normal. Several other critical points were detected along the river course, which is why the authorities were constantly dredging the depth of the **navigable channel**. Under such low water conditions, **energy production** at the Iron Gates, southwestern Romania was also affected and at the Portile de Fier hydropower plant, it decreased by half. At Corabia, southern Romania, the appearance of sand dunes and islands greatly affected the **tourist boat traffic** on the river. Tourist boats were often suspended from leaving the port. In Galati, southeastern Romania, shipowners were notified in advance not to **load the ships** at full capacity.<sup>[19, 20, 21]</sup> Agricultural sector in Dolj county, southern Romania was additionally affected by low water level in the Danube River, as its flow fell below 2500 m<sup>3</sup>/s and the water could no longer be pumped to the **irrigation canals**. Sand islands appeared in the area, and several localities were affected, such as Sadova, Calarasi, Bechet, Dabuleni.<sup>[22]</sup> Drought and heat waves affected water levels also in northwestern quarter of Romania. In late August, **Somes River** in the municipality of Satu Mare, northwestern Romania reached a new historical minimum level of -129 cm. Drought brought to the surface the pillars of the former bridge next to the Decebal bridge. In certain areas, the Somes river could be crossed without much difficulty. Out of 13 representative sections for hydrological drought monitoring in the Somes-Tisa hydrographic basin, two sections had flows below the minimum flow required to meet the quantitative requirements.<sup>[23]</sup> The **Sbant River** in Iasi County, northeastern Romania dried up almost along its entire 10-kilometer length. According to the Prut-Barlad Water Basin Administration, out of the 121 water courses in Iasi, 33 were completely dried up.<sup>[24]</sup>

Prolonged heat and drought caused several rivers to disappear entirely. Dozens more were near the drying out level, altogether destroying **ecosystems** at several locations. **Fish population** was observed disappearing, as well as the **birds and mammals** that fed on them. Drop of water levels due to drought, and heat waves caused huge losses in aquatic life and fish farming, as extremely high temperatures caused the death of thousands of fish in the waters of Iasi and Botosani, northeastern Romania. Water temperature of 32 °C were recorded in some waters, whereas optimal temperature for fish 24–26°, and at 27° feeding is interrupted and a state of stress entered. At the same time, the water level dropped by 10 cm in a week. In a lake in Sulita commune, Botosani county, a total of 1.6 tons of fish died. In the recreational lake Ciric in Iasi, dead fish appeared on the surface due to heat wave. To limit the damage in fish farming, many fish farmers sold fish that did not reach the optimal weight. Fishermen estimate that fish production will be half that of last year because of unfavourable weather.<sup>[25, 26]</sup> **Wild animals** also suffered from the heat and drought, as springs dried up and wildlife was left without a water source in many places. In Dolj, the employees of the hunting funds dug artificial pits and filled them with water brought in by tankers. Due to the heat wave, the animals' behaviour changed, experts say. Similar reports came from Galati County, southeastern Romania where authorities went every morning with the tankers to fill up the reservoirs.<sup>[27, 28, 29]</sup> Pointed out among others were the ecosystem areas depending on Susita River, southwestern Romania, which dried up, Lake Brates and Lake Talabasca in southeastern Romania, the latter declared a **protected area** which also dried up completely.<sup>[30, 31, 32]</sup> Considered one of the largest **wetlands** in southern Romania, Balta Comana (Neajlovu Delta) has become a dry field. The fish began dying, the birds left the place, and **tourism** was severely affected.<sup>[33]</sup> Serious problems were detected in the Carpathian Delta, a **natural area** in Brasov, central Romania, protected for its fish ponds and reed beds where rare bird species nest. Three lakes became expanses of dry land with deep cracks from which dry clam shells emerge. The little life left here huddled in the mud holes, on which dead fish floated.<sup>[34]</sup> According to the Inspectorate for Emergency Situation in Bistrita-Nasaud County, northern Romania, there were more than 80 **wildfires** since the beginning of the year, which affected a total of more than 400 hectares of land. The most extensive fires occurred in September, fuelled by drought and wind, over 300 hectares of agricultural land and forest were affected.<sup>[35]</sup>

According to the National Administration “Romanian Waters”, two sections of rivers from the Arges-Vedea hydrographic basin, southern Romania and one from the Prut-Barlad hydrographic basin, eastern Romania remained dry as of mid-September, while another 20 sections out of the 120 monitored had flows below the minimum required. Due to **water shortages**, the water supply restrictions were maintained in 556 localities, and the filling coefficient in the 40 reservoirs was 70 %, 10 % less than two months ago. <sup>[36]</sup> Hydrological situation was alarming across the entire country. Four rivers dried up, and 32 were in early September in danger of disappearing as well, after the longest drought of the last century. A 20-kilometers stretch of **Jiu River**, southwestern Romania dried up completely, revealing its riverbed of an otherwise wide water course. Except for some puddles, there was no water left in riverbed of one of its tributaries, the 14-kilometer **Sohodol River**. According to the locals, the river has, to their memory, never dried up. Tens of thousands of people from hundreds of localities were under **strict water regime**, supplied with water for only a few hours a day. <sup>[37]</sup> Residents of several localities in Vrancea County, eastern Romania were faced with introduction of drinking water distribution regime due to overall low water availability in public network. Water was distributed in sectors, in certain time intervals or on certain days only. According to the CUP Focsani, the regional operator responsible for the distribution of drinking water in the county, this happened both due to drought, but also due to intensive use of water from the public network for the irrigation of agricultural crops. <sup>[38]</sup> According to the National Administration Romanian Waters, there were by third dekad of July 449 localities in the centralized system where **water was supplied with restrictions**, and another 251 dry wells in areas with only individual water sources. The most affected localities were those in the counties of Botosani, Vaslui, Iasi, Alba, Gorj, Vrancea, Bacau, Neamt, Galati, Hunedoara, Vaslui, Olt, Prahova, Suceava and Arges, all positioned along eastern, southern but also western Romania. <sup>[39, 40]</sup>

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[13] <https://www.agerpres.ro/social/2024/08/08/mures-trufele-devin-tot-mai-rare-din-cauza-secetei-excesive-productia-s-a-diminuat-cu-40--1338979>

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## BULGARIA

Summer 2024 was in Bulgaria the hottest and one of the driest since the beginning of the measurements. **Corn and sunflower** harvest appeared to be worst in the last 10 years. The heat and high temperatures in recent months have taken their toll on cereals, with losses reaching 30 %, with some localised areas experiencing worse scenarios. Farmers in the Yambol region, southeastern Bulgaria harvested halved yields of **sunflower and corn** this year. Sunflower harvest started almost a month earlier, and yields were at only 50-60 kg per hectare, with very few farmers reaching 100 kg per hectare. In a normal season, corn yields were about 700 kg per hectare, but in Rusensko, northern Bulgaria farmers harvested 450-500 kg per hectare. The area of Silistra, northeastern Bulgaria was more affected, yields were between 200 and 300 kg per hectare. <sup>[1, 2, 3, 4]</sup> The quality of the produce was also low, mainly the oil content. Greatly affected was also **rice** production due to drought causing poor hydrological conditions. <sup>[5, 6, 7]</sup> According to the chairman of the National Chamber of Vine and Wine, insufficient rainfall and high temperatures adversely affected the **grapes**, reducing their quality and quantity. The harvest started earlier than expected this year due to dry and hot summer, and yields were lower by 30-40 % compared to the previous year. <sup>[8]</sup> Prolonged drought during summer months reduced **bee pastures**. Bees returned to the hive without pollen, and the combs, which in early September would normally be full, were at that time mostly empty. Drought was forcing more people to give up beekeeping. In the last 5 years, production in Dobrich region alone, northeastern Bulgaria has fallen by 50 %. <sup>[9, 10, 11]</sup>

In mid-July, the Ministry of Environment and Water sent a signal to the Ministry of Agriculture about the **alarming hydrological situation**. The water levels in some of the country's dams were critically low due to the lack of spring floodwaters and another dry year, plus record high temperatures. Zhrebchevo dam in central Bulgaria, built to hold water for irrigation was in mid-July at 42 % of its full occupancy and was expected to continue to lose water due to on-going drought conditions and higher water demand for irrigation. <sup>[12]</sup> In August, wide sandbars appeared on the **Danube River** near Antimovo, northwestern Bulgaria. The place is known in the region as the Bare Island and comes out only during a prolonged drought. <sup>[13]</sup> The **Parvenetska River**, central Bulgaria, which presents a **water supply** for the village of Hrabrino and the two surrounding areas, was in mid-August almost completely dry, leaving no water for the residents. <sup>[14]</sup> At the **Cold Well hydropower plant**, southern Bulgaria, part of the dam turned into a green grass pasture where sheep and cows graze. As of late August, water levels in the dam were at 55 % of its full capacity, with decreasing trend. <sup>[15]</sup> A drastic drop in the water level occurred in the **Koprinka dam**, central Bulgaria as its water level was in mid-August at only 15 % of its capacity, with further draining continuing at 8 m<sup>3</sup>/s. Downstream from the dam, dead **sturgeon fish** were observed in the fish farm near Kazanlak. <sup>[16]</sup> According to the Ministry of Regional Development, 111 000 people were in early August affected by a **partial water regime** in 7 cities, 172 villages and 51 municipalities. Due to drought, water regime was imposed in Pleven, Lovec and Teteven in northern Bulgaria. According to the Ministry of

Environment and Water, at the unusually low filling for this time of the year were in mid-August at the **dams Kamchia (water source** for Varna, Burgas and other settlements on the Black Sea coast), Yasna Polyana (water source for Burgas and settlements and resorts on the Southern Black Sea coast and Burgas region), Tica (water source for Shumen, Veliki Preslav and Targovishte) and Asenovets (main water source for Sliven).<sup>[17]</sup>

**Competition for the scarce water resource** also intensified among farmers in areas affected by drought. For over two months, there has been a **state of emergency** in the municipality of Straldza, eastern Bulgaria due to lack of water. In some villages there has been no water for months, for example, Palauzovo, Polyana, Alexandrovo, Irechekovo, Lyulin, Pravdino. There were also those with a water regime such as Jinot and Leyarovo, and in others the flow rate is reduced.<sup>[18]</sup> In early September, Municipality of Straldzha in Yambol region, eastern Bulgaria extended the partial state of emergency due to lack of **drinking water supply**, which has been in place since mid-July, for another month due to drought. According to some of Palauzovo residents, not a single drop came from the tap. Residents from the higher parts of Djnot reported water supply was partial, only in the evening hours. In addition to households, lack of drinking water supply affected also **livestock breeders**.<sup>[19]</sup>

In mid-September, Bulgaria requested the **activation of funds from the agricultural reserve of the European Union** due to damage caused by drought. In July and August, the country also suffered severely from uncontrollable fires exacerbated by high temperatures and prolonged drought.<sup>[20]</sup>

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## GREECE

In June and July, many Greek islands were facing the risk of **water scarcity** due to reduced rainfalls over the past two years, the lack of snowfall, and the ongoing drought, which resulted in insufficient replenishment of water reserves. The water reserves in Attica, which hosts half of the country's population, were on yellow alert. A general decrease of available water reserves prevailed across the country in July. The General Secretariat for Civil Protection declared a **state of emergency due to water shortages** for a number of areas across Attica, southern Greece and various island. There was a significant drop in the water level of boreholes, and **salinization** observed in many areas. The water reserves problem was this year exacerbated by the combination of the seasonal summer decline in reserves and the increased demand during the tourist season.<sup>[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]</sup>

According to the satellite data processed by climatebook, on July 2, 2023, the total surface area of the **lake Mornos**, central Greece has since last July shrunk from 16.5 km<sup>2</sup> to approximately 12.8 km<sup>2</sup>. The same was

the case with the water reserves in Mornos which are reduced by 30 % compared to last year <sup>[9]</sup>. The continued high temperatures for days combined with the intrusion of sea water into the Delta of the river Evros are said to be the main causes that led to the death of wild horses and affected **island fauna**. <sup>[10, 11]</sup> The combination of strong north-easterly winds, drought and high temperatures, put much of the central and southern Greece under high wildfire risk, with a number of **wildfires** already breaking out across the country in mid-July. <sup>[12]</sup>

Agricultural production was also facing significant problems. In Crete, drought affected olive tree, **vineyard** and greenhouse crops, and restrictions on water consumption for irrigation per acre were imposed in several areas, depending on the type of crop. <sup>[13]</sup> In Nevrokopi, **potato production** decreased because, due to reduced rainfall and snowfall, only 1.8 million m<sup>3</sup> of water were available this year at the Lefkogeia dam, compared to the approximately 7-8 million m<sup>3</sup> required annually. Mastic production in Chios has also declined due to high temperatures. <sup>[14]</sup> **Olive producers** in Magnesia, central Greece were facing significant challenges due to prolonged heatwave and drought. The harvest of green, unripe olives typically begins in September but this year green olives were nowhere to be found. The adverse climate conditions caused the olives to shrivel, turn brown, and fall from the trees. This situation was especially critical in southwestern Magnesia where olive cultivation is a monoculture, putting producers at risk of losing their only source of income. <sup>[15]</sup>

The prolonged drought has severely impacted the production of the renowned Naxos **potato**, leading to a significantly reduced harvest this year. In fact, the crop was not to be cultivated in August and September as usual, and by October, it will no longer be available on the market, according to the island's Union of Agricultural Cooperatives. For the first time in history, Naxos is preparing to import potatoes. Farmers report that production has dropped from 6,000 tons in 2022 to just 1,800 tons this year, putting this PDO (Protected Designation of Origin) product at risk of disappearing. The entire **farming and livestock sector** on the island, which sustains 50 % of the economy, is facing serious challenges due to the **water shortage**. <sup>[16, 17]</sup>

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## TURKEY

By mid-February, the water level in the **Kozan Dam**, southern Turkey, which is a water source for irrigation of many agricultural lands, decreased significantly due to drought, dropping to 28 % of its full occupancy. Due to dry winter in Kozan this year, the dam was facing a threat of drying up. <sup>[1]</sup>

An increase in **sunflower oil prices** was expected due to winter drought, which occurred for a consecutive

season now. According to farmers, sunflower production was negatively affected by drought for a while, and many considered giving up on sunflower oil planting due to low prices due to drought. <sup>[2]</sup>

Due to drought experienced in Yozgat, one of the important grain centres of the Central Anatolia Region, central Turkey, this year's **barley** harvest started two weeks early. Producers expressed yield concerns due to insufficient rainfall and drought <sup>[3]</sup>. Similar reports came from the region of Konya, central-southern Turkey, where despite an increase in planting areas compared to the previous year, there could be a 10 % decrease in barley yield due to drought <sup>[4]</sup>.

Serious increase in temperature and insufficient rainfall in Izmir, northwestern Turkey affected the **water level in Tahtali Dam** that meets the city's drinking water needs. It was observed that the water level in the dam, the occupancy of which fell to 28 %, had receded completely and settlements had become more visible <sup>[5]</sup>. Prolonged lack of rain in Edirne, northwestern Turkey has caused the **flow of the Tunca River**, one of the city's important water resources that used to be a hot topic due to floods, to fall to its lowest level in recent years. Some sections of the river, where citizens normally swim and fish, completely dried up and could be crossed on foot <sup>[6]</sup>. Water drop in Tunca River left impact on **natural life** and cycles. Many other sections of the river still holding water turned green due to plants and algae forming on its surface, and the living space of the fish in Tunca also shrunk. It is observed that some heron birds could easily hunt in the river for this reason <sup>[7]</sup>.

At the end of June, Tunca's flow rate was recorded as 2 cubic meters per second. The low water level in the river became source of concern also for **agriculture** producers in the region. Edirne meets 50 % of Turkey's rice needs. Approximately 20 thousand acres of rice land benefit from the river. Along with rice, corn, clover, and the gardens that meet the city's vegetable and fruit needs are also irrigated from the river. As Tunca's flow rate has not increased also due to drought upstream in Bulgaria where the river springs, there have been **water conflict pressure** on Bulgaria to open the dams and release water <sup>[8, 9]</sup>. Due to the slowdown in flow and falling water levels, **controlled and rotational irrigation** has been implemented on the river. The Edirne Governorship decided that the irrigation in the upper villages close to the Bulgarian border be temporarily suspended, and gradual power cuts to be made across the downstream areas <sup>[10, 11]</sup>.

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### Methodology

DMCSEE Drought monitoring bulletin is prepared on the basis of reanalysis data, remote-sensing data and online media. Air temperature, precipitation, surface water balance and SPI index calculations are based on the European Centre for Medium-Range Weather Forecasts (ECMWF) ERA5-Land monthly averaged data (<https://cds.climate.copernicus.eu/datasets/reanalysis-era5-land-monthly-means?tab=overview>) and using 1991-2020 as a reference period. Remote-sensing product is based on the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Land SAF MSG Daily Fraction of Vegetation Cover MDFVC [LSA-421] product (<https://lsa-saf.eumetsat.int/en/data/products/vegetation/#FVC>), presented for the checked and confirmed locations and using long-term averages from 2004 to the last full year (currently up to and including 2023). Information on drought impacts are obtained from freely available online reports of national authorities and media newspapers.