# Chapter 2. Crop and environmental conditions in major production zones

*Chapter 2 presents the same indicators—RAIN, TEMP, RADPAR, and BIOMSS— as those used in Chapter 1, and combines them with the agronomic indicators—cropped arable land fraction (CALF), maximum vegetation condition index (VCIx), and minimum vegetation health index (VHIn)— to describe crop condition in six Major Production Zones (MPZ) across all continents. For more information about these zones and methodologies used, see the quick reference guide in Annex B as well as the CropWatch bulletin online resources at http://www.cropwatch.com.cn/htm/en/bullAction!showBulletin.action#.*

## 2.1 Overview

Tables 2.1 and 2.2 present an overview of the agroclimatic (Table 2.1) and agronomic (Table 2.2) indicators for each of the six MPZs, comparing the indicators to their fifteen and five-year averages, respectively. The text mostly refers simply to "average" with the averaging period implied.

**Table 2.1 Agroclimatic indicators by Major Production Zone, current value and departure from 15YA (April - July 2022)**

| | RAIN | | TEMP | | RADPAR | | BIOMSS | |
|---|---|---|---|---|---|---|---|---|
| | Current (mm) | Departure (%) | Current (°C) | Departure (°C) | Current (MJ/m²) | Departure (%) | Current (gDM/m²) | Departure (%) |
| **West Africa** | 519 | -11 | 27.5 | 0.1 | 1190 | -1 | 1015 | -5 |
| **North America** | 383 | -8 | 19.5 | 0.5 | 1344 | 0 | 942 | -4 |
| **South America** | 199 | -39 | 17.5 | -0.5 | 836 | 1 | 493 | -25 |
| **S. and SE Asia** | 849 | -11 | 28.8 | 0.3 | 1297 | 4 | 1126 | 0 |
| **Western Europe** | 245 | -31 | 15.5 | 1.1 | 1320 | 7 | 714 | -13 |
| **Central Europe and W. Russia** | 293 | -8 | 14.2 | -0.6 | 1184 | -1 | 787 | -4 |

*Note: Departures are expressed in relative terms (percentage) for all variables, except for temperature, for which absolute departure in degrees Celsius is given. Zero means no change from the average value; relative departures are calculated as (C-R)/R*100, with C=current value and R=reference value, which is the fifteen-year average (15YA) for the same period (AprIl-July) for 2007-2021.*

**Table 2.2 Agronomic indicators by Major Production Zone, current season values and departure from 5YA (April - July 2022)**

| | CALF (Cropped arable land fraction) | | Maximum VCI |
|---|---|---|---|
| | Current | 5A Departure (%) | Current |
| **West Africa** | 89 | -2 | 0.86 |
| **North America** | 92 | -3 | 0.83 |
| **South America** | 97 | -1 | 0.89 |
| **S. and SE Asia** | 76 | -4 | 0.82 |
| **Western Europe** | 97 | 0 | 0.86 |
| **Central Europe and W Russia** | 99 | 1 | 0.90 |

*Note: See note for Table 2.1, with reference value R defined as the five-year average (5YA) for the same period (Apirl-July) for 2017-2021.*

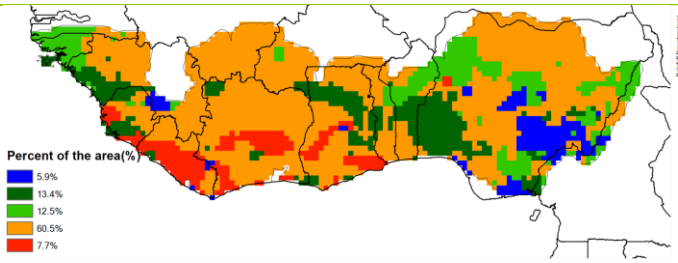
## 2.2 West Africa

The report covers the onset of the main rainy season in the West Africa Major Production Zone (MPZ), with main crops being the cereal crops (maize, sorghum, millet, and rice) and tuber crops (cassava and yams). The growing season onset started later than normal in most of the region, except for parts of central Nigeria and Togo, as well as southwestern coastal areas where the season started early. Overall, most of the region was characterized by below-average and erratic rainfall during this period, particularly the western parts (Guinea-Bissau and northern Guinea) and most of the eastern parts of the region (northern Nigeria) experienced below-average rainfall.. The most affected countries include Sierra Leone (-20%), Gabon (-16%), Nigeria (-14%), Guinea (-13%), Togo (-12%), Equatorial Guinea (-9%), Côte d'Ivoire (-8%), Liberia (-6%), Ghana (-5%) and Burkina Faso (-2%), while Guinea Bissau (+18%) and Benin (+6%) received above average. Temperature (TEMP) for the MPZ was slightly above average (+0.1°C), with stratified spatial-temporal variation effects across the MPZ and more pronounced departures in the north. The solar radiation was below average (RADPAR =1190 MJ/m2) as indicated by -1.3% and was reflected in the potential biomass production (BIOMSS = 1015gDM/$m^2$) with a negative departure (-5%) from the 5YA.

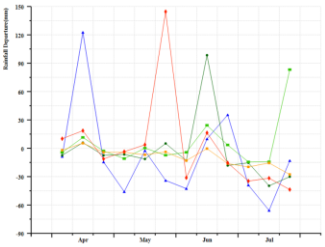
The VCIx map as an indication of vegetation cover shows that the areas with the highest values (>0.8) were in the coastal and central regions, whereas lower values were observed in the northern parts of the MPZ, which were generally drier. The vegetation health index (VHI) map also depicts a spatial and temporal pattern affected by severe drought conditions. At country level, northern Nigeria and northern Togo were most affected.

The cropped arable land fraction (CALF) was at 89% with a slight decrease (-2%). The lowest CALF values were observed in Nigeria at 78% (-4%) and Burkina Faso at 61% (-14%). The low CALF values for Nigeria and Burkina Faso can be attributed to the generally dry environments. Based on these agroclimatic conditions in the MPZ attributed to below-average rainfall deficits, more well-established rainfall will be needed to support crop production especially in the drought vulnerable areas of the MPZ to ensure an adequate soil moisture supply for the growth of the main season crops, which are key to food security in the region.

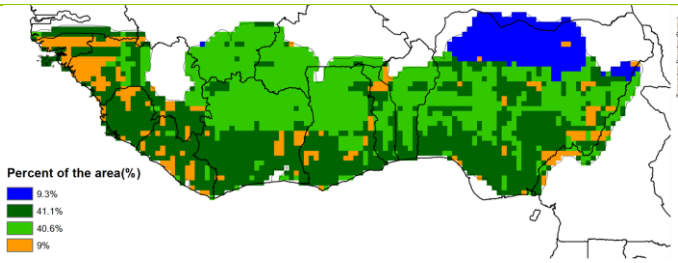
**Figure 2. 1 West Africa MPZ: Agroclimatic and agronomic indicators, April - July 2022.**



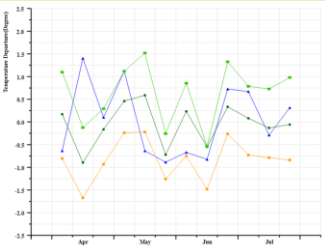

a. Spatial distribution of rainfall profiles



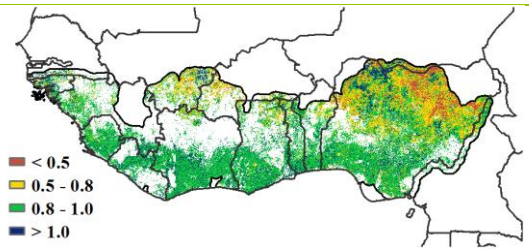
b. Profiles of rainfall departure from average (mm)



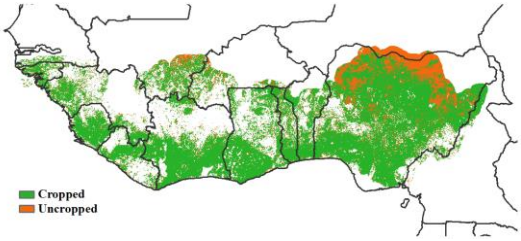

c. Spatial distribution of temperature profiles



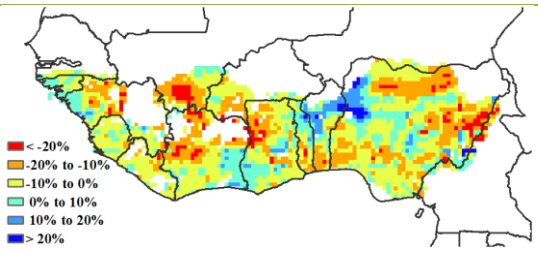
d. Profiles of temperature departure from average (mm)



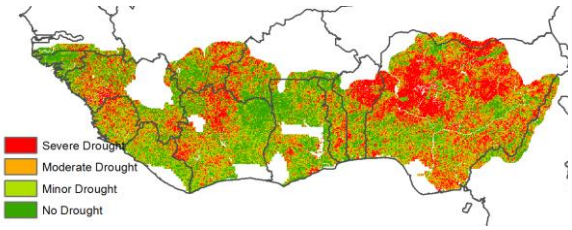

e. Maximum VCI




f. Cropped arable land




g. Biomass accumulation potential departure




h. VHI minimum

*Note:* For more information about the indicators, see Annex B.

## 2.3 North America

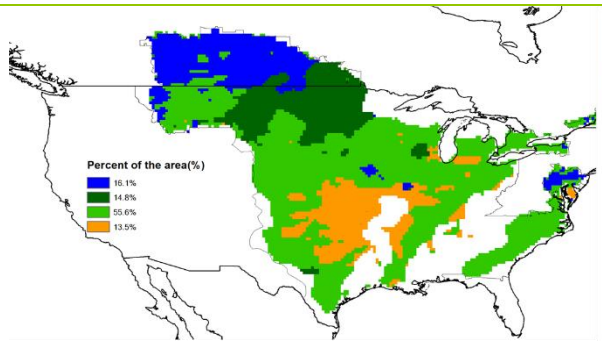
During the current monitoring period of April through July 2022, winter wheat reached maturity and was harvested. Maize reached the silking period and soybean reached seed filling in late July, whereas spring wheat was in its late grain filling phase. The strong heterogeneity of agroclimatic condition led to diverse crop conditions.

For the region as a whole, North America experienced a dry and hot season. Rainfall was 8% below the 15YA and temperature was 0.5°C above average. The rainfall departure profile indicated that the Canadian Prairies received significantly above average rainfall in mid-May and mid-June, while most of the U.S. experienced a rainfall deficit. In May, much warmer than usual temperatures were observed for the central regions of the USA and Canada. Temperature departure profiles showed that temperature was 1-4°C above average in the Southern Plains and Lower Mississippi River, and 1-2°C above average in the Northern Plains and Corn Belt from mid-June to July. Precipitation deficits and above average solar radiation accelerated soil moisture loss leading to localized

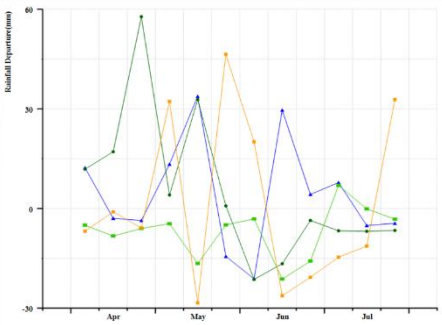
drought and spatial variation in crop conditions. Potential biomass was 4% below average and crop growth was near average, but below 5-year mamximum, in North America during the monitoring period with VCIx of 0.83. The minimum vegetation health index (VHIn) indicated a severe drought in the Southern Plains, where potential biomass was generally 10-20% lower. VCIx indicated good crop conditions in the Canadian prairies (VCIx is above 1.0) and poor crop conditions in the Southern Plains (VCIx is below 0.5). The drought resulted in an increase in the fraction of uncropped land, with CALF showing that 92% of cropland was planted during the monitoring period, 3% lower than the 5YA.

In short, CropWatch assesses crop condition as below average in the Southern Plains, and near or above average conditions in the other areas.

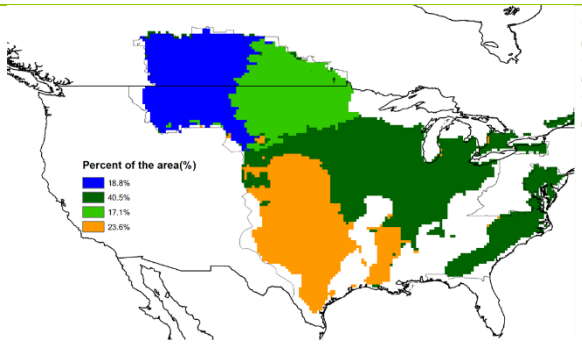
**Figure 2. 2 North America MPZ: Agroclimatic and agronomic indicators, April to July 2022.**



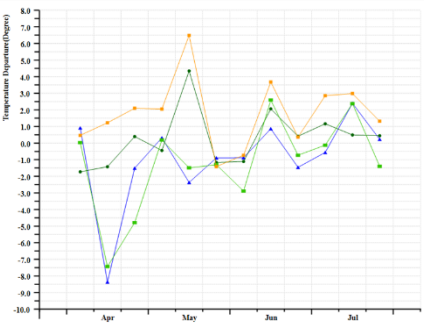

a. Spatial distribution of rainfall profiles



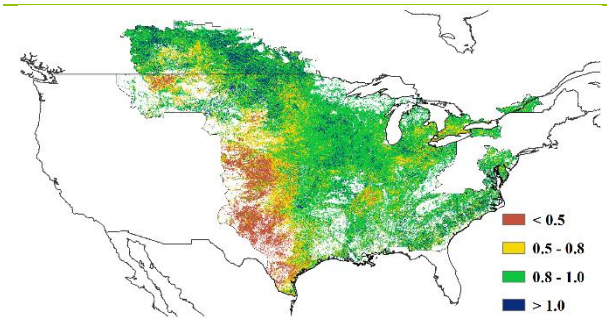

b. Profiles of rainfall departure from average (mm)



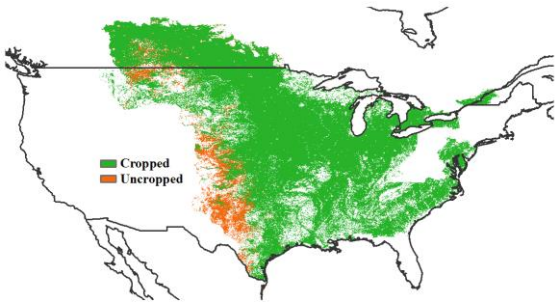

c. Spatial distribution of temperature profiles



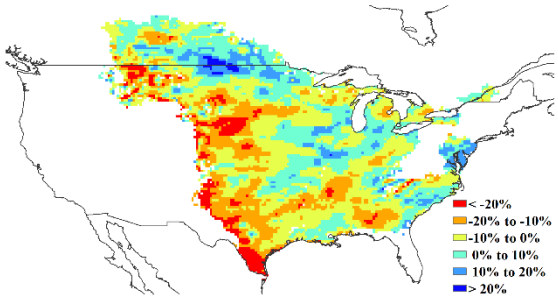

d. Profiles of temperature departure from average (mm)



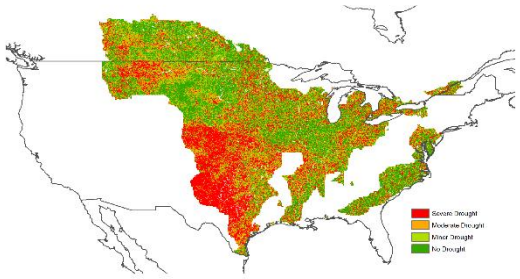

e. Maximum VCI




f. Cropped arable land




g. Biomass accumulation potential departure



h. VHI minimum

*Note:* For more information about the indicators, see Annex B.

## 2.4 South America

The reporting period covers the harvesting of late summer crops (soybean, maize and rice), and the beginning of planting of wheat. The period is mainly a fallow period due to the generally dry conditions during the winter months.

The situation of South America was variable between subregions, with poor conditions in the North and South of the MPZ and good conditions in the Center.

Spatial distribution of rainfall profiles showed five regions, which were mainly distributed along a North-South gradient. The north of the MPZ (orange profile) showed changes from negative anomalies at the beginning of the reporting period to almost no anomalies since mid-June. The second profile (blue) located mainly in Paraná State in Brazil and West of Paraguay showed variability between periods of no anomalies and periods with negative anomalies. Starting in June, all anomalies were negative. The third profile (red) located around Rio Grande do Sul in Brazil and North Mesopotamia and North East Chaco in Argentina showed variation between positive anomalies and no anomalies at the beginning of the reporting period. Since July it had only negative anomalies. The fourth profile (dark green), located mostly in Uruguay and South Mesopotamia in Argentina, showed hardly any anomalies during most of the period, apart from two strong positive anomalies at the end April and July and a negative anomaly at the beginning of May. The last profile (light green) was located in in Argentina (Pampas, South Chaco and Subtropical Highlands) and showed a quite stable pattern with no anomalies.

The temperature profiles showed 5 patterns. All of them showed showed similar trends, but different magnitudes of the anomalies. Most of the profiles showed reductions in April, mid-May and mid-June; and increments at the end of April, May and June. The red profile was located in the north of the MPZ and showed the highest positive departures. The blue and dark green profiles showed intermediate values. The blue profile was observed in Mato Grosso do Sul, Sao Paulo and Parana state in Brazil and in East Paraguay. The dark green profile was observed also in the north of the MPZ, on its western and eastern boundaries. The orange and light green profiles showed the lowest values with negative anomalies in most of the reporting period. The orange profile was located in most of Mesopotamia, Chaco and North of Subtropical Highlands in Argentina, South East Paraguay, North Uruguay and Santa Catarina and Rio Grande do Sul in Brazil. The light green profile was observed in Pampas and South of Subtropical Highlands in Argentina and South Uruguay.

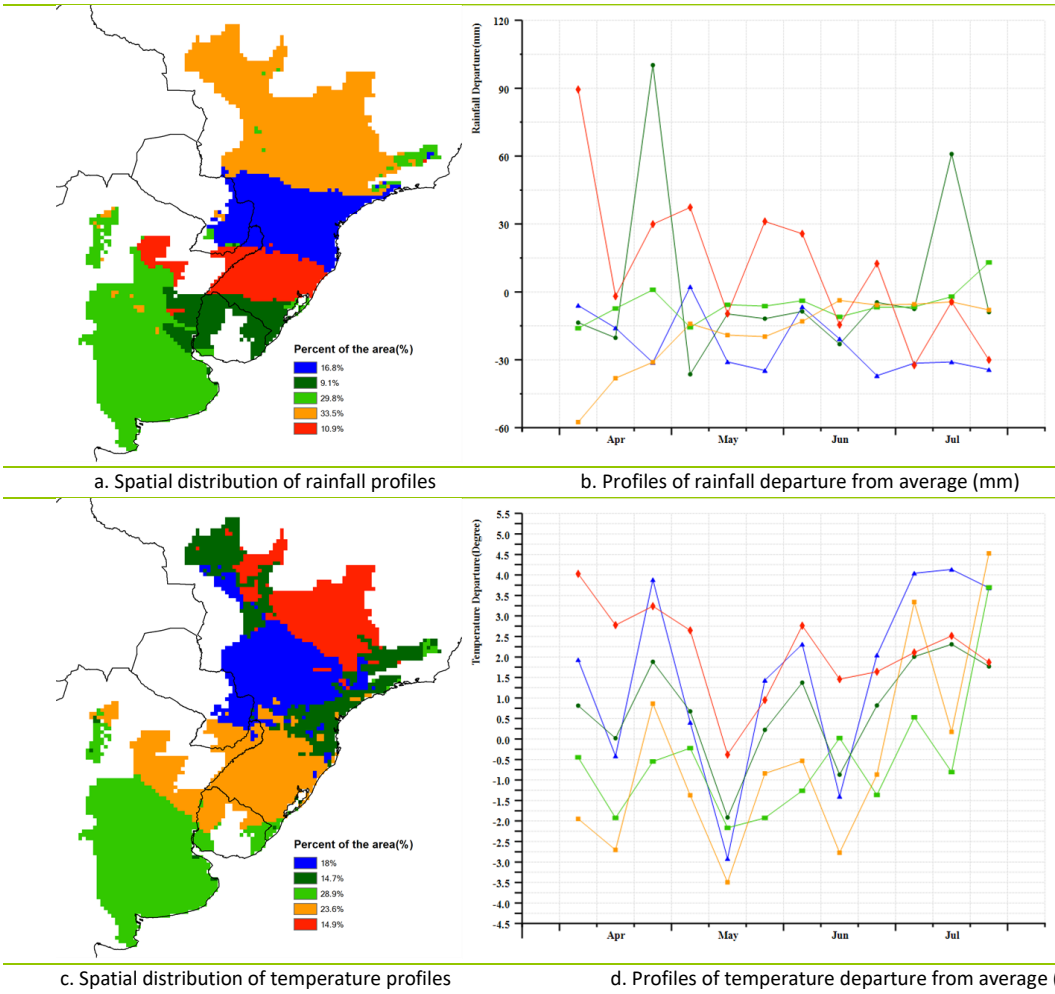
The BIOMSS departure map showed poor conditions with values lower than -20 % in the north and south of the MPZ. This pattern covered most of the MPZ and included Mato Grosso, Mato Grosso do Sul, Goias, Minas Gerais and Sao Paulo in Brazil, West Paraguay and most of the Pampas and

the east of Subtropical Highlands in Argentina. Good conditions were observed in most of Mesopotamia and Chaco in Argentina, East Uruguay and Rio Grande do Sul and Santa Catarina in Brazil.

Maximum VCI showed good conditions with values higher than 0.8 in the north of the MPZ and showed poor conditions in most of the Pampas in Argentina. Although the dry and hot weather in southern Brazil was unfavorable for crops, as presented by the significantly below average BIOMSS, vegetation conditions were in general comparable or even more favorable than in the previous five years especially in the Parana River basin. This could be attributed to the irrigation in the region which mitigates the adverse weather impacts. Crop arable land was fully cultivated in the agricultural areas of the MPZ in Brazil, Paraguay and Uruguay. In Argentina, uncropped areas in the agricultural belt in the center and western Pampas were observed. This might have been due to a delay in the planting of the winter crops.

Several indices showed poor conditions in the north and south of the MPZ. The Pampas showed poor conditions in BIOMSS, maximum VCI, as well as areas that were not cultivated.

**Figure 2. 3 South America MPZ: Agroclimatic and agronomic indicators, April- July 2022**

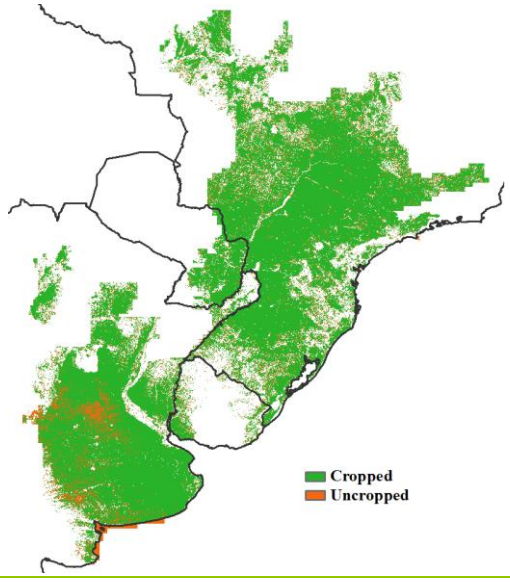



a. Spatial distribution of rainfall profiles

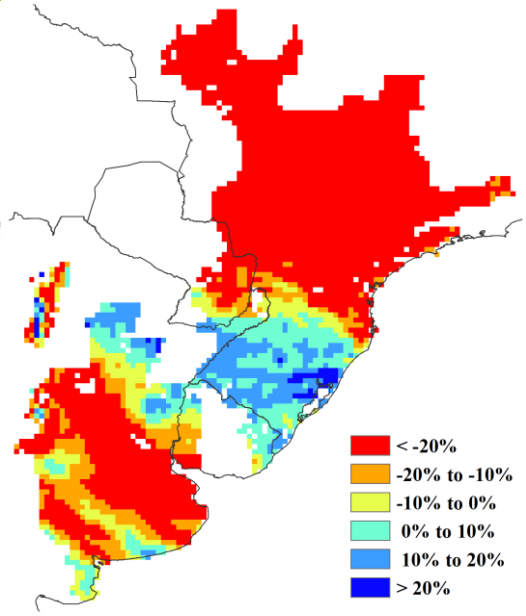
b. Profiles of rainfall departure from average (mm)

c. Spatial distribution of temperature profiles

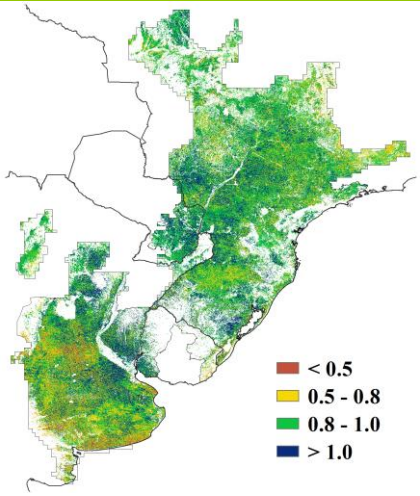
d. Profiles of temperature departure from average (°C)




e. Cropped and uncropped arable land




f. Potential biomass departure from 15YA




g. Maximum VCI

## 2.5 South and Southeast Asia

The South and Southeast Asia MPZ includes India, Bangladesh, Cambodia, Myanmar, Nepal, Thailand and Vietnam. Harvest of wheat and dry season rice was mostly completed in April. Planting of the main rice crop started at the onset of the monsoon rains in June and July.

According to the CropWatch agroclimatic indicators, RAIN was below the 15YA (RAIN -11%), the temperature was above the 15YA (TEMP +0.3℃) and the PADPAR was above the 15YA (RADPAR +4%), whereas BIOMSS was unchanged. CALF was reduced by 4% compared with the 5YA, reaching 76% and VCIx of the MPZ was 0.82.

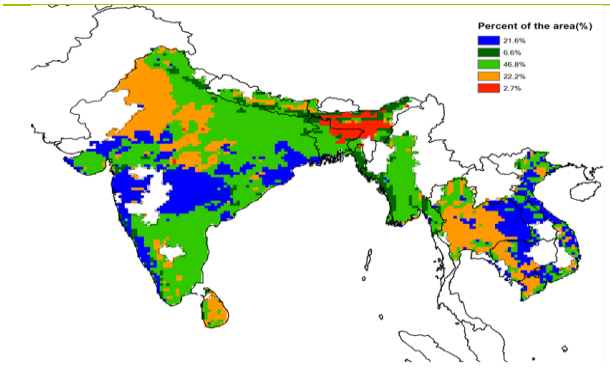
According to the spatial distribution of rainfall profiles, the precipitation for 22.2% of the MPZ showed higher positive departures in July, mainly located in western India, Sri Lanka, central Nepal, southern, eastern and central Thailand, southern and eastern Cambodia and southern Vietnam. The precipitation for 21.6% of the MPZ gradually rose in late June and reached the highest values in mid-July, mainly located in southwestern, central and eastern India, southern Thailand, central Cambodia, central Laos and Vietnam. The precipitation for 6.6% of the MPZ was generally below the average with a particularly low amounts in July, mainly located in northeastern India, southern Nepal, southeastern Bangladesh and southwestern Myanmar. The precipitation for 2.7% of the MPZ showed the strongest positive anomaly in mid-May and mid-June, located in eastern

Bangladesh and eastern India. This strong anomaly had caused severe flooding in those regions. The spatial distribution of temperature profiles shows that the temperature for 30.2% of the MPZ dropped in April and May, then stayed near average after June. It was located in Thailand, Laos, Vietnam, Cambodia, eastern and southern India. In contrast, on 3.2% of the MPZ (Bhutan and northern India) temperatures always stayed at above average levels. The temperature for 21.9% of the MPZ (western India) was fluctuating above or below the average in May and June.

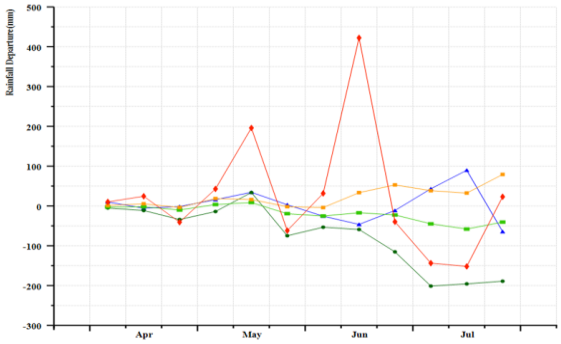
The BIOMSS departure map reveals that the potential biomass in western India and central Thailand was 20% higher than the average level, while the potential biomass in northern, southern, eastern and central India and central Myanmar was estimated to be below average. The Maximum VCI map shows that the index was higher than 1.0 in western and southern India, central Myanmar and eastern Thailand, which indicates that crop condition is better than 5-year maximum. The index was lower than 0.5 in central and northern India, which is related to the cropland fallow or delayed of seeding . From the VHI Minimum map, it can be seen that periods of severe drought occurred in central, northern and eastern India, eastern Bangladesh, southern Myanmar, most of Cambodia and scattered areas in Vietnam, Thailand, Nepal, Sri Lanka and Laos. The CALF map indicates that parts of central Myanmar as well as of India were not yet planted at the end of this monitoring period.

In summary, the crop conditions of summer crops in this MPZ were close to normal.

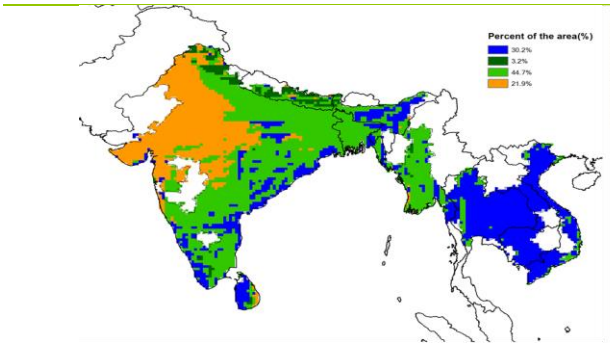
**Figure 2. 4 South and Southeast Asia: Agroclimatic and agronomic indicators, April - July 2022.**



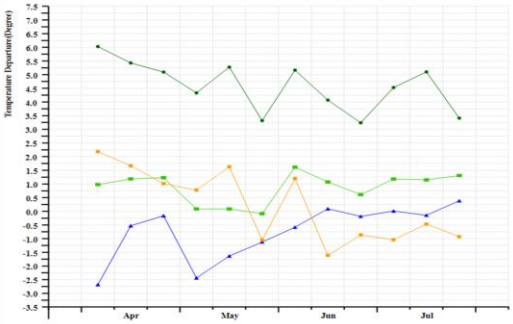

a. Spatial distribution of rainfall profiles



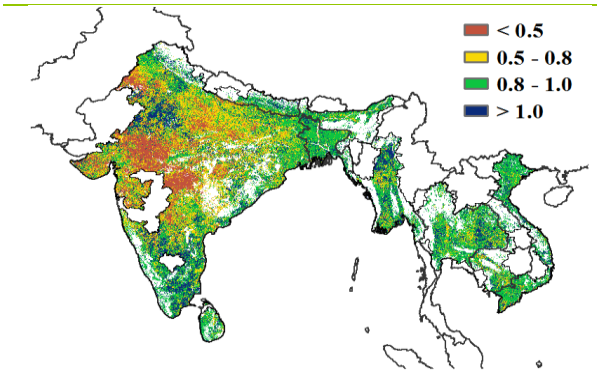

b. Profiles of rainfall departure from average (mm)



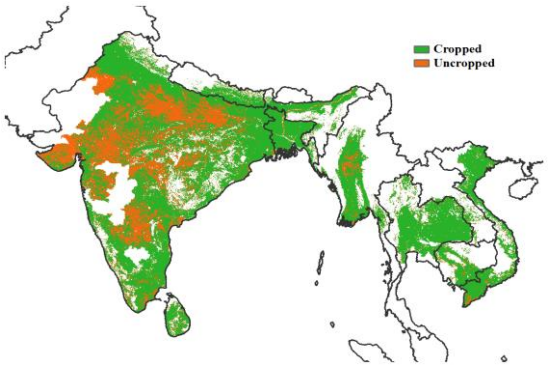

c. Spatial distribution of temperature profiles



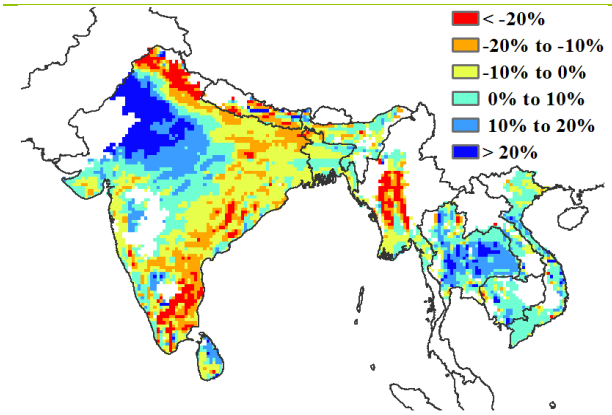

d. Profiles of temperature departure from average (mm)



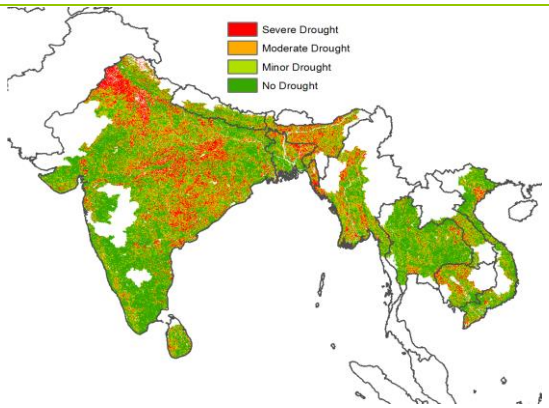

e. Maximum VCI




f. Cropped arable land




g. Biomass accumulation potential departure




h. VHI minimum

## 2.6 Western Europe

This monitoring period covers the growth and grainfilling period of winter wheat. Summer crops had been sown in April and May in this Major Production Zone (MPZ). Most crop production is rainfed. Generally, crop conditions were average or below average in most parts of the MPZ due to persistent precipitation deficits and hot weather as indicated by the agroclimatic and agronomic indicators (Figure 2.6).

The precipitation deficit, which had been observed during the previous two monitoring periods, continued. On average, precipitation was significantly below average (-31%). There were significant spatial and temporal differences in precipitation between the countries: (1) Precipitation in Spain, most of the Czech Republic, Southwestern Slovakia, Northeastern Austria and western part of Hungary, north-western, central and south-eastern Italy, covering 29.4% of the MPZ areas, was generally below average during most of the monitoring period, except for early May, late June and late July; (2) On 37.5% of the MPZ, precipitation was below average in early April and early June. The affected area covered United Kingdom, Denmark, central and northern Germany, and northern and western France; (3) For the rest of the monitoring area (33.1%), covering central, southern and eastern France, southern Germany, and northeastern Italy, precipitation was significantly below average, except for significantly above-average precipitation in early April and late June. Almost all western European countries covered by the MPZ had below-average precipitation. The countries with the most severe precipitation deficits included Hungary (RAIN -55%), Slovakia (RAIN -55%), Spain (RAIN -51%), France (RAIN -37%), Germany (RAIN -28%), UK (RAIN -27%), Italy (RAIN -21%), the Czech Republic (RAIN -21%), Austria (RAIN -17%) and Denmark (RAIN -14%). As the crops are mainly rainfed in the MPZ, the persistent precipitation

deficit had a negative impact on the yield of winter crops, as well as on the growth of summer crops.

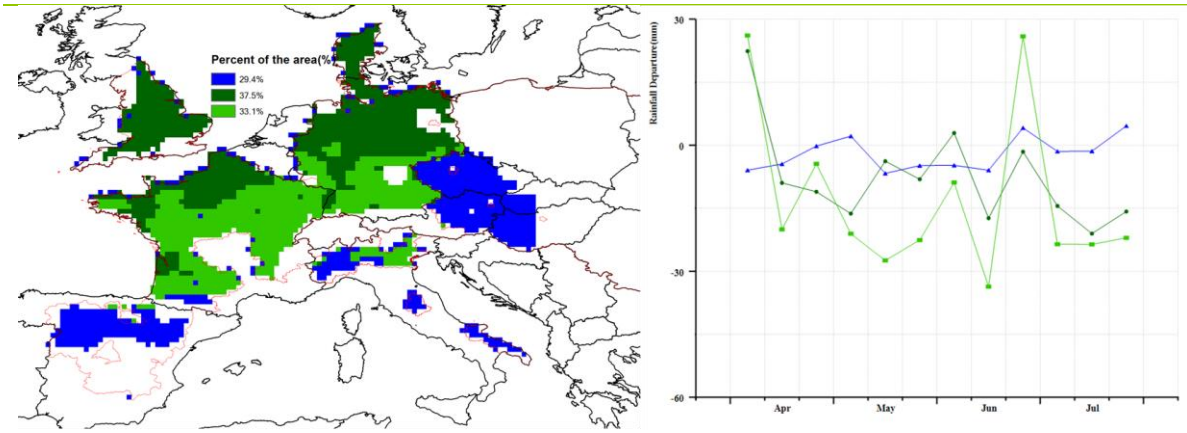
Temperature for the MPZ as a whole was significantly above average (TEMP +1.1%) and radiation was above average with RADPAR up by 7%. As shown in the spatial distribution of temperature profiles, the regions in Denmark, Southeastern Italy, most of the Czech Republic, southwestern Slovakia, northeastern Austria and western parts of Hungary, covering 22.4% of the MPZ areas, experienced slight fluctuations in temperature above and below the average during the monitoring period; 31.5 percent of the MPZ areas (Spain, most of France, northwestern Italy) experienced significantly warmer-than-usual conditions throughout the monitoring period, except for early-April and late-June; 46.1 percent of the MPZ areas (UK, Germany, northern and entral Italy, northeastern France) experienced above-average temperatures throughout the monitoring period, except for early and late April, late May and early July. In addition, hot weather swept through the western part of the MPZ in mid-May, and two heat waves swept through France and Spain again in mid-June and mid-July; High temperatures shortened the grain filling stage of crops and accelerated the maturity, which may have reduced crop yields.

Due to the precipitation deficit and high temperature, the potential BIOMSS was 13% below average. The lowest BIOMSS values (-20% and less) were observed for most parts of Spain, most parts of UK, eastern France, Central and southern Germany. In contrast, BIOMSS was above average (+10% and more) mainly in northwestern Italy and southwestern Austria.

The average maximum VCI for the MPZ reached a value of 0.86 during this reporting period. About 97% of arable land was cropped, which is the same as the recent five-year average in the whole MPZ. The uncropped areas of arable land were mainly concentrated in eastern and southeastern Spain, and a few pockets in almost all other countries of this MPZ. The VHI minimum map shows that relatively large areas of France, Germany, central regions of UK, Spain and Italy were affected by persistent drought conditions.

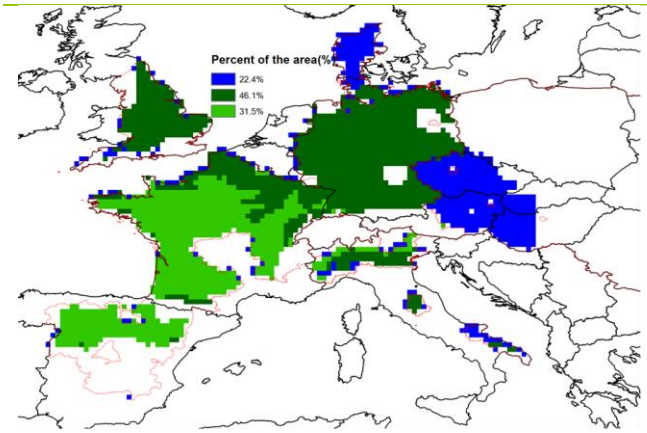
Generally, the conditions of crops in the MPZ were mostly below average, and more rain will be needed in several important crop production areas to ensure an adequate soil moisture supply during the grain-filling phase of the summer crops.

**Figure 2. 5 Western Europe MPZ: Agroclimatic and agronomic indicators, April to July 2022.**

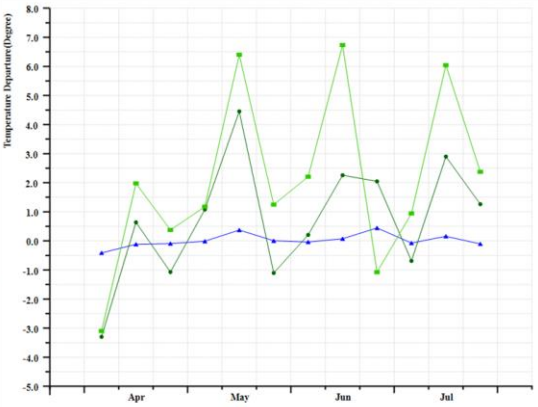



a. Spatial distribution of rainfall profiles

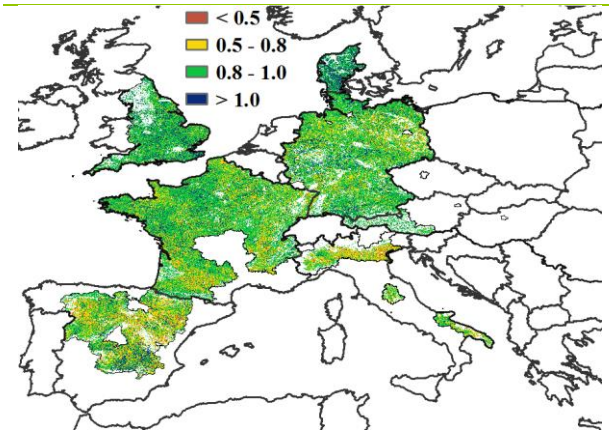
b. Profiles of rainfall departure from average (mm)



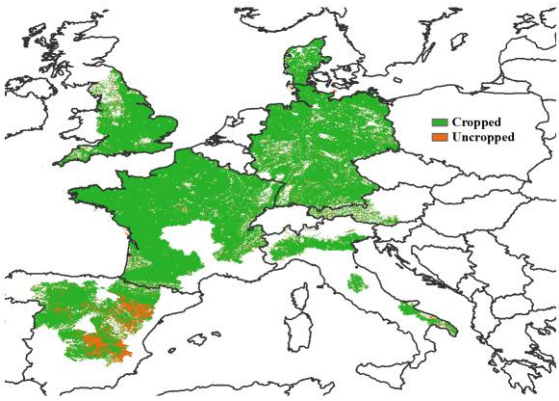

c. Spatial distribution of temperature profiles



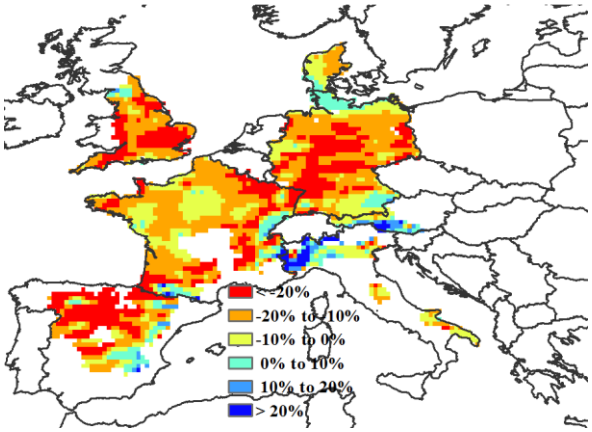

d. Profiles of temperature departure from average (mm)



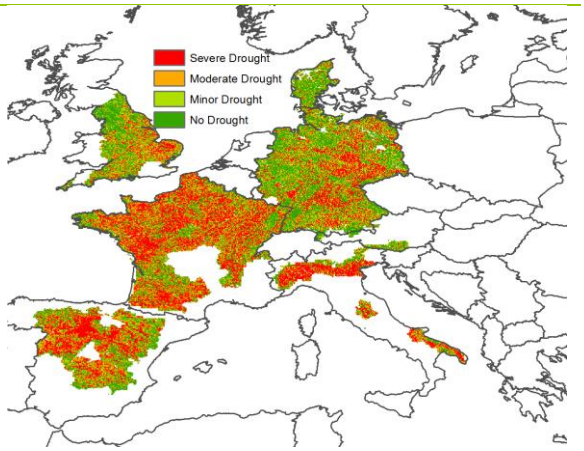

e. Maximum VCI




f. Cropped arable land




g. Biomass accumulation potential departure




h. VHI minimum

*Note:* For more information about the indicators, see Annex B.

## 2.7 Central Europe to Western Russia

This monitoring period covers the vegetative growth of winter wheat and summer crops in Central Europe and western Russia. In general, the agroclimatic indicators in this MPZ were below average, including 8.2% lower precipitation, 0.6°C lower average temperature, and 0.95% lower RADPAR, as compared to the 15YA.

According to the spatial distribution map of rainfall departure, the precipitation in most areas of the MPZ fluctuated around the mean during the monitoring period. The spatial and temporal distribution characteristics were as follows: (1) In early and mid-April, above-average precipitation

occurred in northern Russia, northeastern Ukraine, Belarus, and parts of Poland (62.2% of the MPZ). (2) In early and mid-May, early and mid-June, 78.4% of the MPZ received below-average precipitation, whereas eastern Russia received above-average rainfall. (3) In early July, precipitation within the MPZ was below average; in mid-July, 79.2% of the MPZ received above-average precipitation (+120 mm).

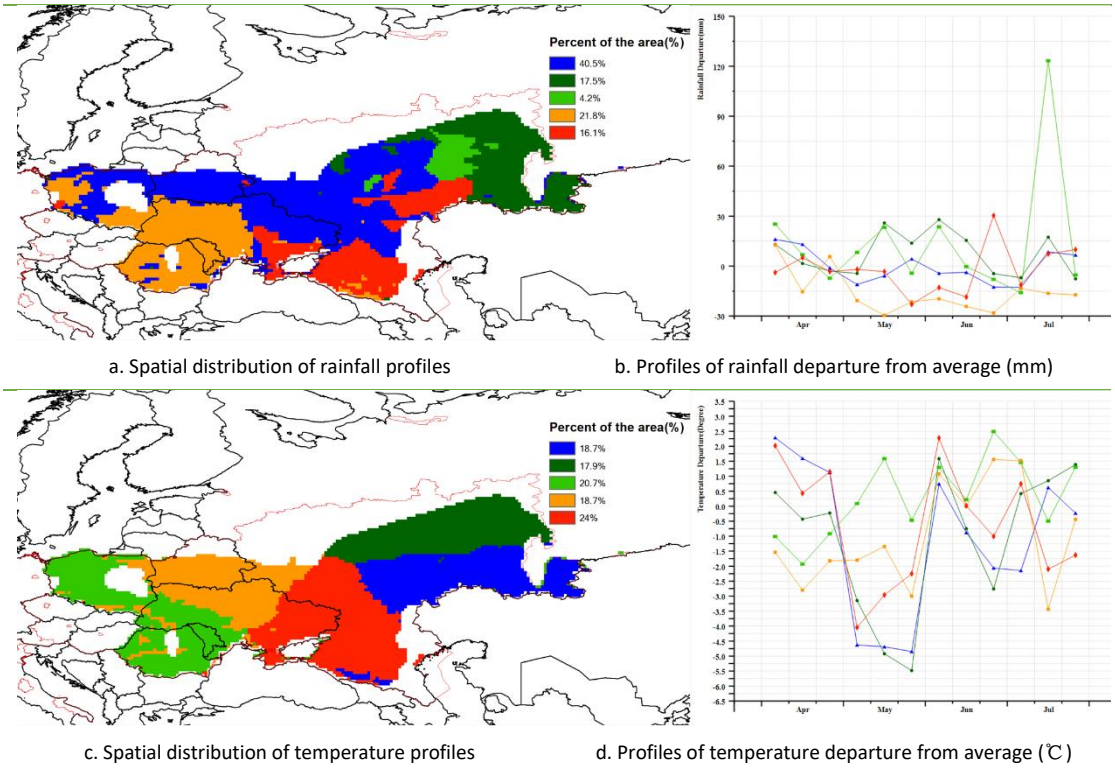
According to the average temperature departure map, temperatures in the MPZ varied significantly during this monitoring period, and the specific spatial and temporal characteristics were shown as follows: (1) In April, temperatures were above average in eastern Ukraine and southern Urals (42.7% of the MPZ). (2) In May, 79.3% of the MPZ had below-average temperatures, mainly in the eastern and central parts of the MPZ, and in early June, the temperatures were above average in the MPZ. (3) From early June to early July, 39.4% of the MPZ had above-average temperatures, mainly in the western part of the MPZ.

The results of CropWatch agronomic indicators show that most of the arable land in the MPZ was planted. The potential biomass in the MPZ was 4.4% lower than the average of the last 5 years. The potential cumulative biomass in northern Russia, northern Belarus, and a small part of Ukraine were more than 10% higher; the areas in which potential cumulative biomass was reduced by more than 10% were mainly located in southern Russia, eastern and southern Ukraine, Moldova, Romania, Hungary, Slovakia, and parts of Poland.

The average maximum VCI for the MPZ reached a value of 0.9 during the monitoring period, the regions below 0.8 were mainly in Ukraine, Moldova, Romania, and Hungary. The VCIx in southeastern Ukraine was below 0.5, which was affected by the Russian-Ukrainian conflict, and crop condition was poor The VHI minimum map shows that southern Russia, northern Ukraine, eastern Romania and Hungary were affected by drought.

Overall, due to precipitation deficits, crop conditions in Central Europe and south-eastern Russia were below average in this monitoring period.

**Figure 2. 6 Central Europe to Western Russia MPZ: Agroclimatic and agronomic indicators, April-July 2022**

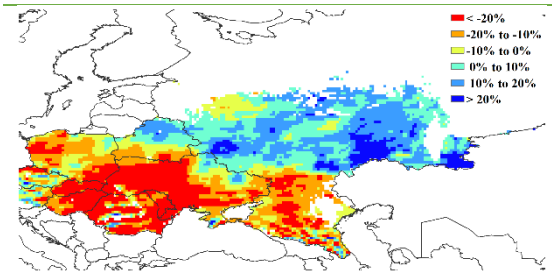



a. Spatial distribution of rainfall profiles

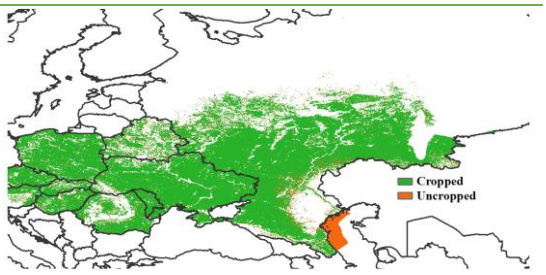
b. Profiles of rainfall departure from average (mm)

c. Spatial distribution of temperature profiles

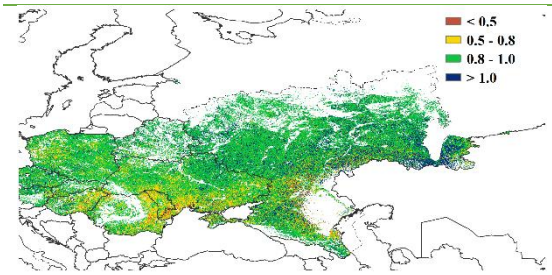
d. Profiles of temperature departure from average (℃)



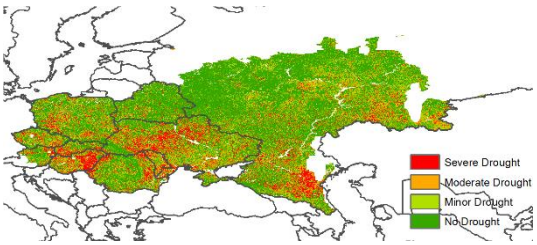

e. Biomass accumulation potential departure




f. Cropped arable land




g. Maximum VCI




h. VHI minimum

*Note:* For more information about the indicators, see Annex B.