# 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 to July 2021)**

| | RAIN | | TEMP | | RADPAR | | BIOMSS | |
|---|---|---|---|---|---|---|---|---|
| | Current (mm) | Departure (%) | Current (°C) | Departure (°C) | Current (MJ/m²) | Departure (%) | Current (gDM/m²) | Departure (%) |
| **West Africa** | 384 | -35 | 28.0 | 0.6 | 1256 | 5 | 742 | -1 |
| **North America** | 484 | 21 | 18.6 | -0.5 | 1342 | 0 | 671 | 1 |
| **South America** | 179 | -45 | 17.2 | -0.8 | 849 | 3 | 297 | -14 |
| **S. and SE Asia** | 922 | -2 | 28.2 | -0.3 | 1244 | 0 | 725 | 3 |
| **Western Europe** | 435 | 25 | 13.3 | -1.3 | 1218 | -2 | 466 | -6 |
| **C. Europe and W. Russia** | 350 | 10 | 15.0 | 0.3 | 1200 | 1 | 541 | 7 |

*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 2006-2020.*

**Table 2.2 Agronomic indicators by Major Production Zone, current season values and departure from 5YA (April to July 2021)**

| | CALF (Cropped arable land fraction) | | Maximum VCI |
|---|---|---|---|
| | Current (%) | 5A Departure (%) | Current |
| **West Africa** | 88 | -3 | 0.82 |
| **North America** | 94 | -1 | 0.89 |
| **South America** | 98 | 0 | 0.86 |
| **S. and SE Asia** | 82 | 6 | 0.88 |

| | CALF (Cropped arable land fraction) | | Maximum VCI |
|---|---|---|---|
| | Current (%) | 5A Departure (%) | Current |
| **Western Europe** | 97 | 0 | 0.92 |
| **Central Europe and W Russia** | 98 | 0 | 0.91 |

*Note: See note for Table 2.1, with reference value R defined as the five-year average (5YA) for the same period (April-July) for 2016-2020.*

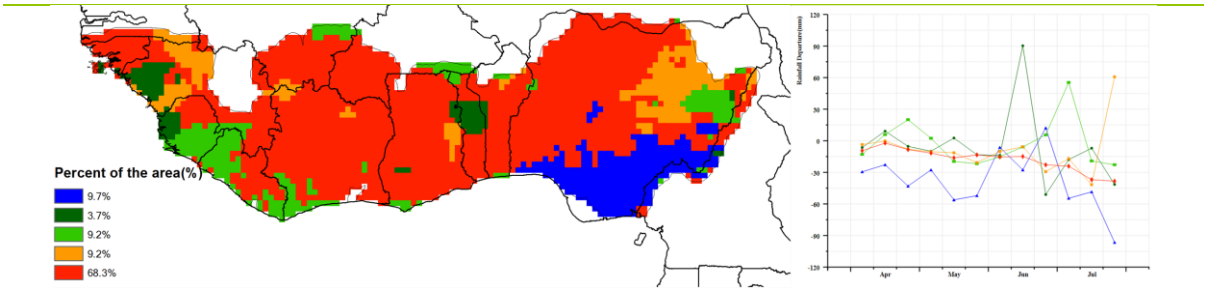
## 2.2 West Africa

This report covers the onset of the main rainy season in the West Africa Major Production Zone (MPZ). The planting of the crops started in May and June. Dominant crops are the cereal crops, such as maize, sorghum, millet, rice and tuber crops, including cassava and yams crops grown in the coastal areas.

Overall, crop conditions were below average in most parts of the MPZ based on the monitored agroclimatic and agronomic indicators. The whole MPZ showed a drop in RAIN (35% below average). Significant spatial-temporal differences in precipitation within the MPZ were observed. A large part of the Zone (68.3%) was characterized by increasing rainfall deficits as the season progressed. The most affected countries include Togo (-45%), Guinea Bissau (-45%), Ghana (-44%), Nigeria (-42%), Côte d'Ivoire (-41%), Burkina Faso (-38%) and Guinea (-30%), while the following countries received near-average rainfall: Gabon (+7%), Equatorial Guinea (-2%), Sierra Leone (-6%) and Liberia (-13%). Temperature (TEMP) for the MPZ was slightly above average (+0.6°C), with stratified spatial-temporal variation effects across the MPZ. The coastal areas (31.7%) experienced near-average temperature. Temperature departures increased towards the north. The solar radiation was well above average with RADPAR (1256 MJ/m2) up by 5% and the highest positive anomaly (+12%) observed in Sierra Leone and Liberia.

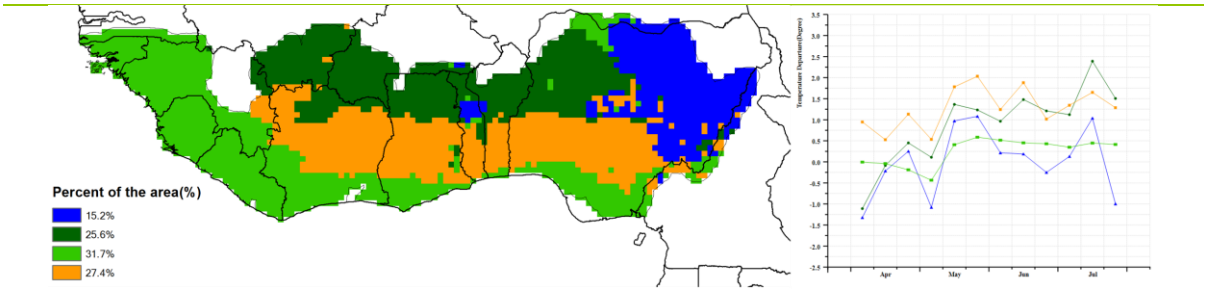
The potential biomass (BIOMSS) departure from the 5YA indicated spatial and temporal stratifications similar to the land-sea spatial pattern with coastal areas experiencing positive anomalies (+10 to +20%), whereas the northern areas experienced negative ones (0 to -20%). The VCIx map as an indication 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 also drier. This trend is also reflected through the vegetation health index (VHI) map depicting spatial and temporal pattern across the region that were most affected by severe drought conditions. The cropped arable land fraction (CALF) was at 88% with a slight decrease (-3%). The lowest CALF values were observed in Nigeria at 76% (-6%). The low CALF values for Nigeria can be attributed to the conflict in northern Nigeria and dry environments. Generally, crop conditions in the MPZ were below average due to rainfall deficits. More rain will be needed in several important crop production areas to ensure an adequate soil moisture supply for the growth of the main season crops, which is the key to food security in the region.

**Figure 2.1 West Africa MPZ: Agroclimatic and agronomic indicators, April to July 2021**



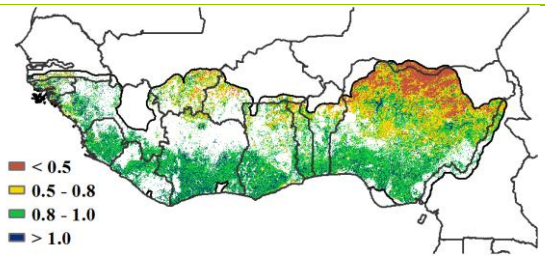

a. Spatial distribution of rainfall profiles

b. Profiles of rainfall departure from average (mm)

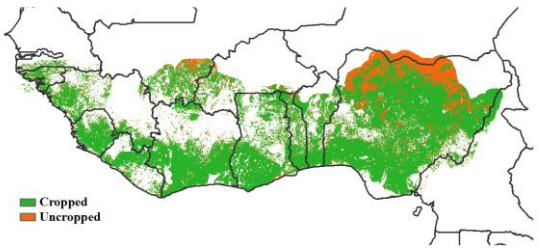



c. Spatial distribution of temperature profiles

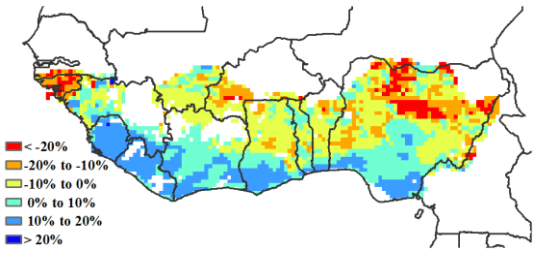
d. Profiles of temperature departure from average(°C)



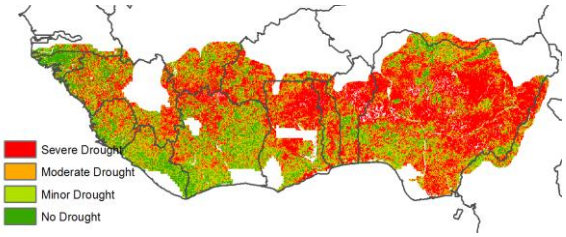

e. Maximum VCI




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

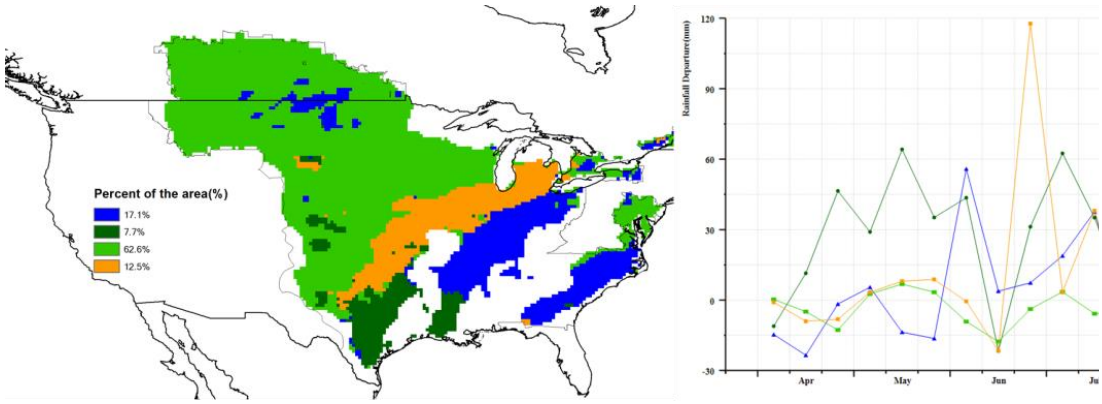
During the current monitoring period from April to July 2021, winter wheat reached maturity and has been harvested. The sowing of maize started in April, followed by soybean in May. Maize reached the silking period and soybean reached seed filling in late July, whereas spring wheat was in its late grain filling phase. The severe drought that occurred in the Prairie and Northern Plains regions resulted in diverse crop condition as indicated by the NDVI development profile (See country analysis for Canada and USA in Chapter 3).

For the region as a whole, rainfall was 21% above the 15YA. Rainfall during the reporting period showed significant spatial variation, with areas in the Prairie and Northern Plains to Western Corn Belt being affected by below-average rainfall between late May and late June, and significantly

above average rainfall was observed in other areas. Temperature was 0.5°C below the 15YA. Areas with insufficient rainfall between late May and late June also suffered from high temperatures that were 4-5°C above the 15YA, accelerating soil moisture loss and resulting in crop water stress. The RADPAR was at average level. The minimum vegetation health index (VHIn) confirmed severe drought in the Prairie and Northern Plains under a combination of temperature and water stress. During the monitoring period, 94% of the cropland was planted, which is 1% lower than the 5YA. The maximum vegetation condition index shows that crop conditions were generally favorable, except for the Southern Prairie and Northern Plains, which were affected by a severe drought.

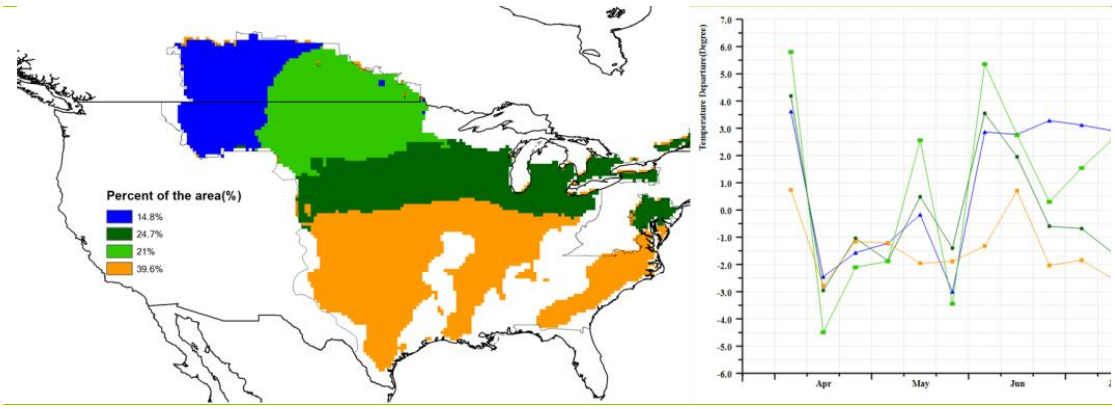
CropWatch assesses the crop condition as below average in the Southern Prairies, Northern Plains and Western Corn Belt and as above average in the other regions.

**Figure 2.2 North America MPZ: Agroclimatic and agronomic indicators, April to July 2021**



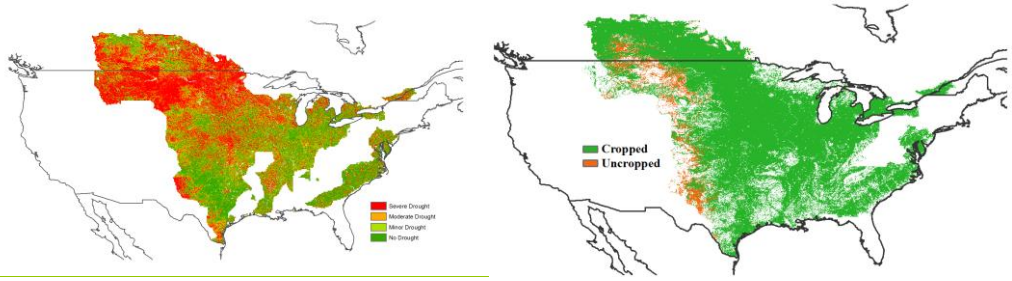

a. Spatial distribution of rainfall profiles

b. Profiles of rainfall departure from average (mm)



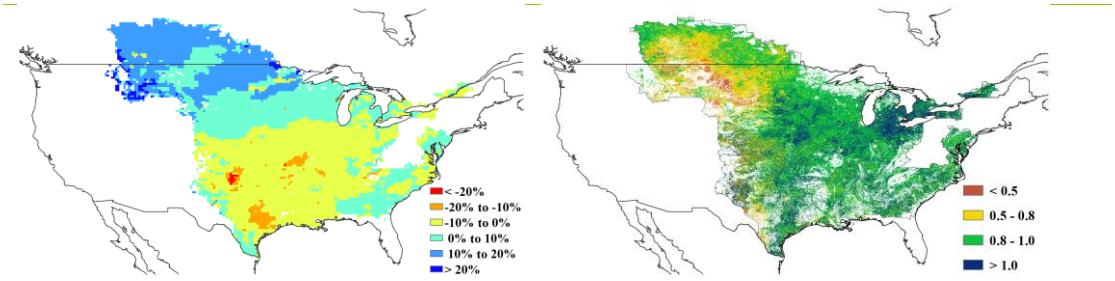

c. Spatial distribution of temperature profiles

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




e. VHI Minimum

f. Cropped and uncropped arable land




g. Biomass accumulation potential departure | h. Maximum VCI

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

## 2.4 South America

The reporting period covers the harvest of late summer crops (soybean, maize and rice) and the beginning of wheat planting. Outside of the wheat production regions, fields are mostly left fallow over the winter months. The situation in South America varied between subregions. The South of the MPZ showed in general good conditions, with no RAIN anomalies and high BIOMSS values, while the North showed poor conditions with negative anomalies in RAIN and low BIOMSS.

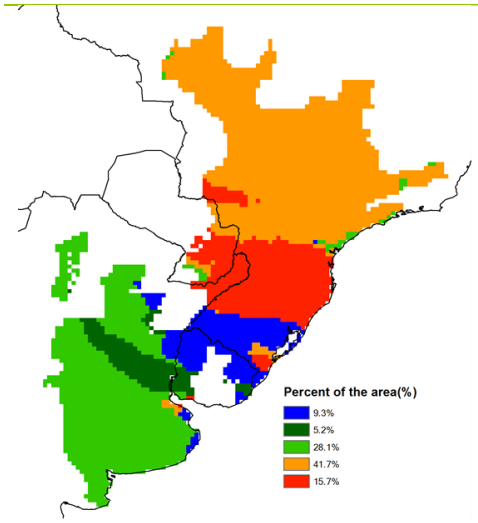
At the MPZ level, rainfall was 45% below average, and temperatures were 0.8 degree cooler and RADPAR 3% above the 15YA. Altogether, the unfavorable condition resulted in BIOMSS estimates that were 14% below the 15YA. The drought conditions in the MPZ were also confirmed by the VHIm map. The spatial distribution of rainfall profiles showed several patterns distributed along a North-South gradient. In the North, the large deficit decreased over time. The region colored in blue had high variability, with negative and positive anomalies with a strong positive peak at the end of June. In the extreme south, almost no departures from the 15YA were observed.

Temperature profiles showed four homogeneous patterns distributed along the North-South direction. All of them showed similar temporal variability, but with different magnitude. The four areas showed the highest values in April and beginning June, while green areas, located in the South showed also a strong positive anomaly at the beginning of July. Light green areas showed more positive anomalies than dark green areas during April. The three Southern regions showed also low values during May and end June. The Northern area (orange) showed the highest positive anomalies on average.

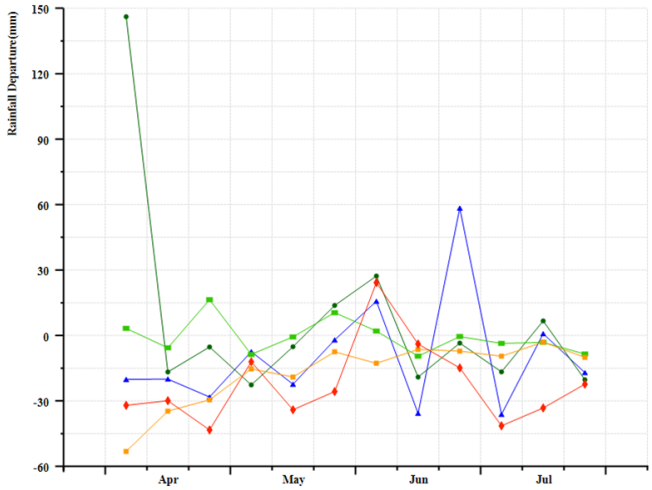
CALF index showed that most areas were cropped in the whole MPZ, except for some sites in the center and south-west Pampas of Argentina. That region was dominated by positive BIOMSS departure values. Poor conditions (lower than -20%) were observed in the northern area of Brazil. The center of the Brazilian agricultural area and other sparse areas like Subtropical highlands in Argentina also showed negative values, but no departures below -20%. Maximum VCI showed in general values higher than 0.8. Values lower than 0.8 were observed in the center and south of Brazilian agricultural area and south west and center Argentine Pampas.

Overall, South America showed better conditions in the South than in the North, in particular referring to RAIN anomalies and BIOMSS. Other indices showed varied patterns. The severe drought conditions in Brazil may negatively impact its wheat production and planting of the crops in the upcoming spring in the southern hemisphere.

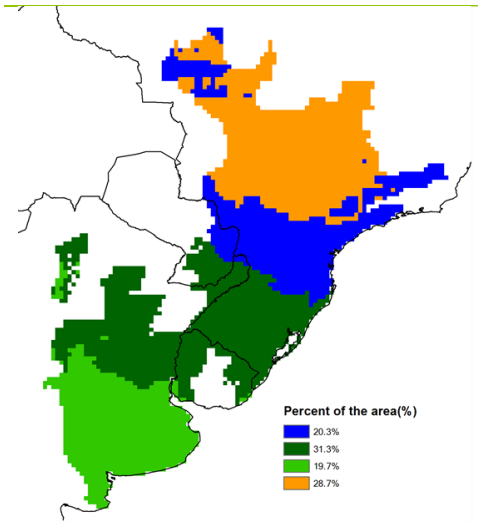
**Figure 2.3 South America MPZ: Agroclimatic and agronomic indicators, April to July 2021**



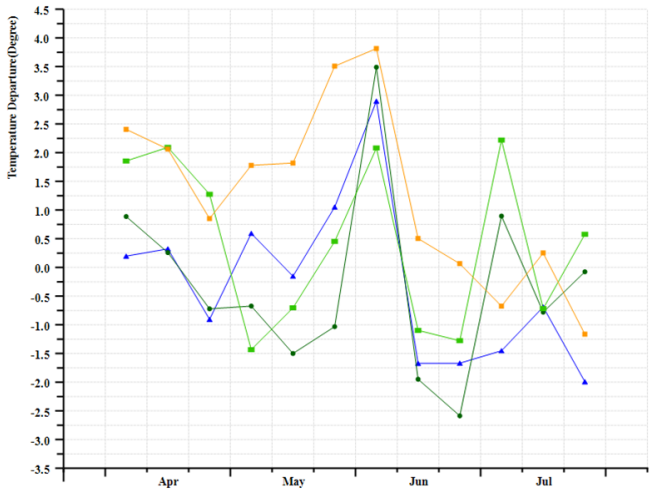

a. Spatial distribution of rainfall profiles



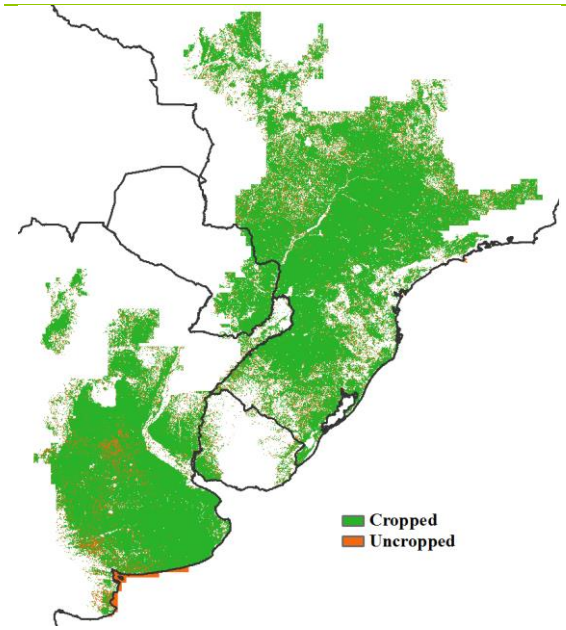

b. Profiles of rainfall departure from average (mm)



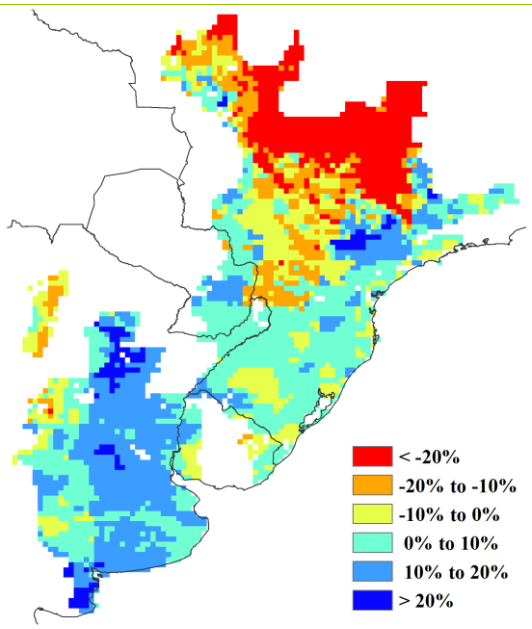

c. Spatial distribution of temperature profiles



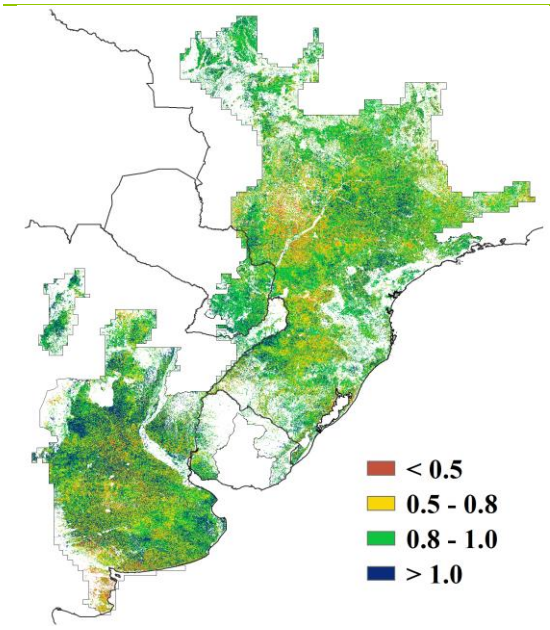

d. Profiles of temperature departure from average (°C)



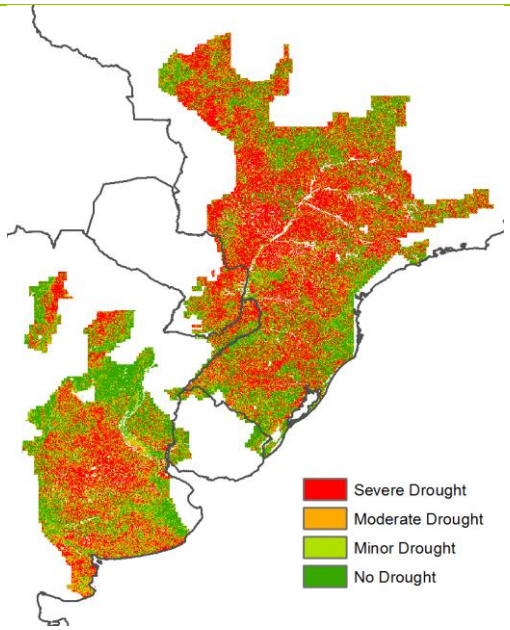

e. Cropped and uncropped arable land




f. Potential biomass departure from 5YA




g. Maximum VCI




h. VHI minimum

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

## 2.5 South and Southeast Asia

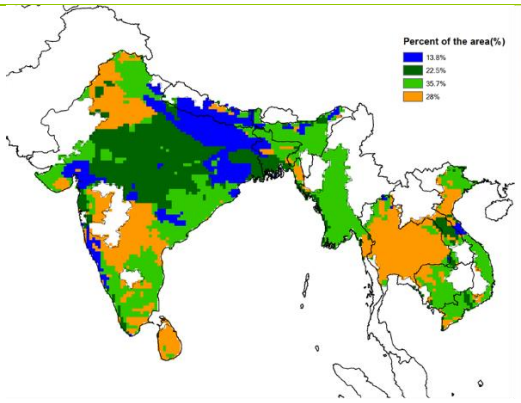
The South and Southeast Asia MPZ includes India, Bangladesh, Cambodia, Myanmar, Nepal, Thailand and Vietnam. This monitoring period covers the harvest of the winter crops, mainly wheat in India and Bangladesh, dry season rice, as well as the planting of the main rice crop in the entire MPZ. For South and Southeast Asia, agroclimatic conditions were average during this period with close-to-average RAIN (-2%), TEMP (-0.5°C), RADPAR (+0%) and BIOMSS (+3%) compared to the 15YA. Meanwhile, compared with the last 5YA, CALF was increased by 6%, reaching 82% and VCIx was 0.88. In general, the crop conditions in South and Southeast Asia are close to average.

The spatial distribution of rainfall profiles showed the precipitation in this MPZ was close to average before mid-May. Rainfall in 28% of the region (southern and northern India, Thailand and a small area of northern Vietnam) was above the average with slight fluctuations. 35.7% of the MPZ (southern and eastern India, Myanmar, Cambodia and Vietnam) had slightly below average conditions all along the reporting period. The precipitation in 13.8% of the MPZ (Eastern India and Nepal) showed above-average conditions with two strong fluctuations from mid-May to mid-June. Rainfall of central India quickly rose to above average in late July. The spatial distribution of temperature profiles showed 61.1% of the MPZ was close to average during the entire monitoring period, mainly in southern India and Southeast Asia. Other regions showed below-average TEMP conditions with heavy fluctuations from May to June but stayed near average in July.

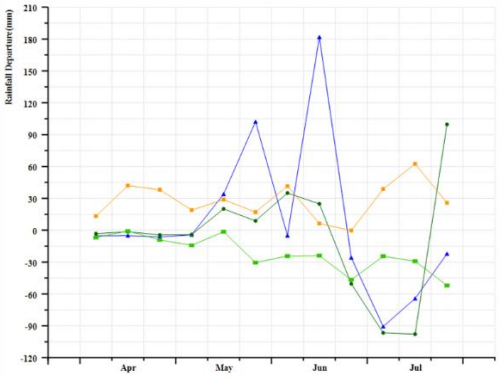
The BIOMSS departure map showed values higher than the average for most of the region, below-average conditions were mainly observed in northern India, eastern India and Nepal. Minimum VHI showed severe drought conditions in northern India, eastern India, central Myanmar and western Cambodia. This may be due to reduced precipitation and higher solar radiation which can be seen from the spatial distribution of rainfall.

In summary, the crop condition of this MPZ is expected to be near average. Conditions are somewhat critical in eastern India, Myanmar and northern Vietnam.

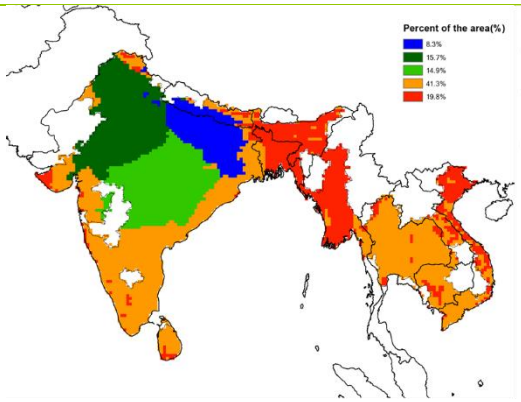
**Figure 2.4 South and Southeast Asia MPZ: Agroclimatic and agronomic indicators, April to July2021**



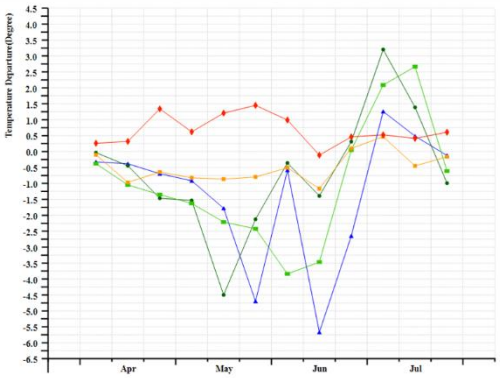

a. Spatial distribution of rainfall profiles



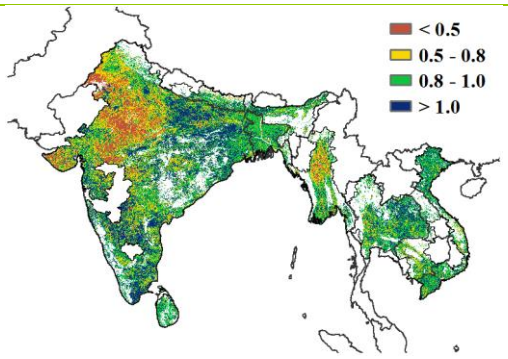

b. Profiles of rainfall departure from average (mm)



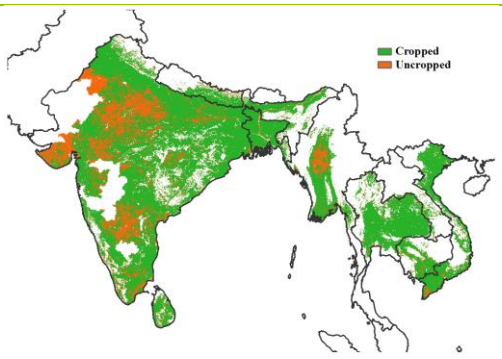

c. Spatial distribution of temperature profiles



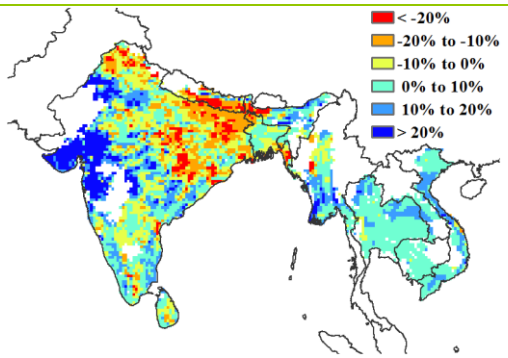

d. Profiles of temperature departure from average (℃)



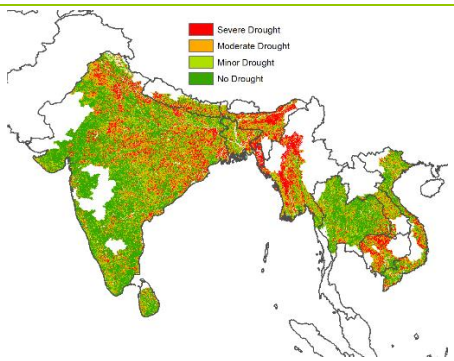

e. Maximum VCI




f. Cropped arable land




g. Biomass accumulation potential departure




h. VHI minimum

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

## 2.6 Western Europe

This monitoring period covers the vegetative growth of winter wheat and summer crops in the Western European Major Production Zone (MPZ). Generally, crop conditions were near or above average in most parts of the Western European MPZ based on the integration of agroclimatic and agronomic indicators (Figure 2.5).

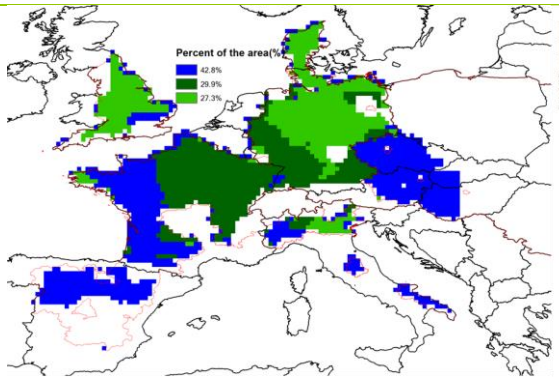
CropWatch agroclimatic indicators show that the whole MPZ showed a significant increase in RAIN (25% above average). Rainfall patterns can be characterized as follows: (1) 42.8 percent of the MPZ areas (Western and south-eastern France (Normandy, Loire, Brittany, Poitou-Charentes, Aquitaine, Sud-Pyrénées), Spain, north-western, central and south-eastern Italy, Czech Republic, Slovakia, Austria and Hungary), experienced below-average precipitation until mid-June and then above average until the end of this monitoring period; (2) during the whole monitoring period, 27.3 percent of the MPZ areas (UK, north-eastern Italy, central and northern Germany (Hesse, Thuringia, Lower Saxony, Saxony-Anhalt, Saxony, Brandenburg, Schleswig-Holstein, Mecklenburg-Vorpommernia)) experienced above-average precipitation with the exception of late April and mid-June; (3) the precipitation for 29.9 percent of the MPZ areas (Côte d'Azur, Auvergne-Rhône-Alpes, Centre, Burgundy-Franche-Comté, Haute-France in France and Baden-Württemberg, southern Bavaria, southeastern North Rhineland-Westphalia, Rhineland-Palatinate in Germany) showed a trend that fluctuated significantly above and below the average until mid-June, with significant below-average precipitation in late April, late May and mid-June, but from late June onwards those region experienced heavy precipitation events; Countries with the most severe precipitation departures included Germany (RAIN +40%), Czech Republic (RAIN +30%), France (RAIN +25%), Denmark (RAIN +21%) and Austria (RAIN +13%), while Italy and UK experienced below-average precipitation (RAIN -7%; RAIN -6%, respectively). Heavy precipitation accompanied by severe floods in some areas of the MPZ has caused severe damage to crops. RADPAR was down by 2%, influenced by the overall excess precipitation in this MPZ.

Temperature (TEMP) for the MPZ as a whole was significantly below average (TEMP -1.3°C). Throughout the monitoring period, temperatures were largely below average across most of the region, with the exception of heatwave events in the UK, France, Germany, Spain and northern Italy in early and mid-June, which may have affected grain growth of winter crops to some extent.

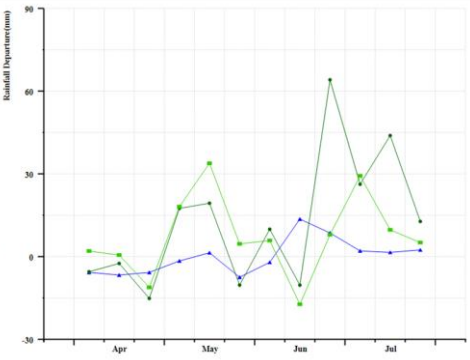
Due to the overall excessive precipitation in the Western European Major Production Zone combined with cooler than usual temperatures, the potential BIOMSS was 6% below average. The lowest BIOMSS values (-10% and below) were mostly concentrated in southern Denmark, western, central and southern Germany, northeastern and southern France. In contrast, BIOMSS was above average (in some cases exceeding a 10% departure) over Spain, central and south-eastern Italy, western France, and west-central UK. The average maximum VCI for the MPZ reached 0.92. More than 97% of the arable land was cropped, which is the same as the recent five-year average. Most uncropped arable land was concentrated in northeastern and southeastern Spain, with patchy distribution in other countries. The VHI minimum map shows that most of Italy and the southern part of Spain were most affected by severe drought conditions.

Generally, crop conditions in the Western Europe MPZ were near or above average. At the same time, crop yields in the MPZ will continue to be of concern due to the combined effects of heavy precipitation, severe floods events and heatwaves.

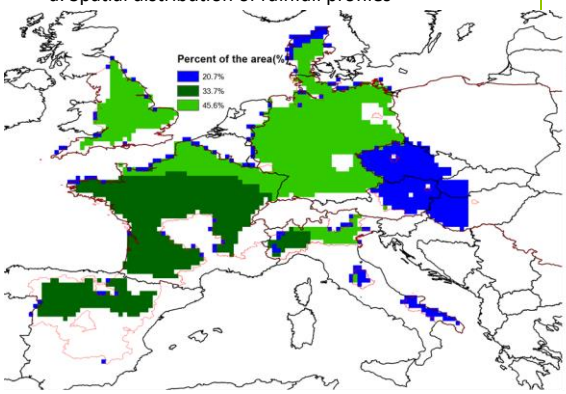
**Figure 2.5 Western Europe MPZ: Agroclimatic and agronomic indicators, April to July 2021**



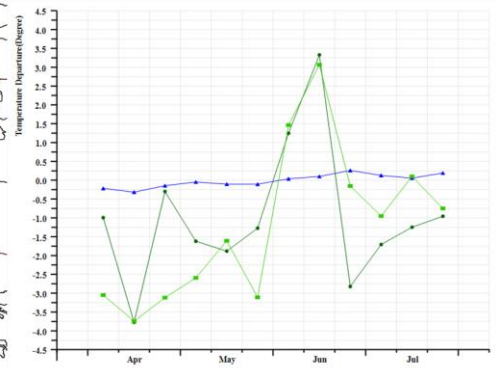

a. Spatial distribution of rainfall profiles



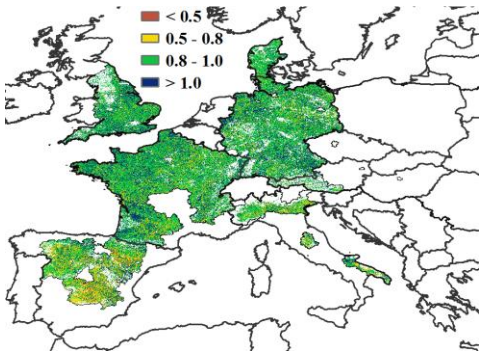

b. Profiles of rainfall departure from average (mm)



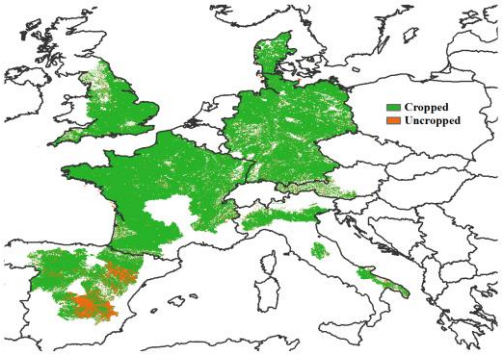

c. Spatial distribution of temperature profiles



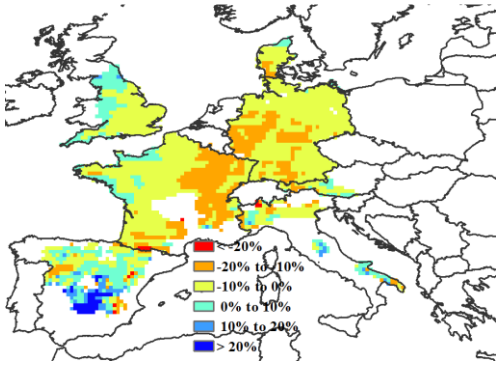

d. Profiles of temperature departure from average (mm)



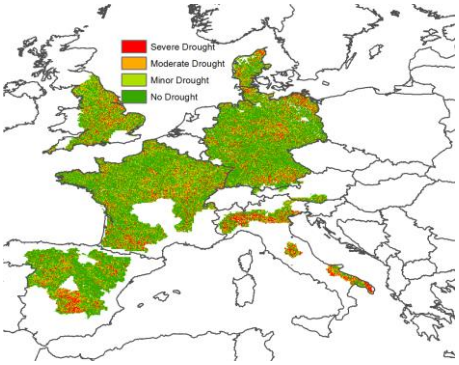

e. Maximum VCI




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

During this monitoring period, the growth of summer crops in this MPZ was above average resulting in a 7% increase of BIOMSS. This was due to higher cumulative rainfall (+9%), 0.3°C lower average temperature and 0.7% higher RADPAR across the main production areas compared to the average of the last 15 years.

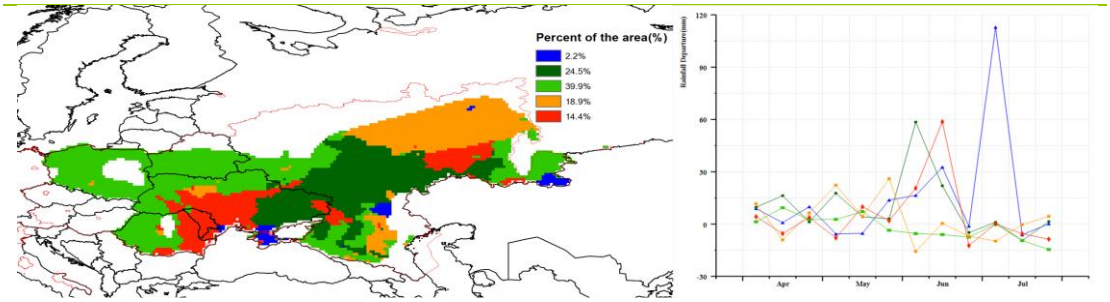
Based on the rainfall departure map, the rainfall varied significantly in the MPZ. The specific spatial and temporal distribution characteristics are as follows: (1) From April to May, the precipitation was slightly above average in Poland, southern Belarus, northern Ukraine, western Romania and parts of Russia. However, the precipitation in these regions was slightly below average in late May;(2) From late May to mid-June, the precipitation in eastern Romania, southern Ukraine and southern Russia (38.9% of the MPZ) increased sharply and was higher than average. After late June, the precipitation in these regions decreased and was lower than average, except for a few areas of western Russia; (3) In early July, the precipitation in some areas accounting for 2.2% of the MPZ increased to the highest value (+105 mm), and then dropped sharply to below-average levels.

According to its departure map, the temperature in the MPZ fluctuated dramatically. The western part of the MPZ, which is mainly distributed in southern Belarus, Moldova, Poland, Ukraine and Romania, accounting for 45.6% of the total area, had lower average temperature from April to early June, with a negative departure by 4.6°C in late April. In July, the temperature in these regions was above average, with the highest positive temperature departure by 6.6°C.

The results of CropWatch monitoring showed that most of the arable land in the MPZ was planted with the exception of a small part of southeastern Russia, where the CALF reached 98%. The BIOMSS in the MPZ increased by 7% compared to the average of the last 15 years. Based on the spatial distribution map of BIOMSS departure, a negative departure by more than 10% occurred in small parts of southern Russia, southern Ukraine and southern Romania. In contrast, the highest positve BIOMSS departure, which was 10% above the average, was mainly located in the western part of Russia, most of Belarus, the northeastern part of Poland and some parts of Romania. The overall Maximum VCI of the MPZ was 0.91 on average, and the areas with the Maximum VCI over 0.8 were mainly located in the western part of the MPZ.

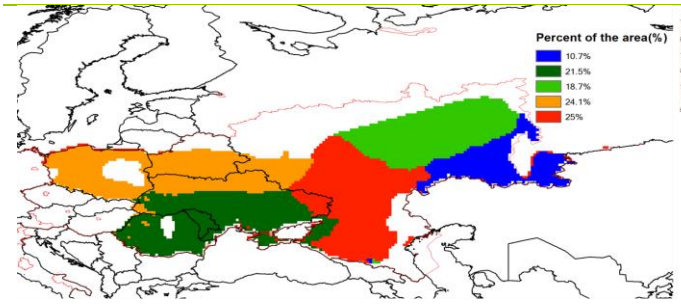
In general, crop growth in the MPZ was above average during the monitoring period. The crops recovered quickly from the generally below-average temperatures in April and May, aided by the overall above-average precipitation. Therefore, the yield in the MPZ is expected to be above average during this monitoring period.

**Figure 2.6 Central Europe to Western Russia MPZ: Agroclimatic and agronomic indicators, April to July 2021**

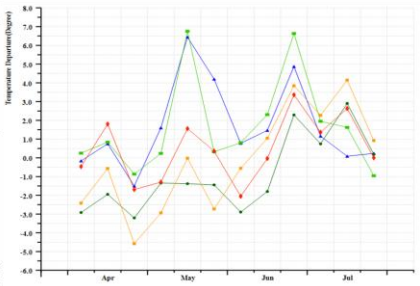



a. Spatial distribution of rainfall profiles

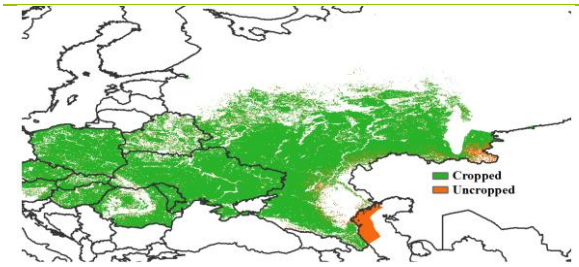
b. Profiles of rainfall departure from average (mm)



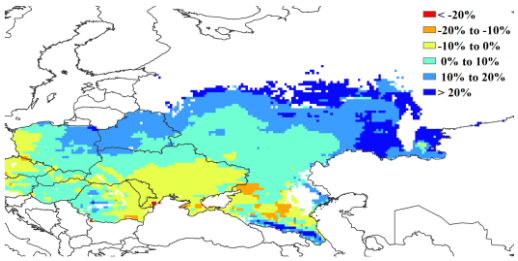

c. Spatial distribution of temperature profiles



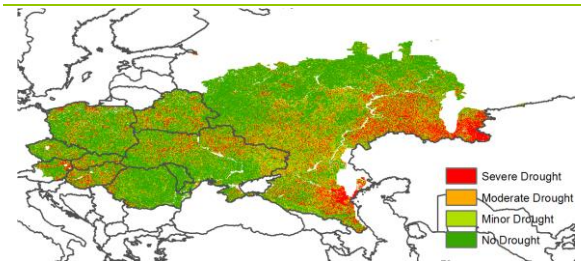

d. Profiles of temperature departure from average (°C)



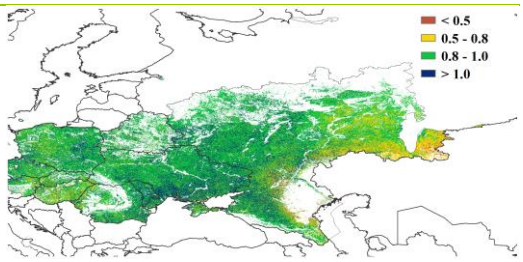

e. Cropped arable land




f. Biomass accumulation potential departure




g. VHI minimum




h. Maximum VCI

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