# CropWatch Bulletin

QUARTERLY REPORT ON GLOBAL CROP PRODUCTION

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**CropWatch Online Resources:** This bulletin along with additional resources is also available on the CropWatch Website at http://www.cropwatch.com.cn and http://cloud.cropwatch.com.cn/.

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**ℹ *NOTE:* CROPWATCH RESOURCES, BACKGROUND MATERIALS AND ADDITIONAL DATA ARE AVAILABLE ONLINE AT WWW.CROPWATCH.COM.CN.**

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# Abbreviations

| | |
|---|---|
| 5YA | Five-year average, the average for the four-month period from January from 2014 to 2018 to April next year; one of the standard reference periods. |
| 15YA | Fifteen-year average, the average for the four-month period from January from 2004 to 2018 to April next year; one of the standard reference periods and typically referred to as “average”. |
| AEZ | Agro-Ecological Zone |
| BIOMSS | CropWatch agroclimatic indicator for biomass production potential |
| BOM | Australian Bureau of Meteorology |
| CALF | Cropped Arable Land Fraction |
| CAS | Chinese Academy of Sciences |
| CWAI | CropWatch Agroclimatic Indicator |
| CWSU | CropWatch Spatial Units |
| DM | Dry matter |
| EC/JRC | European Commission Joint Research Centre |
| ENSO | El Niño Southern Oscillation |
| FAO | Food and Agriculture Organization of the United Nations |
| GAUL | Global Administrative Units Layer |
| GVG | GPS, Video, and GIS data |
| Ha | hectare |
| Kcal | kilocalorie |
| MPZ | Major Production Zone |
| MRU | Monitoring and Reporting Unit |
| NDVI | Normalized Difference Vegetation Index |
| OISST | Optimum Interpolation Sea Surface Temperature |
| PAR | Photosynthetically active radiation |
| PET | Potential Evapotranspiration |
| RADI | CAS Institute of Remote Sensing and Digital Earth |
| RADPAR | CropWatch PAR agroclimatic indicator |
| RAIN | CropWatch rainfall agroclimatic indicator |
| SOI | Southern Oscillation Index |
| TEMP | CropWatch air temperature agroclimatic indicator |
| Ton | Thousand kilograms |
| VCIx | CropWatch maximum Vegetation Condition Index |
| VHI | CropWatch Vegetation Health Index |
| VHIn | CropWatch minimum Vegetation Health Index |
| $W/m^2$ | Watt per square meter |

# Bulletin overview and reporting period

This CropWatch bulletin presents a global overview of crop stage and condition between January and April 2019, a period referred to in this bulletin as the JFMA (January, Februray, March and April) period or just the "reporting period." The bulletin is the 113rd such publication issued by the CropWatch group at the Institute of Remote Sensing and Digital Earth (RADI) of the Chinese Academy of Sciences, Beijing.

**CropWatch indicators**

CropWatch analyses are based mostly on several standard as well as new ground-based and remote sensing indicators, following a hierarchical approach.

In parallel to an increasing spatial precision of the analyses, indicators become more focused on agriculture as the analyses zoom in to smaller spatial units. CropWatch uses two sets of indicators: (i) agroclimatic indicators—RAIN, TEMP, RADPAR, and potential BIOMSS, which describe weather factors and its impacts on crops; and (ii) agronomic indicators—VHIn, CALF, and VCIx, Cropping Intensity, and vegetation indices, describing crop condition and development. Importantly, the indicators RAIN, TEMP, RADPAR, and BIOMSS do not directly describe the weather variables rain, temperature, radiation, or biomass, but rather they are spatial averages over agricultural areas, which are weighted according to the local crop production potential. (ii) PAY indicators: planted area, yield and production.

For each reporting period, the bulletin reports on the departures for all seven indicators, which (with the exception of TEMP) are expressed in relative terms as a percentage change compared to the average value for that indicator for the last five or fifteen years (depending on the indicator).For more details on the CropWatch indicators and spatial units used for the analysis, please see the quick reference guide in Annex B, as well as online resources and publications posted at www.cropwatch.com.cn.

**CropWatch analysis and indicators**

The analyses cover large global zones; major producing countries of maize, rice, wheat, and soybean; and detailed assessments for Chinese regions, 41 major agricultural countries, and 201 Agro-Ecological Zones (AEZs).

This bulletin is organized as follows:

| Chapter | Spatial coverage | Key indicators |
|---|---|---|
| **Chapter 1** | World, using Monitoring and Reporting Units (MRU), 65 large, agro-ecologically homogeneous units covering the globe | RAIN, TEMP, RADPAR, BIOMSS |
| **Chapter 2** | Major Production Zones (MPZ), six regions that contribute most to global food production | As above, plus CALF, VCIx, and VHIn |
| **Chapter 3** | 41 key countries (main producers and exporters) and 201 AEZs | As above plus NDVI and GVG survey |
| **Chapter 4** | China and regions | As above plus high resolution images; |
| **Chapter 5** | Production outlook, and updates on disaster events and El Niño. | |

**Regular updates and online resources**

The bulletin is released quarterly in both English and Chinese. E-mail **cropwatch@radi.ac.cn** to sign up for the mailing list or visit CropWatch online at **www.cropwatch.com.cn**, **http://cloud.cropwatch.com.cn/**

# Executive summary

The current CropWatch bulletin describes world-wide crop condition and food production as appraised by data up to the end of April 2019. It is prepared by an international team coordinated by the Chinese Academy of Sciences.

Special attention is paid to the major producers of maize, rice, wheat and soybean throughout the bulletin. The assessment is based mainly on remotely sensed data. It covers prevailing weather conditions, including extreme factors, at different spatial scales, starting with global patterns in Chapter 1. Chapter 2 focuses on agro-climatic and agronomic conditions in major production zones in all continents. Chapter 3 covers the major agricultural countries that, together, make up at least 80% of production and exports. Each is the object of a detailed analysis. Chapter 3 constitutes the bulk of the Bulletin. Chapter 4 zooms into China. The bulletin also presents the first CropWatch production estimate for selected countries in chapter 5.

The period from January to April 2019 (JFMA) covers the end dormancy for northern hemisphere winter crops, especially wheat, and the early stages of summer crops. In the southern hemisphere, it covers the harvest of summer crops (maize, soybean), or their mid-season and late stages (maize in southern Africa). Closer to the equator, it includes the harvest of the late 2018 crop of maize or rice and the planting of the first 2019 crops, for instance instance in the Philippines, Thailand, Vietnam and Brazil.

**Agro-climatic conditions**

According to the analyses presented in Chapters 1 and 3.1, prevailing climate conditions during the current 2019 JFMA reporting period were closer to average than during a long series of previous CropWatch reporting periods: global rainfall was just 2% above average, which compares with 13% in 2017 and 8% in 2018. Significant continental differences are nevertheless observed, with large rainfall deficits in Oceania (-23%), moderate deficits in central America (late and end of growing season), south America and in southern Africa where JFMA is the core of the maize season. Some national values were rather low, including Venezuela (-54%), Mexico (-49%), Guatemala (-43%), Portugal (-45%) and neighboring Morocco (-39%), the Philippines (-49%), New Zealand (-32%) and Kenya (-40%). The impact of low rainfall is often confirmed by CropWatch agronomic indicators, for instance in Australia where the fraction of cultivated cropland dropped 39% and vegetation condition indices were the lowest among the 20 top exporters of wheat.

Large positive rainfall anomalies occurred in two disjoined areas in the North America (+12%) and in an area extending from west Africa to central Asia (+11%) and eastern Asia (+10%). This area was highlighted in most recent CropWatch bulletins as it seems to have become a permanent feature. Specific countries to be listed include Iraq (+64%) and Syria (+75%). Both Iran (+39%) and Mozambique (+27%) and adjacent areas receive special attention in the section on disasters in Chapter 5 because of the destruction brought about by floods. Globally, the most anomalous conditions are those that prevailed in the eastern Mediterranean and the Middle East, especially Lebanon and Iraq, with precipitation excess larger than 40%, low temperature and sunshine (departures in excess of -1.2°C and sunshine 8% or more below average)

The largest area of spatially consistent positive temperature anomalies occurred in Eurasia in late winter. Examples include +2.2°C in Latvia, +2.4°C in the Buryatia Republic and Vologda Oblast in Russia, +2.5°C in the Yaroslav Oblast and +3.6°C in the Province of Heilongjiang in China. The unseasonably high temperatures may have affected winter crops and forthcoming summer crops in a way that is not yet fully understood, possibly in areas where agronomic and climatic indicators do not agree. Several cold areas occurred in north and south America. For sunshine, low values occurred (1) from west Africa to eastern Asia, (2) northern America and (3) the main temperature summer crop areas in south America. Virtually all other areas experienced above-average radiation.

**2019 Production estimate**

The production estimate proposed in Chapter 5.1 will be updated two times this year. Except for the southern hemisphere, it is currently based largely on a mix of actual crop and weather data for the JFMA period and estimates for May onward, as only one third of the year has elapsed. The share of actual data varies from approximately 18% for maize to 71% for wheat.

CropWatch estimates the global 2019 production of the major commodities at 1005 million tonnes of maize (up 0.7% over 2018), 731 million for rice (up 1.1%), 733 million tonnes of wheat (a 1.5% increase) and 331 million tonnes of soybeans, a 1.2% increase over last year's output. The current estimate is one of the most optimistic issued by CropWatch over the recent cropping seasons, since all crops show positive variations compared with the previous campaign.

Countries that experienced large production increases for maize include mostly Argentina (+7%) and Mexico (+8%) as well as three South-east Asian countries including Bangladesh (+8%), Myanmar (+9%) and Vietnam where the estimated increase reaches 12%. All countries with a significant drop in maize production are located in Africa.

The production of rice increases in south and South-East Asia, starting with India (+1%), Indonesia (+2%), Bangladesh (+6%) and Vietnam (+8%). The most significant decreases occurred in Thailand (-3%) and Cambodia (-8%).

For wheat in several European producers decreases below 2018 output, some of them significantly in Romania (-17%), Turkey (-15%), Belarus (-13%) and Hungary (-11%). Positive values are observed for Italy (+7%) and Great Britain (+8%) and some eastern European and western to central Asian countries, including Ukraine (+4%) and Russia (+9%). The estimates will need to be reassessed because of the uncertainties about the impact of very high temperature in some areas. A production increases is also inferred for China (+1%), Egypt, Brazil, Ethiopia and Pakistan (+4% to +10%). The largest increases are projected for Pakistan (+10%), Morocco (+12%), South-Africa (+14%), Mexico (+17%), and Iran (+19%) where floods have destroyed crops and infrastructure but also supplied much needed water. Production decreases are projected for two southern Hemisphere wheat growers, Argentina and Australia, -3% and -13%. For the United States, the wheat production estimate is up 10%.

Similar to the other rain-fed summer crop in the country, the Argentinian soybean crop is up (+9%) while Brazil stayed at the level of the 2018 output.

The performance of major exporters and importers does not rise any concerns for the availability of maize, rice, wheat and sorghum.

**China**

Climatic variables and the resulting crop condition were generally favorable in the main winter crop producing areas. Both precipitation and temperature were above average (20% and 0.6°C, respectively). The total output of combined winter crops is estimated to reach 127 million tons, an increase of 1.23 million tons (or 1%) above the 2018 season.

The largest drop of winter crop production occurred in the provinces of Hebei and Shaanxi, but also in Shanxi, Hubei, and Chongqing. Henan and Shandong Provinces, the top two provinces in terms of winter crop production, both recovered from their poor situation in 2018 with a year-on-year increase of 2.8% and 5.6%, respectively, due to the simultaneous increase in planted area and yield.

For wheat alone, production is estimated to reach 117 million tons, an increase of 1.35 million tons or 1.2% above 2018. The largest wheat production drop (8.4%) occurred in Shaanxi. This is the largest annual winter crop production drop in percentage since 2013. The winter wheat planted area in Hubei province is 6.2% down from 2018, leading to very significant 7.2% reduction in production.

# Chapter 1. Global agroclimatic patterns

## 1.1 Introduction to CropWatch agroclimatic indicators (CWAIs)

This bulletin describes environmental and crop conditions over the period from January to April 2019, JFMA, referred to as “reporting period”. In this chapter, we focus on 65 spatial “Mapping and Reporting Units” (MRU) which cover the globe, but CWAIs are averages of climatic variables over agricultural areas only inside each MRU. For instance, in the “Sahara to Afghan desert” MRU, only the Nile valley and other cropped areas are considered. MRUs are listed in annex B and serve the purpose of identifying global climatic patterns. Refer to Annex A for definitions and to table A.1 for 2019 JFMA numeric values of CWAIs by MRU).

Although they are expressed in the same units as the corresponding climatological variables, CWAIs are spatial averages limited to agricultural land and weighted by the agricultural production potential inside each area. Correlations between variables (RAIN, TMP, RADPAR, BIOMSS) at MRU scale derive directly from climatology. For instance, the positive correlation (R=0.364) between rainfall and temperature results from high rainfall in equatorial, i.e. in warm areas.

We also stress that the reference period, referred to as “average” in this bulletin covers the 15-year period from 2004 to 2018. Although departures from the 2004-2018 are not anomalies (which, strictly, refer to a “normal period” of 30 years), we nevertheless use that terminology. The listed departures from average differ from but are consistent with other sources such as NOAA1 or Copernicus2 which use longer and less recent reference period of 30 or 100 years. The specific reason why CropWatch refers to the most recent 15 years is our focus on agriculture, as already mentioned in the previous paragraph. 15 years is deemed an acceptable compromise between climatological significance and agricultural significance: agriculture responds much faster to persistent climate variability than 30 years, which is a full generation. For “biological” (agronomic) indicators used in subsequent chapters we adopt an even shorter reference period of 5 years (i.e. 2014-2018) but the BIOMSS indicator is nevertheless compared against the longer 15YA (fifteen years average). This makes provision for the fast response of markets to changes in supply but also to the fact that in spite of the long warming trend, some recent years (e.g. 2008 or 2010-13) were below the trend.

It is stressed that, considering the size of the areas covered in this section, even small departures may have dramatic effects on vegetation and agriculture due to the within zone spatial variability of weather.

## 1.2 Global overview

Departures from average variables, i.e. anomaly patterns characterize the current reporting period more meaningfully than the averages themselves. RAIN was below average in about 60% of the MRUs, resulting in RAIN being 2% above the average value of the 15-year reference period (2004-2018). TEMP was average (just 0.1°C above average) while RADPAR was slightly above average. The current calculation procedure of the biomass production potential BIOMSS depends on rainfall and temperature. During the current reporting period 80% of its variations can be ascribed to RAIN variations and a couple of % only to TEMP. As a result, the global average is 1% above normal (55% of values are above normal).

Compared with previous JFMA periods, especially in 2017 and, to a lesser extent, the 2018, rainfall depths were much closer to the corresponding 15 years average: +13% in 2017, +8% in 2018 and just +2% in 2019 (Figure 1.1). For RADPAR, the current value of +1% follows two negative departures in 2017 (-2%) and 2018

(-5%). Similarly, the global TEMP is slightly positive (departure +0.1°C after negative departures in 2017 (-0.2°C) and in 2018 (-0.1°C). When looking at weighted averages (Table 1.1), world average values are even closer to average.

Although, the current JFMA reporting period was closer to “average” than during the previous seasons, significant continental differences are observed, as illustrated in Table 1.1. RAIN deficits were large in large Oceania (-23%, during summer, mostly in the east and south) and moderate in central America (late and end of growing season), south America (where the reporting period corresponds to late summer crop season in the southern temperature areas) and in Africa where JFMA covers the end of the Mediterranean winter season and the main maize growing season in southern Africa. Well above average precipitation fell over north America (+12%), central (+11%) and eastern Asia (+10%)

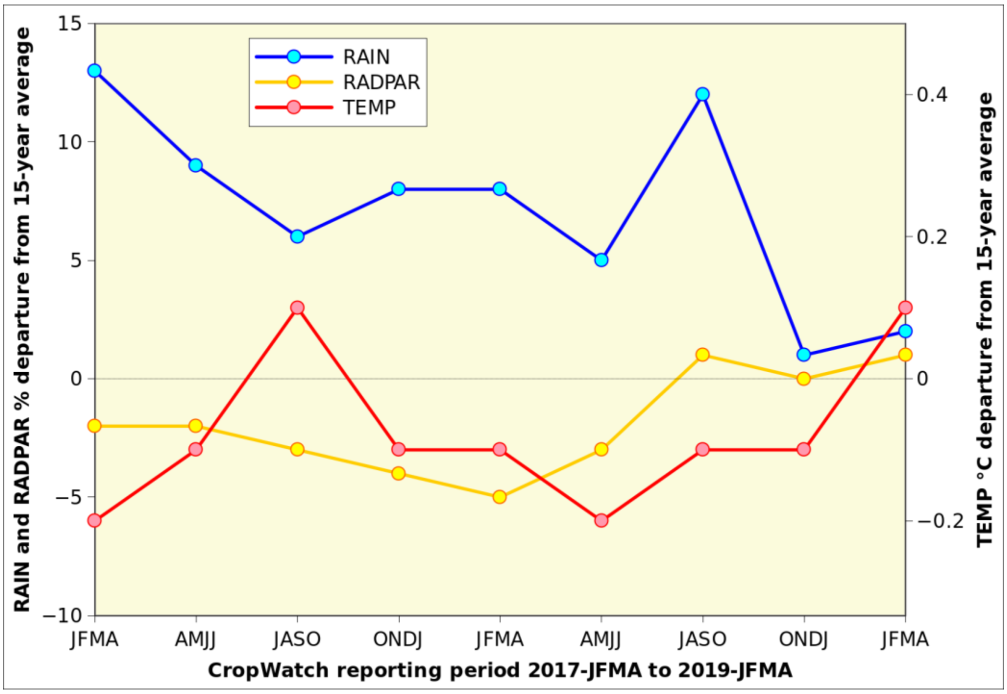
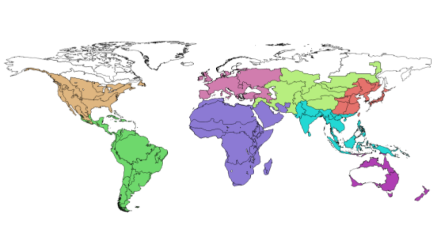



**Figure 1.1 global departure from recent 15-year average of the RAIN, TEMP and RADPAR indicators since 2017 JFMA period (average of 65 MRUs, unweighted)**

**Table1.1 Departures from the recent 15-year average of CropWatch agroclimatic indicators over regional MRU groups during JFMA. Within each group, averages are weighted by the agricultural area of individual MRUs. “Others” include five non agricultural areas shown in white in the map**

| | RAIN % | TEMP °C | RADPAR % | BIOMSS % |
|---|---|---|---|---|
| Africa | −5 | −0.1 | 2 | −6 |
| America S + C | −4 | −0.3 | 2 | −3 |
| America N | 12 | −0.9 | −4 | 0 |
| Asia centre | 11 | 0.7 | −4 | 12 |
| Asia East | 10 | 0.8 | −3 | 8 |
| Asia South | −2 | −0.1 | 2 | 2 |
| Europe | −3 | 0.8 | 2 | 1 |
| Oceania | −23 | 0.4 | 4 | −21 |
| Others | 7 | 2.2 | 0 | 18 |
| World | 0.4 | 0.0 | 0.4 | −0.2 |



Largely uncorrelated temperatures were recorded over north America (-0.9°C) with low sunshine (-4%) while remaining areas of the continent had a smaller temperature deficit (-0.3°C). The largest sunshine deficits next to N. America occurred in central and eastern Asia (-4% and -3%, respectively).

Although the areas listed as "others" are mostly irrelevant for cropping, it is nevertheless interesting to observe large positive rainfall and temperature departure (+7% and +2.2°C, respectively) both resulting from very anomalous conditions in Boreal north America where RAIN was up 21% and TEMP exceeded average by 3.5°C, which is very significant and locally led to unseasonable snow-melt.

Biomass departures roughly follow rainfall anomalies except in north America, resulting from the combined effect of low temperature and low sunshine. The increase is spectacular (+18%) at the highest latitudes.

## 1.3 Rainfall and BIOMSS anomalies

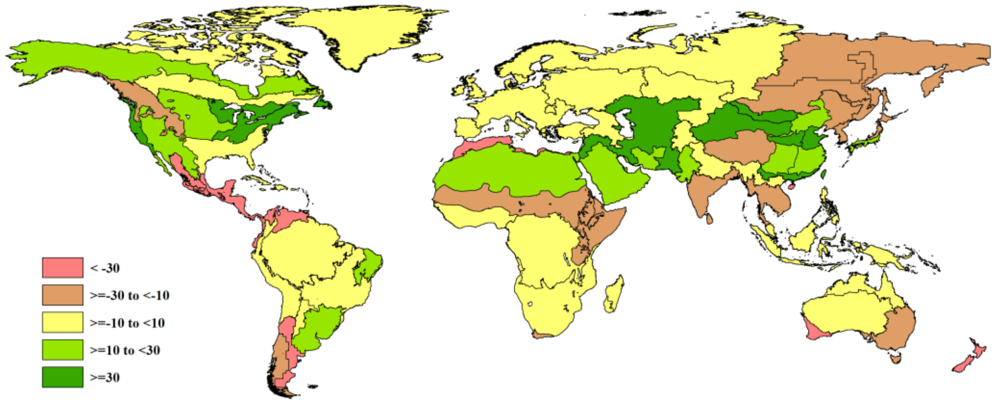



**Figure 1.2 Global map of rainfall anomaly (as indicated by the RAIN indicator) by CropWatch Mapping and Reporting Unit (MRU), departure from 15YA between between January and April 2019**

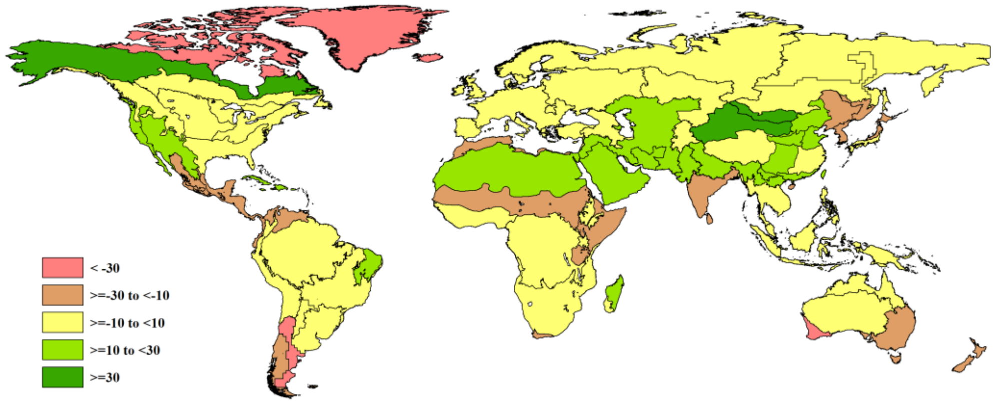



**Figure 1.3 Global map of biomass production potential anomaly (as indicated by the BIOMSS indicator) by CropWatch Mapping and Reporting Unit (MRU), departure from 15YA between between January and April 2019**

Marked rainfall deficits in excess of 30% occurred in Oceania (New Zealand MRU 56, -32%; Nullarbor to Darling in south-west Australia MRU 55, -40%), In Queensland to Victoria (MRU 54), which includes major agricultural areas, the deficit was lower at 23 %, 171 mm instead of the average 222 mm). All these areas have not started their main growing season and the impact on production is currently neutral, even if soil moisture is lower than expected. The same applies to a large extent in Central America (MRU 17 Sierra Madre, -37%) and northern South America (MRU 19, 33%). In the Semiarid Southern cone (MRU 28, -30%) crops play a minor part but the shortage or rainfall has affected rangelands. In the tropical southern Chinese island of Hainan (MRU 33, -39%) the main growing season is just starting but initial conditions are water water stressed. The most severe impact of drought is likely to have occurred in MRU 07, the north

African Mediterranean. Especially in the Maghreb, the end of the main wheat and barley season coincides with the reporting period and the water deficit (-33%) is bound to have affected the maturity of crops.

Less severe, but nevertheless significant deficits affected southern Asia (MRU 45, -13% in southern Asia; MRU 50, -12% continental south-East Asia) and eastern Africa (MRU 02, the east-African Highlands with RAIN down 10%; MRU 04, -17%, the Horn of Africa).

Large positive rainfall anomalies occurred in two disjoined areas in the North America and in an area extending from west Africa to central and eastern Asia. The area was highlighted in most recent CropWatch bulletins as it seems to have become a permanent feature. In northern America, abundant precipitation affected MRUs 13 and 16, the Corn Belt and the west coast, with excesses of 34% and 32%, respectively, two important agricultural areas which have suffered from water logging and floods. In Asia, the highest precipitation was recorded from the eastern edge of the Mediterranean the second area (MRU 31, Western Asia, rainfall up 33%) to China: Huanghuaihai (MRU 34, +34%), southern China (MRU 40, RAIN +43%) and Taiwan (MRU 42, RAIN +45%). In between, we need to mention the Loess region (MRU 36), Gansu-Xinjiang (MRU 32) and Southern Mongolia (MRU 47) with excesses reaching +35%, +61% and +170%, respectively. While the Loess region is a major agricultural area, pastoralism prevails in semi-arid MRUs 32 and 46. In all areas, the precipitation has replenished soil moisture and created favourable conditions for winter spring growth, rangeland development and river flows.

In general, the departures from average of biomass development potential follow precipitation departures, within limits due to the impact of temperature. Among the low rainfall areas (deficit at least 20%), different behaviours of RAIN and BIOMSS only occur in Eastern Central Asia (MRU 52), which covers essentially the northern half of Mongolia, the Republic of Buryatia and the Amur Oblast, where winter crops are marginal productions. MRU 52 had a precipitation deficit of 27%, but BIOMSS was down only 5% due to the large positive temperature anomaly (+2.4°C). Temperatures, however, remained well below freezing. In the Corn Belt, Taiwan and Gansu-Xinjiang, which are all large rainfall excess areas, the biomass potential increased much less than precipitation, (BIOMSS variation of -4%, +23 and +38%, respectively) because precipitations have reached high values above which BIOMSS increases no longer respond to RAIN increases.

## 1.4 Temperatures

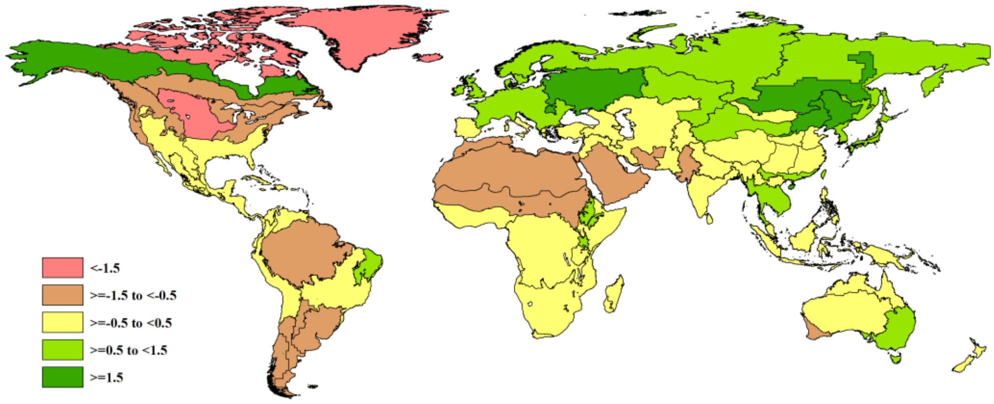



**Figure 1.4 Global map of temperature anomaly (as indicated by the TEMP indicator) by CropWatch Mapping and Reporting Unit (MRU), departure from 15YA between between January and April 2019**

The largest area of spatially consistent positive temperature anomalies occurred in Eurasia, from non-Mediterranean western Europe (MRU 60, +0.5°C) to southern Japan and Korea (MRU 46, +0.6°C). It embeds MRUS with larger anomalies in the west (MRU 58, Ukraine to Ural mountains) and in the east (MRUs 52, eastern Central Asia; MRU 38, North-East China and MRU 35, Inner Mongolia) where the positive temperature anomalies reached 1.7°C, 2.4°C, 3.0°C and 1.6°C, respectively.

The northern half of Africa, much of north America and of South America had cool weather with departures from average in the range from -0.5°C to -1,5°C. The coldest area that deserves to be mentioned is MRU 12, the northern Great Plains, -2.3°C below average, as well the adjacent MRUs of British Columbia to Colorado (MRU 11, -1.5°C below average) and, to a lesser extent, the Corn Belt (MRU 13, -0.7°C).

## 1.5 RADPAR

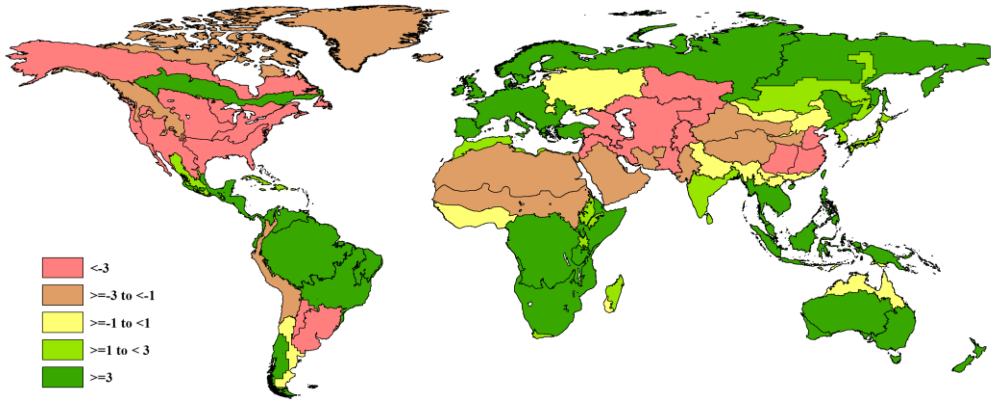



**Figure 1.5 Global map of photosynthetically active vradiation anomaly (as indicated by the RADPAR indicator) by CropWatch Mapping and Reporting Unit (MRU), departure from 15YA between between January and April 2019**

The situation of sunshine is easily summarised: low RADPAR occurred (1) from west Africa to eastern Asia, (2) northern America and (3) the main temperature summer crop areas in south America. Virtually all other areas somehow experienced above-average radiation.

In the first (1), lowest values occur in eastern Asia (MRU 37, Lower Yangtze -15%; MRU 34, Huanghuaihai, -4% and MRU 41, South-West China with -3%) and in western-central Asia, especially mountain areas. They include, in addition to MRU 31 (Western Asia, -6%), the Pamir area (MRU 30, -7%), the Caucasus (MRU 29, -4%) and the Ural to Altai mountain ranges (MRU 62, -3%).

The second (2) includes five MRUs with values from -6% in the two first to 4% in the last: MRU 16, West Coast; MRU 14, Cotton Belt to Mexican Nordeste; MRU 18, south-western US and Northern Mexican highlands; MRU 13, the Corn Belt and MRU 12, the Northern Great Plains.

The third (3) includes MRU 25, Central-north Argentina with RADPAR down 6%, as well as the major summer crop growing area of the Pampas (MRU 26) at 4%. This includes south-eastern Brazil, Uruguay and the north-eastern provinces of Argentina.

The most abnormally sunny regions include New Zealand (MRU 56) and Hainan Island (MRU 33) where the excess sunshine reached 9 and 17%, respectively.

## 1.6 Combinations of anomalies

The above-mentioned high sunshine areas in MRUs 33 and 56 were also, logically, characterised by dry conditions and, at least for Hainan (MRU 33) by significantly warmer than average temperature (+2.0°C).

About half the areas where weather was globally atypical for the JFMA period occurred in Asia, and more specifically in China. This includes low rainfall with high temperature and abundant sunshine in Hainan (MRU 33), North-East China (MRU 38) and eastern-central Asia (MRU 38). Another group of MRUs had high rainfall with either very low RADPAR (Lower Yangtze, MRU 37) or unseasonably warm weather in Inner Mongolia (MRU 35), Taiwan (MRU 42) and Gansu-Xinjiang (MRU 32). On the American continent, two mostly pastoral areas were dry and cold in the south (MRU 28, the Semi-arid Southern Cone and MRU 27, Western Patagonia) or wet and cold with low sunshine in one of the major global agricultural areas, the Corn Belt (MRU 13).

In Africa, both the Sahel (MRU 08) and the Sahara to Afghan Desert (MRU 64) has relatively cool weather (by local standards!) but the second was wetter than average. Southern Australia was dry but cooler than expected in the west and warm in the east.

# 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.

**Table2.1 January to April 2019 agroclimatic indicators by Major Production Zone, current value and departure from 15YA**

| | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure (%) | Current (°C) | Departure (°C) | Current ($MJ/m^2$) | Departure (%) |
| West Africa | 192 | 1 | 28.7 | -0.4 | 1317 | 0 |
| North America | 357 | 15 | 3.8 | -1.1 | 730 | -5 |
| South America | 676 | 2 | 24.0 | -0.3 | 1184 | 1 |
| S. and SE Asia | 124 | -3 | 24.7 | 0.0 | 1214 | 1 |
| Western Europe | 196 | -9 | 6.3 | 0.3 | 608 | 5 |
| C. Europe and W. Russia | 238 | -2 | 0.6 | 1.5 | 483 | -1 |

*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 (January-April) for 2004-2018.*

**Table2.2 January to April 2019 agronomic indicators by Major Production Zone, current season values and departure from 15YA/5YA**

| | BIOMSS ($gDM/m^2$) | | CALF (Cropped arable land fraction) | | Maximum VCI Intensity |
|---|---|---|---|---|---|
| | Current | 15A Departure (%) | Current | 5A Departure (%) | Current |
| West Africa | 602 | 0 | 53 | -2 | 0.89 |
| North America | 753 | -2 | 42 | -2 | 0.86 |
| South America | 1713 | 2 | 99 | 0 | 0.85 |
| S. and SE Asia | 415 | 6 | 72 | -1 | 0.87 |
| Western Europe | 740 | -6 | 94 | -1 | 0.91 |
| Central Europe and W Russia | 680 | 6 | 51 | -20 | 0.75 |

*Note: See note for Table 2.1, with reference value R defined as the fifteen-year average (15YA) for the period (January-April) for 2004-2018 or five-year average (5YA) for the same period (January-April) for 2014-2018.*

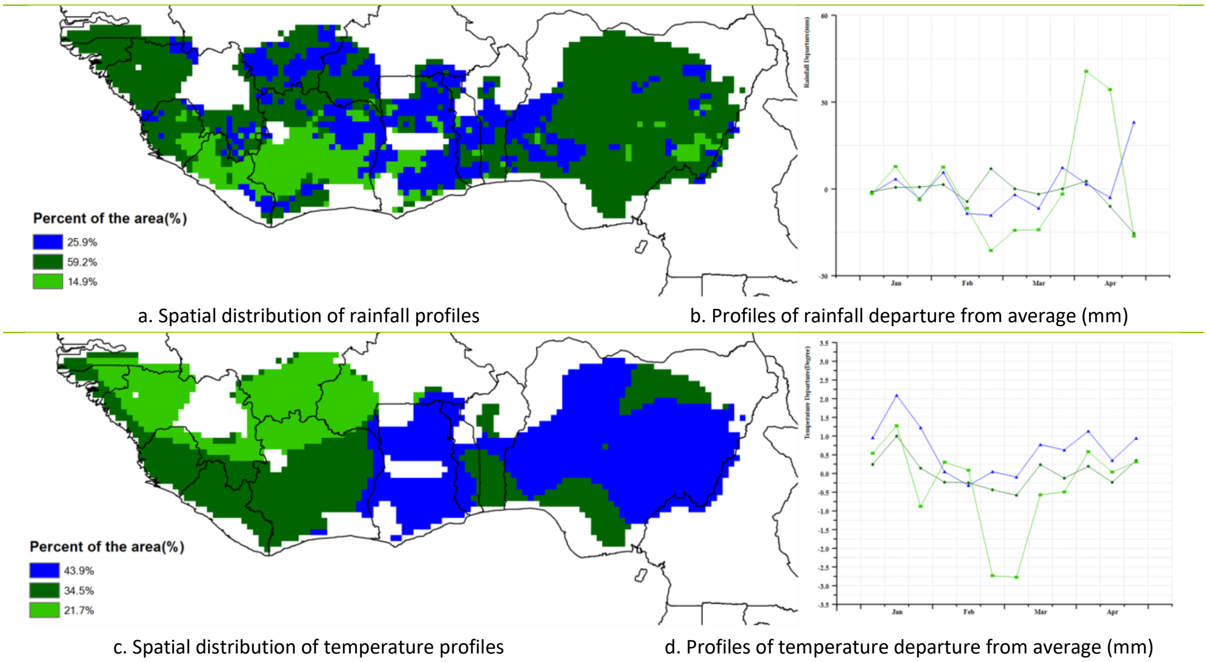
## 2.2 West Africa

The reported period covers the onset of the main growing season for the main crops (cereals: maize, sorghum, millet; tubers: yam and cassava) that are important components of food security in the West African region. Most of the cropped land is along the coastal areas while the northern drier parts are currently uncropped. Dry conditions in most parts of the north are important for the crop harvest April, while onset of the rains in the south (February/March) created conducive environments for land preparation and planting of maize and yams.

The West African region received cumulative rainfall of 192 mm (+1% above average) covering 59.2% of the region with highest amounts in Equatorial Guinea (640mm, +1%). However we expect precipitation to build up starting with the southern coastal areas into the northern areas. The regional average temperature was 28.7°C (-0.4°C departure) and RADPAR reached 1317 MJ/m², an insignificant from the average). The observed fraction of cropped arable land (CALF) is predominantly relevant for the wet coastal areas while northern areas of the West African region are still uncropped. Consequently, the observed biomass production potential was 602 gDM m-2 with low departures (<-20%) covering mostly uncropped northern areas (except for some irrigated winter crops) and coastal parts which experience bimodal rainfall. The observed VCIx for the MPZ was 0.89 predominantly resulting from the coastal areas and northern Nigeria. The VHI minimum map, a proxy characterizing vegetation health or a combined estimation of moisture and thermal conditions showed stresses from mid to northern areas of the MPZ affecting most parts of the country in this regions.

Based on these CropWatch indicators, stable climatic conditions favorable onset of the main long growing season are expected in the MPZ.

**Figure 2.1 West Africa MPZ: Agroclimatic and agronomic indicators, January to April 2019.**

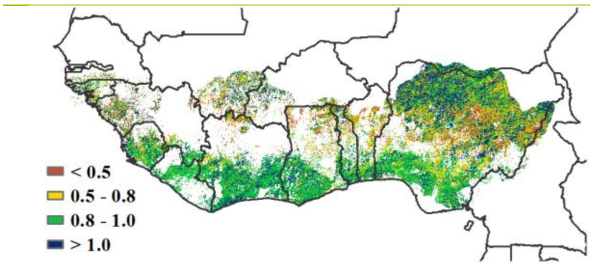



a. Spatial distribution of rainfall profiles

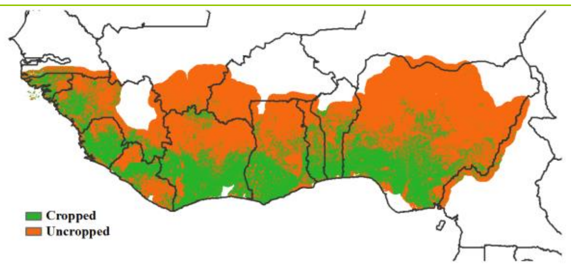
b. Profiles of rainfall departure from average (mm)

c. Spatial distribution of temperature profiles

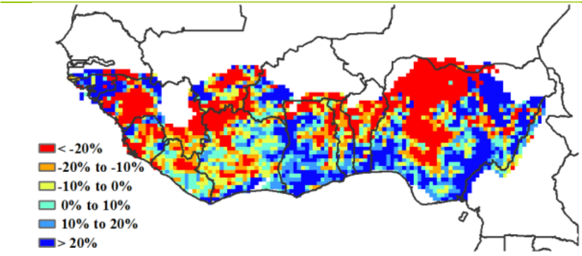
d. Profiles of temperature departure from average (mm)



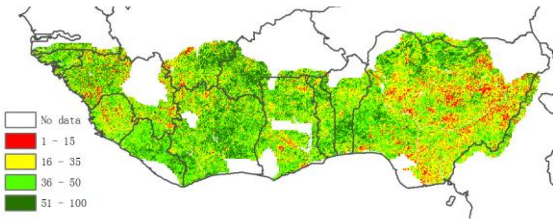

e. Maximum VCI




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

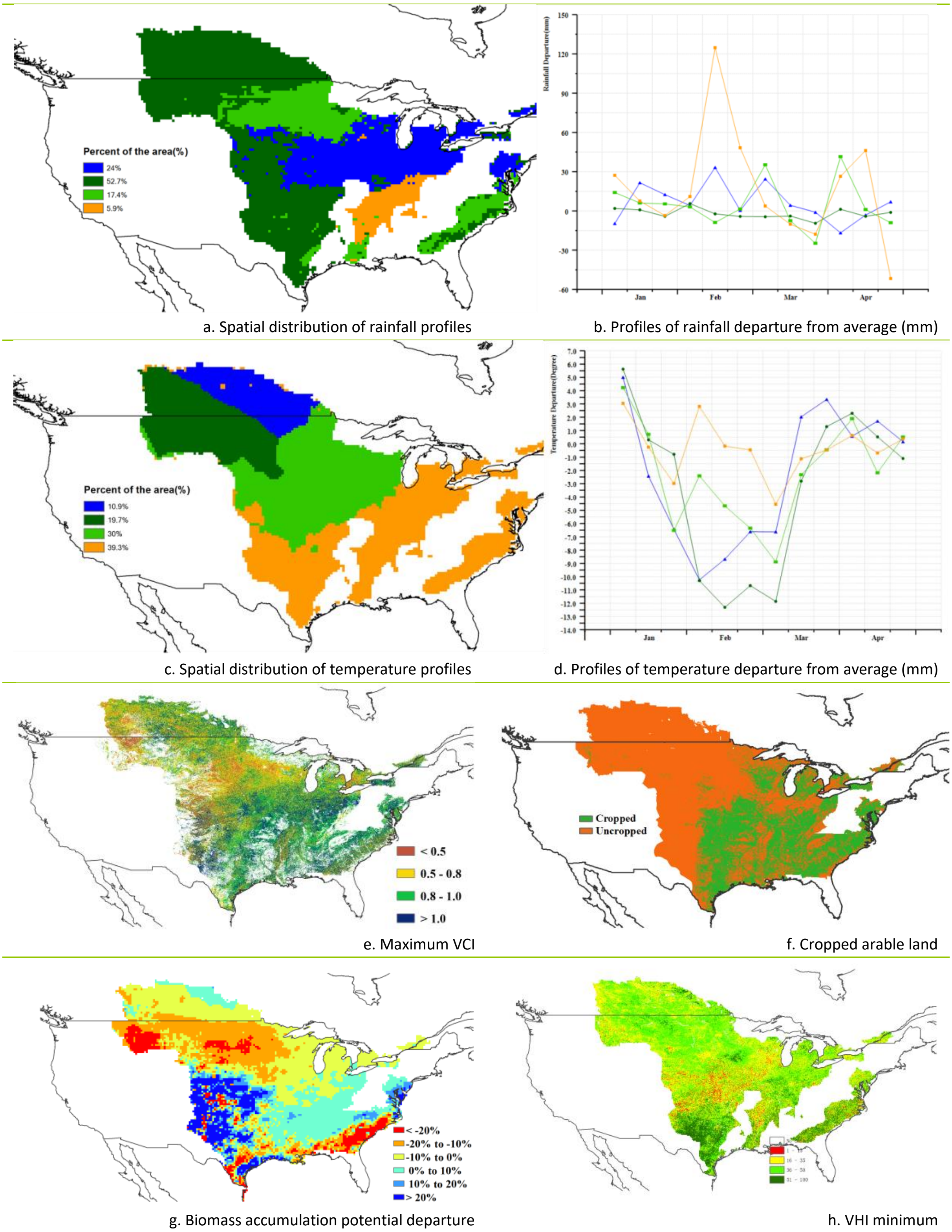
This reporting period covers the major growing season of winter crops, including winter wheat, rye, oats, and rapeseed (canola). Crop condition in major winter crop zones is above average.

Compared to average, precipitation was up 15% while temperature was below by 1.1°C. The photosynthetically active radiation in the MPZ was significantly lower than the average by 5% due to increased cloudiness. A severe cold wave occurred in February and caused the temperature in the Canadian Prairies and Northern Plains to be below average by more than 10°C. Precipitation in the middle and lower Mississippi River was 150 mm higher than average in late February, which led to floods. Fortunately, because most spring crops had not yet been sown in February, the abnormal weather did not directly impact agricultural production.

Due to the cold wave, sowing was, however, delayed, which caused the cropped area land to drop 2% below the 5-year average. Above average precipitation and low temperature reduced the risk of drought, as confirmed by VHIn, except for scattered areas in the Great Plains. As to the major winter crops producing zone, potential biomass in Central and southern Great Plains was 20-30% higher than average due to adequate soil moisture. High VCIx also confirms the good crop condition in Central and southern Great Plains.

In summary, the condition of winter crops is above average and CropWatch estimates that winter crop production is likely to above average as well.

**Figure 2.2 North America MPZ: Agroclimatic and agronomic indicators, January to April 2019.**




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.

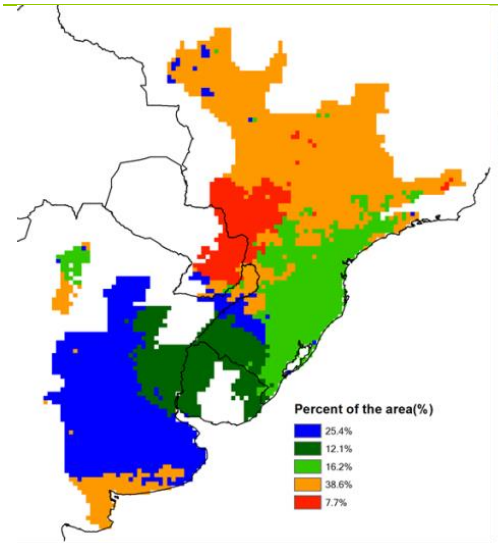
## 2.4 South America

The current Bulletin covers the peak vegetative development and maturity of summer crops in the MPZ. The harvest of maize, soybean and other summer crops will be concluded in May. Overall crop condition in South America was average during the monitoring period.

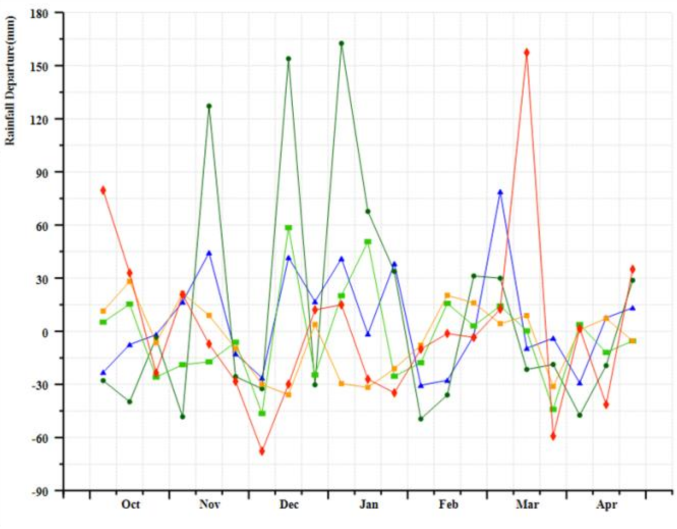
The region showed close to average rainfall (+2% above average). However, according to rainfall departure clusters (Figure 2.3a) spatial variability was large. Some areas experienced large precipitation excesses, such as the north-eastern Pampas, Uruguay and South Brazil. In East Paraguay and the border area between the Paraná region of Brazil and Paraguay, precipitation deficit had occurred in November 2018 during the previous CropWatch reporting period. TEMP showed a slight reduction of 0.3°C. All of the areas illustrated in Figure 2.3b showed high variability in temperature anomalies during the period with a range of change of 3°C or larger. Central Mato Grosso in North-west Brazil suffered abnormally warm weather from February to early April. Other areas showed lower values around March and positive anomalies at the beginning and end of this reporting period. Argentina and Uruguay recorded negative anomalies in March at a time when almost no anomalies occurred in Brazil. RADPAR showed an increment of 1 % over average.

BIOMSS was 2 % above average, again with a lot of spatial variability (Figure 2.3g). Negative anomalies were observed in the South of the Pampas, Chaco and Center of Brazilian agricultural area, while positive anomalies where observed in North-east Argentina, as well as in Northern and Southern Brazil. As was also observed during the previous reporting period, all arable land was cropped (Cropped Arable Land Fraction of 100 %), which represents a 3 % increment compared to 5 years average (Figure 2.3f). Maximum VCI showed on average values of 0.75. Values higher than 0.8 were observed in most of the region, with the exception of some places in South-west and North-west Argentina and some patches in Brazil (Figure 2.3e), including southern Rio Grande do Sul and eastern Paraná States. Minimum VHI showed in general values lower than 50 (Figure 2.3h). In particular quite low values (less than 15) were dominant over some of the main agricultural subregions like Paraná in Brazil and the Argentinian Pampas, where crops suffered from short-term water stress during the rainfall deficit period.

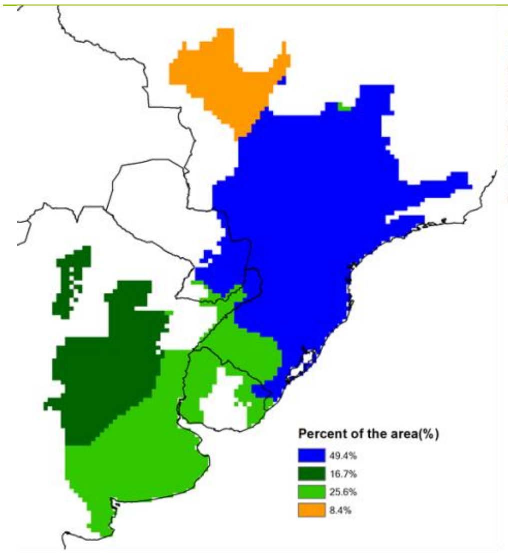
**Figure 2.3 South America MPZ: Agroclimatic and agronomic indicators, January to April 2019.**



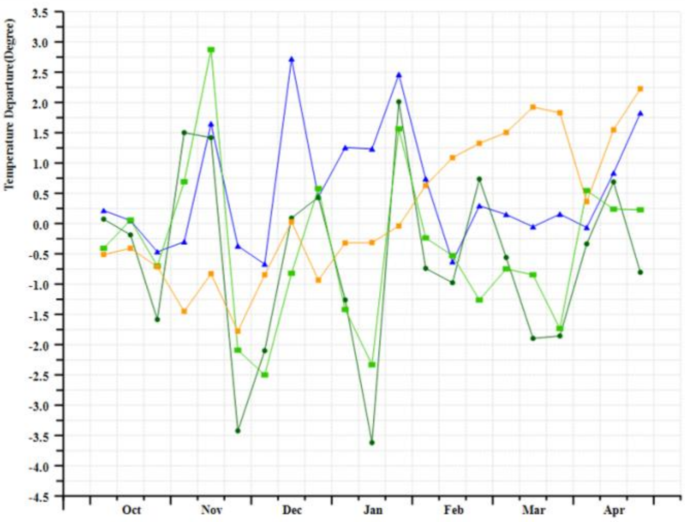

a. Spatial distribution of rainfall profiles



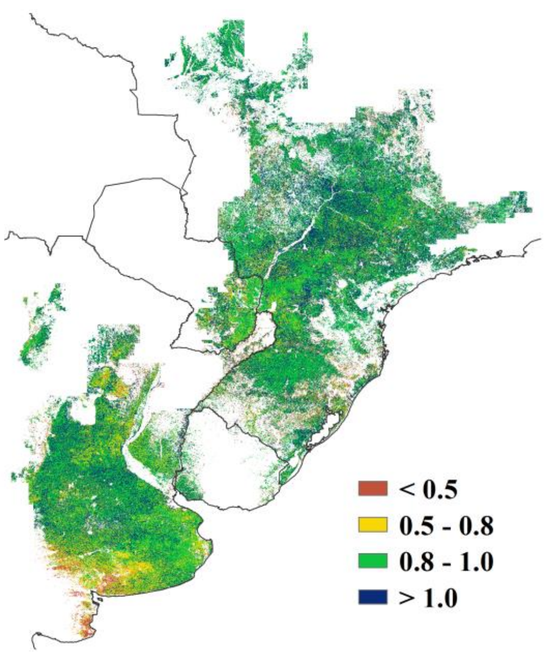

b. Profiles of rainfall departure from average (mm)



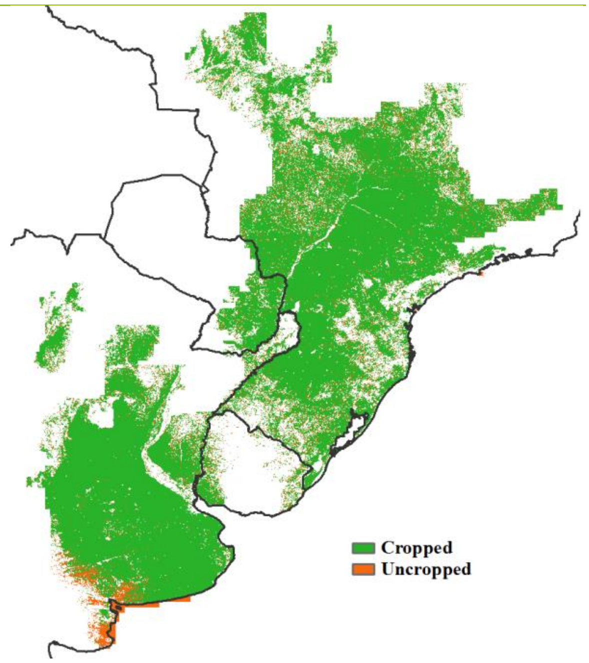

c. Spatial distribution of temperature profiles



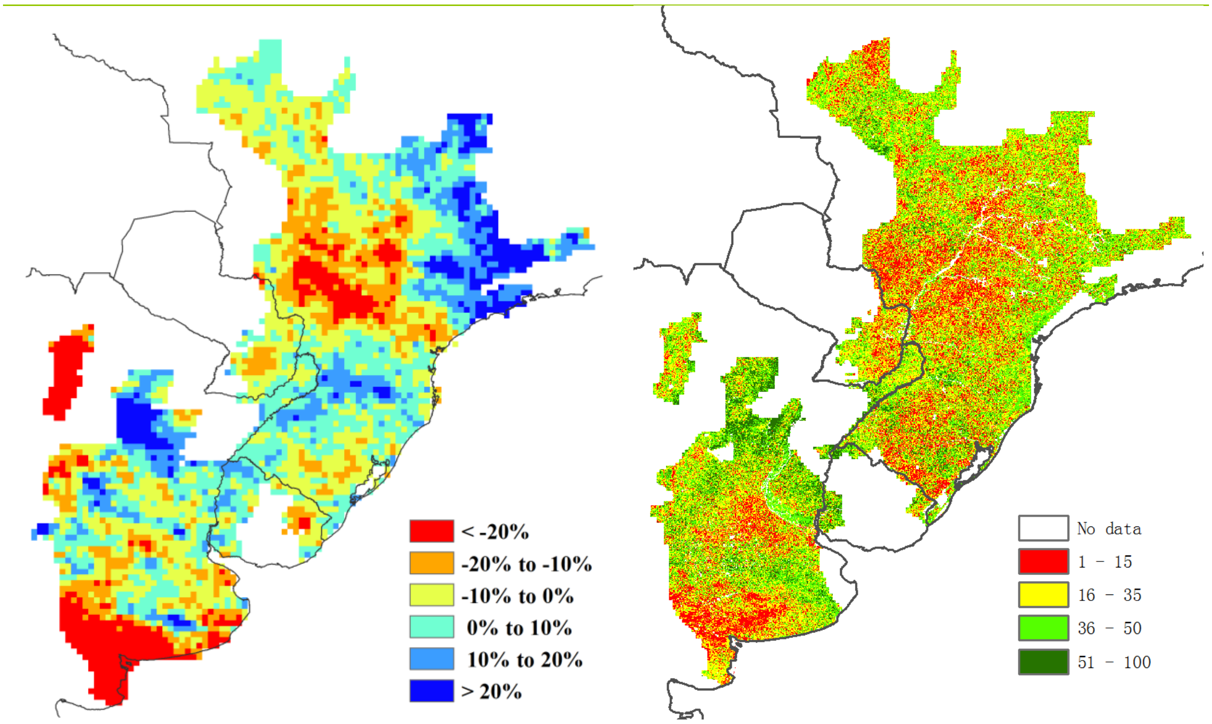

d. Profiles of temperature departure from average (mm)




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.

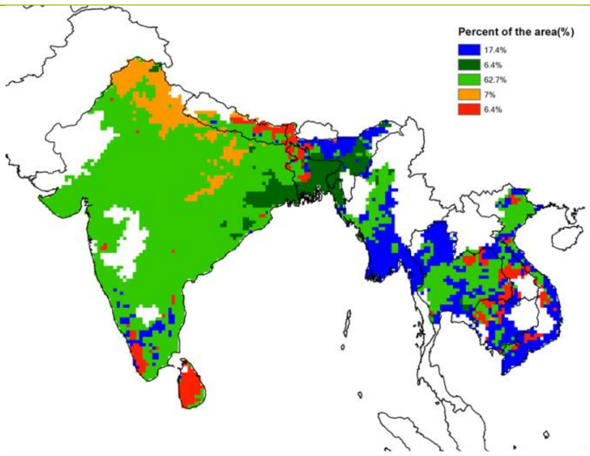
## 2.5 South and Southeast Asia

Overall crop condition was favorable in South and South-east Asia over the reporting period, as indicated by both above-average BIOMSS (+6%) and a relatively high value for VCIx (0.87). This derives directly from average agroclimatic conditions (RAIN -3%, TEMP 0.0°C, RADPAR +1%, all compared to their respective averages).

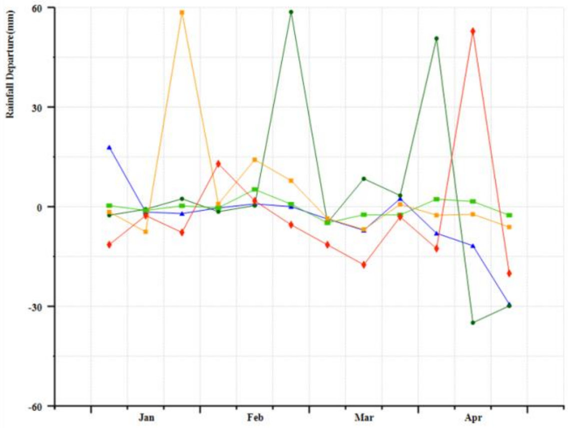
62.7% of cultivated areas experienced average rainfall throughout the monitoring period; they are mainly located in the western part of the MPZ, covering most regions of India. In contrast, rainfall fluctuated largely over time in other parts of the MPZ. Temperatures profiles were generally above average in the north-west, central and eastern parts of the MPZ, including southern India, Bangladesh, Myanmar, Thailand, Cambodia, Laos and Vietnam (59.3% of the arable areas). Remaining areas (making up 40.7% of crop land) showed more significant variations in temperature, with the values consistently below average especially in northern India and Nepal.

Most of the MPZ was actually cropped but uncropped areas occurred in southern and central India, Myanmar and Thailand. According to the map of VCIx patterns, favorable crop condition, with the values greater than 0.8, developed in the north-western and eastern parts of the MPZ, including northern India, Nepal, Bangladesh and Vietnam; moderate values between 0.5 and 0.8 were common in central and southern India, Myanmar and Thailand. The poorest crops (VCIx below 0.5) appeared in southern and western India. Consistent with the pattern of VCIx, above-average BIOMSS was located in the north-western and eastern parts of the MPZ, especially northern India, southern Myanmar, Vietnam and southern Thailand. On the contrary, below-average BIOMSS occurred in central and southern India, northern Thailand and Sri Lanka, probably due to drought. This is confirmed by the spatial patterns of VHIn, as the lowest values (below 15) also occurred in southern India, northern Thailand, Sri Lanka, Cambodia and Laos.

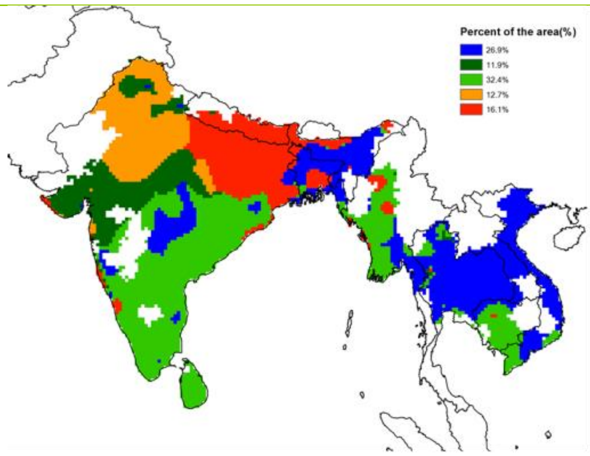
**Figure 2.4 South and Southeast Asia MPZ: Agroclimatic and agronomic indicators, January to April 2019**



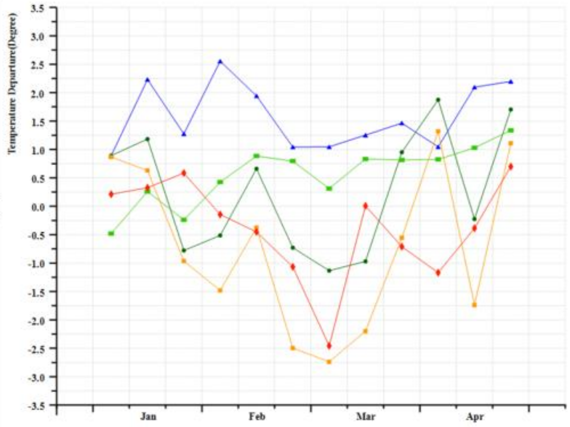

a. Spatial distribution of rainfall profiles



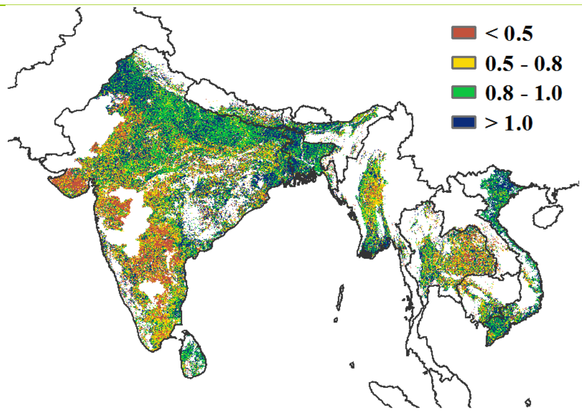

b. Profiles of rainfall departure from average (mm)



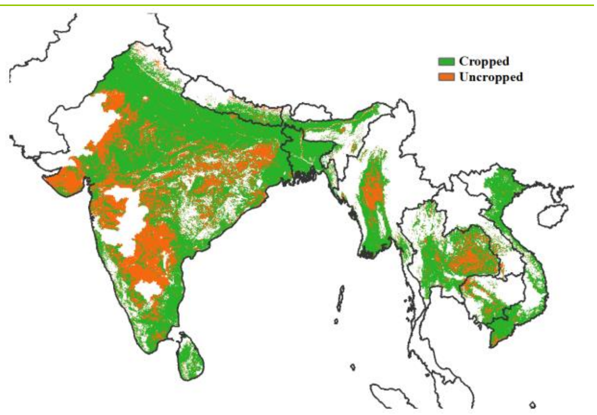

c. Spatial distribution of temperature profiles



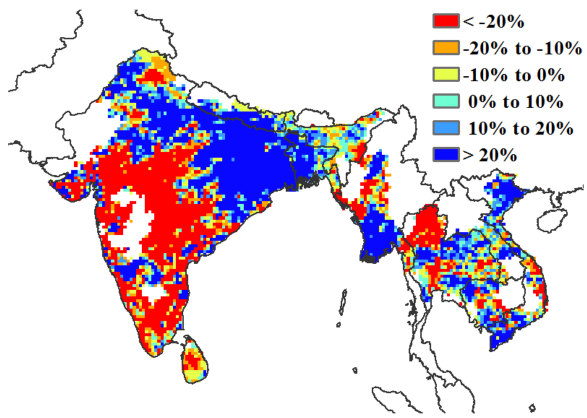

d. Profiles of temperature departure from average (mm)



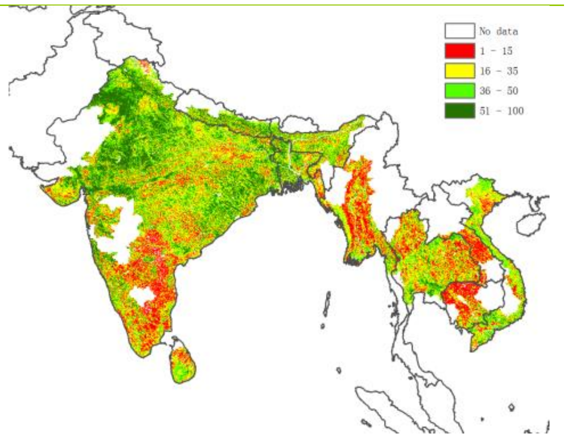

e. Maximum VCI




f. Cropped arable land




g. Biomass accumulation potential departure




h. VHI minimum

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

## 2.6 Western Europe

The reporting period covers the core of the winter crops season of the continental Western European MPZ: winter crops were overwintering or beyond dormancy and summer crops have been planted, and will continue to be planted in the cooler areas. Crop condition was generally above average in most parts of MPZ based on the integration of agroclimatic and agronomic indicators (Figure 2.5).

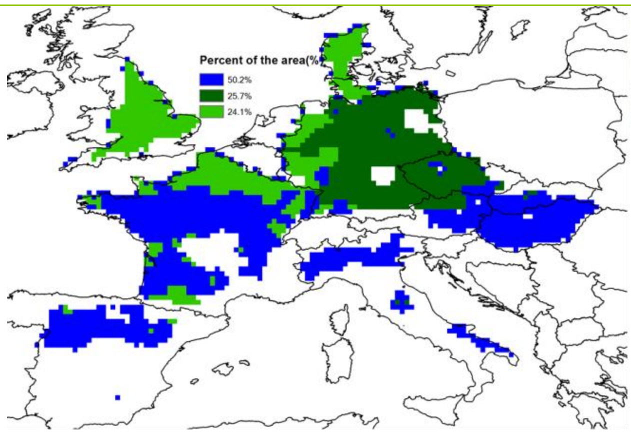
A large contrast is observed among countries in relation to rain. The whole MPZ showed a large drop in RAIN (9% below average), quite larger than in the other major agricultural zones in the world (Table 2.1). The spatial distribution of rainfall profiles indicates that the poor precipitation was observed in 50% of the entire MPZ (most of France, Italy, Spain, south-eastern Czech Republic, eastern Austria, southern Slovakia and Hungary) almost throughout the monitoring period. The most severely affected countries were Austria (RAIN -25%), Italy (RAIN -24%), Spain (RAIN -19%) and France (RAIN -18%). Crop growth in of the major winter wheat producing areas (eastern Hungary and central France) was impacted by continuous dry weather conditions. The other half of the cropland in the MPZ recorded above average precipitation in early February and late February to early March.

Temperature (TEMP) for the MPZ as a whole was above average (+0.3°C), and radiation was well above average with RADPAR at +5%. Most parts of MPZ experienced warmer-than-usual conditions from February to March, while below the average temperature mostly occurred in January; frost damage had very limited impact on crop growth. Planting of spring crops is well advanced in most regions based on the agroclimatic indicators but in the region that was affected by the persistent dry weather, only 94% of arable lands were cropped (i.e. 1% below average) in the area including Hungary, Austria, Italy, central France and Spain. More rain is needed in the coming months to raise soil moisture levels, and create favorable conditions for the growth of winter crops.

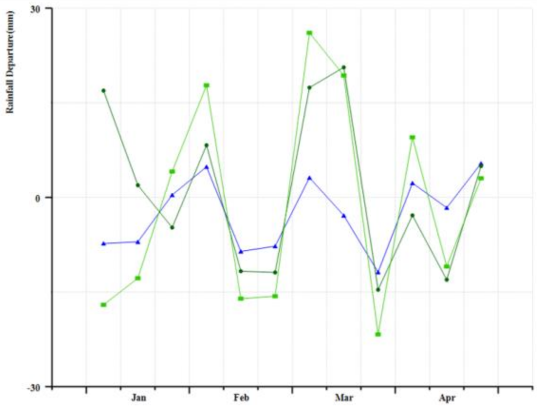
Due to more than 50% of the region experiencing persistent dry weather and overall warmer-than-usual conditions for the MPZ, the biomass accumulation potential BIOMSS was 6% below average. The lowest BIOMSS values (-20% and below) occurred in Hungary, Austria, Italy, France, Spain and UK, and this spatial distribution is consistent with the above-mentioned precipitation deficit region. In contrast, BIOMSS was above average (sometimes exceeding a 10% departure) over Germany and Denmark. The average maximum VCI for the MPZ reached 0.91.

Generally, crop condition of winter crops in Western Europe was favorable, but more rain will be needed in several important crop production areas to ensure an adequate soil moisture supply for the ongoing winter.

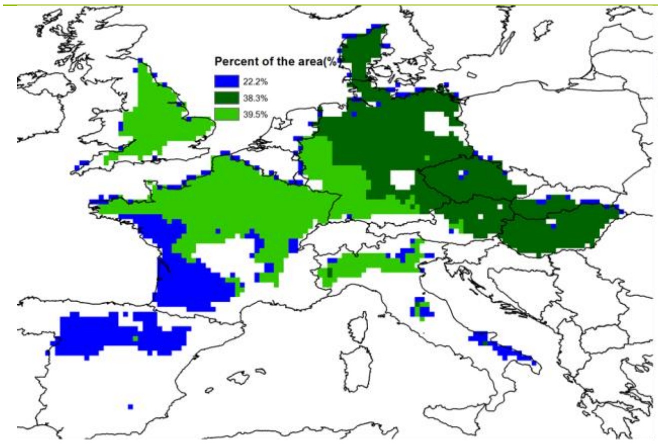
**Figure 2.5 Western Europe MPZ: Agroclimatic and agronomic indicators, January to April 2019.**



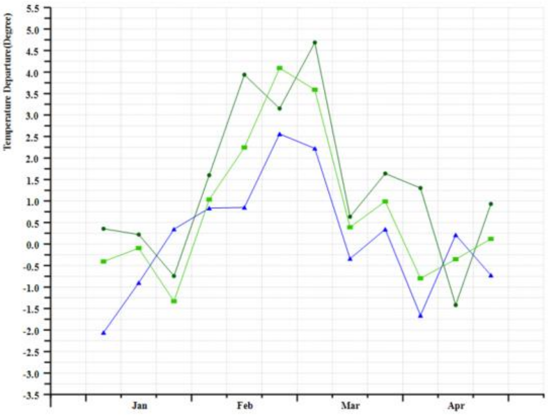

a. Spatial distribution of rainfall profiles



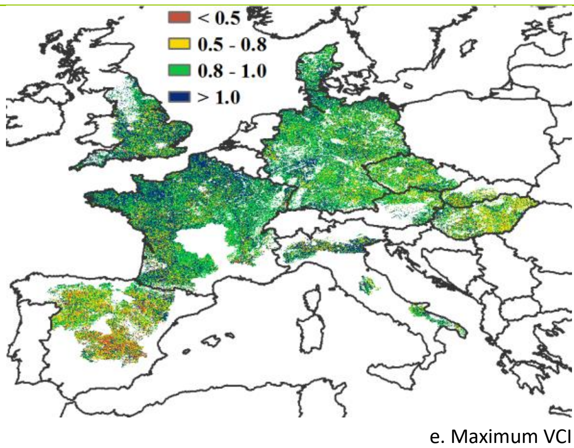

b. Profiles of rainfall departure from average (mm)



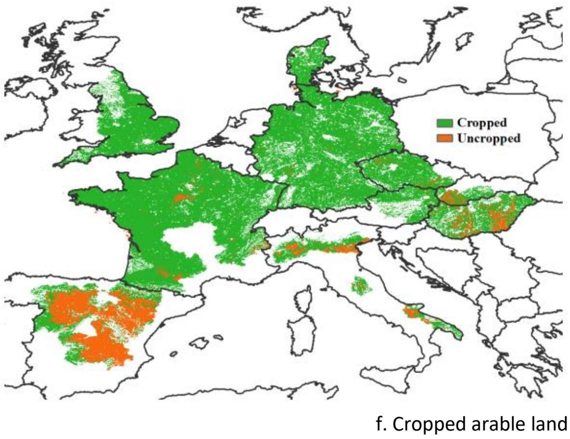

c. Spatial distribution of temperature profiles



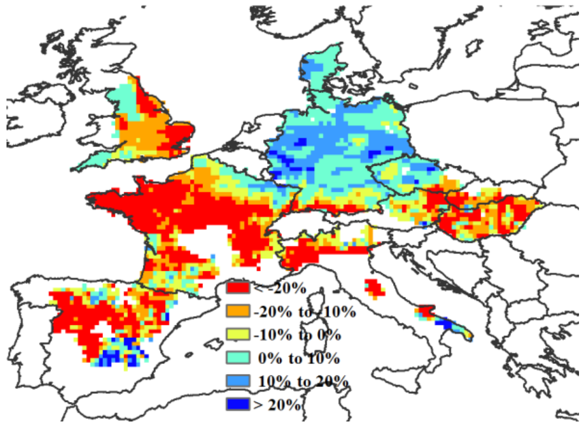

d. Profiles of temperature departure from average (mm)



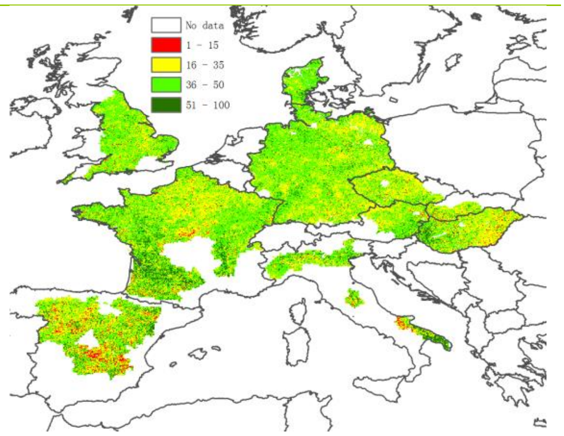

e. Maximum VCI




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

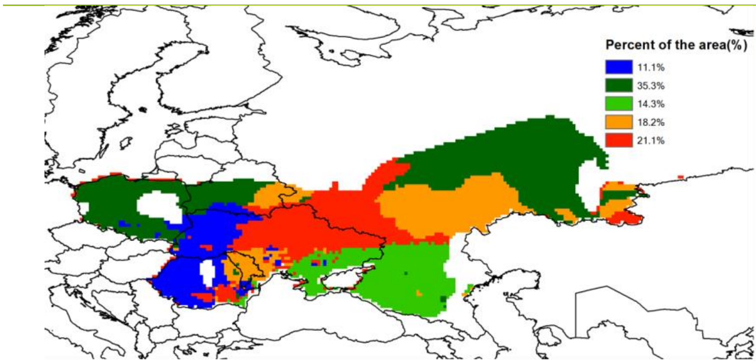
During the current monitoring period, main winter crops in central Europe to western Russia were in the field and dormant. Sowing of summer crop was in underway, starting in the south and west of the MPZ. Agroclimatic variables show average conditions for rainfall (down 2% below average) and sunshine (RADPAR down 1%) but 1.5°C warmer than average weather, which is significant for the large area of the MPZ (Figure 2.6).

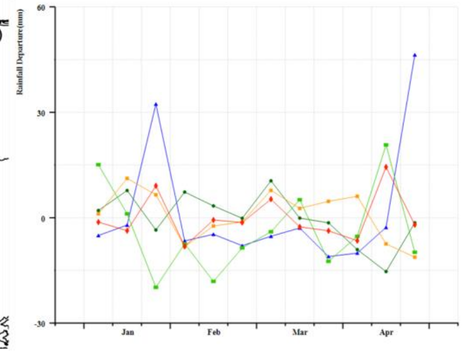
The temperature profiles displayed overall above average values from February to March for most parts of Belarus, Romania, north-west Ukraine, central and western parts of Western Russia. The departures range from 0.9°C to 5.3°C, affecting 72.7% of the MPZ. The effect on crops is mixed as the high temperature has locally damaged crops through defreezing-refreezing cycles, and increased crop water demand. Slightly below average temperature between 0.0°C and 0.3°C occurred in late February and late March in 27.3% of the areas, including western Belarus, Poland, Romania, central and south-eastern Moldova, and southern Ukraine.

Off average rainfall was recorded in Poland (RAIN -4%), Ukraine (-4%), Belarus (-14%), and central and southern West Russia. Only Romania had above-average water supply (+12%), resulting from high rainfall that occurred in late January and late April when precipitation was more than 30% and 45% above average in Romania and in the west of Ukraine. Below rainfall around -15% was observed in late January, mid-February and middle-April over the southern part of Western Russia (Adygeya Republic, Stavropolskiy Kray, southern Rostovskaya Oblast), and south-eastern Ukraine. The reduced rainfall has not necessarily had a negative impact on the dormant winter crops, unless temperature has prematurely broken dormancy.

The biomass accumulation potential (BIOMSS) of the MPZ was close to average, being 6% above. Largest increases (more than 10%) occurred in southern Poland. According to the maximum VCI map values were above 0.8 in Poland, West Belarus and Eastern Ukraine. The maximum VCI was below 0.5 in most of Western Russia, where the arable land was apparently uncropped. For the MPZ as a whole CALF dropped 20 percentage points compared to the recent five-year average, which may be due to abnormal phenology or to winter drought brought about by high temperature.

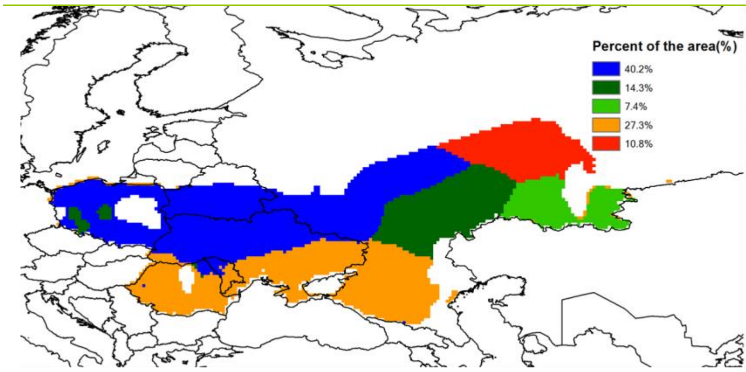
**Figure 2.6 Central Europe-Western Russia MPZ: Agroclimatic and agronomic indicators, January to April 2019.**

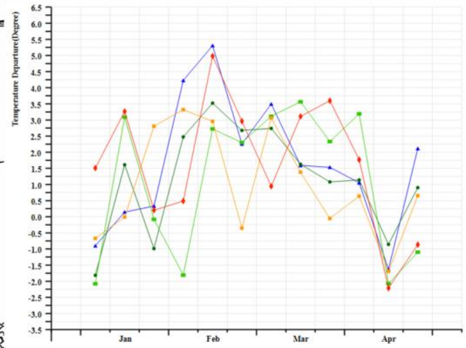



a. Spatial distribution of rainfall profiles

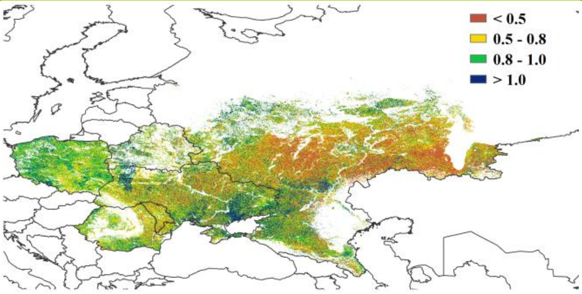
b. Profiles of rainfall departure from average (mm)

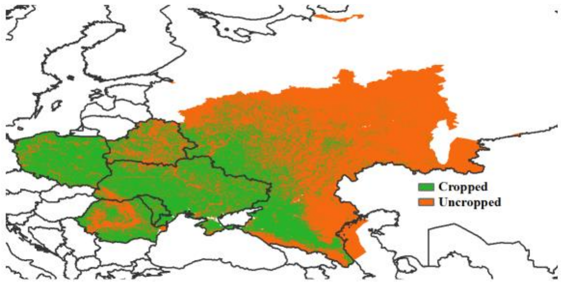



c. Spatial distribution of temperature profiles

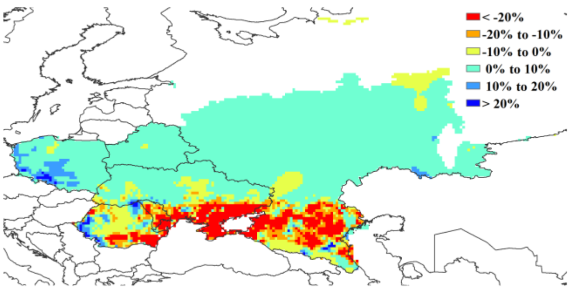
d. Profiles of temperature departure from average (mm)

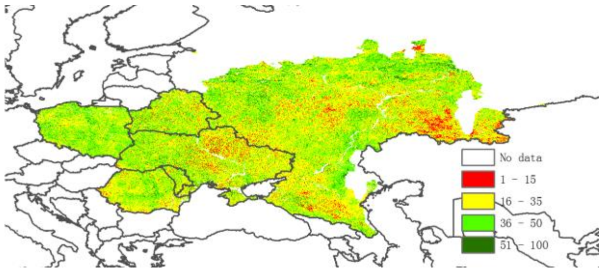



e. Maximum VCI

f. Cropped arable land




g. Biomass accumulation potential departure

h. VHI minimum

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

# Chapter 3. Core countries

## 3.1 Overview

*Chapter 1 has focused on large climate anomalies that sometimes reach the size of continents and beyond. The present section offers a closer look at individual countries, including the 41 countries that together produce and commercialize 80 percent of maize, rice, wheat, and soybean. As evidenced by the data in this section, even countries of minor agricultural or geopolitical relevance are exposed to extreme conditions and deserve mentioning, particularly when they logically fit into larger patterns.*

**1. Introduction**

The global agro-climatic patterns that emerge at the MRU level (chapter 1) are reflected with greater spatial detail at the national and subnational administrative levels described in this chapter. The “core countrie”, including major producing and exporting countries are all the object of a specific and detailed narrative in the later sections of this chapter, while China is covered in Chapter 4. Sub-national units and national agro-ecological zones receive due attention in this chapter as well.

In many cases, the situations listed below are also mentioned in the section on disasters (chapter 5.1) although they tend to be limited spatially, so that the statistical abnormality is not necessarily reflected in the climate statistics that include larger areas. No attempts are normally made, in this chapter, to identify global patterns that were already covered in Chapter 1. The focus is on 165 individual countries and sometimes their subdivisions for the largest ones. Some of them are relatively minor agricultural producers at the global scale, but their national production is nevertheless crucial for their population, and conditions may be more extreme than among the large producers.

**2. Overview of weather conditions in major agricultural exporting countries**

The current section provides a short overview of prevailing conditions among the major exporters of maize, rice, wheat and soybeans, conventionally taken as the countries that export at least one million tonnes of the covered commodities. Just 20 countries include the top 10 exporters with the United States and Argentina exporting all four crops and Brazil, Ukraine and Russia exporting three of them each!

**Maize**: Three out of four maize exporters where the crop was in the field during the reporting period had moderate to large excess precipitation, including Argentina (+14%), South Africa (+14%) and Paraguay (+21%). Both Argentina and Paraguay also had below average temperature (-1.2°C and -0.8°C) and sunshine (-4% and -1%), respectively. The Cropped Arable Land Fraction (CALF) was very close to average and Maximum VCI (VICx) was moderate, indicating some negative impact of excess precipitation. Although South Africa had an overall positive water balance, the value of +14% situation results from very dry conditions followed by a late season spell of abundant rainfall associated with the Mozambican cyclones (refer to section on disasters in chapter 5).

In India the period covered includes the harvest of Rabi crops, including Rabi maize and wheat. Agroclimatic and agronomic indicators describe a globally average situation which should also result in fair crops.

In the northern hemisphere where maize is still to be planted, significant precipitation excesses in the USA (+19%) and Serbia (+30%) have provided good soil moisture but may have negatively impacted winter wheat. Below average rainfall affected mostly France (-18%) and Hungary (-12%).

**Rice**: India, the main exporter of rice, cultivates the crop during both the Rabi season (where it has reached maturity) and the Kharif season, where the crop is in early stages. As mentioned above for maize, indicators give no reason for concern. In south-east Asia, the reporting period covers the late harvest of one crop and the early stages of spring rice. Both Thailand and Vietnam recorded a moderate precipitation deficit (-12% and -6%) with above-average temperature and 6% excess sunshine compared with average. When taking into consideration CALF and VCIx, crop condition is assessed as average in Thailand but favourable in Vietnam where VCIx reaches 0.98. In Pakistan and the USA, the rice crop is yet to be planted and there is no reason for concern.

**Wheat**: Twenty countries in both hemispheres export more than 1 million tonnes of wheat. The top five exporters market more than 10 million tonnes internationally, including the USA, Canada, Russia, France and Australia. In Australia, the JFMA period covers the end of the 2018-19 harvest (up to January) and the early stages of the 2019-20 crop (from April). Very dry conditions have affected the period (RAIN down 17% below average) with a marked drop in CALF (-38%) and unfavourable VCIx (0.42), the lowest value by far among the 20 top exporters. The 2018-19 crop is unlikely to have been satisfactory, but the impact on the ongoing wheat season is still open.

Although the USA experienced very wet and cool conditions, the agronomic indicators reach values which indicate globally average conditions for winter wheat. Both Canada and Russia had about average precipitation and sunshine, but temperatures departed markedly from average with a drop in Canada (-1.4°C) and a rise in Russia (1.7°C). Both countries, however, recorded a drop in CALF (-28% and -35%) and just moderate VCIx (0.80 and 0.72), respectively. Crops are best assessed as just fair. Weather conditions relatively similar to those of Canada and Russia affected Ukraine but agronomic indicators are somewhat more favourable (-11% for CALF and VCIx at 0.81). Although France had a marked drop in RAIN (-18%), agronomic indicators are very favourable (normal CALF and rather large VCIx at 0.95) most probably resulting from favourable sunshine (+6%), a variable which is usually the dominant limiting factor in northern hemisphere winter wheat production.

Among the countries ranking 7 to 12 for wheat exports, which cover the range from nine to three million tons (Germany, Argentina, Kazakhstan, Romania, Bulgaria, India) all had close to or above average rainfall, with the largest positive departures in Bulgaria (+8%), Romania (+12%) and Argentina (+14%). All had VCIx values above 0.75 (up to 0.93 in Germany) but CALF was down 11% in Romania and and 13% in Kazakhstan, where warm weather (1.4°C above average) may have led to snow-melt and cold damage. For Argentinian wheat, the conditions are largely irrelevant as the harvest ended in early January.

All the remaining wheat exporters (ranks 13 to 20) had mostly slight to moderate precipitation deficits from -1% (Brazil) and -3% (Czechia) to -15% (United Kingdom), the only exception being Mexico with a very significant 49% drop. The only other “abnormal” weather was recorded in Lithuania (RADPAR +10%). In Mexico, where winter wheat is currently at mid-season, the States with the largest wheat production potential all suffered large rainfall deficits (Guanajuato -67%; Hidalgo -74%; Queretaro -82%). In spite of irrigation, the magnitude of the deficit is such that an impact on crops is very likely. In Brazil wheat is just being planted and mostly average JFMA weather is not expected to significantly affect the future output (to be harvested at the end of 2019).

**Soybean**: Among the eight countries that export more than 1 million tonnes of soybeans, all except Argentina, Brazil, Uruguay and Paraguay are located in the northern hemisphere and, as such, are planting or are still to plant soybeans that will develop from late spring and summer. In south America, however, the reporting period covers mid-season stages to early harvest and, as such, the current indicators are very relevant for soybean. Brazil experienced average conditions and indicators (VCIx at 0.78) point at average crop condition. Argentina, Uruguay and Paraguay experienced similar conditions characterised by above average precipitation (between +12% and +21%), below average temperature (0.8°C to 1.2°C below average) lower than normal sunshine (-1% to -5%). In Argentina, the only country for which CropWatch agronomic indicators are available, values are average. Altogether, the soybean output is therefore assessed as average as well at this stage of the season.

## 3. Weather anomalies and biomass production potential changes

### A Caveat

All variables are compared against the recent 15-year average (2004-2018). This constitutes a change compared to the previous bulletins where BIOMSS was compared against the recent 5-year average (5YA). Agronomic indicators, however, are compared against the 5YA as before. Figure 3.1 shows "very dry" and "very wet" conditions in several areas that are currently in their dry season, for instance in the west African Sahel. In Niger, for instance, the rainfall deficit reaches 65%: 2 mm were estimated for a country where the 15YA reaches 6 mm over the reporting period. In other words, the country is in its dry season and no rain is actually expected: there is no drought. The text below refers only to areas where significant amounts of rainfall are actually expected. It is also stressed that in many equatorial areas where large amounts of rainfall are actually expected, below average rainfall not necessarily constitutes drought. An example in Malaysia during the current reporting period: average rainfall reaches 1042 mm, so that the amount recorded (712 mm) is 32% below average. 712 mm, however, corresponds to about 6 mm per day, which is sufficient to cover the requirements even of water demanding crops. In fact, the deficit in Malaysia probably corresponds to a slightly longer than average "dry season" in February and, as such, does not rise concerns.

### Rainfall and biomass

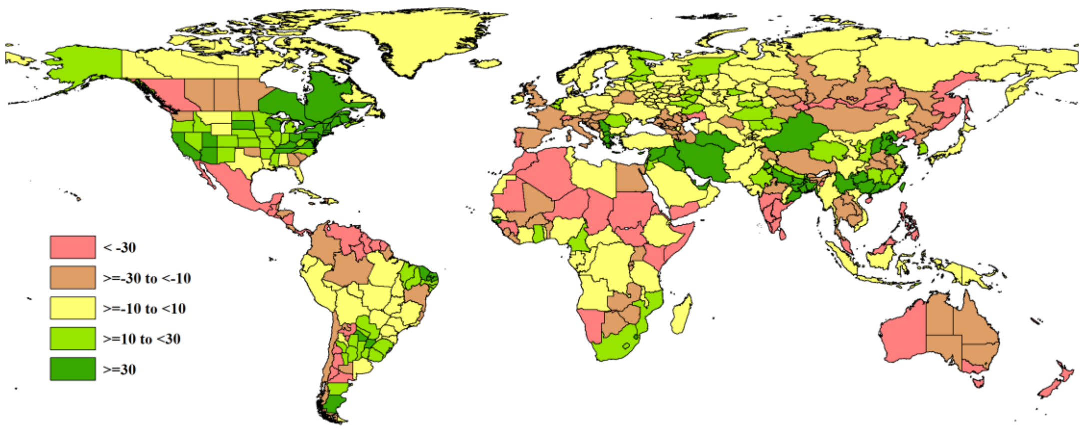



**Figure 3.1 Global map of rainfall anomaly (as indicated by the RAIN indicator) by country and sub-national areas, departure from 15YA between January and April 2019**

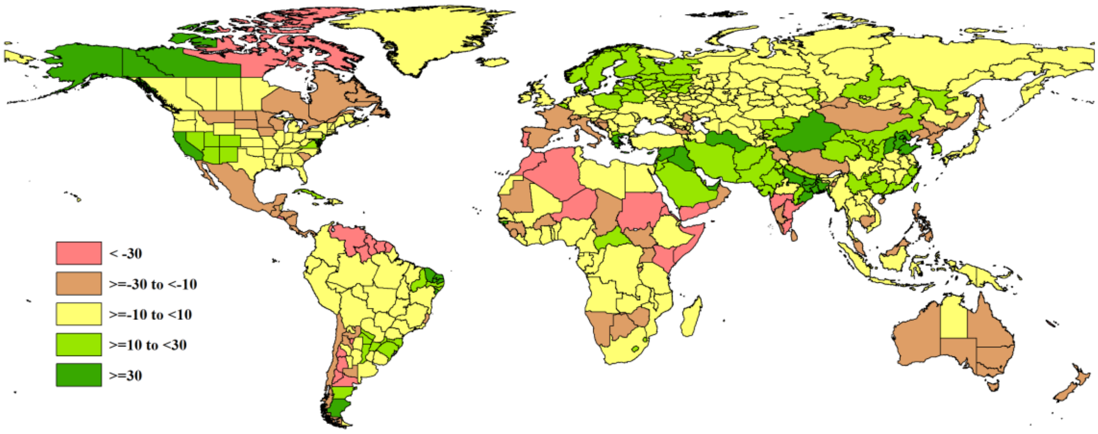



**Figure 3.2 Global map of biomass production potential anomaly (as indicated by the BIOMSS indicator) by country and sub-national areas, departure from 15YA between January and April 2019**

### (1) Dry conditions

Rather dry conditions are observed in several tropical and equatorial countries, especially around the Caribbean basin, including Guyana and French Guyana (both at -80%), Suriname (-72%), Venezuela (-54%), Mexico (-49%), Panama (-46%) as well as Guatemala (-43%) and Nicaragua (-32%).

In the western Mediterranean area, several countries are likely to have suffered a shortage of precipitation for they main agricultural season, especially Portugal (-45%), Morocco (-39%) and Algeria (-34%).

In south-eastern Asia and Oceania, the largest deficits occurred in New Caledonia (-58%), THE Philippines (-49%), New Zealand (-32%).

In Africa, we need to report the precipitation shortfalls that occurred in the Horn of Africa in Somalia (-53%), Kenya (-40%) and Uganda (-25%) and in parts of Southern Africa that were not affected by the two cyclones that crossed to Mozambique Channel, namely Namibia (-42%).

**(2) Wet conditions**

The largest precipitation excesses at the national level include some countries bordering the Mozambique Channel (Mozambique +27%, Eswatini +35%), the eastern Mediterranean and the Middle-East (Kuwait +29%, Qatar +30%, Iran +39%, Lebanon +42%, Iraq +64%, UAE +71%, Syria +74%, Greece +76% and Cyprus +90%).

Some of those countries (e.g. Iran) are covered in chapter 5 (section on disasters) because of serious floods that also affected some neighbouring countries belonging to semi-arid central and western Asia such as Turkmenistan (+64%) central Asian countries Pakistan (+6%). Much of the destruction was due to heavy precipitation following a prolonged drought.

**(3) Biomass**

Biomass very closely follows precipitation as 84% of biomass variability is accounted for by rainfall variability, with very few exceptions usually brought about by low temperature, as in North Macedonia (RAIN +66%, BIOMSS +15%).

**3.3 Temperature anomalies**

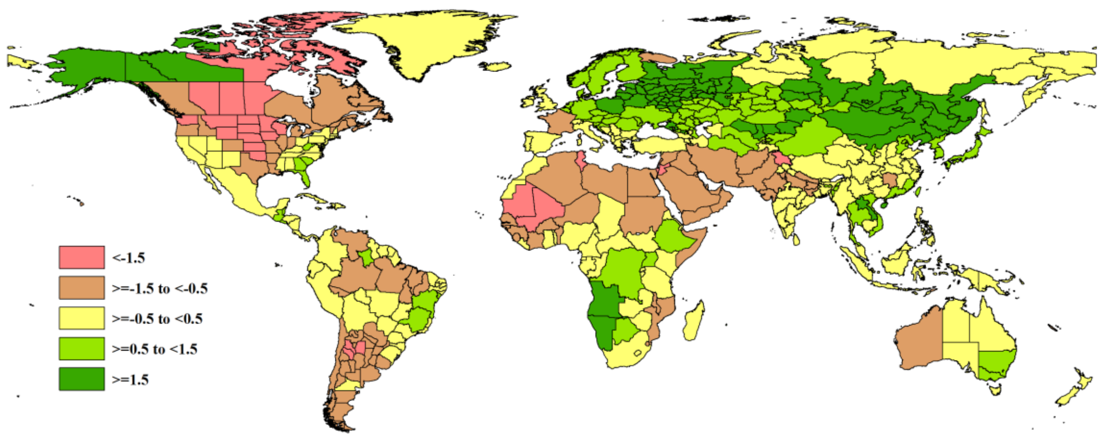



**Figure 3.3 Global map of temperature anomaly (as indicated by the TEMP indicator) by country and sub-national areas, departure from 15YA between January and April 2019**

**(1) Low temperature**

With the exception of Morocco, most of the area from west Africa to southern Himalayas areas experienced below average temperature, which includes a number of countries with departures in excess of 1.5°C; they occurred in Mauritania (-2.2°C), Jordan, Mali and Tunisia (all three at -1.6°C) and Israel (-1.5°C). Eleven more countries had cool weather (between 1.0°C and 1.4°C below average), mostly over winter crop areas including Iraq (-1.4°C), Egypt (-1.3°C) and Pakistan (-1.3°C) and with the two Indian States of Bihar (-1.4°C) and Jharkhand (-1.0°C) as the easternmost areas.

On the American continent, the countries to mention include winter in Canada (-1.4°C) and summer in Argentina (-1.2°C), Chile (-1.1°C) and Uruguay (-1.0°C). In the US, the average departure was moderate (-0.7°C) but individual States recorded larger values which include South Dakota and Montana (-3.5), North Dakota (-3.0). Slightly less severe conditions prevailed in the major maize and soybean producing areas of Minnesota (-2.6), Nebraska (-2.4) and Iowa (-2.0). Some impact on winter wheat is likely in Nebraska.

**(2) High temperature**

Most high temperatures occurred in a huge area from Belgium to Japan across central Asia. In western Eurasia the largest departures occurred around and east of the Baltic, including Poland (+1.6°C), Russia (+1.7°C), Belarus (+1.9°C), Lithuania (+2.0), Estonia (+2.1) and Latvia (+2.2) with departures between +1.0°C and +1.4°C in Czechia, Denmark, Germany, Hungary, Slovakia and Ukraine. In Russia, some western Oblasts and Republics departures exceeded the listed ones, reaching +2.4°C in the Buryatia Republic and Vologda Oblast, +2.3°C in the Oblasts of Tver and Novgorod and between +2.2 and +2.0 in the Republic of Karelia and the Oblasts of Moscow, Arkhangelsk, Kostroma, Pskovs, Leningrad, Nizhny Novgorod, Vladimir and the Russian enclave in the EU, Kaliningrad. Several of the listed areas, especially in Russia, experienced snow-melt because of the warm wave with a potential negative impact on winter crops.

In central Eurasia, it is in order to list Mongolia (+2.2°C) as well as Kyrgyzstan, Uzbekistan and Kazakhstan which all averaged +1.4°C above the average. At the subregional level it is in order to mention some Regions in in Kazakhstan (Almaty +2.3°C, Kyzylorda +2.1 and Jambyl +1.9°C) and Russian Oblasts (including Yaroslav +2.5°C, Tomsk +2.0°C and Kemerovo +2.0°C). On the eastern margin of the continent, some Russian oblasts of limited agricultural importance and some Chinese provinces recorded high values, for instance the Jewish Autonomous (+3.4) and the Chita (+2.8) Oblasts, the Kray of Promorsky (+3.1°C), the Agin-Buryat Okrug (+2.9°C) as well the neighbouring Chinese provinces of Jilin (+2.8°C) and Heilongjiang (+3.6°C). Heilongjiang recorded one of the largest temperature anomalies among the more than 3100 countries, sub-national administrative units and agro-ecological zones monitored by CropWatch. Among agriculturally relevant areas it is exceeded only by some south-west African areas in Angola (Huila, Cunene) and Namibia (Ohangwena) with +3.7°C and +3.8°C anomalies. The largest departures occur north-western America, especially in the Yukon Territory in Canada, a subarctic region in Boreal America (MRU 61 which also includes Alaska), where temperature was 6.2°C above average, making it the most anomalous region in terms of temperature.

Three additional groups of countries are to be listed: (1) south-east Asian with Viet Nam (+1.2°C), Korea DPR (+1.3°C) and Laos (+1.5°C), (2) southern Africa with Botswana (+1.1°C), Angola (+1.7°C) and Namibia (+2.2°C) and (3) Guatemala (+1.4°C) and Belize (+1.5°C) in central America.

### 3.4 RADPAR anomalies

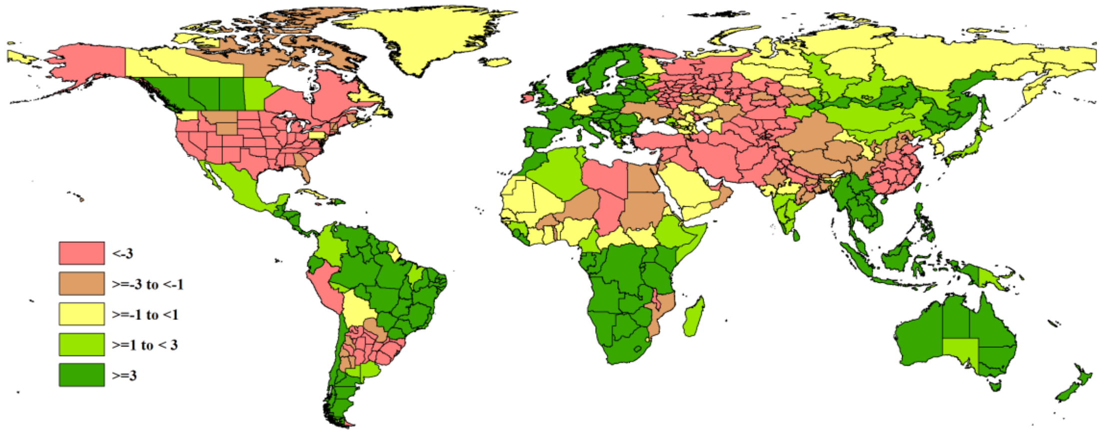



**Figure 3.4 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by country and sub-national areas, departure from 15YA between January and April 2019**

**(1) Below average sunshine**

Compared with above-average sunshine, relatively few countries experienced below average sunshine (35%). Most of them have already been listed above among regions with wet and those with cool conditions. In central-western Asia. They include Uzbekistan and Tajikistan (-10%), Turkmenistan (-8%), Afghanistan (-6%) and Pakistan (-6%) leading to the western Mediterranean and Middle Eastern countries of Lebanon and Iraq (-8%), Syria (-7%) and Cyprus (-6%). The area is connected in the east with Nepal (-6%) through several northern Indian States including Haryana (-5%) and Himachal Pradesh (-7%)

In other continents, countries that deserve mention are Ireland (-7%) and the United States (-6%, with lowest values in Louisiana (-11%), -9% in California, Mississippi and Illinois, -8% in Arkansas, Indiana, South Dakota and Missouri and -7% in Iowa, Utah, Nevada, Texas, Oklahoma, Arizona and Nebraska.

**(2) Above average sunshine**

Above average sunshine was recorded in central and northern south America (+6% to +10% in Honduras, Guatemala, Costa Rica, Belize and Guyana), central and eastern Africa (+6% to 11% in the two Congos, Tanzania, Uganda, Rwanda and Burundi), and southern Africa (+6% to +9% in Mauritius, Angola, Namibia, Botswana and Lesotho) as well as in New Zealand (+9%).

Also to be mentioned: south-east Asia and seventeen European countries from France, Denmark and the United Kingdom (+6%) to Portugal and Montenegro (+10%) to the Baltic countries (+10% in Lithuania, +12% in Estonia). In south-east Asia, countries with departures larger than 6% include Thailand, Viet Nam, Philippines, Laos (+9%) and Malaysia (+10%). In several of them sunshine is the main limiting factor for the rice crop planted from January and the abundant sunshine will positively affect crop development and growth.

**3.5 Combinations of anomalies**

Globally, the most anomalous conditions are those that prevailed in the eastern Mediterranean and the Middle East, especially Lebanon and Iraq, with precipitation excess larger than 40%, low temperature (departure larger than 1.2°C and low sunshine below 8%). A group of neighbouring countries (Jordan, Israel, Syria and Cyprus) and Kuwait had high rainfall combined with low sunshine or cool weather, or both, but weaker departures than in Lebanon and Iraq.

Similar conditions with excess rain, cool weather and low sunshine also affected Nepal (RAIN +24%, TEMP -0.8°C, RADPAR -6%) and the United States (RAIN up 19%, temperature down 0.7°C and sunshine down 6%) during winter. As shown above, conditions can be more extreme when zooming into individual States. In

Latin America conditions were unusual in a similar fashion but in a different season (summer) in Uruguay and Argentina with a moderate increase in precipitation (+12% and +14%, respectively), cool weather (drops of 1.0°C and 1.2°C) and sunshine down (-5% and -4%).

In southern Africa, Namibia recorded a sharp drop in rainfall (-42%) associated with heatwave conditions (+2.2°C) and sunshine up 8%. Rangeland and cattle are bound to have suffered.

**Table 3.0. January – April 2019 agro-climatic and Agronomic indicators by country, current value and departure from average.**

| Code | | Agro-climatic indicators | | | | Agronomic indicators | |
|---|---|---|---|---|---|---|---|
| | Country | Departure from 15YA (2004-2018) | | | | Departure from 5YA (2014-2018) | Current |
| | | RAIN (%) | TEMP(°C) | PAR(%) | BIOMSS (%) | CALF (%) | VCIx |
| **AFG** | Afghanistan | -2 | -1.1 | -6 | 4 | - | 0.78 |
| **AGO** | Angola | -6 | 1.7 | 6 | -2 | -4 | 0.80 |
| **ARG** | Argentina | 14 | -1.2 | -4 | 1 | -1 | 0.81 |
| **AUS** | Australia | -17 | 0.5 | 4 | -21 | - | 0.42 |
| **BGD** | Bangladesh | 32 | 0.3 | -1 | 35 | 1 | 1.03 |
| **BLR** | Belarus | -14 | 1.9 | 9 | 13 | -15 | 0.81 |
| **BRA** | Brazil | -1 | -0.1 | 5 | 3 | 1 | 0.78 |
| **KHM** | Cambodia | -26 | 0.0 | 4 | -17 | 1 | 0.83 |
| **CAN** | Canada | 0 | -1.4 | 2 | -7 | - | 0.80 |
| **CHN** | China | 20 | 0.6 | -4 | 10 | -5 | 0.90 |
| **EGY** | Egypt | -20 | -1.3 | -1 | -19 | 4 | 0.97 |
| **ETH** | Ethiopia | 5 | 0.8 | 2 | 3 | 7 | 0.85 |
| **FRA** | France | -18 | -0.5 | 6 | -15 | 0 | 0.95 |
| **DEU** | Germany | 5 | 1.2 | 1 | 9 | 0 | 0.93 |
| **HUN** | Hungary | -12 | 1.0 | 4 | -9 | -5 | 0.83 |
| **IND** | India | -3 | -0.3 | 0 | 8 | -3 | 0.83 |
| **IDN** | Indonesia | -2 | -0.4 | 4 | -2 | 0 | 0.00 |
| **IRN** | Iran | 39 | -0.7 | -5 | 19 | 47 | 1.00 |
| **ITA** | Italy | -24 | 0.1 | 9 | -19 | 1 | 0.94 |
| **KAZ** | Kazakhstan | 4 | 1.4 | -4 | 6 | - | 0.76 |
| **KEN** | Kenya | -40 | 0.1 | 5 | -39 | -3 | 0.76 |
| **MEX** | Mexico | -49 | 0.1 | 1 | -29 | 1 | 0.82 |
| **MNG** | Mongolia | -27 | 2.2 | 2 | -18 | - | 0.91 |
| **MAR** | Morocco | -39 | 0.0 | 3 | -36 | 0 | 0.80 |
| **MOZ** | Mozambique | 27 | -0.6 | -1 | 4 | 0 | 0.94 |
| **MMR** | Myanmar | 1 | 0.3 | 4 | 1 | 2 | 0.94 |
| **NGA** | Nigeria | 9 | -0.3 | -1 | 8 | -3 | 0.89 |
| **PAK** | Pakistan | 6 | -1.3 | -6 | 10 | 7 | 0.90 |
| **PHL** | Philippines | -49 | -0.5 | 7 | -28 | 0 | 0.94 |
| **POL** | Poland | -4 | 1.6 | 4 | 12 | -2 | 0.85 |
| **ROU** | Romania | 12 | 0.8 | 3 | 5 | -11 | 0.76 |
| **RUS** | Russia | -3 | 1.7 | -1 | 4 | -35 | 0.72 |
| **ZAF** | South Africa | 14 | 0.3 | 5 | 8 | 0 | 0.83 |
| **LKA** | Sri_Lanka | -31 | -0.1 | 4 | -23 | 0 | 0.96 |
| **THA** | Thailand | -12 | 0.6 | 6 | -10 | -3 | 0.83 |
| **TUR** | Turkey | -1 | -0.1 | -3 | 1 | -7 | 0.75 |
| **UKR** | Ukraine | -4 | 1.2 | -1 | 2 | -11 | 0.81 |
| **GBR** | United Kingdom | -15 | 0.2 | 6 | -3 | 0 | 0.99 |
| **USA** | United States | 19 | -0.7 | -6 | 3 | -1 | 0.86 |
| **UZB** | Uzbekistan | 5 | 1.4 | -10 | 9 | - | 1.00 |
| **VNM** | Vietnam | -6 | 1.2 | 6 | 3 | 1 | 0.98 |
| **ZMB** | Zambia | -12 | 0.0 | 4 | -9 | 0 | 0.91 |

## 3.2 Country analysis

This section presents CropWatch analyses for each of 41 key countries (China is addressed in Chapter 4). The maps refer to crop growing areas only and include several graphs: (a) Phenology of major crops; (b) Crop condition development based on NDVI over crop areas at national scale, comparing the January - April 2019 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum VCI (over arable land) for January - April 2019 by pixel; (d) Spatial NDVI patterns up to January - April 2019 according to local cropping patterns and compared to the 5YA; and (e) NDVI profiles associated with the spatial pattern under (d). Next, separate graphs (labeled as figures (f), (g), and subsequent letters) are included to illustrate crop condition development graphs based on NDVI average over crop areas for different regions within the country, again comparing the January - April 2019 period to the previous season and the five-year average (5YA) and maximum.

Refer to Annexes A for additional information about indicator values by country. Country agricultural profiles are posted on **www.cropwatch.com.cn**.

Figures 3.5 - 3.45 are Crop condition for individual countries ([AFG] Afghanistan - [ZMB] Zambia) including sub-national regions during January - April 2019.

# [AFG] Afghanistan

The current reporting period covers the early stages of spring wheat (which was planted in March) as well as the late dormancy and re-growth of winter wheat.

Precipitation reached 173mm, 1.9% lower than the average. Both temperature and sunshine were below average (TEMP 5.0°C, down 1.1°C; RADPAR: 919MJ/m², down 6%). The cropped arable land fraction (CALF) was only 19%, which nevertheless represents a significant rise (90%) above the 5YA. According to the NDVI development graph crops were poor between January and February, but their condition increased rapidly after February. The distribution map of the best vegetation condition index (VCIx) shows that the VCIx was highest in most areas of the north and the value reached 0.8. The national NDVI development profile for Afghanistan presents below average values before march but later improved. The spatial NDVI patterns compared to the five-year average indicate that NDVI was above average in 11.4% of arable land mainly in the north and west of Badghis and below average values in the other regions. NDVI was near average in 36.4% of the cultivated land areas, especially in Kandahar. Thirty-eight percent of the areas (including Daikondi, Oruzgan and neigboring areas) were below average.

**Regional analysis**

CropWatch subdivides Afghanistan into four zones based on cropping systems, climatic zones and topography. They are described below as Dry region, Central region with sparse vegetation, Mixed dry farming and irrigated cultivation region, and Mixed dry farming and grazing region.

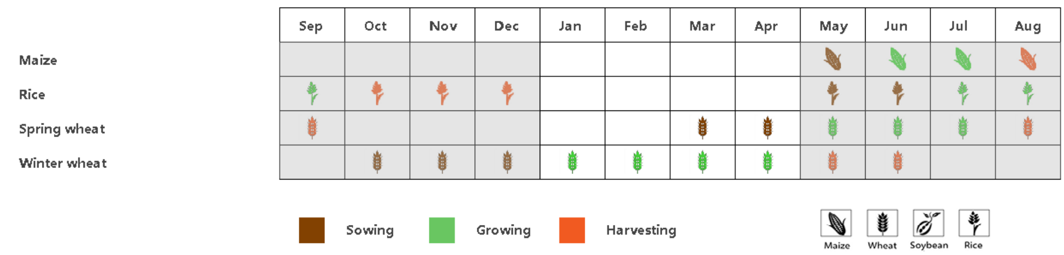
In the Central region with sparse vegetation, the following indicator values were observed: Rain 102mm, 28% down below average; TEMP 1.2°C, -1.2°C; RADPAR 960MJ/m², -5%; CALF 6%, +21% and VCIx: 0.75.

Precipitation of the Dry region was close to average at 139 mm. Temperature was the highest among the four AEZs. The CALF was seasonably low and VCIx was just 0.44.

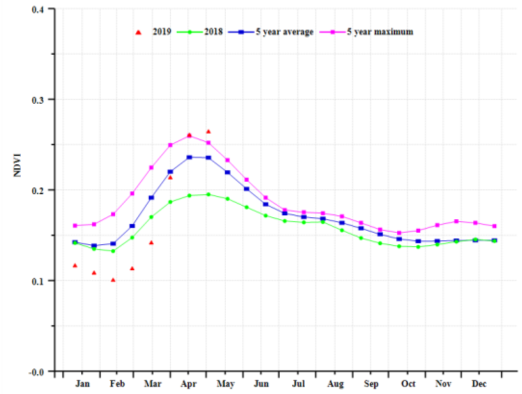
The Mixed dry farming and irrigated cultivation region consists mainly of farmland and irrigated areas and the effects of the drought mentioned in previous reports have been mitigated by normal rainfall amounts of 214mm. CALF reached 30%, which is the highest in the four regions and a significant increase over previous seasons (+79%). Overall, the VCIx in this area was very high, reaching 0.99.

Mixed dry farming and grazing region recorded 178 mm of RAIN, 7% above average. The temperature was 5.2°C, 1.8°C below average. The RADPAR was 949MJ/m², closed to the average. The CALF (21%) was 159% higher than the average and VCIx at 0.83 indicates good production prospects.

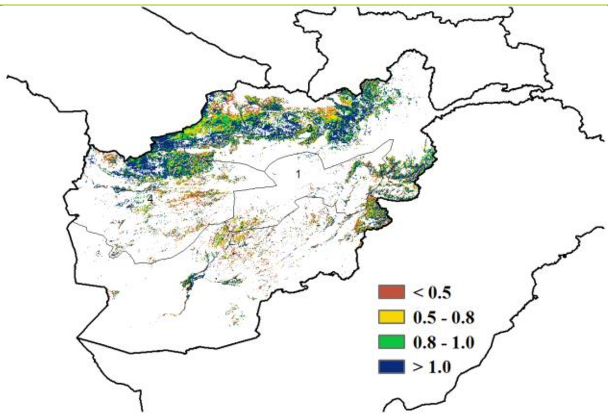
**Figure 3.5 Afghanistan's crop condition, January - April 2019**



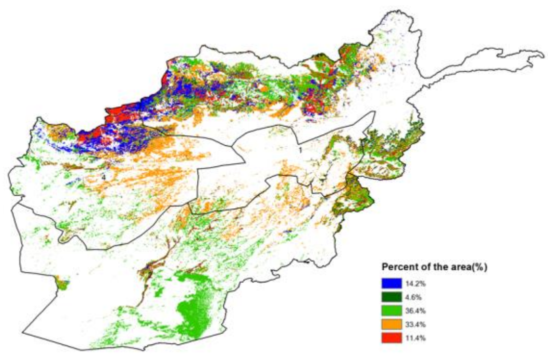

(a). Phenology of major crops



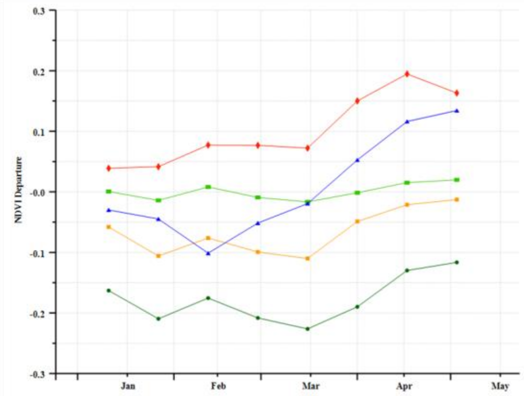

(b) Crop condition development graph based on NDVI



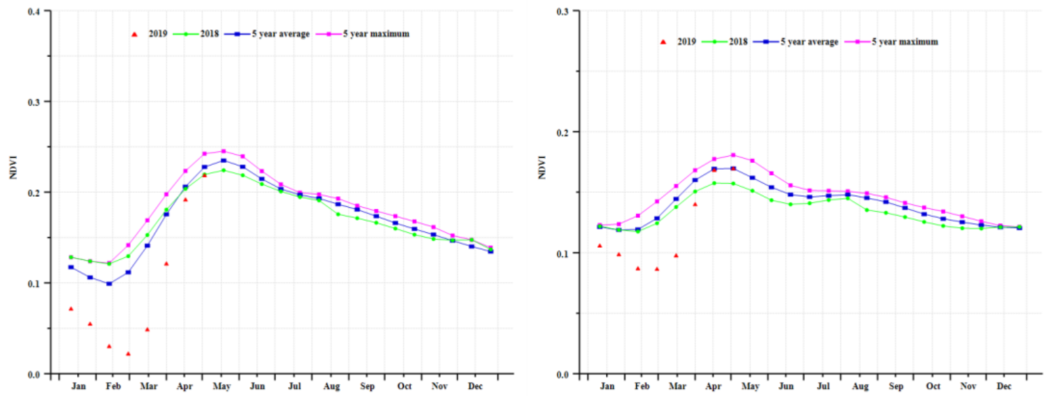

(c) Maximum VCI



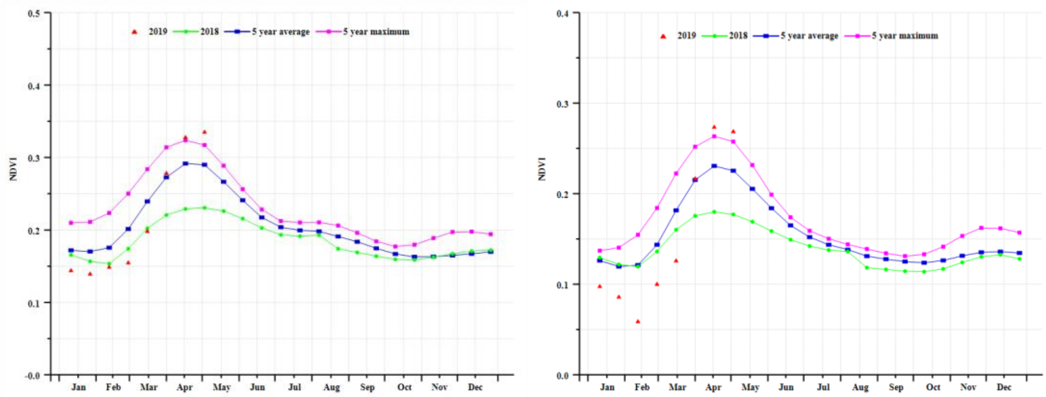

(d) Spatial NDVI patterns compared to 5YA




(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Central region with sparse vegetation (left) and Dry region(right))




(g) Crop condition development graph based on NDVI (Mixed dry farming and irrigated cultivation region (left) and Mixed dry farming and grazing region (right))

**Table 3.1 Afghanistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Central region with sparse vegetation | 102 | -28 | 1.2 | -1.2 | 960 | -5 |
| Dry region | 139 | -2 | 8.1 | -1.6 | 1019 | -4 |
| Mixed dry farming and irrigated cultivation region | 214 | -1 | 3.6 | -0.5 | 824 | -8 |
| Mixed dry farming and grazing region | 178 | 7 | 5.2 | -1.8 | 949 | -5 |

**Table 3.2 Afghanistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Central region with sparse vegetation | 440 | -13 | 6 | 21 | 0.75 |
| Dry region | 527 | 15 | 4 | 34 | 0.44 |
| Mixed dry farming and irrigated cultivation region | 687 | 10 | 30 | 79 | 0.99 |
| Mixed dry farming and grazing region | 675 | 14 | 21 | 159 | 0.83 |

# [AGO] Angola

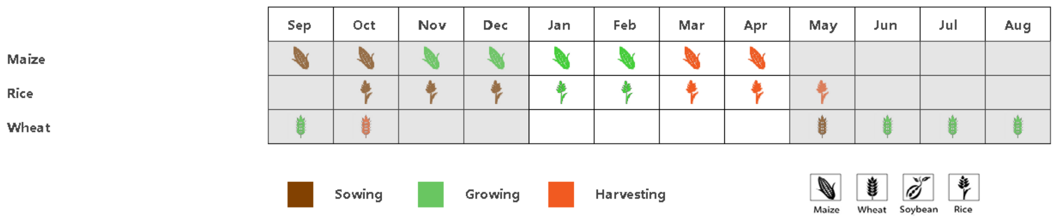
Covering the late growth and harvest of Maize and Rice, the CropWatch agroclimatic indicators inform us that RAIN was below average (-6%) while both temperature and radiation were above (TEMP +1.7°C, RADPAR +6%). The resulting agronomic variables show both decreased, biomass by 2% and the cropped arable land fraction by 4%. According to the NDVI development graph values were below average throughout almost the entire monitoring period. At the end of January, mid-February and mid-April, crop condition was none the less above average. The maximum VCI map shows that the most favorable situation occurred in the north-western areas (especially in the provinces of Zaire, Uíge, Benga and Cuanza Norte). The NDVI profiles indicate that in the provinces of Benguela, Huambo and Huíla, the condition of crops exceeded the previous five-years average. This area corresponds to 30% of the total cropped area. Among the total cropped area, 4.3%, registered below average crop condition during January; however, these areas recovered and kept about the average during the entire monitoring period. In general, crop condition was unfavourable during the monitoring period.

## Regional Analysis

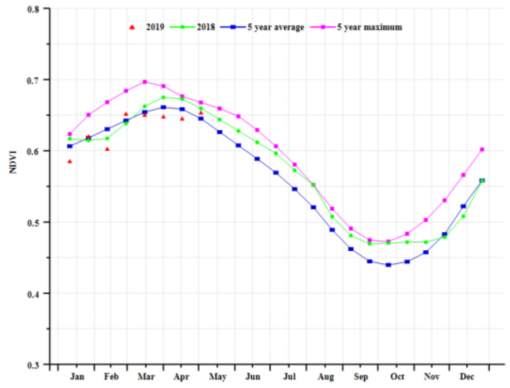
Considering the cropping systems, climatic zones and, and topographic conditions, Angola is divided into six agro-ecological zones (AEZs): the Central Plateau, Humid, Sub-humid, Semi-arid, Arid and Desert.

Excepting the Central Plateau zone, all the agro-ecological zones showed below average crop conditions during the entire monitoring period. The agroclimatic factors have influenced the crop condition in these regions, as all the zones excepting the Sub-humid zone, showed a shortage of rainfall. A significant drop in rainfall was verified in the Semi-arid zone (RAIN down 28%). In this region, both temperature and radiation recorded an increase by about 1.9°C and 9% respectively. It is also important to mention that despite the increase in rainfall (+9%) recorded in the Sub-humid zone, temperature and radiation increased by about 1.6°C and 5%, respectively. The significant increase in temperature and radiation also occurred in the Central Plateau region (TEMP +2.7°C, RADPAR +7%). Biomass and CALF registered decreases in the Arid and Semi-arid zones. In the Arid zone, the Biomass decreased by 10% and the CALF by about 24% while in Semi-arid zone the biomass dropped by 12% and the CALF decreased by 7%. The maximum VCI values recorded during this period were low in the Arid zone, about 0.64.

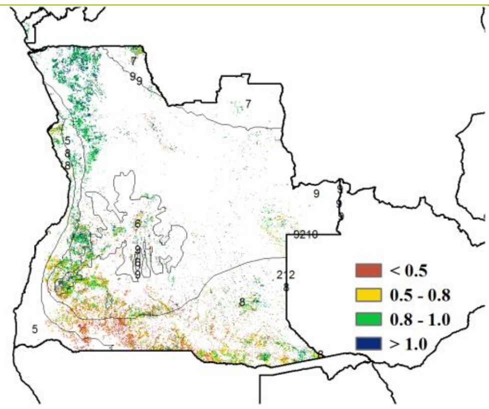
**Figure 3.6 Angola's crop condition, January – April 2019**



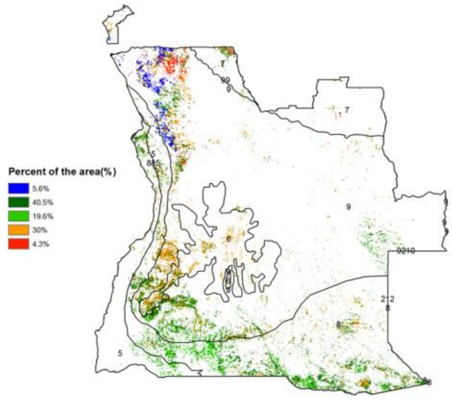

(a). Phenology of major crops



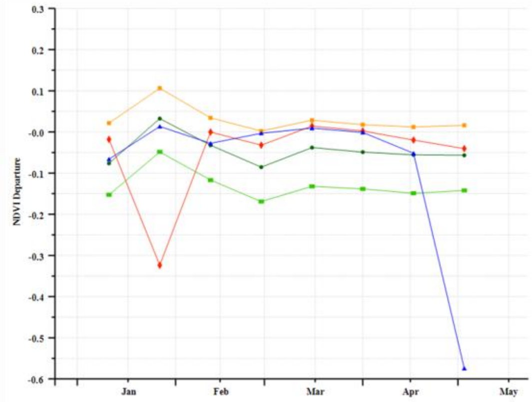

(b) Crop condition development graph based on NDVI



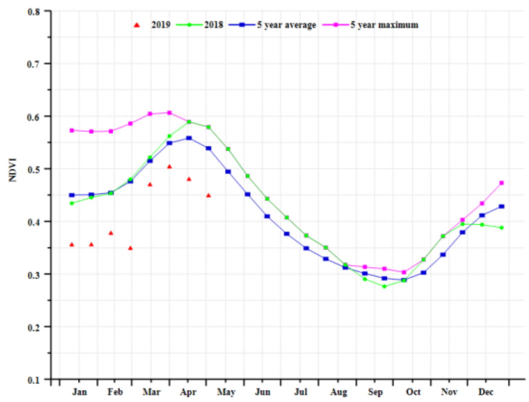

(c) Maximum VCI



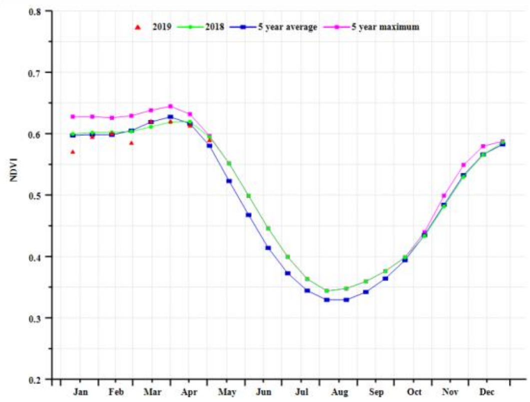

(d) Spatial NDVI patterns compared to 5YA



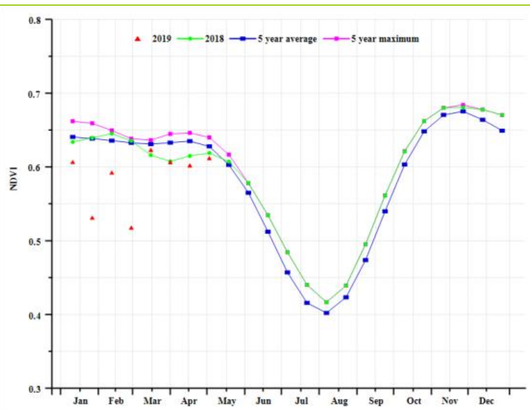

(e) NDVI profiles



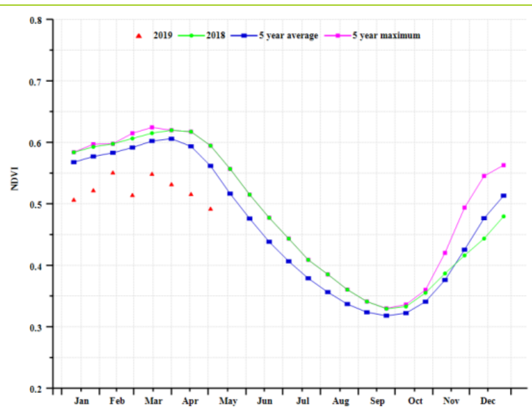

(f) Crop condition development graph based on NDVI- Arid zone



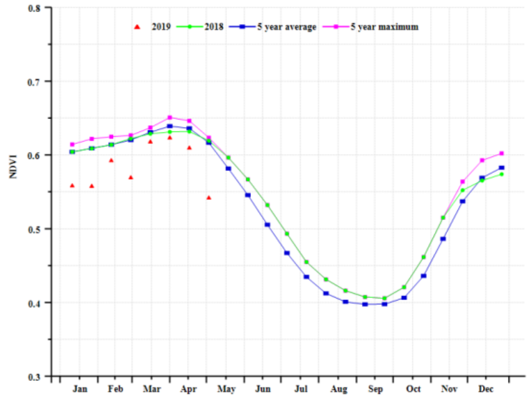

(g) Crop condition development graph based on NDVI - Central Plateau




(h) Crop condition development graph based on NDVI- Humid zone




(i) Crop condition development graph based on NDVI - Semi-arid zone




(j) Crop condition development graph based on NDVI- Sub-humid zone

**Table 3.3 Angola agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| **Arid Zone** | 309 | -21 | 25.5 | 0.2 | 1257 | 1 |
| **Central Plateau** | 635 | -3 | 23.1 | 2.7 | 1157 | 7 |
| **Humid zone** | 558 | -6 | 26.0 | 0.5 | 1202 | 6 |
| **Semi-Arid Zone** | 391 | -28 | 26.5 | 1.9 | 1284 | 9 |
| **Sub-humid zone** | 685 | 9 | 25.7 | 1.6 | 1198 | 5 |

**Table 3.4 Angola agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 5YA (%) | Current (%) | Departure from 5YA (%) | Current |
| **Arid Zone** | 1038 | -10 | 69 | -24 | 0.64 |
| **Central Plateau** | 1800 | 1 | 100 | 0 | 0.89 |
| **Humid zone** | 1853 | 0 | 100 | 0 | 0.92 |
| **Semi-Arid Zone** | 1331 | -12 | 91 | -7 | 0.70 |
| **Sub-humid zone** | 1833 | 7 | 100 | 0 | 0.88 |

# [ARG] Argentina

The reporting period is the main growing season for summer crops: maize, rice and soybean (Figure 3.7.a). Most wheat was harvested during the previous reporting period, after which late soybean was planted. The overall situation was average: Rainfall showed a 14% increment compared to average. Temperature was down 1.2°C and RADPAR showed a reduction of 4.3 %. BIOMSS showed an increment of 0.9% above the average and Maximum VCI reached 0.81; compared to the previous five seasons, CALF was reduced by 1% point.

CropWatch subdivides Argentina into eight agro-ecological zones (AEZ) based on cropping systems, climatic zones, and topography; they are identified by numbers in the NDVI profiles map (Figure3.7 b). Only four of them are found to be relevant for crop cultivation: the Humid Pampas (region 13), the Chaco (region 11), Mesopotamia (region 12) and the Subtropical highlands (region 17) for which the crop conditions will be discussed with some detail in this section.

Spatial distribution of NDVI profiles show better than average conditions for the main agricultural area of the humid Pampas as well as for Subtropical highlands during the critical period of maize and soybean (Figure 3.7 c). A more stable pattern was observed in the Depressed Pampas (also referred to as "Flooded Pampas") that are dominated by grasslands (blue area, 17.3% of agricultural land). In the Southeast of the Humid Pampas, a region dominated by winter crops, negative anomalies were observed for most of the reporting period.

## Regional analysis

Crop condition development graphs based on NDVI show below average values for the whole country, but NDVI values where higher than last year for most of the period (Figure 3.7.d). Humid Pampas showed values lower than average from January to March and no anomalies since April. Values were, as for the whole country, higher than last year's for most of the period (Figure 3.7.e). Chaco region didn’t show anomalies during most of the reporting period and showed values higher than those observed during last year (Figure 3.7.f). Mesopotamia showed almost no anomalies during the reporting period, but showed values much higher than last year's in particular during end of February and March (Figure 3.7.g). Subtropical highlands showed almost no anomalies and similar values to last year with the exception of a quite high negative anomaly at mid March (Figure 3.7.h).

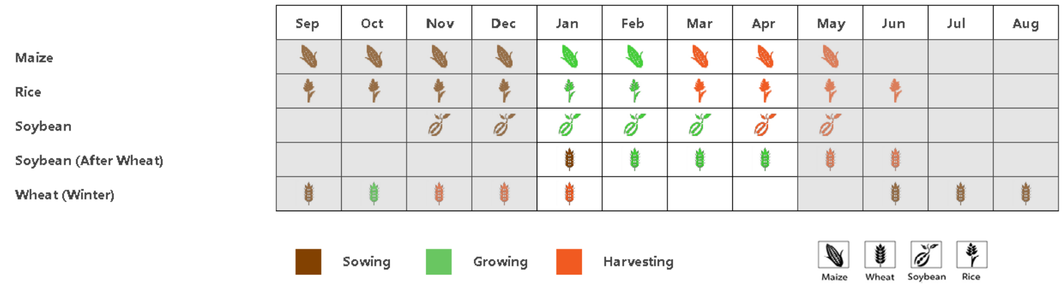
VCIx map showed quite good conditions for the whole country, which is dominated by values higher than 0.8, with the exception of lower values observed over Southwest of Humid Pampas and South Chaco (Figure 3.7.b).

RAIN showed high positive anomalies in Chaco (+44 %) and Mesopotamia (+26 %), while Humid Pampas showed a 7% increment in this variable (Table 3.7). On the contrary, a strong negative anomaly in RAIN was observed in Subtropical highlands (-32 %). TEMP showed negative anomalies for the 4 regions considered, ranging from -1.1 degree in the Pampas to -1.4 degree in Chaco and Subtropical highlands. RADPAR showed negative anomalies for these regions: Pampas (-0.7 %), Subtropical highlands (-7.1 %), Mesopotamia (-8.6 %) and Chaco (-9.9 %).

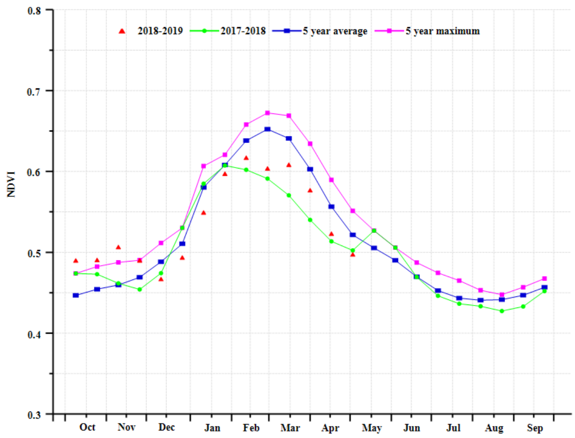
BIOMSS anomalies where associated also in magnitude to precipitation anomalies (Table3.8), being positive in Chaco (+18.8 %), Mesopotamia (+12.4 %) and Humid Pampas (+0.5 %), and negative in Subtropical highlands (-21.8 %). Maximum VCI was quite high for the Humid Pampas (0.88) and almost 0.15 lower for the other regions considered: Subtropical highlands (0.72) and Mesopotamia and Chaco (0.71). CALF was almost average showing slight changes for all the regions: HumidPampas (-0.33 %), Chaco (+0.02 %), Subtropical highlands (+0.04 %) and Mesopotamia (+0.14 %).

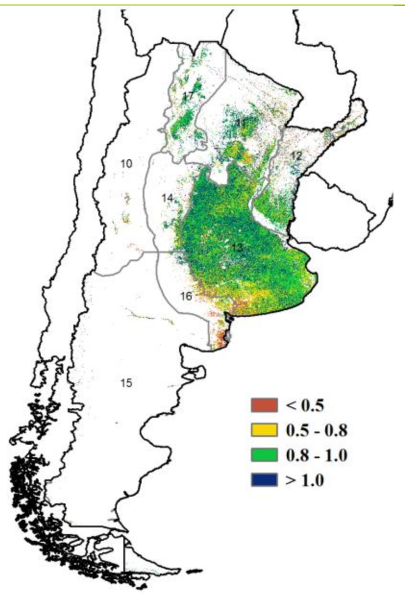
The combination of high rainfall, low temperature and low sunshine is likley to have affected crops negatively in some areas, also indirectly through increased incidence of diseases and interference with harvest operations.

**Figure 3.7 Argentina's crop condition, January - April 2019**



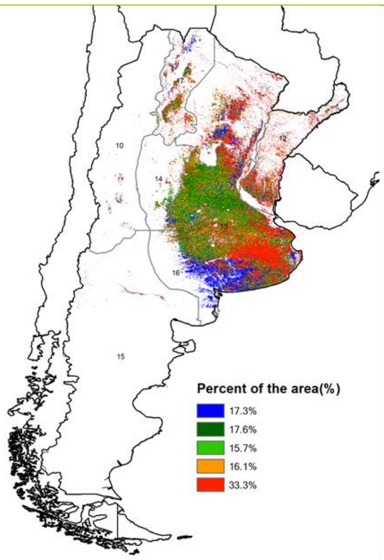

(a). Phenology of major crops

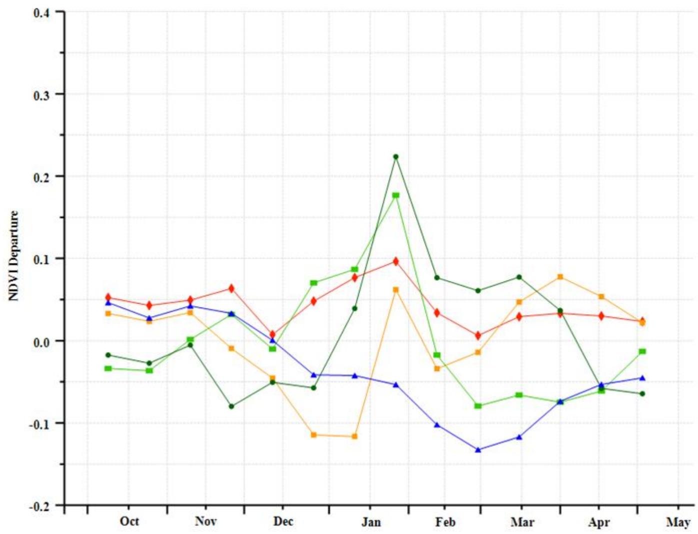



(b) Crop condition development graph based on NDVI

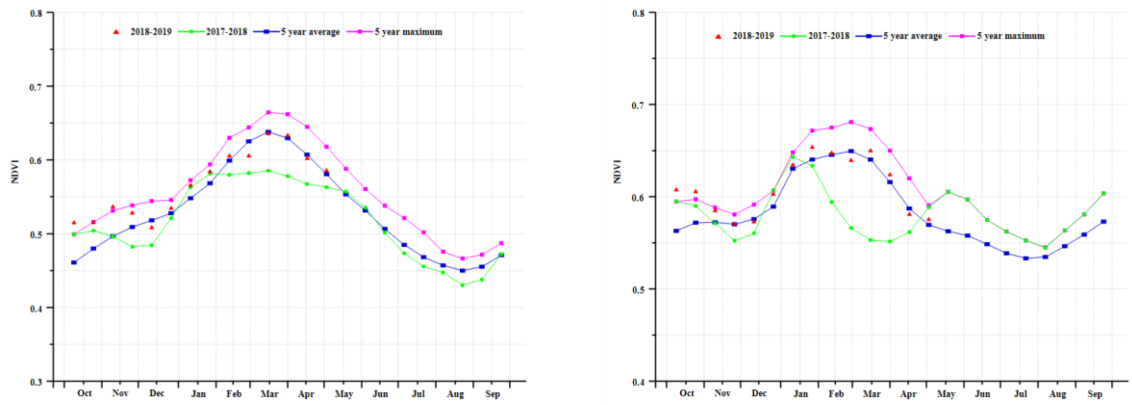
(c) Maximum VCI



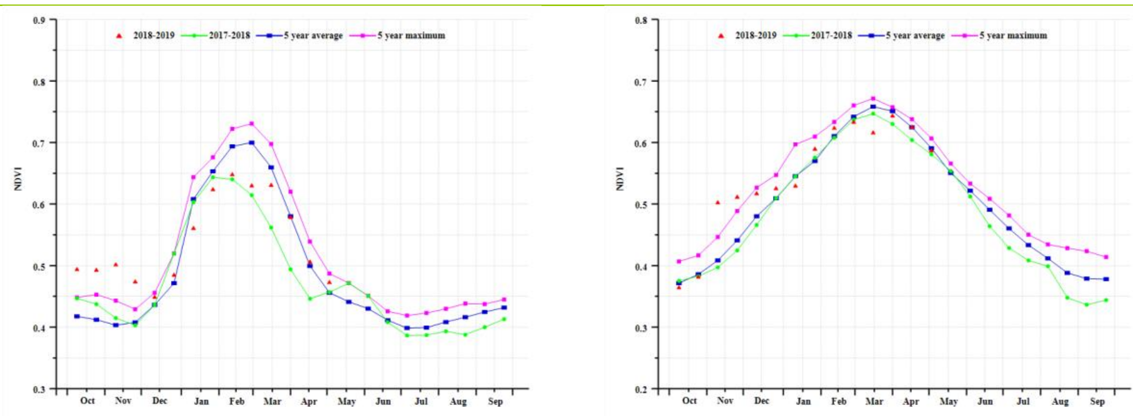




(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles




(f) Crop condition development graph based on NDVI (NDVI_Chaco (left) and Mesopotamia (right))




(g) Crop condition development graph based on NDVI (Humid Pampas (left) and Subtropical highlands (right))

**Table 3.5 Argentina's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| Chaco | 884 | 44 | 24.3 | -1.4 | 1036 | -10 |
| Mesopotamia | 816 | 26 | 23.4 | -1.2 | 1083 | -9 |
| Humid Pampas | 517 | 7 | 20.4 | -1.1 | 1206 | -1 |
| Subtropical highlands | 399 | -32 | 22.8 | -1.4 | 1046 | -7 |

**Table 3.6 Argentina's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January – April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Chaco | 1857 | 19 | 100 | 0.0 | 0.71 |
| Mesopotamia | 1769 | 12 | 100 | 0.1 | 0.71 |
| Humid Pampas | 1398 | 1 | 99 | -0.3 | 0.89 |
| Subtropical highlands | 1142 | -22 | 100 | 0.0 | 0.72 |

# [AUS] Australia

Wheat and barley, the main cereal crops of Australia, are usually planted from May to July and harvested from October to January. The monitored period thus covers only the end of the last harvesting season with no crops in the field for most of the reporting period. Agro-climatic indicators show below average conditions: RAIN -17%, TEMP +0.5°C, RADPAR 4%. As a result, the biomass accumulation potential shows a decrease of 21% compared with last 15 years. Negative departures of rain were observed in all the states: New South Wales: -16%, South Australia: -24%, Victoria: -33%, and Western Australia: -34%, leading to unfavorable soil moisture conditions for the planting of wheat and barley in the coming months. The maximum VCI is 0.42 all over the region, except for southeastern Queensland (above 0.8), where cotton has reached maturity. Although CALF decreased by 38 percentage points compared with the recent five-year average, this does not necessarily indicate a reduction of the planted area at this stage of the season.

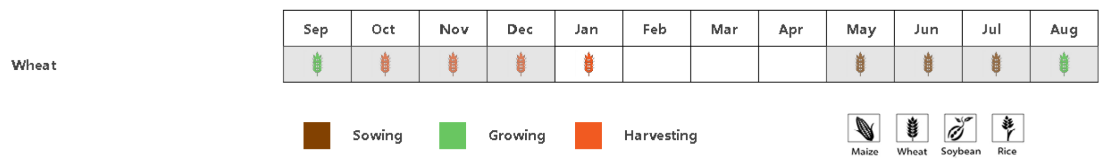
**Regional analysis**

This analysis adopts five agro-ecological regions for Australia, namely the Southeastern Wheat Zone, Southwestern Wheat Zone, Arid and Semi-arid Zone, Wet Temperate and Subtropical Zone, and Subhumid Subtropical Zone.

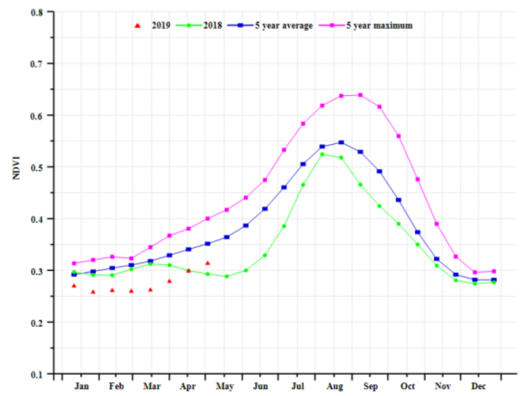
Compared with the last 15 years average, the rainfall for these 5 sub-regions above was as follows: -23%, -39%, -13%, -3% and -34% respectively. Low rainfall, especially for the Southwestern Wheat Zone and Subhumid Subtropical Zone, will possibly have some negative impact on the soil moisture, probably less so in the Wet Temperate and Subtropical Zone which had the least negative departure of rainfall below average. The temperature was above average in Southeastern Wheat Zone, Wet Temperate and Subtropical Zone, and Subhumid Subtropical Zone with 0.8°C, 0.5°C, and 1.2°C, while it was close to average or slightly below for the Arid and Semi-arid Zone and the Southwestern Wheat Zone (0.8℃ drop). RADPAR exceeded average for the 5 sub-regions by, repsctively, 4%, 5%, 3%, 3%, and 7%. As a result, the potential accumulated biomass shows values of -20%, -30%, -6%, -13% and -30%, compared with average.

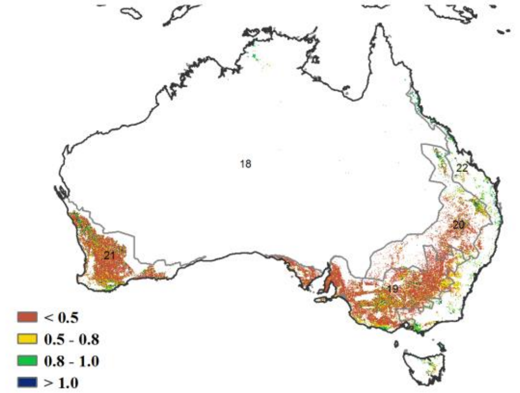
Due to low rainfall and high temperature and RADPAR, the agroclimatic conditions in Australia have been below average so far, spectaculalrly so when considering record low NDVI curves. Hopefully irrigation can make up for the dry conditions in the coming planting season of wheat and barley. CropWatch will keep on monitoring the crop condition in the next bulletin.

**Figure 3.8 Australia's crop condition, January - April 2019**



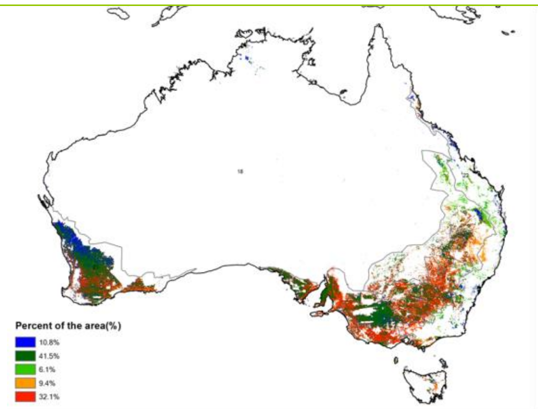

(a). Phenology of major crops

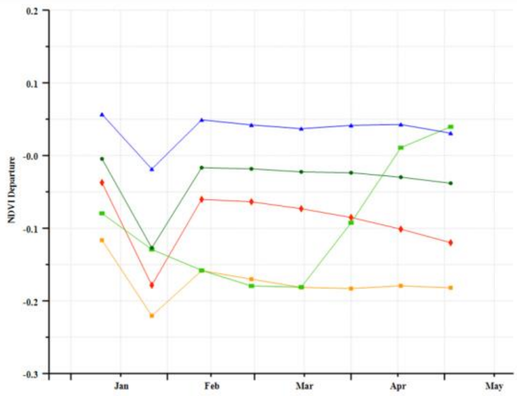



(b) Crop condition development graph based on NDVI

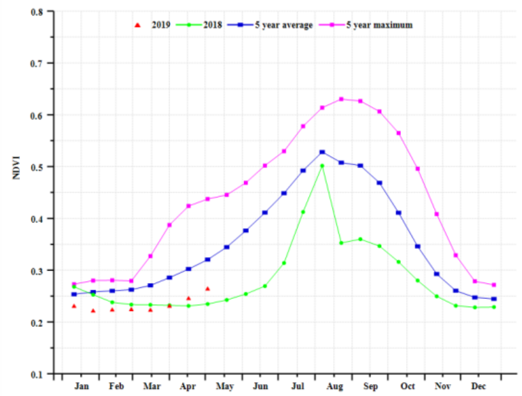
(c) Maximum VCI

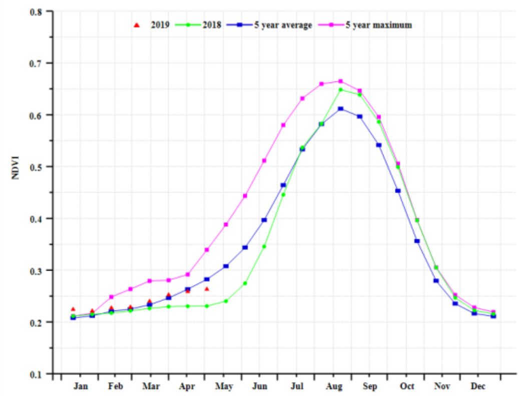


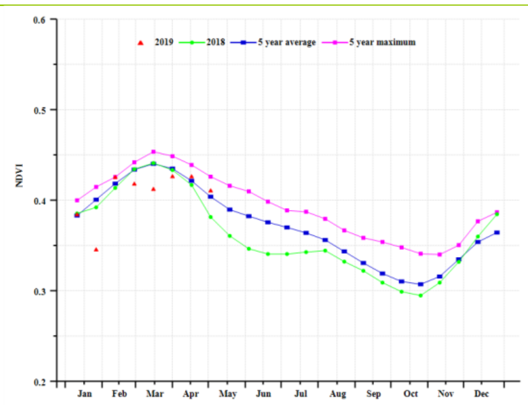

(d) Spatial NDVI patterns compared to 5YA

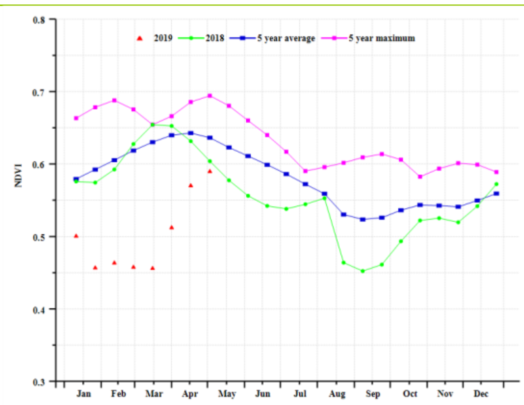
(e) NDVI profiles



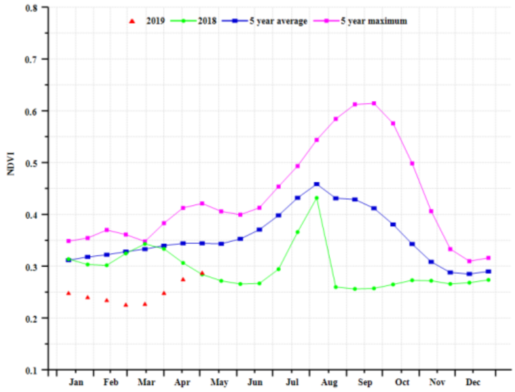




(f) Crop condition development graph based on NDVI (South-eastern wheat zone (left) and South-western wheat zone (right))




(g) Crop condition development graph based on NDVI (Arid and semi-arid zone (left) and Wet temperate and sub-tropical zone (right))




(h) Crop condition development graph based on NDVI (Sub-humid subtropical zone)

**Table 3.7 Australia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Southeastern wheat zone | 110 | -23 | 21.8 | 0.8 | 1255 | 4 |
| Southwestern wheat zone | 66 | -39 | 20.7 | -0.8 | 1300 | 5 |
| Arid and semiarid zone | 829 | -13 | 27.7 | 0.0 | 1274 | 3 |
| Wet temperate and subtropical zone | 386 | -3 | 21.6 | 0.5 | 1170 | 3 |
| Subhumid subtropical zone | 168 | -34 | 25.4 | 1.2 | 1340 | 7 |

**Table 3.8 Australia's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| Southeastern wheat zone | 473 | -20 | 14 | -53 | 0.35 |
| Southwestern wheat zone | 329 | -30 | 11 | -45 | 0.44 |
| Arid and semiarid zone | 1322 | -6 | 68 | 0 | 0.69 |
| Wet temperate and subtropical zone | 874 | -13 | 88 | -8 | 0.69 |
| Subhumid subtropical zone | 585 | -30 | 21 | -47 | 0.37 |

AFG AGO ARG AUS **BGD** BLR BRA CAN DEU EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN KHM LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [BGD] Bangladesh

The Reporting period covers the full cycle of dry winter season rice (Boro) and wheat crops; both are irrigated. Although the period between January and April does not correspond to the monsoon the country nevertheless received 299 mm rainfall which is about 32% above average. The temperature at 24.2°C was just 0.3°C above average. The recorded RADPAR of 1174 MJ/m$^2$ was lower than average by about 1%. Due to good growing environmental conditions CALF reached 97%; NDVI ranged between 0.45 and 0.65 and VCIx reached 1.03, a record high. The avaliable information indicates very good prospects for the current Boro and wheat crops. The NDVI profile map indicates that the conditions were consistently above average in 10% of the crop land but well below throughout the whole reporting period in 4.5% of arable land. REmaing areas fluctuate around the average (below average until March).

**Regional analysis**

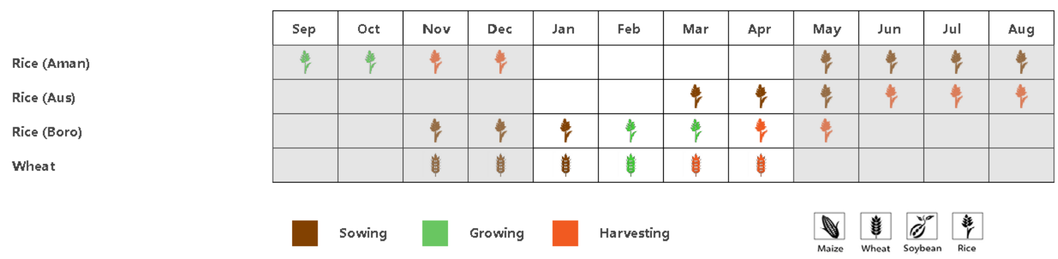
Bangladesh can be subdivided into four regions namely: the Coastal region, the Gangetic plain, the Hills and the Sylhet basin. The Coastal region received excessive rainfall (283 mm, +53% over average) and TEMPwas average at 25.3°C (-0.5°C). RADPAR reached 1206 MJ/m$^2$ (-1%). The NDVI was initially low in January and February but rose in March and exceed the average in April; CALF at 87% and VCIx at 1.05 indicate good performance.

The Gangetic plains recorded 233 mm (RAIN +56% over average) and TEMP was about average (+0.3°C) while RADPAR was 3% below. The NDVI was similar to the previous zone, starting low and exceeding the average in April. High CALF (97%) and VCIx at 1.05 with BIOMSS up 53% (against 15YA) indicate good prospects.

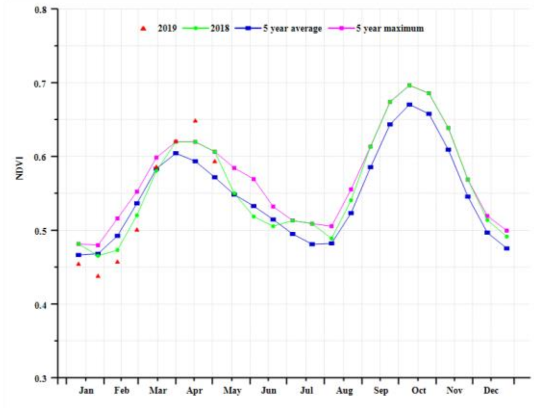
Sylhet Basin received the largest precipitation amount (393mm). TEMP was 0.4°C above the average and there is no difference between RADPAR average and 15Y average. The BIOMSS potential of 1041gDM/m$^2$ (the highest for any region) is also 30% above the 15YA. NDVI was initially low but exceeded 0.6 in March and early April then decreased to average. With CALF at 99% and VCIx of 0.90 (even higher than1.00 in large patches in the region), crop prospects are probably the most favorable in the country.

The Hills recorded 246mm (+21%), with marginally above average TEMP (24.5°C, an increase of 0.4°C) but favourable sunshine (RADPAR of 661MJ/m2, +7%). NDVI was high in January, decreased to below average from January to February and increased to nearly the 5YA average from March to April. BIOMSS was above average (+7%), CALF as high as 96% and crop condition with good at 0.92 VCIx.

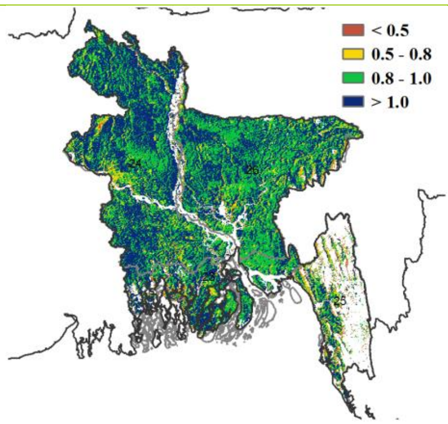
**Figure 3.9 Bangladesh's crop condition, January - April 2019.**



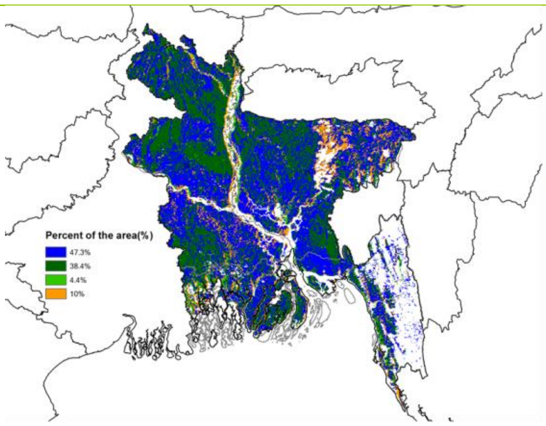

(a). Phenology of major crops



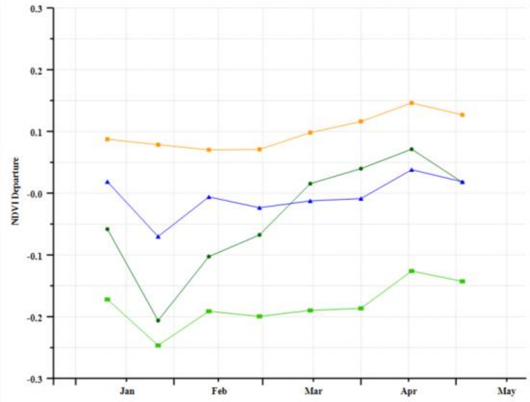

(b) Crop condition development graph based on NDVI



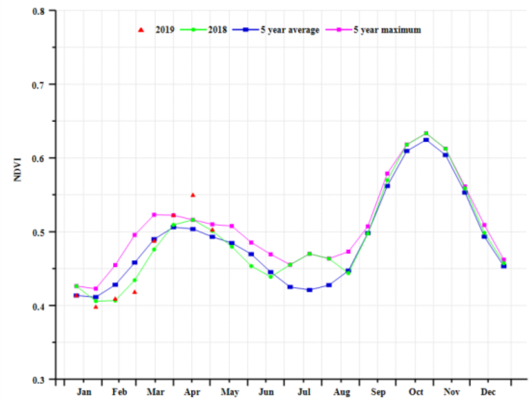

(c) Maximum VCI

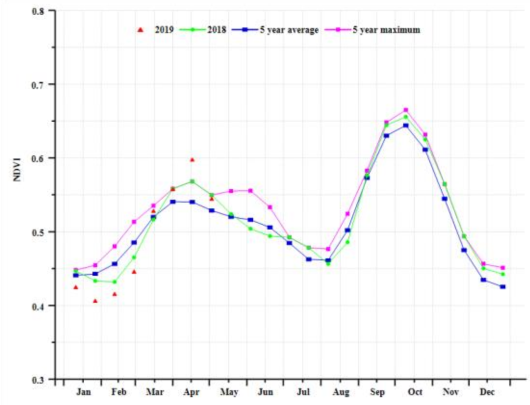



(d) Spatial NDVI patterns compared to 5YA

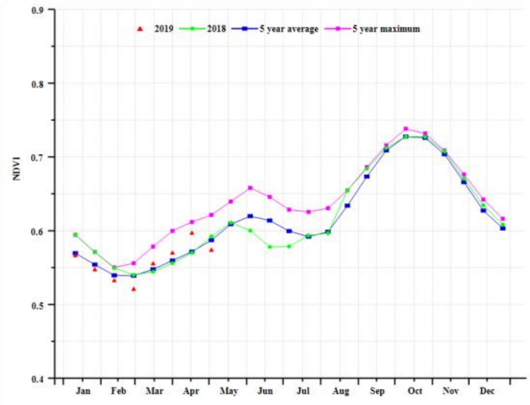


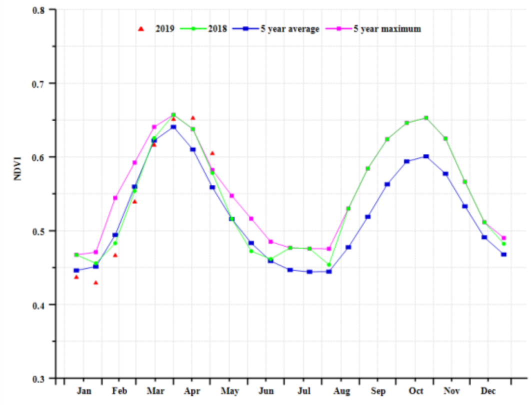

(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Coastal Region (left) and Gangetic Region (right))




(g) Crop condition development graph based on NDVI (Hill Region (left) and Sylhet Basin (right))

**Table 3.9 Bangladesh's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Coastal region | 283 | 53 | 25.3 | 0.5 | 1206 | -1 |
| Gangetic plain | 244 | 56 | 24.0 | 0.3 | 1146 | -3 |
| Hills | 246 | 21 | 24.5 | 0.4 | 1259 | 0 |
| Sylhet basin | 393 | 15 | 23.8 | 0.4 | 1159 | 0 |

**Table 3.10 Bangladesh's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Coastal region | 781 | 29 | 87 | 5 | 1.05 |
| Gangetic plain | 848 | 53 | 97 | 1 | 1.05 |
| Hills | 661 | 7 | 97 | 0 | 0.92 |
| Sylhet basin | 1041 | 30 | 99 | 1 | 1.00 |

AFG AGO ARG AUS BGD **BLR** BRA CAN DEU EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN KHM LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [BLR] Belarus

Wheat was the major crop in the field during the monitoring period and spring wheat was sowed from March.

Rainfall deficit (-13%) with abundant sunshine (+9%) and a significantly increased temperature (+1.9°C) resulted in 13% higher than average potential biomass. Agronomic indicators show a satisfactory maximum vegetation condition index (VCIx 0.8) while the cropped arable land fraction (CALF) deceased 14% to 75%. The nationwide NDVI time plot was marginally higher than last year values from February and close to 5-year average from mid-March. The spatial patterns of NDVI profiles show that around 71% of cropped areas eventually reached 5-year average, except for some places in southeast and middle west (Gomel and Minsk Oblasts). In south-eastern and central areas (Mogilev and Minsk Oblasts) VCIx was between 0.5-0.8, while the value was above 0.8 in the west (Oblats of Grodno and Brest). Overall, both agroclimatic and agronomic conditions were satisfactory, although the impact of warm weather on winter wheat is difficult to assess among others because high temperature has modified phenology and increased water consumption. Spring wheat is probably in good shape, with a risk of moisture deficit for both spring and winter wheat later in the season,

**Regional analysis**

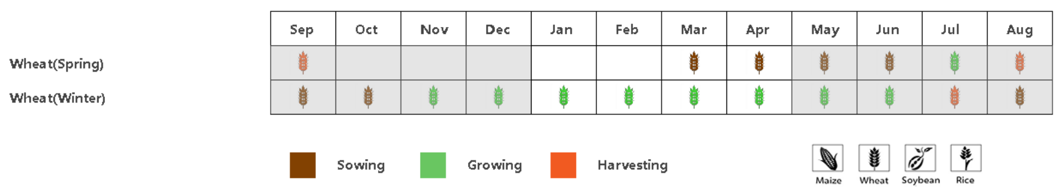
Based on cropping system, climatic zones and topographic conditions, regional analyses are provided for three agro-ecological zones (AEZ), including Northern Belarus (Vitebsk, northern area of Grodno, Minsk and Mogilev), Central Belarus (Grodno, Minsk and Mogilev and Southern Belarus which includes the southern halves of Brest and Gomel regions.

Northern Belarus suffered a deficit in rainfall (-18%), while temperature and radiation were well above average (+2.1°C and +10%, respectively) which resulted in a potential biomass increase of 13%. Agronomic indicators show that CALF fell 20%, while VCIx reached a moderate value (0.78). The Regional NDVI development curve was close to 5-year average since March, indicating moderate crop prospects.

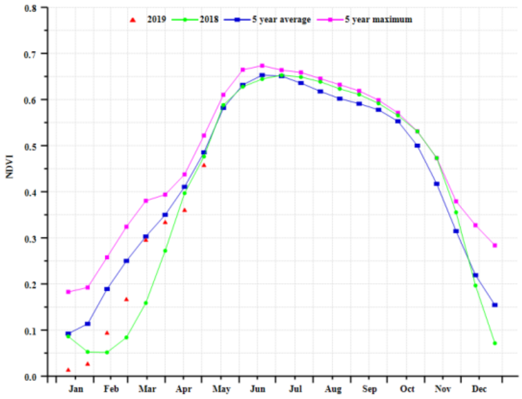
Central Belarus also recorded a rainfall deficit (-12%) combined with abnormally high temperature (+1.8°C) and radiation (+9%), VCIx at 0.83 and high CALF (81%). BIOMSS is up 12%. As in the previous AEZ, NDVI showed a "recovering trend" since March brought about by spring wheat emergence.

The situation in Southern Belarus was similar to the two previous areas, rainfall was below average (8%), while temperature and radiation were 1.8°C and 4.3% above, respectively. Projected biomass would increase by 13%. Normal agronomic indicators (CALF 78%, VCIx 0.8) suggest crop development was fair so far.

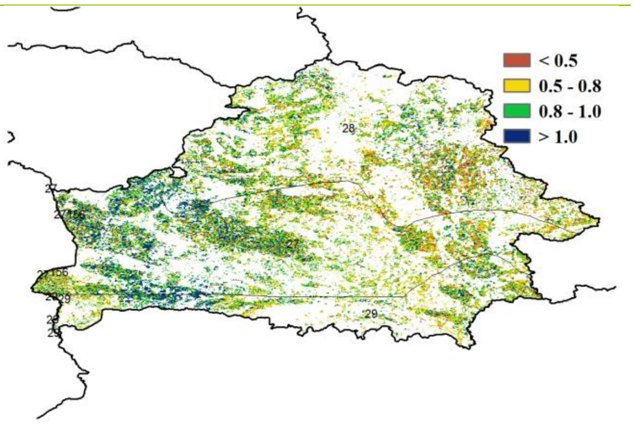
**Figure 3.10 Belarus's crop condition, January - April 2019**



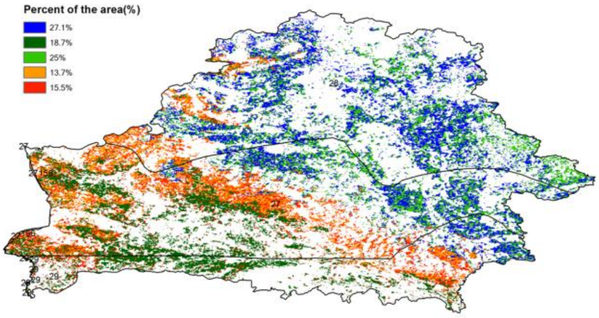

(a). Phenology of major crops



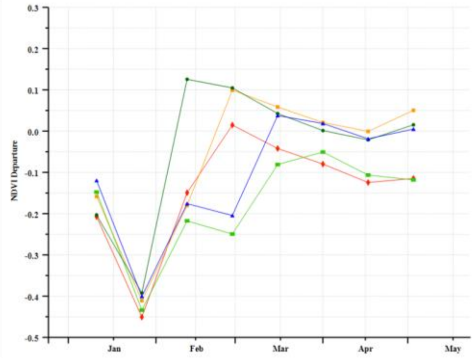

(b) Crop condition development graph based on NDVI



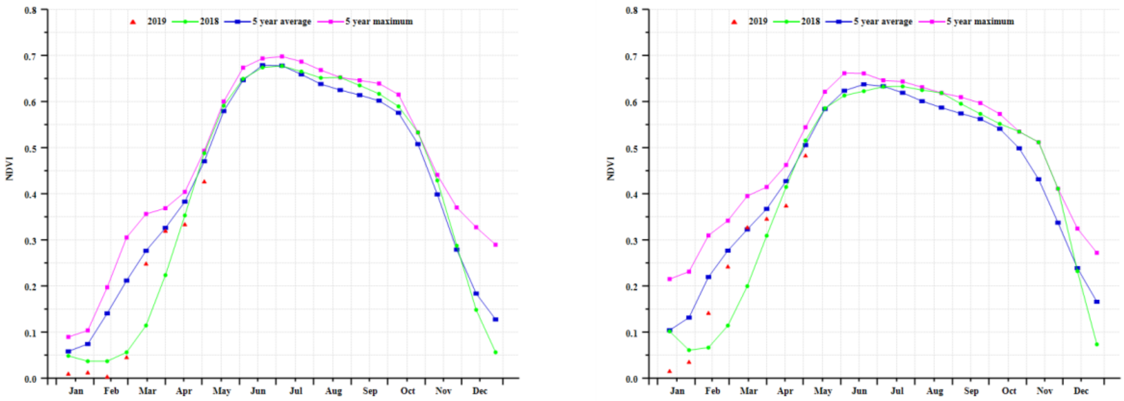

(c) Maximum VCI



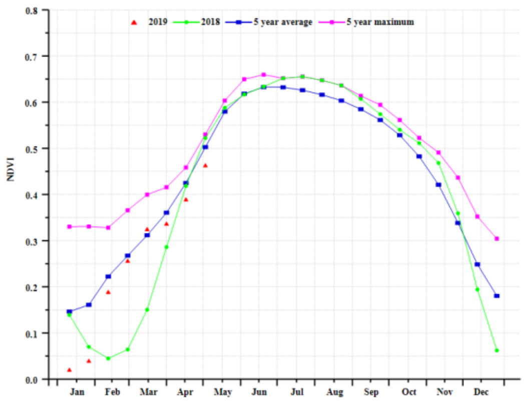

(d) Spatial NDVI patterns compared to 5YA




(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Northern Belarus), and (Central Belarus).




(g) Crop condition development graph based on NDVI (Southern Belarus)

**Table 3.11 Belarus's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019.**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Center | 235 | -12 | 2.2 | 1.8 | 461 | 9 |
| North | 219 | -18 | 1.3 | 2.1 | 449 | 11 |
| South-west | 239 | -9 | 2.7 | 1.8 | 457 | 4 |

**Table 3.12 Belarus's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019.**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Center | 825 | 12 | 81 | -11 | 0.83 |
| North | 765 | 13 | 67 | -20 | 0.78 |
| South-west | 862 | 13 | 78 | -15 | 0.81 |

# [BRA] Brazil

This bulletin covers the growth and maturity of summer crops (maize, soybean and rice) in central and south Brazil while crops are still at peak growing period in north and north-east Brazil. Crop condition in Brazil was overall average compared to the previous five years.

All agro-climatic indicators present very average conditions with 1% above average rainfall, 0.1℃ lower temperature and 5% above average radiation. There is also no significant departure from 15YA of ten-day rainfall and temperature according to the seasonal profiles. Normal and stable rainfall and temperature conditions benefited crops and resulted in 3% above average biomass production potential BIOMSS. Among the nine major agricultural states, rainfall patterns were as follows: (1) Rio Grande Do Sul and Ceara received sufficient rainfall 14% and 44% above average, respectively; (2) 5% or 6% negative departures of rainfall were recorded in Mato Grosso Do Sul, Mato Grosso, and Minas Gerais; (3). Rainfall in Goias, Parana and Sao Paulo were close to average. Temperature for all nine states stayed close to average with largest anomaly at 0.6 degree above average in Minas Gerais. Large positive departure of BIOMSS from 15YA were observed in Rio Grande Do Sul, Ceara and Santa Catarina which coincides with the rainfall departure pattern.

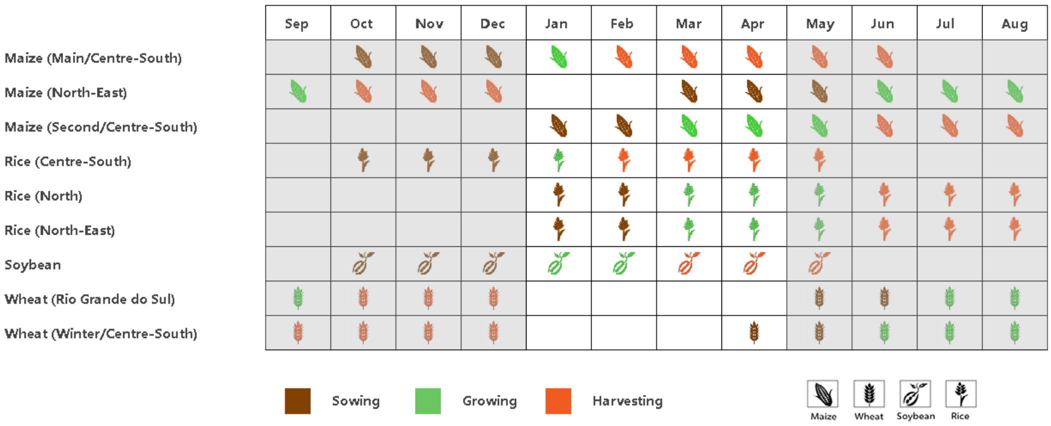
The national NDVI development profile for Brazil presents close to average values in early January and exceeded the 5-year maximum during at end of April. However, the NDVI values were obviously lower than 5YA between end of January and early April. The 2019 NDVI profile fluctuates before early March, indicating variable condition. The VCIx map (national average at 0.78) does not show marked spatial variations. However, NDVI departure from average maps and profiles show different patterns from south to north: generally average to above average conditions in central to southern regions while adverse conditions were observed in the north and north-east, particularly in the lower Amazon basin. National CALF is 1% above average, indicating a close to average crop planted area. The great difference of crop condition from central-south to north and north-east indicates a favorable outputs for main summer crops while unfavorable outputs are expected from late planted summer crops.

**Regional analysis**

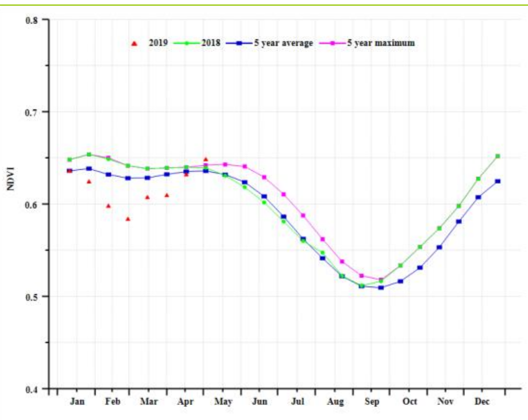
Based on cropping systems, climatic zones, and topographic conditions, eight agro-ecological regions are identified for Brazil. They include the Amazonas, Central Savanna, Coast, North-eastern mixed forest and farmland, Mato Grosso, Nordeste, Parana basin and Southern subtropical rangelands. Over the recent reporting period, large departures of rainfall were identified in three zones: Amazonas (-13%), Nordeste (-22%) and Southern Subtropical rangelands (+23%). The Coast zone received the least rainfall at 435 mm and North-eastern mixed forest and farmland recorded the largest amount at 1411mm during the last four months, 8% below average and 9% above average respectively. Temperature was close to average except for North-eastern mixed forest and farmland where 1.1 below average temperature was observed. The Southern Subtropical rangelands are the only zone with below average radiation (-9%). Nordeste and Southern Subtropical rangelands presented above average BIOMSS thanks to abundant rainfall while BIOMSS in all other zones presented either average or below average conditions. All zones showed average CALF compared to 5YA except for Coast and Nordeste zone.

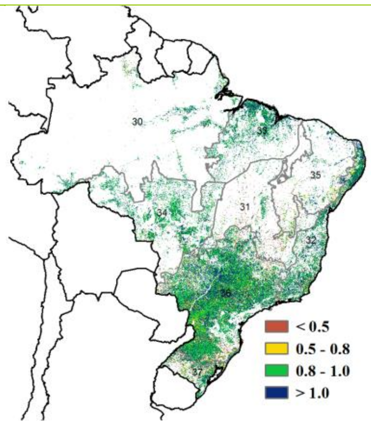
According to the regional NDVI profiles, the eight zones were sorted into three groups: (A) Double cropping pattern in Mato Grosso Zone, (B) single cropping but reaching peak stage in the north and north-east of Brazil, including Nordeste, Amazonas, Coast, and North-eastern mixed forest and farmland, and (C) maturity to harvest at end of May in Central Savanna, Parana basin and Southern subtropical rangelands. For group A, the crop profile follows same pattern as the national profile and the crop condition reached the best condition during the past 5 years at the end of April. For Group B, crop condition was above average in Nordeste zone. Amazonas and North-eastern mixed forest and farmland presented below average crop condition. Significant below average crop condition was observed in Coast region which received the lowest as well as below average rainfall among the zones. In Group C, Southern subtropical rangelands showed average crop condition and the harvesting was almost concluded by the end April. Crop condition was below average in Central Savanna and Parana basin although the agro-climatic conditions were close average. The major reason is the water shortage during the previous period (October 2018 to January 2019) when crops were at early sowing to early growing stage.

**Figure 3.11 Brazil's crop condition, January - April 2019**



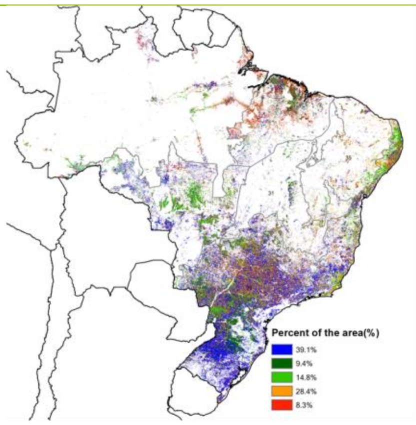

(a). Phenology of major crops

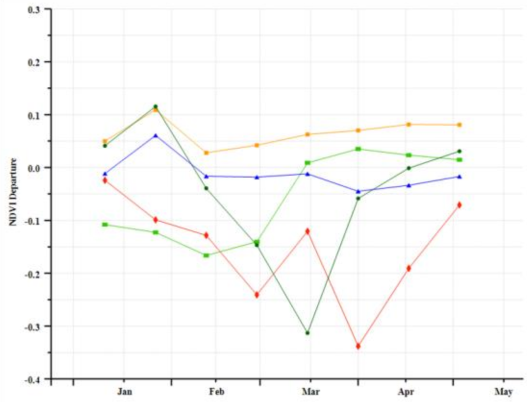



(b) Crop condition development graph based on NDVI

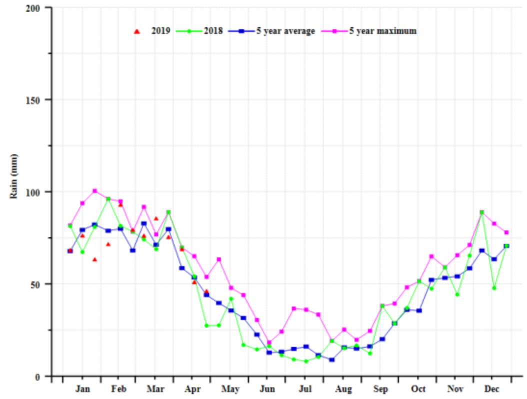
(c) Maximum VCI

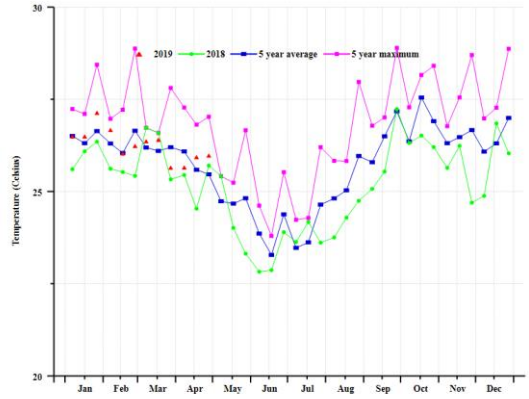



(d) Spatial NDVI patterns compared to 5YA

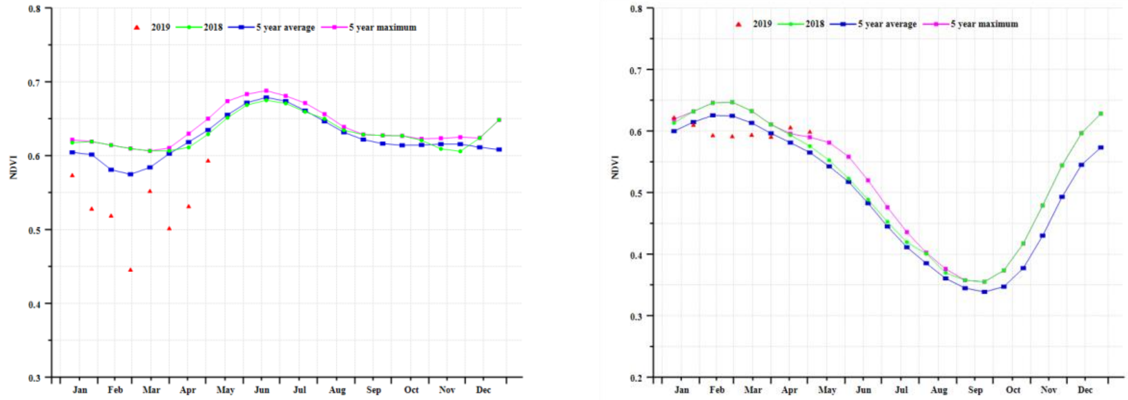
(e) NDVI profiles



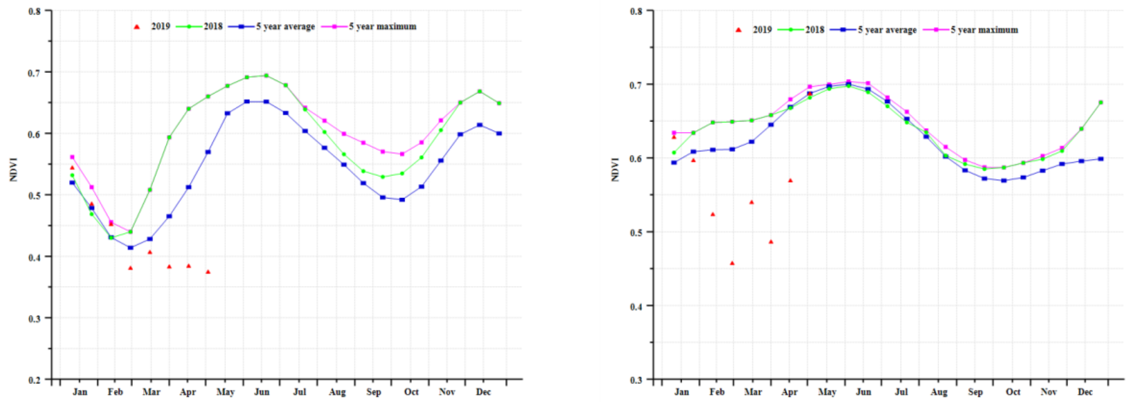




(f) Brazil national rainfall pofile

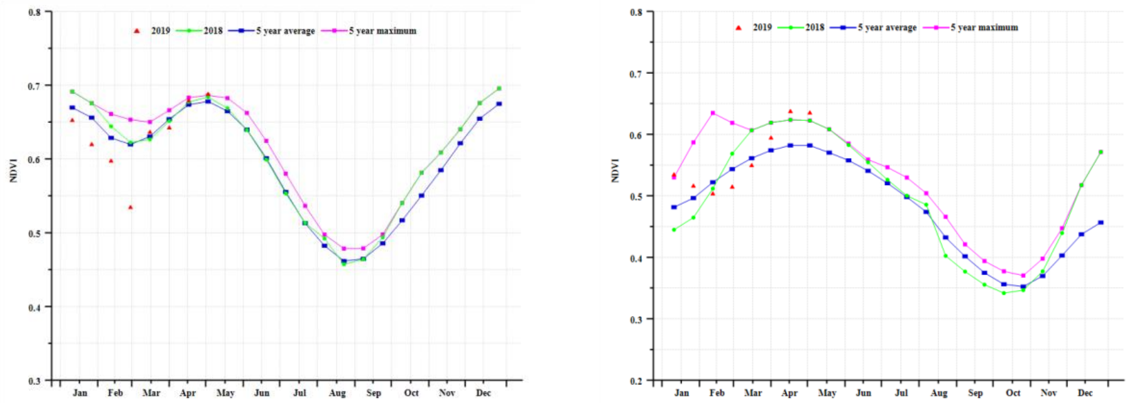
(g) Brazil national temperature pofile



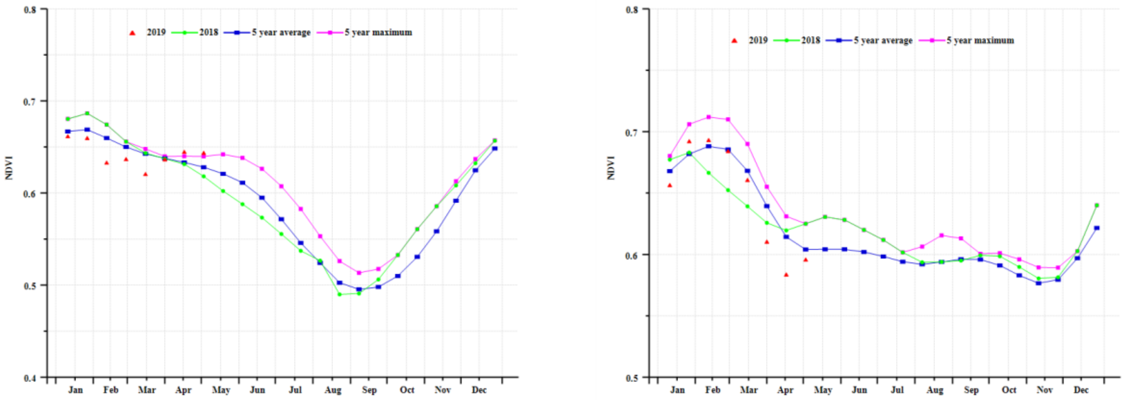

(h) Crop condition development graph based on NDVI ((Amazonas) (left) and (Central Savanna) (right))




(i) Crop condition development graph based on NDVI (Coast (left) and Northeastern mixed forest and farmland (right))




(j) Crop condition development graph based on NDVI (Mato Grosso region (left) and Nordeste (right))




(k) Crop condition development graph based on NDVI (Parana basin (left) and Southern subtropical rangelands (right))

**Table 3.13 Brazil's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| Amazonas | 1068 | -13 | 27.1 | -0.4 | 1097 | 4 |
| Central Savanna | 659 | -4 | 26.3 | 0.0 | 1320 | 8 |
| Coast | 435 | -8 | 26.6 | 0.3 | 1332 | 9 |
| Northeastern mixed forest and farmland | 1411 | 9 | 26.7 | -1.1 | 1168 | 4 |
| Mato Grosso | 1029 | -4 | 27.1 | -0.2 | 1164 | 7 |
| Nordeste | 583 | 22 | 28.3 | 0.6 | 1303 | 5 |
| Parana basin | 685 | -1 | 24.9 | 0.1 | 1213 | 4 |
| Southern subtropical rangelands | 741 | 23 | 23.7 | -0.6 | 1064 | -9 |

**Table 3.14 Brazil's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Amazonas | 2157 | -6 | 99 | 0 | 0.66 |
| Central Savanna | 1753 | 2 | 100 | 0 | 0.55 |
| Coast | 1220 | 2 | 100 | 1 | 0.80 |
| Northeastern mixed forest and farmland | 2504 | 4 | 100 | 0 | 0.72 |
| Mato Grosso | 2340 | 1 | 100 | 0 | 0.72 |
| Nordeste | 1527 | 20 | 97 | 7 | 0.53 |
| Parana basin | 1853 | 2 | 100 | 0 | 0.87 |
| Southern subtropical rangelands | 1751 | 10 | 100 | 0 | 0.76 |

AFG AGO ARG AUS BGD BLR BRA **CAN** DEU EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN KHM LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [CAN] Canada

The current reporting period covers winter wheat in Canada. Most agricultural areas were still covered in snow from January to March, which limits the relevance of NDVI-based indicators in the three months leading to April.

Nationwide, rainfall was average (RAIN, 0%), temperature TEMP was below by -1.4°C, while the radiation was slightly above average (RADPAR, +2%). The CALF was markedly below the recent 5-years average (-28%), and VCIx reached 0.80. The potential biomass was below the recent 15-years average (BIOMSS, -7%) due to the low temperature.

Compared to their recent average, the three main wheat provinces had a precipitation shortfall (Alberta -26%, Manitoba –19%, Saskatchewan -29%) and rather low temperature (Alberta -1.9°C, Manitoba -1.7°C, Saskatchewan -1.8°C). Though the radiation were slightly above the average (Alberta +5%, Manitoba +2%, Saskatchewan +7%), the three provinces have below average biomass production potentials (Alberta -4%, Manitoba –7%, Saskatchewan -4%) generally indicating unfavorable growth of winter wheat.

Though the agro-climatic and agronomic indicators were poor, NDVI improved over 2018 in April was close to the recent 5-years average.

Although current indicators are mixed, the overall condition of winter wheat in Canada could turn favorable if conditions (especially rainfall) are favourable from May.

**Regional analysis**

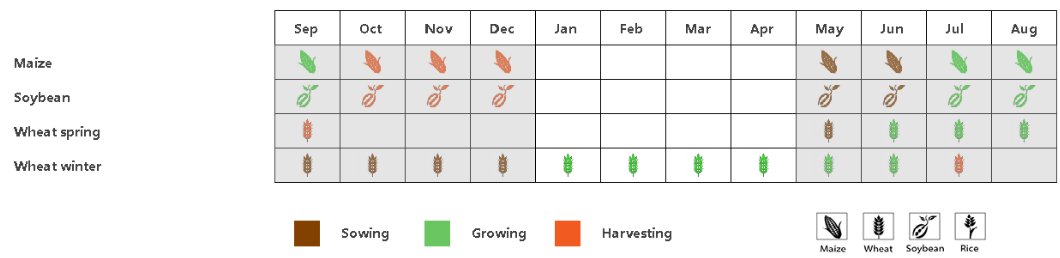
The Prairies (area identified as 53 in the maximum VCI map) and Saint Lawrence basin (49, covering Ontario and Quebec) are the major agricultural regions.

In the Prairies, the main food production area in Canada, rainfall was below average (RAIN 140 mm, -26%), temperature was largely lower than the recent average (-1.9°C), while the radiation was slightly above average (+6%). Due to the rainfall deficit and low temperature, the potential biomass was slightly below average as well (BIOMSS, -5%). The Cropped Arable Land Fraction fell significantly below the 5YA (-50%), and the VCIx was 0.81. The NDVI values from late March to April were better than during 2018 and close to the last 5-years average. Even if winter wheat condition in the region should be favorable, production could be poor due to the low CALF.

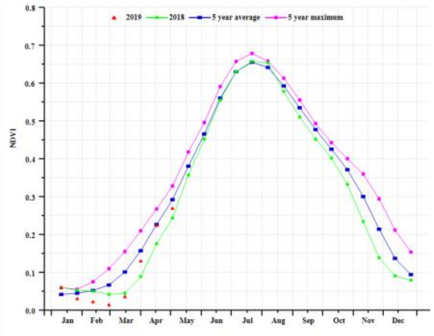
In the Saint Lawrence basin, rainfall was significantly above average (391 mm equivalent to +38%), the temperature and radiation were both slightly below average (TEMP -0.9°C; RADPAR -3%). Both potential biomass and the Cropped Arable Land Fraction were below the average (BIOMSS -10%, CALF -27%), while the VCIx was 0.79. The NDVI profiles also indicate unfavorable conditions. Production of this region is likely to be poor.

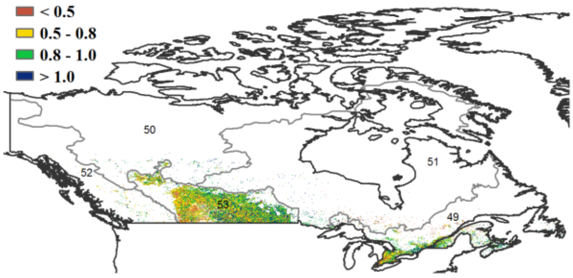
Overall, the current wheat production prospects of Canada are unfavourable, but the outcome of the season could still favorable depending on weather from May.

**Figure 3.12 Canada's crop condition, January - April 2019**

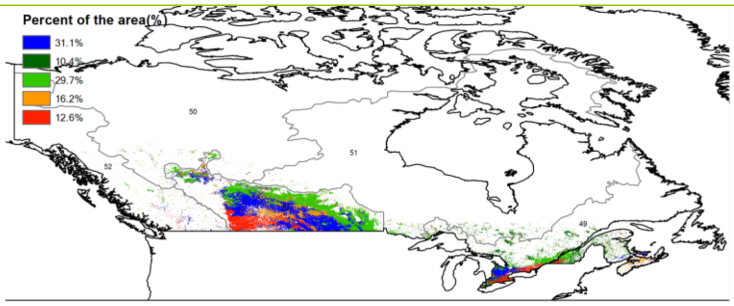


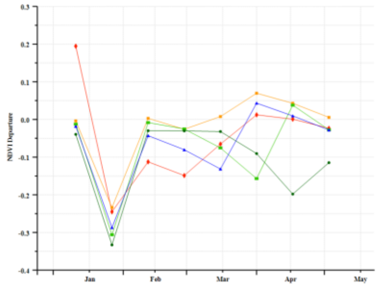

(a). Phenology of major crops



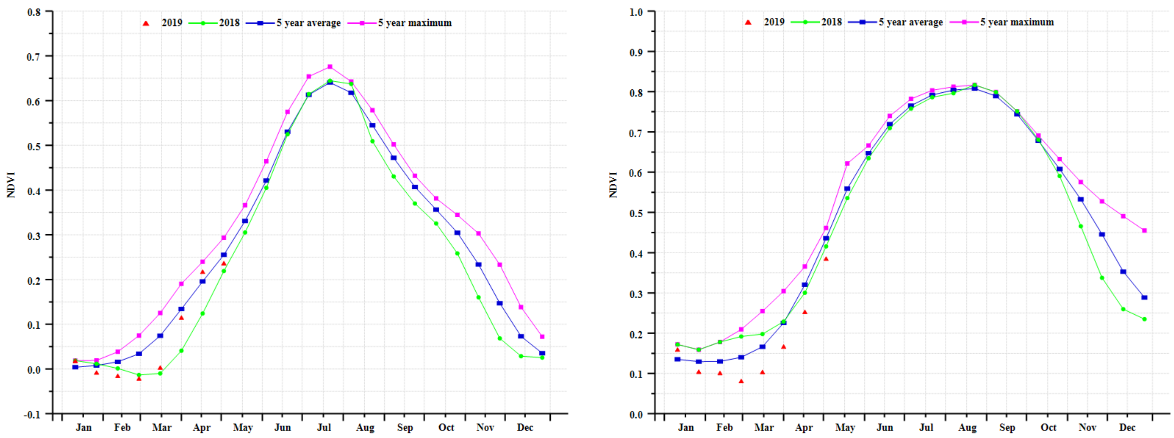




(b) Crop condition development graph based on NDVI (c) Maximum VCI




(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles




(f) Crop condition development graph based on NDVI (Canadian Prairies region (left) and Saint Lawrence basin region (right))

**Table 3.15 Canada's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Saint Lawrence basin | 391 | 38 | -6.0 | -0.9 | 568 | -3 |
| Prairies | 140 | -26 | -8.8 | -1.9 | 603 | 6 |

**Table 3.16 Canada agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Saint Lawrence basin | 409 | -10 | 36 | -27 | 0.79 |
| Prairies | 411 | -5 | 3 | -50 | 0.81 |

# [DEU] Germany

During this reporting period, winter wheat and barley were at the vegetative stage, and maize was being planted. Generally, the crops in Germany showed above average condition in most regions.

For the country, total precipitation (as measured by the RAIN indicator) was 5% above average, temperature was well above average (Temp, +1.2°C) and radiation just above (RADPAR, +1%). Significantly above average precipitation occurred throughout the country from January to early-February, early March to mid-March and after mid-April. In addition to late January and early April to mid-April, warmer-than-usual conditions prevailed over the entire country during this reporting period. Due to favorable temperature and adequate water supply, the biomass production potential (BIOMSS) is expected to increase 9% over average nationwide.

As shown in the national crop condition development graph and the NDVI profiles, national NDVI values were below average before early February, then close to and above the average from mid-February to mid-April, and then again below average after mid-April. These observations are confirmed by the NDVI profiles and 63.9% of regional NDVI values were above average after early February according to the NDVI profiles. The spatial pattern is reflected by VCIx, especially in the southern Bavarian Plateau area, with a VCIx of 0.93 for Germany overall. The outlook of winter crops is above average. CALF during the reporting period was 99%, the same as the recent five-year average.

Generally, the values of agronomic indicators show favorable condition for most winter crops and the sowing of summer crops in Germany.

**Regional analysis**

Based on cropping systems, climatic zones, and topographic conditions, six sub-national agro-ecological regions are adopted for Germany. They include: The Wheat zone of Schleswig-Holstein and the Baltic coast, Mixed wheat and sugar beets zone of the north-west, Central wheat zone of Saxony and Thuringia, Sparse crop area of the east-German lake and Heathland area, Western sparse crop area of the Rhenish massif, and the Bavarian Plateau.

**Schleswig-Holstein and the Baltic coast** is among the major winter wheat zones of Germany. The region experienced warm weather (TEMP, +1.8°C) and radiation above average (RADPAR, +1%); RAIN was average. As a result, BIOMSS is expected to increase by 13% compared to average. As shown in the crop condition development graph based on NDVI, the values were above average or over the five-year maximum, except late in January. The area has a high CALF (100%) as well as a favorable VCIx (0.96), indicating high cropped area and favorable crop prospects.

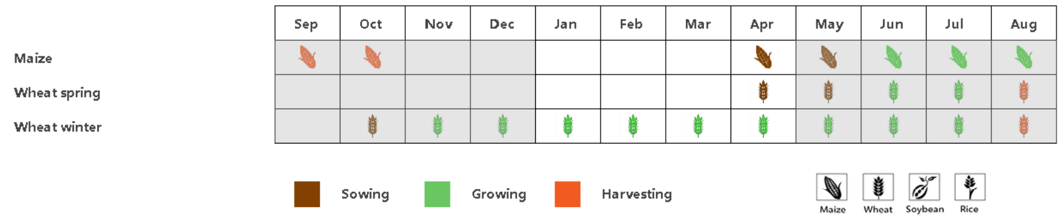
Wheat and sugar-beets are major crops in the **Mixed wheat and sugar-beets zone of the north-west**. Compared to average, RAIN was above (+12%), and so were temperature (TEMP +1.3°C), radiation (RADPAR +1%) and BIOMSS (+12%). As shown in the crop condition development graph based on NDVI, the values were above average or over the five-year maximum during this monitoring period. The area has a high CALF (100%) and crop condition for the region is good according to the high VCIx (0.94).

**Central wheat zone of Saxony and Thuringia** is another major winter wheat zone. RAIN and TEMP were above average (+3% and +1.3°C, respectively) and radiation was average. Mostly due to favourable temperature condition, the biomass potential (BIOMSS indicator) increased by 9% above average. As shown in the crop condition development graph based on NDVI, the values were below average before early February, and above those of 2018 and close to average after early February. The area has a high CALF (99%) and the VCIx of 0.92 for this region also shows favorable crop prospects.

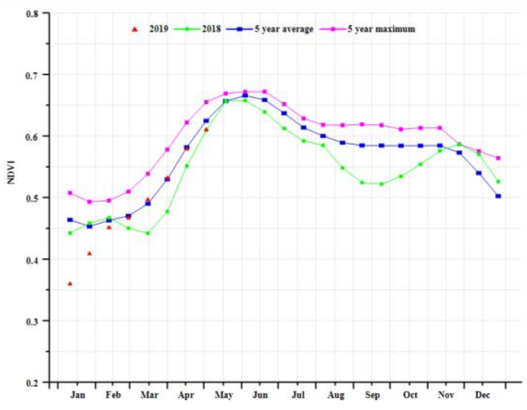
Crop condition was fair in the **East-German lake and Heathland sparse crop area** and **Western sparse crop area of the Rhenish massif**. Adequate rain was recorded in those two regions (RAIN +8% and +18%, respectively), as well as significantly above average temperatures (+1.5°C and +1.0°C). Radiation in East-German lake and Heathland sparse crop area was above average (RADPAR +2%) and below average (-2%) in Western sparse crop area of the Rhenish massif. Due to adequate rain and suitable temperature condition, BIOMSS was higher by 11% and 13%, respectively, compared to the average of the past 15 years, and CALF was at 99% for both. As shown in the crop condition development graph based on NDVI, the values in East-German lake and Heathland sparse crop area was below average in early January, then above average from mid-January to mid-April, and again below average after mid-April; the values in Western sparse crop area of the Rhenish massif was above those of 2018 during this reporting period, except January. Overall, favorable crop condition was recorded with high VCIx values of 0.89 for the eastern and 0.98 for the western areas, respectively, showing favorable crop prospects for two regions.

Next to wheat, two summer crops (maize and potato) are the major crops on the **Bavarian Plateau**. The CropWatch agroclimatic indicators show that close to normal weather was recorded for RAIN (-7%), TEMP (+0.8°C) and RADPAR (+1%). Compared to average, BIOMSS increased 2%. The area has a high CALF (98%) as well as a favorable VCIx (0.90), indicating high cropped area and favorable winter crop prospects.

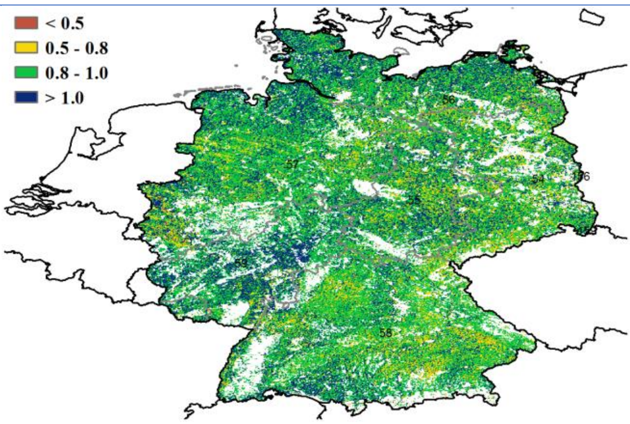
**Figure 3.13 Germany's crop condition, January-April 2019**



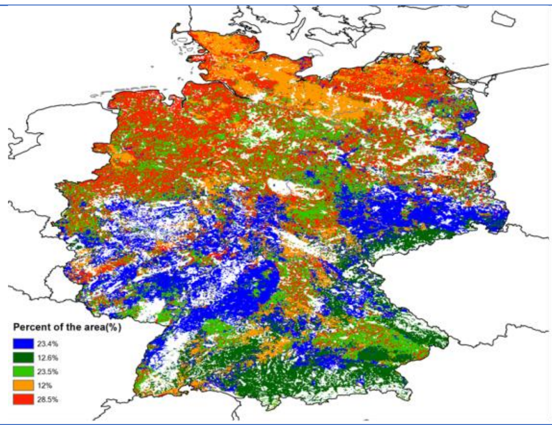

(a). Phenology of major crops



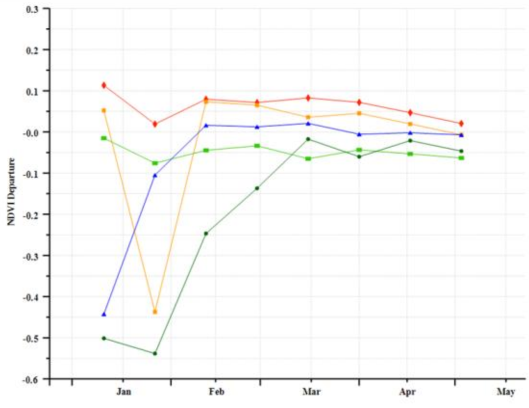

(b) Crop condition development graph based on NDVI



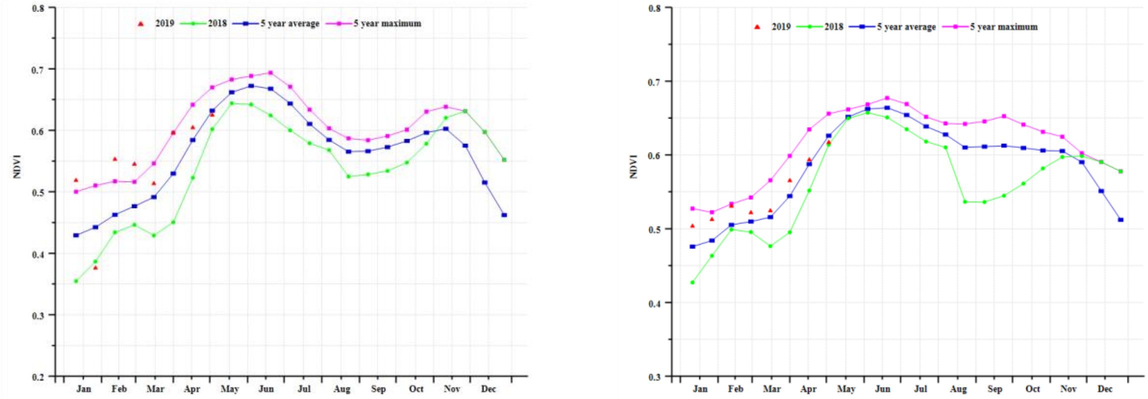

(c) Maximum VCI



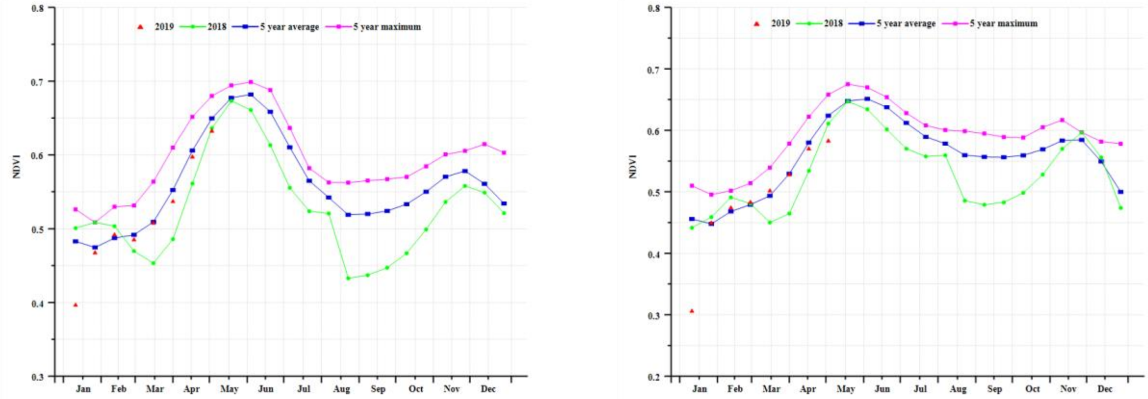

(d) Spatial NDVI patterns compared to 5YA



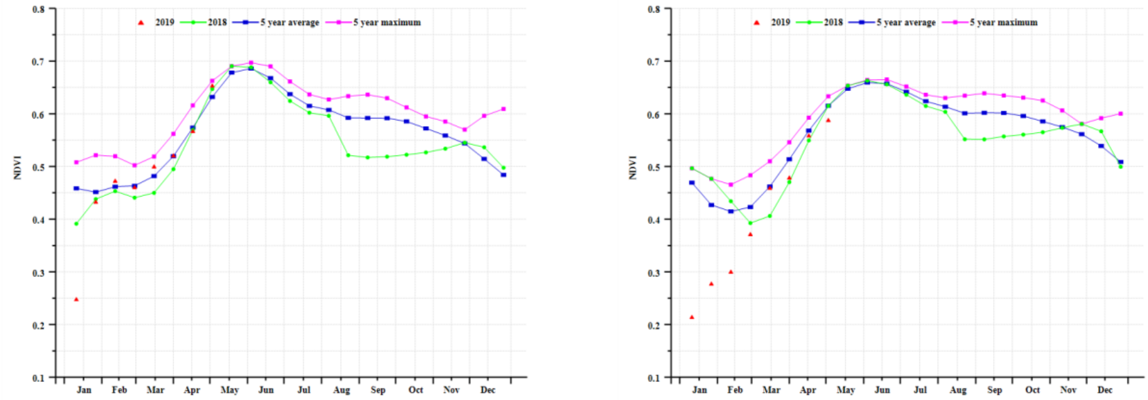

(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Wheat zone of Schleswig-Holstein and the Baltic coast (left) and Mixed wheat and sugar beets zone of the north-west(right))




(g) Crop condition development graph based on NDVI (Central wheat zone of Saxony and Thuringia(left) and Sparse crop area of the east-German lake and Heathland (right))




(h) Crop condition development graph based on NDVI (Western sparse crop area of the Rhenish massif (left) and Bavarian Plateau (right))

**Table 3.17 Germany agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Wheat zone of Schleswig-Holstein and the Baltic coast | 267 | 0 | 5.9 | 1.8 | 463 | 1 |
| Mixed wheat and sugarbeets zone of the north-west | 321 | 12 | 6.3 | 1.3 | 483 | 1 |
| Central wheat zone of Saxony and Thuringia | 249 | 3 | 5.7 | 1.3 | 508 | 0 |
| East-German lake and Heathland sparse crop area | 267 | 8 | 5.5 | 1.5 | 508 | 2 |
| Western sparse crop area of the Rhenish massif | 290 | 18 | 5.6 | 1.0 | 505 | -2 |
| Bavarian Plateau | 212 | -7 | 4.4 | 0.8 | 572 | 1 |

**Table 3.18 Germany's agronomic indicators by sub-national regions, current season's value and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Wheat zone of Schleswig-Holstein and the Baltic coast | 1043 | 13 | 100 | 0 | 0.96 |
| Mixed wheat and sugarbeets zone of the north-west | 1096 | 12 | 100 | 0 | 0.94 |
| Central wheat zone of Saxony and Thuringia | 964 | 9 | 99 | 0 | 0.92 |
| East-German lake and Heathland sparse crop area | 1009 | 11 | 99 | 0 | 0.89 |
| Western sparse crop area of the Rhenish massif | 1024 | 13 | 99 | 0 | 0.98 |
| Bavarian Plateau | 847 | 2 | 98 | -1 | 0.90 |

AFG AGO ARG AUS BGD BLR BRA CAN DEU **EGY** ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN KHM LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [EGY] Egypt

The reporting period covers the final stages of winter wheat and the start of the sowing of both maize and rice. The recorded rainfall (RAIN) was 42 mm, 20% less than the average (15YA), the average temperature was 15°C (-1.3°C). The radiation (RADPAR) was 1013MJ/m2 (-1%) and the estimated biomass (BIOMSS) was 225gDM/m2 (-19%). The nation-wide NDVI development graph shows that the condition of the crops was below the 5 years average. NDVI profile maps indicate that about 29% of cultivated areas were above average and about 21% of the total cropped area conditions were below average. The rest of the area fluctuated around the average throughout the reporting period. The VCIx map indicates that the condition of the current crops, mainly the winter wheat, is good. This agrees with the whole country VCIx value (0.97). Prospects for winter wheat are favorable.

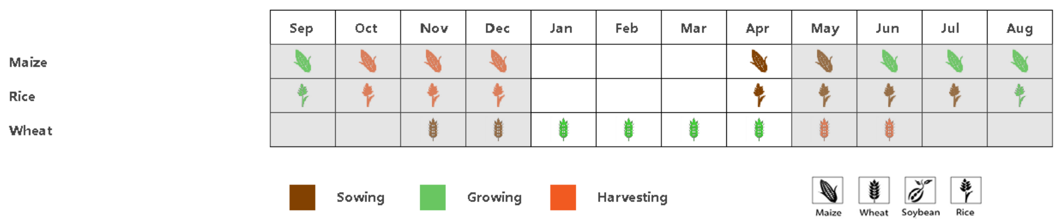
**Regional analysis**

Egypt can be subdivided into three agro-ecological zones (AEZ) based mostly on cropping systems, climatic zones, and topographic conditions. Only two of them are relevant for crops: the Nile Delta and Mediterranean coastal strip, and the Nile Valley.

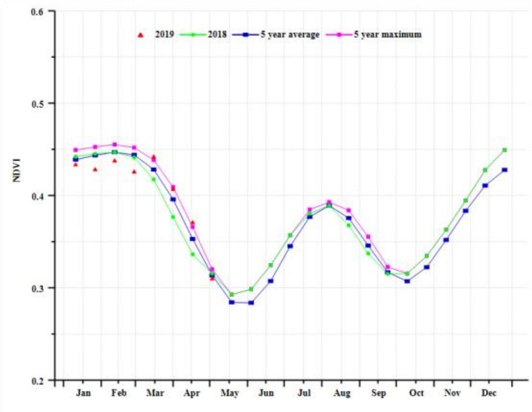
In the first zone, the average rainfall was 30 mm (-29%), while in the Nile Valley zone it reached 128 mm, an increase of 24% over average. Due to most of the Egyptian crop production being irrigated, rainfall makes little change in the outcome of the season. RADPAR for both zones was about -1% below average and the BIOMSS index shows a decrease of -15% in Nile Delta and Mediterranean coastal strip zone, and 38% increase over Nile Valley zone compared to the 15YA.

The NDVI-based Crop condition development graphs indicate below average conditions for both zones but, crop condition was lower in the Nile Delta and Mediterranean coastal strip zone than in Nile Valley zone, in agreement with the VCIx values (0.94 and 1.13, respectively).

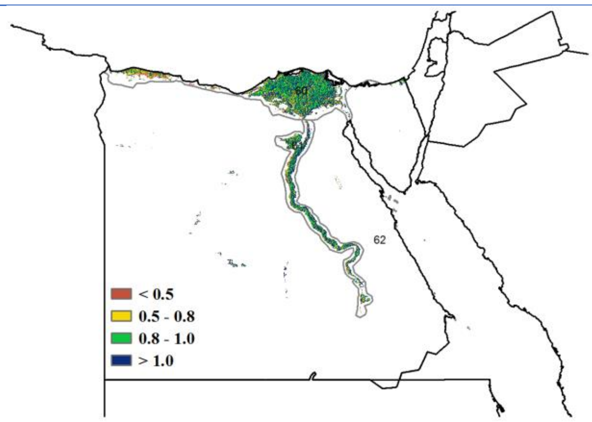
**Figure 3.14 Egypt's crop condition, January - April 2019**



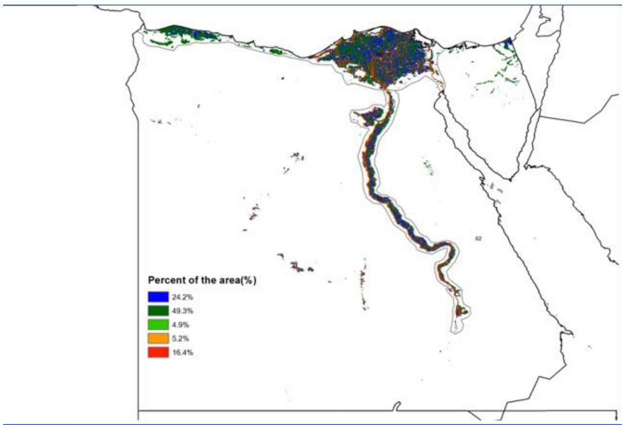

(a). Phenology of major crops



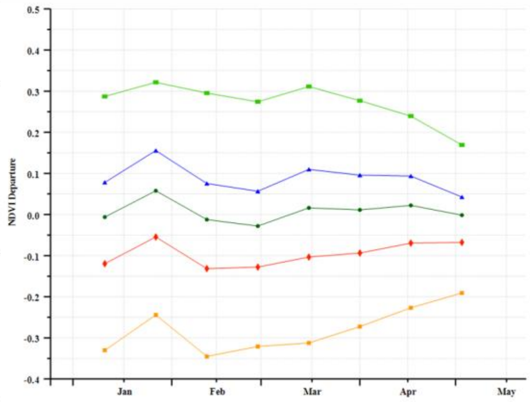

(b) Crop condition development graph based on NDVI



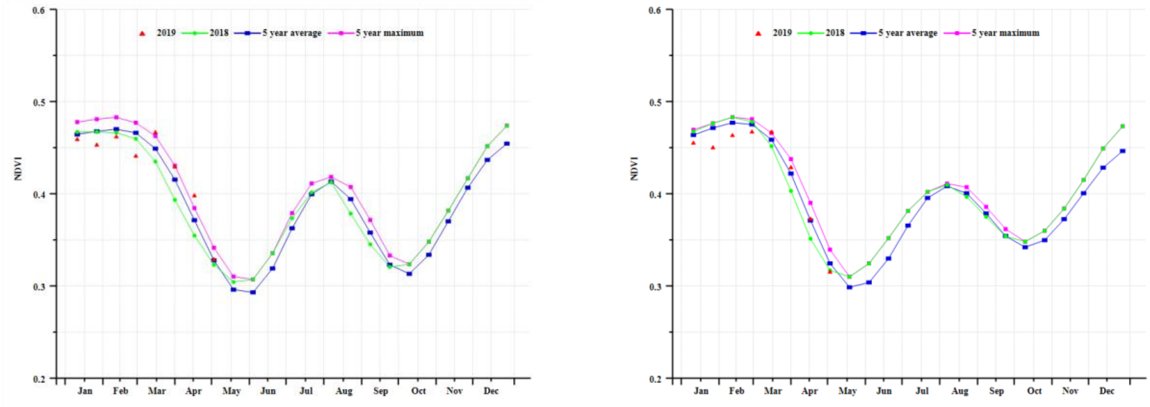

(c) Maximum VCI




(d) Spatial NDVI patterns compared to 5YA




(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Nile Delta (left) and Nile Valley (right))

**Table 3.19 Egypt's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| Nile Delta and Mediterranean coastal strip | 30 | -29 | 15.2 | -1.4 | 994 | -1 |
| Nile Valley | 128 | 24 | 16.0 | -1.6 | 1118 | -1 |

**Table 3.20 Egypt's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Nile Delta and Mediterranean coastal strip | 188 | -15 | 71 | 3 | 0.94 |
| Nile Valley | 357 | 38 | 81 | 5 | 1.13 |

# [ETH] Ethiopia

The reporting period covers the beginning of the early Belg season in bimodal rainfall areas, especially wheat and maize in East and West Hararghe and western SNNPR. It also includes the very first sowing of long maturing Meher crops (maize, barley and sorghum), teff and wheat in central and northern areas, Oromia and Amhara regions.

At the national level, all CropWatch agro-climatic and agronomic indicators were slightly above average: RAIN, +5%, TEMP +0.8°C, RADPAR +2%, BIOMSS +3% and CALF +7%. According to the NDVI-based season development graph, crop condition was below the five years average. The maximum VCI value was 0.85 and recorded as "good". According to NDVI clusters and profiles 47% of the country experienced less favorable crop condition. Other areas (central Oromia, Amhara, and Eastern Tigray) enjoyed favorable condition with the maximum VCI ranging from 0.8 to 1.0. The reported period is till too early for assessing the outcome of the Belg crops but there is currently no reason for concern. In particular, land preparation is for Meher crops (to be harvested from August to December) is taking place under favourable conditions.

**Regional Analysis**

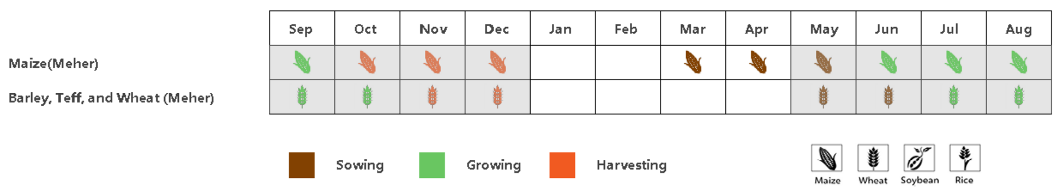
The reporting period covers main rain-fed cereal producer areas found in the South-eastern mixed-maize zone, Western mixed maize zone, and Central-northern maize-teff highlands zone.

**The South-eastern mixed maize zone** recorded 104 mm of rainfall, a significantly drop of 58% below average. TEMP and the RADPAR were 1.1°C and 8% above average, respectively. The resulting BIOMSS is down 48%, which may affect livestock condition and production. CALF decreased by 40%. NDVI was below the five-year average, accompanied by a recorded low value of maximum VCI 0.54. CropWatch assesses the conditions in the south-eastern mixed-maize zone as unfavorable.

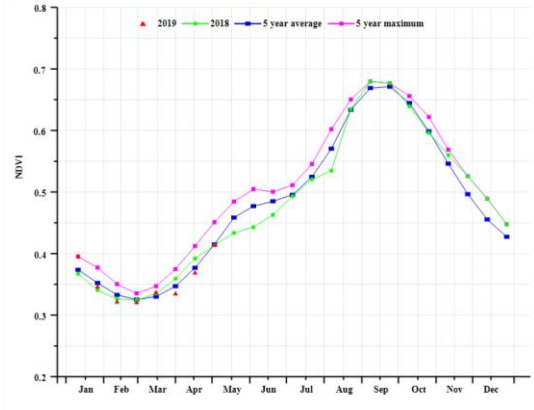
Unlike the South-eastern mixed maize zone, **the Western mixed maize zone** experienced slightly above average or average weather conditions: Rain +10%, TEMP +0.3°C, RADPAR average and BIOMSS +6%. CALF increased 1% but relatively low VCIx prevails (0.75). NDVI was above average from January to Mid- March but then dropped to slightly below average until the end of April. Conditions remain favorable for Meher land preparation and livestock production.

Except for a small drop in sunshine (RADPAR -1%) all indicators were above average in **the Central-northern maize-teff highlands zone**: at 166 mm RAIN was 37% above the average, temperature increased 1.1°C and BIOMSS was up 30%. Like the western mixed maize zone, this zone was favorable for livestock production. CALF showed a significant increase of 30%. This zone contains Central Amhara, the main teff and wheat-producing areas. Based on high NDVI (above the 5YA) and VCIx above 1 conditions were favorable for land preparation and first early planting for the Meher season.

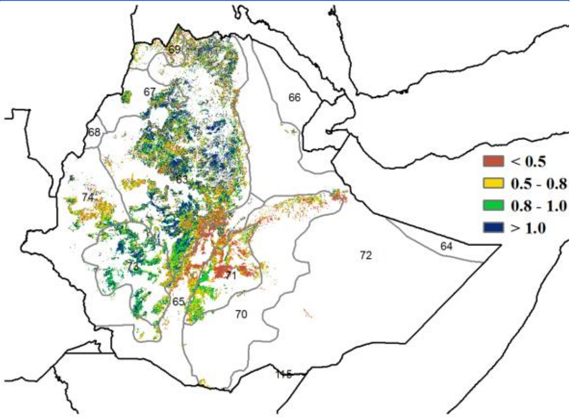
**Figure 3.15 Ethiopia's crop condition, January - April 2019**



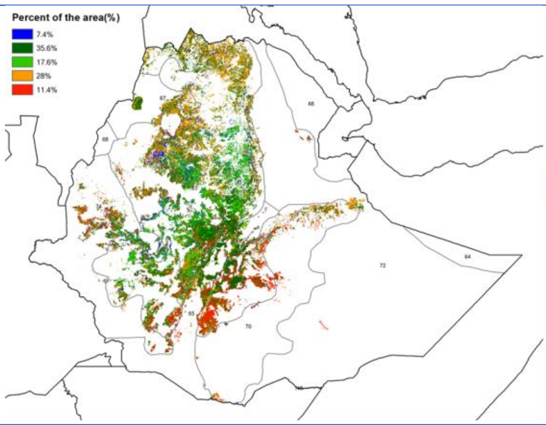

(a). Phenology of major crops



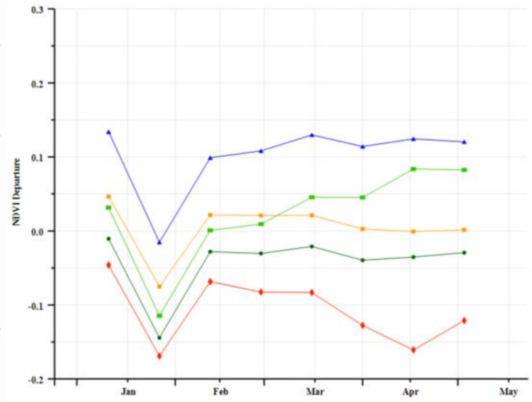

(b) Crop condition development graph based on NDVI



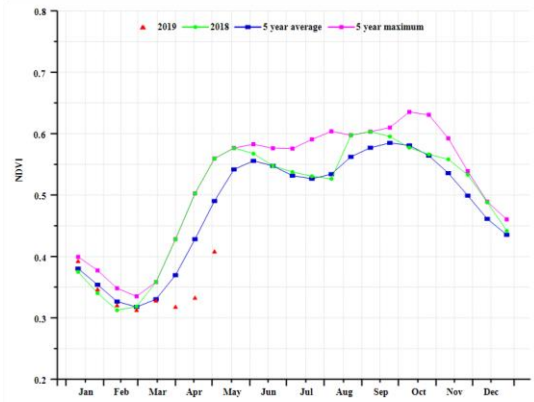

(c) Maximum VCI

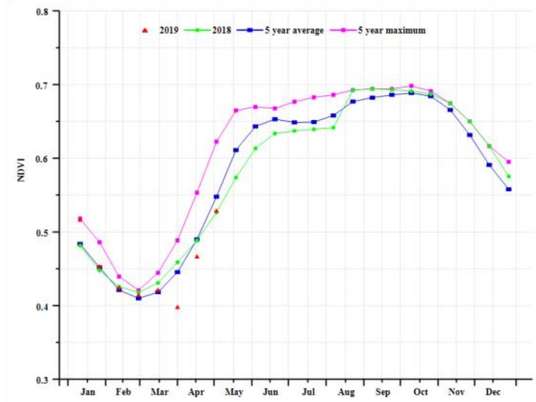



(d) Spatial NDVI patterns compared to 5YA

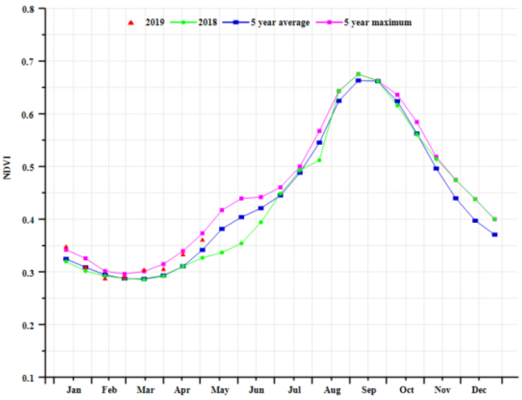



(e) NDVI profiles




(f) Crop condition development graph based on NDVI (south-eastern mixed-maize (left) and western mixed maize zone (right))




(g) Crop condition development graph based on NDVI (Central-northern maize-teff highlands zone)

**Table 3.21 Ethiopia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| South-eastern mixed maize zone | 104 | -58 | 23.3 | 1.1 | 1395 | 8 |
| Western mixed maize zone | 162 | 10 | 25.5 | 0.2 | 1291 | 0 |
| Central-northern maize-teff highlands | 166 | 37 | 21.2 | 1.0 | 1397 | -1 |

**Table 3.22 Ethiopia's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| South-eastern mixed maize zone | 461 | -42 | 38 | -40 | 0.54 |
| Western mixed maize zone | 595 | 6 | 95 | 1 | 0.75 |
| Central-northern maize-Teff highlands | 667 | 30 | 35 | 38 | 0.95 |

# [FRA] France

The monitoring period covers winter wheat growth, as well as the sowing of spring wheat and maize. CropWatch agroclimatic indicators show that the conditions were close to average at the national level only for temperature (-0.5°C compared with average). RAIN was low (down 18%) and sunshine was high (RADPAR +6%). The NDVI development graph for the entire country indicates crop condition below the average of the past five years before March but close to average values in April. The spatial NDVI patterns compared to the five-year average indicate that NDVI was average in 68.4% of arable land, which is also reflected by the maximum VCI (VCIx) in the different areas, with a VCIx of 0.95 for France overall. It is unclear at this early stage whether winter crops will be affected negatively by rainfall or positively by increased sunshine, which is frequently a limiting factor in France.

**Regional analysis**

Considering cropping systems, climatic zones, and topographic conditions, additional sub-national detail is provided for eight agro-ecological zones. They are identified in the maps by the following numbers: (78) Northern barley region; (82) Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean; (79)Maize_barley and livestock zone along the English Channel, (80) Rapeseed zone of eastern France;(75) Massif Central Dry zone; (81) South-western maize zone; (76) Alpes region and (77), the Mediterranean zone.

In the **Northern barley region**, RAIN was 9% below average, while RADPAR was 8% above. Biomass were below average 4%, reflecting overall average crop condition.

**The Mixed maize/barley and rapeseed zone** from the Center to the Atlantic Ocean recorded 85 mm of rainfall over four months (RAIN -26%). Temperature was 0.6°C below, but RADPAR was 8% above. The drop in BIOMSS was 26% compared to the five-year average. The NDVI profile confirms the conditions of crop was average.

**The Maize/barley and livestock zone** along the English Channel experienced average temperature, RAIN was 23% below average, and biomass 20% below average. According to the NDVI profile and VCIx map, crop condition was not satisfactory in the region.

**The Rapeseed zone of eastern France** recorded a 12% rainfall deficit, with above average values for RADPAR (3%). BIOMSS for the region is 11% below the five-year average, reflects the generally normal crop and especially pasture condition, as confirmed by the NDVI development graph.

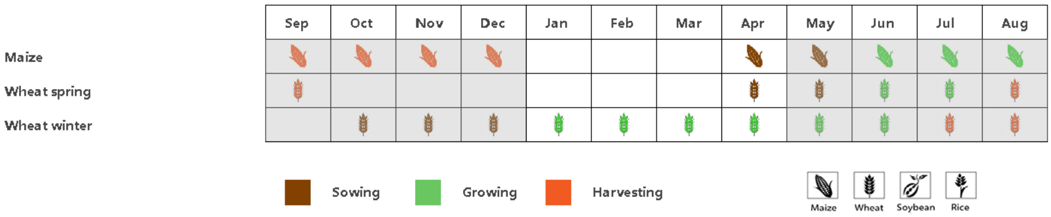
Mostly unfavorable climatic conditions dominated the **Massif Central Dry zone** over the reporting period. Rainfall was 25% below average (159 mm over four months). Temperature was 0.6°C below average. The dry conditions have hampered biomass development (BIOMSS down 21%) which is most relevant for pastures.

**The South-western maize zone** is one of the major irrigated maize regions in France. Temperature dropped 1.0°C below average. RAIN was average, but radiation was above expectations (RADPAR+2%). Crop condition was average according to the NDVI development graph, as confirmed by the decrease of BIOMSS by 5% compared to the 5YA. The VCIx map, shows that the crop condition was normal.

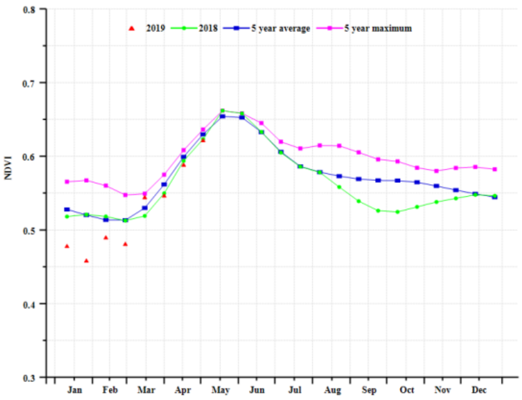
Generally, the most unfavorable weather conditions were observed in the **Alpes region** (RAIN -41%) even if other indicators remain close to average. According to the NDVI profiles, crop condition remained unfavorable before April. BIOMSS is 25% below its five-year average, and the VCIx value of 0.82 for the region is the lowest in the country.

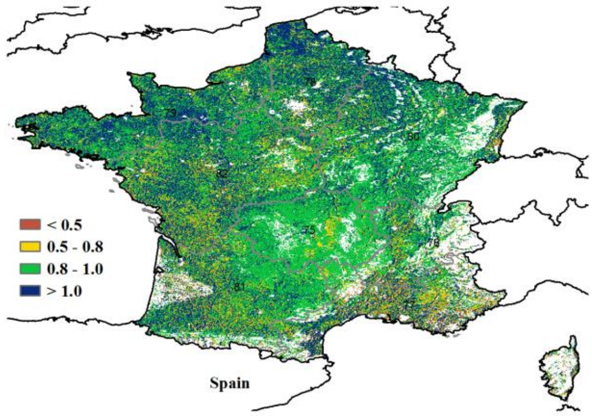
Finally, environmental conditions for the **Mediterranean zone** were unfavorable with the following values: RAIN -35%, TEMP -0.2°C, and RADPAR +8%. Most arable land in this region was cropped during the monitoring period. Despite the VCIx of 0.92, the NDVI profile confirms that crop condition was similar to 2018 and below average.

**Figure 3.16 France's crop condition, January - April 2019**



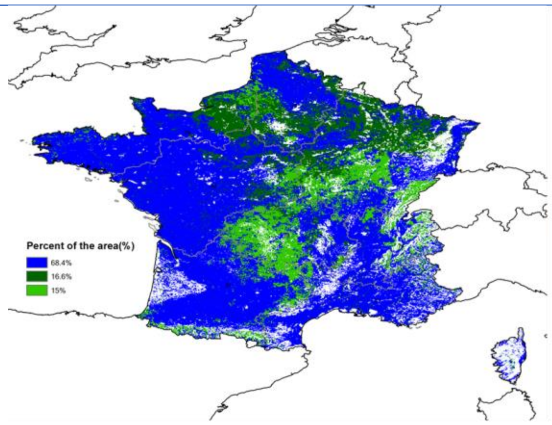

(a). Phenology of major crops

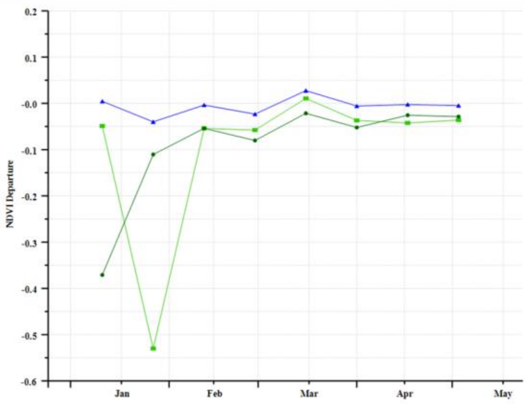



(b) Crop condition development graph based on NDVI

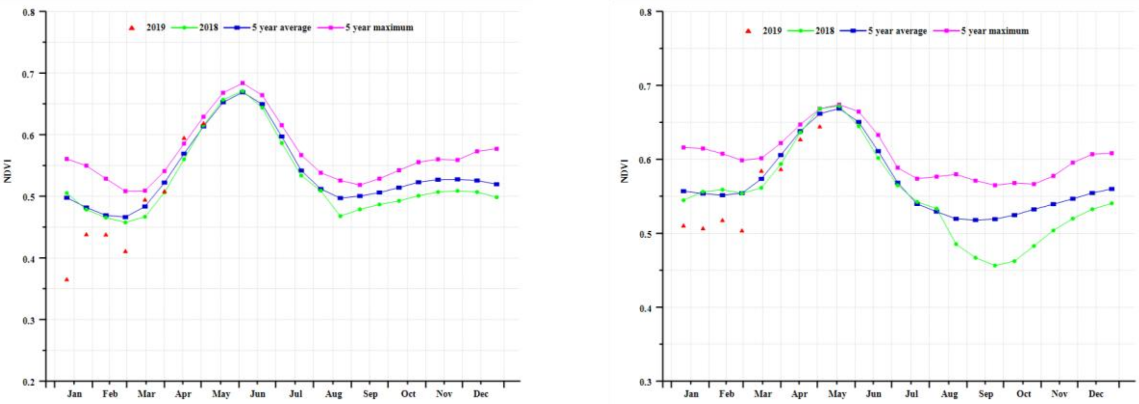
(c) Maximum VCI



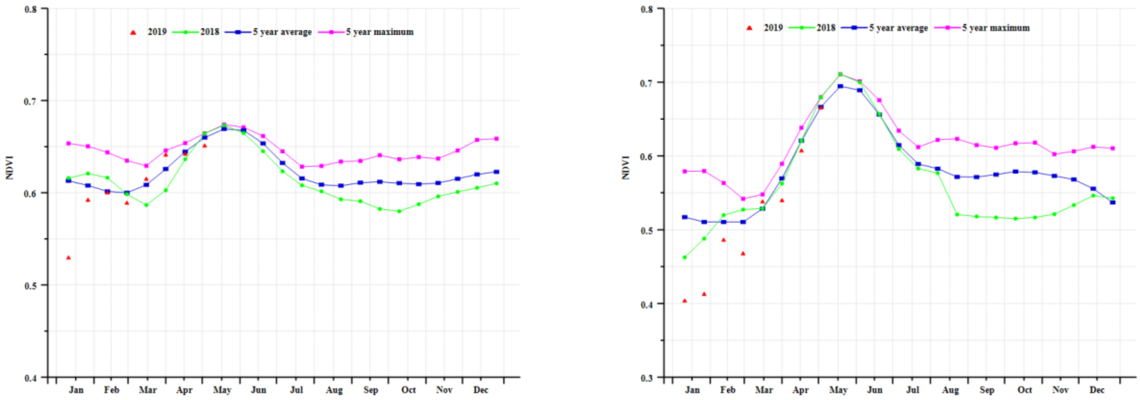




(d) Spatial NDVI patterns compared to 5YA

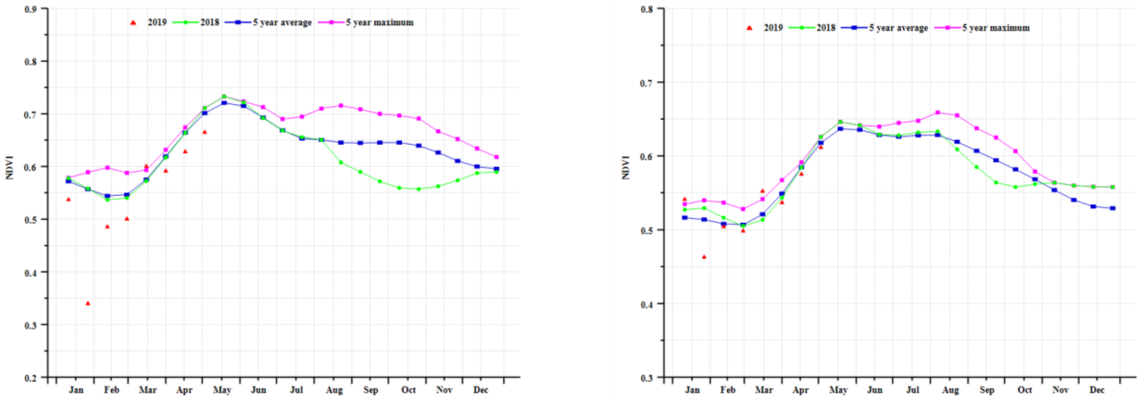
(e) NDVI profiles



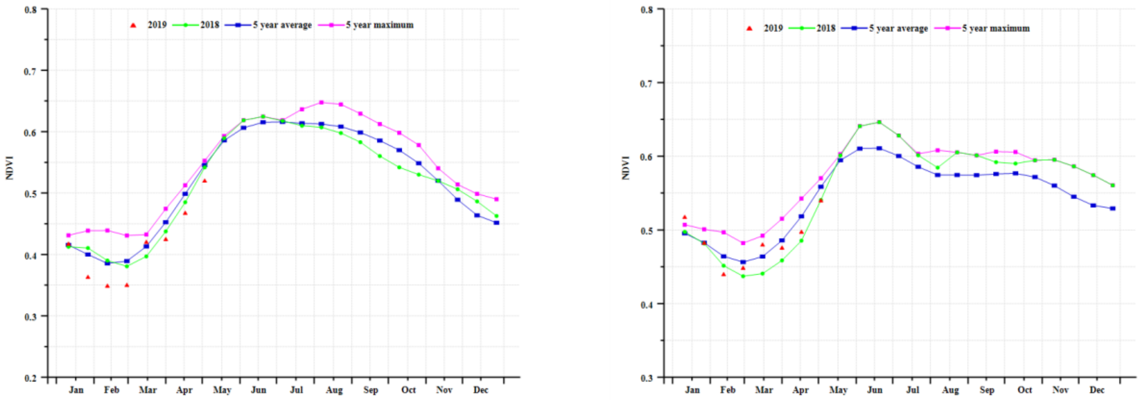

(f) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))




(g) Crop condition development graph based on NDVI (Maize, barley and livestock zone (left) and Rapeseed zone (right))




(h) Crop condition development graph based on NDVI (Dry Massif Central zone (left) and Southwest maize zone (right))




(i) Crop condition development graph based on NDVI (Eastern Alpes region (left) and Mediterranean zone (right))

**Table 3.23 France's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m2) | Departure from 15YA (%) |
| Northern Barley zone | 220 | -7 | 7.2 | 0.1 | 565 | 8 |
| Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean | 85 | -26 | 7.9 | -0.6 | 625 | 8 |
| Maize barley and livestock zone along the English Channel | 142 | -23 | 8.0 | -0.1 | 566 | 5 |
| Rapeseed zone of eastern France | 160 | -12 | 6.0 | -0.4 | 571 | 3 |
| Massif Central Dry zone | 159 | -25 | 5.6 | -0.6 | 637 | 6 |
| Southwest maize zone | 243 | 2 | 7.8 | -1.0 | 688 | 6 |
| Alpes region | 146 | -41 | 3.7 | -0.8 | 699 | 5 |
| Mediterranean zone | 138 | -35 | 6.3 | -0.2 | 797 | 8 |

**Table 3.24 France's agronomic indicators by sub-national regions, current season's value and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Northern Barley zone | 896 | -4 | 100 | 0 | 1.01 |
| Mixed maize /barley and rapessed zone from the Centre to the Atlantic Ocean | 396 | -26 | 100 | 0 | 0.95 |
| Maize barley and livestock zone along the English Channel | 644 | -20 | 100 | 0 | 1.00 |
| Rapeseed zone of eastern France | 689 | -11 | 99 | 0 | 0.97 |
| Massif Central Dry zone | 630 | -21 | 100 | 0 | 0.92 |
| Southwest maize zone | 779 | -5 | 98 | 0 | 0.94 |
| Alpes region | 536 | -25 | 85 | -2 | 0.82 |
| Mediterranean zone | 531 | -24 | 89 | 2 | 0.92 |

# [GBR] United Kingdom

Crops showed generally favorable condition during the reporting period. Currently, wheat, winter barley, and rapeseed are in the vegetative stages. Agroclimatic indicators show that rainfall and biomass were below average (RAIN, -15%) and biomass (BIOMSS, -3%) with close to average temperature (TEMP,0.2°C), radiation (RADPAR) is marked increased by 6.2%. Biomass decreased the recent fifteen-year average due to a shortage rainfall. As shown by the NDVI profiles, the national NDVI values were higher than average from late January to February and March and April, but they dropped twice which are late February and late April. According to the crop condition development graph, NDVI values were above average only 37.6% including East Lothian, Berwick, Northumberland, Durham and most of Yorkshire, some area of Lincoln, Suffolk, Essex and Warwick, Worcester, Buckingham, Hertford and Surrey. 62% of the region qualified below average crop condition at the time of reporting in Rutland, Cambridge, southern part of Lincoln, Nottingham, and Fife, Perth, Angus, Kincardine, and South west region (Cornwall, Oxfort, Berk and Wilt). The VCIx was good at 0.99 and area of cropped arable land fraction (CALF) is unchanged compared to its five-year average.

**Regional analysis**

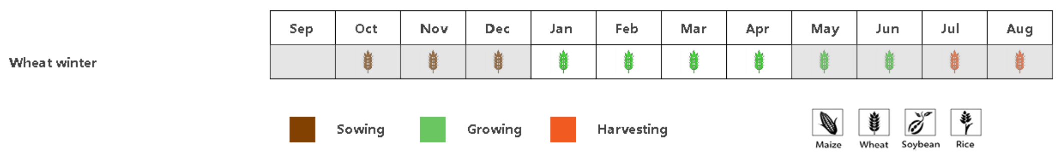
CropWatch has adopted three agro-ecological zones (AEZ) to provide a more detailed spatial analysis for the country; they include the Central sparse crop region (covering northern England, Wales, and Northern Ireland), the Northern barley region (Scotland and northern England), and the Southern mixed wheat and barley region (southern England). The Southern mixed wheat and barley region is characterized by unchanged fraction of cultivated arable land (CALF) compared to average. In the Central sparse crop area and the Northern barley region CALF increased by 1%.

In the **Central sparse crop area and the Northern barley region,** CALF increased by 1%. The area is one of the country's major agricultural regions in terms of crop production. Agroclimatic conditions include below average rainfall (-5%), above average TEMP (+0.2°C) and RADPAR (+3%), which resulted in above average BIOMSS (+4%). NDVI values were above average according to the region's crop condition development graph from January to February but NDVI was below average in late February and March. The VCIx was unusually high at 1.02.

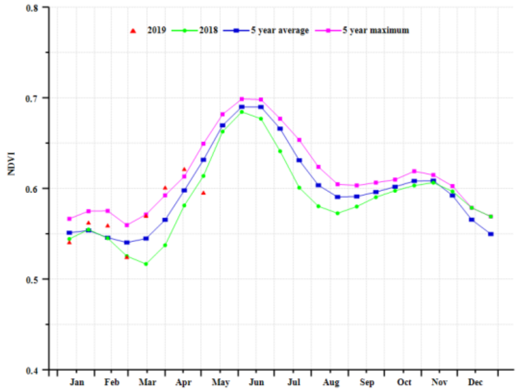
In the **main barley region**, the NDVI was below average according to the crop condition graphs from January to late February, and above average in March to late April. Compared to average, RAIN was low (down 17%), the temperature was close to average (+0.2°C) and radiation was above (+5%). The biomass production potential was up 5% compared to average. The VCIx was very hight at 1.00.

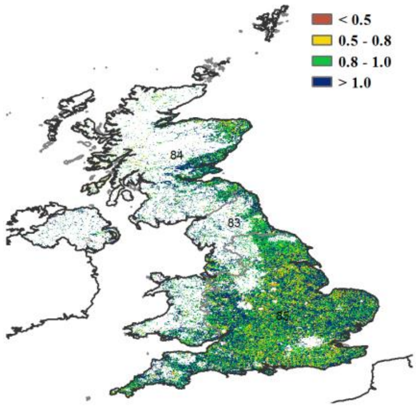
In the third region, **the southern mixed wheat and barley region**, NDVI was close to average but dropped in late April. Agroclimatic conditions include RAIN -21%, relatively close to average TEMP (+0.2°C) and rather high radiation (+8%). The regional VCIx (0.97) was well above average.

**Figure 3.17 United Kingdom crop condition, January - April 2019**



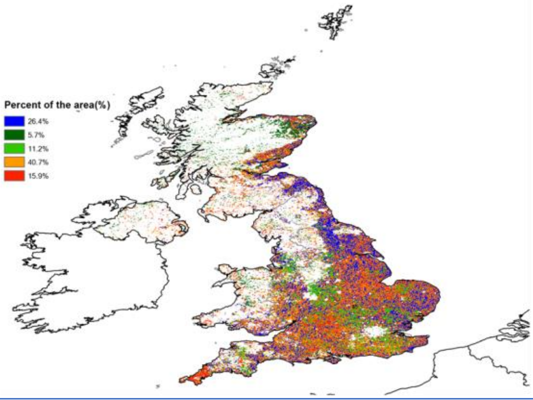

(a). Phenology of major crops

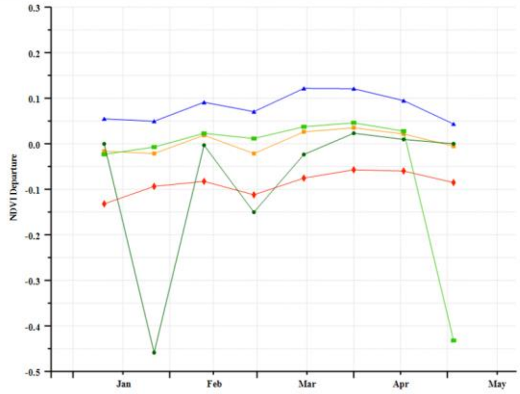



(b) Crop condition development graph based on NDVI

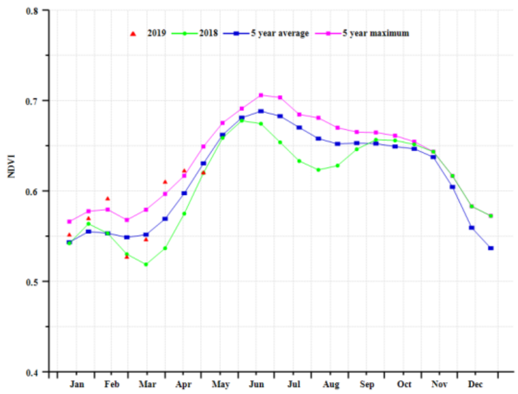
(c) Maximum VCI

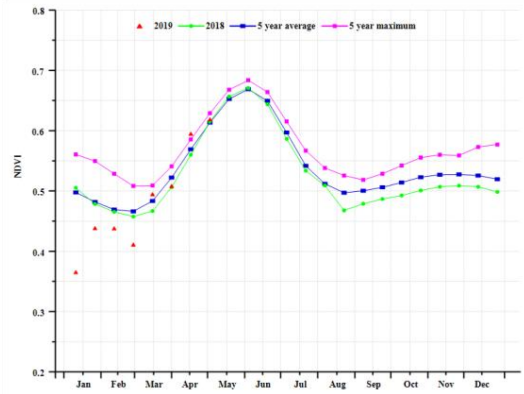


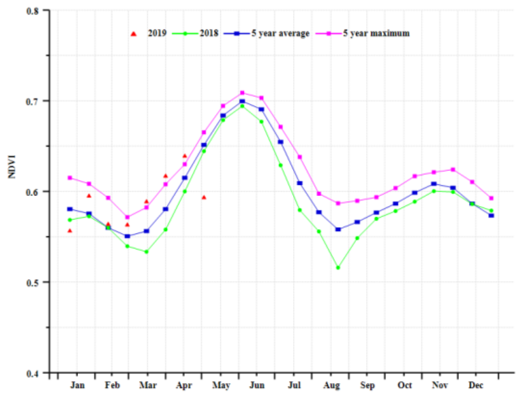

(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Sparse crop area of N England, Wales and N. Ireland (left) and Northern Barley region (right))




(g) Crop condition development graph based on NDVI (Southern mixed wheat and Barley region)

**Table 3.25 United Kingdom's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| Northern Barley area (UK) | 402 | -17 | 5.2 | 0.2 | 381 | 5 |
| Southern mixed wheat and Barley zone (UK) | 235 | -21 | 7.1 | 0.2 | 494 | 8 |
| Central sparse crop area (UK) | 384 | -5 | 6.4 | 0.2 | 423 | 3 |

**Table 3.26 United Kingdom's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Northern Barley area (UK) | 986 | 6 | 96 | 1 | 1.00 |
| Southern mixed wheat and Barley zone (UK) | 918 | -12 | 100 | 0 | 0.97 |
| Central sparse crop area (UK) | 1063 | 4 | 99 | 1 | 1.02 |

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# [HUN] Hungary

At the end of dormancy and early spring growth winter wheat showed generally unfavorable condition, at a time when early summer crop (e.g. maize) cultivation is starting. The BIOMSS is down 9.0% due to shortage of rainfall (RAIN -12%). Temperature was close to average and radiation was above by 4%. According to nationwide NDVI graphs, crop condition was below average with the maximum VCI value reaching 0.83 and the cropped arable land fraction (CALF) down at the national level. Crop condition was above average throughout the reporting period in 14.3% of arable land in western Transdanubia, and 85.7% was below average including Puszta, Northern and Central Hungary and central and southern Transdanubia.

**Regional analysis**

CropWatch has adopted four agro-ecological zones (AEZ) to provide a more detailed spatial analysis for the country. They included Northern Hungary, Central Hungary, the Puszta and Transdanubia. Specific observations for the reporting period are included for each region. In the all sub-regions, the cropped arable land fraction is down below the 5YA: 2% in the North Hungary, 6% in Central Hungary, 10% in the Puszta and just 1% in Transdanubia.

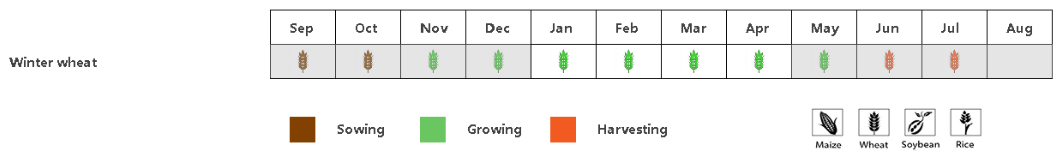
**Central Hungary** is one of the major agricultural regions in terms of crop production. A sizeable share of winter wheat, maize and sunflower is planted in this region. Agroclimatic conditions include above average radiation (RADPAR +4.5%), slightly above average temperature (TEMP +1.0°C) and below average rainfall (RAIN, -10%). The biomass production potential decreased by 6% and VCIx was just fair at 0.78. NDVI was below average.

**Northern Hungary** is another important winter wheat region. The NDVI was below average according to the crop condition graph. Compared with the recent average, temperature was about average (TEMP, +0.9°C), radiation was well above (RADPAR, +5.0%) while rainfall and biomass both dropped compared with average (RAIN -16%, BIOMSS, -13%). The VCIx was normal at 0.83.

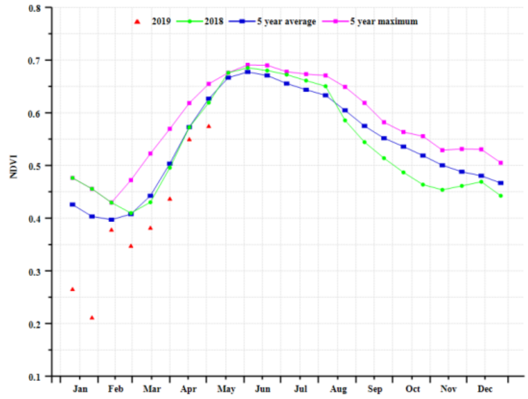
**The Puszta region** grows mostly winter wheat, maize and sunflower especially in the counties of Jaz-Nagykum-Szolnok and Bekes. According to NDVI development graph, crop condition was below average from January to April. The biomass is decreased by 10% due to low rainfall (RAIN -8%) while temperature was average (TEMP +0.9°C) and radiation was above average (RADPAR 3.0%). The maximum VCI was a normal 0.79.

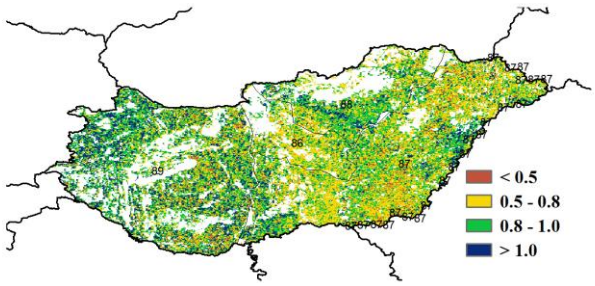
**Southern Transdanubia** cultivates winter wheat, maize and sunflower, mostly in Somogy and Tolna counties. The RAIN was below average (-13%) with both temperature and radiation above average (TEMP +1.1°C, RADPAR +4.2%). The biomass decreased by 7% below average in this period. The maximum VCI was normal 0.88. The NDVI values were below average but picked up in February and April.

**Figure 3.18 Hungary's crop condition, January - April 2019.**

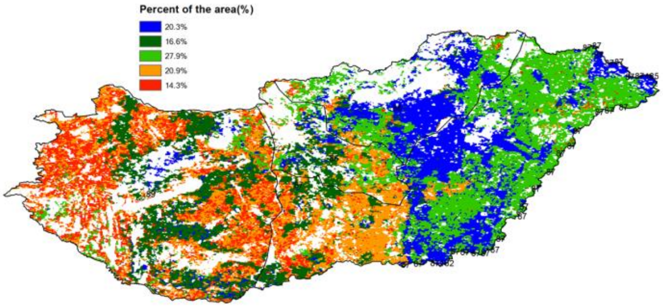


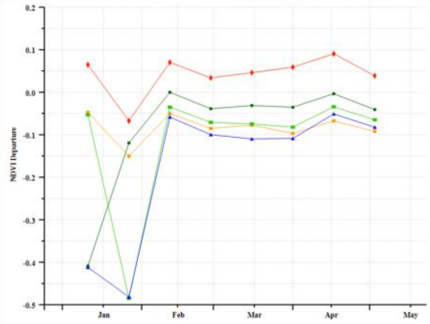

(a). Phenology of major crops



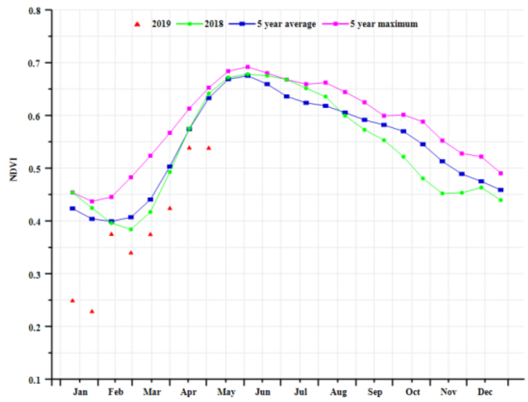



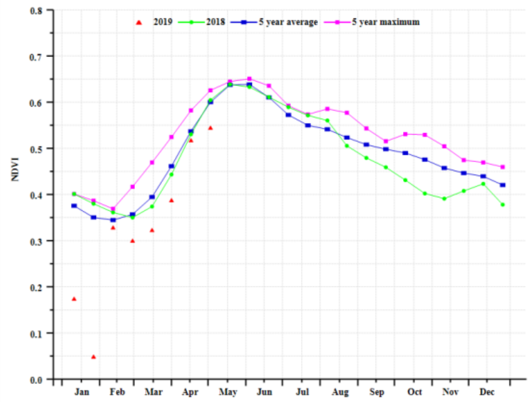

(b) Crop condition development graph based on NDVI (c) Maximum VCI



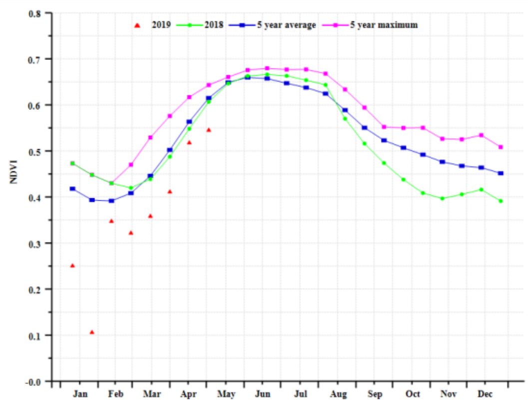



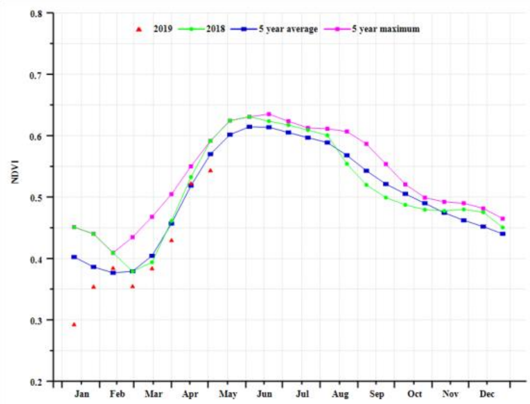

(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles




(f) Crop condition development graph based on NDVI (Central Hungary (left) and North Hungary (right))




(g) Crop condition development graph based on NDVI (Great Plain (left) and Western Transdanubia (right))

**Table 3.27 Hungary's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| **Central Hungary** | 120 | -10 | 6.0 | 1.0 | 648 | 5 |
| **North Hungary** | 118 | -16 | 5.4 | 0.9 | 620 | 5 |
| **Great Plain** | 117 | -8 | 6.1 | 0.9 | 633 | 3 |
| **Transdanubia** | 132 | -13 | 6.3 | 1.1 | 666 | 4 |

**Table 3.28 Hungary's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| **Central Hungary** | 555 | -6 | 93 | -6 | 0.78 |
| **North Hungary** | 546 | -13 | 97 | -2 | 0.83 |
| **Great Plain** | 515 | -10 | 86 | -10 | 0.79 |
| **Transdanubia** | 596 | -7 | 94 | -1 | 0.88 |

AFG AGO ARG AUS BGD BLR BRA CAN DEU EGY ETH FRA GBR HUN **IDN** IND IRN ITA KAZ KEN KHM LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [IDN] Indonesia

The harvest of rainy season maize was completed in Java and Sumatra, while the main rice harvest started in March. According to agroclimatic indicators, Indonesia experienced sunny but average weather conditions: rainfall (RAIN -2%) and temperature (TEMP -0.4°C) were slightly below average, while radiation was up 4%. The biomass production potential fell slightly by 2%. Due to unexplained factors, the NDVI values were unrealistically low in the national NDVI development graph compared to the recent five-year average in mid-January and early February. Crop condition was below average from March. According to NDVI profiles, 90.7% of the arable land had around average crop condition, including Java, which has the largest share of cropped areas in the country, Kalimantan and Sulawesi. 9.3% of the arable land of Indonesia (mostly in Papua province) was below average due to cyclone Trevor (refer to Chapter5).

**Regional analysis**

The analysis below focuses on four agro-ecological zones, namely Sumatra (92), Java (90, the main agricultural region in the country), Kalimantan and Sulawesi (91) and West Papua (93), among which former three are relevant for crops cultivation. The numbers correspond to the labels in the VCIx and NDVI profile maps.

According to agroclimatic conditions of **Java**, rainfall (RAIN +3%) and radiation (RADPAR +5%) were slightly above average, while temperature (TEMP -0.1°C) was average, resulting in a small rise of the biomass production potential (BIOMSS +1%). According to the NDVI development graph, crop condition was below the 5-year average. However, considering that the CALF increased by 27% crop production in Java is likely to be average.

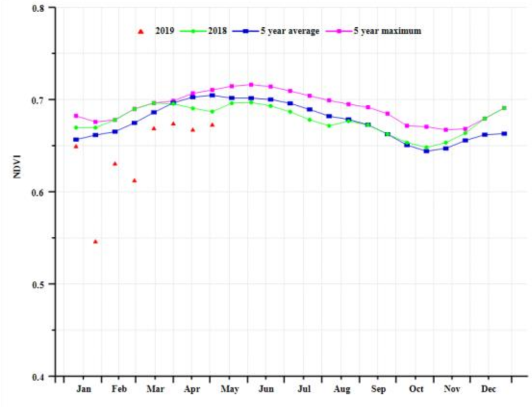
The agro-climatic conditions of **Kalimantan and Sulawesi** follow the same patterns as the country as a whole: accumulated rainfall down (RAIN -8%), temperature about average (TEMP -0.3°C) and radiation up (RADPAR +4%), leading to a 5% decrease of the biomass production potential. According to the NDVI development graph, crop condition was below to 5-year average. Considering the favorable VCIx value of 0.99, the crop condition shown in NDVI development graph maybe underestimated. The fraction of cropped arable land (CALF) also increased by 15% compared with average. Altogether crop production prospects are favorable.

Rainfall (RAIN, +5%) and radiation (RADPAR +5%) were slightly above average in **Sumatra**, while temperature (TEMP -0.3°C) was just below average, leading to a small increase of the biomass production potential (BIOMSS +3%). As shown in the NDVI development graph, crop condition was close to the 5-year average. Considering favorable VCIx value of 0.98 and the 21% rise in CALF crop condition and production may exceed average.

Considering that the fraction of cropped arable land increased 14% over the last five-year average and due to mostly average agro-climatic conditions CropWatch assesses the condition of crops during the reporting period as average to above average.

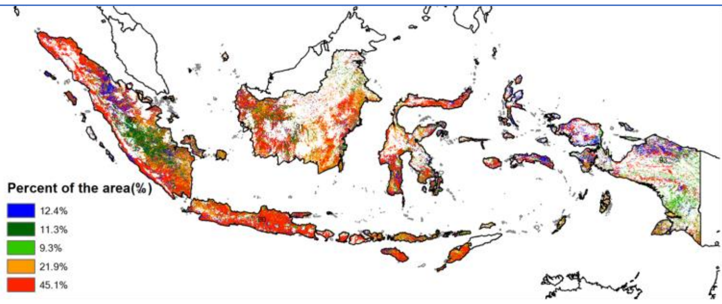
**Figure 3.19 Indonesia's crop condition, January - April 2019**


(a). Phenology of major crops

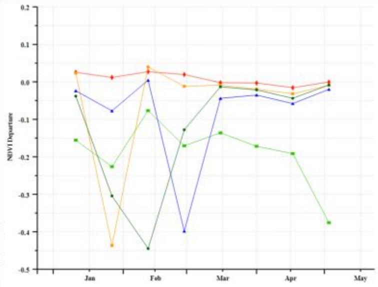



(b) Crop condition development graph based on NDVI

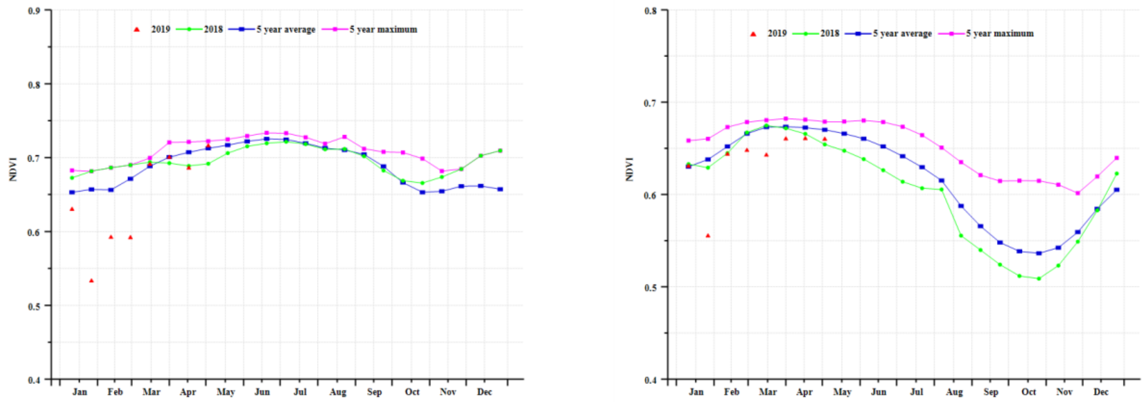

(c) Maximum VCI



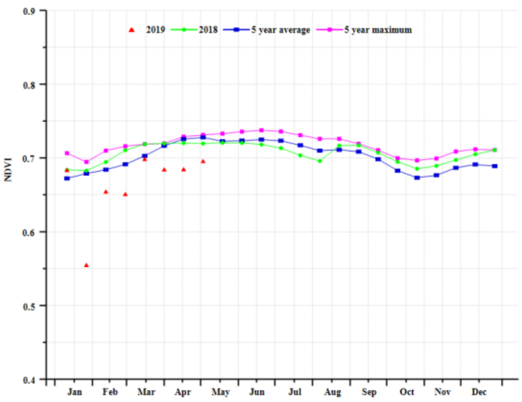

(d) Spatial NDVI patterns compared to 5YA




(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Sumatra (left) and Java (right))




(g) Crop condition development graph based on NDVI (Kalimantan-Sulawesi)

**Table 3.29 Indonesia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA(%) | Current (°C) | Departure from 15YA(%) | Current (MJ/m²) | Departure from 15YA(%) |
| Java | 1150 | 3 | 25.8 | -0.1 | 1214 | 5 |
| Kalimantan and Sulawesi | 1019 | -8 | 26.0 | -0.3 | 1153 | 4 |
| Sumatra | 1133 | 4 | 25.9 | -0.3 | 1147 | 5 |
| West Papua | 1401 | 1 | 24.7 | -0.9 | 976 | 0 |

**Table 3.30 Indonesia's agronomic indicators by sub-national regions, current season's value and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA(%) | Current (%) | Departure from 5YA(%) | Current |
| Java | 2112 | 1 | 99 | 27 | - |
| Kalimantan and Sulawesi | 2142 | -5 | 100 | 15 | 0.99 |
| Sumatra | 2240 | 3 | 100 | 21 | 0.98 |
| West Papua | 2266 | -3 | 100 | -7 | 0.97 |

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# [IND] India

Kharif(summer) maize and rice in India have been harvested in January whereas Rabi (winter) rice and wheat were still growing between January and February; the harvest started in March. Crop condition was slightly below average over the reporting period, as indicated by the graph of NDVI development at the national level.

The CropWatch agroclimatic indicators show that nationwide rainfall, temperature and RADPAR were average (-3%, -0.3°C and 0%, respectively). Moreover, the overall VCIx was moderate, with a value of 0.83. However, the values of this indicator show marked spatial differences, with high values (greater than 0.8) being located in northern and eastern India while low values (less than 0.5) appear in the southern and western parts. As shown by the map ofspatial NDVI patterns compared to 5YA and corresponding NDVI profiles， 23.4% of crops showed above-average condition throughout the monitoring period, which were mainly located in northern India. In contrast, 25.9% of planted areas experienced continuously below-average crop condition, distributed in southern and western India. These spatial patterns of NDVI were thus generally consistent with those of VCIx. Considering the CALF decreased by 3%compared to average, the crop production of this season is estimated to be slightly below average. As shown by the maps in figures 2.4g, 2.4h, 3.1, 3.2 and 3.4, the patterns are directly related to weather, as further described below.

**Regional analysis**

Building on cropping systems, climatic zones and topographicconditions, India is divided into eight agro-ecological zones:the Deccan plateau (94), the Eastern coastal region (95), theGangetic plains (96), the Assam and north-eastern region (97),Agriculture areas in Rajasthan and Gujarat (98), theWestern coastal region (99), the North-western dry region (100) andthe Western Himalayan region (101).

The **Deccan plateau** recorded 48 mm of rainfall (-20%) and average temperature and radiation, which led to slightly below-average crop condition, as indicated by the graph of NDVI development in this region. The BIOMSS decreased by 11% compared to average. The VCIx was moderate, with a value of 0.81. The crop production is expected to be below average, considering in addition that CALF decreased 7%.

In the **Eastern coastal region**, precipitation and temperature both declined (11% and 0.2°C, respectively) whereas radiation slightly increased by 1%. As shown by the NDVI profile, crop condition was generally below average. This is consistent with a below-average BIOMSS (-10%). The VCIx was 0.80. The CALF slightly declined 1% compared to average.

As a very important crop production zone in India, the **Gangetic plains** received well above-average rainfall (+62%) but below-average temperature and radiation (-1.0 °C and -3%, respectively). Crop condition in this area was below average before early February but improved thereafter to average or above average. The VCIx was high at 0.94. As the CALF increased by 2%, the crop production of this season is estimated to be above average.

The **Assam and north-eastern region** recorded 296 mm of rainfall, with a decrease of 16% compared to average. The radiation was average while the temperature increased 0.5°C. According to the graph of the NDVI development, crop condition in this region was average or above average. This is also corroborated by very high VCIx (0.98). As the CALF was above average (+3%), the outlook of crop production in this region is very promising.

In the Agriculture areas in **Rajasthan and Gujarat,** rainfall increased 5% compared with average, whereas temperature and sunshine (RADPAR) slightly decreased by 0.8°C and 1%, respectively. Average crops prevailed in the region over the reporting period, as implied by the NDVI profile. The VCIx was moderate, with a value of 0.76. As the CALF declined by 10%, the crop production is expected to be below average.

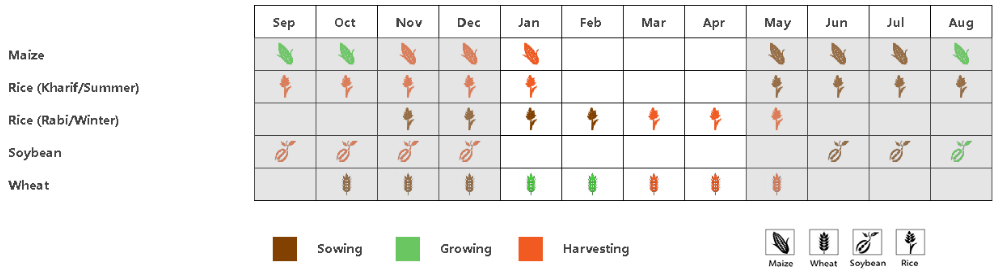
The **North-western dry region** covers northern parts of Rajasthan and Gujarat. Rainfall increased 15% while temperature and radiation fell 1.3°C and 3% compared to average. As shown by the graph of

NDVI development, crop condition was generally average over the monitoring period. The VCIx was 0.74. Considering the spectacular CALF increase by 22%, the larger area may offset mediocre crop condition and the crop production for this region could still be average.

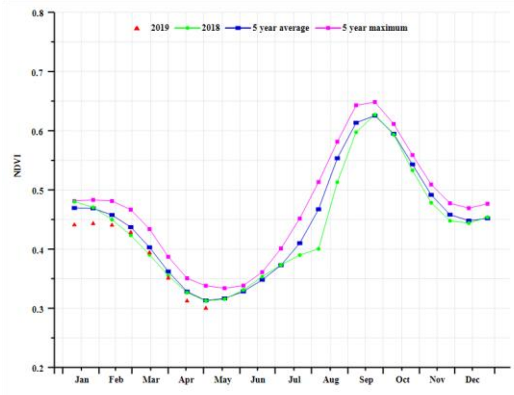
The **Western coastal region** recorded significantly below-average rainfall (-36%) and near average temperature and radiation (-0.1°C and 3%, respectively), which led to poor crop condition in the region, as indicated by the NDVI profile. Additionally, the BIOMSS dropped 25% below average. The VCIx was 0.70, which was the lowest among all the agro-ecological zones. Considering further that CALF decreased by 11%, crop production of this season is expected to be well below average,

In the **Western Himalayan region**, precipitation increased 5% while temperature and radiation declined 0.4°C and 6%, respectively. As shown by the NDVI time profile, crop condition was below average before late February but average or above average since early March. This favorable situation was also confirmed by above-average BIOMSS (+13%) and an impressively high VCIx (0.97). The CALF sightly increased 1% compared to average. Overall, the crop production in this region is expected to be above average.

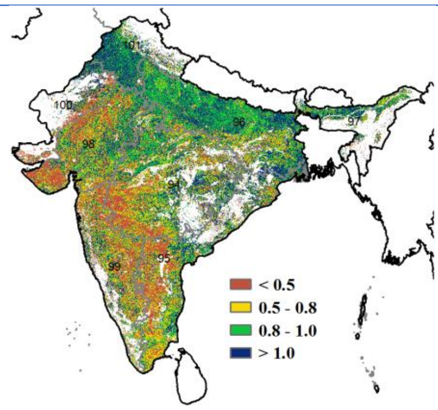
**Figure 3.20 India's crop condition, January - April 2019**



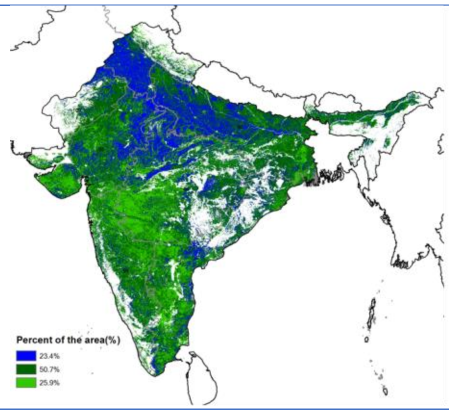

(a). Phenology of major crops



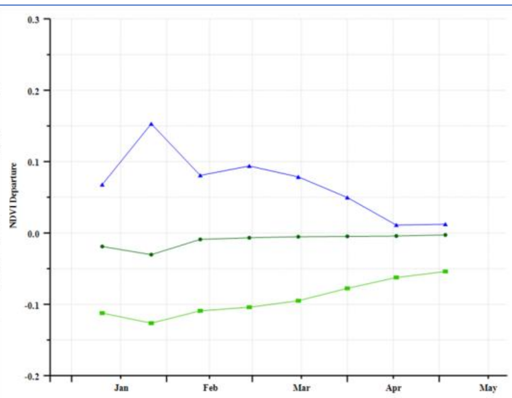

(b) Crop condition development graph based on NDVI



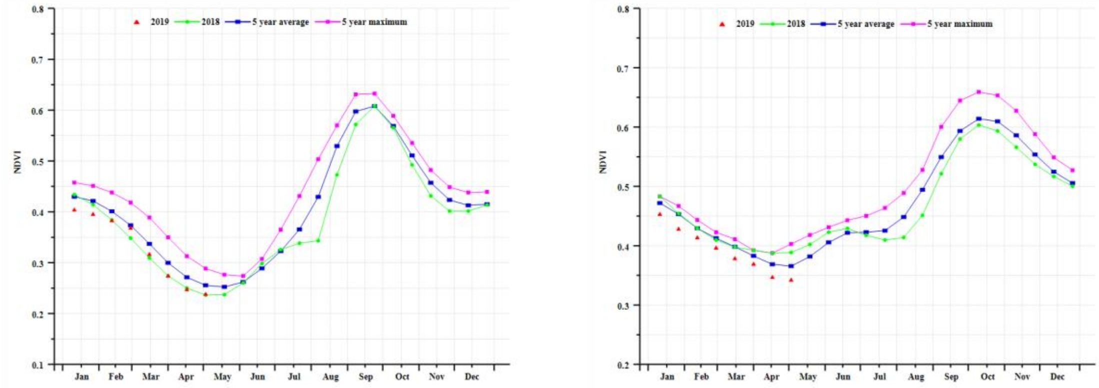

(c) Maximum VCI



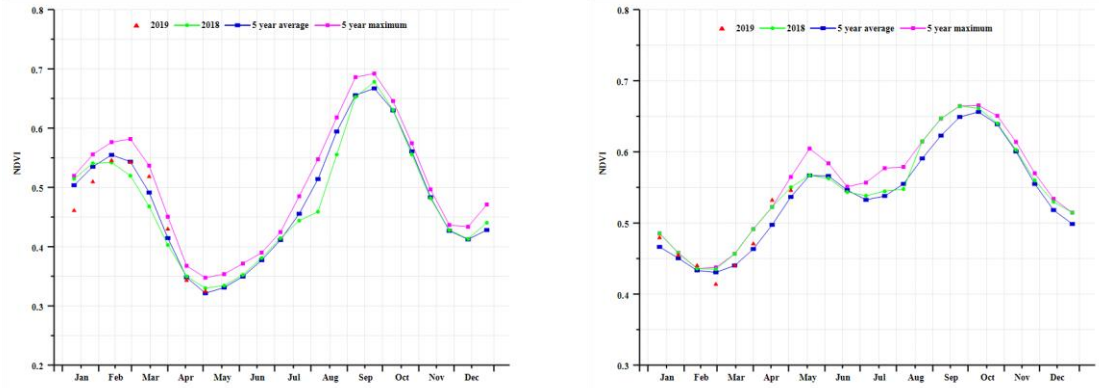

(d) Spatial NDVI patterns compared to 5YA



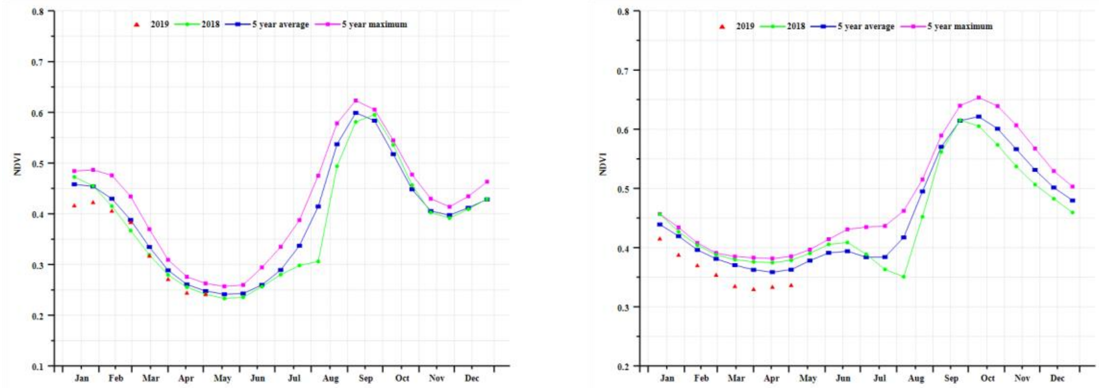

(e) NDVI profiles



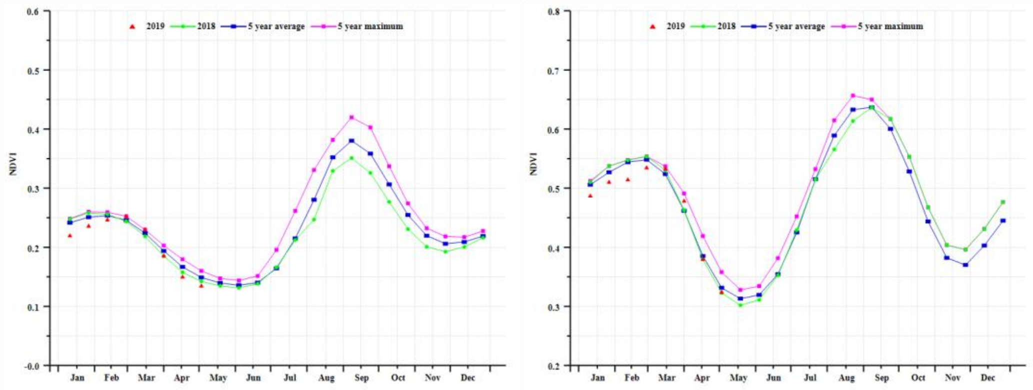

(f) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))




(g) Crop condition development graph based on NDVI (Gangatic Plains (left) and North Eastern Region (right))




(h) Crop condition development graph based on NDVI (Agriculture areas in Rajastan and Gujarat (left) and Western Coastal Region (right))




(i) Crop condition development graph based on NDVI (North-western dry region (left) and Western Himalayan Region (right))

**Table 3.31 India's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Deccan Plateau | 48 | -20 | 25.9 | 0.0 | 1275 | 0 |
| Eastern coastal region | 74 | -11 | 27.2 | -0.2 | 1298 | 1 |
| Gangatic plain | 130 | 62 | 22.6 | -1.0 | 1163 | -3 |
| Assam and north-eastern regions | 296 | -16 | 20.5 | 0.5 | 1103 | 0 |
| Agriculture areas in Rajastan and Gujarat | 25 | 5 | 24.2 | -0.8 | 1268 | -1 |
| Western coastal region | 54 | -36 | 26.3 | -0.1 | 1382 | 3 |
| North-western dry region | 27 | 15 | 22.5 | -1.3 | 1197 | -3 |
| Western Himalayan region | 179 | 5 | 10.8 | -0.4 | 1007 | -6 |

**Table 3.32 India's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Deccan Plateau | 217 | -11 | 56 | -7 | 0.81 |
| Eastern coastal region | 270 | -10 | 65 | -1 | 0.80 |
| Gangatic plain | 202 | -28 | 84 | 2 | 0.94 |
| Assam and north-eastern regions | 896 | 1 | 92 | 3 | 0.98 |
| Agriculture areas in Rajastan and Gujarat | 121 | 12 | 47 | -10 | 0.76 |
| Western coastal region | 203 | -25 | 42 | -11 | 0.70 |
| North-western dry region | 142 | 22 | 15 | 22 | 0.74 |
| Western Himalayan region | 549 | 13 | 93 | 1 | 0.97 |

AFG AGO ARG AUS BGD BLR BRA CAN DEU EGY ETH FRA GBR HUN IDN IND **IRN** ITA KAZ KEN KHM LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [IRN] Iran

Crop condition was generally above average, but dropped to below average since March, then recovered to above average during late April. Winter wheat is still growing, and rice was planted from April. Accumulated rainfall (RAIN, 39%) was above average, while temperature (TEMP, -0.7°C) and radiation (RADPAR, -5%) were below average over the last four months. The favorable agro-climatic conditions resulted in an increase in the BIOMSS index by 19% compared to average. However, it is worth noting that from the middle of March to early of April floods hit some parts of northern, western and south-western Iran (refer to the section on disasters in Chapter 5)， severely affecting winter crop growth and summer crop planting. The national average of maximum VCI index reached 1.0, and the Cropped Arable Land Fraction (CALF) significantly increased by 47% compared to the recent five-year average.

According to the national NDVI development graphs, crop condition was above average throughout the monitoring period in about 41.7% of cropland, mainly in part of the South-west, Kermanshah and Luristan provinces in the west and central regions, and some areas of Golestan and Razavi Khorasan provinces in the north-eastern region. Remaining croplands experienced unfavorable crop condition during the monitoring period, affecting mainly the north-western region.

Overall, the outcome of winter crops during the current season is expected to be favorable.

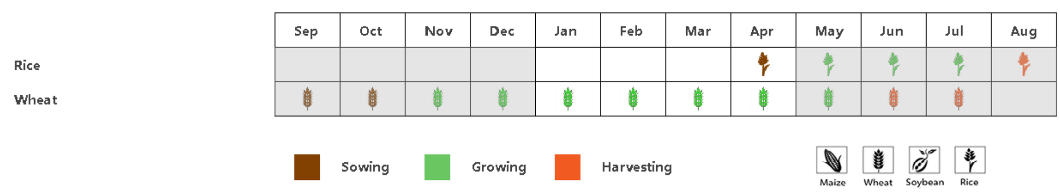
**Regional analysis**

Based on cropping systems, climatic zones, and topographic conditions, three sub-national agro-ecological regions can be distinguished for Iran, among which two are relevant for crop cultivation. The two regions are referred to as the Semi-arid to sub-tropical hills of the west and north (104), and the Arid Red Sea coastal low hills and plains (103).

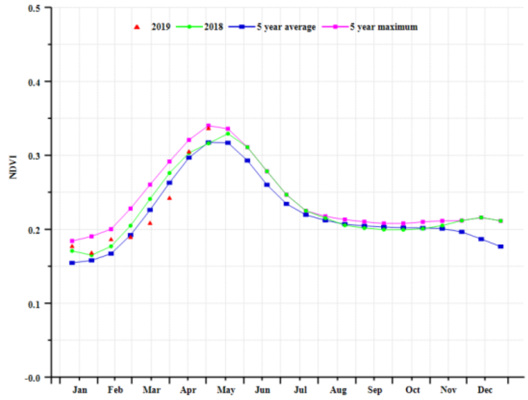
In the **Semi-arid to sub-tropical hills of the west and north region**, NDVI profiles show similar changes as in the whole Iran country. The accumulated rainfall was 309mm (32% above average), while temperature (TEMP -0.6°C) and radiation were below average (RADPAR -6%). The favorable weather conditions resulted in an increase of BIOMSS by 10%. CALF rose 39%, and the average VCIx (1.0) was very and unusually high. The outcome for winter crops of this region is estimated to be favorable.

Crop condition in the **Arid Red Sea coastal low hills and plains region** was above five-year average and five-year maximum during this monitoring season. The region received 296 mm of rainfall. The abundant rainfall (RAIN +82%) resulted in a significant increase of BIOMSS by 56%. The CALF also increased significantly by 124% compared to five-year average, and the national VCIx (1.2) was higher than the best values on record. The outlook for winter crops in this region is highly favorable.

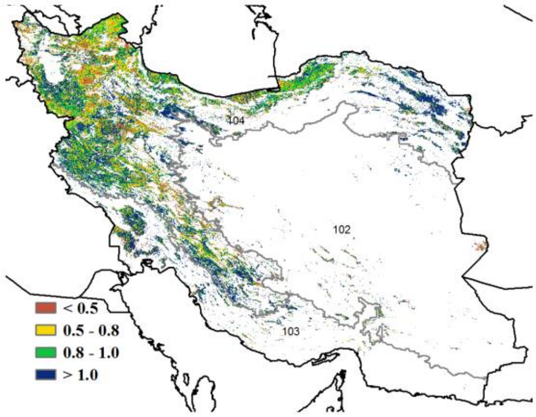
**Figure 3.21 Iran's crop condition, January - April 2019**



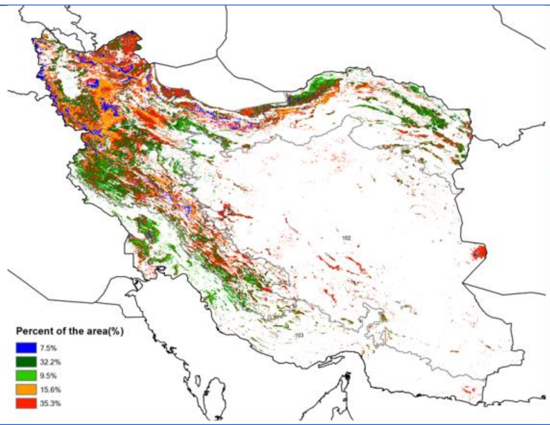

(a) Phenology of major crops



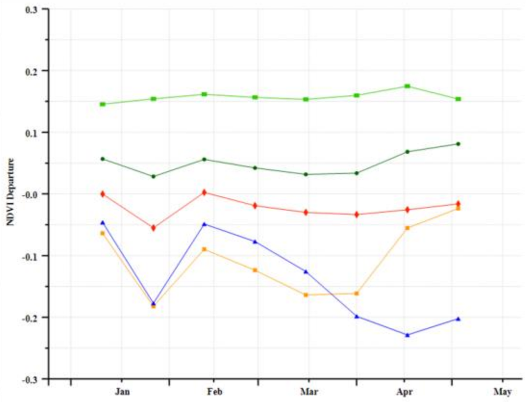

(b) Crop condition development graph based on NDVI



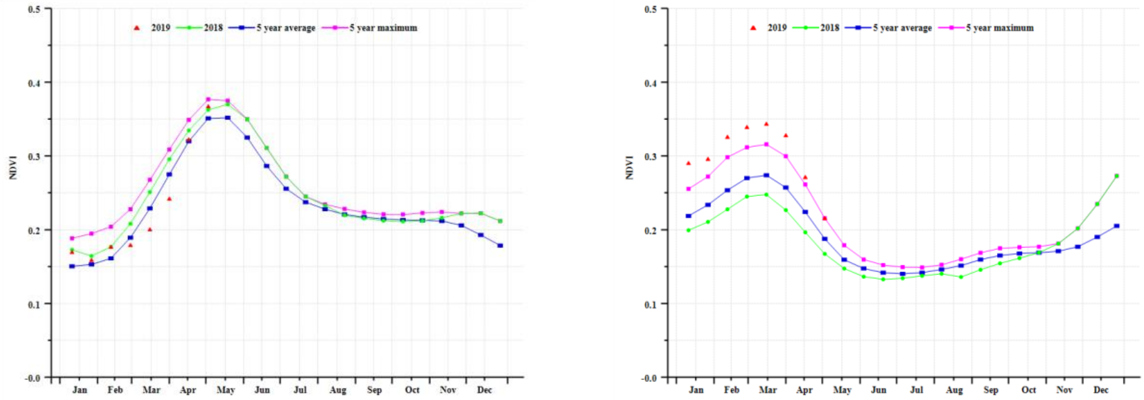

(c) Maximum VCI




(d) Spatial NDVI patterns compared to 5YA




(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Semi-arid to sub-tropical hills of the west and north region (left) and Arid Red Sea coastal low hills and plains region (right))

**Table 3.33 Iran's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| Semi-arid to sub-tropical hills of the west and north | 309 | 32 | 4.8 | -0.6 | 920 | -6 |
| Arid Red Sea coastal low hills and plains | 296 | 82 | 15.0 | -1.3 | 1006 | -6 |

**Table 3.34 Iran's agronomic indicators by sub-national regions, current season's value and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Semi-arid to sub-tropical hills of the west and north | 794 | 10 | 32 | 39 | 1.00 |
| Arid Red Sea coastal low hills and plains | 871 | 56 | 42 | 124 | 1.20 |

# [ITA] Italy

This reporting period is the main growing season of winter wheat, sown between October and December. Spring and summer crops, including maize and rice, were planted from the end of April.

Nationwide, early NDVI values were below average (around 0.5) and started increasing after February, a situation similar to what happened in 2018. In April, values started to rise over 2018 and exceeded the average, eventually reaching the maximum of 5 years at the end of the reporting period. NDVI was above average in 25.4% of the arable land, mainly in the south of the country. 20.6% of was below the average and occurred mostly in northern Basilicata and southern Lombardy. Remaining areas were around the average. Rainfall was well below average (-24%), the temperature was average and RADPAR was 9% above average. BIOMSS dropped 19% but VCIx was satisfactory (0.94) with CALF increased about 1.4%. Overall crop condition in the country is about average.

**Regional analysis**

Based on cropping systems, climatic zones, and topographic conditions, four sub-national regions can be distinguished for Italy: East coast, Po Valley, Islands and Western Italy.

On the **East coast**, RAIN and TEMP were average (+ 3% and -0.2°C compared with average), but RADPAR was high (+8%). Overall condition of wheat was about average with BIOMSS up 3%, VCIx at 0.93 with a high CALF value of 0.99. The crop condition development graph of NDVI indicates that initially poor conditions developed into average ones from April. The output is expected to be average.

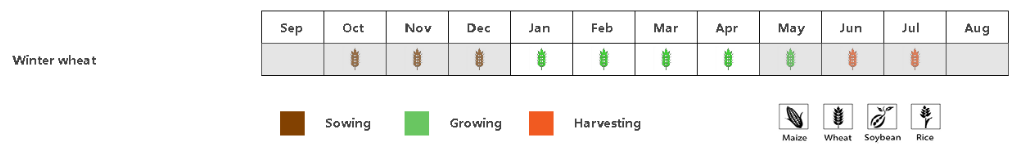
The **Po Valley** recorded insufficient rainfall, average temperature and RADPAR with high VCIx and CALF, resulting in below average biomass production potential: RAIN -29%, TEMP +0.5°C, RADPAR 9%, BIOMSS -24%, VCIx 0.99 and CALF 99%. The crop condition development graph of NDVI indicates condition better than the 5 years average after March and even above the maximum after April. This represents a spectacular recovery considering that initial NDVI values were below 0.4. Below average to average output is expected, depending largely on late spring weather.

In the **Islands**, the combination of a severe precipitation shortage (-38%), average TEMP (-0.6%) and above average RADPAR (+7%) led to a BIOMSS drop of 31% compared with the average. VCIx was satisfactory (0.91) and CALF was high (99%). The crop condition development graph of NDVI indicates below 5YA values. Generally, below average output is expected.

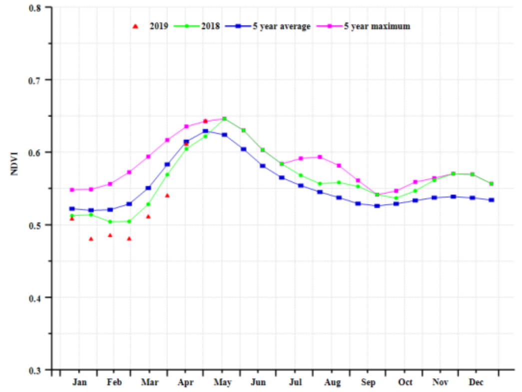
The situation in **Western Italy** was almost normal (TEMP, VCIx 0.90, CALF 99%) but sunshine was high (+9%) and RAIN was low (-20%). BIOMSS fell -16%. NDVI was below average as well and below average production is expected.

If the water supply improves after April, the winter wheat production could be satisfactory.

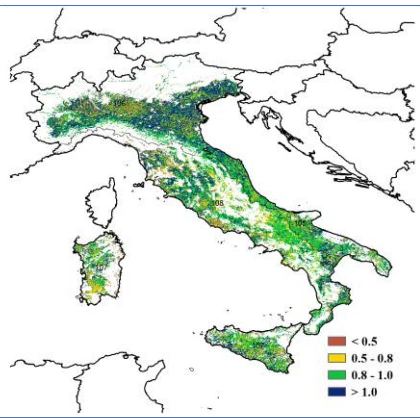
**Figure 3.22 Italy's crop condition, January - April 2019.**



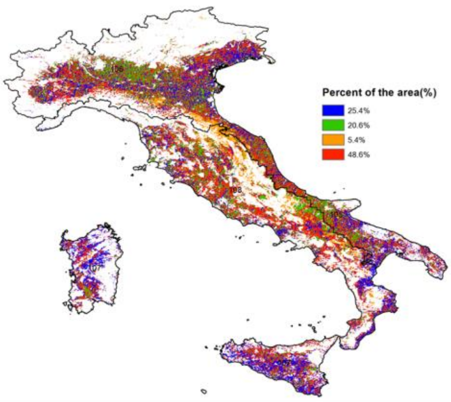

(a). Phenology of major crops



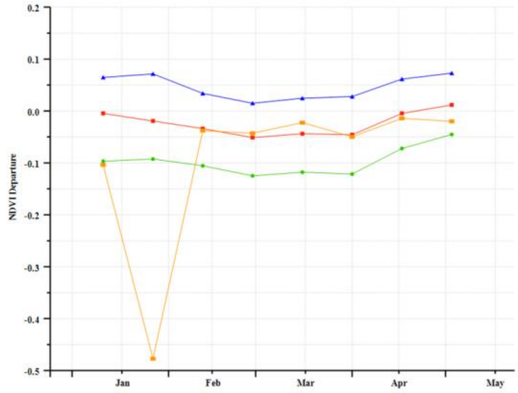

(b) Crop condition development graph based on NDVI



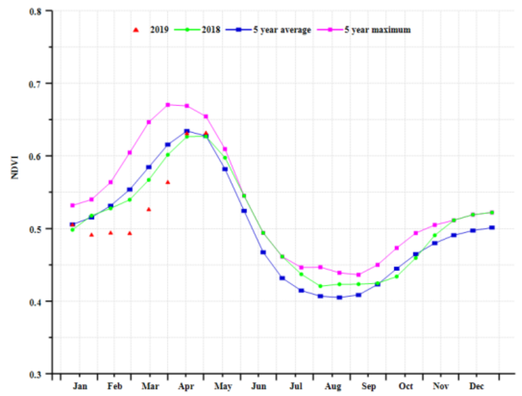

(c) Maximum VCI



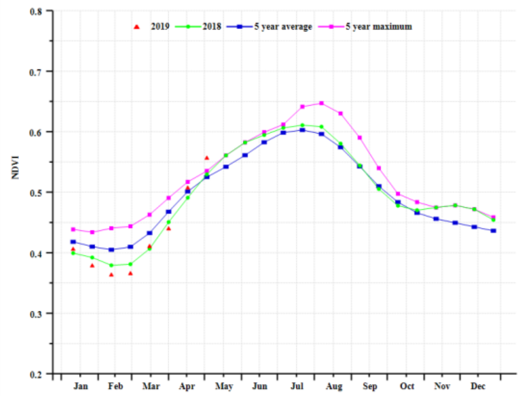

(d) Spatial NDVI patterns compared to 5YA



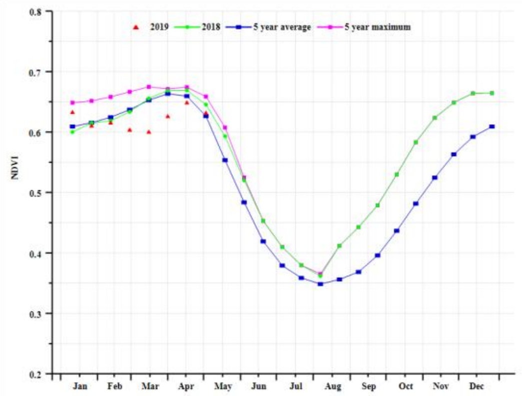

(e) NDVI profiles



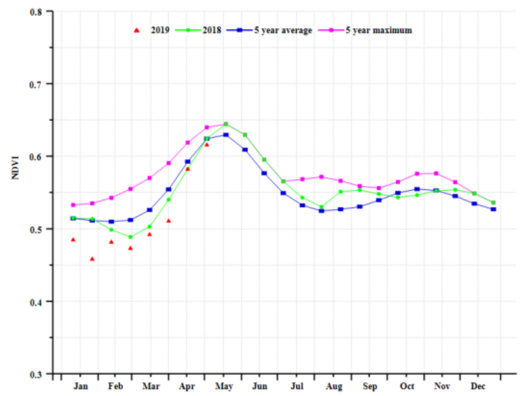

(f) East coast (Italy) crop condition development graph based on NDVI




(g) Po Valley (Italy) crop condition development graph based on NDVI




(h)Islands (Italy) crop condition development graph based on NDVI




(i). Western Italy (Italy) crop condition development graph based on NDVI

**Table 3.35 Italy's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| **East coast** | 121 | 3 | 10 | -0.2 | 812 | 8 |
| **Po Valley** | 123 | -29 | 7 | 0.5 | 7279 | 9 |
| **Islands** | 67 | -38 | 10 | -0.6 | 887 | 7 |
| **Western Italy** | 130 | -20 | 8 | -0.02 | 7869 | 9 |

**Table 3.36 Italy's agronomic indicators by sub-national regions, current season's value and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| **East coast** | 554 | 3 | 99 | 0.4 | 0.93 |
| **Po Valley** | 499 | -24 | 92 | 4.2 | 0.99 |
| **Islands** | 321 | -31 | 99 | 0.1 | 0.91 |
| **Western Italy** | 545 | -16 | 99 | -0.03 | 0.90 |

# [KAZ] Kazakhstan

The country currently cultivates limited amounts of winter rye and wheat in southern areas, and spring crops will be planted from May. As such, the national average VCIx of 0.76 and the Cropped Arable Land Fraction decrease of 13% apply mostly to rangeland. Among the CropWatch agroclimatic indicators, RAIN and TEMP were above average (+4% and +1.4°C), while RADPAR was below (-4%). The combination of the factors resulted in high BIOMSS (+10%) compared to the fifteen-year average. As shown by the NDVI development graph, the winter vegetation condition was close to average in April, even if value where seasonably low (< 0.2). NDVI cluster graphs and profiles show that southern parts of country were above average from February to April. The spatial NDVI pattern and profile show that the vegetation condition in 59.6% of areas was above average from March to April in parts of Kokshetau, Pavlodar, Kostanay, Nursultan, Karaganda, Kyzylorda, Shymkent and Taraz provinces and some parts of north and east Kazakhstan: Semey, Almaty, Aktobe and Oral provinces. Overall, vegetation condition was normal.

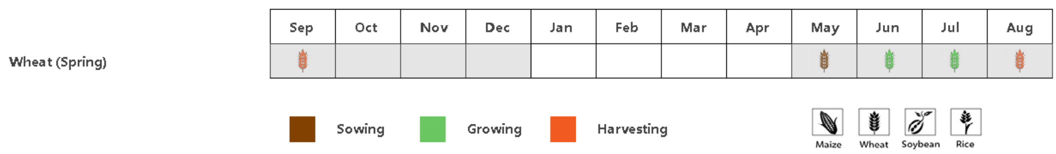
**Regional analysis**

In the **Northern zone**, NDVI was below the five-year average in March and late April and above or close to the average in other months. RAIN and TEMP were above average (+5% and +1.2°C), but RADPAR was below average (-4%). The agroclimatic indicators also resulted in an increase of the BIOMSS index by 4%. The maximum VCI index was 0.74. Among the CropWatch indicators, agroclimatic condition was favorable in this zone.

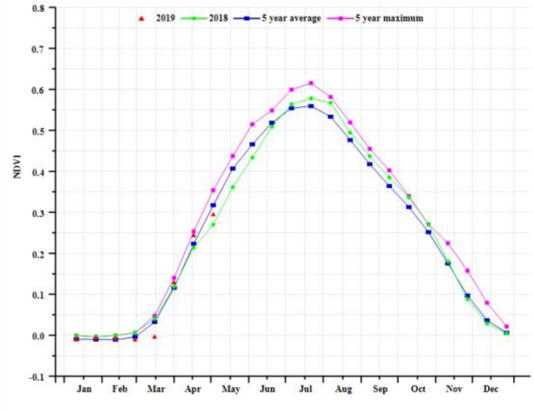
The condition of vegetation and rangelands was generally below the five-year average from late February to late March and close to the average in other months in the **Eastern plateau and south-eastern zone**. RAIN and TEMP were above average (+3% and +2.0°C), RADPAR was below (-4%) and BIOMSS is up 14%. The maximum VCI index was 0.82, and the cropped arable land fraction increased by 3%.

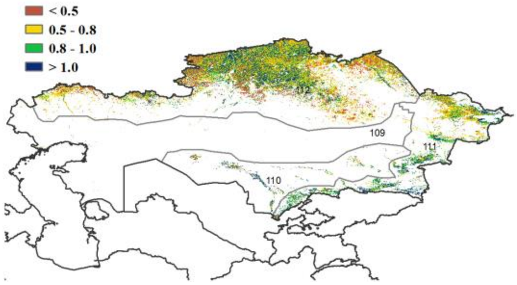
The **South zone** recorded generally above average NDVI from late February to April. RAIN and TEMP were +19% and +1.7°C above average, but and RADPAR was below average (-7%). The agroclimatic indicators also resulted in an increase of the BIOMSS index by 15%. The maximum VCI index was 1.02 due to high and frequently non-freeze temperature.

**Figure 3.23 Kazakhstan's crop condition, January - April 2019**



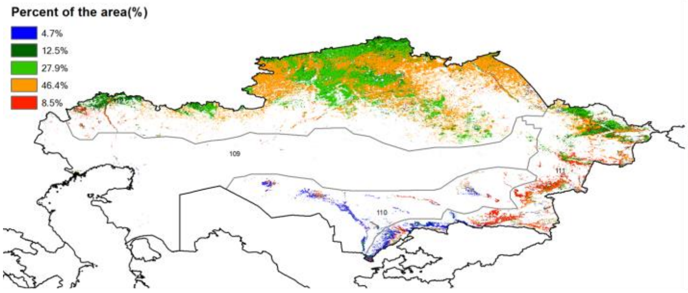

(a). Phenology of major crops

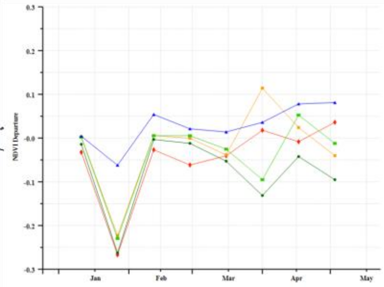



(b) Crop condition development graph based on NDVI

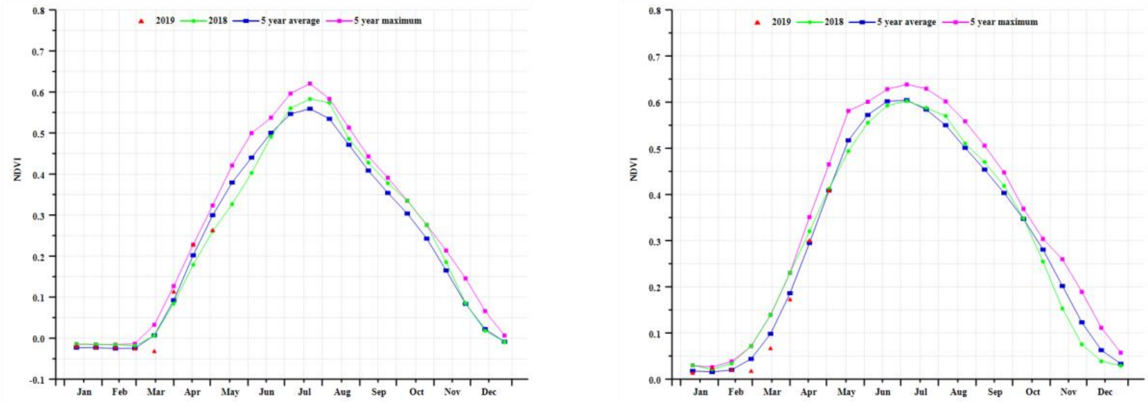
(c) Maximum VCI



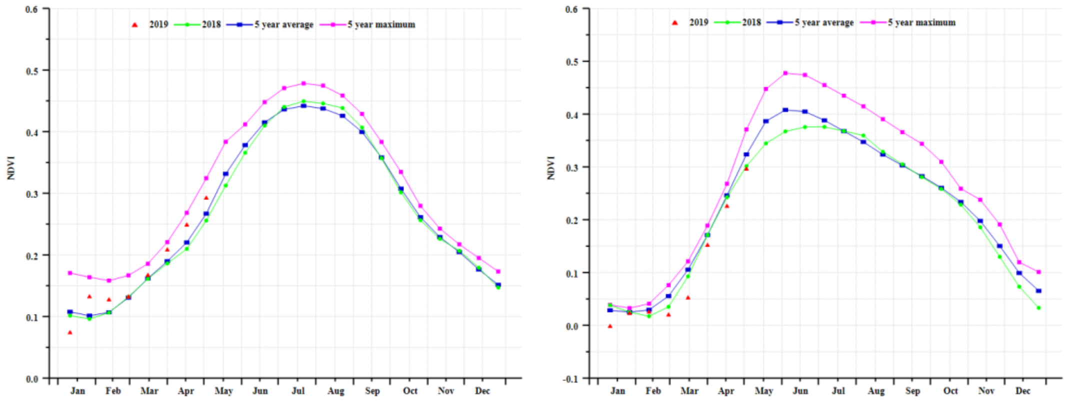




(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles




(f) Crop condition development graph based on NDVI in Northern region (left) Eastern plateau and southeastern region (right))




(g)Crop condition development graph based on NDVI in South region(left) and Central non-agricultural region (right)

**Table 3.37 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| Northern region | 155 | 5 | -6.6 | 1.2 | 573 | -4 |
| Eastern plateau and southeastern region | 168 | 1 | -2.9 | 2.0 | 743 | -3 |
| South region | 166 | 19 | 3.5 | 1.7 | 717 | -7 |
| Central non-agriculture region | 138 | -10 | -3.0 | 1.5 | 663 | -2 |

**Table 3.38 Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Northern region | 463 | 2 | - | - | 0.74 |
| Eastern plateau and southeastern region | 534 | 13 | 38 | 3 | 0.82 |
| South region | 633 | 15 | - | - | 1.02 |
| Central non-agriculture region | 538 | -2 | - | - | 0.66 |

# [KEN] Kenya

Kenya experiences a large variety of rainfall patterns, mostly referred to as long rain and short rain and resulting in similar cropping patterns: long rain maize and wheat, short rain maize.

Long rain maize was planted during the reporting period while short rain maize reached maturity and harvest. The rainfall recorded nationwide was 184mm, a significant drop of 40% below average. Temperature and RADPAR were above average by 0.1°C and 5%, respectively. The low precipitation led to reduced BIOMASS that dropped 39% below average. The cropped arable land fraction was reduced by 3%. The maximum VCIx value was 0.76. According to clusters and the map of NDVI profiles, crop condition was below average except during mid-January, which indicates a poor short rains crop at the time of harvest. This is confirmed by the national graph of crop condition development which stayed below average until the end of the reporting period. During the reported period, wheat and maize crops are expected from the major production areas. However, the spatial NDVI patterns indicate that NDVI was below average in many central areas. This spatial pattern only partially reflected by VCIx, the national average of which reached 0.87, with low values in pastoral areas of the Rift Valley (Laikipia, Nakuru and Trans-Nzioia, where wheat is an important production) but also some Western area (for instance from Bungoma, where maize and cattle are the main-stays of the agricultural economy).

Generally, due to the rainfall deficit, the agronomic indicators mentioned above show less than average conditions for some important crop areas of Kenya.

**Regional analysis**

Considering the cropping system, climatic zones and topographic conditions we divided this country into four agro-ecological zones (AEZ): The Coast, Highland agriculture zone, northern rangelands, and south-west.

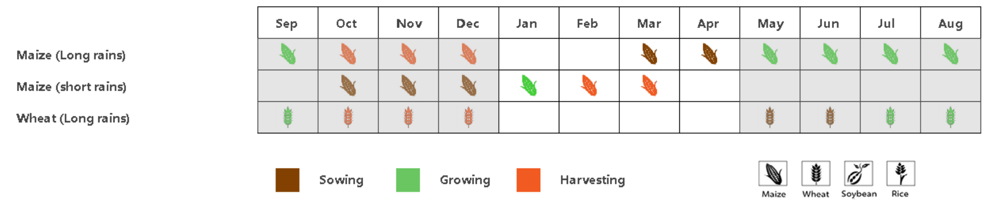
The **Coast** includes the districts of Kilifi, Kwale and Malindi. It recorded low rainfall, 31 mm, 80% below average while TEMP and RADPAR were above average (0.1°C and +6%). The total biomass production was below average by -71% compared to 5YA. The NDVI profile was also below average with marked fluctuations at the start of the reporting period. Throughout the reporting period, maximum VCIx was 0.79 with CALF at 95%. Overall, the coastal area, where the rainy season is just starting, had conditions unfavorable for livestock and crops.

In the mostly temperate **Highland agriculture zone** NDVI was above average during January but then dropped to below average until the end of the reported period. At 187 mm rainfall was 38% below average. The temperature and sunshine were up (TEMP +0.1°C, RADPAR +6%) and BIOMASS was down 41% below average. The CALF (91%) was 4% below average. The maximum VCIx value was recorded at 0.75. In general, based on all CropWatch indicators the crop condition is assessed as unfavorable where VCIx was low.

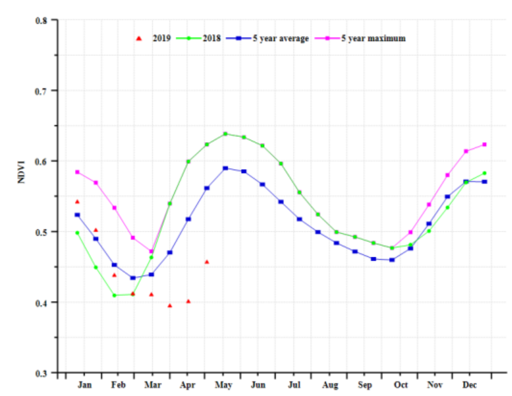
The **northern rangelands** recorded scarce of rainfall with RAIN at 85 mm, or 51% below average, affecting districts such as Turkana, Samburu, and Baringo. The deficit leads to a decrease in the total biomass production (BIOMASS down 46%). The temperature was above average by 0.6°C and RADPAR slightly up by 3%. The NDVI development curve shows values below the five years average during the entire monitoring period. The maximum VCI was low compare to other regions at 0.58. The cropped arable land fraction also decreased (CALF, -22%). Since the region is mostly pastoral the prevailing conditions had a negative effect on livestock production.

The **South-west** districts include Kisumu, Migori, Siaya, and Busia. Those districts are major producers of wheat and maize, which are in full growth. The total amount of rainfall was high (327 mm) but still 35% below average, leading to a reduction of total biomass production (-24%). The temperature was average (-0.1°C departure) and RADPAR was 3% above. While the Cropped arable land fraction remained constant. The NDVI based crop condition development shows there were fluctuations values during the monitoring period. The maximum VCI was reached 0.79. The expected production is average at best in the North and still favorable in the South.

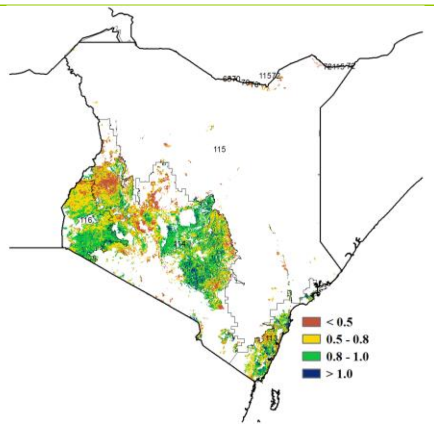
**Figure 3.24 Kenya's crop condition, January – April 2019**



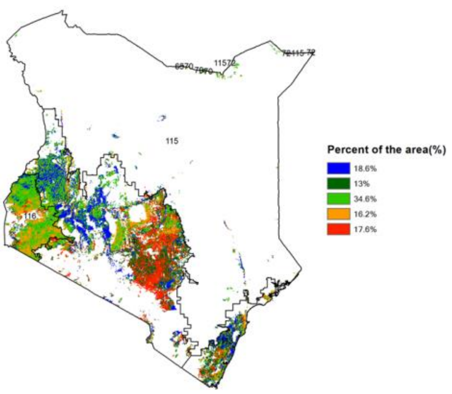

(a). Phenology of major crops



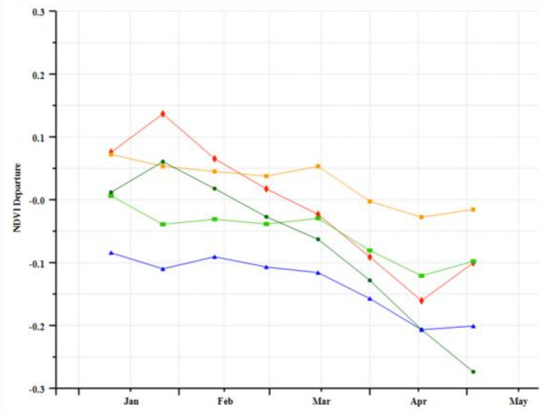

(b) Crop condition development graph based on NDVI



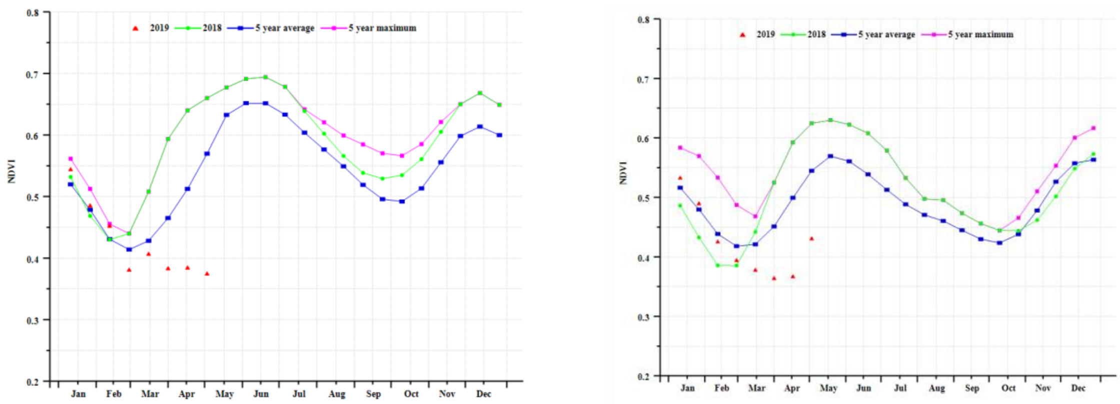

(c) Maximum VCI



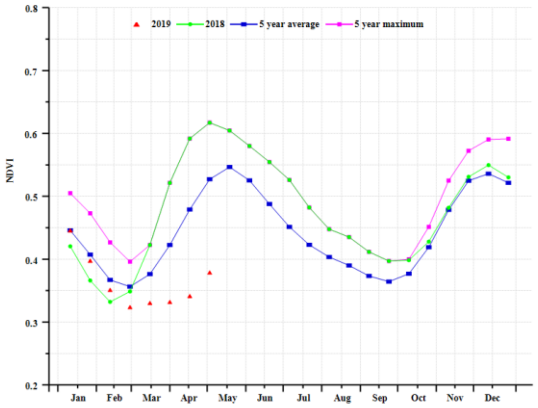

(d) Spatial NDVI patterns compared to 5YA

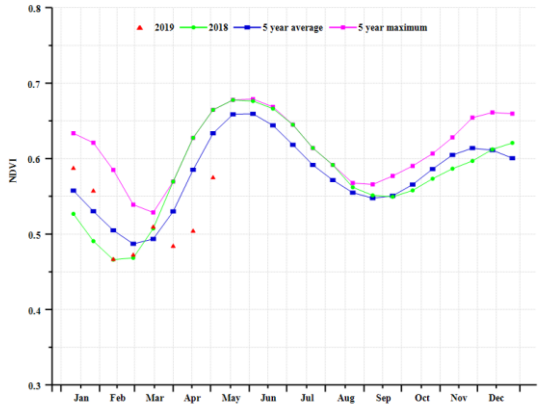



(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Coast(left) and Highland agriculture zone(right))




(g) Crop condition development graph based on NDVI (Northern rangelands (left) and South-west (right))

**Table 3.39 Kenya's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| **Coastal** | 31 | -80 | 29.1 | 0.1 | 1411 | 4 |
| **Highland agriculture zone** | 187 | -38 | 22.5 | 0.1 | 1407 | 6 |
| **Northern rangelands** | 85 | -51 | 28.8 | 0.6 | 1361 | 3 |
| **South-west** | 327 | -35 | 22 | -0.1 | 1362 | 3 |

**Table 3.40 Kenya's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January – April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| **Coastal** | 151 | -71 | 95 | 5 | 0.79 |
| **Highland agriculture zone** | 546 | -41 | 91 | -4 | 0.75 |
| **Northern rangelands** | 306 | -46 | 61 | -22 | 0.58 |
| **South-west** | 1162 | -24 | 99 | 0 | 0.79 |

AFG AGO ARG AUS BGD BLR BRA CAN DEU EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN **KHM** LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [KHM] Cambodia

January to April covers the growing period and early harvesting stage of maize, and the harvesting time of rainy season rice. Compared to average, CropWatch agro-climatic indicators show a sharp drop in rainfall (RAIN -26%), no change for air temperature and a slight increase in radiation (RADPAR, +3%), resulting in a sharp drop in biomass production potential (BIOMASS, -17%). Moderate VCIx is observed around the Tongle Sap (<0.8), with lowest values below 0.5 in the western part of the country.

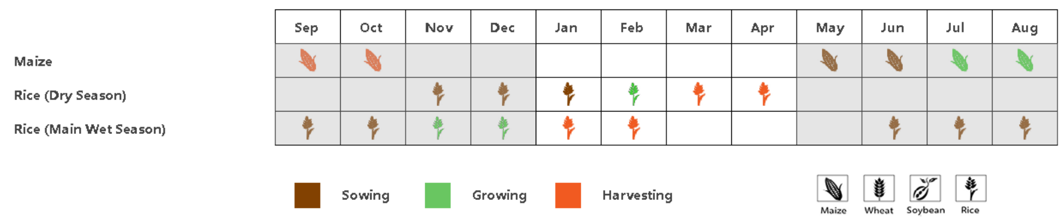
The nationwide NDVI profile displays an obvious deficit compared with 5-year average but spatial NDVI clusters only partially confirm the VCIx distribution. In March and April, 45.4 % of cropped areas display above or near average condition, with 46.2% slightly below average by 0.05 NDVI units and only 8.4% with NDVI 0.2 units below average. No clear spatial patterns emerge although the poorest crops seem to be located along the tributaries of Tonle Sap.

**Regional Analysis**

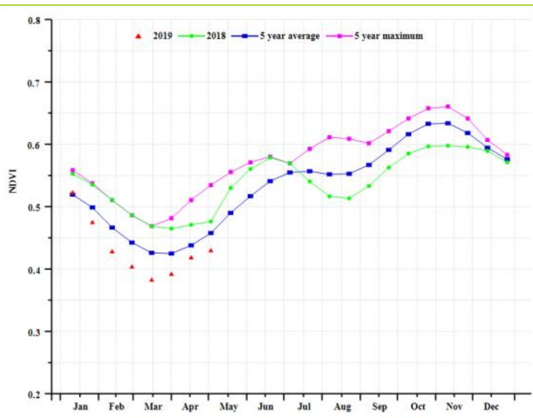
Based mostly on climate differences and topography four agro-ecological regions can be distinguished, starting with the Tonle Sap lake area where rainfall and especially temperature are influenced by the lake itself. The second and the third area, referred to as the "Mekong valley between Tonle-sap and Vietnam border" and "Northern plain and northeast" covers agriculturally less important regions east of the Lake. In the last zone, the "South-western Hilly region" monsoon plays a larger part than in the other regions where the Mekong supplies most water to farming.

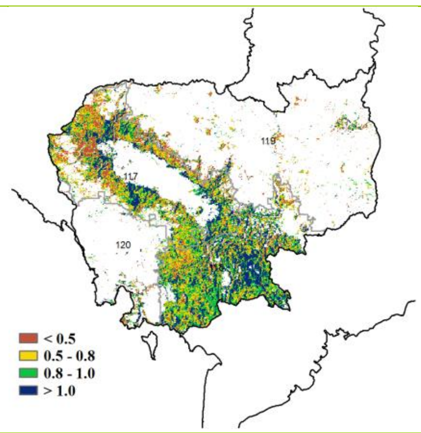
All four regions suffered a reduction in rainfall compared with average in the range of 10% (Tonle Sap) to 43% in the Mekong valley between Tonle Sap and the Vietnam border. All regions had about average temperature and a positive RADPAR departure (2 to 3%) which, however, reached 6% in the northern plain and North-east. Drought caused an 8% drop in BIOMSS near Tonle Sap but larger departures from -9% to -25% in other regions. NDVI profiles also display unsatisfactory crops in all four regions. NDVI was persistently below average except in January in the Tonle Sap basin and the Mekong valley between Tonle Sap and the Vietnam border and at the end of April in the south-western Hills.

**Figure 3.25 Cambodia's crop condition, January – April 2019**



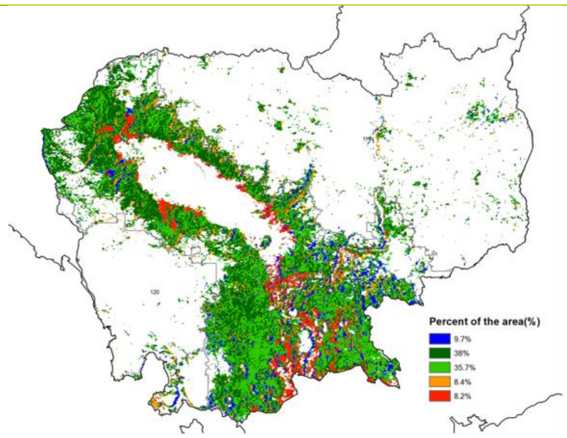

(a). Phenology of major crops



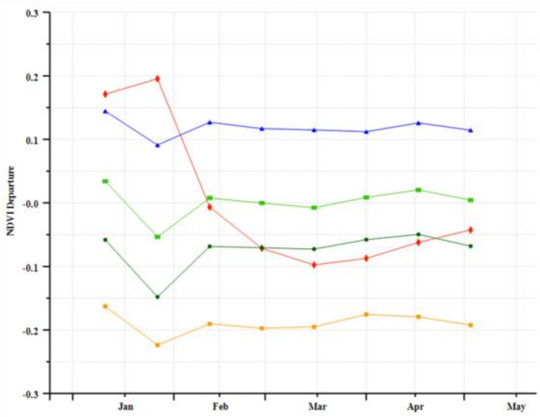




(b) Crop condition development graph based on NDVI

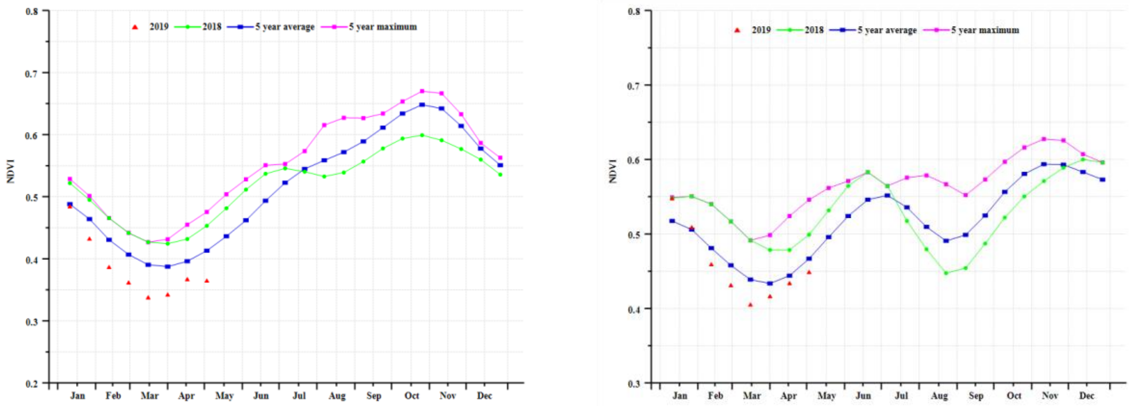
(c) Maximum VCI



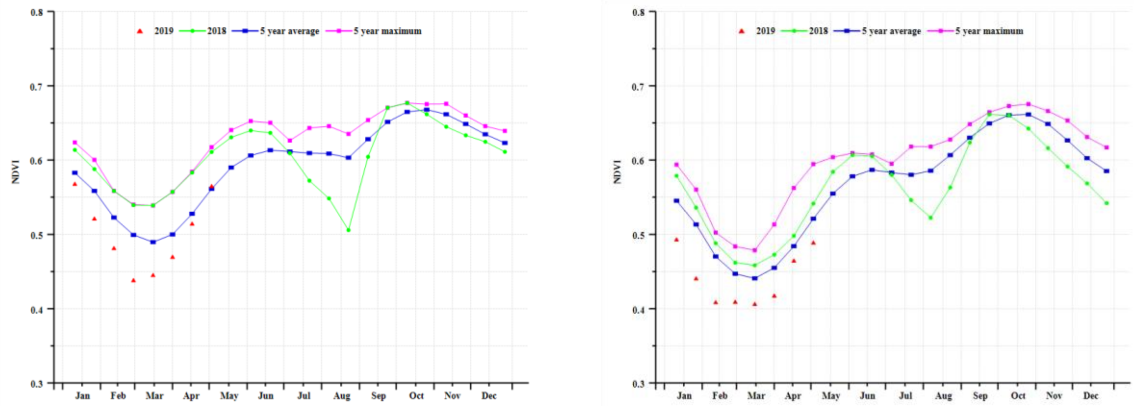

(d) Spatial NDVI patterns compared to 5YA




(e) NDVI profiles




(f) Crop condition development graph based on NDVI_Central Tonle-Sap plain (left) and Mekong valley between Tonle-sap and Vietnam borders (right))




(g) Crop condition development graph based on NDVI_Southwest Hilly region (left) and Northern plain and northeast (right))

**Table 3.41 Cambodia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m2) | Departure from 15YA (%) |
| Tonle Sap | 167 | -10 | 29.2 | -0.2 | 1185 | 2 |
| Mekong valley between Tonle-sap and Vietnam border | 103 | -43 | 29.2 | -0.2 | 1204 | 3 |
| Northern plain and northeast | 125 | -33 | 28.8 | 0.3 | 1236 | 6 |
| Southwest Hilly region | 244 | -22 | 26.9 | -0.3 | 1179 | 3 |

**Table 3.42** Cambodia, agronomic indicators bysub-national regions, current season's values and departure from 5YA/15YA, January – April 2019

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Tonle Sap | 605 | -8 | 65 | -5 | 0.80 |
| Mekong valley between Tonle-sap and Vietnam border | 440 | -26 | 87 | 8 | 0.89 |
| Northern plain and northeast | 465 | -23 | 88 | -7 | 0.69 |
| Southwest Hilly region | 859 | -9 | 98 | 1 | 0.86 |

# [LKA] Sri Lanka

Sri Lanka cultivates mainly maize and rice in rotation. The main Maha season extends from October to December or March (depending on location) mostly in the east. Much of the west has bimodal rainfall with the second Yala season centered around March-June. The monitoring period covers the entire growth and harvesting season of main Maha rice and maize, as well as early sowing season of Yala rice and maize. According to the CropWatch monitoring results, crop condition was below average during January to April.

Nationwide, rainfall dropped 31% below average, while temperature and radiation were near average (-0.1°C and 4%, respectively). As shown by agronomic indices, the fraction of cropped arable land (CALF) remained comparable with the 5-year average. Low precipitation in the country may have had a negative influence on Maha crops and resulted in low biomass (BIOMSS -23%). The crop condition development graph based on NDVI displayed an unfavorable situation during the whole period. Crop condition dropped below average since January and reached minimum during mid-April. Similar conditions also occurred in sub-national regions as described below. Poor performance of NDVI profiles may be related to dry climate over the country.

Spatial heterogeneity was significant throughout the country according to NDVI clusters map and profiles. 17.1% area of the cropland displayed good crop condition during January to April, mainly distributed in scattered areas in Colombo to Galla, Kurunegala, Kandy, Nuwara Eliya and Badulla. 45.2% area of the cropland, distributed in the same areas as above, enjoyed average conditions before mid-February and slowly declined since then. The remaining cropland showed negative departures at different times and locations. 21.4% of cropland was below average since mid-February around Puttalam, Anuradhapura, Trincomalee and Polonnaruwa. 7.4%, scattered in north-eastern areas, deviated far from average in February. In addition, 8.9% of the cropland (between Anuradhapura and Trincomalee) showed negative values during the whole period. The maximum VCI map displays a mostly fair situation with low values distributed in south-western regions and high values occurring throughout the country.

**Regional analysis**

Based on the cropping system, climatic zones and topographic conditions, three sub-national agro-ecological zones (AEZ) can be distinguished for Sri Lanka. They are the Dry zone, the Wet zone, and the Intermediate zone.

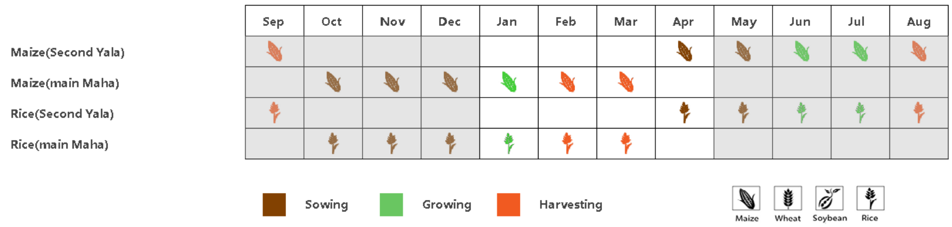
There is little difference between the three AEZs in terms of agronomic indices. The CALF for the three sub-national zones is almost the same and shows full cropping. VCIx values are above 0.95 for the Dry zone and the Intermediate zone, and somewhat lower (0.89) for the Wet zone. The BIOMSS indices, however, displayed different decreases: 28%, 12% and 26%, respectively.

The **Dry zone** is the largest of the three AEZs and located in the eastern half of the country (from north to south). The agro-climatic conditions show that rainfall fell 45% compared with average, while both temperature and radiation were near. Crop condition of the zone was below average during almost the whole period, akin to the nationwide situation

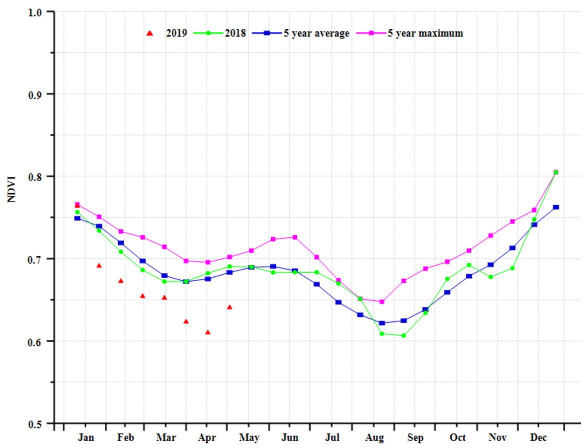
The **Wet zone** covers the smallest area (in the south-west) as well as the “most favorable” agro-climatic condition among AEZs. Rainfall was below average by 9% and temperature and radiation were respectively close to average and above (+0.1℃ and +7%). Indicators were near average before mid-March and deteriorated since then, but crops are nevertheless assessed as average.

In the **Intermediate zone** agro-climatic indicators are close to national values. The rainfall decreased by 32% and both temperature and radiation are slightly above average. According to the NDVI development graphs, crop condition is near average.

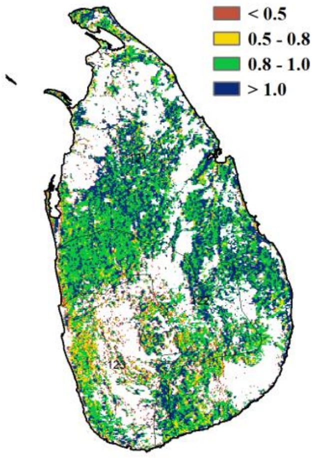
**Figure 3.26 Sri Lanka's crop condition, January - April 2019**



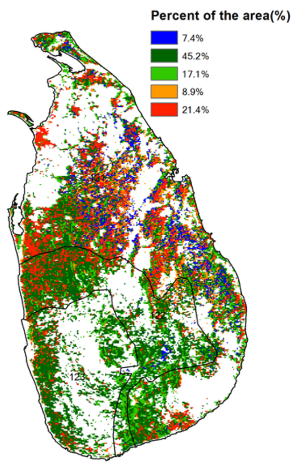

(a). Phenology of major crops

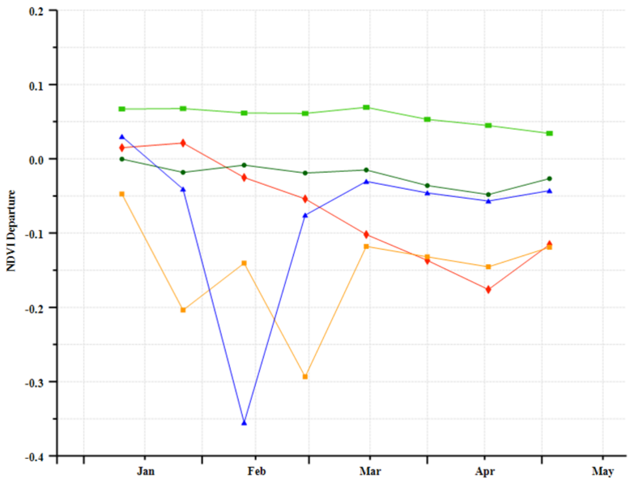



(b) Crop condition development graph based on NDVI



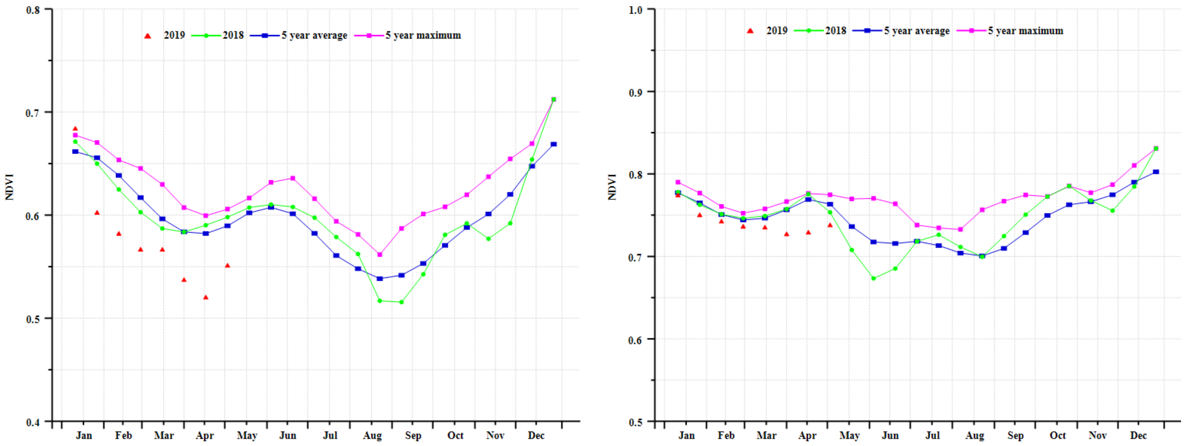

(c) Maximum VCI



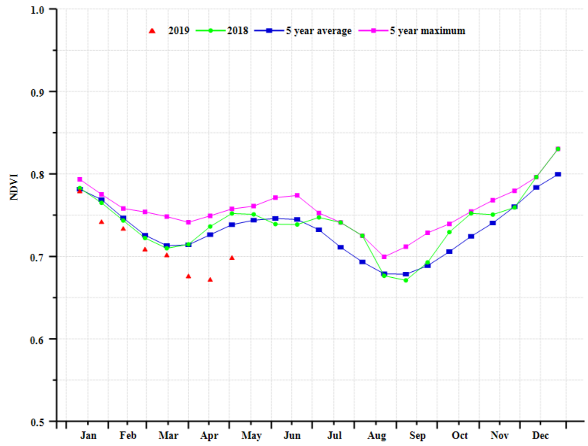




(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Dry zone (left) and Wet zone (right))




(g) Crop condition development graph based on NDVI (Intermediate zone)

**Table 3.43** Sri Lanka's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Dry zone | 258 | -45 | 28 | -0.1 | 1303 | 3 |
| Wet zone | 698 | -9 | 25 | -0.1 | 1217 | 7 |
| Intermediate zone | 446 | -32 | 27.1 | -0.1 | 1213 | 4 |

**Table 3.44** Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Dry zone | 799 | -28 | 99 | 1 | 0.98 |
| Wet zone | 1508 | -12 | 100 | 0 | 0.89 |
| Intermediate zone | 1111 | -26 | 100 | 0 | 0.95 |

# [MAR] Morocco

Winter wheat was growing, and maize was planted during the reporting period. The CropWatch agroclimatic indicators show that the rainfall (RAIN) was well 39% below the average with no significant change in the temperature (TEMP) compared with average. The estimated RADPAR was slightly above the average (by 3% increase), while the BIOMSS was significantly down (36%) due to the drop in the rainfall. The CALF was average but low (58%).

Nationwide, NDVI showed above average values until mid-February. Crop condition then dropped below the 5YA until the end of the reporting period. The same pattern is confirmed at the sub-national level: only 13.4% of the total cropped area remained above average during the whole reporting period. The VCIx ranged between moderate (0.5 – 0.8) to high (0.8 -1.0) for most regions except the central part of Souss-Massa and Guelmim-Oued Noun Provinces and the coastal part of the Oriental Province where the VCIx was low (< 0.5). Nationwide, the estimated VCIx was moderate (0.8). Altogether, CropWatch estimates depict fair crop conditions.

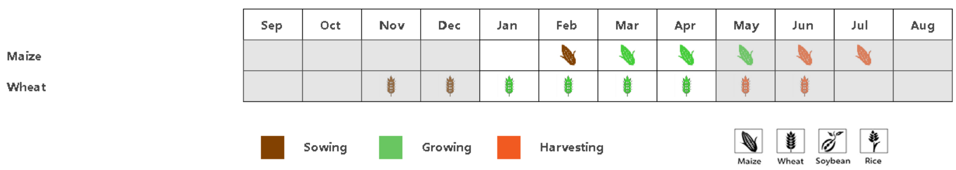
**Regional analysis**

Based on the cropping system, climatic zones, and topographic conditions, four sub-national agro-ecological regions (AEZs) can be distinguished for Morocco. Only three of them are relevant for crops: **Sub-humid northern highlands** including central Centre-Nord Region and northen Centre-Sud, **Warm semi-arid zone** covering the regions of Nord-Oriental and the broad Tensift TRegion, and **Warm sub-humid zone** of the Nord-Ouest Region.

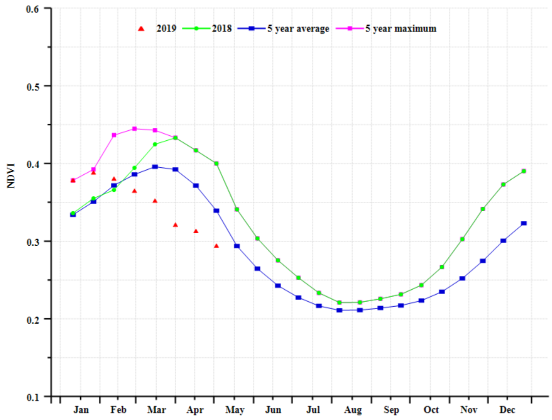
The agroclimatic indicators for the three AEZs show a high reduction in rainfall (-34%, 40% and 43%, respectively) with about average temperature (departures between -0.1°C and +0.1°C). RADPAR was slightly above average (3% to 4%) for the three zones. The agronomic indicators showed a 35% to 40% reduction in the estimated BIOMSS. The CALF was above the average for the first and third zones (5 and 6%, respectively) but 11% below the average for the second zone. Also, the maximum VCI was high (0.9) for the first and the third zone but moderate (0.7) for the second, the Warm semi-arid zone.

The NDVI development graphs follow the same pattern as the nationwide NDVI-based graph: condition of crops was first above average and then dropped to be below average. The difference between zones was in the time when the crop conditions turned to be below average: March for **Sub-humid northern highlands**, end of January for **Warm semi-arid zones**, and end of February for **Warm sub-humid zones**.

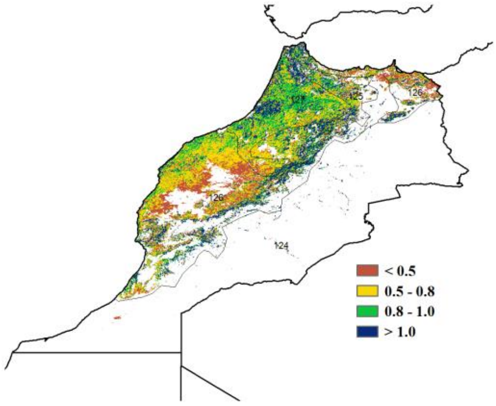
**Figure 3.27 Morocco's crop condition, January - April 2019**



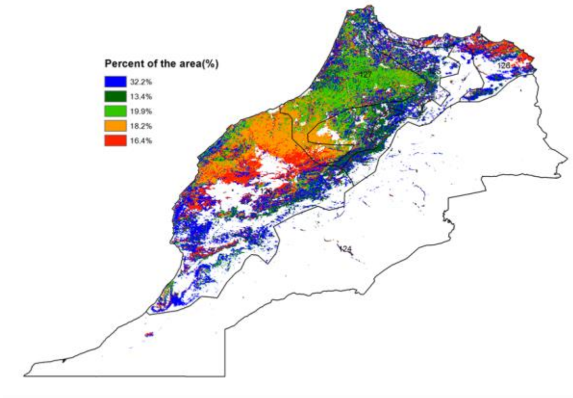

(a). Phenology of major crops



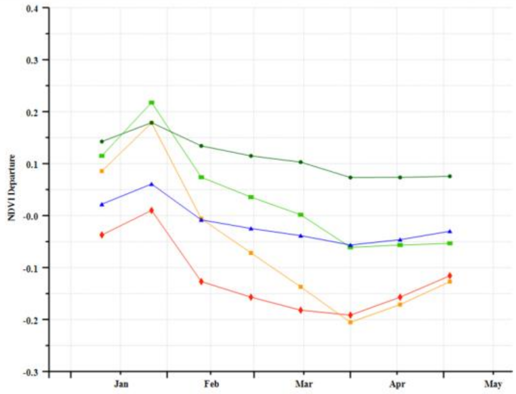

(b) Crop condition development graph based on NDVI



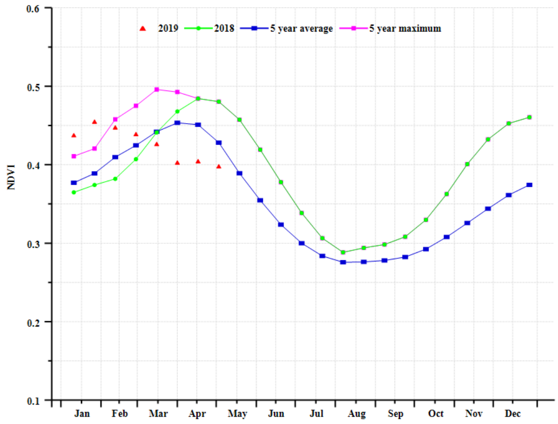

(c) Maximum VCI

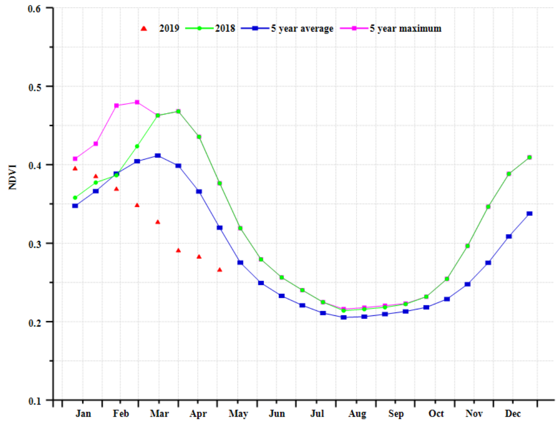



(d) Spatial NDVI patterns compared to 5YA

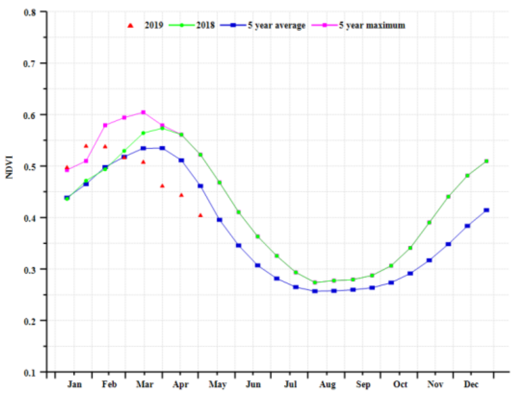



€ NDVI profiles




(f). Crop condition development graph based on NDVI (Sub-humid northern highlands).and (g). Warm semiarid zones )




(h) . crop condition development graph based on NDVI, Warm subhumid zones.

**Table 3.45 Morocco's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Sub-humid northern highlands | 124 | -34 | 10 | 0.1 | 990 | 3 |
| Warm semi-arid zones | 72 | -40 | 12.3 | 0.1 | 1112 | 4 |
| Warm sub-humid zones | 116 | -43 | 12.4 | -0.1 | 1003 | 3 |

**Table 3.46 Morocco's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Sub-humid northern highlands | 452 | -35 | 66 | 5 | 0.9 |
| Warm semi-arid zones | 270 | -37 | 40 | -11 | 0.7 |
| Warm sub-humid zones | 440 | -39 | 83 | 6 | 0.9 |

# [MEX] Mexico

Maize has reached harvesting from January to March in North-west Mexico; rice and soybean planting started from April. Winter wheat was growing between January and March and matured in April. According to the crop condition development graph based on NDVI, crop condition at the national level was average from early January to early February but deteriorated continuously from late February through April.

The CropWatch agro-climatic indicators show that temperature and RADPAR were average (+0.1°C and +1%, respectively) but rainfall dropped 49%, which might have negatively affected crop growth, as shown by BIOMSS (down 29%) and a relatively low VCIx (0.80). Low VCIx values (below 0.5) were widespread in central and eastern Mexico (such as Durango, Zacatecas, Guanajuato and Nuevo Leon), whereas high values (above 0.8) occurred in the south-eastern and north-western parts of the country, including Veracruz-Llave, Tabasco, Chiapas and Sonara. Consistent with the pattern of VCIx, below-average NDVI, accounting for 21.3% of all arable land, mainly appears in eastern Mexico (i.e., Tamaulipas and Nuevo Leon). In contrast, 22% of cropped areas recorded continuously above average NDVI in north-western, northern and south-eastern parts of the country (covering Sonara, Chihuahua, Coahuila De Zaragoza, Tabasco and Chiapas). Crop production of the current season is assessed as below average, although the average CALF of the country increased 1% compared to the past 5-year average.

Regional analysis

Based on cropping systems, climatic zones and topographic conditions, Mexico is divided into four agro-ecological regions. They include Arid and semi-arid regions (128), Sub-humid temperate region with summer rains (130), Sub-humid hot tropics with summer rains (131) and Humid tropics with summer rainfall (129).

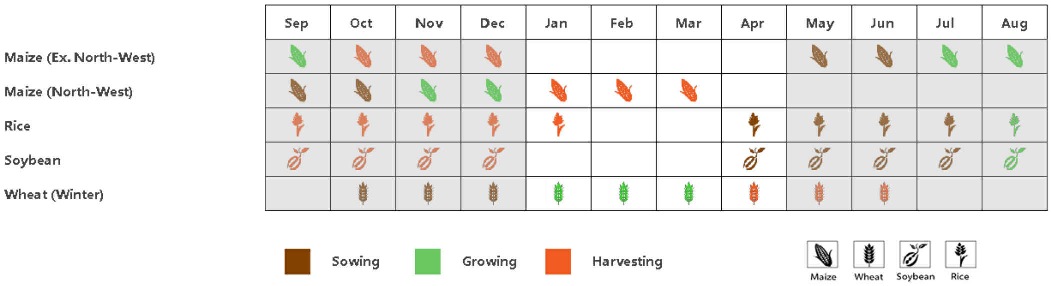
**Arid and semi-arid regions** are located in northern and central Mexico. During the current monitoring period the regions recorded lower than average precipitation and radiation (-23% and -2%, respectively) but average temperature which, This led to generally below-average crop condition, as indicated by the NDVI time profile.This is corroborated by relatively low values for BIOMSS (5% below average) and VCIx (0.79). Although the CALF was 3% greater than average, the prospects for crop production in these areas are not favourable.

As important crop production regions of southern Mexico, the **Sub-humid temperate region** experienced a very pronounced decline in rainfall, a decrease of 62% compared to average, which resulted in unsatisfactory crop condition, as confirmed by low BIOMSS (-55%) and VCIx (0.75). Moreover, the NDVI values were also generally below average, especially in the late stage of the reporting period. Considering that CALF decreased 1%, the production outlook for these regions is assessed as be below average.

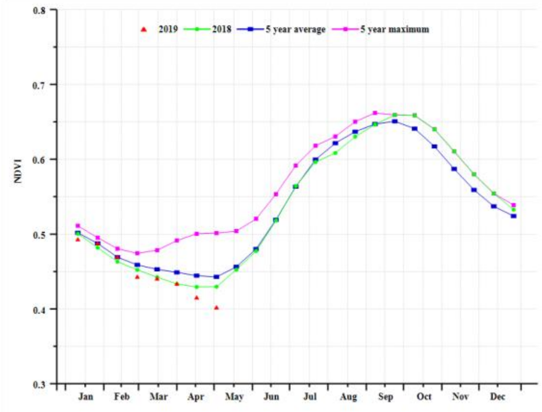
In the **Sub-humid hot tropics with summer rains**, temperature and radiation increased (0.5°C and 2%, respectively) but rainfall declined 60%, which resulted in below-average BIOMSS (-48%). The trend of crop condition development was similar to the previous region, which showed a deterioration during the reporting period. The average VCIx of the regions, remains at 0.87.

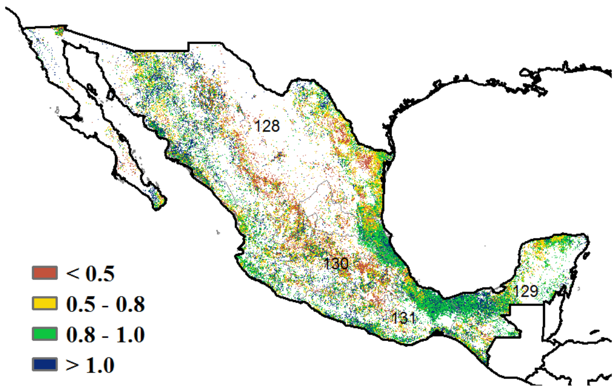
The **Humid tropics with summer rainfall** recorded rainfall that was significantly below average (-58%) while temperature and radiation were above average (+0.2°C and +4%). According to crop condition development graph based on NDVI, crop condition was generally below average in these areas, which is consistent with the decreased BIOMSS (-44%). The average VCIx in the areas was 0.89.

**Figure 3.28 Mexico's crop condition, January - April 2019**



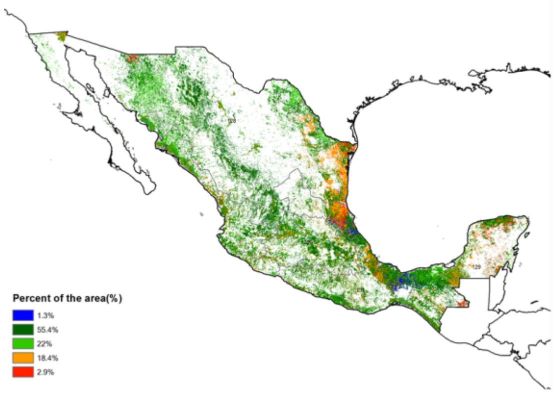

(a). Phenology of major crops

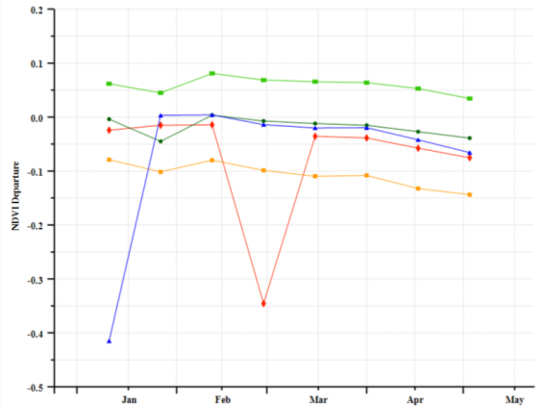



(b) Crop condition development graph based on NDVI

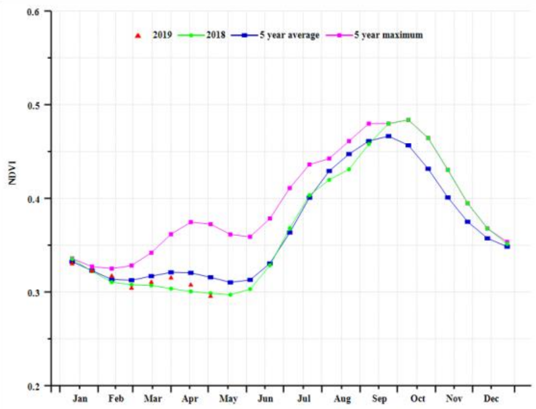
(c) Maximum VCI

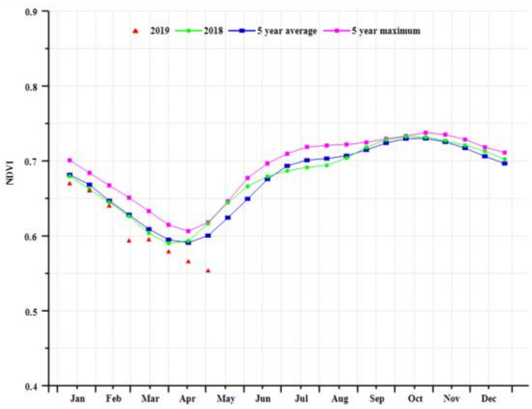


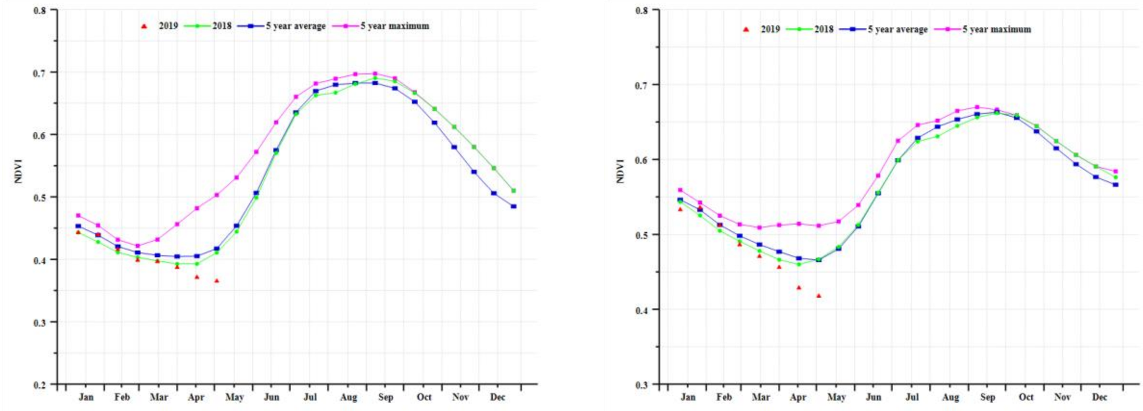

(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Arid and semi-arid regions (left) and Humid tropics with summer rainfall (right))




(g) Crop condition development graph based on NDVI (Sub-humid temperate region with summer rains (left) and Sub-humid hot tropics with summer rains (right))

**Table 3.47 Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Arid and semi-arid regions | 58 | -23 | 16.1 | -0.1 | 1207 | -2 |
| Sub-humid temperate region with summer rains | 32 | -62 | 19.3 | 0.5 | 1351 | 2 |
| Sub-humid hot tropics with summer rains | 34 | -60 | 21.5 | 0.2 | 1277 | 2 |
| Humid tropics with summer rainfall | 70 | -58 | 25.6 | 0.2 | 1209 | 4 |

**Table 3.48 Mexico's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Arid and semi-arid regions | 259 | -5 | 40 | 3 | 0.79 |
| Sub-humid temperate region with summer rains | 148 | -55 | 52 | -1 | 0.75 |
| Sub-humid hot tropics with summer rains | 163 | -48 | 83 | 2 | 0.87 |
| Humid tropics with summer rainfall | 324 | -44 | 99 | 0 | 0.89 |

AFG AGO ARG AUS BGD BLR BRA CAN DEU EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN KHM LKA MAR MEX **MMR** MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [MMR] Myanmar

Myanmar cultivates maize, rice (two seasons) and wheat as its main crops, which are distributed across the eastern mountains, central plains and the western coastal areas. The monitoring period exactly covers the harvesting season of maize. The second rice was still growing in the first two months and was harvested from March. The wheat maturity was reached in February. CropWatch assesses crop condition throughout the country as generally comparable to the average of the previous five years.

Precipitation (RAIN), temperature (TEMP) and radiation (RADPAR) were all somewhat above average (+1%, +0.3°C and +4%, respectively) with the crop arable land fraction (CALF) increasing by 2% compared to the 5-year average. BIOMSS is up 1%. The crop condition development graph based on NDVI shows a favorable situation: average in January, close to the 5-year maximum in February, followed by a sight decline in March and April. Similar fluctuations of crop condition can also be seen in NDVI profiles of the agro-ecological regions described in the regional analysis below. During the monitoring period, the maximum VCI value for the whole country is 0.94.

In terms of spatial distributions, most of cropland across the country displayed good condition except for several patches in the Central Plain and the western coast of Tanintharyi Region. Arable land with above average NDVI (36.1% of cropland) occurs in northern Ayeyarwady Region, Yangon Region, east of Bago Region and clustered areas around Sagaing Region and Magwe Region. Slightly below average NDVI occurred in southern Sagaing Region, Magwe Region, Mandalay Region and west of Shan State (36.6% of cropland). The VCIx map displays a similar spatial distribution pattern of high values all over the country, accompanied by low values in scattered locations.

**Regional analysis**

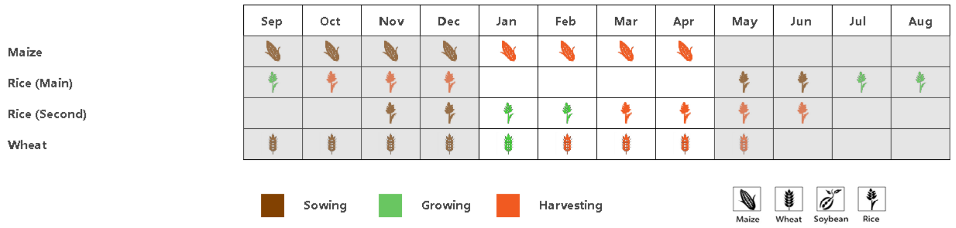
Based on the cropping system, climatic zone and topographic conditions, three sub-national agro-ecological regions (AEZs) can be distinguished for Myanmar. They are the Coastal region, the Central plain, and the Hills region.

The **Coastal region** is located in south-western Myanmar and cultivates mainly maize. The Coast experienced the most favorable conditions among the three AEZs, which was also the case during the previous ONDJ period. Rainfall exceeded average by 22% and both temperature and radiation were slightly above average (TEMP up 0.2°C, RADPAR up 4%). CALF is 4% above the 5-year average. Crop condition is also above average for the region, of which the biomass displays an increase of 13% over average and the maximum VCI value reaches 1.03, indicating outstanding crops.

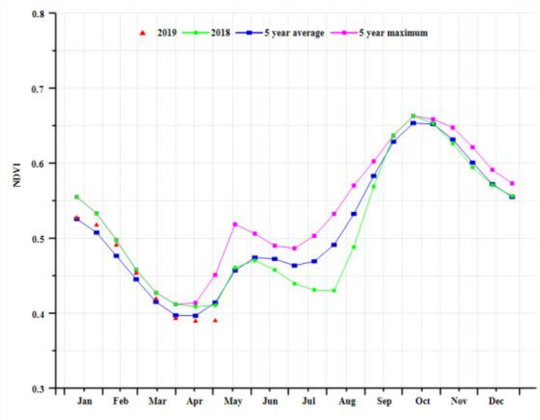
The **Central plain** is the main rice growing area in Myanmar, covering several Regions such as Magwe, Mandalay and northern Bago. Agro-climatic conditions were roughly similar to those in the Coastal region. Rainfall is above average (RAIN +13%) with both temperature and radiation above average as well (TEMP 0.3°C and RADPAR 4%). The CALF reached 70%, 1% over average, and the biomass raises 8% compared to 15-year average. The condition of crops is fair with maximum VCI of 0.88.

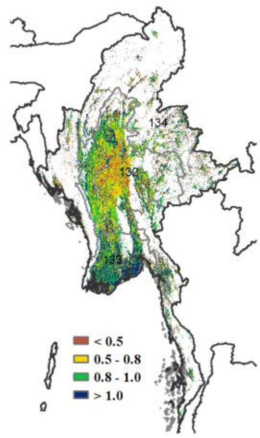
Maize is the main crop in the **Hills region** (States of Shan, Kachin, Chin and Rakhing and Sagaing Region). Compared with the other two AEZs, rainfall varies in the opposite direction while temperature and radiation remain comparable: RAIN -11%, TEMP -0.2°C and RADPAR 4%. Affected by relatively poor conditions, the biomass declines by 6%. However, crop condition remains average according to NDVI profiles and the high maximum VCI value (0.99).

**Figure 3.29 Myanmar's crop condition, January - April 2019**

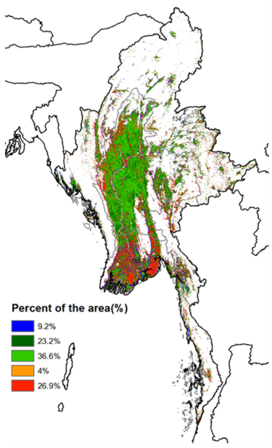


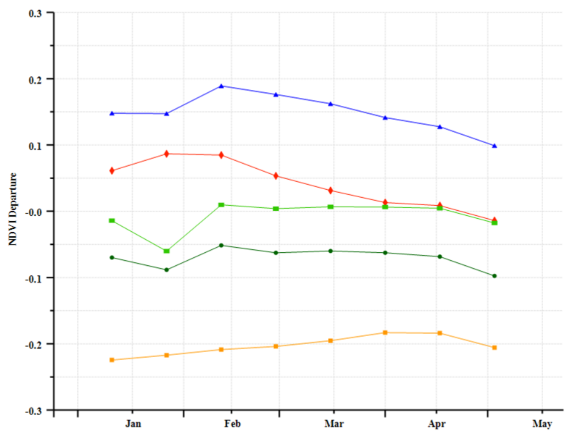

(a). Phenology of major crops



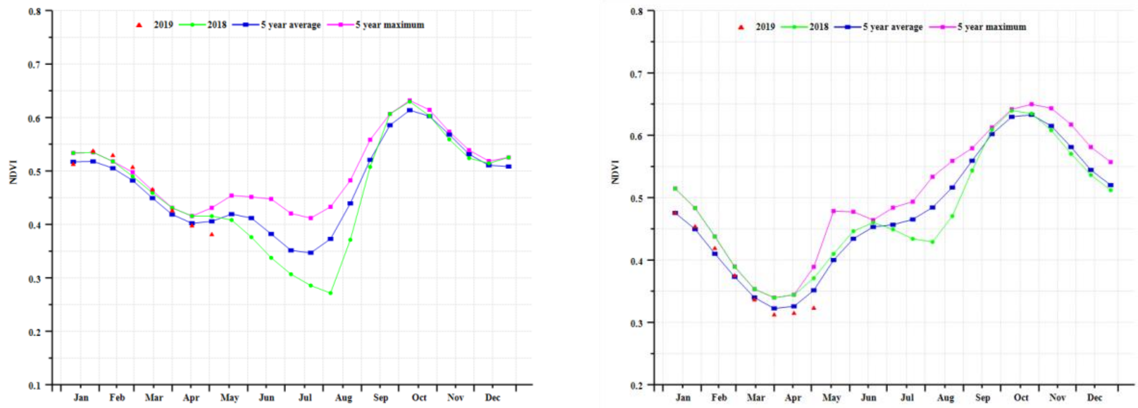




(b) Crop condition development graph based on NDVI (c) Maximum VCI

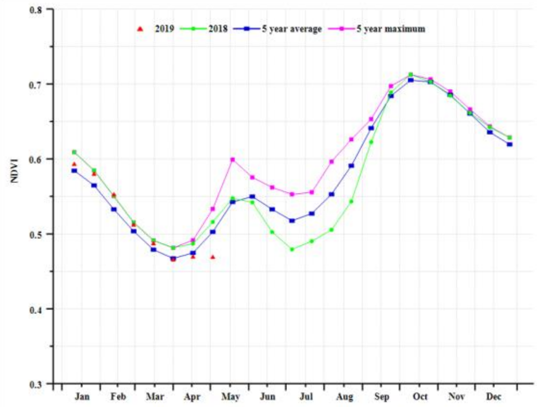



(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles




(f) Crop condition development graph based on NDVI (Coastal region (left) and Central plain (right))




(g) Crop condition development graph based on NDVI (Hill region)

**Table 3.49 Myanmar's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| **Coastal region** | 114 | 22 | 28.8 | 0.4 | 1332 | 4 |
| **Central plain** | 60 | 13 | 25.8 | 0.3 | 1318 | 4 |
| **Hill region** | 94 | -11 | 21.9 | 0.2 | 1267 | 4 |

**Table 3.50 Myanmar's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| **Coastal region** | 361 | 13 | 90 | 4 | 1.03 |
| **Central plain** | 253 | 8 | 70 | 1 | 0.88 |
| **Hill region** | 383 | -6 | 94 | 2 | 0.99 |

# [MNG] Mongolia

Due to seasonably cold weather, no crops were grown in Mongolia during the monitoring period. The national average VCIx was 0.91. Among the CropWatch agroclimatic indicators, RAIN was below average (-27%) and TEMP and RADPAR were above (+2.2°C and +2%). The combination of factors resulted in low BIOMSS (18% below average). As shown by the NDVI development graph, the vegetation condition was above average from January to late March and below average in April. However, NDVI was lower than 0.2, which is indicates essentially bare soil or dry vegetation, or snow. The national NDVI development graph and the spatial NDVI profiles show that 84.5% of arable lands were above average from February to late March, mostly in Khentii, eastern parts of Dornod, Selenge and patches in Bulgan and Hovsgol provinces. The observation is clearly related to high temperature.

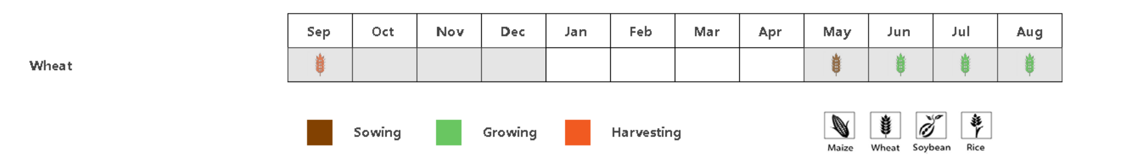
**Regional analysis**

In the **Khangai Khuvsgul region**, NDVI was above the five-year average from January to March and close to the average in April. RAIN was below average (-7%), while TEMP and RADPAR were above average (+1.4°C and +2%). The BIOMSS index decreased by 11% compared to the fifteen-year average. The maximum VCI index was 1.

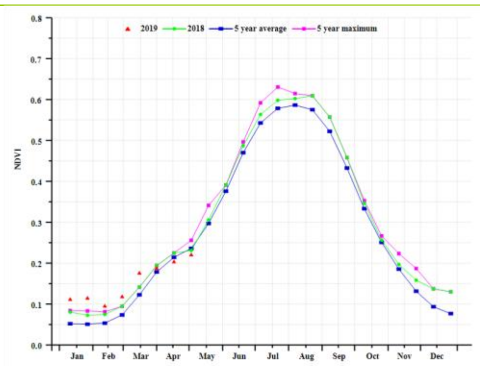
Vegetation condition was above the five years average from January to March and below the five years average in April in the **Selenge-Onon region**. Accumulated rainfall was well below average (RAIN -46%). TEMP and RADPAR were above average (+2.5°C and +3%). The BIOMSS index decreased by 29% compared to fifteen years average. The maximum VCI index was 0.89.

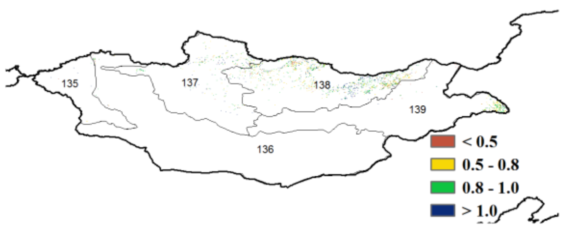
According to the NDVI development graph, vegetation condition in the **Central and Eastern Steppe Region** was above the five-year maximum. RAIN and TEMP were above average (+19% and +3.5°C), while BIOMSS index increased by 15% compared fifteen years average and RADPAR was above five years average (+1%) in this region. The maximum VCI index was 0.80. Unseasonably favourable conditions have benefited grasslands but much water was lost to increased evaporation due to unusually warm weather.

**Figure 3.30 Mongolia's crop condition, January - April 2019**



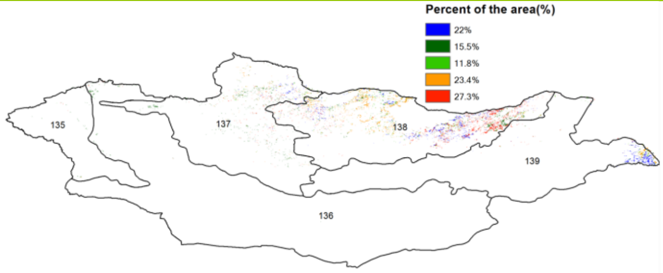

(a). Phenology of major crops

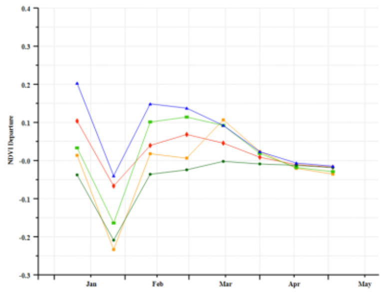


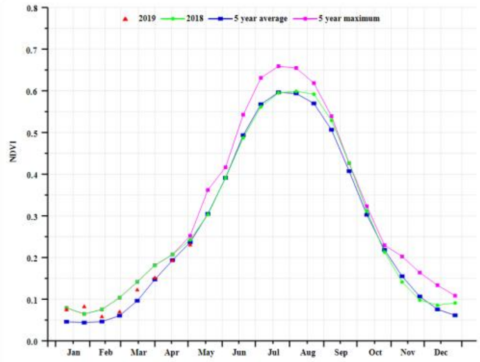

(b) Crop condition development graph based on NDVI

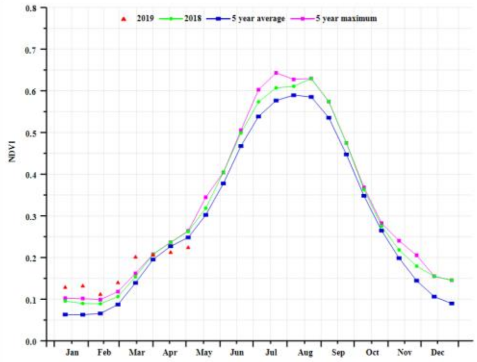
(c) Maximum VCI



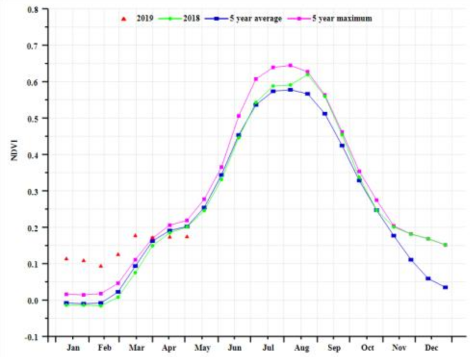



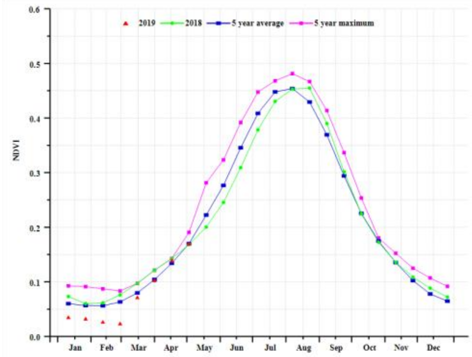

(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



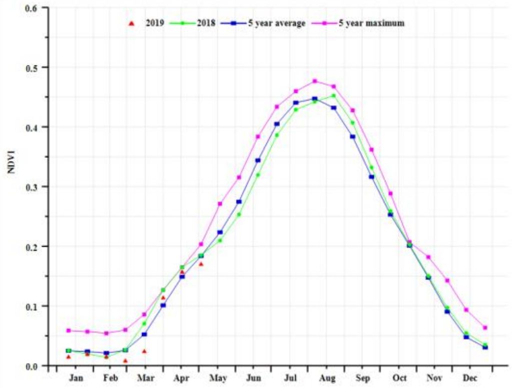




(f) Crop condition development graph based on NDVI Hangai Khuvsgul Region (left), and Selenge-Onon Region (right))




(g) Crop condition development graph based on NDVI Central and Eastern Steppe Region (left), and Altai Region (right))




(h) Crop condition development graph based on NDVI (Gobi Desert Region)

**Table 3.51 Mongolia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| Hangai Khuvsgul Region | 51 | -7 | -13.2 | 1.4 | 821 | 2 |
| Selenge-Onon Region | 36 | -46 | -10.2 | 2.5 | 814 | 3 |
| Central and Eastern Steppe Region | 90 | 19 | -9.4 | 3.5 | 819 | 1 |
| Altai Region | 93 | -9 | -12.8 | 1.1 | 768 | 2 |
| Gobi Desert Region | 32 | -31 | -15.9 | 0.9 | 794 | 3 |

**Table 3.52 Mongolia's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Hangai Khuvsgul Region | 212 | -5 | - | - | 1.00 |
| Selenge-Onon Region | 195 | -29 | - | - | 0.89 |
| Central and Eastern Steppe Region | 313 | 15 | - | - | 0.80 |
| Altai Region | 342 | 31 | - | - | 0.85 |
| Gobi Desert Region | 159 | -27 | - | - | 0.84 |

AFG AGO ARG AUS BGD BLR BRA CAN DEU EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN KHM LKA MAR MEX MMR MNG **MOZ** NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [MOZ] Mozambique

The monitoring period covers the growth and harvest of Maize and Rice and, the sowing and early growth of Wheat. Compared to average, the agroclimatic indicators for this period showed an increase in rainfall by about 27%. The rainfall profile for this period reveals high values during the end of January and Mid-March. The high rainfall recorded in mid-March is directly related to the IDAI cyclone which overwhelmed the country, particularly in the Buzi and Lower Zambezi river basins. This event caused floods which had a significant impact on crop conditions over these regions. Additional detail is provided in Chapter 5. Both temperature and radiation decreased by about 0.7°C and 1%, respectively. The agronomic indicators show an increase in Biomass (+4%) and the cropped arable land fraction (0.3%) over the country. The maximum VCI recorded for this period was 0.94.

The NDVI development graph indicates unfavourable crop conditions from February till the end of the monitoring period when compared to the past five-years average. According to the spatial NDVI above 5YA crop condition was observed in 24.3% of the total cropped area, most notably in Southern Tete and Northern Sofala. Besides, 14.7% of the cropped area had below average crop conditions during the entire monitoring period, which includes a sudden drop during mid-March, mostly in Sofala and Zambézia Provinces. The observed floods influenced the low crop conditions recorded over these areas. Despite the unfavourable crop conditions in most of the cropped areas, nationwide, better than average (VCIx was observed.

Floods affected mostly the central Provinces of Sofala and Manica. By March 26th, the inundated area was about 251,000 Ha (about 3.6% of the total country's cropland area). By April 9th, 158,000 Ha (corresponding to 1.4% of the total country's cropland area) were still under water with crops completely lost. The floods did not have a significant impact on crop condition nationwide. The CropWatch estimated 2019 production to reach 2044 thousand tons for Maize and 374 thousand tons for Rice. This production corresponds to a variation of -2% and -0.5% for Maize and Rice, respectively, when compared to the year 2018.

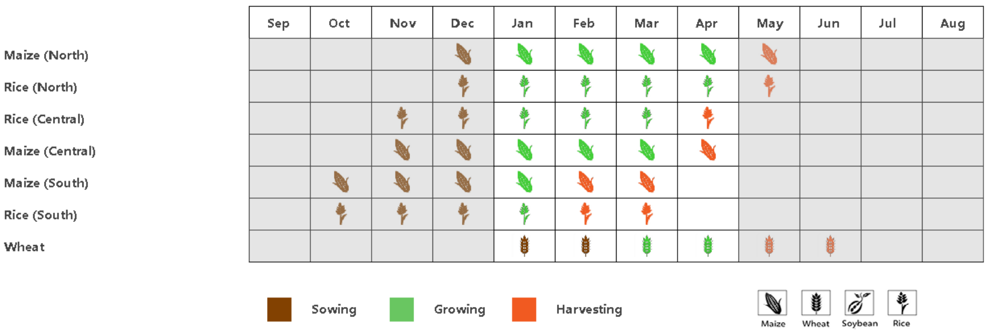
**Regional analysis**

According to the cropping system, topography and climate, Mozambique is subdivided into five agro-ecological zones (AEZ), listed as follow: (1) Buzi basin (2) Northern high altitude areas (3) Low Zambezi basin (4) Northern coast and (5) Southern region.

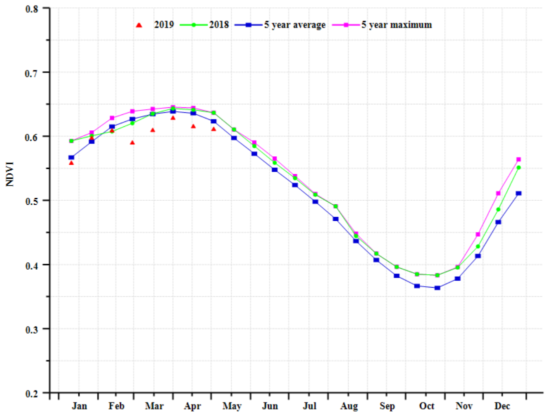
During the monitoring period, except for **Northern high altitude areas**, the agro-ecological zones showed a significant increase in rainfall, and the **Low Zambezi** river basin and **Buzi basin** were the ones that stood out most with an increase in rainfall of about 49% and 52%, respectively. The rainfall profiles indicate that during mid-March, the recorded rainfall exceeded 350mm and 150mm in the Buzi basin and the Lower Zambezi basin, respectively. The temperature patterns recorded indicate a reduction in all agro-ecological zones, varying from -4.0°C to -1.0°C. The radiation has fell in all sub-regions except for the **Northern Coast area**.

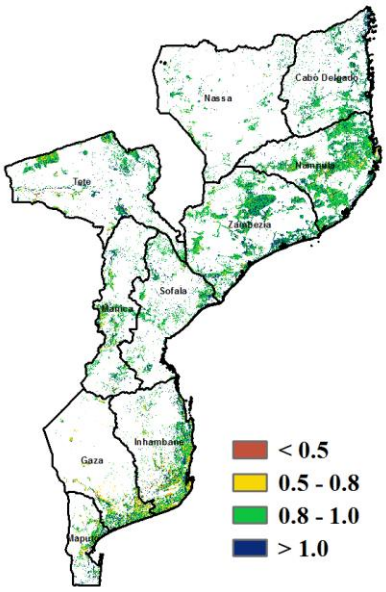
The NDVI development graphs indicate that the crop condition was not favourable during almost the entire monitoring period in all agro-ecological zones, most notable in the **Buzi basin** and **Lower Zambezi** river basin which were the regions most affected by the floods. Nonetheless, in the **Southern region**, crop condition recovered at the end of April. The recorded rainfall influenced the Biomass index in these regions and the nearby regions as well. Again, the **Lower Zambezi** river basin is the one that stands out with an increase of about 12% over the average. The cropped arable land area (CALF) was close to the 5YA and VCIx ranges between 0.90 to 0.95.

**Figure 3.31 Mozambique's crop condition, January - April 2019**



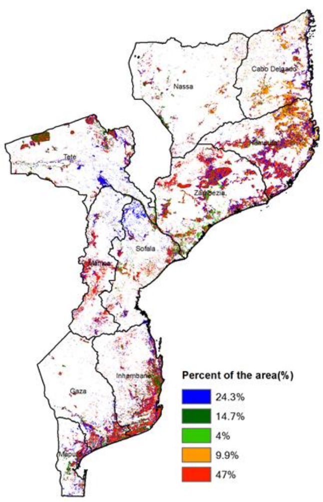

(a). Phenology of major crops

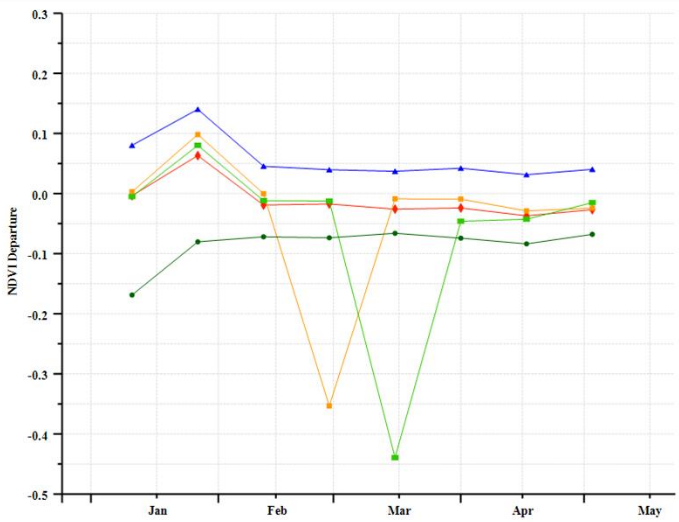



(b) Crop condition development graph based on NDVI

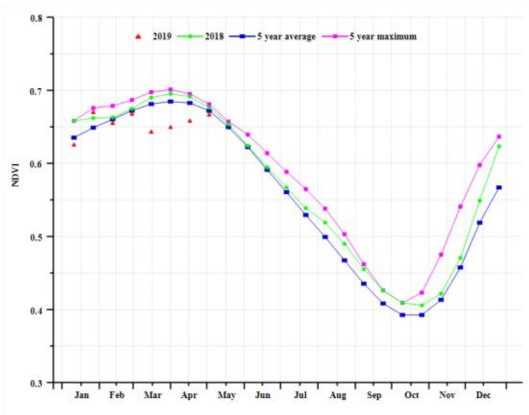
(c) Maximum VCI

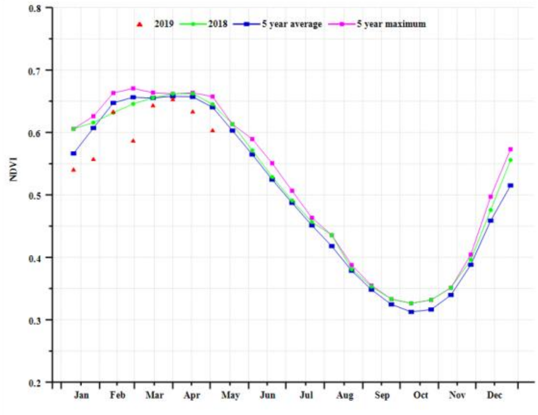


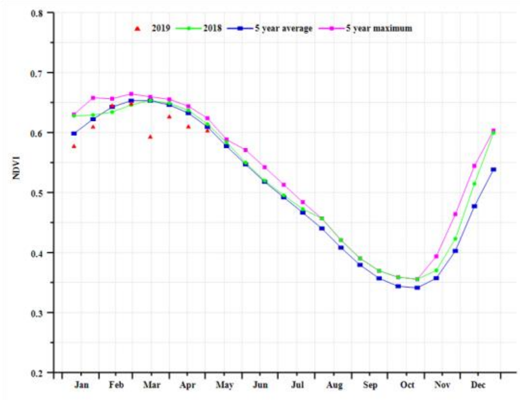

(d) Spatial NDVI patterns compared to 5YA

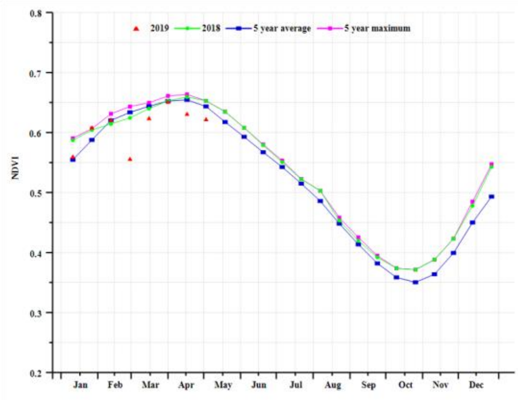
(e) NDVI profiles



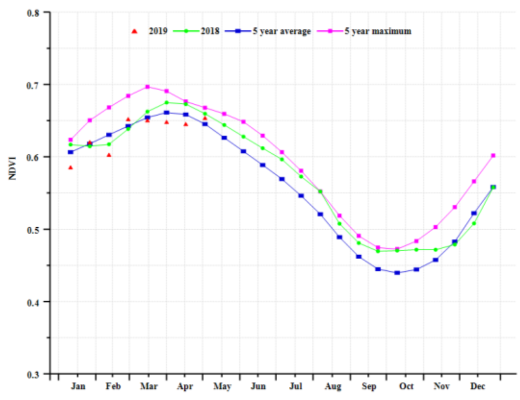



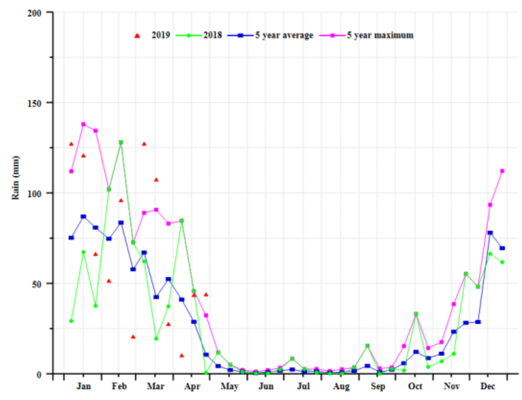

(f) Crop condition development graph based on NDVI- Buzi basin (g) Crop condition development graph based on NDVI- Northern high altitude areas



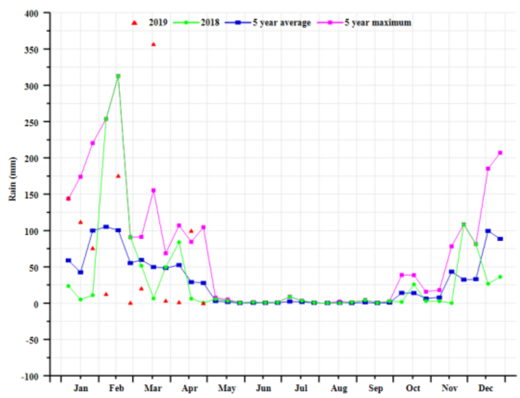



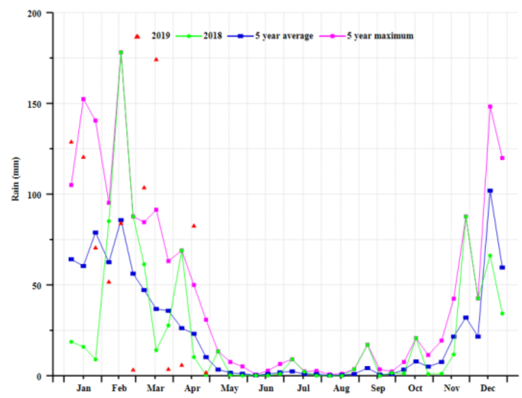

(h) Crop condition development graph based on NDVI- Lower Zambezi River basin (i) Crop condition development graph based on NDVI- Northern coast region




(j) Crop condition development graph based on NDVI- Southern region (k) National rainfall profiles, January-April 2019




(l) Buzi basin rainfall profile, January-April 2019 (m) Low Zambezi river basin rainfall profile, January-April 2019

**Table 3.53** Mozambique's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Buzi basin | 1004 | 52 | 25.5 | -1.0 | 1232 | -1 |
| Northern high altitude areas | 806 | 4 | 24.8 | -0.4 | 1099 | -3 |
| Low Zambezi River basin | 833 | 49 | 26.2 | -1.0 | 1173 | -3 |
| Northern coast | 978 | 18 | 26.6 | -0.5 | 1200 | 0 |
| Southern region | 577 | 36 | 27.0 | -0.5 | 1188 | -1 |

**Table 3.54** Mozambique's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Buzi basin | 1488 | 3 | 100 | 0 | 0.92 |
| Northern high altitude areas | 1873 | 1 | 100 | 0 | 0.95 |
| Low Zambezia River basin | 1581 | 12 | 99 | 0 | 0.94 |
| Northern coast | 1879 | 3 | 100 | 0 | 0.95 |
| Southern region | 1101 | 2 | 99 | 1 | 0.90 |

AFG AGO ARG AUS BGD BLR BRA CAN DEU EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN KHM LKA MAR MEX MMR MNG MOZ **NGA** PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [NGA] Nigeria

The reporting period covers the harvest of second maize and of irrigated rice. It also includes the sowing of the main maize crop in the south as well as the rain-fed rice. Rainfall was above average (RAIN +9%). while the temperature and radiation registered a decrease (TEMP -0.3ºC and RAPDAR -1%). The total biomass production potential increased (BIOMASS +8%) although the cropped Arable Land Fraction (CALF) fell 3%. The NDVI development graph shows crop condition to be close to or above average at the end of period, after a below average spell from Mid-February to March. The northern region of the country registered good maximum vegetation condition index (VCIx) above 0.8, while the southern region recorded lower values. The poorest VCIx occurs in the central regions with many patches below 0.5 VCIx, mainly in the States of Niger, Ajbuja and Nassarawa. The maximum VCI was 0.89 countrywide. NDVI clusters and profile graphs show favorable average conditions in 76.6 % of the country, specially the northern part which is currently in the dry, crop-less season, except for some irrigated crops such as wheat. Overall, the outlook for the second maize crop and dry rice is favorable.

**Regional analysis**

Considering the cropping systems, climatic zones, and topographic conditions, Nigeria is divided into four agro-ecological zones (AEZ). They are referred to (from north to south and by increasing rainfall) as Sudano-Sahelian, Guinean savanna, Derived savanna and Humid forest zone.

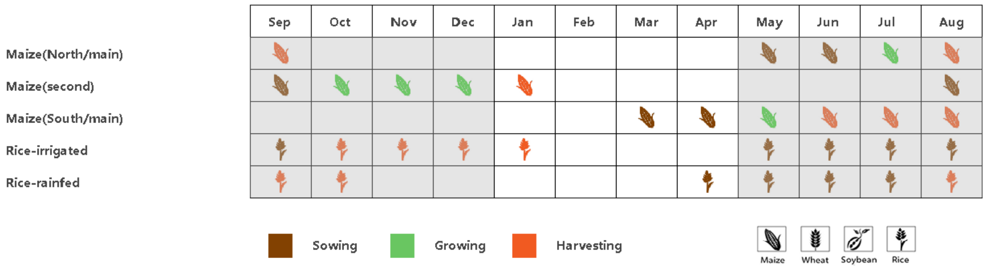
During the reported period, in **Sudano-Sahelian region** was in the middle of its dry season. Rainfall will resume about June. Some irrigated dry season wheat is cultivated in the north-east. According to the NDVI profiles, the situation is normal.

The **Guinean Savanna** compare to the humid forest zone and derived savanna, the recorded total amount of rainfall was seasonably low at 71mm but nevertheless slightly below average (-13%). The rainy season is due to start late May or in June. Temperature and sunshine were close to average (TEMP -0.2°C, RADPAR -3%). The drop in biomass production was 4%, which may have affected rangeland, which plays an important role in the AEZ. The CALF was also decreased by 11% compared to the average. However, NDVI, it was above the five-year maximum and the situation is best described as average.

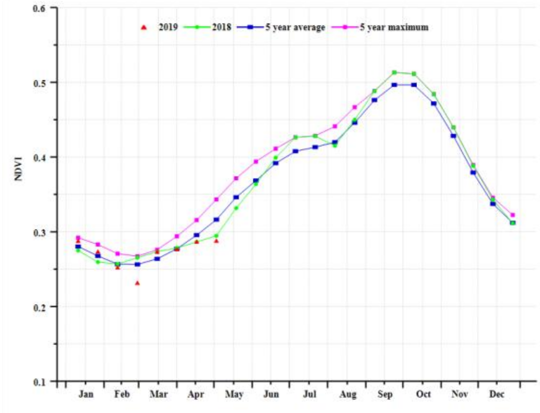
In the **derived Savanna** the rainy season normally starts from late April (west) to May (East) and the reporting period covers early stages of maize. The total amount of rainfall was recorded at 206 mm, which is 7% above average. Temperature and radiation remained constant compared to average. The increase in rainfall led to an 11% increase in total biomass production, while Arable land fraction (CALF) dropped by 4% below the recent five-year average. Maximum VCIx reached 0.84 and NDVI values were above average the previous 5 years. Overall, based on the indicators the conditions were favorable and there is no reason for concern.

In the **Humid forest zone**, crops, including rain-fed rice and maize have been growing since March. The high rainfall (RAIN, 516mm) was 18% above average. TEMP was slightly below average (-0.6°C) but with RADPAR up 3% and favorable precipitation, BIOMASS exceeds average by 14%. The arable land fraction remained constant. In spite of some NDVI fluctuations before or at the beginning of the season, maximum VCI is at 0.91 and crop prospects at average or above. This also applies for other important food crops in Nigeria such as Cassava and Yams.

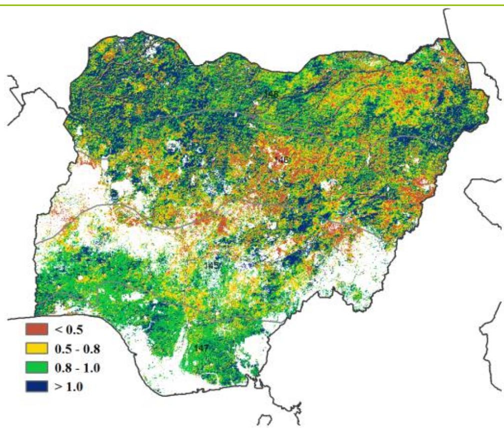
**Figure 3.32 Nigeria's crop condition, January - April 2019**



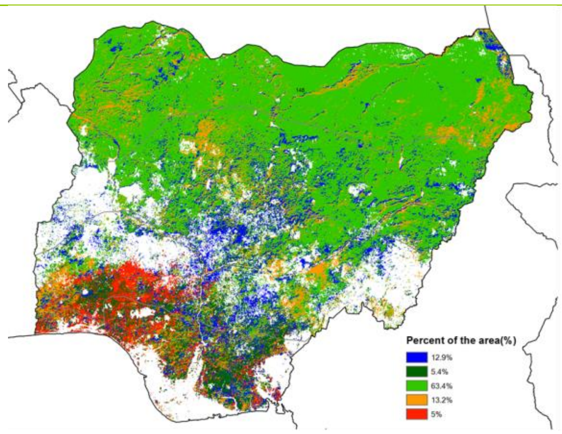

(a) Phenology of major crops



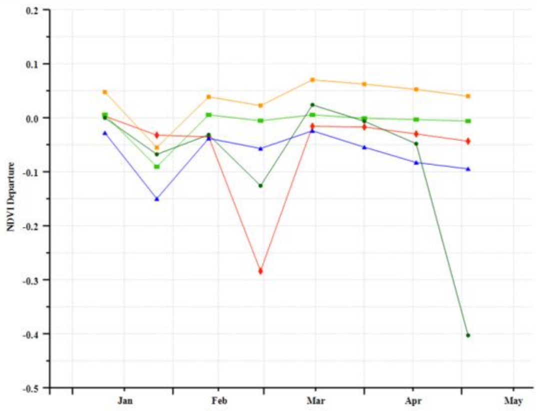

(b) Crop condition development graph based on NDVI



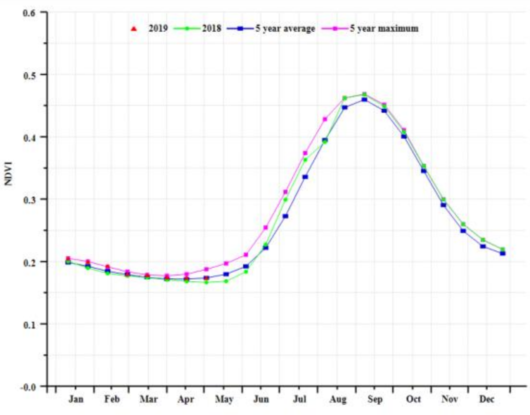

(c) Maximum VCI

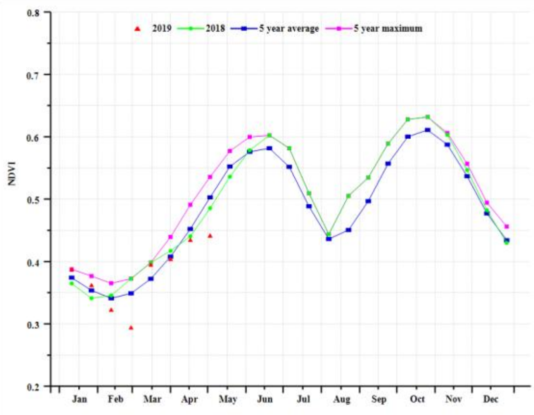



(d) Spatial NDVI patterns compared to 5YA

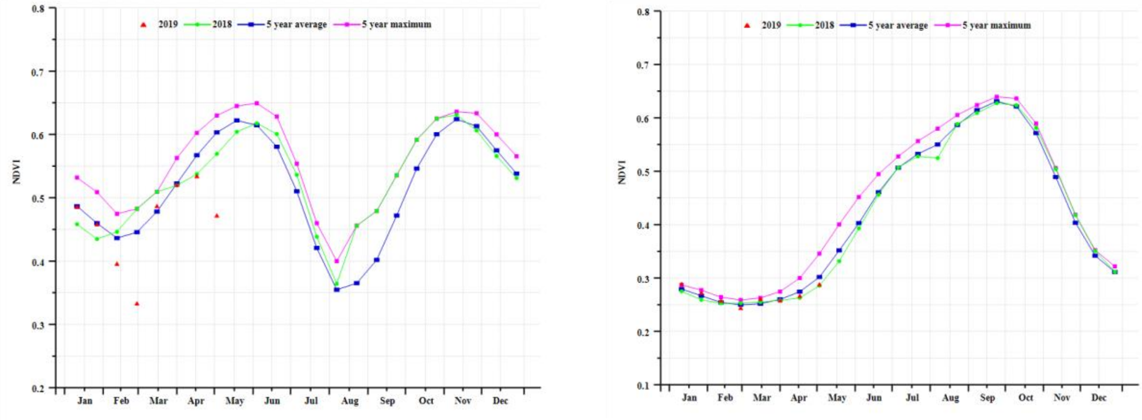



(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Soudano-sahelian region (left) and Derived savanna zone region (right))




(g) Crop condition development graph based on NDVI (Humid forest zone region (left) and Guinean savanna region (right))

**Table 3.55 Nigeria's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| **Soudano-Sahelian zone** | 10 | -29 | 29.2 | -0.6 | 1357 | -2 |
| **Derived savanna zone** | 206 | 7 | 29.4 | 0.0 | 1300 | 0 |
| **Humid forest zone** | 516 | 18 | 28.7 | -0.6 | 1286 | 3 |
| **Guinean savanna** | 71 | -13 | 29.1 | -0.2 | 1349 | -3 |

**Table 3.56 Nigeria's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMASS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| **Soudano-sahelian zone** | 50 | -17 | 1 | 21 | 0.96 |
| **Derived savanna zone** | 738 | 11 | 70 | -4 | 0.84 |
| **Humid forest zone** | 1442 | 14 | 97 | 0 | 0.91 |
| **Guinean savanna** | 280 | -4 | 8 | -11 | 0.84 |

# [PAK] Pakistan

The reporting period covers most of the winter wheat cycle from vegetative to harvest. It also touches the field preparation and sowing of maize. Crop condition was generally favorable from February to April. Compared with average, RAIN was 6% above, while TEMP and RADPAR showed decreases (-1.0°C and -6% respectively). The combination of all the agro-climatic indicators resulted in BIOMSS exceeding the 15YA by 10%. The fraction of cropped arable land (CALF) increased by a very significant 7%, which supports expectations of favourable winter wheat output.

As shown by the NDVI development graph at the national level, crop condition was low to average in January, and increased to average or above average from February to April. The spatial NDVI patterns and profiles show that 44.8% of the cropped areas were just on the average, and 21.6% were below average, essentially in the north-eastern areas and the South. Punjab and the Indus river basin, two major wheat producing areas present above average NDVI during the key crop growing period from February to April. Considering that weather, in particular rainfall, have been favorable so far, winter wheat prospects are rather promising.

Regional analysis

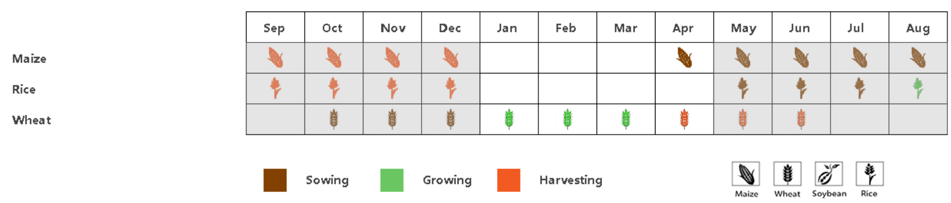
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based essentially on geography and agro-climatic conditions: the Northern highlands, Northern Punjab region and the Lower Indus river basin in south Punjab and Sind.

In the **Northern highlands** RAIN was 17% below average. RADPAR and TEMP were low compared to average (-8% and -1.0°C respectively). Accordingly, BIOMSS was just average. The region achieved a rather low CALF of 51%. The NDVI development graph shows below average crop condition from February to April, especially in the north. CropWatch expects below average production in the area.

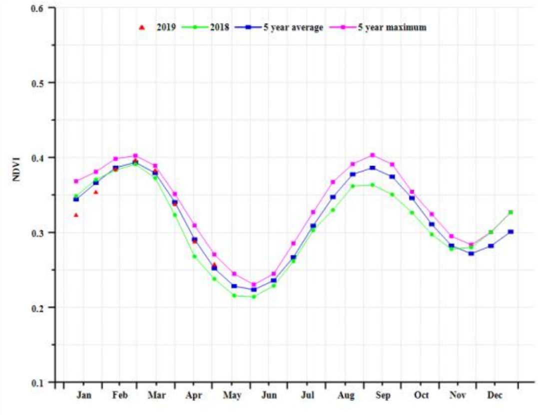
**Northern Punjab**, the main agricultural region in Pakistan recorded abundant RAIN (33% above average). TEMP was below average by 1.5°C, and the RADPAR departure was -7%. The resulting BIOMSS exceeded the recent fifteen-year average by 35%. The area had a very favorable VCIx of 1.01 and CALF of 89% (3% above 2018). Except for January, crop condition assessed through NDVI shows high values. Overall, the projected wheat output is at least average.

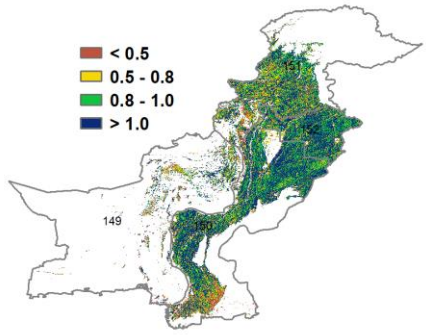
In the **Lower Indus river basin in south Punjab and Sind**, RAIN was significantly above average of 44%, while TEMP was below average by 1.4°C and sunshine was below average as well (RADPAR down 4%). The estimated BIOMSS departure of 58% compared to the fifteen-year average is probably optimistic, even considering that the vast majority of crops is irrigated. January crop condition based on NDVI was below average, but the low CALF (67%) is an increase over the recent 5YA (+7%); VCIx at 0.95 indicates favorable crop condition. Overall, prospects remain favorable for the region.

**Figure 3.33 Pakistan's crop condition, January - April 2019**



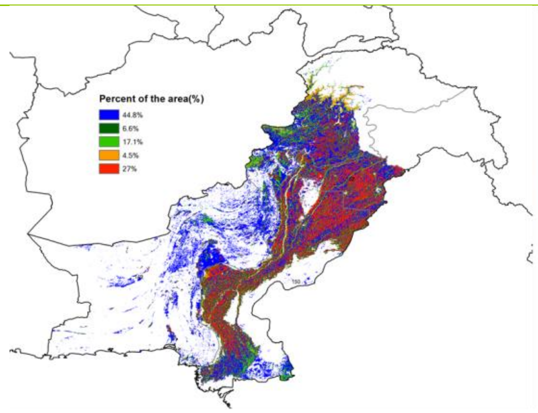

(a). Phenology of major crops

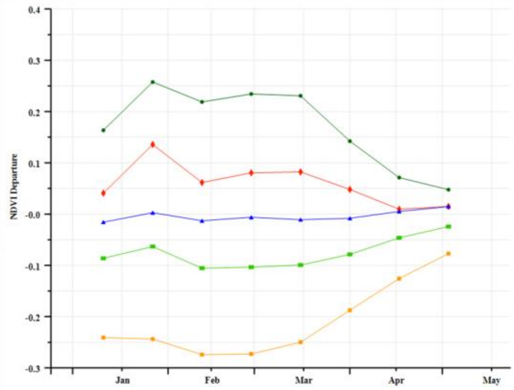



(b) Crop condition development graph based on NDVI

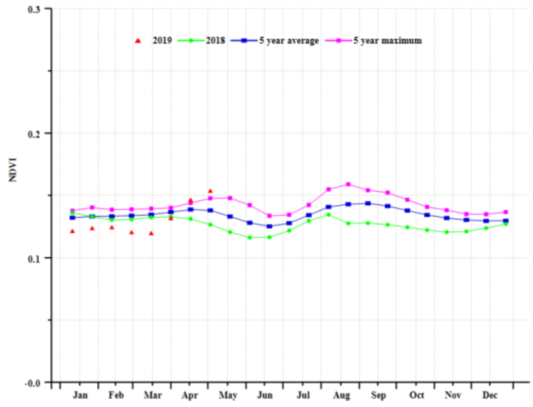
(c) Maximum VCI

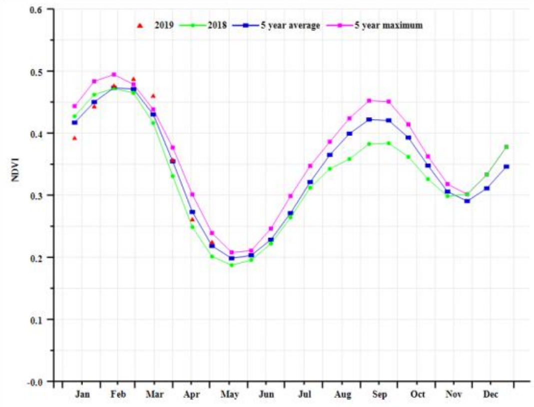


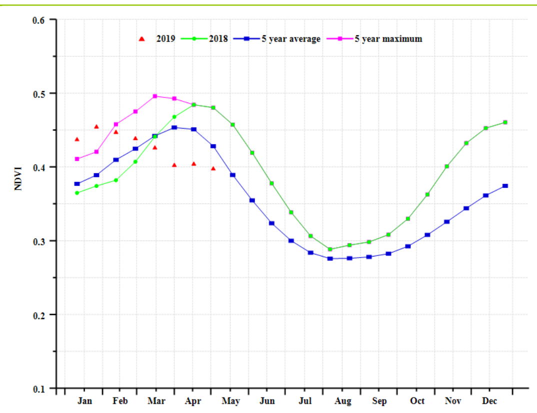

(d) Spatial NDVI patterns compared to 5YA

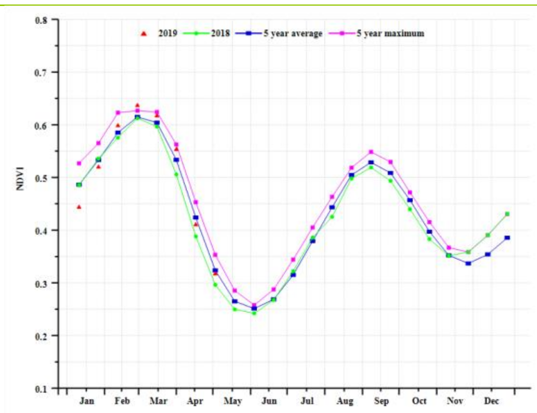
(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Balochistan Non-agricultural Region (left) Lower Indus river basin in south Punjab and Sind (right))




(g) Crop condition development graph based on NDVI (Northern Highlands (left) Northern Punjab (right))

**Table 3.57** Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Balochistan | 115 | 33 | 14.6 | -1.3 | 1118 | -4 |
| Lower Indus river basin in south Punjab and Sind | 87 | 44 | 20.8 | -1.4 | 1132 | -4 |
| Northern highlands | 193 | -17 | 7.4 | -1.0 | 886 | -8 |
| Northern Punjab | 185 | 33 | 17.7 | -1.5 | 958 | -7 |

**Table 3.58** Pakistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

| Region | BIOMSS | | CALF | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current (%) | Departure from 5YA (%) | Current |
| Balochistan | 418 | 31 | 1 | 127 | 0.64 |
| Lower Indus river basin in south Punjab and Sind | 378 | 58 | 67 | 7 | 0.95 |
| Northern highlands | 634 | 0 | 51 | 12 | 0.94 |
| Northern Punjab | 777 | 35 | 89 | 3 | 1.01 |

AFG AGO ARG AUS BGD BLR BRA CAN DEU EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN KHM LKA MAR MEX MMR MNG MOZ NGA PAK **PHL** POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [PHL] Philippines

The monitoring period covers the harvest of secondary rice and maize, as well as the sowing of the main rice and maize crops. According to the NDVI profiles for the country, crops generally showed unfavorable condition. Nationwide, precipitation (RAIN) presents a marked negative departure of 49% compared with average, accompanied by above average radiation (+7%) and below average temperature (-0.5°C). The rainfall deficit resulted in BIOMSS being 28% below average.

The cropped arable land fraction (CALF) nation-wide was almost 100%. The spatial patterns of NDVI profiles show that: (1) 47.0% of the cropped areas experienced average conditions, in patches of the whole country; (2) 22.7% had slightly above average conditions, mostly in the Center and the North, from Negros and Cebu to Luzon; (3) 16.6%, mostly as patches in Mindanao and Luzon experienced below average conditions; (4) 13.7% had average conditions after a marked drop in mid-January that affected essentially Samar, Leyte, and about one third of Mindanao.

**Regional analysis**

Based on cropping systems, climatic zones and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are the Northern lowlands of Mindanao to western Visayas region, the Negros and central Visayas Islands region and the Forest islands region (mostly southern and western islands).

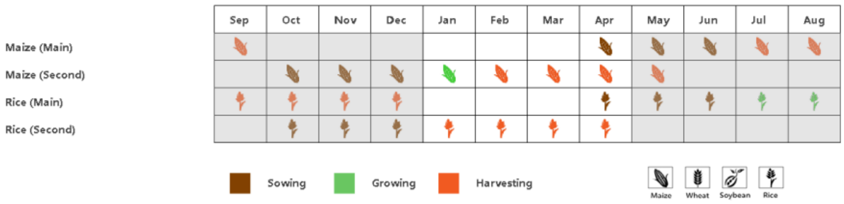
The **Northern lowlands of Mindanao to western Visayas region** experienced a rainfall deficit (RAIN -40%), slightly low temperature (TEMP -0.4°C)， and well above average radiation (RADPAR +12%). According to the NDVI profiles for the region, crop condition was below the five-year average. BIOMSS was down 19% compared to the average.

The **Negros and central Visayas Islands region** experienced a rainfall deficit (RAIN -49%), slightly low temperature (TEMP -0.3°C)， and above average radiation (RADPAR +7%). According to the NDVI profiles for the region, crop condition was above the five-year average from January to February except mid-January, then below five-year average. BIOMSS was down 20% below average.

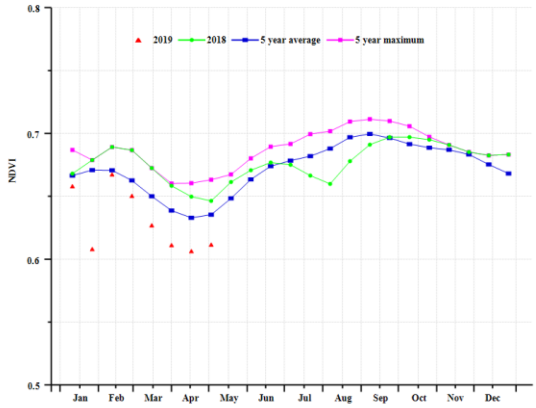
The **Forest islands region** experienced the largest rainfall deficit (RAIN -52%), low temperature (TEMP -0.6°C)， and above average radiation (RADPAR +2%). According to the NDVI profiles for the region, crop condition was below the five-year average. BIOMSS was down 33% from average.

In spite of the poor performance of rainfall and NDVI, the assessment of the crop situation in the Philippines is less straightforward than it seems, especially when considering that sunshine is often a limiting factor for crops in tropical areas. The Forest islands region, for instance, recorded 476 mm against the average of 991 mm, a large deficit. But 476 mm is nevertheless equivalent to 4 mm/day, at a time when potential evapotranspiration is of the same order of magnitude, i.e. generalised water stress is unlikely. In the other zones, however, water supply was possibly insufficient for lowland (i.e. rainfed) rice, but additional sources of water are frequently available and resorted to. Finally, CALF reached 100% and VCIx was unusually high in all agro-ecological zones. Considering that early and late crop stages have limited water requirements compared with full vegetative development, it is very likely that the dry rice and second maize that were harvested in February and March, as well as the wet rice and first maize that have just been planted are doing well, with a national crop condition gradient from north to south.

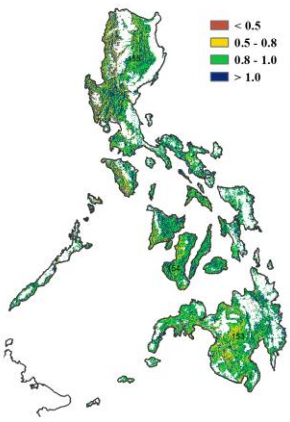
**Figure 3.34 Philippines's crop condition, January - April 2019**



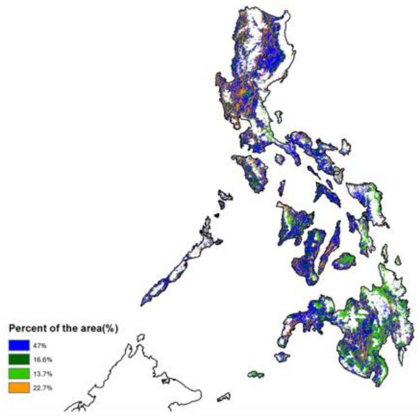

(a). Phenology of major crops



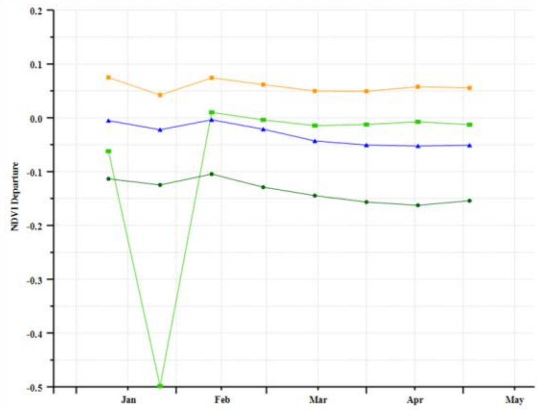

(b) Crop condition development graph based on NDVI



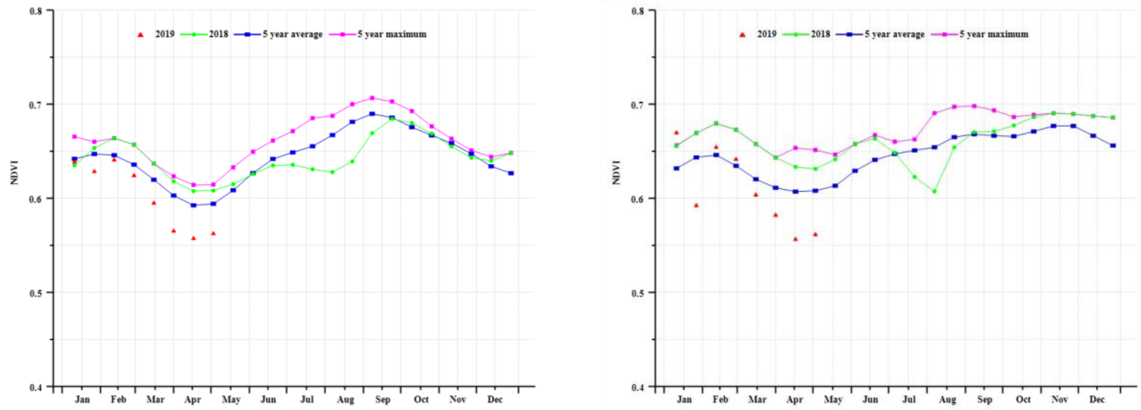

(c) Maximum VCI



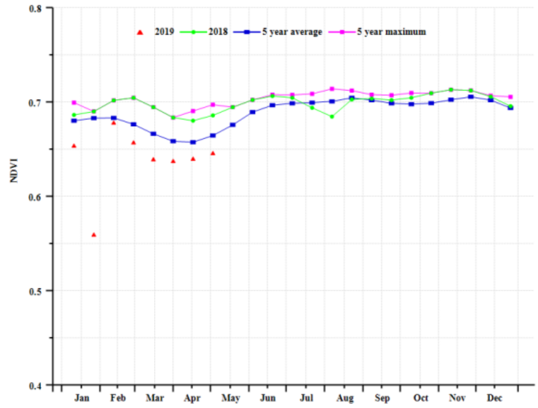

(d) Spatial NDVI patterns compared to 5YA




(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Northern lowlands of Mindanao to western Visayas region (left)，Negros and central Visayas Islands region (right))




(g) Crop condition development graph based on NDVI(Forest islands region)

**Table 3.59 Philippines's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| **Northern lowlands of Mindanao to western Visayas region** | 188 | -40 | 25.2 | -0.4 | 1209 | 12 |
| **Negros and central Visayas Islands region** | 253 | -49 | 26.1 | -0.3 | 1300 | 7 |
| **Forest islands region** | 476 | -52 | 25.7 | -0.6 | 1173 | 2 |

**Table 3.60 Philippines's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| **Northern lowlands of Mindanao to western Visayas region** | 667 | -19 | 99 | 0 | 0.95 |
| **Negros and central Visayas Islands region** | 947 | -20 | 100 | 0 | 0.95 |
| **Forest islands region** | 1056 | -33 | 100 | 0 | 0.94 |

# [POL] Poland

In Poland, the reporting period covers the dormancy and re-growth of winter wheat. Due to close to average precipitation (-4%), warmer weather and more abundant sunshine than average (TEMP +1.6°C, RADPAR +4%), potential biomass increased by 12%. Additional rain is needed in next months for the growth of crop during spring. Due to the favorable condition, VCIx was high at 0.86. Compared to last 5 years, CALF was decreased by 2% but remains close to full cropping (97% of arable land cropped).

As shown by the crop condition development graph, national NDVI was below average in January as snowfall occurred in winter. From February to March, NDVI was above the average of last 5 years due to sufficient precipitation and heat. However, NDVI was below average in April, possibly because of dry soils affected by more intense that usual evapotranspiration. Sub-national NDVI profiles show very similar condition throughout the country from late February.

Overall, crop condition is satisfactory.

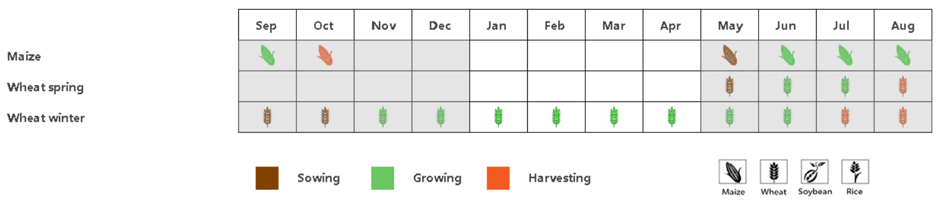
**Regional analysis**

The country was divided into four zones by agro-ecoligical characteristic including: (a) the Northern oats and potatoes areas covering the northern half of West Pomerania, eastern Pomerania and Warmia-Masuria), (b) the Northern-central wheat and sugar-beet area (Kuyavia-Pomerania to the Baltic sea), (c) the Central rye and potatoes area (Lubusz to South Podlaskie and northern Lublin), and (d) the Southern wheat and sugar-beet area (Southern Lower Silesia to southern Lublin and Subcarpathia along the Czech and Slovak borders).

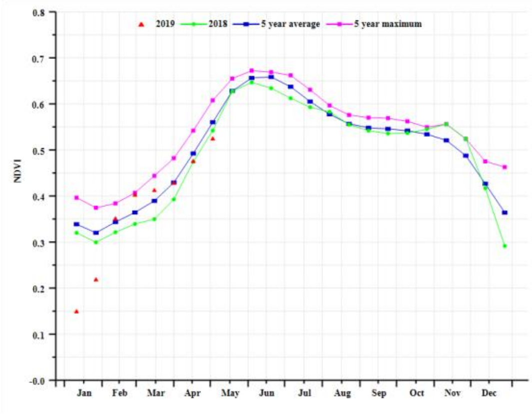
Compared to last 15 years, **the Northern oats and potatoes area**, **Northern-central wheat and sugar-beet area** and **Central rye and potatoes area** recorded somewhat drier but much warmer conditions (RAIN: -5%, -7% and -9%; TEMP: +1.9°C, +1.6°C and +1.7°C). RADPAR was higher than average in three zones (+5%, +5% and +4%, respectively). BIOMSS was significantly higher than average (+14%, +10% and +12%) due to favorable temperatures. In spite of a drop in CALF in the three zones (down 2%), CALF was still high at 96%, 95% and 97%, respectively. Due to the favorable condition, VCIx in three zones reached 0.86, 0.88 and 0.85 respectively.

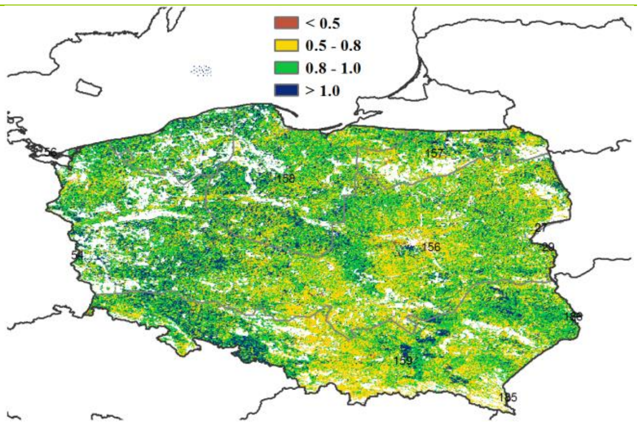
Different from above three zones, **the Southern wheat and sugar-beet area** was slightly wetter than average (RAIN +2%) but marginally less warm (TEMP +1.4°C). RADPAR was above average (+2%). Compared to last 15 years, BIOMSS increased by 11%. The area had a high CALF (97%) as well as a favorable VCIx (0.84).

**Figure 3.35 Poland's crop condition, January-April 2019**



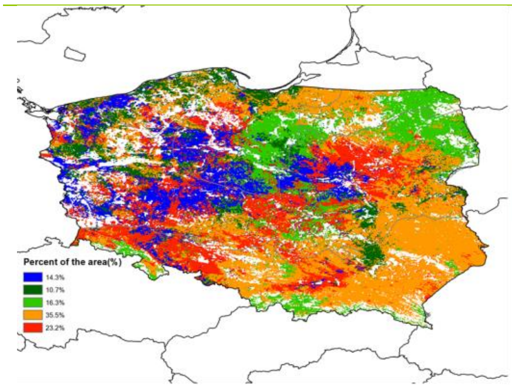

(a). Phenology of major crops

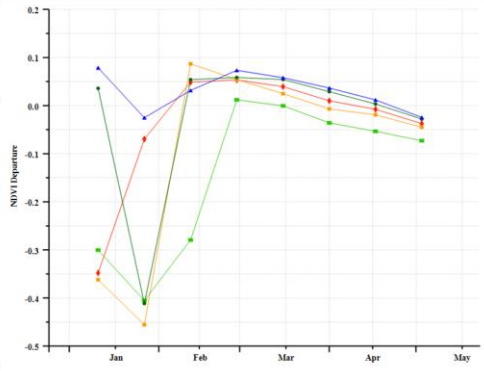



(b) Crop condition development graph based on NDVI

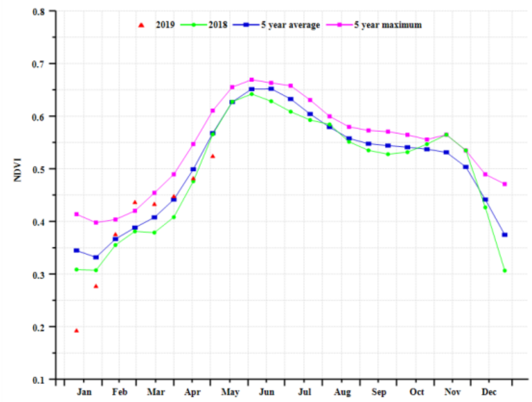
(c) Maximum VCI

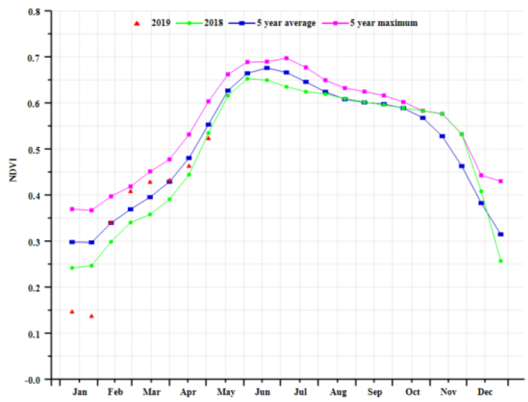


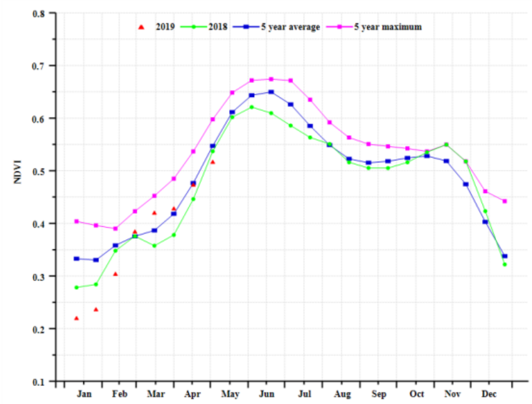

(d) Spatial NDVI patterns compared to 5YA

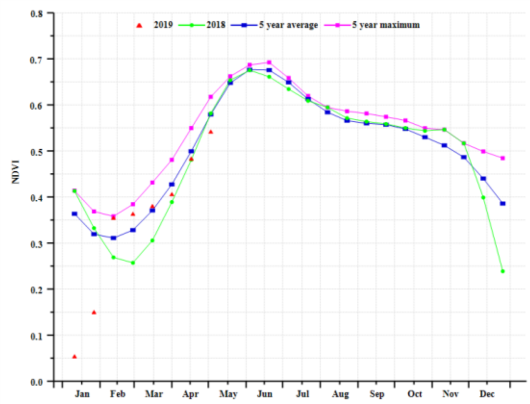
(e) NDVI profiles




(f) Crop condition development graph based on NDVI, Central rye and potatoes area (left) and Northern oats and potatoes area (right).




(g) Crop condition development graph based on NDVI, Northern-central wheat and sugar beet area (left) and Southern wheat and sugar beet area (right).

**Table 3.61 Poland's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m2) | Departure from 15YA (%) |
| Central rye and potatoes area | 238 | -8 | 4.3 | 1.7 | 484 | 4 |
| Northern oats and potatoes areas | 259 | -5 | 3.6 | 1.9 | 461 | 5 |
| Northern-central wheat and sugarbeet area | 229 | -7 | 4.0 | 1.6 | 484 | 5 |
| Southern wheat and sugarbeet area | 271 | 2 | 3.9 | 1.4 | 522 | 2 |

**Table 3.62 Poland's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| Central rye and potatoes area | 950 | 12 | 97 | -2 | 0.85 |
| Northern oats and potatoes areas | 901 | 14 | 96 | -2 | 0.86 |
| Northern-central wheat and sugarbeet area | 915 | 10 | 95 | -2 | 0.88 |
| Southern wheat and sugarbeet area | 921 | 11 | 97 | -2 | 0.84 |

AFG AGO ARG AUS BGD BLR BRA CAN DEU EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN KHM LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL **ROU** RUS THA TUR UKR USA UZB VNM ZAF ZMB

# [ROU] Romania

Winter wheat began vegetative growth and winter dormancy after being sown from October. The overall condition of the crop just fair (VCIx = 0.76). Rainfall was much higher than average (+35%) and temperature and sunshine were close to average (TEMP +0.3°C, RADPAR +1%). Biomass show betters condition (BIOMSS +18%) while CALF dropped dramatically by 35%. The low CALF indicates below average production prospects due to reduced hectarage.

The nationwide NDVI development graph indicates that crop growth was below average during the reporting period, which is consistent with the decreased CALF and low VCIx.

According to the spatial NDVI profiles, rather low NDVI (0.2 units or more below average) prevailed in 13.3% of cropped areas, mostly in the area referred to below as the Eastern and southern maize, wheat and sugar beet plains.

**Regional analysis**

More detail is provided below for three main agro-ecological zones (AEZ) of the country. They include the Central mixed farming and pasture Carpathian hills; the Eastern and southern maize, wheat and sugar beet plains; the Western and central maize, wheat and sugar beet plateau.

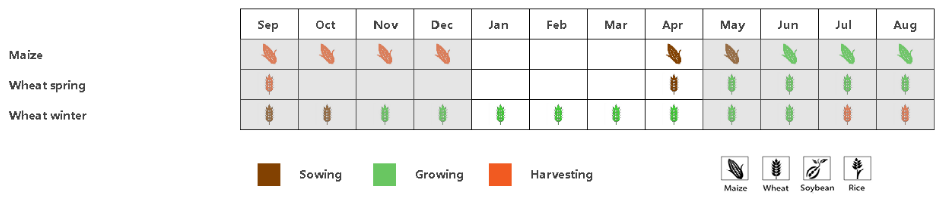
In **the Eastern and southern maize, wheat and sugar beet plains** rainfall increased 3% over average, temperature was up 0.7°C and the sunshine departure was +2%. However, CALF was -15% below the 5YA and the VCIx was low (0.75).

**The Western and central maize, wheat and sugar beet plateau** had a much larger positive rainfall anomaly (+24%), a temperature increase above average of nearly one degree (0.9°C) and sunshine up 5%. As a result, the biomass potential of this region increased 8%. CALF was somewhat lower than average (-4%). Similar to the Eastern and southern maize, wheat and sugar beet plains, VCIx was low in this region (0.79) but nevertheless the highest in the country.

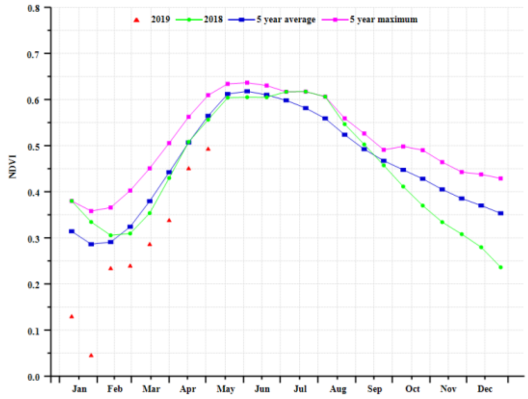
As for **the Central mixed farming and pasture Carpathian hills**, the increase in BIOMSS (+8%) was beneficial to pasture development, as were the moderate rainfall increase (+15% above average), sunshine (+4%) and temperature (+0.7°C). CALF dropped 7% and the VCIx was the lowest in the country (0.73).

Generally, crop condition is just average or below and planted area was well below average. Only about 14.1% of cropland experienced consistently average conditions including the counties of Tulcea and Constanta on the Black Sea; parts of Dolj, Olt and Teleorman in the south and parts of Timis and Caras-Severin in the west. The final outcome of the season will be largely conditioned by agroclimatic conditions in May but a favorable winter wheat season remains unlikely.

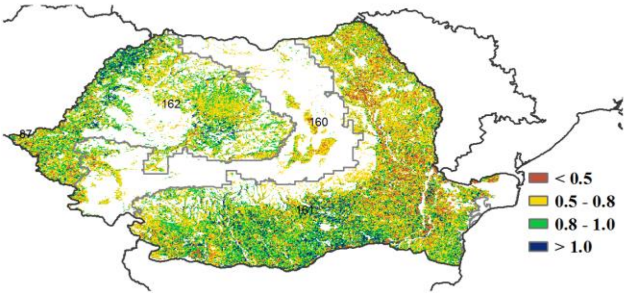
**Figure 3.36 Romania's crop condition, January-April 2019**



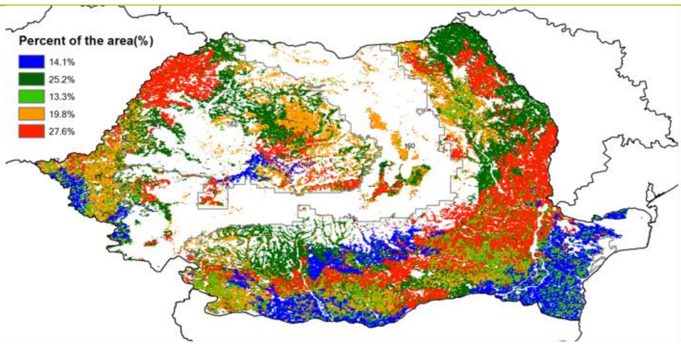

(a). Phenology of major crops



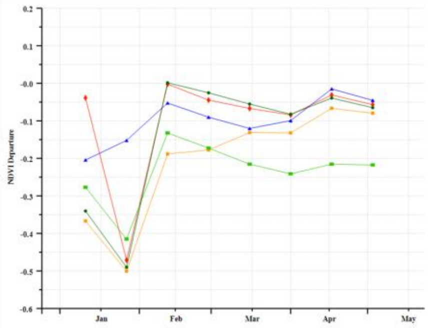

(b) Crop condition development graph based on NDVI



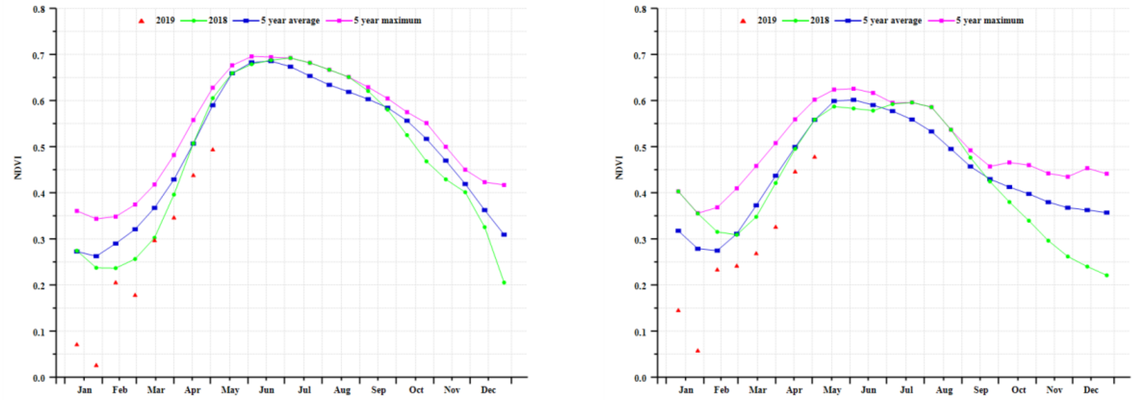

(c) Maximum VCI



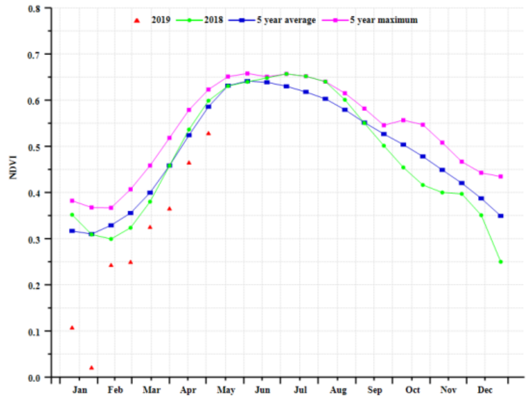

(d) Spatial NDVI patterns compared to 5YA




(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Central mixed farming and pasture Carpathian hills (left) and Eastern and southern maize, wheat and sugarbeet plains (right))




(g) Crop condition development graph based on NDVI (Western and central maize, wheat and sugar beet plateau)

**Table 3.63 Romania's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current ($MJ/m^2$) | Departure from 15YA (%) |
| Central mixed farming and pasture Carpathian hills | 276 | 15 | 1.6 | 0.7 | 643 | 4 |
| Eastern and southern maize, wheat and sugar beet plains | 198 | 3 | 4.9 | 0.7 | 666 | 2 |
| Western and central maize, wheat and sugar beet plateau | 250 | 24 | 4.2 | 0.9 | 664 | 5 |

**Table 3.64 Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| Central mixed farming and pasture Carpathian hills | 754 | 8 | 100 | -7 | 0.73 |
| Eastern and southern maize, wheat and sugar beet plains | 755 | 2 | 100 | -15 | 0.75 |
| Western and central maize, wheat and sugar beet plateau | 808 | 8 | 100 | -4 | 0.79 |

# [RUS] Russia

The period from February to May (i.e. one month after the current reporting period) includes snow-melt and the subsequent crop re-growth after winter dormancy, with large spatial variations depending on geography and spring conditions. The same applies to the phenology of spring crops, of which the first are just being sown.

National NDVI profiles show a delay in the start of the growing period, being close to the previous year but lower than the 5-year average. Temperatures were above both the average and the values of last year until April, when they became close to the previous year's observations. Nationwide, the average temperature departure reached an exceptionally high value of +1.7°C, with even larger anomalies at the local scale. Average Precipitation was first close to average, then close to last year's low values and eventually below both last year and the average.

Regional data on NDVI show that the late crop calendar indicated by national data was observed in most regions of Russia.  Since a similar situation was observed during the previous year, it is likely that NDVI development will follow patterns close to those of the 2018.

Lowest VCIx values were observed in Middle Volga, Ural-Volga-Vyatka, Central Black Earth, Middle and East Siberian regions. This situation is mainly due to late start of post-dormancy crop development. In South and North Caucasus regions VCI shows mostly favourable values above 0.8.

The map of spatial NDVI profile clustering confirms VCIx patterns. The most favorable situation with positive departure is observed in 3.6 % of cropped areas and corresponds to regions with highest VCIx. The worst situation with largest negative departure affects 17.8 % of the cropland, mainly in Middle Volga region where VCIx is close to 0.5. Average NDVI occurs in 18.0% of arable lands, mostly located in the Central and Central Black Earth regions.

Generally, the current situation with late start of crop development is similar to the situation during 2018.  In most regions of Russia NDVI is close to both 2018 and 5YA values. However, a drop in rainfall at the end of April accompanied by drop in NDVI values in main crop growing regions might be a sign of future decrease in biomass. We stress that the above-average temperature patterns that prevailed in Russia is rather unusual; it is described in some detail in the Overview (chapter 3.1) of the current chapter on "Main producing and exporting countries".  The warm wather occurred at the same time as very significant drops in CALF observed in most regions of Russia, in the range from 6% to 74 % below the 5YA. Whether the drop is real and will be confirmed in future reports or whether the observation is due mostly to late phenology need close monitoring in the next CropWatch bulletin.

**Regional analysis**

In the **Central, Central Black Earth** and **North-western regions** rainfall was close to average but temperature was above by 1.7 to 2.2 °C. NDVI development started late (in March) and was below 5YA but higher than during 2018 and reaching 5YA at the beginning of April. However, at the end of April NDVI dropped below 5YA and its 2018 level. This decrease is not reflected in the modeled biomass which is by 9-14 % higher than 5YA.

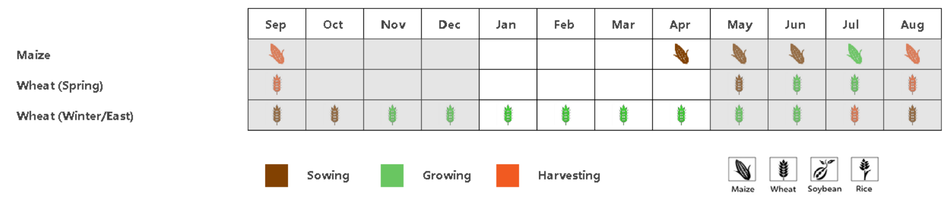
A similar NDVI pattern was observed in **Middle Volga, Western Siberia** and **Ural-Volga-Vyatka regions**. In **Middle Volga** and **Ural-Volga-Vyatka regions** rainfall and temperature were above average (by 6% and 1.4°C to 1.6°C, respectively), but RADPAR was below, which could potentially cause the delay in start of the vegetation period. Rainfall shortage (-11%) was the main factor causing the season to be late in Western Siberia. The temperature was slightly above average.

Significant rainfall shortage (26% to 42% below average) was observed in **East Siberia, Middle Siberia, Amur Krai and Primorie regions**. The temperature was well above average by 2.2 °C. Despite the lack of rain, NDVI of **East Siberia** was 5YA values, sometimes rising to 5-year maximum and the level of 2018. In **Middle Siberia** NDVI was near both the 5YA and 2018 values until the end of April when it dropped slightly. **Amur Krai and Primorie zones** were the most affected by rainfall shortage and much higher temperature (2.7 °C above average), while NDVI stayed below 5YA and the 2018 values. However, the modeled biomass was only slightly above the average.

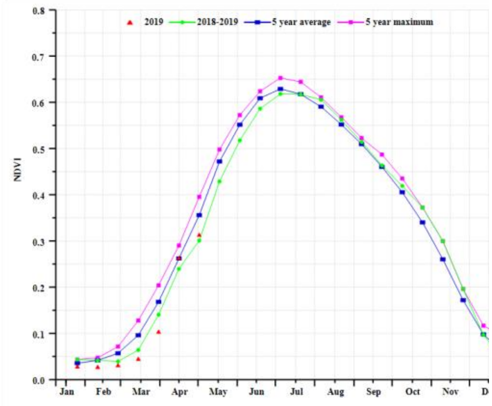
**North and South Caucasus regions** also experienced rainfall shortage (13-12 % below average) with temperature much higher than by 2.6°C to 3.3°C. In **the Northern Caucasus** this resulted in late crop season and NDVI staying below 5-year average but close to the level of the previous year. In Southern **Caucasus region** the situation was worse as NDVI stayed below 5year average and previous year level. Observed drop in modeled biomass was higher in **Northern Caucasus region**, while in **the Southern Caucasus** modeled biomass was close to 5-year average.

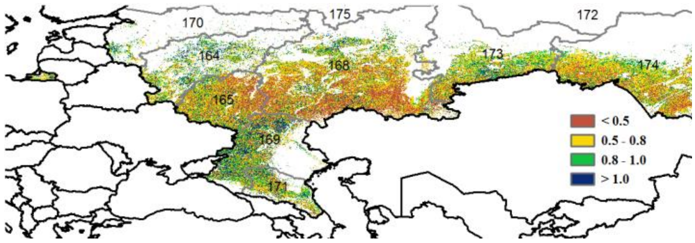
Vegetation season just started in **Subarctic and West Subarctic regions**. NDVI now reached 5-year average level. Despite late start, modeled biomass is above 5-year average.

**Figure 3.37 Russia's crop condition, January-April 2019**



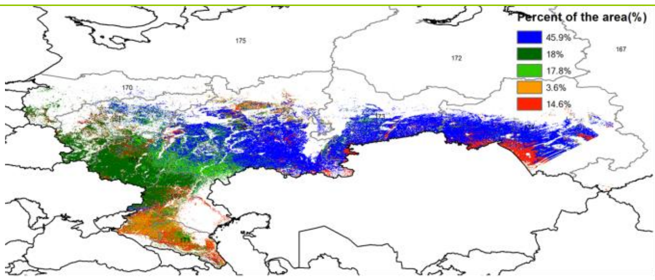

(a). Phenology of major crops

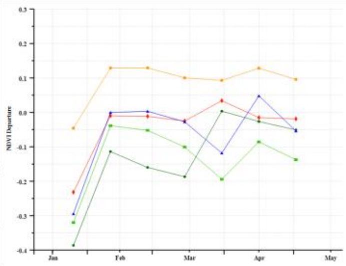



(b) Crop condition development graph based on NDVI

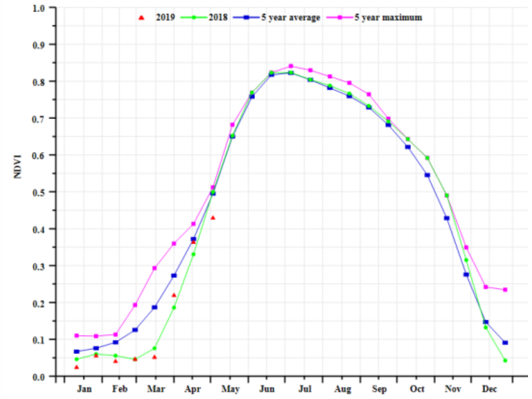
(c) Maximum VCI

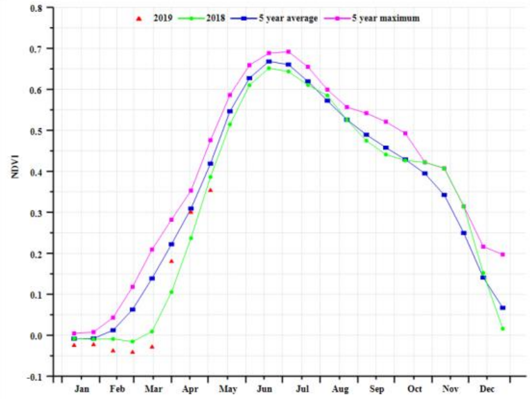


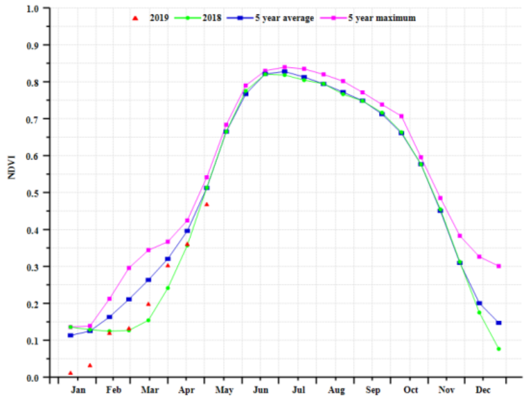
(d) Spatial NDVI patterns compared to 5YA

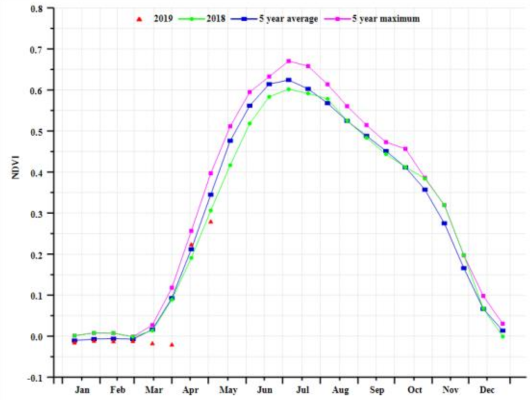
(e) NDVI profiles



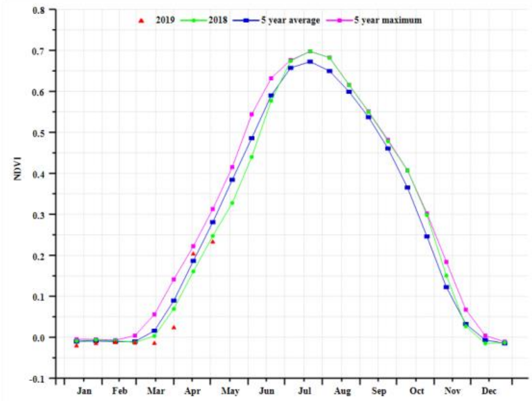



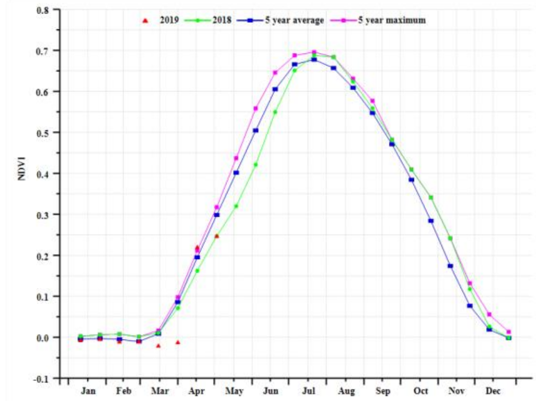

(f) Crop condition development graph based on NDVI in Central Russia (left) and the central Black Soils area (right))



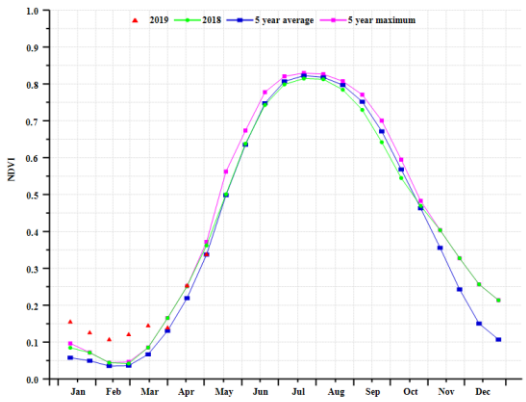



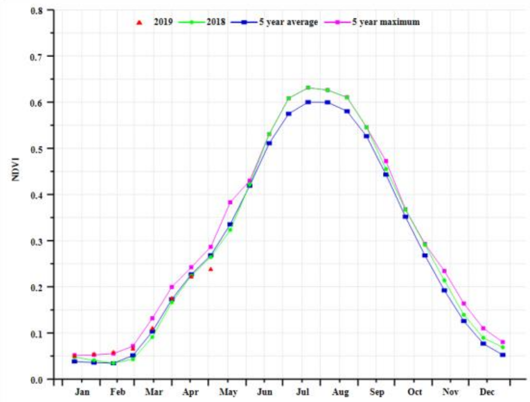

(g) Crop condition development graph based on NDVI the north-western Region including Novgorod (left) and the Middle Volgan (right))



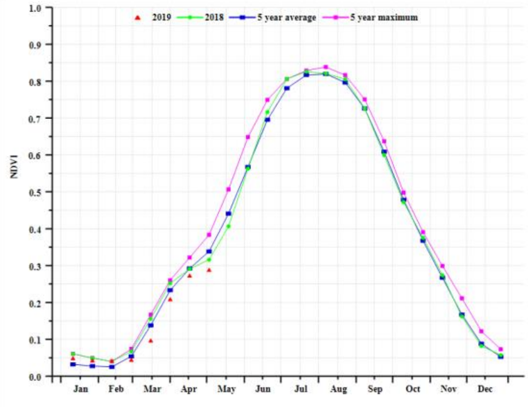



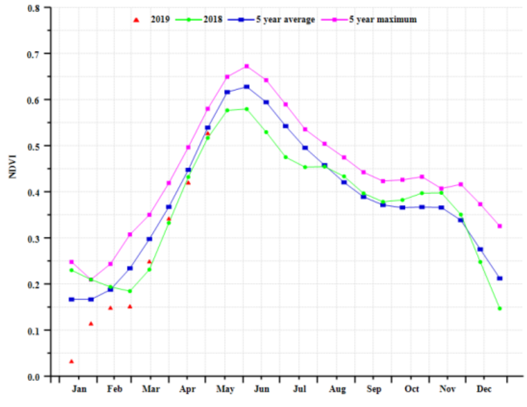

(h) Crop condition development graph based on NDVI in the Western Siberia (left) and the Ural and western Volga region (right))



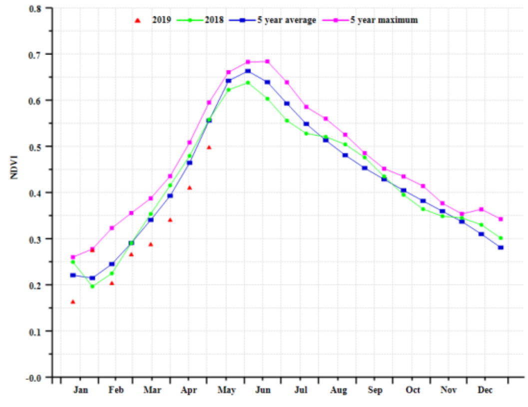



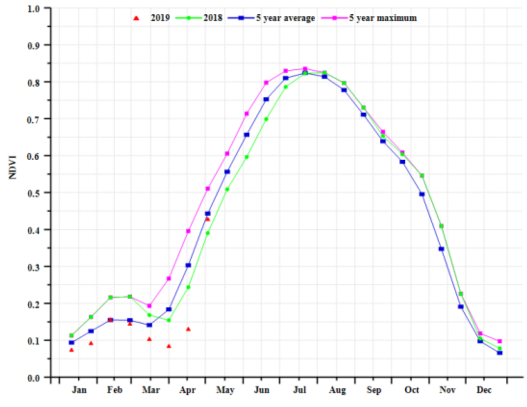

(i) Crop condition development graph based on NDVI in the Eastern Siberia (left) and the Middle Siberia (right)



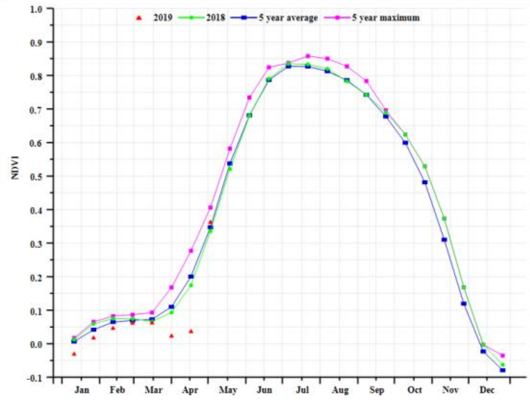




(j) Crop condition development graph based on NDVI in the Amur and Primorsky Krai (left) and the Northern Caucasus (right)




(j) Crop condition development graph based on NDVI in the southern Caucasus (left) and the Subarctic region (right)




(k) Crop condition development graph based on NDVI in the western subarctic region

**Table 3.65** Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Amur and Primorsky Krai | 73 | -26 | -8.9 | 2.7 | 707 | 3 |
| Central Russia | 265 | 1 | -0.9 | 2.1 | 379 | -3 |
| Central black soils area | 261 | 0 | -0.3 | 1.7 | 429 | -6 |
| Eastern Siberia | 88 | -42 | -9.0 | 2.2 | 688 | 8 |
| Middle Siberia | 91 | -28 | -11.4 | 2.2 | 650 | 3 |
| Middle Volga | 264 | 6 | -3.9 | 1.6 | 418 | -4 |
| Northwest Region including Novgorod | 273 | 2 | -0.5 | 2.2 | 373 | 4 |
| Northern Caucasus | 184 | -13 | 2.6 | 0.9 | 579 | -1 |
| Southern Caucasus | 223 | -12 | 3.3 | 1.0 | 672 | 0 |
| Subarctic region | - | - | - | - | - | - |
| Ural and western Volga region | 196 | 6 | -6.7 | 1.4 | 411 | -6 |
| Western Siberia | 168 | -11 | -7.9 | 1.5 | 473 | -2 |
| West subarctic region | 291 | 8 | -4.4 | 2.1 | 281 | -6 |

**Table 3.66** Russia's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| Amur and Primorsky Krai | 306 | 2 | 2 | -69 | 0.83 |
| Central Russia | 636 | 11 | 44 | -33 | 0.84 |
| Central black soils area | 687 | 9 | 34 | -38 | 0.65 |
| Eastern Siberia | 298 | -2 | 20 | 14 | 0.98 |
| Middle Siberia | 268 | 0 | 3 | 20 | 0.87 |
| Middle Volga | 518 | 7 | 9 | -68 | 0.63 |
| Northwest Region including Novgorod | 650 | 14 | 57 | -17 | 0.84 |
| Northern Caucasus | 666 | -6 | 67 | -6 | 0.82 |
| Southern Caucasus | 689 | -1 | 63 | -17 | 0.76 |
| Subarctic region | - | - | 47 | -17 | 0.90 |
| Ural and western Volga region | 427 | 3 | 3 | -67 | 0.77 |
| Western Siberia | 408 | 3 | 1 | -74 | 0.68 |
| West subarctic region | 472 | 11 | 11 | -42 | 0.90 |

# [THA] Thailand

The planting of the second rice crop started in early January, while the harvest of the main rice has been completed. During this monitoring period, temperature (TEMP +0.5°C), rainfall (RAIN +10%) and radiation (RADPAR +4%) were above average, which led to a 20% increase in BIOMSS. Nationwide, crop condition was slightly below average as shown in NDVI development graph. NDVI departure profiles clustering shows that in 22.6% of the country crop condition was below average before December but it recovered later as the second rice crop was planted. This applies to the center of Central double and triple-cropped rice lowlands and the south of Western and southern hill areas. In the North-eastern single-cropped rice region, which represents 48.8% of arable lands in Thailand, crop condition was slightly below average. Crop condition was persistently below average in 22.8% of arable land, mostly in the form of patches occurring throughout the country). Altogether, considering the favorable VCIx value of 0.84, the crop condition is assessed as average.

The harvest of Thailand's main (monsoon) rice was completely in early January, while the second season rice was ready for harvest in April. Monsoon crops (Maize and rice) are in their very early stages.

According to Agroclimatic indicators, Thailand experienced dry and warm weather compared with average. The rainfall from January to April was below average by 12%, while temperature and radiation were up by 0.6 °C and 6%, which led to a decrease of biomass production potential (BIOMSS) by 10%. As shown in the development of NDVI graph, crop condition was below the 5YA. At the beginning of the monitoring period, crop condition was close to average in January but the difference between current and average condition widened after February. According to the NDVI departure profile cluster map, crop condition was above average in some patches in Nakhon Sawan, Lopburi and Phitsanulok accounting, 11.4% of total arable land. Crop condition in 37.0% of the arable land was close to average, mostly in the south and center of Thailand, which is confirmed by the maximum VCIx map. 40.0% of total arable land was slightly below average, while remaining areas (accounting for 11.6% of total arable land) were significantly below average.

To sum up, the crop condition was "close to average" (between -0.1 and 0.1 from average) in just under 90% of crop land (88.6%), average in 37% of areas. Considering that VCIx reached 0.83 on average and that CALF decreased by just 3% the recently harvested crops are best qualified as "average or below" based mainly on the poor performance of rainfall. The outcome of the current monsoon maize and rice is still open.

**Regional analysis**

The regional analysis below focuses on some of the already mentioned agro-ecological zones of Thailand, of which some are mostly defined by the rice cultivation typology. Agro-ecological zones include Central double and triple-cropped rice lowlands (115), South-eastern horticulture area (116), Western and southern hill areas (117) and the Single-cropped rice north-eastern region (118). The numbers correspond to the labels in the VCIx and NDVI profile maps.

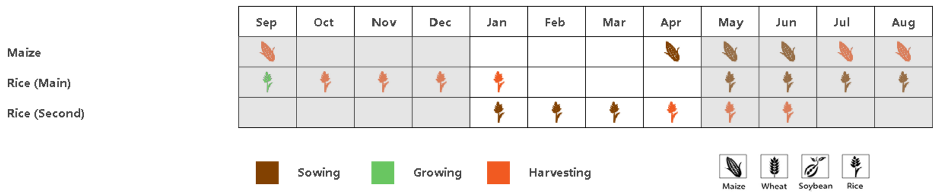
Indicators for **the Central double and triple-cropped rice lowlands** follow the same patterns as those for the country as a whole: temperature (TEMP +0.6C) and radiation (RADPAR +5%) were above average, and accumulated rainfall was significantly below (RAIN -20%), resulting in a biomass production potential decrease (BIOMSS, -9%). According to the NDVI development graph, crop condition was first close to average but deteriorate to below average at the end of the monitoring period. Overall, the situation was below average despite the VCIx value of 0.89 was fair and the fraction of cropped arable land (CALF) slightly increased by 3%.

The rainfall of **the South-eastern horticulture area** suffered a significant decrease of 22%, while temperature (TEMP +0.3°C) and radiation (RADPAR +4%) experienced the same changes as the whole country. The VCIx map, NDVI development graph, and BIOMSS indicators (BIOMSS, -11%) all lead to the conclusion that crop condition was unfavorable.

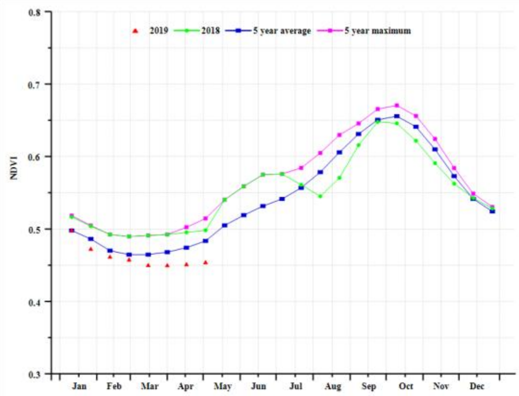
Crop condition in **the Western and southern hill areas** was disappointing according to the Agroclimatic indicators (TEMP +0.3°C, RADPAR +6%, and BIOMSS -17%) when compared to their respective averages due to the deficit of rainfall (-11%). According to the NDVI development graph, crop condition was below average.

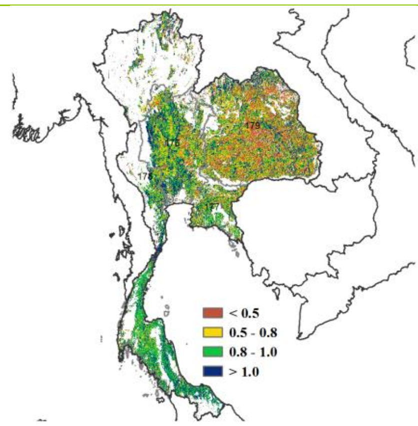
Finally, the situation in the **Single-cropped rice north-eastern region** was also less than satisfactory. According to CropWatch indicators rainfall (RAIN -7%) was below average, temperature (TEMP +1.2°C) and radiation (RADPAR +7%) were above average. BIOMSS was just average. NDVI development graph, however, shows that crop condition was below average, which is confirmed by an unfavorable VCIx value of 0.73.

**Figure 3.38 Thailand's crop condition, January-April 2019**



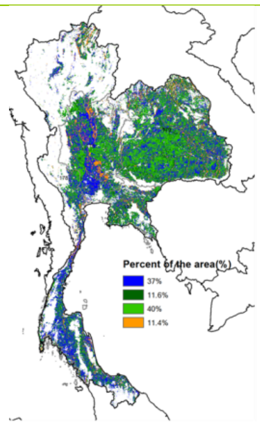

(a). Phenology of major crops

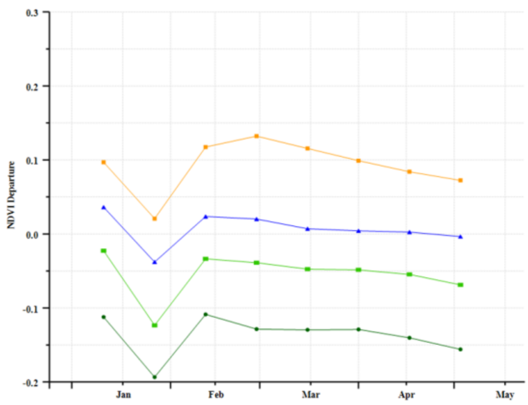



(b) Crop condition development graph based on NDVI

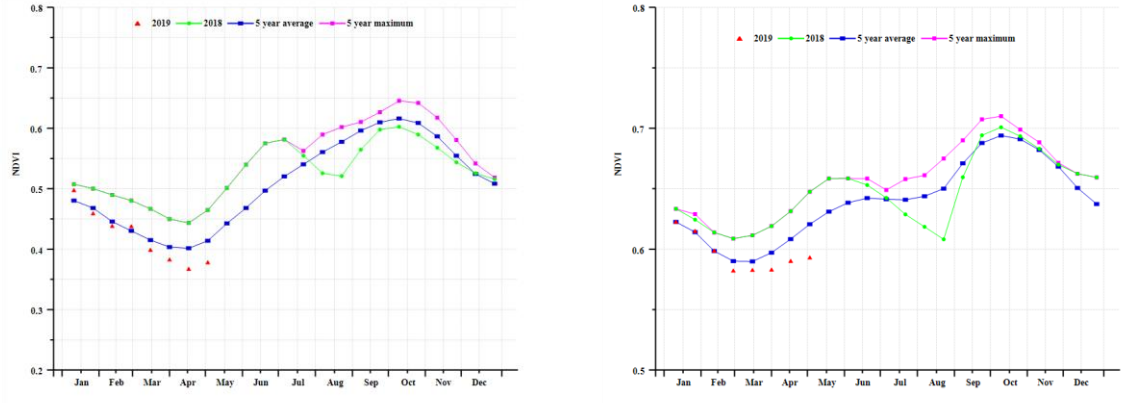
(c) Maximum VCI



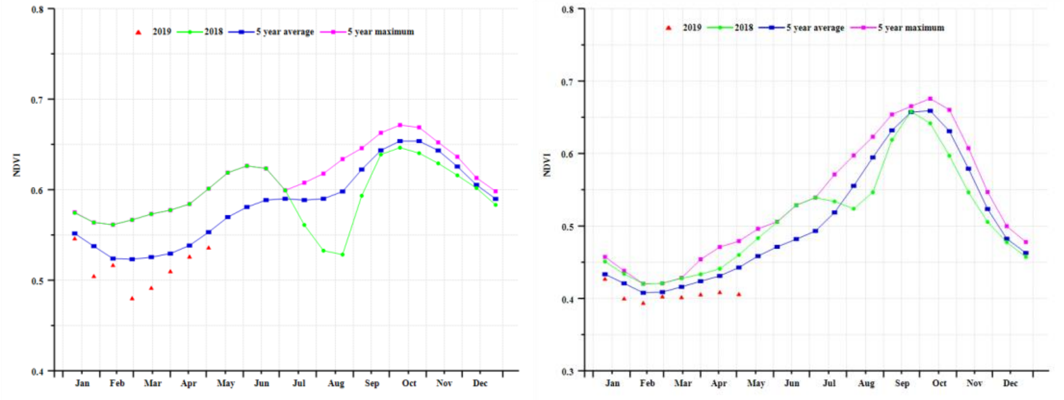




(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Central double and triple-cropped rice lowlands (left) and Western and southern hill areas (right))




(f) Crop condition development graph based on NDVI (South-eastern horticulture area (left) and Single-cropped rice north-eastern region (right))

**Table 3.67 Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Central double and triple-cropped rice lowlands | 108 | -20 | 28.4 | 0.6 | 1221 | 5 |
| South-eastern horticulture area | 216 | -22 | 28.2 | 0.3 | 1236 | 4 |
| Western and southern hill areas | 223 | -11 | 26.8 | 0.3 | 1283 | 6 |
| Single-cropped rice north-eastern region | 149 | -7 | 28.5 | 1.2 | 1168 | 7 |

**Table 3.68 Thailand's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| Central double and triple-cropped rice lowlands | 463 | -9 | 89 | 2 | 0.89 |
| South-eastern horticulture area | 784 | -11 | 94 | 0 | 0.84 |
| Western and southern hill areas | 555 | -17 | 98 | 2 | 0.95 |
| Single-cropped rice north-eastern region | 596 | 0 | 60 | -11 | 0.73 |

# [TUR] Turkey

Crop condition in Turkey was below average during the whole monitoring period. Maize and rice were planted at the end of the reporting period, while winter wheat was still growing. Rainfall, sunshine and temperature were somewhat below average (RAIN -1%, RADPAR -3%, TEMP -0.1°C), which lead to the average biomass accumulation potential (BIOMSS +1%). The cropped arable land fraction (CALF) decreased by 7% and the maximum VCI was 0.75. According to the spatial NDVI patterns map, crop condition was above average in and around the provinces of Ankara, Eskisehir, Afyon and Konya in the Central Anatolian region and some areas including the provinces of Gaziantep and Mardin in south-eastern Turkey. Consistently low NDVI between 0.1 and 0,.2 units below average prevailed in the east, east of and including the provinces of Diyarbakir and Erzincan. Overall, the output of winter crops will be less than favorable.

**Regional analysis**

The regional analysis covers four agro-ecological zones (AEZ): the Black Sea area, Central Anatolia, Eastern Anatolia and Marmara Aegean Mediterranean lowland zone.

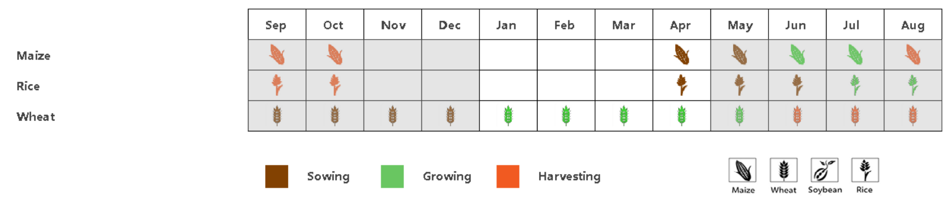
In **the Black Sea zone**, the NDVI was close to and above average in February, but below in other months. Rainfall and sunshine were below average (RAIN -11%, RADPAR -1%). The biomass was average (BIOMSS +1%). VCIx reached 0.78 and CALF is down 7%. The output of crops will average or below.

**The Central Anatolian region** had below average NDVI during the reporting period, except for mid-February. Both rainfall and sunshine were below average (RAIN -5%, RADPAR -2%). The biomass production potential was average (BIOMSS +2%). CALF fell 8% below average, and the VCIx was 0.78. The condition of crops is assessed as average at best.

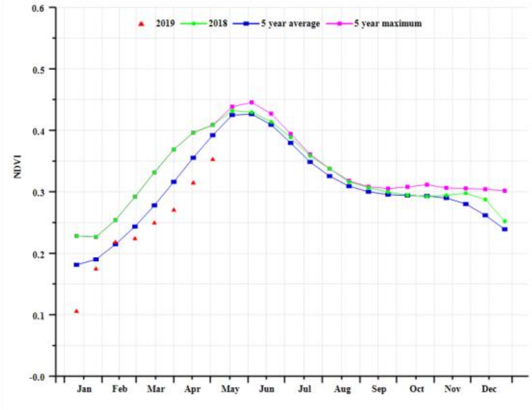
In **the Eastern Anatolian plateau**, the NDVI was above and close to average on the January and February, but below average in March and April. This zone experienced a shortage of rainfall and sunshine (RAIN -11%, RADPAR -6%), which result in a large decrease of CALF (-27%). The VCIx was low at 0.59. All indicators agree in describing crops as poor for this AEZ.

As shown by the NDVI profile in **the Marmara Aegean Mediterranean lowland zone**, the NDVI was below average during the whole reporting period. The temperature and radiation was below average (TEMP -0.3°C, RADPAR -4%) but rainfall exceeded average by 12%. The CALF was average (+1%) and VCIx is the highest in the country. Crop production prospects are estimated to be at least average.

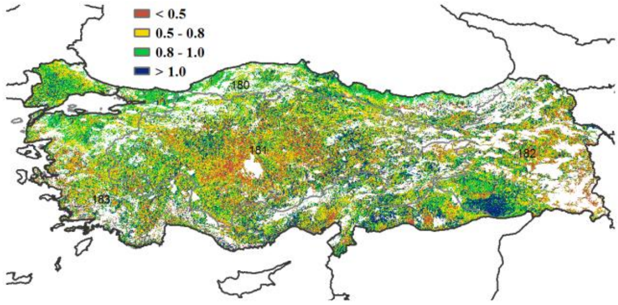
**Figure 3.39 Turkey's crop condition, January-April 2019**



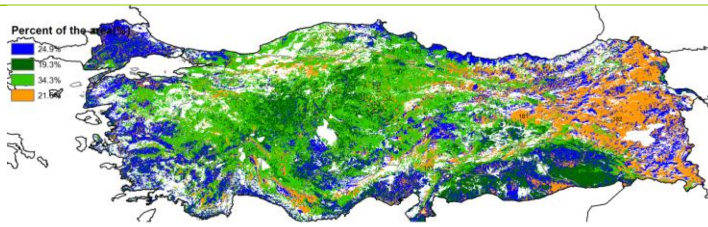

(a). Phenology of major crops



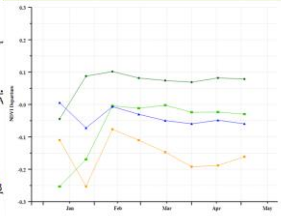

(b) Crop condition development graph based on NDVI



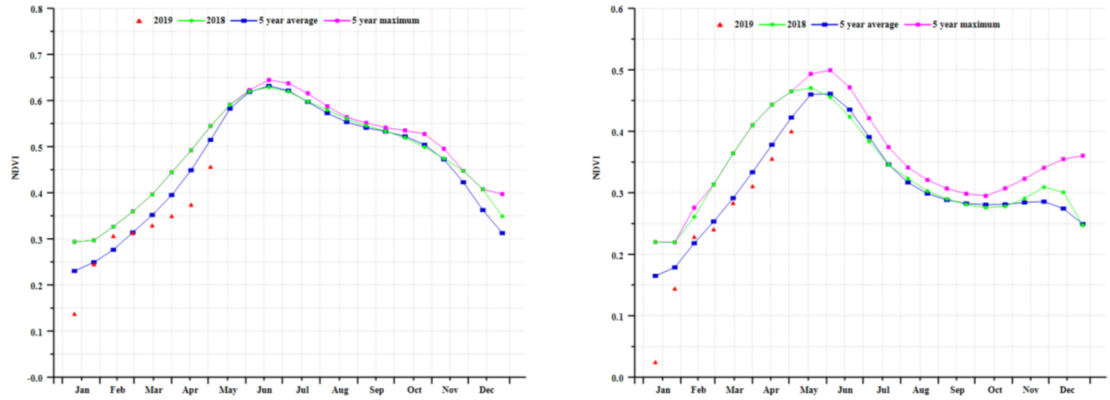

(c) Maximum VCI



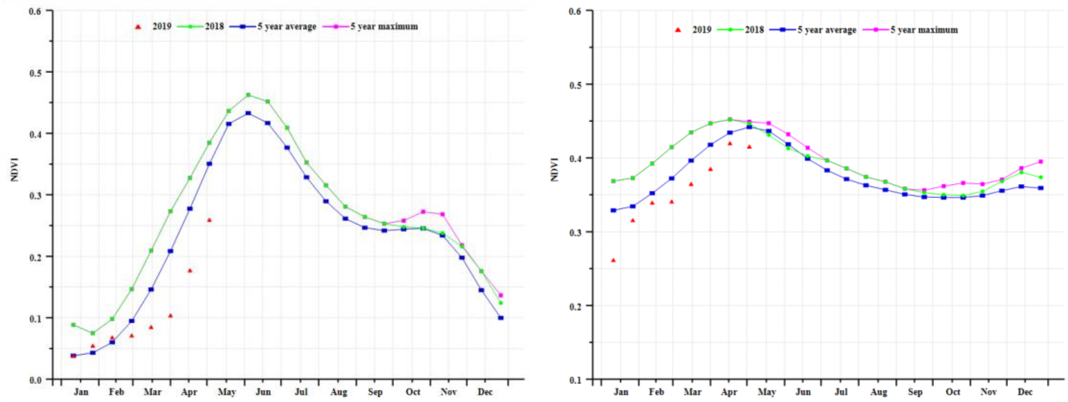

(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Black Sea region (left) and Central Anatolia region (right))




(f) Crop condition development graph based on NDVI (Eastern Anatolia region (left) and Marmara_Agean_Mediterranean lowland region (right))

**Table 3.69 Turkey's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Black Sea region | 286 | -11 | 4.7 | 0.4 | 705 | -1 |
| Central Anatolia region | 306 | -5 | 3.7 | 0.0 | 814 | -2 |
| Eastern Anatolia region | 231 | -11 | -0.5 | -0.5 | 780 | -6 |
| Marmara Agean Mediterranean lowland region | 365 | 12 | 7.5 | -0.3 | 801 | -4 |

**Table 3.70 Turkey's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| Black Sea region | 848 | 1 | 71 | -7 | 0.78 |
| Central Anatolia region | 874 | 2 | 39 | -8 | 0.78 |
| Eastern Anatolia region | 608 | -5 | 29 | -27 | 0.59 |
| Marmara Agean Mediterranean lowland region | 977 | 4 | 74 | 1 | 0.84 |

# [UKR] Ukraine

Only winter wheat was in the field during the reporting period since maize was harvested up to December and will be planted in April-May.

As shown by the national agroclimatic indicators, rainfall (RAIN, 210 mm) and radiation (RADPAR, 520 MJ/m$^2$) were below the average by 4% and 1%, respectively, while temperature (2.9°C, +1.2°C) was much higher than the average. As a result of favorable temperature, potential biomass based on weather condition was forecast to increase to 755 g DM/m$^2$, 2% above the 15-year average. Agronomic indicators were normal for crop development, although cropped arable land fraction (CALF 72%, 10% below average) showed a decrease. VCIx reached to 0.81, which was a relative high value indicating fair crop condition, with the lowest values occurring in central-northern areas.

The NDVI development curve at the national level suggests crop condition reached close to or above 5YA values after mid-March. In 38.6% of arable land concentrated in north-east and east NDVI was well below average until mid-March. Since then, 68.3% of areas have reached at least average NDVI values with 31.7%, mainly in the west, at moderately low values of -0.1 NDVI units.

In summary overall situation was fair for winter wheat but reduced areas will reduce output.

**Regional analysis**

Regional analyses are provided for four agro-ecological zones (AEZ) defined by their cropping systems, climatic zones and topographic conditions. They are referred to as **Central wheat area** (184) with the Poltava, Cherkasy, Dnipropetrovsk and Kirovohrad Oblasts; **Northern wheat area** (186) with Rivne, **Eastern Carpathian hills** (185) with Lviv, Zakarpattia and Ivano-Frankivsk oblasts, and the **Southern wheat and maize area** (187) with Mykolaiv, Kherson and Zaporizhia oblasts.

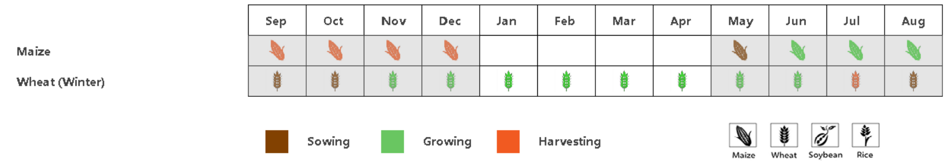
**The Central wheat area** recorded average rainfall (208 mm, -3%) and radiation (508 MJ/m$^2$, -2%) but significant increased temperature (2.4°C, +1.1℃). Warm weather condition has benefited wheat growth and the biomass production potential increased by 9% (822 g DM/m$^2$) as compared to 5-year average. Agronomic indicators show a low CALF (58%, -18%) and fair VCIx (0.75). Similar to national NDVI development trend, crop growth rapidly recovered to 5-year average since middle March. Production prospects are just average or below, mainly due to the drop in CALF.

**The Northern wheat area** received 2% higher than normal rainfall, normal radiation (-1%) and warmer temperature (2.5°C, +1.5°C), indicating 9% higher potential biomass. It had moderate CALF of only 68% (down 17% below 5YA) a fair VCIx of 0.78. Cropped area was lower but crop condition was fair. The NDVI development curve has reached the 5-year average from mid-February. As in the previous AEZ, production prospects are just average or below.

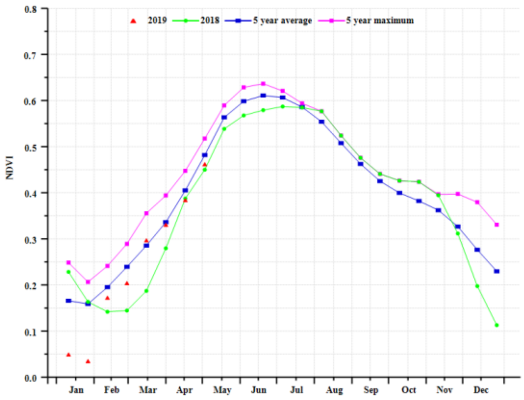
**The Eastern Carpathian hills** experienced similar agroclimatic and agronomic condition as above two AEZs, normal rainfall (-3%) and radiation (-2%), but higher temperature (+1.2°C). The area had fair VCIx (0.74) and relatively better CALF (87%), a value nevertheless 10% below average. The biomass production potential is up 7% and the NDVI development curve was about average. Crop production prospects are somewhat more favourable than in the two previous AEZs.

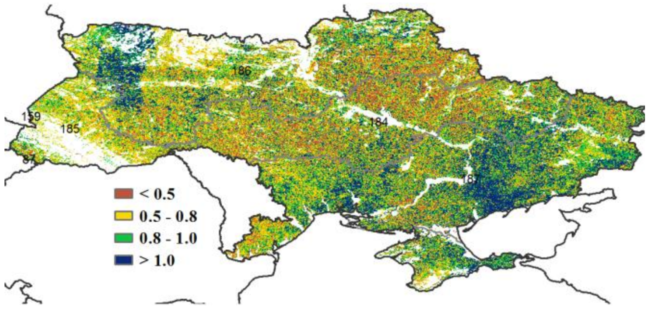
**The Southern wheat and maize area** was deficient in rainfall (-17%) with higher temperature of about 1.1°C and average radiation (-0.3%), which led to 9% reduction in potential biomass. Agronomic indices were favorable with both high CALF (80%) and VCIx (0.88). The NDVI in the area was also marginally higher than last year and 5-year average since February. In spite of low rainfall, the crop condition in the area is assessed as average.

**Figure 3.40 Ukraine's crop condition, January-April 2019**



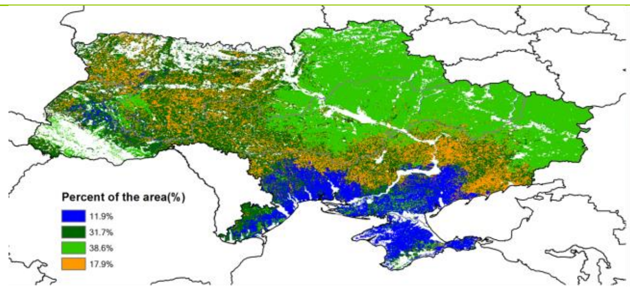

(a). Phenology of major crops

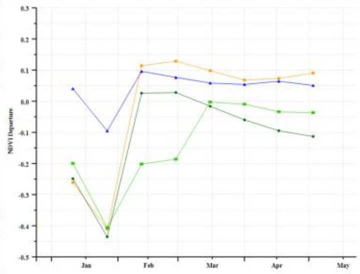



(b) Crop condition development graph based on NDVI

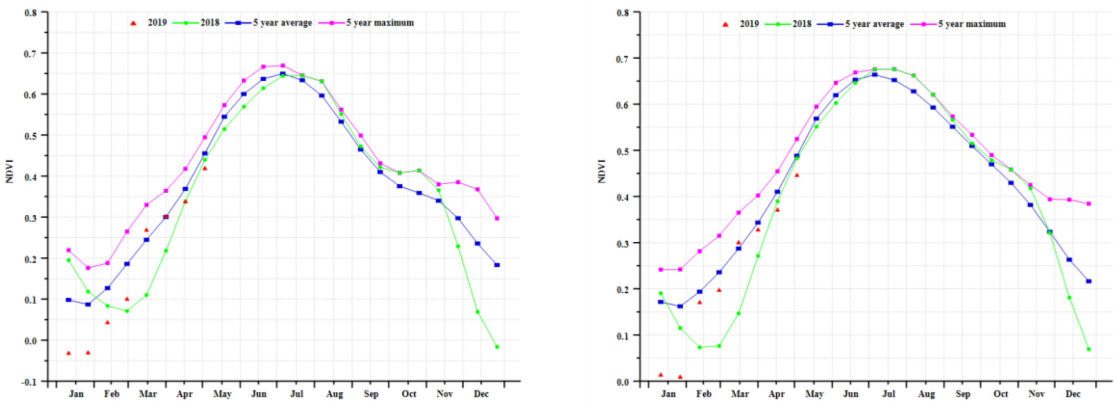
(c) Maximum VCI



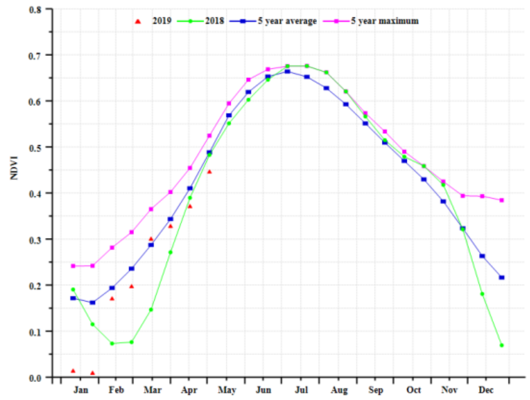



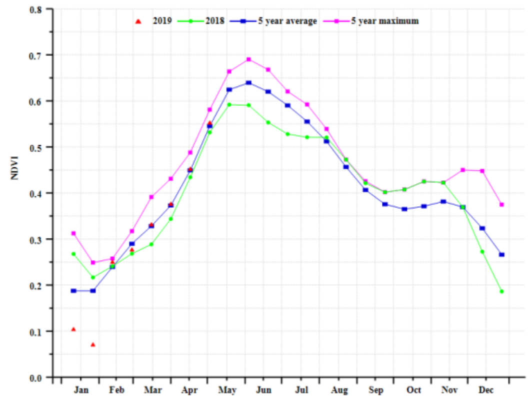
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Cebntral wheat area (left) and Northern wheat area (right))




(f) Crop condition development graph based on NDVI (Eastern Carpathian hills (left) and Southern wheat and maize area (right))

**Table 3.71 Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019.**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| **Central wheat area** | 208 | -3 | 2.4 | 1.1 | 508 | -2 |
| **Northern wheat area** | 256 | 2 | 2.5 | 1.5 | 472 | -1 |
| **Eastern Carpathian hills** | 239 | -3 | 2.9 | 1.2 | 539 | -2 |
| **Southern wheat and maize area** | 152 | -17 | 3.3 | 1.1 | 569 | 0 |

**Table 3.72 Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019.**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| **Central wheat area** | 822 | 9 | 58 | -18 | 0.75 |
| **Northern wheat area** | 849 | 9 | 68 | -17 | 0.78 |
| **Eastern Carpathian hills** | 838 | 7 | 87 | -10 | 0.74 |
| **Southern wheat and maize area** | 624 | -9 | 80 | -1 | 0.88 |

# [USA] United States

The reporting period covers the middle of the growing season of winter crops (winter wheat, rye, oats, canola) and contitutes the early sowing season of maize, soybean, wheat spring and rice. In general, NDVI development graph indicate the condition of current winter crops is more favorable than last year's.

The winter cereals are distributed over the States of Kansas, Oklahoma, Texas, Colorado, Nebraska, Washington, California, Montana and South Dakota. Canola has been planted in North Dakota. In Kansas, South Dakota, Nebraska, North Dakota, California precipitation was well above average by 16%, 41%, 22%, 24%, and 67%, respectively. Among the major winter crop production zones, Oklahoma and Washington suffered precipitation deficits reaching -16% and -12%; both states should be watched for water stresses in the coming months. Below average temperature and RADPAR occurred in all agricultural States, with the coldest weather in North Dakota (-3.0°C below average), Montana (-3.5°C), and South Dakota (-3.5°C).

The favorable crop condition was observed in Abilene in Texas, and Sacramento and Bakersfield of California. Oklahoma City to Wichita is the most important winter wheat producing area in the United States, where crop condition is still below average although it improved since March. Another important winter crop region with far below crop condition before April due to drought covers Spokane to Kennewick in Washington, and the Great Falls region in Montana. Crops have been recovering recently in the area but the most important canola region, North Dakota, remains below average.

The regional differences in crop condition are also confirmed by the maximum VCI (VCIx). Nationwide, VCIx reached to 0.86 in the United States. The highest values (above 1) occur in Abilene (Texas), and Sacramento and Bakersfield (California). Low values were recorded in North Dakota, Montana, and Washington States. The fraction of actually cultivated arable land was average.

In summary, the crop condition in Washington, Montana, North Dakota and Oklahoma still needs close monitoring; good crop production can be expected in California, Texas and Kansas.

**Regional analysis**

The regional analysis focuses on winter crop producing regions of United States, including California, the Northwest, Northern Plains, and Southern Plains.

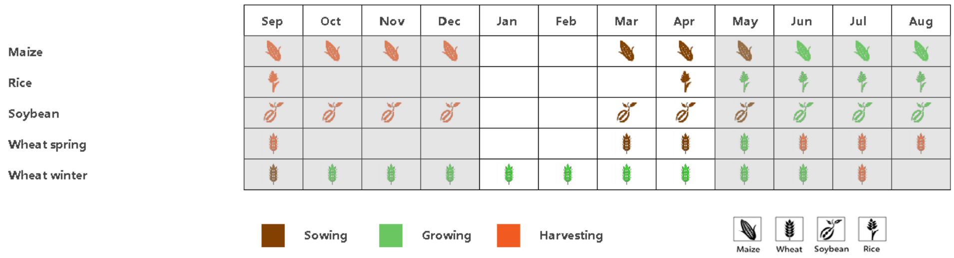
The main agricultural area between Sacramento and Bakersfield had significantly above average crop condition, as indicated by the NDVI development graph. In **California** temperature was close to average (-0.3°C) and precipitation exceeded average by 82%, which replenished much needed soil moisture reserves. The potential biomass is up 38% over average and CALF increased by 9%. VCIx at 0.99 confirms the favourable crop condition.

The **Southern Plains** are the most important winter crops producing zone of the United States; they include Texas, Oklahoma and Kansas. Crop condition reached the 5 year maximum at the end of the monitoring period, in April 2019. CropWatch agro-climatic indicators show average weather condition: precipitation and temperature were 2% and 1.2°C below average. Precipitation was 12% below average in Oklahoma but average or above average in other States. It is worth noting that the CALF in the region has increased significantly, by 10% above the 5YA. The good crop condition was confirmed by VCIx of 0.92 and winter crop production prospects are favorable.

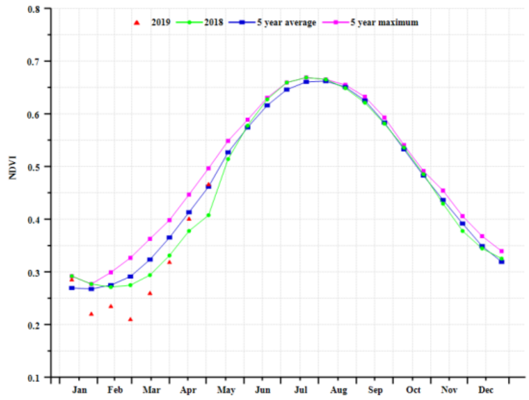
The **Northern Plains** are another important winter crop producing zone of United States, including South Dakota, North Dakota, and Montana. Crop condition was below the 5-year average during the current monitoring period. Precipitation was up 10% compared with average while temperature and RADPAD were significantly lower than average by 3.2°C and 13%, respectively. The sowing, growth and development of crops in this region was blocked by the cold wave and abnormally low RADPAR that resulted in a significant reduction in CALF of 56%. The 0.72 VCIx confirmed the poor crop growth in this monitoring period. Production prospects are unfavorable.

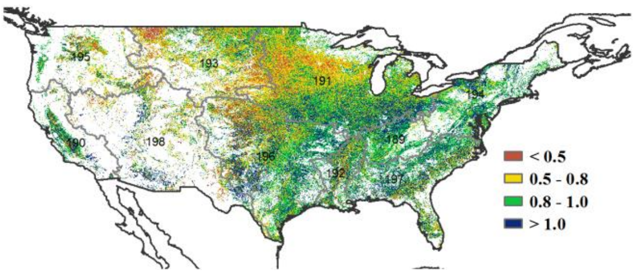
Crop condition was significant below the average in **the North-West**, the fourth major winter crop production zone of the United States. Precipitation was close to average, only slightly higher than average by 4%, while the temperature dropped 1.2°C below average. Washington, the major State of the Northwest region suffered insufficient precipitation (12% below average) The drought led to an 11% reduction in CALF while VCIx was just fair (0.75). Crop prospects are average at best.

**Figure 3.41 United States's crop condition, January-April 2019**



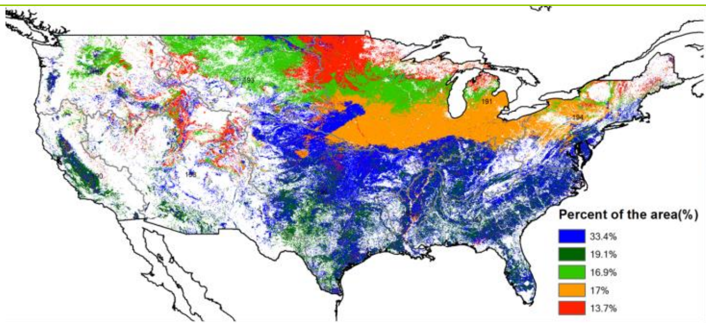

(a). Phenology of major crops

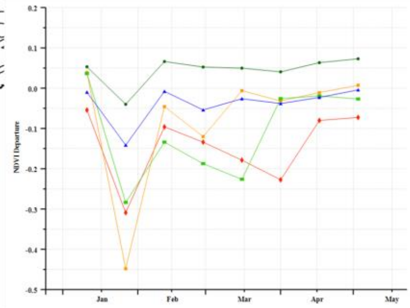



(b) Crop condition development graph based on NDVI

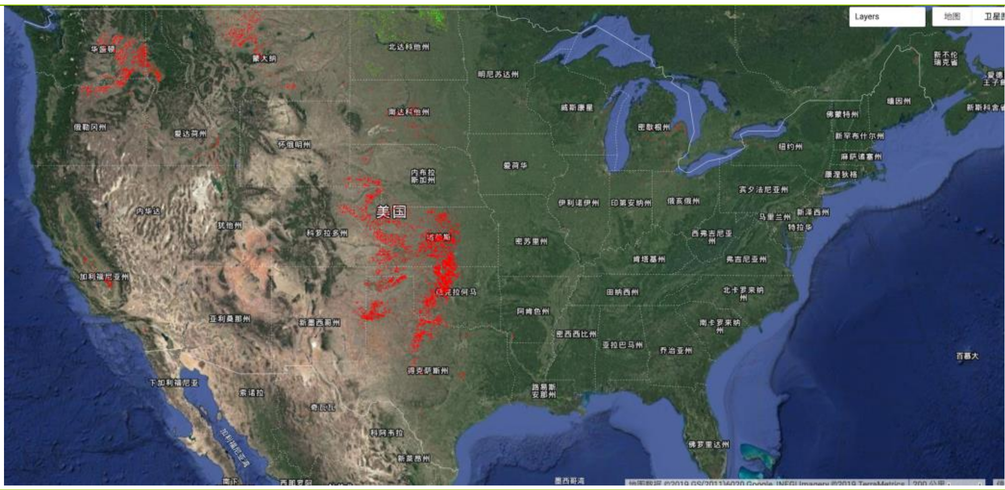
(c) Maximum VCI



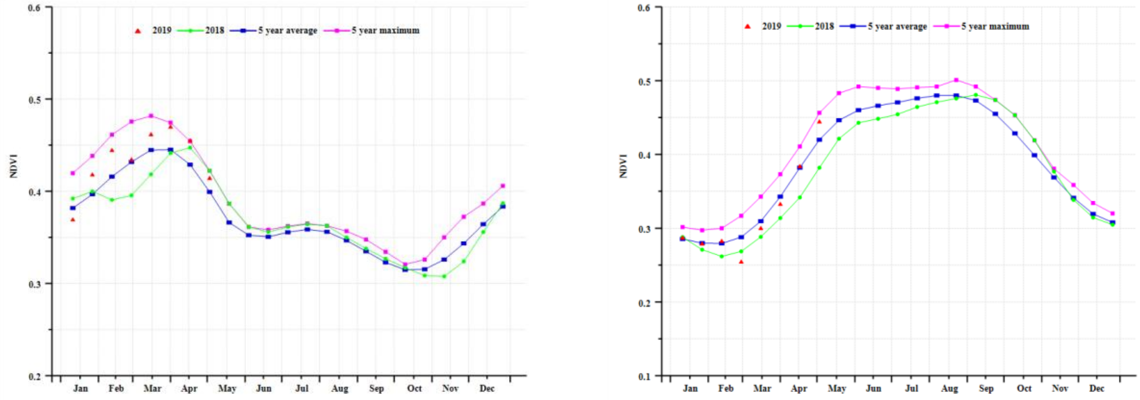




(d) Spatial NDVI patterns compared to 5YA

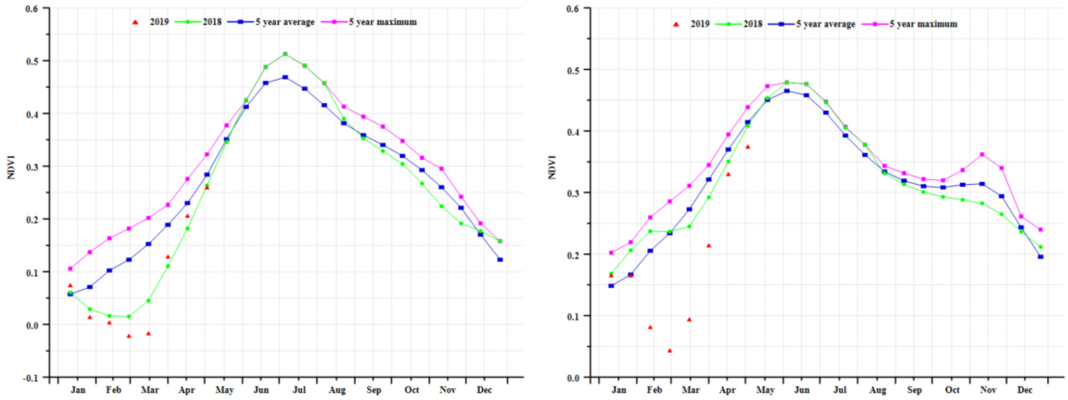
(e) NDVI profiles



(f) Winter crops and canola distribution of United States(red color: winter crops, green color: canola)




(g) Crop condition development graph based on NDVI, California (left) and Southern Plains (right))




(h) Crop condition development graph based on NDVI, Northern Plains (left) and Northwest (right))

**Table 3.73** **United States's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019.**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| **California** | 315 | 68 | 7.5 | -0.3 | 815 | -9 |
| **Northwest** | 247 | 4 | 0.2 | -1.2 | 643 | -3 |
| **Northern Plains** | 212 | 10 | -4.6 | -3.2 | 724 | -4 |
| **Southern Plains** | 265 | -2 | 8.8 | -1.2 | 830 | -7 |

**Table 3.74 United States's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019.**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current ($gDM/m^2$) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| **California** | 784 | 36.4 | 79 | 9 | 0.99 |
| **Northwest** | 672 | 2.4 | 52 | -11 | 0.75 |
| **Northern Plains** | 527 | -12.7 | 5 | -58 | 0.72 |
| **Southern Plains** | 780 | 5.9 | 67 | 10 | 0.92 |

# [UZB] Uzbekistan

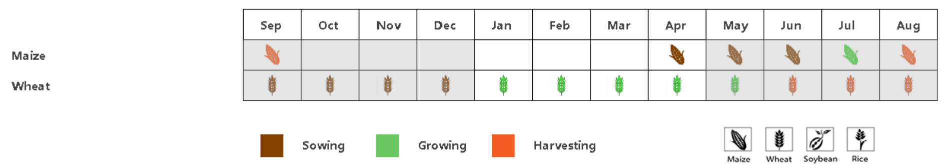
The reporting period covers the sowing of maize at the end of April and the end of winter dormancy and vernal re-growth of winter wheat. The national average VCIx was 1, the highest value on record; the cropped arable land fraction CALF increased by 64%. Among the CropWatch agroclimatic indicators, TEMP and RAIN were above average (1.4°C and 5%), while RADPAR was fell 10%. The combination of factors resulted in increased BIOMSS (9%) compared to the recent average. As shown by the NDVI development graph, crop condition was above the average of the previous five-year average. Spatial NDVI clusters and profiles show that 58.8% of the agricultural areas enjoyed above average condition from February to late March in most parts of the Guliston, Mubarek, Qunghirot, Altynkul, Samarqand, Chimbay, Bekabad, Farish and Kasan provinces, as well as limited areas in the provinces of Kagan, Bukhoro, Quqon, Namangan, Andijon, Farghona and Beruni. Between March and late April, 59.1% of the agriculture areas had above average condition in most of the four eastern provinces, Urganch, Khiva, Tashkent, Gizhduvan, Navoiy, Kattakurgan, Guliston, Jizzakh and Bekabad provinces. Condition was below or average in remaining areas. Overall, crop condition was favorable.

**Regional analysis**

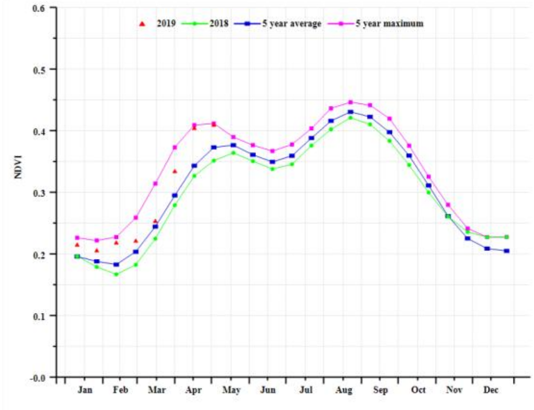
In the **Eastern hilly cereals zone**, NDVI was above the five-year average from January to late April. NDVI exceeded the five-year maximum throughout April. RAIN and TEMP were above average (6% and 1.3°C) and RADPAR was below average (10%). The combination of the factors resulted in high BIOMSS (+11% compared to average). The maximum VCI index was 1.02, and the cropped arable land fraction increased by 64%. The crop condition was favorable during monitoring period in this zone and a bumper crop is expected.

The **Aral Sea cotton zone**, crop condition was above compared with the five years average in January and close to the five averages from February to late April. However, NDVI value was below 0.2 from January to April which indicates the absence of crops in this zone where cotton is the main commodity. Among the CropWatch agroclimatic indicators, accumulated rainfall and radiation were below average during the monitoring period (RAIN -6% and RADPAR -11%) but temperature was significantly above (TEMP +2.0°C). The BIOMSS index increased 2% compared to the fifteen-year average. The maximum VCI index was 0.91.

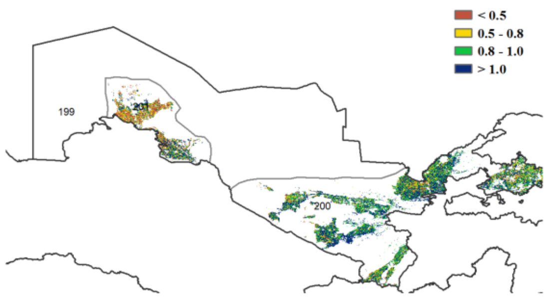
**Figure 3.42 Uzbekistan's crop condition, January - April 2019**



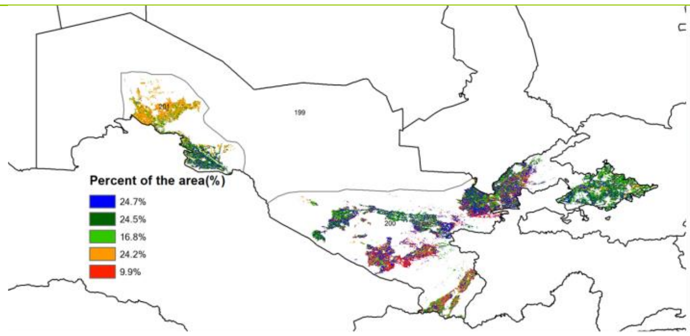

(a). Phenology of major crops



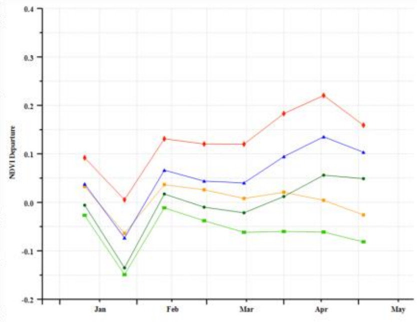

(b) Crop condition development graph based on NDVI



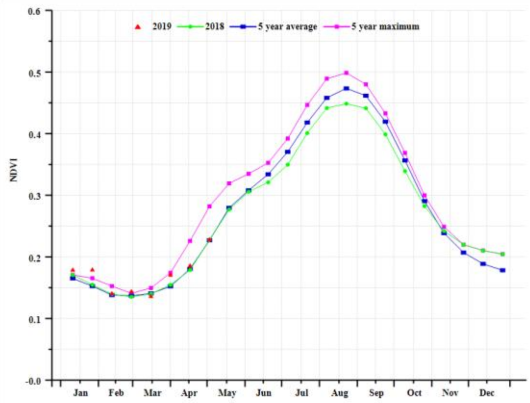

(c) Maximum VCI

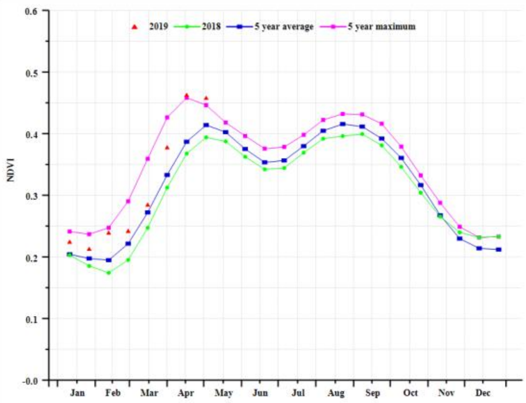



(d) Spatial NDVI patterns compared to 5YA

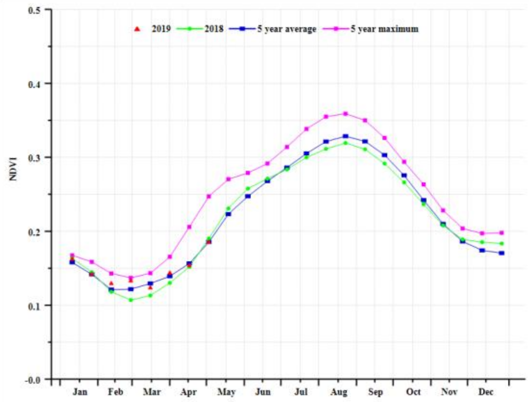



(e) NDVI profiles




(f) Crop condition development graph based on NDVI Aral Sea cotton region (left) Eastern hilly cereals region (right)




(g) Crop condition development graph based on NDVI Central region with sparse crops

**Table 3.75** **Uzbekistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| **Aral Sea cotton zone** | 141 | -6 | 6.0 | 2.0 | 724 | -11 |
| **Eastern hilly cereals zone** | 221 | 6 | 7.5 | 1.3 | 766 | -10 |
| **Central region with sparse crops** | 217 | -11 | 6.4 | 2.0 | 707 | -13 |

**Table 3.76** **Uzbekistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| **Aral Sea cotton zone** | 584 | 2 | - | - | 0.91 |
| **Eastern hilly cereals zone** | 751 | 11 | 67 | 64 | 1.02 |
| **Central region with sparse crops** | 759 | 12 | - | - | 0.57 |

# [VNM] Vietnam

The monitoring period covers the sowing and growth of spring and winter rice in both the north and south of the country, with differences due to altitude. Most rice is cultivated in the Red River Delta (north) and in the Mekong Delta in the south.

Nationwide, the condition of crops is above the reference 5YA in 30.6% of croplands (mainly in the south-east of the country) where a VCIx above 0.8 confirms the favorable situation. Unfavorable crops occur in about 29.2% of the arable land (mainly in the north-west of the country). Due to the erratic behavior of NDVI (possibly due to cloudiness) its interpretation is inconclusive. Compared with average, precipitation decreased 6%, while the temperature (+1.2°C) and RADPAR (+6%) both increased. The biomass production potential was up 3% above average, with high CALF up +1% and a very favourable VCIx of 0.98. CropWatch currently predicts the rice output to be below 2018 values.

**Regional analysis**

Based on cropping systems, climatic zones, and topographic conditions, several agro-ecological zones (AEZ) can be distinguished for Vietnam, among which three are most relevant for crops cultivation: Northern zone with Red river Delta, the Central coastal areas from Thanh Hoa to Khanh Hoa and Southern zone with the Mekong Delta.

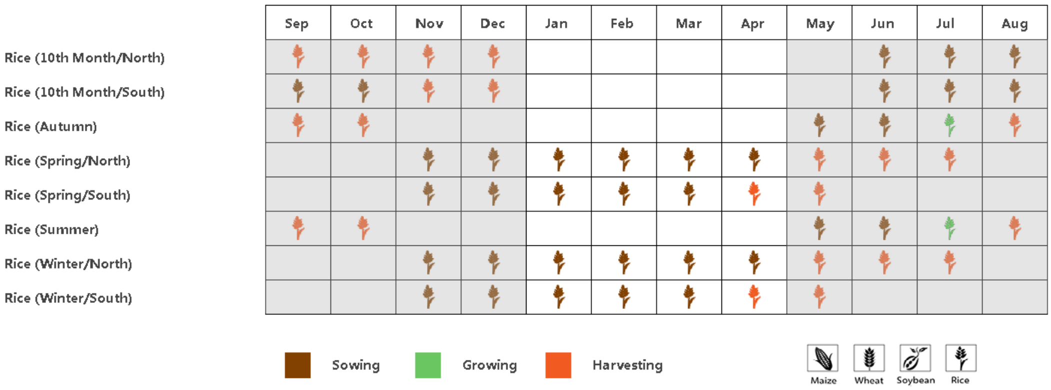
**The Northern zone with Red river Delta** recorded about average rainfall (RAIN +6%), RADPAR (-2%) but high temperature (TEMP 1.6°C above average). With high CALF (99%) and VCIx (1.00), the BIOMSS significantly increased (+17%) compared to the average. The NDVI development graph showed an unstable trend with values above the 5 years maximum in April. Based on the agro-climatic indicators and NDVI development graph, output is likely to be average or above.

The situation and expected impact on crop production in **the Central coastal areas from Thanh Hoa to Khanh Hoa** is conditioned by low precipitation (RAIN -10%), high temperature (TEMP +1.7°C) and abundant sunshine (RADPAR +16%). BIOMSS is down 2% but VCIx (1.01) and CALF (+1%) describe fair to good condition. The crop condition development graph based on NDVI was above the 5 years maximum during February but decreased after March. Below average output is likely for rain-fed crops but irrigated crops should be doing fine.

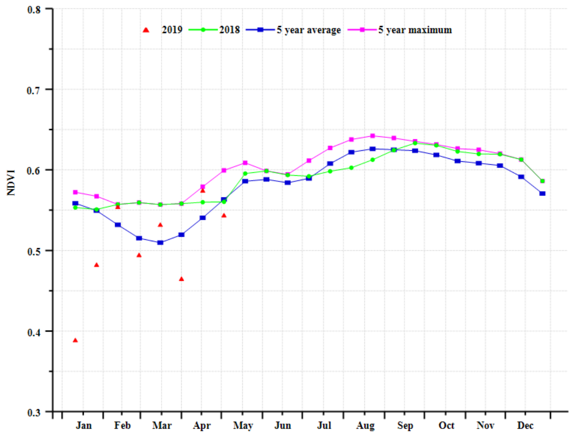
The fraction of cropped arable land (CALF) in **the Southern zone with the Mekong Delta** for the reporting period is close to average (up 1%). Vegetation condition indices (maximum VCI) are favorable (0.94), accompanied by a decrease in BIOMSS (-7%) resulting from the obvious shortage of precipitation (RAIN, -17%) along with an increase in radiation (RADPAR +6%) and average temperature (TEMP +0.5°C). The crop condition development graph of NDVI indicates values that are below the 5 years average and last year's condition. CropWatch expects below average production in the area.

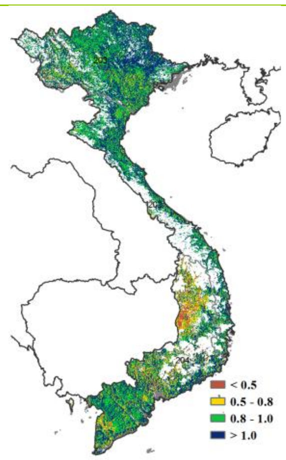
With crop condition in over 60% of the croplands average or below average, crop prospects are expected to be average or below.

**Figure 3.43 Vietnam's crop condition, January -April 2019**



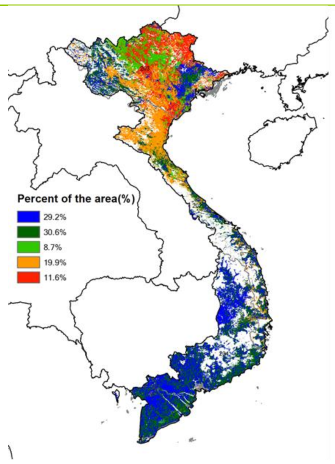

(a). Phenology of major crops

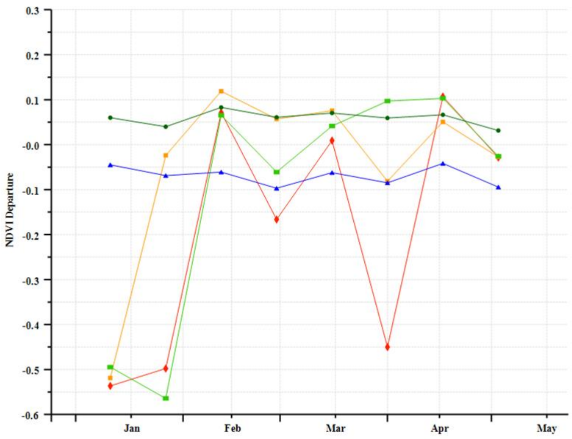



(b) Crop condition development graph based on NDVI

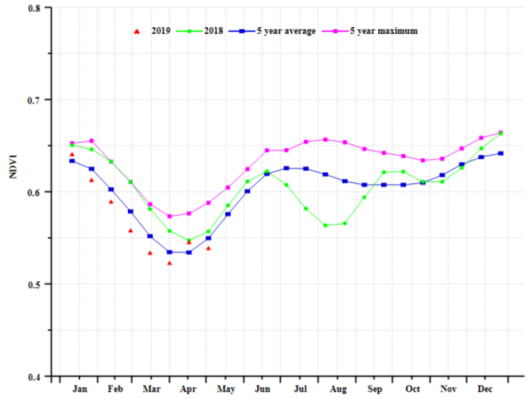
(c) Maximum VCI

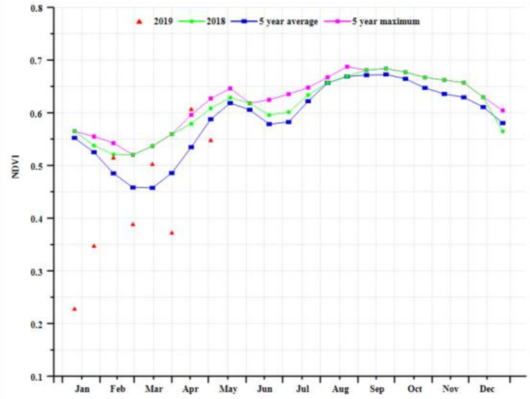


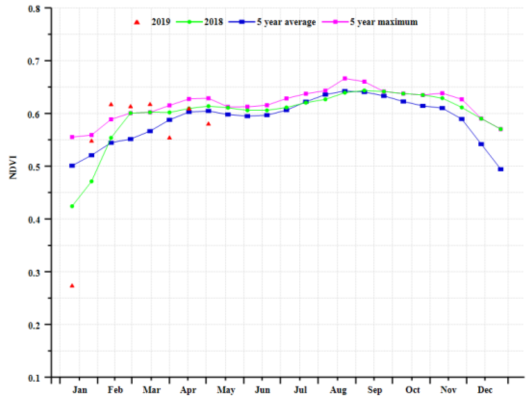

(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles




(f) Crop condition development graph based on NDVI Southern Vietnam (left), and Northern Vietnam (right).




(g) Crop condition development graph based on NDVI (Central Vietnam).

**Table 3.77 Vietnam's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January -April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| **North_Vietnam** | 192 | 6 | 20.3 | 1.6 | 772 | -2 |
| **Central_Vietnam** | 167 | -10 | 24.8 | 1.7 | 1061 | 16 |
| **South_Vietnam** | 143 | -17 | 26.5 | 0.5 | 1222 | 6 |

**Table 3.78 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January -April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| **North_Vietnam** | 712 | 17 | 99 | 1 | 1.00 |
| **Central_Vietnam** | 588 | -2 | 99 | 1 | 1.01 |
| **South_Vietnam** | 504 | -7 | 92 | 1 | 0.94 |

# [ZAF] South Africa

The reporting period corresponds to the growing of summer crops such as maize, to be harvested from May while the harvest of soybean started in April.

The rainfall (RAIN) increased 14% above the average and the temperature (TEMP) was up just 0.3°C. The estimated RADPAR was 5% above the average with BIOMSS 8% above the average and average CALF at 85%.

80.3% of cropland showed below average NDVI until the end of March, after which values exceeded average. In remaining areas crop condition was above average during the whole period, mostly in the Free State. While the estimated nationwide VCIx value was high (0.8), the maximum VCI map shows large variations in VCIx among provinces. Values were very high (>1) in Mpumalanga and Gauteng provinces, high (0.8 – 1) for most regions except some regions in Western Cape and North West provinces where the VCIx was low (<0.5). In general, all CropWatch estimates indicate fair crop conditions.

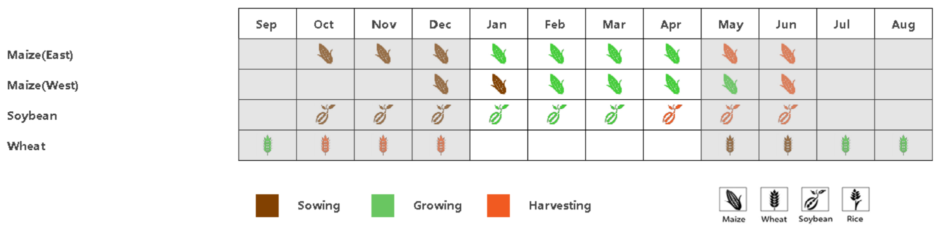
**Regional analysis**

Based on the cropping system, climatic zones, and topographic conditions, four sub-national agro-ecological regions (AEZs) can be distinguished for South Africa. Only three of them are relevant for crops; **Humid Cape Fold mountains**, **Mediterranean zone**, and **Dry Highveld and Bushveld maize areas**.

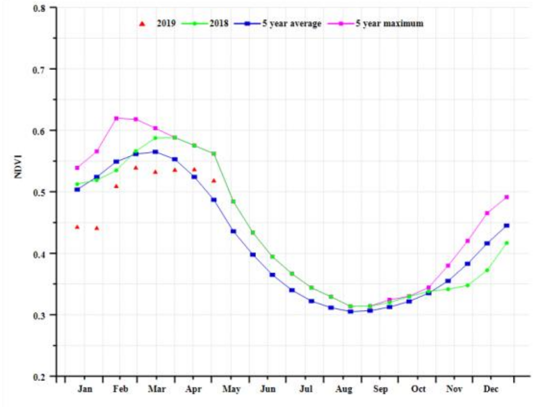
The agroclimatic indicators for the three AEZs show an increase in the rainfall over average by 16, 13, and 15%, respectively, while the temperature was below the average for the first two zones (by 0.2 and 0.5°C, respectively) and 0.4°C above the average for **the Dry Highveld and Bushveld maize areas**. The estimated RADPAR was at average (1133MJ/m$^2$) for **the Humid Cape Fold mountains** and above average for the other two zones by 1% and 6%, respectively. The CropWatch agronomic indicators show an increase in the estimated BIOMSS for the three zones between 4% and 14%. The CALF was at the average for the first and third zones, but 26% above in **the Mediterranean zone**. The maximum VCI was high (0.83 and 0.89) for the first and the third zone but low (0.38) for **the Mediterranean zone**.

In **Humid Cape Fold mountains**, crop condition started below the average but passed the average after mid-March. In **the Mediterranean zone**, the crop condition exceeded average in early March. **The Dry Highveld and Bushveld maize areas** had above average crop condition only during April.

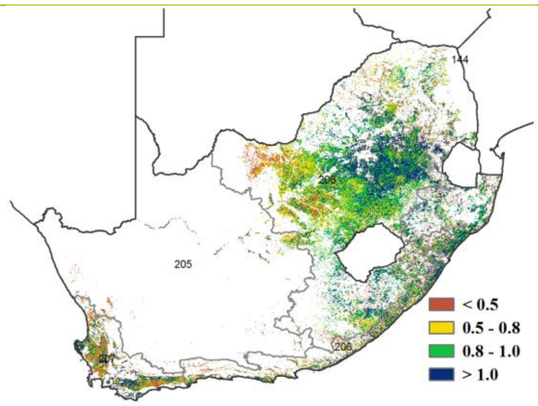
**Figure 3.44 South Africa's crop condition, January -April 2019**



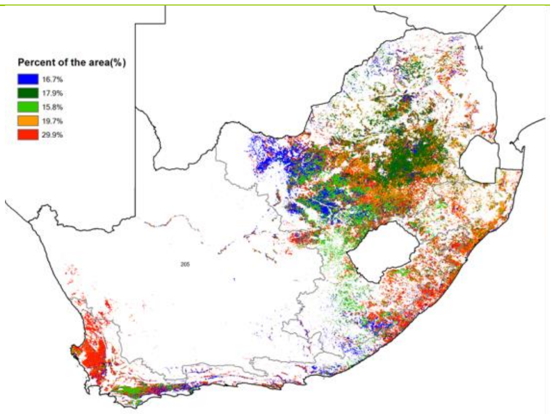

(a). Phenology of major crops



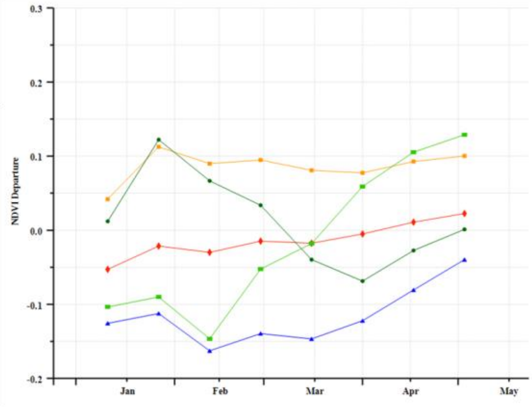

(b) Crop condition development graph based on NDVI



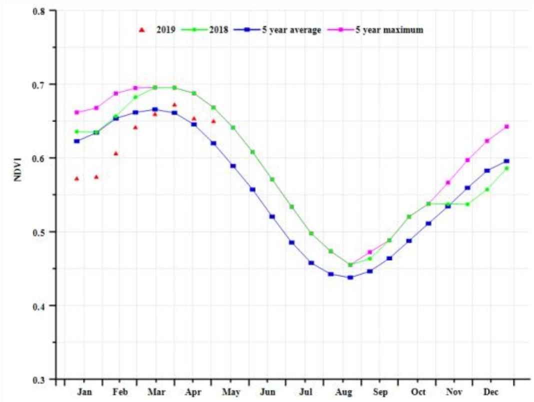

(c) Maximum VCI

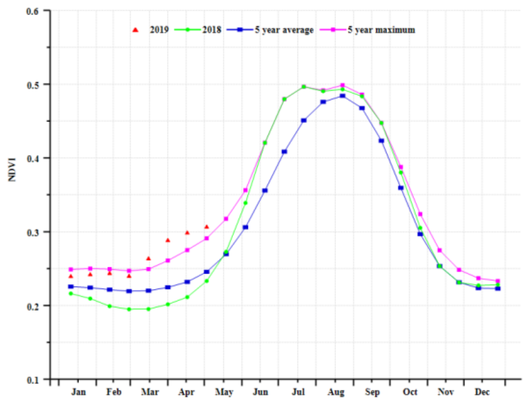



(d) Spatial NDVI patterns compared to 5YA

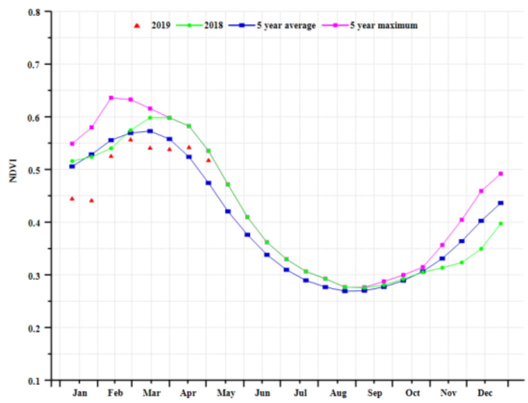



(e) NDVI profiles




(f) Crop condition development graph based on NDVI (Humid Cape Fold Mountains (left) and Mediterranean wheat zone (right))




(f) Crop condition development graph based on NDVI (Dry Highveld and Bushveld maize zone)

**Table 3.79 South Africa's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January -April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| **Humid Cape Fold Mountains** | 352 | 16 | 21.4 | -0.2 | 1133 | 0 |
| **Mediterranean Zone** | 97 | 13 | 19.0 | -0.5 | 1320 | 1 |
| **Dry Highveld and Bushveld** | 418 | 15 | 20.9 | 0.4 | 1331 | 6 |

**Table 3.80 South Africa's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January -April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| **Humid Cape Fold Mountains** | 1136 | 14 | 96 | 0 | 0.83 |
| **Mediterranean Zone** | 370 | 4 | 28 | 26 | 0.38 |
| **Dry Highveld and Bushveld** | 1335 | 10 | 92 | 0 | 0.89 |

# [ZMB] Zambia

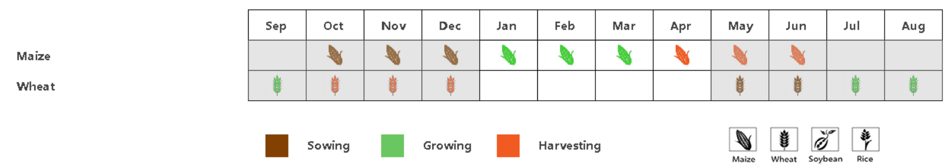
The reported period covers crop establishment, vegetative, reproductive, maturity and harvesting phase under rain-fed conditions for main cereal crops (maize, sorghum, millet). Harvesting of rain-fed crops started in April; their production was severely affected by rainfall deficits mostly during months of February and March. A decrease of cereal production is expected in the Southern, Western and parts of Central Provinces which account for close to one-third of the national cereal output. After harvesting of rain-fed crops in April, large scale (commercial) farms prepare and plant irrigated winter wheat which give approximately 200,000 tonnes national annual production.

Any rainfall deficit during the sensitive phase of crop development greatly reduces agriculture production prospects. According to overall agroclimatic and agronomic indicators, the 2019 season, experienced decreased rainfall (14% below average), increased radiation (+2%) and a marginal temperature decrease (-0.1 degree Celsius) which led to decreased biomass production (-14%). This was reflected in the below average crop development condition throughout this period. This was observed by lower NDVI, despite the increased area under cultivation (CALF +12% 5YA Departure) and maximum VCI of 0.94. However, most of the cultivated area had maximum VCI varying from 0.8 to 1.0 except for the central and southern parts of the country experiencing maximum VCI between 0.5 to 0.8. The spatial distribution of NDVI profiles attest 35% - mainly northern parts which experienced positive NDVI Departures while the rest of the country and predominantly the central and southern parts suffered negative NDVI departures. The seasonal deficits in rainfall are the predominant factor in the unfavourable production as reflected in the NDVI profiles. Most of the cropped land in Southern, Lusaka and Western Provinces experienced stressed vegetation conditions especially in the month of March, hence a high likelihood of reduced crop harvest and yields. The poor rainfall establishment at the start of the season contributed to the reduced cropped land area.

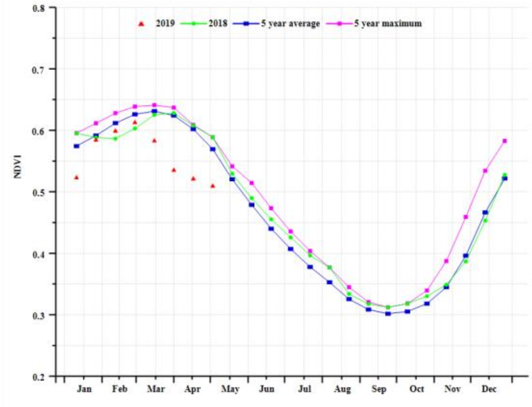
In terms of the agro-ecological region analysis, all the agro-ecological regions received less annual rainfall than the expected 15YA with highest deviations (-26%, 15 YA Dep.) observed for the Luangwa and Zambezi Valleys (AEZ I), followed by Western Semi-Arid Plain (AEZ IIb), Central, Eastern and Southern (AEZ IIa) and minimal deviations (-2%, 15YA Dep.) for Northern High Rainfall Zone (AEZ III). This was reflected in the annual biomass production trends in the regions AEZ I (1131 gDM/m$^2$: -22% 15YA Dep.) compared to AEZ III (1891 gDM/m$^2$: +2% 15YA Dep.). However, the Cropped Arable Land Fraction (CALF) remained at 100% with negligible deviation from the 15YA (0%). Both the NDVI and BIOMASS showed a strong departure from 15YA, indicating reduced potential agricultural production in region AEZ IIa, AEZ IIb and AEZ I due mainly the reduced rainfall in these regions.

CropWatch indicators point to the fact that poor harvest will affect food security particularly in the Southern Province, rural Lusaka and western parts of the country. Since it has become more evident that the rainfall received in recent times is lower than the 5YA, and this has caused severe food insecurity, an adaptation strategy would be to investment in water harvesting infrastructures to enable use of harvested rainfall water rationally during farming seasons.

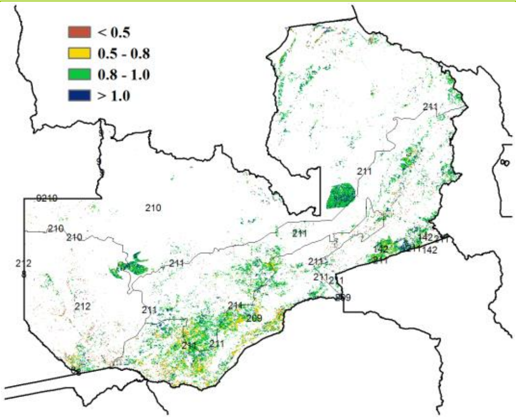
**Figure 3.45 Zambia's crop condition, January - April 2019**



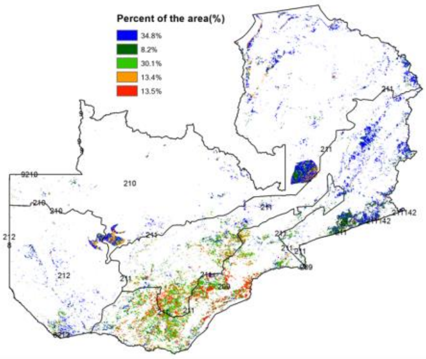

a). Phenology of major crops



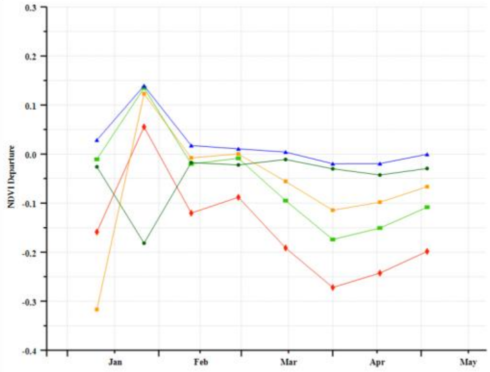

(b) Crop condition development graph based on NDVI




(c) Maximum VCI




(d) Spatial NDVI patterns compared to 5YA




(e) NDVI profiles

**Table 3.81 Zambia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January -April 2019**

| Region | RAIN | | TEMP | | RADPAR | |
|---|---|---|---|---|---|---|
| | Current (mm) | Departure from 15YA (%) | Current (°C) | Departure from 15YA (°C) | Current (MJ/m²) | Departure from 15YA (%) |
| Luanguwa Zambezi rift valley | 375 | -26 | 25.5 | 0.2 | 1314 | 6 |
| Northen high rainfall zone | 675 | -2 | 23.1 | 0.0 | 1136 | 2 |
| Central-eastern and southern plateau | 517 | -11 | 24.3 | -0.2 | 1198 | 2 |
| Western semi-arid plain | 412 | -22 | 25.2 | 0.3 | 1359 | 13 |

**Table 3.82 Zambia's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January -April 2019**

| Region | BIOMSS | | Cropped arable land fraction | | Maximum VCI |
|---|---|---|---|---|---|
| | Current (gDM/m²) | Departure from 15YA (%) | Current | Departure from 5YA (%) | Current |
| Luanguwa Zambezi rift valley | 1131 | -22 | 100 | 0 | 0.86 |
| Northen high rainfall zone | 1891 | 1 | 100 | 0 | 0.95 |
| Central-eastern and southern plateau | 1503 | -7 | 100 | 0 | 0.93 |
| Western semi-arid plain | 1226 | -19 | 100 | 0 | 0.90 |

# Chapter 4. China

*After a brief overview of the agro-climatic and agronomic conditions in China over the reporting period (section 4.1), Chapter 4 presents an updated estimate of national winter crop production (4.2) and describes the situation by region, focusing on the seven most productive agro-ecological regions of the east and south: Northeast China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze, Southwest China, and Southern China (4.3). Section 4.4 describes trade prospects (import/export) of major crops. Additional information on the agroclimatic indicators for agriculturally important Chinese provinces are listed in table A.11 in Annex A.*

## 4.1 Overview

During the current monitoring period, winter wheat and rapeseed were still growing while most of other crops (i.e., maize, early rice, single season rice and soybean) were at sowing. Overall, agroclimatic condition were favorable and beneficial for crops growth. At the national scale rainfall and temperature increased respectively 20% and 0.6°C compared to average, whereas RADPAR declined by 4%. Consequently, BIOMSS was 10% above average and VCIx was relatively high, with a value of 0.90.

Spatially, 86.8% of arable land experienced average precipitation throughout the reporting period. Remaining areas (13.2% of crop land) in the south-eastern region, underwent rainfall fluctuations over time. The most pronounced high rainfall anomalies (more than 210 mm above average) affected 2.9% of agricultural areas from mid-April in the border area of Guangdong, Guangxi, Hunan and Jiangxi provinces. In contrast to rainfall, temperature anomalies were very variable over time especially in North-east China, including Heilongjiang, Jilin and Liaoning Province, where the anomalies ranged between -2.5 and +9.0°C, and exceptional value. Fortunately, the dramatic variations in temperature anomalies in North-east China might have little effect on crops because they occurred before the start of the growing season, as shown by the graph of cropped and uncropped land in China (Figure 4.4). In addition to North-east China, uncropped areas were also occurred in the North-west and northern parts of China.

The cropping season is well underway in southern and central China. According to the spatial VCIx patterns (Figure 4.5), southern and south-east China enjoy favorable crop condition (VCIx larger than 0.8); values between 0.5 and 0.8 appear in Central China. This is also where patches of extreme low values of VHIn (below 15; Figure 4.6) do occur, including central Anhui and Shaanxi Provinces and southern Jiangsu Province. High VHIn values (above 36) are widespread in China.

As for the main producing regions at the sub-national level, rainfall was significantly above average in all the regions, ranging between +15% and +43%, except for North-east China (-28%). Temperatures were close to average in Huanghuaihai, Loess region, Lower Yangtze, Southern China and South-west China, with the departures between -0.3°C and +0.6°C. In contrast, North-east China and Inner Mongolia experienced warm weather (+3.0°C and +1.6°C). RADPAR in all regions was close to average, except for Lower Yangtze, where it dropped 15% below average. BIOMSS increased in almost all the regions compared to average, with the anomalies ranging from +8% to +25%. CALF markedly fell below average in the Loess region (20%) and North-east China (66%), but was close to average in other regions. VCIx was relatively high for all the regions values between 0.80 and 0.98.

**Table 4.1 CropWatch agroclimatic and agronomic indicators for China, January to April 2019, departure from 5YA and 15YA**

| Region | Agroclimatic indicators | | | | Agronomic indicators | |
|---|---|---|---|---|---|---|
| | Departure from 15YA (2004-2018) | | | | Departure from 5YA (2014-2018) | Current |
| | RAIN (%) | TEMP (°C) | RADPAR (%) | BIOMSS (%) | CALF(%) | Maximum VCI |
| **Huanghuaihai** | 34 | 0.2 | -4 | 25 | -1 | 0.91 |
| **Inner Mongolia** | 25 | 1.6 | 0 | 21 | - | 0.93 |
| **Loess region** | 35 | 0.3 | -2 | 18 | -20 | 0.80 |
| **Lower Yangtze** | 21 | -0.3 | -15 | 8 | -2 | 0.93 |
| **North-east China** | -28 | 3.0 | 4 | -12 | - | 0.83 |
| **Southern China** | 43 | 0.6 | 0 | 15 | 1 | 0.98 |
| **Soutwest China** | 15 | 0.2 | -3 | 11 | 0 | 0.94 |

**Figure 4.1 China crop calendar**

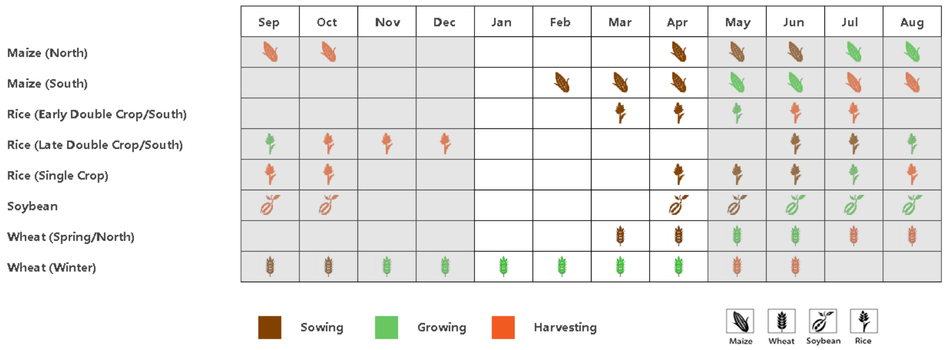



**Figure 4.2 China spatial distribution of rainfall profiles, January-April 2019**

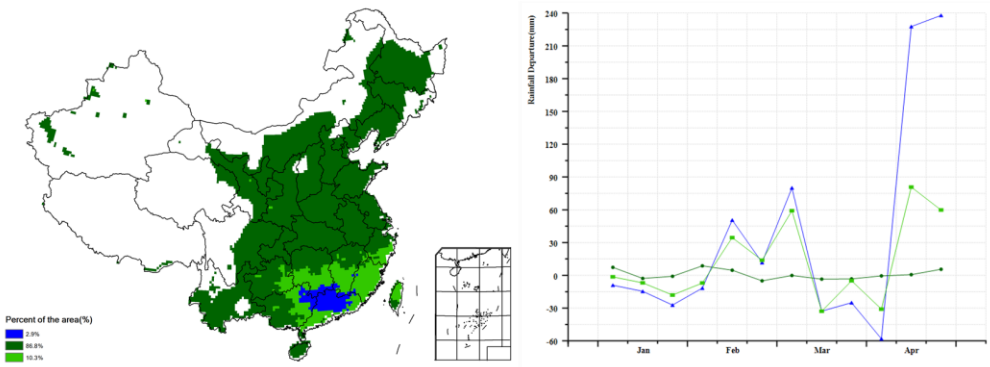



**Figure 4.3 China spatial distribution of temperature profiles, January-April 2019**

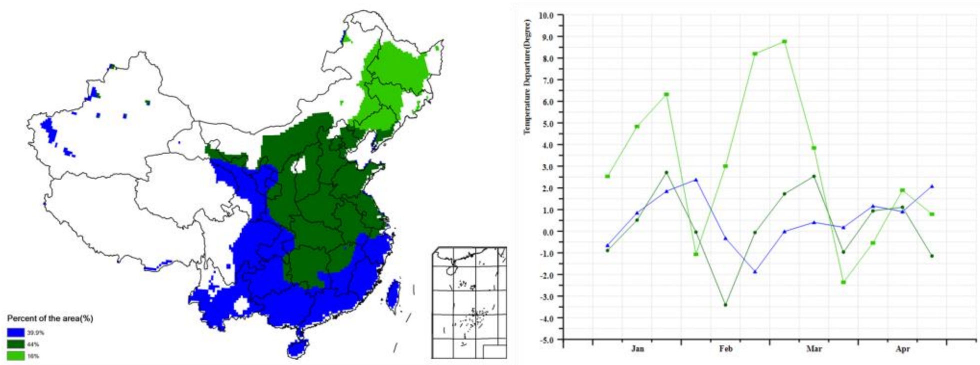


**Figure 4.4 Cropped and uncropped arable land by pixel, January-April 2019**

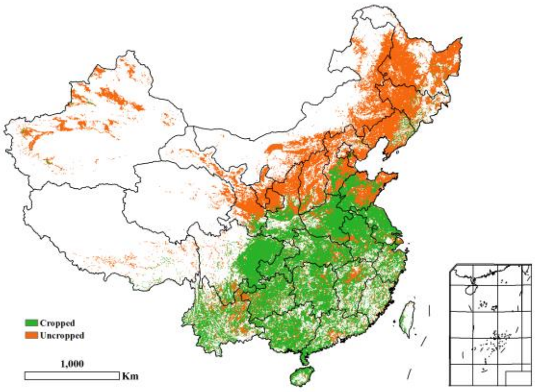



**Figure 4.5 China maximum Vegetation Condition Index (VCIx), by pixel, January-April 2019**

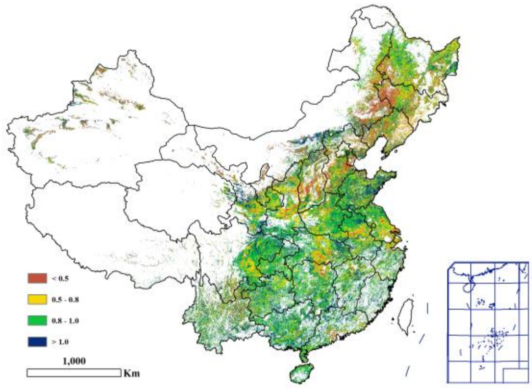
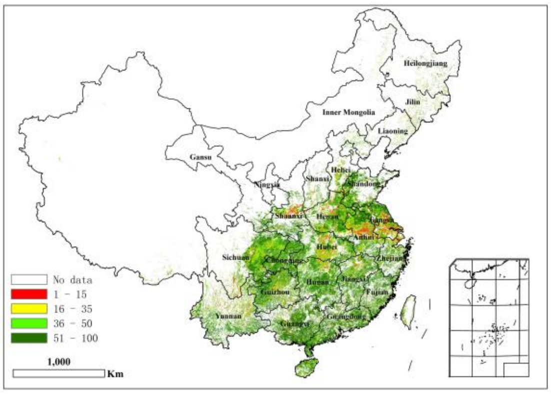



**Figure 4.6 China Vegetation Health Index Minimum (VHIn), by pixel, January-April 2019**




## 4.2 China's winter crops production

**Table 4.2 China, 2019 winter crops production (thousand tons) and percentage difference with 2018, by province**

| | 2018 | | | 2019 | |
|---|---|---|---|---|---|
| | production (thousand ton) | Area change (%) | Yield change (%) | Production change (%) | Production (thousand ton) |
| **Hebei** | 12654.9 | -1.3 | -1.6 | -2.8 | 12297 |
| **Shanxi** | 2418.6 | -2.4 | -2.7 | -5.1 | 2296 |
| **Jiangsu** | 10171.2 | 0.0 | 1.3 | 1.3 | 10304 |
| **Anhui** | 11839.3 | -1.1 | 3.0 | 1.9 | 12058 |
| **Shandong** | 23687.5 | 1.5 | 4.0 | 5.6 | 25010 |
| **Henan** | 26224.5 | 1.8 | 1.0 | 2.8 | 26952 |
| **Hubei** | 5755.4 | -2.5 | -0.9 | -3.4 | 5562 |
| **Chongqing** | 2319.4 | -0.2 | -1.8 | -2.0 | 2274 |
| **Sichuan** | 5507.4 | 0.5 | 1.0 | 1.5 | 5590 |
| **Shaanxi** | 4278.9 | -2.3 | -6.9 | -9.0 | 3895 |
| **Gansu** | 3211.1 | 10.2 | -2.6 | 7.3 | 3446 |
| **Sub total** | 108068.0 | - | - | 1.5 | 109685 |
| **Other provinces** | 18160.3 | - | - | -2.2 | 17768 |
| **National total*** | 126228.3 | 0.6 | 0.3 | 1.0 | 127453 |

* Production of Taiwan province is not included.

Winter wheat and total winter crops production were estimated by integrating several high resolution satellite images, agro-climatic indicators as well as sample surveys of winter wheat and rapeseed fieds in Anhui, Hubei, Shaanxi and other provinces.

Winter crop condition in the main producing areas was generally favorable. The overall precipitation in January to April was about 20% higher than the average, and the temperature was slightly above (+0.6 °C), were conducive to the development and growth of winter crops.

The total output of winter crops is estimated to be 127.45 million tons. Compared with 2018, the increase is about 1.23 million tons, up 1.0% from 2018 (Table 4.2).

Adverse weather conditions affected Hebei, Shaanxi, Shanxi, Hubei, and Chongqing Provinces where both yield and planted area were below 2018 values. The largest drop of winter crop production occurred in Hebei and Shaanxi provinces, with a reduction of 358 thousand tons and 384 thousand tons, respectively. Henan and Shandong provinces, the top two provinces in terms of winter crop production, both recovered from their poor situation in 2018, and produced 728 thousand tons and 1323 thousand tons more than 2018 respectively, with a year-on-year increase of 2.8% and 5.6%. Both planted area and average yield in Henan and Shandong have increased simultaneously. The output of winter crops in other provinces also increased over 2018.

**Table 4.3 China, 2019 winter wheat area, yield, and production and percentage difference with 2018, by province**

| | **Area (kha)** | | | **Yield (kg/ha)** | | | **Production (thousand ton)** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **2018** | **2019** | Delta(%) | **2018** | **2019** | Delta (%) | **2018** | **2019** | Delta (%) |
| **Hebei** | 2026 | 2000 | -1.3 | 6150 | 5997 | -2.5 | 12456 | 11994 | -3.7 |
| **Shanxi** | 533 | 520 | -2.4 | 4472 | 4272 | -4.5 | 2384 | 2223 | -6.7 |
| **Jiangsu** | 1946 | 1955 | 0.5 | 5045 | 5154 | 2.2 | 9816 | 10076 | 2.7 |
| **Anhui** | 2422 | 2389 | -1.4 | 4655 | 4834 | 3.8 | 11275 | 11546 | 2.4 |
| **Shandong** | 4091 | 4154 | 1.5 | 5739 | 5969 | 4.0 | 23476 | 24794 | 5.6 |
| **Henan** | 5049 | 5138 | 1.8 | 5173 | 5225 | 1.0 | 26122 | 26846 | 2.8 |
| **Hubei** | 1044 | 979 | -6.2 | 4126 | 4085 | -1.0 | 4308 | 4000 | -7.2 |
| **Chongqing** | 349 | 345 | -1.2 | 3319 | 3256 | -1.9 | 1158 | 1123 | -3.1 |
| **Sichuan** | 1268 | 1295 | 2.1 | 3636 | 3693 | 1.6 | 4612 | 4781 | 3.7 |
| **Shaanxi** | 1076 | 1059 | -1.6 | 3872 | 3605 | -6.9 | 4165 | 3817 | -8.4 |
| **Gansu** | 390 | 430 | 10.2 | 4099 | 4010 | -2.2 | 1598 | 1722 | 7.8 |
| **Sub total** | 20193 | 20263 | 0.3 | 5020 | 5079 | 1.2 | 101371 | 102923 | 1.5 |
| **Other provinces*** | 3025 | 3052 | 0.9 | 4805 | 4698 | -2.2 | 14534 | 14336 | -1.4 |
| **National total*** | 23218 | 23315 | 0.4 | 4992 | 5029 | 0.7 | 115905 | 117259 | 1.2 |

* Production of Taiwan province is not included.

The total winter wheat production in 2019 is estimated to reach 117.26 million tons, an increase of 1.35 million tons or 1.2% from 2018. The national winter wheat area is 23,314.8 thousand hectares, an increase of 0.4% over the same period of last year, mainly due to the contributions of the two main winter wheat producing provinces of Henan and Shandong. The average winter wheat yield nationally was 5029 kg/ha, an increase of about 0.7% compared to 2018 (Table 4.3).

Both planted area and average yield of winter wheat in Henan, Shandong, Jiangsu, and Sichuan increased above 2018 values, leading to an increase of 724 thousand tons, 1318 thousand tons, 260 thousand tons and 169 thousand tons, respectively. Favorable weather conditions in Gansu where most winter crops are rain-fed benefited the sowing and crop development, resulting in a signficant increase of 10.2% in lanted area and 124 thousand tons increase of production. Water deficit in Shaanxi, Shanxi and Hebei leads to large yield drop and the winter wheat productions are 348 thousand tons, 462 thousand tons, and 161 thousand tons lower than 2018. It needs to be highlighted that the production drop in Shaanxi is 8.4%, the largest annual winter crop production drop in percentage since 2013. The winter wheat planted area in Hubei province is 6.2% down from 2018, the largest drop among all major producing provinces, leading to 7.2% production reduction.

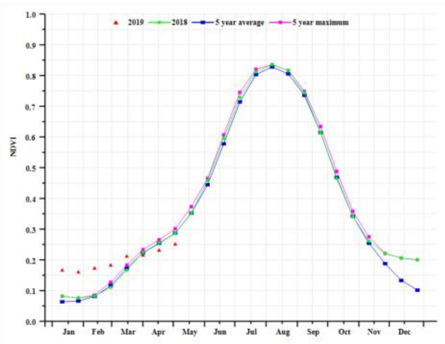
## 4.3 Regional analysis

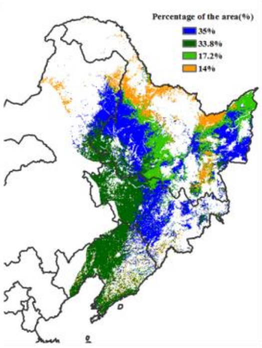
Figures 4.7 through 4.13 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Phenology of major crops; (b) Crop condition development graph based on NDVI, comparing the current season up to April 2019 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for January to April 2019 (compared to the (5YA)); (d) NDVI profiles associated with the spatial patterns under (c); (e) maximum VCI (over arable land mask); and (f) biomass for January to April 2019. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

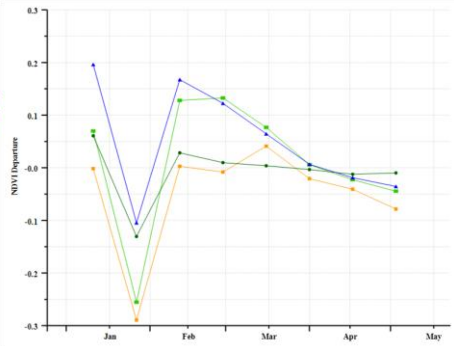
# Northeast region

Due to the cold weather in North-east China during the current monitoring season, there is no crop growing in the field, as indicated by low NDVI values in the crop development profile. The farmers start land preparation and sowing of spring crops in late April, including wheat, maize and soybean. Weather conditions so far were dry (RAIN -28%) and warm (TEMP +3°C), which has reduced soil moisture storage and reduced the biomass production potential by -12% on average, with larger reductions in the east of the region. Initial growing conditions are thus less than optimal as insufficient water supply may hamper the sowing, germination and early growth of the spring planted. CropWatch will keep tracking the agroclimatic and agronomic conditions in the future months.

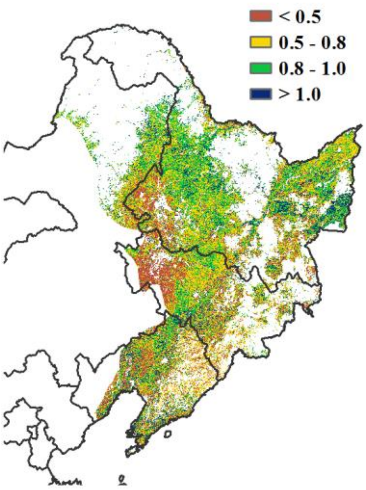
**Figure 4.7 Crop condition China Northeast region, January - April 2019**

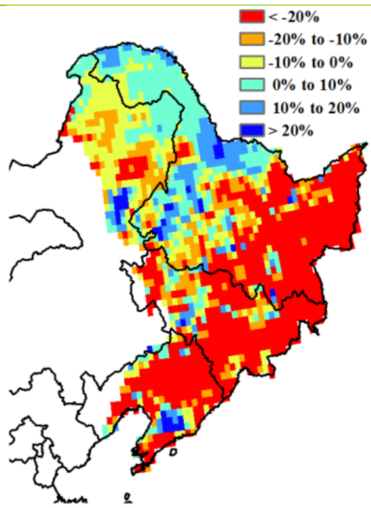



(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles



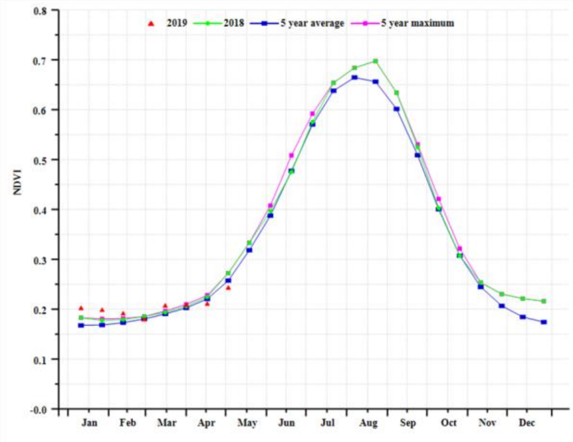




(d) Maximum VCI (e) Biomass departure

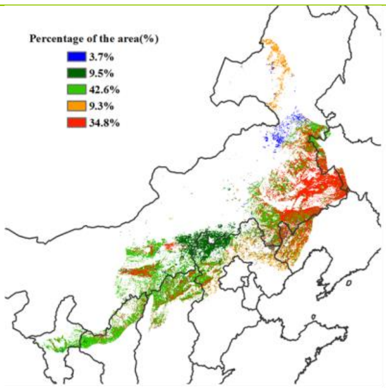
# Inner Mongolia

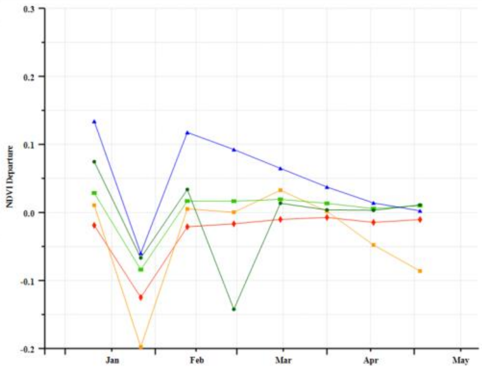
Most field crops have not been planted yet in Inner Mongolia due to the seasonally low temperature. Sowing started only from late April, along with gradually increasing temperatures. Considering agroclimatic indicators in the first four months of this year, rain and temperature indices were above average (RAIN +25 %, TEMP +1.6°C), and the RADPAR accumulation was just average, resulting in a potential biomass increase of 21%. Though the average of VCIx was 0.93 for the whole areas, it is of limited agronomic significance at this time of the year. Temperature was significantly higher than the historical average, which may cause early sowing. Stored soil moisture is abundant and will benefit the germination of crops and grazing lands alike. Current prospects for the region are favorable.

**Figure 4.8 Crop condition China Inner Mongolia, January - April 2019**



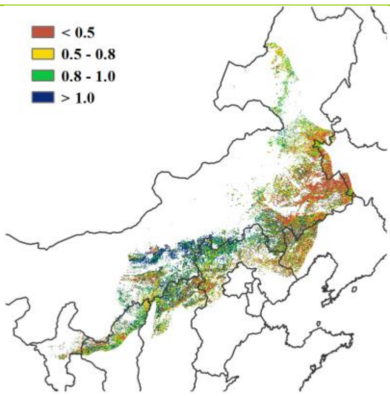

(a) Crop condition development graph based on NDVI

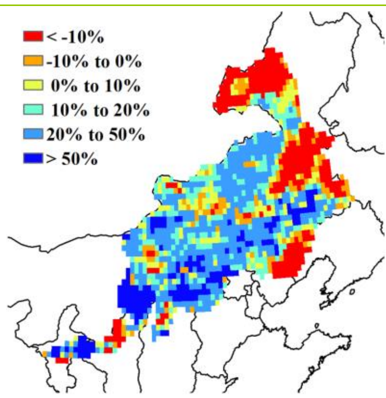



(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles



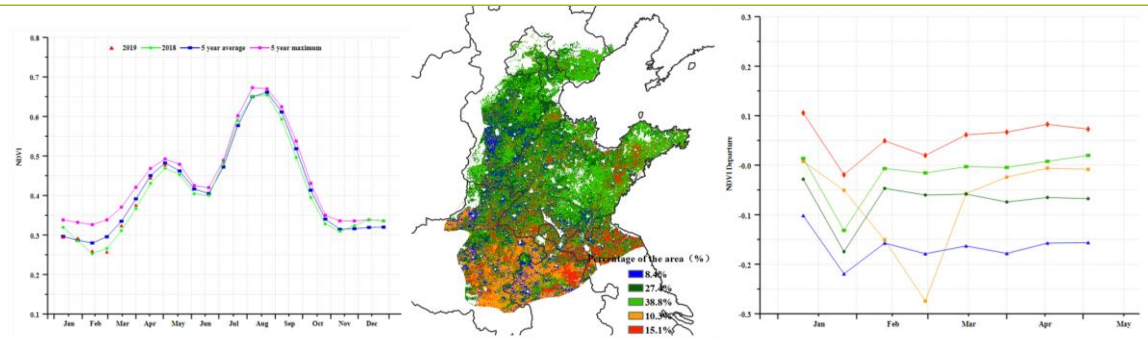

(d) Maximum VCI

(e) Biomass departure

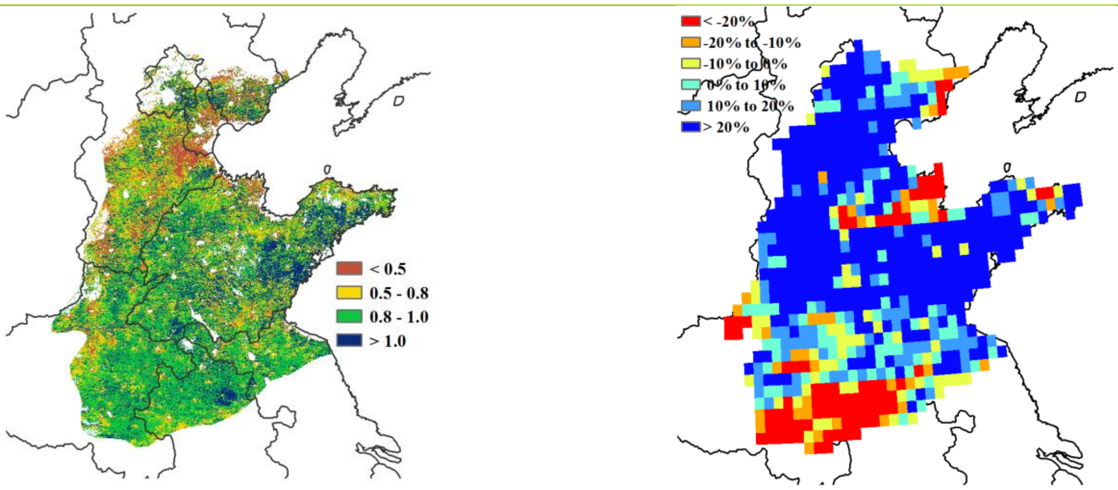
# Huanghuaihai

Huanghuaihai is part of the North China Plain and cultivates winter wheat and summer maize in rotation as its main crops. The bulletin monitored crop condition during January to April when the winter wheat started to revive and grow, with the harvest taking place in mid-June. According to the crop condition development graph based on NDVI, the crop condition of winter wheat was average during most of the monitoring period, with a sight drop in February. The maximum VCI value was 0.91 which confirms the good crop condition. As assessed by CropWatch indicators, the agro-climatic and agronomic conditions were generally favorable. Compared to average, the precipitation (RAIN) increased greatly by 34% and the temperature (TEMP) rose slightly (+0.2°C), while the radiation (RADPAR) showed a reduction of 4%. The favorable growing environment contributed to a significant increase of 25% in potential biomass compared to average. The cropped arable land fraction (CALF) was on 5-year average. The whole region displayed NDVI values that are below but close to average. As shown by NDVI clusters and profiles, north of Jiangsu and some clustered areas displayed above-average values, which is about 15.1% of the region. 38.8% of cropland across Heibei and Shandong Provinces showed negative departures during late January and early February, while on average at other times. For other areas of the region, the crop condition was below average to varying degrees, especially in the East of Henan and North of Anhui. The biomass departure map confirms the distribution of NDVI clusters, with increases in the North of the region and decreases in south.

**Figure 4.9 Crop condition China Huanghuaihai, January - April 2019**




(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

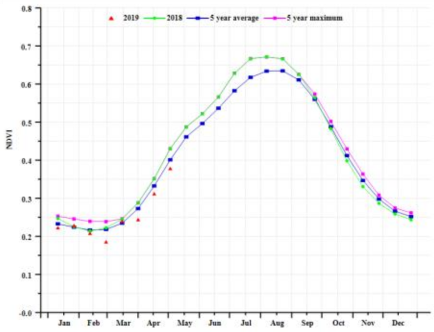



(d) Maximum VCI (e) Biomass departure

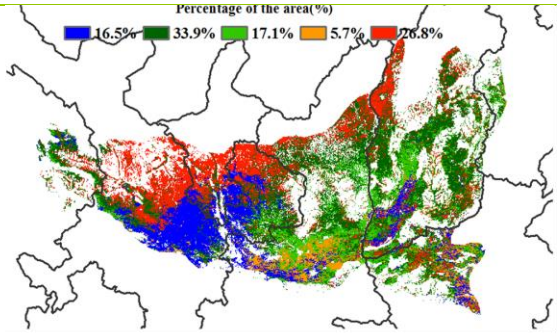
# Loess region

According to the regional NDVI development graph, crop condition was generally fair in the Loess region. The main crops in the region are currently winter wheat, spring wheat, and spring Maize. Winter wheat was sowed during late September to middle October and will be harvested in June. Spring wheat and Maize were just sowed during late March to April. During the monitoring period, rainfall (RAIN) exceeded average by 35%, while temperature (TEMP) was 0.3°C above. Radiation (RADPAR) was 2% below average, which may adversely affect the process of photosynthesis. In most of the area, the analyses based on spatial NDVI clusters and profiles are consistent with VCIx. NDVI clusters and profiles show that crop condition was close to average in some parts of the region, such as northwestern Shanxi, south central Ningxia, and central and eastern Gansu, while the crop condition was below average and underwent some fluctuation during late January to late February in south central Gansu, southern Ningxia, and southwestern Shanxi, etc. The fraction of cropped arable land (CALF) for the region decreased 20 percentage points when compared with the five-year average, which indicates about one fifth of the land is uncropped. The potential biomass indicator (BIOMASS) was 18% above average, with above average values in every province within the Loess region. According to the VCIx map, current crop condition of the region is quite unfavorable, especially in most parts of Shanxi, and central Shaanxi.

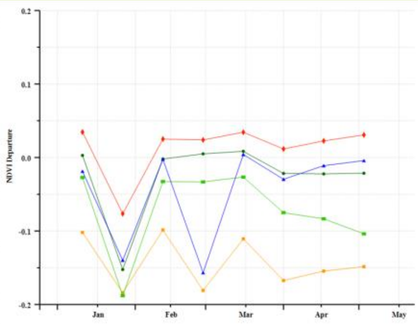
**Figure 4.10 Crop condition China Loess region, January - April 2019**



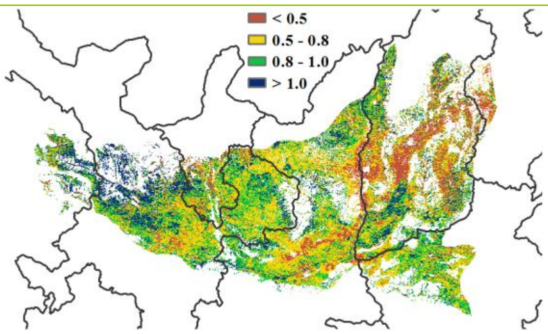

(a) Crop condition development graph based on NDVI



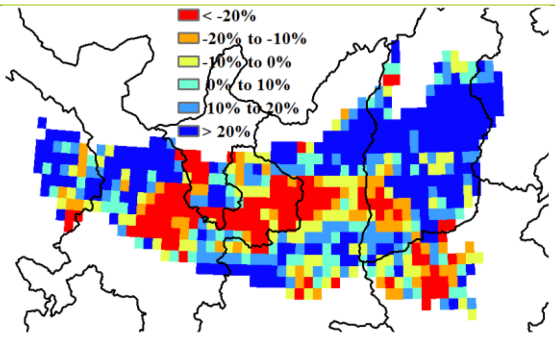

(b) Spatial NDVI patterns compared to 5YA




(c) NDVI profiles




(d) Maximum VCI

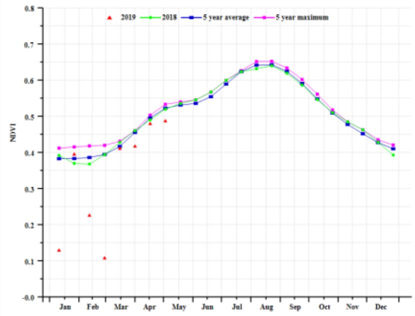



(e) Biomass departure

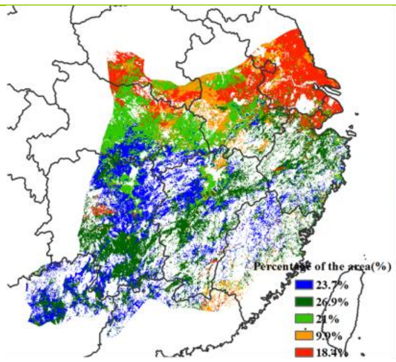
# Lower Yangtze region

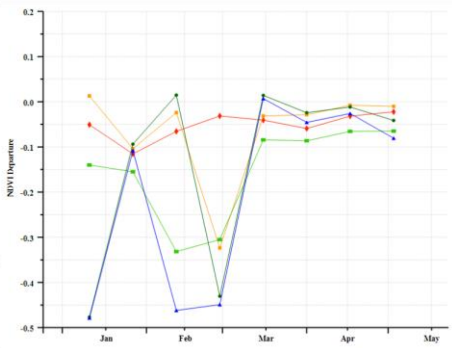
During this monitoring period, only winter crops like wheat and rapeseed are in the field, essentially in Henan, Anhui, Jiangsu and Hubei provinces. According to the CropWatch agro-climatic indicators, Lower Yangtze experienced a wet winter. Temperature (TEMP -0.3°C) and sunshine (RADPAR -15%) were below average while precipitation was significantly above (RAIN, +21%), which resulted in an increase of the biomass production potential by 8%. As shown in the NDVI development graph, crop condition was close to but slightly below average. The abnormally low values that occurred in February may be due to the effect of clouds. Although the biomass production potential increased, most of the northern wheat region of the lower Yangtze suffered a significant decrease of BIOMSS (more than 20%) including the west of Jiangsu, the middle of Anhui Provinces north of Hubei and South of Henan province. According to the NDVI profile, the crop condition in the winter cropped area was slightly below average, including Henan, Anhui, Jiangsu, and Hubei province, which is confirmed by the VCIx map. Overall, considering the favorable VCIx value of 0.93, the crop condition was assessed as close to but below average.

**Figure 4.11 Crop condition Lower Yangtze region, January - April 2019**



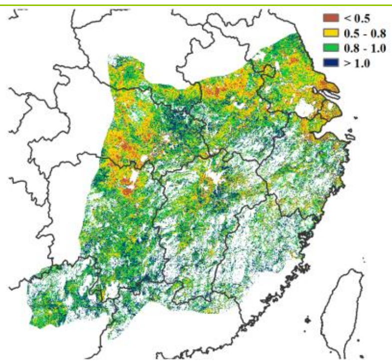

(a) Crop condition development graph based on NDVI

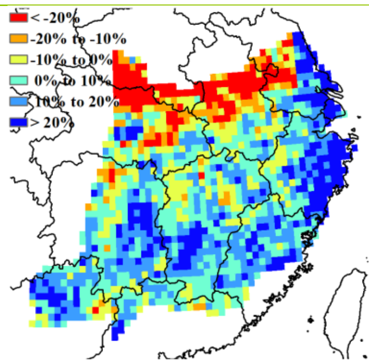



(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles



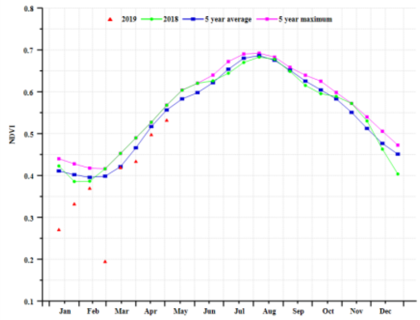

(d) Maximum VCI

(e) Biomass departure

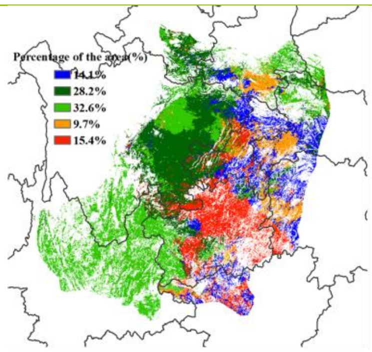
# Southwest China

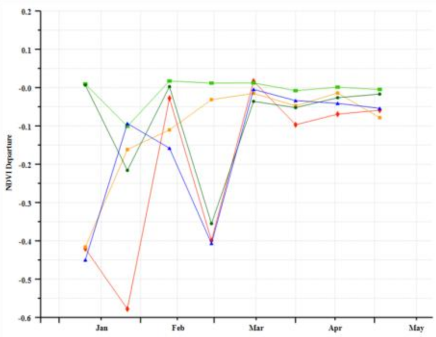
The reporting period covers late dormancy and post-dormancy to flowering of winter wheat. According to the regional NDVI profile, crop condition was generally below the 5-year average, although it improved gradually after mid-March. Rainfall was above average (RAIN +15%) and radiation and temperature were close to average (RADPAR -3%, and TEMP at +0.2°C). Favorable weather conditions resulted in 11% above 15YA BIOMSS. The cropped arable land fraction remained at the same average level as the previous five years. According to the spatial NDVI profiles, values were close to average from mid-March to late April, except in Chongqing and neighboring areas in Eastern Sichuan, which recorded very low NDVI due to low RAIN (-7% and -9%, respectively). Average NDVI throughout the monitoring period was observed in western Guizhou and Yunnan, in spite of both precipitation and radiation being significantly above average (See Annex A.11). The maximum VCI reached 0.94, indicating the crop growth status at the peak of the growing season was comparable with the previous five years. The mixture of positive and negative departures of indicators show overall unfavorable crop condition.

**Figure 4.12 Crop condition Southwest China region, January - April 2019**



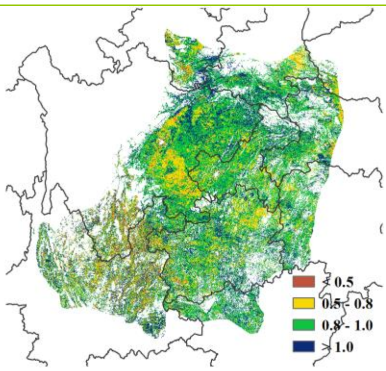

(a) Crop condition development graph based on NDVI

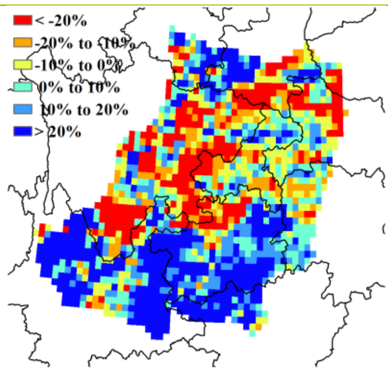



(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles



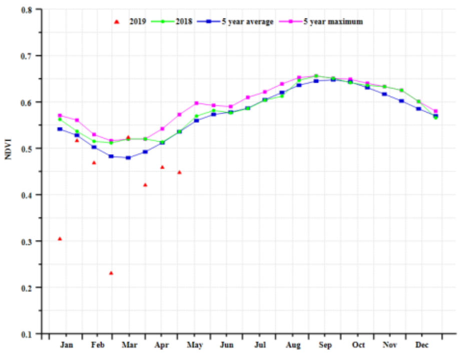

(d) Maximum VCI

(e) Biomass departure

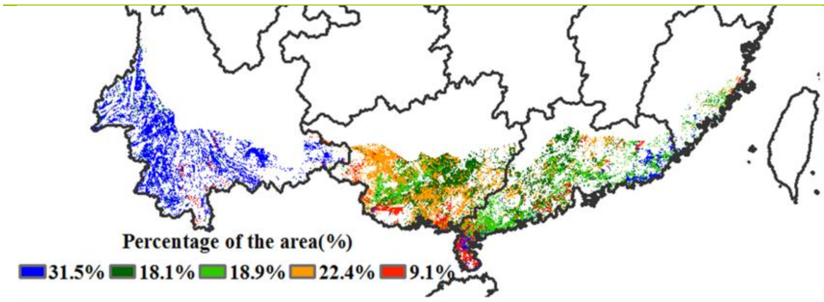
# Southern China

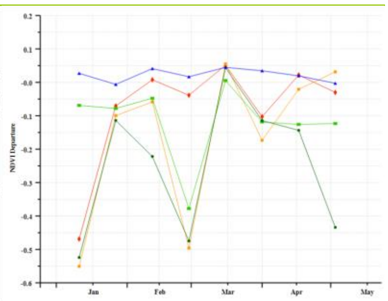
In Southern China, winter wheat was approaching maturity and the sowing of early rice was concluded during the reporting period. The NDVI was below the previous five-year average except for mid-March, indicating overall below average crop condition. The rainfall and temperature were above average (RAIN +43%, TEMP +0.6°C), while the sunshine was average. The cropped arable land fraction was average (CALF +1%), and the biomass was above average (BIOMSS +15%). Although all provinces within the region received significantly above average rainfall (Guangdong +69%, Guangxi +39%, Yunnan +42%, Fujian +27%), the impacts vary widely. The heavy rainfall in January in Yunnan provided suitable soil moisture for winter wheat while excessive rainfall in April in Guangdong, Guangxi and Fujian hampered transplanting and growth of early rice. The NDVI departure clustering also confirms the above mentioned patterns (Figure 4.12, b, c): the NDVI was close to or above average during the reporting period in Yunnan while the other three provinces present below average NDVI. The region needs closer monitoring in the coming months.

**Figure 4.13 Crop condition Southern China region, January - April 2019.**



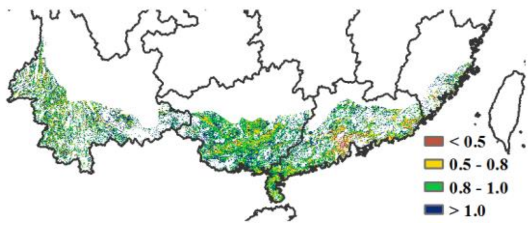

(a) Crop condition development graph based on NDVI

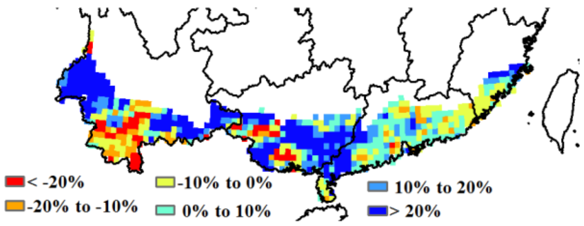


(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles




(d) Maximum VCI

(e) Biomass departure

## 4.4 Major crops trade prospects

This section analyzes the import and export situation of the maize, rice, wheat, and soybean in the first quarter of 2019 in China.

**Maize**

In the first quarter of 2019, maize imports reached 981.9 ktons, an increase of 76.2% over 2018. The main suppliers were Ukraine and Russia, accounting for 97.7% and 1.7% of imports respectively. Imports amounted to 212 million USD. The Democratic People's Republic of Korea was the only destinations of Chinese maize exports, which reached 1.5 ktons. The value of the export was 389.6 thousand USD.

**Rice**

In the first quarter, the total import of rice in China was 586.4 ktons, a decrease of 24.4% compared to the previous year. The imported rice mainly stems from Thailand, Pakistan, Cambodia and Vietnam, accounting for 41.0%, 33.6%, 12.9% and 4.7% of imports respectively. The expenditure for rice import was 328 million USD. Total rice exports over the period were 479.2 ktons, mainly exported to Egypt, Cote d'Ivoire, Turkey and the Republic of Korea (accounting for 38.6%, 13.4%, 9.7% and 7.5%, respectively). The value of the exports was 190 million USD.

**Wheat**

Chinese wheat and wheat products imports in the first quarter of 2019 totaled 1 million tons, up by 60.8% year-on-year. The main sources include Canada (65.5%), Kazakhstan (9.8%), and the United States (4.1%). Imports amounted to 318 million USD. Wheat and wheat products exports 70.6 kilotons went mainly to the Democratic People's Republic of Korea (70.1%) and Chinese Hong Kong (22.7%). The generated income for wheat and wheat products exports was 27 million USD.

**Soybean**

In the first quarter of 2019, the total import of soybean decreased by 14.4% to 16.75 million tons in China. Brazil, the United States and Argentina respectively contributed 58.0%, 15.2% and 12.8%, for a total value of 7279 million USD. Soybean exports were 33.5 ktons, up 8.8%.

**Trade prospects for major cereals and oil crop in China for 2019**

Based on the latest monitoring results, China crop imports are projected to increase. The projections are based on remote sensing data and the Major Agricultural Shocks and Policy Simulation Model, which is derived from the standard GTAP (Global Trade Analysis Project).

**Maize**

According to the model forecast, maize imports will increase by 12.4% in China in 2019, while its exports will be basically flat. At present, the global maize supply and demand situation continues to maintain the loose posture, the price continues to drop. Domestic maize prices have stopped falling and stabilized recently, with a rising trend in the later stage. It is expected that China's maize imports will further increase in 2019.

**Rice**

According to the model forecast, rice imports and exports will increase by 8.1% and 15.6% respectively in 2019. With the increase of labor and other production costs, China's rice production competitiveness continues to decline, which directly affects the amount of rice imports. It is expected that China's rice imports will slightly increase in 2019, but still within the quota range.

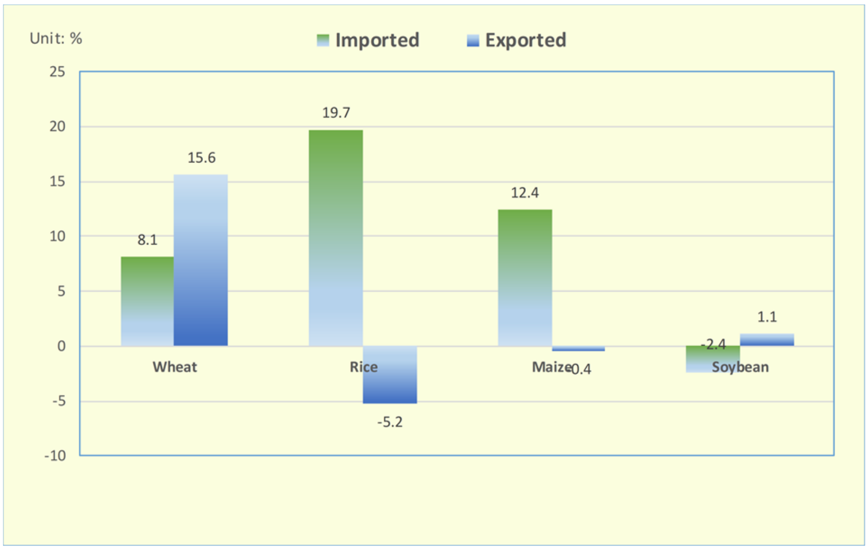
**Wheat**

According to the model forecast, wheat imports will increase by 19.7%, while exports will decrease by 5.2%. Wheat imports are expected to increase slightly in 2019 as global supplies remain ample, prices continue to weaken and the spread between domestic and foreign prices widen. However, with the further improvement of domestic wheat quality, wheat imports will continue to decline in the future.

**Soybean**

According to the model forecast, China's soybean imports will decrease by 2.4% in 2019, while exports will slightly increase by 1.1%. Affected by the supply-side structural reform of agriculture, China's soybean planted area should continue to increase, and the external dependence will further decrease. However, soybean imports will remain high. In 2019, China's soybean imports are expected to decline, but will be affected by economic and trade friction and other factors of uncertainty.

**Figure 4.14 Rate of change of imports and exports for rice, wheat, maize, and soybean in China in 2019 compared to those for 2018(%).**



# Chapter 5. Focus and perspectives

*Building on the CropWatch analyses presented in chapters 1 through 4, this chapter presents first early outlook of crop production for 2019 (section 5.1), as well as sections on recent disaster events (section 5.2), Mozambique floods based on satellite data (5.3) and an update on El Niño (5.4).*

## 5.1 CropWatch food production estimates

### Methodological introduction

Table 5.1 presents the first estimate by the CropWatch team of global maize, rice, wheat and soybeans production in 2019. It is issued at a time when many winter crops in the northern hemisphere are still growing and summer crops are in very early stages, or even to be planted; in the southern hemisphere the harvest of the summer season/monsoon season has been completed. Updates will be published in the August 2019 and November 2019 CropWatch bulletins.

The estimate is based on a combination of remote-sensing models (for major commodities at the national level) and statistical trend-based projections for minor producers and for those countries which will harvest their crops later during 2019, for which no directly observed crop condition information is as yet available. In Table 5.1 below, the percentage of modelled global production varies according to crops: 18% for maize, 56% for rice, 71% of wheat (most of it being northern hemisphere winter wheat) and 39% for soybeans. When considering numbers of countries, the percentages are much smaller: 7%, 8%, 13% and 1%, respectively. While the percentage of countries will increase only marginally in the next bulletins, the share of modelled production will gradually increase and reach to 80% to 90% in the final bulletin of the year that will be issued in November.

The 41 countries for which production estimates are provided are described in detail in chapter 3 while a whole chapter is devoted to China (Chapter 4). The 41 + 1 countries are referred to conventionally as the “Key Targeting Countries”. “Others” include the 142 countries from Albania, Algeria, Armenia [...] to Venezuela, Yemen and Zimbabwe. The total output for “other” countries was obtained by adding national projections for 2019 rather than projecting the sum. The reason for doing so is that countries sometimes phase out crops for a variety of reasons (e.g. soybean in Macedonia or Syria) and production projections that turn negative can be set to zero. This effect remains hidden when sums are projected.

The calibration of production model is crop-specific, i.e. based on different crop masks for each crop and that, for each crop and country; both yield variation and cultivated area variation are taken into account when deriving the production estimates. The key targeting countries represent at least 80% or production and 80% of exports.

CropWatch production estimates differ from other global estimates by the use of geophysical data in addition to statistical and other reference information such as detailed crop distribution maps.

## Production estimates

CropWatch estimates the global 2019 production of the major commodities at 1005 million tonnes of maize, up 0.7% over 2018, 731 million for rice (up 1.1%), 733 million tonnes of wheat (a 1.5% increase) and 331 million tonnes of soybeans, a 1.2% increase over last year's output(table 5.1). The current estimate is one of the most optimistic issued by CropWatch over the recent cropping seasons, in that all crops show positive variations compared with the previous campaign.

### *Maize*

Countries that experienced large production increases include mostly Argentina (+7%) and Mexico (+8%) as well as three South-east Asian countries including Bangladesh (+8%), Myanmar (+9%) and Vietnam where the estimated increase reaches 12%, the highest national increase, equivalent to about 624,000 tonnes. Vietnamese maize exports have fluctuated a lot over the last ten years, from 100 to 50,000 tonnes. It is likely that the country will make more maize available internationally. In Argentina, the increased production represents 3.6 million tonnes while Brazil, another traditional maize producer, stayed approximately at the level of the previous season (+1%), at the same level as Angola and Indonesia.

All countries with a significant drop in maize production are located in Africa, starting with Egypt (-1%) and Mozambique (-2%). The regions of southern and eastern Africa experienced difficult conditions including drought and excess precipitation associated with two tropical cyclones. As a rule, the effect of drought is more severe than cyclones because the impact of the second is limited in space, even if it can be very destructive. South Africa is the main maize producer in the region. Its output is down 5%, on par with Kenya but less severe than Zambia (-10%).

### *Rice*

A major observation is the increase in rice production in south and South-East Asia, starting with India (+1%), Indonesia (+2%), Bangladesh (+6%) and Vietnam (+8%). The volume is up 1.4 million tonnes in all countries, except in Bangladesh where the increase reaches 2.7 million tonnes. Argentina, a relatively minor producer, mainly for export, recorded a 9% increase after a poor year when production dropped by about 5%.

In clear relation with weather conditions, production dropped 1% in Mozambique, Myanmar and the Philippines, but by 3% in Thailand and by 8% in Cambodia.

### *Wheat*

Several European producers of wheat show decreases below 2018 output, some of them significant: Romania -17%, Turkey -15%, Belarus -13% Hungary -11%, Poland -5% and Germany and France -1%. Positive values are observed for Italy (+7%) and Great Britain (+8%).

The positive changes that occur in some eastern European and western to central Asian countries, including Ukraine (+4%) and Russia (+9%) are somewhat uncertain because of very unusual winter conditions characterized by unseasonably high temperatures; this may have affected crops in a way that is not yet fully understood.

Production increases are also inferred for China (+1%), Egypt, Brazil, Ethiopia and Pakistan (+4% to +10%). The largest increases are projected for Pakistan (+10%), Morocco (+12%), South-Africa

(+14%), Mexico (+17%), and Iran (+19%) where floods have destroyed crops and infrastructure but also supplied much needed water.

Production decreases are projected for two southern Hemisphere wheat growers, Argentina and Australia, -3% and -13%, respectively. In the United States, the wheat production will increase 10%.

***Soybean***

In the northern hemisphere the crop is still to be planted, so that only Argentina and Brazil can be meaningfully mentioned here. Similar to the other rain-fed summer crop, the Argentinian Soybean crop is up (+9%) while Brazil stayed at the level of the 2018output.

## Major importers and exporters

Table 5.2 shows the performance of the major importers and exporters of maize, rice as paddy, wheat and soybeans according to the data in table 5.1, both in terms of volume and of percentage. About 15 countries that are not covered in Table 5.1 are part of the top ten importers or exporters. They include Bolivia, Paraguay and Uruguay among the exporters and, among the importers, Algeria, Benin, Colombia, Côte d'Ivoire, Iraq, Japan, Korean Republic, Netherlands, Nigeria, Saudi Arabia, Senegal, and Spain.

Since the 10 top exporters dominate the production landscape, the percentage change in their output relatively closely follows table 5.1: +0.3% for maize exporters and +0.7% for producers, 1.4% for rice exporters and +1.1% for producers, 1.7% for wheat exporters and 1.5% for producers and, for soybean, 0.3% for exporters and 1.2% for producers.

Overall, the top 3 exporters increased their maize output by 2.3%, while the increases reach 1.6% for rice, a significant 6.5% for wheat and 0.4% for soybean. For wheat, the top exporter, the United States, is expected to outperform all immediate competitors.

For maize, the exporters ranking 6 to 10 did relatively better (+4.6%) than the countries in ranks 1 to 5 (+1.4%). For rice the corresponding percentages are 1.3% and 1.7%; they are mainly due to the drop in Thailand (-3%) and the increase in Argentina (+9%). For maize, the first group includes Ukraine (-7%) and France (-14%) while the second has Hungary (-10%) and Paraguay (+12%). Negative values in the second group (ranks 6 to 10) for Wheat (-0.2%) and soybean (-4.3%) are due to the poor performance of wheat in Romania (10th exporter, production down 17%). For soybean, difference is brought about by Uruguay (6th exporter) which has suffered a negative trend in soybean production in recent years. In terms of production volumes, the top 5 producers of soybean have increased their output by 1.5 million tonnes, while those ranking 6 to 10 have a deficit of 643 thousand tonnes.

Even if production volumes of importers are obviously lower than those of exporters, the volumes have increased, mostly by percentages larger than those of exporters, illustrating the efforts some countries are making to reduce their dependence on foreign markets. For soybean in particular, China – the first global soybean importer – has recently reversed the negative production trend and the trend-based production for 2019 is up 2.6%. For importers 3 to 4 (Mexico, Germany, Spain) the increases amount to 5%, 34% and 15%, respectively.

Altogether, Table 5.2 presents a situation where no particular tension is expected to affect the trade of maize, rice, wheat and soybean, as far as supply and demand is concerned. However, since many productions in the Table are trend-based, the situation may evolve as more modelled data become available. The changes will be reflected in the revised Table 5.2 in the August 2019 CropWatch bulletin.

**Table5.1 2019 cereal and soybean productions estimates in thousands tonnes**

| | Maize | | Rice | | Wheat | | Soybean | |
|---|---|---|---|---|---|---|---|---|
| | 2019 | Δ% | 2019 | Δ% | 2019 | Δ% | 2019 | Δ% |
| Angola | 2813 | 1 | | | | | | |
| Argentina | 53154 | 7 | 1849 | 9 | 18009 | -3 | 51459 | 9 |
| Australia | | | | | 21456 | -13 | | |
| Bangladesh | 2368 | 8 | 47593 | 6 | | | | |
| Belarus | 2337 | 4.1 | 48063 | 6.2 | 240.9 | -13 | 118 | 7.1 |
| Brazil | 86556 | 1 | 12194 | 5 | 4572 | 7 | 97656 | 0 |
| Cambodia | | | 8111 | -8 | | | | |
| China | | | | | 117259 | 1 | | |
| Egypt | 5477 | -1 | 6276 | 3 | 11226 | 4 | | |
| Ethiopia | | | | | 4388 | 9 | | |
| France | | | | | 36124 | -1 | | |
| Germany | | | | | 26500 | -1 | | |
| Hungary | | | | | 4422 | -12 | | |
| India | | | 156321 | 1 | 90267 | -1 | | |
| Indonesia | 17138 | 1 | 66707 | 2 | | | | |
| Iran | | | 2607 | 5 | 16462 | 19 | | |
| Italy | | | | | 7817 | 7 | | |
| Kenya | 3309 | -5 | | | | | | |
| Mexico | 25436 | 8 | | | 4188 | 17 | | |
| Morocco | | | | | 7902 | 12 | | |
| Mozambique | 2044 | -2 | 374 | -1 | | | | |
| Myanmar | 1859 | 9 | 24907 | -1 | | | | |
| Nigeria | | | 4915 | 5 | | | | |
| Pakistan | | | | | 26310 | 10 | | |
| Philippines | | | 19555 | -1 | | | | |
| Poland | | | | | 9576 | -5 | | |
| Romania | | | | | 6255 | -17 | | |
| Russia | | | | | 57549 | 9 | | |
| South Africa | 12466 | -5 | | | 1792 | 14 | | |
| Sri Lanka | | | 2470 | 2 | | | | |
| Thailand | | | 370130 | -3 | | | | |
| Turkey | | | | | 16888 | -15 | | |
| Ukraine | | | | | 21965 | 4 | | |
| United Kingdom | | | | | 14883 | 8 | | |
| USA | | | | | 39497 | 10 | | |
| Vietnam | 5769 | 12 | 48441 | 8 | | | | |
| Zambia | 2125 | -10 | | | | | | |

| | Maize | | Rice | | Wheat | | Soybean | |
|---|---|---|---|---|---|---|---|---|
| | 2019 | Δ% | 2019 | Δ% | 2019 | Δ% | 2019 | Δ% |
| Sub-total | 220515.3 | 3 | 439334.6 | 1.9 | 567719.0 | 1.9 | 149115.1 | 2.8 |
| **Global** | 1005434.5 | 0.7 | 730716.8 | 1.1 | 733264.4 | 1.5 | 331047.4 | 1.2 |

*Note: All the national production values in the table of remote sensing model based estimates while the global production was projected by adding up the model-based production and trend-based model for all other countries. Δ is the percentage of change of 2019 production when compared with corresponding 2018 values*

**Table5.2 Comparison of 2019 and 2018 production of major importers and exporters as well as the change in the offer and demand 2017 and 2018.**

| | | Change in production volume in 1000 tonnes | | | | Change in production in % | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maize | Rice | Wheat | Soybean | Maize | Rice | Wheat | Soybean |
| Exporters | Top1 | 7122 | 1401 | 3687 | -3025 | 1.9 | 0.9 | 10.3 | -2.7 |
| | Top3 | 11838 | 3709 | 8093 | 993 | 2.3 | 1.6 | 6.5 | 0.4 |
| | Top 10 | 10999 | 4066 | 4577 | 861 | 1.7 | 1.4 | 1.7 | 0.3 |
| | 1 to 5 | 7685 | 3345 | 4734 | 1504 | 1.4 | 1.3 | 2.6 | 0.5 |
| | 5 to 10 | 3314 | 721 | −157 | −643 | 4.6 | 1.7 | −0.2 | −4.3 |
| Importers | Top1 | 0 | 1456 | 436 | 366 | 0 | 0.7 | 4 | 2.6 |
| | Top3 | 1788 | 1679 | 41 | 41 | 7.5 | 0.8 | 3.1 | 3.4 |
| | Top 10 | 1354 | 3232 | 3848 | 234 | 3.2 | 1.1 | 7.7 | 2.8 |
| | 1 to 5 | 1181 | 1733 | 1241 | 411 | 3.5 | 0.8 | 5 | 3.4 |
| | 5 to 10 | 172 | 1499 | 2607 | −177 | 2.1 | 2.2 | 10.3 | −15.0 |

*Note: The table lists percent changes as well as absolute amounts based on table 5.1*

## 5.2 Disaster events

### *Introduction*

According to the WMO report, 2018 was the fourth warmest year on record and 2015–2018 were the four warmest years on record; the long-term warming trend continues: ocean heat content is at a record high and global mean sea level continues to rise while Arctic and Antarctic sea-ice continues melting. Extreme weather had an impact on lives and sustainable development on every continent with average global temperature now about 1°C above pre-industrial levels. Most worryingly: we are not on track to meet climate change targets and temperature increases are literally out of control, gradually eroding many habits of wasteful use of climate resources. This year, for instance, after the “day zero” alert in Cape Town during 2018, similar situations of urban water shortage risks have been developing in Australia.

For the current reporting period, the main disasters in terms of their human impact include the continued drought conditions in the Horn of Africa and southern Africa, western Asian floods at the end of March and April (Afghanistan, Iran and Pakistan), and especially the two tropical cyclones (Idai and Kenneth) which struck Mozambique in April. It is a constant observation among many flooded areas during the reporting period that floods are made worse when they occur after prolonged periods of drought, illustrating the fact that flood and drought management plans need to be developed concomitantly (see below).

*Extreme conditions by type*

*Drought and fires*

Up to the impact of cyclones Idai and Kenneth in the western areas of southern Africa, the prevailing situation was one of drought, affecting mostly southern Angola, southern Zambia, the northern half of Namibia and the north of Zimbabwe, with the situation described as severe by FEWSNET in south-west Angola and adjacent north-west Namibia and the border area between Zambia and Zimbabwe. In Namibia, close to 150,000 people lived in drought affected regions at the beginning of the reporting period, according to UNICEF.

In the Horn of Africa many populations continue to suffer from the precarious situation that developed during in 2018 and during the previous reporting period, including south-east Ethiopia and south-east South Sudan and the northern half of Uganda. According to FAO/SWALIM reports, large parts of the central and northern regions in Somalia were suffering from abnormally dry conditions and river flows were below average and below the values recorded during the two previous seasons. ReliefWeb reported at the beginning of April that 1.5 million people were in IPC phase 3 or 4. According to FEWSNET, rainfall was insufficient (except in the south) during April, which coincides with the beginning of Gu season (April-June). In Kenya, the condition of pastures kept declining in 15 districts of the semi-arid areas during February, according to the Bulletin issued by the National Drought Management Authority

Drought is also reported in March-April from the Dominican Republic and over the western coastal areas of Panama, Costa Rica and Nicaragua and from the Southern Island of New Zealand where fires destroyed 2500 Ha of vegetation in the first half of February. Still in Oceania, Western Australia and the Northern Territory had the warmest March on record at +2.1°C above average, in spite of some cooling brought about by two severe tropical cyclones (Trevor and Veronica), which also affected Queensland. Bush-fires affected the east of Victoria, destroying more than 10000 Ha of bush. In Tasmania, 3% of the area was burned (200000 Ha). Elderly people and wildlife were affected severely. At the end of April and early May, the dams supplying Sydney, Darwin, Melbourne and Brisbane had reached critical levels close to 50% of capacity and water conservation measures had to be implemented.

The general area covering western Iran, Pakistan and Afghanistan has been suffering from dry conditions during the winter crop season. In Pakistan, dry conditions prevailed mostly over north-west Baluchistan. According to Muslim Aid, 270,000 Families and 3.5 million heads of cattle were affected in 18 districts of Baluchistan. The drought manifests itself by falling water levels in wells which have not been replenished due to shortage of rains over several years. In early March, the International Federation of Red Cross and Red Crescent Societies reported “Alarmingly high rates of disease and malnutrition in drought-affected areas” in Pakistan, especially southern Sindh and Baluchistan. Due to shortage of irrigation water, the food production in the affected areas was reported to be down about one third compared with average years.

Before the cyclone hit the province (Manicaland), the area had been classified as IPC 3 due to drought, with some limited areas in IPC 4 (Buhera district, north-east of Chimanimani and Chipinge). Next to water stressed crops in the field, which had reached harvest, stored food and cattle suffered as well.

*Cold weather and severe winter conditions*

Algeria suffered from several episodes of cold weather which started in January 2019; two of them occurred from 4 - 7 February (affecting 15 Departments) and from 21-22 March, affecting 5 Departments. About 800 families were affected.

*Tropical cyclones, storms, tornadoes, heavy rainfall and floods*

More than 20,000 families (about 100,000 people) suffered from flash floods in Philippine Region XI (Davao Oriental) at the beginning of February. During mid to late to mid-February, floods affected California while in Colombia, the end of February suffered floods when the San Juan and other rivers in the Chocò department made more than 3000 families homeless; at the end of April, the south-western Department of Nariño suffered from floods affecting 5,500 families.

From 8 to 12 February an estimated 500000 heads of cattle died due to floods in Queensland (which is about 5% of the State's livestock population) due to rainfall with a return period of about 1 in 500 years, after prolonged drought.

Just after mid-March, cyclone Trevor destroyed 85 houses in Papua New Guinea, where 15,000 people faced food shortages. In the western half of the Island (Eastern Indonesia) flash floods and landslides killed at least 50 people in Papua province.

The United States were struck by several extreme events, including at the beginning of March in Alabama where a tornado killed 23. Nebraska had floods around mid-April while in the Southern US tornadoes and floods left 6 people dead in Texas (especially in the central Texan town of Franklin), Mississippi, Louisiana, Arkansas and Georgia.

Cyclones are a relatively rare occurrence in continentalsouthern Africa, with the exception of Madagascar. In 2000, for instance, cyclone Eline affected Malawi, Mozambique, Zambia, and Zimbabwe through heavy rainfall, but there has been no prior occurrence of a disaster like the one caused by Idai. The cyclone first made landfall on 4 March in the north of the country (Figure 5.1), but then moved back into the Mozambique channel where it gained strength and eventually turned west again when it hit central Mozambique on 14 March, then Zimbabwe and Malawi the following day. At least1000 people were killed directly, more than half (602) in Mozambique. 1.85million people are in need of assistance in Mozambique, of which 1.7 millionneed urgent food supplies in Sofala, Manica, Tete and Zambezia provinces. The disaster occurred at the time close to harvest; destroying many crops that had previously been struck by drought (2.4 million Zimbabweans are in need of food aid due to drought).

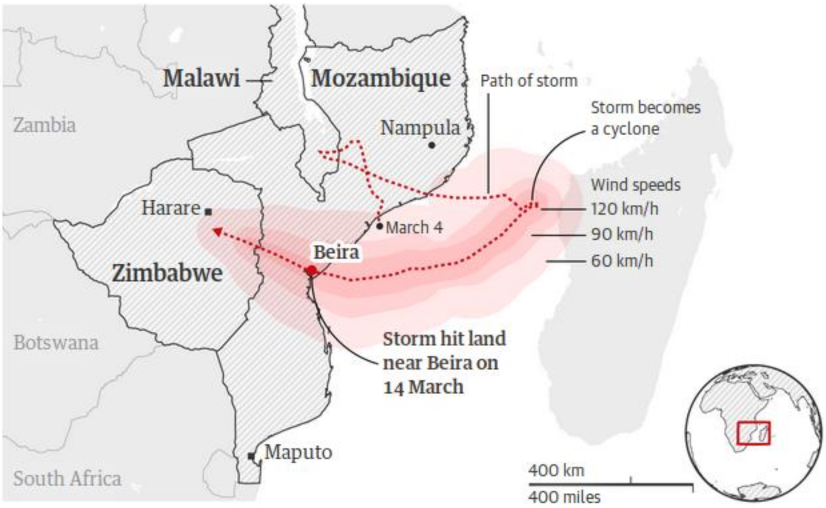



**Figure 5.1 Track of cyclone Idai**

*Secondary source: https://www.theguardian.com/world/2019/mar/23/families-stranded-without-aid-in-wake-of-mozambique-cyclone; Primarysource: GDACS*

According to the International Federation of Red Cross and RedCrescent Societies, 90 % of the area of Central Mozambique and Beira was "destroyed" (Figure 5.2), including houses, food, communications and roads. Indirect deaths due to landslides and diseases include at least 180 people in Zimbabwe, in Chipinge and especially in Chimanimani district, where 15,000 peoplewere affected (Figure 5.3). In Malawi, Mozambique and Zimbabwe the damage isestimated by the World-bank at US$ 2 billion in terms of recovery costs of infrastructure and livelihoods. In particular, the infrastructure was damaged in the Beira corridor which connects the harbour of Beira with Zimbabwe, Malawi and Zambia, affecting the supply of food, fuel and other goods in the region.

**Figure 5.2 Destruction in Beira following cyclone Idai.**

*Source: https://media.ifrc.org/ifrc/press-release/mozambique-cyclone-90-per-cent-beira-surrounds-damaged-destroyed/*

Five weeks after Idai, in the final days of April, cyclone Kenneth hit mostly the Comoros archipelago (185,000 affected) and, in Mozambique (200,000 affected), the northern area of Cabo Delgado, especially Ibo Island and the coastal districts of Macomia and Quissanga. Wind speeds reached 220 km/h; 38 people died and flash floods contaminated boreholes, especially on Ibo. Kenneth led to abundant rain in parts of South Africa but largely spared southern Tanzania. 70 people are reported dead in KwaZulu-Natal province, including some in Eastern Cape Province due to mudslides. On Comoros Island, ACAPS reported on 30 April that the cyclone had severe impacts on livelihoods as an estimate of 60-80% of staple crops have been destroyed and over 1600 livestock lost. 45,000 people were affected and 10,000 houses were destroyed.

Interestingly, both Idai and Kenneth caused limited damage in Madagascar.

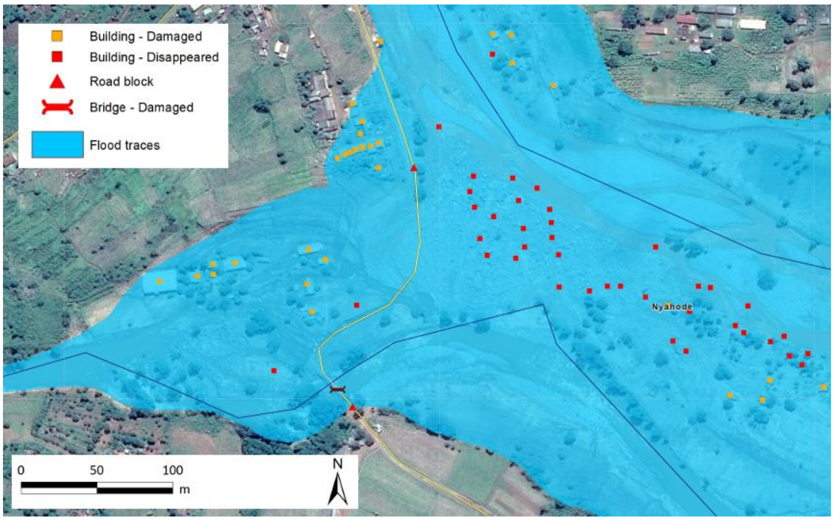



**Figure 5.3 Satellite-based assessment of the extent of Idai flooded land in south-east Zimbabwe.**

*Approximate coordinates of the centre of the map: 32.85833°E and 20.05694°S. Based on a Disaster Charter map available at https://disasterscharter.org/image/journal/article.jpg?img_id=1553526&t=1553179274100*

Repeated episodes of floods-over-drought affected Afghanistan: on 6 March 20 died in 8 provinces including Kandahar, at a time when 13 million people were food insecure and just under 4 million on the verge of famine due to drought and violence, with over 250,000 displaced people. Livestock suffered badly from the excess water.

Later in March and early April widespread floods occurred again in a larger area in western Asia, in northern Pakistan, west Afghanistan, Turkmenistan and especially west Iran. The timing coincided with Nowruz, the Persian New Year, when families reunite and extensively travel. Khuzestan province and most of South-west Iran were particularly severely hit. Floods affected four fifths of the country's 31 provinces, mostly in the western half bordering Afghanistan and Pakistan. All three countries had previously experiencing rainfall shortages, which worsened the impact of floods and landslides. 78 people died in Iran, 1140 were injured with tens of thousands displaced, and many houses, roads and bridges destroyed in about a 1/3 of the national road network (including highways). According to FAO, the most affected provinces include, next to Khuzestan, also Mazandaran, Golestan and Lorestan and Khuzestan, just before the harvest of the main winter wheat crop and at the time when summer crops are emerging. Damage in the agricultural sector is estimated at US% 1.5 billion and between 2 and three times more globally. At mid-April, ReliefWeb estimated that 12 million people were affected, with 2 million in need of direct assistance and 370,000 displaced. 65,000 houses were destroyed and more than 110,000 were damaged.

**Figure 5.4 Afghan Red Crescent Society volunteers rescuing people affected by the floods.**

*Source: http://adore.ifrc.org/Download.aspx?FileId=233279.*

In neighboring Afghanistan, the New Humanitarian reported at the end of March that flash floods that swept away thousands of homes (Figure 5.4) and killed dozens in the two north-western provinces of Herat and Badghis, and seven more provinces, with more than 280,000 people affected and 63 killed, not to mention innumerable sheep. According to the Afghan Red Crescent Society, more than 650,000 people lack basic needs, including sanitation and health care and 1.6 million children suffering acute malnutrition.

## 5.3 Mozambique floods based on satellite data

The Cyclone IDAI brought intense rains over 1000mm during the period of 13th to 26th March 2019 and resulted in severe disaster for Mozambique, particularly in central and southern provinces. Based on Sentinel-1 SAR imageries, water extent during flooding periods and ten days after the flooding was retrieved, compared to water extent at the normal season.

Flood water extent occupied a total of 2,761,245.4 hectares (corresponding to 3.5% of the total country's area) of land from 13th – 26th March and 1,057,214.4hectares (corresponding to 1.3% of the total country's area) by 9th April. Figure 1 shows the remaining water extent by 9th April and the changes from the flooding period before 26th March. Gaza, Maputo, Inhambane and Sofala (about 12.3%, 6.1%, 5.9% and 5.6% of the whole province flooded are highlighted as the most affected provinces with 928,087.0ha, 137,047.7ha, 406,225.4ha and 381,248.8haof land inundated during the flooding period.

Atdistrict level, Chicualacuala, Chigubo and Mandlakazi in Gaza (with 238,891.0ha,226,816.0ha and 72,239.5ha land flooded respectively), Matutuine, Moamba and Magude in Maputo province (flooded area at 53,654.0ha, 28,895.3ha and 26,924.3ha,respectively),Panda, Mabote and Inharrime in Inhambene province (with 121,547.3ha, 53,460.7haand 47,171.4ha of land flooded, respectively) and Buzi, Machanga and Nhamatandain Sofala (with 130,259.9ha, 128,257.3ha and 30,611.5ha of land flooded, respectively) are highlighted as the most severe flooding districts.

By April 9th, about 61.7% (corresponding to 1,704,030.9 hectares) of flood water retreated after the flooding period. But Gaza, Maputo and Inhambane are still suffering, with an area of 462,872.5ha, 81,514.0haand 229,821.0ha of land flooded, accounting for about 6.1%, 3.6% and 3.3% of the whole province, respectively. Among these three provinces, Chicualacuala,Mandlakazi, Chockwe, Matutuine, Moamba, Magude, Panda, Inharrime, and Mabote stillhave large areas of land that have been flooded and not subsided yet..

Observations from the satellite showed that croplands were severe damaged. A total of 251,060.0 hectares of cropland were under water during the flooding period, and 157,897.5hectares still remained flooded by April 9th, 2019. Croplands in Gaza province were mostly affected, accounting for 48.8% of total flooded cropland area nationally during the flooding period and 62.2% by April 9th.For each province, about 16.4%, 8.3%, 3.7% and 27% of cropland in Gaza, Inhambane, Maputo and Sofala provinces were covered by flooding water, corresponding to 122,501.2ha, 31,010.8ha, 11,020.8haand 15,391.4ha, respectively.

The districts where cropland were severely affected include Chibuto and Mandlakazi districts in Gaza province (with 25,281.9ha, 19,723.4haof flooded cropland area respectively),Jangamo and Homoine in Inhambane province (13,305.4ha and 3,753.2ha), Moamba and Magude in Maputo province (4,421.5ha and3,132.8), Buzi and Nhamatanda in Sofala province (9,724.7ha and 1,682.6ha).

Gaza, Inhambane and Maputo were still suffering from floodingand about 7.8%, 3.7% and 2.3% of cropland in each province were covered by flood water, corresponding to 58,590.7ha, 13,822.7ha and 6,744.9ha, respectively. The statistics for this period show that Chockwe and Chibuto districts in Gaza province (with 10,999.0ha and 9,862.47ha of flooded cropland area respectively), Jangamo and Panda in Inhambane province (with 8,270.7.1ha, 1,223.1ha of flooded cropland area respectively) and Moamba and Magude in Maputo province (with 2,897.19ha and 1,724.9ha of flooded cropland area respectively) are highlighted as the most affected ones.

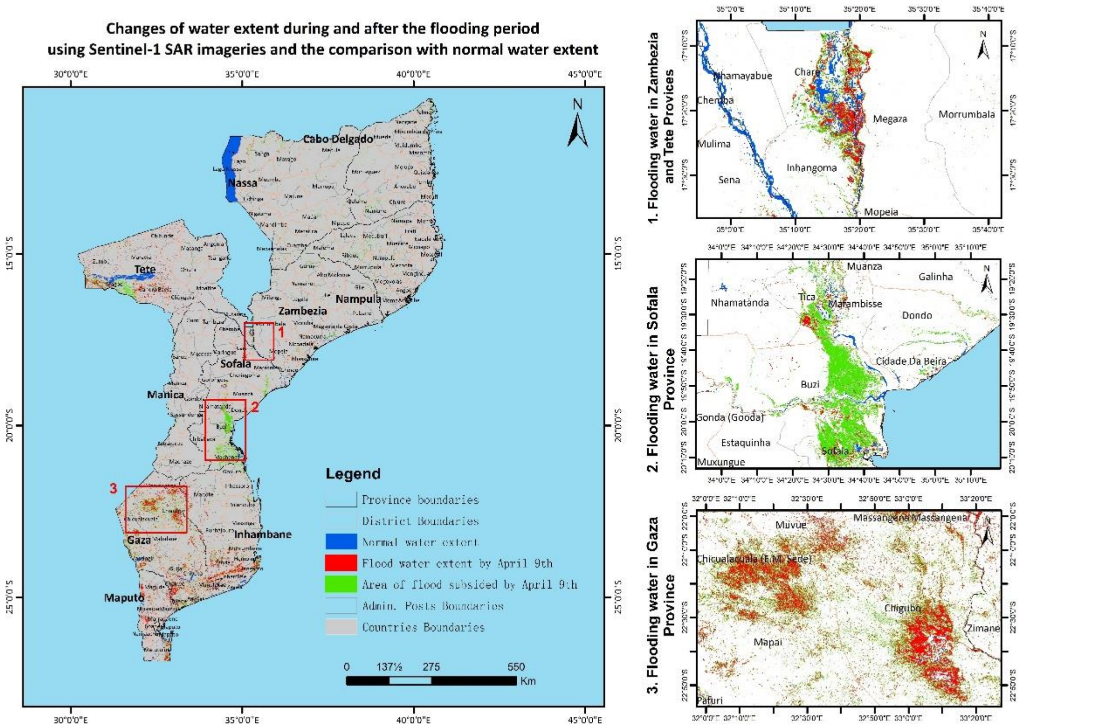



**Figure 5.5 Waterextension in over Mozambique between 13th -26th March2019 and 26th March to 09th April 2019.**

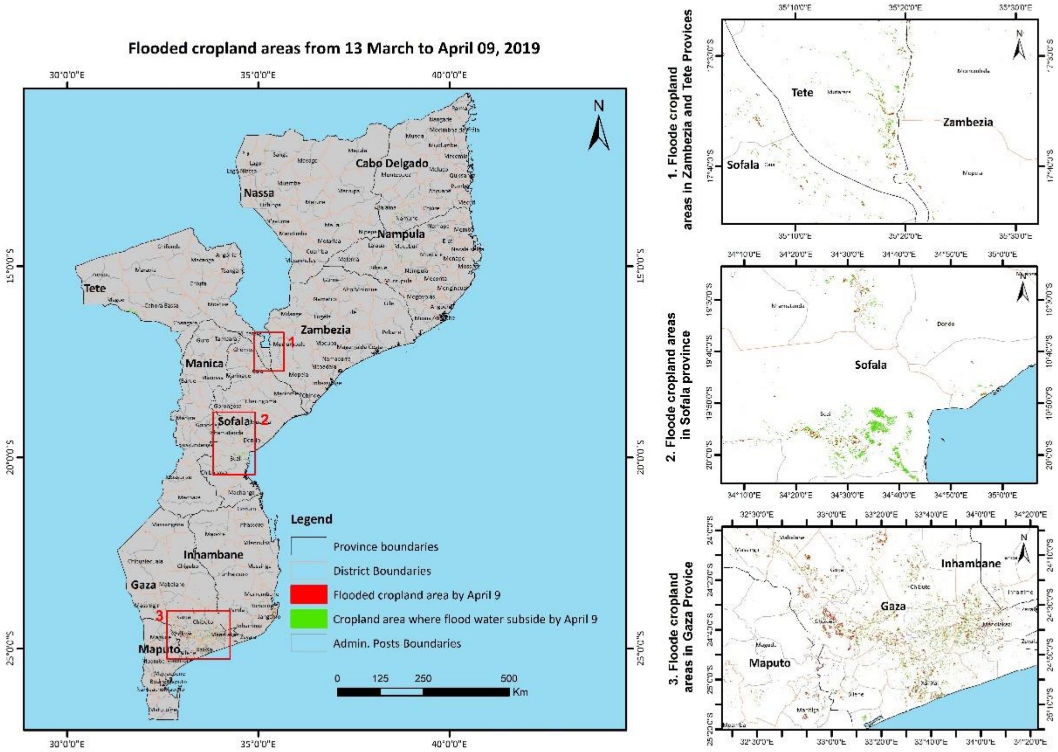



**Figure 5.6 Affected cropland areas by floods from 13th March to 9th April 2019**

## 5.4 Update on El Niño

A weakening El Nino trend has occurred across the Pacific Ocean so far. Figure 5.7 illustrates the behavior of the standard Southern Oscillation Index (SOI) of the Australian Bureau of Meteorology (BOM) from April 2018 to April 2019. Sustained positive values of the SOI above +7 typically indicate La Niña while sustained negative values below −7 typically indicate El Niño. Values between about +7 and −7 generally indicate neutral conditions.

During the current season, SOI decreased sharply from -0.6 in January to -13.5 in February, then increased to -6.8 in March, and increased to -1.3 in April 2019, indicating a weak El Nino condition.

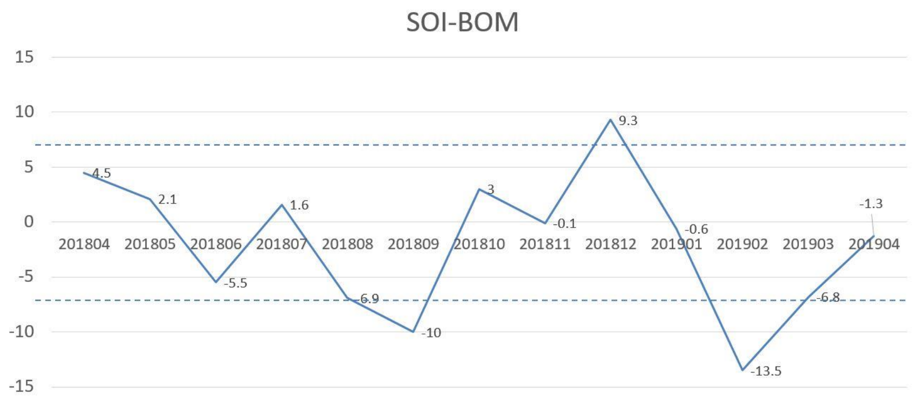



**Figure 5.7 Monthly SOI-BOM time series from April 2018 to April 2019**

The sea surface temperature anomalies in April 2019 for NINO3, NINO3.4, and NINO4 regions are +0.7°C, +0.7°C, and +0.6°C in sequence, a litter warmer than the 1961-1990 average according to BOM (see Figure 5.8-5.9). Both of BOM and NOAA conjecture that the warmer condition indicates a weak El Niño trend. CropWatch will keep monitoring the situation.

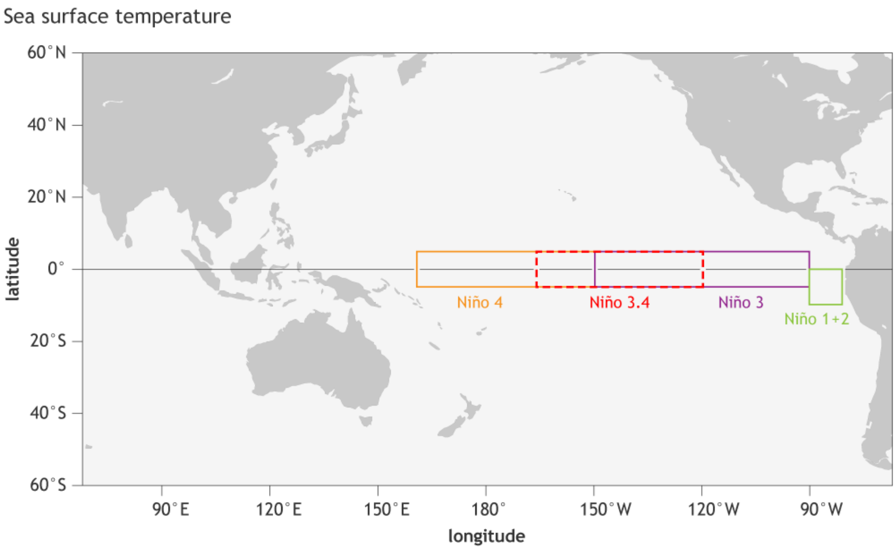



**Figure 5.8 Map of NINO Region**

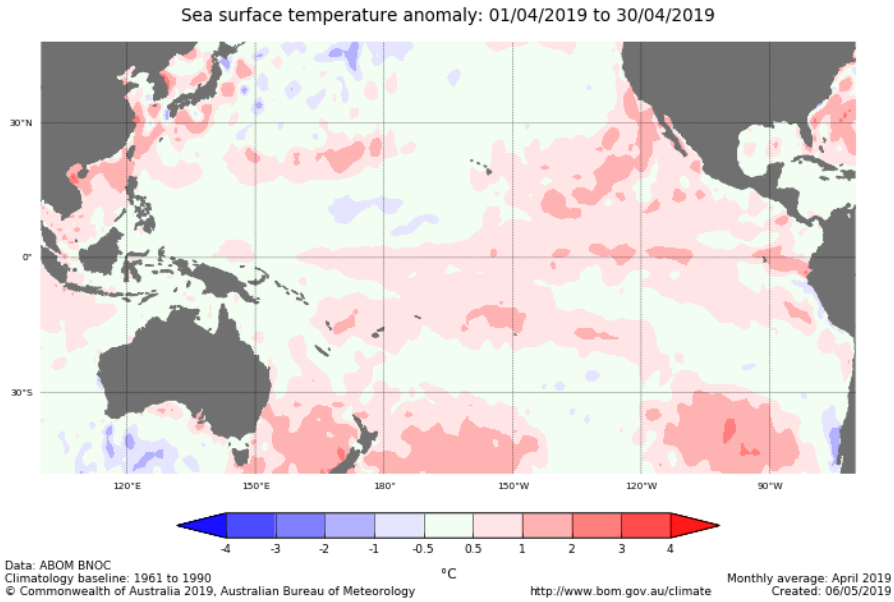



**Figure 5.9 April 2019 of sea surface temperature departure from the 1961-1990 average**

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# Annex A. Agroclimatic indicators and BIOMSS

**Table A.1 January - April 2019 agroclimatic indicators and biomass by global Monitoring and Reporting Unit**

| 65 Global MRUs | | RAIN Current (mm) | RAIN 15YA dep. (%) | TEMP Current (°C) | TEMP 15YA dep. (°C) | RADPAR Current(MJ/m²) | RADPAR 15YA dep. (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA dep. (%) |
|---|---|---|---|---|---|---|---|---|---|
| C01 | Equatorial central Africa | 500 | 0 | 26.3 | 0.4 | 1238 | 5 | 1527 | 1 |
| C02 | East African highlands | 192 | -10 | 21.6 | 0.7 | 1384 | 3 | 677 | -9 |
| C03 | Gulf of Guinea | 206 | 0 | 28.6 | -0.4 | 1314 | 1 | 675 | -1 |
| C04 | Horn of Africa | 274 | -17 | 25.1 | -0.1 | 1346 | 6 | 830 | -16 |
| C05 | Madagascar (main) | 1051 | 4 | 25.2 | 0.1 | 1187 | 2 | 2106 | 10 |
| C06 | Southwest Madagascar | 467 | 5 | 25.6 | -0.3 | 1216 | -1 | 1271 | 1 |
| C07 | North Africa-Mediterranean | 95 | -33 | 11.5 | -0.6 | 983 | 2 | 353 | -30 |
| C08 | Sahel | 21 | -27 | 29.3 | -0.7 | 1358 | -2 | 72 | -23 |
| C09 | Southern Africa | 530 | 4 | 24.6 | 0.2 | 1263 | 4 | 1303 | -3 |
| C10 | Western Cape (South Africa) | 98 | -14 | 19.3 | -0.2 | 1284 | 2 | 395 | -13 |
| C11 | British Columbia to Colorado | 250 | -11 | -4.5 | -1.5 | 686 | -2 | 477 | -6 |
| C12 | Northern Great Plains | 232 | 12 | -2.3 | -2.3 | 714 | -4 | 565 | -6 |
| C13 | Corn Belt | 455 | 34 | -0.1 | -0.7 | 635 | -5 | 682 | -4 |
| C14 | Cotton Belt to Mexican Nordeste | 374 | 6 | 12.1 | -0.2 | 826 | -6 | 1030 | 4 |
| C15 | Sub-boreal America | 203 | -7 | -10.2 | -1.4 | 544 | 3 | 349 | -4 |
| C16 | West Coast (North America) | 301 | 32 | 6.4 | -0.6 | 729 | -6 | 798 | 24 |
| C17 | Sierra Madre | 49 | -37 | 16.4 | 0.4 | 1311 | 1 | 224 | -25 |
| C18 | SW U.S. and N. Mexican highlands | 122 | 24 | 8.9 | -0.3 | 1019 | -5 | 443 | 16 |
| C19 | Northern South and Central America | 167 | -33 | 26.5 | -0.1 | 1195 | 4 | 476 | -28 |
| C20 | Caribbean | 169 | -4 | 24.3 | -0.1 | 1138 | 1 | 647 | 13 |
| C21 | Central-northern Andes | 671 | -3 | 16.8 | 0.1 | 1014 | -2 | 1373 | 1 |
| C22 | Nordeste (Brazil) | 560 | 23 | 28.2 | 0.5 | 1313 | 5 | 1495 | 21 |
| C23 | Central eastern Brazil | 734 | -3 | 26.4 | 0 | 1248 | 6 | 1819 | 0 |
| C24 | Amazon | 1119 | -6 | 27 | -0.5 | 1097 | 4 | 2219 | -3 |
| C25 | Central-north Argentina | 541 | 1 | 23.9 | -1.4 | 1092 | -6 | 1421 | -2 |
| C26 | Pampas | 676 | 15 | 22.7 | -0.8 | 1137 | -4 | 1624 | 7 |
| C27 | Western Patagonia | 71 | -26 | 13 | -1 | 1241 | 4 | 338 | -16 |
| C28 | Semi-arid Southern Cone | 121 | -30 | 17.9 | -1 | 1312 | 0 | 386 | -33 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| C29 | Caucasus | 249 | -5 | 2.9 | -0.1 | 766 | -4 | 701 | -4 |
| C30 | Pamir area | 208 | -9 | 3 | -0.2 | 848 | -7 | 629 | 4 |
| C31 | Western Asia | 218 | 33 | 7.1 | -0.2 | 866 | -6 | 658 | 22 |
| C32 | Gansu-Xinjiang (China) | 122 | 61 | -1.1 | 0.7 | 878 | -2 | 414 | 36 |
| C33 | Hainan (China) | 100 | -39 | 23.6 | 2 | 1078 | 17 | 439 | -15 |
| C34 | Huanghuaihai (China) | 140 | 34 | 6.8 | 0.2 | 889 | -4 | 539 | 25 |
| C35 | Inner Mongolia (China) | 91 | 25 | -2.7 | 1.6 | 907 | 0 | 381 | 21 |
| C36 | Loess region (China) | 115 | 35 | 3.4 | 0.3 | 969 | -2 | 433 | 18 |
| C37 | Lower Yangtze (China) | 494 | 21 | 10.7 | -0.3 | 615 | -15 | 1188 | 8 |
| C38 | Northeast China | 62 | -28 | -3.9 | 3 | 823 | 4 | 304 | -12 |
| C39 | Qinghai-Tibet (China) | 148 | -23 | 2.1 | 0 | 1048 | -1 | 392 | -9 |
| C40 | Southern China | 345 | 43 | 16.9 | 0.6 | 816 | 0 | 804 | 15 |
| C41 | Southwest China | 183 | 15 | 10.3 | 0.2 | 777 | -3 | 625 | 11 |
| C42 | Taiwan (China) | 264 | 45 | 18.4 | 1.2 | 1019 | 7 | 832 | 23 |
| C43 | East Asia | 107 | -23 | -0.8 | 1.3 | 796 | 3 | 398 | -10 |
| C44 | Southern Himalayas | 161 | 3 | 19.5 | -0.1 | 1121 | -1 | 548 | 17 |
| C45 | Southern Asia | 94 | -13 | 26.6 | 0 | 1300 | 1 | 298 | -11 |
| C46 | Southern Japan and Korea | 341 | 12 | 7.5 | 0.6 | 820 | 2 | 1045 | 10 |
| C47 | Southern Mongolia | 181 | 170 | -8.2 | -0.2 | 860 | 0 | 524 | 80 |
| C48 | Punjab to Gujarat | 59 | 20 | 22.3 | -1.1 | 1184 | -2 | 273 | 28 |
| C49 | Maritime Southeast Asia | 1012 | -8 | 25.6 | -0.4 | 1126 | 5 | 1983 | -5 |
| C50 | Mainland Southeast Asia | 153 | -12 | 27.3 | 0.6 | 1240 | 6 | 515 | -8 |
| C51 | Eastern Siberia | 136 | -27 | -9.9 | 1.3 | 592 | 6 | 316 | 6 |
| C52 | Eastern Central Asia | 64 | -28 | -11.6 | 2.4 | 723 | 3 | 240 | -5 |
| C53 | Northern Australia | 807 | -3 | 26.7 | -0.4 | 1225 | 1 | 1613 | -5 |
| C54 | Queensland to Victoria | 171 | -23 | 22.5 | 0.9 | 1258 | 5 | 573 | -23 |
| C55 | Nullarbor to Darling | 65 | -40 | 20.6 | -0.8 | 1298 | 5 | 322 | -31 |
| C56 | New Zealand | 112 | -32 | 15.3 | 0.2 | 1082 | 9 | 523 | -21 |
| C57 | Boreal Eurasia | 283 | -4 | -4 | 1.1 | 408 | 6 | 496 | 9 |
| C58 | Ukraine to Ural mountains | 250 | 0 | -0.4 | 1.7 | 442 | -1 | 658 | 7 |
| C59 | Mediterranean Europe and Turkey | 204 | -5 | 7.8 | -0.1 | 820 | 5 | 671 | -6 |
| C60 | W. Europe (non Mediterranean) | 231 | -4 | 5.5 | 0.5 | 586 | 4 | 806 | 0 |
| C61 | Boreal America | 370 | 21 | -5.4 | 3.5 | 419 | -5 | 425 | 32 |
| C62 | Ural to Altai mountains | 169 | -2 | -6.8 | 1.4 | 531 | -3 | 438 | 5 |
| C63 | Australian desert | 116 | -8 | 22.8 | -0.1 | 1337 | 4 | 508 | -4 |
| C64 | Sahara to Afghan deserts | 104 | 23 | 17.1 | -1.1 | 1161 | -2 | 358 | 24 |
| C65 | Sub-arctic America | 76 | -1 | -24.5 | -1.7 | 305 | -2 | 62 | -34 |

**Table A.2 January - April 2019 agroclimatic indicators and biomass by country**

| Country code | Country name | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure(°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|---|
| ARG | Argentina | 173 | -2 | 4.9 | -1.1 | 919 | -6 | 606 | 10 |
| AUS | Australia | 554 | -6 | 25.8 | 1.7 | 1228 | 6 | 1590 | -2 |
| BGD | Bangladesh | 605 | 14 | 21.6 | -1.2 | 1137 | -4 | 1396 | 1 |
| BRA | Brazil | 225 | -17 | 22.6 | 0.5 | 1258 | 4 | 580 | -21 |
| KHM | Cambodia | 299 | 32 | 24.2 | 0.3 | 1174 | -1 | 873 | 35 |
| CAN | Canada | 229 | -14 | 1.9 | 1.9 | 455 | 9 | 806 | 13 |
| CHN | China | 856 | -1 | 26.3 | -0.1 | 1207 | 5 | 1932 | 3 |
| EGY | Egypt | 254 | 0 | -8.1 | -1.4 | 572 | 2 | 371 | -7 |
| ETH | Ethiopia | 255 | 20 | 7.7 | 0.6 | 789 | -4 | 604 | 10 |
| FRA | France | 265 | 5 | 5.5 | 1.2 | 516 | 1 | 985 | 9 |
| DEU | Germany | 42 | -20 | 15 | -1.3 | 1013 | -1 | 225 | 8 |
| IND | India | 194 | 5 | 22.4 | 0.8 | 1386 | 2 | 698 | 3 |
| IDN | Indonesia | 160 | -18 | 6.8 | -0.5 | 637 | 6 | 630 | -15 |
| IRN | Iran | 324 | -15 | 6.3 | 0.2 | 441 | 6 | 974 | -3 |
| KAZ | Kazakhstan | 124 | -12 | 6.1 | 1 | 646 | 4 | 556 | -9 |
| MEX | Mexico | 1147 | -2 | 25.7 | -0.4 | 1117 | 4 | 2194 | -2 |
| MMR | Myanmar | 97 | -3 | 24 | -0.3 | 1240 | 0 | 324 | 8 |
| NGA | Nigeria | 289 | 39 | 6.9 | -0.7 | 956 | -5 | 755 | 19 |
| PAK | Pakistan | 119 | -24 | 8.1 | 0.1 | 776 | 9 | 495 | -19 |
| PHL | Philippines | 159 | 4 | -4.9 | 1.4 | 632 | -4 | 495 | 6 |
| POL | Poland | 184 | -40 | 23.7 | 0.1 | 1395 | 5 | 555 | -39 |
| ROU | Romania | 145 | -26 | 28.8 | 0 | 1206 | 4 | 550 | -17 |
| RUS | Russia | 401 | -31 | 27.1 | -0.1 | 1264 | 4 | 1000 | -23 |
| ZAF | South Africa | 99 | -39 | 11.8 | 0 | 1051 | 3 | 347 | -36 |
| THA | Thailand | 50 | -49 | 20 | 0.1 | 1248 | 1 | 231 | -29 |
| TUR | Turkey | 88 | 1 | 24.5 | 0.3 | 1295 | 4 | 335 | 1 |
| GBR | United Kingdom | 48 | -27 | -11.1 | 2.2 | 815 | 2 | 211 | -18 |
| UKR | Ukraine | 843 | 27 | 26.3 | -0.6 | 1182 | -1 | 1603 | 4 |
| USA | United States | 181 | 9 | 29.2 | -0.3 | 1324 | -1 | 476 | 8 |
| UZB | Uzbekistan | 153 | 6 | 14.7 | -1.3 | 1014 | -6 | 498 | 27 |
| VNM | Vietnam | 325 | -49 | 25.5 | -0.5 | 1198 | 7 | 870 | -28 |
| AFG | Afghanistan | 249 | -4 | 4.1 | 1.6 | 492 | 4 | 932 | 12 |
| AGO | Angola | 229 | 12 | 4 | 0.8 | 661 | 3 | 768 | 5 |
| BLR | Belarus | 209 | -3 | -4.1 | 1.7 | 481 | -1 | 484 | 4 |
| HUN | Hungary | 177 | -12 | 27.8 | 0.6 | 1230 | 6 | 565 | -10 |
| ITA | Italy | 309 | -1 | 4.3 | -0.1 | 790 | -3 | 848 | 1 |
| KEN | Kenya | 209 | -4 | 2.9 | 1.2 | 521 | -1 | 755 | 2 |
| LKA | Sri_Lanka | 353 | 19 | 4.6 | -0.7 | 747 | -6 | 742 | 3 |
| MAR | Morocco | 213 | 5 | 7.3 | 1.4 | 761 | -10 | 716 | 9 |
| MNG | Mongolia | 167 | -6 | 23.8 | 1.2 | 1016 | 6 | 600 | 3 |
| MOZ | Mozambique | 375 | 14 | 20.9 | 0.3 | 1296 | 5 | 1161 | 8 |
| ZMB | Zambia | 525 | -12 | 24.3 | 0 | 1220 | 4 | 1482 | -9 |

**Table A.3 Argentina, January - April 2019 agroclimatic indicators and biomass (by province)**

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure(°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| Buenos Aires | 443 | -2 | 19.5 | -1.1 | 1235 | 2 | 1199 | -8 |
| Chaco | 1131 | 69 | 24.5 | -1.4 | 1020 | -11 | 1955 | 20 |
| Cordoba | 520 | 13 | 21.1 | -1.2 | 1181 | -4 | 1464 | 5 |
| Corrientes | 904 | 35 | 24.1 | -1.3 | 1039 | -12 | 1912 | 19 |
| Entre Rios | 756 | 24 | 22.3 | -1.2 | 1112 | -7 | 1578 | 5 |
| La Pampa | 353 | -15 | 20.5 | -0.9 | 1286 | 2 | 1055 | -17 |
| Misiones | 714 | 2 | 24.1 | -0.8 | 1142 | -4 | 1946 | 14 |
| Santiago Del Estero | 625 | 23 | 23.7 | -1.6 | 1030 | -9 | 1538 | 7 |
| San Luis | 449 | 11 | 20.2 | -1.1 | 1222 | -2 | 1372 | 4 |
| Salta | 407 | -37 | 22.7 | -1.2 | 1029 | -7 | 1204 | -21 |
| Santa Fe | 744 | 25 | 22.7 | -1.2 | 1090 | -8 | 1724 | 11 |
| Tucuman | 314 | -40 | 21.8 | -1.4 | 1094 | -8 | 930 | -35 |

**Table A.4 Australia, January - April 2019 agroclimatic indicators and biomass (by state)**

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure(°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| New South Wales | 187 | -16 | 23.4 | 1.2 | 1293 | 4 | 626 | -18 |
| South Australia | 89 | -24 | 20.5 | 0.3 | 1228 | 3 | 427 | -16 |
| Victoria | 95 | -33 | 19.6 | 0.6 | 1193 | 5 | 430 | -29 |
| W. Australia | 105 | -34 | 21.3 | -0.7 | 1301 | 5 | 381 | -27 |

**Table A.5 Brazil, January - April 2019 agroclimatic indicators and biomass (by state)**

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure (°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| Ceara | 882 | 44 | 27.8 | -0.1 | 1287 | 4 | 2172 | 40 |
| Goias | 774 | -1 | 25.7 | -0.1 | 1292 | 7 | 2068 | 4 |
| Mato Grosso Do Sul | 665 | -5 | 27.1 | -0.1 | 1263 | 7 | 1717 | -7 |
| Mato Grosso | 1003 | -6 | 27.1 | -0.1 | 1183 | 7 | 2333 | 1 |
| Minas Gerais | 577 | -6 | 25.5 | 0.6 | 1286 | 8 | 1590 | 1 |
| Parana | 626 | -2 | 24.1 | 0.1 | 1209 | 4 | 1738 | 0 |
| Rio Grande Do Sul | 710 | 14 | 23.5 | -0.2 | 1087 | -8 | 1832 | 12 |
| Santa Catarina | 721 | 8 | 22.2 | 0.1 | 1075 | -4 | 1933 | 10 |
| Sao Paulo | 673 | -2 | 25.2 | 0.2 | 1201 | 6 | 1830 | 1 |

**Table A.6 Canada, January - April 2019 agroclimatic indicators and biomass (by province)**

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure (°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| Alberta | 137 | -26 | -7.9 | -1.9 | 581 | 5 | 432 | -4 |
| Manitoba | 161 | -19 | -10.6 | -1.7 | 588 | 2 | 348 | -7 |
| Saskatchewan | 129 | -29 | -10.0 | -1.8 | 606 | 7 | 384 | -4 |

**Table A.7 India, January - April 2019 agroclimatic indicators and biomass (by state)**

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure (°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| **Andhra Pradesh** | 27 | -55 | 28.1 | -0.1 | 1317 | 1 | 129 | -43 |
| **Assam** | 310 | -19 | 22.5 | 0.4 | 1057 | 0 | 1005 | 2 |
| **Bihar** | 120 | 59 | 22.5 | -1.4 | 1175 | -3 | 536 | 72 |
| **Chhattisgarh** | 73 | 6 | 25.4 | -0.2 | 1251 | -1 | 336 | 15 |
| **Daman and Diu** | 26 | 92 | 24.8 | -1.4 | 1385 | 1 | 122 | 93 |
| **Delhi** | 125 | 97 | 20.6 | -1.2 | 1077 | -7 | 598 | 103 |
| **Gujarat** | 11 | 6 | 25.6 | -0.6 | 1330 | 0 | 67 | 21 |
| **Goa** | 9 | -60 | 25.2 | -0.4 | 1428 | 1 | 51 | -42 |
| **Himachal Pradesh** | 229 | 8 | 4.6 | -0.2 | 980 | -7 | 546 | 6 |
| **Haryana** | 117 | 20 | 19.5 | -1.2 | 1077 | -5 | 515 | 29 |
| **Jharkhand** | 137 | 96 | 23.0 | -1.0 | 1179 | -4 | 577 | 88 |
| **Kerala** | 169 | -35 | 26.7 | -0.2 | 1353 | 4 | 536 | -27 |
| **Karnataka** | 54 | -37 | 26.4 | -0.3 | 1368 | 3 | 222 | -24 |
| **Meghalaya** | 414 | -14 | 19.8 | 1.0 | 1112 | 3 | 1077 | 7 |
| **Maharashtra** | 18 | -53 | 27.1 | 0.4 | 1378 | 3 | 91 | -45 |
| **Manipur** | 167 | -34 | 18.2 | 1.0 | 1178 | 2 | 592 | -17 |
| **Madhya Pradesh** | 48 | -12 | 24.2 | -0.3 | 1256 | 0 | 220 | -2 |
| **Mizoram** | 226 | 2 | 20.4 | 0.7 | 1243 | 0 | 669 | 5 |
| **Nagaland** | 248 | -14 | 17.0 | 0.8 | 1112 | 2 | 928 | 5 |
| **Orissa** | 116 | 41 | 25.7 | -0.4 | 1216 | -2 | 473 | 38 |
| **Puducherry** | 51 | -41 | 28.2 | 141.2 | 1395 | 0 | 233 | -15 |
| **Punjab** | 163 | 30 | 18.6 | -0.4 | 999 | -6 | 627 | 25 |
| **Rajasthan** | 34 | 19 | 22.5 | -1.2 | 1195 | -2 | 160 | 22 |
| **Sikkim** | 329 | 18 | 5.1 | -0.4 | 1205 | -4 | 558 | 4 |
| **Tamil Nadu** | 54 | -53 | 28.5 | 0.3 | 1357 | 3 | 225 | -41 |
| **Tripura** | 342 | 4 | 23.4 | 0.3 | 1182 | 2 | 832 | 2 |
| **Uttarakhand** | 212 | 15 | 9.9 | -0.3 | 1090 | -5 | 562 | 10 |
| **Uttar Pradesh** | 109 | 47 | 21.8 | -1.0 | 1148 | -3 | 466 | 50 |
| **West Bengal** | 204 | 51 | 24.4 | -0.3 | 1183 | -2 | 696 | 43 |

**Table A.8 Kazakhstan, January - April 2019 agroclimatic indicators and biomass (by oblast)**

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure (°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| Akmolinskaya | 162 | 17 | -7.4 | 1.3 | 574 | -7 | 429 | 1 |
| Karagandinskaya | 138 | 10 | -6.6 | 1.3 | 678 | -4 | 451 | 2 |
| Kustanayskaya | 154 | -3 | -6.9 | 1.0 | 539 | -5 | 456 | 2 |
| Pavlodarskaya | 121 | 6 | -7.3 | 1.2 | 581 | -3 | 445 | 3 |
| Severo kazachstanskaya | 153 | 1 | -7.5 | 1.2 | 511 | -3 | 416 | 1 |
| Vostochno kazachstanskaya | 133 | -15 | -7.5 | 1.7 | 723 | 1 | 409 | 4 |
| Zapadno kazachstanskaya | 224 | 16 | -2.9 | 0.9 | 577 | -1 | 609 | 4 |

**Table A.9 Russia, January - April 2019 agroclimatic indicators and biomass (by oblast, kray and republic)**

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure (°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| Bashkortostan Rep. | 244 | 2 | -5.3 | 1.6 | 450 | -3 | 468 | 7 |
| Chelyabinskaya Oblast | 170 | 1 | -6.3 | 1.2 | 479 | -3 | 440 | 3 |
| Gorodovikovsk | 281 | -1 | 4.3 | 1.2 | 584 | -1 | 887 | 6 |
| Krasnodarskiy Kray | 154 | -24 | -1.9 | 1.5 | 559 | 1 | 476 | -4 |
| Kurganskaya Oblast | 188 | 10 | -6.8 | 1.2 | 423 | -6 | 431 | 2 |
| Kirovskaya Oblast | 287 | 3 | -4.3 | 1.8 | 316 | -10 | 478 | 7 |
| Kurskaya Oblast | 279 | 6 | 0.6 | 1.5 | 428 | -5 | 734 | 8 |
| Lipetskaya Oblast | 240 | -8 | -0.5 | 1.7 | 429 | -6 | 677 | 9 |
| Mordoviya Rep. | 226 | -11 | -2.3 | 1.8 | 426 | -1 | 587 | 9 |
| Novosibirskaya Oblast | 163 | -14 | -8.4 | 1.6 | 447 | -2 | 395 | 3 |
| Nizhegorodskaya O. | 246 | -6 | -2.2 | 2.0 | 367 | -6 | 582 | 10 |
| Orenburgskaya Oblast | 237 | 7 | -5.0 | 1.2 | 538 | 0 | 507 | 5 |
| Omskaya Oblast | 175 | -3 | -8.4 | 1.2 | 416 | -6 | 386 | 0 |
| Permskaya Oblast | 290 | 9 | -5.8 | 1.8 | 326 | -10 | 432 | 6 |
| Penzenskaya Oblast | 255 | -1 | -2.6 | 1.5 | 434 | -3 | 581 | 7 |
| Rostovskaya Oblast | 169 | -16 | 2.5 | 1.1 | 558 | -1 | 660 | -7 |
| Ryazanskaya Oblast | 252 | -5 | -1.3 | 1.8 | 397 | -5 | 633 | 9 |
| Stavropolskiy Kray | 171 | -15 | 4.4 | 1.1 | 622 | 0 | 678 | -10 |
| Sverdlovskaya Oblast | 222 | 7 | -6.1 | 1.7 | 370 | -5 | 437 | 6 |
| Samarskaya Oblast | 283 | 19 | -3.9 | 1.4 | 466 | -3 | 534 | 6 |
| Saratovskaya Oblast | 277 | 19 | -2.5 | 1.0 | 498 | -3 | 603 | 4 |

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure (°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| Tambovskaya Oblast | 238 | -10 | -1.4 | 1.6 | 434 | -6 | 638 | 8 |
| Tyumenskaya Oblast | 205 | 8 | -7.6 | 1.4 | 370 | -8 | 404 | 2 |
| Tatarstan Rep. | 275 | 11 | -3.9 | 1.7 | 386 | -6 | 513 | 7 |
| Ulyanovskaya Oblast | 257 | 10 | -3.5 | 1.5 | 434 | -3 | 538 | 6 |
| Udmurtiya Rep. | 285 | 6 | -4.7 | 1.8 | 335 | -8 | 469 | 7 |
| Volgogradskaya O. | 229 | 1 | 0.1 | 1.0 | 547 | -1 | 710 | 3 |
| Voronezhskaya Oblast | 274 | 5 | 0.2 | 1.6 | 474 | -7 | 721 | 8 |

**Table A.10 United States, January - April 2019 agroclimatic indicators and biomass (by state)**

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure (°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| Arkansas | 618 | 24 | 9.7 | -0.6 | 727 | -8 | 1379 | 5 |
| California | 312 | 67 | 7.7 | -0.3 | 821 | -9 | 778 | 37 |
| Idaho | 267 | 10 | -2.1 | -0.9 | 695 | -3 | 598 | 0 |
| Indiana | 451 | 26 | 3.3 | -0.5 | 639 | -8 | 912 | -3 |
| Illinois | 375 | 18 | 2.6 | -1.1 | 653 | -9 | 880 | -3 |
| Iowa | 351 | 28 | -1.5 | -2.0 | 654 | -7 | 674 | -12 |
| Kansas | 218 | 16 | 3.7 | -1.8 | 820 | -6 | 681 | 8 |
| Michigan | 362 | 21 | -2.3 | -1.1 | 592 | -4 | 573 | -9 |
| Minnesota | 316 | 24 | -6.6 | -2.6 | 597 | -6 | 453 | -17 |
| Missouri | 450 | 11 | 4.9 | -1.1 | 706 | -8 | 1028 | -1 |
| Montana | 196 | -3 | -5.2 | -3.5 | 698 | -2 | 510 | -15 |
| Nebraska | 214 | 22 | -0.4 | -2.4 | 768 | -7 | 687 | 0 |
| North Dakota | 252 | 24 | -7.9 | -3.0 | 645 | -3 | 435 | -15 |
| Ohio | 468 | 31 | 3.2 | 0.0 | 648 | -4 | 904 | 1 |
| Oklahoma | 245 | -16 | 7.9 | -1.5 | 816 | -7 | 857 | 2 |
| Oregon | 261 | 16 | 2.9 | -0.9 | 629 | -4 | 776 | 7 |
| South Dakota | 274 | 41 | -4.4 | -3.5 | 682 | -8 | 542 | -16 |
| Texas | 230 | -4 | 12.9 | -1.0 | 865 | -7 | 761 | 9 |
| Washington | 222 | -12 | 1.5 | -1.5 | 595 | 0 | 742 | 4 |
| Wisconsin | 391 | 33 | -4.0 | -1.8 | 618 | -4 | 528 | -13 |

**Table A.11 China, January - April 2019 agroclimatic indicators and biomass (by province)**

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure (°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| Anhui | 262 | -14 | 9.3 | -0.2 | 730 | -11 | 908 | -5 |
| Chongqing | 180 | -7 | 9.4 | 0.0 | 709 | -6 | 690 | 1 |
| Fujian | 534 | 27 | 13.2 | 0.7 | 650 | -8 | 1259 | 13 |
| Gansu | 658 | 69 | 17.1 | 0.9 | 671 | -4 | 1097 | 11 |
| Guangdong | 82 | 10 | 2.3 | 0.4 | 985 | 0 | 337 | 15 |
| Guangxi | 421 | 39 | 15.3 | -0.1 | 508 | -18 | 1001 | 21 |
| Guizhou | 266 | 38 | 10.6 | 0.2 | 584 | -8 | 817 | 25 |
| Hebei | 99 | 57 | 2.4 | 0.5 | 912 | -3 | 409 | 39 |

| | RAIN Current (mm) | RAIN 15YA Departure (%) | TEMP Current (°C) | TEMP 15YA Departure (°C) | RADPAR Current (MJ/m²) | RADPAR 15YA Departure (%) | BIOMSS Current (gDM/m²) | BIOMSS 5YA Departure (%) |
|---|---|---|---|---|---|---|---|---|
| **Heilongjiang** | 122 | -12 | 7.9 | -0.2 | 877 | -4 | 527 | -7 |
| **Henan** | 61 | -24 | -5.2 | 3.6 | 786 | 6 | 301 | -8 |
| **Hubei** | 237 | -13 | 8.7 | -0.5 | 734 | -9 | 862 | 1 |
| **Hunan** | 485 | 20 | 9.8 | -0.9 | 548 | -17 | 1206 | 8 |
| **Jiangsu** | 65 | -26 | -2.8 | 2.8 | 861 | 4 | 315 | -14 |
| **Jiangxi** | 217 | 4 | 8.4 | 0.1 | 782 | -10 | 812 | 6 |
| **Jilin** | 589 | 17 | 11.4 | -0.4 | 569 | -17 | 1398 | 9 |
| **Liaoning** | 64 | -31 | 0.3 | 1.7 | 890 | 1 | 308 | -23 |
| **Inner Mongolia** | 83 | 9 | -4.5 | 2.3 | 876 | 1 | 358 | 20 |
| **Ningxia** | 50 | 21 | 1.9 | 0.5 | 999 | -1 | 226 | 23 |
| **Shaanxi** | 106 | -9 | 9.4 | 0.3 | 867 | -1 | 421 | -8 |
| **Shandong** | 175 | 77 | 6.4 | 0.3 | 905 | -3 | 608 | 44 |
| **Shanxi** | 118 | 16 | 5.1 | 0.2 | 935 | -1 | 478 | 13 |
| **Sichuan** | 135 | 66 | 1.7 | 0.4 | 942 | -2 | 489 | 32 |
| **Yunnan** | 149 | 42 | 13.8 | 0.4 | 1103 | 6 | 505 | 23 |
| **Zhejiang** | 500 | 26 | 10.2 | 0.3 | 630 | -16 | 1370 | 21 |

# Annex B. Quick reference to CropWatch indicators, spatial units and methodologies

The following sections give a brief overview of CropWatch indicators and spatial units, along with a description of the CropWatch production estimation methodology. For more information about CropWatch methodologies, visit CropWatch online at www.cropwatch.com.cn**.**

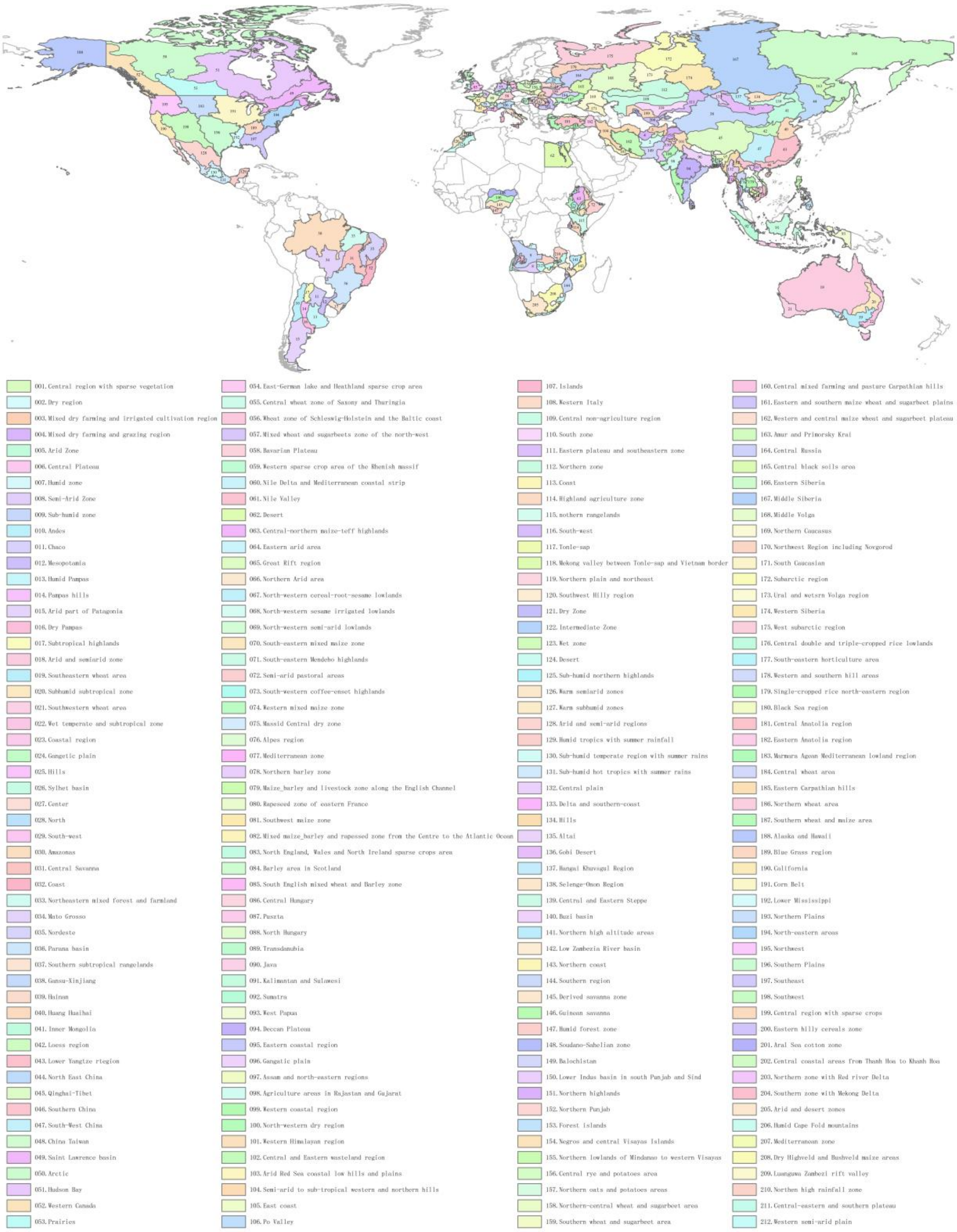
**Agroecological zones for 42 key countries**

***Overview***

212 agroecological zones for the 42 key countries across the globe

***Description***

42 key agricultural countries are divided into 212 agro-ecological zones based on cropping systems, climatic zones, and topographic conditions. Each country is considered separately. A limited number of regions (e.g., region 001, region 027, and region 127) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of the 42 key countries. Some regions are more relevant for rangeland and livestock monitoring, which is also essential for food security.




**CropWatch indicators**

The CropWatch indicators are designed to assess the condition of crops and the environment in which they grow and develop; the indicators—RAIN (for rainfall), TEMP (temperature), and RADPAR (photosynthetically active radiation, PAR)—are not identical to the weather variables, but instead are value-added indicators computed only over crop growing areas (thus for example excluding deserts and rangelands) and spatially weighted according to the agricultural production potential, with marginal areas receiving less weight than productive ones. The indicators are expressed using the usual physical units (e.g., mm for rainfall) and were thoroughly tested for their coherence over space and time. CWSU are the CropWatch Spatial Units, including MRUs, MPZ, and countries (including first-level administrative districts in select large countries). For all indicators, high values indicate "good" or "positive."

| INDICATOR | | | |
|---|---|---|---|
| **BIOMSS** | | | |
| **Biomass accumulation potential** | | | |
| Crop/ Ground and satellite | Grams dry matter/m$^2$, pixel or CWSU | An estimate of biomass that could potentially be accumulated over the reference period given the prevailing rainfall and temperature conditions. | Biomass is presented as maps by pixels, maps showing average pixels values over CropWatch spatial units (CWSU), or tables giving average values for the CWSU. Values are compared to the average value for the last five years (2014-2018), with departures expressed in percentage. |
| **CALF** | | | |
| **Cropped arable land and cropped arable land fraction** | | | |
| Crop/ Satellite | [0,1] number, pixel or CWSU average | The area of cropped arable land as fraction of total (cropped and uncropped) arable land. Whether a pixel is cropped or not is decided based on NDVI twice a month. (For each four-month reporting period, each pixel thus has 8 cropped/ uncropped values). | The value shown in tables is the maximum value of the 8 values available for each pixel; maps show an area as cropped if at least one of the 8 observations is categorized as "cropped." Uncropped means that no crops were detected over the whole reporting period. Values are compared to the average value for the last five years (2014-2018), with departures expressed in percentage. |
| **CROPPING INTENSITY** | | | |
| **Cropping intensity Index** | | | |
| Crop/ Satellite | 0, 1, 2, or 3; Number of crops growing over a year for each pixel | Cropping intensity index describes the extent to which arable land is used over a year. It is the ratio of the total crop area of all planting seasons in a year to the total area of arable land. | Cropping intensity is presented as maps by pixels or spatial average pixels values for MPZs, 42 countries, and 7 regions for China. Values are compared to the average of the previous five years, with departures expressed in percentage. |
| **NDVI** | | | |
| **Normalized Difference Vegetation Index** | | | |
| Crop/ Satellite | [0.12-0.90] number, pixel or CWSU average | An estimate of the density of living green biomass. | NDVI is shown as average profiles over time at the national level (cropland only) in crop condition development graphs, compared with previous year and recent five-year average (2014-2018), and as spatial patterns compared to the average showing the time profiles, where they occur, and the percentage of pixels concerned by each profile. |
| **RADPAR** | | | |
| **CropWatch indicator for Photosynthetically Active Radiation (PAR), based on pixel based PAR** | | | |
| Weather /Satellite | W/m$^2$, CWSU | The spatial average (for a CWSU) of PAR accumulation over agricultural pixels, weighted by the production potential. | RADPAR is shown as the percent departure of the RADPAR value for the reporting period compared to the recent fifteen-year average (2004-2018), per CWSU. For the MPZs, regular PAR is shown as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile. |
| **RAIN** | | | |
| **CropWatch indicator for rainfall, based on pixel-based rainfall** | | | |
| Weather /Ground | Liters/m$^2$, CWSU | The spatial average (for a CWSU) of rainfall accumulation over agricultural | RAIN is shown as the percent departure of the RAIN value for the reporting period, compared to |

| INDICATOR | | | |
|---|---|---|---|
| and satellite | | pixels, weighted by the production potential. | the recent fifteen-year average (2004-18), per CWSU. For the MPZs, regular rainfall is shown as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile. |
| **TEMP** | | | |
| **CropWatch indicator for air temperature, based on pixel-based temperature** | | | |
| Weather /Ground | °C, CWSU | The spatial average (for a CWSU) of the temperature time average over agricultural pixels, weighted by the production potential. | TEMP is shown as the departure of the average TEMP value (in degrees Centigrade) over the reporting period compared with the average of the recent fifteen years (2004-18), per CWSU. For the MPZs, regular temperature is illustrated as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile. |
| **VCIx** | | | |
| **Maximum vegetation condition index** | | | |
| Crop/ Satellite | Number, pixel to CWSU | Vegetation condition of the current season compared with historical data. Values usually are [0, 1], where 0 is "NDVI as bad as the worst recent year" and 1 is "NDVI as good as the best recent year." Values can exceed the range if the current year is the best or the worst. | VCIx is based on NDVI and two VCI values are computed every month. VCIx is the highest VCI value recorded for every pixel over the reporting period. A low value of VCIx means that no VCI value was high over the reporting period. A high value means that at least one VCI value was high. VCI is shown as pixel-based maps and as average value by CWSU. |
| **VHI** | | | |
| **Vegetation health index** | | | |
| Crop/ Satellite | Number, pixel to CWSU | The average of VCI and the temperature condition index (TCI), with TCI defined like VCI but for temperature. VHI is based on the assumption that "high temperature is bad" (due to moisture stress), but ignores the fact that low temperature may be equally "bad" (crops develop and grow slowly, or even suffer from frost). | Low VHI values indicate unusually poor crop condition, but high values, when due to low temperature, may be difficult to interpret. VHI is shown as typical time profiles over Major Production Zones (MPZ), where they occur, and the percentage of pixels concerned by each profile. |
| **VHIn** | | | |
| **Minimum Vegetation health index** | | | |
| Crop/ Satellite | Number, pixel to CWSU | VHIn is the lowest VHI value for every pixel over the reporting period. Values usually are [0, 100]. Normally, values lower than 35 indicate poor crop condition. | Low VHIn values indicate the occurrence of water stress in the monitoring period, often combined with lower than average rainfall. The spatial/time resolution of CropWatch VHIn is 16km/week for MPZs and 1km/dekad for China. |

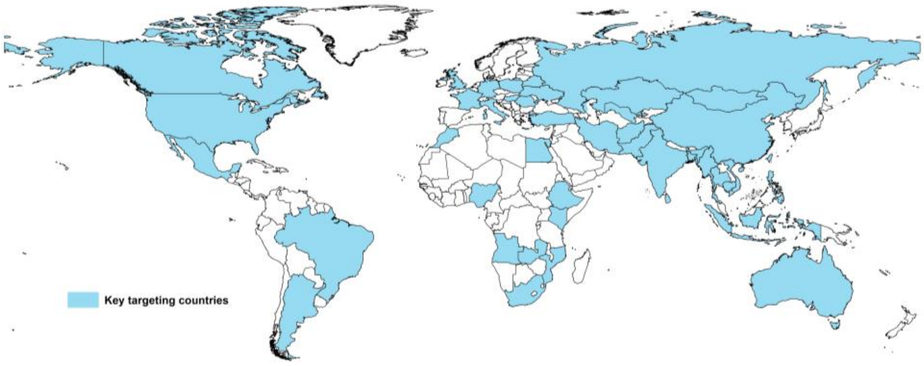
*Note:* Type is either "Weather" or "Crop"; source specifies if the indicator is obtained from ground data, satellite readings, or a combination; units: in the case of ratios, no unit is used; scale is either pixels or large scale CropWatch spatial units (CWSU). Many indicators are computed for pixels but represented in the CropWatch bulletin at the CWSU scale.

### CropWatch spatial units (CWSU)

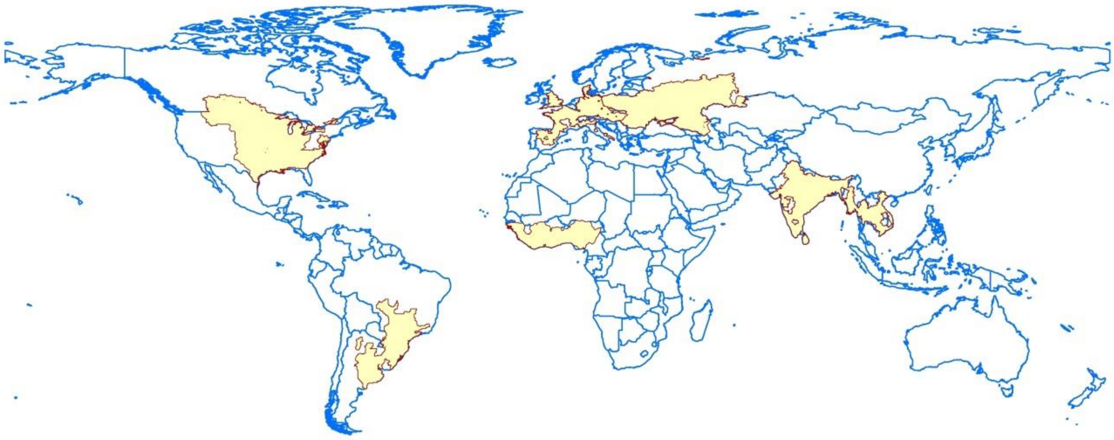
CropWatch analyses are applied to four kinds of CropWatch spatial units (CWSU): Countries, China, Major Production Zones (MPZ), and global crop Monitoring and Reporting Units (MRU). The tables below summarize the key aspects of each spatial unit and show their relation to each other. For more details about these spatial units and their boundaries, see the CropWatch bulletin online resources.

| SPATIAL LUNITS | |
| --- | --- |
| **CHINA** | |
| *Overview* | *Description* |
| Seven monitoring regions | The seven regions in China are agro-economic/agro-ecological regions that together cover the bulk of national maize, rice, wheat, and soybean production. Provinces that are entirely or partially included in one of the monitoring regions are indicated in color on the map below. |

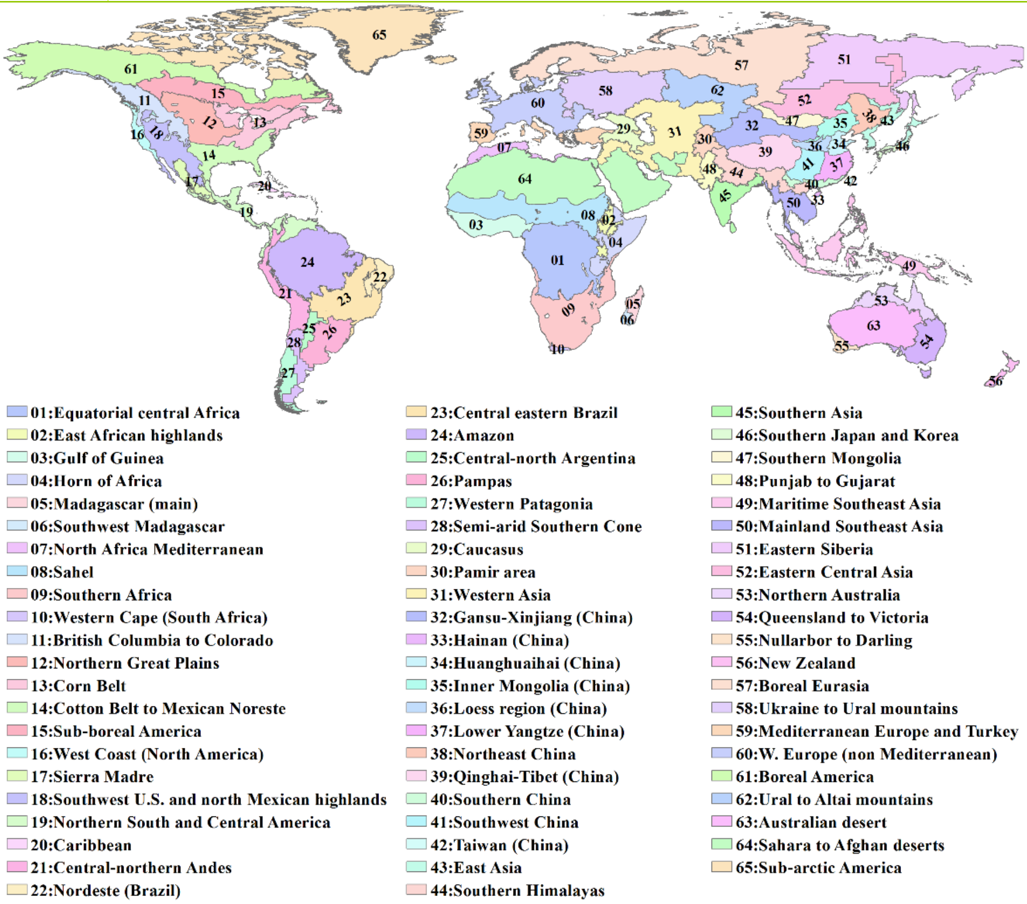
| **Countries (and first-level administrative districts, e.g., states and provinces)** | |
|---|---|
| *Overview* | *Description* |
| 42 countries to represent main producers/exporters and other key countries. | CropWatch monitored countries together represent more than 80% of the production of maize, rice, wheat and soybean, as well as 80% of exports. Some countries were included in the list based on criteria of proximity to China (Uzbekistan, Cambodia), regional importance, or global geopolitical relevance (e.g., four of five most populous countries in Africa). The total number of countries monitored is "41 + 1," referring to 41 and China itself. For the nine largest countries—, United States, Brazil, Argentina, Russia, Kazakhstan, India, China, and Australia, maps and analyses may also present results for the first-level administrative subdivision. The CropWatch agroclimatic indicators are computed for all countries and included in the analyses when abnormal conditions occur. Background information about the countries' agriculture and trade is available on the CropWatch Website, **www.cropwatch.com.cn**. |




| **Major Production Zones (MPZ)** | |
|---|---|
| *Overview* | *Description* |
| Seven globally important areas of agricultural production | The six MPZs include West Africa, South America, North America, South and Southeast Asia, Western Europe and Central Europe to Western Russia. The MPZs are not necessarily the main production zones for the four crops (maize, rice, soybean, wheat) currently monitored by CropWatch, but they are globally or regionally important areas of agricultural production. The seven zones were identified based mainly on production statistics and distribution of the combined cultivation area of maize, rice, wheat and soybean. |



| **Global Monitoring and Reporting Unit (MRU)** | |
|---|---|
| *Overview* | *Description* |
| 65 agro-ecological/agro-economic units across the world | MRUs are reasonably homogeneous agro-ecological/agro-economic units spanning the globe, selected to capture major variations in worldwide farming and crops patterns while at the same time providing a manageable (limited) number of spatial units to be used as the basis for the analysis of environmental factors affecting crops. Unit numbers and names are shown in the figure below. A limited number of units (e.g., MRU-63 to 65) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of global production. Additional information about the MRUs is provided online under **www.cropwatch.com.cn** . |




## Production estimation methodology

The main concept of the CropWatch methodology for estimating production is the calculation of current year production based on information about last year's production and the variations in crop yield and cultivated area compared with the previous year. The equation for production estimation is as follows:

$$Production_i = Production_{i-1} * (1 + \Delta Yield_i) * (1 + \Delta Area_i)$$

Where i is the current year, $\Delta Yield_i$ and $\Delta Area_i$ are the variations in crop yield and cultivated area compared with the previous year; the values of $\Delta Yield_i$ and $\Delta Area_i$ can be above or below zero.

For the 31 countries monitored by CropWatch, yield variation for each crop is calibrated against NDVI time series, using the following equation:

$$\Delta Yield_i = f(NDVI_i, NDVI_{i-1})$$

Where $NDVI_i$ and $NDVI_{i-1}$ are taken from the time series of the spatial average of NDVI over the crop specific mask for the current year and the previous year. For NDVI values that correspond to periods after the current monitoring period, average NDVI values of the previous five years are used as an average expectation. $\Delta Yield_i$ is calculated by regression against average or peak NDVI (whichever yields the best regression), considering the crop phenology of each crop for each individual country.

A different method is used for areas. For China, CropWatch combines remote-sensing based estimates of the crop planting proportion (cropped area to arable land) with a crop type proportion (specific type area to total cropped area). The planting proportion is estimated based on an unsupervised classification of high resolution satellite images from HJ-1 CCD and GF-1 images. The crop-type proportion for China is obtained by the GVG instrument from field transects. The area of a specific crop is computed by multiplying farmland area, planting proportion, and crop-type proportion of the crop.

To estimate crop area for wheat, soybean, maize, and rice outside China, CropWatch relies on the regression of crop area against cropped arable land fraction of each individual country (paying due attention to phenology):

$$Area_i = a + b * CALF_i$$

where a and b are the coefficients generated by linear regression with area from FAOSTAT or national sources and CALF the Cropped Arable Land Fraction from CropWatch estimates. $\Delta Area_i$ can then be calculated from the area of current and the previous years.

The production for "other countries" (outside the 31 CropWatch monitored countries) was estimated as the linear trend projection for 2014 of aggregated FAOSTAT data (using aggregated world production minus the sum of production by the 31 CropWatch monitored countries).

# Data notes and bibliography

*Notes*

[1] Although Yemen is not part of the Horn of Africa (HoA), it is geographically close and maintains close links to the region. The countries of the HoA are grouped in the regional development association IGAD (Inter-governmental Authority on Development, with headquarters in Djibouti). IGAD has recently established the IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI, 2016).

[2] Under-investment in agriculture was one of the main drivers of the 2008 crisis of high food prices (Mittal 2009, ATV 2010), even if several other local and global triggering factors can be identified (Evans 2008).

[3] Previous large humanitarian crises were those of the West African Sahel (from the early sixties to the mid eighties), the Ethiopian droughts of the mid-eighties, the Indian Ocean tsunami of 2004, several large earthquakes (for example, Haiti, 2010), and floods and medical emergencies (such as the West African Ebola outbreak, 2013-16).

[4] http://www.agrhymet.ne/eng/index.html

[5] http://www.icpac.net/

[6] Belg is harvested before or during July.

[7] "Purely man-made disasters" is, however, a concept that deserves a closer look, as many wars and insurgencies are partially triggered by shortages of natural resources, including land. As such, most “man-made disasters” do have an environmental component.

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# Online resources

Online Resources posted on **www.cropwatch.com.cn** , **http://cloud.cropwatch.com.cn/**

This bulletin is only part of the CropWatch resources available. Visit **www.cropwatch.com.cn** for access to additional resources, including the methods behind CropWatch, country profiles, and other CropWatch publications. For additional information or to access specific data or high-resolution graphs, simply contact the CropWatch team at **cropwatch@radi.ac.cn**.

CropWatch bulletins introduce the use of several new and experimental indicators. We would be very interested in receiving feedback about their performance in other countries. With feedback on the contents of this report and the applicability of the new indicators to global areas, please contact:

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